ENVIRONMENTAL REPORT FOR THE PROPOSED SHORELINE PROTECTION WORKS AT PORT ROYAL STREET

Submitted to:

JAMAICA SOCIAL INVESTMENT FUND

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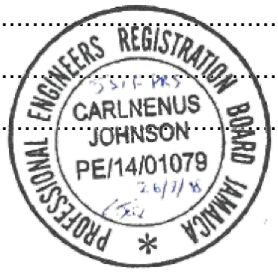

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EXECUTIVE SUMMARY

DESCRIPTION OF PROPOSED PROJECT

The Port Royal Street coastline has experienced moderate to severe erosion since Hurricane Ivan (2004). The shoreline of immediate concern is approximately 1,250 metres long; extending from the Bank of Jamaica (BOJ) parking lot in the west to the Rae Town fishing beach in the east. The road edge within this strip generally varies between 0.5 and 12.0 metres from the shoreline. The consequences of any failure of the road is of national interest. There are currently coastal protection measures implemented that have been severely damaged and have outlived their useful life. It is therefore necessary that plans be put in place to secure the coastline along this strip.

The proposed shoreline protection works includes construction of approximately 1 km of composite seawall and revetment structure from the Ministry of Foreign Affairs to Rae Town. The proposed crest for the revetment is 2.2m and the wall is 2.7 m above mean sea level. The revetment is to extend 10 m seaward with the toe of the structure buried approximately 2.4 m below the seafloor. Two (2) public bathroom facilities will also be constructed as part of the proposed project. The proposed timeline for this project is approximately fifteen months.

The primary armour stones to be used in revetment construction will range from 0.6 Tons to 2.2 Tons (0.6m – 1.0.m) while the secondary armour stones will vary from 0.08 Tons to 0.3 Tons (0.3m – 0.5m). Both layers of armour are required in order to resist the 100 Year Return Period Design wave conditions. Sensitivity analysis revealed the maximum size armour units correspond to a peak wave period of 3.9 seconds.

The primary construction equipment to be used on site will comprise of excavator, dump trucks and flat beds to deliver rock and fill to site. Hydraulic excavators with grab attachments will be used for individual placement of rock armour.

ENVIRONMENTAL BASELINE DESCRIPTION

Climate

Average minimum temperatures range from a low of 22.3 °C in January and February, to a high of 25.6 °C in July. Average maximum temperatures range from a low of 29.6 °C in February, to a high of 31.9 °C in August. Average rainfall is at its highest in May to June and September to October, with October having the highest average monthly rainfall (167 mm) and rain days (10). Relative humidity at 7am had an annual mean of 77.3%, while at 1pm had an annual mean of 64.4%. The dominant wind direction is from the east with an average wind speed of 14.8 knots (7.61 m/s).

Marine Water Quality

Physicochemical water quality (temperature, conductivity, salinity, dissolved oxygen, turbidity, total dissolved solids and pH) was considered normal for tropical coastal marine areas influenced by various sources of land run-off. There are various sources of land run-off and freshwater input in the form of drains, gullies and sewage outfall pipes affect coastal water quality in the project area. The Barnes Gully and sewage outfall pipe in the vicinity of the Tower Street Adult Correctional Facility affect chemical parameters such as BOD, faecal coliform and enterococcus bacteria, causing these values to be elevated.

Noise

Most of the noise during all monitoring sessions (morning, early afternoon and late afternoon) can be attributed to vehicular traffic along the main road, while noise closer to the site of the new Ministry of Foreign Affairs building can be attributed not only to vehicular traffic, but also to noise from construction site activity. Station 7 (located south of the Old Ice factory near to the mouth of the Barnes Gully) is the only station which was compliant with the NEPA daytime noise guideline during all three monitoring sessions.

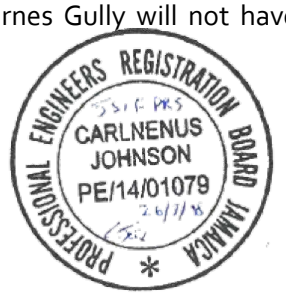
Particulates

Coarse particles are airborne pollutants that fall between 2.5 and 10 micrometres in diameter. Fine particle are airborne pollutants that fall below 2.5 micrometres in diameter. Sources of coarse particles include crushing or grinding operations, and dust stirred up by vehicles traveling on roads. Sources of fine particles include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

All locations had average PM10 and PM2.5 particulate values compliant with the 24-hour standards of 150 $\mu g/m^3$ and 35 $\mu g/m^3$ respectively. Labour day activities in the community on May 23rd whereby chopping of bush, digging of dirt and general rubbish clean-up activities took place, would have contributed to elevated particulate concentrations seen on this sampling day. PM2.5 particulate concentrations at the various stations may be due to proximity to the main road and associated motor vehicle exhaust emissions.

Vibration

From a human standpoint, most equipment used during the construction process would result in vibration which is either imperceptible or barely perceptible at the closest receptors. The use of a vibratory pile driver in the vicinity of the Old Ice factory for the installation of a pedestrian bridge at Barnes Gully will result in vibrations which may cause annoyance to occupants in nearby buildings if the vibrations are continuous. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project. Pile driving activities for installation of the pedestrian bridge at Barnes Gully will not have any effect on the boundary wall of the General Penitentiary.



Terrestrial Community

The proposed project includes modifications to both the seaward and landward sides of the roadway. Solid waste litters both sides of the road, however dense accumulations of both solid waste and marine debris occur along the coastline. The terrestrial areas are highly modified with some vegetation found along the coastline and poorly maintained lands. Coastal species include a Black mangrove and few small white mangroves near a drain, Noni trees, Seaside Mahoe, grasses and shrubs.

The intertidal area is composed of rocks and boulders from previous modifications during road construction. Most of this area is covered with extremely large collections of solid waste. Drains and gullies carry large volumes of solid waste and in some areas, sewage and nutrients. During the study untreated sewage was seen flowing out of a drain, causing the water to have a high odour and milky appearance, the surrounding rocks were covered with a white film. No intertidal community was observed, it is possible that crabs and snails maybe present in some of these areas, however the overall degradation appears to limit the establishment of intertidal community.

Birds utilize various sections of the nearshore, including some sections of the shoreline, vegetation, boats, buoys and moorings. Solid waste covers sections of the coastline and within the water column. Birds were seen resting on large plastic mounds outside the Rae Town gully as well as foraging in and around the general project area.

Marine Community

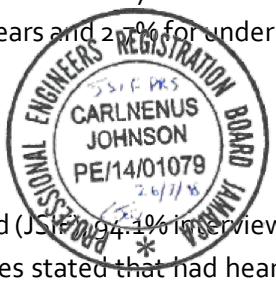
Large schools of juvenile fish and jelly fish populations were also seen in the area. The eutrophication of the harbour provides a rich food source for some species. Although no commercially important species were seen, fishermen state conch and shrimp are abundant while lobster and crab are less so. Fish and invertebrate species observed during the benthic survey include: sea bream, mullet, maccaback, urchins, jellyfish, bivalves, sponges, anemones. Fish and invertebrates reported by fishermen in the project area include: tarpon, barracuda, jack, snapper, parrotfish, kingfish, snook, queen conch, black conch, urchins, lobster, shrimp, crab and sea cucumber.

Community Perception Survey

Of those persons interviewed who offered a response, 57.3% indicated that they were employed, 37.0% stated they were unemployed while 5.7% of individuals were retired. Of the 57.3% indicating they were employed 36.0% indicated that they were self-employed and 58.0% had an employer. The remaining six percent (6.0%) offered no response. Additionally, for those indicating they were employed forty percent (40.0%) stated they were engaged in casual labour, 18.0% were semi-skilled, 21.0% were skilled, 4.0% were artisans while 15.0% stated they were professionals. The remaining two percent (2.0%) offered no response.

Regarding the head of household, 59.0% indicated that they were the head of their households. Of the 41.0% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 84.2% of household heads were employed, while 12.0% were unemployed and 3.8% were retired.

In general, interviewees resided in their communities over the long term. Approximately sixty-five percent (64.8%) of individuals resided in their communities for all their life, and 10.9% resided in their community in excess of fifteen years. Approximately six percent (5.9%) stated they lived in their community for between ten and fifteen years; 8.6% resided for between five and ten years. Just over seven percent (7.1%) resided in their community for between three and five years and 2.7% for under two years.



Awareness of the proposed Project

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF) 94.1% interviewees offered a response. Approximately twenty six percent (25.6%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 74.4% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 21.3% stated they were made aware via newspaper, 40.4% indicated awareness was via television, 10.1% stated radio, 13.5% indicated community meeting and 33.7% indicated that they heard of JSIF through word of mouth while 3.4% of interviewees stated other and further indicated that their awareness of JSIF was via the internet and research. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 93.8% of respondents offered a response. Of these individuals, 14.1% of individuals stated that they had heard of the JDVRP while 859% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 14.1% of respondents who heard of the JDVRP, 10.2% indicated that awareness was via the newspaper, 32.7% indicated television, 6.1% stated radio, while 14.3% stated they were made aware via community meeting and 36.7% indicated word of mouth. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

In response to whether respondents knew what a revetment was, 89.7% of respondents offered a response. Of those who responded 5.1% indicated that they knew what a revetment was while 94.9% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 91.6% of interviewees responded. Of this number, 17.4% of individuals stated that they were aware of the proposal while 82.6% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an

awareness of the proposed project, 6.8% stated that they were made aware via the newspaper, 25.4% stated television, 5.1% stated awareness via radio while 8.5% stated community meeting and 62.7% stated that they were made aware via word of mouth.

Concerns about proposed Project

Regarding whether respondents had any concerns about the project, 91.1% of interviewees offered responses. Of these persons, 21.1% indicated that they had concerns about the project while 78.9% stated that they did not have any concern. Concerns expressed pertained to:

- Impact on livelihood to include fishers and other persons with businesses along the 1.3km area (e.g. cook shop owners) (1.5%)
- Whether the project will actually come to fruition (4.7%)
- Impact on the fishing village (1.5%)
- Impact on existing infrastructure (road) (3.1%)
- Whether shoreline stabilization will provide protection against hurricane (1.5%)
- Whether work opportunities will be created (20.0%)
- The benefit/effect the project will have on the community (30.8%)
- The effect on families (1.5%)
- Communities not being consulted about the project (1.5%)
- Possible dislocation (10.8%)
- The revetment blocking the view of the ocean (4.7%)
- The duration of the project (3.1%)
- Whether the community will have access (1.5%)
- Whether the community will be involved in the project (1.5%)
- Whether there will be long term maintenance post construction (1.5%)
- Whether the project will go as planned (1.5%)
- General safety and the safety of the facility post construction (3.1%)
- The lack of information on the project (4.7%)
- Whether there will be options for community interaction (1.5%)

<u>Fisher Perception Survey</u>

Awareness of the proposed Project

In response to whether respondents knew what a revetment was, 100.0% of respondents offered a response. Of those who responded 3.6% indicated that they knew what a revetment was while 96.4% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, all interviewees responded. Of this number, 17.9% of individuals stated that they were aware of the proposal while 82.1% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 20.0% stated that they were made aware via television, while 20.0% stated community meeting and 60.0% stated that they were made aware via word of mouth.

Concerns about proposed Project

Regarding whether respondents had any concerns about the project, 100.0% of interviewees offered responses. Of these persons, 50.0% indicated that they had concerns about the project while 50.0% also stated that they did not have any concern. Concerns expressed pertained to:

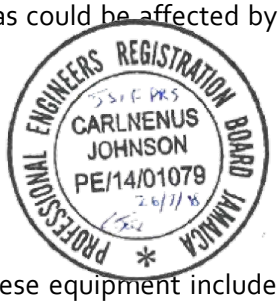
- How the fisherfolk will be affected (21.4%)
- The fisherfolk being dislocated (7.1%)
- There will be limited access to the ocean and docking space (14.3%)
- he possible impact on marine life (7.2%)
- Whether work opportunities will be created (7.2%)
- How the fisherfolk will benefit (14.3%)
- Whether affected persons will be compensated (7.1%)
- Whether the project will actually be implemented (7.1%)
- The lack of project information (7.1%)

POTENTIAL IMPACTS OF THE PROPOSED PROJECT AND RECOMMENDED MITIGATION

Marine Water Quality

During construction, the immediate areas around the project site will have the potential to have reduced water quality. The storage of material will have the potential to generate turbidity, sedimentation and possible run-off from land. Rainfall has the potential to carry the sediments into the nearshore area.

Armour rocks placed in the water may also contribute to elevated TSS and turbidity levels, especially if they are not washed before being placed in the water. Additionally, these areas could be affected by wave action and currents resulting in the transportation of silt down current.



Mitigation: Turbidity barriers, Washing of armour rocks

Noise Pollution

Construction necessitates the use of heavy equipment to carry out the job. These equipment include bulldozers, backhoes, excavators etc. These possess the potential to have a direct negative impact on the noise climate. Noise directly attributable to site clearance activity should not result in noise levels in the residential areas to exceed 55dBA during day time (7am – 10 pm) and 50 dBA during night time (10 pm – 7 am). Where the baseline levels are above the stated levels then it should not result in an increase of the baseline levels by more than 3dBA.

Mitigation:

i. *Use equipment that has low noise emissions as stated by the manufacturers.*
ii. *Use equipment that is properly fitted with noise reduction devices such as mufflers.*
iii. *Operate noise-generating equipment during regular working hours (e.g. 7 am – 6 pm) to reduce the potential of creating a noise nuisance during the night.*
iv. *Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is workers operating equipment generating noise of ≥ 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.*

Air Quality

Site preparation and construction has the potential to have a two-folded direct negative impact on air quality of the surrounding area. The first impact is air pollution generated from the construction equipment and transportation. The second is from fugitive dust from the proposed construction areas and raw materials stored on site. Fugitive dust has the potential to affect the health of construction workers, the resident population and the surrounding vegetation.

Mitigation:

i. *Areas should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter, more windy days, this frequency should be increased.*
ii. *Cover or wet construction materials to prevent a dust nuisance. This includes those being transported on trucks.*
iii. *Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.*

Vibration

From a human standpoint, most equipment used during the construction process would result in vibration which is either imperceptible or barely perceptible at the closest receptors. The use of a vibratory pile driver in the vicinity of the Old Ice factory for the installation of a pedestrian bridge at Barnes Gully will result in vibrations which may cause annoyance to occupants in nearby buildings if the vibrations are continuous. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project. Pile driving activities for installation of the pedestrian bridge at Barnes Gully will not have any effect on the boundary wall of the General Penitentiary.

Mitigation:

i. *Phase demolition, earth-moving and ground-impacting operations so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately.*
ii. *Avoid night time activities. People are more aware of vibration in their homes during the night time hours.*
iii. *Select demolition methods not involving impact, where possible.*
iv. *Have regular meetings or devise a communication strategy to inform the residents and businesses of construction activities.*

Biological Environment

The excess sedimentation from site preparation and construction activities may result in clogging of fish and invertebrate gills and may result in their death. Invertebrates; bivalves, sponges, worms and anemones, living in or on the substrate and may be affected by construction activities which may result in the loss and/or displacement of these species as well as habitat loss.

Seabirds forage and roost in the area. The removal of vegetation and general construction activities may temporarily displace these birds. The small mangrove stand in the project area is likely to be removed along with other trees and shrubs as a result of site preparation and revetment construction.

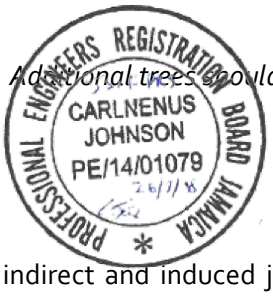
Operationally, the armour rock will provide habitat for invertebrates and fish. Rocks may also provide suitable substrate for the settlement and recruitment of sessile organisms such as sponges.

Mitigation:

As many trees as possible should be left unchanged during all activities. Some trees will be removed as a result of site clearance and construction; however, additional trees should be planted as part of the landscape plan. Where possible trees and vegetation preferred by the existing coastal avifauna population should be included in the landscape plan.

In addition:

i. *Mangroves should be preserved if possible*
ii. *Mangroves should be included in the landscape plan where possible.*
iii. *As many trees as possible should be left unchanged during all activities. Additional trees should be planted as part of the landscape plan.*



Employment

The work force should include trade men and labourers and should create indirect and induced jobs during construction. This will result in employment within the study area and has the potential to be a significant positive impact. It is anticipated that some labourers will be from sourced from nearby communities.

Wastewater and Solid Waste Generation

The disposal of the wastewater generated at the construction campsite has the potential to have a minor negative impact on surface water. During site preparation solid waste and marine debris are part of the existing shoreline and will need to be removed prior to any construction activities. During construction activities solid waste and marine debris will continue to be deposited in these areas. Solid waste and marine debris must not be allowed to re-enter the marine environment and should be removed and properly disposed.

Mitigation:

i. *Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 25 workers per chemical toilet should be used.*

ii. *Careful removal and separation of solid waste and marine debris during the removal of the revetment rock.*
iii. *Skips and bins should be provided designated for the recovered solid waste and marine debris should be provided.*
iv. *The skips and bins should be adequately designed and covered to prevent access by vermin and minimise odour.*
v. *The skips and bins should be emptied regularly to prevent overfilling.*
vi. *Disposal of the contents of the skips and bins should be done at an approved disposal site.*

Traffic

The transportation and use of heavy equipment and trucks is required during construction and this has the potential to directly impact traffic flow along roads, especially during peak-hour traffic times.

Mitigation

i. *Construction traffic should be scheduled for off peak hours to avoid or minimise any congestion at the intersection.*
ii. *Adequate and appropriate road signs should be erected to warn road users of the construction activities.*
iii. *Flagmen should be employed to regulate traffic and assist construction vehicles.*

Recreational Users and Fishers

The probability that access to the coastline will be prohibited during construction activities is high due to physical blockades and safety concerns. As a result, persons who utilize the coastline for walking, jogging, sightseeing or fishing will have reduced or no access. Fishers may also be subject to reduced catch in the immediate project area due to the high level of construction activity and resultant turbidity in the water which may deter fish from the area.

Operationally, users of the area will benefit from more favourable aesthetics as a result of the proposed project. This will include a new boardwalk for users of the area for walking, jogging and/or sightseeing. Designated parking and other amenity areas for users will also benefit users of the area.

Mitigation:

Continued consultation and meetings with fisherfolk before and during construction to discuss measures to minimize impact on their livelihood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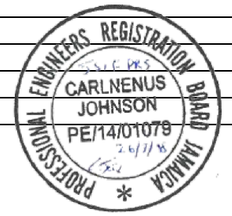
The potential impacts are summarized in the impact matrices below:

Site Preparation and Construction

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
Physical												
	Water Column	General Site Prep and Clearance	Increased sedimentation (turbidity and TSS)	X				X	1	1	1	-1
			Increased water pollution (oils, solid waste etc.)	X				X	1	1	1	-1
		Construction	Increased sedimentation (turbidity and TSS)	X				X	1	1	1	-1
			Increased water pollution (oils, solid waste etc.)	X				X	1	1	1	-1
	Buildings and Occupants	General Site Prep and Clearance	Vibration imperceptible or barely perceptible by humans. Vibration will have no effect on building structures.					X	1	1	1	-1
		Construction	Vibration imperceptible or barely perceptible by humans. Vibration will have no effect on building structures.					X	1	1	1	-1
	Airshed	General Site Prep and Clearance	Reduced Air quality and Noise Pollution	X				X	1	1	1	-1
		Construction	Reduced Air quality and Noise Pollution	X				X	1	2	1	-1.33
Biological	Fish	General Site Prep and Clearance	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
		Construction	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	
	Marine invertebrates	General Site Prep and Clearance	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
		Construction	Increased sedimentation (TSS and turbidity)	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
	Avifauna	General Site Prep and Clearance	Displacement and loss of habitat	X				X	2	1	1	-1.33
		Construction	Displacement and loss of habitat	X				X	2	1	1	-1.33
	Mangroves	General Site Prep and Clearance	Species loss	X				X	3	2	1	-2
		Construction	N/A				X					
	Coastal Vegetation	General Site Prep and Clearance	Habitat and Species loss	X				X	3	1	1	-1.67
		Construction	Remaining plant Health reduced from dust and emissions	X				X	1	1	1	-1
	Coastline/ Intertidal Zone	General Site Prep and Clearance	Habitat and Species loss	X				X	3	1	1	-1.67
		Construction	Habitat and Species loss	X				X	3	1	1	-1.67
Human/ Social	Road Surfaces	General Site Prep and Clearance	Wear and tear from transport of heavy material and equipment	X				X	1	1	1	-1
		Construction	Wear and tear from transport of heavy material and equipment	X				X	1	1	1	-1
	Visual Impact	General Site Prep and Clearance	Increased solid waste generation	X				X	1	1	1	-1
			Increased dust levels	X				X	1	1	1	-1
		Construction	Increased solid waste generation	X				X	1	1	1	-1
			Increased wastewater generation	X				X	1	1	1	-1
			Increased dust levels	X				X	1	1	1	-1
	Recreational Users	General Site Prep and Clearance	Reduced access to coastline	X				X	1	1	1	-1
		Construction	Reduced access to coastline	X				X	1	1	1	-1
	Road Users and Pedestrians	General Site Prep and Clearance	Delays and disruption from traffic	X				X	1	1	1	-1
		Construction	Delays and disruption from traffic	X				X	1	1	1	-1
			Exposure to noise and dust	X				X	1	1	1	-1
			Exposure to contaminated marine water	X				X	1	2	1	-1.33
			Increased Accident Potential	X				X	1	1	1	-1
	Fishers	General Site Prep and Clearance	Limited/reduced access to fishing areas	X				X	1	1	1	-1
			Reduced catch	X				X	1	1	1	-1

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
		Construction	Limited/reduced access to fishing areas	X				X	1	1	1	-1
			Reduced catch	X				X	1	1	1	-1
	Labour Force/Local Economy	General Site Prep and Clearance	Increased employment	X		X			2	3	2	2.33
			Exposure to noise and dust	X				X	1	1	1	-1
			Increased Accident Potential	X				X	1	1	1	-1
		Construction	Increased employment	X		X			2	3	2	2.33
			Exposure to noise and dust	X				X	1	1	1	-1
			Exposure to contaminated marine water	X				X	1	2	1	-1.33
			Increased Accident Potential	X				X	1	1	1	-1



Operation

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
Physical												
	Water Column	Operations	N/A				X					
	Airshed	Operations	N/A				X					
Biological	Coral	Operations	Armour rock serves as substrate for coral recruitment	X		X			3	1	1	1.67
	Seagrass	Operations	N/A				X					
	Rocky Shore and Intertidal Zone	Operations	Armour rock serves as habitat for invertebrates	X		X			3	1	1	1.67
	Fish	Operations	Armour rock serves as habitat and refuge from larger predators	X		X			3	3	1	2.33
	Avifauna	Operations	N/A				X					
Human/ Social	Ground Transportation (Traffic)	Operations	N/A				X					
	Recreational Users	Operations	More amenity spaces	X		X			3	3	1	2.33
			Increased aesthetic appeal	X		X			3	3	1	2.33
	Road Users and Pedestrians	Operations	Increased aesthetic appeal	X		X			3	2	1	2
	Fishers	Operations	Armour rock act as fish aggregation device	X		X			3	3	1	2.33

1.0 INTRODUCTION

The Port Royal Street coastline has experienced moderate to severe erosion since Hurricane Ivan (2004). The shoreline of immediate concern is approximately 1,250 metres long; extending from the Bank of Jamaica (BOJ) parking lot in the west to the Rae Town fishing beach in the east. The road edge within this strip generally varies between 0.5 and 12.0 metres from the shoreline. The consequences of any failure of the road is of national interest. There are currently coastal protection measures implemented that have been severely damaged and have outlived their useful life. It is therefore necessary that plans be put in place to secure the coastline along this strip.

In 2009 CEAC Solutions designed measures on behalf of the National Works Agency (NWA) to protect the Port Royal Street shoreline. The proposed measures have not been implemented to date.

The Jamaica Social Investment Fund (JSIF) has in recent times (2016) under the World Bank funded Jamaica Disaster Vulnerability Reduction Project (JDVRP), received funding towards implementing a solution to enhance Jamaica's resilience to disaster and climate risk. The Port Royal Street shoreline protection was chosen for benefit from the project funds.

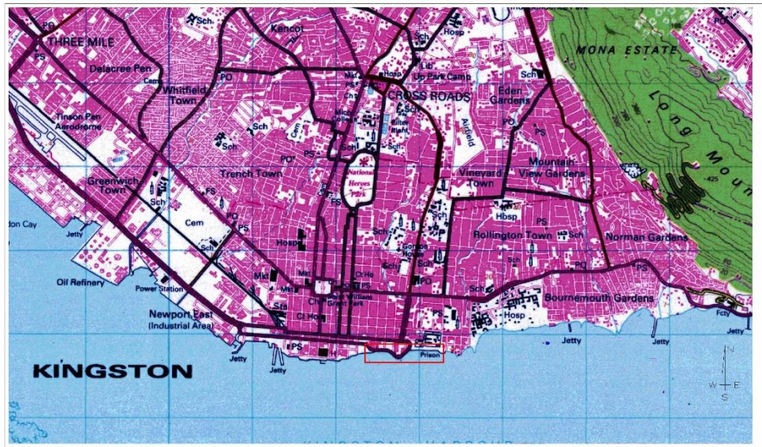
JSIF indicated that due to the passage of time there was a need to review and possibly update the designs to include additional considerations that may include but not be limited to climate change as well as social impacts. CEAC Solutions was therefore engaged by JSIF to review the 2009 designs and to update same to include the above-mentioned considerations.

2.0 DESCRIPTION OF THE PROPOSED PROJECT

According to the terms of reference for the project, the objective of the JDVRP is to enhance Jamaica's resilience to disaster and climate risk under three components; Technical Assistance for Improved Disaster and Climate Resilience; Risk Reduction; and Contingent Emergency Response. This project falls within the second component; Risk reduction to include rehabilitation of key infrastructures to reduce Jamaica's vulnerability to adverse natural events. These may include construction and/or rehabilitation of national and sub-national priority infrastructure such as bridges and urban drainage, public facilities and coastal protection measures.

The proposed shoreline protection works includes construction of approximately 1 km of composite seawall and revetment structure from the Ministry of Foreign Affairs to Rae Town. The proposed crest for the revetment is 2.2m and the wall is 2.7 m above mean sea level. The revetment is to extend 10 m seaward with the toe of the structure buried approximately 2.4 m below the seafloor. Two (2) public bathroom facilities will also be constructed as part of the proposed project. The proposed timeline for this project is approximately fifteen months.

Project design drawings can be seen in **Error! Reference source not found.** - Figure 2-15.



Location Map
Scale = 1:25,000

SHEET LISTING

CEAC SOLUTIONS
CIVIL · ENVIRONMENTAL · COASTAL
ENGINEERING EXCELLENCE

Client:
11 Oxford Road,
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Engineers:
CEAC Solutions Co. Ltd
20 Windsor Avenue
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Phone: (876)-946-2210
Fax: (876)-978-6760
e-mail: admin@ceasolutions.com

Notes:
1. Notes

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

Drawing Status
- For submission
- For tender
- For construction
- For review

Revisions

No.	Description	Date

PORT ROYAL STREET COASTLINE PROTECTION

Client: Jamaica Social Investment Fund
Project Name: Port Royal Street Coastline Protection
Sheet Name: Title Sheet

Project number:	CEAC-2018-00
Date:	2018-06-21
Drawn by:	MH
Designed by:	CB, CJ & KT
Checked by:	CB

CEAC-2018-00-C.001

Scale: As Shown

Figure 2-1 Location Map and title page for project design drawings

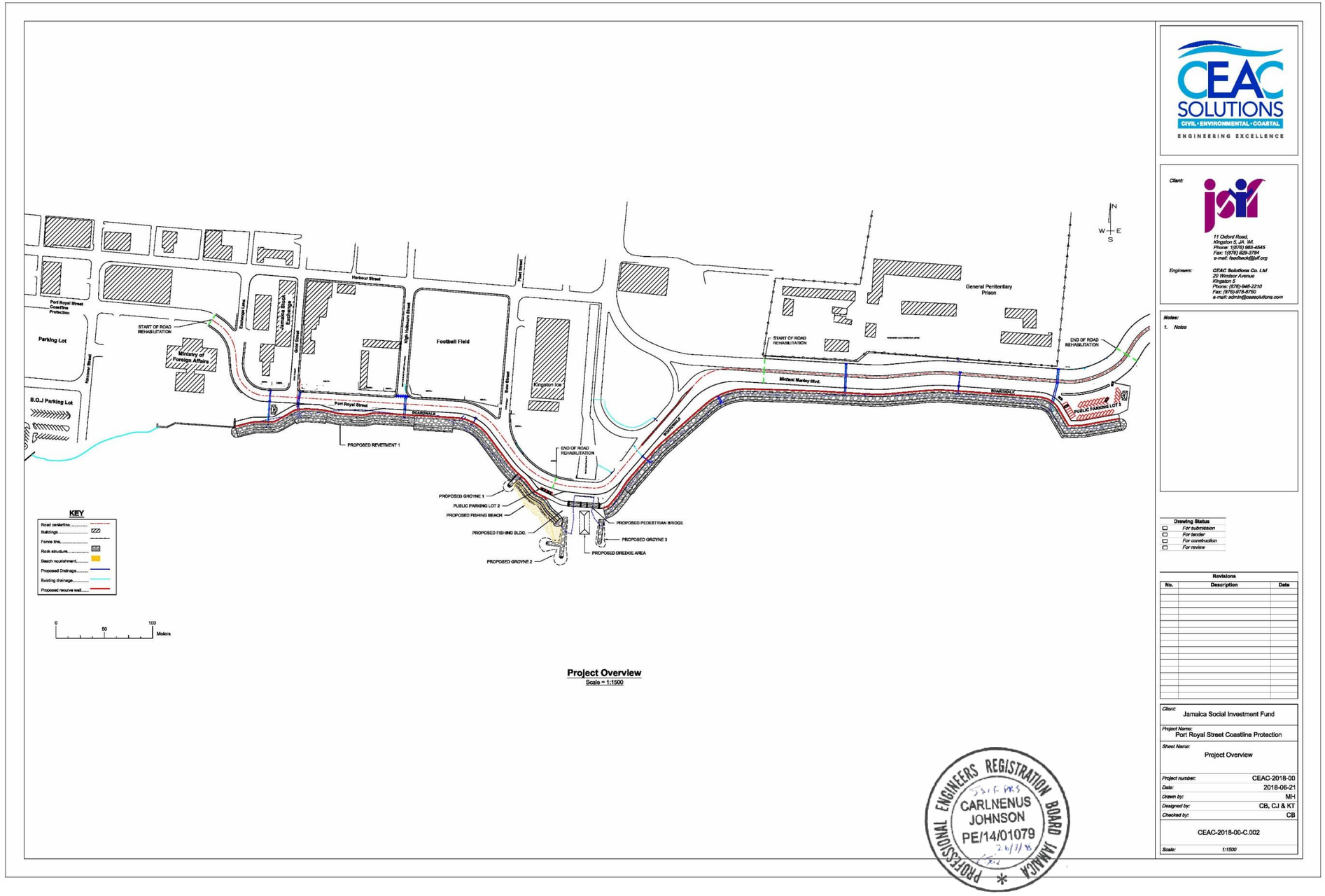
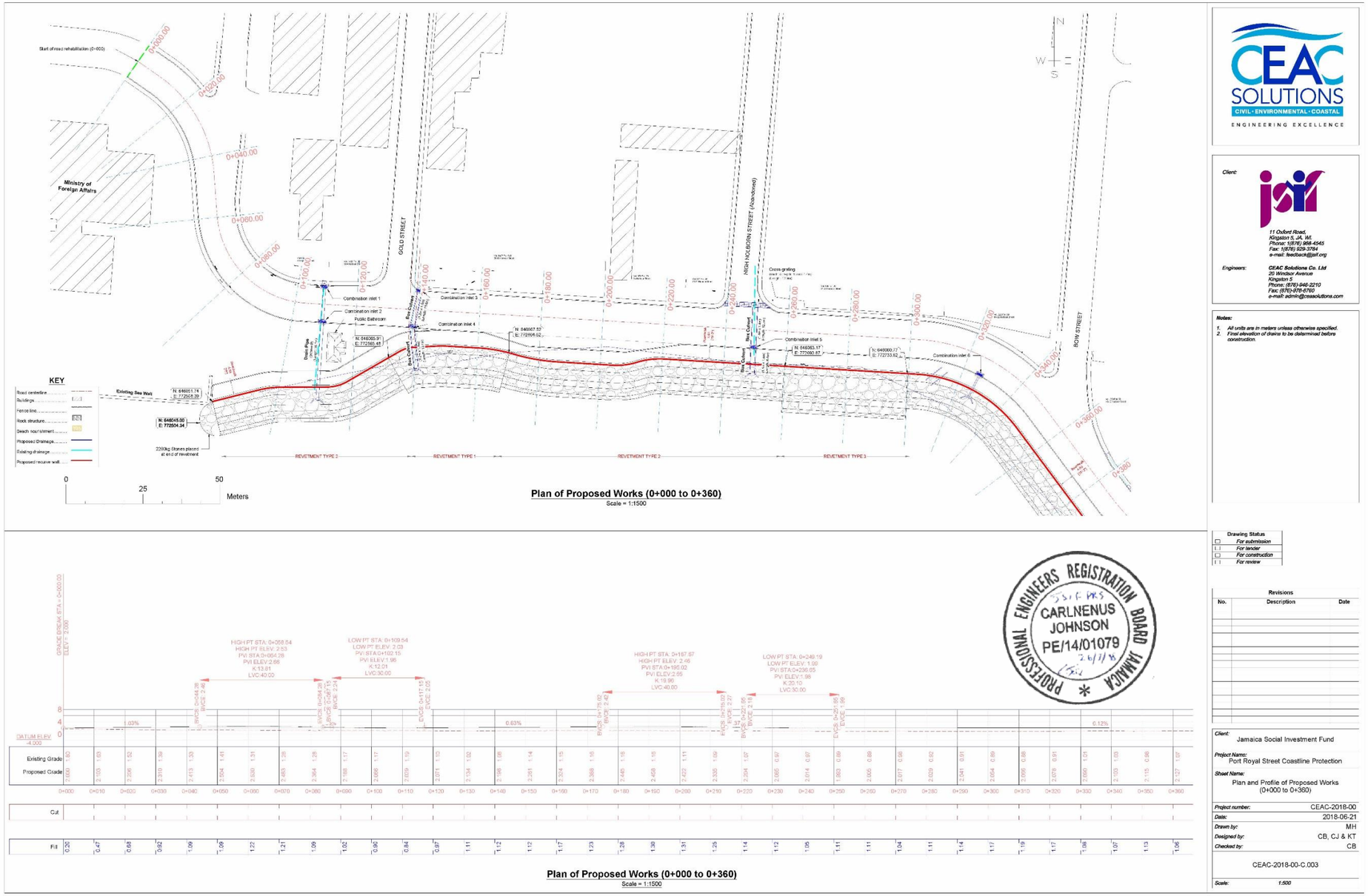


Figure 2-2 Project Overview



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Notes:
1. All units are in meters unless otherwise specified.
2. Final elevation of drains to be determined before construction.

Drawing Status
- For submission
- For tender
- For construction
- For review

Revisions

No.	Description	Date

Client: Jamaica Social Investment Fund
Project Name: Port Royal Street Coastline Protection
Sheet Name: Plan and Profile of Proposed Works (0+000 to 0+360)

Project number:	CEAC-2018-00
Date:	2018-06-21
Drawn by:	MH
Designed by:	CB, CJ & KT
Checked by:	CB

CEAC-2018-00-C.003

Scale: 1:500

Figure 2-3 Plan and Profile of Proposed Works (0+000 to 0+360)

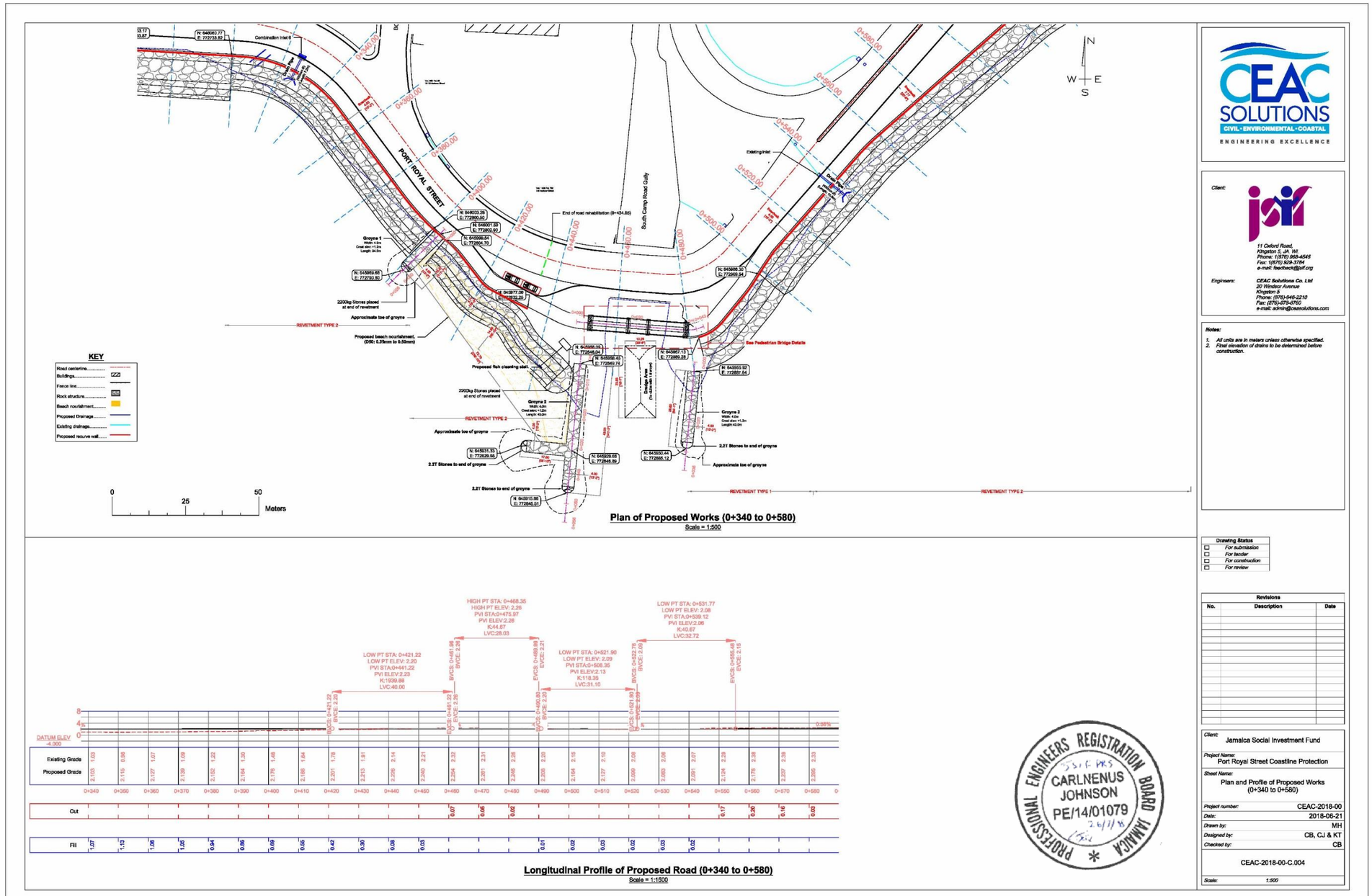

Figure 2-4 Plan and Profile of Proposed Works (0+340 to 0+580)

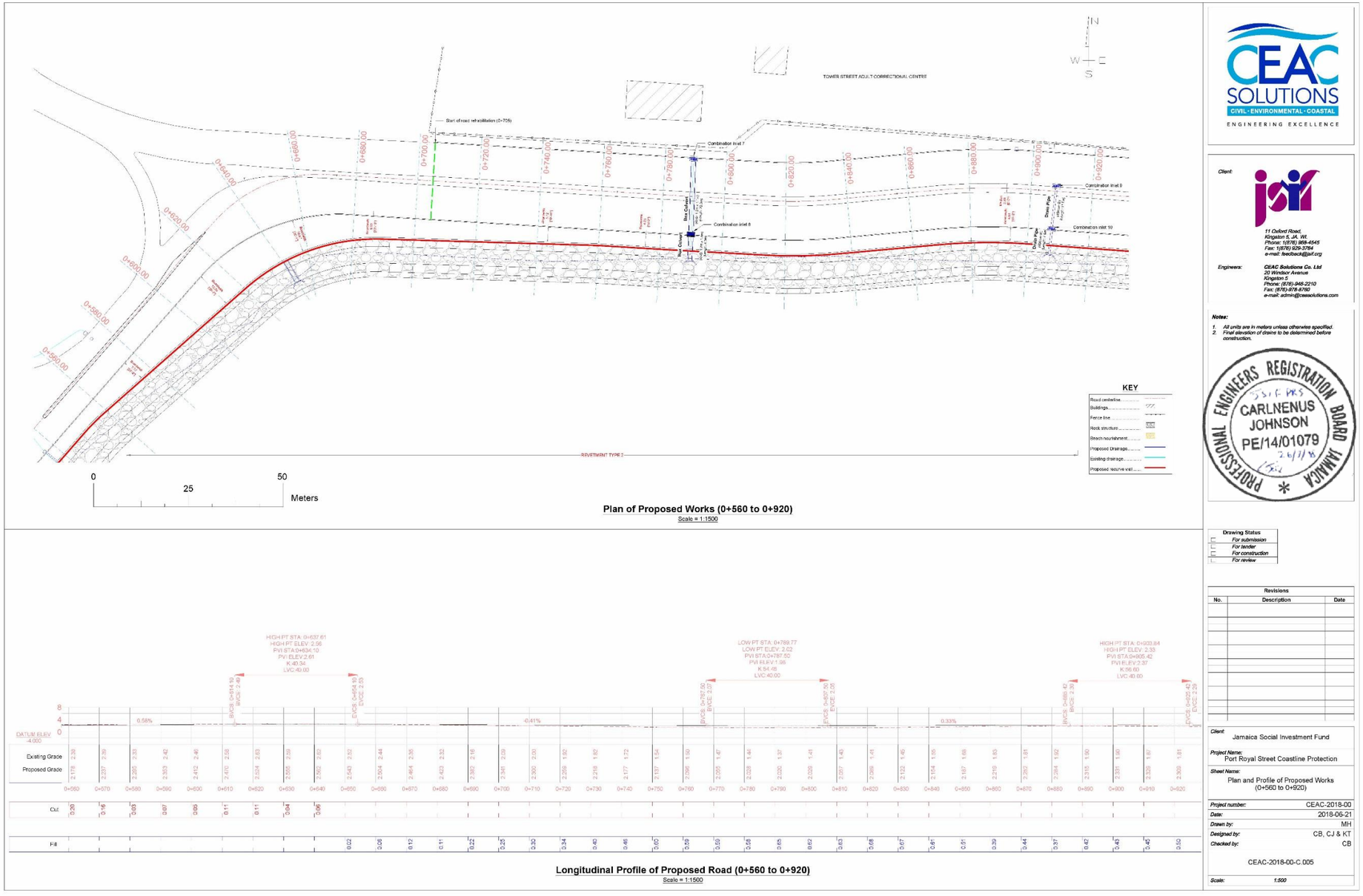

Figure 2-5 Plan and Profile of Proposed Works (0+560 to 0+920)

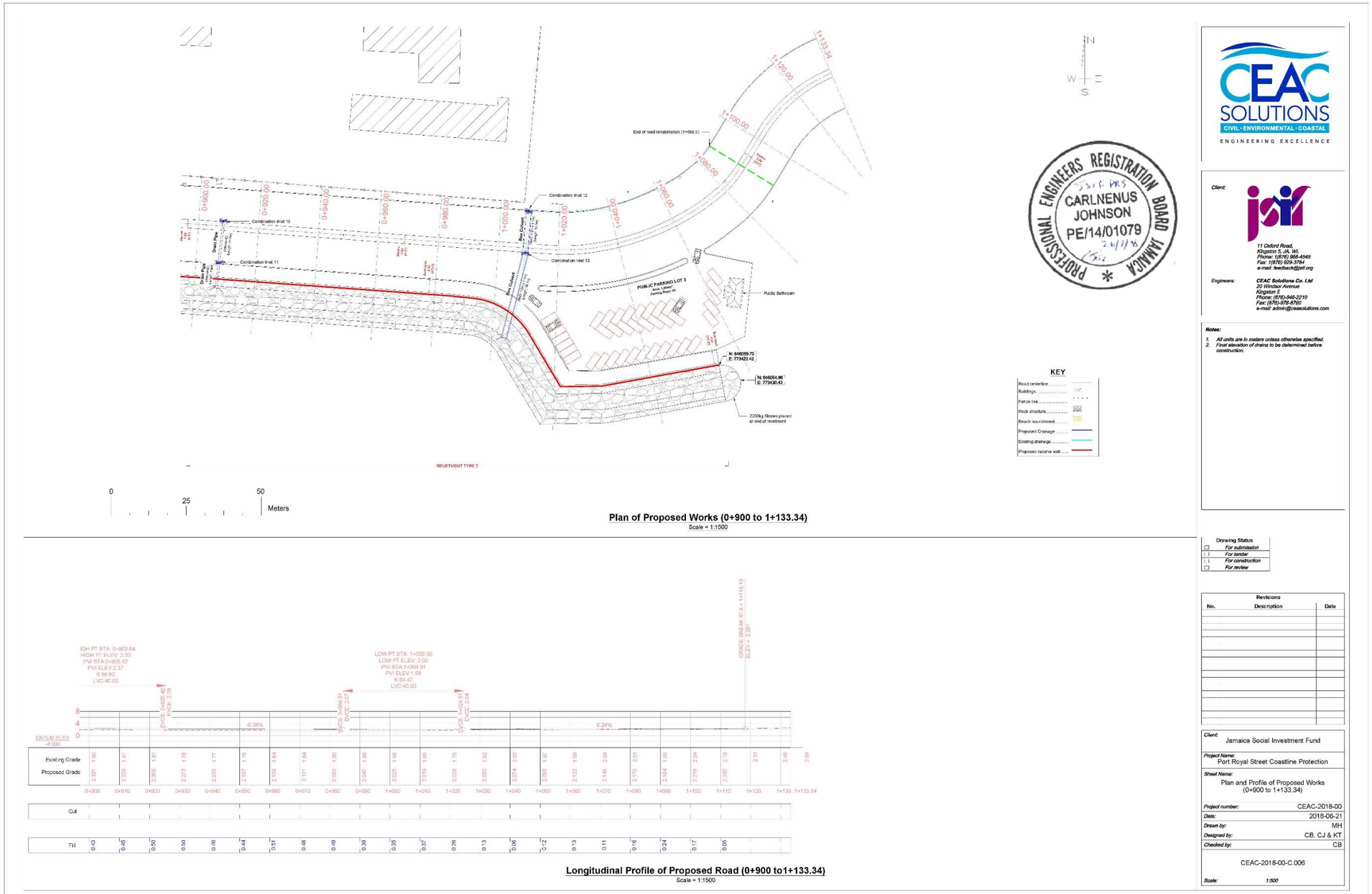

Figure 2-6 Plan and Profile of Proposed Works (0+900 to 1+133.34)

