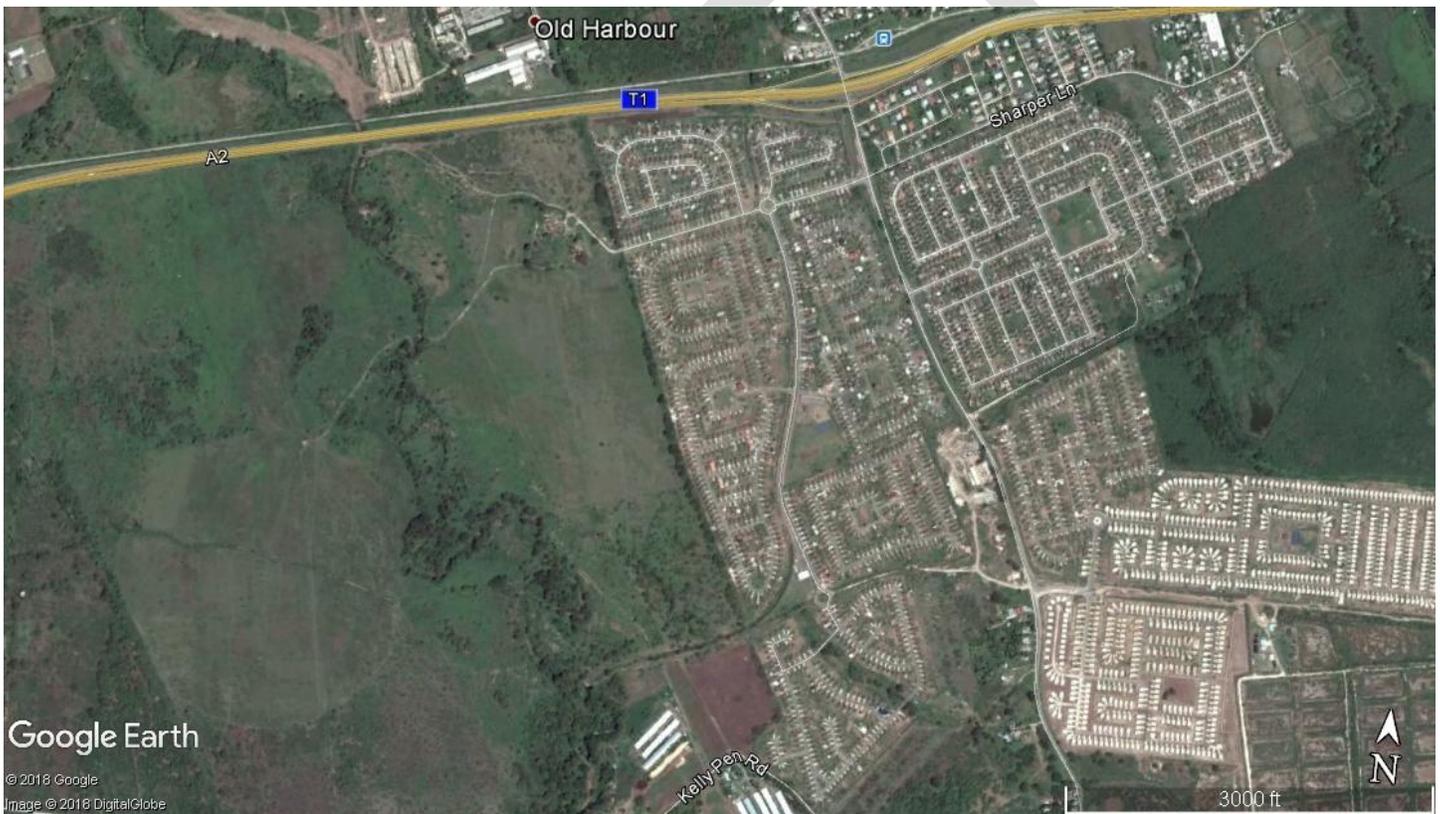


ENVIRONMENTAL IMPACT ASSESSMENT WHIM ESTATES HOUSING DEVELOPMENT

For
Whim Development Company Ltd.

March 18, 2019



DRAFT REPORT

Prepared for:

Whim Development Company Ltd.
P.O. Box #4, Old Harbour P.O.
Old Harbour
St. Catherine

Prepared by:

Environmental Solutions Ltd.
7 Hillview Avenue
Kingston 10
Jamaica



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List of Abbreviations

C-CAM	Caribbean Coastal Area Management
dBa	Decibel
DEM	Digital Elevation Model
EIA	Environmental Impact Assessment
ESL	Environmental Solutions Limited
GPS	Global Positioning System
JFB	Jamaica Fire Brigade
JPS	Jamaica Public Service Company Limited
JNHT	Jamaica National Heritage Trust
NEPA	National Environment and Planning Agency
NHV I	New Harbour Village I
NHV II	New Harbour Village II
NHV III	New Harbour Village III
NIC	National Irrigation Commission
NGO	Non-Governmental Organization
NSWMA	National Solid Waste Management Agency
NWC	National Water Commission
OHE	Old Harbour Estates
PBPA	Portland Bight Protected Area
PIOJ	Planning Institute of Jamaica
SCMS	St. Catherine Municipal Corporation
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
TOR	Terms of Reference
WDCL	Whim Development Company Limited
WEL	Well Engineered Living
WMU	Watershed Management Unit

WQ Water Quality
WRA Water Resources Authority

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The team from Whim Development Company Limited was particularly helpful in providing the necessary information regarding the project and facilitating the project team on various site visits. We are grateful.

Completion of this report would not have been possible without the contributions and inputs of the ESL project team which included:

Eleanor Jones	Environmental Management Specialist, Lead Consultant
Abigail McIntosh	Senior Environmental Analyst, Project Manager
Annmarie Goulbourne	Senior Environmental Analyst
Richard Coutou	Geologist and Environment Analyst
Rashidah Khan-Haqq	Senior Environmental Chemist
Mario Christie	Environmental Chemist
Dr. Arpita Mandal	Hydrologist
Brandon Hay	Ecologist
Balcostics Ltd.	Field Data Collection

Executive Summary

Environmental Solutions Limited (ESL) was contracted by Whim Development Company Limited (WDCL) to undertake an Environmental Impact Assessment (EIA) for the proposed Whim Estates Housing Development in Old Harbour, St. Catherine. This document presents the EIA report prepared to support the permit application for the development as required by the National Environment and Planning Agency (NEPA) and was completed in accordance with NEPA's TOR (Appendix I). ESL's project team which prepared this EIA is presented in Appendix II.

The Whim Estates

Whim Development Company Limited proposes to construct an 876-unit gated housing community in Old Harbour, St. Catherine, thus creating homes for approximately 3,700 persons. The development will include amenities such as a community centre and playing fields and will have provisions for schools and a commercial centre. The Whim Estates housing development will be situated on 70 hectares of abandoned agricultural lands adjacent to New Harbour Village II and south of Highway 2000 (Figure ES1). The location is less than 5 minutes' drive from the town of Old Harbour and has easy access to both the eastbound and westbound lanes of Highway 2000 via the South Road.

The development will consist of lots with a minimum lot size of 418 sq. metres. Residential units will consist of two designs: a two-bedroom, one-bathroom configuration; and a two-bedroom, two-bathroom layout. The units will be constructed using cast-in-place technology similar to what has been used for the construction of New Harbour Village I, II and III.

Water for the development will be supplied by a deep well located on the property. The project designs also include internal roads with a 6.1m carriageway and 9.75m road reserve. The site also has an extensive internal drainage network which ultimately drains any runoff into a wider and realigned Bower's Gully. The gully will also have a retention pond to assist with the flow of water downstream of the estate. The potential also exists for the Estate to be developed even further as provisions will be made for a school reserve on lands consisting of 48,000 sq. metres south of the Whim Estates housing development and a commercial centre on 9,000 sq. metres of land adjacent to the school reserve.

Old Harbour is one of Jamaica's fastest growing urban centres and the Whim Estates Housing Development will assist in providing housing. The Estate also conforms to the Highway 2000 Corridor

Development Plan and adheres to The Town and Country (Saint Catherine) Provisional Development Order, 2017 as the area is zoned for Residential Development (see Figure 3.1).



Figure ES1: Location of Whim Estates

Status of the Whim Estates Housing Development

At the time of preparation of the EIA, the developers were well advanced in the concept and design of the Whim Estates Housing Development. The following documents were made available for review and this allowed for a comprehensive assessment on the environmental risk and opportunities associated with the project:

- *Whim Estates Housing Development Project Brief*
- *Traffic Impact Study Whim Estates Limited Residential Development, St. Catherine, Jamaica*
- *Bower's Gully Flood Study*
- *Drainage Report for Whim Estates Housing Development, Old Harbour, St. Catherine, Jamaica*
- *Engineering Report - Water Analysis Report for Proposed Housing Development at Whim Estates*
- *Design Report for the Whim Estates Waste Water Treatment Facility*

- *Engineering Report - Sewer Analysis for Proposed Housing Development at Whim Estates*
- *Whim Estates Road Designs*
- *Whim Estates Internal Drainage Designs*
- *Whim Estates Water Supply Designs*
- *Whim Estates Storm Water Drainage Designs*
- *Whim Estates Water Treatment Executive Summary Report.*

The development will be completed in two stand-alone phases. Phase 1 comprises the construction of 556 housing units, the sewage treatment facility and the Bower’s Gully realignment – all to be completed in 24–30 months. Phase 2 will see the completion of 320 housing units in 10–12 months.

Key Findings

The key findings in this EIA are captured and discussed in 5 questions.

1) Is the Whim Estates Housing Development compatible with the overall character and environment of the area?

The project is situated near the town centre of Old Harbour which has been considered one of the fastest growth centres in Jamaica. Within the last decade, several large housing developments have been constructed in and around Old Harbour. These include The Aviary and New Harbour Village (NHV) I, II, III and IV. The Whim Estates will be located adjacent to the NHV II housing development which has 1,388 housing units.

The area’s environmental characteristics were also examined in terms of geology, hydrogeology, natural hazard risks, ecology, surface water quality, air quality, noise and socio-economic characteristics. Some of the key features of the environment are discussed in Table ES1.

Table ES1: Key environmental features identified on the Whim Estates

Physical Environment	Key Findings
Topography, Geology and Soils	<p>The area has a very low gradient and therefore, there is no risk of landslides.</p> <p>No major faults have been identified within the area.</p> <p>Soils have been described as clayey loam and sandy loam.</p> <p>The geology is described as alluvium underlain by deep limestones.</p>
Hydrology	<p>The underlying deep limestone aquifer has adequate water resources with a</p>

	<p>low risk of inadequate yield during periods of low rainfall and recharge.</p> <p>Deep limestone wells are also at a lower risk of contamination from nutrients and saltwater intrusion.</p> <p>None of the current producing wells in the area has shown signs of declining yield during the last 5 years.</p>
Ecology	<p>The site is disused agricultural and farmlands of the Whim Pen Estate.</p> <p>The vegetation is described in general terms as highly disturbed secondary field or fallow lands and does not have natural habitat zones or zonation.</p> <p>Four vegetation zones have been identified:</p> <ol style="list-style-type: none"> I. Mixed Pasture: The northern quarter overgrown pasture with occasional trees. The Guango tree is most common, but there are also mango, hog plum, and bastard cedar trees; II. Overgrown Pasture: The central half of the property dominated mainly by tall Guinea grass; III. Guango Woodland: The southern quarter is a mixture of Guango trees, woodlands and Guinea grass; IV. Dry Stream Bed: Overgrown with water plants – mainly reeds. <p>28 species of birds, all common and widespread in Jamaica and tolerant of human settlements, were identified.</p> <p>Other species observed included 2 species of owls, 1 species of reptile and 1 mammal all of which are common across Jamaica.</p>
Socio-Economic Environment	Key Findings
Heritage	No cultural heritage sites or national monuments are declared on this site.
Population	<p>Old Harbour has one of the highest growth rates in Jamaica.</p> <p>Major housing developments have been contributing to the high population growth rates.</p>
Land Use and Land Use Patterns	Site has been zoned for residential development in the St. Catherine (Provisional) Development Order 2017 (Figure 3.1).
Existing Infrastructure	Electricity is easily available from low- and high-tension wires which run in close proximity to the property.

	<p>Several wells around the area and on the site provide potable water.</p> <p>There is a network of main roads, highways and parochial roads throughout the area.</p> <p>Public transportation is readily available.</p>
Social Services	<p>The site is in close proximity to hospitals, a health centre, fire station and police station.</p> <p>Several schools are located in the Old Harbour and Old Harbour Bay areas.</p> <p>Other services nearby include tax offices, court house, post office, library, market and financial institutions.</p>

Stakeholder consultations were conducted through surveys, one-on-one interviews and group stakeholder meetings. A great majority of respondents perceived the project to be good. Many believe that it will benefit the community as it will create employment and provide housing solutions for persons interested in living in the area. Business respondents also believed that the development will increase business sales as residents will use the many services and facilities in and around Old Harbour. Most stakeholders also believed that the project will not be disruptive to the communities, and the Jamaica Fire Brigade (JFB) welcomed the development as it would potentially decrease the number of bush fires occurring in the area.

Some stakeholders, however, believed there would be some risk associated with the development such as the Health Centre, Police and the National Solid Waste Agency (NSWMA) which suffer from limited resources to respond adequately to the growing population in the area. The NHV II Citizens' Association also expressed concerns related to security, access, traffic and pollution which may stem from the development.

Potential residents will have access to a wide range of opportunities and supporting amenities in and around south St. Catherine once the Highway 2000 Corridor Development Plan and the Port Esquivel Special Economic Zone are implemented.

Overall, the project site has the physical environmental characteristics to support a large housing development, and this is supported by other large developments that have been successfully constructed and operated in the area. In addition, the project site has been characterised as having only secondary vegetation and no endemic or endangered species have been identified. With overall support

from the surrounding communities, the proposed housing development is compatible, and will help to enhance the general character of the area.

2) What are the key environmental and social concerns that may be considered for the proposed project?

The proposed project components were analysed in the context of the existing natural and built environment and the associated potential environmental risks and opportunities. The impacts have been considered for both the construction and operational phases and cumulative impacts have also been considered taking into account previous and future developments.

Construction Phase Impacts

- Clearing large areas during construction will expose top soil which can be entrained during rainfall events. This is also possible where stockpiled material is exposed to rain. This can cause sediment loading in surface runoff and the impacts associated with this can be irreversible.
- Site clearing, and stockpiling of material can also cause concerns for ambient air quality. The particulate matter in the air is expected to increase on windy days. This is particularly important as it can impact the environment and the health of persons downwind of the construction activities.
- Noise pollution is common to all developments and many sources of noise pollution can be identified on a construction site. Prolonged exposure may have effects on persons and animals in and around the site and can have irreversible impacts on auditory functions.
- The use of a batching plant in construction raises the risk of fugitive dust and sediment-laden runoff from the site and these can have potential negative impacts on the environment.
- The transportation and storage of petroleum and other chemicals increase the risk of spillage. Other risks include combustion of flammable fuels and inhalation of toxic fumes. Any spills must be contained and cleaned as leaching into soils and shallow aquifers, and runoff into drains and gullies can have negative impacts on the environment.
- Construction can produce large amounts of waste and the proper disposal is important to ensure the sustainability of the environment.
- Most of the existing flora is expected to be removed during construction. However, no native flora has been identified on the site and all species identified are common across Jamaica.

- Removal of vegetation during construction will affect the existing fauna. No rare or endangered species have been identified and the existing fauna will migrate to the surrounding habitat.
- Construction activities are expected to create various forms of direct and indirect employment in the community. However, construction phase employment can sometimes be short-lived and only exists for the duration of the project.
- It is expected that the construction activity will also increase business sales with the provision of goods and services during the construction phase.
- There is low risk in the destruction of heritage or national monuments.

Operational Phase Impacts

- Natural hazards associated with the site are not unique to the area and can be experienced across Jamaica. These include earthquakes, high winds, droughts and tropical cyclones.
- Flooding is generally a concern as the development will increase runoff, however, this is not expected as internal drainage designs and training of the Bower's Gully is expected to decrease the impacts from flooding.
- Increased temperature and decreased rainfall due to climate change can impact the available water resources in the long term.
- No negative impacts are foreseen with the wastewater treatment facility provided that it is adequately maintained.
- The development is expected to produce 28 tonnes of solid waste per week and this may put additional strain on NSWMA in collecting the waste in a timely manner.
- Access to the development is a concern for the NHV II Citizens' Association.
- An increase in impervious areas will result in an increase in surface runoff. As a result, appropriate drainage management measures will need to be put in place.
- The Bower's Gully realignment is expected to ensure the development is not impacted by flooding.

Cumulative Impacts

- The widening of the Bower's Gully will prevent flooding in and around the Whim Estates; however, increased runoff may impact areas around the lower Bower's Gully downstream of the site.

- The expected population growth in Old Harbour with additional housing developments will continue to increase the demand for social services. Without additional resources, services such as police, fire brigade, health and solid waste collection and disposal will continue to be strained.
- The increasing population will also increase the demand for potable water. This will be exacerbated with the expected increase in temperatures and decrease in rainfall.
- Increased employment and residential opportunities within the area may also encourage in-migration of people which may cause increased social interactions, both positive and negative.
- As the population increases growth around Old Harbour, traffic congestion within the town is expected to increase in the medium to long term.

3) Are any site-specific mitigation measures required for risks and opportunities that may arise from the project?

Mitigation measures have been discussed and are designed to reduce or eliminate the potential impacts identified. Mitigation measures are described for both the construction and operational phases of the project.

Construction Phase Mitigation Methods

- To limit the impact of sediment loading, material should be stored away from drainage paths and they should be properly bermed. Stockpiles of material should be covered where possible and the areas should be paved or revegetated as soon as possible.
- Frequent wetting of the site can reduce fugitive dust and dust screens/vegetation barriers should be erected around the site to trap any fugitive dust.
- Temporary noise barriers and vegetation buffers could be used to decrease the impacts of noise from the construction site. Work activity should also be scheduled to reduce the impact of noise on the surrounding communities.
- Stationary noise sources should be located as far as possible from neighbouring communities and personnel operating equipment should wear the required personal protective equipment.
- Pre-washed material should be used in the batching plant to reduce any fugitive dust and all vehicle transporting material should be covered en route to the site.

- Over-saturation of cleared areas should be avoided to reduce the migration of sediments into drainage systems and on to roads.
- A construction monitoring programme is recommended to continuously assess the effectiveness of the control measures.
- Petroleum storage tanks should be constructed to NEPA standards for aboveground storage tanks. A daily leak detection system should also be implemented.
- The developer is encouraged to retain and replant similar plant species on the property after construction and should encourage residents to undertake landscaping to replace vegetation loss.
- Where possible, trees which are considered mature should be retained. They should be clearly marked and protected to ensure they are not removed or bulldozed.
- The developer is encouraged to communicate closely with the surrounding communities to ensure that they are aware of the construction schedule and the potential impacts.

Operational Phases Mitigation Methods

- The Bower's Gully realignment and widening is projected to reduce flood risk.
- Houses should be well engineered to national building code standards to contend with potentially high winds and seismic activity.
- The developer is encouraged to consider rainwater harvesting and the reuse of wastewater for irrigation in addition to employing green technologies and alternative energy solutions.
- WDCL is encouraged to work closely with the NHV II Citizens' Association to ensure that security and access to the Whim Estates will be safe, efficient and suitable.

4) Is any further work required to improve the understanding of the site's environmental status in the context of risks and opportunities?

After review of all the technical reports, analysis of data collected and stakeholder consultations, it is the considered opinion of the consultants that most of the environmental aspects related to the development are understood and the mitigation measures proposed will reduce or eliminate any potential impacts.

5) What is the overall recommendation for the proposed project?

It is the considered opinion of the consultants that based on the potential impacts identified and the mitigation measures proposed, the Whim Estates Housing Development is a suitable use of the site.

Further, the *Town and Country Planning (Saint Catherine) Provisional Development Order, 2017* also zones the area for residential use.

The project will also inject significant capital in the economy through the purchase of construction materials and equipment and also the contraction of services.

DRAFT

1 Introduction

1.1 Purpose

Environmental Solutions Limited (ESL) was contracted by Whim Development Company Limited (WDCL) to undertake an Environmental Impact Assessment (EIA) for the Proposed Housing and Subdivision Development at Whim Pen, Old Harbour, St. Catherine.

This document represents the draft EIA report prepared for the proposed housing development and has been developed based on the specific Terms of Reference (TOR) received from the National Environment and Planning Agency (NEPA) (see [Appendix I](#)). While the project will be constructed in two development phases, and submissions to NEPA were made in two parts (Table 1.1); this EIA covers both development phases.

Table 1.1: Submissions filed to NEPA by WDCL

PART 1 SUBMISSION	
Development Phase 1	Application for Subdivision Approval (556 units) on Lot 2A (approximately 67 Hectares)
Development Phase 2	Application for Planning Approval (320 units) on Lot 2A reserve plus parts of Old Harbour Estates (OHE) Lots 3A & 3B and the National Irrigation Commission (NIC) canal reserve (total approximately 24 Hectares)
PART 2 SUBMISSION	
Development Phase 2	Application for Subdivision Approval (320 units) on Lot 2A reserve plus parts of OHE Lots 3A & 3B and the NIC canal reserve (total approximately 24 Hectares).

1.2 Project Location and Contextual Background

Whim Development Company Limited (WDCL) proposes to develop a residential development on 70 hectares (ha) of abandoned agricultural land in Old Harbour, St. Catherine. The development, which will be called Whim Estates, will consist of 876 housing units and is expected to accommodate approximately 3,500 persons.

The land is bounded to the north by Highway 2000, to the south by the Kelly Pen/Content Parochial Road, to the east by New Harbour Village II housing development, and to the west by the Bower's Gully and Old Harbour Estates' (OHE) agricultural lands beyond that (Figure 1.2).



Figure 1.1: Location of Whim Estates Housing Development



Figure 1.2: Location of Site for the Whim Estates (Lot 2A) bounded by Bower's Gully to the West, New Harbour Village II (NHV II) to the East and Highway 2000 to the North

2 Methodology

A team of experienced professionals was assembled to carry out the required assessment. The team is presented in [Appendix II](#). The consultants worked closely with Whim Development Company Limited to conduct site visits, and to collect baseline and other data.

2.1 General Approach

A reconnaissance visit to the site of the proposed development was conducted by the team of consultants to determine salient environmental issues. Subsequent site visits were made to collect detailed primary data within the project site and in the surrounding areas. Other developments and surrounding land use information were also reviewed in the context of compatibility with the proposed project including potential positive, negative and cumulative impacts.

This project is located adjacent to several other major developments (Figure 2.1), therefore, there is a plethora of environmental assessments, and technical reports in and around this area which provide a great deal of information on environmental aspects and impacts. The technical data also include site specific reports which were produced for WDCL by other consultants. [Appendix III](#) shows a list of relevant reports used to aid this study. These were referenced in the development of this assessment where possible.



Figure 2.1: Other Developments around the Whim Estates Housing Development

Additional surveys and meetings were held to update the information on public perception and participation. A buffer zone no less than 1km was used for this EIA (Figure 2.2) and the assessment focused on impacts of the construction and operations of the housing development and its supporting activities.

Additional baseline studies included ecology, air quality (including noise) and water quality.

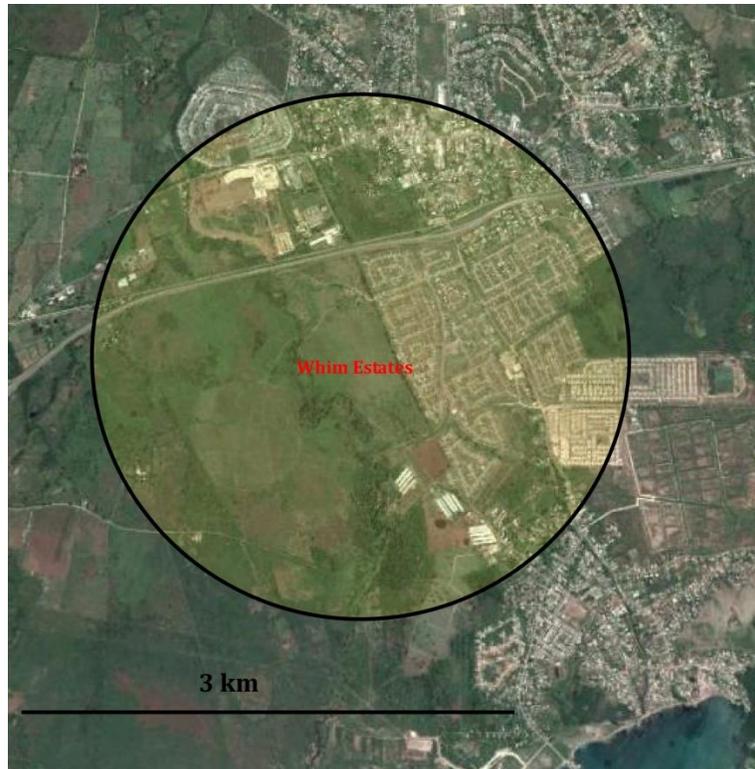


Figure 2.2: Buffer Zone of no less than 1km

The following sub-sections describe the approach taken for each category of natural and built environmental parameters.

2.2 Physical Assessment

2.2.1 Topography, Geology and Soils

The approach included field investigations, review of relevant literature, and analysis of topographic, geological and soil maps for the area. Maps used included Geological Map, Sheet 10 which outlines the superficial geological features, St. Catherine soil map, and Google Earth Imagery.

2.2.2 Climate

The climatic conditions were studied using data from nearby weather stations which is available from the Meteorological Office of Jamaica. Literature, such as the *State of the Jamaican Climate 2015 (2017)* produced by the Climate Studies Group, Mona, was also reviewed, and the climatic conditions, climate change projections and variability for the area were extracted from the relevant reports.

2.2.3 Hydrology and Drainage

The hydrological study for Whim Development (Lot 2A) was carried out using a combination of field work, modelling, and literature review. Previous technical reports, the New Harbour Village II EIA (2009) and the Bower's Gully Flood Study (2018) were also incorporated into the study.

The drainage and flood studies are based on the standard methods as quoted in the Guidelines for Preparing Hydrologic and Hydraulic Design Reports for Drainage Systems of Proposed Developments (NWA, 2015). A detailed methodology on the hydrological methods used for this study can be found in [Appendix IV](#).

Surface and groundwater assessments were carried out to determine the available water resources for the new development. This was done by looking at the static water levels of the existing wells in the subwatershed and around the property using data available from the Water Resources Authority (WRA). Production data available from the National Water Commission (NWC) and the WRA were also used to examine the trend in water availability.

2.2.4 Water Quality

Three (3) water quality sampling stations were selected for investigation and assessed to establish the baseline state prior to the start of development. Each sampling station was geo-referenced for traceability and future monitoring requirements.

Selection of the sampling points was done considering the project sphere of influence. Due to the dry nature of the site, a control station could not be established. Only three samples were collected as there were no other locations with surface water. Figure 2.3 shows the locations from which the samples were taken, while Table 2.1 describes the locations from which the samples were taken.

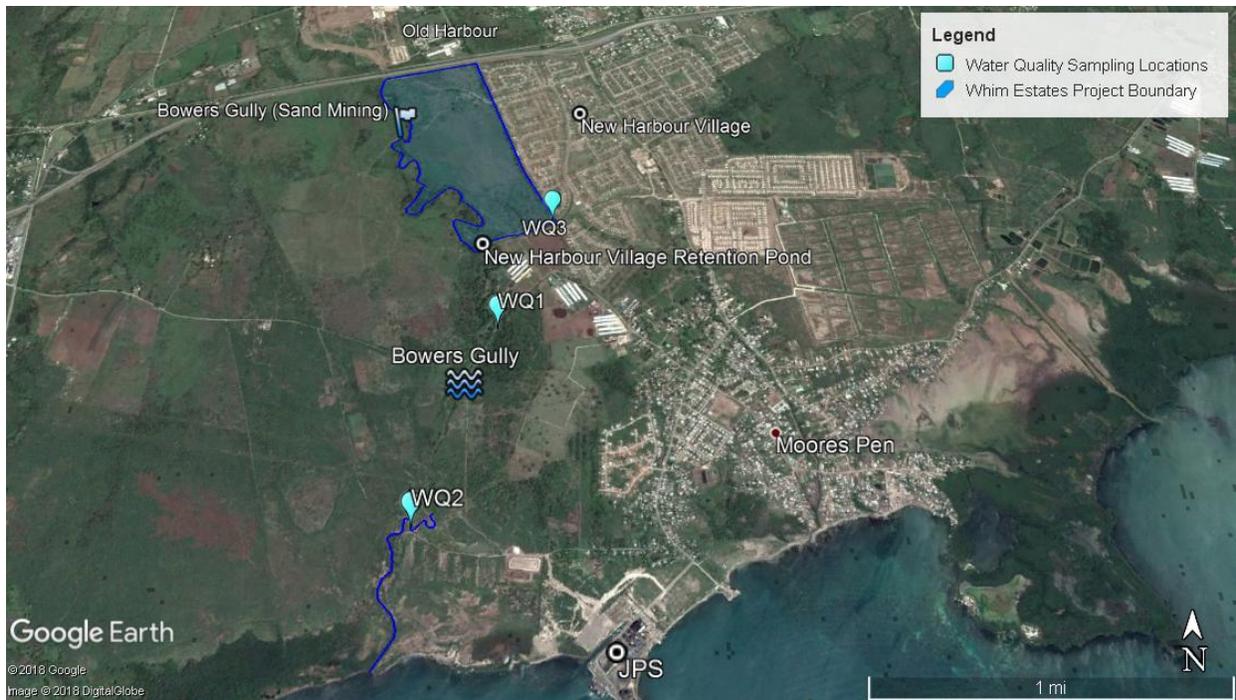


Figure 2.3 Location of Water Quality Sampling Sites

Table 2.1: Water Quality Stations for Whim Estates Housing Development

WQ Station	Station Location	GPS Coordinates (Degrees, Minutes, Seconds)
WQ1	South of the property – Bower’s Gully	17°54'51.22"N 77° 06'46.71"W
WQ2	Bower’s Gully – ~2000 metres away from southern boundary of project	17°54'15.54"N 77° 6'58.59"W
WQ3	Southern end of earthen gully along east boundary of project site	17°55'13.74"N 77° 6'37.70"W

Water samples were collected at an appropriate depth below the surface to obtain representative conditions. In addition, samples were collected where the water was well mixed, far enough from points of significant inflows.

Samples collected were kept at 4°C and transported to the ISO/IEC 17025 Accredited Quality and Environmental Health Laboratory at Environmental Solutions Limited for analysis within the analysis hold time for each test parameter. Table 2.2 shows the WQ parameters assessed during this exercise.

Field observations and *in situ* measurements were made with respect to odour, colour, pH, dissolved oxygen, total dissolved solids, electrical conductivity/salinity and temperature at each site. An YSI Pro Plus Multiparameter System (MPS) was used for all field measurements. Results obtained were compared to the 2009 Draft Jamaica National Ambient Water Quality Standard for Freshwater.

Table 2.2: Water Quality Parameters

Water Quality Parameters	
➤ pH	➤ Biochemical Oxygen Demand
➤ Temperature	➤ Chemical Oxygen Demand
➤ Dissolved Oxygen	➤ Alkalinity
➤ Total Dissolved Solids	➤ Chloride
➤ Salinity	➤ Sulphate
➤ Conductivity	➤ Nitrate
➤ Phosphate	➤ Chromium
➤ Total Coliform	➤ Cadmium
➤ Faecal Coliform	➤ Iron
➤ Total Suspended Solids	➤ Copper
➤ Enterococci	➤ Manganese
➤ Fats, Oil and Grease	➤ Lead
➤ Calcium	➤ Zinc
➤ Magnesium	

2.2.5 Air Quality and Noise

Air quality measurements were taken at six (6) sites in the project area and its environs. The air monitors were placed away from any known sources of pollution to prevent bias. Each sampling station was geo-referenced for traceability and future monitoring requirements (Figure 2.4). Sampling locations are described in Table 2.3.

Particulate matter was measured using calibrated pumps (with flow rates 1–5 and 5–15L/min), attached to pre-weighed Polyvinyl Chloride (PVC) filters. The pumps were calibrated with a calibrated DryCal DC-Lite primary flow metre from Bios International Corporation prior to use. Measurements done were for a 24-hour period after which the monitoring devices were collected and returned to the laboratory where the filters were stabilised and weighed to determine a Time Weighted Average (TWA) value for the particulates. The results at the end of the sampling period were compared with NEPA and US EPA Ambient Standards.

Noise level readings were averaged over a 3-minute interval and the average noise level recorded in decibels (dBA). Wind direction and any unusual local noise sources were recorded at each sampling location. Noise measurements were taken using a Quest SoundPro SE/DL series sound level metre. The noise metre was calibrated before and after each set of readings with a calibrator that was pre-calibrated at the factory. The results at the end of the sampling period were compared with NEPA Standard of 55dBA for residential areas since the predominant land use around the project site is residential.

In all instances, the sampling location for the noise measurements coincided with the sites selected for ambient air quality measurements.

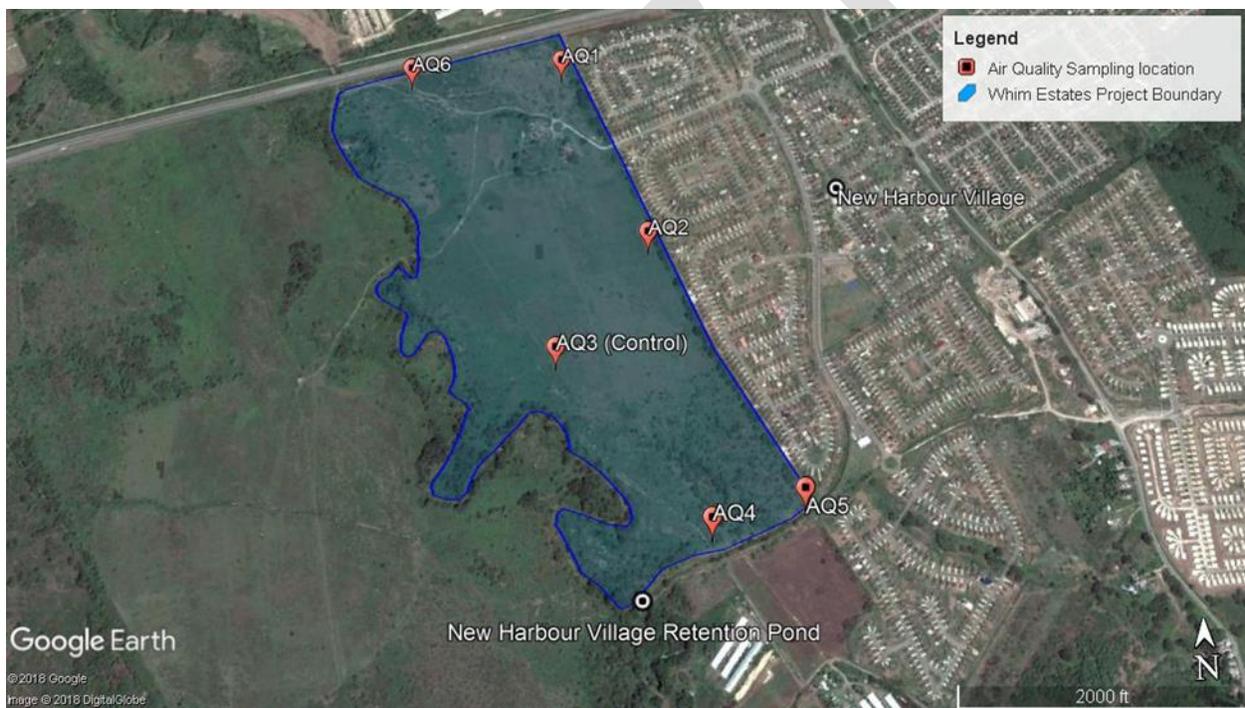


Figure 2.4: Location of Air Quality Monitoring Stations

Table 2.3: Air Quality Monitoring Sites at Whim Estate

Sample Site	Description	GPS Coordinates (Degrees, Minutes, Seconds)
AQ1	Pump placed along East Boundary of property	17°55'48.36" N, 77°6'54.87" W
AQ2	Middle point along the Eastern Fence Boundary	17°55'33.28" N, 77°6'48.46" W
AQ3	Control	17°55'24.46" N, 77°6'56.14" W
AQ4	Middle of Southern Boundary of Property	17°55'11.35" N, 77°6'44.95" W
AQ5	Lower Eastern section of Southern Boundary of Property near fence line for New Harbour Village Phase II	17°55'13.99" N, 77°6'37.81" W
AQ6	Northern Section of property approximately 100 metres South of Highway	17°55'48.20" N, 77°7'37.38" W

2.2.6 Heritage/Culture

The Jamaica National Heritage Trust (JNHT) and existing reports were consulted to determine whether any notable heritage or archaeological elements were present on the Whim Estates Property.

2.3 Ecological Assessment

Flora and fauna surveys were conducted on July 3, 2018 and July 15, 2018. Bird surveys were conducted on July 15 using timed point counts located along trails on the property. Points were chosen a minimum of 200m apart to minimise double counting of individual birds from nearby sites. Ten points were chosen (Figure 2.5 and Table 2.4) and counts were conducted at six-minute intervals between the hours of 6:00 am and 9:00 am in order to sample during the period of highest activity for the majority of bird species, and to maximise detectability. The counts were used to calculate an abundance index for each species where the total number of individuals was weighted by the number of points where they occur and the total number of points. The field visit to the site on July 3, 2018 was conducted at dusk to observe nightlife.

All plant species observed were recorded and each species was given a DAFOR rating based on their abundance relative to the entire site and not on sectional abundance. All observations of other species of mammals and reptiles were counted and recorded. All species identified during the field visits are presented in the species list appended to this report ([Appendix IX](#)). However, these field visits are not expected to be exhaustive and therefore, additional species known either from previous surveys of the

site or from areas nearby have been included in discussions since they are likely to occur. The mention of neotropical migrant warblers, for example, is relevant and therefore included although they would not have been present during the season when fieldwork was conducted.



Figure 2.5: Bird Survey Sites on the Whim Estate

Table 2.4: Coordinates for the Sampling Points on Whim Estate

Point #	Latitude (N)	Longitude (W)	Survey Time (hrs)
078	17 55'43.0"	77 06'52.8"	6:14
079	17 55'45.9"	77 07'00.9"	6:25
080	17 55'47.4"	77 07'08.6"	6:38
082	17 55'38.4"	77 07'02.6"	6:53
083	17 55'33.0"	77 07'07.2"	7:08
084	17 55'29.4"	77 06'59.0"	7:19
085	17 55'22.1"	77 06'54.6"	7:28
086	17 55'17.3"	77 06'47.9"	7:38
087	17 55'07.8"	77 06'50.6"	7:49
088	17 55'12.9"	77 06'38.8"	8:06

3 Legislation and Regulatory Consideration

There are several relevant national environmental and planning laws and regulations related to developments such as the Whim Estates. These also include regulations for the construction and operation of the development and supporting activities, such as sewage treatment and water supply facilities.

3.1 Relevant Legislation, Policies and Regulations

1. The Town and Country Planning (St. Catherine) Provisional Development Order, 2017
2. The Natural Resource Conservation (Permits and Licences) (Amendment) Regulations, 2015
3. The Natural Resource Conservation (Watershed and Sludge) Regulations, 2013
4. The Office of Utilities Regulation Act, 2005
5. The Natural Resources Conservation Authority (Air Quality) Regulations, 2002
6. The National Solid Waste Management Authority Act, 2001
7. The Endangered Species (Protection, Conservation and Regulations of Trade) Act, 2000
8. The Natural Resources Conservation (Portland Bight Protected Area) Regulations, 1999
9. Environmental Review and Permitting Process, 1997
10. The National Land Policy, 1996
11. Water Resources Act, 1995
12. Natural Resources Conservation Authority Act, 1991
13. The Local Improvements Act, 1991
14. Registration of Titles Act, 1989
15. Jamaica National Heritage Trust Act, 1985
16. The Public Health Act, 1976
17. The Housing Act, 1976
18. The Clean Air Act, 1964
19. Town and Country Planning Act, 1958
20. Land Acquisition Act, 1947
21. The Wild Life Protection Act, 1945
22. The Watersheds Protection Act, 1945

3.2 Permits Required

The project will require the following NEPA permits/licences:

1. Construction of housing projects of 51 or more houses (Phase 1)
2. Construction of housing projects of 51 or more houses (Phase 2)
3. Modification of waterways for the transfer of water resources or river training works
4. Construction and operations of petroleum storage and dispensing facility
5. Construction of batching and crushing plants (mobile and fixed)
6. Waste water and sludge
 - I. Application for licence to operate a treatment plant
 - II. Application for licence to construct sewage wastewater treatment facility
 - III. Application for licence for discharge of sewage and trade effluent into the environment.

3.3 Land Use Patterns

The primary land use of the project site was agricultural, particularly sugar cane cultivation, until about 2012. The site, which now has predominantly ruinate lands, not been in use for several years. Currently, the site has an old shed and farm house situated in the north-east section of the property. The area has now been zoned in the Town and Country Planning (Saint Catherine) Provisional Development Order, 2017, as residential (Figure 3.1).

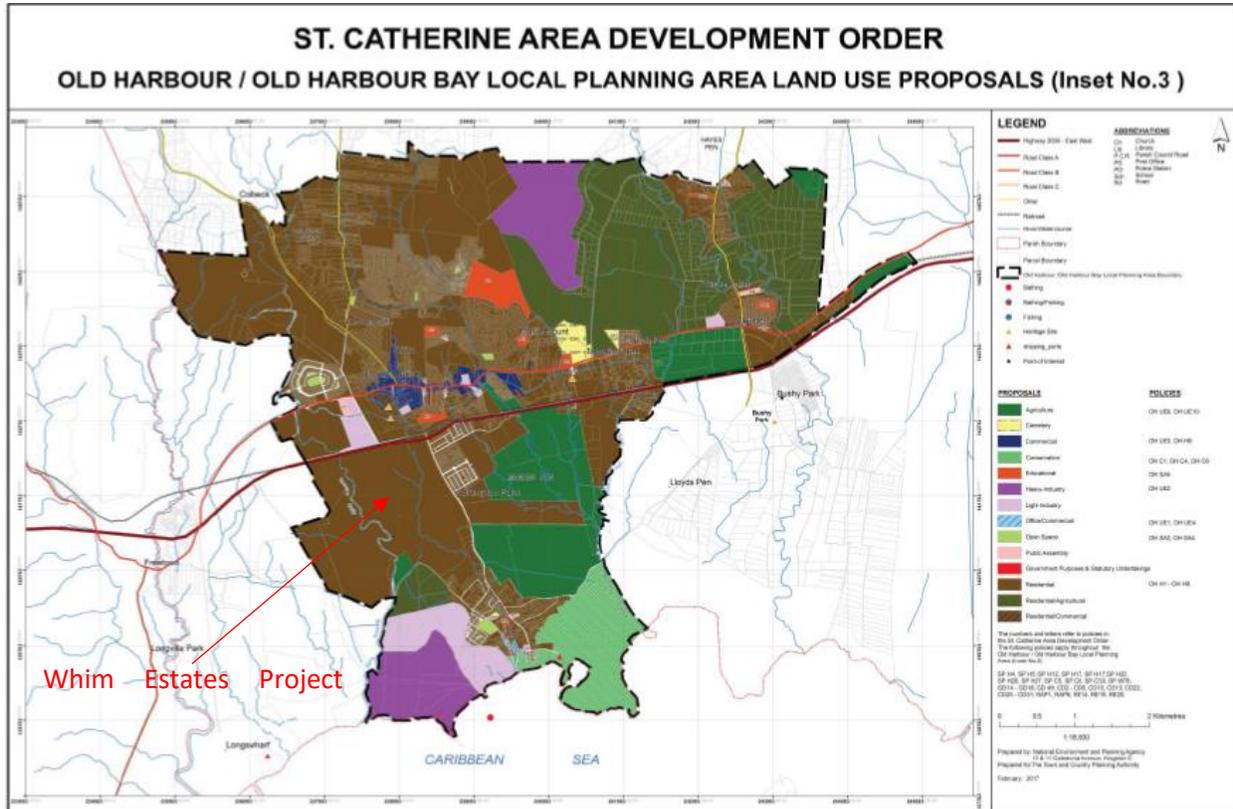


Figure 3.1: Old Harbour/Old Harbour Bay Local Planning Area and the Location of Whim Estates in the St. Catherine Development Order 2017 located in an area zoned for residential development

3.4 Public Access Rights

The site is a privately owned property with a gated entrance. The public has not historically enjoyed public access rights as the site was previously being cultivated by the current owners.

There is no current indication that the land is being used as there has been no agricultural activity for several years. Very few livestock were observed on the site, however, these were determined to be transient and not resident on the property.

There is an easement that runs along the north of the property that has a Jamaica Public Service Company (JPS) power line and a sewer line from New Harbour Village IV traversing through it.

4 Project Description

As indicated above, Whim Estates is situated in Old Harbour, St. Catherine and lies adjacent to the New Harbour Village II Housing Development (Figure 4.1). The housing development is designed to offer single-family homes on individual lots in a secure gated community. It will consist of 876 standalone single-family housing units resulting in a projected population of approximately 3,500 persons. The development will consist of residential lots with a minimum lot size of 418 square metres (4,500 square feet) and comprise either a 2–bedroom, 1–bathroom unit or a 2–bedroom, 2–bathroom unit (Figure 4.2). The design will allow for an optional carport to the side or rear of the property and will allow for the addition of solar water heaters, air conditioning and home security. The community will also benefit from supporting amenities which will include community and convenience centres as well as sporting and recreational facilities (Figure 4.3).

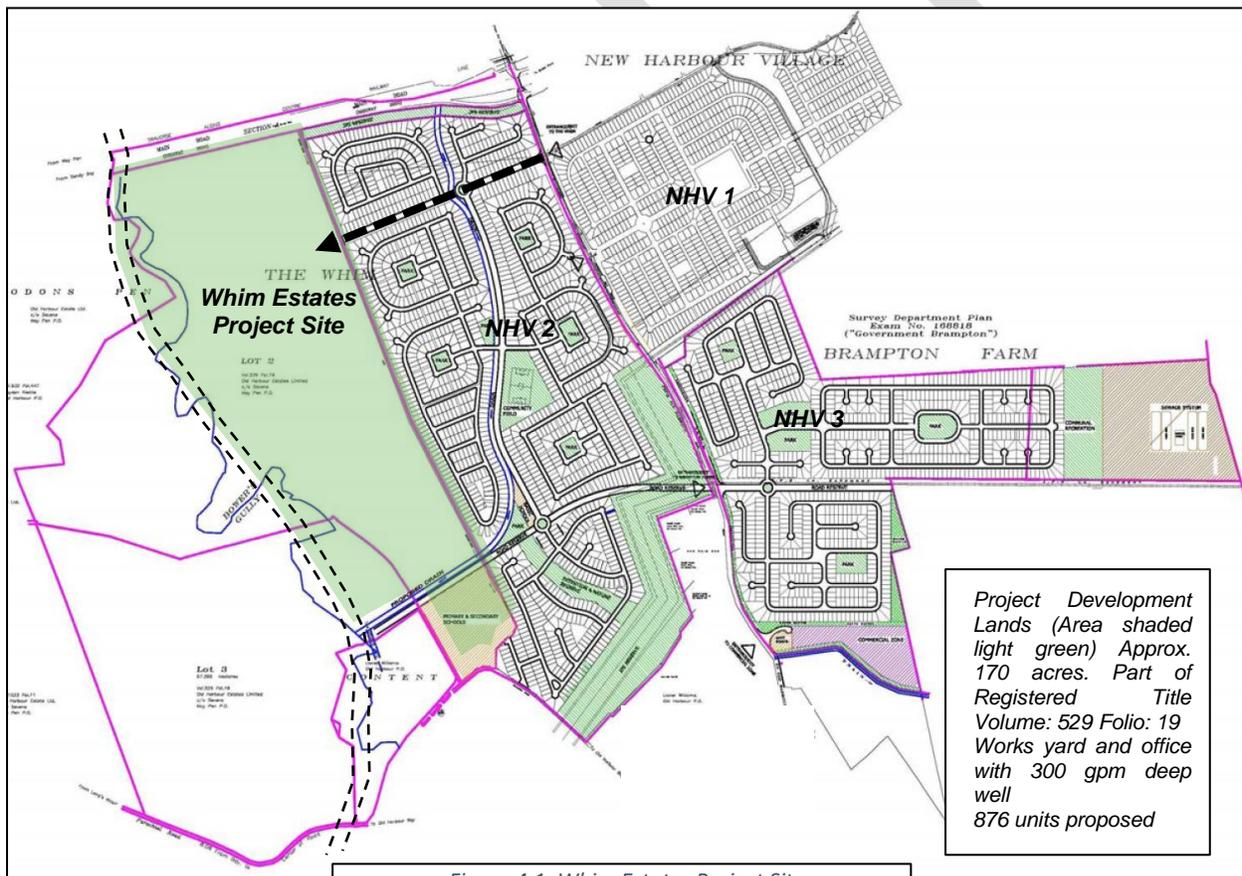


Figure 4.1: Whim Estates Project Site

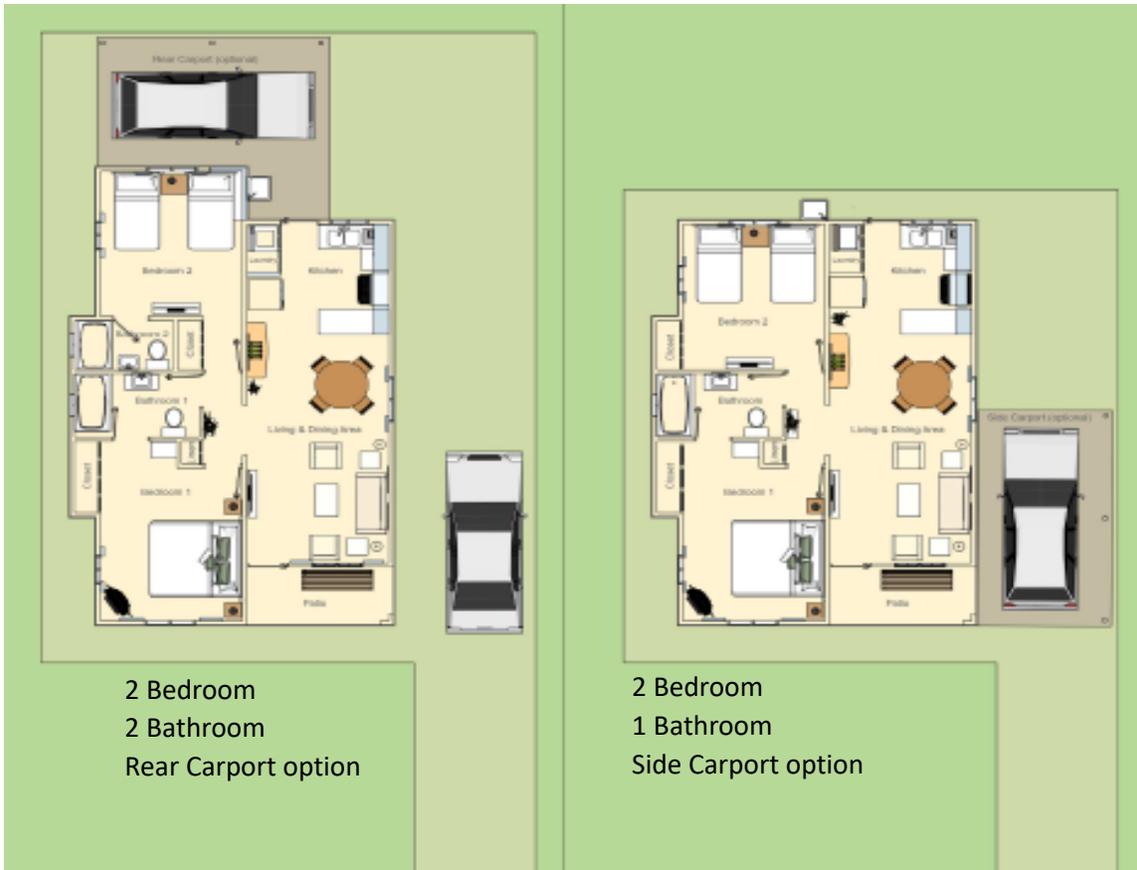


Figure 4.2: Layout of Houses at the Whim Estates



Figure 4.3: Proposed Amenities for the Whim Estates

The Whim Estates project requires sub-division of the original 177-hectare Whim Pen Title (Volume 529 Folio: 19) into four lots in order to meet the developer's requirements. This proposed sub-division adheres to the zoning guidelines of the Portmore to Clarendon Park, Highway 2000 Corridor Development Plan. The housing development also falls within the residential zone for *the St. Catherine (Provisional) Development Order, 2017*.

4.1 Development Phases

4.1.1 Phases 1 and 2

The project will be divided into two development phases as two standalone developments designed to work as a single gated community when both are completed (Figure 4.4).



Figure 4.4: Development Phase 1 (left image) and Development Phase 2 (right image) for the Whim Estates

Development Phase 1 will comprise 556 units. Phase 2 will comprise 320 units and will include major infrastructure work for the realignment of the Bower's Gully and the NIC canal.