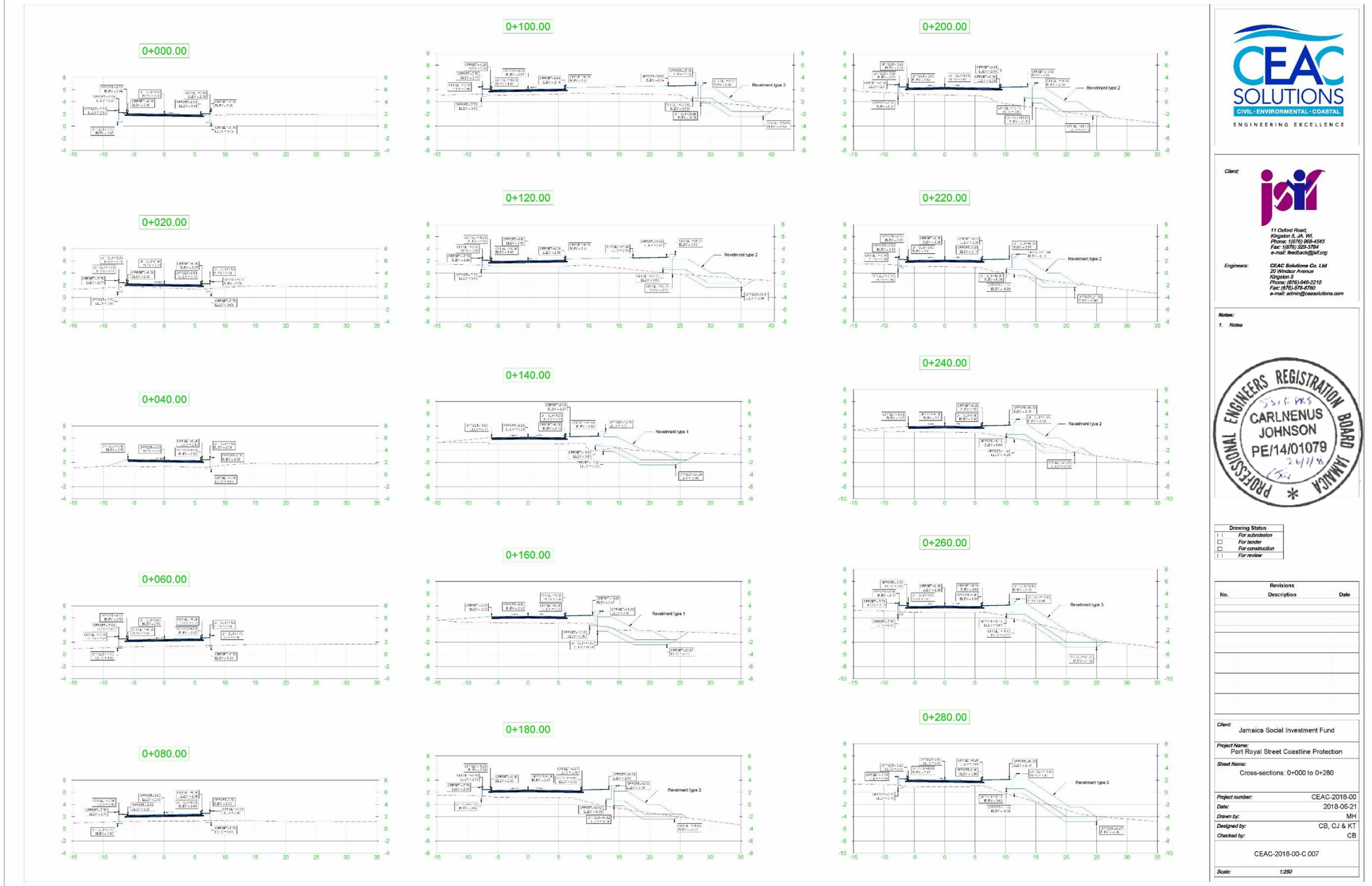

Figure 2-7 Cross Sections: 0+000 to 0+280

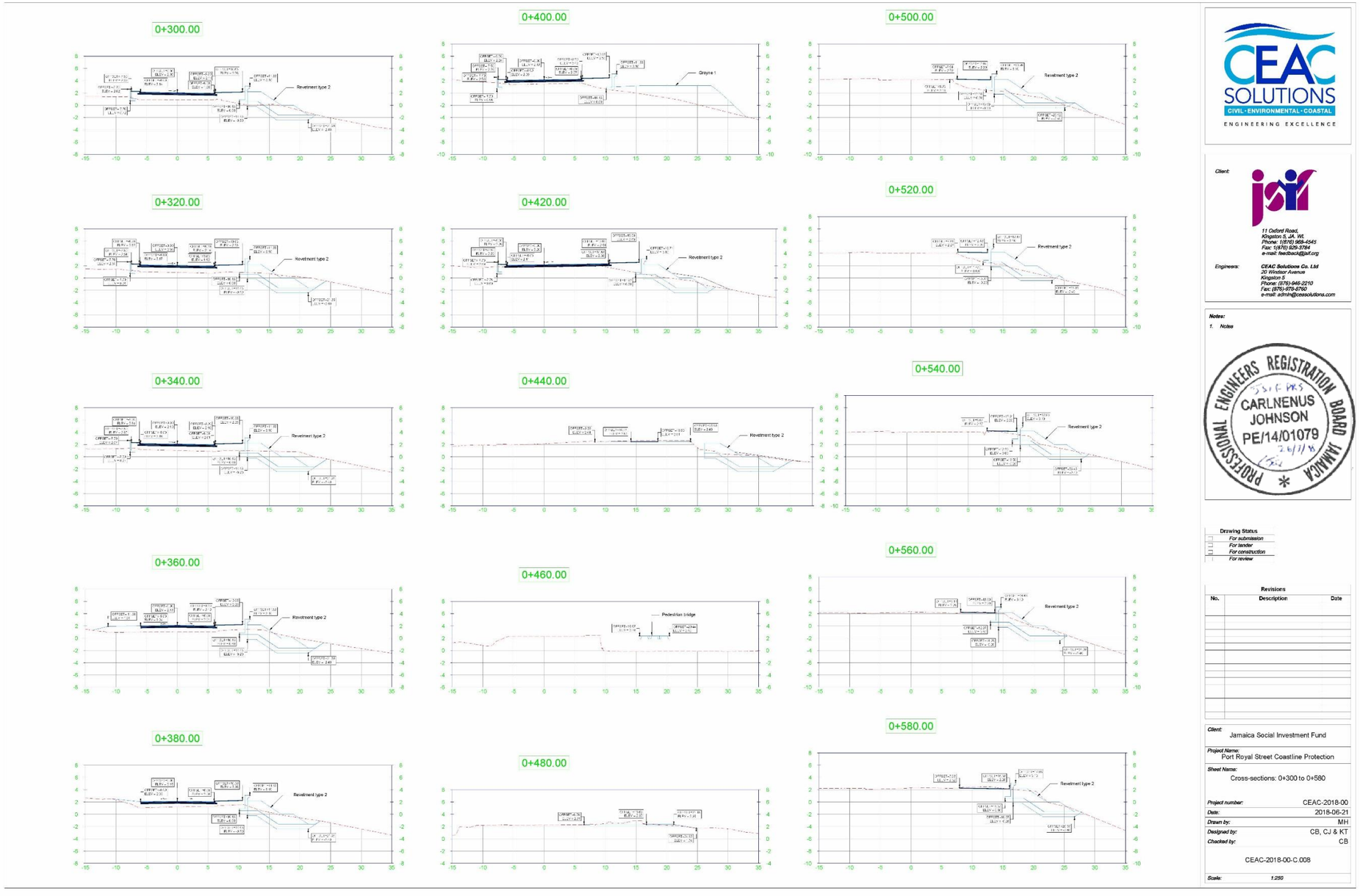

Figure 2-8 Cross Sections: 0+300 to 0+580

Figure 2-9 Cross Sections: 0+600 to 0+880

Figure 2-10 Cross Sections: 0+900 to 1+133.34

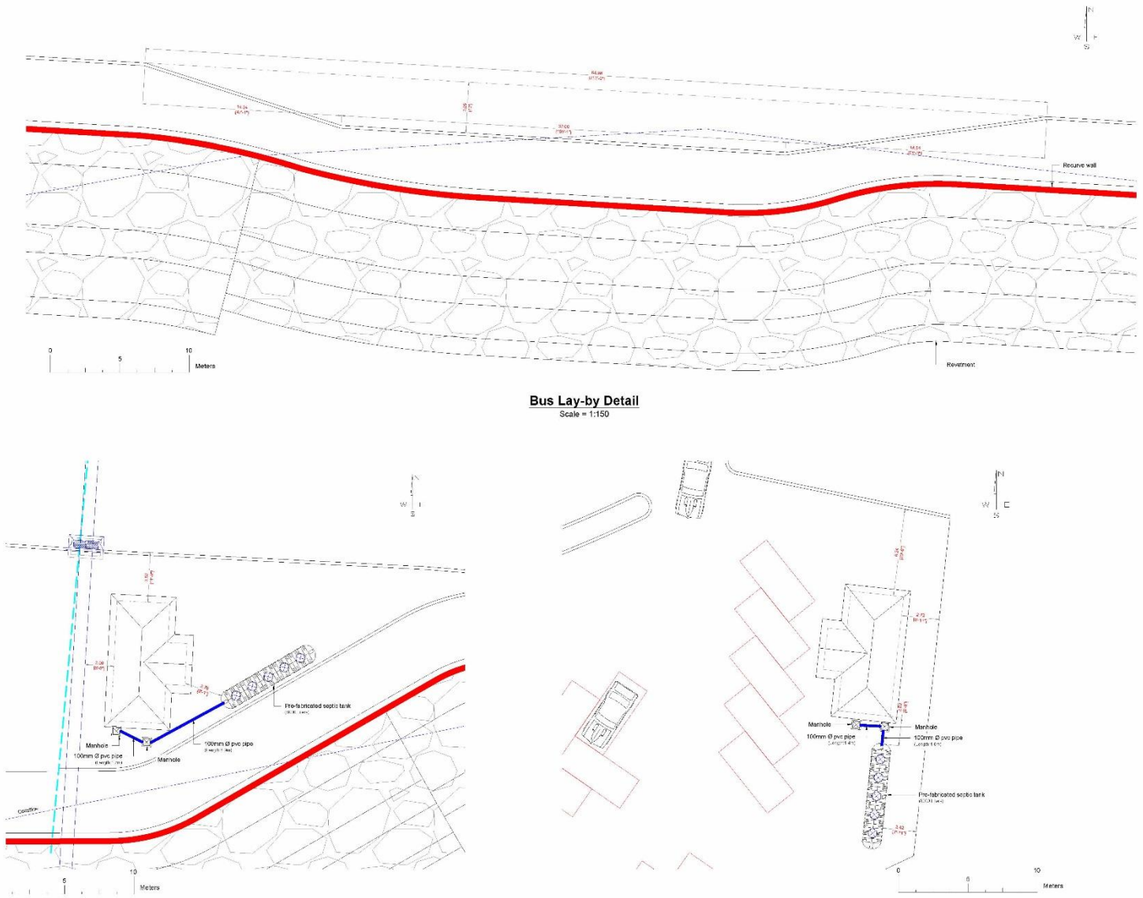

Figure 2-11 Bus Bay and Bathroom Layouts

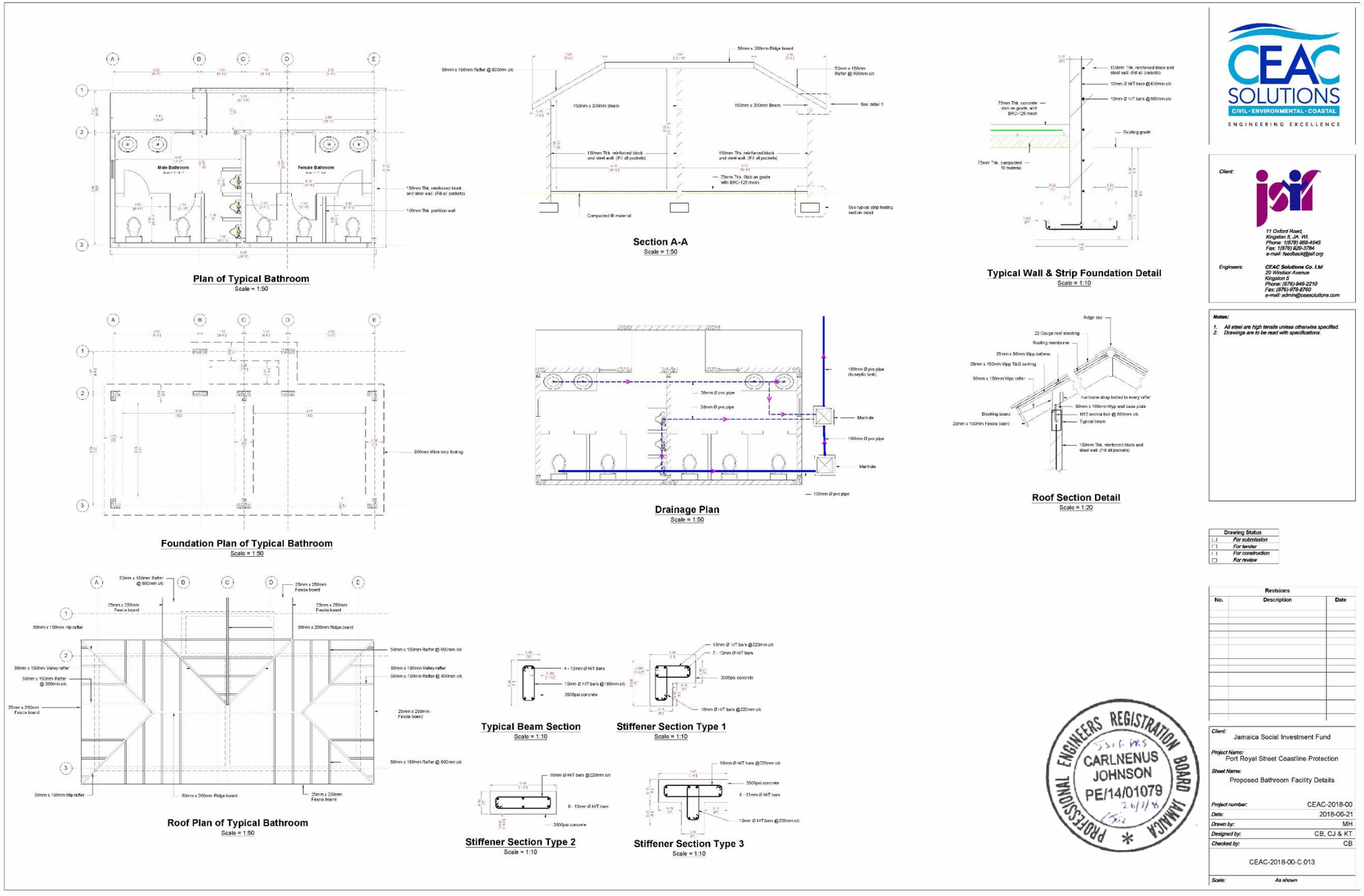

Figure 2-12 Proposed Bathroom Facility Details

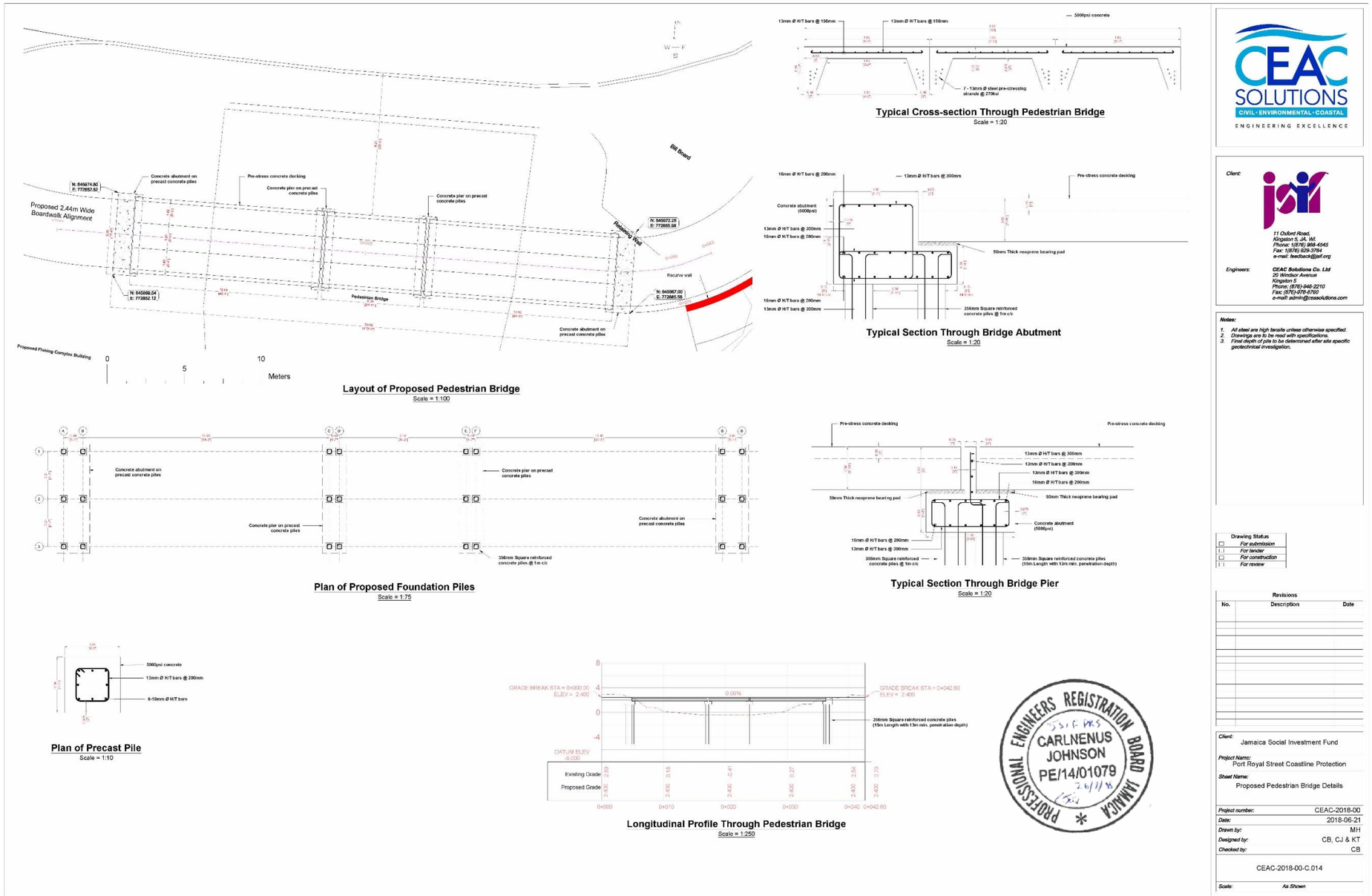

Figure 2-13 Proposed Pedestrian Bridge Details

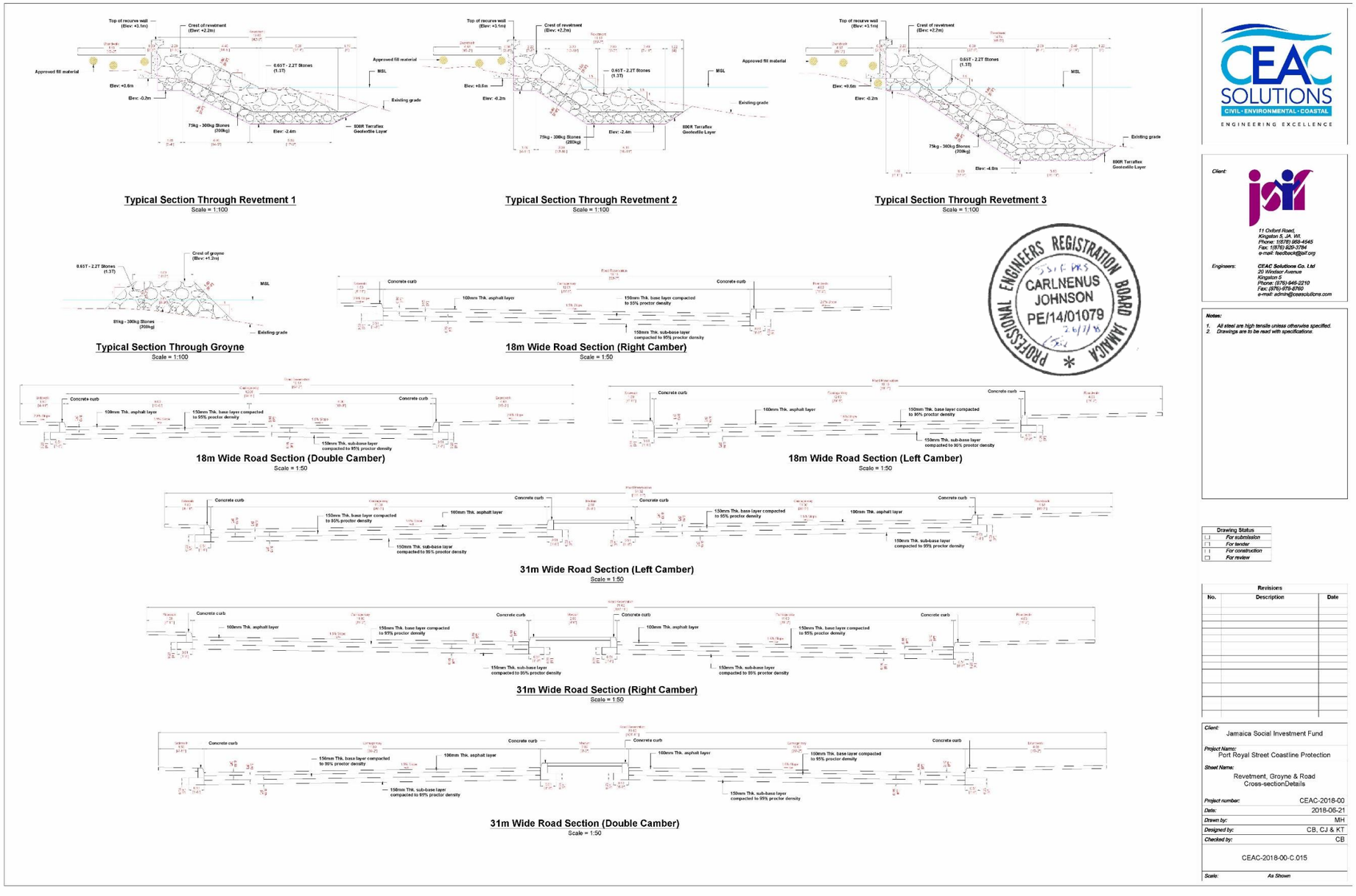

Figure 2-14 Revetment, Groyne and Road Cross-Section Details

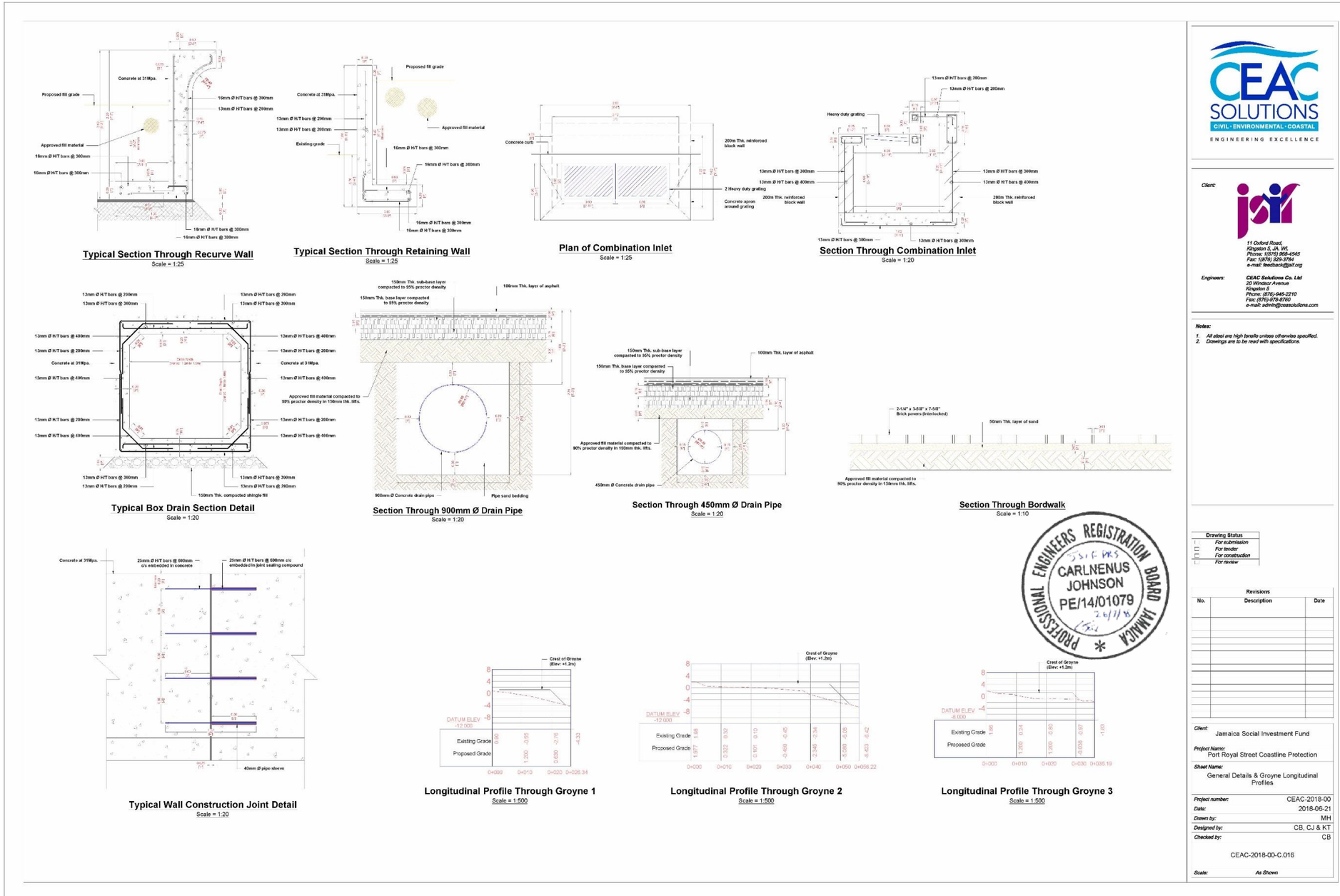

Figure 2-15 General Details and Groyne Longitudinal Profile

2.1 ARMOUR ROCK SIZING

The primary armour stones will range from 0.6 Tons to 2.2 Tons (0.6m – 1.0.m) while the secondary armour stones will vary from 0.08 Tons to 0.3 Tons (0.3m – 0.5m). Both layers of armour are required in order to resist the 100 Year Return Period Design wave conditions (Table 2-1). Sensitivity analysis revealed the maximum size armour units correspond to a peak wave period of 3.9 seconds.

Table 2-1 Summary of empirical design results for Port Royal Street Revetment for 100 year Return Period.

	Crest Armour Stones	Slope Armour Stones	Filter Stones	Toe Armour Stones
M15 (Kg)		647	81	
M50 (Kg)	1264	1264	158	
M85 (Kg)		2185	273	2185

2.2 QUARRIES ASSESSMENT

An assessment was conducted for five (5) quarries which were used by contractors for the supply of core fill and armour stones under the Palisadoes Road Rehabilitation project completed in 2010. The five (5) quarries are located in St. Catherine and St. Thomas as follows:

- St Catherine
  - Hill Run - Armour Stones
  - Paul Mountain - Armour Stones
  - Sure Products (Ferry) - Armour Stones

- St. Thomas
  - Blacks Quarry – Armour Stones
  - Caribbean Aggregates – Core fill

It is important to note that whichever quarry is selected to supply armour stones for the proposed project, the amour stones being used should be washed off properly to avoid adding suspended solids to the marine environment. Washing should not take place at the project site, but at a staging area off site or upon leaving the quarry.

2.2.1 Mogul Transport & Construction (Hill Run Aggregates) – QL1679

This quarry is located in Hill Run, approximately 4.3 km south west of Portmore, St. Catherine and is approximately 22.3 km west of the project area. The quarry has been involved in previous projects such as:

- Highway 2000,
- New Era Homes developments
- Gordon Cay expansion project.

The quarry had a reserve of approximately 404,682 square metres and expected to produce ~~1000~~ tons of armour stone per day.

The unused sections of is estimated to have had reserves amounting to 971,238 cubic metres using a 15% production rate. In other words, the quarry has the potential resource to satisfy this project. The boulders stockpiled on site were irregular in shape which also ideal for the purposes of this project. It should be noted however that some staining as well as weathered rocks were noticeable in the stockpiles.

Samples taken from this quarry were tested for both their water absorption and specific density characteristics. The results showed that the stones met and exceeded the specifications described in the contract. The water absorption coefficient of the stones was found to be 2.8% which is within the 5% specified.

2.2.2 Sure Products Manufacturing Company Limited (Ferry Pen) - QL1950

Sure Products Manufacturing Company Limited has a licensed quarry at Ferry Pen, St. Catherine which is approximately 17.3 km northwest of the project site.

Samples taken from this quarry were tested for both their water absorption and specific density characteristics. The results showed that the rocks surveyed met and exceeded the specifications set out in the contract. The water absorption coefficient was found to be 1.4% which exceeded the 5% maximum coefficient stated.

In summary, the Ferry Pen quarry has stones which are suitably shaped and sized for the works, the majority of which meet the criteria for the primary armour stones in the revetment. The geology of the stones also met and exceeded the specifications set out in the contract. It is important to note however that visual inspection revealed cracking in the rocks and the rock profile making these stones unsuitable for the revetment works.

2.2.3 Black's Quarry

Black's Quarry is located in Bull Bay St. Thomas approximately 5.2 Km north east of the site and was involved in the initial Palisadoes Emergency works. In 2010, the quarry was capable of producing 1500 tonnes per day.

Samples taken from this quarry were tested for both their water absorption and specific density characteristics. The results were in agreement with the initial visual observation as the water absorption coefficient was 5.4% which exceeds the maximum allowable water absorption coefficient specified in the contract of 5%. The stones did meet the criteria for specific density with a value of 2.49% which fall within the range specified (2.45 to 2.5).

In summary, Black's quarry is estimated to have stones which are suitably shaped and sized for the works, however the geology of the stone material is not suitable for these works.

2.2.4 Earthcrane Haulage Ltd. (Caribbean Aggregate Yallahs) – QL No.1225

Caribbean Aggregate is located along the Yallahs River at Albion, St. Thomas, approximately 16.8 km southeast of the site with licenses to quarry only 0.1 hectares of the parcel of land with Volume 606 and Folio 14. The Quarry has been involved in previous projects, the most recent being the Palisadoes Road Rehabilitation project.

Visual inspection of the stones under the crusher onsite revealed that the cut stones were non-plastic and free from clay or any other deleterious material. The stones were semi-rounded however this is less important when the being used as fill material.

In summary, the material at the site is geologically suitable however the gradation tests show that the material was meeting the specifications before crushing. Crushing is therefore unnecessary based on the sample taken from the source. The quarry owner should therefore re-access the source and adjust fill material production methods accordingly.

2.3 EQUIPMENT TO BE USED

The Primary construction equipment to be used on site will comprise of excavator, dump trucks and flat beds to deliver rock and fill to site. Hydraulic excavators with grab attachments will be used for individual placement of rock armour. Additional equipment that may be required are listed in Table 2-2.

Table 2-2 Other equipment that may be required

1	Crane
2	Backhoe
3	Tractor
4	Bulldozer

5	Water tanker
6	Flatbed
7	Dump Truck
8	Compressor
9	Forklift
10	Vibrating marl/Trench roller
11	Plate compactor
12	Diesel hammers
13	Hydraulic hammers
14	Hydraulic press-in equipment
15	Vibratory hammers
16	Piling rigs
17	Drilling rigs

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 PHYSICAL

3.1.1 Climate

Climate data was taken from the Environmental Impact Assessment for the Caribbean Cement Company Limited's Proposed Quarrying and Mineral Processing at Halberstadt Quarry, conducted by EnviroPlanners in January 2018. Climate data used was taken from the weather station at the Norman Manley International Airport (NMIA).

The proposed project area is located only 3 km north of the NMIA and there are no terrain or topographical features that would cause difference in climate between the two locations. This NMIA climate data is therefore be considered representative of the proposed project site.

Table 3-1 summarizes temperature, rainfall and relative humidity values over the period 1951 -1980. Average minimum temperatures range from a low of 22.3 °C in January and February, to a high of 25.6 °C in July. Average maximum temperatures range from a low of 29.6 °C in February, to a high of 31.9 °C in August. Average rainfall is at its highest in May to June and September to October, with October having the highest average monthly rainfall (167 mm) and rain days (10). Relative humidity at 7am had an annual mean of 77.3%, while at 1pm had an annual mean of 64.4%.

Table 3-2 summarizes the wind speed and direction data for the period 1981 to 1990. The data shows the dominant wind direction is from the east with an average wind speed of 14.8 knots (7.61 m/s).

Table 3-1 Averaged temperature, rainfall and relative humidity data for the NMIA from 1951 - 1980

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual Mean
Maximum Temp. (°C)	29.8	29.6	29.8	30.3	30.8	31.2	31.7	31.9	31.7	31.3	31.1	30.5	30.8
Minimum Temp. (°C)	22.3	22.3	22.9	22.6	24.7	25.3	25.6	25.3	25.3	24.8	24.1	23.1	24.0
Rainfall (mm)	18	16	14	27	100	83	40	81	107	167	61	31	62.1
No. of rain days	4	4	3	5	5	6	4	6	8	10	6	4	5.4
Rel. Hum. 7am (%)	80	78	77	77	76	73	76	76	78	80	79	78	77.3
Rel. Hum. 1pm (%)	61	62	64	60	66	65	65	68	68	65	65	64	64.4
Sunshine (Hours)	8.3	8.6	8.5	8.7	8.2	7.7	8.2	8	7.2	7.4	7.8	7.8	8.0

Table 3-2 Average Wind Speed and Direction for the period 1981 - 1990

	WIND DIRECTION																
Wind speed (Knots)	NNE 020-030	NE 040-050	ENE 060–070	E 080–100	ESE 110-120	SE 130-140	SSE 150-160	S 170-190	SSW 200-210	SW 220-230	WSW 240-250	W 260-280	WNW 290-300	NW 310-320	NNW 330-340	N 350-010	All DIR
0																	12792
1 – 3	102	47	61	151	66	60	85	143	88	84	64	290	556	644	798	438	3677
4 – 6	373	194	346	796	431	371	545	1035	457	297	281	697	1435	2253	3486	2104	15101
7 – 10	536	311	857	2470	1434	1027	1093	1429	578	279	216	545	866	1801	3787	3020	20249
11 - 16	169	121	868	5520	3675	1714	751	257	87	59	31	79	96	255	809	930	15421
17 - 21	35	14	265	3734	3322	1475	327	45	10	4	2	6	8	53	108	97	9505
22 - 27	15	0	59	2786	3254	1509	238	12	3	1	1	3	5	54	51	70	8061
28 - 33	7	0	8	594	520	224	19	7	1	0	1	0	5	24	31	52	1493
34 - 40	0	0	0	7	8	10	3	3	0	0	1	0	1	15	0	13	61
41 - 47	0	0	1	1	0	1	4	0	0	0	0	0	0	0	0	0	7
48 - 55	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
56 - 63	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	3
>63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Average Speed	18.54	19.09	18.29	14.80	13.67	14.32	17.74	19.46	19.16	18.11	18.03	16.99	16.59	17.54	18.54	18.89	13.94

3.1.2 Water Quality

3.1.2.1 Methodology

Two (2) marine water quality sampling exercises were conducted at eight (8) stations on May 2nd and 11th, 2018. Weather conditions were fair and sunny during sampling with calm seas. Their locations are listed in Table 3-3 and depicted in Figure 3-1.

Temperature, conductivity, salinity, dissolved oxygen, turbidity, total dissolved solids and pH were collected *in situ* using a Hydrolab water quality multi probe meter. Whole water samples were collected in pre-sterilized bottles, stored on ice and taken to Caribbean Environmental Testing and Monitoring Services Limited (CETMS Ltd.) for analysis of Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), phosphates, nitrates, faecal coliform bacteria and enterococcus bacteria. Each of the water quality samples was collected at a depth of approximately 0.5 m; this was facilitated with the use of a boat. The Hydrolab calibration certificate can be seen in Appendix 1.

Table 3-3 Coordinates of water sampling stations

STATION #	LOCATION (JAD2001)	
	NORTHINGS	EASTINGS
1	646048.795	772510.204
2	646061.267	772685.892
3	645929.644	772869.953
4	645611.177	772865.820
5	646081.211	773139.642
6	646061.491	773350.770
7	646013.620	773596.911
8	646051.251	773804.870

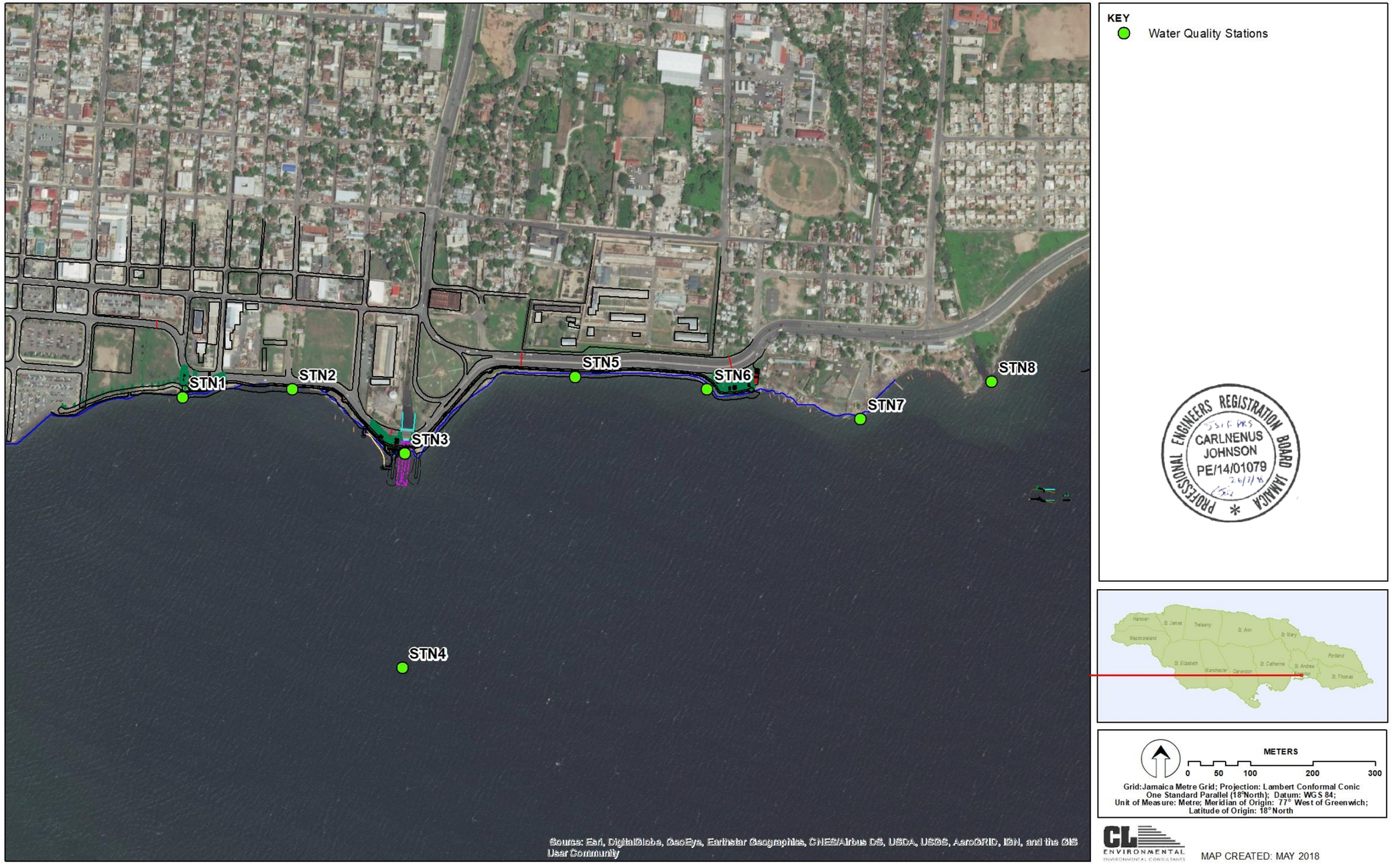

Figure 3-1 Marine water quality sampling locations

3.1.2.2 Results

Table 3-4 shows the average physical data while Table 3-5 shows the average biological and chemical data for the stations sampled.

Table 3-4 Average physical water quality data

Stn.	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)
1	29.10	53.52	35.47	8.13	5.92	2.68	34.30
2	29.00	53.70	35.47	8.12	5.56	4.65	33.98
3	29.11	53.43	35.35	8.05	4.42	9.28	34.20
4	28.85	53.72	35.57	8.16	6.33	3.74	34.39
5	28.97	53.64	35.50	8.12	5.46	4.58	34.30
6	29.13	53.40	35.39	8.13	5.99	6.43	34.25
7	28.95	53.70	35.57	8.11	5.80	16.00	34.38
8	29.18	53.59	35.53	8.13	6.11	12.43	34.34
NEPA Std.	-	-	-	***8 – 8.4***	-	-	-

Table 3-5 Average biological and chemical water quality data

STN.	BOD (mg/l)	TSS (mg/l)	NITRATE (mg/l)	PHOSPHATE (mg/l)	Faecal Coliform (mpn/100ml)	Enterococcus (mpn/100ml)
1	68.0	4.0	1.85	0.19	770	49
2	94.5	8.5	1.70	0.91	10500	>1600
3	125.0	50.0	2.75	5.59	16000	>1600
4	85.5	4.5	1.45	0.09	95	<1.8
5	128.0	21.5	2.65	1.15	16000	>1600
6	79.5	7.5	1.80	0.32	16000	>1600
7	61.5	6.0	1.50	0.73	9750	1600
8	74.0	5.5	1.15	0.37	8650	240
NEPA Std.	***1.16***	-	***0.007-0.014***	***0.001-0.003***	***13***	-

NB. Numbers in red are non-compliant with the NEPA standard/guideline

TEMPERATURE

Temperature values varied across the stations ranging from 28.85 – 29.18 ºC. Highest temperatures were obtained at station 8 whereas the lowest was obtained at station 4. Higher temperatures were observed at stations closer to shore due to various sources of land run-off in the form of drains, gullies and sewage outfall pipes. Station 4, located furthest from shore, had the lowest temperature values. The water temperatures recorded were expected in a tropical marine area influenced by the Trade Winds (≈27 –30 ºC).

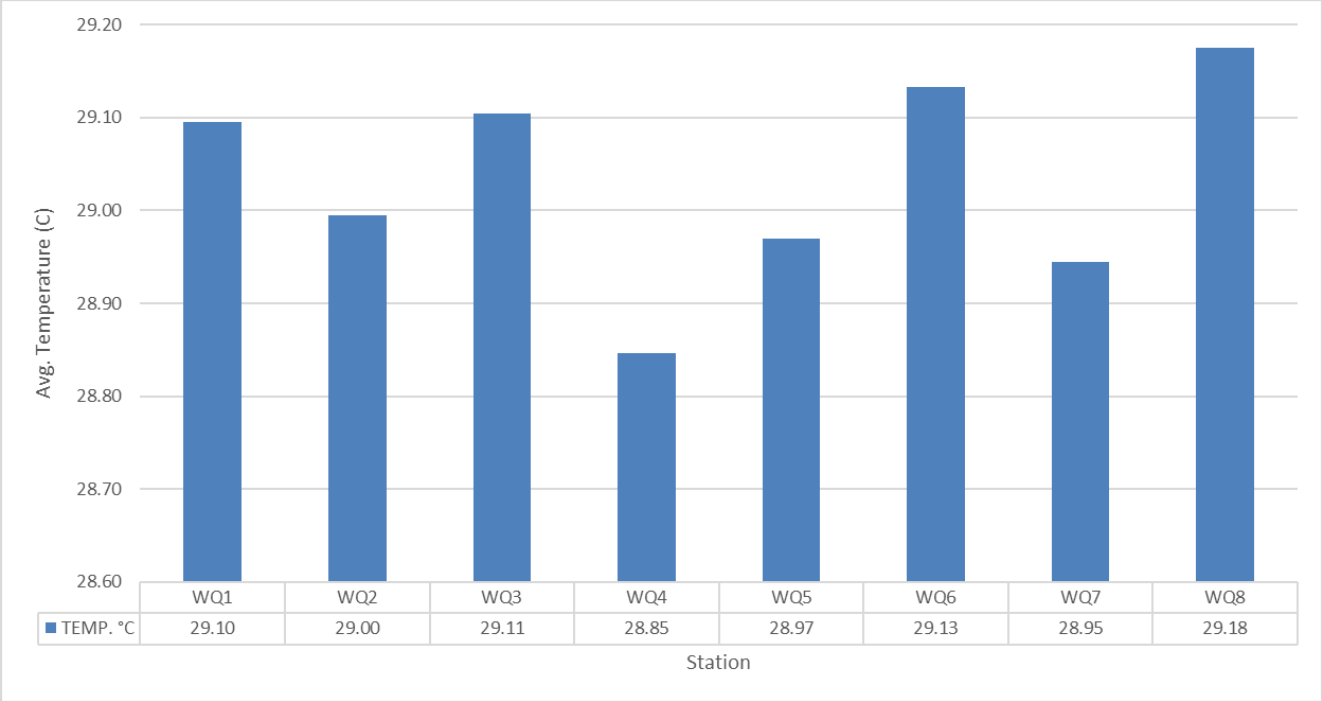

Figure 3-2 Temperature values at the various stations

SPECIFIC CONDUCTIVITY (SPC)

Conductivity varied across the stations ranging from 53.40 – 53.72 mS/cm. Highest specific conductivity was obtained at station 4 and the lowest specific conductivity was obtained at station 6. Lower conductivities were observed at stations closer to shore due to various sources of land run-off and freshwater input in the form of drains, gullies and sewage outfall pipes. Station 4, located furthest from shore, had the highest conductivity values.

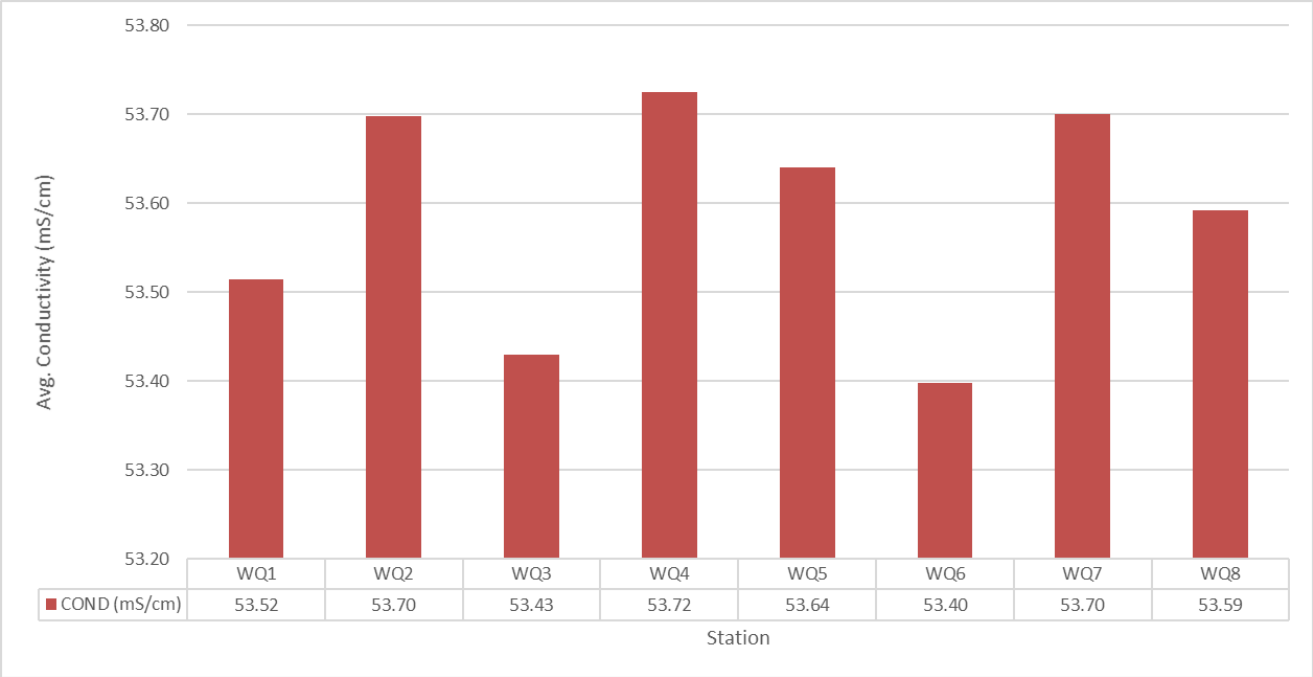

Figure 3-3 Conductivity values at the various stations

SALINITY

Salinity varied across the stations ranging from 35.35 – 35.57 ppt. Station 4 had the highest salinity values whereas station 3 had the lowest values. Lower salinity values were observed at stations closer to shore due to various sources of land run-off and freshwater input in the form of drains, gullies and sewage outfall pipes. Station 4, located furthest from shore, had the highest salinity values.

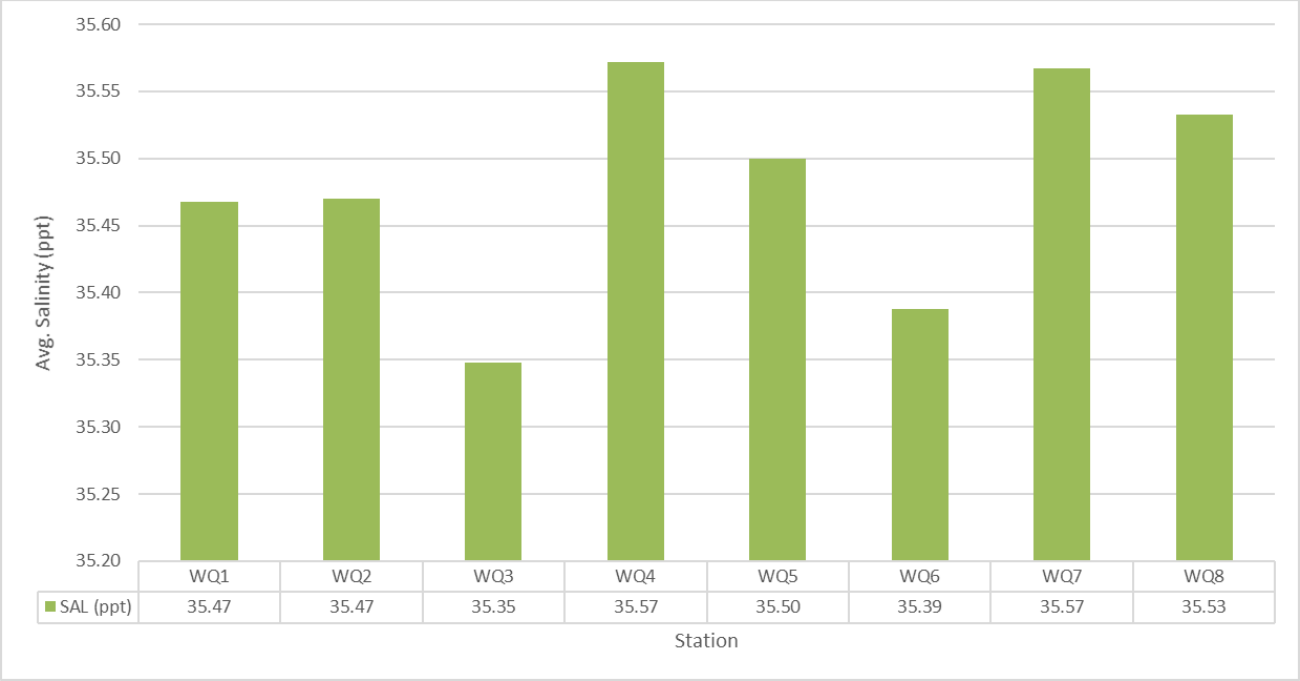

Figure 3-4 Salinity values at the various stations

PH

The pH values showed minor variation across the stations ranging from 8.05 - 8.16. The highest pH values were obtained at station 4 located furthest from shore, whereas the lowest pH obtained at station 3. In marine waters, pH levels tend to range between 8-9 pH units. All pH values were compliant with the NEPA pH standard of 8 – 8.4 pH units. Higher pH indicates the possibility of photosynthesis changing the pH within the zone.

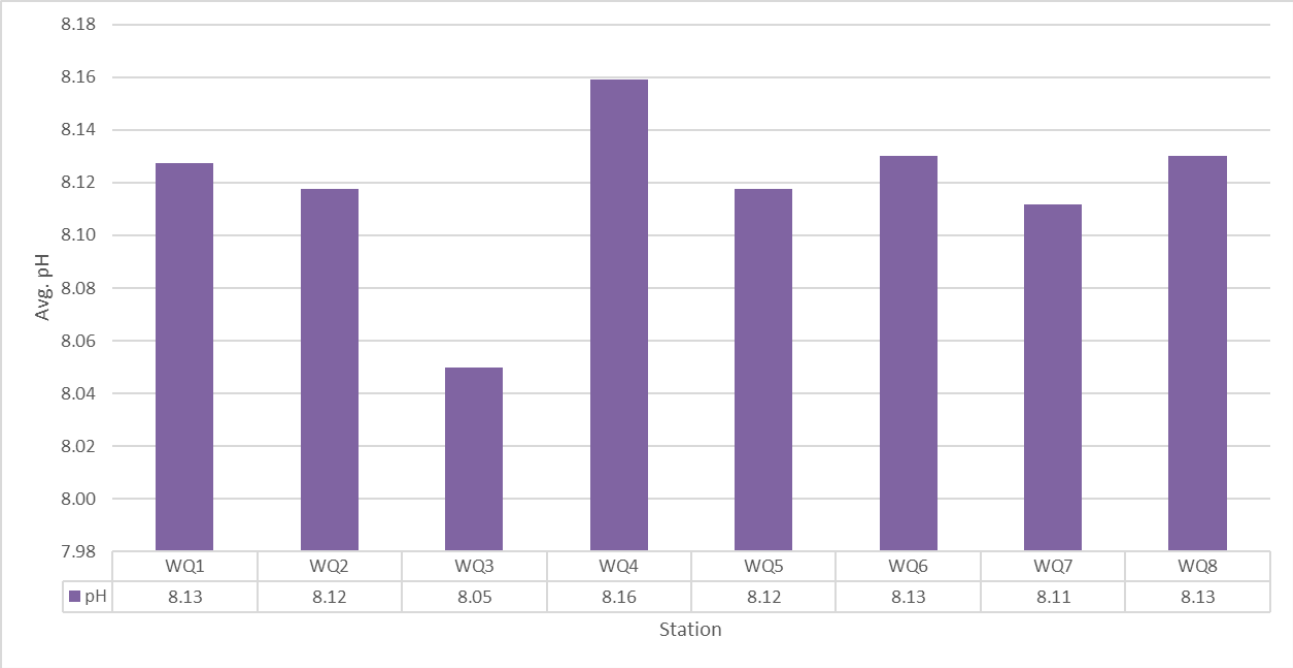

Figure 3-5 pH values at the various stations

DISSOLVED OXYGEN (DO)

Dissolved oxygen values varied across the stations ranging from 4.42 – 6.33 mg/l. Station 4 had the highest dissolved oxygen values as it was located furthest from the shoreline and less prone to increase oxygen demand from bacteria in the water compared to stations closer to shore located by sources of land run-off (drains, gullies, sewage outfall pipes). Stations closer to shore would, on average, have a lower dissolved oxygen content due to increased oxygen demand from higher bacteria concentrations. Dissolved oxygen levels were all within acceptable levels (>4 mg/l) and above the level that would be considered detrimental to aquatic life (≤ 3 mg/l).

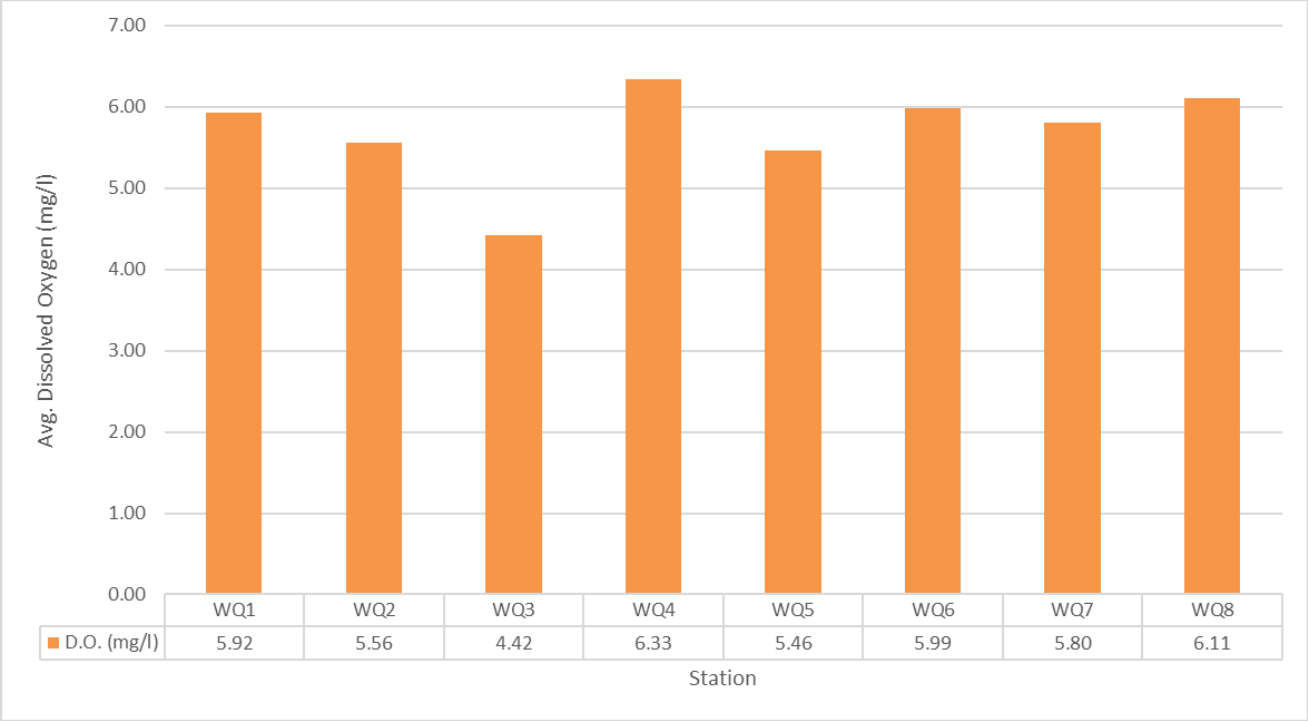

Figure 3-6 Dissolved oxygen values at the various stations

TURBIDITY

Turbidity varied across the stations ranging from 2.68 – 16.0 NTU. The highest turbidity was obtained at station 7 by the mouth of a drain, while the lowest was obtained at Station 1. Land run-off also has the ability to affect turbidity values especially those closest to shore. Station 1 and Station 4 had the lowest turbidity values. Station 4 is located furthest from shore and isn't impacted as much as the other stations located at the mouth of drains/gullies/sewage outfall pipes.

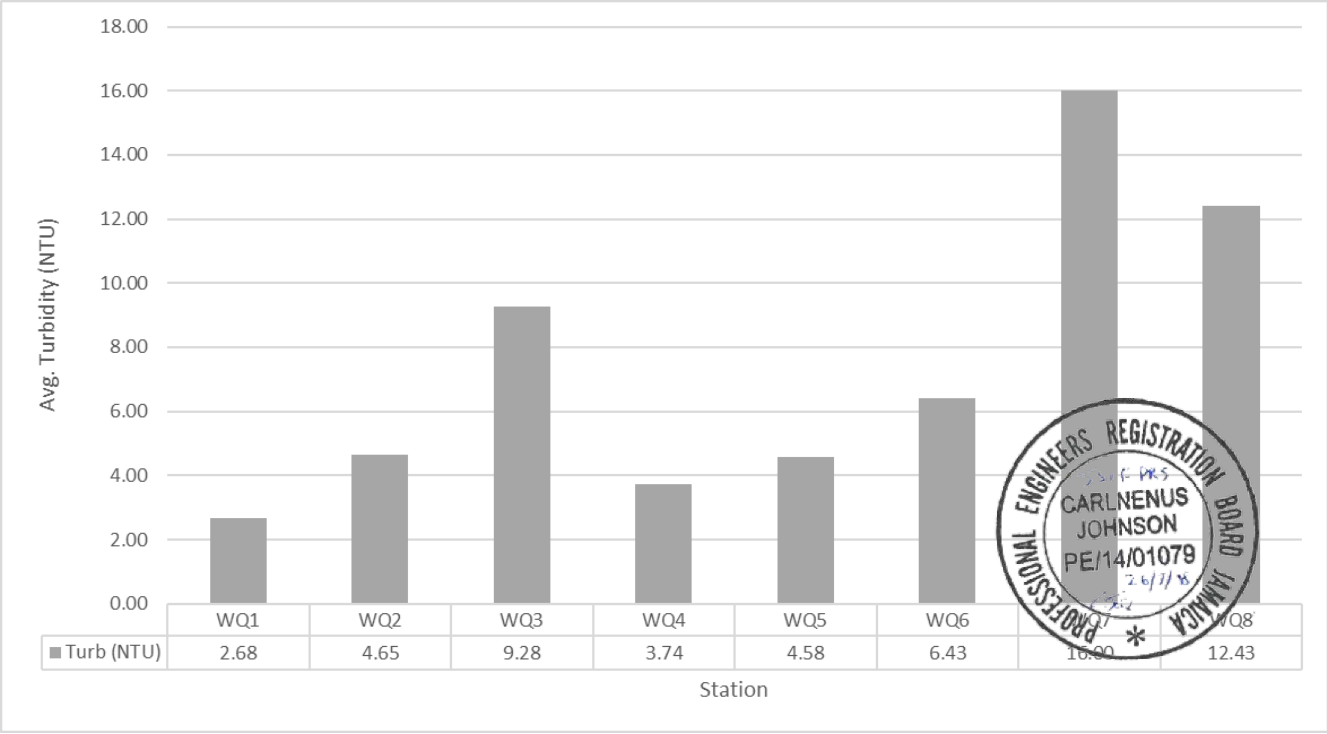

Figure 3-7 Turbidity values at the various stations

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TOTAL DISSOLVED SOLIDS (TDS)

The TDS values varied little across the stations ranging from 33.98 – 34.39 g/l. Highest values were obtained from station 4 located furthest from shore whereas the lowest values were obtained at station 2.

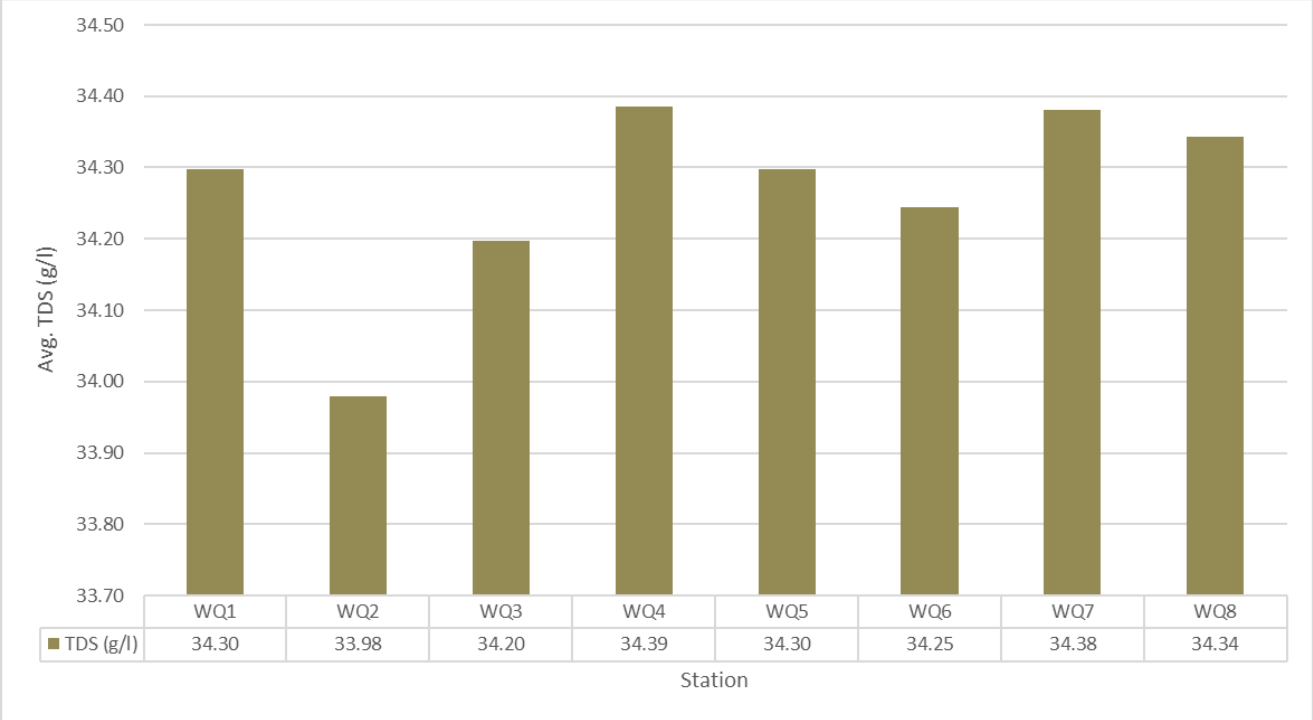
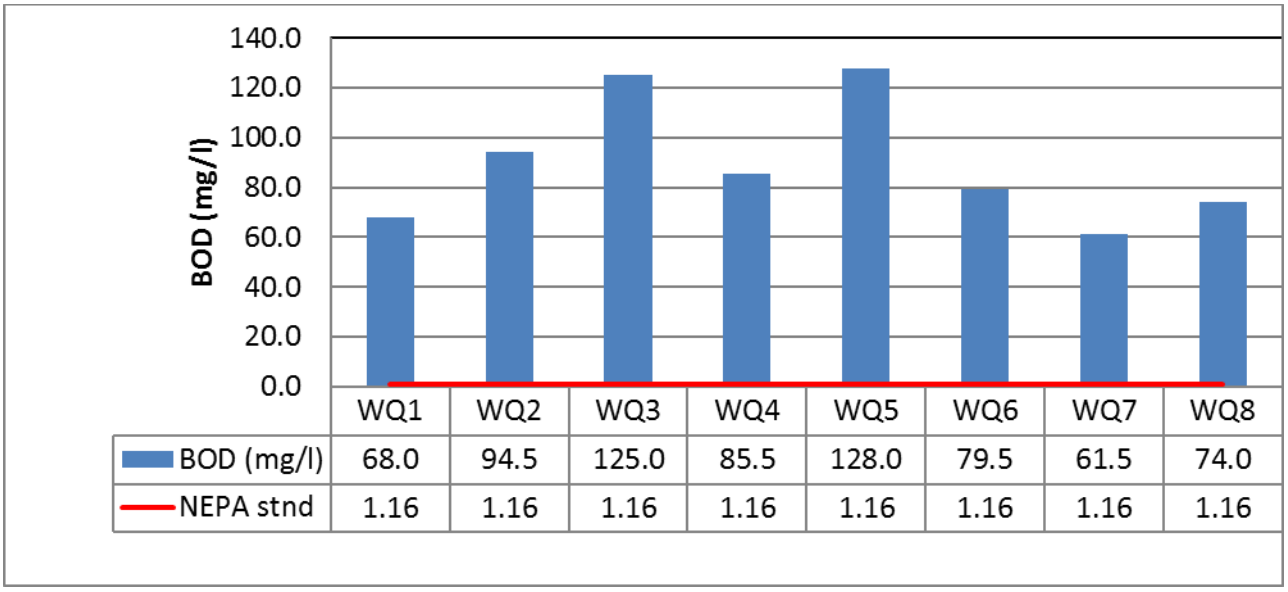


Figure 3-8 TDS values at the various stations

BIOCHEMICAL OXYGEN DEMAND

Average BOD values varied across the stations ranging from 61.5 – 128 mg/l. All Stations had BOD values which were elevated and non-compliant with the NEPA BOD Standard of 1.16 mg/l. Stations 3 (located at the mouth of the Barnes gully) and 5 (sewage outfall pipe in the vicinity of the Tower Street Adult Correctional Facility) had the highest BOD values. The BOD is the amount of dissolved oxygen (D.O.) needed by microorganisms (bacteria etc.) to breakdown organic material in the water sample. The higher the BOD, the more D.O. needed and/or higher concentration of microorganisms in the water, and the less D.O. available.



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8
BOD (mg/l)	68.0	94.5	125.0	85.5	128.0	79.5	61.5	74.0
NEPA stnd	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16

Figure 3-9 BOD values at the various stations

TOTAL SUSPENDED SOLIDS

TSS concentrations were elevated and highest at Stations 3 (located at the mouth of the Barnes gully) and 5 (sewage outfall pipe in the vicinity of the Tower Street Adult Correctional Facility). TSS concentrations at the other locations were all less than 10 mg/l, indicating clear water.

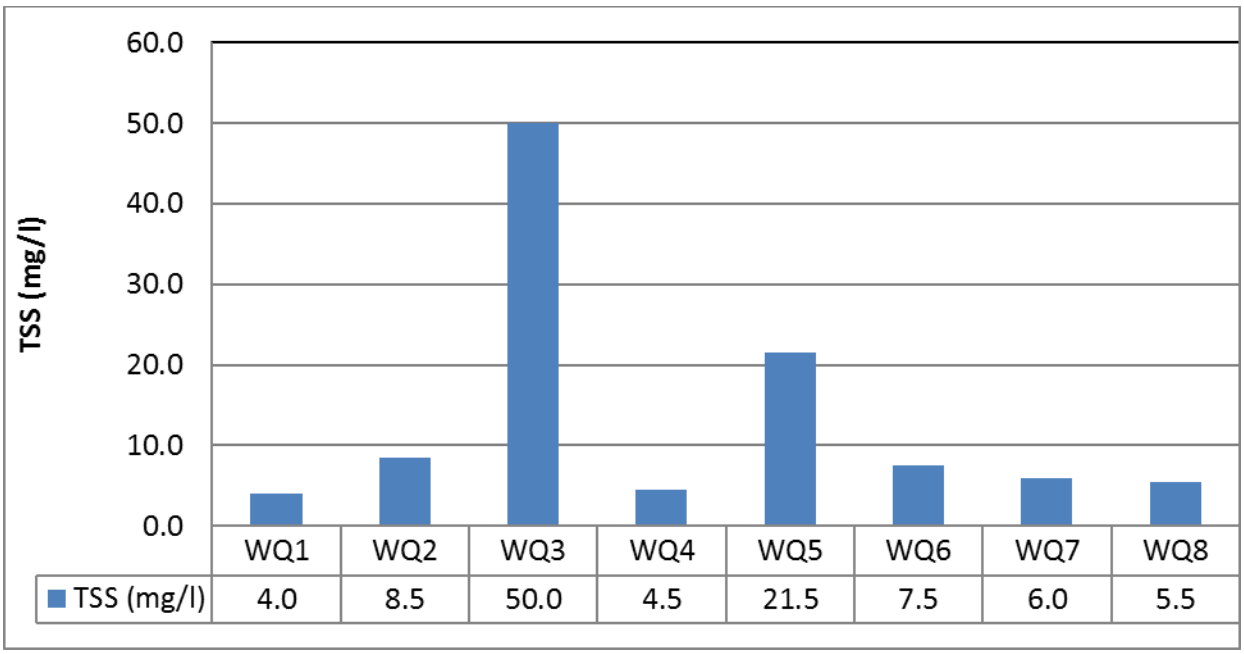
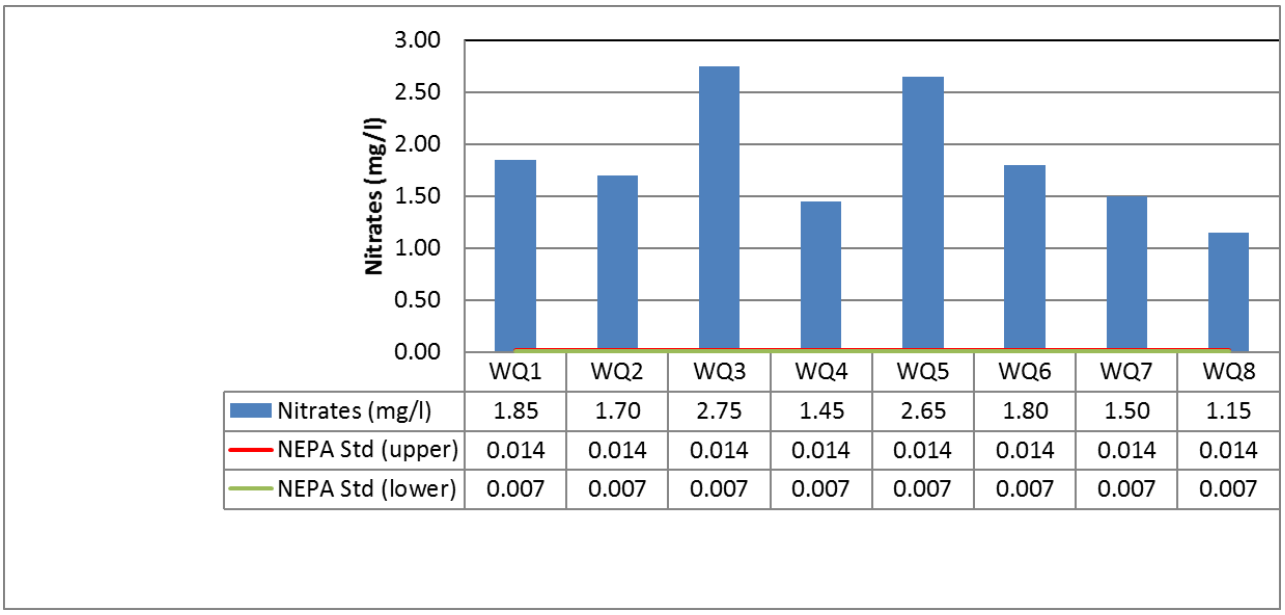


Figure 3-10 TSS values at the various stations

NITRATE

Nitrate values varied across the stations ranging from 1.15 – 2.75 mg/l. The lowest nitrate values were reported at station 8 whereas the highest value was reported at stations 3 and 5. Station 3 is located at the mouth of the Barnes gully and Station 5 is located at the mouth of the sewage outfall pipe in the vicinity of the Tower Street Adult Correctional Facility. All stations were above the NEPA standard for Seawater for nitrates.

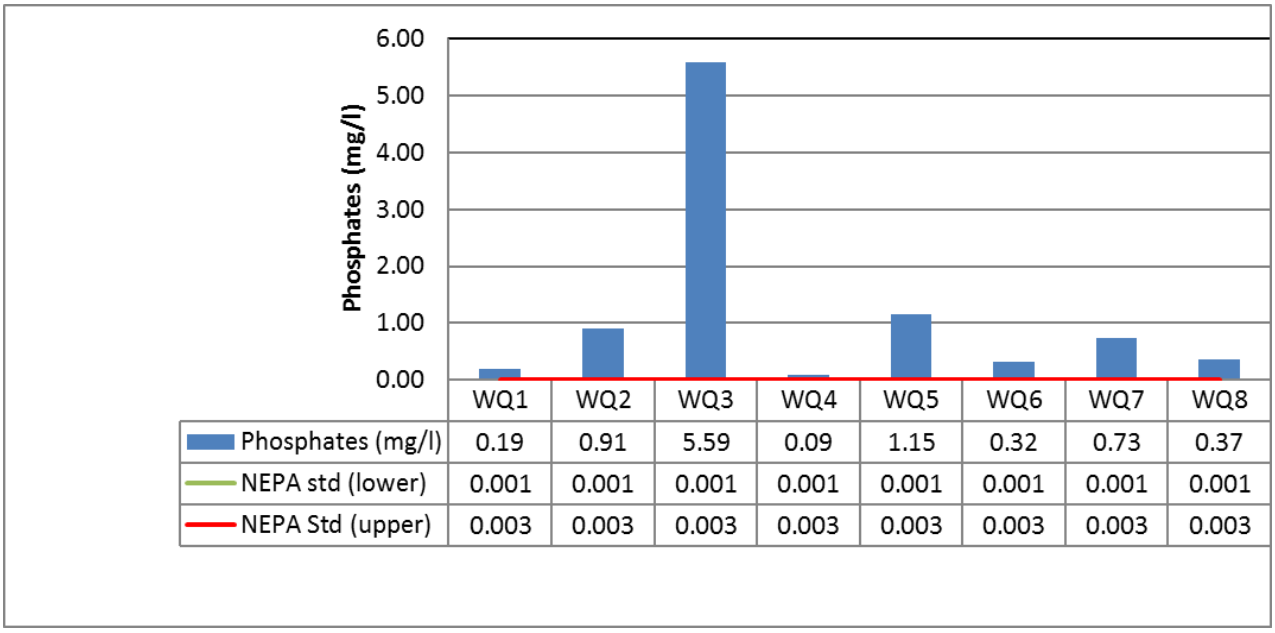


	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8
Nitrates (mg/l)	1.85	1.70	2.75	1.45	2.65	1.80	1.50	1.15
NEPA Std (upper)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
NEPA Std (lower)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007

Figure 3-11 Nitrate values at the various stations

PHOSPHATE

Phosphate values varied across the stations ranging from 0.09 – 5.59 mg/l. The lowest phosphate values were reported at station 4, located furthest from shore and least affected by point sources of pollution. The highest phosphate value was observed at station 3 located at the mouth of the Barnes gully. All stations were above the NEPA standard for Seawater for phosphates.

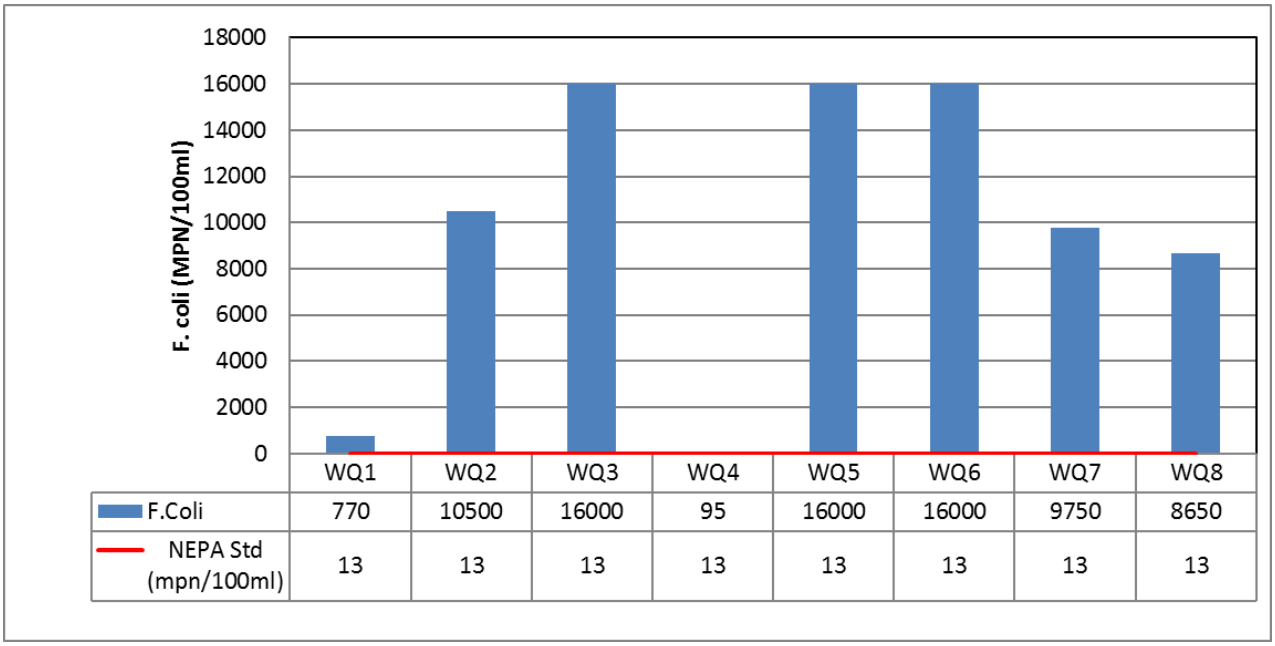


	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8
Phosphates (mg/l)	0.19	0.91	5.59	0.09	1.15	0.32	0.73	0.37
NEPA std (lower)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEPA Std (upper)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Figure 3-12 Phosphate values at the various stations

FAECAL COLIFORM

Faecal coliform (F. Coli) values at all stations were non-compliant with the NEPA marine coliform standard of 13 MPN/100ml. Stations 3, 5 and 6 had the highest coliform values (>16,000 MPN/100ml), while Station 4 had the lowest coliform value of 95 MPN/100ml. Station 4 is located furthest from shore and least affected by point sources of pollution while all other Stations are located at the discharge points of drains/gullies/sewage outfall pipes, hence the elevated faecal coliform values at these stations.



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8
F.Coli	770	10500	16000	95	16000	16000	9750	8650
NEPA Std (mpn/100ml)	13	13	13	13	13	13	13	13

Figure 3-13 Faecal coliform values at the various stations

ENTEROCOCCUS

Enterococcus bacteria values ranged from a low of <1.8 MPN/100ml to a high of >1600 MPN/100ml. Stations 2, 3, 5, 6 and 7 had the highest enterococcus values (>1600 MPN/100ml), while Station 4 had the lowest value of <1.8 MPN/100ml. Station 4 is located furthest from shore and least affected by point sources of pollution while all other Stations are located at the discharge points of drains/gullies/sewage outfall pipes, hence the elevated enterococcus values at these stations.

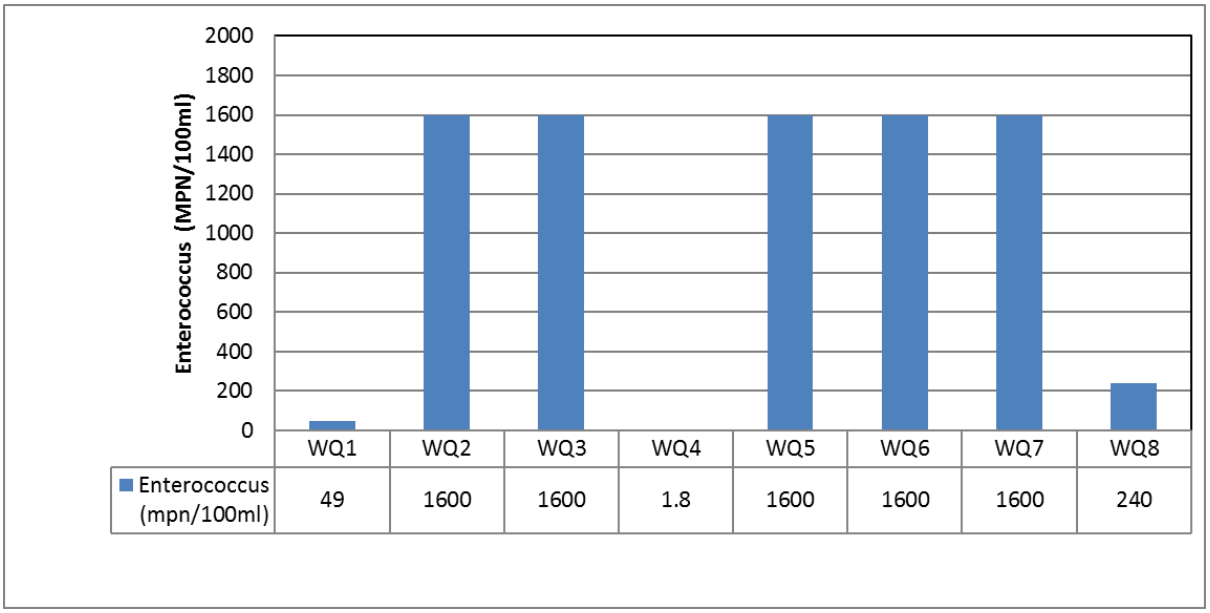


Figure 3-14 Enterococcus bacteria values at the various stations

3.1.3 Noise

3.1.3.1 Methodology

Noise level readings were taken on Wednesday May 2nd, 2018 using Quest Technologies SoundPro DL Type 1 hand held sound level meters with real time frequency analyser setup in an outdoor monitoring kit. The octave band analysis was conducted concurrently with the noise level measurements. Measurements were taken in the third octave which provided thirty-three (33) octave bands from 12.5 Hz to 20 kHz (low, medium and high frequency bands).

The noise meters were calibrated pre and post noise assessment by using a Quest QC - 10 sound calibrator (Appendix 2). The meters were programmed using the Quest suite Professional II (QSP II) software to collect third octave, average sound level (Leq) over the period, Lmin (The lowest level measured during the assessment) and Lmax (The highest level measured during the assessment) every ten seconds.

Average noise levels over the period were calculated within the QSP II software using the formula;

$$\textit{Average dBA} = 20 \log 1/N \quad \sum_{j=1}^{N} 10^{(Lj/20)}$$

where N = number of measurements, L_j = the jth sound level and j = 1, 2, 3 .... N.

Three (3) minute noise readings were taken at each location and programmed to collect data every second. Noise readings were taken at each location at various times throughout the day. The first set of readings were taken during the morning (between 8:35am and 9:54am); the second set was taken in the early afternoon (between 1:04pm and 2:03pm); and the third set was taken in the late afternoon (between 4:20pm and 5:09pm). Table 3-6 and Figure 3-15 lists and shows the locations of the noise monitoring stations. A windscreen (sponge) was placed over the microphone to prevent measurement errors due to noise caused by wind blowing across the microphone. The microphone of the meters was at a height of approximately 1.5m above ground. There were no vertical reflecting surfaces within 3 m (10 feet) of the microphone.

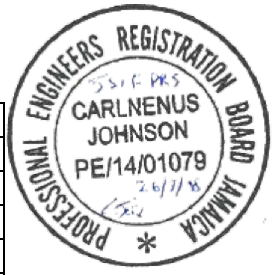


Table 3-6 Noise monitoring location coordinates

STATION #	LOCATION (JAD2001)	
	NORTHINGS	EASTINGS
1	646089.222	772509.905
2	646063.122	772505.389
3	646064.628	772518.430
4	646058.104	772532.483
5	646075.677	772530.481
6	646038.310	772770.846
7	645965.588	772848.621

8	646083.770	773001.155
9	646060.532	773420.340

Figure 3-15 Locations of noise monitoring stations

3.1.3.2 Results

Table 3-7, Table 3-8 and Table 3-9 shows the noise data collected during the morning session, early afternoon session and late afternoon session respectively. Stations 1, 5, 6 and 8 were the only stations which were non-compliant with the NEPA daytime noise guideline during all three monitoring sessions. Stations 1 and 5 are located on the site of the construction of the new Ministry of Foreign Affairs building, hence elevated noise levels are expected here. Stations 6 and 8 are located along the main road, closer in proximity to the road than that of Stations 7 and 9. Most of the noise during all monitoring sessions can be attributed to vehicular traffic along the main road, while noise at Stations 1 - 5 can be attributed not only to vehicular traffic, but also to noise from construction site activity. Station 7 is the only station which was compliant with the NEPA daytime noise guideline during all three monitoring sessions.

Table 3-7 Comparison of noise levels at the various stations during morning session

Stn.#	Zone	Time	Average Noise Level (dBA)	Min (dBA)	Max (dBA)	Geometric Centre Frequency (Hz)	Octave Frequency Range (Hz)
1	Commercial	8:35 – 8:38am	72.4	55.1	80.2	50	45-56
2	Commercial	8:59 – 9:02am	59.9	53.6	68.6	80	71-90
3	Commercial	9:03 – 9:06am	59.7	51.2	67.3	63	56-71
4	Commercial	8:49 – 8:52am	59.9	51.7	69.0	63	56-71
5	Commercial	8:43 – 8:46am	79.9	59.2	96.2	160	143-180
6	Commercial	9:46 – 9:49am	67.4	50.5	75.7	50	45-56
7	Commercial	9:54 – 9:57am	57.0	49.9	65.3	40	36-45
8	Commercial	9:35 – 9:38am	70.6	50.1	80.9	80	71-90
9	Commercial	9:24 – 9:27am	54.7	45.2	63.9	50	45-56
NEPA Daytime Guideline	**Commercial**	**7am – 10pm**	***65***	**-**	**-**	**-**	**-**

N.B. Values in red are non-compliant with the NEPA daytime noise guideline

Table 3-8 Comparison of noise levels at the various stations during early afternoon session

Stn.#	Zone	Time	Average Noise Level (dBA)	Min (dBA)	Max (dBA)	Geometric Centre Frequency (Hz)	Octave Frequency Range (Hz)
1	Commercial	2:04 – 2:07pm	67.5	56.8	73.8	12.5	11-14
2	Commercial	1:52 – 1:55pm	59.9	54.5	67.8	12.5	11-14
3	Commercial	1:57 – 2:00pm	60.6	56.4	67.5	12.5	11-14
4	Commercial	1:38 – 1:41pm	65.5	62.2	68.0	12.5	11-14
5	Commercial	1:44 – 1:47pm	81.3	59.9	98.8	200	178-224
6	Commercial	1:28 – 1:31pm	75.0	56.4	91.7	200	178-224
7	Commercial	1:20 – 1:23pm	62.5	58.9	70.2	12.5	11-14
8	Commercial	1:12 – 1:15pm	69.2	57.9	77.1	12.5	11-14
9	Commercial	1:04 – 1:07pm	67.3	62.9	74.0	12.5	11-14
NEPA Daytime Guideline	**Commercial**	**7am – 10pm**	***65***	-	-	-	-

N.B. Values in red are non-compliant with the NEPA daytime noise guideline

Table 3-9 Comparison of noise levels at the various stations during late afternoon session

Stn.#	Zone	Time	Average Noise Level (dBA)	Min (dBA)	Max (dBA)	Geometric Centre Frequency (Hz)	Octave Frequency Range (Hz)
1	Commercial	5:09 – 5:12pm	81.5	66.1	99.4	1250	1114-1403
2	Commercial	5:04 – 5:07pm	71.1	55.2	82.0	63	56-71
3	Commercial	5:00 – 5:03pm	66.4	55.8	76.6	63	56-71
4	Commercial	4:50 – 4:53pm	63.2	56.1	79.5	50	45-56
5	Commercial	4:56 – 4:59pm	68.5	58.5	77.0	31.5	28-35
6	Commercial	4:43 – 4:46pm	67.3	48.7	78.2	80	71-90
7	Commercial	4:36 – 4:39pm	61.8	55.0	74.4	63	56-71
8	Commercial	4:29 – 4:32pm	71.3	56.0	83.9	80	71-90
9	Commercial	4:20 – 4:23pm	64.9	59.5	70.8	40	36-45
NEPA Daytime Guideline	**Commercial**	**7am – 10pm**	***65***	-	-	-	-

N.B. Values in red are non-compliant with the NEPA daytime noise guideline

3.1.4 Ambient Particulates (PM10 & PM2.5)

Coarse particles are airborne pollutants that fall between 2.5 and 10 micrometres in diameter. Fine particle are airborne pollutants that fall below 2.5 micrometres in diameter. Sources of coarse particles include crushing or grinding operations, and dust stirred up by vehicles traveling on roads. Sources of fine particles include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

3.1.4.1 Methodology

PM10 and PM2.5 particulate sampling was conducted for 24 hours, using Airmetrics Minivol Tactical Air Samplers. Each of the two PM10 sampling exercises were conducted for 24 hours each on May 23rd – 24th, and May 25th – 26th, 2018. Each of the two PM2.5 sampling exercises were conducted for 24 hours each on May 16th – 17th, and May 24th – 25th, 2018. The locations are listed in Table 3-10 and illustrated in Figure 3-16.

Table 3-10 Particulate (PM10 and PM2.5) monitoring locations

STATION #	LOCATION (JAD2001)	
	NORTHINGS	EASTINGS
1	646095.540	772539.550
2	646069.170	772768.120
3	646105.281	773089.091
4	646132.211	773401.905

Plate 1 Particulate sampler at Station 1

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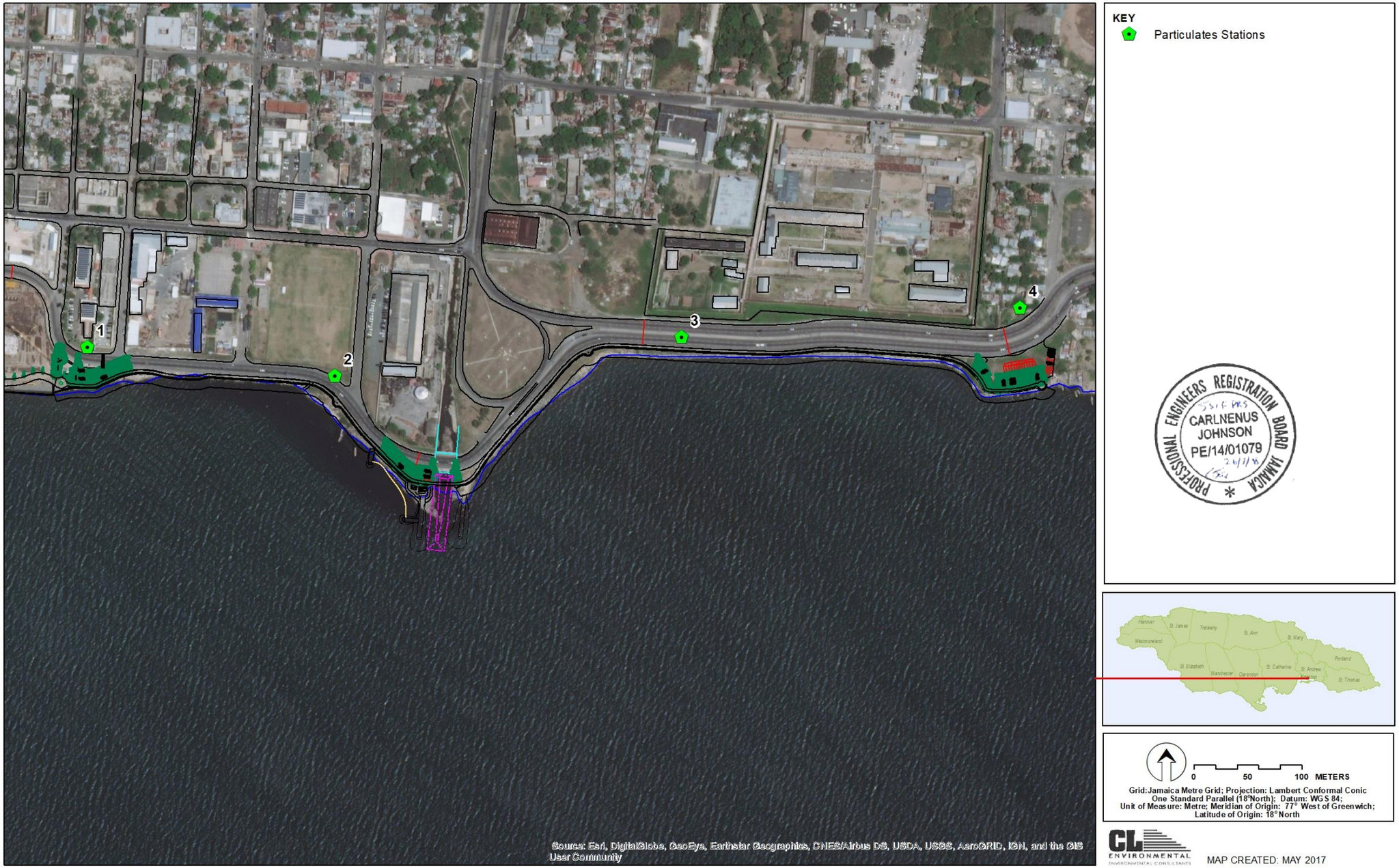

Figure 3-16 Particulate monitoring sampling locations

3.1.4.2 PM10 Results

All locations had average PM10 particulate values compliant with the 24-hour NEPA standard of 150 µg/m³. Average PM10 values ranged from 44.86 µg/m³ at Station 2, to 136.25 µg/m³ at Station 4. The highest PM10 concentrations were found at Station 4. The sampling exercise on May 23rd resulted in a PM10 value of 217.78 µg/m³ which is non-compliant with the NEPA standard of 150 µg/m³. This was due to labour day activities in the community whereby chopping of bush, digging of dirt and general rubbish clean-up activities took place, which would have resulted in elevated particulate concentrations.

The results of the PM10 sampling runs are shown in Table 3-11 below.

Table 3-11 PM 10 Results

STATION	AVERAGE RESULT (µg/m³)	RANGE (µg/m³)	NEPA STD. (µg/m³)
1	49.24	41.94 – 56.53	150
2	44.86	43.19 – 46.53	150
3	82.22	43.75 – 120.69	150
4	136.25	54.72 – 217.78	150

N.B. Values in red are non-compliant with the NEPA standard

3.1.4.3 PM2.5 Results

All locations had average PM2.5 particulate values compliant with the 24-hour US EPA standard of 35 µg/m³. Average PM2.5 values ranged from 18.17 µg/m³ at Station 4 to 21.95 µg/m³ at Station 3. PM2.5 particulate concentrations at the various stations may be due to proximity to the main road and associated motor vehicle exhaust emissions.

The results of the PM2.5 sampling runs are shown in Table 3-12 below.

Table 3-12 PM 2.5 Results

STATION	AVERAGE RESULT (µg/m³)	RANGE (µg/m³)	US EPA STD. (µg/m³)
1	20.13	12.89 – 27.38	35
2	18.69	13.63 – 23.76	35
3	21.95	13.68 – 30.22	35
4	18.17	16.51 – 19.83	35

3.1.5 Vibration

Construction activities often generate vibration complaints. This may be as a result of interfering with persons normal routines/activities. This can become more acute if the community has no understanding of the extent and duration of the construction. This can lead to misunderstandings if the contractor is insensitive by the communities although he may believe he is in compliance with the required conditions/ordinances.

Construction activities can result in various degrees of ground vibration. This is dependent on the type of equipment used and the methodologies employed.

Various governmental agencies have criteria regarding architectural and structural damage, as well as annoyance and acceptability of vibration. In general, most of the criteria specify that for a PPV less than approximately 3.048 mms-1 (0.12 inches per second), the potential for architectural damage due to vibration is unlikely. A PPV of approximately 3.048 mms-1 (0.12 inches per second) to 12.7 mms-1 (0.50 inches per second) there is potential for architectural damage due to vibration, and for a PPV greater than approximately 12.7 mms-1 (0.50 inches per second) the potential for architectural damage due to vibration is very likely.

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mms-1 to 0.3 mms-1 (British Standard BS 5228-2:2009). An indication of the effects of ground vibration on humans is detailed by the standard and detailed in Table 3-13.

Table 3-13 Guidance on the effects of vibration

VIBRATION LEVEL	EFFECT
0.14 mms^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mms^{-1}	Vibration might be just perceptible in residential environments.
1.0 mms^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mms^{-1}	Vibration is likely to be intolerable for any more than a brief exposure to this level.

The effects of construction vibration (both on humans and buildings) is summarized in Table 3-14.

Table 3-14 Effects of Construction Vibration

PEAK PARTICLE VELOCITY (mm/sec)	EFFECTS ON HUMANS	EFFECTS ON BUILDINGS
< 0.127	Imperceptible	No effect on buildings
0.127 – 0.381	Barely perceptible	No effect on buildings
0.508 – 1.27	Level at which continuous vibrations begin to annoy in buildings	No effect on buildings
2.54 – 12.7	Vibrations considered unacceptable for people exposed to continuous or long-term vibration	Minimal potential for damage to weak or sensitive structures
12.7 – 25.4	Vibrations considered bothersome by most people, however tolerable if short-term in length	Threshold at which there is a risk of architectural damage to buildings with plastered ceilings and walls. Some risk to ancient monuments and ruins.
25.4 – 50.8	Vibrations considered unpleasant by most people	U.S. Bureau of Mines data indicates that blasting vibration in this range will not harm most buildings. Most construction vibration limits are in this range.

PEAK PARTICLE VELOCITY (mm/sec)	EFFECTS ON HUMANS	EFFECTS ON BUILDINGS
>76.2	Vibration is unpleasant	Potential for architectural damage and possible minor structural damage

Vibrations from various types of construction equipment under a wide range of construction activities have been measured by the Federal Transit Administration (FTA) in the United States. The data in Table 3-15 provides a reasonable estimate for a wide range of soil conditions. Additional data on other equipment are represented in Table 3-16, which were obtained from measurements on several projects including the Central Artery/Tunnel Project in Boston and from several published sources including the FTA Manual and Dowding's Textbook.

Table 3-15 Vibration source levels for construction equipment (from measured data)

Table 12-2. Vibration Source Levels for Construction Equipment (From measured data.[7,8,9,10])			
Equipment		**PPV at 25 ft (in/sec)**	**Approximate L_v† at 25 ft**
Pile Driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58
† RMS velocity in decibels (VdB) re 1 micro-inch/second			

Source: FTA (2006)

To predict the vibration at a receptor from the operation of the equipment listed in Table 3-15, the following equation is used:

$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$

where: PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance

PPV (ref) is the reference vibration level in in/sec at 25 feet from Table 12-2

D is the distance from the equipment to the receiver.

Table 3-16 Equipment Vibration Emission Levels

Equipment Description	Vibration Type Steady or transient	Ref PPV at 100 ft.
Auger Drill Rig	Steady	0.011125
Backhoe	Steady	0.011
Bar Bender	Steady	N/A
Boring Jack Power Unit	Steady	N/A
Chain Saw	Steady	N/A
Compactor	Steady	0.03
Compressor	Steady	N/A
Concrete Mixer	Steady	0.01
Concrete Pump	Steady	0.01
Concrete Saw	Steady	N/A
Crane	Steady	0.001
Dozer	Steady	0.011
Dump Truck	Steady	0.01
Excavator	Steady	0.011
Flat Bed Truck	Steady	0.01
Front End Loader	Steady	0.011
Generator	Steady	N/A
Gradall	Steady	0.011
Grader	Steady	0.011
Horizontal Boring Hydraulic Jack	Steady	0.003
Hydra Break Ram	Transient	0.05
Impact Pile Driver	Transient	0.2
Insitu Soil Sampling Rig	Steady	0.011125
Jackhammer	Steady	0.003
Mounted Hammer hoe ram	Transient	0.18975
Paver	Steady	0.01
Pickup Truck	Steady	0.01
Pneumatic Tools	Steady	N/A
Scraper	Steady	0.000375
Slurry Trenching Machine	Steady	0.002125
Soil Mix Drill Rig	Steady	0.011125
Tractor	Steady	0.01
Tunnel Boring Machine (rock)	Steady	0.0058
Tunnel Boring Machine (soil)	Steady	0.003
Vibratory Pile Driver	Steady	0.14
Vibratory Roller (large)	Steady	0.059
Vibratory Roller (small)	Steady	0.022
Welder	Steady	N/A
Concrete Batch Plant	Steady	N/A
Pumps	Steady	N/A
Blasting	Transient	0.75
Clam Shovel	Transient	0.02525
Rock Drill	Steady	0.011125
3-ton truck at 35 mph	Steady	0.0002

To predict the vibration at a receptor from the operation of the equipment listed in Table 3-16, the following equation is used:

$$PPV_{equipment} = PPV_{ref} (100/D_{rec})^{n}$$

Where:

PPV_{ref} = *reference PPV at 100 ft.*
D_{rec} = *distance from equipment to the receiver in ft.*
n = 1.1 (the value related to the attenuation rate through ground)

The closest residential and commercial receptors to the proposed project are:

- Ministry of Foreign Affairs Building: 54 metres (177 feet).
- Old Ice Factory: 110 metres (361 feet).
- Tower Street Adult Correctional Facility (General Penitentiary) boundary wall: 35 metres (115 feet).
- Rae Town Community: 70 metres (230 feet)

The vibration impact was predicted on these closest receptors with the use of eight (8) primary pieces of construction equipment (Table 3-17 - Table 3-20).

Table 3-17 Predicted vibration levels at Ministry of Foreign Affairs Building in PPV in/sec and PPV mm/sec in brackets

EQUIPMENT	RECEPTOR VIBRATION
Large Bulldozer	0.005 (0.119)
Loaded Truck	0.004 (0.102)
Jack Hammer	0.002 (0.047)
Back Hoe	0.006 (0.149)
Dump Truck	0.005 (0.135)
Frontend Loader	0.006 (0.149)
Excavator	0.006 (0.149)
Flat Bed Truck	0.005 (0.135)

As seen in Table 3-17, comparing these levels with the British Standard from a human standpoint, most equipment used would result in vibration which is barely perceptible. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project.

Table 3-18 Predicted vibration levels at the Old Ice Factory in PPV in/sec and PPV mm/sec in brackets

EQUIPMENT	RECEPTOR VIBRATION
Vibratory Pile Driver	**0.03 (0.87)**
Large Bulldozer	0.002 (0.04)
Loaded Truck	0.001 (0.034)
Jack Hammer	0.001 (0.016)
Back Hoe	0.003 (0.068)
Dump Truck	0.002 (0.061)
Frontend Loader	0.003(0.068)
Excavator	0.003(0.068)
Flat Bed Truck	0.002 (0.061)

The closest location for possible pile driving activities is at the Barnes Gully for the installation of a pedestrian bridge. The closest receptor to this is the Old Ice Factory. As seen in Table 3-18, comparing these levels with the British Standard from a human standpoint, most equipment used would result in vibration which is imperceptible. The use of a vibratory pile driver for installation of the pedestrian bridge will result in vibrations which may cause annoyance to occupants in nearby buildings if the vibrations are continuous. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project.

Table 3-19 Predicted vibration levels at the General Penitentiary in PPV in/sec and PPV mm/sec in brackets

EQUIPMENT	RECEPTOR VIBRATION
Large Bulldozer	0.009 (0.228)
Loaded Truck	0.008 (0.194)
Jack Hammer	0.004 (0.089)
Back Hoe	0.009 (0.239)
Dump Truck	0.009 (0.217)
Frontend Loader	0.009 (0.239)
Excavator	0.009 (0.239)
Flat Bed Truck	0.009(0.217)

As seen in Table 3-19, comparing these levels with the British Standard from a human standpoint, most equipment used would result in vibration which is barely perceptible. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project. Pile driving activities for installation of the pedestrian bridge at Barnes Gully will not have any effect on the boundary wall of the General Penitentiary.

Table 3-20 Predicted vibration levels at the Rae Town Community in PPV in/sec and PPV mm/sec in brackets

EQUIPMENT	RECEPTOR VIBRATION
Large Bulldozer	0.003 (0.081)
Loaded Truck	0.003 (0.069)
Jack Hammer	0.001 (0.032)
Back Hoe	0.004 (0.111)
Dump Truck	0.004 (0.101)
Frontend Loader	0.004 (0.111)
Excavator	0.004 (0.111)
Flat Bed Truck	0.004 (0.101)

As seen in Table 3-20, comparing these levels with the British Standard from a human standpoint, most equipment used would result in vibration which is imperceptible. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project.

3.2 BIOLOGICAL

Kingston Harbour The harbour is heavily influenced by anthropogenic sources and as such both benthic and coastal habitats are significantly impacted. The degradation of the coastal environments has resulted in highly modified communities. The overabundance of jellyfish, a relatively productive fishery (large schools of juvenile fish) and a general lack in diversity and abundance of all other benthic species all indicate a severely disturbed environment. Road works, development and solid waste have reduced the terrestrial community to a few trees, shrubs and grasses. The last remaining mangrove stands in the project area are composed of a single black mangrove tree and a few white mangrove trees. Seabirds utilize the area for roosting and foraging, particularly in areas where fishermen operate.

3.2.1 Method

Roving surveys were conducted on and along the coastline both within and nearby the proposed project area for benthic and coastal areas (Figure 3-17). An additional windscreen survey was done along the roadway. Observations during various study days were also used in generating a species list and photo inventory. A secondary species list was generated from interviews with fishermen in the project area.

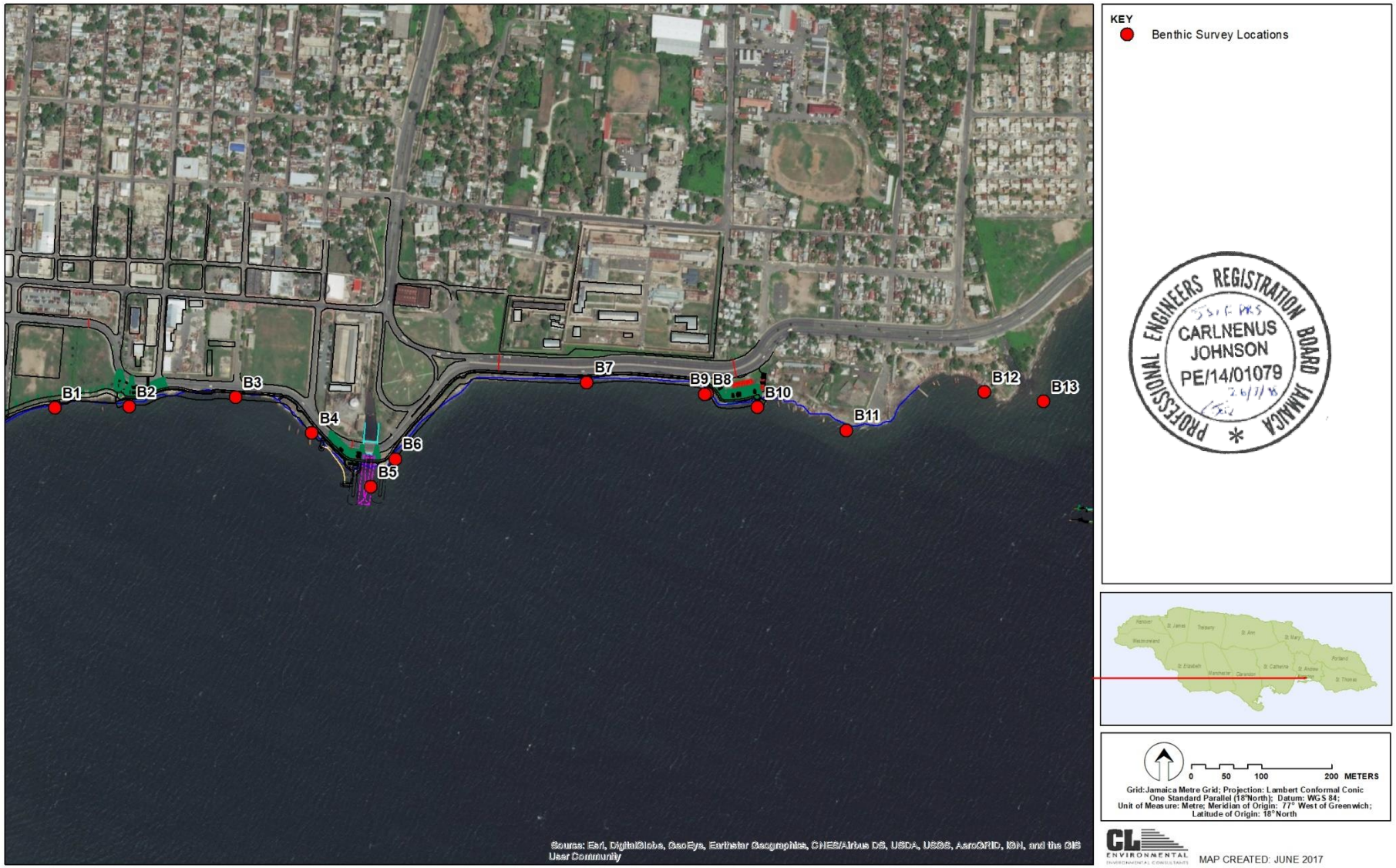

Figure 3-17 Map showing Benthic survey points

3.2.2 Terrestrial Community

The proposed project includes modifications to both the seaward and landward sides of the roadway. Solid waste litters both sides of the road, however dense accumulations of both solid waste and marine debris occur along the coastline. The terrestrial areas are highly modified with some vegetation found along the coastline and poorly maintained lands. Coastal species include a Black mangrove and few small white mangroves near a drain, Noni trees, Seaside Mahoe, grasses and shrubs.

The mangroves (Plate 2 and Plate 3) are found by a drain. They trap solid waste from the drain and the harbour. Sections of the pneumatophores are covered with plastic bottles and solid waste. The drain has a very strong odour suggesting raw or untreated sewage runs through the drain. Other trees and shrubs occur along the road way (Plate 4). Solid waste and sewage along with the general road operation have resulted in a highly degraded terrestrial community.

The intertidal area is composed of rocks and boulders from previous modifications during road construction. Most of this area is covered with extremely large collections of solid waste (Plate 5 and Plate 6). Drains and gullies carry large volumes of solid waste and in some areas, sewage and nutrients. During the study untreated sewage was seen flowing out of a drain (Plate 7), causing the water to have a high odour and milky appearance, the surrounding rocks were covered with a white film. No intertidal community was observed, it is possible that crabs and snails maybe present in some of these areas, however the overall degradation appears to limit the establishment of intertidal community.

Plate 2 Black mangrove by a drain, pneumatophores covered with solid waste

Plate 3 White mangroves near a drain

Plate 4 Noni trees and seaside Mahoe along the roadway

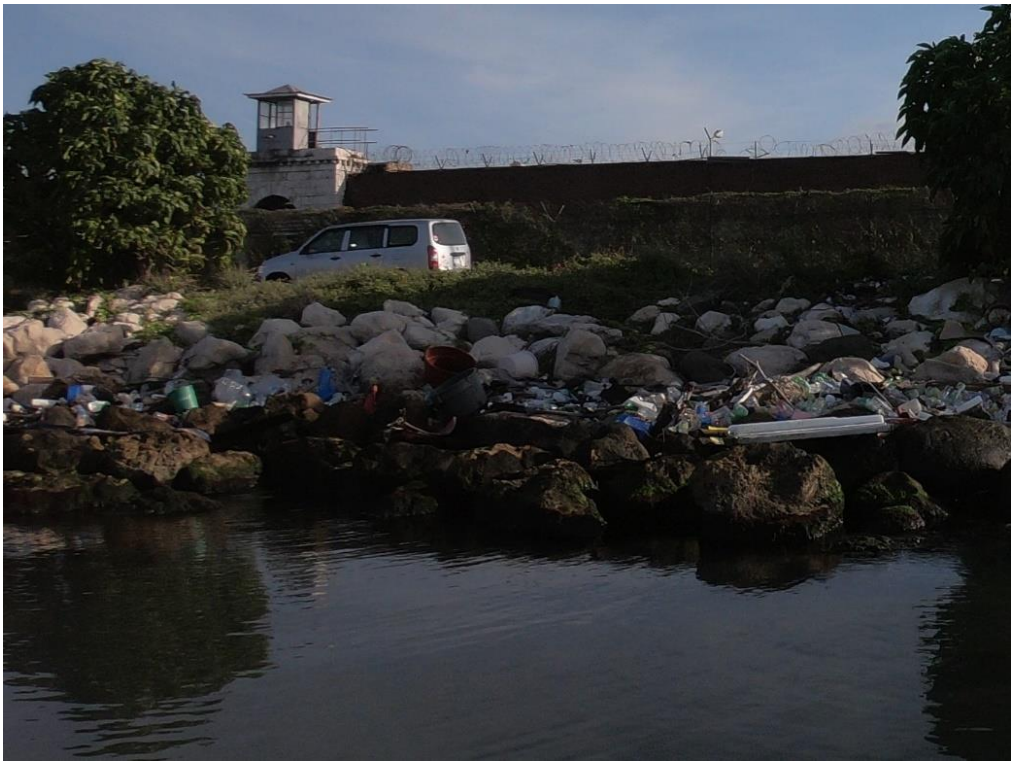

Plate 5 Solid waste all along the coastline

Plate 6 Solid waste and marine debris cover the nearshore and shoreline

Plate 7 Untreated sewage flowing out of a drain

3.2.2.1 Sea Birds

Seabirds, including the Brown Pelican, Frigate birds (Plate 8), terns, goats and dogs utilize these areas. Birds utilize various sections of the nearshore, including some sections of the shoreline, vegetation, boats, buoys and moorings. Solid waste covers sections of the coastline and within the water column.

Birds were seen resting on large plastic mounds outside the Rae Town gully as well as foraging in and around the general project area.

Plate 8 Magnificent Frigate Bird

3.2.3 Marine Community

Kingston Harbour's ecosystems and habitats have been studied over many years (Webber and Webber 2003.), with emphasis on the impacts on sensitive species and ecosystems. Mangroves and seagrass beds can be found in various locations around the harbour and most notably those located within the Palisadoes Port Royal Protected Area and RAMSAR site. Other protected species around the harbour include hard corals, soft coral and crocodiles along with commercially important species (conch, shrimp, lobster, coastal and pelagic fish). These systems exist along with major transhipment activities, port facilities, industrial activity, coastal modification, pollution, several coastal communities and other human influences. The Harbour also supports recreational, subsistence and commercial fisheries.

Large schools of juvenile fish and jelly fish populations were also seen in the area. The eutrophication of the harbour provides a rich food source for some species. Although no commercially important species were seen, fishermen state conch and shrimp are abundant while lobster and crab are less so. Fish species during the benthic survey were seen and the additional species recorded during the study are given in Table 3-21. The fish and invertebrates reported by fishermen are given in Table 3-22.

Table 3-21 Summary of the fish and invertebrates seen during the study

FISH (Common Name)	Comment
Bream	Several schools of juveniles were seen along sections of the shoreline
Mullet	Several were seen jumping along different sections of the coastline (varying sizes)
Maccaback	Seen along the rocky shoreline
Urchins	One (1) seen along the eastern section of the project area
Jellyfish	Several species seen regularly. Massive increase in the population was seen during the month of May 2018
Bivalves	Seen in various areas along the shoreline, growing on rocks and varying artificial substrate
Sponges	Mainly seen in nearshore of Rae town and Ministry of Foreign Affairs
Anemone	Occasionally seen in the substrate

Table 3-22 Fish and Invertebrates reported by Fishermen

FISH	INVERTEBRATES
Tarpon	Queen Conch
Barracuda	Black Conch

FISH	INVERTEBRATES
Jack	Sea urchin
Snapper (a few species)	Lobster
Parrot fish	Shrimp
Kingfish	Crab
Snook	Sea cucumber
Marcel	*Urchins*
Sprat	*Bivalves*
Shad	

Examples of species seen during the survey are shown in Plate 9 - Plate 10.

Plate 9 Anemone in silty, rocky substrate and plastic debris

Plate 10 Sponges encrusting on rocks and rubble

3.2.3.1 Substrate Composition

The nearshore marine environment all along the project area is heavily influenced by multiple sources of pollution and coastal modification. Several drains and a few gullies enter the harbour in the project area. These carry large volumes of solid waste, runoff and effluent (including untreated sewage). The substrate is composed of rocks, sand, solid waste, marine debris, silt and sand. Some areas are siltier while some have more rocks, pebbles and sand. Pieces of plastic litter the seafloor, mimicking natural shells and sand (Plate 11 and Plate 12). Visibility in the area is generally very poor, due to high turbidity levels and resultant low light levels.

Rocks, rubble and solid waste are over grown with macroalgae which is then covered in a fine sediment which is easily resuspended (Plate 13 - Plate 18). Some invertebrates (sponges and bivalves) can encrust and survive, however the nearshore diversity and density are extremely reduced. The rocky areas and solid waste provide habitat for large schools of juvenile fish. Turbidity and sedimentation may significantly impact filter feeding and sessile animals, clogging filaments as well as preventing settlement of larvae. The overabundance of jelly fish is an indicator of eutrophication which is harmful to most coastal species. The lack of diversity and distribution of the benthic community is a clear indication of a highly stressed environment.