The construction phase will have two main sub-phases: the Mobilisation Phase; and the Main Construction Phase. During the Mobilisation Phase, the first 25 homes will be constructed to the north-eastern end of the Whim Estate. This will also include two model homes for marketing purposes. During this phase, access for construction vehicles, personnel and for potential residents will be through the NHV II main entrance and main road way (Figure 4.5). For the mobilisation phase, the homes will be constructed without the use of batching plants, that is, traditional construction methods will be used. This is further elaborated in Section 4.7.

During the main construction phase, access for all construction vehicles and workers will be from the west (Figure 4.5). A batching plant and an additional petroleum storage facility will also be constructed on the site.



Figure 4.5: Access to Whim Estates during Mobilisation and Construction Phases

4.1.2 Bower's Gully Realignment

The Bower's Gully north of Highway 2000 has been trained twice in the past 13 years (Figure 4.6). This training has somewhat straightened and widened the course of the gully. The current course south of Highway 2000 is estimated to be 3.3km in length, and less than 10m wide. The proposed training will further straighten the gully channel, reducing the length to approximately 2.3km and widening the

channel to 50m (Figure 4.7 and Figure 4.8). It will also include the addition of an oval shaped dry-retention pond. The pond will have a length of 164.2m and a width of 162.1m and an overall depth of 1m (Figure 4.9). The pond will be lined with 0.3m thick drain rock. The size of the new Bower's Gully will protect flooding up to a 1 in 100-year event (see Bower's Gully Flood Study, Premier Land and Water Ltd. 2018).

The retention pond which will be included is not a requirement by the National Works Agency (NWA) for the Bower's Gully realignment. It is intended to decrease the discharge rate during small rainfall events, allowing sediments to settle before the discharge continues downstream (Figure 4.9). The pond is not intended to control discharge and flooding in very large rainfall/storm events.



Figure 4.6: Previous Work done on the Bower's Gully

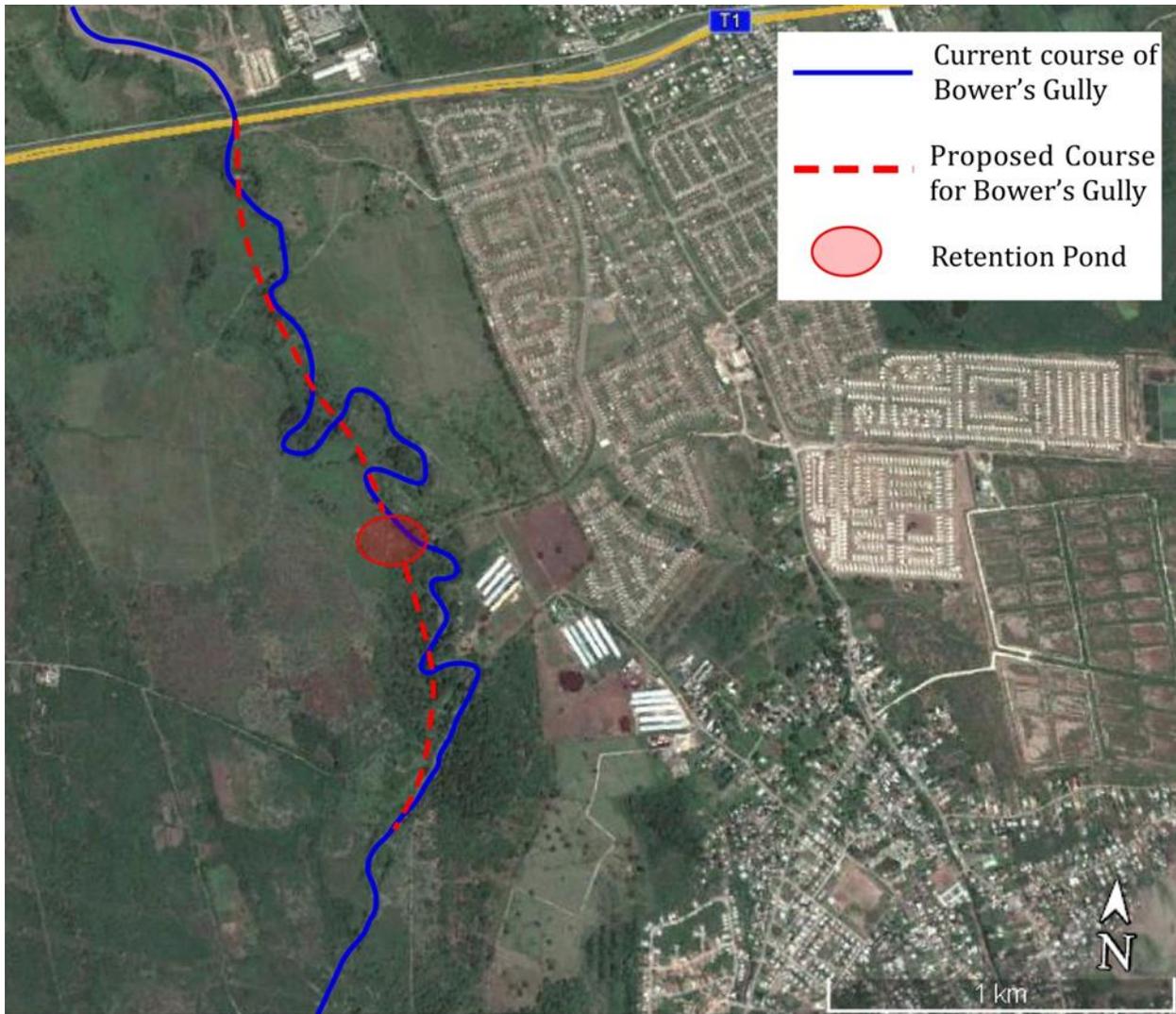


Figure 4.7: Current State of Bower's Gully and Expected Training of Bower's Gully

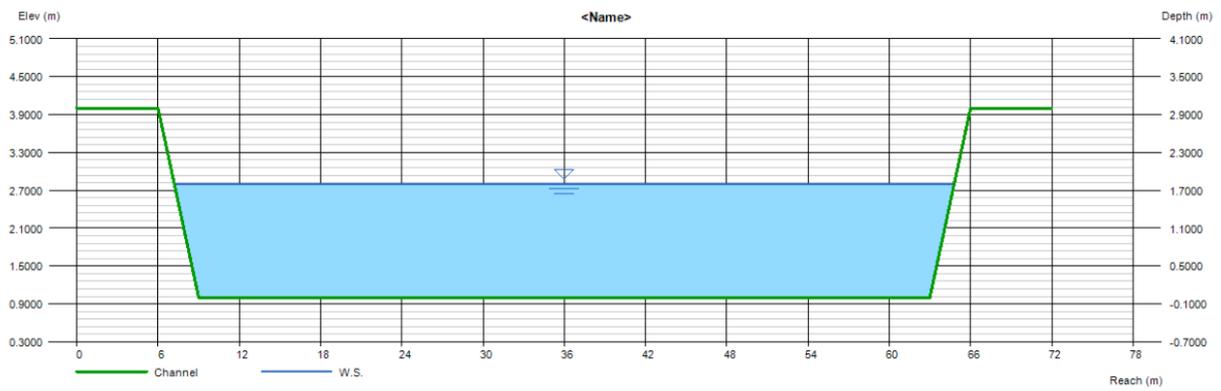


Figure 4.8: Dimensions of the proposed Bower's Gully

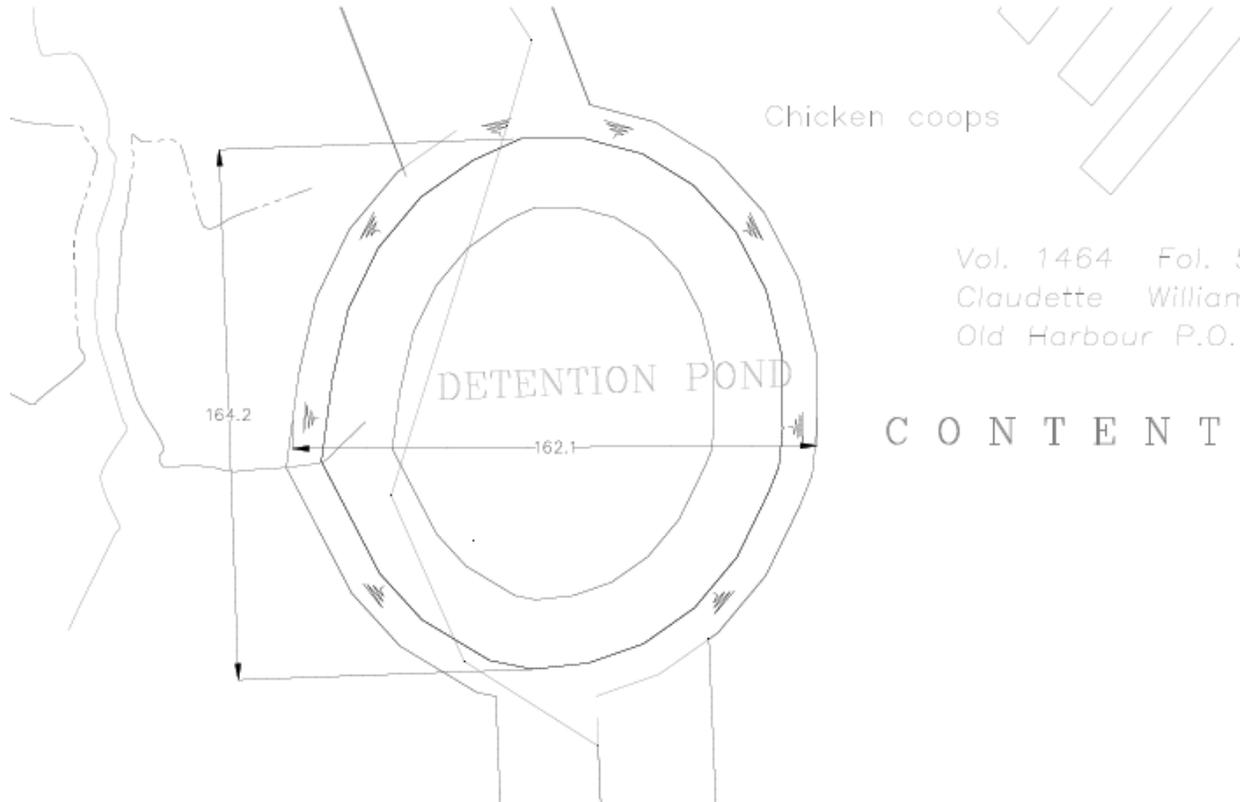
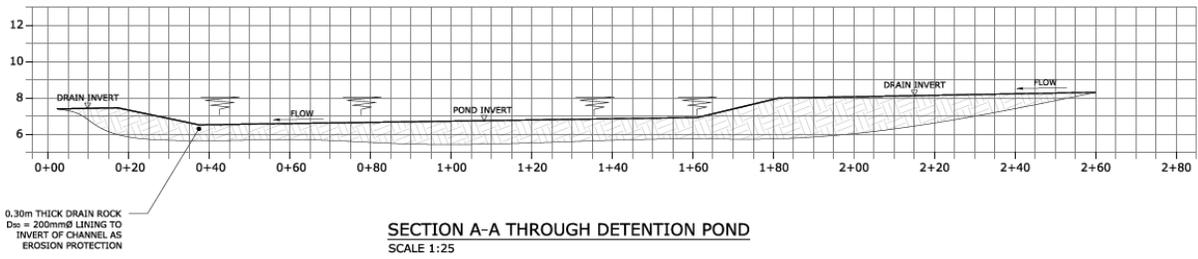


Figure 4.9: Layout Plan for the Retention Pond (values in metres)

Premier Land & Water Development



Suite # 16
13 West Kings House Road,
Kingston 10.
Tel./Fax: (876) 669-7119
Email:premierlwdevelopment@gmail.com

January 31, 2019
Processing Officer
National Environment and Planning Agency
10 Caledonia Ave.
Kingston 5

RE: THE WHIM ESTATES DETENTION POND

We hereby confirm that the function of the detention pond is solely for the purpose of sedimentation in the storm water discharged from the project site. This pond has no hydraulic function as the drain accommodates a catchment area of approximately ten thousand (10,000) hectares and would therefore far exceed the capabilities of any detention structure in this area. If this pond is deemed unnecessary by the agencies then we will submit an as built drawing removing the structure upon construction of the drain. If you have any further questions or concerns, please do not hesitate to contact us.

Regards,

Premier Land and Water Development

A handwritten signature in black ink, appearing to read "SR", is written over a light grey watermark of a large downward-pointing chevron.

Stephan Rampair (MBA, PE, MJIE)
Civil Engineer/ Managing Director

Figure 4.10 Engineer's statement on the Retention Pond

The construction of the realigned Bower's Gully will be done in three phases as described in the land clearance phasing in [Section 4.7.5 Site/Vegetation Clearance](#). In Phase 1, the upper section of the Bower's Gully will be completed; Phase 2 will handle the middle section, and the lower section and retention pond will be handled in Phase 3.

The material extracted from the area of the new gully will be used to infill the old gully channel where needed. Extra material will be stored and used to form levees along the new gully course and to level areas on the project site.

4.1.3 National Irrigation Commission (NIC) Canal Relocation

Currently an NIC canal runs through the OHE agricultural lands, entering the proposed Whim Estate property from the west. The NIC canal eventually turns south exiting the estate on the southern boundary. The canal currently does not have any water flowing in it and is in a state of disrepair (Figure 4.11).

WDCL has proposed to NIC that the canal be reconstructed/relocated to ensure that the canal will not be impacted by the housing development and can be used in the future. The proposed route for the NIC canal will run along the western boundary flowing south. The canal will then turn towards the east after crossing the main road reserve running along the southern side of the road towards the east-north-east until it rejoins the current location south of the Whim Estate (Figure 4.12).



Figure 4.11: Defunct NIC Canal on the Whim Estate

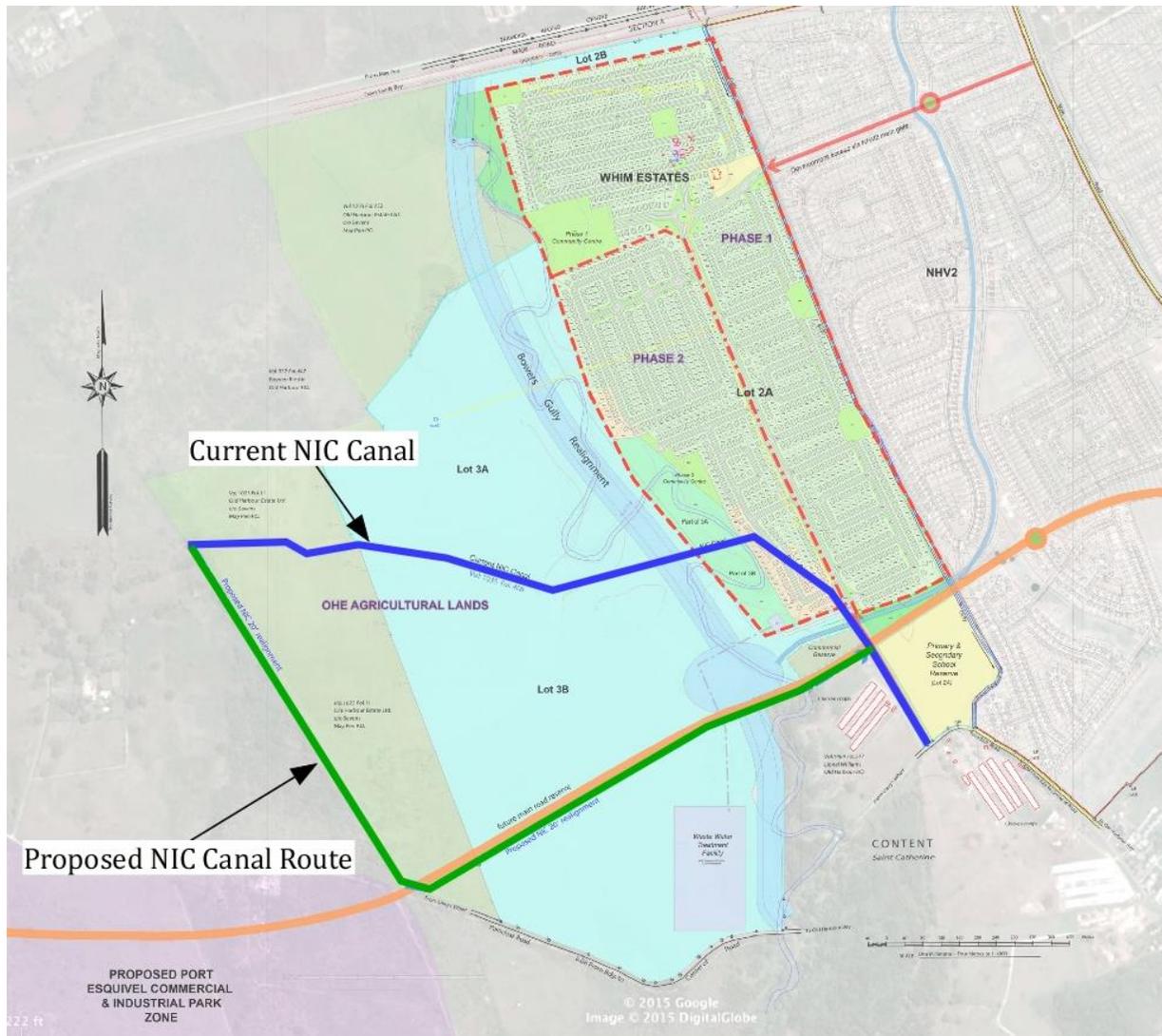


Figure 4.12: Current and Proposed Routes for the NIC Canal

4.2 Site Access

There are currently four possible access routes to the Whim Estates (Figure 4.13). These routes include:

Route I – From South Road through the main entrance of NHV II. This will allow entry to the Whim Estates property from the north-east. This is the preferred and primary access route for the operational phase of the development and will be utilised as the access route for only the mobilisation phase during the construction period. This route has a road reserve of 26 metres which was established in the Sale Agreement for access to future development at the Whim Estates.

Route II – From South Road enter through the secondary access for NHV II. This route will allow entry to the Whim Estates property from the south and is the secondary access route for the operational phase of the development, therefore satisfying the Municipal Corporations requirement of two access points to the housing development.

Route III – From South Road via Kelly Pen Road. This will allow entry to the Whim Estates from the south.

Route IV – From Freetown via Kelly Pen Road across the Bower’s Gully. This will allow entry to the Whim Estates from the south-west and will be the primary access route during the main construction phase.

Other possible routes may exist through the OHE Lot3A and 3B, however, these are currently private roads and may therefore require permission for use as well as extensive road works.



Figure 4.13: Possible Access Routes to Whim Estates

4.3 Drainage

The drainage system that has been designed is based on the NWA *Guidelines for Preparing Hydrological and Hydraulic Design Reports for Drainage Systems of Proposed Subdivisions* (2015). It consists of a

network of pipes and box culverts ranging in diameter and width from 600mm to 1,200mm, into which storm water runoff will enter via a series of curb inlets distributed throughout the road network.

The *Drainage Report for Whim Estates Housing Development, Old Harbour, St. Catherine, Jamaica W.I.* (Whim Report I), prepared by Premier Land and Water Development (November 2017), shows that the proposed network drains the property in 4 blocks, all eventually draining into the realigned Bower's Gully (Figure 4.14).

Drainage Block A – This block drains the north-eastern portion of the property with the discharge flowing into the realigned Bower's Gully.

Drainage Block B – This block drains the eastern portion of the property with the discharge flowing into the Eastern Drain. The Eastern Drain flows south and discharges into the Earthen Gully to the South of the Whim Estates. The Earthen Gully then flows westward and terminates into the realigned Bower's Gully.

Drainage Block C – This block drains the mid-western side of the Whim Estates with discharge on to the green fields. The runoff eventually flows into the realigned Bower's Gully.

Drainage Block D – This block drains the southern portion of the Whim Estates. The flow discharges into the Earthen Gully at the south of the estate. The Earthen Gully then flows westward and discharges into the realigned Bower's Gully.

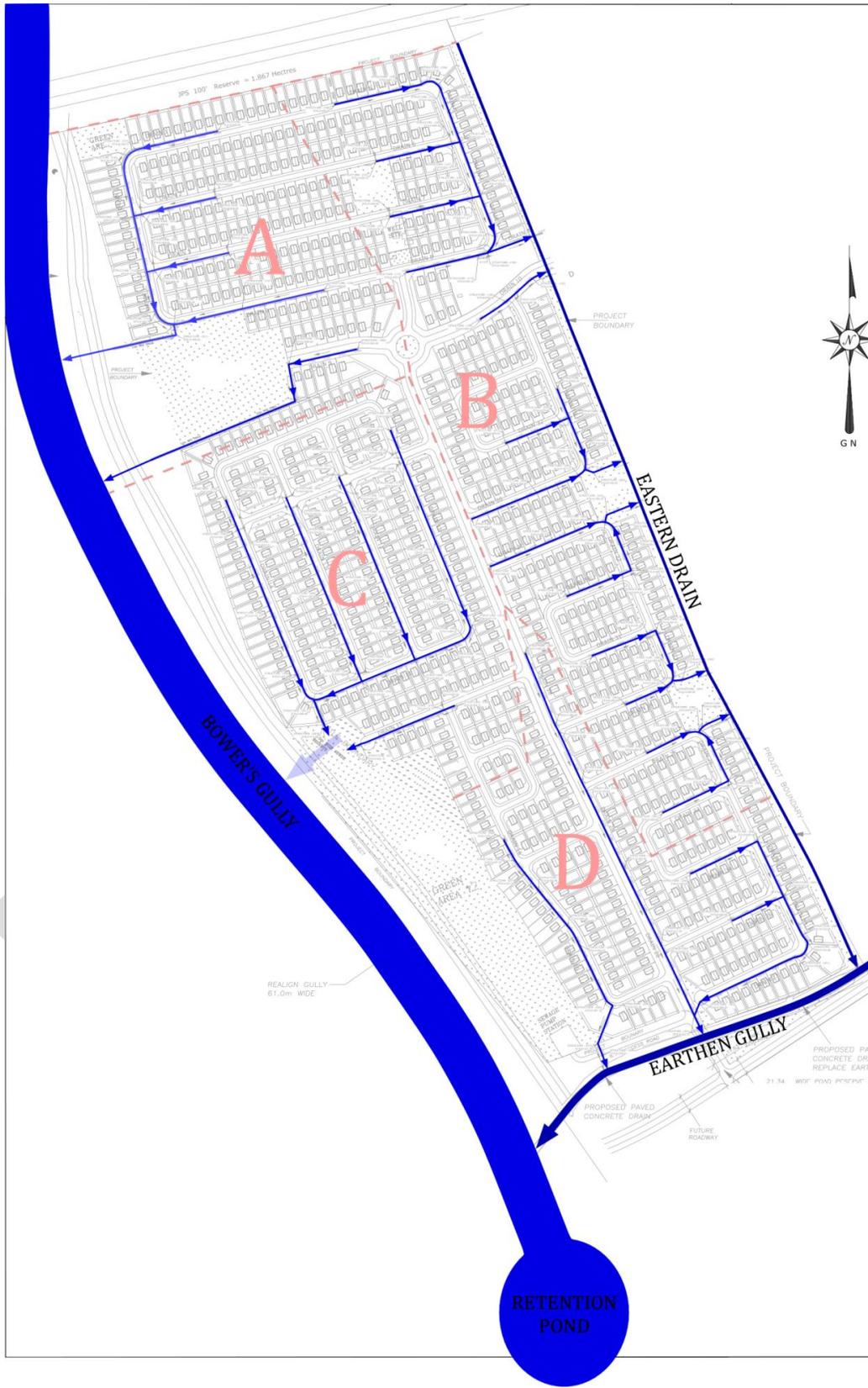


Figure 4.14: Overall Layout of Drainage Network

4.4 Utilities

4.4.1 Potable Water

Potable water will be supplied from a deep well located on the site operating under a 5-year licence issued by the Water Resources Authority ([Appendix V](#)). The well is licensed for “Domestic/Public Supply” with a permitted abstraction rate of 1,657 cubic metres per day.

Details of the treatment of portable water are given in the Whim Estates Potable Water Treatment Plant Executive Summary (Whim Report II). The water will be treated using a chlorine gas-injected system. The chlorine injection rate will be adjusted to attain a suitable range of residual chlorine concentrations at the various sample points at the well head and distribution system. This will ensure that the chlorine demand of the pipe network is met, and the minimum residual chlorine concentrations are achieved.

It has been estimated that the demand for water will be approximately 0.23m³ (208 litres) per person per day. This gives a total daily demand of 805m³ based on a population of 3,500 occupants at the Whim Estates. This daily demand is well below the 1,657m³ abstraction rate allowed per day and therefore sufficient potable water will be available for the community. An assessment of the available potable water resources can be found in Section 5.1.5 Hydrology.

4.4.2 Electricity

It is estimated that each unit will require/demand on average 2,362.59KVA of electricity. With a total of 879 units the overall demand for electricity for the residential units has therefore been estimated to be 2,069.63KVA (Table 4.1). Additional electricity will be required for the supporting services and amenities and this has been calculated as 206.96KVA. Therefore, the total required for the Whim Estates is 2,276.59KVA.

The Jamaica Public Service Company Limited (JPS) has committed to provide this supply upon approval of the Electrical Distribution Design outlined in JPSCo’s commitment to Whim Estates ([Appendix VI](#)).

Table 4.1: Estimated Electricity Demand for Residential Units

Typical Two Bedroom Unit				
Item	Quantity	Voltage(V)	Rating(A)	Total VA
110v Outlet	14	110	15	23,100.0
220v outlet	1	220	15	3,300.0
Lights	9	110	0.85	841.5
Stove	1	220	22	4,840.0
Air Condition	2	220	13	5,720.0
				0.0
Total				37,801.5
Domestically Diversified 25%				9,450.4
Utilizing Demand Factor				2,362.59

Total demand = 876 x Unit demand i.e. 876 x 1.971.75KVA **2,069.63** KVA

4.4.3 Roads

All internal roads (Figure 4.15) will have a reservation width of 9.75m with a 6.1m dual carriageway. There will be some roads within the internal network which will have additional green space reservations to provide pedestrian access and the potential to enhance landscaping features.



Figure 4.15: Internal Roads at Whim Estates

4.4.4 Solid Waste Management

The NSWMA is responsible for waste collection in Old Harbour and Old Harbour Bay. Once the development is completed and the St. Catherine Municipal Corporation gives final approval, the information will be sent to the NSWMA to create a schedule for waste collection on the Whim Estates.

The NSWMA's original schedule indicates that solid waste collection will usually occur once every seven days, however, the current schedule is once every nine days.

4.5 Landscaping

The site layout of Whim Estates will have several green areas (Figure 4.16), which include an area designated as a community centre. Green areas will be grassed and trees will be planted where possible. This will include local fruit trees and other decorative trees.



Figure 4.16 Designated Green Areas at Whim Estates

4.6 Wastewater/Sewage Treatment

The wastewater treatment facility will be located on approximately 4 hectares of land to the southern section of the OHE, namely, Lot 3B (Figure 4.17). The wastewater from the development will be treated to the tertiary level by a series of waste stabilisation ponds inclusive of anaerobic, facultative and maturation ponds with the final treatment step being a constructed wetland (Figure 4.18). The system is designed to meet specific requirements: firstly, a peak capacity of 788.65 m³/d; and secondly, NEPA's sewage effluent standards.

Primary treatment will occur at the head works located before the anaerobic treatment ponds. This will involve the use of 2 bar screens and grit channels to remove any solids. These screens will be cleaned manually, and the waste incinerated. Wastewater/sewage influent will be split into 2 anaerobic ponds (22.3m x 11.1m, 2.5m deep) each leading into a facultative pond (53m x 26m, 1.5m deep). From the facultative pond flows are sent through a series of 2 maturation ponds (57.5m x 28.8m, 1.5m deep). The flows are then combined from the second maturation ponds to lead into the constructed wetland (35mx11.7m- 0.8m deep). The system will also include an operator's building and laboratory as well as parking facilities.

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Figure 4.17: Location of the Whim Estates Waste Water Treatment Facility

4.7 Construction Details

Construction of the Whim Estates will be contracted to a private company, Well Engineered Living (WEL). This company will be responsible for all construction aspects of the housing development and will also be responsible for acquiring the necessary permits and licences for the batching plant and petroleum storage.

4.7.1 Construction Methodology

Construction for the housing units will utilise the cast-in-place technology which has been used for similar housing projects such as NHV I, II, III and IV.



Figure 4.19: Cast-in-place Technology to be used on Whim Estates

4.7.2 Equipment and Storage

In the mobilisation phase, no batching plant and storage facilities will be constructed. The works scheduled to be completed will take place on site using traditional methods of mixing concrete. Material will be stored on site in the Whim Estates Works Yard which is already located on the site (Figure 4.20). The site has an existing above ground diesel storage tank and pump with a containment bund, air compressor shed, service ramp, storage room and service shed. A site office is also located near to the works yard.

During the construction phase, a new property works yard will be developed (Figure 4.21). This site will have storage for materials, a concrete batching plant and additional petroleum storage facilities. Materials stored will include sand, gravel and concrete. The batching plant will be located to the western side of the site away from the residential areas.



Figure 4.20: Works Yard currently at Whim Estates

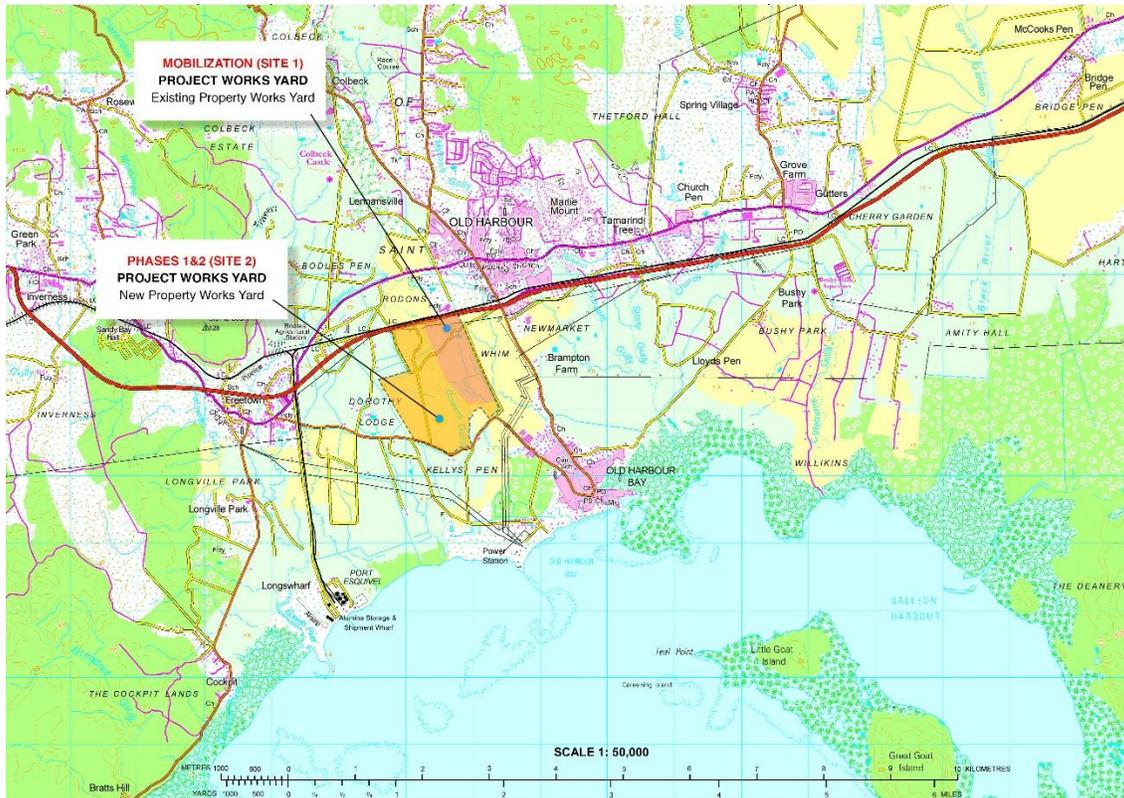


Figure 4.21: Location for additional Works Yard

4.7.3 Workforce

WEL will employ approximately 100 skilled and unskilled labourers for the project over the entire construction phase. An emphasis will be placed on employing persons living within the surrounding communities. WEL will also target persons with previous experience within the construction industry and who may have worked on construction projects in the area such as New Harbour Village I, II and III.

4.7.4 Construction Schedule

Each development phase is divided into sections and blocks. The houses will be constructed in the order listed in Table 4.2 and as shown on Figure 4.22.

Table 4.2: Indicative Construction Schedule

Phase	No. of Units	Timeline
Phase 1	556	24–30months
• Section 1.1	102 units	
• Section 2.1	95 units	
• Section 3.1	123 units	
• Section 4.1	92 units	
• Section 5.1	144 units	
Phase 2	320	10–12 Months
• Section 1.2	52 units	
• Section 2.2	149 units	
• Section 2.3	61 units	
• Section 2.4	58 units	
Total Project Timeline	876	34–42 months

**WHIM ESTATES
PROPOSED PROJECT CONSTRUCTION SCHEDULE**

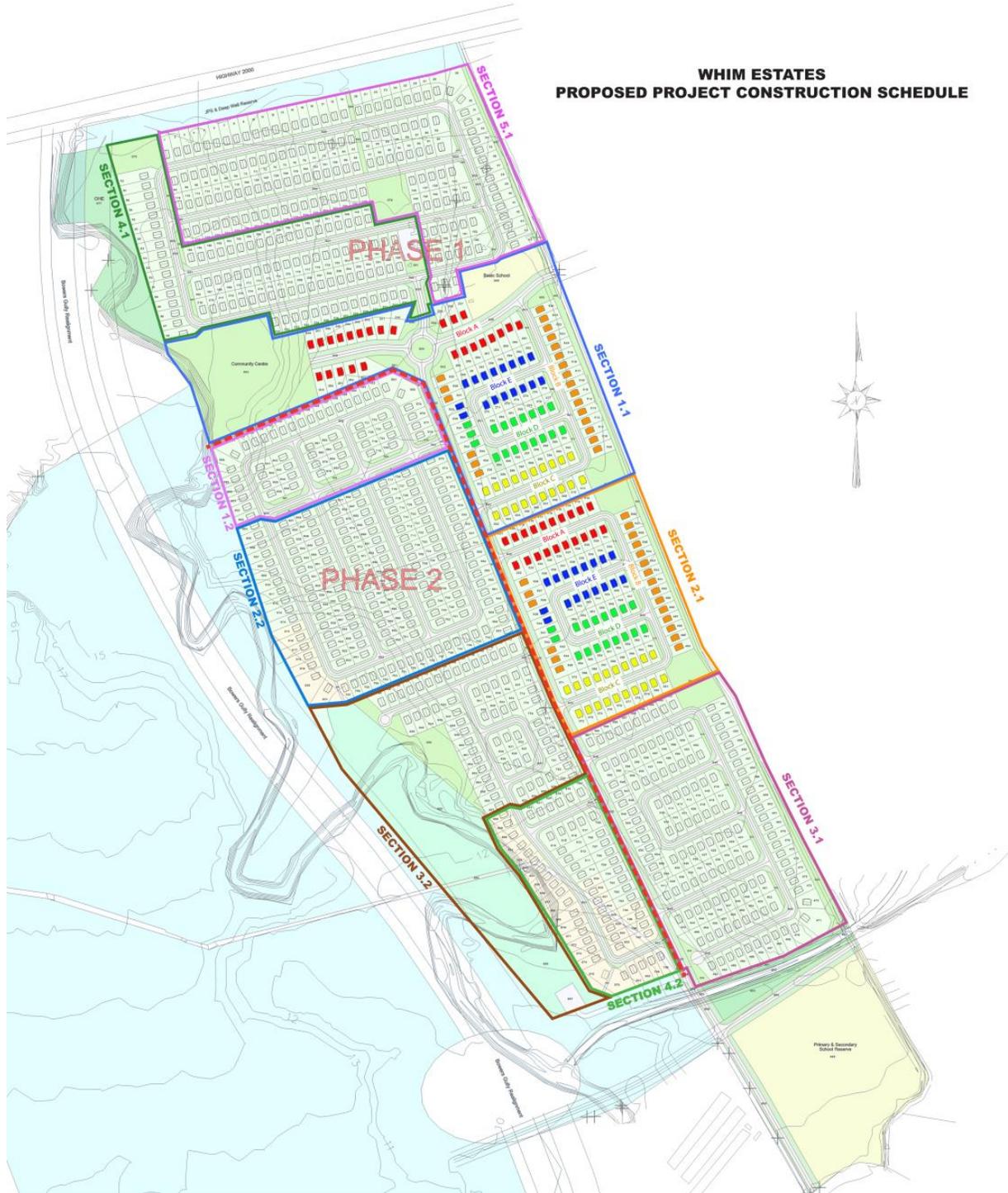


Figure 4.22: Construction Phasing

4.7.5 Site/Vegetation Clearance

In order to decrease the impacts associated with the clearing of vegetation, the site will be cleared in 3 stages (Figure 4.23):

Section 1: This consists of two areas: the northern section of the property; and the area reserved for the Sewage Treatment Facility. The total area has been estimated to be 32 hectares.

Section 2: This is the middle section of the property and consists of a total area of 35 hectares.

Section 3: This is the southern section of the property including the area reserved for the retention pond. The total estimated area is 26 hectares.

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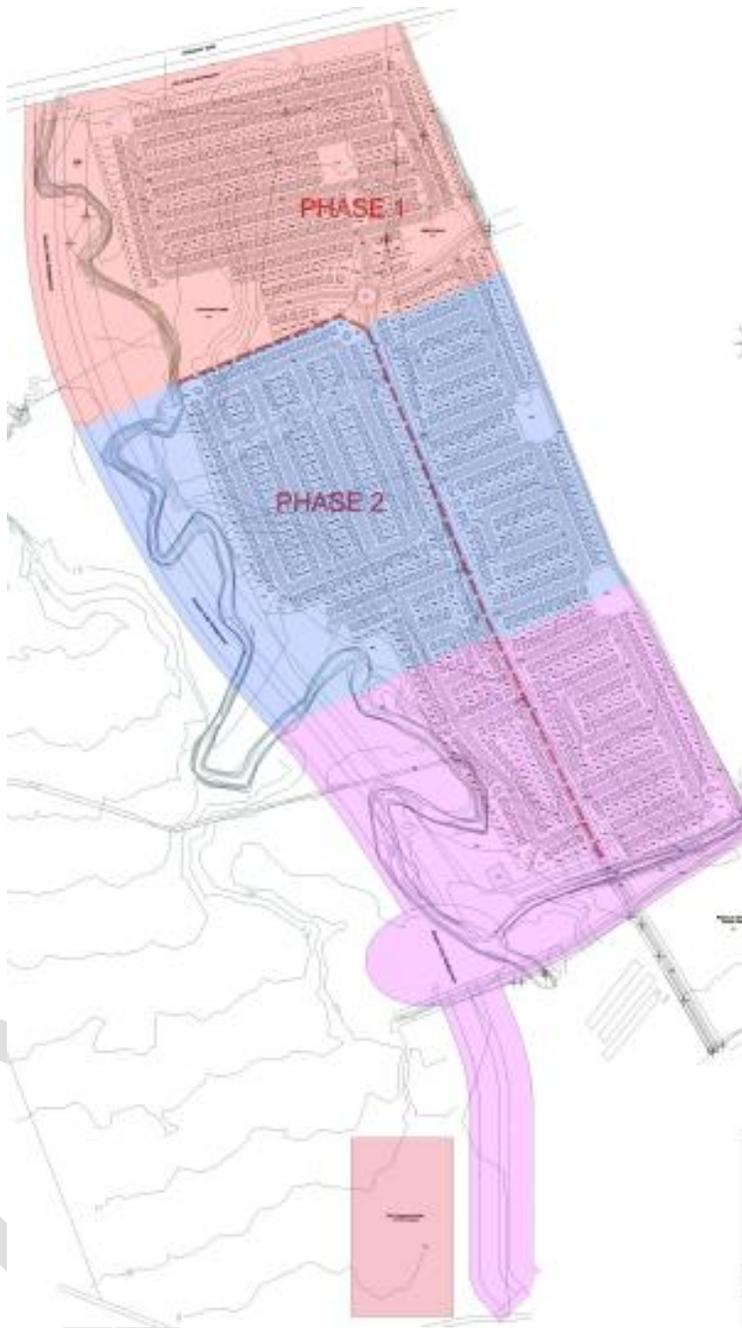


Figure 4.23: Site Clearance Phasing for the Whim Estates

5 Description of the Environment

5.1 Physical Environment

5.1.1 Climate

5.1.1.1 Temperature

The nearest meteorological station is the Bodles Weather Station which is situated 1.5km north-west of the Whim Estate. The monthly mean maximum temperatures (1987–2015) at Bodles range from 30.9°C in the winter periods to 33.5°C in the summer periods. Monthly mean minimum temperatures for the same period range from 18.6°C in winter to 22.7°C in summer (CSGM, 2017).

5.1.1.2 Rainfall

Jamaica has a tropical marine climate with an average annual rainfall of 1,981.2mm (78 inches). The island traditionally has a bimodal rainfall pattern with May and October averaging the highest rainfall. Jamaica's wet season corresponds with the Tropical Atlantic Hurricane Season, when Caribbean countries are affected by a range of low-pressure and hurricane events between June and November each year. Repeated patterns of prolonged drought in recent years due primarily to the El Niño effect have impacted the incidence of rainfall.

The 30-year mean rainfall map (1971–2000) of the island, clipped to the area of the Bower's Gully watershed shows that the Whim Estates lie in the relatively dry section of the island along the coast with a 30-year mean annual rainfall ranging from ~1,600 to 1,000mm (*Figure 5.1*).

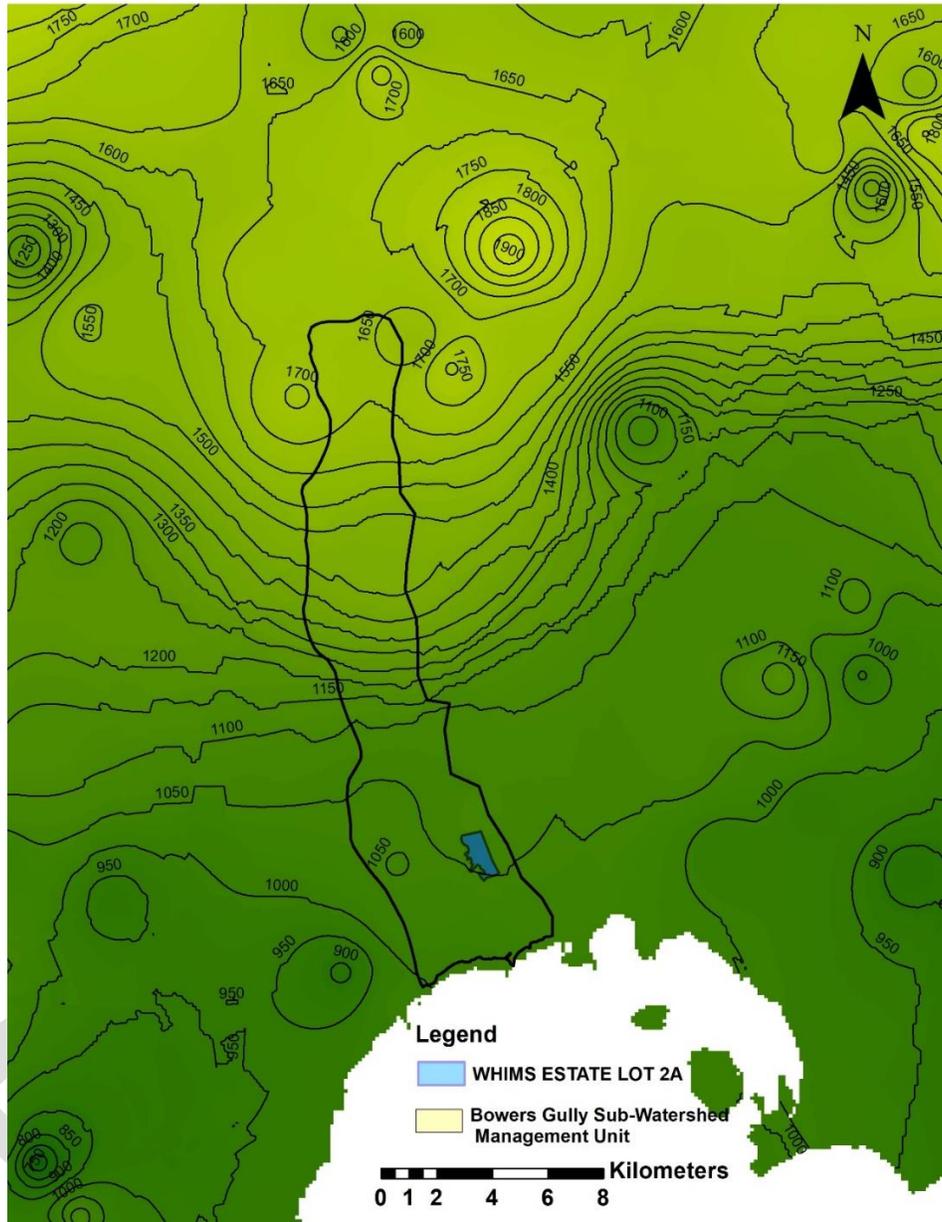


Figure 5.1: 30-year Mean Rainfall Map for the Bower's Gully Watershed

Analysis of rainfall data from 8 stations within and around the watershed over a 22-year time span shows that the peak 24-hour maximum occurs during 2004–2008 which were years of active hurricanes and tropical storms (Hurricane Ivan, 2004 and Tropical Storm Gustav, 2008) (Figure 5.2).

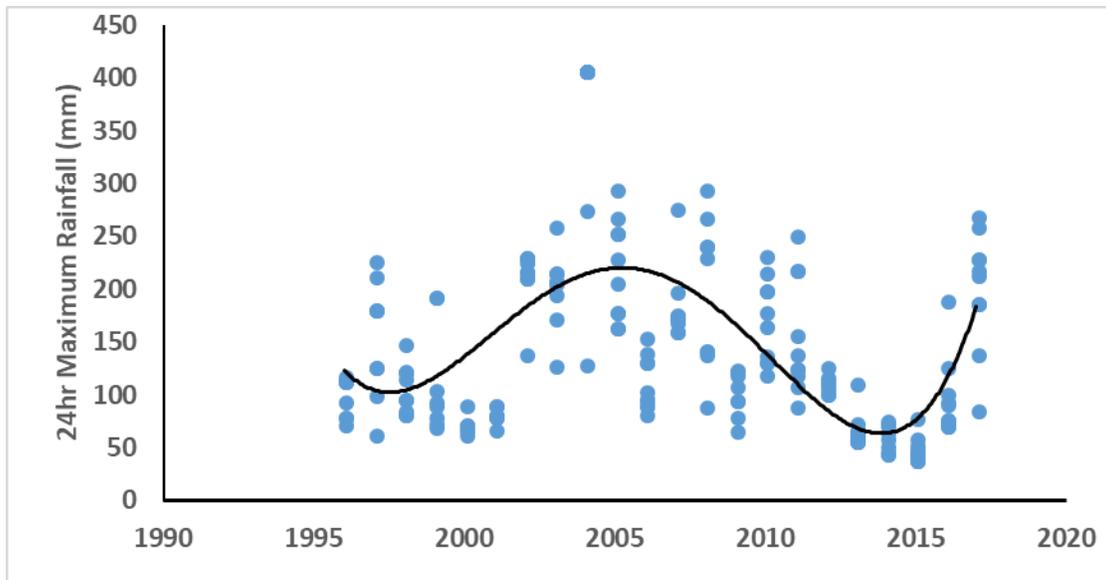


Figure 5.2: 24-hour Maximum Rainfall Decadal Cycle for the Bower's Gully Watershed

The period 2009–2010 was marked by the onset of the drought in the Caribbean and Jamaica after 30 years and was marked by islandwide low rainfall leading to severe water shortages in parts of the island. The lowest rainfall was recorded in 2014–2015 which corresponds to the long drought from 2014–2015 for Jamaica. In the years following 2015, there has been an increase in the trend in rainfall with the months of May–June 2017 recording high rainfall for the early rainfall season of Jamaica.

5.1.2 Topography

The site is relatively flat. The highest point on the site occurs to the north east with an elevation of approximately 21m (69 feet) above sea level. There is a gentle slope from the highest point towards the Bower's Gully and the south west of the site. At the south-western section, the elevation reaches its lowest point of 12m (40 feet) above sea level (Figure 5.3).

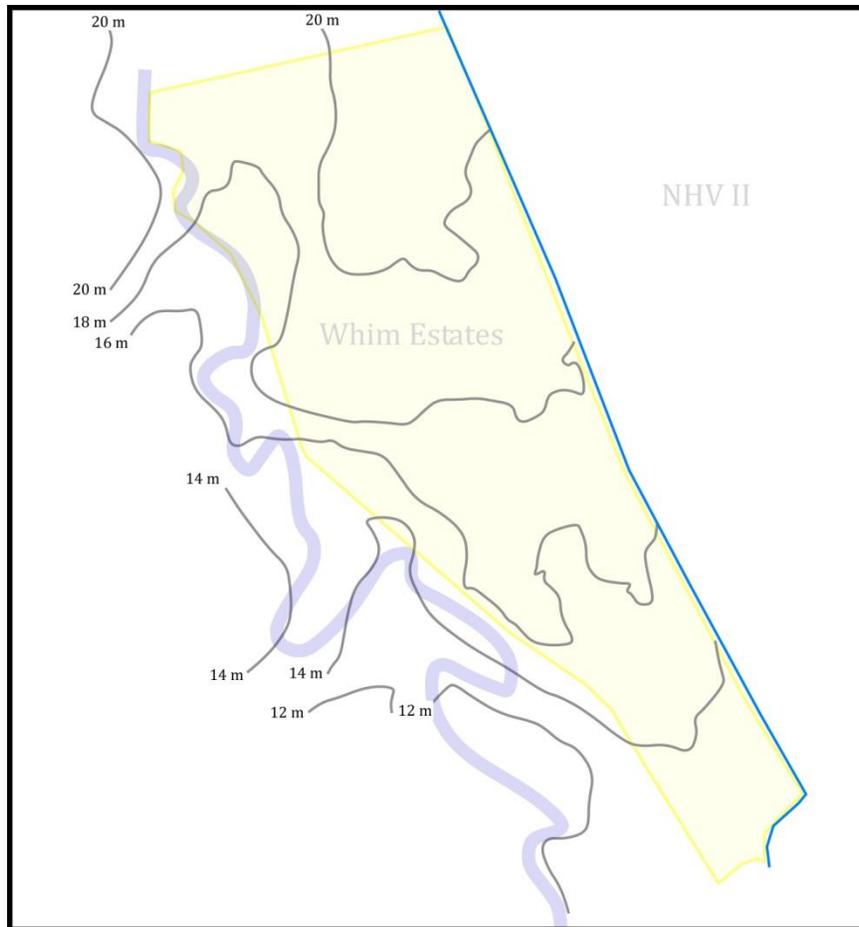


Figure 5.3: Topography of the Whim Estates

5.1.3 Geology and Soils

The geology of the area consists of superficial Plio-Pleistocene alluvium deposits overlaying the Newport Formation of the White Limestone Group (Figure 5.4 and Figure 5.5). The alluvium deposits consist of coarse gravels, sand, silts and clays derived from the Rio Cobre River which discharged sediments on to the St. Catherine Plains during the Plio-Pleistocene epoch (ESL, 2006). The thickness of the alluvium ranges from a few metres in distal areas and several hundred metres in more proximal areas. The overlying soils in the area are derived from the underlying alluvium (ESL, 2002). These soils have been described as clayey loam and silty clays with some sand horizons (Figure 5.6). Around the Bower's Gully, the soils have been described as sandy loam (Figure 5.6). Within the soils and underlying alluvium, there are sandy horizons which are sometimes infiltrated with water, forming perched aquifers.

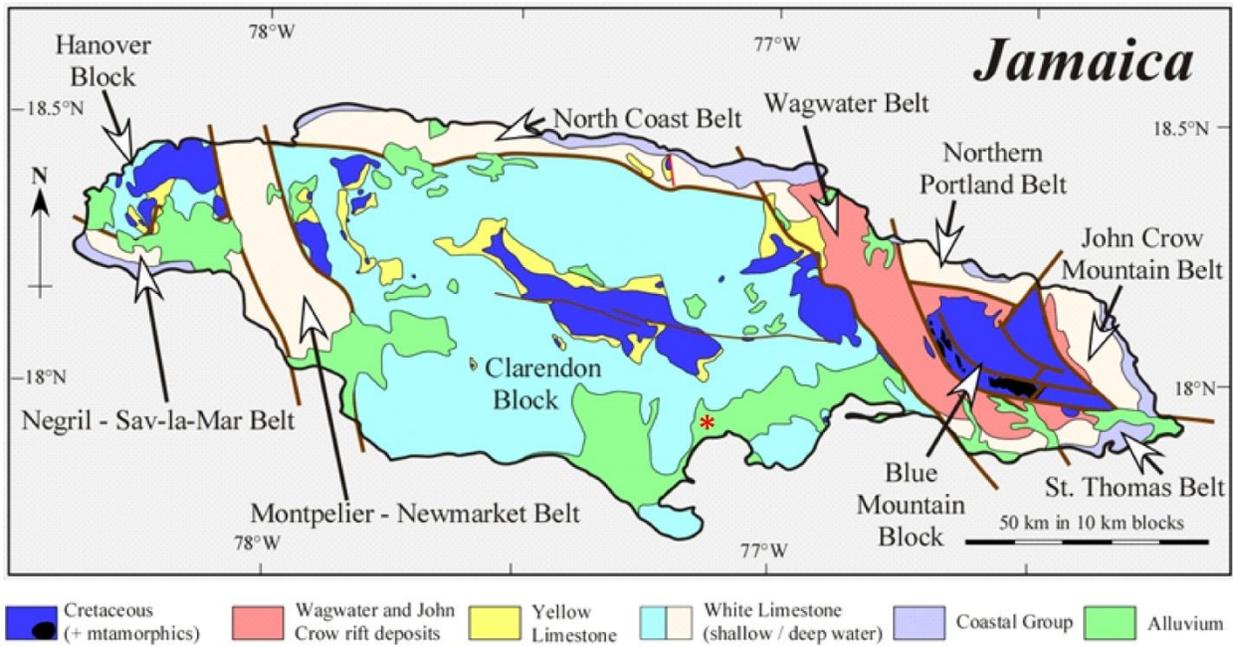


Figure 5.4: Geology Map of Jamaica showing Location of the Proposed Whim Estates (Mitchell, 2016)

Whim Estate Geology

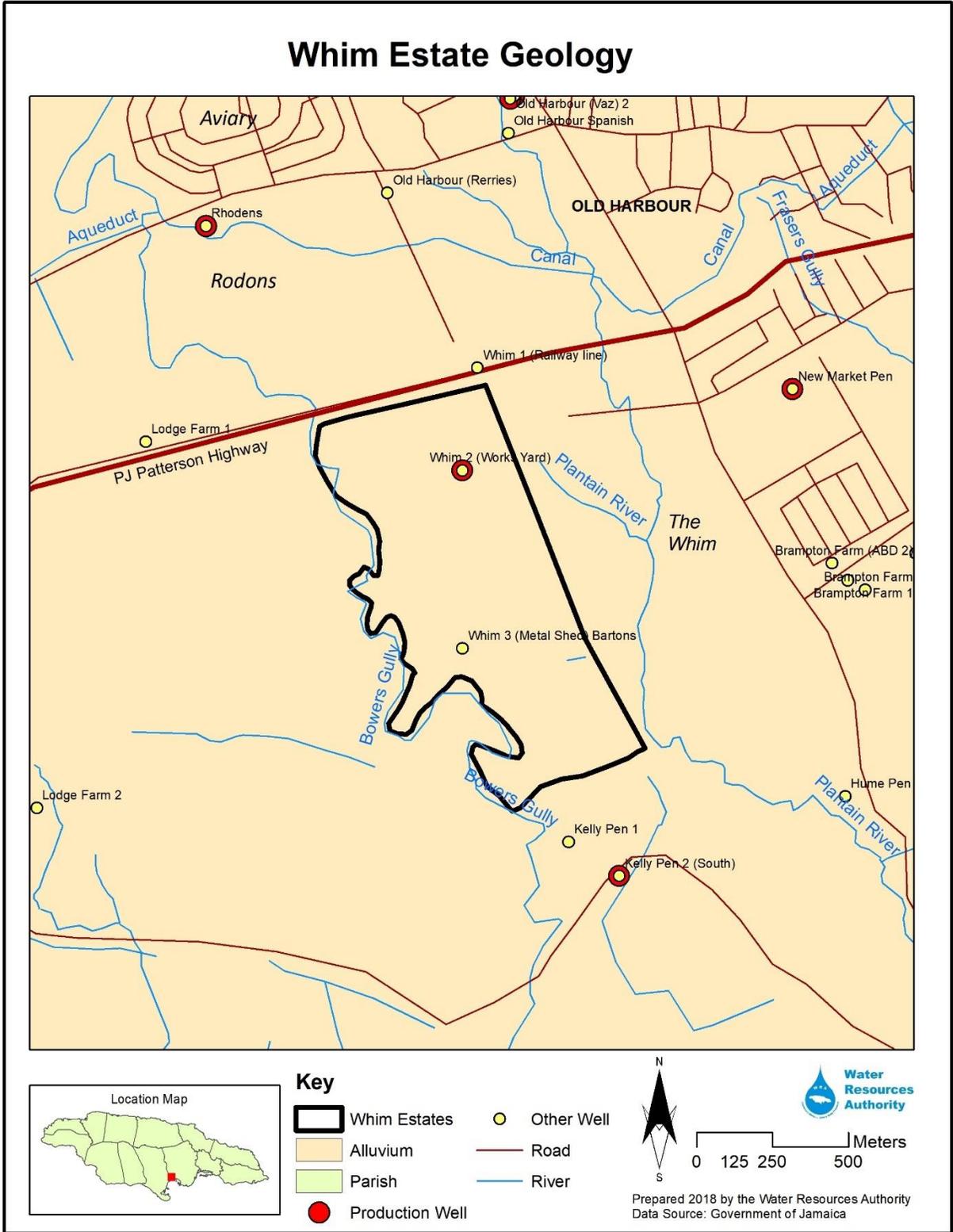


Figure 5.5: Geology Map of the Whim Estate (WRA, 2018)

Whim Estate Soil Texture

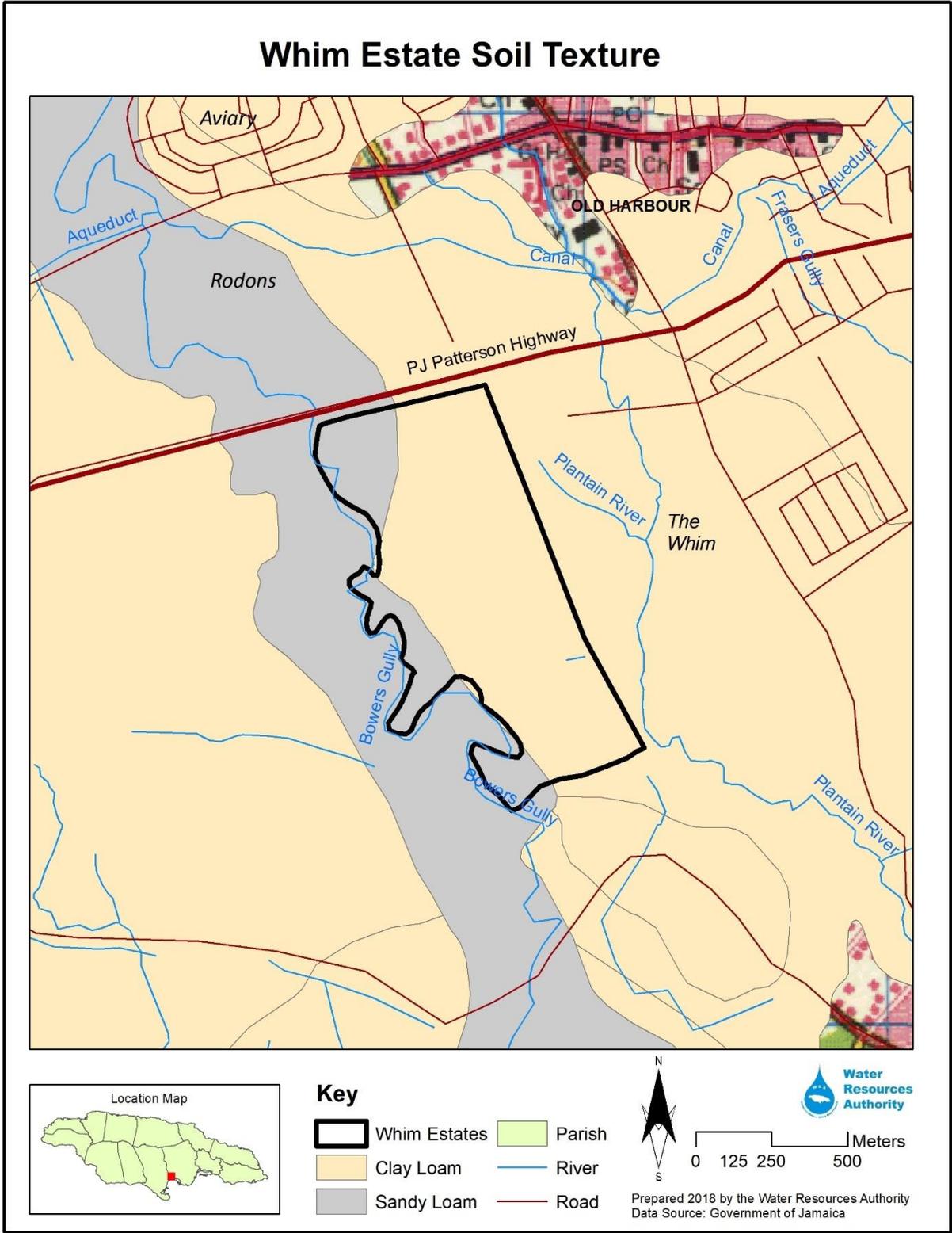


Figure 5.6: Soil Map for the Whim Estate (WRA)

5.1.4 Faults and Seismicity

Jamaica is dissected by a series of major and minor faults. The major faults lie within the Montpelier-Newmarket Belt and the Blue Mountain Block and generally trend south-east to north-west (Figure 5.7). Several minor faults occur within the Clarendon Block that trends east-west crossing almost through the centre of the island. Jamaica is also on the northern margin of the Caribbean Plate and is therefore also affected by the left lateral strike-slip faults associated with the Walton, Enriquillo and Oriente Fracture Zones.

The project site does not lie directly in any major fault zone; however, minor faults do exist around the area. Due to the overlying alluvium, unidentified minor faults may also exist in the underlying limestones.

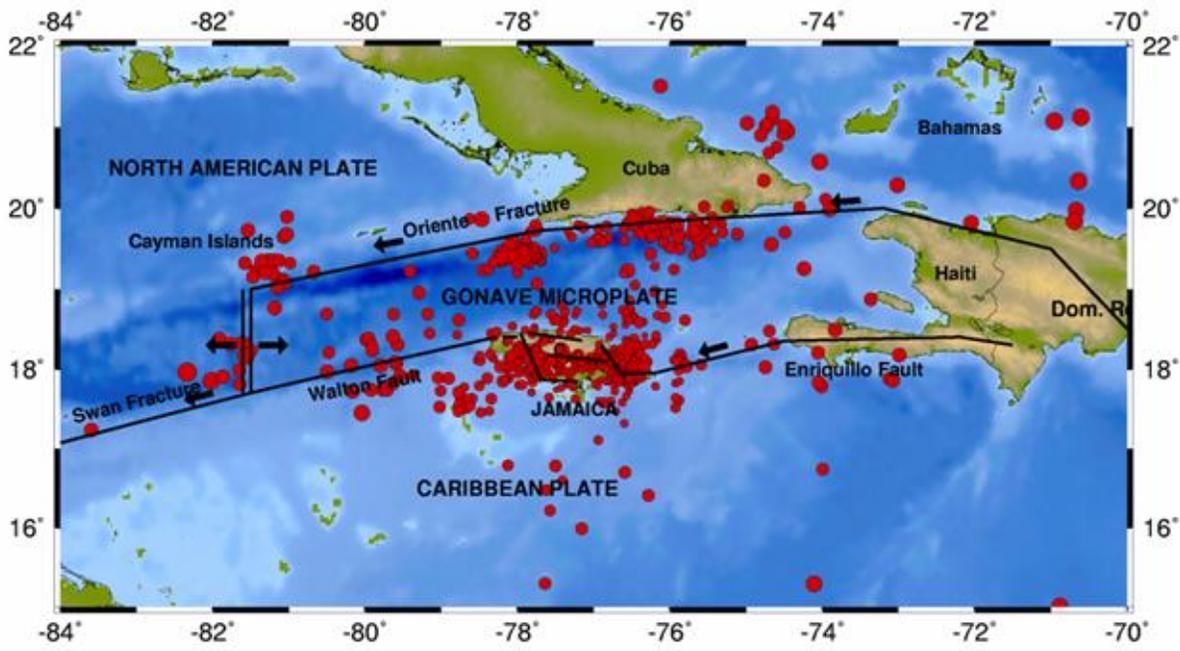


Figure 5.7: Location of Jamaica on the Caribbean Plate with associated Fault Zones and Earthquakes (Mitchell and Brown, 2014)

5.1.5 Hydrogeology

Surface Hydrology

The Bower's subwatershed (Figure 5.8) is a part of the Rio Cobre watershed and is drained by the main Bower's Gully which runs to the west of the property. There are no significant rivers or streams in the area surrounding the property except the gully and the man-made NIC canal.

Using a digital elevation model (DEM), catchments, drainage channels, and drainage junctions were extracted for the area. This showed that the entire Bower's Gully subwatershed as defined by the Water

Resources Authority (WRA) comprises an area of 4,070 hectares with the dominant slope towards the south (i.e., towards the coast). The elevation of the watershed ranges from as high as 685m in the north to as low as ~2m near the coastline. The topographic survey carried out by the Premier Land and Water Development (2017) shows elevation in and around the property ranging from 21m on the northern limit of the property to 14m in the south. The overall gradient is shallow and towards the south following the general slope. Based on this topography, the DEM has also indicated that the Whim Estate covers four water catchments (Figure 5.9).

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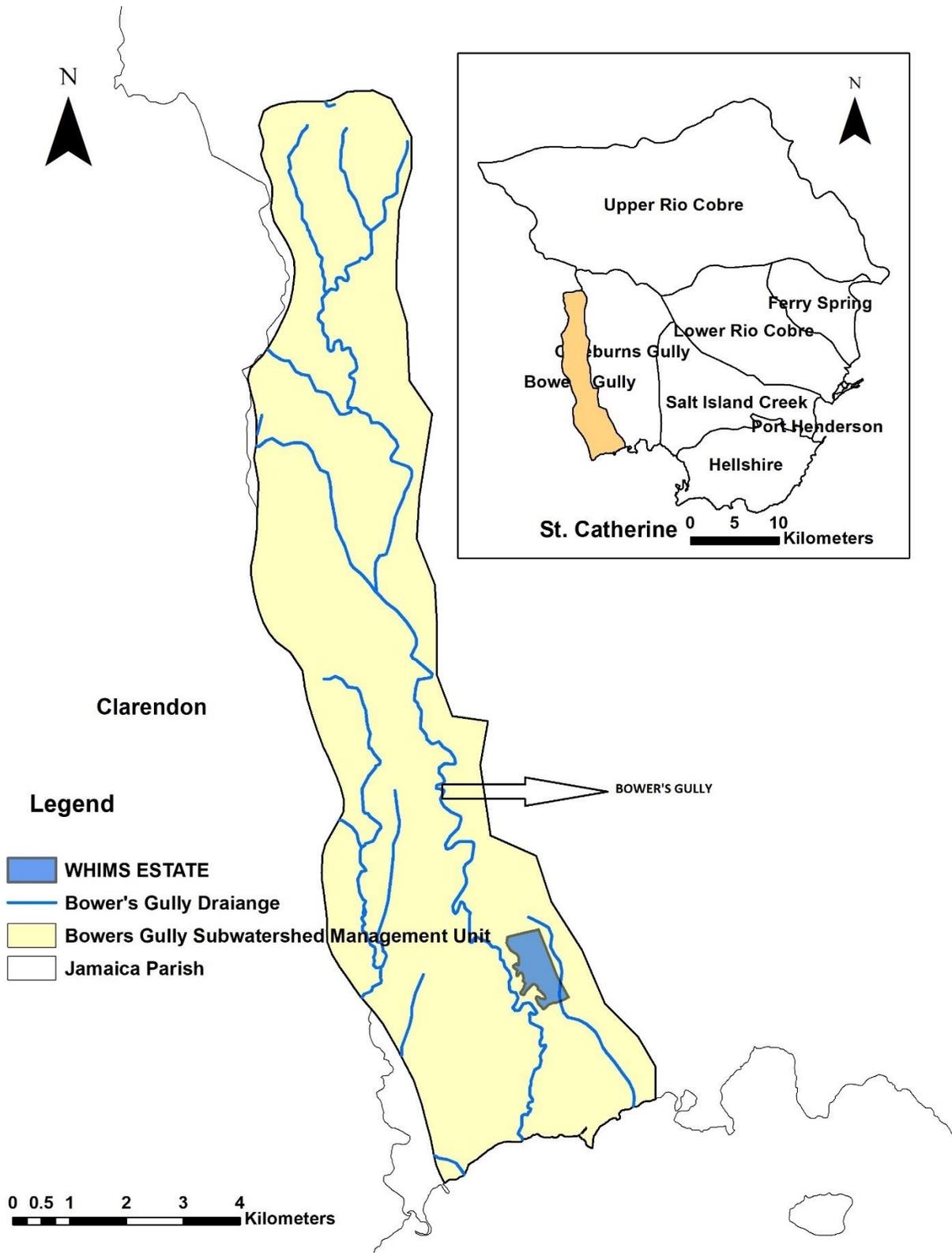


Figure 5.8: The Bower's Gully Subwatershed and the Whim Estate Site



Figure 5.9: Catchment and Drainage Network showing downstream Flow towards the Whim Estates

Sub-surface hydrology

The Bower's Gully subwatershed has four hydro-stratigraphic units which are delineated based on the geology of the area. These are namely the Limestone Aquifer, Coastal Aquiclude, Alluvium Aquifer and the Basal Aquiclude (Figure 5.10). The limestone aquifer located in the central section of the basin comprises the white-cream coloured limestones of the White Limestone Group. The southern and south-central part of the basin is underlain by the alluvium aquifer.

The wells shown in Figure 5.10, although seen to lie spatially on the alluvium aquifer, are, however, abstracting water from the limestone aquifer underneath as per the records of static water level data obtained from the Water Resources Authority (WRA). With the exception of the Whims 2, Whims 3, Rhodens and Kelly Pen wells, all the wells are drilled to the limestone aquifer which is the dominant aquifer in the parish of St. Catherine covering an area of 762km² (Draft WRA Master Plan, 2005). The depth of drilling ranges from 103m at Colbeck Machado to a low of 37.5m at Whims Estate.

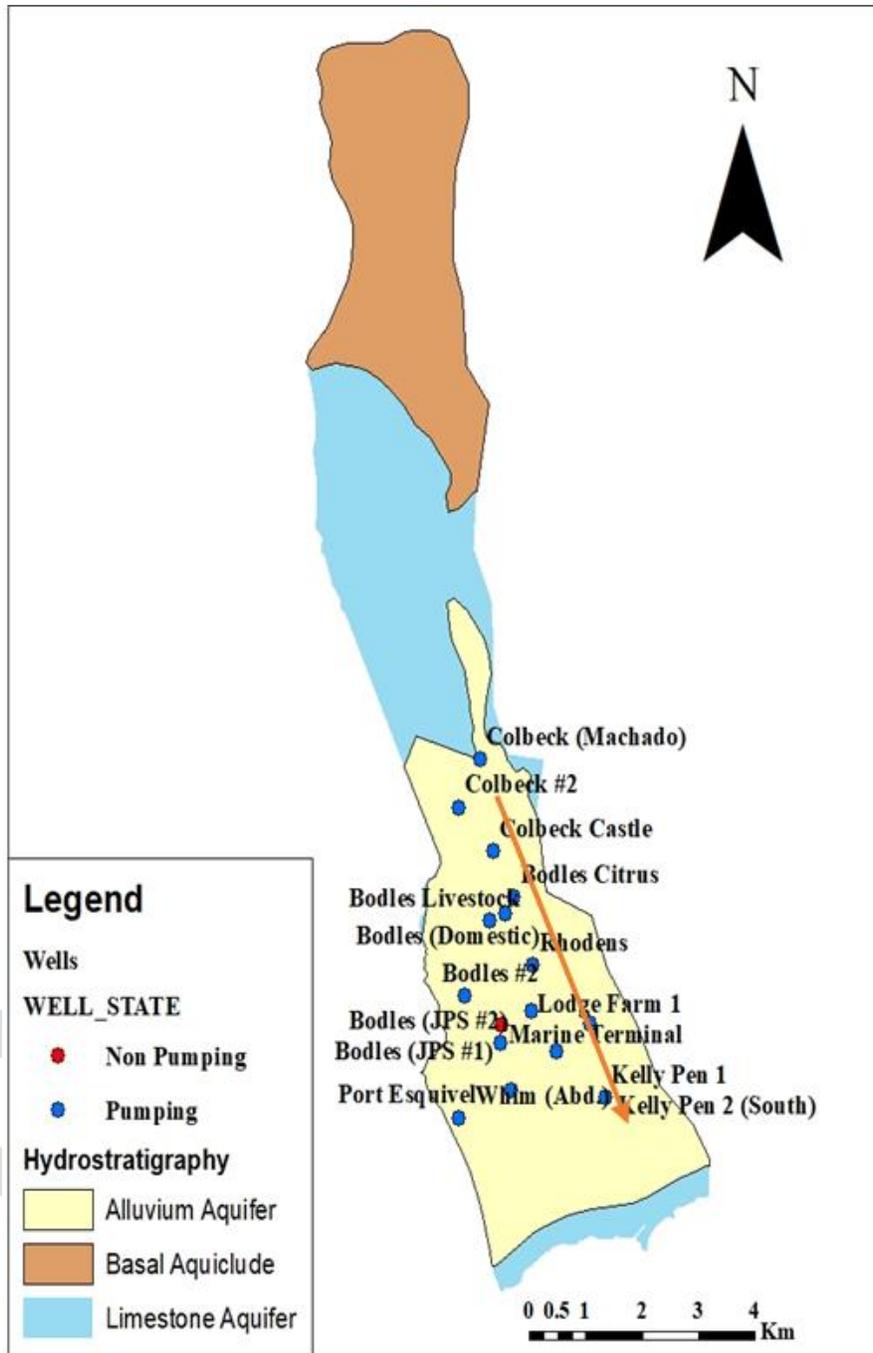


Figure 5.10: Aquifers, Well and direction of Water Flow around the Whim Estates

Overall, groundwater flow direction is towards the south. Table 5.1 shows that the limestone wells are deeper than the alluvium wells and thus would be at a lesser risk from drying up during periods of low rainfall and recharge as well as from contamination from nutrients and saline water intrusion.

Table 5.1: Well Depth and Aquifer in the Bower's Gully Subwatershed Management Unit (Source: WRA)

Well	Depth (feet)	Aquifer
Colbeck (Machado)	103.1	Limestone
Colbeck Castle	70.0	Limestone
Bodies JPS #1 Replacement	37.5	Limestone
Bodies #2	47.5	Limestone
Bodies Livestock	62.5	Limestone
Kelly Pen 2 (south)	9.4	Alluvium
Marine Terminal	37.5	Limestone
Lodge Farm 2	37.5	Limestone
Old Harbour (Vaz)1	36.6	Limestone
Old Harbour (Vaz)2	37.5	Limestone
Rhodens	39.7	Alluvium
Whims 2 (Works Yard)	37.5	Alluvium
Whims 3 (Metal Farm) Bartons	37.5	Alluvium

Available Water Resources

As the only source of water for the property would be from groundwater wells, a water resource assessment for the property is very crucial for development. Any increase in demand from new developments can affect the available resources which may show signs of declining if sufficient recharge is not met through rainfall.

The Draft WRA Master Plan (2005) shows that the Rio Cobre Basin has an effective yield of approximately 408m³ per year which comprises both the surface and groundwater resources. Agriculture is the main consumer of groundwater and surface water for the Rio Cobre Basin as compared to the other sectors. Water from this basin is often used for providing potable water to the Kingston Basin during times of shortage. The existing data from WRA and NWC show that the wells in and around the property are used for irrigation and industrial uses (JPS, Bodles and NIC irrigation wells).

Data on the available Static Water Level (water level in the wells under a no-pumping equilibrium condition) were sourced from the WRA web database to show the temporal trend. There is inconsistency of data as seen from the graphs (Figure 5.11) which may be due to the abandonment of the well. The interpretation was therefore done only using the available data.

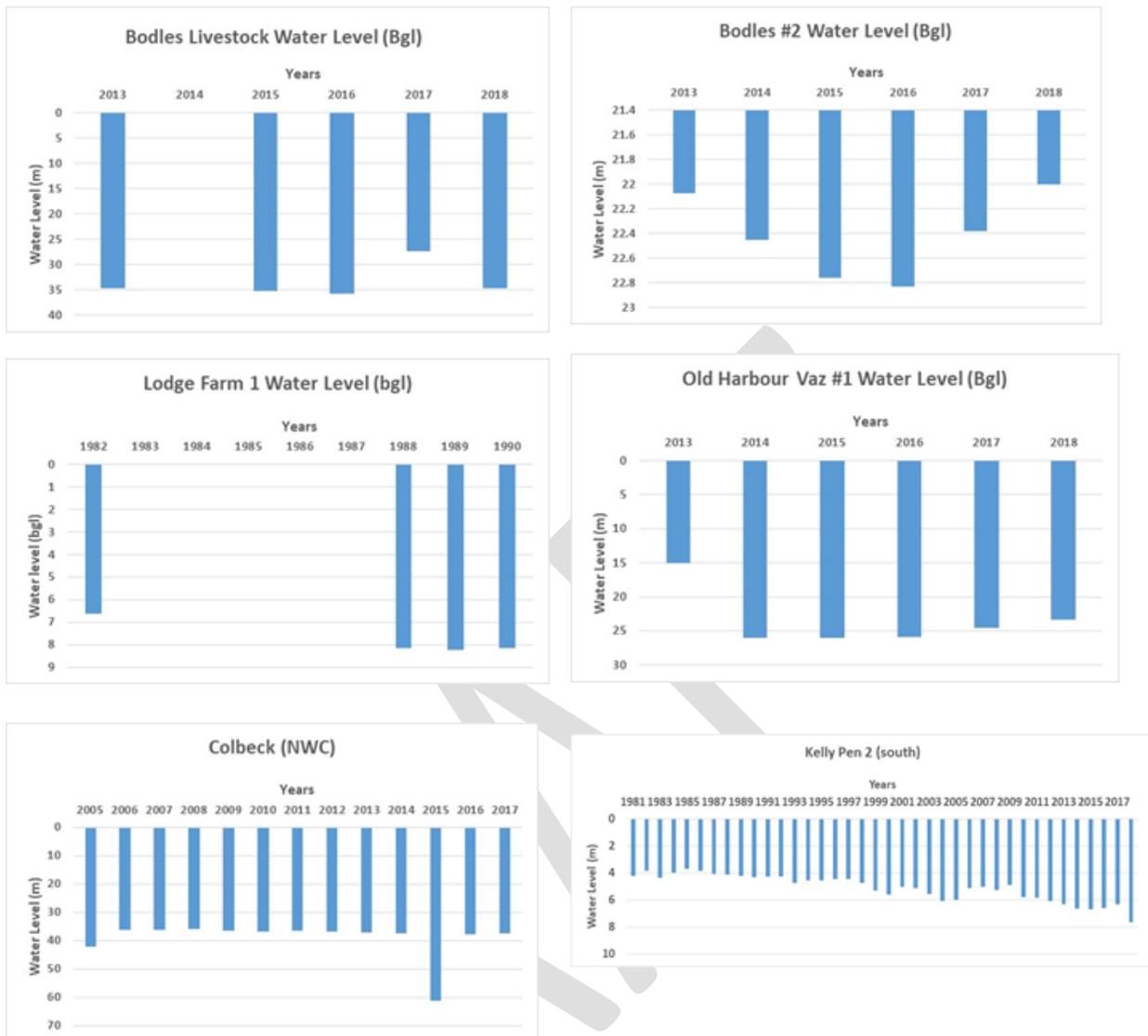


Figure 5.11: Static Water Level (bgl in metres) for the Wells of the Bower's Gully

There is limited data for the alluvium wells, therefore, only data from the limestone wells were analysed. From the data, the following general statements can be made:

- There has not been much significant change in the levels of groundwater;
- The Colbeck, Bodles, Old Harbour Vaz1 and Kelly Pen wells all show a decline in the year 2015 which corresponds to a drought;
- Where seasonal data were available (i.e., monthly rainfall data), a slight decrease in water levels was noted in the drier months (January–May) followed by an increase in the wet period (August–November) concurrent with the temporal trend in the rainfall pattern (See [Appendix VII](#) for graphs showing seasonal trend analysis for the Bodles and Colbeck Castle wells);

- Due to the variability in available well production data (see [Appendix VIII](#)), a conclusive statement cannot be made about whether the increase or decrease is from an increase in demand or decrease in rainfall and recharge;
- Overall in the last ten years, production has shown an increase in the years 2010, 2011 and again in 2015 and 2017. This could be due to an increase in demand for the years when drought occurred (2010 and 2015) causing a decrease in surface water levels and increased pumping to meet additional demand from the groundwater reserves;
- None of the wells show 'drying-up' in the recent 5 years and thus based on the data available, it can be said there is reasonable groundwater reserve.

5.1.6 Surface Water Quality

There were at least three waterways identified on the property (Figure 5.12). One waterway runs south along the Whim Estates and New Harbour Village II boundary. This originates off site from the north across the highway. Water was found in the lower sections of this earthen drain/waterway at the south of the property. The second is the lower Bower's Gully which flows south bound and empties into the Caribbean Sea; this runs along the western boundary of the project site. The Bower's Gully appears to be an ephemeral surface water body and was dry for most of the visible length of the waterway. The third waterway flows through New Harbour Village II then westward into a retention pond that eventually flows over into the Bower's Gully.

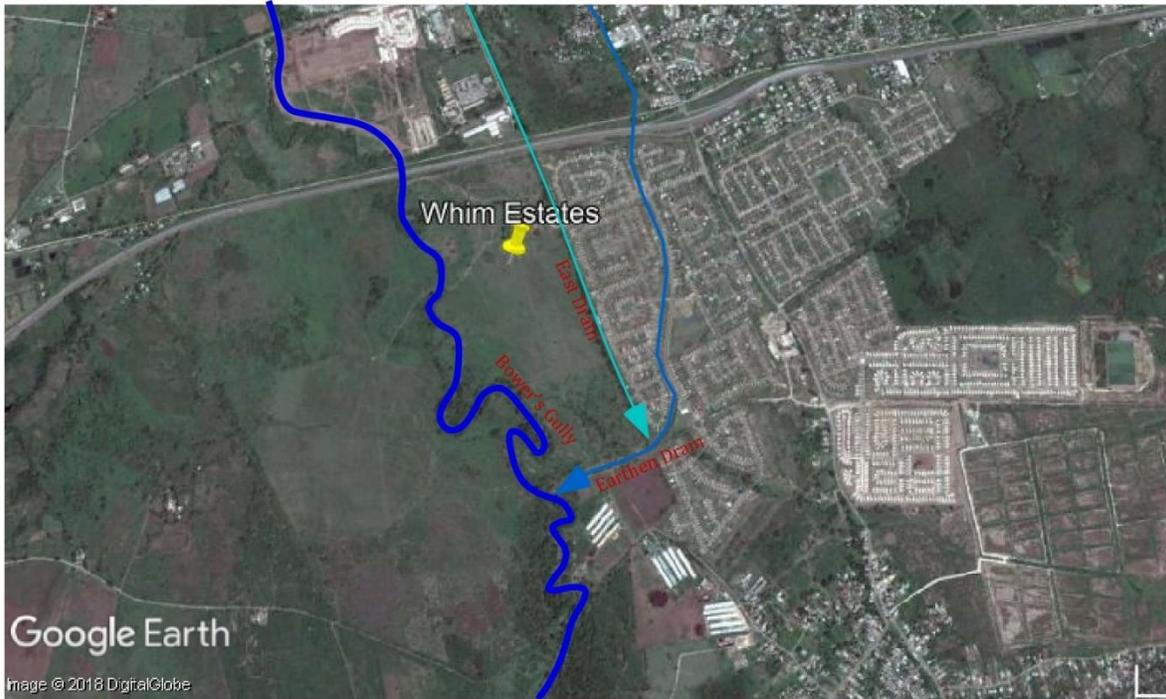


Figure 5.12: Waterways observed on Site

Samples were taken from three points as illustrated in Figure 2.3. The results of the surface water quality analysis are given in Table 5.2.

Table 5.2: Water Quality Data for Whim Estates

Parameters (units)	WQ1	WQ2	WQ3	Draft Jamaica National Ambient Water Quality (WQ) Standard – Freshwater, 2009
pH (pH units)	7.30	7.8	7.49	7.00-8.40
Temperature (°C)	27.9	33.6	23.5	-
Dissolved Oxygen (mg O)	1.85	5.88	0.66	-
Total Dissolved Solids (mg/L)	923	-	690	120 -300 mg/L
Salinity (ppt)	0.71	38.7	0.66	-
Conductivity (µS/cm)	1500	-	1390	150.0-600 µS/cm
Biochemical Oxygen Demand (mg O ₂ /L)	1.5	<0.1	2.6	0.8-1.7mg/L
Chemical Oxygen Demand (mg O ₂ /L)	12	-	6	-
Alkalinity (mg CaCO ₃ /L)	354.67	162.67	267	-

Parameters (units)	WQ1	WQ2	WQ3	Draft Jamaica National Ambient Water Quality (WQ) Standard – Freshwater, 2009
Chloride (mg Cl ⁻ /L)	338	-	452	5.0-20.0mg/L
Sulfate (mg SO ₄ ²⁻ /L)	59	3000	38	3.0-10.0mg/L
Nitrate (mg NO ₃ ⁻ /L)	2.7	<0.01	8	0.1 – 7.5mg/L
Nitrate as Nitrogen (mg N/L)	0.6	0.05	-	-
Phosphate (mg PO ₄ ³⁻ /L)	<0.02	0.05	0.63	0.01-0.8mg/L
Total Coliform (MPN/100mL)	920	280	>1600	-
Faecal Coliform (MPN/100mL)	33	39	1600	-
Total Suspended Solids (mg/L)	26	20	4	-
Enterococci (MPN/100mL)	46	79	>1600	-
Fats, Oil and Grease (mg/L)	3	<1	<1	-
Calcium (mg Ca/L)	103	762	109	40.0 - 101.0
Magnesium (mg Mg/L)	33.8	1400	28.4	3.6 – 27.0 mg/L
Chromium (µg Cr/L)	<20	<20	<20	-
Cadmium (µg Cd/L)	<10	<10	<10	-
Iron (µg Fe/L)	81	449	46	-
Copper (µg Cu/L)	<10	65	<10	-
Manganese (µg Mn/L)	106	96	<10	-
Lead (µg Pb/L)	<20	<20	<20	-
Zinc (µg Zn/L)	<10	<10	<10	-

Summary Findings:

- Total Suspended Solids (TSS) – The total suspended solids levels are higher for WQ1 and WQ2 compared to WQ3 due to the nature of the sampling locations. WQ1 and WQ2 were visibly turbid and low flowing. WQ3 was a much smaller stream that flowed through a thickly vegetated channel which would offer some filtering and settling effects;
- Biochemical oxygen demand (BOD) levels were within the ambient water quality guidelines with the exception of WQ3. This may indicate the influence of organics on this stream;
- The concentrations of other parameters, such as nutrients and bacteria, suggest that the possible source of the organics may be sewage. The concentration of nitrates in a water body is used as an indicator of contamination by anthropogenic sources such as wastewater from

sewage discharge and/or fertilisers from agricultural runoff. Phosphates are generally from similar sources as nitrates, but typically include trade effluent sources. Both nitrates and phosphates were highest in WQ3 water sample further suggesting possible sewage contamination;

- Enterococci, Total and Faecal Coliform – Coliforms and enterococci bacteria levels were elevated in all samples, but greatest in WQ3. There is again a strong possibility that there is influence from a source of sewage at WQ3 as these microorganisms are indicative of recent faecal contamination;
- Salinity – The salinity level of WQ2 indicates that this section of the Bower's Gully is being significantly influenced by seawater. Along with the elevated salinity, the water temperatures also indicate significant influence from a marine source at WQ3 (33.6°C) as marine waters tend to have higher temperatures than fresh inland water sources;
- Alkalinity – Marine waters tend to have lower alkalinities than fresh water sources as indicated from the results. Alkalinity speaks to the buffering capacity of the water body;
- Fats, Oil & Grease (FOG) were detected at WQ1 and are consistent with the high chemical oxygen demand (COD) level observed at this site as well. The stream at this location was not flowing and as such the stagnation could have influenced these parameters as there was not a noticeable discharge source;
- Dissolved Oxygen (DO) levels were highest at WQ2 (at 5.88mg/L). Various marine animals were seen, for example a stingray and a pipe fish. Mangrove plants were also observed.

5.1.7 Air Quality and Noise

Air Quality (AQ)

The particulates of greatest concern to humans are those with an internal diameter of below 10 microns, generally referred to as respirable particulates. Respirable particulates on undeveloped lands are generally from a combination of natural and anthropogenic sources such as pollen, dust and smoke from burning or vegetation clearing. Six (6) air quality monitoring stations were set up as shown in Figure 2.4. The results of the assessment are given in Table 5.3.

Table 5.3: Results of the Air Quality and Noise Assessments

Sample Site	Particulate Matter Concentration (μgm^{-3}) for 24-hour period	NRCA Particulate Matter Concentration (μgm^{-3}) for 24-hour Period	Noise Measurements (dBa)	NRCA Noise Guideline (dBa)
Pump placed along east boundary of property (AQ1)	8.7	150	54.1	55
Middle point along the Eastern Fence Boundary (AQ2)	156.4		51.7	
Control (AQ3)	22.8		45.7	
Middle of Southern Boundary of Property (AQ4)	6.1		51.5	
Lower section of Southern Boundary of Property near to New Harbour Village Phase II Fence (AQ5)	2.6		49.9	
Northern Section of Property approximately 100 metres South of Highway (AQ6)	40.5		102.7	

The particulate matter concentrations were within NEPA ambient 24-hour standard for all the sites except AQ2, where the concentration exceeded the ambient standard by $6.4\mu\text{g}/\text{m}^{-3}$. The concentration of PM_{10} measured at this sampling station was also significantly higher than the other sampling stations. Based on the observations made during the assessment, no known source of particulate matter was seen near to this sampling site. The possibility of the particulate matter being transported to this sampling station by wind is plausible as the project site was dry, mostly covered with vegetation and generally windy.

The location of the New Harbour Village II relative to this sampling site suggests that the site may be impacted by fugitive dust from current/ongoing construction/renovation activities. Additional data from future monitoring activities at this location can confirm this.

Noise

The noise levels measured were within the cited NRCA Noise Guidelines of 55dBA (residential areas) for all the sites except AQ6, which was located near to the highway and was therefore impacted by noise generated from passing vehicular traffic.

Currently, the main sources of noise impact to the project site appear to originate from the nearby highway. The impact of noise on the project site will therefore vary depending on the traffic, other activities close to the project site and prevailing wind direction.

5.1.8 Sources of Existing Pollution

Several sources of existing pollution were observed around the Whim Estates site.

Air Quality – Chicken Farms are located to the south of the Whim Estates. Odours related to these farms were detected while on the property and in the surrounding communities.

Highway 2000 lies to the north of the Whim Estates and therefore could be a source of air and noise pollution. Similarly, New Harbour Village II forms the eastern boundary of the Whim Estates and this can also be the source of noise pollution.

Water Pollution – The earthen drain located to the south of the Whim Estates and the drain along the eastern boundary of the site contain flowing water in some sections. Water quality tests at this site indicated contamination by faecal coliform ([Section 5.1.6 Surface Water Quality](#)). As previously mentioned, the concentrations of other parameters such as nutrients and bacteria, suggest that the possible source of the organics may be sewage. However, this does not originate from the Whim Estates site as no sources of possible sewage have been identified on the estate.

At the south-western section of the property, chicken manure was observed in stockpiles along the lower Bower's Gully bank (Figure 5.13). This can also have potential impacts on the water quality along lower Bower's Gully.



Figure 5.13: Chicken Waste dumped on the Banks of the Bower's Gully

6 Natural Hazards

6.1.1 Hurricanes

Jamaica is susceptible to tropical cyclones as it is in the Atlantic Hurricane Belt. The island has been impacted by over 20 tropical depressions, tropical storms and hurricanes over the past 75 years (CSGM, 2017). The hurricane season runs from June 1 to November 30 each year with the peak period from mid-August to late November. Based on historical data, the CSGM (2017) has determined that the parish of St. Catherine has a 43% chance of a hurricane passing within 50km of the parish each year.

Climate change projections do not indicate an increase in the number of tropical storms or hurricanes affecting Jamaica and the wider Caribbean. However, the intensity of tropical cyclones is projected to increase underscoring the imperative for hurricane resistant designs.

6.1.2 Earthquakes

The most active earthquake zones within Jamaica are the faults associated with the Blue Mountains Block in eastern Jamaica. Figure 6.1 shows the epicentre of earthquakes around Jamaica with most earthquakes associated with the Blue Mountains Block. Figure 6.2 represents a 100-year return period earthquake of Magnitude VIII from within the Blue Mountains Block. If such an event occurs, St. Catherine will experience shaking at a magnitude VII on the Modified Mercalli Intensity Scale.

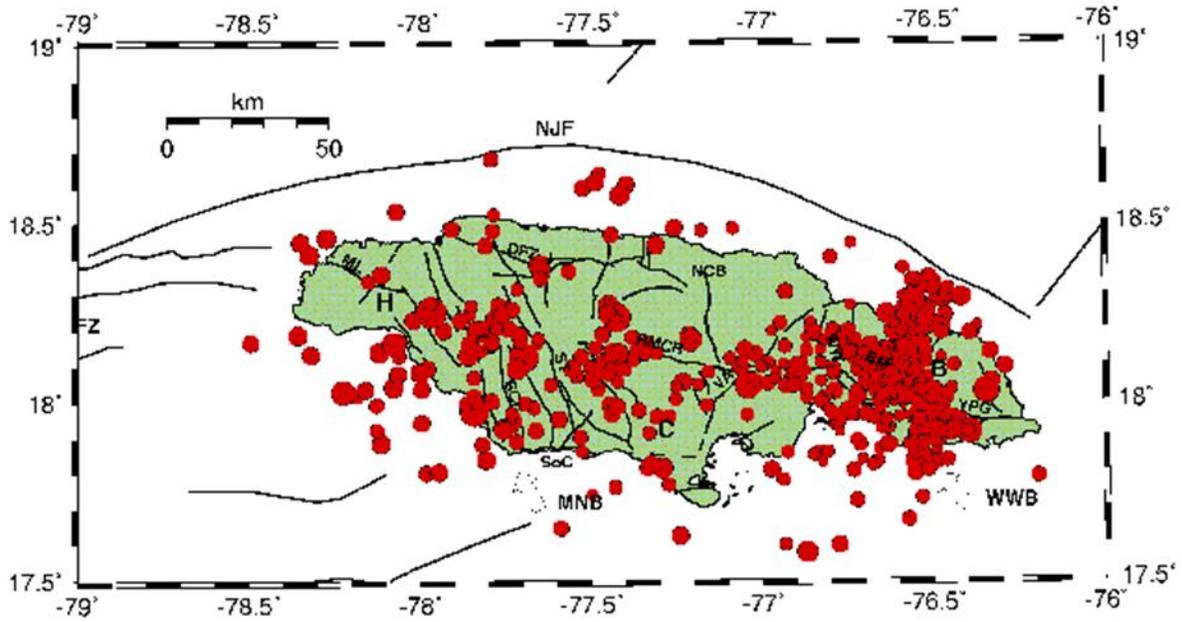


Figure 6.1: Jamaica Seismicity 1997–2007 (Mona GeolInformatics and UWI Earthquake Unit, unknown)



Figure 6.2: 100-year Return Period Earthquake of Magnitude VIII from within the Blue Mountains Block (Mona GeolInformatics and UWI Earthquake Unit, unknown)

6.1.3 Climate Change and Variability

Climate predictions for the St. Catherine area generally show an increase in temperatures continuing until the end of the century (CSGM, 2017). CSGM (2017) has also determined that rainfall is expected to decrease until the end of the century for St. Catherine and most of Jamaica. Projections for the south coast of Jamaica suggest that sea level may rise between 50cm and 80cm by the end of the century (CSGM, 2017).

6.2 Biological Environment

The site consists of former farmlands and the fields have become overgrown with secondary shrub vegetation. Large areas of the northern half are thickly overgrown with Guinea grass *Panicum maximum* at a height of approximately 0.7m. Guango trees *Samanea saman* are the most dominant tree species with the tallest specimens growing beside the Bower's Gully along the western side of the site.

The site is relatively flat, but with gentle undulations particularly on the western side where it descends into the bed of the Bower's Gully. The vegetation could be described in general terms as highly disturbed secondary field or fallow lands and does not have natural habitat zones or zonation. The current vegetation is very sparse and is struggling with the effects of a prolonged drought. The vegetative community is, however, not uniform and could be divided roughly into four zones (Figure 6.3). These zones contain very similar species, but are distinct in their growth form, relative abundance of species, amount of disturbance and length of time the area appears to have remained fallow. The zones are discussed in further detail below.



Figure 6.3: Vegetation Zones at the Whim Estates

The western side is influenced by the regular moisture from the Bower's Gully, however, most of the stream bed, particularly the northern half, is dry for the majority of the year. The northern quarter of the site is overgrown pasture with occasional trees. The Guango tree is most common, but there are also mango trees *Mangifera indica*, hog plum trees *Spondias mombin* and Bastard Cedar *Guazuma ulmifolia*. Most of the central half of the property is a grassland zone which is dominated mainly by tall Guinea grass *Panicum maximum*. The southern quarter is a mixture of Guango tree woodlands and Guinea grass (Figure 6.4). A small drainage ditch runs along the eastern side next to the housing development and this drain is overgrown with water plants, mainly Reedmace *Typha domingensis*.



Figure 6.4: Guango Tree Woodland and Guinea Grass

6.2.1 Flora

1. Mixed pasture – The northern pasture in the vicinity of the farm house is dominated by Guinea grass *Panicum maximum* which is very patchy and has more of a mixture of other grasses, weeds and trees when compared to the other zones. Most of the larger trees in this area were mangoes *Mangifera indica* (most were of the variety known locally as common or hairy mango), Bastard Cedar *Guazuma ulmifolia*, and hog plum *Spondias mombin* trees. Other frequently occurring trees in this zone included the cashaw tree *Prosopis juliflora*, lead tree *Leucaena leucocephala*, as well as several French cotton trees *Calatropis procera*. The trees in this zone were more abundant and closer together on the western side than the eastern side, which might be because it is less disturbed or because it benefits from proximity to water (Bower's Gully). The hog plum trees were a fairly abundant feature in the north-western corner of this zone, but were absent from the other zones on the site. The area immediately surrounding the farm house also has a few large trees such as a large tamarind tree *Tamarindus indica*, several coconut trees *Cocos nucifera* as well as other varieties of mangoes which have evidently been planted on the compound.

2. Overgrown pasture – The central portion of the site is dominated by a relatively open field which is dominated mainly by Guinea grass. Other species of weeds are also present mainly along roadways and trails because the dominant grass grows thick and averages over 0.7m in height. This growth appears to be somewhat effective in excluding many other species from competing for space and hence, the grass maintains its dominance in this zone. There are also several mango and Guango trees widely scattered in this zone, but the area is generally open (Figure 6.5).



Figure 6.5: Overgrown Pasture on Whim Estates

3. Guango woodland – The southern quarter of the site is a wooded area that is dominated by Guango trees. The trees are of medium height suggesting that the growing period has not been more than a few years. This is because Guango trees are relatively fast growing if they are in a suitable habitat, but they can grow quite large and will still require a few decades to reach their full size of up to 35–40m. This woodland has an average canopy height of up to 15m which is half of the potential height of these trees. Although it is not advisable to make predictions of age based on height alone, because many factors contribute to the rate of growth of any individual tree, the height of the trees indicate that they have been growing for 15 to 20 years. The other distinctive feature of this site is that the understory is dominated by Guinea grass, which has grown even higher and thicker than in the open areas of the overgrown field to the north because the upper canopy frequently shades it from the harsh drying effects of the sun.

4. Dry stream bed (Bower's Gully) – The Bower's Gully is an intermittent stream in the region of the project site, but has permanent flows in its upper and lower reaches. The stream flow regularly returns during periods of heavy rains and can continue for a few days to a few weeks afterwards depending on the amount of rainfall and the height of the water table. The woodland along the banks of the stream was dominated by very large Guango trees which grow on either side of the stream beds and provides shade cover over much of the river. Thick clumps of common bamboo *Bambusa vulgaris* and giant reeds *Arundo donax* also grow in sections along the edge of the stream. Several species of vines and other grasses such as African star grass *Cynodon nlemfuensis* also grow in the southern parts of the stream bed. It should be noted that the northern section of the stream appears to have been recently widened and trained into a more straightened channel form (Figure 6.6). The middle portion also showed evidence of the use of heavy equipment, but this section had not been channelised, while some sections

show evidence of removal of sand from the stream bed (Figure 6.7). The southern part of the stream is thickly overgrown with grasses and vines which suggest that this area receives inflows of water more often than the northern part of the river bed. The eastern and southern sides of the entire site are bounded by a drainage channel. This channel contained running water (at the time of these surveys) and support additional aquatic vegetation which is not currently present in the Bower's Gully such as Reedmace *Typha domingensis* and Water Pennyworts *Centella asiatica*.



Figure 6.6: Evidence of Channelling in the Bower's Gully north of Whim Estates



Figure 6.7: Evidence of Sand Mining in the Bower's Gully

6.2.2 Fauna

6.2.2.1 Birds

Only twenty-eight bird species were observed during the field visits. That was not unexpected given the small size of the area, its low floral diversity and high level of human disturbance on and surrounding the site. This, however, represents a small fraction of the possible species known to occur in nearby

habitats. Other factors such as the prolonged drought and season of the year have also contributed to a relatively low bird count. This site is not a significant habitat for many migratory species, but since more than half of the species that live in Jamaica are neotropical migrants, they would most likely be breeding in North America during this survey period.

The presence of permanent water and aquatic vegetation resulted in the detection of a few waterbird species, such as the Green Heron *Butorides virescens* and the Black-crowned Night-heron *Nycticorax nycticorax*, both of which were seen near the channels. The Glossy Ibis *Plegadis falcinellus* which feeds almost exclusively in muddy soil along freshwater streams and ponds was also observed.

Endemic bird species – In general, all the species encountered are common and widespread residents in Jamaica. Most of them are also very tolerant of human disturbances and are more likely to be encountered in suburban areas as well as in microhabitats within urban areas (e.g., gardens and parks), but are also observed in native forest habitats. Only three of Jamaica's twenty-nine extant endemic species were detected, namely, the Jamaican Woodpecker *Melanerpes radiolatus*, the Jamaican Vireo *modestus* and the Jamaican Parakeet *Eupsittula nana*.

Jamaican Woodpeckers are often associated with large trees with wide trunks and were commonly detected in the very large Guango trees growing along the banks of the Bower's Gully. At least one pair of Woodpeckers was observed taking nest bedding to a hollow they had created in one of these trees and this suggested they were nesting.

Jamaican Vireos are common in secondary and natural forested habitats in dry or wet areas throughout the island. This species is often very vocal and has an unusually loud voice for its diminutive size and it is also known to make a wide range of other sounds including mimicking the calls of other bird species and even non-natural sounds from its environment.

The Jamaican Parakeet *Eupsittula nana*, formerly known as the Olive-throated Parakeet *Aratinga nana*, has recently been reclassified as a distinct species from what is now called the Aztec Parakeet *Eupsittula astec* which is the new name given to the population in Mesoamerica and Central America. No species of birds considered to be "Endangered" under the International Union for Conservation of Nature (IUCN) Red List were observed on the site.

Migrant bird species – Neotropical migratory birds account for nearly half the total number of bird species occurring in Jamaica. This survey was conducted in July which is the summer season when all neotropical migrant species are on the northern breeding grounds. The species lists ([Appendix IX](#))

include the six most common Neotropical Wood Warblers that are known from the area and are most likely to return to this site. Migratory birds are known to have a very high site fidelity which means that they return to the same wintering and breeding grounds in Jamaica and North America.

Nocturnal birds – Surveys conducted at dusk and dawn identified several Barn Owls (*Tyto alba*) at a location near to the Bower's Gully in the southwestern corner of the site. Both species of Owls in Jamaica commonly roost in large trees in the daytime and they are particularly fond of large mango trees because of their height and dense foliage which provides concealment and a defence against predators as they roost during the daytime. Also, the fallen fruits of the trees are attractive to rats and mice that are a favourite prey for these birds.

The Antillean Nighthawk *Chordeiles gundlachi* is a migratory species that comes to Jamaica from South America in April to breed. This species is regularly observed in the area throughout their migration, however, they were not observed during these surveys.

No Jamaican Owls *Pseudoscops grammicus* were detected during the night visit, but this species is common in the area and should also be expected to be present. The only other night bird detected was the Black-crowned Night-heron (*Nycticorax nycticorax*) which was heard calling from the reeds in the southern drainage ditch. This bird is also a waterbird and it is often heard calling as it flies over wetland areas at dusk; this species also has a characteristic call which sounds like "Quok" which is also the local name for that species.

6.2.2.2 Butterflies

Only two species of butterflies were observed during the surveys, and this represents a small fraction of the actual number of species known from the area. This is due mainly to the effects of the prolonged drought in the area. Previous surveys for the neighbouring site indicated that more than eighteen species were present in the area. The Gulf Fritillary *Agraulis vanillae* (previously known as *Dione vanillae*) was the only large butterfly seen, while several of the much smaller fast-moving Skippers (members of the family Hesperidae) were observed, but not identified. The specimen observed was most probably from the group of Cane Skippers such as the Watson's Cane Skipper *Panoquina sylvicola woodruffi*.