Plate 11 **Section of the seafloor littered with small pieces of plastic, solid waste, rocks and rubble**

Plate 12 **Section of the seafloor littered with small pieces of plastic, solid waste, rocks and rubble**

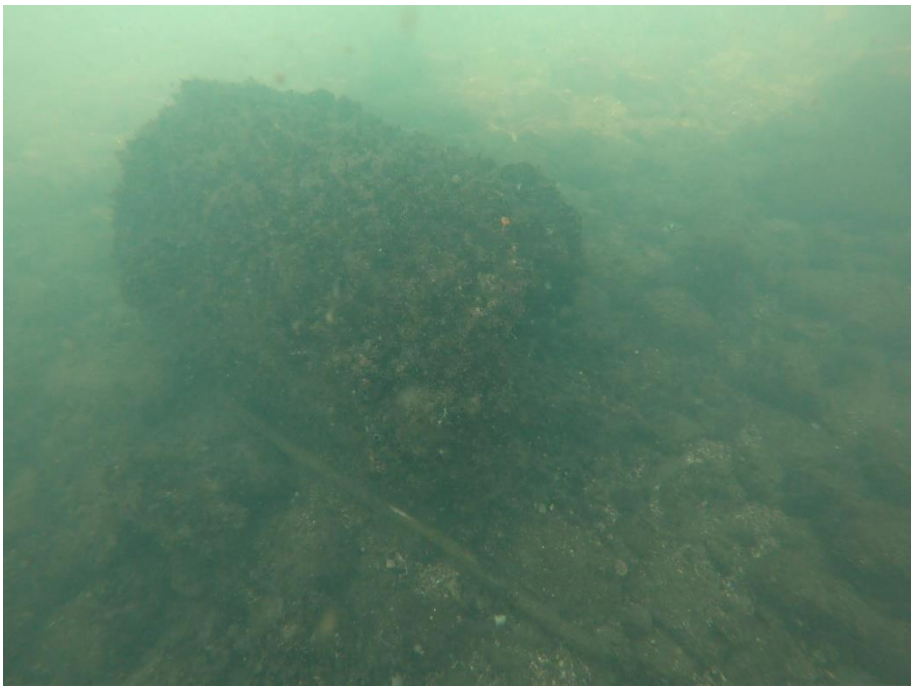

Plate 13 **Rock, rubble and silt, covered by macroalgae**

Plate 14 **Rocks, rubble and solid waste covered in silt and sediment**

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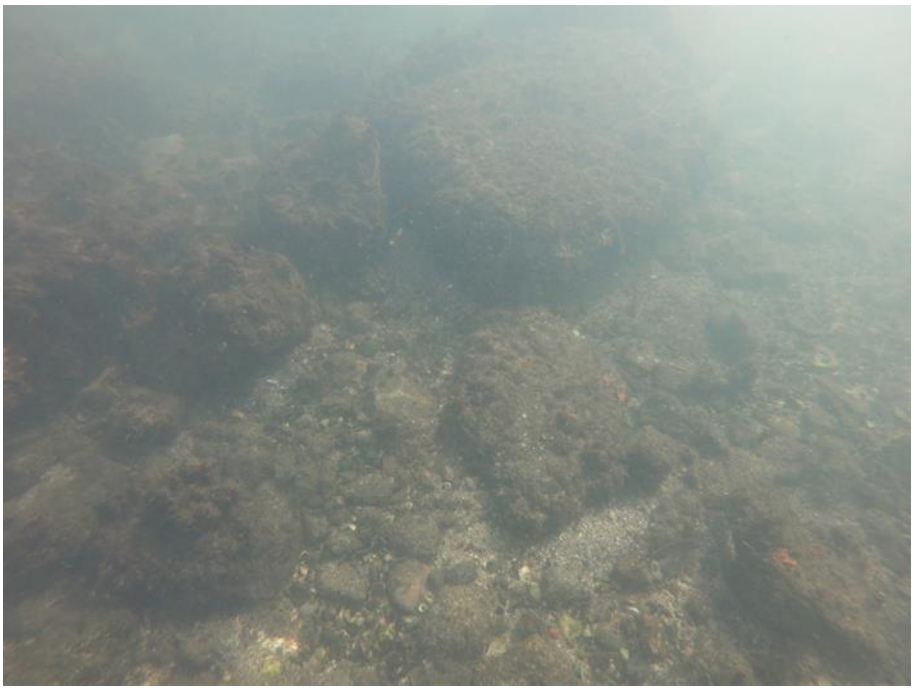


Plate 15 **Rocks, rubble and solid waste covered in silt and sediment**

Plate 16 **Macroalgae and sediment covering the seafloor**

Plate 17 **Less silty area with fish, sponges and macroalgae**

Plate 18 **Sand, rocks and macroalgae in a deeper part of the nearshore**

3.3 SOCIO-ECONOMIC

3.3.1 Demography, Services and Infrastructure

3.3.1.1 Approach

Social Impact Area

In order to assess the various social elements of the proposed project, a Social Impact Area (SIA) is established. An SIA may be described as the estimated spatial extent of the proposed project's effect on the surrounding communities. Demographic analyses are carried out utilising this SIA demarcation, and social services, infrastructure and industrial facilities are described in relation to this area as well. For the purposes of this project, a two (2) kilometre buffer around the proposed development area defined the SIA (Figure 3-18). The southern half of the SIA primarily falls over Kingston Harbour, whilst the land-based portion of the SIA is located completely or partially within the following 23 communities:

1. Vineyard Town
2. Woodford Park
3. Jones Town
4. Allman Town
5. Newport East
6. Hannah Town/ Craig Town
7. Fletchers Land
8. Campbell Town
9. Rollington Town
10. Kingston Gardens
11. Denham Town
12. Franklyn Town
13. Newton Square
14. Tivoli Gardens
15. Central Down Town
16. East Down Town
17. Passmore Town
18. West Down Town
19. Bournemouth Gardens
20. Manley Meadows
21. Rae Town
22. Southside
23. Port Royal

Demographic Analyses and Census Database

Population data were extracted from the Statistical Institute of Jamaica (STATIN) 2011 Population Census database for the SIA by enumeration district (ED). This was undertaken using Geographic Information Systems (GIS) methodologies, which were also used to derive visual representations of the data. It should be noted that all Census data relates to the resident population and does not take into consideration persons working in or visiting the ED.

In order to derive information from the census data the following computations were made:

- ***Population growth*** - was calculated using the formula [$i_2 = i_1 (1 + p)^x$]; where i_1 = initial population, i_2 = final population, p = actual growth rate and x = number of years.
- ***Population density*** – was derived by dividing the population by the land area. This is useful for determining the locations of greater concentrations of population.

- ***Dependency ratio*** – was calculated using the formula [child population + aged population /working population X 100], where the child population is between ages 0-14, the aged population is 65 & over, and the working population is between ages 15-64 years. This ratio is useful for understanding the economic burden being borne by the working population.
- ***Male sex ratio*** – was calculated by using the formula [male population / female population X 100]. This in effect denotes the number of males there are to every 100 females and is useful for determining the predominant gender in a particular area.
- ***Domestic water consumption*** - was calculated based on the assumption that water usage is 227.12 litres/capita/day and sewage generation at 80% of water consumption. Water consumption for workers in Jamaica is calculated at 19 litres/capita/day and sewage generation at 100% water consumption.
- ***Domestic garbage generation*** - was calculated at 4.11 kg/household/day (National Solid Waste Management Authority).

Other Data

Geospatial data for various services and infrastructure, including schools, health centres, hospitals, police stations, fire stations and post offices were obtained from the Mona GeoInformatics Institute. Additional data were also gleaned from the 1984 national topographic maps (metric series) and satellite imagery available for the project. Other data sources are stated where applicable throughout.

Figure 3-18 Map showing the Social Impact Area (SIA)

3.3.1.2 Demography

Population Growth

The total population within the SIA in 2011 was approximately 67,892 persons (STATIN 2011 Population Census). Examination of the 2001 population data showed that there were approximately 71,916 persons within the SIA in 2001. From this population, and that calculated for the year 2011 (67,892 persons), it was estimated that the actual growth within the SIA between 2001 and 2011 was approximately -0.57% per annum. Based on this growth rate, at the time of this study (2018), the population was approximately 65,210 persons and is expected to be 56,467 persons over the next twenty-five years if the current population growth rate remains the same. The annual growth rate for the SIA (-0.57%) is similar to that for the parish of Kingston (-0.80%) but differs to that for St. Andrew (0.33%) and the island (0.36%) between 2001 and 2011 (STATIN, 2011). Using the regional rate for Kingston, the population in 2018 is estimated to be 64,180 persons, and in 2043, 52,504 persons.

Figure 3-19 depicts the population within each enumeration district (ED) for the years 2001 and 2011. As seen here, population distribution changed spatially throughout the SIA.

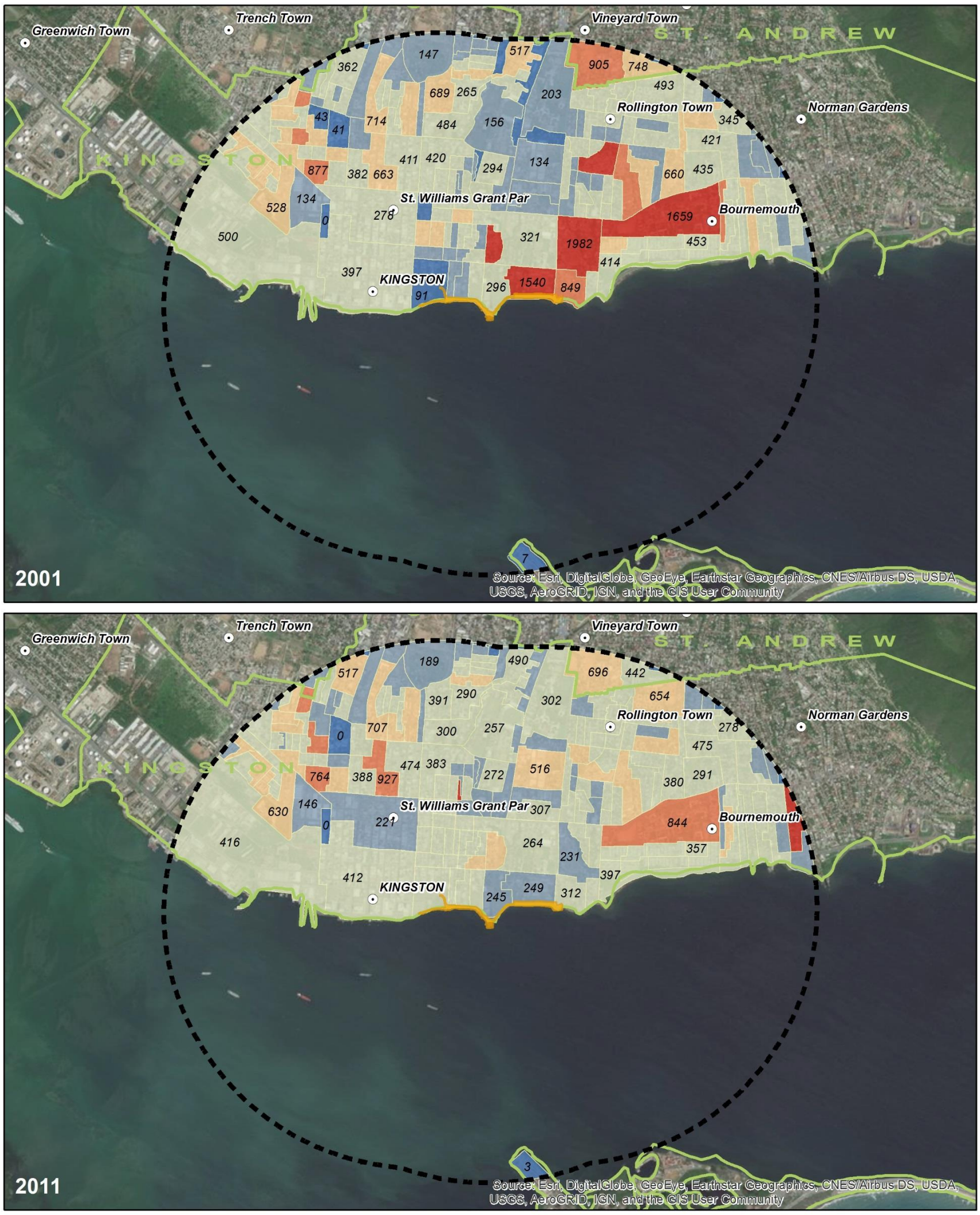
Population Density

The land area within the SIA was calculated to be approximately 8.15 km^2. With a population of 67,892 persons, the overall population density was calculated to be 8,328 persons/km^2. This population density is drastically higher than the national level (245 persons/km^2), as well as the regional densities of 3,921 and 1,321 persons/km^2 for Kingston and St. Andrew respectively (Table 3-23).

Table 3-23 Comparison of population densities for the year 2011

Source: STATIN Population Census 2011

Category	Jamaica	Kingston	St. Andrew	SIA
Land Area (km^2)	10,991.0	22.7	433.9	8.2
Population	2,697,983	89,057	573,369	67,892
Population Density	245	3,921	1,321	8,328



Data source: STATIN Population Census 2011 and 2001

Figure 3-19 SIA 2001 and 2011 population data represented in enumeration districts

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Age & Sex Ratio

The segment of a population that is considered more vulnerable are the young (children less than five years old) and the elderly (65 years and over). In the SIA population, 8.7% comprised the vulnerable young category, whilst 5.9% comprised the elderly.

Table 3-24 shows the percentage composition of each age category of the population. This is compared on a national, regional and local (SIA) level. Percentage age distribution in the SIA for the 0-14 years' age cohort (27.8%) is comparable to the parish of Kington and island figures (27.9% and 26.1% respectively). As mentioned previously, elderly persons aged 65 years and greater make up 5.9% of the SIA population; and this value is lower than other extents investigated. Within the SIA, the 15-64 years' age category accounted for 66.3% and can therefore be considered a working age population, similar to that for the nation (65.9%) and the parishes of Kingston (66.0%) and St. Andrew (69.9%) (Table 3-24).

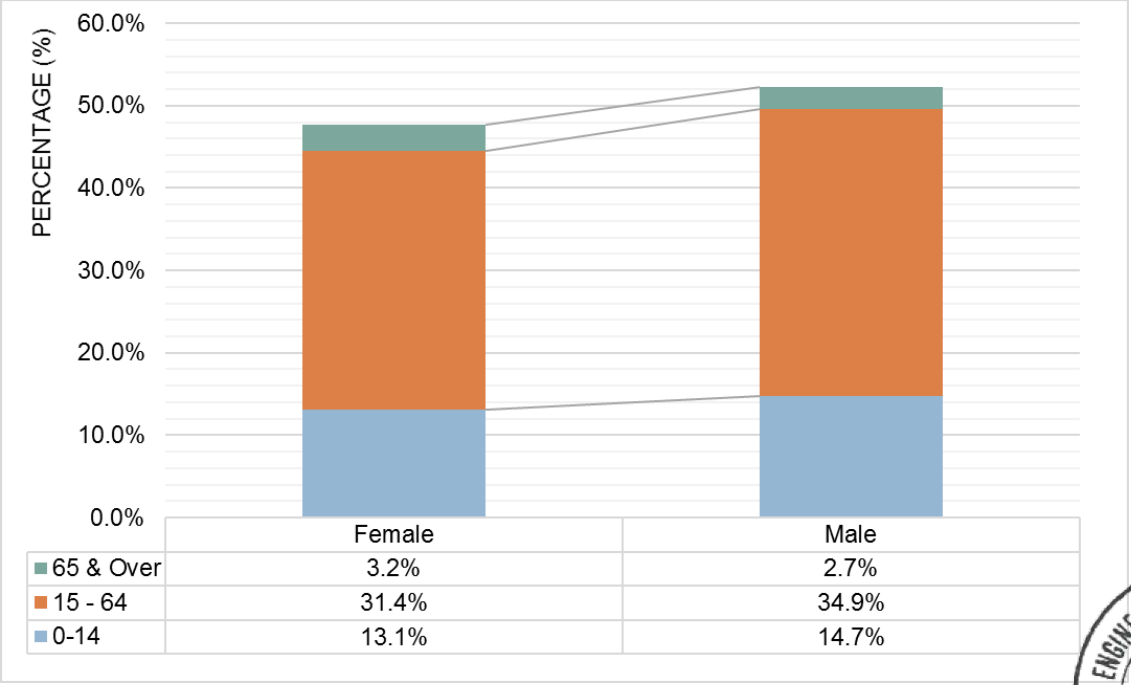
Table 3-24 Age categories as percentage of the population for the year 2011

Source: STATIN Population Census 2011

Age Categories	Jamaica	Kingston	St. Andrew	SIA
0-14	26.1%	27.9%	22.6%	27.8%
15 - 64	65.9%	66.0%	69.9%	66.3%
65 & Over	8.1%	6.1%	7.5%	5.9%

As seen in Figure 3-20, Census 2011 data indicated that there were less females within the age cohorts of 15-64 years and 65 years and over when compared to males. However, when these age groupings are further divided using a population pyramid, other patterns emerge. As seen in Figure 3-21; a greater number of females is discerned between the ages of 40 and 44 years, as well as 70 years and older.

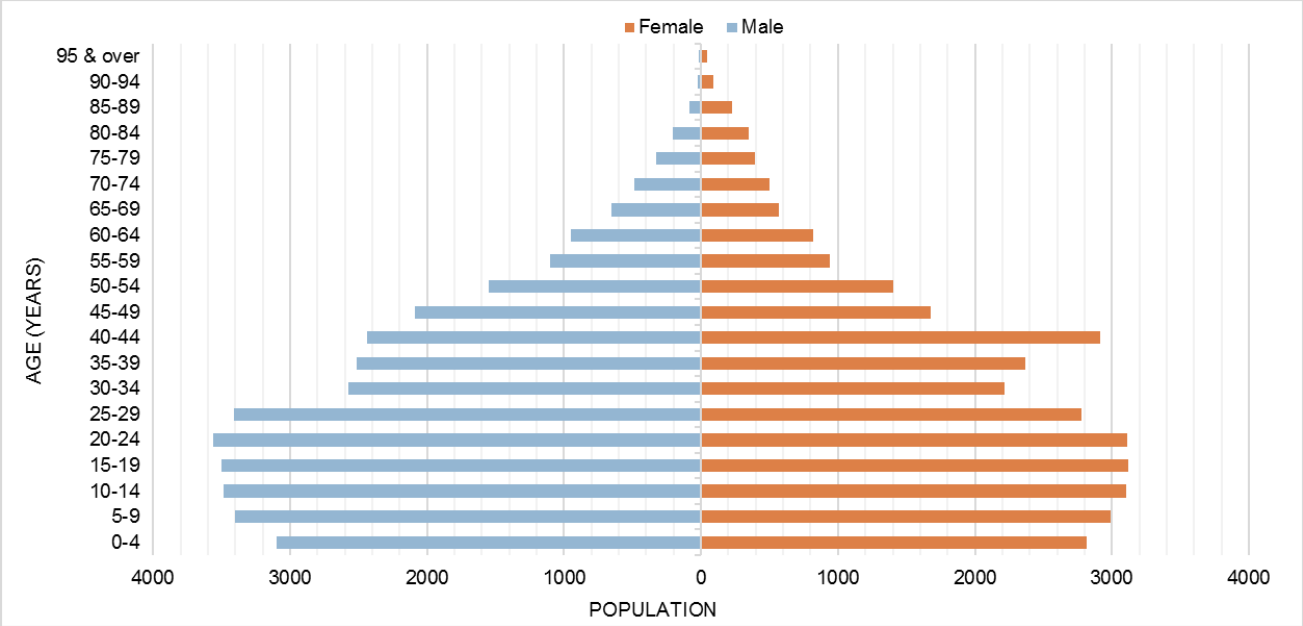
Sex ratio for all age cohorts within the SIA was calculated to be 109.5 males per one hundred females; this ratio however varies spatially across the SIA (Figure 3-22).



	Female	Male
65 & Over	3.2%	2.7%
15 - 64	31.4%	34.9%
0-14	13.1%	14.7%

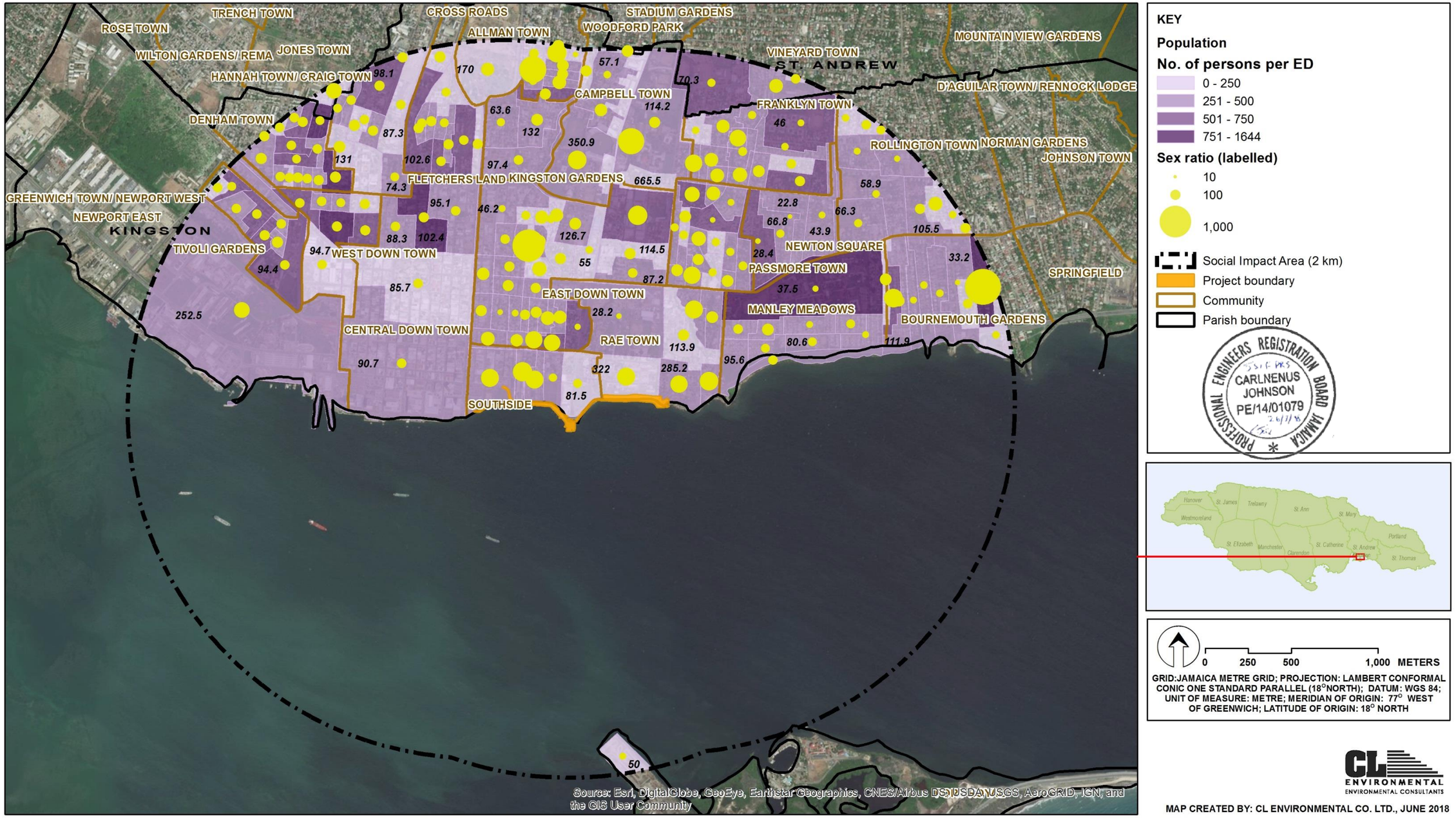
Source data: STATIN Population Census 2011

Figure 3-20 **Male and female percentage population by age category for the SIA in 2011**



Source data: STATIN Population Census 2011

Figure 3-21 **Population pyramid for the SIA in 2011**

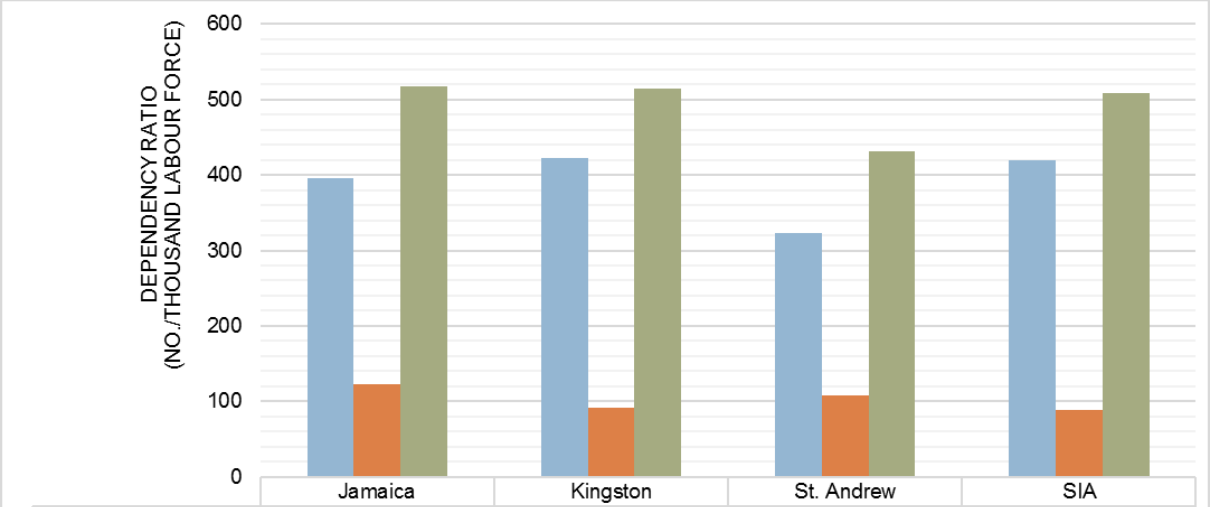


Source data: STATIN Population Census 2011

Figure 3-22 Sex ratio by ED within the SIA

Dependency Ratios

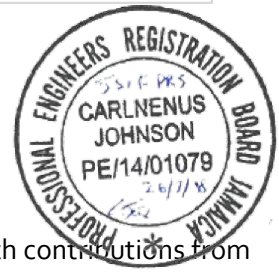
The child dependency ratio for the SIA in 2011 was 419.8 per 1000 persons of labour force age; old age dependency ratio stood at 88.3 per 1000 persons of labour force age; and societal dependency ratio of 508.1 per 1000 persons of labour force. This indicates that the youth (child dependency) are far more dependent on the labour force for support when compared with the elderly in the SIA. The SIA child dependency is comparable to that for Kingston (423.0) and higher than the figures for all other extents investigated (Figure 3-23), whilst old age dependency is the lowest amongst all extents.



	Jamaica	Kingston	St. Andrew	SIA
Child Dependency	395.4	423.0	323.0	419.8
Old Age Dependency	122.4	92.2	108.0	88.3
Societal Dependency	517.8	515.2	431.0	508.1

Source: STATIN Population Census 2011

Figure 3-23 Comparison of dependency ratios for the year 2011

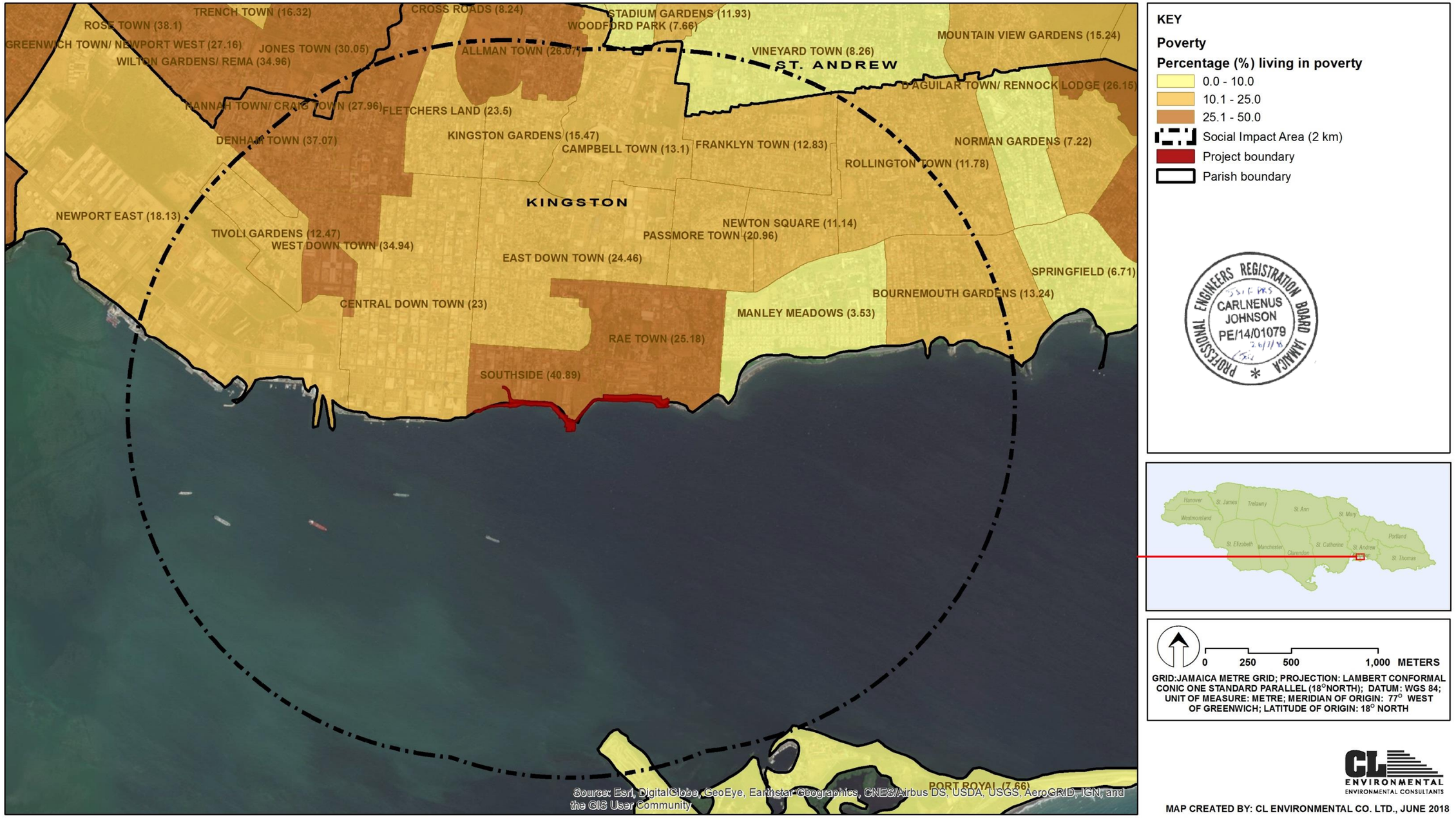


3.3.1.3 Poverty

The poverty GIS dataset developed by the Planning Institute of Jamaica (PIOJ) (with contributions from STATIN, Social Development Commission (SDC) and the University of Technology), primarily identifies areas of poverty by community. As described by PIOJ, for the 2002 poverty map:

> The indicators utilized were those that best predicted per capita consumption levels in households based on data from the Jamaica Survey of Living Conditions (JSLC) 2002. Relevant variables that were common to this survey and the Population Census 2001 were selected and tested for similarity. The satisfactory variables were then applied to the census data to obtain estimates of the consumption levels of the households that had consumption levels islandwide. Members of households that had consumption levels below the poverty line for the region in which their household was located were deemed to be in poverty. The proportion of persons in poverty in each community was used to rank the 829 communities.

As seen in Figure 3-24, the SIA population ranges between 12% and 41% of persons living in poverty.



Data source: PIOJ (with contributions from STATIN, SDC and the University of Technology

Figure 3-24 Proportion of persons in poverty in each community

3.3.1.4 Education

For 2011, the highest level of educational attainment for the national, regional and SIA extents are represented in Table 3-25. When the highest level of educational attainment within the SIA is calculated as a percentage, it becomes evident that there is a propensity towards the attainment of primary and secondary education. Fifty-four percent (53.5%) of the SIA population attained a secondary school education as the highest level, followed by 28.1% attaining primary education. SIA secondary educational attainment is highest amongst the extents investigated; whilst, primary education in the SIA is lower when compared to the attainment percentage for the island (34.4%) and comparable with those for the parishes of Kingston and St. Andrew (Table 3-25). Tertiary education attainment (combined university and other) as the highest level of education is lowest in the SIA (6.0%), compared to the island (9.9%) and St. Andrew parishes (15.4%), but comparable to Kingston (6.1%).

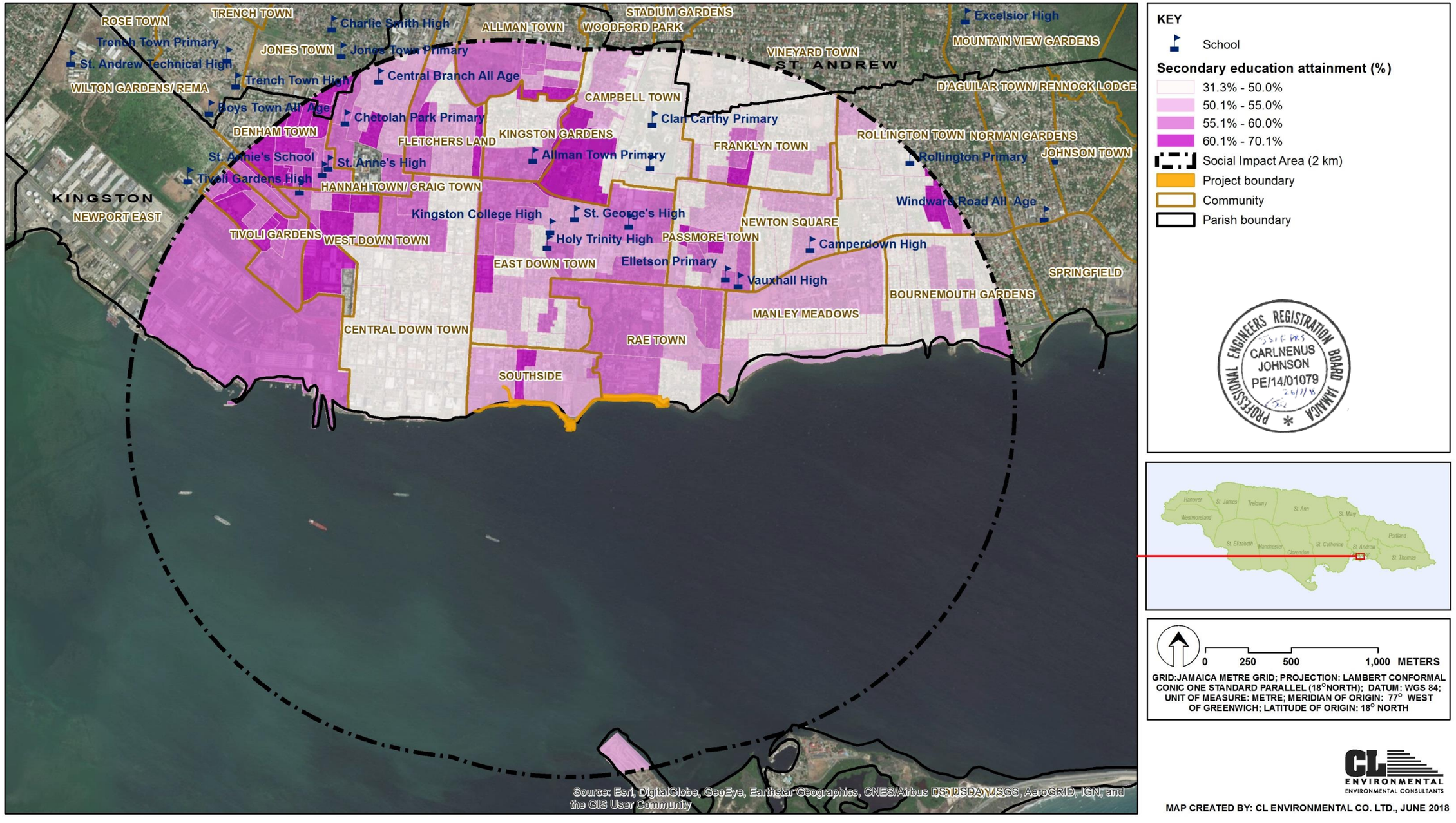
Table 3-25 Population 3 years old and over by highest level of educational attainment as a percentage, for the year 2011

Source: STATIN Population Census 2001

	Jamaica	Kingston	St. Andrew	SIA
No Schooling	0.7%	0.5%	0.4%	0.5%
Pre Primary	4.8%	5.8%	4.0%	5.7%
Primary	34.4%	28.6%	27.1%	28.1%
Secondary	45.7%	52.8%	46.8%	53.5%
University	4.7%	2.3%	9.6%	2.3%
Other Tertiary	5.2%	3.8%	5.8%	3.7%
Other	0.5%	0.5%	0.7%	0.4%
Not Stated	0.0%	5.7%	5.6%	5.7%

The relatively high proportion of the population in proximity to the project location attaining a secondary education suggests that the labour pool is relatively educated, and as such, there should be no problem in obtaining non-technical workers from the community. Figure 3-25 depicts secondary education attainment within the SIA and the location of schools in proximity to the proposed development. Sixteen (16) schools are located within the demarcated SIA:

1. Allman Town Primary
2. Alpha Academy High
3. Camperdown High
4. Central Branch All Age
5. Chetolah Park Primary
6. Clan Carthy Primary
7. Denham Town Primary / High
8. Elletson Primary
9. Holy Trinity High
10. Jessie Ripoll Primary
11. Kingston College High
12. Rollington Primary
13. St. Anne's High
14. St. Annie's School
15. St. George's High
16. Vauxhall High



Source: Education (STATIN Population Census 2011), Schools (MGI)

Figure 3-25 Percentage population attaining a secondary education within the SIA

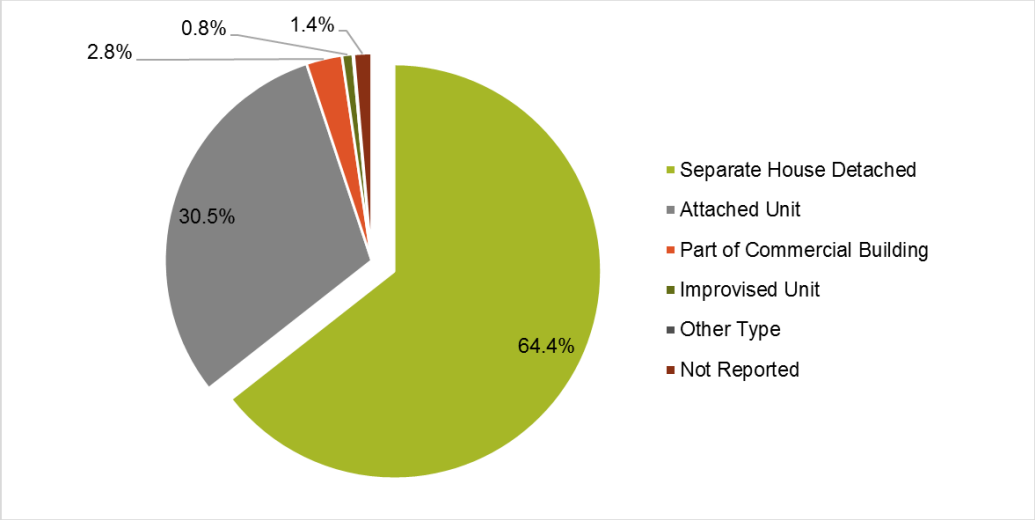
3.3.1.5 Housing

Housing Units, Dwellings and Households

For the purposes of this study, the definition of housing unit, dwelling and household are those used in the population census conducted by the Statistical Institute of Jamaica (STATIN). The definition states that:

- A **housing unit** is a building or buildings used for living purposes at the time of the census.
- A **dwelling** is any building or separate and independent part of a building in which a person or group of persons lived at the time of the census". The essential features of a dwelling unit are both "separateness and independence". Occupiers of a dwelling unit must have free access to the street by their own separate and independent entrance(s) without having to pass through the living quarters of another household. Private dwellings are those in which private households reside. Examples are single houses, flats, apartments and part of commercial buildings and boarding houses catering for less than six boarders.

Approximately 64.4% of the housing units in the SIA were of the separate detached type, 30.5% were attached, 2.8% part of a commercial building, 0.8% improvised unit, and 1.5% not reported or other type (Figure 3-26).



Source: STATIN Population Census 2011

Figure 3-26 Percentage of housing units by type within the SIA

There were 10,251 housing units, 21,979 dwellings and 22,426 households within the SIA in 2011. The average number of dwellings in each housing unit was 2.1 and the average household to each dwelling was 1.0 (Table 3-26). The average household size in the SIA was 3.0 persons/ household and varies spatially by ED (Figure 3-28).

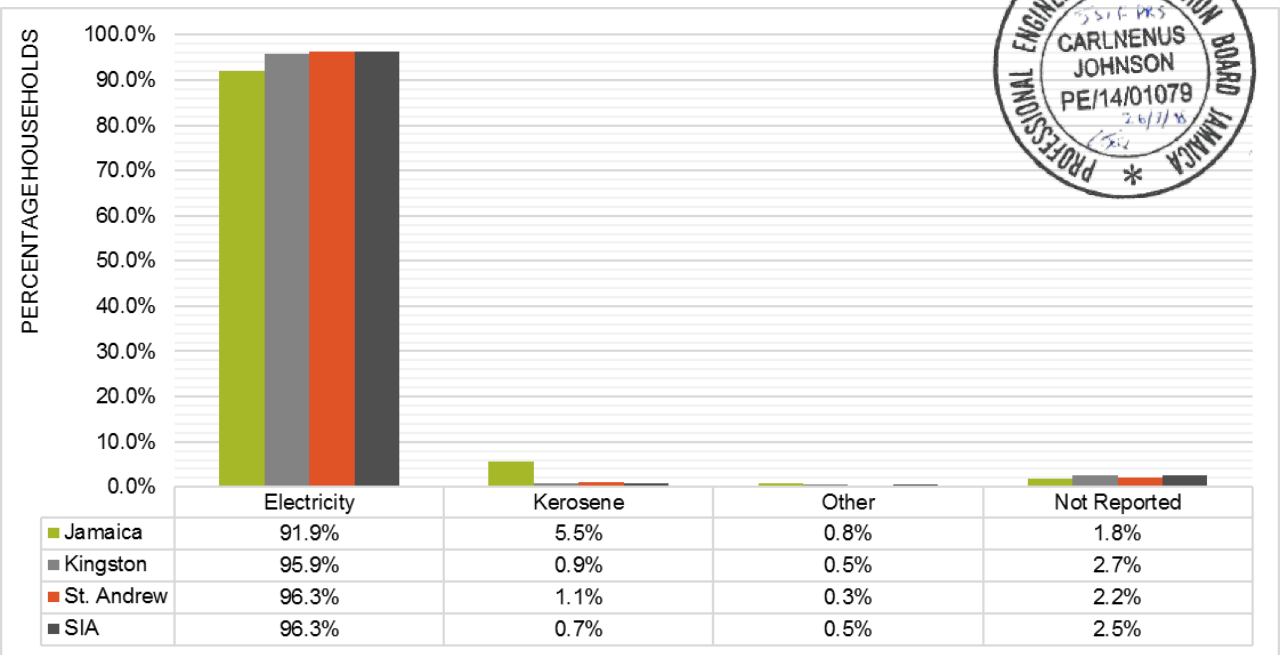
Table 3-26 Comparison of national, regional and SIA housing ratios for 2011

Source: STATIN Population Census 2001

	Jamaica	Kingston	St. Andrew	SIA
Dwelling/Housing Unit	1.2	2.0	1.5	2.1
Household/Dwelling	1.0	1.0	1.0	1.0
Average Household Size	3.1	3.0	3.0	3.0

Lighting

Figure 3-27 details the percentage of households using a particular category of lighting. Data for all extents (SIA, parish and national) reveal that the majority of the population utilise electricity as their main source of lighting. Approximately ninety-six percent (96.3%) of households within the SIA use electricity, this is comparable to the percentages for St. Andrew and Kingston (96.3% and 95.9% respectively) and higher than that for the island (91.6%).

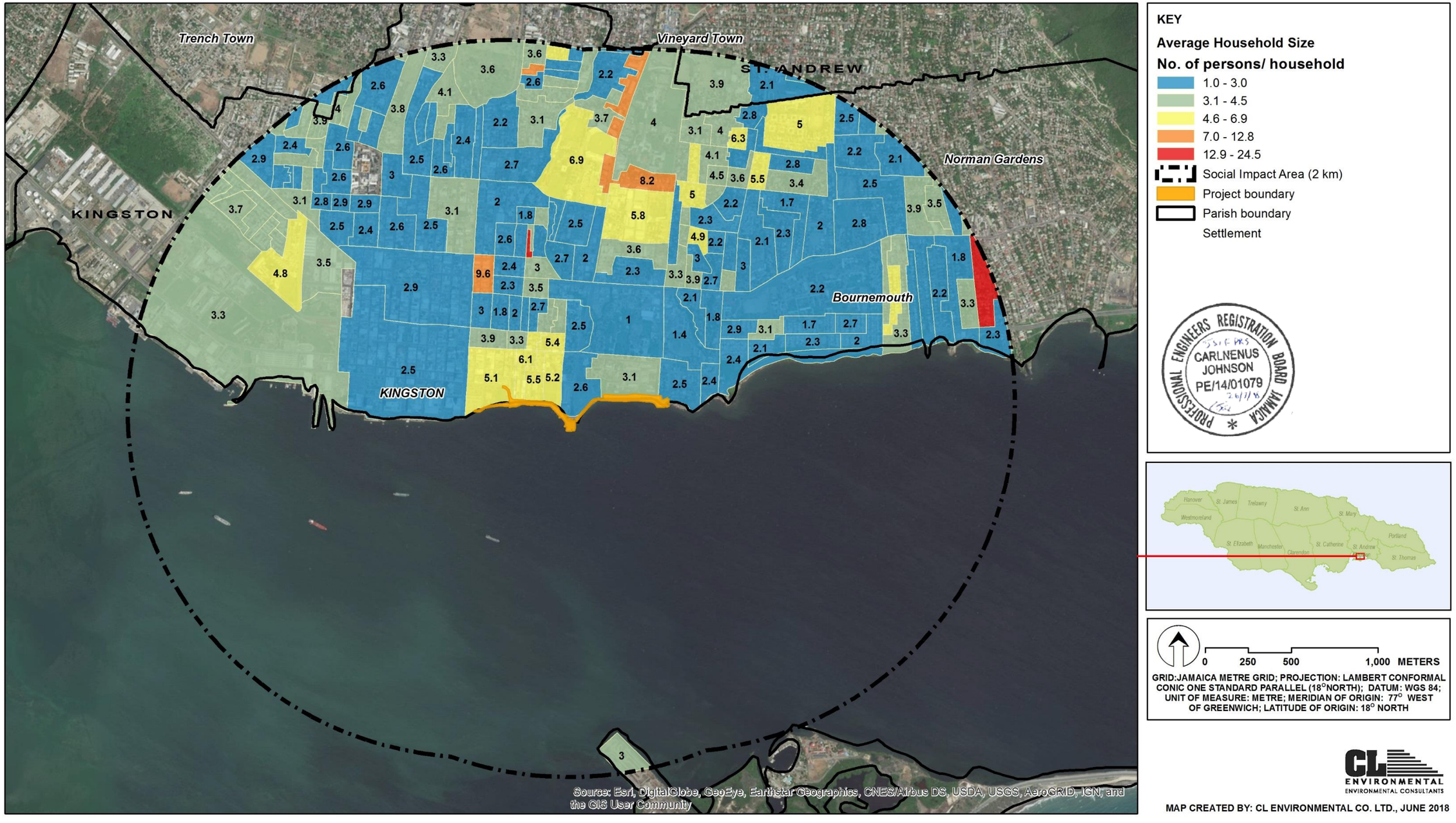


	Electricity	Kerosene	Other	Not Reported
Jamaica	91.9%	5.5%	0.8%	1.8%
Kingston	95.9%	0.9%	0.5%	2.7%
St. Andrew	96.3%	1.1%	0.3%	2.2%
SIA	96.3%	0.7%	0.5%	2.5%

Source: STATIN Population Census 2011

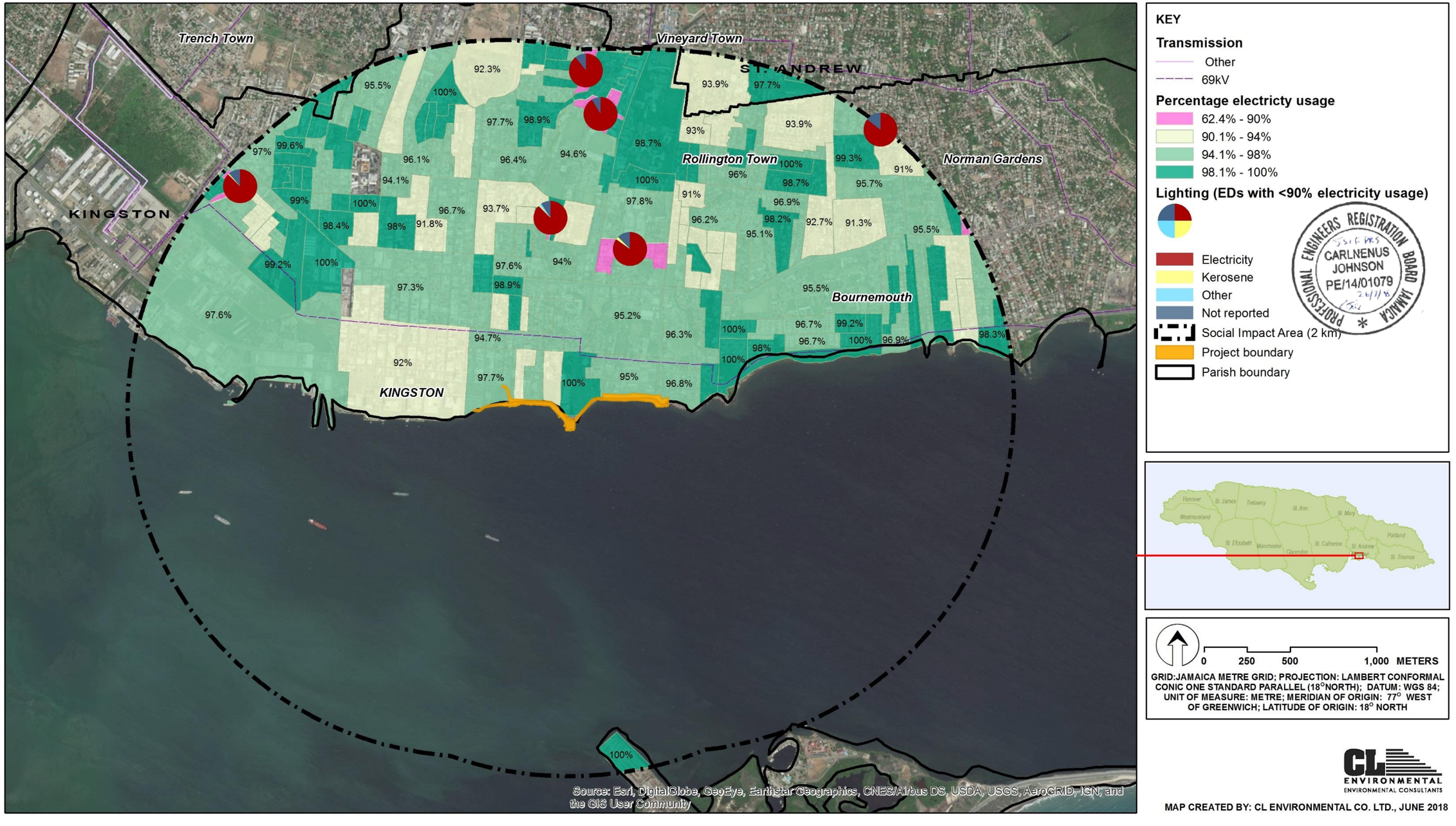
Figure 3-27 Percentage households by source of lighting

The use of electricity is not consistent throughout the SIA (Figure 3-29); in EDs where electricity usage is less than 90%, other types of lighting source such as kerosene or other types not reported are used more. Overall however, the percentage of households using kerosene as their main means of lighting in the SIA (0.7%) was lower than that Jamaica (5.5%), and similar to that for Kingston and St. Andrew (0.9% and 1.1% respectively).



Source: Education (STATIN Population Census 2011), Schools (MGI)

Figure 3-28 Household size by ED within the SIA for 2011



Source: STATIN Population Census 2011

Figure 3-29 Percentage electricity usage for the year 2011 and location of transmission lines within the SIA

Domestic Water Supply

The National Water Commission (NWC) is the public agency responsible for providing Jamaica's domestic water supply. The majority of the households within the SIA (95.2%) received their domestic water supply from a public source. This is similar to other extents investigated using Census 2011 data (Table 3-27).

Table 3-27 Percentage of households by water supply for the year 2011

Source: STATIN Population Census 2011

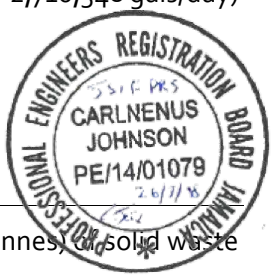
	Category	Jamaica	Kingston	St. Andrew	SIA
Public Source	**Piped in Dwelling**	49.7%	51.2%	70.9%	48.9%
	Piped in Yard	16.5%	40.1%	18.0%	45.0%
	Stand Pipe	7.1%	1.5%	2.5%	0.9%
	Catchment	2.2%	0.8%	0.6%	0.4%
Private Source	**Into Dwelling**	6.4%	2.2%	2.9%	1.1%
	Catchment	9.8%	0.5%	1.1%	0.6%
	Spring/ River	3.0%	0.0%	1.2%	0.0%
	Trucked Water/Water Truck	2.1%	0.3%	0.5%	0.0%
	Other	1.8%	1.1%	0.9%	0.9%
	Not Reported	1.3%	2.3%	1.5%	2.0%

Water demand for the SIA in 2018 is estimated to be 14,810,430 litres/day (~3,912,502 gals/day) and is expected to decrease to 12,824,729 litres/day (~3,387,936 gals/day) over the next twenty-five years based on population growth rates calculated previously.

Wastewater Generation and Disposal

It is estimated that approximately 11,848,344 litres/day (~3,130,002 gals/day) of wastewater is generated within the study area (for 2018) and is expected to decrease to 10,259,783 litres/day (~2,710,348 gals/day) over the next twenty-five years based on calculated growth rates.

Census 2011 data for wastewater disposal methods was not available.



Solid Waste Generation and Disposal

It is estimated that at the time of this study (2018), approximately 88,529 kg (~89 tonnes) of solid waste was being generated.

The National Solid Waste Management Authority (NSWMA) is responsible for domestic solid waste collection within the study area and specifically, MPM Waste Management Ltd. covers the parishes of Kingston and St. Andrew (as well as St. Catherine and St. Thomas). In residential areas, garbage is collected once per week. This service is provided free (partial covered by property taxes) for the households within the area. The waste is transported to the Riverton Waste Disposal Site (landfill) located in southeast St. Catherine, approximately 8km northwest of the proposed development area.

Riverton Waste Disposal Site is approximately 1.19 m^2 (119 hectares). It receives approximately 60% of the island's waste. Solid waste collection for commercial and industrial facilities is done by arrangements by these entities with private contractors.

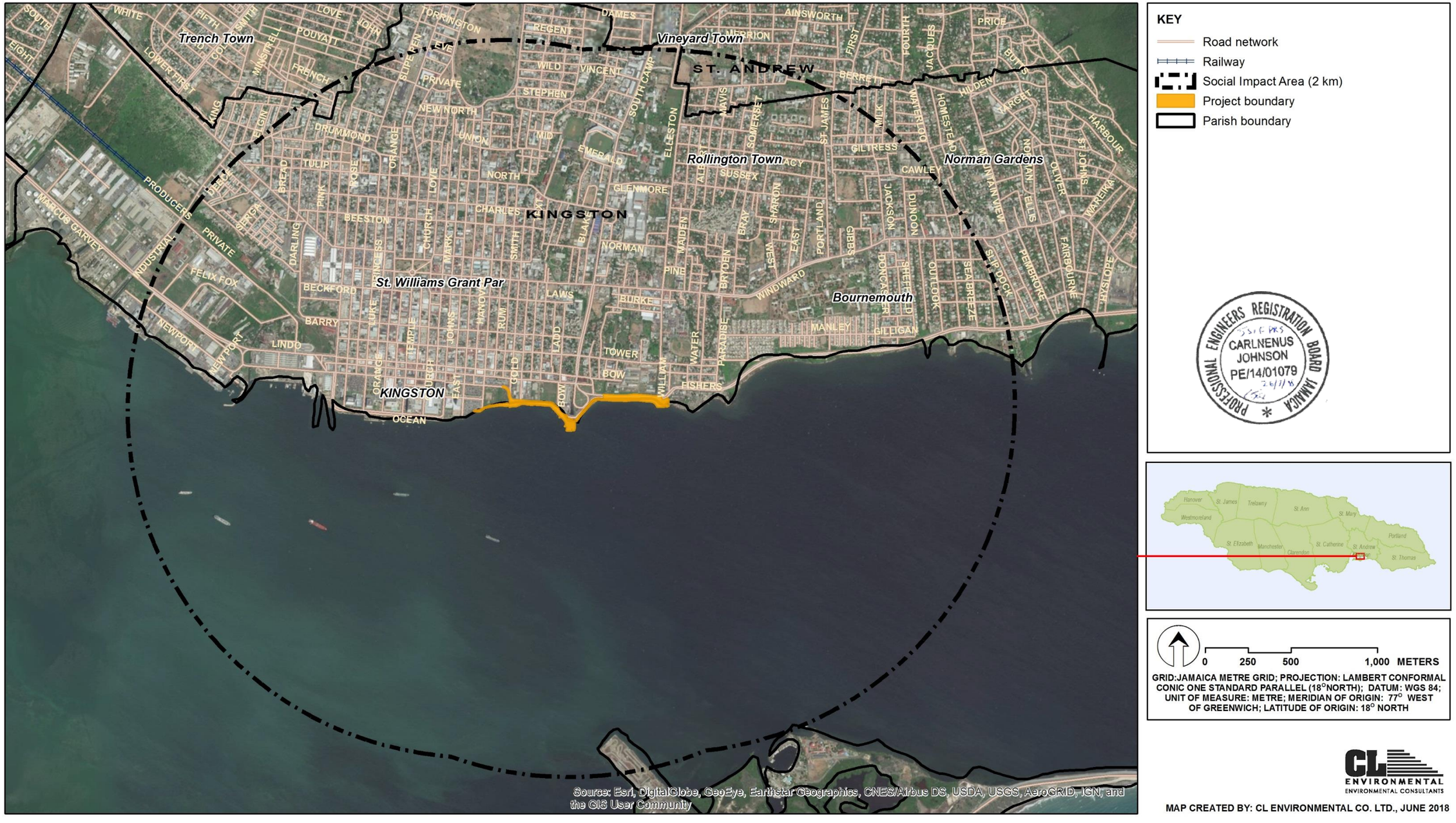
3.3.1.6 Transportation

Airfields, Aerodromes and Airports

Air transport facilities do not exist within the SIA; however, Tinson Pen Astrodome is situated 5km northwest of the development area and the Norman Manley International Airport (NMIA), approximately 3.5km southeast of the development area. The NMIA is the primary airport for business travel to and from Jamaica and for the movement of air cargo. There are 13 scheduled airlines serving many international destinations and the average daily aircraft movement is 67 flights. In 2013, total passenger movements were approximately 1.37M and freight (cargo/mail) was 11,503 metric tonnes.