6.2.2.3 Reptiles

The native reptiles of Jamaica are mostly endemic to the island, however, most species are very sensitive to human disturbance and are easily displaced by alien invasive species, particularly alien predators like the mongooses, cats and dogs. During these surveys the only types of reptiles detected were tree lizards. The endemic Jamaican Gray Anole *Anolis lineatopus* was seen on the trunk of a tree. Several individuals of the Jamaican Croaking Lizard *Aristelliger praesignis* species were heard calling from the trees all around the site at dusk and dawn. A reptile survey is likely to reveal more lizard species.

The Jamaican Pond Turtle *Pseudemys terrapen* was not observed, however, they often utilise water courses such as ditches, canals and streams as conduits from which to explore new areas looking for ponds or open water areas that may be a suitable habitat in which to settle.

The American Crocodile *Crocodylus acutus* is known to occur in the lower portion of the Bower's Gully nearer to the coast. The crocodile is locally and globally threatened and enjoys full legal protection in Jamaica. Although no crocodiles were seen during the surveys, crocodiles also travel along water courses particularly during periods of rainfall when the drains have more water. This might be a cause for concern for residents who may live in the community next to drains that could seasonally contain crocodiles, however, the nearby communities have effectively eliminated the threat by constructing a security wall around the perimeter of the community which prevents crocodiles and other wildlife from roaming into any potential conflict situations.

No snakes were observed in the area. Although there is potential for some of the smaller species to occur, they would be very rare and difficult to detect.

6.2.2.4 Mammals

The only mammal observed on the site was the Small Indian Mongoose (*Herpestes javanicus*). Additionally, two small herds of domestic goats *Capris hircus* (~30) and a small herd of cattle *Bos taurus* (~20) were found roaming the property and grazing on the grasses and shrubs. Neither rats nor mice were observed, but they are almost certain to be a feature particularly around the area of the old farmhouse. Feral cats and dogs are also known to be a feature in the surrounding housing developments and are also highly likely to be present.

6.2.2.5 Amphibians

No native frogs or toads were observed, however, the introduced species such as the Bullfrog *Rana catesbiana* and the Cane Toad *Bufo marinus* were detected in the thick aquatic vegetation growing in the drains along the eastern and southern sides of the site. A third introduced species, which is variously known as the Johnstone's Robber Frog, the Antillean Whistling Frog or Coqui *Eleutherodactylus johnstonei*, is also well known in the surrounding areas and although the dry conditions made it unlikely to be detected, it is also expected to be present. Unfortunately, all three species are invasive alien species that have been introduced and are now naturalised into most habitats islandwide. They are also believed to be partly responsible for the decline of many local species because many native amphibians do not tolerate human disturbance well, but these invasive alien species are not easily disturbed which gives them a clear competitive advantage.

6.2.2.6 Fish

The aquatic vegetation growing in the drains along the eastern and southern side was very dense and would probably make it difficult for fish to survive, however, a small open area near a bridge provided space for a few Mosquitofish, *Gambusia* sp. and probably the endemic Black-bellied Limnia *melanogaster* as well. Additionally, in the south-western corner of the site, there was a bridge over the southern canal with a concrete weir with a plunge pool that appears to allow excess water from the drainage ditch to flow over the weir and into the Bower's Gully. No standing water could be seen in the ditch or the gully at this point, however, the plunge pool contained water with fish occasionally turning at the surface. This could have contained several species of fish, however, the only species identified was the African Perch or Tilapia *Oreochromis mossambica* formerly known as *Tilapia mossambica*.

6.2.3 The Portland Bight Protected Area

This development is located within the boundaries of the Portland Bight Protected Area (PBPA) (Figure 6.8). It is Jamaica's largest protected area and has been in existence since April 1999. The management of Jamaica's proposed system of protected areas is the responsibility of the National Environment and Planning Agency (NEPA) and their policy is to delegate some of this responsibility to local non-governmental organisations (NGOs). The Caribbean Coastal Area Management (C-CAM) Foundation is a local environmental NGO that has been delegated some management responsibilities within the PBPA since 2003. The site of the Whim Estate is not located within or near to any area that is currently designated as highly ecologically sensitive or has been zoned for any sort of special protection under the PBPA management plan.

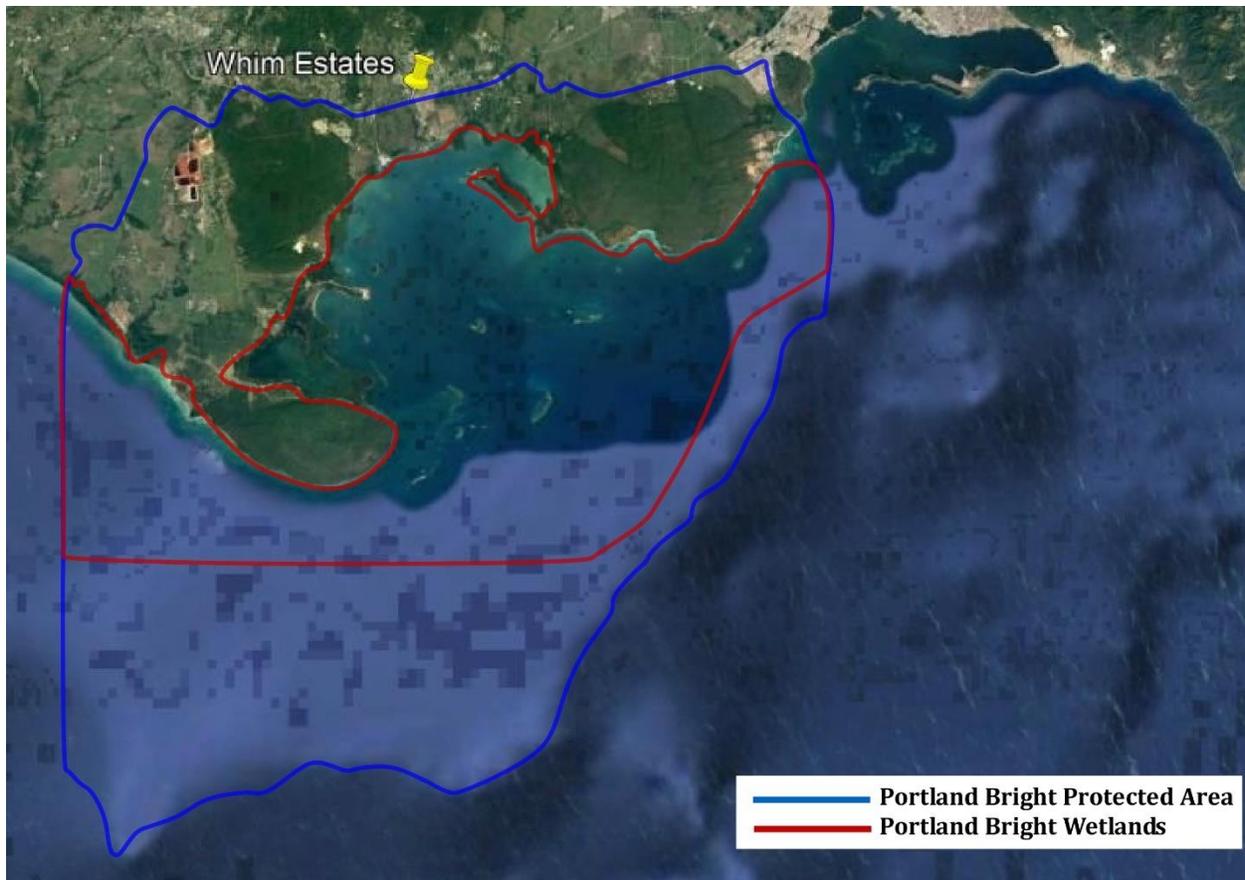


Figure 6.8: Location of Project Site within the PBPA

6.3 Socio-economic Environment

6.3.1 Heritage

As stated in the New Harbour Village I, II and III EIA (ESL, 2006), the subject property once formed a part of the old Whim property. Sugarcane, tobacco, cattle and other livestock were well established activities on the property. A structural foundation was discovered in the area of the NHV II before construction in 2006 and this caught the attention of the Jamaica National Heritage Trust as it was believed that this may have been a part of the Whim/Kelly Great House. The EIA for NHV I, II and III recommended watching briefs for these sites, however, in the construction of New Harbour Village II (adjacent to the Whim Estates) no further evidence was found to indicate that the project area has any cultural or heritage significance.

The EIA conducted for Highway 2000 (ESL, 2007) referred to the Strategic Environmental Assessment (SEA) done along a wide corridor in 1999–2000 for the highway from Sandy Bay to Williamsfield. The

area investigated included the majority of the project site. The SEA identified a list of heritage assets of concern (Table 6.1) (provided by JNHT) along a wide corridor for Highway 2000 which lies just north of the project site. A view of the list indicates that no assets of interest lie within the project area.

A search of the JNHT 2017 List of Heritage Sites and National Monuments was also conducted and no heritage sites or national monuments were identified or declared for the project site. The JNHT was also provided with the site location in July 2018 and has not indicated any areas of interest in the project area up to publishing of this EIA.

Table 6.1: Listed Sites noted within the Highway 2000 Corridor (Taken from: Dessau Soprin International, 2000): Source Jamaica National Heritage Trust (ESL, 2007)

Location	Grid Reference	Nature of Site	Description of Monument
Freetown	233900E/141900N	Village	Taino settlement (650AD). Post-emancipation village (1900s African-Jamaican, Anglo/Jamaica)
Toby Abbot		Pen	Taino settlement (650AD). Anglo-Jamaica influence
Inverness	230300E/140100N	Pen	Taino Settlement (650-1950AD). Important sisal hemp factory Taino, Anglo-Jamaica influence
Free People		Church	18 th century settlement of free Negroes, historic church
Hunts Pen		Church	18 th century structure
Sandy Bay		Caves (3)	Several limestone caves housing bats, guano
Halse Hall		Estate, Great House and tombs	18 th century great house on Jamaica Gazette List Associated with an early settlement family
Belle Plain		Estate	Former sugar cane plantation, old ruins, works Anglo-Jamaican influence
Toll Gate (Erin)		Estate	Sugar plantation. Possible ruins. Toll was taken not far from this property
Scotts Park	206400E/153400N	Church	18 th century structure
Porus		Midden	Former Taino settlement which may contain vernacular structures
Hope		Pen	Old cattle range which may have old stone works and other structures

Williamsfield		Historic Town	19 th century settlement, early Pen-church, post office, great house, Anglo-Jamaican influence
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6.3.2 Demographics

The project falls within the Old Harbour/Old Harbour Bay Local Planning Area (Figure 3.1). Therefore, the community catchment area considered includes the Old Harbour and Old Harbour area. In 1991, the population of Old Harbour was 17,966 (PIOJ, 2007) and this grew to an estimated 23,610 by 2011 (Population Census, 2011). Old Harbour is considered to have one of the highest growth rates in Jamaica and the population and town is continually growing and spilling over towards Old Harbour Bay (PIOJ, 2007). Old Harbour Bay had an estimated population in 2011 of 5,870 people.

The PIOJ has estimated growth rates for Old Harbour with and without major housing development projects; with major housing developments, PIOJ has projected an estimated population for Old Harbour of 146,300 by 2020, and for Old Harbour Bay 20,565 by 2030 (Table 6.2).

Table 6.2: Projected Population for Old Harbour and Old Harbour Bay (PIOJ, 2007)

Area	1991	2001	2005	2010	2015	2020	2025	2030
Future Population Projections without major housing developments								
Old Harbour	17,966	23,823	27,432	31,589	36,375	41,887	48,234	55,543
Future Population Projections with major housing developments								
Old Harbour	17,966	23,823	31,685	78,577	136,729	146,300	156,540	167,498
Old Harbour Bay	5,591	6,344	8,374	17,502	18,972	20,565	22,292	24,165

6.3.3 Existing Infrastructure

6.3.3.1 Electricity

Both high and low voltage overhead wires were observed traversing the site. There are two sets of power lines: one entering from the north, that is used to supply power to the existing infrastructure on site; the second runs from the south, and anecdotal reports suggest that this line is not active (Figure 6.9).

The Jamaica Public Service Company (JPS) currently provides electricity to the general area. This would be the source of the power to the development and will make power supply fairly simple.



Figure 6.9: Existing Power Lines traversing the Site

6.3.3.2 Water

Potable water in the area is provided by deep wells and from the NWC network. Currently, the adjoining NHV II water supply is provided from wells within the area through the NWC service and network. There are currently two wells on the property.

An abandoned irrigation canal coming from the west crosses the site towards the south of the property (Figure 4.11). As previously mentioned, the developer intends to relocate this canal to accommodate the development.

6.3.3.3 Telecommunications

Both wired, and wireless telecommunications services are available within the nearby areas and communities.

6.3.3.4 Sewer Line

There are currently no existing sewer lines on Lot 2A, the project site for the Whim Housing Development. However, a 100mm sewer line runs north of the site on Lot 2B (Figure 6.10). This sewer line originates from the New Harbour Village IV housing development to the north. The sewer line runs south, crossing Highway 2000 under the bridge at Bower's Gully before heading east through the Lot 2B Reserve. The sewer line then enters New Harbour Village II where it runs along the eastern boundary of the property before connecting to the sewer system in New Harbour Village II.

A 'Grant of Easement' was given by Old Harbour Estates Limited to Gore Development Limited to facilitate the passage of the sewer line in 2017 ([Appendix X](#)).

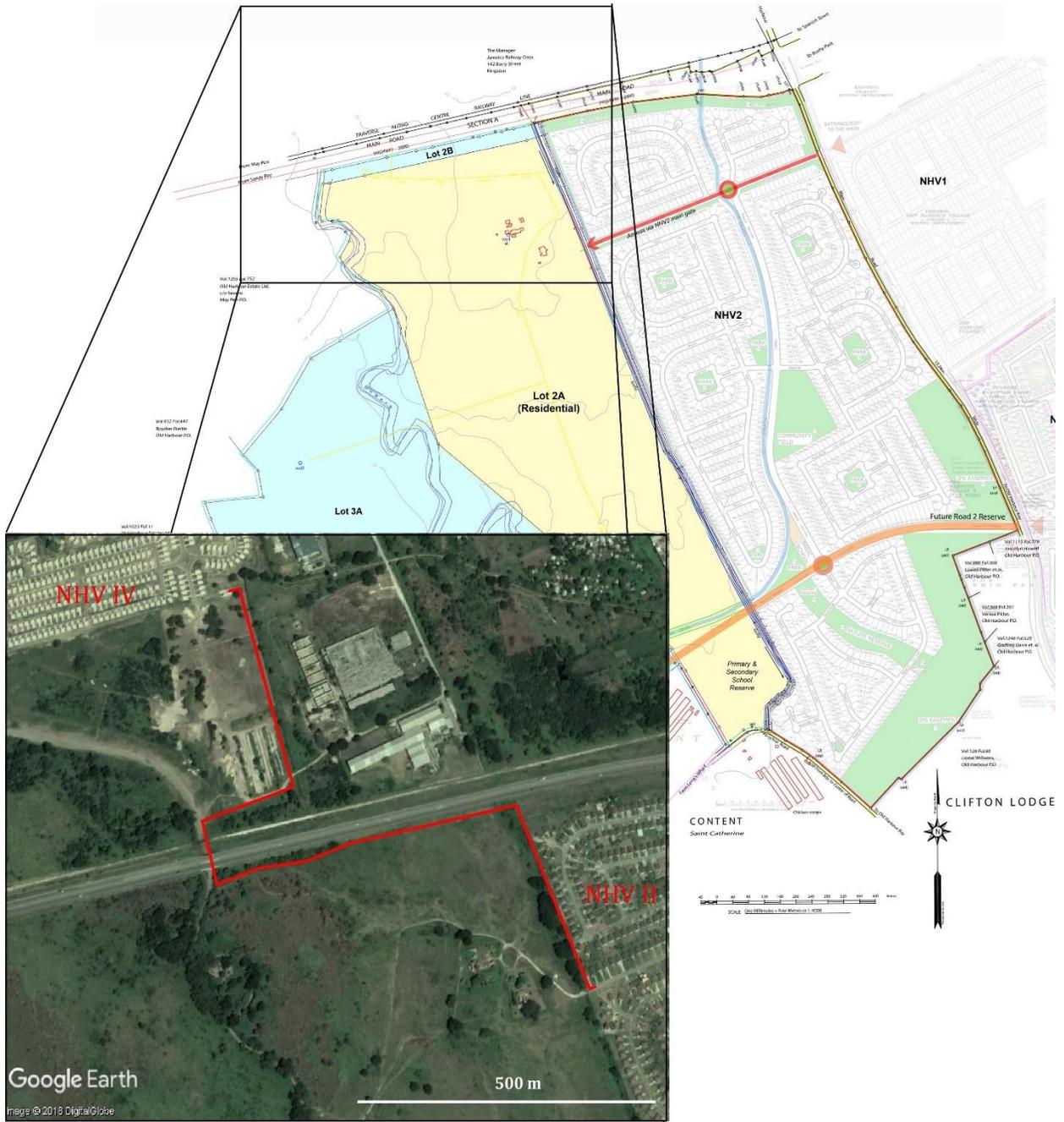


Figure 6.10 SewerLine (shown in red) from NHV IV which passes through Lot 2B Reserve and joins the Sewer System in NHV II

6.3.3.5 Roads

The area is serviced by the Old Harbour to Old Harbour Bay main road (Figure 4.13) and this can be accessed through the current road reserve through NHV II. A secondary road reserve is located further south and there is also a parochial road with access to the south of the property and another road to the west. Highway 2000 (Kingston to May Pen) forms the northern boundary of the property with exit and entrance ramps that can be assessed from the main road.

There are existing unpaved roads within the property that may have been used as farm roads in the past (Figure 6.11).



Figure 6.11: Google Earth Image showing existing Internal Roadways

6.3.3.6 Public Transportation

Transportation in the area is provided by mainly privately-owned and public passenger vehicles (taxis and bus services). Currently, the Jamaica Urban Transport Company (JUTC) has a premium bus service to the New Harbour Village housing developments (Table 6.3).

Table 6.3: Details for the JUTC Bus Service to NHV (JUTC, 2018)

Route #	Origin	Destination	Via	Depot	Origin to Destination	Depot to Origin	Depot to Destination	Route Type
132	New Harbour Village	Cross Roads	Vineyards Toll, Washington Boulevard, HWT, New Kingston	Portmore	45 km	28 km	17 km	Premium Express Service
131	New Harbour Village	Cross Roads	Vineyards Toll, Marcus Garvey Drive, City	Portmore	45 km	28 km	17 km	Premium Express Service

6.3.4 Traffic

Highway 2000 runs along the northern boundary of the proposed development. An exit/entrance ramp was recently added in Old Harbour, thus improving the drive time to Kingston and other nearby urban centres. The Old Harbour to Old Harbour Bay main road provides the present access to NHV II and will serve as the access to Whim Estates as well. It is a two-lane 24-foot wide paved road. The roadways in the general area of the Whim Estate are generally flat and paved. Except for Highway 2000, all other roads are undivided, multi-lane roads (Figure 6.12). The major intersection which is considered is the South Street Intersection and the on-off ramps with Highway 2000.

South Street provides the access for residents in the NHV I, II and III as well as residents in Moores Pen, Terminal Road and Old Harbour Bay. The current traffic volumes are not considered heavy by the Old Harbour Police until reaching the Old Harbour City Intersection.

A Traffic Impact Study (*Whim Report III, Premier Land and Water, 2018*) indicated that the major intersection of South Street and the on-off ramps with Highway 2000 are already operating above capacity.



Figure 6.12: Main Roads around Whim Estates

6.3.5 Solid Waste Management Facilities

Solid waste collection is the responsibility of the National Solid Waste Management Agency (NSWMA). The project area is within the St. Catherine B Zone with scheduled collection every Monday. Collection within the St. Catherine B Zone is contracted by the NSWMA to private companies or truck owners. The NSWMA reports that currently the collection service provided is once every 9 days; this exceeds by two days the recommended waste collection schedule of once every 7 days. The collected waste is carried to the nearest waste disposal site, which is the Riverton Landfill.

6.3.6 Health Services

As commented on in the EIAs for NHV I, II and III, the nearest hospitals are the May Pen Hospital and the Spanish Town Hospital, both of which are Type B facilities. The May Pen Hospital has approximately 170 beds, while the Spanish Town Hospital has of 430 beds and is generally the preferred hospital of choice for emergencies. Both hospitals are approximately 20km away and it takes generally between 15 to 20 minutes' drive from the Whim Estates.

The Old Harbour Health Centre (Figure 6.13) is located less than 10 minutes' drive from the Whim Estates and is situated in Old Harbour (Figure 6.14). The Old Harbour Health Centre is a Type 3 facility; however, it operates with both staff and equipment constraints to meet the growing demand. The Old Harbour Health Centre also provides satellite services to other communities such as Bellas Gate, Brown's Hall, Bartons, Red Ground, Old Harbour Bay and Spring Village.



Figure 6.13: Old Harbour Health Centre

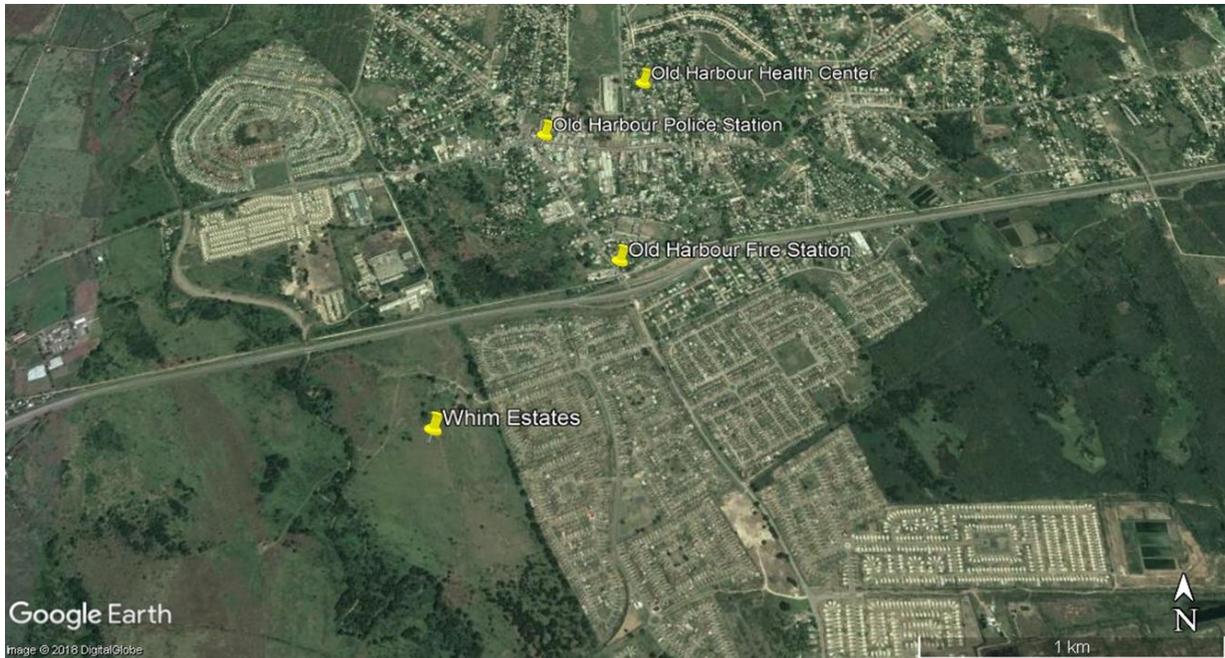


Figure 6.14: Location of Health Centre, Fire Station and Police Station in relation to Whim Estates

6.3.7 Fire Services

The Old Harbour Fire Station is located about 1km from the Whim Estates which is less than 5 minutes' drive (Figure 6.14 and Figure 6.15). The Fire Station currently only has one fire engine (unit) available and on average, responds to 3 to 5 calls per day. These are mostly bush fires during the dry season. The Fire Prevention Department plays an active role in educating and sensitising the public about fire prevention. This has allowed for a general decrease in fires at residential facilities.



Figure 6.15: Old Harbour Fire Station

6.3.8 Crime and Police Services

The Old Harbour Police Station is located less than 2km, which is less than 10 minutes' drive from the Whim Estates (Figure 6.15 and Figure 6.16). A police post is also located in Old Harbour Bay; however, this post only serves the Old Harbour Bay area and will not service the Whim Estates unless the Old Harbour Bay Police cannot attend to the emergency reported. In 2009, the Old Harbour Police Station had a force of about 40 officers and this has not changed over the past few years and they are constrained by the lack of personnel and transportation resources.



Figure 6.16: Old Harbour Police Station

6.3.9 Other Services

Within Old Harbour and Old Harbour Bay, various other facilities and services are present. These are listed in Table 6.4: Social Facilities in Old Harbour and Old Harbour Bay (SDC, 2014 and SDC, 2017).

Table 6.4: Social Facilities in Old Harbour and Old Harbour Bay (SDC, 2014 and SDC, 2017)

Service	No.	Area	Name
Old Harbour			
Church	36	Within	
School	30	Within	1 Vocational – HEART Trust NTA 1 Community College – Portmore Community College High School – Old Harbour High School 1 All Age School – Planters Hall 2 Preparatory School – Monsignor Collin, Old Harbour Prep 5 Primary Schools – Davis, Good Hope, Bois Content, Old Harbour, Marlie Mount 20 Early Childhood Intuitions
Tax Office	1	Within	Old Harbour Tax Office
Court House	1		Old Harbour Court House
Post Office	1	Within	Old Harbour Post Office
Cemetery	1	1 km	Church Pen (St. Dorothy's)
Market	1	Within	Old Harbour Market
Financial Institutions	6	Within	Bank of Nova Scotia Jamaica Ltd. National Commercial Bank Jamaica National Building Society People's Cooperative Bank First Heritage Cooperative Credit Union St. Catherine Cooperative Credit Union
Library	1	Within	Old Harbour Library
Old Harbour Bay			
Church	12		n/a
Schools	6		n/a
Police Station	1	Within	Old Harbour Bay Police Station
Post Office	1	Within	Old Harbour Post Office

7 Public Participation

As detailed in Section 2, the stakeholder consultations conducted followed three different approaches:

1. Community Questionnaires
2. One-on-one Interviews with Key Stakeholders
3. Group Stakeholder Meetings

The results of these are discussed below.

7.1 Community Questionnaires

A community questionnaire was developed ([Appendix XI](#)), and 200 persons were canvassed throughout the six communities surrounding the proposed Whim Estates Housing Development (Figure 7.1). The most relevant questions are discussed below, and additional results can be found in Appendix XII.



Figure 7.1: Communities surveyed

7.1.1 Perception of the Project by the Community

Figure 7.2 shows that 31% of the 200 respondents interviewed in the surrounding communities indicated that the project is very good and 44% said it was good. Respondents in the Old Harbour area had the highest overall rate of perceiving the project as good (82%). Respondents in Moores Pen had the lowest approval rating (68% good) for the project. Overall, only 6% of all respondents had a poor perception of the project (disapprove or highly disapprove of the project). An average of 17% of respondents were neutral about the development and 2% provided no responses.

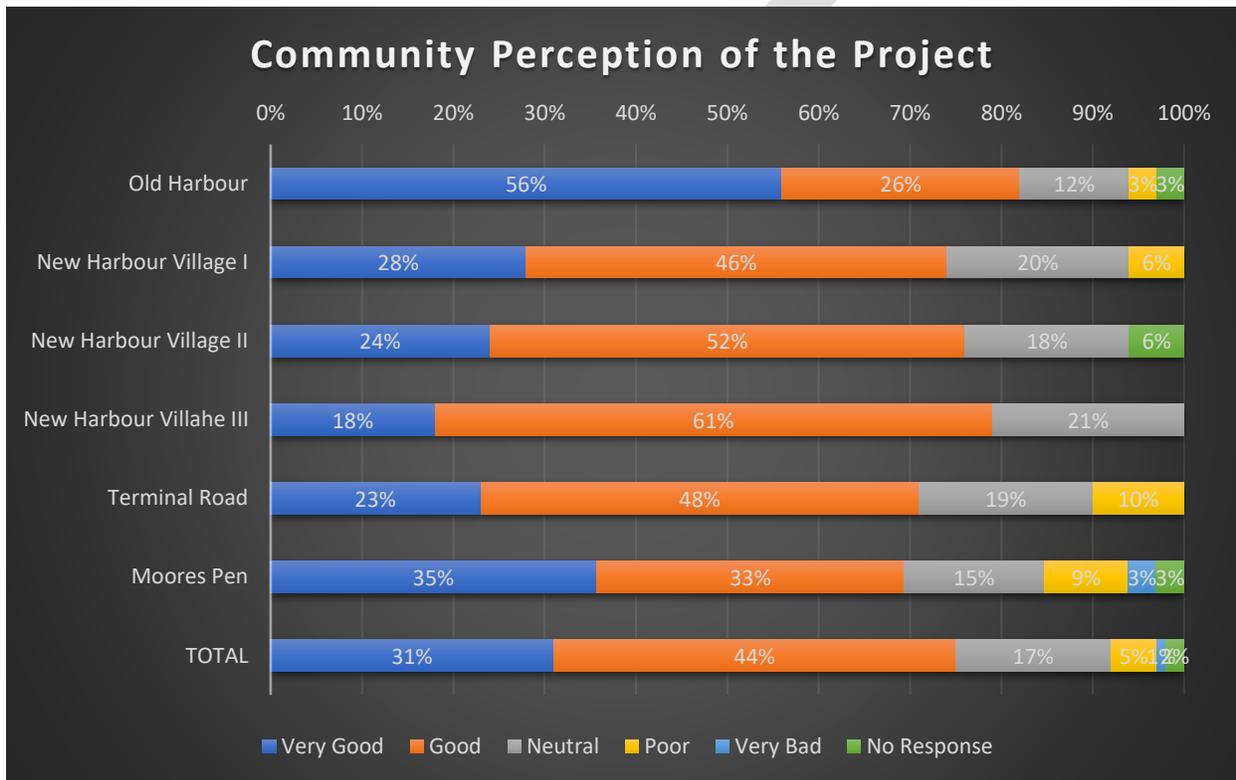


Figure 7.2: Perception of the Project by the Community

7.1.2 Community Views of the Project

Seventy-nine percent of the total respondents indicated that the Whim Estates Housing Development was very necessary or necessary and only 9% considered it to be unnecessary or very unnecessary. Seven percent (7%) had no perception about the project and 5% of the respondents did not give any response (Figure 7.3). Ninety-one percent (91%) of respondents from Old Harbour indicated that the project is necessary with only 3% believing it was unnecessary and 6% giving no response. Respondents from New Harbour Village III and Moores Pen had the highest responses to the project being unnecessary for the area, with 12% each.

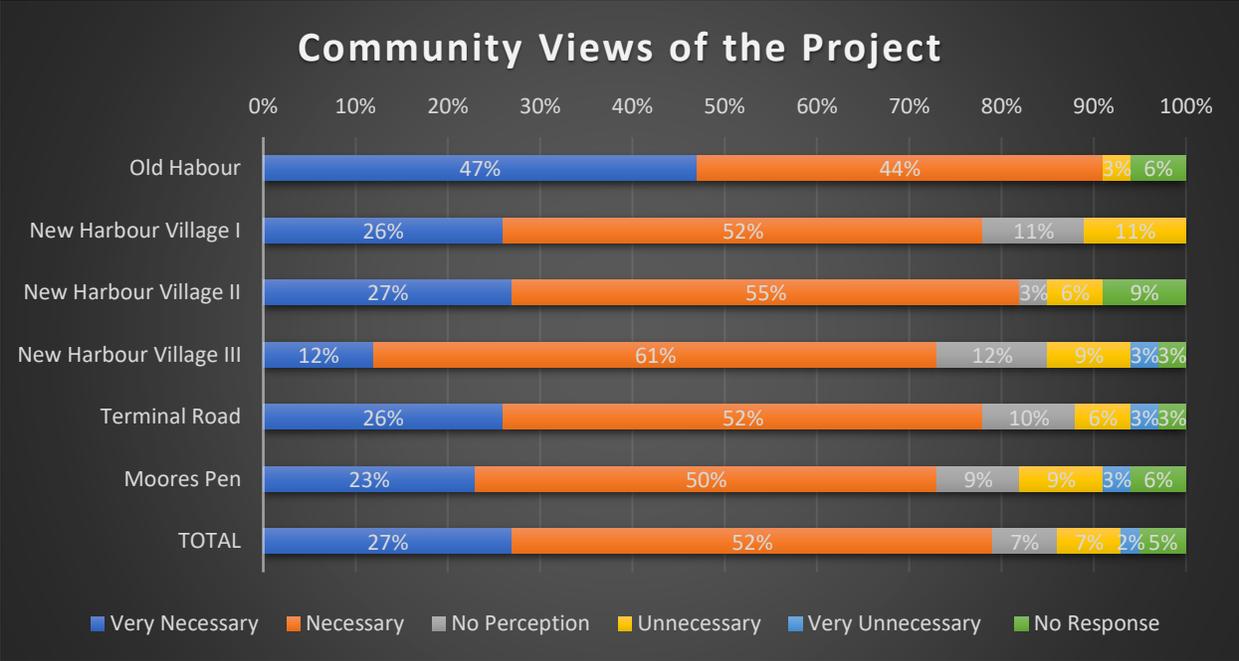


Figure 7.3: Community Views of the Project

7.1.3 Community fears/reservations about the Project

Overall, 62% of all respondent had no fear or reservations about the development, while 15% believed that it is likely to cause an increase in crime (Figure 7.4). Respondents also feared or had reservations about the affordability of the homes, the changes in land use, the increase in noise level and possible sewage disposal challenges. Other fears and reservations (19%) included decreased water supply, increased traffic and pollution. Respondents of New Harbour Village I and Moores Pen had the highest response of having no fears or reservations about the project, while respondents of New Harbour Village III had more fears and reservations about the project than the other communities surveyed. They generally feared that the development will encourage crime, cause an increase in sewage waste and increased traffic.

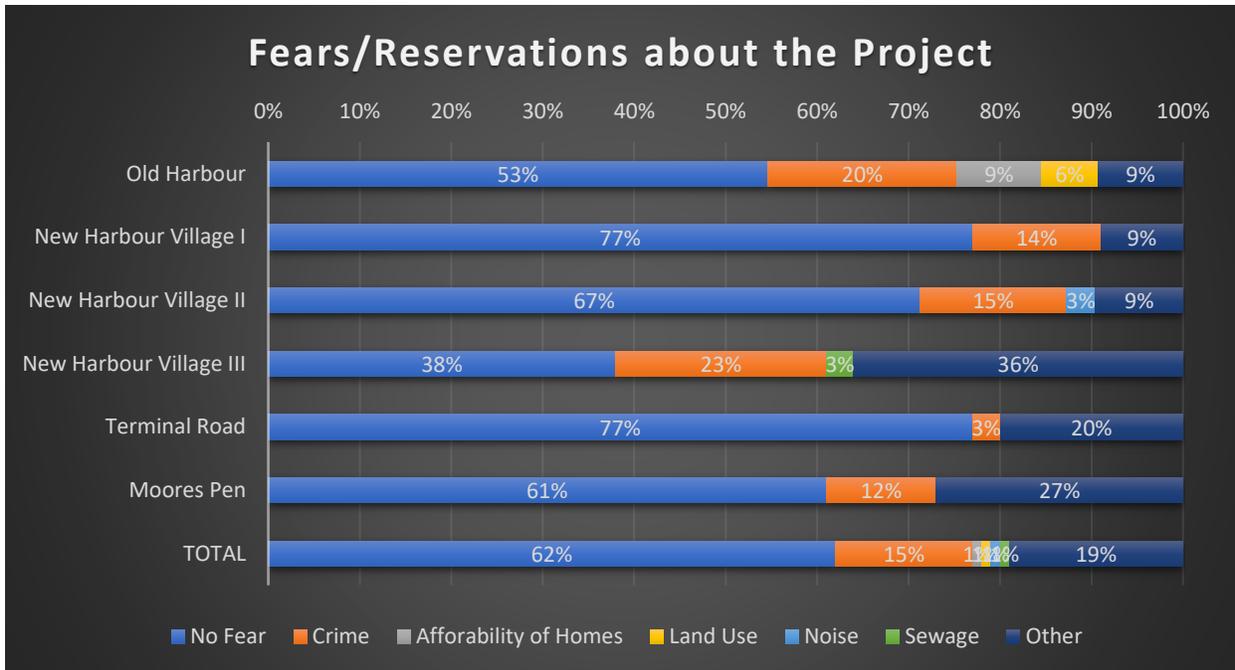


Figure 7.4: Fears or Reservations about the Project

7.1.4 Main Benefits from the Project

Respondents generally believed that employment will be the main benefit they will get from the housing development. Fifty-seven percent (57%) of all respondents indicated that jobs will be created during the construction and operational phases of the project (Figure 7.5). Respondents of Terminal Road (65%) and Moores Pen (70%) had the highest expectation of employment. Eleven percent (11%) of all respondents indicated that the housing development will create greater access to housing in the area and 7% of all respondents said that the development will increase business sales in the area. Respondents in Old Harbour and New Harbour Village II (17% each) believed that business sales will increase. Fourteen percent (14%) of total respondents said there will be no benefits from the development with the highest response (30%) coming from the New Harbour Village III community.

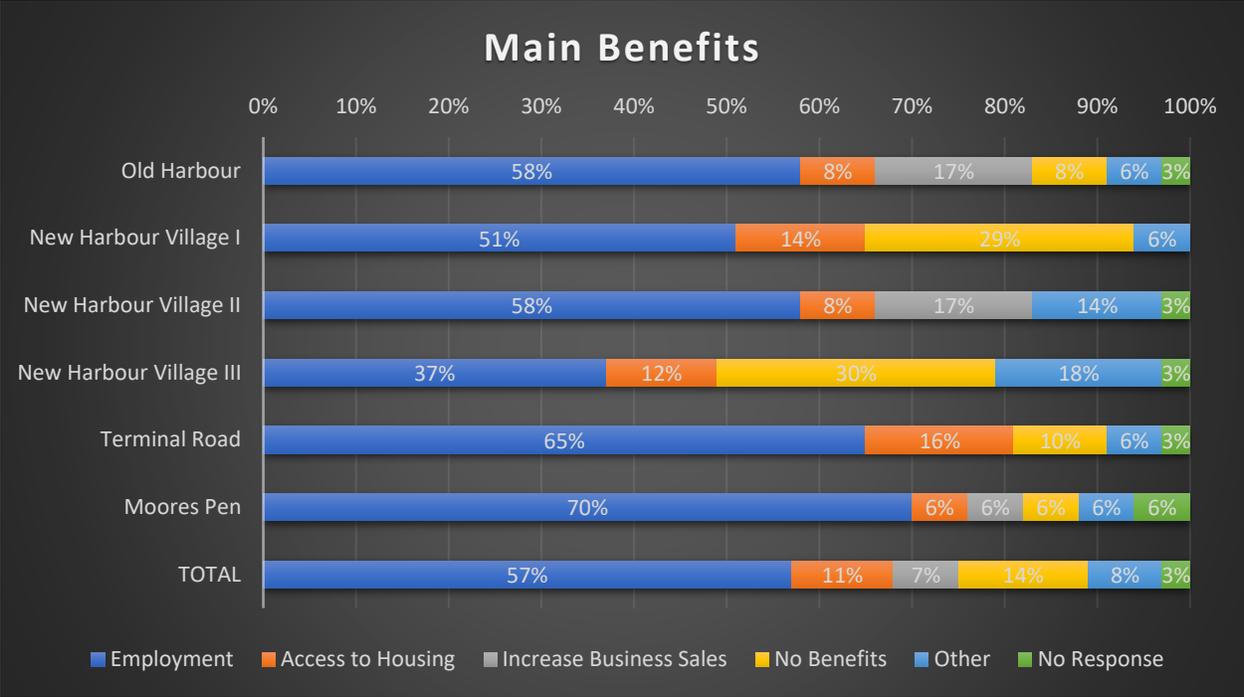


Figure 7.5: Main Benefits from the Project

7.1.5 Environmental Concerns associated with the Project

When asked about the main environmental concerns associated with the project, 51% of all respondents said there were no environmental concerns (Figure 7.6). Seven percent (7%) voiced the view that air pollution will be a concern as well as deforestation. Respondents also expressed concerns regarding water supply, noise pollution and sewage. Other concerns included dust and decrease in rainfall. Respondents in Moores Pen and NHV II had the fewest environmental concerns with 67% and 64% respectively indicating that they have no concerns. Respondents of New Harbour Village III had the most environmental concerns which included drainage and flooding, air pollution, noise pollution, sewage and water supply.

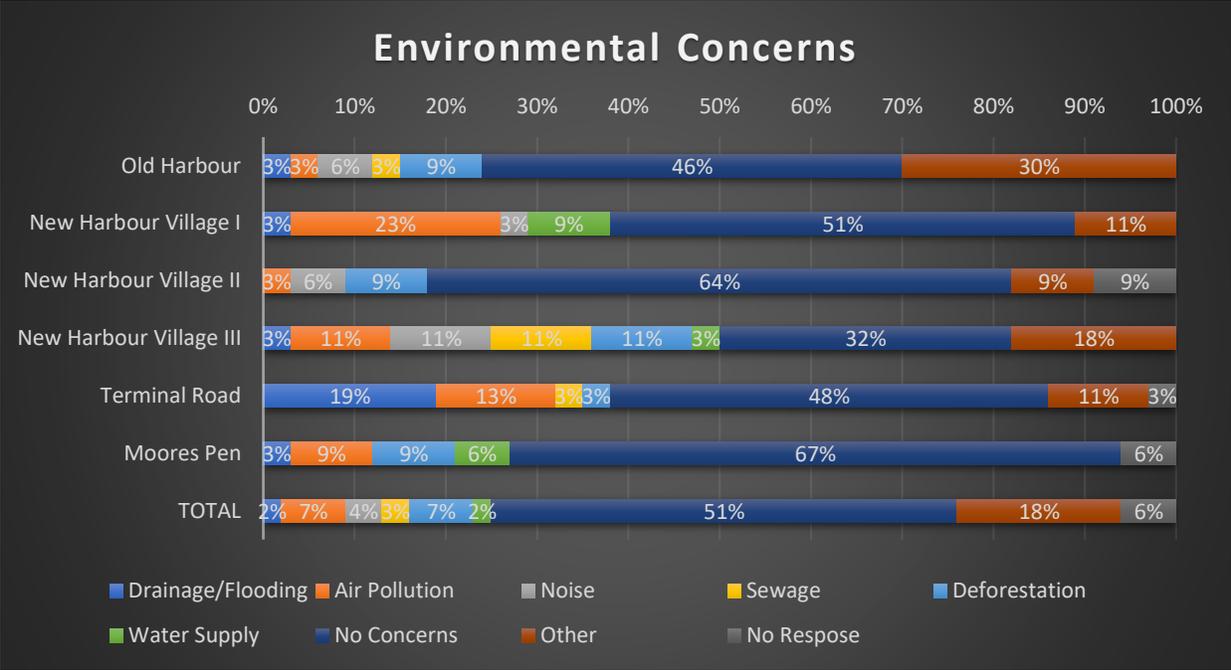


Figure 7.6: Main Environmental Concerns

7.1.6 Community Views on Flooding in the Area

Eighty-one percent (81%) of all respondents indicated that they have not experienced flooding in their communities, while 6% indicated that they have experienced flooding (Figure 7.7). The community along Terminal Road had the highest response to flooding in the community (13%). On average, 13% of respondents did not know if flooding was a problem in the community.

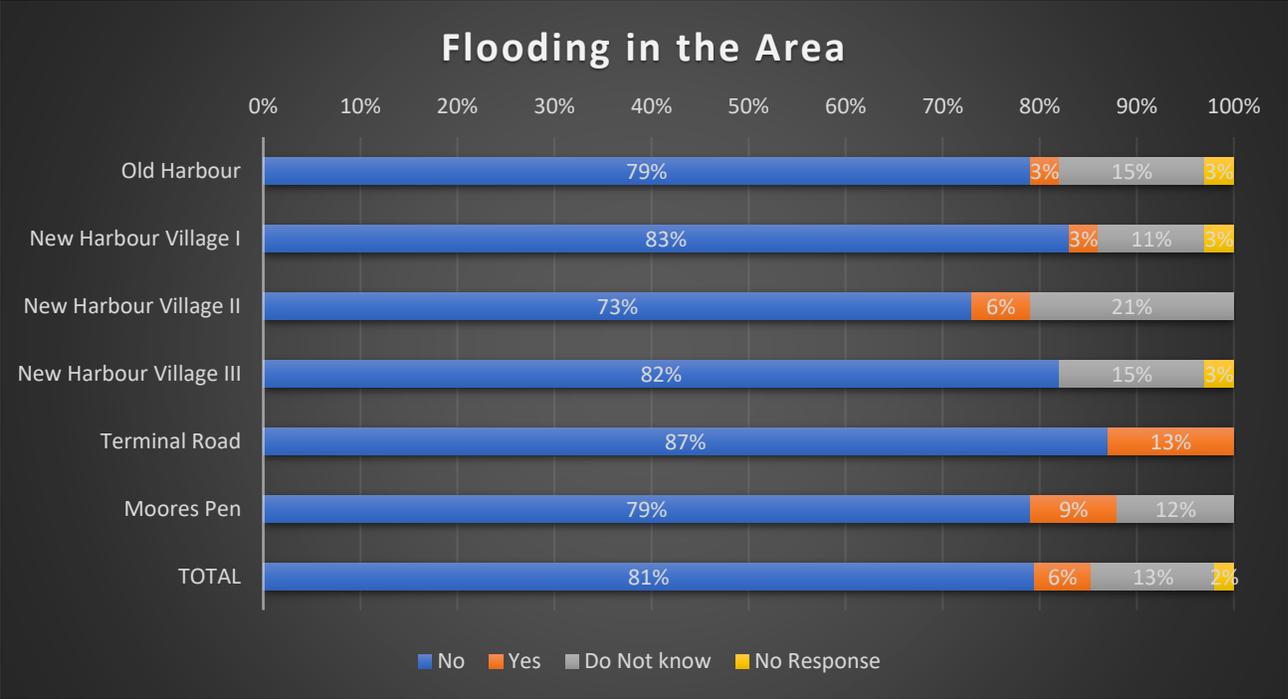


Figure 7.7: Flooding in the Community

7.1.7 Alternative Options for Land Use

Respondents were asked about alternative options that should be considered for the use of the property. Ten percent (10%) of all respondents said there were no other alternatives, thus suggesting that the housing development was best suited for the property. Twenty-two percent (22%) of respondents believed that it should remain as a farm and 30% (highest) believed that it should have a commercial use (Figure 7.8). The respondents who indicated commercial use wanted the space to be used for a plaza, mall, shopping centre or entertainment centre. Other uses indicated by the communities for the area included industrial uses, educational uses such as the construction of schools and technical teaching facilities and medical facilities such as a health centre or hospital. Respondents from New Harbour Village I had the largest number of responses recorded (20%) and these responses indicated that the housing development was the only option and there was no alternative; respondents from New Harbour Village II and III, on the other hand, had the highest number of responses that indicated that there were other alternative uses for the area.

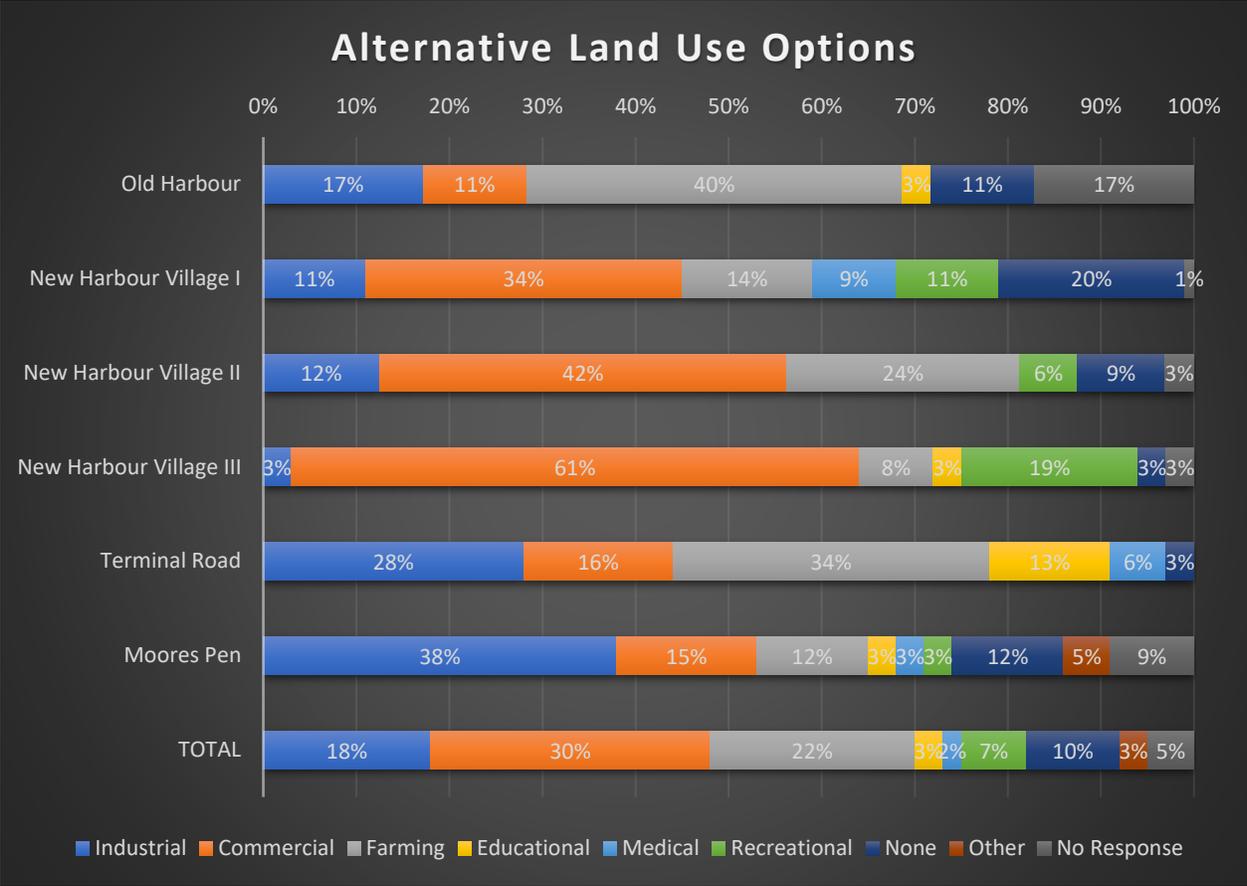


Figure 7.8: Alternative Land Uses

7.1.8 Disruption to the Communities by the Project

Eighty-one percent (81%) of all respondents indicated that the project will not be disruptive to the communities, while only 14% indicated that the project will be disruptive with 4% indicating that it will be very disruptive. Residents of Terminal Road (16%), Moores Pen (15%) and New Harbour Village II (12%) had the most responses which indicated that the project will be disruptive or highly disruptive (Figure 7.9). Respondents of Old Harbour indicated the least disruption to the community with only 6% of respondents indicating that the project will be disruptive.

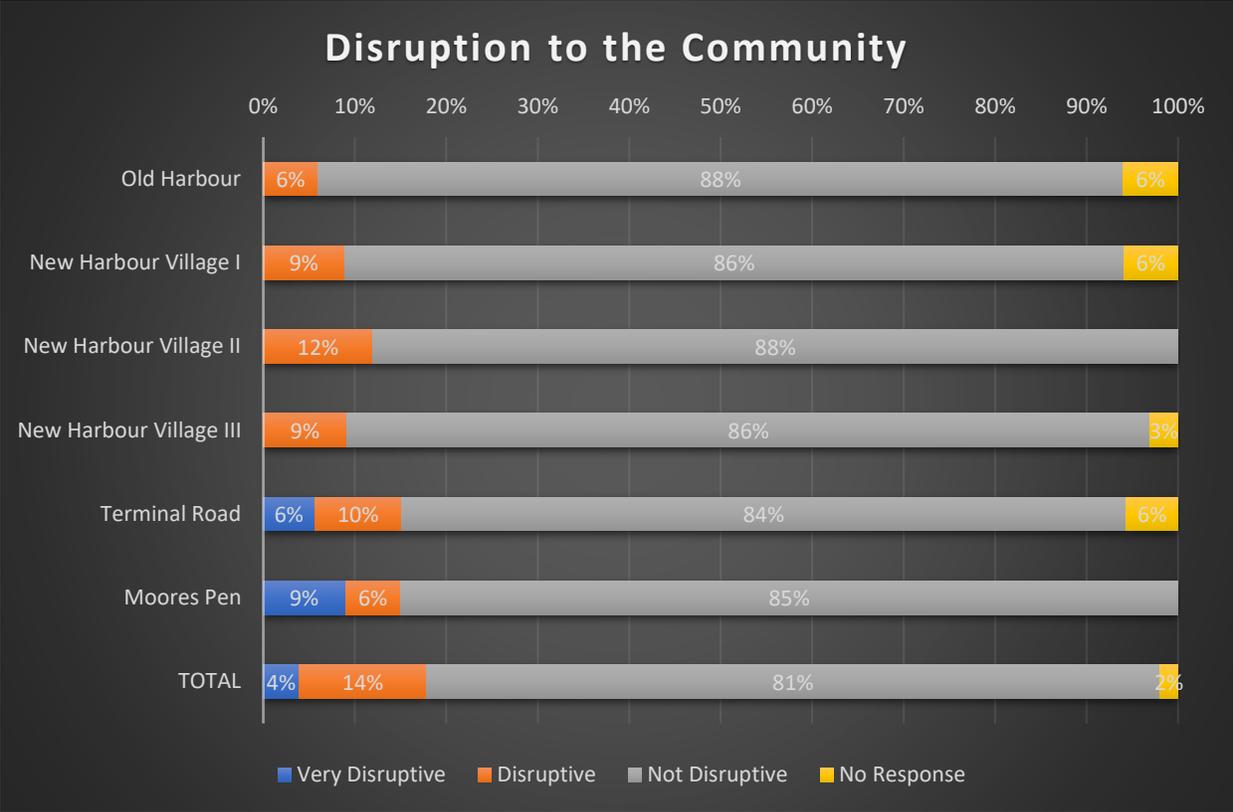


Figure 7.9: Will the project be disruptive to the community?

7.2 Key Stakeholder Interviews

Several consultations were conducted with key stakeholders in the community. These included business places, fire services, the health centre and the New Harbour Village II Citizens’ Association.

7.2.1 Jamaica Fire Brigade (Old Harbour)

The Jamaica Fire Brigade (JFB) indicated that there is no problem with new and large housing projects as people are generally sensitised and take precautions to prevent fires. Most of the calls are to deal with bush fires, which average about three per day and there has not generally been an increase in calls relating to fires at homes or businesses.

The only challenge they have experienced with new housing developments are poor/inadequate fire hydrant systems or connections. Currently, the fire hydrant at NHV I is the main source to refill the fire trucks, however, one of the NHV II hydrants gives a lot of trouble and is usually not used for refilling. Other locations used are hydrants near the Aviary and Marley Mount.

7.2.2 Old Harbour Health Centre

Over the years, the Old Harbour Health Centre has seen an increase in the number of patients seen on a daily basis. At present, they average 300 patients a day and this is over their current capacity. While there have been plans for the construction of a larger facility, this has not yet happened.

The general concern for the Old Harbour Health Centre is the expected increase in the number of persons using the facility as the population of the area increases. They also have challenges accessing the gated communities to carry out health and family-related investigations.

7.2.3 Old Harbour Business Places

There were several business places in Old Harbour, which included at least five wholesalers and retailers, three hardware stores, several banks, a market and other commercial and food outlets. The consensus from the business owners was that they welcome the new housing developments as they expect that they will gain increased sales from the large residential population nearby.

They expressed no concerns about increased crime or traffic as they do not believe this has changed over the past few years.

7.2.4 National Solid Waste Management Agency

Currently, the NSWMA is experiencing delays in the collection of solid waste in the Old Harbour/Old Harbour Bay areas as the quantity of waste to be collected exceeds the capacity of the number of trucks available. The original schedule indicated that solid waste collection would occur once every seven days, however, the current schedule for collection is once every nine days. This is expected to increase as the new large housing developments increase the solid waste output in the area. The NSWMA does not have the resources currently to increase the number of trucks contracted.

7.2.5 Water Resources Authority

The Water Resources Authority indicated that they have a rigorous process for determining the quantity of water allowed to be produced from each well before a well licence is granted. This process ensures that the aquifer can adequately recharge in a sufficient amount of time without causing major drawdown and impact to other nearby pumping wells or cause salt water intrusion.

7.2.6 New Harbour Village II

A stakeholder consultation was held with executive members of the New Harbour Village II Citizens' Association ([Appendix XIII](#)). The project description as outlined in Section 4 was presented to the

members. The executive body of the Citizens' Association expressed several concerns about the Whim Estate Housing Development, because of its proximity to New Harbour Village II.

The initial concerns focused on the construction phase of the project. There were queries regarding the working hours, measures being put in place to control dust, and mechanisms for addressing grievances. They also expressed concern about the transportation of construction material and equipment to the site, and asked about the main access point/s to the construction site.

The association also expressed concerns about the sewer connection as they have been experiencing major problems since New Harbour Village IV has been connected to NHV II sewer. Issues include foul odours and overflowing of the sewer.

The use of the land was also a concern as the NHV II association members reported that they were not told that a housing development would be placed on the neighbouring property when they were purchasing their homes. They indicated that it was suggested that the area would be a farm where persons could purchase fresh produce. They also expressed concerns about the use of the NHV II entrance as they thought this was a private road.

NHV II Citizens' Association also indicated that they currently have a major problem with the collection of contributions from community members to help cover the cost of security at the entrance gate. They expressed concern about the likelihood of having to share the same entrance gate with the new development and wanted to know if there were arrangements in place which would guarantee that the Whim Estates would contribute to the NHV II's security-related expenses.

Other concerns expressed by the NHV II Citizens' Association included the further development of the wider area, which included schools, businesses and agriculture. Concerns about water supply and the quality of the water were also raised and the association representatives wanted to know how their supply would be affected by the new development. They also wanted more information about the security of the housing schemes during the construction and operational phases.

Representatives from the developer's project team were present to address the concerns of the citizens. It should be noted that further public consultation in the form of a town hall meeting will take place once the EIA draft report has been submitted to NEPA. The outcome of the town hall meeting will be elaborated on in the final EIA report.

8 Impact Identification and Analysis

An analysis of the proposed project components has been carried out in order to identify the major potential environmental risks and opportunities. The impacts have been distinguished by magnitude (a ranking from major to minor/significant to insignificant), direction (positive and negative impacts), duration of impacts (temporary or permanent), and permanence (reversible or irreversible). A summary of the impact assessment is presented in Table 9.2.

The impacts have been considered for both the construction and operational phases, however, some impacts are common to both phases and as such, will not be repeated in the discussion. Cumulative impacts have also been identified considering previous developments and any proposed development within the sphere of influence of the subject development. Where appropriate, mitigation measures have been recommended. These are outlined in [Section 8 Impact Mitigation](#).

8.1 Construction Phase

Construction impacts are usually short term and are easily mitigated. However, if not monitored and managed correctly, these short-term impacts can sometimes have costly and irreversible consequences.

8.1.1 Site Clearance

The clearing of vegetation on large areas of land can result in the exposure of top soil during construction. During rainfall events, the soil can be easily entrained into runoff causing erosion and sediment-laden runoff. Stockpiles of earth materials can also be entrained into runoff. This is expected to be a short-term impact as the land is resurfaced during construction. Mitigation against this impact is important as the impacts are considered irreversible. Slope stability is not expected to be a problem as the property has a very low gradient.

8.1.2 Air Quality

As mentioned in [Section 5.1.7 Air Quality and Noise](#), if the existing conditions change such as extensive vegetation removal for construction, the particulate matter concentrations within the environment are expected to increase. The generation of fugitive dust from the construction activities on the site and from vehicular traffic and heavy equipment entering and leaving the project site, particularly on dry and windy days, will impact the surrounding environment and possibly, the health of persons downwind of the activities.

8.1.3 Noise Pollution

Virtually all development projects have noise impacts. Noise during construction may be due to activities such as land clearance, transporting materials, and so on. Prolonged exposure to elevated

noise levels generated on the project site during construction may affect persons on and around the project site. This can result in adverse health impacts and impact on auditory functions. Noise may also affect animals.

Baseline noise measurements were generally below 55dBa except for along the boundary of the property shared with the highway. Noise measurements went up to 100dBa along the highway and are therefore likely to continue to exceed the recommended standard during construction. Changes in noise levels are, however, expected to be short term. Section 8 outlines recommended mitigation measures.

8.1.4 Batching Plant

The batching plant operations are similar to those used for the NHV developments. This will be a dry batching plant and therefore, there are no issues envisaged where sediment-laden water discharge will occur. However, dust discharge may emanate from the offloading and loading of cement and aggregates. These can have potential negative impacts and measures must be implemented to mitigate against the likely outcomes.

8.1.5 Transport and Storage of Petroleum and other Hazardous Materials

Spillage may occur during the transportation of fuel and other hazardous materials (chemicals, etc.) on and off site, and/or during the loading and off-loading process. Storage tanks may be aged or have structural defects and may result in leaks to the environment. There are also risks of exposure to flames resulting in possible explosions. The risks associated with the storage facility are magnified due to the proximity of the site to the NHV II housing development and the Bower's Gully, in which marine animals were reported downstream of the site. The proper storage of petroleum and hazardous materials during construction is important to ensure that there is no leaching into the soil or runoff into the nearby drainage system. Leaching of chemicals into the soil can affect the water quality in the shallow aquifers.

8.1.6 Solid Waste

Waste generated from a construction site can originate from the following:

- Used product containers, such as cement bags, tile boxes, paint containers, etc.
- Used construction materials (cut rebar, broken blocks, tiles, wasted poured cement, spilled aggregates)
- Cut vegetation and trees
- Unsuitable excavated materials
- Used oil and spilled fuel.

The improper control, collection and disposal of construction waste will result in adverse health impacts as well as potential pollution of waterways, both on site, if not properly collected and off site, if not properly disposed of. Improper waste storage can also encourage pest infestations which can have adverse impacts on human health.

8.1.7 Sewage Waste

Construction workers will be on site and if there are not enough suitable bathroom facilities available, they will resort to less satisfactory and unsanitary ways of sewage disposal which can have impacts on human health and the environment. Such facilities should also have adequate storage and/or treatment for human waste to ensure contamination of the environment does not occur.

8.1.8 Biological

The species of flora and fauna that have been identified on the site are common in disturbed habitats and many of them will most likely continue to find marginal habitats within the converted landscape. During the construction phase, most of the existing vegetation is likely to be removed which will result in loss of habitat for some of the fauna identified. However, as observed with the adjacent sites, once the area is occupied by new residents and revegetated into gardens, many of the current species will return to the area.

The potential for recolonisation of native flora is very low as the surrounding properties are themselves highly disturbed and do not therefore provide a source for recolonisation of the site with native flora. The history of cultivation of the site and the separation and isolation from native forests by the surrounding development also limit the diversity of the flora and fauna.

Migratory birds are known to have a very high site fidelity which means that they return to the same territories for their wintering and breeding grounds in Jamaica and North America.

When this development occurs, these species will be displaced and will be forced to compete with other species for new territories. This means that habitat loss in wintering grounds such as Jamaica has a disproportionately higher impact on the population of Warblers than similar losses in the breeding area. Another factor is that the available territories are much larger on their breeding grounds given the much larger size of North America when compared to the islands of the Caribbean. More recent research into the wintering ecology of Neotropical Warblers has been revealing that males will often outcompete females for the prime wintering habitats which means that females are largely left to survive on sub-standard habitats such as disturbed woodlands like this site. That means females are

generally more abundant in secondary habitats which are also at higher risk of further habitat loss. However, since females are essential to the reproductive capacity and survival of every species and the habitat available to them is being lost at a rate disproportionately higher than for males, the cumulative effect of the conversion of secondary habitats to urbanisation is higher than originally believed. These new findings are causing increasing alarm among scientists and conservationists as well as the general public in North America where they are noticing continuing declines in warbler populations.

The native reptiles of Jamaica are mostly endemic to the island, however, most species are very sensitive to human disturbance and are easily displaced by alien invasive species, particularly alien predators like the mongooses, cats and dogs.

8.1.9 Socio-Economic

It is expected that there will be socio-economic impacts for both the construction and operational phases of the proposed development.

During the construction phase, a direct socio-economic impact of the project is the generation of employment for both skilled and unskilled workers. Employment opportunities should continue for the duration of the project, as oftentimes homeowners do further expansion work and this can continue indefinitely.

An indirect economic impact of the project is that opportunities will be created for the supply of various goods and services; this is also expected to continue for the duration of the construction phase.

From the perspective of demographics, the PIOJ has projected an estimated population increase for Old Harbour to 146,300 by 2020 and 20,565 for Old Harbour Bay by 2030 (Table 6.2). Changes in population size can be both temporary (as workers may move in to the area during the construction phase) and permanent, as increased housing opportunities open up. As mentioned in Section 4.6.3, workers from neighbouring communities would be given preference for employment, so it is not anticipated that population increase would likely be attributable to any significant influx in migrant workers.

In addition to providing 876 housing solutions in response to the Kingston Metropolitan Area's (KMA) growing demand for housing, the proposed development features include the provision of supporting amenities such as a community centre, convenience store, sports and recreational facilities. Approximately 48,000 m² (12 acres) of land, previously approved to serve NHV II and the surrounding environs, will be retained for the provision of a primary and a secondary school. The potential also exists to significantly expand the sports and recreational amenities accessible to Whim Estates as well as the

School Reserve on additional lands owned by Old Harbour Estates Ltd. Provisions have also been made for the establishment of a commercial centre on approximately 9,000 m² of land.

Interviews with key stakeholders revealed that of the social services presently being provided in the general area, the most stressed were the healthcare and solid waste management services. It is anticipated that with the addition of a housing development with approximately 3,500 persons, the present health centre in Old Harbour would not be able to cope, nor would the May Pen or Spanish Town hospitals. The NSWMA would also have to contract additional trucks in order to meet the demand for waste collection.

As described in Section 6, a number of survey respondents from neighbouring communities expressed fear that the development would bring with it an increase in crime. Current crime statistics were not provided by the Old Harbour Police, however, they indicated that there were resource constraints that impacted effective policing. It can therefore be assumed that any increase in population size would put further constraints on the ability of the police to serve the area effectively.

8.1.10 Heritage

The risk to heritage assets is considered to be minor. However, the potential exists for artefacts, though currently unidentified, to be found during construction activities. In such instances it is recommended that work be halted and the JNHT be immediately contacted to come and assess the findings.

8.2 Operational Phase

8.2.1 Natural Hazard Risk

The site's location makes it susceptible to some natural hazards, however, these are not unique to the site and can be experienced across Jamaica.

The site has a lower risk of flooding through the engineering designs of the internal drainage, the realignment and upgrading of the Bower's Gully and the addition of a flood retention pond. Landslides and erosion are not a potential risk as the gradient of the area is less than one degree. St. Catherine and the rest of Jamaica are at risk to earthquakes, however, the soil type at the site is not vulnerable to liquefaction as it is predominantly clayey loam overlying limestones. The site is also vulnerable to impacts such as wind damage and lightening from tropical cyclones.

8.2.2 Climate Change

As discussed in [Section 6.2.3 Climate Change and Variability](#), climate predictions for the St. Catherine area generally show an increase in temperature continuing until the end of the century while rainfall is expected to decrease over the same period for both St. Catherine and most of Jamaica.

This rise in temperature will increase the demand for water in St. Catherine and the decreased rainfall can have impacts on both the demand for water and the overall re-charge of groundwater aquifers. While these impacts are not expected to occur in the short term, mitigation strategies should be considered for long-term solutions to ensure adequate supply is available.

The community is not expected to be directly affected from sea-level rise in the short to medium term. However, groundwater supply can be affected by salt water intrusion as sea levels rise and over abstraction of groundwater occurs.

8.2.3 Utilities

8.2.3.1 Water Supply

Adequate groundwater is available to supply the development as shown in [Section 5.1.4 Hydrology and Drainage](#). However, as discussed above, the water sources may be impacted by the effects of climate change. This can include drawdown and over abstraction from wells as well as increased saline intrusion. Therefore, a highly rational policy on water abstraction and distribution will have to be implemented for the future.

8.2.3.2 Sewage Generation, Treatment and Disposal

The wastewater treatment plant located south of the Whim Estates is not expected to have any negative impacts if appropriately maintained. The system outlined is more robust and stable than mechanical treatment systems; in addition, decline in performance occurs slowly and therefore is more predictable and manageable. They are also less prone to invasive species such as vermin.

The type of plant and the setback from residents should ensure that there are no impacts on the neighbouring properties and there are no anticipated safety issues although normal precautionary measures should be put into place.

The effluent from the anaerobic ponds to the reed beds will be fed via sub-surface drains, thus eliminating any foul odour which may be present. Uptake of nutrients by the reed beds and oxidation of the primary effluent by the root system of the reed beds should ensure that the final effluent to the Bower's Gully is safe and routinely meets all NEPA standards.

The lower Bower's Gully is known to flow throughout the year and the effluent from the treatment facility is not expected to cause flooding, therefore, there is no significant hydrological impact.

8.2.3.3 Solid Waste Generation

It is estimated that 28 tonnes of solid waste will be generated from the 876 units and associated facilities every week. Waste collection and disposal is the responsibility of the NSWMA who has expressed resource constraints.

The consultants recommend that the Whim Estates development contract its own solid waste haulage contractor as the addition of this development to the NSWMA's collection schedule will further exacerbate the challenges being experienced.

8.2.3.4 Electricity

All power lines will be maintained within the internationally established setbacks to ensure safe distances are maintained between the lines and inhabited areas. This is particularly important for high voltage lines which will run at the north end of the property within a JPS reserve (Lot 2B).

8.2.3.5 Communications

No impacts on the communication and other utilities are envisaged.

8.2.3.6 Transportation and Traffic

The traffic impact study commissioned by the developer indicates that the proposed development is expected to add an additional 2,608 daily trips, of which only 215 and 278 of those trips are expected to occur during AM and PM peak hours respectively. This is reportedly not expected to add significant congestion during peak hours to the major intersections (see Traffic Impact Study Whim Estates Limited Residential Development, St. Catherine (2018).

Some of the additional traffic and commuters are expected to use the Highway 2000 to and from Kingston. Traffic within the New Harbour Village Community along the northern entrance is expected to increase significantly if this is used as the primary access to Whim Estates. The 2018 Traffic Impact Study indicated that 90% of the traffic from the development will head north bound onto South Street and 10% will head south. Sixty percent (60%) will continue north on South Street into Old Harbour, 20% will head east on to Highway 2000 and 10% will head west on to Highway 2000 (Figure 8.1). Further details on existing traffic and projected traffic growth rates are discussed in Traffic Impact Study Whim Estates Limited Residential Development, St. Catherine (2018).



Figure 8.1 Traffic Details from Whim Estates Impact Study (TIS, 2018)

8.2.3.7 Development Access

All four potential access routes to the proposed development were assessed. The general impacts for each route are discussed in Table 8.1.

Table 8.1: Impacts from Access Routes to Whim Estates

Route	Impact	
	Positive	Negative
Route I	This is the shortest route to access Whim Estates from Old Harbour or Highway 2000.	<p>Main access to NHV II road is no more than 7m wide at the bridge. If this is used as the primary access to Whim Estates, it will have to be upgraded, including the expansion of a bridge.</p> <p>The NHV II Citizens' Association has expressed concern about the use of this road as the primary access to Whim Estates. They have cited security concerns, increased traffic, noise, and dust pollution. They have also expressed concerns about the traffic flow at the entrance of the gated community.</p>
Route II	The second shortest route to access Whim Estates from Old Harbour or Highway 2000	<p>The south access road is not developed, and it will take considerable capital to create the required road.</p> <p>This access route also will be through NHV II and will dissect NHV II. This may cause concerns within the NHV II community.</p>
Route III	This route requires no interaction with the NHV II community.	<p>The second longest route from Old Harbour or Highway 2000</p> <p>The Kelly Pen Road is in poor condition and will need considerable upgrading in order to be the primary access to the community.</p>
Route IV	This route requires no interaction with the NHV II community.	<p>The longest route from Old Harbour, Highway 2000 and Freetown</p> <p>The Kelly Pen Road is in poor condition and will need considerable upgrading. This will also require an additional bridge to be built over the lower Bower's Gully.</p>

8.2.4 Aesthetics and Landscape

The aesthetics of the area is expected to improve during the operational phase of the development. At present the site is overgrown. Houses and lots will have significant room to improve the landscape with green areas for gardening and planting of trees. Where possible, trees currently on the site should be preserved.

8.2.5 Hydrology and Drainage

8.2.5.1 Runoff

The catchment area covers approximately 1,050 hectares of land (Figure 8.2). The conversion into housing of 70 of the 1,050 hectares, currently occupied by a forested area classified as “Plantation” under the land use classification, will change the land cover which will, in turn, affect the peak discharge post rainfall. There will be an expected increase of ~7% of impervious area post development within the wider catchment area.

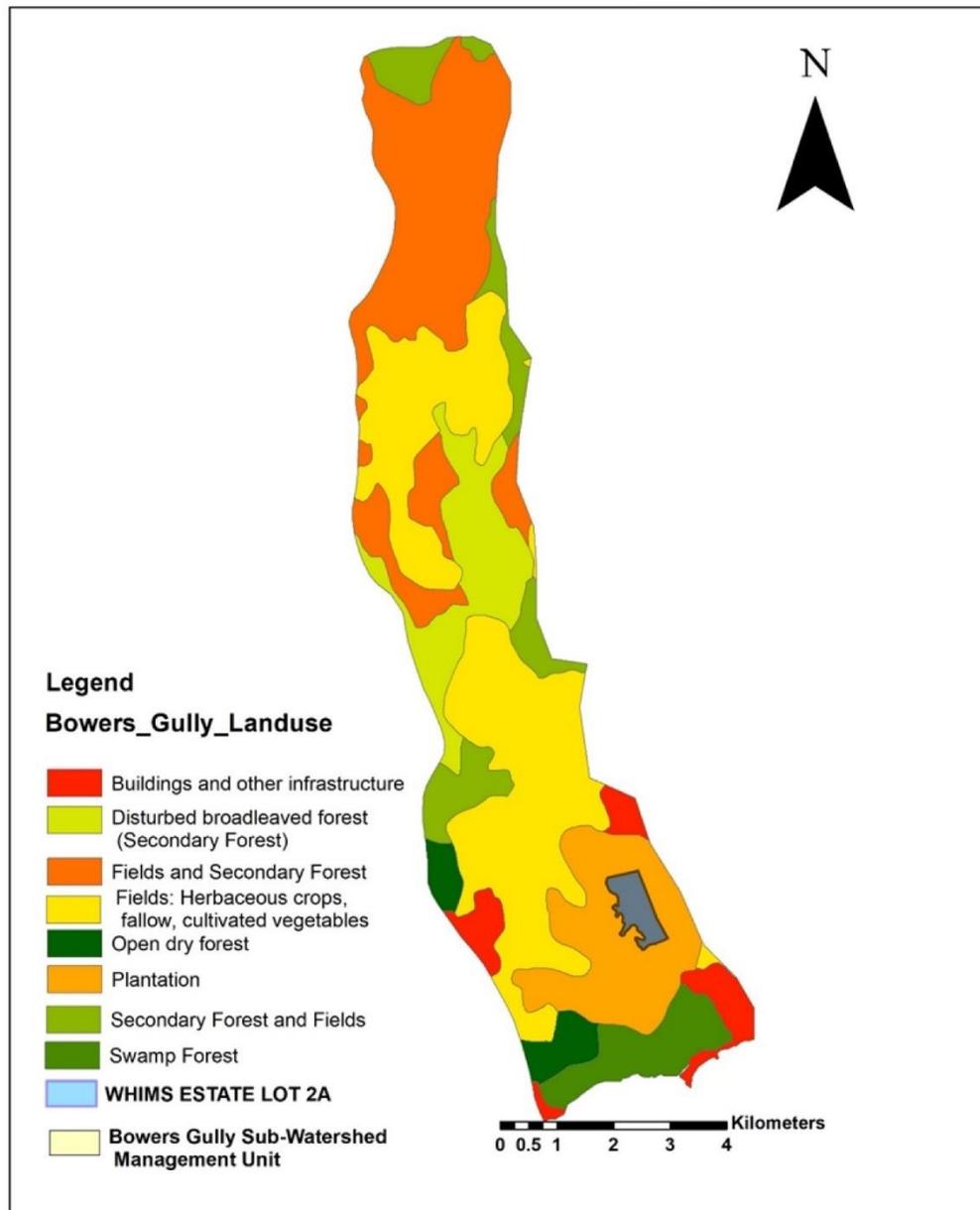


Figure 8.2: Land use types in the Bower's Gully Watershed showing the Location of Whim Estates

For the purposes of this assessment, the subject property has been separated into sub-catchments (Figure 5.9 and Figure 8.3). Catchment A has an area of 0.9km² and it is expected that there will be a post-development increase in impervious surfaces for the catchment by 50%. Catchments B – D would also undergo a change in the runoff coefficient with an estimated 30% increase in impervious areas.

An increase in impervious areas will result in an increase in surface runoff. The simulated results in Figure 8.4 show direct runoff volumes and infiltration outputs of the four catchments covering the Lot 2A (Figure 8.4) pre- and post-development for a 100-year flow and rainfall of May 2017. Catchment A shows the highest increase in volume of surface runoff and peak discharge primarily due to its larger area and the reduced infiltration post-development. This is because approximately 50% of the catchment is under consideration for development. This increased runoff would be accommodated into newly designed internal drains and the widening of the Bower's Gully to prevent flooding. (See [Section 8 Impact Mitigation](#)).

A sediment loading study is not suitable for this case as this should be done over an extended period of time and current methods used for interpolation and estimating sediment loads in the absence of this data are highly inaccurate and lead to under- or overestimation of actual loads. The project area is also largely developed with New Harbour Village IV and The Aviary to the north, New Harbour Village II to the east and several chicken farms to the south. Therefore, attributing sediment load to any site will be highly inaccurate without baseline data before the establishment of these surrounding developments. The Bower's Gully is also void of surface water except during heavy rainfall events and storm events, therefore it is impossible to collect base data and sediment load data from the gully.

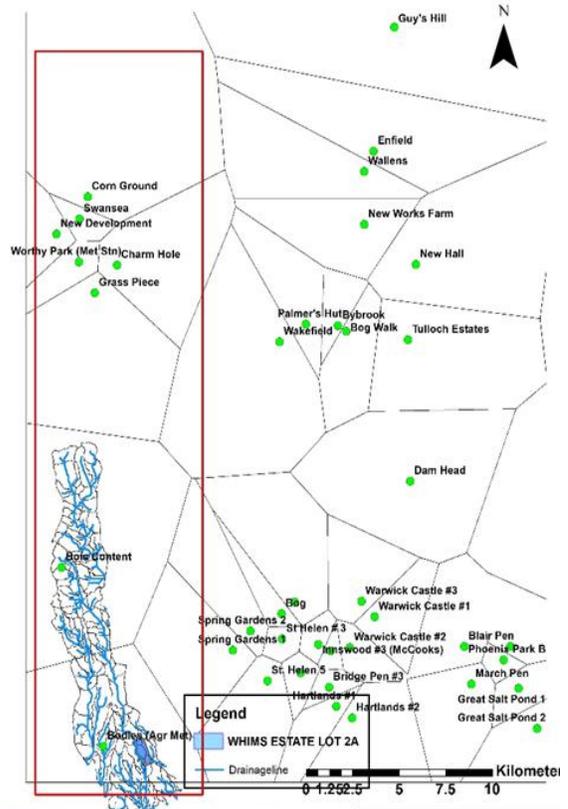
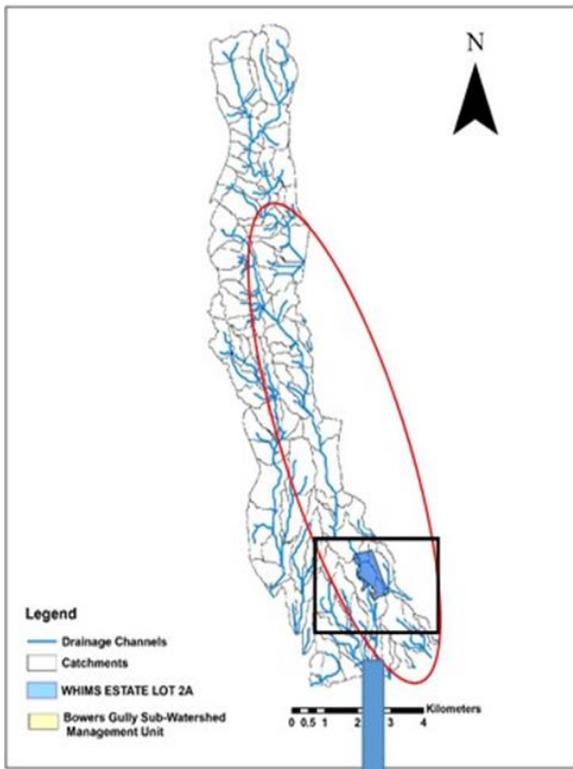


Figure 8.3: Catchment Model showing the Location of the Study Area (blue) and all Gullies which contribute to downstream Flow

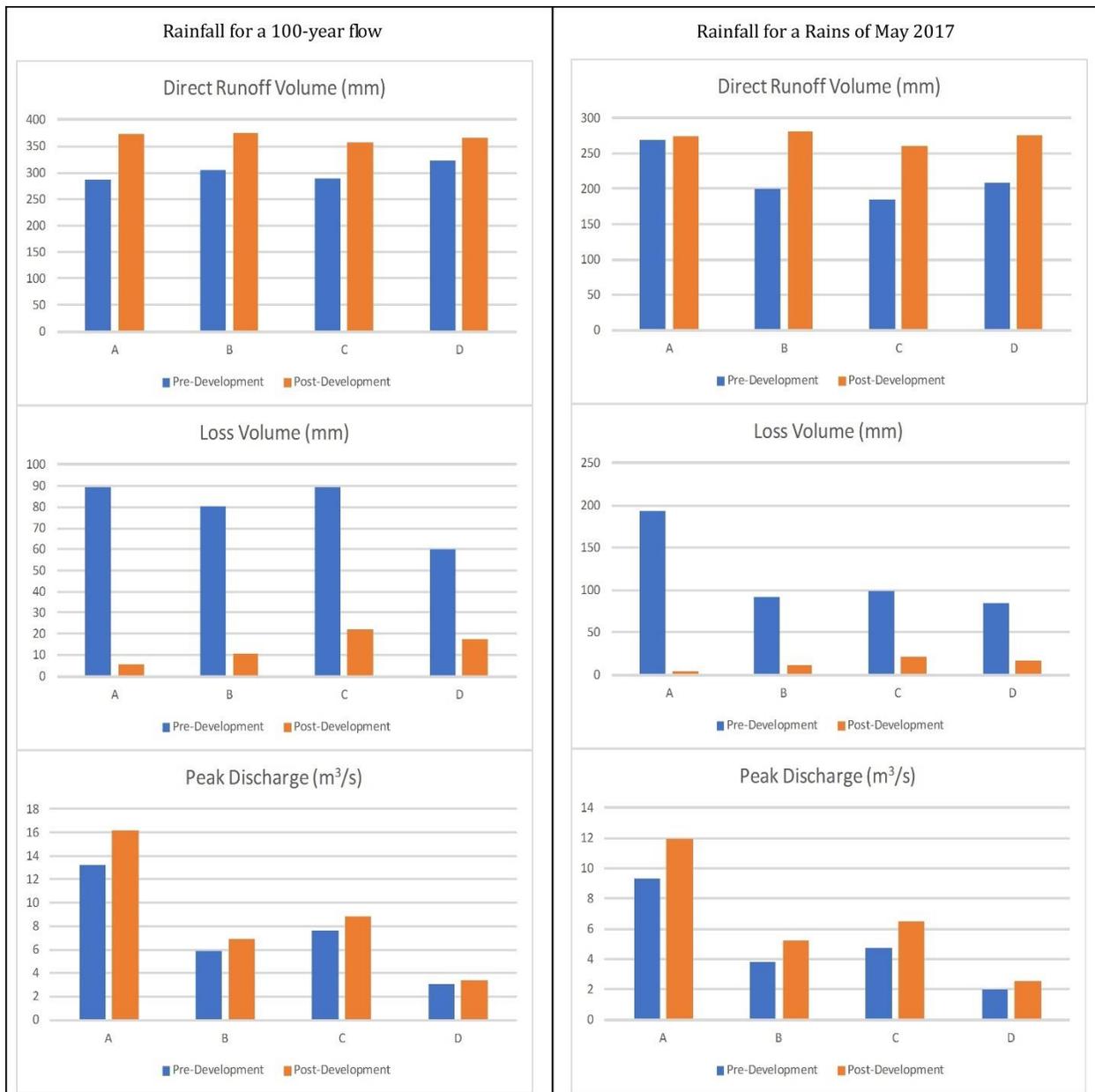


Figure 8.4 Direct Runoff, Infiltration Loss and Peak Discharge for the four Catchments pre- and post-development at Whim Estates for 100-year and May 2017 Flow Events

8.2.5.2 The Bower's Gully

Phase II of the proposed development requires the Bower's Gully to be realigned. This work is expected to straighten the river channel and will include the widening of the channel and the creation of a retention pond (Figure 4.7). The peak discharge both pre- and post-development was modelled in order to inform the design of the river training.

The proposed design for the training of the Bower's Gully is to replace the earthen drain with a re-aligned drain, with a 0.5% slope and a bottom width of 54m and a top width of 60m (Figure 4.8).

Further hydraulic modelling and analysis done by Premier Land and Water Development for the lower Bower's Gully south of the project site indicates that the height of the water in the gully will be 0.09m lower for a 1 in 100-year event post-realignment (Figure 8.5). Therefore, the realignment and training of the Bower's Gully will ensure that the Whim Estates will not be impacted from flooding and will also reduce the risk of flooding immediately downstream from the project site.

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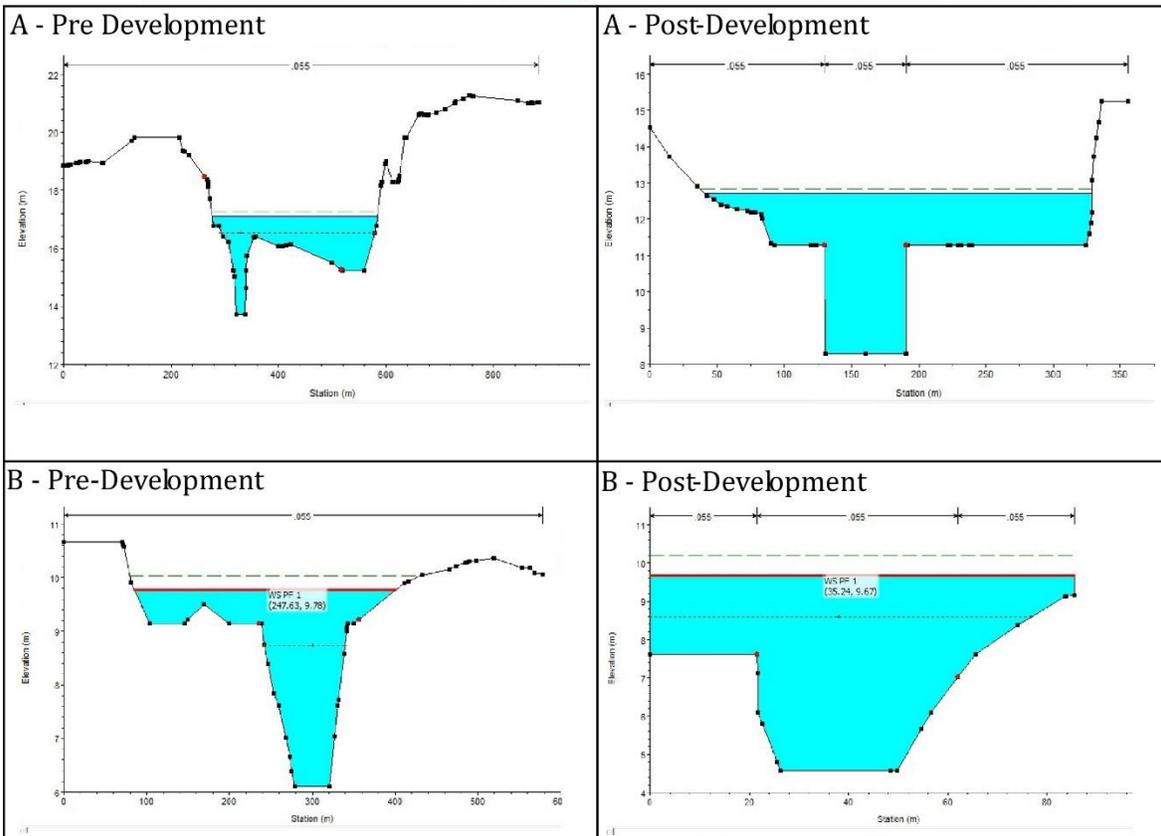
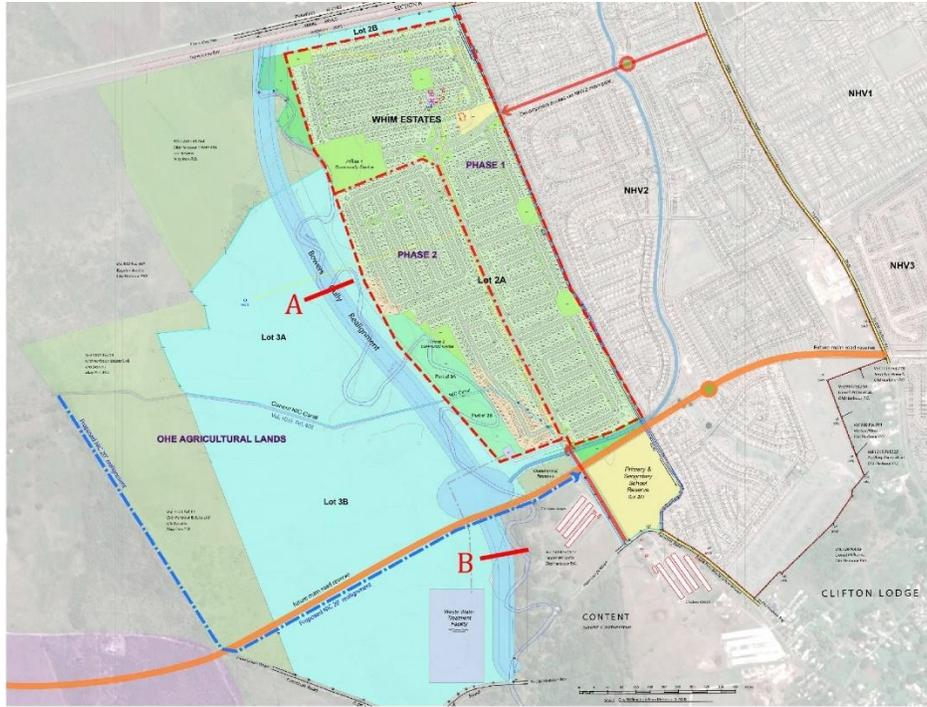


Figure 8.5: Hydraulic Modelling for two Locations south of the Whim Estates post-development for a 1 in 100 yr event showing lower Water Levels due to the widening of the Bower's Gully and the Inclusion of a Retention Pond (Premier Land and Water Development).

8.2.6 Public Health, Safety and Security

There is likely to be increased strain on the limited resources of the public health and security services in Old Harbour, mainly the Old Harbour Health Centre and the Old Harbour Police Station.

The main public health concern is the treatment of sewage. Currently, the surface water quality sampling ([Section 5.1.6 Surface Water Quality](#)) has identified the presence of coliform in surface waters at the south-eastern end of the property. This problem can be solved provided that the source is identified, and the relevant stakeholders ensure that the problem is corrected.

8.3 Cumulative Impacts

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. Thus, the cumulative impacts of an action can be viewed as the total effects of that action on a resource, ecosystem, or human community, and all other activities affecting that resource. Cumulative impacts are also assessed in terms of the incremental effect that acts cumulatively with the effects of other actions, either past, existing or future. Consideration is given to the effect of projects planned for the reasonably foreseeable future.

8.3.1 Construction Activities

The Old Harbour Area continues to see an increase in construction activities which include residential housing developments such as New Harbour Village IV. Additionally, industrial and agricultural activities are in the planning stages for the proposed Port Esquivel Special Economic Zone. Planned activities include the development of an Industrial Park and Port Facility; educational, medical, environmental and emergency services; a business district; and also commercial as well as light and heavy industrial activities.

Generally, this will be good for Old Harbour and the economy of Old Harbour and Jamaica. However, as with all developments, construction activities may bring negative impacts including increased inconveniences such as noise, dust, traffic congestion and impacts on existing infrastructure.

It is important to have continued environmental monitoring during prolonged construction and to ensure that there is proper planning so that roads and other infrastructure are upgraded and continuously maintained as development continues. Traffic management plans should also take into consideration future developments.

8.3.2 Regional Drainage and Flooding

Limited flooding has been reported in the area and along Bower’s Gully. However, the proposed improved drainage for the Bower’s Gully and the creation of a retention pond in accordance with NWA guidelines may provide further solutions to prevent flooding.

The widening of the Bower’s Gully channel will allow for accommodation of increased runoff both from the project site and from developments upstream. However, this may have further impacts downstream in the lower Bower’s Gully.

8.3.3 Water

The estimated population growth for Old Harbour and Old Harbour Bay is outlined in [Section 5.4.1 Demographics](#). The Town and Country Planning (St. Catherine) Provisional Development Order, 2017 also indicates expansion of the residential areas around Old Harbour and Old Harbour Bay. Additionally, it also outlines areas for agricultural and industrial development.

Cumulatively, the demand for potable water in the region is expected to increase over the next several years. This can have a significant impact on groundwater resources which climate change is expected to exacerbate. The expected water demand based on future population projects for Old Harbour and Old Harbour Bay is presented in Table 8.2. This expected water demand is based on the future population projections for Old Harbour and Old Harbour Bay using an estimated demand of 0.172m³/day per person. It is important to note that this does not include demand from agricultural, industrial and commercial industries.

Table 8.2: Future expected Water Demand

Area	1991	2001	2005	2010	2015	2020	2025	2030
Future Population Projects without major housing developments								
Old Harbour	17,966	23,823	27,432	31,589	36,375	41,887	48,234	55,543
Expected Water Demand (m³/day)	3,090.152	4,097.556	4,718.304	5,433.308	6,256.50	7,204.564	8,296.248	9,553.396
Future Population Projects with major housing developments								
Old Harbour	17,966	23,823	31,685	78,577	136,729	146,300	156,540	167,498
Expected Water Demand (m³/day)	3,090.152	4,097.556	5,449.82	13,515.24	23,517.39	25,163.6	26,924.88	28,809.66
Old Harbour Bay	5,591	6,344	8,374	17,502	18,972	20,565	22,292	24,165
Expected Water Demand	961.652	1,091.168	1,440.328	3,010.344	3,263.184	3,537.180	3,834.224	4,156.38

8.3.4 Employment

The Whim Estates Housing Development and other developments within the area will provide both temporary (construction workers) and permanent employment. This will be generally beneficial for the residents in and around Old Harbour and for the economy, though not precisely quantifiable.

There is also expected to be increased migration into the area and this initial movement of people may cause social conflicts and encourage crime. The developers as well as other social services such as police and the health services must be vigilant of any problems arising and be prepared to mitigate them cooperatively.

8.3.5 Social Infrastructure and Services

With the increase in the population in the Old Harbour area and the expected plans for industrial developments near Port Esquivel, there will be a need for improvement in social infrastructure and services within the Old Harbour and Old Harbour Bay areas.

The cumulative impacts of all developments must be dealt with on a regional basis and be recognised by all concerned in both the public and private sectors. The areas which should be included for upgrade and modernisation should entail health services, educational services, the police and the fire brigade. Both the government and private developers need to contribute to the development and improvement of these services.

8.3.6 Solid Waste Management

The increased solid waste from the Whim Estates and other developments within the area will put further strain on the capabilities of the NSWMA. These new developments present opportunities for the practice of solid waste management reduction, sorting and recycling. These strategies can alleviate the problem of solid waste management collection and disposal.

8.3.7 Traffic

The traffic solutions within Old Harbour and the surrounding regions should be approached on a regional basis. The National Works Agency should be supported by other public and private entities to ensure suitable solutions which consider future development are implemented

The Old Harbour area is a regional population growth centre and therefore has become a vital transportation link. Traffic congestion within Old Harbour and along the main road is expected to increase. The overall Old Harbour main road will require some improvements in the medium-long term to ensure the road can manage the increased volume of traffic.

9 Impact Mitigation

9.1 Construction Phase

9.1.1 Site Clearance

The proposed mitigation measures to limit the impact of sediment- laden runoff as a result of vegetation clearance are as follows:

- Excavated or other material should be stored away from drainage paths and properly bermed;
- Stockpiles of excavated or other material should be covered, where possible;
- Exposed surfaces should be paved or revegetated as soon as possible.

9.1.2 Air Quality and Noise

The possible measures that can be implemented to mitigate the adverse impacts on air quality and noise due to activities during the construction phase are outlined in Table 9.1 below:

Table 9.1: Impacts on Air Quality during the Construction Phase

Main Issues	Sources	Possible Impacts	Mitigation
Increase in air pollutants and dust	Land clearing	Adverse health impact contractors, employees, residents and animals	Install dust screens/vegetative barriers around the site
	Improper storage and transportation of fine earth material		Frequently wet site to reduce fugitive dust
	Burning of vegetation and/or construction/domestic waste		Revegetate or pave exposed surfaces as soon as possible
	Fugitive dust from unpaved roads		Undertake vegetation clearance in phases
	Emissions from vehicles		Cover fine earth material stored on site, where possible
			Vehicles should be properly maintained to ensure they are always working optimally.

			Periodic monitoring should be done to ensure compliance with the regulatory and best practice levels.
Noise	From land clearing activities Vehicular traffic Heavy equipment operating	Adverse health impact contractors, employees, residents and animals.	<p>Temporary noise barriers can be erected around noisy areas using plywood or any other absorbing material.</p> <p>The use of vegetative buffers is encouraged.</p> <p>A buffer zone can be left between the proposed development and the highway which has been identified as a noisy area.</p> <p>Ensure vehicles and equipment on site are properly maintained.</p> <p>Work activity should be scheduled to control noise exposure.</p> <p>High noise areas should be identified, and appropriate, personal protective gears worn.</p> <p>Stationary noise sources like generators and compressors should be positioned as far as possible from noise sensitive receivers such as neighbouring communities</p>

9.1.3 Batching Plant

Mitigation for the Batching Plant should include:

- The use of pre-washed aggregates to reduce the release of air-borne particulates during offloading of aggregates;
- The maintenance of a watering truck on site for watering road surfaces as needed to minimise fugitive dust. Exposed roadways should be watered frequently and vehicle speeds should be restricted. Watering would not be necessary on days when rainfall exceeds 2.5mm;
- The monitoring of over-saturated conditions so as to avoid mud being tracked on to public roads. Where possible, roads should be washed and cleaned appropriately;

- If open stockpiles of batching plant materials are a requirement, these should be semi-enclosed to prevent wind mobilisation and recessed to prevent transportation by rainfall;
- The covering en route of vehicles transporting aggregate materials to the site and stockpiles of fines should be covered on windy days;
- A monitoring programme for dust and it is recommended to continuously assess the effectiveness of control measures in meeting NEPA's ambient air quality standards.

9.1.4 Petroleum Transport and Storage

The petroleum storage facility may require a permit from NEPA and as such, will have to meet its standards for leak detection. The following will also apply:

- The tank should have a steel casing and will be located as an aboveground storage tank (AST). This will facilitate visual inspections for leaks;
- The tank should be surrounded by a bund wall. The capacity of the containment bund must be sized to accommodate more than the volume of the fuel that is stored within the tank and to restrict fuel contamination. This is to ensure that if a spill occurs, the fuel will be contained, and the quality of the fuel will be maintained so that it can be recovered and re-used;
- The leak detection system for the diesel storage tank must include daily visual tank and bund inspections and stock reconciliation. Fuel gauges should be read daily to track stock levels and ensure losses are negligible.

The developer will have to ensure that workers are briefed on safe actions that will have to be adhered to when operating around or handling hazardous materials. Additionally, appropriate containerisation and labelling of these potentially hazardous materials will be required so that persons will have immediate knowledge of the following:

- The characteristics of the materials being stored
- The potential health hazards
- Emergency response requirements.

Further, the developer will have to ensure that operators who will be required to handle these materials have the requisite protective equipment to do so safely.

9.1.5 Solid Waste

Mitigation measures related to solid waste storage and disposal, during both the construction and operation phases, include ensuring that sufficient and adequately sized solid waste receptacles are

provided on site. These should include clearly labelled waste bins around the work site and large skips for construction waste. Further, receptacles should be covered, where possible, and raised off of the floor to prevent pest infestations. Waste should be stored in a centralised area and should be regularly removed and disposed of off site in an approved solid waste disposal facility.

WDCL should collaborate closely with the NSWMA to ensure that the waste for both the construction and operational phases is disposed of properly. The consultants recommend that the Whim Estates Development contract its own solid waste haulage contractor as the addition of this development to the NSWMA's collection schedule will further exacerbate the challenges being experienced. A waste management plan should be developed and followed during the construction phase.

9.1.6 Sewage

With regard to sewage generated during the construction phase, the developer and/or the contractor should ensure that waste from portable toilets and other temporary facilities is properly collected and disposed of.

Once the sewage treatment plant is constructed and operational, a monitoring programme is recommended for the treated effluent. The monitoring programme will allow the operators to assess the efficacy of the treatment systems and will allow for the detection of any abnormalities in the effluent quality.

In order to mitigate any adverse impacts from the sewage treatment and disposal system its location and design have been carefully chosen. The location of the system with its reserves, setback and landscaping will minimise any aesthetic impacts or odour nuisance.

The design of the system (anaerobic ponds and reed beds) will ensure a stable, conservative form of treatment that should consistently meet NEPA standards. The key to this is in its proper design, operation and maintenance. Monitoring of the plant and its effluent is also critical for early detection of any malfunction or decline in performance. [Section 4.6 Wastewater/Sewage Treatment](#) discusses the details of the facility.

The hydrology of the Bower's Gully into which the effluent will be discharged is stable except in times of very heavy rains. It is recommended to construct and maintain earthen berms around the waste water treatment plant to prevent flooding, while not restricting effluent discharge.

The ecology of the Bower's Gully (water quality, flora and fauna) should not be adversely impacted by the effluent discharges. However, precaution should be taken by fencing the waste water treatment plant to minimise access of any invasive species and animals.

9.1.7 Biological

Habitat loss is anticipated due to vegetation clearance. Particularly for some of the common bird species found on site; these are expected to return once the site has been revegetated/landscaped.

Where possible, the developer is encouraged to retain large trees and replant similar species. The developer should encourage landscaping in the development to replace vegetation lost, and this could encourage the re-establishment of dislocated species. This will be also especially important for migratory species that are likely to return to this area.

9.1.8 Socio-Economic

To mitigate against any negative social and/or economic impacts the developer should adhere to the following guidelines:

- Communicate with surrounding communities about the project and the construction schedule so that they may be aware of potential increases in human interaction and traffic;
- Implement the proper use of construction signs, detours and flag-men as appropriate;
- Continue dialogue with government and other relevant agencies to integrate the provisions for social services into the project design. This should include schools, medical facilities, police facilities, fire brigade facilities, facilities for the differently-abled, and bus stop facilities.

The project is expected to contribute an overall benefit to the community of Old Harbour and Old Harbour Bay as it will increase income generation and overall employment. The full extent of the benefits will be widespread; however, much needed upgrading of social facilities will be necessary to accommodate the growing population and its related social needs/demands.

9.1.9 Heritage

To protect potential heritage material from loss during land clearance and excavation, the developer should implement a chance-find procedure should any such materials be recovered during construction.

9.2 Operational Phase

9.2.1 Natural Hazards

The design and sizing of both the Bower's Gully re-alignment and the storm water drainage network on site took into account peak flow projections. For the main drains through the development, the 1:100-year storm values were used to ensure that the drains have the capacity to contain this flow with freeboard to account for siltation. Floor levels for the housing units will also be set at the 1:100-year level or >0.45m above the roads. The addition of the flood retention pond is expected to slow storm flows and encourage settling before discharge into the lower reaches of the Bower's Gully.

Houses should be engineered with national building code standards, which should consider the resistance to high winds and seismic activity.

9.2.2 Climate Change

In order to limit its exposure and vulnerability while enhancing its contribution to climate change, it is recommended that the development, where possible, include certain mitigation measures:

- Allow for rainwater harvesting and reuse of wastewater for irrigation purposes;
- Encourage homeowners to use low-carbon technologies and carbon-neutral practices, such as alternative energy (e.g., solar panels);
- Include energy-efficient equipment throughout the development – lighting, electrical equipment, and so on;
- Employ building methods that increase resilience against storms and strong winds.

9.2.3 Site Access and Traffic

WDCL is encouraged to work closely with the New Harbour Village II Citizens' Association to ensure that security and access through the New Harbour Village II will be efficient and suitable. The two entities should ensure free and uninterrupted access for residents and contractors to the Whim Estates and New Harbour Village II along Route I ([see Section 4.2](#)).

Where appropriate, provisions should be made to upgrade the road to accommodate the increased traffic.

9.2.4 Aesthetics

A conceptual landscape plan prepared by a competent landscape architect should be included for the project so as to provide guidelines for achieving the desired outcomes especially for public spaces.

9.3 Risk Assessment

Table 9.2 summarises the possible impacts, the magnitude of these impacts and the mitigation strategy or strategies developed for each impact.