Road Network

The existing road network within and surrounding the SIA is depicted in Figure 3-30.



KEY

- Road network
- Railway
- Social Impact Area (2 km)
- Project boundary
- Parish boundary

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

0 250 500 1,000 METERS

GRID:JAMAICA METRE GRID; PROJECTION: LAMBERT CONFORMAL CONIC ONE STANDARD PARALLEL (18°NORTH); DATUM: WGS 84; UNIT OF MEASURE: METRE; MERIDIAN OF ORIGIN: 77° WEST OF GREENWICH; LATITUDE OF ORIGIN: 18° NORTH

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MAP CREATED BY: CL ENVIRONMENTAL CO. LTD., JUNE 2018

Figure 3-30 Road network and transportation infrastructure located in the SIA

3.3.1.7 Social, Health and Emergency Services

Telecommunication

The parishes of Kingston and St. Andrew, and thereby the study area as well, are served with landlines provided by Flow Jamaica Limited (formerly LIME Jamaica Limited). Wireless (mobile) communication is provided by Digicel Jamaica Limited and Flow; a network to support internet connectivity is also provided by Flow.

Post Offices

Three (3) post offices are found within the demarcated SIA: 13 Kings St; Allman Town Vincent Street; and Winward Road (Figure 3-31).

Health Centres

One health centre exists within the SIA, namely the Old Harbour Bay Health Centre situated approximately 1.25 km northeast of the project area. This health centre, along with others situated in the parish of St. Catherine and depicted in Figure 3-31, (e.g. Old Harbour and Church Pen) fall under the responsibility of the Southeast Regional Health Authority (SERHA).

Eight (8) health centres exist within the SIA (Table 3-28); all fall under the responsibility of the Southeast Regional Health Authority (SERHA). Type II centres (Lenworth Jacob) are serviced by a visiting Doctor and Nurse Practitioner and serves a population of about 12,000 persons. Family health (including antenatal, postnatal, child health, nutrition, family planning & immunization); curative, dental, environmental health, Sexually Transmitted Infections (STIs) treatment, counselling & contact investigation; child guidance, mental health and pharmacy are the services provided. Majesty Gardens, Rollington Town and Denham Town are Type III facilities; family health services, including antenatal, postnatal, child health, nutrition, family planning & immunization are offered (Southeast Regional Health Authority (SERHA) n.d.). At Type V health centres (Slipe Pen Road and Windward Road), all services available at Type III are also provided, in addition to specified specialty and laboratory services.

Table 3-28 Health centres located within the project SIA

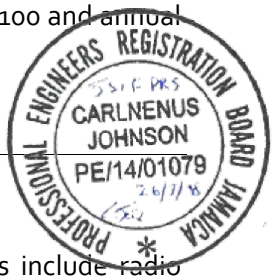
Name	Type	Ownership
Alpha Dental	Type 8 Health Centre	Public
Slipe Pen Road	Type 5 Health Centre	Public
East Queen Street	Type 7 Health Centre	Public
Lenworth Jacob	Type 2 Health Centre	NGO
Majesty Gardens	Type 3 Health Centre	Public
Rollington Town	Type 3 Health Centre	Public
Windward Road	Type 5 Health Centre	Public
Denham Town	Type 3 Health Centre	Public

Hospitals

There are four (4) hospitals within the SIA: Victoria Jubilee Hospital (Type S Specialist, Public); Kingston (Public) Hospital (Type A, Public); Bellevue (Type S Specialist, Public) and St. Josephs Hospital (Private). All belong to the SERHA.

Victoria Jubilee Hospital (VJH) provides services to the maternal community, training and research for doctors, nurses, midwives and other health care personnel. VJH sees more than 70,000 women and approximately 9,000 babies are delivered each year. The institution has a bed capacity of 304 (211 adults and 93 babies) with a staff complement is 171. The VJH was incorporated into the Kingston Public Hospital.

Kingston Public Hospital is a multi-disciplinary institution which provides both secondary and tertiary care and is a final referral point for such services. The following services are provided by the hospital: Diagnostic Imaging, Diagnostic Laboratory, Pharmacy, Medical & Surgery, Physiotherapy, Dietary, Radiotherapy, General & Emergency Surgery, Neurosurgery, Ear, Nose, Throat Surgery (ENT), and Urological Surgery amongst others. It has a bed capacity of 505, staff complement of 1,100 and annual patient load of 160,000.



Ambulance

Ambulance services operating within the parishes of Kingston and St. Andrew include:

- Ambucare - Network of life sustaining units on call 24 hours a day. Services include radio dispatched vehicles, pre-hospital medical response, air ambulance link (overseas) and standby for events and functions.
- Deluxe - Service team consists of specially trained emergency drivers and EMTs. Services include emergency and non-emergency transfers, hospitals and nursing homes, individual companies, stand-by at public events, ground transportation for air ambulance link-up, pre-arranged transport to & from clinics, treatment facilities and laboratories.
- St. Johns - Home nursing and first aid training to individuals and organisations as well as providing health services at sporting events, parties, corporate events and other events.

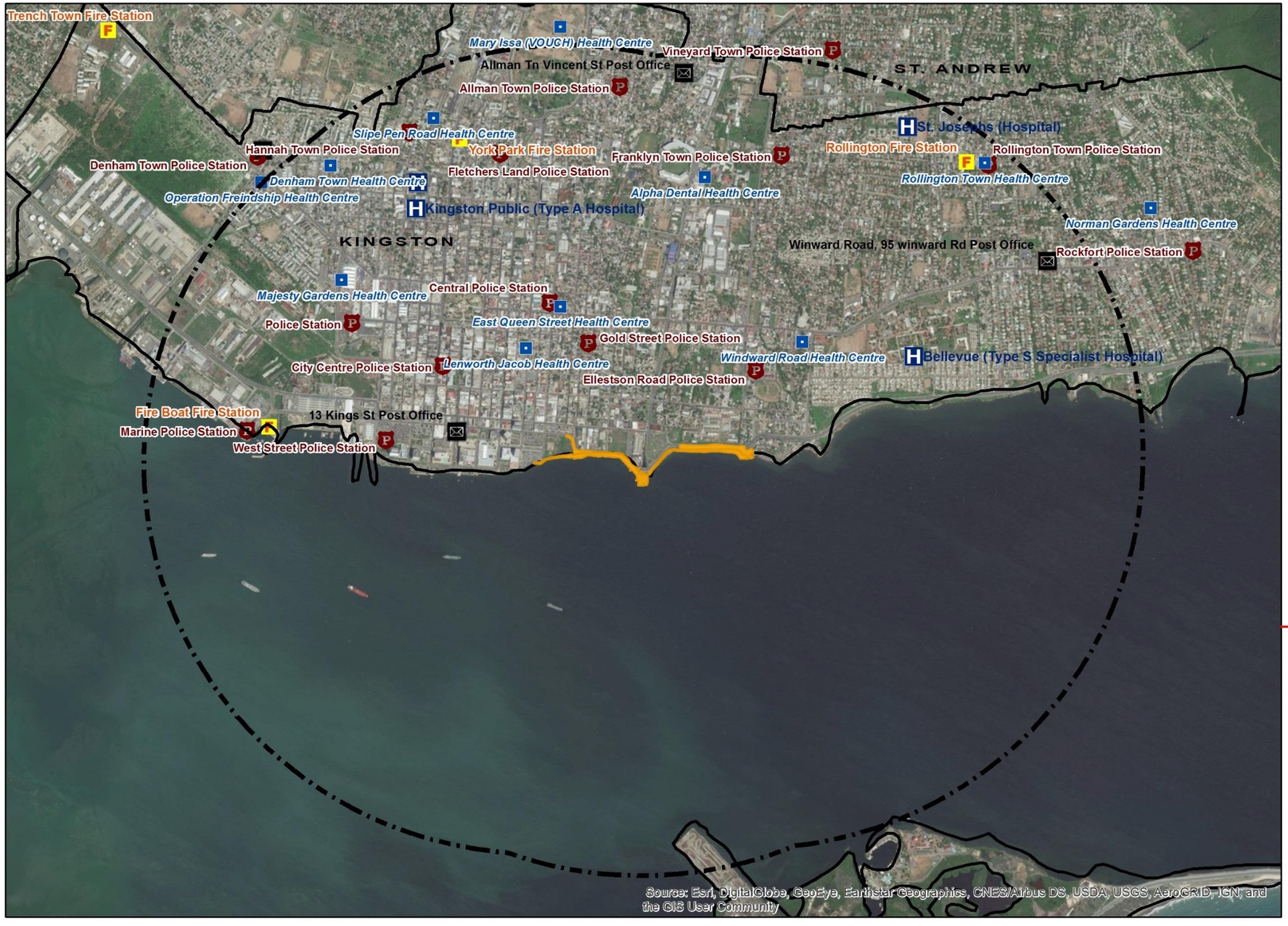
Fire Stations

Three (3) fire stations are situated within the 2 km SIA, specifically at York Park, Rollington and Fire Boat (Figure 3-31); these stations fall under Area I. Fire stations island-wide are served by a fleet of 91 operational firefighting and rescue vehicles and 58 utility vehicles. There are also 3 fire boats, one each assigned to the harbours in Kingston, Montego Bay and Ocho Rios. The Fire Prevention and Public Relations Division and the Emergency Medical Service (EMS) provide fire prevention services and emergency medical rescue/ paramedic services (Jamaica Fire Brigade 2012).

Police Stations

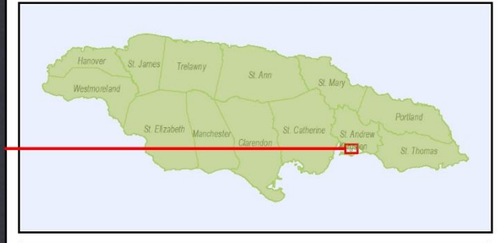
Eleven (11) police stations exist within the SIA surrounding the proposed development area and are part of Police Area 4 (Figure 3-31):

1. Rollington Town
2. Ellestson Road
3. West Street
4. Central
5. Hannah Town
6. Fletchers Land
7. Allman Town
8. City Centre
9. Gold Street
10. Franklyn Town
11. Marine



KEY

- Health centre
- Police station
- Hospital
- Fire station
- Post office
- Social Impact Area (2 km)
- Project boundary
- Parish boundary



0 250 500 1,000 METERS

GRID:JAMAICA METRE GRID; PROJECTION: LAMBERT CONFORMAL CONIC ONE STANDARD PARALLEL (18°NORTH); DATUM: WGS 84; UNIT OF MEASURE: METRE; MERIDIAN OF ORIGIN: 77° WEST OF GREENWICH; LATITUDE OF ORIGIN: 18° NORTH

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MAP CREATED BY: CL ENVIRONMENTAL CO. LTD., JUNE 2018

Data source: Mona GeoInformatics Institute

Figure 3-31 Social. health and emergency services located in and around the SIA

3.3.2 Land Use and Zoning

3.3.2.1 Land Use

Within the study area, land cover is characterised as built-up/ infrastructure (Figure 3-33). Industrial developments and ports exist within the SIA, including West Kingston Power Plant and the port of Kingston. Commercially, the study area has offices, financial centres (e.g. Bank of Jamaica), restaurants, bars, a market (Coronation Market), a fishing village (Rae Town), factories such as the Newport Feed Mills. Residential areas (communities) adjoining the proposed development area are Rae Town and Southside. Housing developments in proximity to the proposed site can be classified as low to low middle-income developments. Recreational facilities are located in these residential areas, where there are community centres, football fields and hard courts for netball and basketball.

The Kingston and St. Andrew and the Pedro Cays Provisional Development Order 2017 has listed 14 categories that fall within the study area:

i. Office Commercial
ii. Commercial
iii. Heavy Industry
iv. Recreational/Commercial
v. Light Industry
vi. Private Parking Facility
vii. Educational
viii. Residential
ix. Transportation Centre
x. Institutional
xi. Residential/Light Industry
xii. Cemetery/Crematoria
xiii. Fishing Beach
xiv. Fishing and Bathing Beach

3.3.2.2 Protected Areas

Protected areas examined here include all areas of land or water protected by various laws in Jamaica, as well as international agreements, that fall within or in proximity to the project area; these include fish sanctuaries or Special Fishery Conservation Areas (SFCAs), protected areas (declared and proposed), national parks, forest reserves, marine parks, game reserves and national heritage and monuments. Specific to this project, the project does not traverse any protected area; however, portions of the general Palisadoes Port Royal Area and specifically the Palisadoes-Port Royal Protected Area, Palisadoes-Port Royal Ramsar Site and Port Royal and the Palisadoes, a Protected National Heritage (protected under three different legislative declarations) are within the boundaries of the SIA. Figure 3-33 gives an overview of the location of the protected areas in relation to the project area and SIA. The Palisadoes

Port Royal Area is located 2 km south of the proposed location; this general area (Palisadoes/ Port Royal) is protected under the following legal instruments and agreements:

- Natural Resources Conservation Authority Act (NRCA) (1991) - The Palisadoes/ Port Royal Protected Area (PPRPA) was declared as a protected area on September 18, 1998.
- Jamaica National Heritage Trust Act - Declared a National Heritage Site on July 22, 1999.
- Convention on Wetlands of International Importance (Ramsar) - Designated a Wetland of International Importance (Ramsar Site) in April 2004.

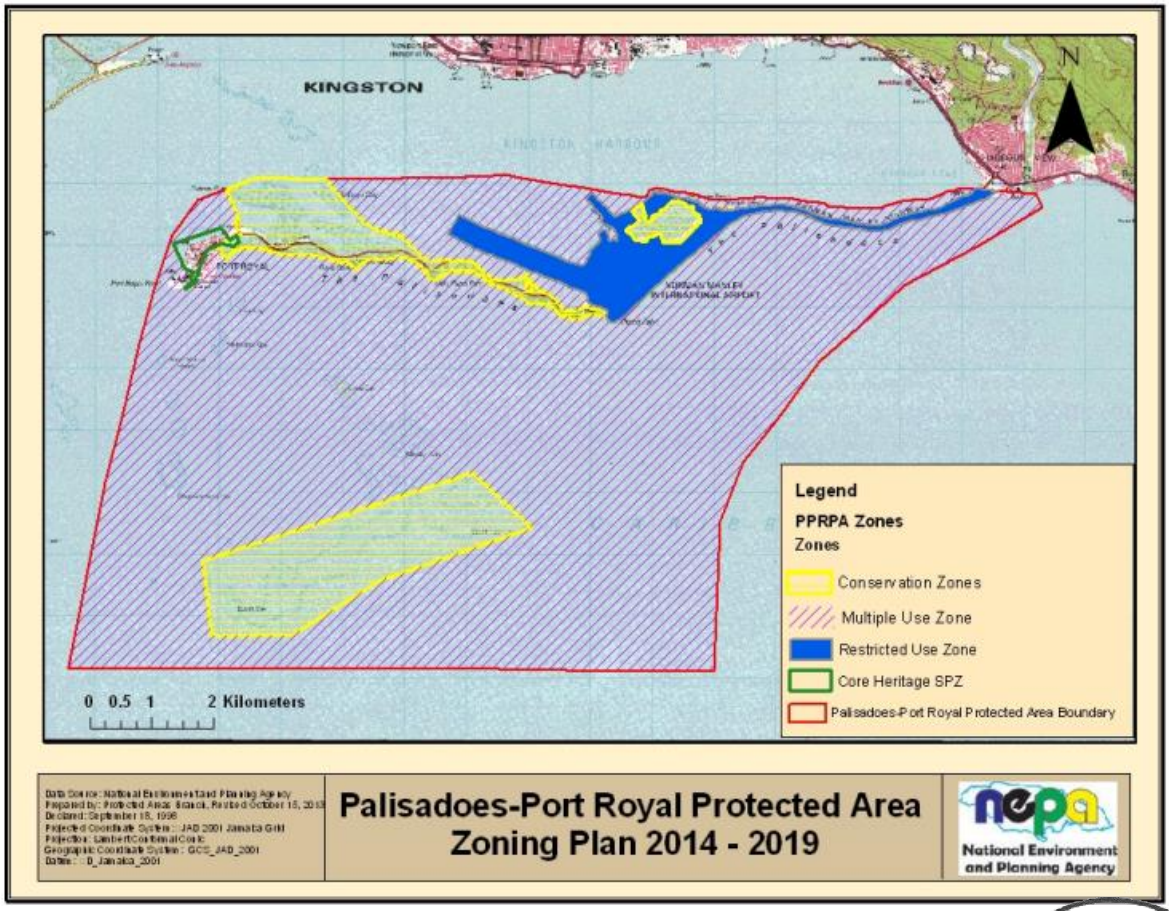
Palisadoes-Port Royal Protected Area (P-PRPA)

Palisadoes-Port Royal Protected Area (P-PRPA) was declared as a protected area on September 18, 1998 and is one of nine (9) protected areas declared under the Natural Resources Conservation Authority Act (NRCA) (1991). As mentioned previously, it was first declared as protected under the Beach Control Act on 8 May 1967.

The P-PRPA is approximately 7,523 hectares (75.23 km^2) (The Protected Areas Branch, The National Environment and Planning Agency 2013) and comprises the tombolo (Palisadoes), offshore cays, reefs and mangroves. The area was given protected status owing to historic and archaeological sites of educational and cultural significance; spiritual values; natural resources as a basis for the livelihood for residents and other communities; unique ecosystem (sand/ dune, coral reef, lagoon, seagrass beds); nesting sites for sea turtles, birds and fish; offers protection and a shelter for small vessels/ boats during storms and hurricanes; and acts as major gateway i.e. by sea (sea ports) and air (airports).

Four zones (Figure 3-32) are distinguished (The Protected Areas Branch, The National Environment and Planning Agency 2013):

1. Restricted Use Zone
2. Conservation Zone
3. Multiple-use Zone
4. Core Heritage Special Purpose Zone(SPZ)



Source: The Protected Areas Branch, The National Environment and Planning Agency (2013)

Figure 3-32 Zones of the Palisadoes-Port Royal Protected Area (2014-2019)

Palisadoes-Port Royal Ramsar Site

On 22 April 2005, the Palisadoes Port Royal area was designated a Wetland of International Importance (Ramsar Site) under the Convention on Wetlands of International Importance (Ramsar). The site is located on the southeast coast of Jamaica and covers approximately 7523.08 hectares including the cays, shoals, mangrove lagoons, mangrove islands, coral reefs, seagrass beds and surrounding shallow water, excluding the urban centres on the Tombolo (the town of Port Royal and the Airport complex) (Webber, et al. 2005).

The historic and cultural value of the area is very high as it includes forts on the dunes and a portion of the city of Port Royal. The site includes three categories of wetlands classified as underrepresented by the seventh Conference of Parties (1999): coral reefs, mangroves and sea-grass beds, all significant in biodiversity and in ecologically sensitive areas which are essential to the maintenance of waterfowl and fish populations. The Tombolo and the associated mangrove areas form the southern boundary of the site and the seaward boundary of the Kingston Harbour, reported to be the seventh largest natural harbour in the world. (Webber, et al. 2005). Important species found within this Ramsar site include the American Crocodile (*Crocodylus acutus*), the Reid Seahorse (*Hippocampus reidi*), the Hawksbill turtle

(*Eretmochelys imbricata*), the Brown Pelican (*Pelecanus occidentalis*), the West Indian Manatee (*Trichechus manatus manatus*), the Bottlenose Dolphin (*Tursiops truncatus*), the Red Mangrove (*Rhizophora mangle*), the Black Mangrove (*Avicennia germinans*) and the White Mangrove (*Laguncularia racemosa*). (National Environment and Planning Agency n.d.).

Port Royal and the Palisadoes, a Protected National Heritage

On 22 July 1999, the Port Royal area was declared as protected under the Jamaica National Heritage Trust Act. Although Port Royal is perhaps the focus of this site with its rich history and numerous heritage sites, the complete heritage site encompasses the land and structures as part of Harbour Head Pen, the Palisadoes (situated south of the project) and Port Royal, and the adjoining sea and cays.

3.3.2.3 Zoning

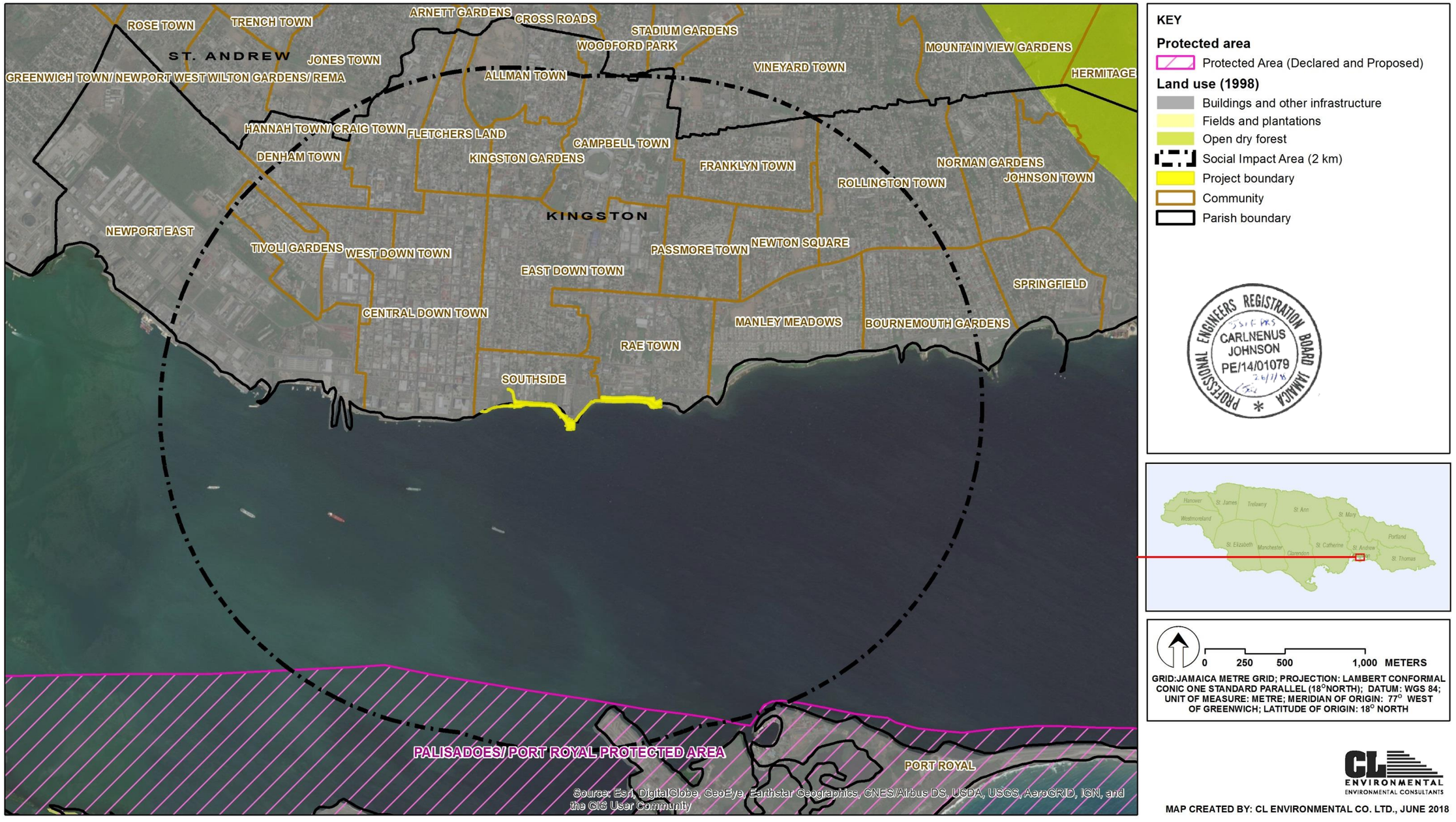
Kingston and St. Andrew and the Pedro Cays Provisional Development Order 2017

The proposed project location falls within the boundaries of the Kingston and St. Andrew and the Pedro Cays Provisional Development Order 2017. The area of the proposed development is zoned mainly as recreational. There are also areas zoned office/commercial and one area zoned Government Purposes & Statutory Undertakings (General Penitentiary).

3.3.2.4 Historical and Cultural

Within the SIA, there are numerous cultural and historic sites. Listed are some of the sites as are documented on the Jamaica National Heritage Trust website:

i. 150 East Street
ii. Coke Methodist
iii. East Queen Street Baptist Church
iv. Holy Trinity Cathedral
v. Kingston Parish Church
vi. Wesley Methodist Church
vii. Gordon House
viii. Hibbert House /Headquarters House
ix. Institute of Jamaica
x. Liberty Hall
xi. Ward Theatre
xii. St. William Grant Park
xiii. Tower Street - General Penitentiary
xiv. Negro Aroused Sculpture
xv. Public Building East and Public Building West; and
xvi. Kingston Railway Station



Data sources: Land use (Forestry Department, 1998) and protected areas (NEPA and MGI)

Figure 3-33 Land use and protected areas within the SIA

4.0 PUBLIC PARTICIPATION

4.1 PURPOSE AND APPROACH

The National Environment and Planning Agency (NEPA) recognizes the critical role played by the public, including civil society, community-based and non-governmental organizations (CBO's and NGO's). The process of public participation and sensitization is designed to enhance the awareness of stakeholders and/or the general public in an open sphere. This helps to ensure that persons who are likely to be impacted are knowledgeable and therefore able to implement precautionary measures to safeguard their interests. It also seeks to facilitate stakeholder participation in the monitoring and enforcement of the conditions under which approvals are being granted.

The stakeholder consultation programme for this project included the following main mechanisms:

1. Perception Survey (Community Stakeholders)
    a. Community (Residents)
    b. Fishers

4.2 PERCEPTION SURVEY

4.2.1 Community (Residents)

4.2.1.1 Methodology

During the period May 24-27, 2018 Three Hundred and Fifty-Two (352) community questionnaires were administered within a five hundred metre radius of the 1.3 kilometre stretch of shoreline along Port Royal Street proposed for shoreline stabilization upgrades (Figure 1). Fifty-one percent (51.0%) respondents were male and 49.0% were female.

Of the Three Hundred and Fifty-Two (352) respondents age cohort distribution was as follows; 31.6% were 18-25 years of age, 22.4% were 26-33 years, 17.6% were age 34-41 years, 12.9 % were age 42-50 years, 7.2% were age 51-60 years and 8.3% were older than sixty years of age.

The community questionnaires were administered and addressed the following major issues:

- General acceptability of the proposed project by community-based stakeholders.
- Fears and expectations about the specific project, including any anticipated social conflict and crime.
- Perceptions and attitudes of the community.
- General health, safety and environmental concerns related to the project.

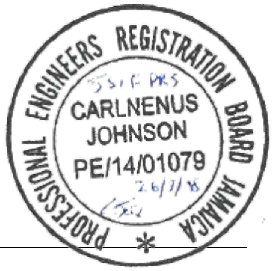
A total of five main communities were visited. These communities were Southside, Telaviv, Parade Gardens, Rae Town and Manley Meadows.

Percentages presented are for the total number of persons offering responses; in instances where respondents did not offer an answer to a question, they were not considered part of the analyses.

4.2.1.2 Limitations

Prior to commencing the field exercise, information indicated that the population within a one-kilometer radius of the site was 7,439 individuals and a minimum of number of 366 persons needed to be surveyed to allow for a 95% confidence limit. During the actual field exercise, the following limitations were encountered/arose and contributed to the team not being able to meet the number of 366 persons:

- The stated population (7,439) represented individuals of all ages and therefore included children who would not be eligible to be interviewed (only individuals eighteen years of age or older were considered for interviews).
- There were times during the survey period when gun violence erupted preventing the team from entering some areas.



With a sample size of 352 persons give a confidence level of approximately 89.3%.

4.2.1.3 Survey Findings and Results

Summary (All Communities)

Of those persons interviewed who offered a response, 57.3% indicated that they were employed, 37.0% stated they were unemployed while 5.7% of individuals were retired. Of the 57.3% indicating they were employed 36.0% indicated that they were self-employed and 58.0% had an employer. The remaining six percent (6.0%) offered no response. Additionally, for those indicating they were employed forty percent (40.0%) stated they were engaged in casual labour, 18.0% were semi-skilled, 21.0% were skilled, 4.0% were artisans while 15.0% stated they were professionals. The remaining two percent (2.0%) offered no response.

Regarding the head of household, 59.0% indicated that they were the head of their households. Of the 41.0% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 84.2% of household heads were employed, while 12.0% were unemployed and 3.8% were retired.

In general, interviewees resided in their communities over the long term. Approximately sixty-five percent (64.8%) of individuals resided in their communities for all their life, and 10.9% resided in their community in excess of fifteen years. Approximately six percent (5.9%) stated they lived in their community for between ten and fifteen years; 8.6% resided for between five and ten years. Just over

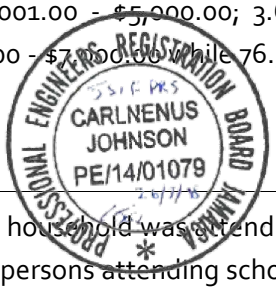
seven percent (7.1%) resided in their community for between three and five years and 2.7% for under two years.

Employment

Regarding the number of persons employed within households, 39.9% of interviewees stated they were the only person employed in their household. Just under thirty-one percent (30.9%) of respondents stated that two persons were employed, 10.8% stated three persons, 2.9% stated four persons while less than one percent (0.9%) stated five persons. Approximately two percent (1.5%) of interviewees stated that more than five persons were employed in their household. Additionally, 13.1% of interviewees indicated that no one in their household was employed

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 62.8% of respondents offered an answer for their personal weekly income. Of those who offered responses, less than one percent (0.4%) of persons earned less than five hundred dollars each week. Just over one percent (1.4%) indicated that income was between $501.00 - $1000.00, while 3.2% stated income of $1,001.00 - $1,500.00, 2.3% indicated $1,501.00 - $2,000.00; 5.9% indicated income of $2,001.00 - $3,000.00. Approximately four percent (4.1%) indicated income of $3,001.00 - $4,000.00; 11.7% indicated income of $4,001.00 - $5,000.00; 5.4% indicated income of $5,001.00 - $6,000.00, 5.9% indicated income of $6,001.00 - $7,000.00 while 59.7% indicated weekly household income was in excess of $7,000.00.

Of those interviewed 71.3% of respondents offered an answer for their weekly household income derived from all sources. Of those who offered responses, no household (0.0%) earned less than one thousand dollars each week. Less than one percent (0.8%) indicated that income was less than $1,001.00 - $1,500.00. 0.4% indicated $1,501.00 - $2,000.00; 1.6% indicated income of $2,001.00 - $3,000.00; 2.4% indicated income of $3,001.00 - $4,000.00; 8.4% indicated income of $4,001.00 - $5,000.00; 3.6% indicated income of $5,001.00 - $6,000.00, 6.4% indicated income of $6,001.00 - $7,000.00 while 76.5% indicated weekly household income was in excess of $7,000.00.



Education

As it pertained to education, 56.1% of interviewees indicated someone in the household was attending school. Of this number, 92.2% provided information on the actual number of persons attending school. Approximately forty six percent (45.8%) of respondents and 30.5% indicated two persons while 13.6% indicated three persons. Additionally, 3.4% stated that four persons within their household were attending school, 2.8% indicated five persons while 3.9% stated more than five persons. At it related to the school being attended 35.4% stated that the school being attended was infant/basic, 55.7% stated primary/all age, 37.5% stated high school, 2.6% college 6.8% university and 3.1% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

Regarding the highest level of education completed, 91.4% of those interviewed offered a response. Of this number less than one percent (0.9%) indicated that they did not attend school; 12.7% stated they completed primary/all age school, 13.6% stated that they did not complete high school, 53.0% completed high school, 5.9% college, 4.1% university and 9.8% HEART/Vocational Training Institution.

Awareness of JSIF, Jamaica Disaster Vulnerability Project and the Proposed Project

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), 94.1% interviewees offered a response. Approximately twenty six percent (25.6%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 74.4% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 21.3% stated they were made aware via newspaper, 40.4% indicated awareness was via television, 10.1% stated radio, 13.5% indicated community meeting and 33.7% indicated that they heard of JSIF through word of mouth while 3.4% of interviewees stated other and further indicated that their awareness of JSIF was via the internet and research. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 93.8% of respondents offered a response. Of these individuals, 14.1% of individuals stated that they had heard of the JDVRP while 859% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 14.1% of respondents who heard of the JDVRP, 10.2% indicated that awareness was via the newspaper, 32.7% indicated television, 6.1% stated radio, while 14.3% stated they were made aware via community meeting and 36.7% indicated word of mouth. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

In response to whether respondents knew what a revetment was, 89.7% of respondents offered a response. Of those who responded 5.1% indicated that they knew what a revetment was while 94.9% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 91.6% of interviewees responded. Of this number, 17.4% of individuals stated that they were aware of the proposal while 82.6% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 6.8% stated that they were made aware via the newspaper, 25.4% stated television, 5.1% stated awareness via radio while 8.5% stated community meeting and 62.7% stated that they were made aware via word of mouth.

Concerns about the Project

Regarding whether respondents had any concerns about the project, 91.1% of interviewees offered responses. Of these persons, 21.1% indicated that they had concerns about the project while 78.9% stated that they did not have any concern. Concerns expressed pertained to:

- Impact on livelihood to include fishers and other persons with businesses along the 1.3km area (e.g. cook shop owners) (1.5%)
- Whether the project will actually come to fruition (4.7%)
- Impact on the fishing village (1.5%)
- Impact on existing infrastructure (road) (3.1%)
- Whether shoreline stabilization will provide protection against hurricane (1.5%)
- Whether work opportunities will be created (20.0%)
- The benefit/effect the project will have on the community (30.8%)
- The effect on families (1.5%)
- Communities not being consulted about the project (1.5%)
- Possible dislocation (10.8%)
- The revetment blocking the view of the ocean (4.7%)
- The duration of the project (3.1%)
- Whether the community will have access (1.5%)
- Whether the community will be involved in the project (1.5%)
- Whether there will be long term maintenance post construction (1.5%)
- Whether the project will go as planned (1.5%)
- General safety and the safety of the facility post construction (3.1%)
- The lack of information on the project (4.7%)
- Whether there will be options for community interaction (1.5%)

On the issue of how respondents thought the project would affect their life, 37.3% of respondents indicated that the project would not affect their life in any way, while 13.9% anticipated a positive impact and 2.4% anticipated a negative impact. 46.4% were not sure if the project would affect their life.

Regarding the 2.4% of individuals anticipating a negative impact 50.0% of respondents anticipated that they would be relocated/displaced (residence or business), 25.0% anticipated that fisherfolk would be negatively affected and 25.0% anticipated losing their livelihood.

Regarding the 13.9% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- The area would be developed (7.1%)
- A recreational space would be available to them (40.5%)
- Flooding would be reduced (7.1%)
- Employment opportunities would be created (9.5%)

- The shoreline would be protected (4.8%)
- The area would become a tourist attraction (2.4%)
- The shoreline would be beautified (16.7%)
- The community would be developed (7.1%)
- Unity between communities would be facilitated (2.4%)
- Marine life would be preserved (2.4%)

Dependency on the Proposed Project Site

On the issue of dependency on the location for any type of business 90.4% of those interviews stated that they did not depend on the location. Just under ten percent (9.6%) of respondents stated that they depended on the land. Of this number land was used for income generation by one means or another either by conducting business or having their customer base in the area (81.2%) (e.g. general vending, fish vending, hair dressing, furniture making). Additionally, 15.7% stated that the area was used for fishing and 3.1% indicated that they used the area for relaxation

When asked if they knew of anyone who depended on the proposed site for any type of business/farming or residence 84.7% of those offering responses indicated that they did not know of anyone who depended on the proposed site. Of the 15.3% of interviewees who indicated that they knew of someone who depended on the proposed location, 57.4% stated that they knew someone who used the area for fishing, while 8.5% knew persons who used the area for fish vending. Approximately fifteen percent (14.9%) indicated that they knew individuals who used the area to generate income, 12.8% for business, 4.3% for leisure and 2.1% for furniture making.

Housing

On the issue of housing and social services, 26.5% of respondents indicated they owned their home, 0.6% leased, 22.0% rented the home they occupied; 2.7% stated their homes were government owned 18.6% were squatters, 28.7% lived in family owned homes and 0.9% stated "other", which encompassed those who rented the premises they occupied. When asked about the land on which dwellings were located, 18.5% of respondents indicated that they owned the land, 2.7% leased, 11.8% stated their homes were on government lands, 21.2% squatted, 33.7% had their homes on family land, and 12.1% stated "other". Those indicating "other" were respondents who stated that they were renters and persons who were in the process of paying taxes for the land.

Approximately seventy percent (69.5%) of dwellings had concrete and block walls, 21.3% of dwellings were wood/board structures 0.3% zinc and 8.9% stated other as the walls of their dwellings were made of both wood and concrete. Regarding roof type, 67.5% of respondents stated their roof type was metal sheeting, 28.2% stated concrete while 1.9% stated wood and 0.6% indicated other as the roofs of the dwelling was a combination of concrete and metal, metal and wood or wood and concrete.

Social Facilities and Services

Both water closets and pit latrines were in the study area. Just over ninety-four (94.4%) percent of interviewees stated that their toilet facility was a water closet while 2.3% stated that they had pit latrines. Additionally, 2.1% of respondents indicated that they did not have a toilet facility while 1.2% stated "other" but did not offer any further response.

Approximately ninety-nine percent (99.1%) of respondents stated that they used electricity for household lighting and 0.9% indicated kerosene oil.

Regarding the main fuel used for cooking, 95.6% of respondents stated gas as the main fuel for cooking while 4.1% stated coal. Less than one percent (0.3%) stated wood.

Regarding water supply, 95.6% of interviewees stated that their household domestic water supply was public piped water into their dwelling, 0.3% stated private tank, 2.6% indicated the public standpipe; 0.3% indicated private water truck and 1.2% stated "other", and cited that supply was from neighbours.

Regarding problems with the domestic water supply 90.4% of respondents stated there were no problems with the supply while 9.6% of respondents indicated that they had an issue. Of these respondents, 31.3% indicated irregular water supply and 43.8% indicated low water pressure. Approximately six percent (6.3%) stated that no pipes were run in their community and 15.6% stated that they received no water at all. Some respondents (3.0%) did not offer a response.

Where problems with the water supply were citied, respondents indicated that they bought water (9.4%) and used the community standpipe (34.4%). Just under fifty-seven percent (56.3%) stated "other" and specified collecting water ahead of disruptions in supply and getting water from neighbours.

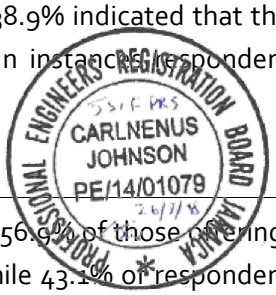
Of the respondents confirming problems with domestic water supply 64.5% stated that they stored water in drums, 3.2% stated that they used aboveground/black tanks while 32.3% stated "other" and named buckets and bottles as the main storage containers.

On the issue of the main method of garbage disposal, 93.6% of respondents stated that the public garbage truck was their main method of garbage disposal, 5.8% stated that they burned their garbage and 0.6% stated other and indicated that they disposed of garbage in the nearby gully. Regarding the frequency of garbage collections, 42.6% of those offering a response stated that collections were done once per week, 23.1% stated collections were twice per week, 15.4% stated a frequency of every two weeks while 5.9% stated that garbage collections were done once per month and 10.5% stated other and further indicated that collections were done occasionally or rarely.

When asked about where health care was most often obtained in the event of illness, 26.6% indicated that they went to the public clinic, 57.7% stated healthcare was accessed at the public hospital, while 13.6% stated the private doctor and 2.1% stated the private hospital.

As it related interviewees having specific health conditions, 15.6% of those offering responses stated that they suffered from asthma, 13.6% stated sinusitis, 2.0% respectively stated coughing and congestion/bronchial problems, while 6.3% stated that they suffered from chest pains and 0.6% stated bouts of diarrhoea. Just over sixty-two percent (62.2%) of respondents stated that they did not suffer from any of the named conditions. In instances respondents suffered from multiple conditions therefore percentages exceeded one hundred.

Regarding where shopping was usually done, 6.3% stated the supermarket, 22.7% stated the market, 12.2% stated that shopping was done at both the supermarket and market, 38.9% indicated that they shopped at the community shop while 55.4% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.



Recreational Facilities

When asked if recreational spaces were located in interviewees communities, 56.9% of those offering a response stated that there was not recreational space in their community while 43.1% of respondents indicated that a recreational space was in their community. Spaces named were Breezy Castle, the Multicare Field and Park, GP Sports Club, Bellevue Field, Manley Meadows Community Centre, the CDC Centre, the PORA Community Centre (also referred to as the Parade Gardens Community Centre), the STEM Centre, LINK, URBAN, Rae Town Playing Field, Rae Town Recreational Centre, Rise Life Management, Junior Centre and the Grace Kennedy Youth Foundation.

Regarding what persons did for fun in their community, 44.6% stated street dance/parties, 13.4% stated youth clubs, 15.3% sports clubs/bars, 3.4% service clubs/charity while 17.9% stated church groups/activities and 13.6% stated other and specified gambling, socialising on the street, relaxing in the privacy of their homes and doing nothing.

Natural Hazards

When asked about flooding 7.5% of respondents indicated that their community was affected by flooding while 92.5% stated that flooding did not affect their community. Those indicating that their community was affected stated that flooding occurred only during times of heavy rain (65.4%), each time there was a rainfall event (19.2%) and during hurricanes (11.5%).

Regarding whether the proposed 1.3Km area was affected by flooding, 39.9% of interviewees, stated that the proposed area was not affected by flooding, while 51.3% stated that they did not know if the area was affected. Of the 8.8% of those stating that the proposed area was affected by flooding, 20.0% stated that flooding occurred each time there was a rainfall event, 40.0% stated only in times of heavy rains and 43.3% stated flooding occurred during hurricanes. Some respondents offered multiple responses. On the issue of how water levels rose only 40.0% of those indicating that the area was affected by flooding offered a response. Of this number 25.0% indicated that water levels were less than 0.3 metres while 75.0% stated that water levels rose to between 0.3 and 1.7 metres.

On the issue of whether there are problems with frequent fires at the proposed area, 49.6% of respondents indicated that the proposed site was not affected by frequent fires while 50.4% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire offered no further details.

Protected Area or Area of Historic, National or Environmental Importance

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 56.9% of interviewees stated they did not know of any such area or site, 38.1% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 5.0% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.

Places named were:

- Victoria Pier
- The Palisadoes Strip
- The construction site of the Ministry of Foreign Affairs Building
- The fishing village
- The entire Port Royal Street Area
- The National Library
- The Craft Market
- The Statue (at the bottom of South Camp Road)
- The Waterfront

Percentages presented for community respondents are for the total number of respondents.

Southside

Approximately twenty-nine percent (28.7%) of respondents were from the Southside community. Just under forty-nine percent (48.5%) respondents were male and 51.5% were female.

Age cohort distribution was as follows; 32.3% were 18-25 years of age, 24.3% were 26-33 years, 13.1% were age 34-41 years, 10.1% were age 42-50 years, 11.1% were age 51-60 years and 9.1% were older than sixty years of age.

Of those persons interviewed who offered a response, 56.4% indicated that they were employed, 33.7% stated they were unemployed while 9.9% of individuals were retired. Of the 56.4% indicating they were employed 28.1% indicated that they were self-employed and 66.7% had an employer. The remaining 5.2% offered no response. Additionally, for those indicating they were employed 38.6% stated they were engaged in casual labour, 17.5% were semi-skilled, 14.0% were skilled, 7.0% were artisans while 21.1% stated they were professionals. The remaining 1.8% offered no response.

Regarding the head of household, 59.4% indicated that they were the head of their households. Of the 40.6% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 90.0% of household heads were employed, while 2.5% were unemployed and 7.5% were retired.

In general, interviewees resided in their communities over the long term. Just over seventy-one percent (71.4%) of individuals resided in their communities for all their life, and 7.2% resided in their community in excess of fifteen years. Two percent (2.0%) stated they lived in their community for between ten and fifteen years; 7.1% resided for between five and ten years. Just over eight percent (8.2%) resided in their community for between three and five years and 4.1% for under two years.

EMPLOYMENT

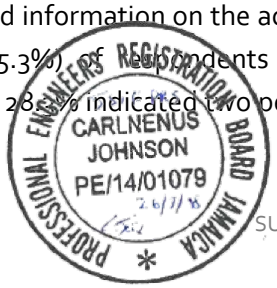
Regarding the number of persons employed within households, 41.0% of interviewees stated they were the only person employed in their household. Thirty-four percent (34.0%) of respondents stated that two persons were employed, 10.0% stated three persons, 2.0% stated four persons while no household had stated five persons employed. Three percent (3.0%) of interviewees stated that more than five persons were employed in their household. Additionally, 10.0% of interviewees indicated that no one in their household was employed.

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 73.3% of respondents offered an answer for their personal weekly income. Of those who offered responses, no one (0.0%) of persons earned less than five hundred dollars each week. Just over one percent (1.4%) indicated that income was between $501.00 - $1000.00, while 2.7% stated income of $1,001.00 - $1,500.00, 2.7% also indicated $1,501.00 - $2,000.00; 5.4% indicated income of $2,001.00 - $3,000.00. Approximately eight percent (8.1%) indicated income of $3,001.00 - $4,000.00; 12.2% indicated income of $4,001.00 - $5,000.00; 4.0% indicated income of $5,001.00 - $6,000.00, 8.1% indicated income of $6,001.00 - $7,000.00 while 55.4% indicated weekly household income was in excess of $7,000.00.

Of those interviewed 88.1% of respondents offered an answer for their weekly household income derived from all sources. Of those who offered responses, no household (0.0%) earned less than two thousand dollars each week. Approximately one percent (1.1%) 1.6% indicated income of $2,001.00 - $3,000.00; 3.4% indicated income of $3,001.00 - $4,000.00; 12.4% indicated income of $4,001.00 - $5,000.00; no one (0.0%) indicated income of $5,001.00 - $6,000.00, 7.9% indicated income of $6,001.00 - $7,000.00 while 75.2% indicated weekly household income was in excess of $7,000.00.

EDUCATION

As it pertained to education, 55.1% of interviewees indicated someone in the household was attending school. Of this number, 98.1% provided information on the actual number of persons attending school. Approximately forty five percent (45.3%) of respondents indicated that one person within their household was attending school while 28.3% indicated two persons and 15.1% indicated three persons.



Additionally, 9.4% stated that four persons within their household were attending school, 1.9 indicated five persons while no one (0.0%) stated more than five persons. As it related to the school being attended 33.3% stated that the school being attended was infant/basic, 61.1% stated primary/all age, 24.1% stated high school, 3.7% college, 13.0% university and 3.7% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

Regarding the highest level of education completed, 98.0% of those interviewed offered a response. Of this number one percent (1.0%) indicated that they did not attend school; 13.1% stated they completed primary/all age school, 12.1% stated that they did not complete high school, 56.5% completed high school, 5.1% college, 5.1% university and 7.1% HEART/Vocational Training Institution.

AWARENESS OF JSIF, JAMAICA DISASTER VULNERABILITY PROJECT AND THE PROPOSED PROJECT

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), 98.0% interviewees offered a response. Approximately thirty percent (30.3%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 69.7% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 16.7% stated they were made aware via newspaper, 33.3% indicated awareness was via television, 10.0% stated radio, 23.3% indicated community meeting and 43.3% indicated that they heard of JSIF through word of mouth while 6.7% of interviewees stated "other" and further indicated that their awareness of JSIF was via the internet and research. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 98.0% of respondents offered a response. Of these individuals, 16.2% of individuals stated that they had heard of the JDVRP while 83.8% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 16.2% of respondents who heard of the JDVRP, no one (0.0%) indicated that awareness was via the newspaper, 25.0% indicated television, 6.3% stated radio, while 18.8% stated they were made aware via community meeting and 37.5% indicated word of mouth. It should be noted that percentages were below one hundred as some interviewees did not indicate the medium through which they were made aware of the JDVRP.

In response to whether respondents knew what a revetment was, 95.0% of respondents offered a response. Of those who responded 5.2% indicated that they knew what a revetment was while 94.8% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 95.0% of interviewees responded. Of this number, 19.8% of individuals stated that they were aware of the proposal while 80.2% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 10.5% stated that they were made aware via the newspaper, 5.3%

stated television, no one (0.0%) stated awareness via radio while 15.8% stated community meeting and 68.4% stated that they were made aware via word of mouth.

CONCERNS ABOUT THE PROJECT

Regarding whether respondents had any concerns about the project, 90.1% of interviewees offered responses. Of these persons, 13.2% indicated that they had concerns about the project while 86.8% stated that they did not have any concern. Concerns expressed pertained to:

- Whether the project will actually come to fruition (25.0%)
- Whether work opportunities will be created (16.7%)
- The benefit/effect the project will have on the community (8.3%)
- Possible dislocation (16.7%)
- The revetment blocking the view of the ocean (16.7%)
- Whether the community will have access (8.3%)
- Whether there will be long term maintenance post construction (8.3%)

On the issue of how respondents thought the project would affect their life, 29.9% of respondents indicated that the project would not affect their life in any way, while 14.4% anticipated a positive impact and 2.1% anticipated a negative impact. 53.6% were not sure if the project would affect their life.

Regarding the 2.1% of individuals anticipating a negative 100.0% anticipated losing their livelihood.

Regarding the 14.4% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- The area would be developed (14.3%)
- A recreational space would be available to them (21.4%)
- Flooding would be reduced (14.3%)
- The shoreline would be beautified (28.6%)
- The community would be developed (14.3%)
- Unity between communities would be facilitated (7.1%)

DEPENDENCY ON THE PROPOSED PROJECT SITE

On the issue of dependency on the location for any type of business 89.9% of those interviews stated that they did not depend on the location. Just over ten percent (10.1%) of respondents stated that they depended on the proposed location. Of this number land was used for income generation by one means or another either by conducting business or having their customer base in the area (70.0%). Additionally, 30.0% stated that the area was used for fishing.

When asked if they knew of anyone who depended on the proposed site for any type of business 80.8% of those offering responses indicated that they did not know of anyone who depended on the proposed

site. Of the 19.2% of interviewees who indicated that they knew of someone who depended on the proposed location, 82.4% stated that they knew someone who used the area for fishing, while 5.9% respectively knew persons who used the area for vending, cook shop operation and business.

HOUSING

On the issue of housing and social services, 36.7% of respondents indicated they owned their home, 1.0% leased, 23.5% rented the home they occupied; no one (0.0%) stated their homes were government owned, 13.3% were squatters, 24.5% lived in family owned homes and 1.0% stated "other", which encompassed those who were staying with family/friends. When asked about the land on which dwellings were located, 27.6% of respondents indicated that they owned the land, 4.1% leased, 12.2% stated their homes were on government lands, 15.3% squatted, 30.6% had their homes on family land, and 10.2% stated "other". Those indicating "other" were respondents who stated that they were renters.

Approximately eighty percent (79.6%) of dwellings had concrete and block walls, 12.2% of dwellings were wood/board structures, 0.0% zinc and 8.2% stated "other" as the walls of their dwellings were made of both wood and concrete. Regarding roof type, 60.9% of respondents stated their roof type was metal sheeting and 39.1% stated concrete.

SOCIAL FACILITIES AND SERVICES

Ninety-eight (98.0%) percent of interviewees stated that their toilet facility was a water closet while no one (0.0%) stated that they had pit latrines. Additionally, 1.0% of respondents indicated that they did not have a toilet facility while 1.0% stated "other" but did not offer any further response.

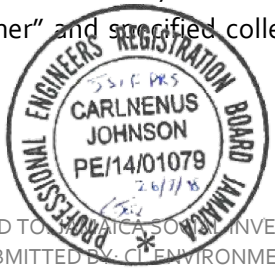
All respondents (100.0%) stated that they used electricity for household lighting.

Regarding the main fuel used for cooking, 99.0% of respondents stated gas as the main fuel for cooking while 1.0% stated coal.

Regarding water supply, 97.0% of interviewees stated that their household domestic water supply was public piped water into their dwelling, 2.0% indicated the public standpipe and 1.0% stated "other", however no further information was given.

Regarding problems with the domestic water supply 86.2% of respondents stated there were no problems with the supply while 13.8% of respondents indicated that they had an issue. Of these respondents, 23.1% indicated irregular water supply and 61.5% indicated low water pressure. Approximately eight percent (7.7%) stated that they received no water at all. Some respondents (7.7%) did not offer a response.

Where problems with the water supply were citied, respondents indicated that they used the community standpipe (30.8%). Just over sixty-one percent (61.5%) stated "other" and specified collecting water ahead of disruptions in supply and getting water from neighbours.



Of the respondents confirming problems with domestic water supply 75.0% stated that they stored water in drums, 8.3% stated that they used aboveground/black tanks while 16.7% stated "other" and named buckets and bottles as the main storage containers.

On the issue of the main method of garbage disposal, 95.0% of respondents stated that the public garbage truck was their main method of garbage disposal, 3.0% stated that they burned their garbage and 2.0% stated "other" and indicated that they disposed of garbage in the nearby gully or on New Road. Regarding the frequency of garbage collections, 44.7% of those offering a response stated that collections were done once per week, 25.5% stated collections were twice per week, 7.4% stated a frequency of every two weeks while 3.2% stated that garbage collections were done once per month and 14.9% stated "other" and further indicated that collections were done Irregularly, daily, three times per week and rarely.

When asked about where health care was most often obtained in the event of illness, 25.5% indicated that they went to the public clinic, 58.2% stated healthcare was accessed at the public hospital, while 14.3% stated the private doctor and 2.0% stated the private hospital.

As it related interviewees having specific health conditions, 13.9% of those offering responses stated that they suffered from asthma, 9.9% stated sinusitis, 2.0% stated coughing, 4.0% indicated congestion/bronchial problems, while 10.9% stated that they suffered from chest pains and 1.0% stated bouts of diarrhoea. Just over sixty-one percent (61.4%) of respondents stated that they did not suffer from any of the named conditions. In instances respondents suffered from multiple conditions therefore percentages exceeded one hundred.

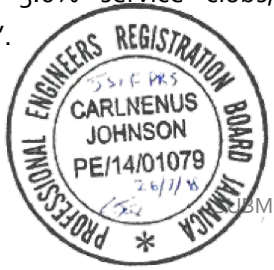
Regarding where shopping was usually done, 2.0% stated the supermarket, 25.7% stated the market, 11.9% stated that shopping was done at both the supermarket and market, 35.6% indicated that they shopped at the community shop while 56.4% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.

RECREATIONAL FACILITIES

When asked if recreational spaces were located in interviewees communities, 35.8% of those offering a response stated that there was no recreational space in their community while 64.2% of respondents indicated that a recreational space was in their community. Spaces named were Breezy Castle, the Multicare Field and Park, the PORA Community Centre (also referred to as the Parade Gardens Community Centre), the STEM Centre, LINK, URBAN, Rae Town Playing Field, Rae Town Recreational Centre, Rise Life Management, the Grace Kennedy Youth Foundation.

Regarding what persons did for fun in their community, 32.7% stated street dance/parties, 10.9% stated youth clubs, 15.8% sports clubs/bars, 3.0% service clubs/charity while 18.8% stated church groups/activities and 19.8% stated "other".

NATURAL HAZARDS



When asked about flooding 3.1% of respondents indicated that their community was affected by flooding while 96.9% stated that flooding did not affect their community. Those indicating that their community was affected stated that flooding occurred only during times of heavy rain (66.7%). The remaining 33.3% offered no response.

Regarding whether the proposed 1.3Km area was affected by flooding, 33.0% of interviewees, stated that the proposed area was not affected by flooding, while 58.8% stated that they did not know if the area was affected. Of the 8.2% of those stating that the proposed area was affected by flooding, 37.5% stated that flooding occurred each time there was a rainfall event, 12.5% stated only in times of heavy rains and 50.0% stated flooding occurred during hurricanes. On the issue of how water levels rose, only 12.5% of those indicating that the area was affected by flooding offered a response. Of this number 100.0% indicated that water levels were less than 0.3 metres.