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Table 9.2: Summary Assessment of Possible Impacts, Magnitude and Mitigation Strategies for the Whim Estates

Activities/Main Issues	Possible Impacts	Possible Impacts				Mitigation Measures
		Direction	Duration	Magnitude	Permanence	
Construction Phase						
Erosion due to site vegetation clearing activities	Potential for sediment-laden runoff downstream towards the ocean	Negative	Short-term	Moderate	Irreversible	A site clearing plan with monitoring
Air Quality	Fugitive dust from construction activity Health impacts on site workers and nearby communities	Negative	Short-term	Moderate	Reversible	Periodic wetting of unpaved areas The covering of all stockpiled material during storage and construction Phased approach to land clearing Adequate landscaping using trees and shrubs All internal roads paved
Noise	Noise generated during construction can impact site workers and nearest communities	Negative	Short-term	Moderate	Reversible	OSHA 24-hour noise standards should be adhered to Advisories should be sent to nearest communities to communicate planned elevated noise activities Develop a noise abatement plan in relation to construction activities to include monitoring Examine the use of temporary noise barriers where the need arises, in nearest communities
Water Quality	Sediment-laden runoff Downstream flooding The leaching of pollutants from construction spoils	Negative	Long-term	Moderate	Reversible	Develop an erosion and sediment plan to include: Sediment traps, filter fabric fencing, vegetated filter strips, grassed swales

						<p>Pave all internal roads to limit fugitive dust</p> <p>Unused areas to be left vegetated</p> <p>Construction spoils should be stored in areas with impermeable surfaces. Spoils must be disposed of by approved contractors and in a manner approved by the NSWMA.</p>
Clearing of Vegetation	Loss of habitat and potential food for wildlife	Negative	Short-term	Moderate	Irreversible	<p>Limit the duration of the disturbance, clear areas in phases and encourage landscaping of housing lots and green areas after construction</p> <p>Where possible, trees which are considered mature should be retained. Trees should be clearly marked and protected to ensure they are not removed or bulldozed.</p>
Solid Waste Management	Construction debris – pollution to the site, surrounding areas and the watershed	Negative	Long-term	Significant	Reversible	<p>A waste management plan should be developed and utilised during the construction phase</p> <p>Construction waste should be stored in adequately sized containers and sufficiently elevated above the ground to prevent pest infestation</p> <p>The developer should ensure that the required waste collection system is in place before construction begins.</p> <p>Private waste removal services may be considered as one possibility if NSWMA does not have the capacity.</p>
Hurricane and Wind Damage	Damage or loss due to heavy wind, flooding	Negative	Long-term	Significant	Reversible/ Irreversible	<p>Adherence to building codes</p>

	Loss of vegetation cover leading to increased sediment-laden runoff					Develop an erosion and sediment plan to include: Sediment traps, filter fabric fencing, vegetated filter strips, grassed swales
Drainage	Drainage challenges pre- and post-construction	Negative	Short-term	Moderate	Reversible	Proper drainage to accommodate storm water runoff may be required for construction phase.
Loss of Green Space (Visual Preference)	Loss of green space at Whim Estates	Negative	Long-term	Moderate	Irreversible	Establishment of landscaped environment as well as improving existing green space
Increased Human Presence	Construction workers remove, collect or damage wildlife	Negative	Short-term	Minor	Reversible	Inform workers to limit any unnecessary cutting, clearing, removal or collecting of wildlife
Traffic	Loss of travel time during construction mobilisation for New Harbour Village I, II and III, Moores Pen and Terminal Road	Negative	Short-term	Significant	Reversible	Road upgrading and maintenance Development of a traffic plan to minimise impacts
Operational Phase						
Hurricane and Wind Damage	Housing damage or loss due to heavy winds and flooding	Negative	Life of project	Significant	Reversible	Adherence to building codes
Climate Change	Increased temperatures leading to higher energy costs for cooling Stress on vegetation More intense storm events leading to increased potential damage to housing	Negative	Life of project	Moderate leading to significant	Reversible	Observance of building codes Consideration should be given for the use of rainwater harvesting for future water supply. Homes should have provisions for inclusion of green housing features in the future (e.g., solar panels)
Water Resources	Potable water supply systems	Negative	Medium-long-term	Significant	Irreversible	If drought conditions become frequent, water availability will be affected with lower production Need alternative measures as back-up, for example, rain-water harvesting
Water Quality	Sediment-laden runoff	Negative	Life of project	Moderate	Reversible	Periodically review the erosion and

	Downstream flooding						<p>sediment plan to include the status of:</p> <p>Sediment traps, filter fabric fencing, vegetated filter strips, grassed swales</p> <p>Maintenance of the paving cover of all internal roads</p> <p>Unused areas kept vegetated</p>
Drainage and Storm Water Runoff	Drainage challenges post-construction	Negative	Short-term	Moderate	Reversible	<p>Ensure drains are adequate for 50-year and 100-year events</p> <p>Ensure drains are maintained and cleaned regularly</p>	
Clearing of Vegetation	New vegetation planted for landscaping over time	Positive	Long-term	Minor	Reversible	<p>Landscape vegetation may support wildlife</p> <p>Encourage use of native species</p>	
Fragmentation of Habitat	Residents bring potentially invasive species which may escape into the forest	Negative	Long-term	Severe	Irreversible	<p>Areas not being developed must be protected from further development</p>	
Introduction of Invasive Species	Residents bring potentially invasive species which may spread into surrounding areas	Negative	Long-term	Moderate	Reversible, but difficult	<p>Educate property owners to utilise native species or non-invasive species</p>	
Air Quality	<p>Fugitive dust construction activities</p> <p>Health impacts on residents and nearby communities</p>	Negative	Short-term	Moderate	Reversible	<p>Covering of stored building materials</p> <p>Periodic wetting of unpaved areas</p> <p>Maintenance of adequate landscaping using trees and shrubs</p> <p>All internal roads kept paved</p>	
Noise	Repairs, maintenance or expansion construction works can cause noise pollution and detrimental health effects to occupants	Negative	Short-term	Moderate	Reversible	<p>OSHA noise standards adhered to</p> <p>24-hour advisories to nearest communities of planned elevated noise activities</p>	

						<p>Devise a post-construction noise abatement plan in relation to ad hoc construction activities to include monitoring</p> <p>Examine use of temporary noise barriers where the need arises, in nearest communities</p> <p>When necessary, employ dampening of exposed areas in dry periods</p>
Solid Waste Management	<p>In the absence of sustained on site management, pollution to the site, surrounding watershed</p> <p>Delays in collection and disposal with consequent health threats to residents and near communities</p>	Negative	Lifespan of the housing development project	Moderate	Reversible	<p>A solid waste management system that seeks to address minimisation, recycling and even diversion</p> <p>A strong citizens' association to be put in place at time of residential development</p> <p>Private garbage collection services if NSWMA does not have the effective capacity</p>
Loss of Green Space	Loss of areas of green space	Negative	Lifespan of project	Moderate	Irreversible	Establishment of landscaped environment as well as protecting and improving designated green spaces
Traffic	Increased traffic in New Harbour Village II, along main road and within Old Harbour	Negative	Short-term	Significant	Reversible	Ensure road upgrading and maintenance

10 Energy Use and Conservation

Electricity will be the main form of energy used at the Whim Estates. This will be supplied solely by JPS.

Energy efficiency could be a centrepiece of this development. It must demonstrate a commitment to best practices in energy consumption, energy management and minimising the carbon footprints including:

- Cooling and heating system design and management
- Architectural design to reduce energy demand
- Maximising the use of alternative energy, e.g., solar power
- Utilising vegetation and landscaping to reduce heating and induce cooling
- Integrated building controls
- Lighting control
- Efficient energy distribution.

11 Analysis of Alternatives

Based on a review of the relevant government policies and guidelines, namely, the Town and Country Planning (Saint Catherine) Provisional Development Order, 2017 (2017), and the Highway Corridor Development Plan 2004–2005, the consultants have determined that for this site, there can be only two options: “housing development” or to “do nothing”. This is because the Provisional Development Order has the area designated for residential development and therefore, this has limited the alternatives for the use of this site.

Do Nothing (no action) – This action would mean that the site will remain as overgrown/abandoned farmlands with no improvements. Therefore, there will be no added benefit of increased employment, or contribution to community or overall national economic development. The property will also remain unsecured and abandoned and may therefore encourage squatting and other criminal and illegal activities. It will also continue to be a fire hazard as the JFB has responded to many bush fires at the site.

Housing Development – The housing development is expected to create some 876 homes in a location designated for residential development. The housing development also has easy access to Highway 2000 therefore ensuring that residents will have easy transportation to and from Kingston. During the construction and development phases, the project is expected to create employment thus contributing to the overall growth of Old Harbour and the national economy. Additionally, the project is expected to

inject significant capital into the economy through the purchase of construction materials, equipment and services.

12 Environment Monitoring and Management

When the permit is granted for the proposed Whim Estates Housing Development and before site mobilisation, site preparation, and construction activities begin, a monitoring programme should be prepared for submission to NEPA for their approval.

The aim of the monitoring programme is to ensure the following:

1. Compliance with relevant guidelines and legislations
2. Implementation of mitigation measures
3. Conformance with general and specific conditions outlined in the permit
4. Long-term minimisation of negative environmental impacts.

The monitoring programme should include the following components:

- Inspection protocols
- Parameters to be monitored, including,
 - Ambient Air Quality
 - Water Quality
 - Perimeter Noise
- Construction monitoring
 - Worker health and safety
 - Disposal of solid waste
 - Disposal of hazardous material
 - Disposal of liquid waste
- Materials handling and storage
- Covering of haulage vehicles
- Transportation of construction materials
- Deployment of flag-men and signposting
- Storage of fines and earth materials
- Storage of petroleum and fuel.

The monitoring programme cannot be prepared and finalised before the permit has been issued and received from NEPA. The terms and conditions of the permit must be taken into consideration and included in the monitoring programme. However, the consultants recommend that the duration of the monitoring programme should be for the entire duration of the construction period, with monthly sampling and reporting. We recommend monitoring sites for the same number of sites used for the baseline study for AQ, WQ and noise. However, the locations may vary depending on the locations of the various phases of construction, prevalent wind direction, water and proximity to other developments.

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DRAFT

14 Appendices

14.1 Appendix I – Terms of Reference

TERMS OF REFERENCE

for an

ENVIRONMENTAL IMPACT ASSESSMENT

for a

PROPOSED HOUSING and SUBDIVISION PROJECT

at

WHIM PEN, OLD HARBOUR, ST. CATHERINE

by

WHIM DEVELOPMENT COMPANY LIMITED

Prepared and Submitted by: (insert relevant information: consultant/applicant)

28 May 2018

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The purpose of this document is to establish the Terms of Reference (TOR) for the EIA.

The EIA report must be produced in accordance with the approved TOR.

Where the need arises to modify the TOR, the required amendments/modifications are to be made and submitted to the Agency. Approval for the TOR must be obtained from the Agency, in writing, prior to the commencement of the EIA study.

The Terms of Reference to conduct the Environmental Impact Assessment are as follows:

The National Environment and Planning Agency and the Natural Resources Conservation Authority reserves the right to reproduce, transfer and disclose any and all contents contained in the submitted environmental impact assessment report without the written consent of the proponent, consultants and/or its agents.

The Terms of Reference to conduct the Environmental Impact Assessment (EIA) are as follows:

1. EXECUTIVE SUMMARY

Provide a brief statement on the content of the EIA report. The executive summary should provide a comprehensive overview and objectives for the project proposal, natural resources, justification for the project etc. In addition, it should include relevant background information and provide a summary of the main findings, including but not limited to main impacts and mitigation measures, analyses and conclusions in the report.

2. INTRODUCTION

The introduction should provide a background and seek to explain the need for and the context of the project and the EIA. It should also provide the delineation and justification of the boundary of the study area, general methodology, assumptions and constraints of the study.

The study area shall include at least the area within a 1km radius of the boundaries of the proposed site.

3. LEGISLATION AND REGULATORY CONSIDERATION

Outline the pertinent regulations, standards, government policies and legislation governing environmental quality, safety and health, cultural significant finds, protection of sensitive areas, protection of endangered species, siting and land use control at the local and national levels. The examination of the legislation should include at minimum, legislation such as the Natural Resources Conservation Authority Act 1991, Natural Resources Conservation Regulations 1996, amended 2015, Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013, Beach Control Act, Jamaica National Heritage Trust Act, Wild Life Protection Act, National Solid Waste Management Authority Act, the Housing Act, the Town and Country Planning Act, Building Act and Codes and Standards promulgated there under, Development Orders and Plans and all appropriate international convention/protocol/treaty where applicable. Describe traditional land use and advise of any prescriptive rights including public access rights.

4. PROJECT DESCRIPTION

Prepare a detailed description of the project. This section will provide information on the proposed project and should include:

- History and background of the project,
- A location map at a scale of 1:12,500 (or an appropriate scale)
- The total area of the site.
- A site layout plan showing the various components and design elements of the proposed development.
- A comprehensive description of all components and the various design elements of the project. e.g. total number of lots and/or houses, the types of units, total area to be utilized, the proposed phases, amenities to serve the proposed development such as parks, pool and club house
- Expected project components and alternatives that may be considered by the developer,
- Schematic plans,
- A detailed landscape plan highlighting grading and proposed changes in topography.
- Details of proposed access(es) to the site to be used for pre-construction, construction and operational phases:
- Details on infrastructure development including design plans for all components of the development including the proposed wastewater/sewage treatment system and disposal of treated effluent must be clearly outlined.
- A comprehensive drainage assessment. This assessment should take into consideration existing natural drainage channels, particularly the Bowers Gully, proposed man-made drainage/water features or any proposed changes in topography. Potential issues of increased surface runoff and sediment loading must also be addressed. Special emphasis should also be placed on the storm water run-off, drainage patterns, characteristics of the aquifer, including the level and status of the groundwater.
- In addition plans for providing utilities, particularly details relating to the source of potable water and electricity generation, roads and other services should be clearly stated.
- A Waste Management Plan which clearly outlines expected types and quantities of construction waste during the construction phase, general waste arising from material consumption of the workforce, as well as, the expected waste during the operational phase should be completed. Details should also be provided for any central disposal area(s) being considered to serve the proposed development
- Details of equipment and machinery to be involved, how these will be mobilized and areas to be used for storage of machinery and material should be clearly indicated.
- Details of workforce, including proposals for mobilization and accommodation should be indicated.
- All phases of the project should be clearly defined, the relevant time schedules provided and phased maps, diagrams and appropriate visual aids included in the Environmental Impact Assessment report.
- The study area should be clearly delineated and referenced. Taking into account the types of resources located in the area and the magnitude of the associated impacts, the study area should be large enough to include all valued resources that might be significantly affected by the project.

5. DESCRIPTION OF THE ENVIRONMENT

A survey of the proposed development site should be conducted for both the wet and dry seasons. This information will form the basis upon which impacts of the project will be assessed.

The following aspects should be described in this section:

5.1 PHYSICAL ENVIRONMENT

- Topography, soil type, climate, drainage, geology (including but not limited to seismicity and faults), geomorphology of the site and hazard vulnerability including impacts on current landscape, aesthetic appeal and hydrology should be examined. Special emphasis should be placed on storm water runoff, drainage patterns in particular the Bowers Gully and any works proposed for same. Percolation tests should also be conducted within the proposed study area.
- Water quality for any aquatic (riverine) environment or surface water feature in the vicinity of the development. Quality Indicators should include but not be limited to Nitrate, Phosphate, Faecal Coliform, Salinity and Total Suspended Solids.
- Climatic conditions and air quality in the area of influence including particulates.
- Noise levels of undeveloped site and the ambient noise in the area of influence.
- Sources of existing pollution and extent of contamination.
- Availability of solid waste management facilities.

5.2 CARRYING CAPACITY

- The ecological carrying capacity of the site should be assessed

5.3 NATURAL HAZARDS

A risk assessment of the development in relation to the following must be undertaken

- Hurricanes, Earthquakes
- Natural hazard risk assessment should take in account climate change projections.

5.4 BIOLOGICAL ENVIRONMENT

Description of terrestrial habitats, existing vegetation, flora and fauna surveys inclusive of a species list; commentary on the ecological health, function and value in the project area, threats and conservation significance. This should include:

- A detailed qualitative and quantitative assessment of terrestrial and aquatic habitats in and around the proposed project sites and the areas of impact. This must also include flora and fauna surveys and should include species lists.
- Special emphasis should be placed on rare, endemic, threatened, protected, endangered, invasive and economically important species. Migratory species should also be considered. There may be the need to incorporate micro-organisms to obtain an accurate baseline assessment. Identification and description of the different ecosystem types and structure including species dominance, species dependence, habitats/niche specificity, community structure and diversity, possible biological loss or habitat fragmentation ought to be considered.

The field data collected should include, but not be limited to:

- Vegetation profile

- Other benthic features of the proposed development areas as well as the areas of potential impact
- Species lists must be provided for each community
- A habitat map of the area

5.5 HERITAGE

- An assessment of artifacts, archaeological, and cultural features of the site should be undertaken. Where there is a need this should be conducted in collaboration with the Jamaica National Heritage Trust.

5.6 SOCIO-ECONOMIC ENVIRONMENT

- Demography, regional setting, location assessment and current and potential land-use patterns (of neighbouring properties); description of existing infrastructure such as transportation, electricity, water and telecommunications, and public health safety; cultural peculiarities, aspirations and attitudes should be explored; and other material assets of the area should also be examined. There should also be an assessment of the present and proposed uses of the site and surrounding areas including any land acquisition needs and impacts on current users of the area during and post development. A socio-economic survey to determine public perception of the project (both negative and positive) should also be completed and this should include but not be limited to potential impacts on social, aesthetic and historical/cultural values. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires.

6. PUBLIC PARTICIPATION

Describe the public participation methods, timing, type of information provided and collected from public and stakeholder target groups meetings. The sampling methodology employed must be appropriate for the population size and distribution and must be weighted towards the communities in closest proximity to the proposed development. The instrument used to collect the information must be included in the appendix. Stakeholder meetings should also be held to inform the public of the proposed development and the possible impacts and gauge the feeling/response of the public toward the development.

The issues identified during the public participation process should be summarized and public input that has been incorporated or addressed in the EIA should be outlined.

Public Meeting(s) should be held in accordance with the Guidelines for Conducting Public Presentation at a time and location signed off by the National Environment and Planning Agency (NEPA). A public meeting will be held to present the findings of the EIA once the EIA is completed and submitted for consideration. All relevant documents are required to be made available to the public. In addition, any material change to the design of the project will require a further public meeting to be undertaken by the developer and all changes made to the document should be clearly outlined to the public.

7. IMPACT IDENTIFICATION AND ANALYSIS

A detailed analysis of the project components should be done in order to identify the major potential environmental, health and safety impacts of the project; distinguish between levels of impact, significance of impact (a ranking from major to minor/significant to insignificant should be developed), positive and negative impacts, duration of impacts (long term or short term or immediate), direct and indirect impacts, reversible or irreversible, long term and immediate impacts and identify avoidable impacts.

Cumulative impacts should also be evaluated taking into account previous developments and any proposed development immediately adjacent to the subject development within the area. The identified impacts should be profiled to assess the magnitude of the impacts. The major concerns surrounding environmental, health, and safety issues should be noted and their relative importance to the design of the project and the intended activities indicated. The extent and quality of the available data should be characterized, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should then be ranked as major, moderate and minor and presented in separate matrices for all the phases of the project (i.e. preconstruction, construction, occupation, operational and decommissioning/closure). The potential impacts may be subdivided into Physical Impacts, Biological Impacts and Socio-economic and Cultural Impacts. All impacts should be listed, ranked and assessed, preferably in a single table.

The impacts to be assessed will include but not be limited to the following:

7.1 PHYSICAL

- o Impacts of construction activities such as site clearance, earthworks, geotechnical and engineering requirements and spoil disposal
- o Impacts of spills (such as oil and chemical spills)
- o Impacts on Air Quality
- o Impacts on Water Quality (pollution of potable, coastal, surface and ground water)
- o Impacts on Climate Change
- o Demands/requirements of the following must be quantified
 - Water Supply
 - Sewage Treatment and Disposal - Empirical data must be provided to show that the proposed sewage treatment facility has the capacity to remove the nutrients to meet the National Sewage Effluent Standards;
 - Wastewater Disposal
 - Trade Effluent Discharges (if any)
 - Solid Waste Disposal
 - Electrical Power (fossil fuels, wind, sun, wave and tidal)
 - Communications and other utility requirements
 - Transport Systems and supporting infrastructure required
- o Operation and maintenance – waste disposal, site drainage, sewage treatment and disposal solution, and air quality;

- o Impacts on visual aesthetics and landscape
- o Noise
- o Change in drainage pattern, including but not limited to the Bowers Gully
- o Carrying capacity of the proposed site

7.2 NATURAL HAZARD

Potential impact of Natural Hazards: (such as Hurricanes and Earthquakes) and flooding potential

7.3 BIOLOGICAL

An assessment of the direct and indirect impacts of the project on the ecology of terrestrial and aquatic habitats with emphasis being placed on rare, endemic, threatened, protected, endangered, invasive and economically important species found. This should include habitat loss and fragmentation, loss of species and natural features due to construction and operation. Impact of noise and vibration especially on fauna.

7.4 HERITAGE

Loss of and damage to: artifacts, archaeological, geological and paleontological features.

7.5 HUMAN/SOCIAL/CULTURAL

Effects on socio-economic status such as changes to public access and recreational use, impacts on existing and potential economic activities, public perception, contribution of development to national economy and development of surrounding communities. Socio-economic and cultural impacts to include land use/resource effects.

7.6 PUBLIC HEALTH ISSUES OF CONCERN

7.7 RISK ASSESSMENT

Analyze the risks to human health and ecosystems associated with the development from both human activities and natural phenomenon. This should include: 1) Identifying the hazards; 2) Assessing the potential consequences; 3) Assessing the probability of the consequences and 4) Characterizing the risk and uncertainty. The monetary costs of the risks, the costs of emergency response and/or avoidance of risks should also be considered. The physical, biological and sociological status will provide the framework in which to assess the impacts of the proposed project.

8 IMPACT MITIGATION

The mitigation measures should endeavour to avoid, reduce and remedy the potential negative effects identified while at the same time enhance the positive impacts projected. Mitigation and abatement measures should be developed for each potential negative impact identified. Full details of the methods proposed to be employed in the implementation of these measures should be provided, including details on the scheduling/timelines, source of materials, location and responsible parties where appropriate. Where appropriate, maps and diagrams should also be used to illustrate areas where mitigation measures are proposed to be implemented.

Where possible and applicable green building technology should be examined and a statement made on strategies that will be used to conserve energy and water in relation to this development.

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Terms of Reference for Environmental Impact Assessment

Proposed Subdivision and Housing Development at Whim Pen, Old Harbour, St. Catherine

Final Draft: (28 May 2018)

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9 ENERGY USE AND CONSERVATION

This section should provide methods of energy conservation that could be applied. Alternate sources of energy could also be provided and assessed, and a justification provided for the preferred energy source. Where possible and applicable, green building technology should be examined.

10 ANALYSIS OF ALTERNATIVES

Alternatives to the proposed development/project including the no-action alternative and project design alternatives should be examined. These should be assessed according to the physical, ecological and socio-economic parameters of the site. This examination of alternatives should incorporate the use of the history of the overall area in which the site is located and previous uses of the site itself. Alternatives should also address specific aspects of the project such as methods proposed in the execution of the project (works) that have been identified as being causes of major impacts. A rationale for the selection of any project alternative should be provided.

11 ENVIRONMENTAL MONITORING AND MANAGEMENT

An environmental monitoring and management plan should be developed which will detail the requirements for construction and operational phases of the project. This should include, but not be limited to training for construction and operation staff, as well as include recommendations to ensure the implementation of mitigation measures and long term minimization of negative impacts.

A draft environmental monitoring programme should be included in the EIA, and a detailed version submitted to NEPA for approval should the permit be granted and prior to the commencement of the development. At the minimum the monitoring programme and report should include:

- Introduction outlining the need for a monitoring programme and the relevant specific provisions of the permit(s) and/or licence(s) granted.
- The activity being monitored
- The locations/sites selected for monitoring. These may in instances, be pre-determined by the local authority and should incorporate a control site where no impact from the development is expected.
- The parameters which will be monitored for each activity or implemented mitigation measure
- The methodology to be employed for the monitoring of the various parameters and the frequency of monitoring.
- The frequency of the submission of the monitoring reports to NEPA and other relevant agencies
- The responsible parties for the monitoring
- Possible energy and water conservation measures

The Monitoring report should also include, at minimum:

- Raw data collected. Tables and graphs are to be used where appropriate
- Discussion of results with respect to the development in progress, highlighting any parameter(s) which exceeds the expected standard(s).

- o Recommendations
- o Appendices of data and photographs if necessary.

12 LIST OF REFERENCES

13 APPENDICES

The appendices should include but not be limited to the following documents:

- > Reference documents
- > Photographs/ maps
- > Data Tables
- > Glossary of Technical Terms used
- > Final Terms of Reference
- > Composition of the consulting team, team that undertook the study/assessment, including name, qualification and roles of team members
- > Notes of Public Consultation sessions
- > Instruments used in community surveys

14 ACTIVITIES

In order to effectively and efficiently conduct the Environmental Impact Assessment it will be necessary to carry out various activities which include:

14.1 DOCUMENTATION REVIEW

All documentation pertaining to the development will need to be reviewed. These should include, but not limited to, the project profile, site plan, drainage plan, vegetation clearance plan, applications made for financing or planning approval, and any technical and engineering studies that have been done.

14.2 ANALYSIS OF ALTERNATIVES

Alternatives to the site location, project design and operation conditions will be analyzed including the "no-action" alternative. These alternatives will be assessed based on the physical, ecological and socio-economic parameters of the site identified. The consultant should provide justification for the selection of the chosen alternative(s). The physical, biological and sociological settings will provide the framework in which to assess the different project alternatives. This would clarify, for instance, whether the site could be used for other purposes as well as whether there are any particular aspects of the development that can be sited differently, operated differently, etc.

14.3 IMPACT ASSESSMENT

The consultant should carry out a detailed impact assessment of the project components (pre-construction, construction and operation stages) in order to identify the potential impacts (positive, negative and cumulative impacts) that will be associated with the project. The significance and magnitude (major, moderate and minor) of the impacts identified will also be evaluated through the use of a weighted matrix.

The impacts to be assessed will include but not limited to the following:

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-
- Effects of project design and engineering;
 - Effects on visual aesthetics and landscape;
 - Effect of noise and vibration;
 - Effects of construction activities such as site clearance and geological formation, earthworks, hurricanes, access routes, transportation networks and spoil disposal;
 - Effects of operation and maintenance activities such as waste disposal, traffic management, site drainage, sediment, sewage, public access and air quality; and
 - Effects on ecology including effect on terrestrial and aquatic habitats
 - Emphasis should be placed on any rare, endangered, and endemic species found
 - Effects on socio-economic status such as changes to public access, recreational use, existing and potential uses, contribution of development to national economy and development of surrounding communities.

All findings must be presented in the EIA report and must reflect the headings in the body of the TORs, as well as, references. GIS references should be provided where applicable. One hard copy and an electronic copy must be submitted to NEPA for review after which the Agency will indicate the number of hard copies along with an electronic copy of the report to be submitted. One copy of the document should be perfect bound.

The report should include appendices with items such as maps, site plans, the study team and their individual qualifications, photographs, and other relevant information. All of the foregoing should be properly sourced and credited.

14.2 Appendix II – Team of Experts

1. Eleanor Jones Environmental Management Specialist, Lead Consultant
2. Abigail McIntosh Senior Environmental Analyst, Project Manager
3. Annmarie Goulbourne Senior Environmental Analyst, Project Manager
4. Richard Coutou Geologist and Environment Analyst
5. Rashidah Khan-Haqq Senior Environmental Chemist
6. Mario Christie Environmental Chemist
7. Dr. Arpita Mandal Hydrologist
8. Brandon Hay Ecologist
9. Balcostics Ltd. Field Data Collection

14.3 Appendix III- List of Technical Reports

	Report	Year	Done by
1	Whim Estates Residential Development Old Harbour, St. Catherine Project Brief	2018	Whim Development Company Limited o/a Well Engineered Living (WEL)
2	Traffic Impact Study Whim Estates Limited Residential Development, St. Catherine, Jamaica	2018	
3	Bower's Gully Flood Study	2018	Premier Land and Water Development
4	Drainage Report for Whim Estates Housing Development, Old Harbour, St. Catherine, Jamaica W.I.	2017	Premier Land and Water Development
5	Engineering Report Water Analysis Report for Proposed Housing Development at Whim Estates, Part of Whim Pen	2017	Premier Land and Water Development
6	Phase I Environmental Site Assessment: Solar Photovoltaic Project – Old Harbour, St. Catherine	2013	Environmental Solutions Limited
7	Environmental Impact Assessment: New Harbour Village II & III	2009	Environmental Solutions Limited
8	Environmental Impact Assessment Highway 2000: Phase 1B Sandy Bay to Williamsfield Km:33+000 to 71+500		Environmental Solutions Limited
9	Environmental Impact Assessment for the New Harbour Village Housing Subdivision	2006	Environmental Solutions Limited
10	Design Report for the Whim Estates Waste Water Treatment Facility	undated	Premier Land and Water Development
11	Engineering Report Sewer Analysis for Proposed Housing Development at Whim Estates, Part of Whim Pen	undated	Premier Land and Water Development

14.4 Appendix IV – Methodology for Whim Estates Hydrological Study

The proposed plot is of 70 hectares and is located west of the New Harbour Housing Village and south of the Highway 2000. It is located in the Bower's Gully subwatershed unit of the Rio Cobre watershed management unit and lies on the border of the parish of St Catherine and Clarendon (Figure 1). It is bounded on the east by the Old Harbour to Old Harbour Bay toll road. The NHV II EIA (2009) report mentions the need of the evaluation of important drainage channels around the plot which includes the Bowers Gully to the west, the Whims gully which drains the town of Old Harbour, the Old Harbour Bay Gully and some smaller channels which drains to the south of the plot. The 2009 and 2018 flood and hydrology study for the Bower's Gully subwatershed unit was carried out using rainfall data from stations nearby for estimating flow and thus inundation extent for different return periods (5,10, 25, 50 and 100 years). However, challenges lie in the dataset for the rainfall used for the 2009 report. It uses the stations in the watershed but fails to mention the time period of the data which is important for analysis. In this present study, rainfall – runoff modelling was carried out using the rainfall data from nearby stations to Lot 2A in the watershed for the time period (1992–2017) for which 24hr daily rainfall data was available. Although the standard drainage designs are carried out using the rainfall depths for different return periods it is also important to estimate the flows from storms and hurricanes as well as from short duration high intensity rainfall which are also significant causes of flooding in Jamaica. The year 2017 is notable for such flooding events in the months of May and June where 2-3 days of rainfall caused excess flooding in parts of St Catherine, Clarendon and other sections of the island. Hence this study has used such extreme rainfall data to estimate flows pre- and post- construction as well as for wet and dry Antecedent Moisture condition of the ground.

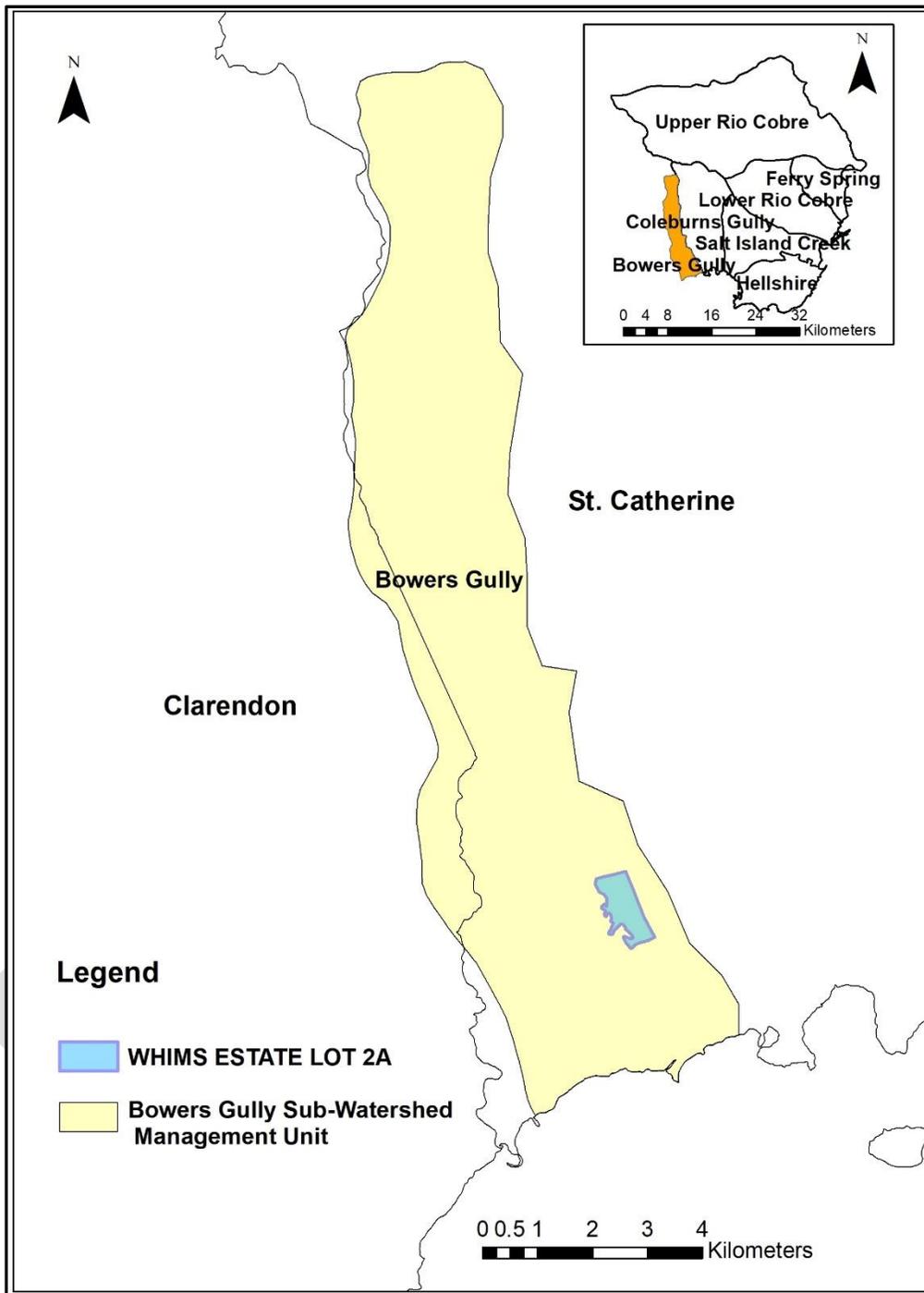


Figure 1 Map showing the location of the Whim Estates and the Bower’s Gully subwatershed management unit.

A 30yr (1951-1981) mean annual rainfall map was created from available data to show the location of the proposed plot and the Bowers Gully watershed management unit with respect to the island’s spatial

rainfall distribution pattern (Figure 3). Daily rainfall data from the rain gauges in the watershed covering a period of 22yrs of consistent data from (1996–2017) was also used for computation of rainfall return periods. The selected stations are shown in Figure 3 within the red box. It should be mentioned here that analysis prior to 1992 could not be conducted due to the fire at the Meteorological Service of Jamaica which had led to loss of data. The daily rainfall data was also used to show the variation in the total yearly and maximum rainfall across the watershed which helped in isolating years of droughts and extreme events such as floods, hurricanes and tropical storms. Runoff analysis for different return periods was carried out using the 24hr annual maximum from the stations shown in Figure 3. In addition, rainfall data from the intensity logger at Mount Thetford (located upstream of the watershed) (Figure 3) which recorded a 3-day total rainfall of 400mm from May 14-16, 2017 was used for the modelling. As like previous work in 2009 and 2018, stations located upstream and at higher elevation to the site was selected to estimate maximum runoff and time to peak runoff (Figure 3). The rainfall return periods for the stations of interest as shown in Table 1 were estimated using the Gumbel moment of means which uses the two parameters ie the mean and standard deviation. It is a commonly used distribution of extreme values (annual series) also called the Gumbel or Extreme Value Type 1 (EV 1) distribution (Viessmann et al, 1977). The 24hr max for each year was calculated from the daily data set for each station from 1992-2017 as sourced from the Meteorological Service of Jamaica from which the mean and the standard deviation are calculated for each station. Formulas and methodology description for determining the frequency factor which is related to the Return Period are also described below.

As seen from Table 1, except Bodles and Bois Content the majority of the stations have data consistent from 1996 to 2017. Hence to keep consistence this time span is selected for calculating the return periods using the equations.

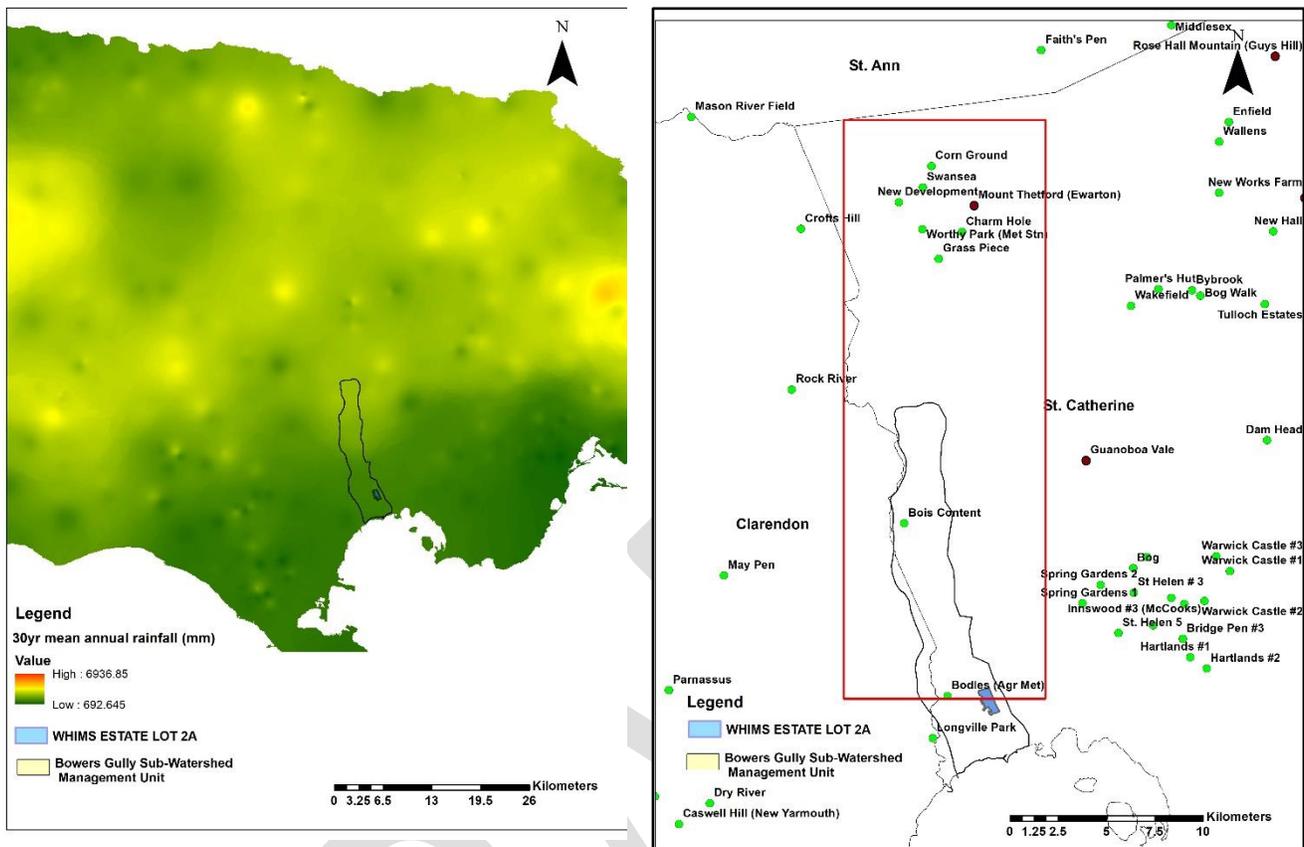


Figure 3 a) Map showing the 30yr mean annual rainfall for Jamaica and the location of the watershed and the property b) location of rainfall stations in the Bowers gully subwatershed as well as in the parish of St Catherine, located upstream of the subwatershed and property.

The hydrology of the Bowers watershed is described here with reference to the overall hydrology and drainage. The Bower's subwatershed is a part of the Rio Cobre watershed (Figure 3) and drained by the main Bower's Gully which runs to the west of the property (Lot 2A). There are no significant rivers or streams in the area surrounding the property except the gully and the man-made NIC canal. The abandoned fish ponds towards the southern end of the property have been identified as significant topographic features within the floodplain. These structures effectively block the eastern overbank flow of the river (Fluid Systems Engineering Ltd, 2009). The report further indicated that the ponds on the eastern bank of the river are a significant restriction to overbank flow when the river is in space. They quickly fill with water and restrict flow thereafter. The low-lying lands in the communities of Burkesfield

and Terminal are directly affected by the obstruction created with the water level increases of up to 0.4m during significant storm events.

Using DEM catchments and the drainage channels as well as the drainage junctions were extracted. This showed that the entire Bower's Gully subwatershed comprises of an area of 4,070 hectares with the dominant slope towards the south (i.e. towards the coast). The elevation of the watershed ranges from as high as 685m in the north to as low as ~2m near the coastline. The topographic survey carried out by the Developer shows elevation in and around the property ranging from 21m on the northern limit of the property to 12m in the south. The overall gradient is shallow and towards the south following the general slope which thus implies runoff from highlands to areas near the property. The catchment model shows that the watershed can be divided into three sets of subwatersheds marked by distinct drainage channels. The set of catchments on the north are characterised by drainage network showing flow direction to the NE with the main channel rising from the highlands and flowing to the east. The second set of catchments shows the channel rising from the highlands in the NW section of the watershed and draining along the west of the property as the Bowers Gully. Flow from these set of catchments and the main channel (gully) will thus contribute to excess runoff during and post heavy rainfall. The third set of catchments will not contribute to any flow in the gully as due to the slope direction and elevation it drains towards the SW corner and away from the property.

The Bowers Gully sub watershed has four hydrostratigraphic units which are delineated based on the geology of the area and following the geological boundaries. These are namely the Limestone Aquifer, the Coastal Aquiclude, Alluvium aquifer and the Basal Aquiclude (Figure 4). The limestone aquifer located in the central section of the basin is comprised of the white - cream coloured limestones of the White limestone Group. The southern and south-central part of the basin is underlain by the alluvium aquifer. The wells as shown in Figure 4 although seen to lie spatially on the alluvium aquifer but are however abstracting water from the limestone aquifer underneath as per the records of static water level data obtained from the Water Resources of Jamaica. Except the wells of Whims 2, 3, Rhodens and Kelly Pen, the remaining of the wells are drilled to the limestone aquifer which is the dominant aquifer in the parish of St Catherine covering an area of 762 sq. km (WRA Master Plan). The depth of drilling ranges from 103m at Colbeck Machado to a low of 37.5 m at Whims and in the alluvium wells. Overall groundwater flow direction is towards the south i.e. south from Colbeck Machado to the wells of Kelly Pen and towards the property. Table 1 below shows that the limestone wells are deeper than the alluvium wells and thus would be at a lesser risk from drying up during periods of low rainfall and

recharge as well as less risk from contamination from nutrients as well as saline water intrusion. The wells in the immediate vicinity of the property are that of Lodge Farm 1, Marine Terminal and Kelly Pen all of which are privately owned wells. The wells of Bodles are owned by JPS are used for irrigation purposes.

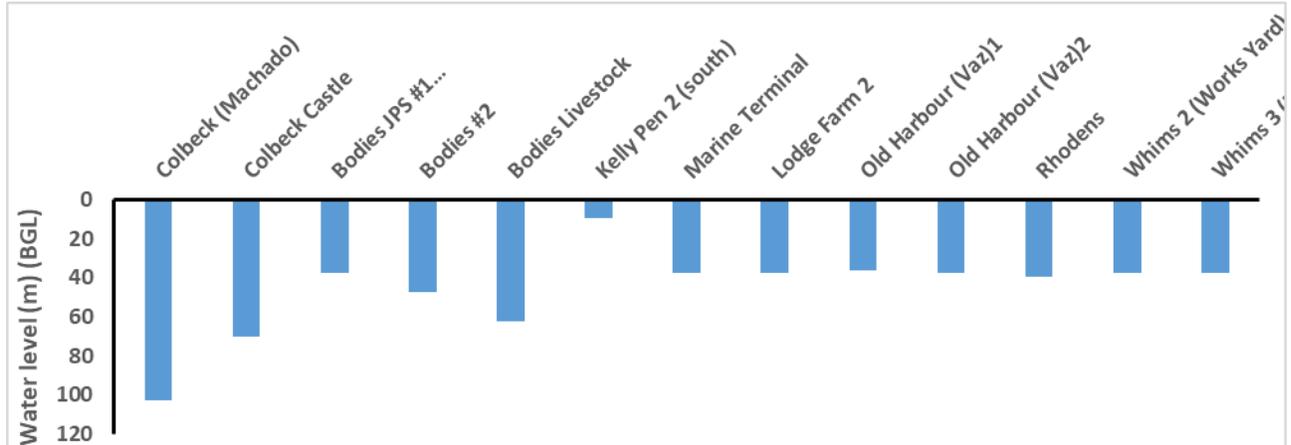


Figure 4 Depth of the wells in the Limestone and Alluvium aquifer of South Rio Cobre basin and in the Bower's Gully subwatershed management unit. (Data from WRA web data base).

Table 1 Depth of the wells and the type of aquifer in the vicinity of the proposed development in the Bower's Gully subwatershed management unit. (Data from WRA webdatabase).

Wells	Depth (feet)	Aquifer
Colbeck (Machado)	103.1	Limestone
Colbeck Castle	70.0	Limestone
Bodies JPS #1 Replacement	37.5	Limestone
Bodies #2	47.5	Limestone
Bodies Livestock	62.5	Limestone
Kelly Pen 2 (south)	9.4	Alluvium
Marine Terminal	37.5	Limestone
Lodge Farm 2	37.5	Limestone
Old Harbour (Vaz)1	36.6	Limestone
Old Harbour (Vaz)2	37.5	Limestone
Rhodens	39.7	Alluvium
Whims 2 (Works Yard)	37.5	Alluvium
Whims 3 (Metal Farm) Bartons	37.5	Alluvium

The water resource assessment for the property is very crucial for development. This will be discussed in connection with the overall surface and groundwater resources for the Rio Cobre basin as shown below in Figure 5. The geology and hydrostratigraphic units as discussed above shows that the main surface drainage is the Bower's gully and primarily composed of limestones and alluvium aquifer which are karstified in places thus implying sub-surface storage for water. Hence the primary source of water for the property would be from groundwater wells which needs to be drilled post detailed geological investigation, sub-surface mapping using geophysical methods (i.e. using resistivity survey). As seen from the figure below the Rio Cobre basin is divided into the Upper and Lower where the wells of the Lower Rio Cobre are divided into both irrigation and domestic water supply. The existing data from WRA and NWC show that the wells in and around the property as shown above are used for irrigation and industrial (JPS, Bodles and NIC irrigation wells). Agriculture is the main consumer of groundwater and surface water for the Rio Cobre basin as compared to the other sectors. The Draft WRA Master Plan (2005) shows that the Rio Cobre basin has an effective yield of ~408 cubic metres which comprises both the surface and groundwater resources. Water from this basin is often used for providing potable water to the Kingston Basin during times of shortage which thus shows that the Rio Cobre basin has sufficient water to sustain the demand. However, an increase in demand from new developments can affect the available resources which may show signs of declining if sufficient recharge is not met through rainfall.

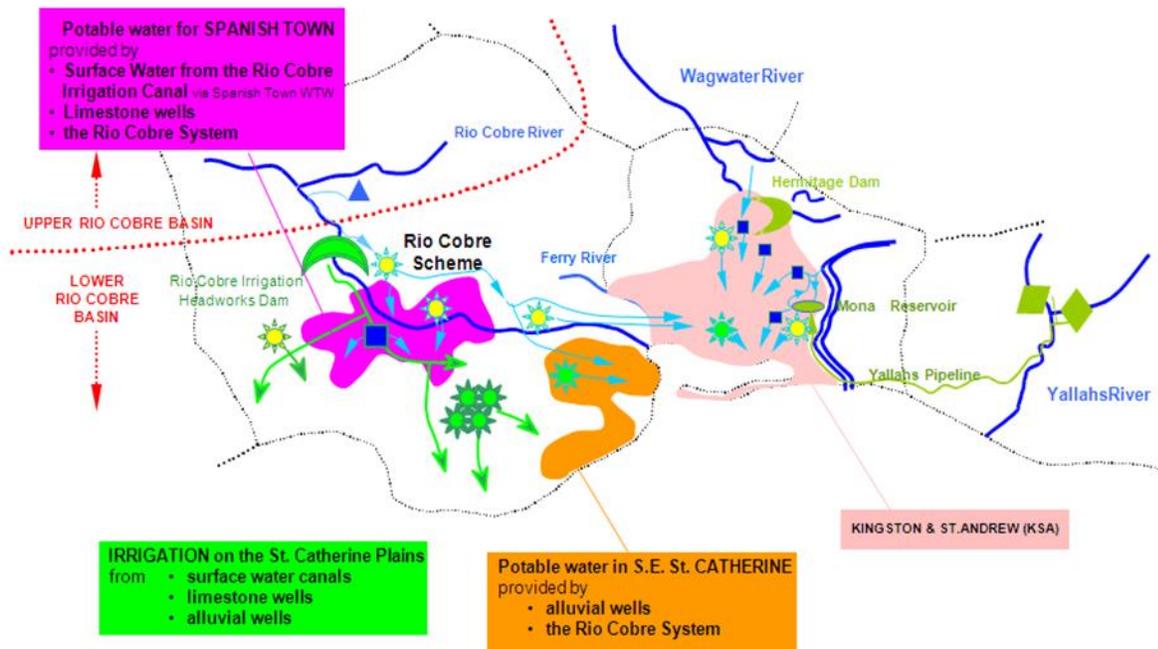


Figure 5 Overall surface and groundwater resources for the Rio Cobre basin

The available Static Water Level (water level in the wells under a no-pumping equilibrium condition) data was sourced from the WRA web database to show the temporal trend. There is inconsistency of data as seen from the graphs below maybe due to abandonment of the well hence the interpretation is done based on limited availability of data (Figure 6).

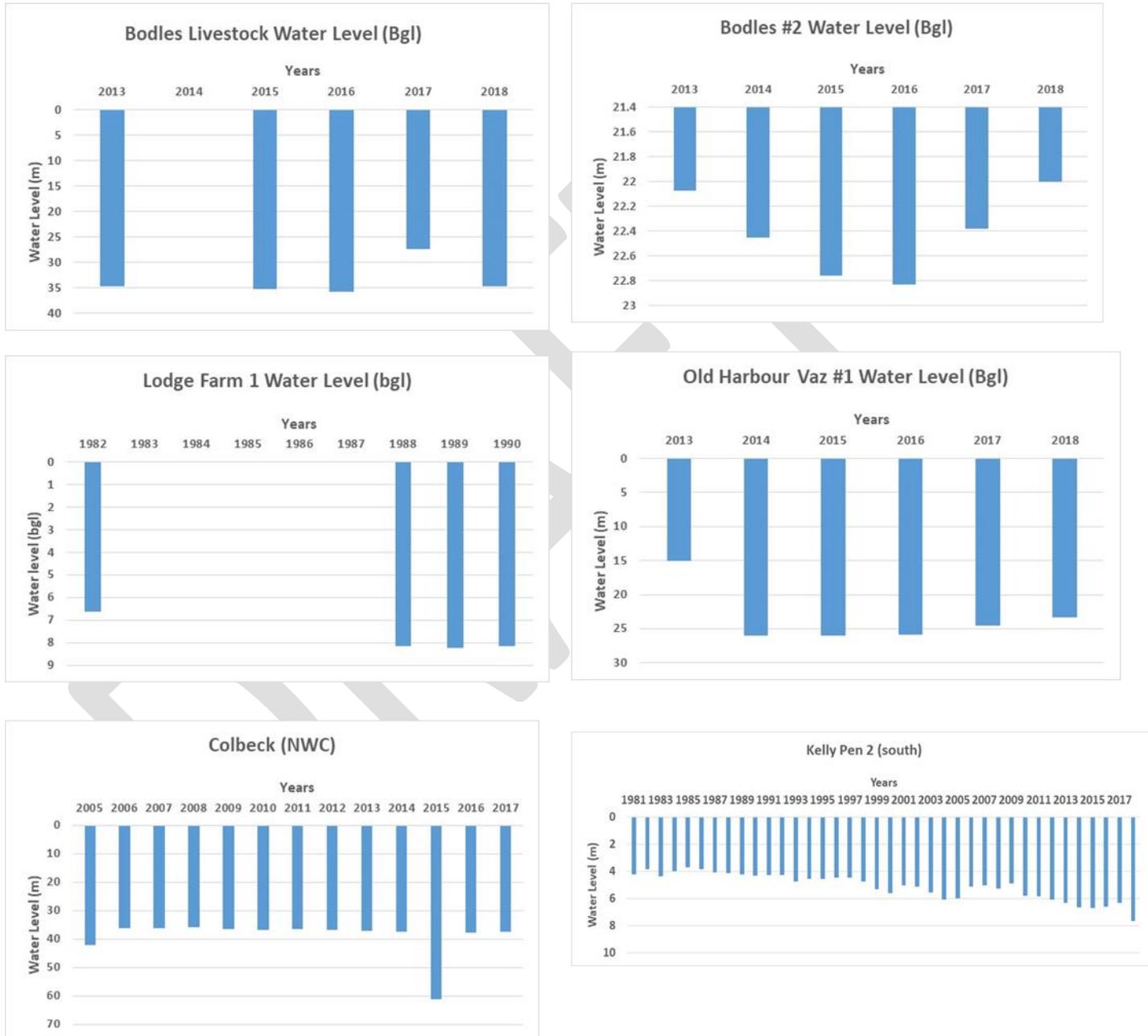


Figure 6 Water level in the wells under a no-pumping equilibrium condition

As seen from the water level, there is no significant change in the levels of groundwater. The wells of Colbeck, Bodles, Old Harbour Vaz1 and Kelly Pen all show a decline in the year 2015 which corresponds to the year of drought. However, the drop is not of significant amount and a change of 200 m approximately is seen for the mean water level for the years. Seasonal trend analysis for the wells is shown below with monthly data for one well for which consistent data is available and which follows the overall trend. The well at Bodles and Colbeck Castle has data from 2006-2017 and shows the slight change in water levels with a slight lowering (~200m) in the drier months (Jan- May) followed by an increase in the wet period (August- November) concurrent with the temporal trend in the rainfall pattern (Figure 7). The years of drought 2014 and 2015 show an overall drop in water level in the wet months as well when compared to 2016 and 2017 which implies change in recharge even though not a very significant amount, yet still to be considered. A similar trend will be seen for all the wells and hence a representative sample is shown here.