On the issue of whether there are problems with frequent fires at the proposed area, 45.8% of respondents indicated that the proposed site was not affected by frequent fires while 54.2% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

PROTECTED AREA OR AREA OF HISTORIC, NATIONAL OR ENVIRONMENTAL IMPORTANCE

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 58.9% of interviewees stated they did not know of any such area or site, 32.6% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 8.4% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.

Places named were:

- Victoria Pier
- The Palisadoes Strip
- The construction site of the Ministry of Foreign Affairs Building
- The fishing village
- The Oceana Hotel
- The Craft Market
- The Waterfront

Telaviv

Approximately seventeen percent (16.5%) of respondents were from the Telaviv community. Just under forty-eight percent (48.2%) respondents were male and 51.8% were female.

Age cohort distribution was as follows; 37.9% were 18-25 years of age, 10.4% were 26-33 years, 24.1% were age 34-41 years, 15.5% were age 42-50 years, 6.9% were age 51-60 years and 5.2% were older than sixty years of age.

Of those persons interviewed who offered a response, 57.9% indicated that they were employed while 41.1% stated they were unemployed. No one was retired. Of the 57.9% indicating they were employed 63.6% indicated that they were self-employed and 36.4% had an employer. Additionally, for those indicating they were employed 33.3% stated they were engaged in casual labour, 15.2% were semi-skilled, 36.4% were skilled, 3.0% were artisans while 6.1% stated they were professionals. The remaining 6.0% offered no response.

Regarding the head of household, 64.9% indicated that they were the head of their households. Of the 35.1% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 90.0% of household heads were employed, while 10.0% were unemployed.

In general, interviewees resided in their communities over the long term. Just over sixty eight percent (68.4%) of individuals resided in their communities for all their life, and 17.6% resided in their community in excess of fifteen years. Seven percent (7.0%) stated they lived in their community for between ten and fifteen years; 3.5% resided for between five and ten years. Approximately four percent (3.5%) resided in their community for between three and five years. No one resided in the community for under two years.

EMPLOYMENT

Regarding the number of persons employed within households, 42.9% of interviewees stated they were the only person employed in their household. Just under thirty-six percent (35.7%) of respondents stated that two persons were employed, 7.1% stated three persons, 1.8% stated four persons while no household had stated five or more persons employed. Additionally, 12.5% of interviewees indicated that no one in their household was employed.

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 60.3% of respondents offered an answer for their personal weekly income. Of those who offered responses, no one (0.0%) of persons earned less than fifteen hundred dollars each week. Approximately three percent (2.8%) indicated that income was between $1,501.00 - $2,000.00; 8.6% indicated income of $2,001.00 - $3,000.00. No one (0.0%) indicated income of $3,001.00 - $4,000.00; 22.9% indicated income of $4,001.00 - $5,000.00; no one (0.0%) indicated income of $5,001.00 - $6,000.00, 8.6% indicated income of $6,001.00 - $7,000.00 while 57.1% indicated weekly household income was in excess of $7,000.00.

Of those interviewed 65.5% of respondents offered an answer for their weekly household income derived from all sources. Of those who offered responses, no household (0.0%) earned less than fifteen hundred dollars each week. Approximately three percent (2.7%) indicated income of $1,501.00 - $2,000.00, no one (0.0%) indicated income of $2,001.00 - $3,000.00 and $3,001.00 - $4,000.00; 15.8% indicated income

of $4,001.00 - $5,000.00; 2.6% indicated income of $5,001.00 - $6,000.00, 2.6% indicated income of $6,001.00 - $7,000.00 while 76.3% indicated weekly household income was in excess of $7,000.00.

EDUCATION

As it pertained to education, 54.7% of interviewees indicated someone in the household was attending school. Of this number, 52.8% provided information on the actual number of persons attending school. Approximately fifty seven percent (57.1%) of respondents indicated that one person within their household was attending school while 25.0% indicated two persons and 10.7% indicated three persons. Additionally, 3.6% stated that four persons within their household were attending school, 3.6% indicated five persons while no one (0.0%) stated more than five persons. As it related to the school being attended 31.0% stated that the school being attended was infant/basic, 51.7% stated primary/all age, 34.5% stated high school, 3.4% college, 6.9% university and 3.4% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

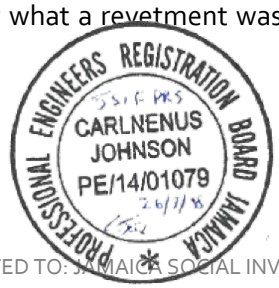
Regarding the highest level of education completed, 98.3% of those interviewed offered a response. Of this number no one (0.0%) indicated that they did not attend school; 15.8% stated they completed primary/all age school, 17.5% stated that they did not complete high school, 49.1% completed high school, 1.8% college, 1.8% university and 14.0% HEART/Vocational Training Institution.

AWARENESS OF JSIF, JAMAICA DISASTER VULNERABILITY PROJECT AND THE PROPOSED PROJECT

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), 96.6% interviewees offered a response. Twenty-five percent (25.0%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 75.0% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 14.3% stated they were made aware via newspaper, 50.0% indicated awareness was via television, 14.3% stated radio, 7.1% indicated community meeting and 28.6% indicated that they heard of JSIF through word of mouth. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 96.6% of respondents offered a response. Of these individuals, 26.8% of individuals stated that they had heard of the JDVRP while 73.2% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 26.8% of respondents who heard of the JDVRP, no one (0.0%) indicated that awareness was via the newspaper, 46.7% indicated television, 6.7% stated radio, while 13.3% stated they were made aware via community meeting and 46.7% indicated word of mouth. It should be noted that percentages exceeded one hundred as some interviewees were made aware via multiple media.

In response to whether respondents knew what a revetment was, 93.1% of respondents offered a response. Of those who responded 3.7% indicated that they knew what a revetment was while 96.3% stated that they did not know what a revetment was.



On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 94.8% of interviewees responded. Of this number, 25.5% of individuals stated that they were aware of the proposal while 74.5% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, no one (0.0%) stated that they were made aware via the newspaper, 57.1% stated television, 14.3% stated awareness via radio while 7.1% stated community meeting and 42.9% stated that they were made aware via word of mouth.

CONCERNS ABOUT THE PROJECT

Regarding whether respondents had any concerns about the project, 96.6% of interviewees offered responses. Of these persons, 37.5% indicated that they had concerns about the project while 62.5% stated that they did not have any concern. Concerns expressed pertained to:

- Whether work opportunities will be created (10.5%)
- The benefit/effect the project will have on the community (26.3%)
- Possible dislocation to include fishers (21.0%)
- The duration of the project (5.3%)
- Whether the project will go as planned (5.3%)
- General safety and the safety of the facility post construction (10.5%)
- The lack of information on the project (15.8%)
- Whether there will be options for community interaction (5.3%)

On the issue of how respondents thought the project would affect their life, 30.9% of respondents indicated that the project would not affect their life in any way, while 21.8% anticipated a positive impact and 1.8% anticipated a negative impact. 45.5% were not sure if the project would affect their life.

Regarding the 1.8% of individuals anticipating a negative 100.0% anticipated being displaced/relocated.

Regarding the 21.8% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- Recreational space would be available to them (45.5%)
- Employment opportunities would be created (27.3%)
- The shoreline would be protected (9.1%)
- The community would be developed (9.1%)
- Marine life would be preserved (9.1%)

DEPENDENCY ON THE PROPOSED PROJECT SITE

On the issue of dependency on the location for any type of business 79.2% of those interviews stated that they did not depend on the location. Approximately twenty-one percent (20.8%) of respondents stated

that they depended on the proposed location. Of this number land was used for income generation by one means or another either by conducting business or having their customer base in the area (90.0%). Additionally, 10.0% stated that the area was used for fishing.

When asked if they knew of anyone who depended on the proposed site for any type of business 76.6% of those offering responses indicated that they did not know of anyone who depended on the proposed site. Of the 23.4% of interviewees who indicated that they knew of someone who depended on the proposed location, 9.1% stated that they knew someone who used the area for fishing, while 72.8% respectively knew persons who used the area for generating income e.g. furniture making, vending, cook shop operation and business while 18.1% stated that persons used the area for leisure.

HOUSING

On the issue of housing and social services, 10.7% of respondents indicated they owned their home, 0.0% leased, 17.9% rented the home they occupied; 7.1% stated their homes were government owned, 32.1% were squatters, 30.4% lived in family owned homes and 1.8% stated "other", which encompassed those who resided on church property. When asked about the land on which dwellings were located, 5.4% of respondents indicated that they owned the land, 5.4% leased, 8.9% stated their homes were on government lands, 33.9% squatted, 39.3% had their homes on family land, and 7.1% stated "other". Those indicating "other" were respondents who stated that they were renters and those who lived on property owned by the church.

Approximately fifty one percent (50.9%) of dwellings had concrete and block walls, 27.3% of dwellings were wood/board structures, 0.0% zinc and 21.8% stated "other" as the walls of their dwellings were made of both wood and concrete. Regarding roof type, 79.6% of respondents stated their roof type was metal sheeting and 8.2% stated concrete, 6.1% stated wood and 6.1% stated "other" as roofs were a combination of metal and wood or metal and concrete.

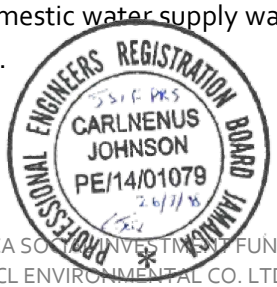
SOCIAL FACILITIES AND SERVICES

Just under eighty-eight (87.5%) percent of interviewees stated that their toilet facility was a water closet while 8.9% stated that they had pit latrines. Additionally, 1.8% of respondents indicated that they did not have a toilet facility while 1.8% stated "other" but did not offer any further response.

Approximately ninety eight percent (98.2%) stated that they used electricity for household lighting while 1.8% indicated that kerosene oil was used.

Regarding the main fuel used for cooking, 92.9% of respondents stated gas as the main fuel for cooking while 7.1% stated coal.

Regarding water supply, 96.4% of interviewees stated that their household domestic water supply was public piped water into their dwelling while 3.6% indicated the public standpipe.



Regarding problems with the domestic water supply 89.3% of respondents stated there were no problems with the supply while 10.7% of respondents indicated that they had an issue. Of these respondents, 66.7% indicated irregular water supply and 33.3% indicated low water pressure.

Where problems with the water supply were citied, respondents indicated that they bought water (16.7%) and used the community standpipe (16.7%). Just under sixty-seven percent (66.6%) stated "other" and specified collecting water ahead of disruptions in supply and seeking water from "other" persons.

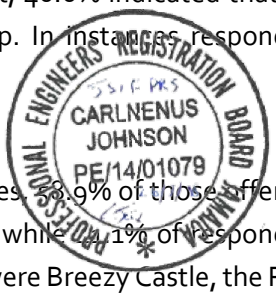
Of the respondents confirming problems with domestic water supply 50.0% stated that they stored water in drums, no one (0.0%) stated that they used aboveground/black tanks while 50.0% stated "other" and named buckets and bottles as the main storage containers.

On the issue of the main method of garbage disposal, 98.2% of respondents stated that the public garbage truck was their main method of garbage disposal and 1.8% stated that they burned their garbage. Regarding the frequency of garbage collections, 23.6% of those offering a response stated that collections were done once per week, 29.1% stated collections were twice per week, 7.3% stated a frequency of every two weeks while 7.3% stated that garbage collections were done once per month and 25.5% stated "other" and further indicated that collections were done Irregularly, daily, three times per week and twice daily.

When asked about where health care was most often obtained in the event of illness, 29.1% indicated that they went to the public clinic, 60.0% stated healthcare was accessed at the public hospital, while 7.3% stated the private doctor and 3.6% stated the private hospital.

As it related interviewees having specific health conditions, 17.2% of those offering responses stated that they suffered from asthma, 12.1% stated sinusitis, 1.7% stated coughing, 0.0% indicated congestion/bronchial problems, while 6.9% stated that they suffered from chest pains and 0.0% stated bouts of diarrhoea. Just over sixty-two percent (62.1%) of respondents stated that they did not suffer from any of the named conditions.

Regarding where shopping was usually done, 8.6% stated the supermarket, 22.4% stated the market, 13.8% stated that shopping was done at both the supermarket and market, 46.6% indicated that they shopped at the community shop while 69.0% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.



RECREATIONAL FACILITIES

When asked if recreational spaces were located in interviewees communities, 58.9% of those offering a response stated that there was no recreational space in their community while 41.1% of respondents indicated that a recreational space was in their community. Spaces named were Breezy Castle, the PORA Community Centre (also referred to as the Parade Gardens Community Centre), Rise Life Management and the Junior Centre.

Regarding what persons did for fun in their community, 37.9% stated street dance/parties, 8.6% stated youth clubs, 6.9% sports clubs/bars, 1.7% service clubs/charity while 31.0% stated church groups/activities and 10.3% stated "other".

NATURAL HAZARDS

When asked about flooding 8.9% of respondents indicated that their community was affected by flooding while 91.1% stated that flooding did not affect their community. Those indicating that their community was affected stated that flooding occurred only during times of heavy rain (80.0%) while 20.0% stated that flooding occurred during hurricanes.

Regarding whether the proposed 1.3Km area was affected by flooding, 43.6% of interviewees, stated that the proposed area was not affected by flooding, while 43.6% stated that they did not know if the area was affected. Of the 12.8% of those stating that the proposed area was affected by flooding, 28.6% stated that flooding occurred each time there was a rainfall event, 57.1% stated only in times of heavy rains and 42.9% stated flooding occurred during hurricanes. It should be noted that respondents offered multiple responses. On the issue of how water levels rose, only 14.3% of those indicating that the area was affected by flooding offered a response. Of this number 100.0% indicated that water levels were less than 0.3 metres.

On the issue of whether there are problems with frequent fires at the proposed area, 50.0% of respondents indicated that the proposed site was not affected by frequent fires while 50.0% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

PROTECTED AREA OR AREA OF HISTORIC, NATIONAL OR ENVIRONMENTAL IMPORTANCE

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 53.7% of interviewees stated they did not know of any such area or site, 42.6% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 3.7% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.

Places named were:

- Victoria Pier and
- The entire Port Royal Street area

Rae Town

Approximately thirty three percent (32.6%) of respondents were from the Rae Town community. Approximately fifty two percent (52.2%) respondents were male while 47.8% were female.

Age cohort distribution was as follows; 22.1% were 18-25 years of age, 28.3% were 26-33 years, 20.4% were age 34-41 years, 15.0% were age 42-50 years, 2.7% were age 51-60 years and 11.5% were older than sixty years of age.

Of those persons interviewed who offered a response, 50.9% indicated that they were employed while 43.0% stated they were unemployed and 6.1% indicated that they were retired. Of the 50.9% indicating they were employed 39.7% indicated that they were self-employed and 55.2% had an employer; 5.1% offered no response. Additionally, for those indicating they were employed 48.3% stated they were engaged in casual labour, 22.4% were semi-skilled, 13.8% were skilled, 3.4% were artisans while 10.3% stated they were professionals. The remaining 1.7% offered no response.

Regarding the head of household, 58.3% indicated that they were the head of their households. Of the 41.7% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 75.0% of household heads were employed, while 22.5% were unemployed and 2.5% were retired.

In general, interviewees resided in their communities over the long term. Just over sixty seven percent (67.3%) of individuals resided in their communities for all their life, and 8.4% resided in their community in excess of fifteen years. Just under six percent (5.6%) stated they lived in their community for between ten and fifteen years; 9.4% resided for between five and ten years. Approximately seven percent (6.5%) resided in their community for between three and five years and 2.8% resided in the community for under two years.

EMPLOYMENT

Regarding the number of persons employed within households, 41.8% of interviewees stated they were the only person employed in their household. Just over twenty-six percent (26.4%) of respondents stated that two persons were employed, 8.2% stated three persons, 5.4% stated four persons while 0.9% respectively indicated that their household had five and more than five persons employed. Additionally, 16.4% of interviewees indicated that no one in their household was employed.

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 46.1% of respondents offered an answer for their personal weekly income. Of those who offered responses, 1.6% of persons stated a weekly income of less than five hundred dollars, 3.2% stated $501 - $1,000.00 while 8.1% stated $1,001.00 - $1,500.00 each week. Approximately two percent (1.6%) indicated that income was between $1,501.00 - $2,000.00; 9.7% indicated income of $2,001.00 - $3,000.00. Additionally, 4.8% indicated income of $3,001.00 - $4,000.00; 14.5% indicated income of $4,001.00 - $5,000.00; 6.5% indicated income of $5,001.00 - $6,000.00, 1.6% indicated income of $6,001.00 - $7,000.00 while 48.4% indicated weekly household income was in excess of $7,000.00.

Of those interviewed 41.7% of respondents offered an answer for their weekly household income derived from all sources. Of those who offered responses, no household (0.0%) earned less than one thousand

dollars each week. Three percent (3.0%) indicated income of $1,001.00 - $1,500.00, no one (0.0%) indicated income of $1,501.00 - $2,000.00 and a similar 3.0% stated income of $2,001.00 - $3,000.00; 4.5% indicated income of $3,001.00 - $4,000.00 while 6.0% indicated income of $4,001.00 - $5,000.00; 7.4% indicated income of $5,001.00 - $6,000.00, 7.4% also indicated income of $6,001.00 - $7,000.00 while 68.7% indicated weekly household income was in excess of $7,000.00.

EDUCATION

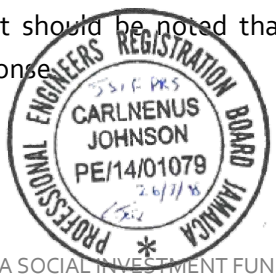
As it pertained to education, 49.1% of interviewees indicated someone in the household was attending school. Of this number, 82.1% provided information on the actual number of persons attending school. Approximately forty six percent (45.7%) of respondents indicated that one person within their household was attending school while 30.4% indicated two persons and 13.0% indicated three persons. No one (0.0%) stated that four persons within their household were attending school, 2.2% indicated five persons and 8.7% stated more than five persons. As it related to the school being attended 44.6% stated that the school being attended was infant/basic, 57.1% stated primary/all age, 41.1% stated high school, 1.8% college, 1.8% university and 1.8% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

Regarding the highest level of education completed, 93.0% of those interviewed offered a response. Of this number 1.9% indicated that they did not attend school; 15.9% stated they completed primary/all age school, 13.1% stated that they did not complete high school, 54.2% completed high school, 5.6% college, 1.9% university and 7.4% HEART/Vocational Training Institution.

AWARENESS OF JSIF, JAMAICA DISASTER VULNERABILITY PROJECT AND THE PROPOSED PROJECT

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), all (100.0%) interviewees offered a response. Approximately Twenty-four percent (23.5%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 76.5% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 25.9% stated they were made aware via newspaper, 40.7% indicated awareness was via television, 11.1% stated radio, 11.1% indicated community meeting and 29.6% indicated that they heard of JSIF through word of mouth while 3.7% stated "other" and specified the internet. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 99.1% of respondents offered a response. Of these individuals, 7.9% of individuals stated that they had heard of the JDVRP while 92.1% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 7.9% of respondents who heard of the JDVRP, 11.1% indicated that awareness was via the newspaper, 22.2% indicated television, no one (0.0%) stated radio, while 22.2% stated they were made aware via community meeting and 33.3% indicated word of mouth. It should be noted that percentages were below one hundred as some interviewees did not offer a response.



In response to whether respondents knew what a revetment was, 94.8% of respondents offered a response. Of those who responded 5.5% indicated that they knew what a revetment was while 94.5% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 96.5% of interviewees responded. Of this number, 12.6% of individuals stated that they were aware of the proposal while 87.4% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 7.1% stated that they were made aware via the newspaper, 21.4% stated television, no one (0.0%) stated awareness via radio while 7.1% stated community meeting and 64.4% stated that they were made aware via word of mouth.

CONCERNS ABOUT THE PROJECT

Regarding whether respondents had any concerns about the project, 98.3% of interviewees offered responses. Of these persons, 19.5% indicated that they had concerns about the project while 80.5% stated that they did not have any concern. Concerns expressed pertained to:

- Whether work opportunities will be created (31.6%)
- The benefit/effect the project will have on the community (47.4%)
- The duration of the project (5.2%)
- Whether shoreline stabilization will provide protection against hurricane (5.2%)
- The effect on families (5.3%)
- Communities not being consulted about the project (5.3%)

On the issue of how respondents thought the project would affect their life, 42.7% of respondents indicated that the project would not affect their life in any way, while 5.5% anticipated a positive impact and 2.7% anticipated a negative impact. 49.1% were not sure if the project would affect their life.

Regarding the 2.7% of individuals anticipating a negative 33.3% anticipated being displaced/relocated while 66.7% were concerned about the potential impact on fisherfolk.

Regarding the 5.5% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- Recreational space would be available to them (50.0%)
- The shoreline would be beautified (25.0%)
- The area would be developed (25.0%)

DEPENDENCY ON THE PROPOSED PROJECT SITE

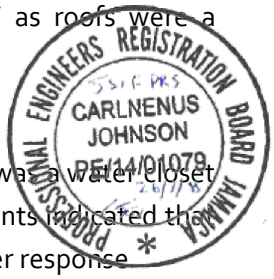
On the issue of dependency on the location for any type of business 94.7% of those interviews stated that they did not depend on the location. Just over five percent (5.3%) of respondents stated that they depended on the proposed location. Of this number land was used for income generation namely for making furniture (50.0%) and vending (50.0%).

When asked if they knew of anyone who depended on the proposed site for any type of business 88.5% of those offering responses indicated that they did not know of anyone who depended on the proposed site. Of the 11.5% of interviewees who indicated that they knew of someone who depended on the proposed location, 83.3% stated that they knew someone who used the area for fishing, while 16.7% knew persons who used the area for fish vending.

HOUSING

On the issue of housing and social services, 30.7% of respondents indicated they owned their home, 1.0% leased, 26.7% rented the home they occupied; 3.0% stated their homes were government owned, 19.8% were squatters and 18.8% lived in family owned homes. When asked about the land on which dwellings were located, 16.5% of respondents indicated that they owned the land, 1.9% leased, 11.7% stated their homes were on government lands, 23.3% squatted, 25.2% had their homes on family land, and 21.4% stated "other". Those indicating "other" were respondents who stated that they were renters and persons who were in the process of paying taxes for the land.

Approximately sixty four percent (63.6%) of dwellings had concrete and block walls, 30.9% of dwellings were wood/board structures, 0.0% zinc and 5.5% stated "other" as the walls of their dwellings were made of both wood and concrete. Regarding roof type, 72.7% of respondents stated their roof type was metal sheeting and 22.2% stated concrete, 1.0% stated wood and 4.1% stated "other" as roofs were a combination of metal and wood or metal and concrete.



SOCIAL FACILITIES AND SERVICES

Just under ninety-five (94.7%) percent of interviewees stated that their toilet facility was a water closet while no one (0.0%) stated that they had pit latrines. Additionally, 4.4% of respondents indicated that they did not have a toilet facility while 0.9% stated "other" but did not offer any further response.

All respondents (100.0%) stated that they used electricity for household lighting.

Regarding the main fuel used for cooking, 94.7% of respondents stated gas as the main fuel for cooking while 4.4% stated coal and 0.9% stated wood.

Regarding water supply, 98.2% of interviewees stated that their household domestic water supply was public piped water into their dwelling while 0.9% indicated the public standpipe and 0.9% also stated "other".

Regarding problems with the domestic water supply 90.8% of respondents stated there were no problems with the supply while 92% of respondents indicated that they had an issue. Of these

respondents, 40.0% stated no water at all, and twenty percent (20.0%) respectively stated no pipes were run in the area, irregular water supply and low water pressure.

Where problems with the water supply were citied, respondents indicated that they bought water (10.0%) and used the community standpipe (40.0%). Sixty percent (60.0%) stated "other" and specified that water was sourced from neighbours.

Of the respondents confirming problems with domestic water supply 50.0% stated that they stored water in drums, no one (0.0%) stated that they used aboveground/black tanks while 50.0% stated "other" and named buckets and bottles as the main storage containers.

On the issue of the main method of garbage disposal, 86.8% of respondents stated that the public garbage truck was their main method of garbage disposal and 13.2% stated that they burned their garbage. Regarding the frequency of garbage collections, 49.5% of those offering a response stated that collections were done once per week, 24.2% stated collections were twice per week, 16.2% stated a frequency of every two weeks while 3.0% stated that garbage collections were done once per month and 4.0% stated "other" and further indicated that collections were done rarely/Irregularly and every "other" day. Three percent (3.0%) of interviewees offered no response.

When asked about where health care was most often obtained in the event of illness, 29.5% indicated that they went to the public clinic, 54.5% stated healthcare was accessed at the public hospital, while 14.2% stated the private doctor and 1.8% stated the private hospital.

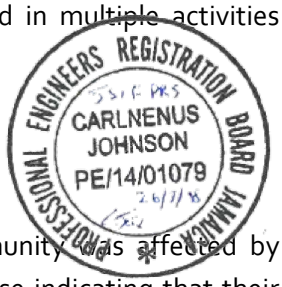
As it related interviewees having specific health conditions, 13.0% of those offering responses stated that they suffered from asthma, 13.0% stated sinusitis, 1.7% stated coughing, 0.0% indicated congestion/bronchial problems, while 4.3% stated that they suffered from chest pains and 0.0% stated bouts of diarrhoea. Just over sixty-two percent (70.4%) of respondents stated that they did not suffer from any of the named conditions. In instances respondents suffered from multiple conditions therefore percentages exceeded one hundred.

Regarding where shopping was usually done, 6.1% stated the supermarket, 20.0% stated the market, 12.2% stated that shopping was done at both the supermarket and market, 42.6% indicated that they shopped at the community shop while 47.8% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.

RECREATIONAL FACILITIES

When asked if recreational spaces were located in interviewees communities, 71.2% of those offering a response stated that there was no recreational space in their community while 28.8% of respondents indicated that a recreational space was in their community. Spaces named were Breezy Castle, GP Sports Club and the Manley Meadows Community Centre.

Regarding what persons did for fun in their community, 56.5% stated street dance/parties, 17.4% stated youth clubs, 18.3% sports clubs/bars, 5.2% service clubs/charity while 9.6% stated church groups/activities and 12.2% stated "other". In instances respondents engaged in multiple activities therefore percentages exceeded one hundred.



NATURAL HAZARDS

When asked about flooding 2.6% of respondents indicated that their community was affected by flooding while 97.4% stated that flooding did not affect their community. Those indicating that their community was affected stated that flooding occurred only during times of heavy rain (100.0%).

Regarding whether the proposed 1.3Km area was affected by flooding, 40.9% of interviewees, stated that the proposed area was not affected by flooding, while 51.3% stated that they did not know if the area was affected. Of the 7.8% of those stating that the proposed area was affected by flooding, 33.3% stated that flooding occurred only in times of heavy rains and 66.7% stated flooding occurred during hurricanes. On the issue of how water levels rose, only 44.4% of those indicating that the area was affected by flooding offered a response. Of this number 50.0% indicated that water levels were less than 0.3 while 50.0% stated that water levels rose to between 0.3 and 1.7 metres.

On the issue of whether there are problems with frequent fires at the proposed area, 52.6% of respondents indicated that the proposed site was not affected by frequent fires while 47.4% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

PROTECTED AREA OR AREA OF HISTORIC, NATIONAL OR ENVIRONMENTAL IMPORTANCE

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 52.2% of interviewees stated they did not know of any such area or site, 43.5% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 4.3% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.

Places named were:

- The fishing Village

Parade Gardens

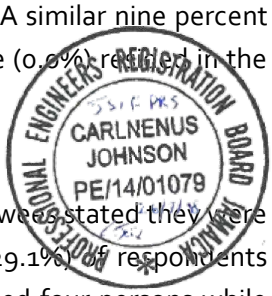
Approximately sixteen percent (15.9%) of respondents were from the Parade Garden community. Approximately fifty six percent (56.4%) respondents were male while 43.6% were female.

Age cohort distribution was as follows; 42.8% were 18-25 years of age, 17.9% were 26-33 years, 16.1% were age 34-41 years, 10.7% were age 42-50 years, 8.9% were age 51-60 years and 3.6% were older than sixty years of age.

Of those persons interviewed who offered a response, 70.9% indicated that they were employed and 29.1% stated they were unemployed while no one (0.0%) indicated that they were retired. Of the 70.9% indicating they were employed 25.6% indicated that they were self-employed and 61.5% had an employer; 12.8% offered no response. Additionally, for those indicating they were employed 33.3% stated they were engaged in casual labour, 17.9% were semi-skilled, 28.2% were skilled, 0.0% were artisans while 15.4% stated they were professionals. The remaining 5.1% offered no response.

Regarding the head of household, 60.7% indicated that they were the head of their households. Of the 39.3% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 85.0% of household heads were employed, while 15.0% were unemployed; no one (0.0%) was retired.

In general, interviewees resided in their communities over the long term. Approximately sixty two percent (61.8%) of individuals resided in their communities for all their life, and 14.5% resided in their community in excess of fifteen years. Just under six percent (5.5%) stated they lived in their community for between ten and fifteen years; 9.1% resided for between five and ten years. A similar nine percent (9.1%) resided in their community for between three and five years while no one (0.0%) resided in the community for under two years.



EMPLOYMENT

Regarding the number of persons employed within households, 34.6% of interviewees stated they were the only person employed in their household. Just over twenty-nine percent (29.1%) of respondents stated that two persons were employed, 18.2% stated three persons, 0.0% stated four persons while 3.6% indicated that their household had five employed persons and 1.8% indicated that more than five persons were employed. Additionally, 12.7% of interviewees indicated that no one in their household was employed.

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 64.3% of respondents offered an answer for their personal weekly income. Of those who offered responses, no one (0.0%) of persons stated a weekly income of less than fifteen hundred dollars, 2.8% stated $1,501 - $2,000.00 while 2.8% stated $1,501.00 - $2,000.00 each week. None of the interviewees (0.0%) indicated that income was between $2,001.00 - $5,000.00, while 5.6% indicated income of $5,001.00 - $6,000.00. Additionally, 8.3% indicated income of $6,001.00 - $7,000.00 while 83.3% indicated weekly household income was in excess of $7,000.00.

Of those interviewed 67.9% of respondents offered an answer for their weekly household income derived from all sources. Of those who offered responses, no household (0.0%) earned less than two thousand

dollars each week. Approximately three percent (2.6%) indicated income of $2,001.00 - $3,000.00, no one (0.0%) indicated income of $3,001.00 - $5,000.00 while 2.6% indicated income of $5,001.00 - $6,000.00, 7.9% also indicated income of $6,001.00 - $7,000.00 while 86.8% indicated weekly household income was in excess of $7,000.00.

EDUCATION

As it pertained to education, 69.1% of interviewees indicated someone in the household was attending school. Of this number, 64.3% provided information on the actual number of persons attending school. Approximately twenty eight percent (27.8%) of respondents indicated that one person within their household was attending school while 41.7% indicated two persons and 16.6 indicated three persons. No one (0.0%) stated that four persons within their household were attending school, 5.6% indicated five persons and 8.3% stated more than five persons. As it related to the school being attended 36.8% stated that the school being attended was infant/basic, 52.6% stated primary/all age, 50.0% stated high school, 0.0% college, 5.3% university and 5.3% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

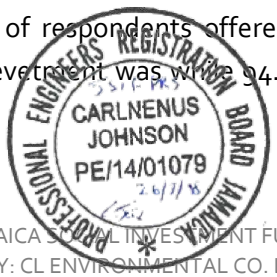
Regarding the highest level of education completed, 98.2% of those interviewed offered a response. Of this number no one (0.0%) indicated that they did not attend school; 7.3% stated they completed primary/all age school, 16.3% stated that they did not complete high school, 47.3% completed high school, 7.3% college, 7.3% university and 14.5% HEART/Vocational Training Institution.

AWARENESS OF JSIF, JAMAICA DISASTER VULNERABILITY PROJECT AND THE PROPOSED PROJECT

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), all (100.0%) interviewees offered a response. Approximately Twenty-three percent (23.2%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 76.8% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 23.1% stated they were made aware via newspaper, 38.5% indicated awareness was via television, 7.7% stated radio, 7.7% indicated community meeting and 30.8% indicated that they heard of JSIF through word of mouth. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 100.0% of respondents offered a response. Of these individuals, 12.5% of individuals stated that they had heard of the JDVRP while 87.5% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 7.9% of respondents who heard of the JDVRP, 57.1% indicated that awareness was via the newspaper, 28.6% indicated television, 14.3% stated radio, while 0.0% stated they were made aware via community meeting and 14.3% indicated word of mouth. It should be noted that percentages were above one hundred as some interviewees offered multiple responses.

In response to whether respondents knew what a revetment was, 92.9% of respondents offered a response. Of those who responded 5.8% indicated that they knew what a revetment was while 94.2% stated that they did not know what a revetment was.



On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 100.0% of interviewees responded. Of this number, 17.9% of individuals stated that they were aware of the proposal while 82.1% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 10.0% stated that they were made aware via the newspaper, 30.0% stated television, 10.0% stated awareness via radio while no one (0.0%) stated community meeting and 70.0% stated that they were made aware via word of mouth. Percentages will exceed one hundred in instances where respondents were made aware through multiple media.

CONCERNS ABOUT THE PROJECT

Regarding whether respondents had any concerns about the project, 98.2% of interviewees offered responses. Of these persons, 16.4% indicated that they had concerns about the project while 83.6% stated that they did not have any concern. Concerns expressed pertained to:

- Whether work opportunities will be created (33.3%)
- The benefit/effect the project will have on the community (33.3%)
- Impact on livelihood (11.1%)
- Impact on the fishing village (11.1%)
- Whether the community will be involved in the project (11.2%)

On the issue of how respondents thought the project would affect their life, 51.7% of respondents indicated that the project would not affect their life in any way, while 16.1% anticipated a positive impact and 1.8% anticipated a negative impact. 30.4% were not sure if the project would affect their life.

Regarding the 1.8% of individuals anticipating a negative 100.0% anticipated being displaced/relocated.

Regarding the 16.1% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- Recreational space would be available to them (50.0%)
- The shoreline would be beautified (25.0%)
- The shoreline would be protected (12.5%)
- The area would become a tourist attraction (12.5%)

DEPENDENCY ON THE PROPOSED PROJECT SITE

On the issue of dependency on the location for any type of business 90.6% of those interviews stated that they did not depend on the location. Approximately nine percent (9.4%) of respondents stated that they depended on the proposed location. Of this number land was used for income generation by one means or another either by conducting business, vending or having their shop in the area (75.0%). Additionally, 25.0% stated that the area was used for fish vending.

When asked if they knew of anyone who depended on the proposed site for any type of business 92.5% of those offering responses indicated that they did not know of anyone who depended on the proposed site. Of the 7.5% of interviewees who indicated that they knew of someone who depended on the proposed location, all respondents (100.0%) knew persons who used the area for generating income e.g., vending and conducting business.

HOUSING

On the issue of housing and social services, 11.3% of respondents indicated they owned their home, no one (0.0%) leased, 18.9% rented the home they occupied; no one (0.0%) stated their homes were government owned, 17.0% were squatters and 50.9% lived in family owned homes while 1.9% stated "other", however no details were provided. When asked about the land on which dwellings were located, 15.1% of respondents indicated that they owned the land, no one (0.0%) leased, 15.1% stated their homes were on government lands, 17.0% squatted, 49.0% had their homes on family land, and 3.8% stated "other". Those indicating "other" were respondents who stated that they were renters.

Approximately seventy one percent (70.9%) of dwellings had concrete and block walls, 20.0% of dwellings were wood/board structures, 1.8% zinc and 7.3% stated "other" as the walls of their dwellings were made of both wood and concrete. Regarding roof type, 77.3% of respondents stated their roof type was metal sheeting and 18.9% stated concrete while 3.8% stated wood.

SOCIAL FACILITIES AND SERVICES

Just under ninety-three (92.6%) percent of interviewees stated that their toilet facility was a water closet while 5.6% stated that they had pit latrines. Additionally, 1.9% stated "other" but did not offer any further response.

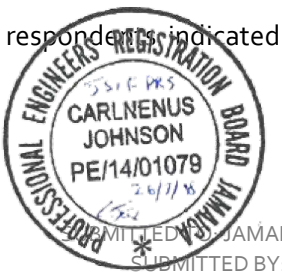
On the issue of what was used for household lighting 96.3% of respondents stated that they used electricity for household lighting while 3.7% stated that kerosene oil was used.

Regarding the main fuel used for cooking, 92.7% of respondents stated gas as the main fuel for cooking while 7.3% stated coal.

Regarding water supply, 92.8% of interviewees stated that their household domestic water supply was public piped water into their dwelling while 1.8% respectively indicated private tank, the public standpipe, private water truck and "other". Those indicating "other" offered no further information.

Regarding problems with the domestic water supply 94.5% of respondents stated there were no problems with the supply while 5.5% of respondents indicated that they had an issue. Of these respondents, 33.3% indicated irregular water supply and 66.7% indicated low water pressure.

Where problems with the water supply were citied, respondents indicated that they bought water (33.3%) and used the community standpipe (66.7%).



Of the respondents confirming problems with domestic water supply all persons (100.0%) stated that they stored water in drums.

On the issue of the main method of garbage disposal, 100.0% of respondents stated that the public garbage truck was their main method of garbage disposal. Regarding the frequency of garbage collections, 41.0% of those offering a response stated that collections were done once per week, 12.5% stated collections were twice per week, 26.8% stated a frequency of every two weeks while 16.1% stated that garbage collections were done once per month and 3.6% stated "other" and further indicated that collections were done occasionally and daily.

When asked about where health care was most often obtained in the event of illness, 24.0% indicated that they went to the public clinic, 59.3% stated healthcare was accessed at the public hospital, while 14.8% stated the private doctor and 1.9% stated the private hospital.

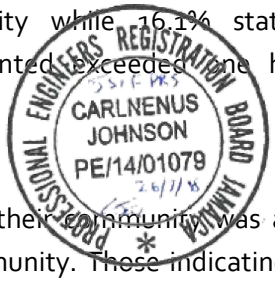
As it related interviewees having specific health conditions, 21.4% of those offering responses stated that they suffered from asthma, 23.2% stated sinusitis, 3.6% stated coughing, 3.6% indicated congestion/bronchial problems, while 0.0% stated that they suffered from chest pains and 1.8% stated bouts of diarrhoea. Fifty percent (50.0%) of respondents stated that they did not suffer from any of the named conditions. In instances some respondents suffered from multiple conditions therefore percentages exceeded one hundred.

Regarding where shopping was usually done, 7.1% stated the supermarket, 25.0% stated the market, 3.6% stated that shopping was done at both the supermarket and market, 33.9% indicated that they shopped at the community shop while 71.4% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.

RECREATIONAL FACILITIES

When asked if recreational spaces were located in interviewees communities, 57.1% of those offering a response stated that there was no recreational space in their community while 42.9% of respondents indicated that a recreational space was in their community. Spaces named were Breezy Castle, the PORA Community Centre (also referred to as the Parade Gardens Community Centre), the CDC Centre and Rise Life Management.

Regarding what persons did for fun in their community, 57.1% stated street dance/parties, 16.1% stated youth clubs, 8.9% sports clubs/bars, 3.6% service clubs/charity while 16.1% stated church groups/activities and 10.7% stated "other". Percentages presented exceeded one hundred as interviewees participated in multiple activities.



NATURAL HAZARDS

When asked about flooding 25.0% of respondents indicated that their community was affected by flooding while 75.0% stated that flooding did not affect their community. Those indicating that their

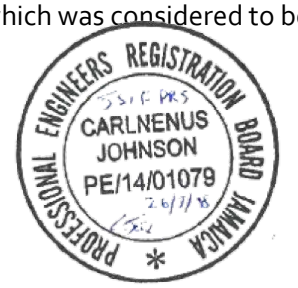
community was affected stated that flooding occurred each time it rains (28.6%) only during times of heavy rain (57.1%) while 14.3% stated that flooding occurred during hurricanes.

Regarding whether the proposed 1.3Km area was affected by flooding, 42.6% of interviewees, stated that the proposed area was not affected by flooding, while 46.3% stated that they did not know if the area was affected. Of the 11.1% of those stating that the proposed area was affected by flooding, 16.7% stated that flooding occurred each time there was a rainfall event and 66.7% stated only in times of heavy rains while 16.6% offered no response. On the issue of how water levels rose 100.0% of those indicating that the area was affected by flooding offered a response. Of this number 16.7% indicated that water levels were less than 0.3 metres while 83.3% indicated that water levels rose to between 0.3 and 1.7 metres.

On the issue of whether there are problems with frequent fires at the proposed area, 52.7% of respondents indicated that the proposed site was not affected by frequent fires while 47.3% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

PROTECTED AREA OR AREA OF HISTORIC, NATIONAL OR ENVIRONMENTAL IMPORTANCE

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 58.2% of interviewees stated they did not know of any such area or site, 40.0% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 1.8% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.



Places named were:

- The National Library

Manley Meadows

Approximately six percent (6.3%) of respondents were from the Rae Town community. Fifty percent (50.0%) respondents were male while 50.0% were female.

Age cohort distribution was as follows; 31.8% were 18-25 years of age, 27.3% were 26-33 years, 9.1% were age 34-41 years, 13.6% were age 42-50 years, 9.1% were age 51-60 years and 9.1% were older than sixty years of age.

Of those persons interviewed who offered a response, 59.1% indicated that they were employed while 27.3% stated they were unemployed and 13.6% indicated that they were retired. Of the 59.1% indicating they were employed 15.4% indicated that they were self-employed and 69.2% had an employer; 15.4% offered no response. Additionally, for those indicating they were employed 38.5% stated they were

engaged in casual labour, 0.0% were semi-skilled, 15.4% were skilled, 0.0% were artisans while 30.8% stated they were professionals. The remaining 15.3% offered no response.

Regarding the head of household, 40.9% indicated that they were the head of their households. Of the 59.1% of interviewees who indicated that they were not household heads; when asked about the head of household, it was learnt that 84.6% of household heads were employed, while 7.7% were unemployed and 7.7% were retired.

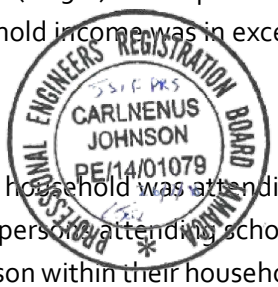
In general, interviewees resided in their communities over the medium term. It should be noted however that Manley Meadows when compared to the other communities is a young community. Just over nineteen percent (19.1%) of individuals resided in their communities for all their life, and 14.3% resided in their community in excess of fifteen years. Just under twenty-four percent (23.8%) stated they lived in their community for between ten and fifteen years; 23.8% resided for between five and ten years. Approximately ten percent (9.5%) resided in their community for between three and five years and 9.5% also resided in the community for under two years.

EMPLOYMENT

Regarding the number of persons employed within households, 31.8% of interviewees stated they were the only person employed in their household. Just under thirty two percent (31.8%) of respondents stated that two persons were employed, 18.2% stated three persons, 4.6% stated four persons while no one (0.0%) indicated that their household had five employed persons. Similarly, no one indicated that more than five persons were employed in their household. Additionally, 13.6% of interviewees indicated that no one in their household was employed.

Respondents in general, expressed some reluctance to disclose information pertaining to income. Of those interviewed 63.6% of respondents offered an answer for their personal weekly income. Of those who offered responses, no one earned a weekly income below $5,000.00 and within the $6,001.00 - $7,000.00 category. Approximately twenty one percent (21.4%) of respondents indicated a weekly of $5,001.00 - $6,000.00 while 78.6% stated weekly household income was in excess of $7,000.00.

Of those interviewed 63.6% of respondents offered an answer for their personal weekly income derived from all sources. Of those who offered responses, no one earned a weekly income below $5,000.00 and within the $6,001.00 - $7,000.00 category. Approximately eleven percent (10.5%) of respondents indicated a weekly of $5,001.00 - $6,000.00 while 89.5% stated weekly household income was in excess of $7,000.00.



EDUCATION

As it pertained to education, 68.2% of interviewees indicated someone in the household was attending school. Of this number, 93.3% provided information on the actual number of persons attending school. Approximately forty six percent (71.4%) of respondents indicated that one person within their household was attending school while 21.4% indicated two persons and 7.2% indicated three persons. No one

(0.0%) stated that four or more persons within their household were attending school. As it related to the school being attended 13.3% stated that the school being attended was infant/basic, 46.7% stated primary/all age, 46.7% stated high school, 6.7% college, 6.7% university and 0.0% HEART/Vocational Training Institute. It should be noted that percentages will exceed one hundred as multiple persons from households attend school.

Regarding the highest level of education completed, 90.9% of those interviewed offered a response. Of this number no one (0.0%) indicated that they did not attend school; 0.0% stated they completed primary/all age school, 5.0% stated that they did not complete high school, 55.0% completed high school, 20.0% college, 10.0% university and 10.0% HEART/Vocational Training Institution.

AWARENESS OF JSIF, JAMAICA DISASTER VULNERABILITY PROJECT AND THE PROPOSED PROJECT

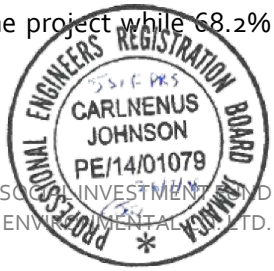
On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), all (100.0%) interviewees offered a response. Approximately Twenty-three percent (22.7%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 77.3% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 40.0% stated they were made aware via newspaper, 60.0% indicated awareness was via television and 20.0% indicated that they heard of JSIF through word of mouth. It should be noted that percentages will exceed one hundred as some interviewees were made aware via multiple media.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), 100.0% of respondents offered a response. Of these individuals, 9.1% of individuals stated that they had heard of the JDVRP while 90.9% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 9.1% of respondents who heard of the JDVRP, 50.0% indicated that awareness was via television and 50.0% indicated word of mouth.

In response to whether respondents knew what a revetment was, 95.5% of respondents offered a response. Of those who responded 4.8% indicated that they knew what a revetment was while 95.2% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, 95.5% of interviewees responded. Of this number, 9.5% of individuals stated that they were aware of the proposal while 90.5% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, all persons (100.0%) stated that they were made aware via word of mouth.

Regarding whether respondents had any concerns about the project, all (100.0%) interviewees offered responses. Of these persons, 31.8% indicated that they had concerns about the project while 68.2% stated that they did not have any concern. Concerns expressed pertained to:



- The benefit/effect the project will have on the community (20.0%)
- Possible dislocation (20.0%)
- Impact on existing infrastructure (road) (40.0%)
- The revetment blocking the view of the ocean (20.0%)

CONCERNS ABOUT THE PROJECT

On the issue of how respondents thought the project would affect their life, 20% of respondents indicated that the project would not affect their life in any way, while 30.0% anticipated a positive impact and 5.0% anticipated a negative impact. 45.0% were not sure if the project would affect their life.

Regarding the 5.0% of individuals anticipating a negative 100.0% anticipated being displaced/relocated.

Regarding the 30.0% of interviewees who indicated that they thought the project would affect their lives positively, anticipated that:

- Recreational space would be available to them (66.6%)
- Employment opportunities would be created (16.7%)
- Flooding would be reduced (16.7%)

DEPENDENCY ON THE PROPOSED PROJECT SITE

On the issue of dependency on the location for any type of business 95.2% of those interviews stated that they did not depend on the location. Approximately five percent (4.8%) of respondents stated that they depended on the proposed location. Of this number 100.0% stated that the area was used for fishing.

When asked if they knew of anyone who depended on the proposed site for any type of business 81.0% of those offering responses indicated that they did not know of anyone who depended on the proposed site. Of the 19.0% of interviewees who indicated that they knew of someone who depended on the proposed location, 75.0% stated that they knew someone who used the area for fishing, while 25.0% knew persons who used the area fish vending.

HOUSING

On the issue of housing and social services, 40.0% of respondents indicated they owned their home, no one (0.0%) leased, 10.0% rented the home they occupied; 10.0% stated their homes were government owned, 5.0% were squatters and 35.0% lived in family owned homes. When asked about the land on which dwellings were located, 30.0% of respondents indicated that they owned the land, no one (0.0%) leased, 10.0% stated their homes were on government lands, 15.0% squatted, 35.0% had their homes on family land, and 10.0% stated "other". Those indicating "other" were respondents who stated that they were renters.

All dwellings (100.0%) had concrete and block walls. Regarding roof type, 15.0% of respondents stated their roof type was metal sheeting and 85.0% stated concrete.

SOCIAL FACILITIES AND SERVICES

All interviewees (100.0%) stated that their toilet facility was a water closet and also stated that they used electricity for household lighting and further indicated that gas was the main fuel used for cooking.

Regarding water supply, 80.0% of interviewees stated that their household domestic water supply was public piped water into their dwelling while 15.0% indicated the public standpipe and 5.0% also stated "other"; however no further information was received.

Regarding problems with the domestic water supply 100.0% of respondents stated there were no problems with the supply.

On the issue of the main method of garbage disposal, 95.2% of respondents stated that the public garbage truck was their main method of garbage disposal and 4.8% stated that they burned their garbage. Regarding the frequency of garbage collections, 55.0% of those offering a response stated that collections were done once per week, 20.0% stated collections were twice per week while 25.0% stated a frequency of every two weeks.

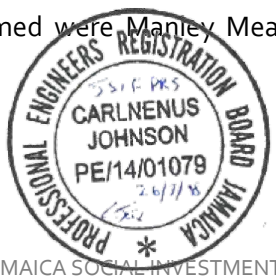
When asked about where health care was most often obtained in the event of illness, 15.8% indicated that they went to the public clinic, 63.2% stated healthcare was accessed at the public hospital, while 21.0% stated the private doctor.

As it related interviewees having specific health conditions, 18.2% of those offering responses stated that they suffered from asthma, 13.6% stated sinusitis, 0.0% stated coughing, 4.5% indicated congestion/bronchial problems, while 9.1% stated that they suffered from chest pains and 0.0% stated bouts of diarrhoea. Just under fifty five percent (54.6%) of respondents stated that they did not suffer from any of the named conditions.

Regarding where shopping was usually done, 18.2% stated the supermarket, 18.2% stated the market, 31.8% stated that shopping was done at both the supermarket and market, 27.3% indicated that they shopped at the community shop while 13.6% stated the wholesale shop. In instances respondents shopped at multiple places therefore percentages exceeded one hundred.

RECREATIONAL FACILITIES

When asked if recreational spaces were located in interviewees communities, 71.4% of those offering a response stated that there was no recreational space in their community while 28.6% of respondents indicated that a recreational space was in their community. Spaces named were Manley Meadows Community Centre and Bellevue Field.



Regarding what persons did for fun in their community, 22.7% stated street dance/parties, 9.1% stated youth clubs, 36.4% sports clubs/bars, 0.0% service clubs/charity while 27.3% stated church groups/activities and 9.1% stated "other". In instances respondents engaged in multiple activities therefore percentages exceeded one hundred.

NATURAL HAZARDS

When asked about flooding 4.5% of respondents indicated that their community was affected by flooding while 95.5% stated that flooding did not affect their community. Those indicating that their community was affected stated that flooding occurred each time there was a rainfall event (100.0%).

Regarding whether the proposed 1.3Km area was affected by flooding, 50.0% of interviewees, stated that the proposed area was not affected by flooding, while 50.0% stated that they did not know if the area was affected. No one (0.0%) stated that the proposed area was affected by flooding.

On the issue of whether there are problems with frequent fires at the proposed area, 40.9% of respondents indicated that the proposed site was not affected by frequent fires while 59.1% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

PROTECTED AREA OR AREA OF HISTORIC, NATIONAL OR ENVIRONMENTAL IMPORTANCE

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 77.3% of interviewees stated they did not know of any such area or site, 18.2% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 4.5% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance.

Places named were:

- The Statue (at the bottom of South Camp Road)

4.2.2 Fishers

4.2.2.1 Methodology

On May 28, 2018 twenty-eight (28) questionnaires specifically aimed at fisherfolk were administered along the 1.3 kilometre stretch of shoreline along Port Royal Street proposed for shoreline stabilization upgrades. Just over ninety-six percent (96.4%) of respondents were male and 3.6% were female.

Percentages presented are for the total number of persons offering responses; in instances where respondents did not offer an answer to a question, they were not considered part of the analyses.

4.2.2.2 Results and Findings

Of the twenty-eight (28) respondents age cohort distribution was as follows; 7.1% were 18-25 years of age, 14.3% were 26-33 years, 17.8% were age 34-41 years, 28.6% were age 42-50 years, 28.6% were age 51-60 years and 3.6% were older than sixty years of age.

Approximately ninety-three percent (92.9%) of interviewees indicated that they were fishers while 7.1% stated that they were not fishers. Regarding whether anyone else in the household was a fisher, 42.9% indicated that someone else in their household was also a fisher, while 57.1% stated that no other fisher was a part of their household. Of this 42.9% of respondents, seventy-five percent (75.0%) offered further responses regarding how many other members of their household were fishers. Just over thirty- three percent (33.3%) indicated that one more person in their household engaged in fishing activities, 22.3% stated that there were two persons while 33.3% stated three persons and 11.1% stated five persons.

On the issue if whether the interviewee was a fish vendor, 55.6% of respondents indicated that they were fish vendors while 44.4% stated that they were not. It should be noted however, that for the most part fishers sold their fish directly to "regular customers" or to vendors who would then sell in the market or other areas. Regarding whether anyone else in the interviewees household was a fish vendor 35.7% of respondents confirmed that others in the household were vendors while 64.3% stated that no other person in their household sold fish. Of this 35.7%, ninety percent (90.0%) offered further responses regarding how many other members of their household were fish vendors. Just under sixty-seven percent (66.7%) indicated that one more person in their household engaged in fishing activities, while 11.1% respectively stated that there were two, three and five persons engaged in fish vending.

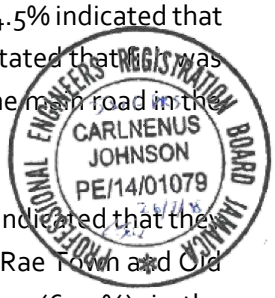
Of those persons interviewed all respondents (100.0%) indicated that they were employed; 96.4% Regarding indicated they were self-employed while 3.6% had an employer. Approximately seven percent (7.1%) of interviewees stated that they were employed part-time, 7.1% also stated that they were employed seasonally while 75.0% stated that they were employed full-time. The remaining 10.8% offered no response.

Regarding the head of household, 96.4% indicated that they were the head of their households while 3.6% of respondents were not head of households.

In response to how long persons were fishers, 39.3% indicated that they were engaged in fishing activities for more than thirty years, 10.7% stated they have been fishers for between twenty-five and thirty years, while 14.3% stated between eighteen and twenty-four years. Additionally, 14.3% also indicated that they have been fishers for between twelve and seventeen years as well as between six and eleven years while 7.1% indicated that they have been fishers for five years or less.

Regarding the number of persons employed within households, 50.0% of interviewees stated they were the only person employed in their household. Just over twenty-three percent (23.1%) of respondents stated that two persons were employed, 15.4% stated three persons, while 11.5% stated five persons.

On the issue of where fish was sold, 78.6% of respondents offered a response. Of this number, 41.0% stated that they did not sell fish in any specific area and further indicated that fish was sold anywhere the demand/ "market" was identified, 45.5% stated that fish was sold on the beach, while 4.5% indicated that fish was sold on the beach as well as in the market in the Downtown area, 4.5% also stated that fish was sold only in the Downtown market and 4.5% further stated that fish was sold along the main road in the area.



In response to where fishing was done various responses were received. Interviewees indicated that they fished in Lime Cay (15.4%), along the shoreline of the Inner Harbour (3.8%), between Rae Town and Old Harbour (3.8%), between Rae Town and Rocky Point (3.8%), within Kingston Harbour (69.2%), in the Hellshire area (3.8%) and outside the Kingston Harbour (38.0%). Percentages are above one hundred as fishers indicated that they fished in multiple areas.

Regarding what tool was used for fishing, 50.0% of respondents used fishing line, 3.8% used the spear, 76.9% used fishing nets, 7.7% utilised fish pots and 7.7% stated "other" and further advised that they used the pall anchor.

Regarding the type of vessel used for fishing 82.1% of interviewees offered a response. Of this number 17.4% stated they used a canoe without and engine while 82.6% stated that they used a canoe equipped with an engine. Of those whose canoes were equipped with engines, just under ninety-six percent (95.7%) stated that their canoes had one engine, while 4.3% stated that the canoe had two engines. It should be noted however that for those stating two engines, only one engine was used at any one time. Engines were interchanged depending on how far from shore fishing would be done.

As it related to engine size, 8.7% of respondents stated that their engine size was 28 feet. It was surmised that the canoe was 28 feet long and used an engine that would have been suitably sized, but no information on the actual horsepower (HP) size of the engine was received. Just over twenty-six percent (26.1%) of respondents stated their engine size was 60HP, 21.7% stated 40HP, 17.4% stated an engine size of 25HP, 17.4% also stated and engine size of %17.4% while 8.7% stated 18HP.

Regarding how many additional persons work on the fishing vessels, 12.5% stated that one additional person worked on the vessel, 29.2% stated two persons, 41.6% indicated three persons, while 4.2% respectively indicated four persons and five persons and 8.3% stated more than five persons.

In response to whether additional persons sold fish with the interviewees, 92.9% of persons offered a response. Of this number 53.8% stated that other persons sold fish with them while 46.2% stated that no other person sold fish with them. Of this 53.8%, approximately seventy-nine percent (78.6%) provided

further information on the actual number of persons. Just over thirty-six percent (36.3%) of respondents stated that one other person sold fish with them, 18.2% indicated that there were two additional persons while 27.3% stated that there were three additional persons and 18.2% stated that four additional persons were involved in selling fish with them.

As it related to how many times per week fish was sold, 7.7% indicated a frequency of twice per week, 15.4% three times weekly, 7.7% four days each week, 30.8% stated five days, 11.5% stated six day and 26.9% indicated that fish was sold seven days per week.

As it pertained to how many times per week fishers went fishing, they indicated that this was dependent on weather conditions. Specifically, 7.7% indicated that they went fishing three times per week, 11.5% stated four times, 19.2% stated fives time per week, 11.5% indicated six times per week while 50.0% stated that they went fishing seven days per week. A small percentage (3.8%) of respondents stated they did not go fishing and further advised that during times of inclement weather they do not go fishing, while when conditions are favourable they go fishing multiple times each week. Percentages exceeded one hundred as some respondents stated the minimum and maximum number of times they went fishing from week to week.

Regarding the species of fish harvested, fishers harvested multiple species therefore percentages exceeded one hundred. Snapper fish was harvested by 92.3% of respondents, Jack by 38.5%, Kingfish by 269%, Grunt fish was harvested by 61.5% of fishers and Sprat by 50.0%.

Regarding the pound catch of fish per week, varying responses were received. Approximately twelve percent (11.5%) indicated that they harvested up to fifty pounds of fish each week, 19.2% stated between 50 and 100 pounds, 15.4% 100lbs – 200lbs. Similarly, 15.4% also indicated that their weekly pound catch was between 200lbs – 300lbs, 11.5% stated 300lbs – 500lbs, 15.4% also stated weekly catch of between 500lbs – 1000lbs while 7.7% stated that catch was in excess of 2000 pounds. Some respondents (3.9%) offered no information on their pound catch.

In response to how the pound catch has changed, 92.9% of those interviewed responded. Approximately sixty-five percent (65.4%) of respondents stated that they did not notice a change while 34.6% stated that the pound catch has decreased. Additionally, as it pertained to whether there is a season when the sale or catch of fish is increased all respondents (100.0%) stated that there was a specific time/season. The specific times indicated were June to July (7.4%), March to April (Easter) (51.9%), both Easter and Christmas (18.5%), during times of good weather (22.2%), weekends and the end of the month (3.8%) and during holidays (7.4%). Percentages exceeded one hundred as some respondents offered multiple responses.

As it related to respondents' observing changes in the types (species) or size of fish harvested all interviewees (100.0%) offered a response. Just under forty-six percent (46.4%) of interviewees stated that they did not notice a change in the species or size of fish harvested, while 17.9% stated that they observed and increase and 35.7% indicated that they observed a decrease.

When asked about possible reasons that led to the observed increases in fish size and/or species respondents stated the following:

- A low/reduced demand for fish (20.0%)
- Migrant fish species "outside fishes" entering the fishing area (60.0%)

Twenty percent (20.0%) of respondents offered no response.

When asked about possible reasons that led to the observed decreased in fish size and/or species respondents stated the following:

- Climate Change (10.0%)
- Pollution (70.0%)
- Dredging of the harbour (40.0%)
- Highway Construction (10.0%)

Percentages exceeding one hundred are attributed to respondents offering multiple responses.

Regarding the average weekly income earned from fish sales, 96.4% of interviewees offered a response. Just under eighty percent (77.8%) of persons stated that their weekly income from fish sales exceeded $8,000.00, while 14.8% stated income of $6,001.00 - $8,000.00, and 3.7% respectively stated income of $2,001.00 - $4,000.00 and less than $1,000.00.

Additionally, as it pertained whether respondents noticed any change in the income earned from fish sales, 60.7% of those interviewed stated that they did not notice a change in income from fish sales while 39.3% of persons stated that they observed a decrease in income. These responded stating a decrease in income from fish sales, further attributed the decrease in sales to:

- Pollution (27.2%)
- Dredging of the Harbour (18.2%)

- An oil spill during the dredging of the harbour (9.1%)
- Few fish in the sea (9.1%)
- A reduction in the number of persons distributing fish (9.1%)
- Variations in the weather/Climate Change (18.2%)
- Both climate change and pollution (9.1%)

On the issue of respondents' awareness of the Jamaica Social Investment Fund (JSIF), 100.0% interviewees offered a response. Approximately fifty-four percent (53.6%) of interviewees stated that had heard of the Jamaica Social Investment Fund (JSIF) while 46.4% stated that they had not heard of JSIF. Of the interviewees stating that they had heard of JSIF 40.0% indicated awareness was via television, 6.7% indicated community meeting and 40.0% indicated that they heard of JSIF through word of mouth while 6.7% of interviewees stated "other" and further indicated that their awareness of JSIF was through seeing advertisements on signboards. Some respondents (6.7%) offered no response. Regarding what respondents heard of JSIF, 66.7% of respondents stated that they heard that JSIF assisted in community development. The remaining respondents did not provide any detail on what they heard.

Regarding respondents' awareness of the Jamaica Disaster Vulnerability Project (JDVRP), all respondents offered a response. Of these individuals, 7.1% of individuals stated that they had heard of the JDVRP while 92.9% stated that they had never heard of the Jamaica Disaster Vulnerability Project (JDVRP). Of the 7.1% of respondents who heard of the JDVRP, 150.0% indicated that awareness was via the television while 50.0% indicated word of mouth. While indicating awareness of the JDVRP, respondents were unable to provide specific detail on what they heard.

In response to whether respondents knew what a revetment was, 100.0% of respondents offered a response. Of those who responded 3.6% indicated that they knew what a revetment was while 96.4% stated that they did not know what a revetment was.

On the issue of respondents' knowledge that of the Jamaica Social Investment Fund's proposal to stabilise approximately 1.3 kilometres of eroded/vulnerable shoreline along Port Royal Street and Norman Manley Boulevard in the Downtown Kingston area, all interviewees responded. Of this number, 17.9% of individuals stated that they were aware of the proposal while 82.1% of those interviewed stated that they were not aware of the proposal. For those respondents indicating an awareness of the proposed project, 20.0% stated that they were made aware via television, while 20.0% stated community meeting and 60.0% stated that they were made aware via word of mouth.

Regarding whether respondents had any concerns about the project, 100.0% of interviewees offered responses. Of these persons, 50.0% indicated that they had concerns about the project while 50.0% also stated that they did not have any concern. Concerns expressed pertained to:

- How the fisherfolk will be affected (21.4%)
- The fisherfolk being dislocated (7.1%)
- There will be limited access to the ocean and docking space (14.3%)
- he possible impact on marine life (7.2%)
- Whether work opportunities will be created (7.2%)
- How the fisherfolk will benefit (14.3%)
- Whether affected persons will be compensated (7.1%)
- Whether the project will actually be implemented (7.1%)
- The lack of project information (7.1%)

On the issue of how respondents thought the project would affect their life, 14.8% of respondents indicated that the project would not affect their life in any way, while 3.7% anticipated a positive impact and 14.8% anticipated a negative impact. 66.7% were not sure if the project would affect their life.

Regarding the 14.8% of individuals anticipating a negative impact 50.5% of respondents anticipated that the project would not favour/dislocate the fisherfolk, 25.0% anticipated pollution and 25.0% anticipated a reduction in the population of fish.

Regarding the 3.7% of interviewees who indicated that they thought the project would affect their lives positively, no further response was offered to indicate in what way this may happen.

Regarding whether the proposed 1.3Km area was affected by flooding, 71.4% of interviewees, stated that the proposed area was not affected by flooding, while 21.4% stated that they did not know if the area was affected. Of the 7.2% of those stating that the proposed area was affected by flooding, 50.0% stated that flooding occurred each time there was a rainfall event and 50.0% also stated only in times of heavy rains. On the issue of how water levels, rose 50.0% of those indicating that the area was affected by flooding offered a response. Of this number all persons indicated that water levels rose to between 0.3 and 1.7 metres.

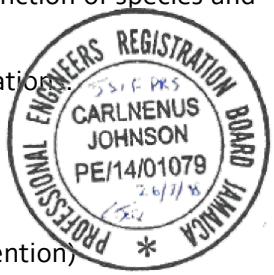
On the issue of whether there are problems with frequent fires at the proposed area, 92.9% of respondents indicated that the proposed site was not affected by frequent fires while 7.1% stated that they did not know if the area was affected. None of the respondents indicated that the proposed area was affected by fire.

Regarding whether there was any site or area along the 1.3Km area considered to be a protected area, historic area or area of national, historic or environmental importance, 32.1% of interviewees stated they did not know of any such area or site, 64.3% stated that no such area was located along the proposed 1.3Km stretch of shoreline while 3.6% indicated that there was an area/site which was considered to be a protected area or area of historic, national or environmental importance. The Ship Channel was named as a protected area.

5.0 IDENTIFICATION AND ASSESSMENT OF POTENTIAL DIRECT AND INDIRECT IMPACTS AND RECOMMENDED MITIGATION

The following criteria [1] (Table 5-1) were used to develop the Impact matrices for the site preparation/construction (Table 5-2) and operational phases (Table 5-3).

- **Direction of Impact-** This describes the nature of the potential impact; positive, negative or no impact of a particular activity on a receptor.
- **Magnitude of Impact:** This is defined by the severity of each potential impact and indicates whether the impact is irreversible or, reversible and estimated potential rate of recovery. The magnitude of an impact cannot be considered high if a major adverse impact can be mitigated.
- **Extent of Impact:** The spatial extent or the zone of influence of the impact should always be determined. An impact can be site-specific or limited to the project area; a locally occurring impact within the locality of the proposed project; a regional impact that may extend beyond the local area and a national impact affecting resources on a national scale and sometimes trans-boundary impacts, which might be international.
- **Duration of Impact:** Environmental impacts have a temporal dimension and needs to be considered. Impacts arising at different phases of the project cycle may need to be considered.
- **Significance of the Impact:** This refers to the value or amount of the impact. Once an impact has been predicted, its significance must be evaluated using an appropriate choice of criteria. The most important forms of criterion are:
    - Specific legal requirements e.g. national laws, standards, international agreements and conventions, relevant policies etc.
    - Public views and complaints
    - Threat to sensitive ecosystems and resources e.g. can lead to extinction of species and depletion of resources, which can result, into conflicts.
    - Geographical extent of the impact e.g. has trans- boundary implications.
    - Cost of mitigation
    - Duration (time period over which they will occur)
    - Likelihood or probability of occurrence (very likely, unlikely, etc.)
    - Reversibility of impact (natural recovery or aided by human intervention)



[1] Taken from - Ogola, P. F. A. 2007. Environmental Impact Assessment General Procedures, presented at Short Course II on Surface Exploration for Geothermal Resources, organized by UNU-GTP and KenGen, at Lake Naivasha, Kenya, 2-17 November, 2007

- Number (and characteristics) of people likely to be affected and their locations
- Cumulative impacts e.g. adding more impacts to existing ones.
- Uncertainty in prediction due to lack of accurate data or complex systems. Precautionary principle is advocated in this scenario.

Table 5-1 Impact assessment criteria for potential environmental impacts

SCORE	0	1	2	3
CRITERIA	Negligible	Minor	Moderate	Significant
DURATION	None	Physical impacts lasting less than a few months before recovery occurs. Impact does not persist after the activity ends.	Physical impacts lasting from a few months to two years before signs of recovery. It is not inter-generational.	Physical impact is persistent after 2 years. Impacts on a biological population over a number of recruitment cycles or generations of the population.
MAGNITUDE	No measurable change in availability of resources or function of systems. No measurable effect on people.	Changes in form and/or ecosystem function and/or a resource. The system maintains the ability to support ecosystem/ resource functions with only minor changes in community value and no overall loss/gain. Only a small fraction of the local community is affected.	Changes in form and/or ecosystem function and/or a resource. The system's ability to support ecosystem/ resource functions and economic benefit is affected but not lost. Only a moderate fraction of the local community is affected.	Changes in form and/or ecosystem function and/or a resource. The system's ability to support ecosystem/resource functions and economic benefit is highly affected. A large fraction of the local community is affected.
EXTENT	None	Isolated effects within activity site.	Localized area close to borders or offsite dispersion pathways.	Widespread: offsite regional effects

Table 5-2 Impact matrix for Site Preparation and Construction

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
Physical	Water Column	General Site Prep and Clearance	Increased sedimentation (turbidity and TSS)	X				X	1	1	1	-1
			Increased water pollution (oils, solid waste etc.)	X				X	1	1	1	-1
		Construction	Increased sedimentation (turbidity and TSS)	X				X	1	1	1	-1
			Increased water pollution (oils, solid waste etc.)	X				X	1	1	1	-1
	Buildings and Occupants	General Site Prep and Clearance	Vibration imperceptible or barely perceptible by humans. Vibration will have no effect on building structures.					X	1	1	1	-1
		Construction	Vibration imperceptible or barely perceptible by humans. Vibration will have no effect on building structures.					X	1	1	1	-1
	Airshed	General Site Prep and Clearance	Reduced Air quality and Noise Pollution	X				X	1	1	1	-1
		Construction	Reduced Air quality and Noise Pollution	X				X	1	2	1	-1.33
Biological	Fish	General Site Prep and Clearance	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
		Construction	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	
	Marine invertebrates	General Site Prep and Clearance	Increased sedimentation (TSS and turbidity).	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
		Construction	Increased sedimentation (TSS and turbidity)	X				X	1	1	1	-1
			Displacement and loss of habitat	X				X	1	1	1	-1
	Avifauna	General Site Prep and Clearance	Displacement and loss of habitat	X				X	2	1	1	-1.33
		Construction	Displacement and loss of habitat	X				X	2	1	1	-1.33
	Mangroves	General Site Prep and Clearance	Species loss	X				X	3	2	1	-2
		Construction	N/A				X					
	Coastal Vegetation	General Site Prep and Clearance	Habitat and Species loss	X				X	3	1	1	-1.67
		Construction	Remaining plant Health reduced from dust and emissions	X				X	1	1	1	-1
	Coastline/ Intertidal Zone	General Site Prep and Clearance	Habitat and Species loss	X				X	3	1	1	-1.67
		Construction	Habitat and Species loss	X				X	3	1	1	-1.67
Human/ Social	Road Surfaces	General Site Prep and Clearance	Wear and tear from transport of heavy material and equipment	X				X	1	1	1	-1
		Construction	Wear and tear from transport of heavy material and equipment	X				X	1	1	1	-1
	Visual Impact	General Site Prep and Clearance	Increased solid waste generation	X				X	1	1	1	-1
			Increased dust levels	X				X	1	1	1	-1
		Construction	Increased solid waste generation	X				X	1	1	1	-1
			Increased wastewater generation	X				X	1	1	1	-1
			Increased dust levels	X				X	1	1	1	-1
	Recreational Users	General Site Prep and Clearance	Reduced access to coastline	X				X	1	1	1	-1
		Construction	Reduced access to coastline	X				X	1	1	1	-1
	Road Users and Pedestrians	General Site Prep and Clearance	Delays and disruption from traffic	X				X	1	1	1	-1
		Construction	Delays and disruption from traffic	X				X	1	1	1	-1
			Exposure to noise and dust	X				X	1	1	1	-1
			Exposure to contaminated marine water	X				X	1	2	1	-1.33
			Increased Accident Potential	X				X	1	1	1	-1
	Fishers	General Site Prep and Clearance	Limited/reduced access to fishing areas	X				X	1	1	1	-1
			Reduced catch	X				X	1	1	1	-1
		Construction	Limited/reduced access to fishing areas	X				X	1	1	1	-1
			Reduced catch	X				X	1	1	1	-1
	Labour Force/Local Economy	General Site Prep and Clearance	Increased employment	X		X			2	3	2	2.33
			Exposure to noise and dust	X				X	1	1	1	-1

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
			Increased Accident Potential	X				X	1	1	1	-1
		Construction	Increased employment	X		X			2	3	2	2.33
			Exposure to noise and dust	X				X	1	1	1	-1
			Exposure to contaminated marine water	X				X	1	2	1	-1.33
			Increased Accident Potential	X				X	1	1	1	-1
											Total Significance Score	-38.00

Table 5-3 Impact matrix for Operations

	Receptor	Activity	Impact	Direct/Indirect		DIRECTION			DURATION	MAGNITUDE	EXTENT	SIGNIFICANCE SCORE
				Direct	Indirect	Pos	None	Neg				
Physical												
	Water Column	Operations	N/A				X					
	Airshed	Operations	N/A				X					
Biological	Coral	Operations	Armour rock serves as substrate for coral recruitment	X		X			3	1	1	1.67
	Seagrass	Operations	N/A				X					
	Rocky Shore and Intertidal Zone	Operations	Armour rock serves as habitat for invertebrates	X		X			3	1	1	1.67
	Fish	Operations	Armour rock serves as habitat and refuge from larger predators	X		X			3	3	1	2.33
	Avifauna	Operations	N/A				X					
Human/ Social	Ground Transportation (Traffic)	Operations	N/A				X					
	Recreational Users	Operations	More amenity spaces	X		X			3	3	1	2.33
			Increased aesthetic appeal	X		X			3	3	1	2.33
	Road Users and Pedestrians	Operations	Increased aesthetic appeal	X		X			3	2	1	2
	Fishers	Operations	Armour rock act as fish aggregation device	X		X			3	3	1	2.33
											Total Significance Score	14.66

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5.1 SITE PREPARATION AND CONSTRUCTION

5.1.1 Physical

5.1.1.1 Water Quality

Impact Analysis

During construction, the immediate areas around the project site will have the potential to have reduced water quality. The storage of material will have the potential to generate turbidity, sedimentation and possible run-off from land. Rainfall has the potential to carry the sediments into the nearshore area. Armour rocks placed in the water may also contribute to elevated TSS and turbidity levels, especially if they are not washed before being placed in the water. Additionally, these areas could be affected by wave action and currents resulting in the transportation of silt down current.

Mitigation

i. During construction, the project site should include sediment control measures such as sediment filters (the most common means) and sedimentation ponds.
    a. Armour rocks being used should be washed off properly. Washing should not take place at the project site, but at a staging area off site or upon leaving the quarry.
    b. A turbidity barrier should be erected within the nearshore waters to prevent the dispersion of contaminants throughout the water.
ii. Monitoring of the water quality in the project area, in particular turbidity, should be conducted at least once weekly during construction.

5.1.1.2 Noise Pollution

Impact Analysis

Construction necessitates the use of heavy equipment to carry out the job. These equipment include bulldozers, backhoes, excavators etc. These possess the potential to have a direct negative impact on the noise climate. Noise directly attributable to site clearance activity should not result in noise levels in the residential areas to exceed 55dBA during day time (7am – 10 pm) and 50 dBA during night time (10 pm – 7 am). Where the baseline levels are above the stated levels then it should not result in an increase of the baseline levels by more than 3dBA.

Construction noise can result in short-term impacts of varying duration and magnitude. The construction noise levels are a function of the scale of the project, the phase of the construction, the condition of the equipment and its operating cycles, the number of pieces of construction equipment operating concurrently. To gain a general insight into potential construction noise impacts that may result from the project, the typical noise levels associated with various types of construction equipment are identified in Table 5-4.

Table 5-4 Typical construction equipment noise levels

Type of Equipment	Typical Sound Level at 50 ft. (dBA Leq.)
Dump Truck	88
Jackhammer	88
Scraper	88
Bulldozer	87
Paver	89
Generator	76
Backhoe	85

Adapted from - Route 101A Widening and Improvements, City of Nashua Hillsborough County, New Hampshire; McFarland-Johnson, Inc. May 30, 2007

Mitigation

v. Use equipment that has low noise emissions as stated by the manufacturers.
vi. Use equipment that is properly fitted with noise reduction devices such as mufflers.
vii. Operate noise-generating equipment during regular working hours (e.g. 7 am – 6 pm) to reduce the potential of creating a noise nuisance during the night.
viii. Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is workers operating equipment generating noise of ≥ 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.

5.1.1.3 Air Quality

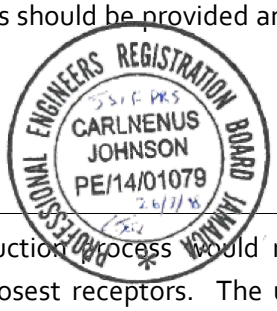
Impact Analysis

Site preparation and construction has the potential to have a two-folded direct negative impact on air quality of the surrounding area. The first impact is air pollution generated from the construction equipment and transportation. The second is from fugitive dust from the proposed construction areas and raw materials stored on site. Fugitive dust has the potential to affect the health of construction workers, the resident population and the surrounding vegetation.

Mitigation

iv. Areas should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter, more windy days, this frequency should be increased.
v. Cover or wet construction materials to prevent a dust nuisance. This includes those being transported on trucks.

vi. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.



5.1.1.4 Vibration

Impact Analysis

From a human standpoint, most equipment used during the construction process would result in vibration which is either imperceptible or barely perceptible at the closest receptors. The use of a vibratory pile driver in the vicinity of the Old Ice factory for the installation of a pedestrian bridge at Barnes Gully will result in vibrations which may cause annoyance to occupants in nearby buildings if the vibrations are continuous. From a building standpoint, the vibration levels predicted will have no effect on building structures within proximity of the proposed project. Pile driving activities for installation of the pedestrian bridge at Barnes Gully will not have any effect on the boundary wall of the General Penitentiary.

Mitigation

a. Sequence of operations:
    v. Phase demolition, earth-moving and ground-impacting operations so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately.
    vi. Avoid night time activities. People are more aware of vibration in their homes during the night time hours.
b. Alternative construction methods:
    vii. Select demolition methods not involving impact, where possible.
    viii. Have regular meetings or devise a communication strategy to inform the residents and businesses of construction activities.

5.1.1.5 Storage of Raw Material and Equipment

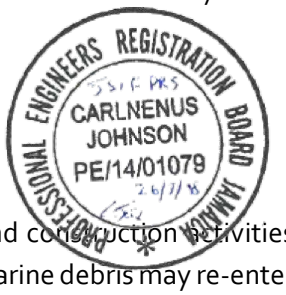
Impact Analysis

Any raw materials used in construction will be stored onsite. There will be a potential for them to become air or waterborne. Stored fuels and the repair of construction equipment has the potential to leak hydraulic fuels, oils etc.

Mitigation

i. A central area should be designated for the storage of raw materials. This area should be lined in order to prevent the leakage of chemicals into the sediment.
ii. Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne.

iii. Fine grained materials (sand, marl, etc.) if any, should be stockpiled away from the coastline and drainage channels and low berms will be placed around the piles which themselves will be covered with tarpaulin to prevent them from being eroded and washed away.
iv. Raw material should be placed on hardstands surrounded by berms.
v. Equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff.
vi. Bulk storage of fuels and oils should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored. In addition, these containers should be surrounded by bunds to contain the volume being stored in case of accidental spillage.



5.1.2 Biological

5.1.2.1 Marine Environment

Potential impacts to the marine environment as a result of site preparation and construction activities are; Excess sedimentation, run off and reduced water quality. Solid waste and marine debris may re-enter the marine environment. As a result, the following mitigation measures should reduce the potential impact to the biological environment.

PRIMARY MITIGATION

i. During construction, turbidity barriers/silt screens are recommended with any beach works or coastal modification near the shoreline. A turbidity barrier should be erected within the nearshore waters to prevent the dispersion of contaminants throughout the water.
ii. Solid waste and marine debris should be removed during site preparation
iii. Solid waste and marine debris deposited in the construction areas should be regularly removed.

Fish

IMPACT

Site preparation and construction activities may result in the temporary loss and/or displacement of any fish and or fish habitat. The excess sedimentation may result in clogging of fish gills and may result in their death.

Marine Invertebrates

IMPACT

Invertebrates; bivalves, sponges, worms and anemones, living in or on the substrate and may be affected by construction activities which may result in the loss and/or displacement of these species as well as habitat loss.

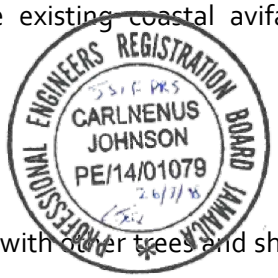
5.1.2.2 Fauna

IMPACT

Seabirds forage and roost in the area. The removal of vegetation and general construction activities may temporarily displace these birds.

RECOMMENDED MITIGATION

As many trees as possible should be left unchanged during all activities. Some trees will be removed as a result of site clearance and construction; however, additional trees should be planted as part of the landscape plan. Where possible trees and vegetation preferred by the existing coastal avifauna population should be included in the landscape plan.



5.1.2.3 Mangroves and Vegetation

IMPACT ANALYSIS

The small mangrove stand in the project area is likely to be removed along with other trees and shrubs as a result of site preparation and revetment construction.

RECOMMENDED MITIGATION

iv. Mangroves should be preserved if possible
v. Mangroves should be included in the landscape plan where possible.
vi. As many trees as possible should be left unchanged during all activities. Additional trees should be planted as part of the landscape plan.

5.1.3 Social

5.1.3.1 Employment

Impact Analysis

The work force should include trade men and labourers and should create indirect and induced jobs during construction. This will result in employment within the study area and has the potential to be a significant positive impact. It is anticipated that some labourers will be from sourced from nearby communities.

Mitigation

No mitigation required.

5.1.3.2 Wastewater Generation and Disposal

Impact Analysis

With every construction campsite comes the need to provide construction workers with showers and sanitary conveniences. The disposal of the wastewater generated at the construction campsite has the potential to have a minor negative impact on surface water.

Mitigation

vii. Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 25 workers per chemical toilet should be used.

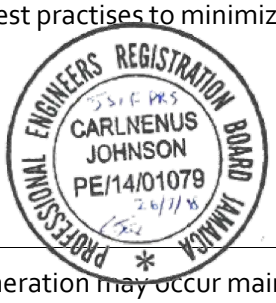
5.1.3.3 Solid Waste and Marine Debris

Impact Analysis

During site preparation solid waste and marine debris are part of the existing shoreline and will need to be removed prior to any construction activities. During construction activities solid waste and marine debris will continue to be deposited in these areas. Solid waste and marine debris must not be allowed to re-enter the marine environment and should be removed and properly disposed.

Mitigation

i. Careful removal and separation of solid waste and marine debris during the removal of the revetment rock.
ii. Skips and bins should be provided designated for the recovered solid waste and marine debris should be provided.
iii. The skips and bins should be adequately designed and covered to prevent access by vermin and minimise odour.
iv. The skips and bins should be emptied regularly to prevent overfilling.
v. Disposal of the contents of the skips and bins should be done at an approved disposal site.
vi. A Waste Management Plan should be prepared and implemented to include the regular removal of solid waste and marine debris deposited in the project area.
vii. Employees should be educated on impacts of solid waste and best practises to minimize impacts to the marine environment.



5.1.3.4 Solid Waste Generation

Impact Analysis

During this construction phase of the proposed project, solid waste generation may occur mainly from:

- From the construction campsite.
- From construction activities such as site clearance and excavation (vegetative debris).

Mitigation

viii. Skips and bins should be strategically placed along the project site.
ix. The skips and bins at the construction campsite should be adequately designed and covered to prevent access by vermin and minimise odour.
x. The skips and bins at both the construction campsite should be emptied regularly to prevent overfilling.
xi. Disposal of the contents of the skips and bins should be done at an approved disposal site.
xii. A Waste Management Plan should be prepared and implemented.

5.1.3.5 Ground Transportation

Traffic Demand Forecasting and Level of Service

The transportation and use of heavy equipment and trucks is required during construction and this has the potential to directly impact traffic flow along roads, especially during peak-hour traffic times.

MITIGATION

iv. Construction traffic should be scheduled for off peak hours to avoid or minimise any congestion at the intersection.
v. Adequate and appropriate road signs should be erected to warn road users of the construction activities.
vi. Flagmen should be employed to regulate traffic and assist construction vehicles.

Road Surface

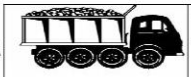
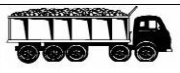
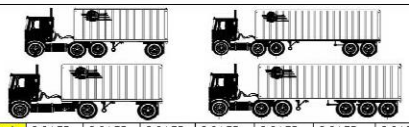
IMPACT ANALYSIS

All trucks are expected to adhere to the NWA standard for the loads per axel they exert on the pavement, otherwise severe deterioration to the road may result. Further, overloaded vehicles are harder to control and more unstable and difficult to stop in an emergency.

MITIGATION

In order to alleviate road damages, all the weight of trucks carrying construction materials must be determined by scale and overloading is strictly prohibited.

SPECIAL PERMIT REQUIREMENTS vehicles exceeding Permit Column data can be issued ith a Special Permit once the vehicle does not exceed the relevant column etc

Maximum Allowable																			
	Permit	MAX Limit	Permit	MAX Limit	MAX Limit	Permit	MAX Limit	MAX Limit	Permit	MAX Limit	MAX Limit	Permit	MAX Limit	MAX Limit	MAX Limit	MAX Limit	MAX Limit	MAX Limit	MAX Limit
Overall Height (m)	3.6	4.15	3.6	4.15	4.15	3.6	4.15	4.15	3.6	4.15	4.15	3.6	4.15	4.15	4.15	4.15	4.15	4.15	4.15
Gross Weight (tons)	12.2	15	12.2	20	25	12.2	30	35	12.2	30	35	12.2	25	30	35	40	45	50	55
Length (m)	9.14	12.8	9.14	12.8	12.8	9.14	12.8	12.8	9.14	12.8	12.8	12.8	17.3	17.3	17.3	17.3	17.3	17.3	17.3
Width (m)	2.44	2.70	2.44	2.70	2.70	2.44	2.75	2.75	2.44	2.75	2.75	2.44	2.75	2.75	2.75	2.75	2.75	2.75	2.75
No. of Axles	2	2	3	3	3	4	4	4	5	5	5	3	3	4	4	5	5	6	6
No. of Tires	6	6	8	8	10	12	12	14	16	16	12	10	10	12	14	16	18	20	22

Please note that

1. Maximum allowable dual tire axle load is **10 tonnes** except super singles/ flotation
2. Maximum allowable single tire axle load is **5 tonnes** except super singles/ flotation
3. maximum allowances **must not exceed manufacturer ratings**, specifications for **vehicles and tires** etc
4. Special permits are required for tucks that exceed one or more of the following criteria:

   a. ***Overall Length of 9.14m (rigid) or 12.8 m (articulated/trailer)***
   b. ***Overall width of 2.44 m,***
   c. ***Gross weight of 12,273 kg,***
   d. ***overhang of 50% of wheelbase,***
   e. ***height of 3.6 m from ground***

Figure 5-1 NWA weight limit requirements for heavy vehicles

5.1.3.6 Emergency Response

Impact Analysis

The possibility of accidental injury is high. There may be either minor or major accidents during project construction.

Mitigation

i. A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers.
ii. The construction management team should have onsite first aid kits and make arrangements for the nurse and doctor at the Kingston Public Hospital to be on call for the construction site. Prior arrangements should be made with health care facilities/clinics to accommodate any eventualities.
iii. Material Safety Data Sheets (MSDS) should be stored onsite.

5.1.3.7 Recreational Users and Fishers

Impact Analysis

The probability that access to the coastline will be prohibited during construction activities is high due to physical blockades and safety concerns. As a result, persons who utilize the coastline for walking, jogging, sightseeing or fishing will have reduced or no access. Fishers may also be subject to reduced catch in the immediate project area due to the high level of construction activity and resultant turbidity in the water which may deter fish from the area.

Mitigation

Continued consultation and meetings with fisherfolk to discuss measures to minimize impact on their livelihood.

5.2 OPERATION

5.2.1 Biological

Marine Fauna

IMPACT

The armour rock will provide habitat for invertebrates and fish. Rocks may also provide suitable substrate for the settlement and recruitment of sessile organisms such as sponges.

Solid waste and marine debris should be removed regularly. This may improve the general conditions in the project area.

5.2.2 Social

5.2.2.1 Recreational Users and Fishers

IMPACT

Users of the area will benefit from more favourable aesthetics as a result of the proposed project. This will include a new boardwalk for users of the area for walking, jogging and/or sightseeing. Designated parking and other amenity areas for users will also benefit users of the area.

Regular removal of solid waste and marine debris will help maintain the aesthetics of the proposed project. This may also encourage others to maintain and preserve other coastal areas.

6.0 ENVIRONMENTAL MANAGEMENT AND MONITORING

An Environmental Management System (EMS) is an important tool which can be used to assist operations managers in meeting current and future environmental requirements and challenges. It can be used to measure a company's operations against environmental performance indicators, thereby helping the company to reach its environmental targets. A good management system will integrate environmental management into a company's daily operations, long-term planning and other quality assurance systems.

It is therefore recommended that several parameters be monitored before during and after the project implementation to record any negative construction impacts and to propose corrective or mitigation measures. The suggested parameters include but are not limited to the following:

1) Water Quality to include but not be limited to:
    a. pH
    b. electrical conductivity
    c. turbidity
    d. BOD
    e. Total Suspended solids (TSS)
    f. Grease and Oils
    g. Faecal Coliform
    h. Nitrates and Phosphates
2) Air quality
3) Noise
4) Solid Waste Generation and Disposal
5) Sewage Generation and Disposal
6) Equipment Maintenance
7) Health and Safety

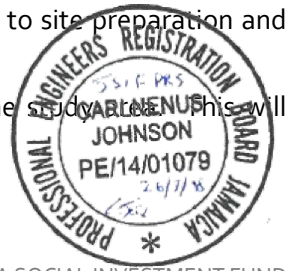
6.1 PHASED RECOMMENDATIONS

6.1.1 Site Preparation and Construction Phase

- Undertake weekly water quality monitoring or a frequency agreed to with NEPA to ensure that the construction works are not negatively impacting on water quality.
  Any organization with the capability to conduct monitoring of the listed parameters should be used to perform this exercise. It is recommended that a report should be given to NEPA at the

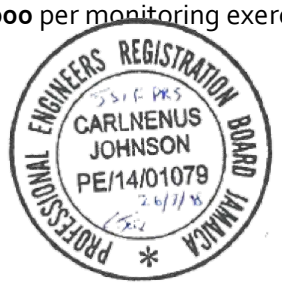
end of each monitoring exercise. This is estimated to cost approximately **J$ 270,000** per monitoring exercise.

- Daily inspections to ensure that construction activities are not being conducted outside of regular working hours (e.g. 7 am – 7 pm). In addition to environmental noise monitoring, a noise survey should be undertaken to determine workers exposure and construction equipment noise emission. Noise monitoring to be conducted monthly at the site and settlements near to site.
  The project engineer / site supervisor should monitor the construction work hours. NEPA should conduct spot checks to ensure that the hours are being followed. The noise survey is estimated to cost approximately **J$150,000** per monitoring exercise.
- Daily monitoring to ensure that fugitive dust from raw materials are not being entrained in the wind and creating a dust nuisance. Frequent wetting along access roads etc. should be conducted.
  The project engineer / site supervisor should monitor the construction work hours. NEPA should conduct spot checks to ensure that this stipulation is being followed. In addition, any Citizens Association within the area can be used to provide additional surveillance. The particulates survey is estimated to cost approximately **J$200,000** per monitoring exercise.
- Conduct daily inspections to ensure that flagmen where necessary are in place and that adequate signs are posted along the roadways where heavy equipment interact with existing roads. This is to ensure that traffic has adequate warnings and direction.
- Undertake daily assessment of the quantity of solid waste generated and keep records of its ultimate disposal. Additionally, solid waste generation and disposal of the campsite should also be monitored.
- Weekly assessment to determine that there are adequate numbers of portable toilets and that they are in proper working order. This will ensure that sewage disposal will be adequately treated.
- Daily monitoring of vehicle refuelling, and repair should be undertaken to ensure that these exercises are carried out on hardstands. This is to reduce the potential of soil/sand contamination from spills. Spot checks should be conducted by NEPA.
- Traffic and maritime operations should be monitored to ensure approved management plans at critical areas are being followed. NEPA and NWA and other relevant authorities should perform spot checks to ensure compliance. Monitoring should be conducted daily to ensure major disruption is avoided. Reports should be made to NWA on a fortnightly basis.
- Undertake daily inspections to ensure that workers are wearing adequate personal protective equipment (PPE), such as hard hats, hard boots, air protection, safety glasses, reflective vests and fall protection if necessary. Ensure that safety signage is in place.
- Health, safety and emergency response plans should be prepared prior to site preparation and construction phases.
- Where possible, construction crews should be sourced from within the study area. This will ensure that the local community will benefit from the investment.



6.1.2 Operational Phase

- Water quality monitoring should be done at least quarterly after construction. If three to six results demonstrate that the site or parts of the site have stabilised, the sampling frequency and sampling locations may be reviewed and reduced or discontinued as per and approved monitoring plan. This is estimated to cost approximately **J$ 270,000** per monitoring exercise.



7.0 APPENDICES

Appendix 1 - Hydrolab Calibration Certificate

OTT Hydromet

Certificate of Instrument Performance

Agency Name: ***CL ENVIRONMENTAL***

Certification for Job# **5831128**

Part/Model Number: DS5	048757

RECEIVED CONDITION: *(One must be checked)*
- [x] Within Tolerance
- [ ] Within Tolerance but Limited *(*see service report)*
- [ ] Out of Tolerance *(*see service report)*

RETURNED CONDITION: *(One must be checked)*
- [x] Within Tolerance
- [ ] Within Tolerance but Limited *(*see service report)*

Test Equipment Used, (ID#): N.I.S.T. - traceable glass thermometer (H-B Thermometer, Serial ***2Z9208)*** and a Cole-Parmer "*PolyStat*" Constant Temperature Circulator

Environmental Conditions:

Actual Temperature:	Instrument Reading:	
10.00 °C	***10.00*** °C	***+0.00*** °C
20.00 °C	***20.03*** °C	***+0.03*** °C
30.00 °C	***29.97*** °C	***-0.03*** °C

Hach Company does hereby certify that the above listed equipment meets or exceeds all Manufacturers' Service Specifications (unless limited conditions apply). Test equipment used for performance verification are calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Where such standards do not exist, the basis for calibration is documented. The proper operation of the above instrument was established at the time of certificate issuance. To insure continued performance, user must adhere to all requirements listed in the instrument manual.

Certified by: John Jenkins Title: Instrument Service Technician

Certification Date: **11/08/2017**

5600 Lindbergh Drive • Loveland, CO 80538
(800) 227-4224 / FAX (970) 461-3924

Doc# 19775.01 Rev. A

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CARLNENUS JOHNSON
PE/14/01079

Appendix 2 – Noise Calibration Certificate

3M Personal Safety Division

3M Oconomowoc
1060 Corporate Center Drive
Oconomowoc, WI 53066-4828
www.3M.com/detection
800 245 0779

3M

Certificate of Calibration

Certificate No: 5523241QII050083

Submitted By: CL ENVIRONMENTAL COMPANY LIMITED
20 WINDSOR AVENUE
KINGSTON 5, JAMAICA

Serial Number:	QII050083	Date Received:	12/6/2017
Customer ID:		Date Issued:	12/16/2017
Model:	QC-10 CALIBRATOR	Valid Until:	12/16/2018
Test Conditions:		Model Conditions:	
Temperature:	18°C to 29°C	As Found:	IN TOLERANCE
Humidity:	20% to 80%	As Left:	IN TOLERANCE
Barometric Pressure:	890 mbar to 1050 mbar		

SubAssemblies:

Description:	Serial Number:

Calibration Procedure: 56V981

Reference Standard(s):

I.D. Number	Device	Last Calibration	Date Calibration Due
ET0000556	B&K ENSEMBLE	4/18/2017	4/18/2018
T00230	FLUKE 45 MULTIMETER	2/4/2016	2/4/2018

Measurement Uncertainty:

+/- 1.1% ACOUSTIC (0.1DB) +/- 1.4% VAC +/- 0.012% HZ
Estimated at 95% Confidence Level (k=2)

Calibrated By: James Neuman 12/16/2017
JAMES NEUMAN Service Technician

Reviewed/Approved By: Paul M. Wegmann 12/16/2017
Technical Manager/Deputy

This report certifies that all calibration equipment used in the test is traceable to NIST or other NMI, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of 3M Detection Solutions.

098-393 Rev. B

An ISO 9001 Registered Company
ISO 17025 Accredited Calibration Laboratory

ACCREDITED
Calibration Laboratory
CERT#1326.01

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

3M Personal Safety Division

3M Oconomowoc
1060 Corporate Center Drive
Oconomowoc, WI 53066-4828
www.3M.com/detection
800 245 0779

3M

Certificate of Calibration

Certificate No: 5523241QII050083

(A) indicates out of tolerance condition

Test Type	Nominal	Tolerance-	Tolerance+	As Found	As Left	Unit
AC OUT/1kHz	1.000	0.950	1.050	1.000	1.000	VAC
Calibration	114.0	113.7	114.3	114.0	114.0	dB
Frequency	1000	980	1020	994	994	Hz

* indicates non accredited

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PE/14/01079

098-393 Rev. B

An ISO 9001 Registered Company
ISO 17025 Accredited Calibration Laboratory

ACCREDITED
Calibration Laboratory
CERT#1326.01

Appendix 3 – Study Team

- **CL Environmental Co. Ltd.:**
  - Carlton Campbell, Ph.D., CIEC (Project Coordination, Client Liaison, Perception Survey)
  - Matthew Lee, M.Sc. (Climate, Water Quality, Noise, Air Quality, Vibration)
  - Rachel D'Silva, B.Sc. (Water Quality, Marine and Terrestrial Biological Community)
  - Karen McIntyre, M.Sc. (Socioeconomic Profile of Community and GIS)
  - Errol Harrison (Field Technician – Air Quality and Noise)
  - Glen Patrick (Field Technician – Air Quality and Noise)

- **CEAC Solutions Co. Ltd.:**

  - Christopher Burgess, PhD. Eng., PE (Project Coordination, Client Liason and Technical Lead)
  - Kristifer Freeman, BSc, Eng. PE (Drainage and Hydrology and Hydraulics)
  - Carlnenus Johnson, MSc. Eng., PE (Hydrodynamic Modelling and Coastal Design)
  - Karl Todd, BSc, Eng. (Data Collection, Wave and Storm Surge Modelling)
  - Marc Henry (Drafting)
  - Andre Gordon, BSc,MBA (Land Surveying)

- **Associate Consultants:**
  - Jannette Manning, M.Sc (Perception Survey)
  - Dane Lynch (Perception Survey)
  - Rachel Mowatt (Perception Survey)
  - Tarik Bernard (Perception Survey)
  - Jodiann Thomas (Perception Survey)
  - Moesha Tracey (Perception Survey)
  - Rasheed Dawkins (Perception Survey)
  - Deidre Dixon (Perception Survey)
  - Monisha Thomas (Perception Survey)

13.16 **Cost estimate**

BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
A	The successful Contractor shall be required to execute all work referred to in the aforementioned Drawings and Bills of Quantities upon the Terms and Conditions contained or referred to in the FIDIC Conditions of Contract for for Construction for Buildings and Engineering Works designed by the Employer (First Edition 1999), the sub-headings of which are summarized below				
B	The Contractor shall be deemed to have examined the Contract Data and the Conditions of Contract. The Contractor shall allow for and price in detail all items of the Condition of Contract including the following amplifying clauses in connection therewith.				
C	Any Expense incurred by the Contractor in complying with conditions left unpriced shall be deemed to be included in rates contained elsewhere in the priced Bill of Quantities				
	1: GENERAL PROVISIONS				
	1.1 Definitions	Sum	1.0		
	1.2 Interpretation	Sum	1.0		
	1.3 Communication	Sum	1.0		
	1.4 Language and Law	Sum	1.0		
	1.5 Priority of Documents	Sum	1.0		
	1.6 Contract Agreement	Sum	1.0		
	1.7 Assignment	Sum	1.0		
	1.8 Care and Supply of Documents	Sum	1.0		
	1.9 Delayed Drawings or Instructions	Sum	1.0		
	1.10 Employer's Use of Contractor's Documents	Sum	1.0		
	1.11 Contractor's Use of Employer's Documents	Sum	1.0		
	1.12 Confidential Details	Sum	1.0		
	1.13 Compliance with Laws	Sum	1.0		
	1.14 Joint and Several Liability	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**-**

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

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BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	2: THE EMPLOYER				
	2.1 Right of Access to Site	Sum	1.0		
	2.2 Permits, Licences or Approvals	Sum	1.0		
	2.3 Employer's Personnel	Sum	1.0		
	2.4 Employer's Financial Arrangements	Sum	1.0		
	2.5 Employer's Claims	Sum	1.0		
	3: THE ENGINEER				
	3.1 Engineer's Duties and Authority	Sum	1.0		
	3.2 Delegation by the Engineer	Sum	1.0		
	3.3 Instruction of the Engineer	Sum	1.0		
	3.4 Replacement of the Engineer	Sum	1.0		
	3.5 Determinations	Sum	1.0		
	4: THE CONTRACTOR				
	4.1 Contractor's General Obligations	Sum	1.0		
	4.2 Performance Security	Sum	1.0		
	4.3 Contractor's Representative	Sum	1.0		
	4.4 Subcontractors	Sum	1.0		
	4.5 Assignment of Benefit of Subcontract	Sum	1.0		
	4.6 Co-operation	Sum	1.0		
	4.7 Setting Out	Sum	1.0	3,840,000.00	3,840,000.00
	4.8 Safety Procedures	Sum	1.0		
	4.9 Quality Assurance				
	4.9.1 Armourstone and core fill	Sum	1.0	320,000.00	320,000.00
	4.9.2 Retaining wall	Sum	1.0	375,000.00	375,000.00
	4.9.3 Initial topo, surveying checks as required and as built	Sum	1.0	1,000,000.00	1,000,000.00
	4.10 Site Data	Sum	1.0		
	4.11 Sufficiency of the Accepted Contract Amount	Sum	1.0		
	4.12 Unforseeable Physical Conditions	Sum	1.0		
	4.13 Rights of Way and Facilities	Sum	1.0		
	4.13.1 Site office and workshop plus accomodation for engineer	Sum	1.0	800,000.00	800,000.00
	4.14 Avoidance of Interference	Sum	1.0		
	4.15 Access Route	Sum	1.0		
	4.16 Transport of Goods	Sum	1.0		
	4.17 Contractor's Equipment	Sum	1.0		
	4.18 Protection of the Environment				
	4.18.1 Dust control	Sum	1.0	315,000.00	315,000.00
	4.18.1 Turbidity barrier	Sum	1.0	1,536,000.00	1,536,000.00
	4.18.1 WQ testing and environmental reporting	Sum	1.0	5,376,000.00	5,376,000.00
	4.19 Electricity, Water and Gas include also sanitary accomodations and mess room	Mths	12.0	250,000.00	3,000,000.00
	4.20 Employer's Equipment and Free-Issue Material	Sum	1.0		
	4.21 Progress Report	Sum	1.0	150,000.00	150,000.00
	4.22 Security of the Site	Sum	1.0	15,066,000.00	15,066,000.00
	4.23 Contractor's Operations on Site	Sum	1.0		
	4.24 Fossils	Sum	1.0		
	4.25 Regulatory Compliance (NEPA Beach Licence, etc.)	Sum	1.0	80,000.00	80,000.00
	4.26 Traffic Management and Control	Sum	1.0	3,697,500.00	3,697,500.00
	4.26.1 Liason with Air Traffic Control Centre	Sum	0.0	50,000.00	-
	4.26.2 Signs and Traffic Controls	Sum	1.0	500,000.00	500,000.00
	4.27 Compliance with Airport Construction Specifications	Sum	0.0	100,000.00	-
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**36,055,500.00**

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA CARLNENUS JOHNSON PE/14/01079

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Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	5: NOMINATED SUBCONTRACTOR				
	5.1 Definition of "Nominated Subcontractor"	Sum	1.0		
	5.2 Objection to Nomination	Sum	1.0		
	5.3 Payments to Nominated Subcontractor	Sum	1.0		
	5.4 Evidence of Payment	Sum	1.0		
	6: STAFF AND LABOUR				
	6.1 Engagement of Staff and Labour	Sum	1.0		
	6.2 Rates of Wages and Conditions of Labour	Sum	1.0		
	6.3 Persons in the Service of Employer	Sum	1.0		
	6.4 Labour Laws	Sum	1.0		
	6.5 Working Hours	Sum	1.0		
	6.6 Facilities for Staff and Labour	Sum	1.0		
	6.7 Health and Safety	Sum	1.0	75,000.00	75,000.00
	6.8 Contractor's Superintendence	Mths	12.0	800,000.00	9,600,000.00
	6.9 Contractor's Personnel	Sum	1.0		
	6.10 Records of Contractor's Personnel and Equipment	Sum	1.0		
	6.11 Disorderly Conduct	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**9,675,000.00**

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
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PE/14/01079

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BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

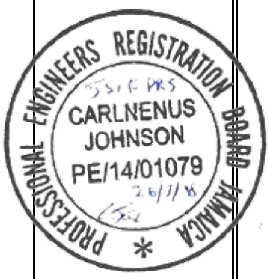
Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	7: PLANT, MATERIALS AND WORKMANSHIP				
Clause	7.1 Manner of Execution	Sum	1.0		
	7.2 Samples	Sum	1.0		
	7.3 Inspection	Sum	1.0		
	7.4 Testing	Sum	1.0		
	7.5 Rejection	Sum	1.0		
	7.6 Remedial Work	Sum	1.0		
	7.7 Ownership of Plant and Materials	Sum	1.0		
	7.8 Royalties	Sum	1.0		
	8: COMMENCEMENT, DELAYS AND SUSPENSION				
	8.1 Commencement of Works	Sum	1.0		
	8.2 Time for Completion	Sum	1.0		
	8.3 Programme	Sum	1.0		
	8.4 Extension of Time for Completion	Sum	1.0		
	8.5 Delays Caused by Authorities	Sum	1.0		
	8.6 Rate of Progress	Sum	1.0		
	8.7 Delay Damages	Sum	1.0		
	8.8 Suspension of Work	Sum	1.0		
	8.9 Consequences of Suspension	Sum	1.0		
	8.10 Payment for Plant and Materials in Event of Suspension	Sum	1.0		
		Sum	1.0		
	8.11 Prolonged Suspension	Sum	1.0		
	8.12 Resumption of Work	Sum	1.0		
	9: TESTS ON COMPLETION				
	9.1 Contractor's Obligations	Sum	1.0	2,000,000.00	2,000,000.00
	9.2 Delayed Tests	Sum	1.0		
	9.3 Retesting	Sum	1.0		
	9.4 Failure to Pass Tests on Completion	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**2,000,000.00**

BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	10: EMPLOYER'S TAKING OVER				
	10.1 Taking Over of the Works and Sections	Sum	1.0		
	10.2 Taking Over of Parts of the Works	Sum	1.0		
	10.3 Interference with Tests on Completion	Sum	1.0		
	10.4 Surfaces Requiring Reinstatement	Sum	1.0		
	11: DEFECTS LIABILITY				
	11.1 Completion of Outstanding Work and Remedying Defects	Sum	1.0	8,400,000.00	8,400,000.00
		Sum	1.0		
	11.2 Cost of Remedying Defects	Sum	1.0		
	11.3 Extension of Defects Notification Period	Sum	1.0		
	11.4 Failure to Remedy Defects	Sum	1.0		
	11.5 Removal of Defective Work	Sum	1.0		
	11.6 Further Tests	Sum	1.0		
	11.7 Right of Access	Sum	1.0		
	11.8 Contractor to Search	Sum	1.0		
	11.9 Performance Certificate	Sum	1.0		
	11.10 Unfulfilled Obligation	Sum	1.0		
	11.11 Clearance of Site	Sum	1.0		
	12: MEASUREMENT AND EVALUATION				
	12.1 Works to be Measured	Sum	1.0		
	12.2 Method of Measurement	Sum	1.0		
	12.3 Evaluation	Sum	1.0		
	12.4 Omissions	Sum	1.0		
	13: VARIATIONS AND ADJUSTMENTS				
	13.1 Right to Vary	Sum	1.0		
	13.2 Value Engineering	Sum	1.0		
	13.3 Variation Procedure	Sum	1.0		
	13.4 Payment in Applicable Currencies	Sum	1.0		
	13.5 Provisional Sums	Sum	1.0		
	13.6 Daywork	Sum	1.0		
	13.7 Adjustment for Changes in Legislation	Sum	1.0		
	13.8 Adjustment for Changes in Cost	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**8,400,000.00**



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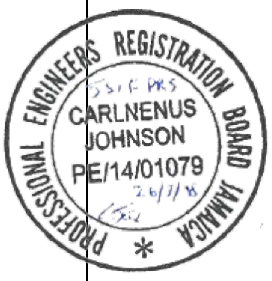
BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	14: CONTRACT PRICE AND PAYMENT				
	14.1 The Contract Price	Sum	1.0		
	14.2 Advance Payment	Sum	1.0		
	14.3 Application for Interim Payment Certificate	Sum	1.0		
	14.4 Schedule of Payments	Sum	1.0		
	14.5 Plant and Materials	Sum	1.0		
	14.6 Issue of Interime Payment Certificates	Sum	1.0		
	14.7 Payment	Sum	1.0		
	14.8 Delayed Payment	Sum	1.0		
	14.9 Payment of Retention Money	Sum	1.0		
	14.10 Statement at Completion	Sum	1.0		
	14.11 Application for Final Payment Certificate	Sum	1.0		
	14.12 Discharge	Sum	1.0		
	14.13 Issue of Final Payment Certificate	Sum	1.0		
	14.14 Cessation of Employer's Liability	Sum	1.0		
	14.15 Currencies of Payment	Sum	1.0		
	15: TERMINATION BY EMPLOYER				
	15.1 Notice to Correct	Sum	1.0		
	15.2 Termination by Employer	Sum	1.0		
	15.3 Valuation at Date of Termination	Sum	1.0		
	15.4 Payment after Termination	Sum	1.0		
	15.5 Employer's Entitlement to Termination	Sum	1.0		
	16: SUSPENSION AND TERMINATION BY CONTRACTOR				
	16.1 Contractor's Entitlement to Suspend Work	Sum	1.0		
	16.2 Termination by Contractor	Sum	1.0		
	16.3 Cessation of Work and Removal of Contractor's Equipment	Sum	1.0		
	16.4 Payment on Termination	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**-**



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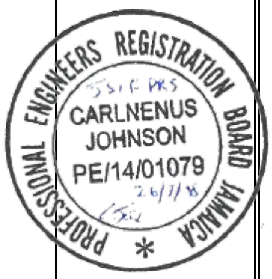
BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART I				
	17: RISK AND RESPONSIBILITY				
	17.1 Indemnities	Sum	1.0		
	17.2 Contractor's Care of the Works	Sum	1.0		
	17.3 Employer's Risks	Sum	1.0		
	17.4 Consequences of Employer's Risks	Sum	1.0		
	17.5 Intellectual and Industrial Property Rights	Sum	1.0		
	17.6 Limitation of Liability	Sum	1.0		
	18: INSURANCE				
	18.1 General Requirements for Insurances	Sum	1.0	16,000,000.00	16,000,000.00
	18.2 Insurance of Works and Contractor's Equipment	Sum	1.0		
	18.3 Insurance against injury to Persons and Damage to Property	Sum	1.0		
	18.4 Insurance for Contractor's Personnel	Sum	1.0		
	19: FORCE MAJEURE				
	19.1 Definition for For Majeure	Sum	1.0		
	19.2 Notice of Force Majeure	Sum	1.0		
	19.3 Duty to Minimise Delay	Sum	1.0		
	19.4 Consequences of Force Majeure	Sum	1.0		
	19.5 Force Majeure Affecting Subcontractor	Sum	1.0		
	19.6 Optional Termination, Payment and Release	Sum	1.0		
	19.7 Release from Performance under the Law	Sum	1.0		
	20: CLAIMS, DISPUTE AND ARBITRATION				
	20.1 Contractor's Claims	Sum	1.0		
	20.2 Appointment of the Dispute Adjudication Board	Sum	1.0		
	20.3 Failure to Agree Dispute Adjudication Board	Sum	1.0		
	20.4 Obtaining Dispute Adjudication Board's Decision	Sum	1.0		
	20.5 Amicable Settlement	Sum	1.0		
	20.6 Arbitration	Sum	1.0		
	20.7 Failure to Comply with Dispute Adjudication Board Decision	Sum	1.0		
	20.8 Expiry of Dispute Adjudication Board's Appointment	Sum	1.0		
	CONDITIONS OF CONTRACT PART I			**Carried to Collection J$**	**16,000,000.00**