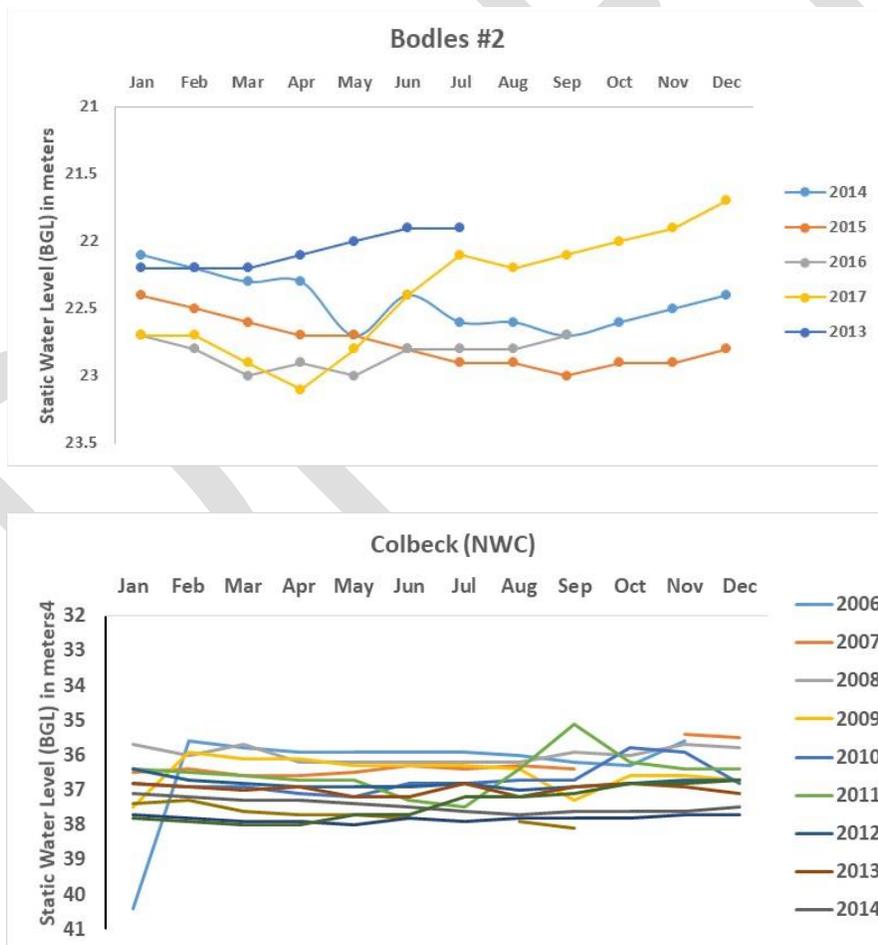


Figure 7 Seasonality in the water levels in the well at Bodles #2 and Colbeck

In terms of production or abstraction data, challenges remain as there is not much data available for the specific wells shown in Figure 7 above. In terms of the alluvium wells data are available only for the wells at Port Esquivel and Whim Yard of which only the former shows recent data records and hence it is shown here. There is limited record for the alluvium well at Whims Yard from 1981-1984 and hence not used for this study. Yearly graphs for the production are shown below in Figure 8. However, for the limestone wells, data exists till 2017 for some of the limestone wells and hence those are shown here for the current study. Production data for wells which show data ending in 1980's is not considered as they are considered abandoned and hence do not contribute to the existing condition of the availability and demand.

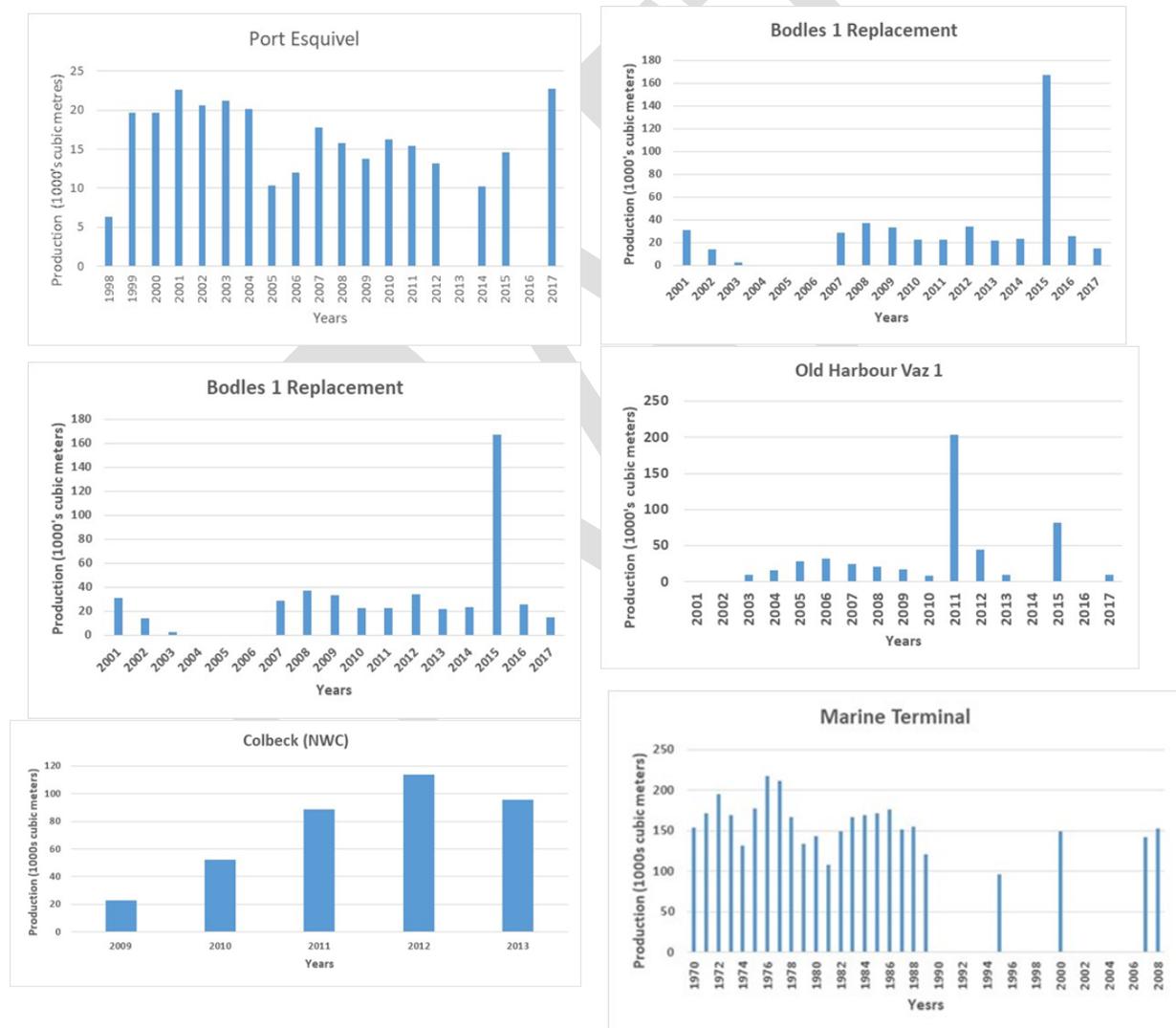


Figure 8 Mean yearly production for the active pumping wells in and around the proposed development. (Data from NWC and WRA).

There is not much significant trend to be seen from the production data for the wells. It varies and a conclusive statement cannot be made whether this increase or decrease is from increase in demand vs decrease in rainfall and recharge. Overall in the last ten years production has shown increase in the years 2010, 2011 and again in 2015 and 2017 as seen from the available wells. This could be due to increase in demand for the years when drought had impacted (2010 and 2015) causing decrease in surface water levels and maybe increased pumping to meet additional resources from the available groundwater reserves. However, none of the wells show drying up in recent 5 years of time span and thus based on data available it can be said there is reasonable groundwater reserves for use in the area.

A commonly used distribution of extreme values (annual series) is the Gumbel or Extreme Value Type 1 (EV 1) distribution [1]. The cumulative distribution function (CDF) of this distribution takes the form:

$$F(X \leq x) = F(x) = \exp\left\{-\exp\left[-\frac{(x-\mu)}{\alpha}\right]\right\}$$

Where the parameters μ and α are functions of the first moment about the origin, and the second moment about the mean respectively. Two of the commonly used methods of estimating the parameters of the extreme value distribution from observed data are the methods of moments and the graphical method. The method of moments uses Chow (1951) general equation for hydrologic frequency

analysis: $x = \bar{x} + Ks$

Where: \bar{x} = first moment about the origin (mean)

s = the square root of the second moment about the mean (standard deviation)

K = frequency factor

Theoretical Extreme Value (EV) Distribution Approach

To illustrate the second approach, let us select the Gumbel (Type I) distribution as our EV distribution. The Gumbel Type I distribution is,

$$G(x; \mu, \beta) = \frac{1}{\beta} e^{\frac{x-\mu}{\beta}} e^{-e^{\frac{x-\mu}{\beta}}} \quad (2)$$

where μ is the location parameter and β is the scale parameter.

It can be shown that the value of the random variable X_T associated with a given return period, T , may be obtained from the following expression,

$$X_T = \bar{X} + K_T S \quad (3)$$

where \bar{X} is the mean of the observations (e.g., arithmetic average of the observations), and S is the standard deviation of the observations. The frequency factor associated with return period T , K_T , is given by

$$K_T = -\frac{\sqrt{6}}{\pi} [0.5772 + \ln(\ln(\frac{T}{T-1}))] \quad (4)$$

The above section shows the formulas for determining the frequency factor which is related to the Return Period (T). Graphically this is carried out by first sorting the annual 24hr max for each station in an ascending order followed by assigning a rank or order with rank = 1 for the smallest and rank = 23 or the number of observations for the data set. The probability of exceedance is calculated for each station using the Weibull formula which is $r / (n+1)$ where r = rank assigned to the sorted data set and n = number of observations. This is also called the Weibull plotting position (1939). The Gumbel variable is thus determined using the inverse of the Log of the probability of exceedance and which when plotted on a probability paper should fall on a straight line. The return period (T) is thus calculated using the following equation:

$$F(x) = \left(1 - \frac{1}{T}\right) \text{ where } T = \text{return period.}$$

The above method has been in existent since 1995 when it was used to develop the IDF curves for the NMIA (Norman Manley International Airport) and SIA (Sangster International Airport) for Jamaica (UWA, 1995) as well as by Burgess et al. 2015.

24hr maximum for the stations close to the Whim Estates and upstream of the Bower's Gully watershed as well as on the property.

	BODLES	BOIS CONTENT	CHARM HOLE	CORN GROUND	NEW DEVELOPMENT	WORTHY PARK	SWANSEA	GRASS PIECE
1992	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	25.5
1994	287	158	0	0	0	0	0	0
1995	89.5	114.3	0	0	0	0	0	0
1996	73	117.1	94.5	119.6	114.2	80.9	115.7	114.3
1997	63.3	101.6	0	213.2	182.3	128	182	227.6
1998	150	86.6	0	122.3	96.9	82.6	116.3	124.3
1999	92	95	74.2	105.9	0	194.5	71	80
2000	63.3	70	0	92	73.1	0	66.7	71.8
2001	92	91.3	0	83.2	80.6	0	81.8	68
2002	140		232.1	232.1	212.5	217.9	226.9	231.3
2003	260.1	128.7	208.8	174.1	217.6	207.8	196.8	209.9
2004	130.2	275.9	408	408	408	408	408	408
2005	254.5	254.6	295	269	180	165	230.2	207.2
2006	132	82.6	155.5	133	97.9	91	104.4	141
2007	175	278	199	173	161	177	175	170
2008	0	90	269.5	232	242	143.4	295.5	139.8
2009	67	125.2	120	110	96	124	80	122
2010	120	166.8	180	139	200	132	233	217
2011	110	90	120	140	220	126	252	157.7
2012	115.8	116.7	105.4	109.4	112.1	102.1	118.6	127.1
2013	74.4	112.1	69	66.5	60.3	57.2	63.3	57.5
2014	45	76.4	72.5	52.5	74.6	46.8	66.5	60.6
2015	45.4	79.1	60.4	54.5	40	44	50.4	47.5
2016	190.6	94.6	93.1	102	78.5	72.3	127.7	74
2017	86.6	214.8	270	140	230	188	220	260

14.5 Appendix V - Licence to Extract Water

FORM B [Regulations 5 (4)]

Licence No. A2016/59

THE WATER RESOURCES ACT, 1995 – SECTION 19(1)
LICENCE TO ABSTRACT AND USE WATER

Old Harbour Estates Limited
Name of Licensee

P.O. Box 4, Old Harbour P.O., St. Catherine
Address of Licensee

is hereby granted a licence to abstract and use water, subject to the provisions of the Water Resources Act and Regulations made there-under and to the terms and conditions herein specified.

Terms and Conditions of Licence

- Water may be abstracted pursuant to this licence only from
Whin #2 (Works Yard) Well
(source)
located at Old Harbour, St. Catherine
such abstraction to be at a rate not exceeding 1,657 cubic metres per day.
- Water abstracted pursuant to this licence may be used for the following purposes only:
Domestic/Public Supply
- Water may be abstracted pursuant to this licence in the following manner only:
Vertical Turbine or Submersible Pump
- Within thirty (30) days of the installation of the pump by which water is to be abstracted the licensee shall install on the supply line leading from such pump, a full flow meter (of a type approved by the Authority) for the purpose of measuring the water abstracted.
- The licensee shall make a monthly return to the Authority of the amount of water abstracted.
- The licence becomes null and void if within twelve months from the date of the issue thereof, no water is abstracted or used from the approved source pursuant to such licence.
- The licence shall be valid for a period of 5 years from the date of the issue thereof, subject to the provisions of the Act and Regulations made thereunder relating to its revocation, suspension and variation.

Additional Terms and Conditions (if any)

- Amount of water abstracted should be submitted by the 10th day of the following month
- Access for water level measurement including a stilling tube to be installed
- Pumping water level must be maintained at least 1 metre above sea level
- Chloride concentration must not exceed 250mg/l
- Water quality be sampled twice yearly (April and November) and analyzed for the following parameters and submitted to WRA: pH, Conductivity, Calcium, Sodium, Chloride, Nitrate, TDS, Sulphate, Magnesium, Total and Faecal Coliform.
- Application for renewal must be submitted at least six (6) months in advance of the expiry date
- The WRA reserves the right to access the property at its convenience to monitor the source

Dated this 12th day of October, 2017

Seal:  [Signature]

[Signature]
Secretary,
Water Resources Authority

14.6 Appendix VI – JPS Commitment to Whim Estates



August 22, 2018

JPS Ref # E & S R180822-01

The Director
WHIM Development Company Limited
PO Box #4, Old Harbour P.O.
Old Harbour
St. Catherine

Attention: Mr. Bruce Donaldson

Dear Sir:

Re: Electricity Supply to Proposed Whim Estates Housing Scheme, Old Harbour, St. Catherine

Reference is made to your letter dated August 13, 2018 on the captioned matter. JPS is pleased to provide supply to the Whim Estates Housing Development.

In order to facilitate the provision of electricity supply, kindly engage a Professional Engineer (Electrical), to prepare an Electrical Distribution Design for submission, in triplicate to JPS for review and approval. The design shall be completed in accordance with the following standards:

1. Jamaica Public Service Distribution Standards-ES1300
2. Application Guide for concrete poles-FM006
3. National Electric Safety Code-ANSI C2
4. Jamaica Standard for Electrical Installation JS: 21, 1992
5. Electrical lighting Act 2015
6. All-Island Electricity License, 2016
7. JPS Rate Schedule, 2017
8. Standard Terms and Condition of Electric Supply
9. JPS Metering facility Policy – 2008
10. The design shall be completed and notarized by a Registered Professional Engineer (Electrical) and licensed to practice in Jamaica.

Upon approval of the design, in order for us to prepare a construction estimate for the electrical supply, we will require the following:

DIRECTORS:
CHANG SUP JO - CHAIRMAN
SUZETTE BUCHANAN
MINNA ISRAEL
HON. CHARLES JOHNSTON
SEIJI KAWAMURA
TATSUYA OZONO
HA KYOUNG SONG
FITZROY VIDAL
COLIN WILLIAMS

JAMAICA PUBLIC SERVICE
COMPANY LIMITED

6 KNUTSFORD BOULEVARD,
KINGSTON 5, JAMAICA

T: (876) 926 3190-9
F: (876) 936.1800

www.myjpsco.com



Bruce Donaldson – Whim Development Company Limited
August 22, 2018
Page 2

1. Copy of Parish Council's Approval and Associated Conditions of Approval
2. Proof of ownership or Authority to erect infrastructure, i.e.
 - a. Copy of Title
 - b. Power of Attorney
 - c. Lease contract etc.
3. Copy of pre-checked Site Plan, to include water, sewerage, drainage, communications and any other utilities or facilities that may impact the distribution system.
4. Copy of Surveyor's Declaration
5. Soft copy of approved electrical distribution design in ACAD 2016 format, superimposed on the site plan, to include water, sewerage, drainage, communications and any other utilities that may impact the distribution system.

DIRECTORS:
CHANG SUP JO - CHAIRMAN
SUZETTE BUCHANAN
MINNA ISRAEL
HON. CHARLES JOHNSTON
SEIJI KAWAMURA
TATSUYA OZONO
HA KYOUNG SONG
FITZROY VIDAL
COLIN WILLIAMS

The Jamaica Public Service will always be of service to you and fully appreciates your business.

Yours truly,

JAMAICA PUBLIC SERVICE
COMPANY LIMITED

JAMAICA PUBLIC SERVICE COMPANY LIMITED

6 KNUTSFORD BOULEVARD,
KINGSTON 5, JAMAICA

Osawaki Wickham
Osawaki Wickham

T: (876) 926.3390-9
F: (876) 936.1800

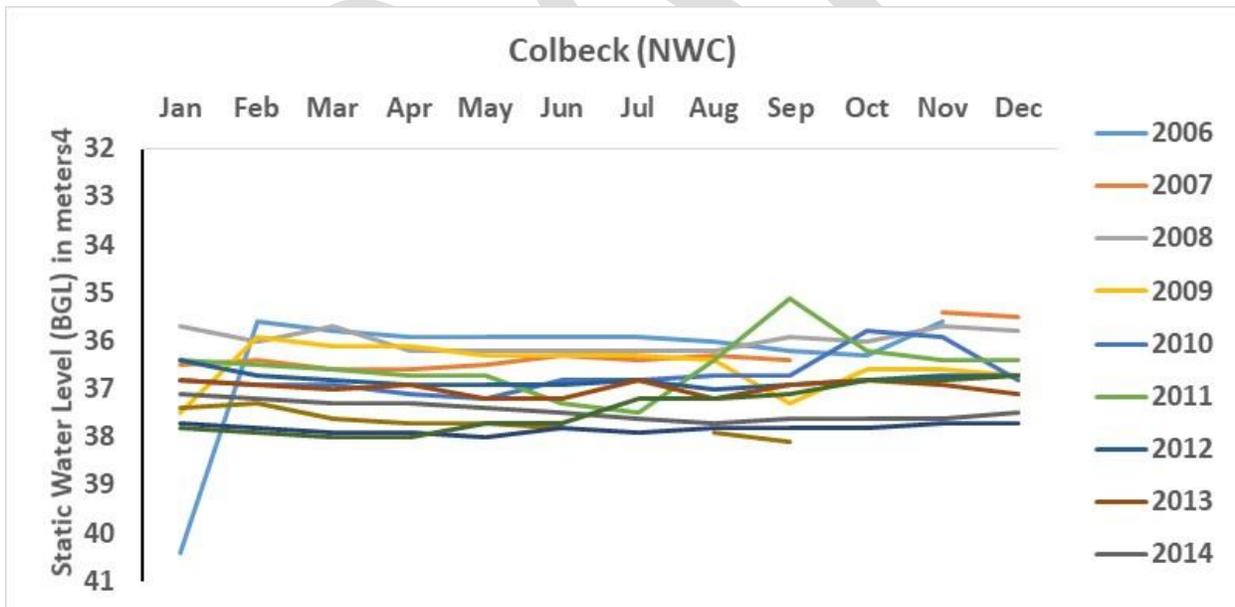
Manager
Engineering & Standards
693A Spanish Town Road
Kingston 11

www.myjpsco.com

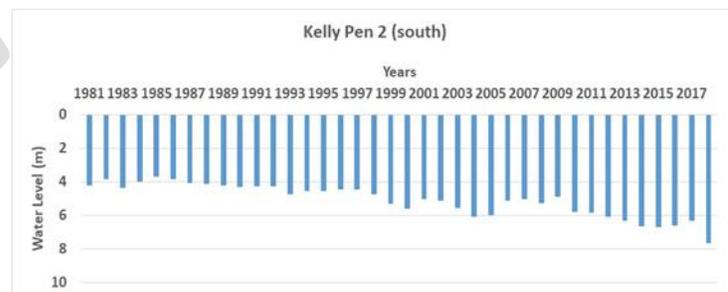
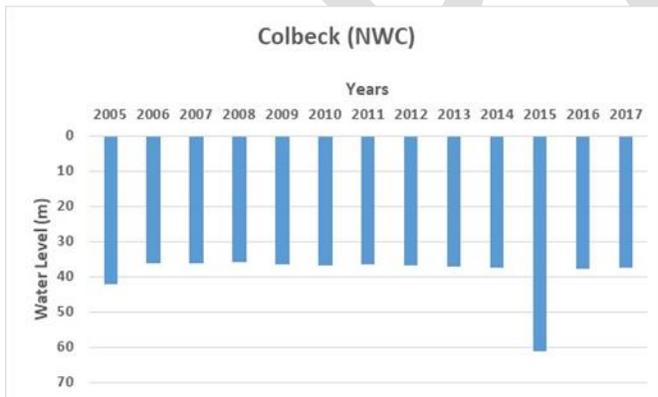
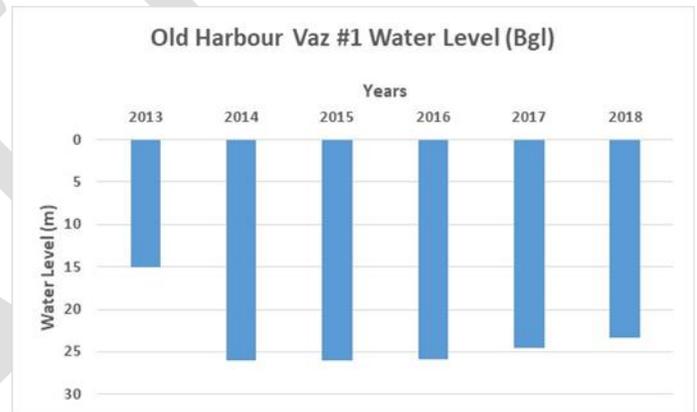
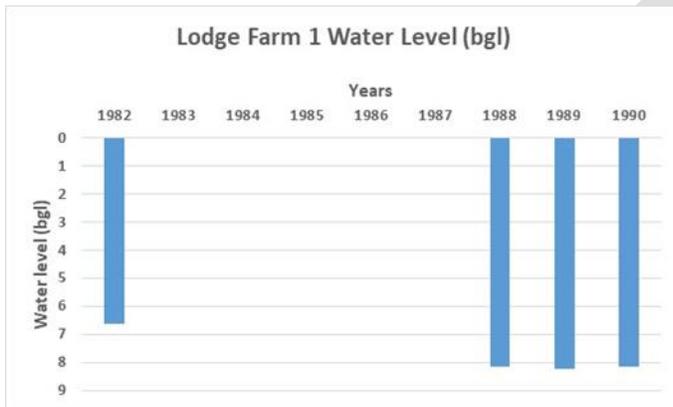
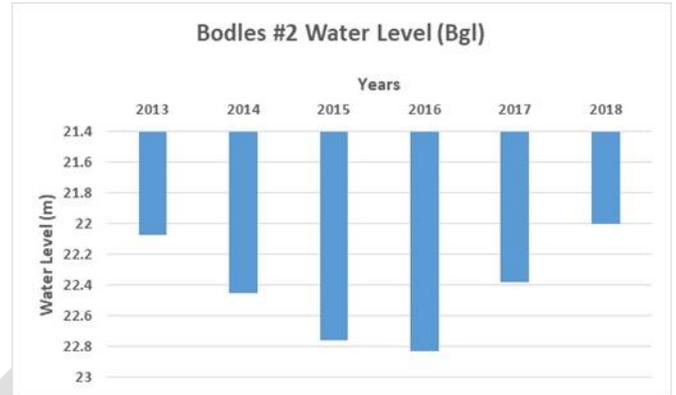
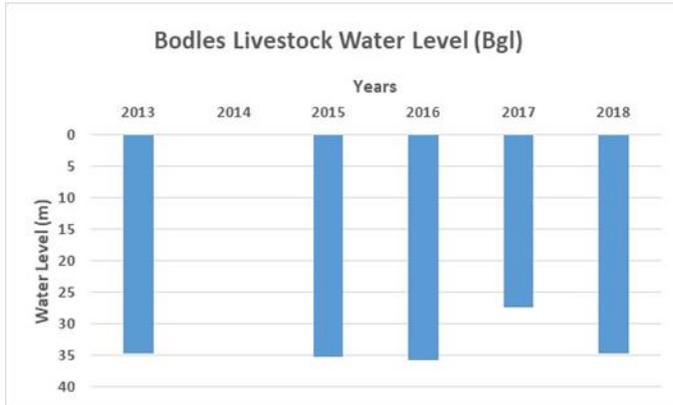
Tel. # 937-9320 / Fax # 937-9259



14.7 Appendix VII - Seasonal Water Levels in the Wells at Bodles #2 and Colbeck



14.8 Appendix VIII – Static Water Level Data for Wells of the Bower’s Gully near the Whim Estates



14.9 Appendix IX – Species Lists

Birds

	Family groups	Family	Common Name	Scientific Name	Status	Points	Score	Index	DAFOR
1	Bitterns and Herons	Ardeidae	Cattle Egret	<i>Bulbicus ibis</i>	b	5	11	5.5	A
2	Bitterns and Herons	Ardeidae	Green Heron	<i>Butorides virescens</i>	b	1	1	0.1	O
3	Bitterns and Herons	Ardeidae	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	b	1	1	0.1	O
4	Ibises and Spoonbills	Threskiornithidae	Glossy Ibis	<i>Plegadis falcinellus</i>	b	3	3	0.9	O
5	New World Vultures	Cathartidae	Turkey Vulture	<i>Cathartes aura</i>	b	2	128	25.6	D
6	Falcons & Caracaras	Falconidae	American Kestrel	<i>Falco sparverius</i>	b	2	2	0.4	O
7	Pigeons & Doves	Columbidae	Rock Dove	<i>Columba livia</i>	b	1	5	0.5	O
8	Pigeons & Doves	Columbidae	White-crowned Pigeon	<i>Patagioenas leucocephala</i>	b	1	1	0.1	O
9	Pigeons & Doves	Columbidae	Mourning Dove	<i>Zenaida macroura</i>	b	3	5	1.5	F
10	Pigeons & Doves	Columbidae	Zenaida Dove	<i>Zenaida aurita</i>	b	2	2	0.4	O
11	Pigeons & Doves	Columbidae	Common Ground-Dove	<i>Columbina passerina jamaicensis</i>	bes	1	3	0.3	O
12	Parrots, Macaws & Allies	Psittacidae	Jamaican Parakeet	<i>Eupsittula nana</i>	be	3	6	1.8	F
13	Cuckoos and Anis	Cuculidae	Smooth-billed Ani	<i>Crotophaga ani</i>	b	4	11	4.4	F
14	Barn-Owls	Tytonidae	Barn Owl	<i>Tyto alba</i>	b	0	0	0	R
15	Nightjars & Allies	Caprimulgidae	Antillean Nighthawk	<i>Chordeiles gundlachii</i>	bs	0	0	0	R
16	Swifts	Apodidae	Black Swift	<i>Cypseloides niger</i>	b	1	3	0.3	O
17	Hummingbirds	Trochilidae	Vervain Hummingbird	<i>Mellisuga minima minima</i>	bes	1	1	0.1	O
18	Woodpeckers & Allies	Picidae	Jamaican Woodpecker	<i>Melanerpes radiolatus</i>	be	4	5	2	F
19	Tyrant Flycatchers	Tyrannidae	Gray Kingbird	<i>Tyrannus dominicensis</i>	bs	1	2	0.2	O
20	Tyrant Flycatchers	Tyrannidae	Loggerhead Kingbird	<i>Tyrannus caudifasciatus jamaicensis</i>	bes	5	8	4	F
21	Mockingbirds & Thrashers	Mimidae	Northern Mockingbird	<i>Mimus polyglottos</i>	b	7	7	4.9	F
22	Vireos & Allies	Vireonidae	Black-whiskered Vireo	<i>Vireo altiloquus</i>	bs	2	4	0.8	O
23	Vireos & Allies	Vireonidae	Jamaican Vireo	<i>Vireo modestus</i>	be	1	1	0.1	O
24	Bananaquits	Emberizidae	Bananaquit	<i>Coereba flaveola flaveola</i>	bes	1	1	0.1	O
25	Grassquits	Emberizidae	Yellow-faced Grassquit	<i>Tiaris olivacea</i>	b	2	2	0.4	O
26	Grassquits	Emberizidae	Black-faced Grassquit	<i>Tiaris bicolor</i>	b	0	0	0	R
27	Emberizids	Emberizidae	Grasshopper Sparrow	<i>Ammodramus savannarum</i>	bes	1	1	0.1	O
28	Emberizids	Emberizidae	Greater Antillean Grackle	<i>Quiscalus niger</i>	bes	2	8	1.6	F

Classification based on H. Raffaele "Birds of the West Indies."

Status according to Downer and Sutton "Birds of Jamaica."

Score determined by numbers of points where each species occurs

Note

Key

b=breeding species
be=Jamaican endemic species
bes=Jamaican endemic sub-species
bs=summers and breeds

Abundance

Very common - seen/heard at >50% of observation points in suitable habitat
Common - seen/heard at 25-50 of observation points in suitable habitats
Locally common - found at >50% of points but habitat type very restricted in area
Uncommon - seen/heard at <25% of points in suitable habitats

D Dominant 10 +
A Abundant 5 to 10
F Frequent 1 to 5
O Occasional 0.1 to 1
R Rare 0

Butterflies

Common Name	Scientific Name
Tropical Silverspot	<i>Dione vanillae insularis</i>
Watson's Cane Skipper	<i>Panoquina sylvicola woodruffi</i> .

Plants

	Family	Common Name	Scientific Name	Growth habit	Provenance	DAFOR
1	Acanthaceae	Duppy Gun	<i>Ruellia tuberosa</i>	Herb	Native	R
1	Amaranthaceae	Devil's horse whip	<i>Achyranthes indica</i>	Herb	Native	R
1	Anacardiaceae	Mango	<i>Mangifera indica</i>	Large tree	Introduced	F
1	Anacardiaceae	Hog Plum	<i>Spondias mombin</i>	Tree	Introduced	O
1	Asclepiadaceae	French Cotton	<i>Calotropis procera</i>	Shrub	Introduced	O
1	Boraginaceae	Duppy Cherry	<i>Cordia alba</i>	Tree	Introduced	R
1	Caesalpiniaceae	Poinciana	<i>Delonix regia</i>	Large tree	Introduced	R
1	Caesalpiniaceae	Tamarind	<i>Tamarindus indica</i>	Large tree	Introduced	R
1	Capparaceae	Wild Caia	<i>Cleome viscosa</i>	Herb	Introduced	O
1	Combretaceae	Almond	<i>Terminalia catappa</i>	Large tree	Introduced	O
1	Compositae	Spanish Needle	<i>Bidens pilosa</i>	Herb	Native	O
1	Compositae	Cupids Shaving Brush	<i>Emilia javanica</i>	Herb	Native	O
1	Compositae	Quacko Bush	<i>Mikania micrantha</i>	Vine	Native	O
1	Compositae	Pigeon Coop	<i>Spilanthes urens</i>	Herb	Native	O
1	Convolvulaceae		<i>Ipomoea spp.</i>	Herb		O
1	Convolvulaceae	Wild Potato, Wild Slip	<i>Ipomoea tiliacea</i>	Vine	Native	O
1	Cucurbitaceae	Cerasee	<i>Momordica charantia</i>	Vine		O
1	Cyperaceae		<i>Cyperus oxylepis</i>	Herb		O
1	Euphorbiaceae	Belly-ache bush	<i>Jatropha gossypifolia</i>	Herb	Native	R
1	Euphorbiaceae	Castor Oil	<i>Ricinus communis</i>	Shrub	Introduced	O
1	Lemnaceae	Reedmace	<i>Typha domingensis</i>	Herb	Native	O
1	Malvaceae	Broomweed	<i>Sida acuta</i>	Herb	Native	O
1	Malvaceae		<i>Sida paniculata</i>	Herb	Native	R
1	Malvaceae	Ballard Bush	<i>Urena lobata</i>	Herb	Native	O
1	Mimosaceae	Park Nut	<i>Acacia macrantha</i>	Tree	Introduced	O
1	Mimosaceae	Wild Popanax	<i>Acacia tortuosa</i>	Small tree	Native	O

Migrants

Family groups	Family	Common Name	Scientific Name	Status
Wood Warblers	Emberizidae	Northern Parula	<i>Parula americana</i>	Uncommon
Wood Warblers	Parulidae	Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	Uncommon
Wood Warblers	Parulidae	Prairie Warbler	<i>Dendroica discolor</i>	Uncommon
Wood Warblers	Parulidae	Palm Warbler	<i>Dendroica palmarum</i>	Locally common
Wood Warblers	Parulidae	American Redstart	<i>Setophaga ruticilla</i>	Common
Wood Warblers	Parulidae	Northern Waterthrush	<i>Seiurus noveboracensis</i>	Uncommon

14.10 Appendix X – The Deed of Grant of Easement

DEED

THIS DEED OF GRANT OF EASEMENT is made the _____ day of _____
2017 BETWEEN:

- (1) OLD HARBOUR ESTATES LIMITED, a limited liability company duly incorporated under the laws of Jamaica having its registered office at P.O. Box 4, Old Harbour Post Office in the parish of Saint Catherine (hereinafter called the "Grantor") (TRN: 000 259 110); and
- (2) GORE DEVELOPMENTS LIMITED, an industrial and provident society duly registered under the Industrial and Provident Societies Act and having its registered office at 2c Braemar Avenue, Kingston 10 in the parish of Saint Andrew (hereinafter called the "Grantee") (TRN: 001 222 945).

WHEREAS

- (1) The Grantor is the registered proprietor of the Grantor's Land.
- (2) The Grantee is the registered proprietor of the Grantee's Land.
- (3) The Grantor has pursuant to one of the provisions of an Agreement of even date herewith between the Grantor and the Grantee and for the consideration mentioned therein agreed to grant the Rights to the Grantee out of the Grantor's Lands for the benefit of the Grantee's Lands.

NOW THIS DEED WITNESSES as follows:

1. **Definitions and interpretation**

In this Deed, unless the context otherwise requires:

- 1.1 "Grantee's Land" means the land and described in Schedule 2 and each and every part of it;
- 1.2 "Grantor's Land" means the land described in Schedule 1 and each and every part of it;
- 1.3 "Plan" means the plan annexed as Annexure A to this Deed;
- 1.4 "Rights" means the rights granted by clause 2 (*Grant of Rights*) and set out in Schedule 3;
- 1.5 "Works" has the meaning given in Schedule 3;
- 1.6 "Grantor" and "Grantee" include their respective successors in title;
- 1.7 Words that indicate one gender include all other genders, words that indicate the singular include the plural and vice versa and words that indicate persons shall be interpreted as extending to a corporate body or a partnership and vice versa;
- 1.8 The clause headings do not form part of this Deed and shall not be taken into account in its construction or interpretation;

April 4, 2017

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- 1.9 Any reference to a clause without further designation is to be construed as a reference to the clause of this Deed so numbered;
- 1.10 The Recitals, Schedules and Annexure form a part of this Deed and shall be read and construed as one herewith; and
- 1.11 Any reference to a colour or letter is to one on the Plan.

2 Grant of Rights

In consideration of and pursuant to the said Agreement abovementioned the Grantor as beneficial owners grant the Rights to the Grantee as and where shown on Annexure A to hold to the Grantee but subject to the observance and performance of the covenants contained in clause 3 (*Grantee's covenants*).

3 Grantee's covenants

The Grantee covenants with the Grantor to observe and perform the requirements of this clause 3.

- 3.1 *Deferral of rights*
The Grantee must not exercise any of the rights granted by this Deed other than surveying until the drawings and specifications for the Works have been approved by the relevant authorities.
- 3.2 *Entry for construction*
Before entry is made on to the Grantor's Land for the purpose of constructing the Works the Grantee must obtain the prior agreement in writing of the Grantor to the date of entry for commencement of the Works which consent must not be unreasonably withheld, delayed or conditioned.
- 3.3 *Completion of works*
The Grantee must carry out and complete the Works within [4] of weeks of the commencement of them in accordance with the drawings and specifications annexed at Annexure B to this Deed (or as same may be amended by the relevant authorities) in a good and workmanlike manner to the reasonable satisfaction of the local planning, public health and other appropriate authorities.
- 3.4 *Maintenance of works*
The Grantee must at its own cost at all times maintain the Works in good repair and working order.
- 3.5 *Entry for maintenance*
Before entry is made on the Grantor's Land after completion of the Works the Grantee must give to the Grantor not less than 48 hours' prior notice in writing except in the case of emergency.
- 3.6 *Damage and indemnity*
The Grantee must forthwith make good all damage caused to the Grantor's Land by the exercise of the Rights and indemnify the Grantor and keep the Grantor indemnified against all losses, claims, demands, actions, proceedings, damages, costs, expenses, or other liability arising in any way from any breach of any of the Grantee's undertakings contained in this Deed or the exercise or purported exercise of any of the Rights.

3.7 *Compensation*
The Grantee must pay to the Grantor fair and reasonable compensation for all damage done to the Grantor's Land by the Grantee which it has not made good to the reasonable satisfaction of the Grantor.

3.8 *Outgoings*
The Grantee must pay all present and future rates, taxes charges, assessments and outgoings imposed on or payable in respect of the Works or the Rights.

3.9 *Legal costs*
The Grantee must pay the stamp duty and registration fee at the Office of Titles payable on this Deed and each party shall bear their own attorneys-at-law costs. The Grantee shall bear and pay the reinstatement and making good of damage and the settlement of all claims for compensation.

4 **Restrictive covenant by Grantor**

4.1 *Covenant*

The Grantor covenants with the Grantee to observe and perform the restrictions contained in clause 4.2 (the "Restrictions") and it is agreed and declared that:

- (a) the benefit of this covenant is to be attached to and enure for each and every part of the Grantee's Land and the Works;
- (b) the burden of this covenant is intended to bind and binds each and every part of the Grantor's Land into whosoever hands it may come but not so as to render the Grantor personally liable for any breach of this covenant arising after the Grantor has parted with all houses built on the Grantor's Land or the part of it on which such breach is committed; and
- (c) an obligation in the Restrictions not to do any act or thing includes an obligation not to permit or suffer that act or thing to be done by another person.

4.2 *Restrictions*

The Restrictions are as follows:

- (a) not to erect any building, structure or erection nor plant any trees over or within [3] metres measured horizontally on either side of the Works other than any trees or shrubs which will not interfere in any way with the Works and the maintenance thereof;
- (b) not to make any material alteration to or any deposit of anything on or within [3] metres on either side of the Works measured horizontally so as to interfere with or obstruct access to the Works or so as to reduce or increase the depth of soil (if any) above the Works but nothing in this sub-clause shall prevent the Grantor or occupier from carrying on normal operations on the Grantor's Land;
- (c) not to do anything on the Grantor's Land which may cause damage to the Works or affect their proper and efficient operation.

5 Consent to noting

The Grantor consents to notice of the Rights and the burden of his restrictive covenant in clause 4 (*Restrictive covenant by Grantor*) being noted against his registered title to the Grantor's Land.

6 Transfer to NWC

The Grantor acknowledges the intention of the Grantee to transfer ownership of the Works to the National Water Commission together with the land upon which the lift station is located so soon after the Works are completed and the National Water Commission agrees to the transfer.

7 Transfer of easement

The Grantor reserves the right, subject to the approval of the Grantee, the National Water Commission and other relevant authorities and at the Grantor's sole cost, to relocate the Works to a different suitable part of the Grantor's Land and on the Grantor granting a like easement to this Deed *mutatis mutandis* to the Grantee, the Grantee will thereupon surrender the easement created by this Deed.

8 Perpetuities

It is agreed and declared that the Rights shall be exercisable only if they and their subject matter come into existence within a period of ninety nine (99) years from the date of this Deed which period is to be the perpetuity period applicable to this Deed.

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SCHEDULE 1
(Grantor's Land)

ALL THAT parcel of land part of Whim Pen in the parish of SAINT CATHERINE comprising 67.120 hectares part of lot 2A and being part of the land comprised in Certificate of Title registered at Volume 529 Folio 19 of the Register Book of Titles

SCHEDULE 2
(Grantee's Land)

ALL THAT parcel of land part of WHIM PEN in the parish of SAINT CATHERINE being the land comprised in Certificate of Title registered at Volume 1436 Folio 280 of the Register Book of Titles

SCHEDULE 3
(Rights)

1. To survey, construct, lay, and afterwards at all times to relay, use, maintain, inspect, renew, replace, remove or render unusable a foul sewer not exceeding 100 millimetres nominal diameter together with markers and other works and ancillary apparatus all being the property of the Grantee in, through, upon and under the Grantor's Land in the position approximately marked by a line highlighted in yellow (the "Works") to drain foul water and domestic effluent from all buildings now or in the future in the housing development known as New Harbour Village IV via the lift station on the Grantee's Land to the NWC sewer manhole located at New Harbour Village II.
2. Full and free access where practicable with all necessary workmen and vehicles machinery and apparatus at all reasonable times and in emergency at any time over the part of the Grantor's Land in connection with the Works.

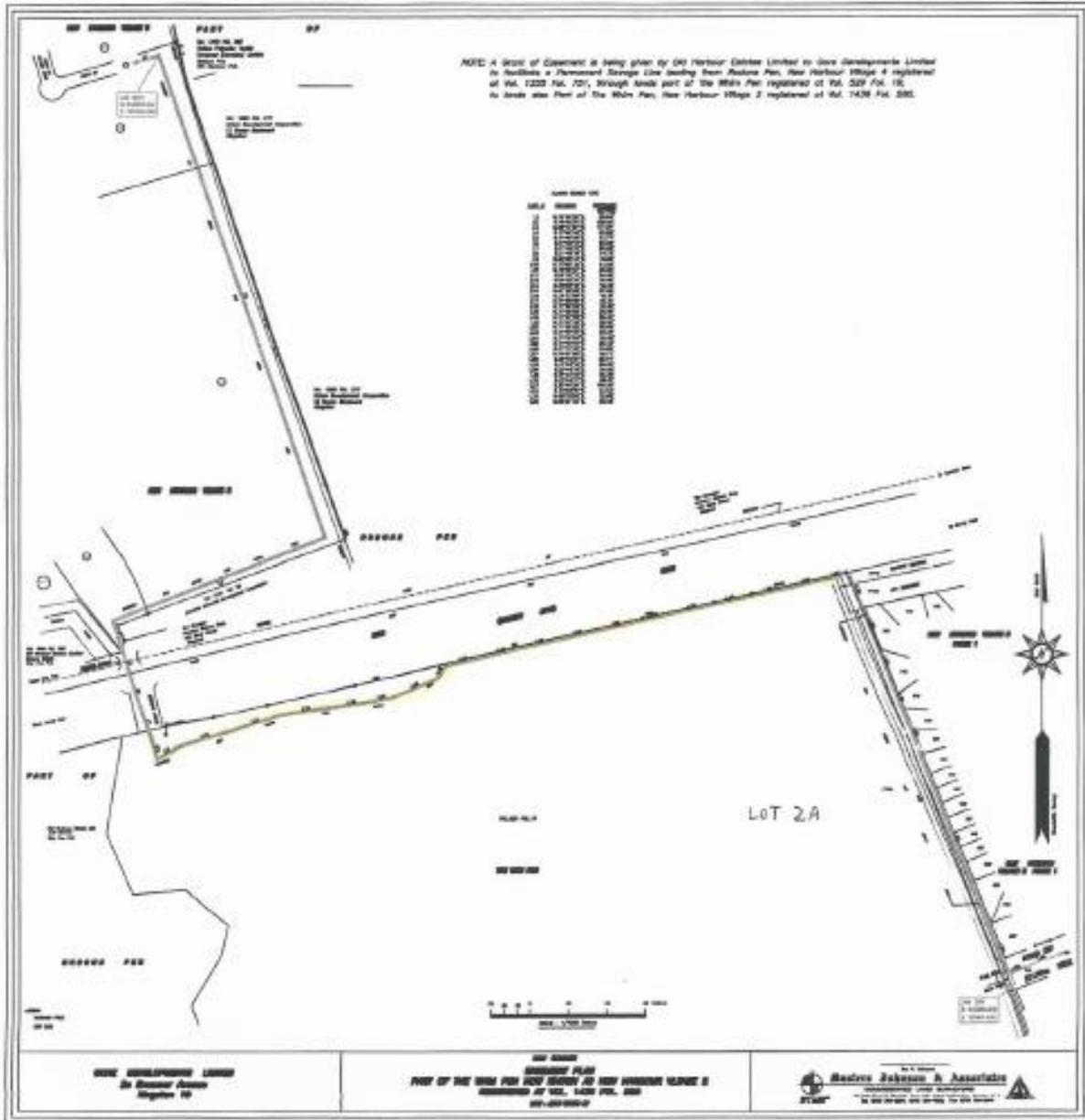
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ANNEXURE A
(Plan)

April 4, 2017

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ANNEXURE A



ANNEXURE B
(Drawings and specifications)

April 4, 2017

GORE DEVELOPMENTS LTD. - RHODENS PEN SUBDIVISION SEWER FORCE MAIN DETAILS

NOTES

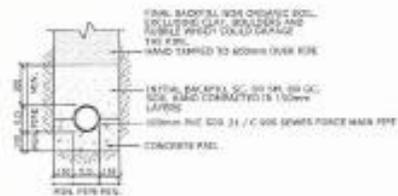
1. DO NOT SCALE DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. REFER DIMENSIONS TO THE ENDS OF THE ENTRIES IMMEDIATELY.
4. CONCRETE TO BE 20 MPa CYLINDRICAL STRENGTH AT 28 DAYS.
5. MAXIMUM AGGREGATE SIZE TO BE 20mm.
6. CLASS 'X' PROTECTION TO BE USED UNLESS OTHERWISE REQUIRED.
7. CLASS 'Z' PROTECTION TO BE USED IN ALL CLAYS AND ORGANIC SOILS.
8. CONCRETE SURROUND TO BE USED WHERE VERTICAL SEPARATION OF SEWER DRAIN AND SANITARY SEWER IS LESS THAN 450mm.

SOIL DESCRIPTION ASTM D-2487

- SC - CLAYEY SANDS AND SANDS WITH FORTIFIED
- EC - CLAYEY / GRAVEL AND GRAVEL - SAND - CLAY MIXTURE
- SW - SAND WITH GRAVEL OR GRAVEL SANDS
- SP - SAND FORTIFIED GRAVEL INCLUDING GRAVELS BUT NO FINES
- SM - SILTY SANDS AND SAND-SILT MIXTURES



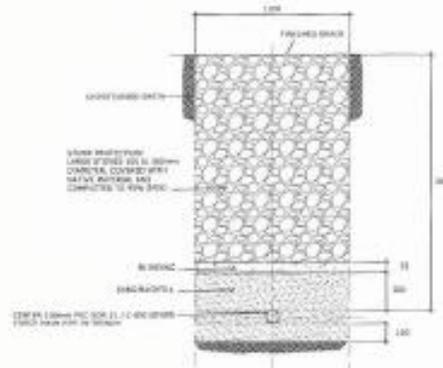
**SEWER FORCE MAIN BEDDING DETAIL -
CLASS "B" PROTECTION**
NOT TO SCALE



CLASS "A" PROTECTION FOR SEWER PIPE
NOT TO SCALE



CONCRETE SURROUND
NOT TO SCALE



**PIPE & PROTECTION BEDDING
ALONG SEWER FORCE MAIN
FROM ST 0+560 TO 0+700**
SCALE 1:50

14.11 Appendix XI – Community Questionnaire

Introduction to the Questionnaire

My name is _____ and I am from Balcostics Ltd., an independent research management company based out of Mandeville, Manchester.

We would like your feedback on the Whim Estates Housing Development. This is a real estate project on 70 hectares of land to be developed in a two-part residential housing development adjacent to the New Harbour Village II residential scheme in Old Harbour.

The development will consist of standalone residential housing and supporting amenities in a gated community. The project is in the preliminary design stages and our survey is part of a NEPA requirement for permitting the project.

Participation in the survey is voluntary. All respondents' information and responses are anonymous and confidential and will be reported in aggregate form only. You may decline to answer any questions you wish and you may withdraw from the survey at any time.