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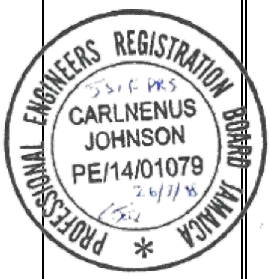
Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART II				
	1.1 Definitions	Sum	1.0		
	1.4 Law and Language	Sum	1.0		
	1.5 Priority of Documents	Sum	1.0		
	4.2 Performance Security	Sum	1.0		
	4.13 Right of Way and Facilities	Sum	1.0		
	8.3 Programme	Sum	1.0		
	14.1 The Contract Price	Sum	1.0		
	14.2 Advance Payment	Sum	1.0		
	14.3 Retention	Sum	1.0		
	18: INSURANCE				
	18.1 Right of Access to Site	Sum	1.0		
	18.2 Permits, Licences or Approvals	Sum	1.0		
	18.3 Employer's Personnel	Sum	1.0		
	20.1 Contractor's Claim	Sum	1.0		
	20.6 Arbitration	Sum	1.0		
	CONDITIONS OF CONTRACT PART II			**Carried to Collection J$**	**-**



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BILL OF QUANTITIES

Port Royal Street Shoreline Protection **Location: Port Royal Street**

Parish: Kingston

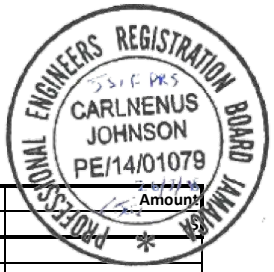
Item No.	Description	Unit	Quantity	Rate J$	Amount J$
	CONDITIONS OF CONTRACT PART II				
	21 Disqualification	Sum	1.0		
	23: Increase or decrease in the cost of materials or labour				
	23.1 Adjustments to Contract Price	Sum	1.0		
	23.2 The prices for the various cost inputs	Sum	1.0		
	23.3 The fluctuations formula	Sum	1.0		
	23.4 The "Monthly Adjusted Amount of Work Done	Sum	1.0		
	23.5 Prices shall be inclusive of GCT where appropriate.	Sum	1.0		
	23.6 No retention shall be held against any payments for fluctuations	Sum	1.0		
	24 Extension of Period of Performance	Sum	1.0		
	CONDITIONS OF CONTRACT PART II			**Carried to Collection J$**	**-**

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

BILL OF QUANTITIES

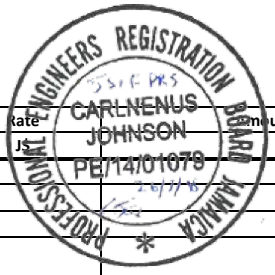
JSIF- Port Royal Street - Shoreline Protection

Location: Port Royal Street
Parish: Kingston

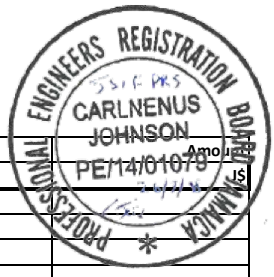


Item No.	Description	Unit	Quantity	Rate J$	Amount J$
1.00	BILL NO. 1- Site Preparation & Earthworks				
1.01	GRUB: Clear footprint of light bushes, removal of trees, grub up roots and dispose away from footprint of revetment and road to approved Landfill				
a	JSE to Barne's Gully	m2	3,028.00	$200.00	$605,600.00
b	Barne's Gully to Rae Town	m2	5,255.36	$200.00	$1,051,072.00
c	Parking Lot(Rae Town)	m2	875.00	$200.00	$175,000.00
1.02	To remove, sort and stockpile armour stones from existing revetment suitable for proposed primary and secondary armour layer; dispose of excess armour stones at approved site or as directed by Engineer.				
a	JSE to Barne's Gully	m3	1,085.60	$3,200.00	$3,473,920.00
b	Barne's Gully to Rae Town	m3	2,316.16	$3,200.00	$7,411,705.60
1.03	EXCAVATION: For base of revetments within limits of revetment footprint to reduce levels for sub grade not exeeding 2.5m deep, include to maintain excavation depths and widths for placement of fill and toe stones. Transport and store material in temporary stock piles or discard as directed by engineer.				
a	JSE to Barne's Gully	m3	5,885.65	$2,400.00	$14,125,550.40
b	Barne's Gully to Rae Town	m3	10,950.95	$2,400.00	$26,282,287.20
	BILL NO. 1- Site Preparation & Earthworks			**To Collection**	**$53,125,135.20**

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
2	BILL NO. 2- Revetment and Retaining Wall Works				
2.01	To supply and place non-woven geotextile in formation, to maintain specified overlaps and fix in place for placement of secondary armour				
a	JSE to Barne's Gully	m2	3,367.20	$1,792.00	$6,034,022.40
b	Barne's Gully to Rae Town	m2	5,621.20	$1,792.00	$10,073,190.40
2.02	**75kg - 300kg Secondary Armour:** To supply, wash, truck to site, transport to site store in temporary stockpile, place and shape in revetment as per Specifications and drawings.(Provisional Measure)				
a	JSE to Barne's Gully	m3	3,442.54	$8,960.00	$30,845,158.40
b	Barne's Gully to Rae Town	m3	5,515.18	$8,960.00	$49,416,039.68
2.03	**650kg- 2200kg Primary Armour:** To supply, wash, truck to site, transport to site store in temporary stockpile, place and shape in revetment as per Specifications and drawings(Provisional Measure)				
a	JSE to Barne's Gully	m3	5,800.96	$18,900.00	$109,638,181.80
b	Barne's Gully to Rae Town	m3	9,218.63	$18,900.00	$174,232,107.00
	Retaining Wall:				
2.04	Supply and place 3 inch minus crushed limestone to foundation of retaing wall, compact to 95% proctor to be placed in 150 mm lifts.				
a	JSE to Barne's Gully	m3	475.80	$3,840.00	$1,827,072.00
b	Barne's Gully to Rae Town	m3	794.30	$3,840.00	$3,050,112.00
2.05	Supply and place 1:3 mortar to form blinding to base of retaining wall (not less than 50mm)				
a	JSE to Barne's Gully	m2	475.80	$1,000.00	$475,800.00
b	Barne's Gully to Rae Town	m2	794.30	$1,000.00	$794,300.00
2.06	Reinforcement To supply, cut bend and place 16mm HT steel bars in retaining wall as per engineering drawings				
a	JSE to Barne's Gully	kg	15,696.37	$180.00	$2,825,346.60
b	Barne's Gully to Rae Town	kg	26,198.30	$180.00	$4,715,693.10
2.07	Supply and install formwork to wall including to prop maintain and remove				
a	JSE to Barne's Gully	m2	2,243.58	$2,400.00	$5,384,592.00
b	Barne's Gully to Rae Town	m2	3,745.43	$2,400.00	$8,989,032.00
2.08	To supply and place 4500psi concrete (sealer, crack inhibitor, water repelant, corrosion inhibitor), expansion joint to wall at 30 metres intervals, with stainless steel rod and sleeve, with cork or other suitable membrane				
a	JSE to Barne's Gully	m3	522.65	$28,000.00	$14,634,144.00
b	Barne's Gully to Rae Town	m3	872.51	$28,000.00	$24,430,224.00
	BILL NO. 2- Revetment and Retaining Wall Works			**To Collection**	**$447,365,015.38**



Item No.	Description	Unit	Quantity	Rate J$	Amount J$
3.00	**BILL NO. 3- Groynes and Beaches**				
3.01	**DREDGE: For base of gryone limits. include for maintainence of excavation depths and widths for placement of secondary armour and primary armour. Transport and store material in temporary stock piles on for use on beach**				
a	Groyne 1	m3	96.00	$4,000.00	$384,000.00
b	Groyne 2	m3	99.00	$4,000.00	$708,160.00
c	Groyne 3	m3	177.04	$4,000.00	$708,160.00
d	Groyne 4	m3	177.04	$4,000.00	$708,160.00
3.02	**650 kg - 2200kg Primary Armour:** To supply, wash, truck to site, transport to site store in temporary stockpile, place and shape in revetment as per Specifications and drawings				
a	Groyne 1	m3	212.00	$18,900.00	$4,006,800.00
b	Groyne 2	m3	264.00	$18,900.00	$7,560,000.00
c	Groyne 3	m3	400.00	$18,900.00	$7,560,000.00
d	Groyne 4	m3	400.00	$18,900.00	$7,560,000.00
3.03	**75kg - 300kg Secondary Armour:** To supply, wash, truck to site, transport to site store in temporary stockpile, place and shape in revetment as per Specifications and drawings				
a	Groyne 1	m3	96.00	$8,960.00	$860,160.00
b	Groyne 2	m3	99.00	$8,960.00	$1,586,278.40
c	Groyne 3	m3	177.04	$8,960.00	$1,586,278.40
d	Groyne 4	m3	177.04	$8,960.00	$1,586,278.40
3.04	To supply and place non-woven geotextile in formation, to maintain specified overlaps and fix in place for placement of secondary armour				
a	Groyne 1	m2	119.00	$1,792.00	$213,248.00
b	Groyne 2	m2	119.00	$1,792.00	$213,248.00
c	Groyne 3	m2	205.67		
d	Groyne 4	m2	205.67	$1,792.00	$368,560.64
3.05	**Provisional Sum** To allow for the transportation of approved excavated material from groyne footprint, not more than 1km, to beach, place, compact and shape to match proposed grade as shown on design drawings.	Sum	1.00	$3,000,000.00	$3,000,000.00
3.06	**Provisional Sum** To allow for the discarding of un-approved excavated material from groyne footprint.	sum	1.00	$1,500,000.00	$1,500,000.00
3.06	**Provisional Sum** To allow for the transportation, placement, compaction and shape to match proposed grade as shown on design drawings. of approved sand to beach should excavated material be deemed unsuitable by the Engineer,	sum	1.00	$5,000,000.00	$5,000,000.00
	BILL NO. 3- Groynes and Beaches			**To Collection**	**$45,109,331.84**



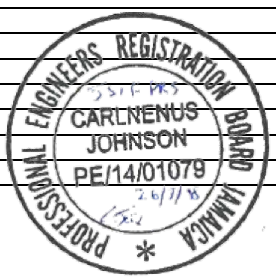
Item No.	Description	Unit	Quantity	Rate J$	Amount J$
4.00	**BILL. NO. 4 -Amenities and Utilities**				
	Boardwalk				
4.01	Fill to base of boardwalk: To supply, truck to site, store, transport 3 inch minus crushed limestone to work area, place, compact and shape in lifts not exceed 0.2 m to 0.1 m below the base of the boardwalk as shown on design drawings				
a	JSE to Barne's Gully	m3	2,837.23	$3,840.00	$10,894,970.88
b	Barne's Gully to Rae Town	m3	3,326.90	$3,840.00	$12,775,276.80
4.02	Fill to base of boardwalk: To supply, truck to site, store, transport sand to work area, place, compact and shape to base of the boardwalk as shown on design drawings				
a	JSE to Barne's Gully	m3	225.46	$1,500.00	$338,188.50
b	Barne's Gully to Rae Town	m3	135.05	$1,500.00	$202,581.00
4.03	To supply and place 3" concrete pavers as shown on drawings while providing joints between pavers ; compact the unit pavers with plate type vibratory compactor				
a	JSE to Barne's Gully	m2	1,673.78	$3,062.26	$5,125,548.50
b	Barne's Gully to Rae Town	m2	2,794.21	$3,062.26	$8,556,585.06
	Sidewalk				
4.01	Fill to base of sidewalk: To supply, truck to site, store, transport 3 inch minus crushed limestone to work area, place, compact and shape in lifts not exceed 0.2 m to 0.075 m below the base of the boardwalk as shown on design drawings				
a	JSE to Barne's Gully	m3	270.00	$3,840.00	$1,036,800.00
b	Barne's Gully to Rae Town	m3	228.00	$3,840.00	$875,520.00
4.02	Steel fabric reinforcement to B.S. 1221 Part A Reference No. 126 weighing 1.98 kg per square metre and laid in concrete slab including 150mm side and end laps (measured nett - no allowance made for laps)				
a	JSE to Barne's Gully	m2	450.00	$1,174.00	$528,300.00
b	Barne's Gully to Rae Town	m2	570.00	$1,174.00	$669,180.00
4.03	To supply and place 3500psi concrete (sealer, crack inhibitor, water repelant, corrosion inhibitor),				
a	JSE to Barne's Gully	m3	45.00	$28,000.00	$1,260,000.00
b	Barne's Gully to Rae Town	m3	57.00	$28,000.00	$1,596,000.00
	Pedestrian Bridge				
a	33m pedestrian bridge as per drawings: 6" and 8" chords, with safety grating and railing, fabricated and installed in location. Nine precast-pre-stressed concrete decks supported on three reinforced concrete piers supported by 24 precast driven piles: supply all material, excavation, formwork, steel and concrete.	Sum	1.00	$31,220,000.00	$31,220,000.00
4.04	**Supply and Installation of Bollards:** Supply and installation of dia 200mm, 1.2 m long bollards as per drawings and specs. Include for foundation excavation 0.45mx0.45mx0.45m and pouring of 0.45mx0.45mx0.45m 3500 psi concrete foundation.				
a	JSE to Barne's Gully	nr	330.00	$2,865.13	$945,493.73
b	Barne's Gully to Rae Town	nr	368.00	$2,865.13	$1,054,368.76
	Furniture				
4.06	Public/street furniture bench, to be approved by the Engineer, fasten to the boardwalk				
a	JSE to Barne's Gully	nr	16.00	$22,680.00	$362,880.00
b	Barne's Gully to Rae Town	nr	10.00	$22,680.00	$226,800.00
4.07	**Public bathrooms(Ministry of Foreign Affairs and Rae Town)**				
	Foundation				
a	Excavate for foundation trench for strip footing in compacted marl commencing at reduced level not exceeding 0.8 m deep and get out	m3	14.50	$1,400.00	$20,295.45
b	Level and compact bottom of excavation to receive concrete	m2	38.66	$542.00	$20,952.64
4.08	**Filling**				
a	Approved marl harcore filling spread levelled and well consolidated in maximum 150 mm thick layers in making up levels under floor	m3	18.64	$3,900.00	$72,697.95
b	Treat surface of ground excavation under building with appropriate poison to eradicate sub-terranean termites by approved pest control firm.	m2	77.32	$400.00	$30,926.40
4.09	**Supply and place Reinforced Concrete(3500 psi) in:**				
a	Foundations	m3	28.99	$28,000.00	$811,818.00
b	Ground Slab	m3	6.21	$28,000.00	$173,978.00
c	Suspended Slab	m3	9.32	$28,000.00	$260,967.00
4.10	**Supply and Place High tension Steel Reinforcement**				
a	13mm Diameter in foundation	kg	122.48	$180.00	$22,045.56
b	Steel fabric reinforcement to B.S. 1221 Part A Reference No. 126 weighing 1.98 kg per square metre and laid in concrete slab including 150mm side and end laps (measured nett - no allowance made for laps)	m2	38.66	$1,174.00	$45,384.49
c	13mm Diameter in Suspended Slab	kg	194.97	$180.00	$35,095.27
4.11	**Walls**				
	Blockwork				

a	Supply and place 150mm block , fill each block pocket as per specifications and engineering drawing inclusive of provisions for windows and door openings.	m2	161.72	$4,500.00	$727,759.80
	Plastering(Internal and external walls)				
b	12mm thick 1:3 cement sand plaster finished smooth with a wood float to walls, Columns and Sides of Beams & Lintols in Building and make ready for painting.	m2	323.45	$1,740.00	$562,800.91
	PAINTER & DECORATOR				
	All emulsion paint to be standard colours - special colours, types of paint, low sheen, enamel, oil, etc. to be re-priced if required Rate shall include for preparation of surfaces, cleaning down, smoothing, knotting, stopping, patching up cracks, etc., protection of floors and fittings, removing and replacing door and window fittings, if required, and cleaning upon completion.				
	Prepare and apply one primer coat and two coats of emulsion to smooth plastered surfaces to internal faces of walls,Columns, sides of Lintel and column faces.	m2	323.45	$1,397.00	$451,857.97
4.12	**SANITARY APPLIANCES**				
	Supply and fix the sanitary appliances and accessories(water closet, urinals sinks, toilet paper holder etc.) in accordance with the drawings and specifications. Including assembling and making all joints, water tight connection to supply and waste pipes including all cutting, fixing and making good finishes disturbed.				
a	American Standard CADET 3 Elongated 1.28 gpf Water closet ADA approved	nr	10.00	$73,000.00	$730,000.00
b	Allow to supply and install double bowl stainless steel sink complete with all accessories counter mounted	nr	4.00	$129,000.00	$516,000.00
c	Allow to supply and install urinal complete with sloan flush valve	nr	6.00	$63,651.00	$381,906.00
d	Allow for the supply and installation of bathroom accessories inclusive of Toilet paper holders, hooks, bars, soap dish, mirrors etc.	item	1.00	$120,000.00	$120,000.00
4.13	**Internal Water supply and sewer installation**				
	Supply and install the following pipes and fittings chased in walls, slab and trenches (measured provisional)				
a	12mm Diameter sch. 40 PVC pipes, inclusive of bends, tees & couplings	m	46.00	$403.00	$18,538.00
b	38mm Diameter sdr 31 pvc pipes, inclusive of bends, tees & couplings	m	34.00	$900.00	$30,600.00
c	100mm Diameter sdr 31 pipes, inclusive of bends, tees & couplings	m	20.00	$2,700.00	$54,000.00
4.14	**External Water supply and sewer installation(measured provisional)**				
a	Excavate trench in soil inclusive of cutting asphalted road. for 38mm diameter water supply pipeline from main not exceeding1.5 m return fill with approved bedding material pipe and return fill in 150mm layers to grade, including to supply PVC pipeline and fittings in trench, push fit joint, diameter 38mm PVC sch. 40	m	100.00	$12,000.00	$1,200,000.00
b	Excavate trench in soil for 100 mm diameter sewer pipeline from main not exceeding1.5 m return fill with approved bedding material pipe and return fill in 150mm layers to grade, including to supply PVC pipeline and fittings in trench, push fit joint, diameter 100 PVC sdr 31	m	18.00	$8,500.00	$153,000.00
c	Excavate trench in earth for 38mm diameter pipe not exceeding 0.7m deep and get out, backfill with approved excavated material.	m	4.00	$5,000.00	$20,000.00
4.15	**Manhole**				
a	manhole size 900mm x 900mm (external dimensions) no greater thn 1 m deep to invert, consisting of 150mm thick concrete base and cover slab, reinforced with BRC Fabric Ref. #126, 100mm thick blockwall sides with all cavities filled solid with concrete, walls reinforced with 13mm MS diameter bars at 400mm on centres vertically and 10mm diameter bars at 400mm on centres horizontally, internal face of wall rendered with a steel float finish, concrete benching to bottom, holed for and including 100mm diameter p.v.c. "S" Trap, 457mm square light duty manhole frame and cover, including all excavations,disposal, backfilling, formwork, etc,.making good to	NR	4.00	$90,000.00	$360,000.00
4.16	**Septic Tank**				
a	Supply and place prefabricated septic tank having an 8000 Litre capacity inclusive of excavation works, leveling, backfilling and compaction of soil surface,	Sum	2.00	$ 1,000,000.00	$2,000,000.00
	BILL. NO. 4 -Amenities and Utilities			**To Collection**	**$86,489,116.67**

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
5.00	BILL NO. 5- Road Works				
5.01	Remove existing asphalt road layer and cart away or dispose of milled asphalt material to nearest approved landfill and compact surface of exposed road base with a vibratory roller to a minimum of 95% proctor density.				
a	JSE to Barne's Gully	m2	4,200.00	$800.00	$3,360,000.00
b	Barne's Gully to Rae Town	m2	7,980.00	$800.00	$6,384,000.00
5.02	Supply and place approved engineering fill within limits of road reservation to reduce levels for formation level. Grade to fall and cambers with approved engineering fill. Roll surface with 10 ton vibratory roller. (Measured Provisional)				
a	JSE to Barne's Gully	m3	3,255.00	$3,840.00	$12,499,200.00
b	Barne's Gully to Rae Town	m3	3,192.00	$3,840.00	$12,257,280.00
5.03	Supply, spread and grade 150mm thick sub-base course of approved river shingle. Roll surface of base with a vibratory roller to a minimum CBR of 80 and density of 95%. (Measured Provisional)				
a	JSE to Barne's Gully	m3	735.00	$3,500.00	$2,572,500.00
b	Barne's Gully to Rae Town	m3	1,197.00	$3,500.00	$4,189,500.00
5.04	Supply, spread and grade 250mm thick base course of approved marly limestone. Roll surface of base with a vibratory roller to a minimum CBR of 80 and density of 95%.				
a	JSE to Roundabout	m3	1,312.50	$3,500.00	$4,593,750.00
b	Roundabout to Rae Town	m3	1,995.00	$3,500.00	$6,982,500.00
5.05	Apply tack coat of MCO at the rate of 50.8 Lit/m2 to base. Supply and place 100 mm asphaltic concrete using a paving machine, rolled to falls and cambers in accordance with the specification.				
a	JSE to Barne's Gully	m2	2535	$3,200.00	$8,112,000.00
b	Barne's Gully to Rae Town	m2	3766	$3,200.00	$12,051,200.00
5.06	Supply, lay and joint 125 x 250 half battered precast kerbs, jointed and bedded in cement/sand (1:3) mortar, laid on concrete as per details provided including all excavation necessary and disposal of surplus excavated material				
a	JSE to Barne's Gully	m	1,046.00	$3,100.00	$3,242,600.00
b	Barne's Gully to Rae Town	m	996.00	$3,100.00	$3,087,600.00
5.06	Line marking; width 100 mm; continuous; two coats road marking compound as specified				
a	JSE to Barne's Gully	m	860.00	$506.00	$435,160.00
b	Barne's Gully to Rae Town	m	2,488.00	$506.00	$1,258,928.00
	BILL NO. 5- Road Works			**To Collection**	**$81,026,218.00**

PROFESSIONAL ENGINEERS REGISTRATION BOARD JAMAICA
CARLNENUS JOHNSON
PE/14/01079

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
6.00	**BILL NO. 6- Drainage Works**				
	Demolish exisitng culverts and Cart Away rubble to approved landfill				
6.01	Box Culvert				
a	Drain 4	m	10.5	$1,500.00	$15,750.00
b	Drain 5	m	10.5	$1,500.00	$15,750.00
c	Drain 7	m	21	$1,500.00	$31,500.00
d	Drain 8	m	21	$1,500.00	$31,500.00
6.02	Pipe Culvert				
a	Drain 3	m	10.5	$1,500.00	$15,750.00
b	Drain 6	m	3	$1,500.00	$4,500.00
6.03	Excavate within existing trench to widen and deepen as necessary to accommodate proposed drain, including compaction of surfaces and to keep excavation free from storm, percolating or standing water by an approved means.				
a	Drain 4	m3	14.22	$2,400.00	$34,128.00
b	Drain 5	m3	11.7	$2,400.00	$28,080.00
c	Drain 7	m3	18.18	$2,400.00	$43,632.00
d	Drain 8	m3	24.06	$2,400.00	$57,744.00
	To supply and place 4500psi concrete (sealer, crack inhibitor, water repelant, corrosion inhibitor).				
6.04	Box Culvert - Walls 200mm Thick				
a	Drain 4	m3	8.058	$26,000.00	$209,508.00
b	Drain 5	m3	6.63	$26,000.00	$172,380.00
c	Drain 7	m3	10.302	$26,000.00	$267,852.00
d	Drain 8	m3	13.634	$26,000.00	$354,484.00
6.05	Box Culvert - Base 250mm Thick				
a	Drain 4	m3	9.48	$26,000.00	$246,480.00
b	Drain 5	m3	7.8	$26,000.00	$202,800.00
c	Drain 7	m3	12.12	$26,000.00	$315,120.00
d	Drain 8	m3	16.04	$26,000.00	$417,040.00
6.06	Box Culvert - Slab 250mm Thick				
a	Drain 4	m3	9.48	$26,000.00	$246,480.00
b	Drain 5	m3	7.8	$26,000.00	$202,800.00
c	Drain 7	m3	12.12	$26,000.00	$315,120.00
d	Drain 8	m3	16.04	$26,000.00	$417,040.00
6.09	Pipe Culvert(precast)				
a	Drain 3	m3	5.17	$26,000.00	$134,460.67
b	Drain 6	m3	1.50	$26,000.00	$39,109.06
	STEEL REINFORCEMENT				
	Supply and place High Tension Steel Bar Reinforcement as Described:				
6.1	13mm in Culvert Slab				
a	Drain 4	kg	148.5624	$180.00	$26,741.23
b	Drain 5	kg	122.4552	$180.00	$22,041.94
c	Drain 7	kg	189.588	$180.00	$34,125.84
d	Drain 8	kg	250.5048	$180.00	$45,090.86
6.11	13mm in Culvert base				
a	Drain 4	kg	148.5624	$180.00	$28,672.54
b	Drain 5	kg	122.4552	$180.00	$23,633.85
c	Drain 7	kg	189.588	$180.00	$36,590.48
d	Drain 8	kg	250.5048	$180.00	$48,347.43
6.12	13mm in Culvert Walls				
a	Drain 4	kg	64.2024	$180.00	$28,672.54
b	Drain 5	kg	53.0136	$180.00	$23,633.85
c	Drain 7	kg	81.7848	$180.00	$36,590.48
d	Drain 8	kg	107.892	$180.00	$48,347.43
	Formwork				
	Formwork and Supports to the following:				
6.13	Side of Walls				
a	Drain 4	m2	56.88	$2,400.00	$136,512.00
b	Drain 5	m2	46.8	$2,400.00	$112,320.00
c	Drain 7	m2	72.72	$2,400.00	$174,528.00
d	Drain 8	m2	96.24	$2,400.00	$230,976.00
6.14	Soffit of Slab				
a	Drain 4	m2	33.18	$2,400.00	$79,632.00



b	Drain 5	m2	27.3	$2,400.00	$65,520.00
c	Drain 7	m2	42.42	$2,400.00	$101,808.00
d	Drain 8	m2	56.14	$2,400.00	$134,736.00
6.15	Edge of Base Slab 250mm High				
a	Drain 4	m2	11.85	$2,400.00	$28,440.00
b	Drain 5	m2	9.75	$2,400.00	$23,400.00
c	Drain 7	m2	15.15	$2,400.00	$36,360.00
d	Drain 8	m2	20.05	$2,400.00	$48,120.00
6.16	To supply material and labour necessary to construct reinfornced concrete combination inlet structure as per drawings and specifications				
a	JSE to Barne's Gully	NR	7	$350,000.00	$2,450,000.00
b	Barne's Gully to Rae Town	NR	6	$350,000.00	$2,100,000.00
6.17	Supply and install Heavy duty metal cross grating 2" spacing with metal supports recessed in concrete to be flush with road surface				
a	JSE to Barne's Gully	NR	14	$55,360.80	$775,051.20
b	Barne's Gully to Rae Town	NR	12	$55,360.80	$664,329.60
	BILL NO. 6- Drainage Works			**To Collection**	**$11,383,229.01**

Item No.	**Description**	**Unit**	**Quantity**	**Rate J$**	**Amount J$**
7.00	BILL NO. 7- Parking Lots				
7.01	Supply and place approved marl within limits of parking reservation in 200mm lifts design grade. Grade to fall and cambers with approved engineering fill.				
	Parking Lot 1	m3	215	$ 3,840.00	$825,600.00
	Parking Lot 2	m3	0	$ 3,840.00	$0.00
	Parking Lot 3	m3	354.4	$ 3,840.00	$1,360,896.00
7.02	Supply, spread and grade 225mm thick base course of approved marly limestone. Roll surface of base with a vibratory roller to a minimum CBR of 80 and density of 95%.				
	Parking Lot 1	m3	96.75	$ 3,600.00	$348,300.00
	Parking Lot 2	m3	33.075	$ 3,600.00	$119,070.00
	Parking Lot 3	m3	199.35	$ 3,600.00	$717,660.00
7.03	Providing and laying 80 mm thick Grass paver block of M -25 grade of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of fine sand, filling the joints with fine sand etc. all complete as per the direction of Engineer.				
	Parking Lot 1	m2	0	$ 3,688.35	$0.00
	Parking Lot 2	m2	0	$ 3,688.35	$0.00
	Parking Lot 3	m2	886	$ 3,688.35	$3,267,876.15
	BILL NO. 7- Parking Lots			**To Collection**	**$6,639,402.15**

Item No.	Description	Unit	Quantity	Rate J$	Amount J$
8.00	BILL NO. 8 - Provisional Sums and Dayworks				
8.01	**Provisional Sums**				
8.02	Street art	Sum	1.00	$ 5,000,000.00	$5,000,000.00
8.03	Landscaping	Sum	1.00	$ 3,000,000.00	$3,000,000.00
8.04	Provisions for the relocation and repair of NWC pipes in the duration of the works	Sum	1.00	$ 15,000,000.00	$15,000,000.00
8.05	Low intensity light fixture to boardwalk: 2100 Lumens, 16' aluminium poles, water proof light fixture, Connection to JPS LV in utility trench, termination and installation to concrete deck at 20 metres intervals	Sum	1.00	$ 15,000,000.00	$15,000,000.00
8.06	Fishing facilities (water connection, fibre glass cleaning stall, composting station and 3 mooring points)	Sum	1.00	$ 3,873,872.00	$3,873,872.00
8.07	**Day Works**				
8.08	The contractor will be reimbursed as defined below for the cost dayworks in accordance with Condition of Contract. Insert below the percentage addition as required to each section of the prime cost for overheads and profit.				
8.09	Provided in respect of the Prime Cost of Labour	Sum	1.00	$ 5,000,000.00	$5,000,000.00
8.10	Percentage addition for overhead and profit for Labour	%	15.00		$750,000.00
8.11	Provided in respect of the Prime Cost of Material	Sum	1.00	$ 5,000,000.00	$5,000,000.00
8.12	Percentage addition for overhead and profit for Material	%	15.00		$750,000.00
8.13	Provided in respect of the Prime Cost of Plant	Sum	1.00	$ 5,000,000.00	$5,000,000.00
8.14	Percentage addition for overhead and profit for Plant	%	15.00		$750,000.00
	BILL NO. 8 - Provisional Sums and Dayworks			**To Collection**	**$59,123,872.00**

	SUMMARY				
1	Cost of Complying with Conditions of Contract				$72,130,500.00
2	BILL NO. 1- Site Preparation & Earthworks				$53,125,135.20
3	BILL NO. 2- Revetment and Retaining Wall Works				$447,365,015.38
4	BILL NO. 3- Groynes and Beaches				$45,109,331.84
5	BILL. NO. 4 -Amenities and Utilities				$86,489,116.67
6	BILL NO. 5- Road Works				$81,026,218.00
7	BILL NO. 6- Drainage Works				$11,383,229.01
8	BILL NO. 7- Parking Lots				$6,639,402.15
9	BILL NO. 8 - Provisional Sums and Dayworks				$59,123,872.00
	Sub-Total				**$862,391,820.25**
	Contingency (5% of Sub-total)				**$43,119,591.01**
	Total				**$905,511,411.27**

Glossary of Technical Terms

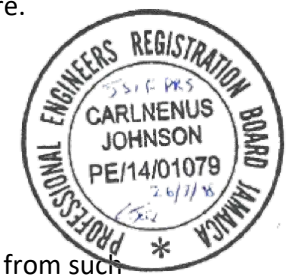
A

ACCRETION

May be either natural or artificial. Natural accretion is the buildup of land, solely by the action of the forces of nature, on a beach by deposition of water – or airborne material. Artificial accretion is a similar buildup of land by reason of an act of man, such as the accretion formed by a GROIN or BREAKWATER, or beach fill deposited by mechanical means.

ADVECTION

Changes in a sea water property (salinity, temperature, oxygen content, etc.) that takes place in the presence of currents. Also, changes in atmospheric properties in the earth's atmosphere.



ALONGSHORE

Parallel to and near the shoreline; LONGSHORE.

B

BATHYMETRY

The measurement of water depths in oceans, seas, and lakes; also information derived from such measurements.

BAY

A recess in the shore or an inlet of a sea between two capes or headlands, not as large as a gulf but larger than a cove. See also BIGHT, EMBAYMENT.

BEACH

The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). The seaward limit of a beach--unless otherwise specified--is the mean low water line. A beach includes foreshore and backshore.

BEACH ACCRETION

See ACCRETION.

BEACH EROSION

The carrying away of beach materials by wave action, tidal currents, littoral currents, or wind.

BEACH FILL

Material placed on a beach to re-nourish eroding shores, usually pumped by dredge but sometimes delivered by trucks

BEACH NOURISHMENT

See BEACH FILL.

BEACH PROFILE

A cross-section taken perpendicular to a given beach contour; the profile may include the face of a dune or sea wall, extend over the backshore, across the foreshore, and seaward underwater into the NEARSHORE zone.

BEACH WIDTH

The horizontal dimension of the beach measured normal to the shoreline and landward of the higher-high tide line (on oceanic coasts) or from the still water level (on lake coasts)

BED

The bottom of a watercourse, or any body of water.

BREAKING

Reduction in wave energy and height in the surf zone due to limited water depth

C

CLIMATE

The characteristic weather of a region, particularly regarding temperature and precipitation, averaged over some significant internal of time (years).

CLOSURE DEPTH

The water depth beyond which repetitive profile or topographic surveys (collected over several years) do not detect vertical sea bed changes, generally considered the seaward limit of littoral transport. The depth can be determined from repeated cross-shore profile surveys or estimated using formulas based on wave statistics. Note that this does not imply the lack of sediment motion beyond this depth.

COAST

(1) A strip of land of indefinite width (may be several kilometers) that extends from the SHORELINE inland to the first major change in terrain features. (2) The part of a country regarded as near the coast.

COASTAL AREA

The land and sea area bordering the SHORELINE.

COASTLINE

(1) Technically, the line that forms the boundary between the coast and the shore. (2) Commonly, the line that forms the boundary between the land and the water, esp. the water of a sea or ocean. The SHORELINE.

CONTINENTAL SHELF

(1) The zone bordering a continent extending from the line of permanent immersion to the depth, usually about 100 m to 200 m, where there is a marked or rather steep descent toward the great depths of the ocean. (2) The area under active littoral processes during the HOLOCENE period. (3) The region of the oceanic bottom that extends outward from the shoreline with an average slope of less than 1:100, to a line where the gradient begins to exceed 1:40 (the CONTINENTAL SLOPE).

CONTOUR

A line on a map or chart representing points of equal elevation with relation to a DATUM. It is called an ISOBATH when connecting points of equal depth below a datum. Also called DEPTH CONTOUR.

CROSS-SHORE

Perpendicular to the SHORELINE

CURRENT

(1) The flowing of water, or other liquid or gas. (2) That portion of a stream of water which is moving with a velocity much greater than the average or in which the progress of the water is principally concentrated. (3) Ocean currents can be classified in a number of different ways. Some important types include the following: (1) *Periodic* - due to the effect of the tides; such Currents may be rotating rather than having a simple back and forth motion. The currents accompanying tides are known as tidal currents; (2) *Temporary* - due to seasonal winds; (3) *Permanent* or *ocean* - constitute a part of the general ocean circulation. The term DRIFT CURRENT is often applied to a slow broad movement of the oceanic water; (4) *Nearshore* - caused principally by waves breaking along a shore.

D

DATUM

Any permanent line, plane or surface used as a reference datum to which elevations are referred.

DATUM, CHART

See CHART DATUM.

DEEP WATER

Water so deep that surface waves are little affected by the ocean bottom. Generally, water deeper than one-half the surface wavelength is considered deep water. Compare SHALLOW WATER.

DEEP WATER WAVES

A wave in water the depth of which is greater than one-half the WAVE LENGTH

DENSITY

Mass (in kg) per unit of volume of a substance; kg/m^3. For pure water, the density is 1000 kg/m^3, for seawater the density is usually more. Density increases with increasing salinity, and decreases with increasing temperature. More information can be found in "properties of seawater". For stone and sand, usually a density of 2600 kg/m^3 is assumed. Concrete is less dense, in the order of 2400 kg/m^3. Some types of basalt may reach 2800 kg/m^3. For sand, including the voids, one may use 1600 kg/m^3, while mud often has a density of 1100 - 1200 kg/m^3.

DEPRESSION

A general term signifying any depressed or lower area in the ocean floor.

DEPTH

The vertical distance from a specified datum to the sea floor.

DIFFRACTION (of water waves)

The phenomenon by which energy is transmitted laterally along a wave crest. When a part of a train of waves is interrupted by a barrier, such as a BREAKWATER, the effect of diffraction is manifested by propagation of waves into the sheltered region within the barrier's geometric shadow.

DUNES

(1) Ridges or mounds of loose, wind-blown material, usually sand. (2) Bed forms smaller than bars but larger than ripples that are out of phase with any water-surface gravity waves associated with them.

DURATION

In wave forecasting, the length of time the wind blows in nearly the same direction over the FETCH (generating area).

DURATION, MINIMUM

The time necessary for steady-state wave conditions to develop for a given wind velocity over a given fetch length.

E

ELEVATION

The vertical distance from mean sea level or other established datum plane to a point on the earth's surface; height above sea level. Although sea floor elevation below msl should be marked as a negative value, many charts show positive numerals for water depth.

EL NIÑO

Warm equatorial water which flows southward along the coast of Peru and Ecuador during February and March of certain years. It is caused by pole ward motions of air and unusual water temperature patterns in the Pacific Ocean, which cause coastal down welling, leading to the reversal in the normal north-flowing cold coastal currents. During many *El Niño* years, storms, rainfall, and other meteorological phenomena in the Western Hemisphere are measurably different than during non-*El Niño* years.

EROSION

The wearing a way of land by the action of natural forces. On a beach, the carrying away of beach material by wave action, tidal currents, littoral currents, or by deflation.

F

FETCH

The area in which SEAS are generated by a wind having a fairly constant direction and speed. Sometimes used synonymously with FETCH LENGTH.

FETCH LENGTH

The horizontal distance (in the direction of the wind) over which a wind generates seas or creates a WIND SETUP.

FETCH-LIMITED

Situation in which wave energy (or wave height) is limited by the size of the wave generation area (fetch).

FLOOD

(1) Period when tide level is rising; often taken to mean the flood current which occurs during this period
(2) A flow beyond the carrying capacity of a channel.

G

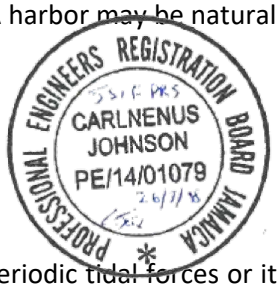
GROYNE (GROIN)

Narrow, roughly shore-normal structure built to reduce longshore currents, and/or to trap and retain littoral material. Most groins are of timber or rock and extend from a SEAWALL, or the backshore, well onto the foreshore and rarely even further offshore. See T-GROIN, PERMEABLE GROIN, IMPERMEABLE GROIN.

H

HARBOUR

Any protected water area affording a place of safety for vessels. See also PORT. A harbor may be natural or man-made.



HIGH TIDE, HIGH WATER (HW)

The maximum elevation reached by each rising tide. See TIDE.

HIGH WATER (HW)

Maximum height reached by a rising tide. The height may be solely due to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions. Nontechnical, also called the HIGH TIDE.

HIGH WATER LINE

In strictness, the intersection of the plane of mean high water with the shore. The shoreline delineated on the nautical charts of the National Ocean Service is an approximation of the high water line. For specific occurrences, the highest elevation on the shore reached during a storm or rising tide, including meteorological effects.

HIGH WATER MARK

A reference mark on a structure or natural object, indicating the maximum stage of tide or flood.

HINDCASTING

In wave prediction, the retrospective forecasting of waves using measured wind information.

HISTORIC EVENT ANALYSIS

Extreme analysis based on hindcasting typically ten events over a period of 100 years.

HURRICANE

An intense tropical cyclone in which winds tend to spiral inward toward a core of low pressure, with maximum surface wind velocities that equal or exceed 33.5 m/sec (75 mph or 65 knots) for several minutes or longer at some points. TROPICAL STORM is the term applied if maximum winds are less than 33.5 m/sec but greater than a whole gale (63 mph or 55 knots). Term is used in the Atlantic, Gulf of Mexico, and eastern Pacific.

HURRICANE PATH or TRACK

Line of movement (propagation) of the eye through an area.

I

INCIDENT WAVE

Wave moving landward.

INNUDATION

To cover completely with water; overflow; flood; swamp

IRREGULAR WAVES

Waves with random wave periods (and in practice, also heights), which are typical for natural wind-induced waves.

J

JONSWAP SPECTRUM

Wave spectrum typical of growing deep water waves developed from field experiments and measurements of waves and wave spectra in the Joint North Sea Wave Project

K

KINEMATIC VISCOSITY

The dynamic viscosity divided by the fluid density.

L

LANDMARK

A conspicuous object, natural or artificial, located near or on land, which aids in fixing the position of an observer.

LENGTH OF WAVE

The horizontal distance between similar points on two successive waves measured perpendicularly to the crest.

LITTORAL

Of or pertaining to a shore, especially of the sea. Often used as a general term for the coastal zone influenced by wave action, or, more specifically, the shore zone between the high and low water marks.

LITTORAL DRIFT, LITTORAL TRANSPORT

The movement of beach material in the littoral zone by waves and currents. Includes movement parallel (long shore drift) and sometimes also perpendicular (cross-shore transport) to the shore

LOAD

The quantity of sediment transported by a current. It includes the suspended load of small particles and the BED LOAD of large particles that move along the bottom.

LONGSHORE

Parallel to and near the shoreline; ALONGSHORE.

LOW TIDE (LOW WATER, LW)

The minimum elevation reached by each falling tide. See TIDE.

LOW WATER (LW)

The minimum height reached by each falling tide. Nontechnically, also called LOW TIDE.

LOW WATER LINE

The line where the established LOW WATER DATUM intersects the shore. The plane of reference that constitutes the LOW WATER DATUM differs in different regions.

LUNAR DAY

The time of rotation of the Earth with respect to the moon, or the interval between two successive upper transits of the moon over the meridian of a place. The mean lunar day is approximately 24.84 solar hours in length, or 1.035 times as great as the mean solar day. Also called TIDAL DAY.

LUNAR TIDE

The portion of the tide that can be attributed directly to attraction to the moon

M

MEAN DEPTH

The average DEPTH of the water area between the still water level and the SHOREFACE profile from the waterline to any chosen distance seaward.

MEAN HIGH WATER (MHW)

The average height of the high waters over a 19-year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the results to the equivalent of a mean 19-year value. All high water heights are included in the average where the type of tide is either semidiurnal or mixed. Only the higher high water heights are included in the average where the type of tide is diurnal. So determined, mean high water in the latter case is the same as mean higher high water.

MEAN SEA LEVEL

The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings. Not necessarily equal to MEAN TIDE LEVEL. It is also the average water level that would exist in the absence of tides.

MEAN TIDE LEVEL

A plane midway between MEAN HIGH WATER and MEAN LOW WATER. Not necessarily equal to MEAN SEA LEVEL.

MEAN WAVE HEIGHT

The mean of all individual waves in an observation interval of approximately half an hour. In case of a Rayleigh-distribution 63% of the significant wave height.

MEDIAN DIAMETER

The diameter which marks the division of a given sand sample into two equal parts by weight, one part containing all grains larger than that diameter and the other part containing all grains smaller.

MINIMUM DURATION

See DURATION, MINIMUM.

MINIMUM FETCH

The least distance in which steady-state wave conditions will develop for a wind of given speed blowing a given duration of time.

N

NEARSHORE

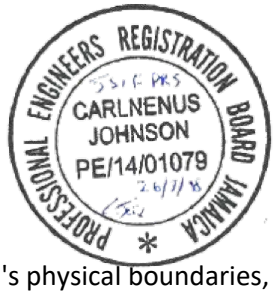
(1) In beach terminology an indefinite zone extending seaward from the SHORELINE well beyond the BREAKER ZONE. (2) The zone which extends from the swash zone to the position marking the start of the offshore zone, typically at water depths of the order of 20 m.

NOURISHMENT

The process of replenishing a beach. It may occur naturally by longshore transport, or be brought about artificially by the deposition of dredged materials or of materials trucked in from upland sites.

NUMERICAL MODELING

Refers to analysis of coastal processes using computational models.



O

OCEANOGRAPHY

The study of the sea, embracing and indicating all knowledge pertaining to the sea's physical boundaries, the chemistry and physics of seawater, marine biology, and marine geology.

OFFSHORE

(1) In beach terminology, the comparatively flat zone of variable width, extending from the SHOREFACE to the edge of the CONTINENTAL SHELF. It is continually submerged. (2) The direction seaward from the shore. (3) The zone beyond the nearshore zone where sediment motion induced by waves alone effectively ceases and where the influence of the sea bed on wave action is small in comparison with the effect of wind. (4) The breaker zone directly seaward of the low tide line.

OFFSHORE CURRENT

(1) Any current in the offshore zone. (2) Any current flowing away from shore.

ONSHORE

A direction landward from the sea.

OPERRATION WAVES

Waves generated locally by wind. It consists of waves of many different wave heights and periods. These waves propagate more or less in the wind direction.

OSCILLATION

(1) A periodic motion backward and forward. (2) Vibration or variance above and below a mean value.

P

PARTICLE VELOCITY

The velocity induced by wave motion with which a specific water particle moves within a wave.

PEAK PERIOD

The wave period determined by the inverse of the frequency at which the wave energy spectrum reaches its maximum.

PERCOLATION

The process by which water flows through the interstices of a sediment. Specifically, in wave phenomena, the process by which wave action forces water through the interstices of the bottom sediment and which tends to reduce wave heights.

PLANFORM

The outline or shape of a body of water as determined by the still-water line.

POORLY-SORTED (POORLY-GRADED)

Said of a clastic sediment or rock that consists of particles of many sizes mixed together in an unsystematic manner so that no one size class predominates.

POROSITY

Percentage of the total volume of a soil sample not occupied by solid particles but by air and water, $\eta = V_v/V_T \times 100$

PROPAGATION OF WAVES

The transmission of waves through water.

R

RADAR

An instrument for determining the distance and direction to an object by measuring the time needed for radio signals to travel from the instrument to the object and back, and by measuring the angle through which the instrument's antenna has traveled.

REEF

An offshore consolidated rock hazard to navigation, with a least depth of about 20 meters (10 fathoms) or less. Often refers to coral FRINGING REEFS in tropical waters

REEF, BARRIER

See BARRIER REEF.

REEF BREAKWATER

Rubble mound of single-sized stones with a crest at or below sea level which is allowed to be (re)shaped by the waves.

REFRACTION (of water waves)

(1) The process by which the direction of a wave moving in shallow water at an angle to the contours is changed: the part of the wave advancing in shallower water moves more slowly than that part still advancing in deeper water, causing the wave crest to bend toward alinement with the underwater contours. (2) The bending of wave crests by currents.

REGULAR WAVES

Waves with a single height, period, and direction.

RETURN PERIOD

Average period of time between occurrences of a given event; it is a measure of frequency. For instance, if the 100 year flood is at 100 cm above normal sea level, it means there is a 1/100 – 1% chance of having a flood higher than 150 cm every year.

RISK ANALYSIS

Assessment of the total risk due to all possible environmental inputs and all possible mechanisms.

(1) An aggregate of one or more minerals; or a body of undifferentiated mineral matter (e.g., obsidian). The three classes of rocks are: (a) Igneous – crystalline rocks formed from molten material. Examples are granite and basalt. (b) Sedimentary – resulting from the consolidation of loose sediment that has accumulated in layers. Examples are sandstone, shale and limestone. (c) Metamorphic – formed from preexisting rock as a result of burial, heat, and pressure. (2) A rocky mass lying at or near the surface of the water or along a jagged coastline, especially where dangerous to shipping.

RUNUP, RUNDOWN

The upper and lower levels reached by a wave on a beach or coastal structure, relative to still-water level.

S

SAND

Sediment particles, often largely composed of quartz, with a diameter of between 0.062 mm and 2 mm, generally classified as fine, medium, coarse or very coarse. Beach sand may sometimes be composed of organic sediments such as calcareous reef debris or shell fragments.

SEA

(1) A large body of salt water, second in rank to an ocean, more or less landlocked and generally part of, or connected with, an ocean or a larger sea. Examples: Mediterranean Sea; South China Sea. (2) Waves caused by wind at the place and time of observation. (3) State of the ocean or lake surface, in regard to waves.

SEA LEVEL

See MEAN SEA LEVEL.

SEA LEVEL RISE

The long-term trend in MEAN SEA LEVEL.

SEDIMENT

(1) Loose, fragments of rocks, minerals or organic material which are transported from their source for varying distances and deposited by air, wind, ice and water. Other sediments are precipitated from the overlying water or form chemically, in place. Sediment includes all the unconsolidated materials on the sea floor. (2) The fine grained material deposited by water or wind.

SETUP, WAVE

Super elevation of the water surface over normal surge elevation due to onshore mass transport of the water by wave action alone.

SETUP, WIND

See WIND SETUP.

SHALLOW WATER

(1) Commonly, water of such a depth that surface waves are noticeably affected by bottom topography. It is customary to consider water of depths less than one-half the surface wavelength as shallow water. See TRANSITIONAL ZONE and DEEP WATER. (2) More strictly, in hydrodynamics with regard to progressive gravity waves, water in which the depth is less than 1/25 the wavelength.

SHOALING

Decrease in water depth. The transformation of wave profile as they propagate inshore.

SHORE

The narrow strip of land in immediate contact with the sea, including the zone between high and low water lines. A shore of unconsolidated material is usually called a BEACH. Also used in a general sense to mean the coastal area (e.g., to live at the shore). Also sometimes known as the LITTORAL.

SHOREFACE

The narrow zone seaward from the low tide SHORELINE, covered by water, over which the beach sands and gravels actively oscillate with changing wave conditions.

SHORELINE

The intersection of a specified plane of water with the shore or beach (e.g., the high water shoreline would be the intersection of the plane of mean high water with the shore or beach). The line delineating the shoreline on National Ocean Service nautical charts and surveys approximates the mean high water line (United States).

SIGNIFICANT WAVE

A statistical term relating to the one-third highest waves of a given wave group and defined by the average of their heights and periods. The composition of the higher waves depends upon the extent to which the lower waves are considered. Experience indicates that a careful observer who attempts to establish the character of the higher waves will record values which approximately fit the definition of the significant wave.

SIGNIFICANT WAVE HEIGHT

The average height of the one-third highest waves of a given wave group. Note that the composition of the highest waves depends upon the extent to which the lower waves are considered. In wave record analysis, the average height of the highest one-third of a selected number of waves, this number being determined by dividing the time of record by the significant period.

SIGNIFICANT WAVE PERIOD

An arbitrary period generally taken as the period of the one-third highest waves within a given group. Note that the composition of the highest waves depends upon the extent to which the lower waves are considered. In wave record analysis, this is determined as the average period of the most frequently recurring of the larger well-defined waves in the record under study.

SILT

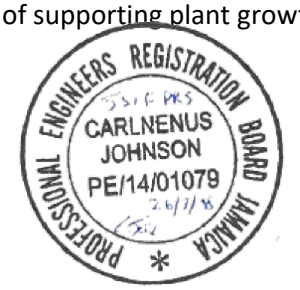
Sediment particles with a grain size between 0.004 mm and 0.062 mm, i.e. coarser than clay particles but finer than sand. See SOIL CLASSIFICATION.

SLOPE

The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25, indicating one unit rise in 25 units of horizontal distance; or in a decimal fraction (0.04). Also called GRADIENT.

SOIL

A layer of weathered, unconsolidated material on top of bed rock; in geologic usage, usually defined as containing organic matter and being capable of supporting plant growth.



SOIL CLASSIFICATION (size)

An arbitrary division of a continuous scale of grain sizes such that each scale unit or grade may serve as a convenient class interval for conducting the analysis or for expressing the results of an analysis. There are many classifications used.

SORTING

Process of selection and separation of sediment grains according to their grain size (or grain shape or specific gravity).

STILL-WATER LEVEL (SWL)

The surface of the water if all wave and wind action were to cease. In deep water this level approximates the midpoint of the wave height. In shallow water it is nearer to the trough than the crest. Also called the undisturbed water level.

STORM SURGE

A rise above normal water level on the open coast due to the action of wind stress on the water surface. Storm surge resulting from a hurricane also includes that rise in level due to atmospheric pressure reduction as well as that due to wind stress.

SURGE

(1) The name applied to wave motion with a period intermediate between that of the ordinary wind wave and that of the tide, say from ½ to 60 min. It is low height, usually less than 0.9 m (3 ft). (2) In fluid flow, long interval variations in velocity and pressure, not necessarily periodic, perhaps even transient in nature. (3) see STORM SURGE.

SURVEY, TOPOGRAPHIC

A survey which has, for its major purpose, the determination of the configuration (relief) of the surface of the land and the location of natural and artificial objects thereon.

SUSPENDED LOAD

(1) The material moving in suspension in a fluid, kept up by the upward components of the turbulent currents or by colloidal suspension. (2) The material collected in or computed from samples collected with a SUSPENDED LOAD SAMPLER. Where it is necessary to distinguish between the two meanings given above, the first one may be called the "true

SWELL

Wind-generated waves that have traveled out of their generating area. Swell characteristically exhibits a more regular and longer period and has flatter crests than waves within their fetch (SEAS).

T

TIDAL PERIOD

The interval of time between two consecutive, like phases of the TIDE.

TIDAL RANGE

The difference in height between consecutive high and low (or HIGHER HIGH and LOWER LOW) waters.

TIDE

The periodic rising and falling of the water that results from gravitational attraction of the Moon and Sun and other astronomical bodies acting upon the rotating Earth. Although the accompanying horizontal movement of the water resulting from the same cause is also sometimes called the tide, it is preferable to designate the latter as TIDAL CURRENT, reserving the name TIDE for the vertical movement.

TOPOGRAPHY

The configuration of a surface, including its relief and the positions of its streams, roads, building, etc.

TROPICAL STORM

A tropical cyclone with maximum winds less than 34 m/sec (75 mile per hour). Compare with HURRICANE (winds greater than 34 m/sec).

TROUGH

A long and broad submarine DEPRESSION with gently sloping sides.

W

WATER DEPTH

Distance between the seabed and the still water level.

WATER LEVEL

Elevation of still water level relative to some datum.

WATERLINE

A juncture of land and sea. This line migrates, changing with the tide or other fluctuation in the water level. Where waves are present on the beach, this line is also known as the limit of backrush (approximately, the intersection of the land with the still-water level.)

WAVE

A ridge, deformation, or undulation of the surface of a liquid.

WAVE CLIMATE

The seasonal and annual distribution of wave height, period and direction.

WAVE DIRECTION

The direction from which a wave approaches.

WAVE FORECASTING

The theoretical determination of future wave characteristics, usually from observed or predicted meteorological phenomena.

WAVE FREQUENCY

The inverse of wave period.

WAVE HEIGHT

The vertical distance between a crest and the preceding trough. See also SIGNIFICANT WAVE HEIGHT.

WAVE PERIOD

The time for a wave crest to traverse a distance equal to one wavelength. The time for two successive wave crests to pass a fixed point. See also SIGNIFICANT WAVE PERIOD.

WAVE PROPAGATION

The transmission of waves through water.

WAVE SPECTRUM

In ocean wave studies, a graph, table, or mathematical equation showing the distribution of wave energy as a function of wave frequency. The spectrum may be based on observations or theoretical considerations. Several forms of graphical display are widely used.

WAVE TRANSFORMATION

Change in wave energy due to the action of physical processes.

WAVELENGTH

The horizontal distance between similar points on two successive waves measured perpendicular to the crest.

WEIBULL DISTRIBUTION

A model probability distribution, commonly used in wave analysis.

WELL-SORTED

Clastic sediment or rock that consists of particles all having approximately the same size. Example: sand dunes.

WIND SETUP

On reservoirs and smaller bodies of water (1) the vertical rise in the still-water level on the leeward side of a body of water caused by wind stresses on the surface of the water; (2) the difference in still-water levels on the windward and the leeward sides of a body of water caused by wind stresses on the surface of the water. STORM SURGE (usually reserved for use on the ocean and large bodies of water