COMMUNITY QUESTIONNAIRE WHIM ESTATES

Community Name: _____

Respondent's Name: _____ Contact: _____

Sex: _____ **Age Range:** 18-35 years 36-59 years 60 years & over

Community Demographics

1. What would you say is the age distribution of the community?

0-17: ____% 18-35: ____% 36-59: ____% >60: ____%

2. What are the main occupations in the community?

i) _____ ii) _____ iii) _____

3. How would you describe unemployment in your community?

Very High High Low Very Low

4. Is the community changing in size?

Growing Rapidly Growing Slowly Not Changing
 Declining Slowly Declining Rapidly

What are the reasons for this? _____

5. Are there any known or potential cultural or heritage sites around the community?

Yes No If yes, please describe: _____

6. What are the main land uses in and around the community?

i) _____ ii) _____ iii) _____

7. Who would you recommend as a person being very knowledgeable about the community? Name

and Position: _____ Contact: _____

Water Consumption

8. What is the main water source for the community? _____

9. What are some of the other water sources? i) _____ ii) _____

10. Is the water service adequate? Yes No Sometimes

Explain if not adequate or sometimes adequate: _____

Flooding

11. Is flooding a problem for you community? Yes No

If yes, please explain when and where the flooding occurs: _____

12. Do you know of any reports of flooding in other surrounding areas or communities?

Yes

No

If yes, please explain when and where the flooding occurs: _____

Farming, Agricultural and Industrial Activities

13. How does the community feel about the existing agricultural and industrial activities near the community? _____

14. Has the community experience any effects (noise, odour, air quality) from existing nearby agricultural and industrial activities? _____

The Project

15. Do you think that this project would meet the approval of your community?

Highly approve

Approve

Neutral

Disapprove

Highly Disapprove

If disapprove or highly disapprove, please explain why: _____

16. Do you perceive that the project is;

Very Necessary

Necessary

No Perception

Unnecessary

Very unnecessary

Please explain why: _____

17. Please identify any specific fears or reservations the community members may have about the project: _____

18. Please identify any specific benefits or opportunities the community members may have from the project: _____

19. What would be the main environmental concerns that the community would have regarding this project? _____

20. What alternative land use options do you think the community would prefer for this site, if any?

21. What do you think the community can offer this project? _____

22. Do you see flooding as a serious problem for this project?

Yes

No

Do not know

If yes, please explain: _____

23. Do you know of any new developments that are presently underway in this area or that should be starting soon? (*Housing/commercial/industrial construction, road construction repairs, social facilities, govt. projects*) _____

24. How do you feel about future agricultural and industrial activities being near your community?

25. What do you think will be the impacts and/or opportunities from future agricultural and industrial activities near your community? _____

26. Do you think the project and the new developments (*mentioned in Q23 above*) will get in the way of each other?

Yes

No

Do not know

If yes, please explain: _____

27. How disruptive do you think this project will be to the community?

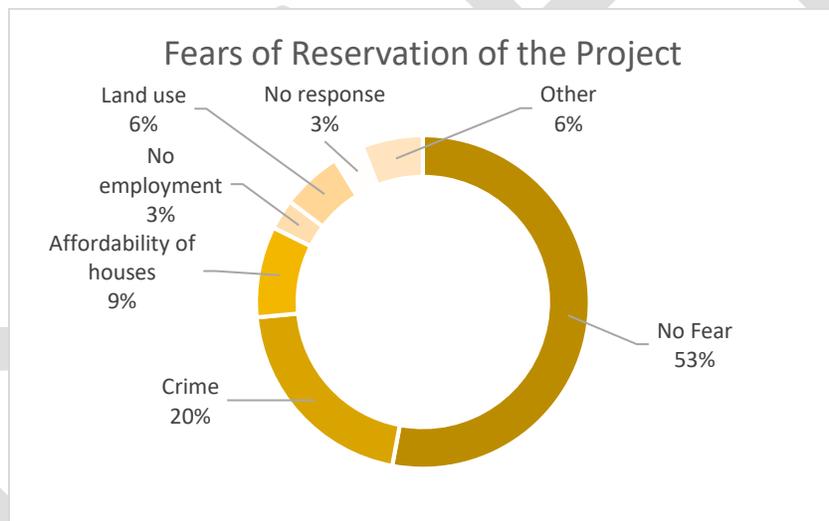
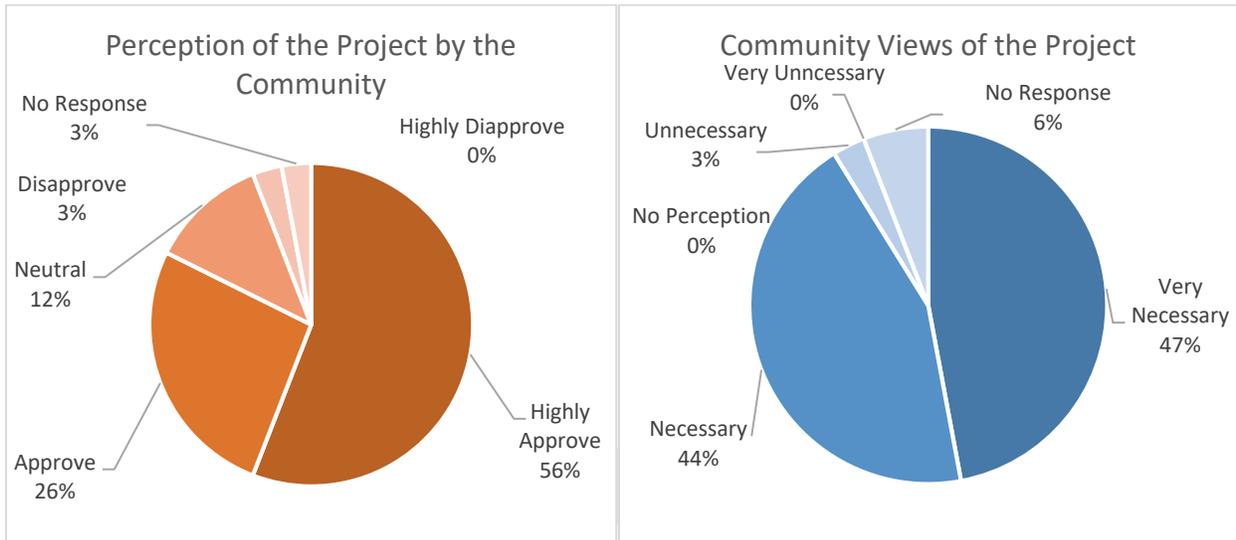
Very Disruptive

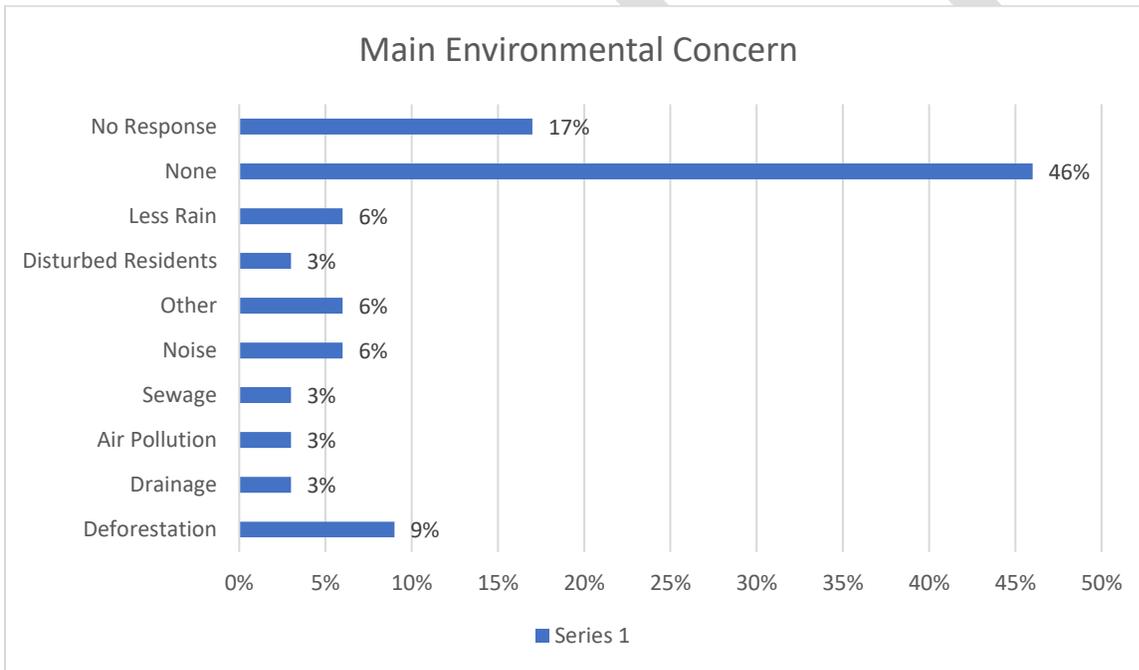
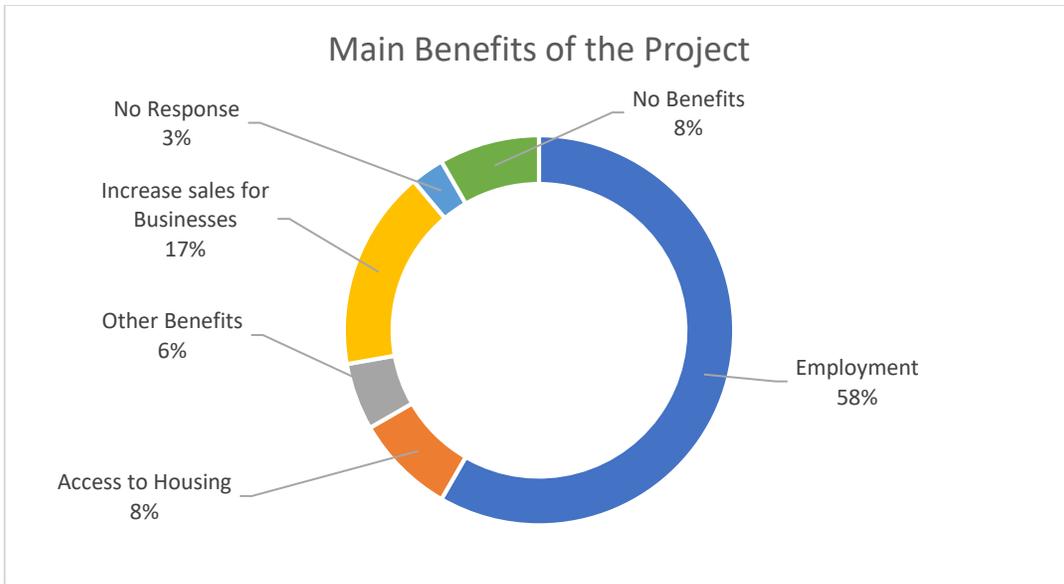
Disruptive

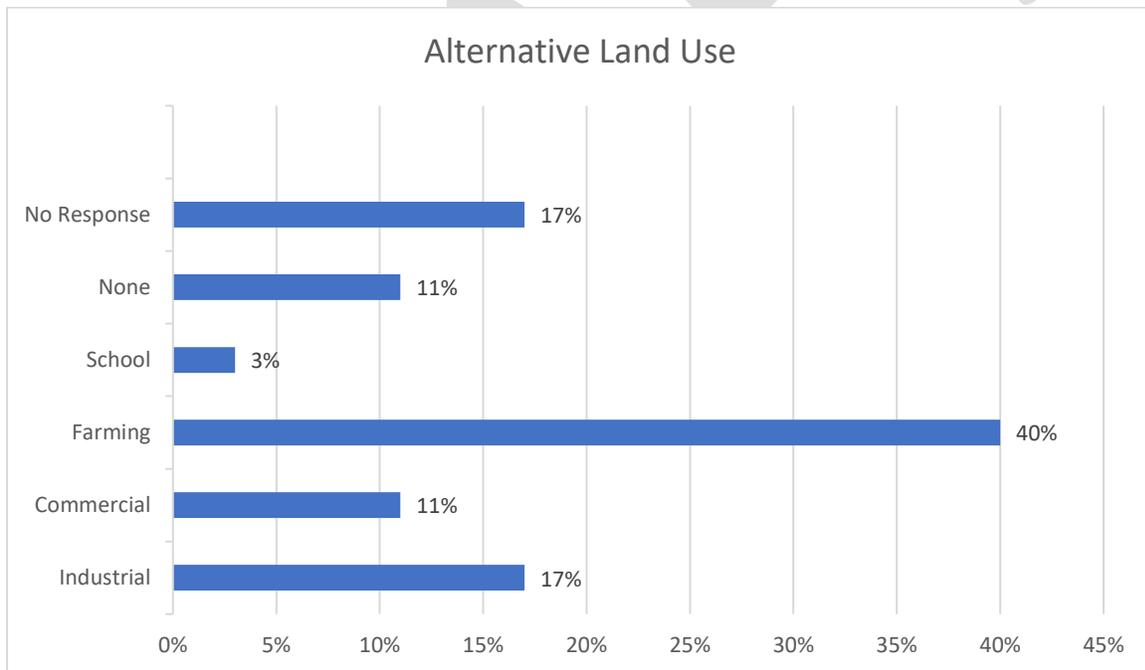
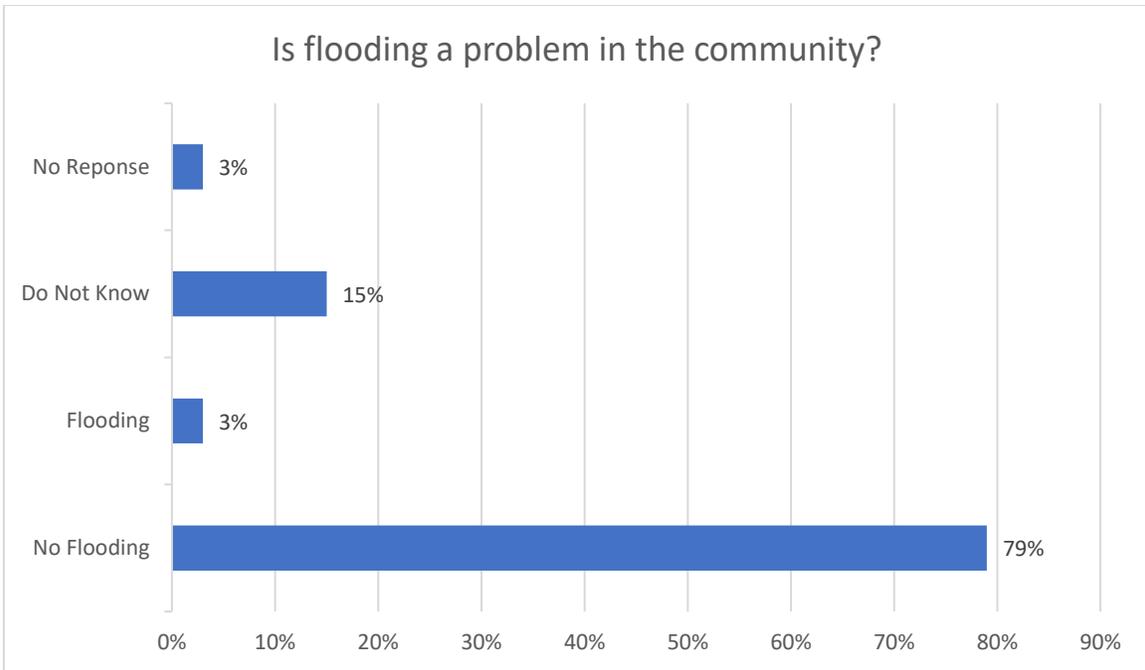
Not Disruptive

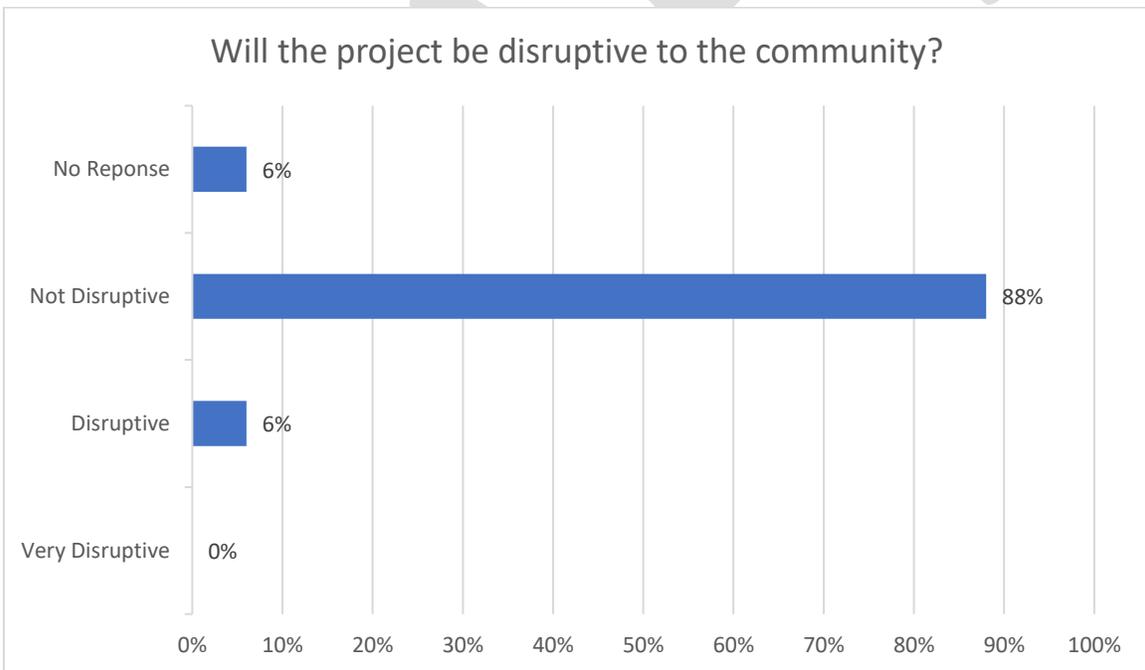
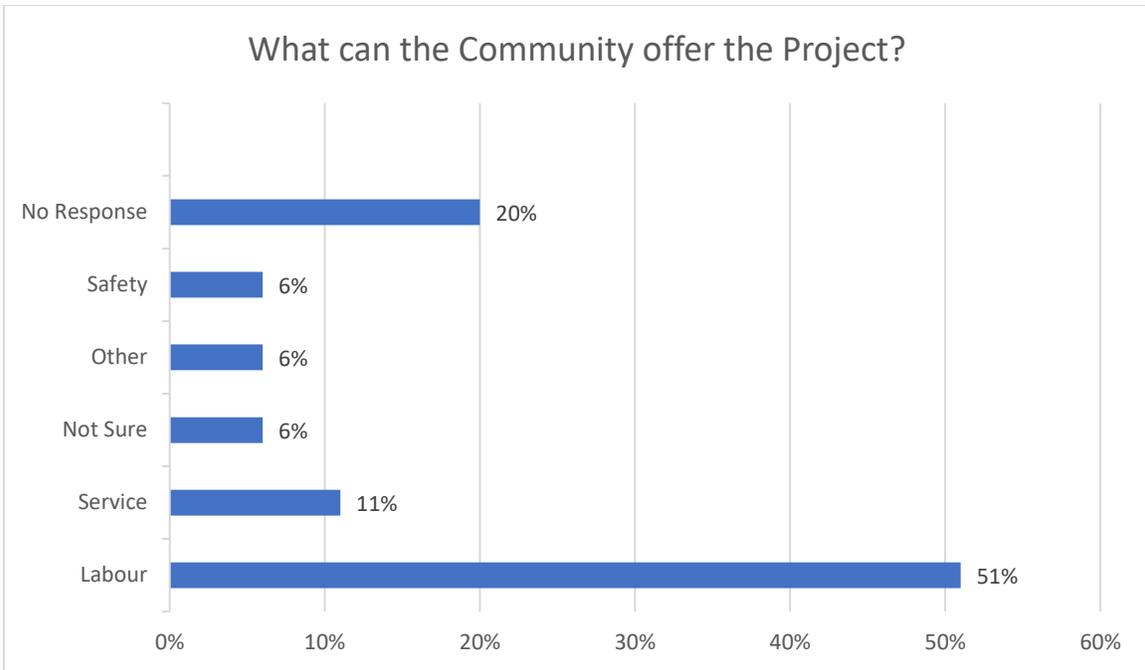
14.12 Appendix XII – Community Questionnaire Response by Community

OLD HARBOUR

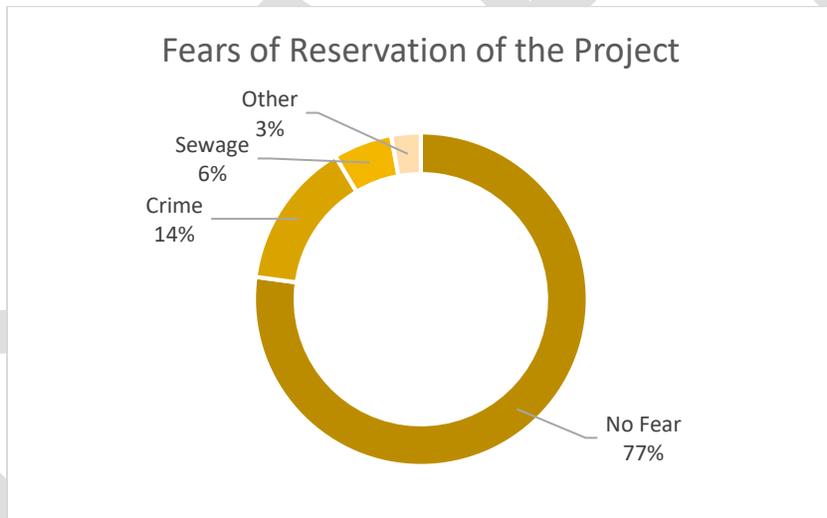
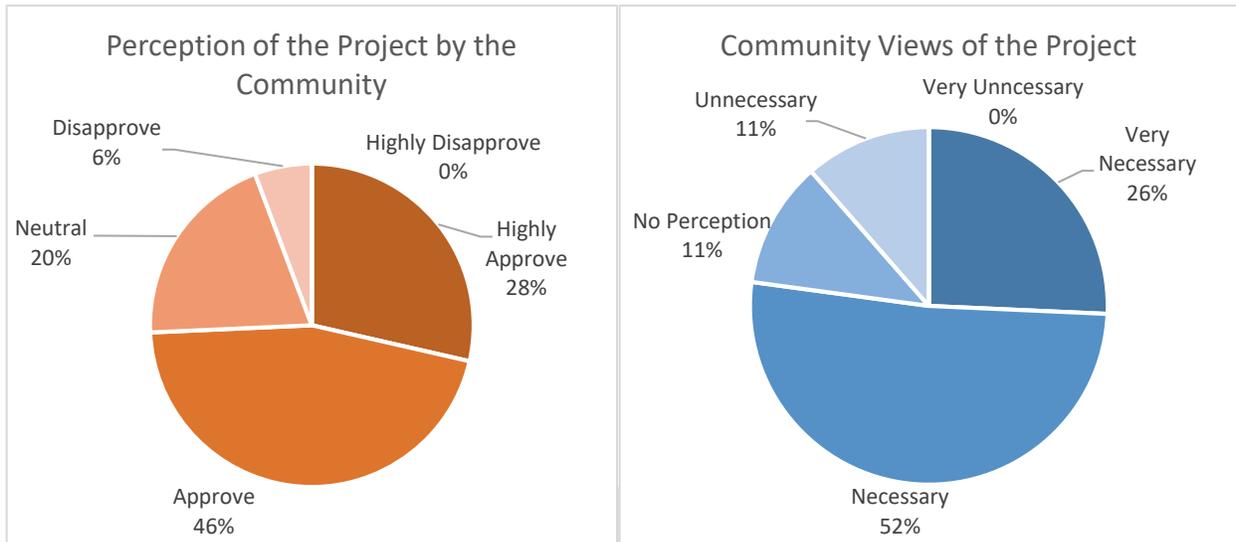


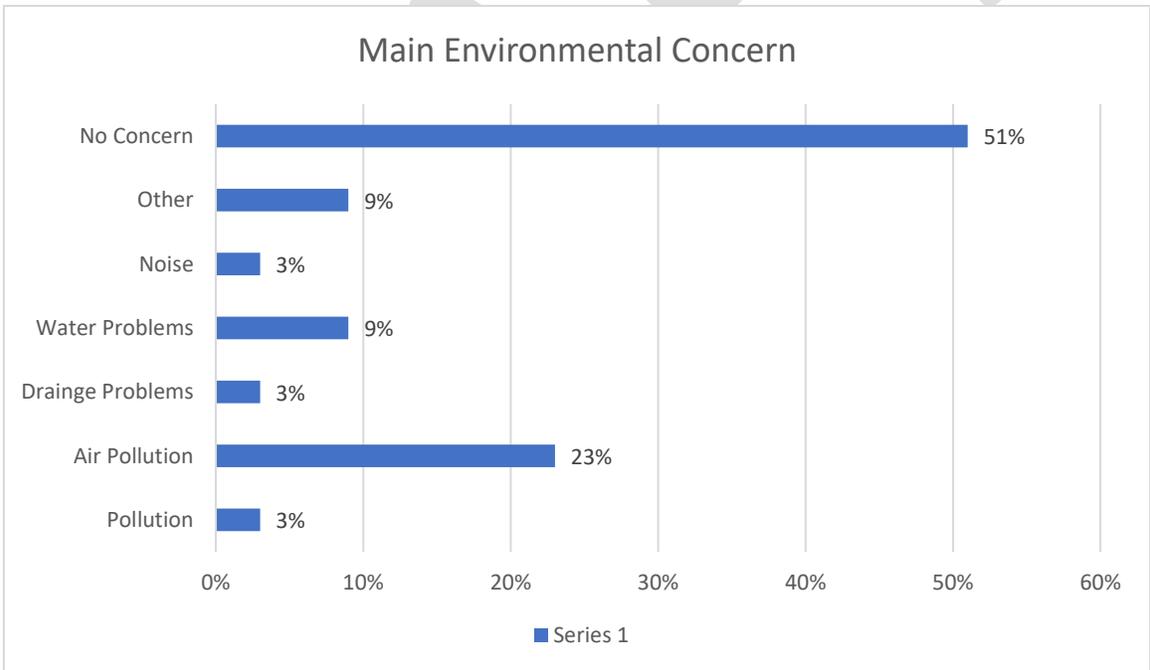
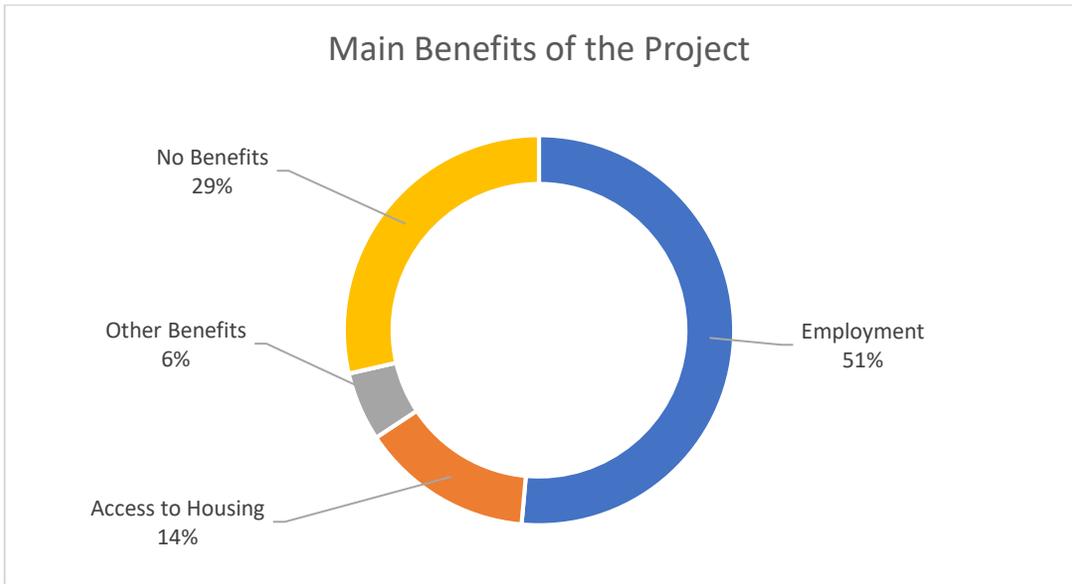


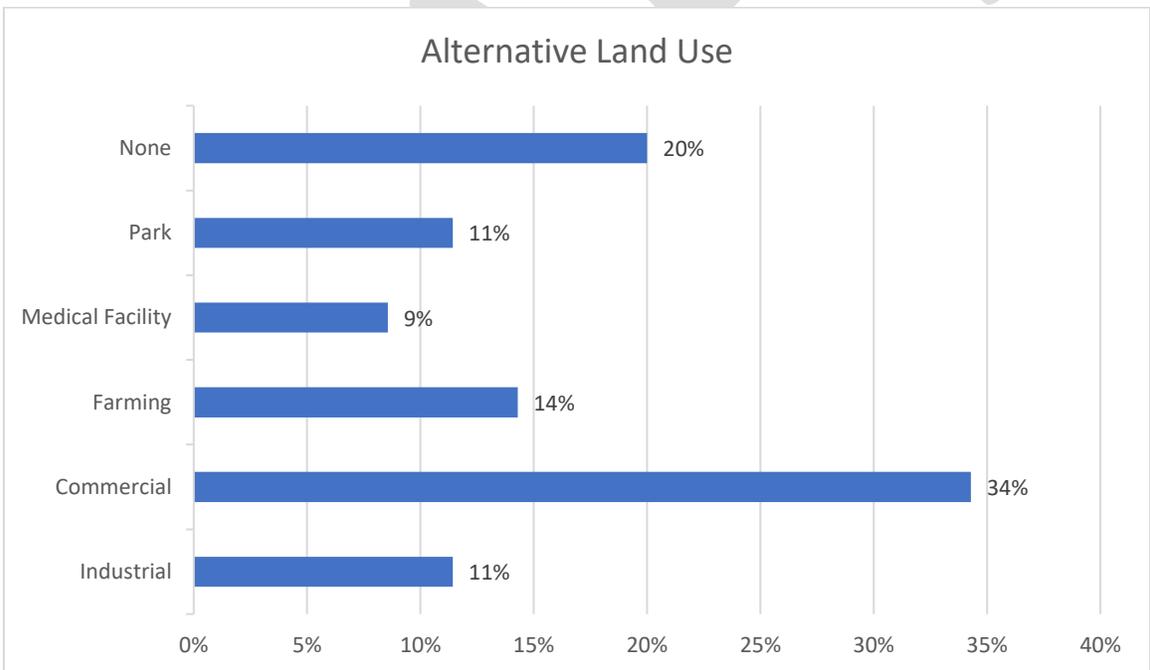
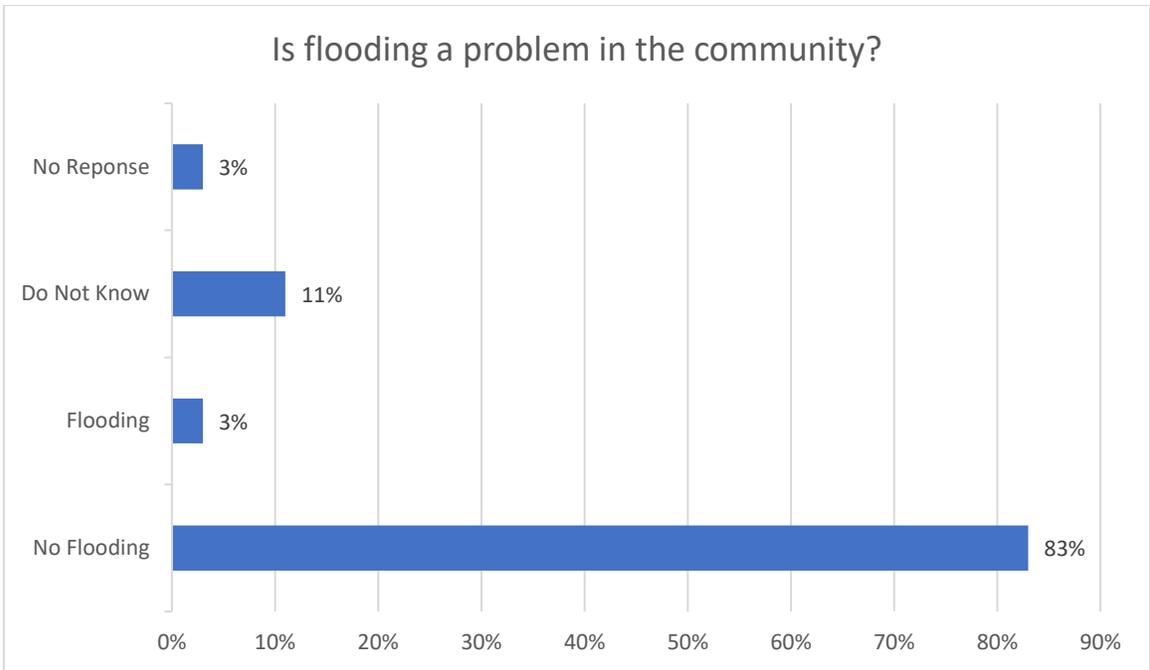


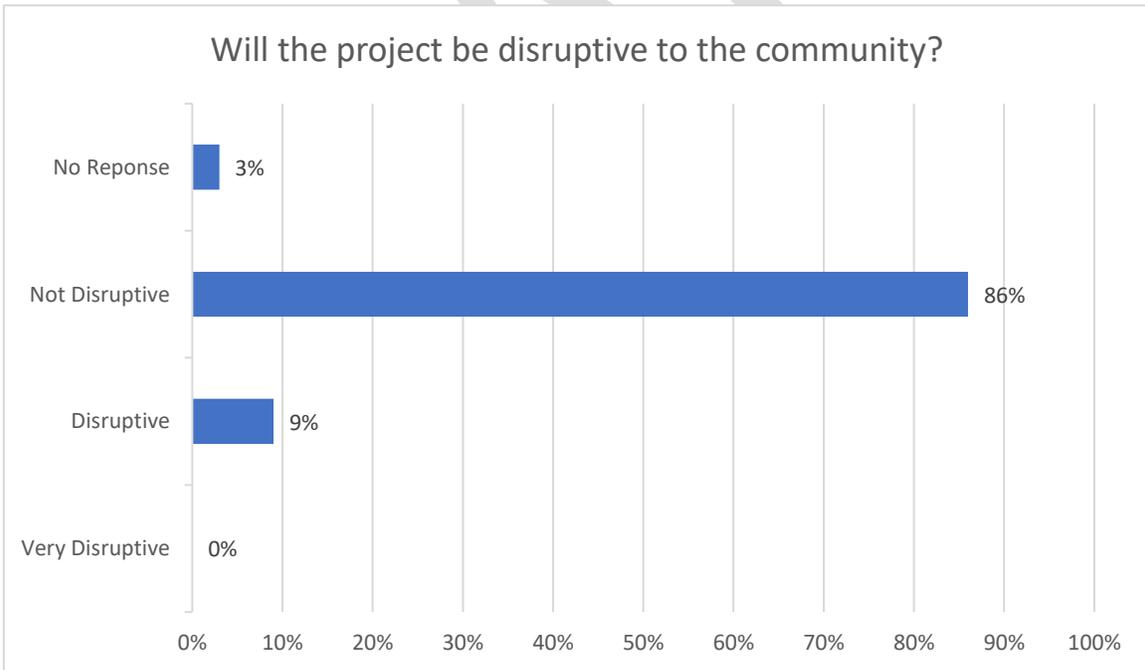
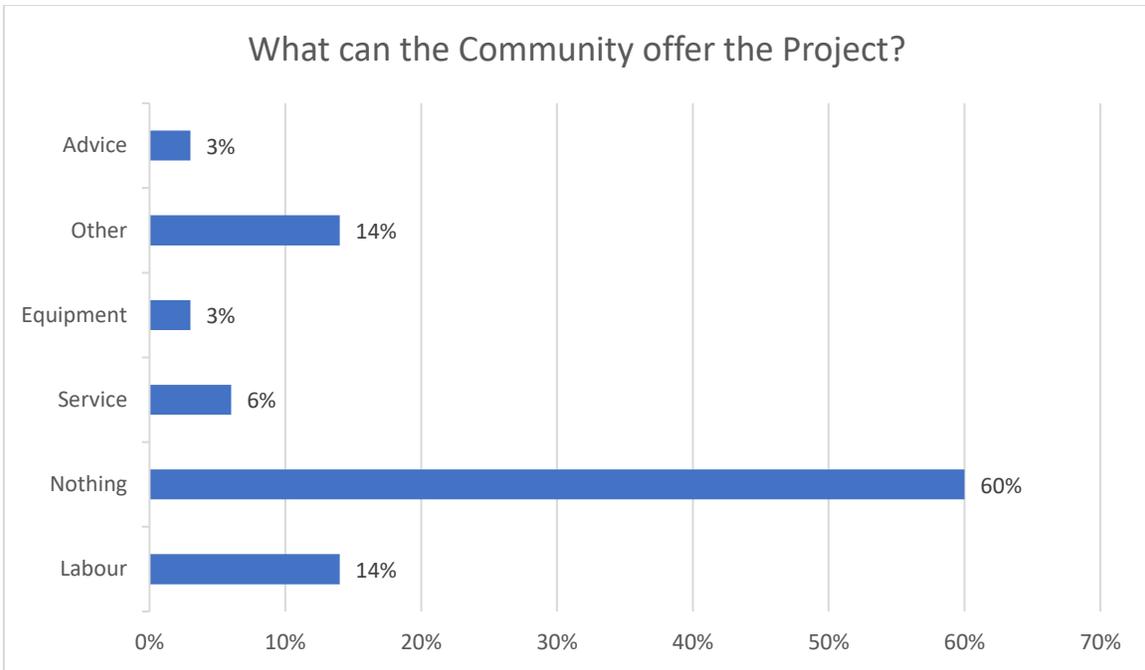


NEW HARBOUR VILLAGE I

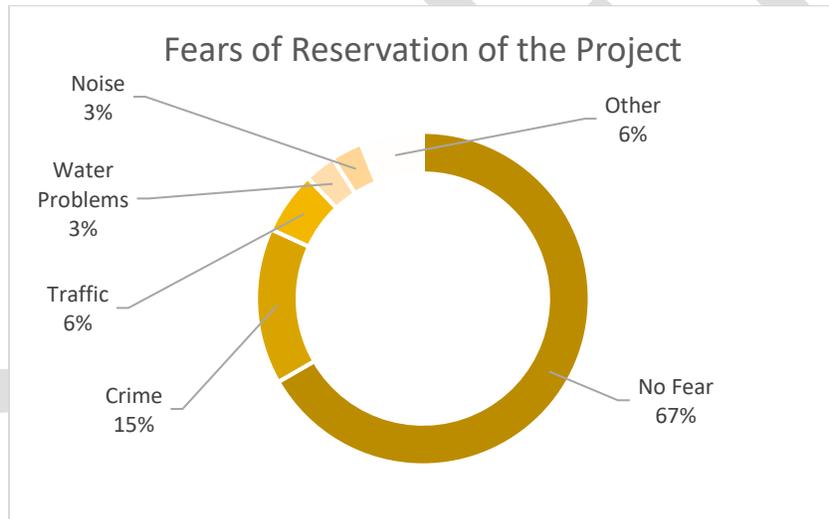
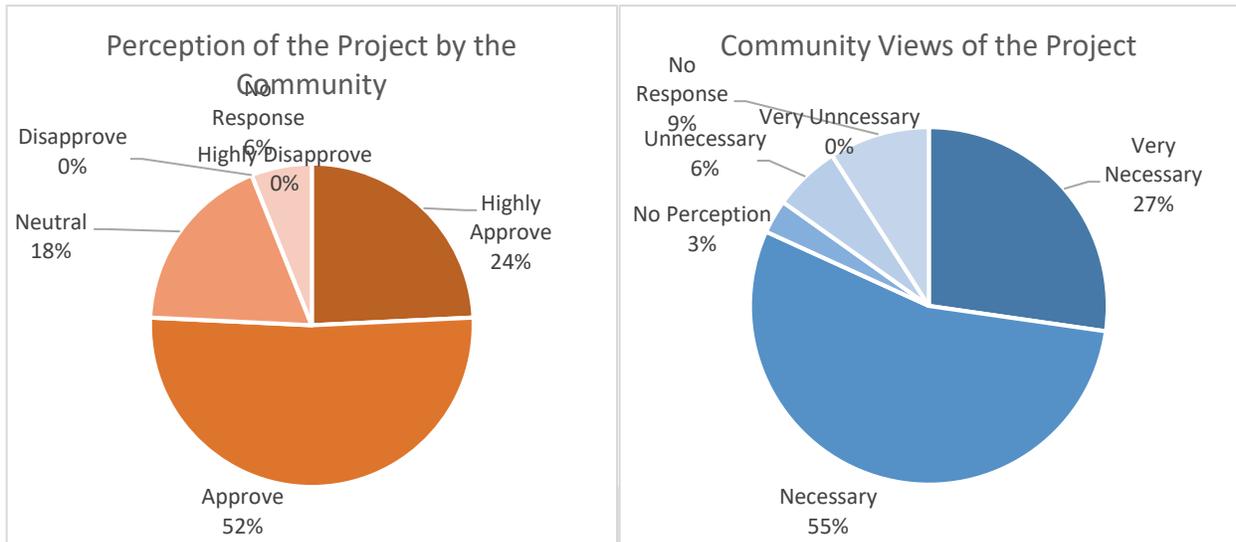


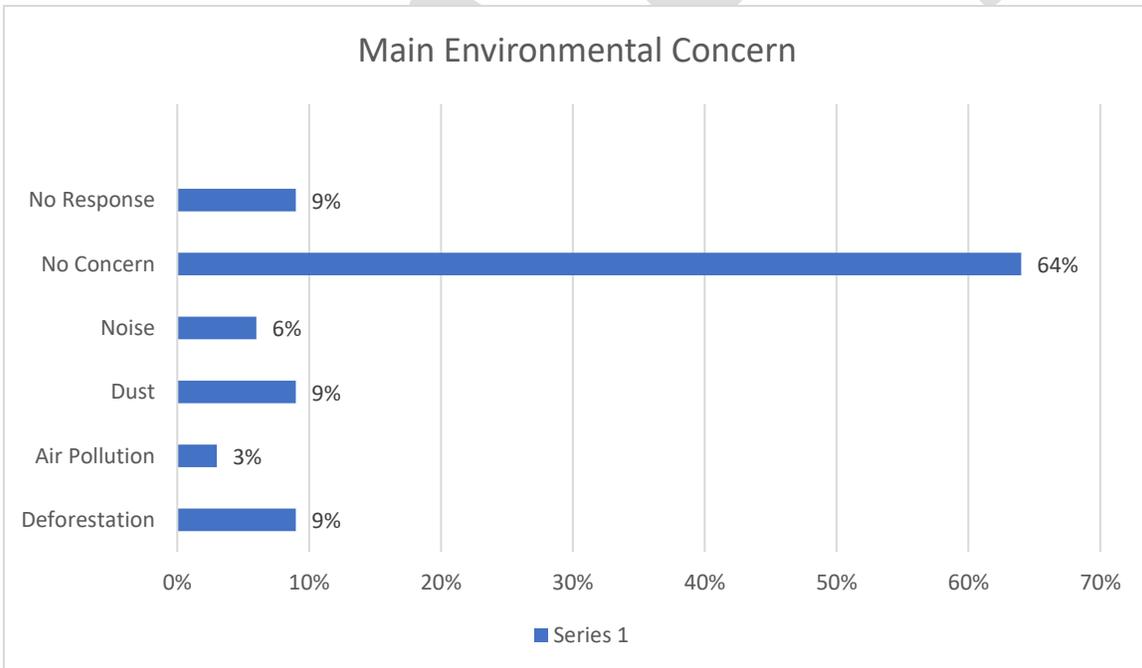
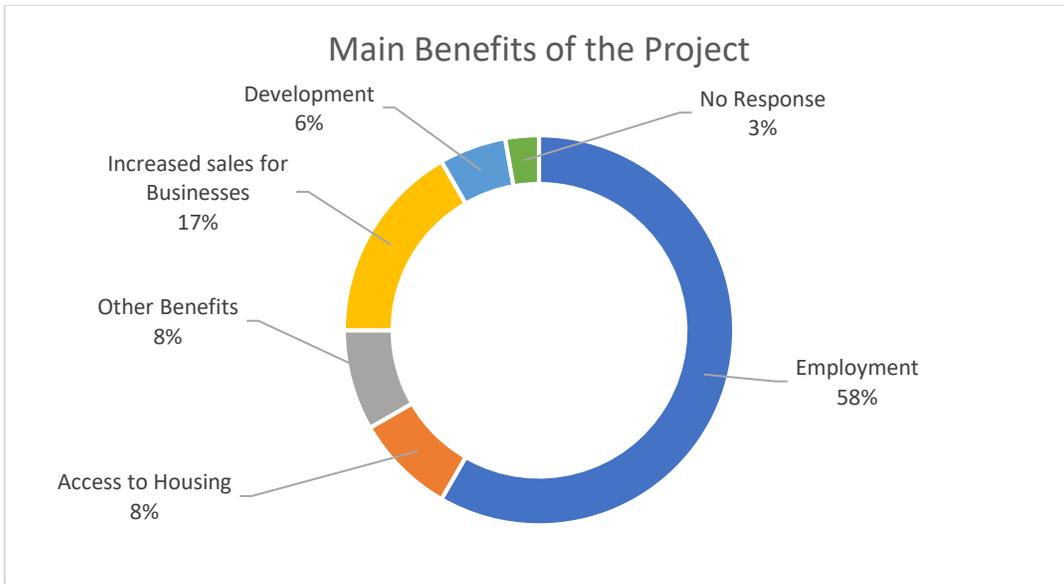


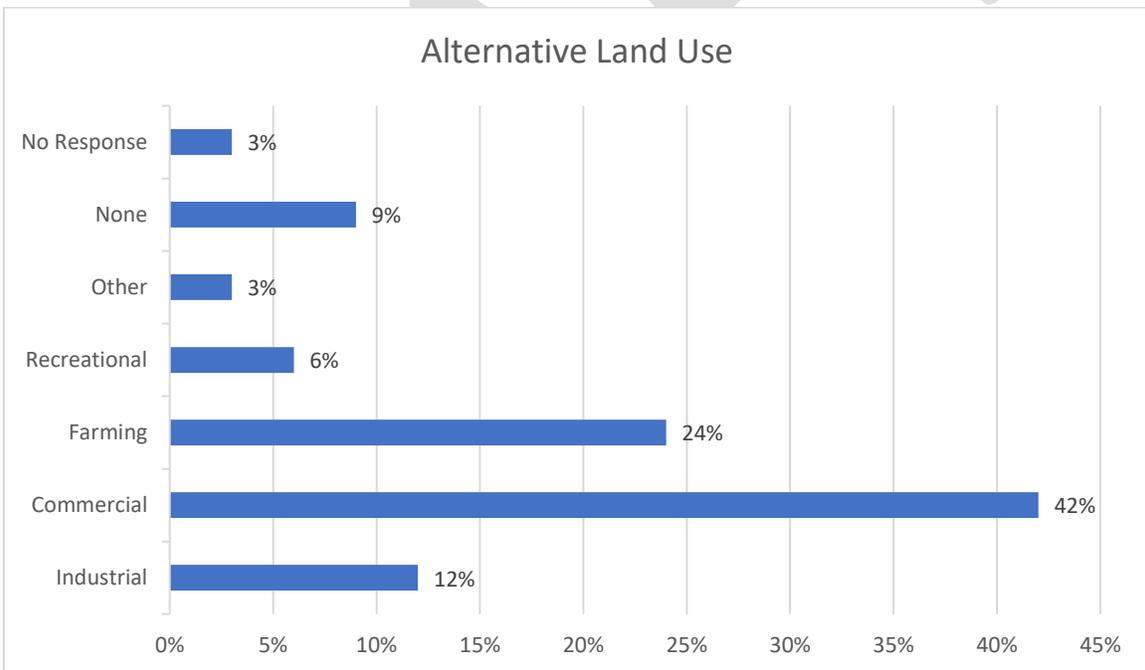
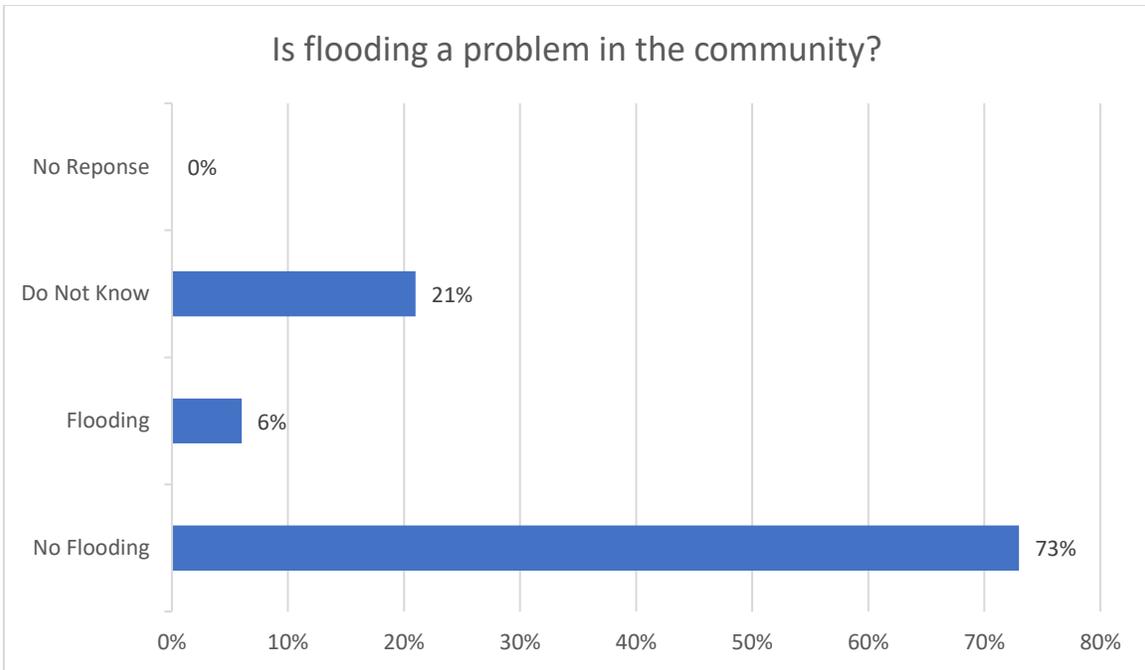


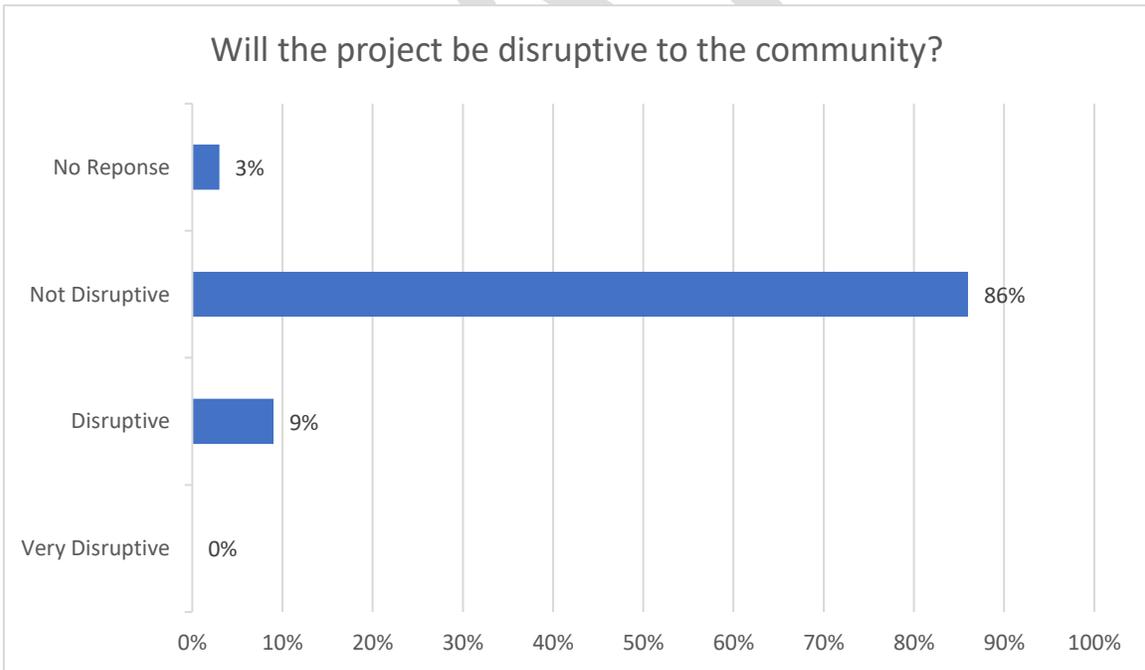
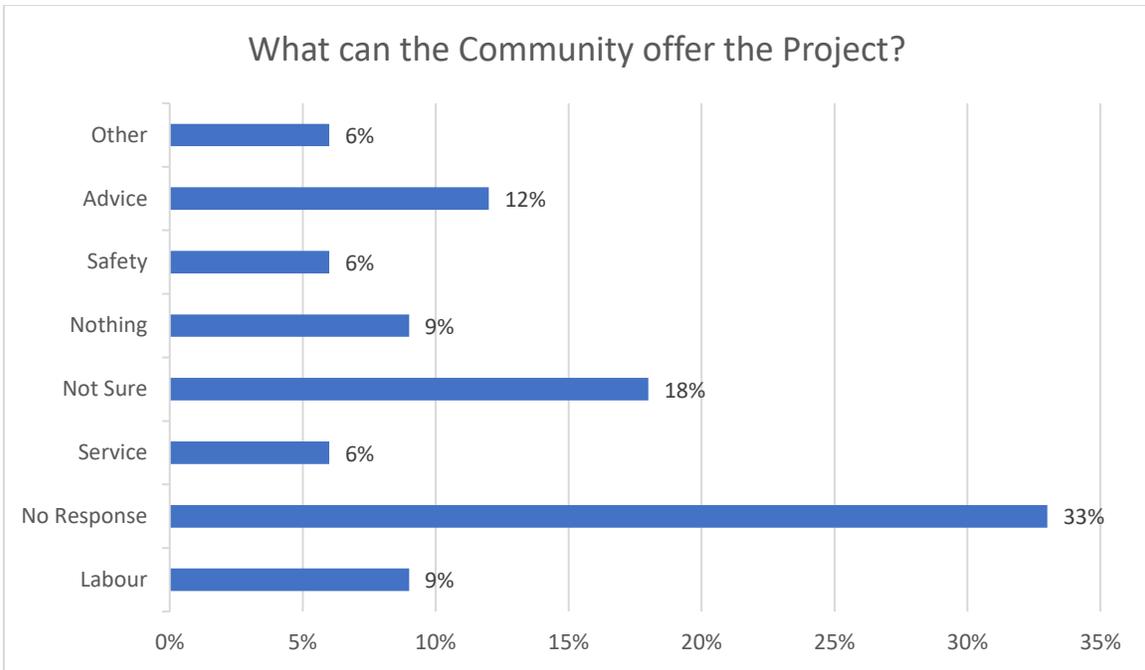


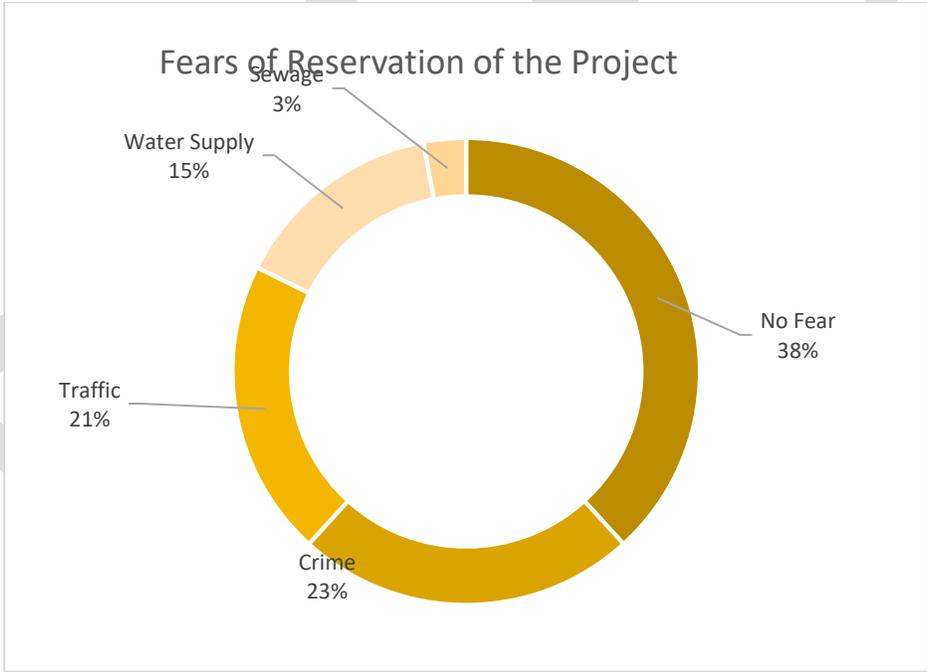
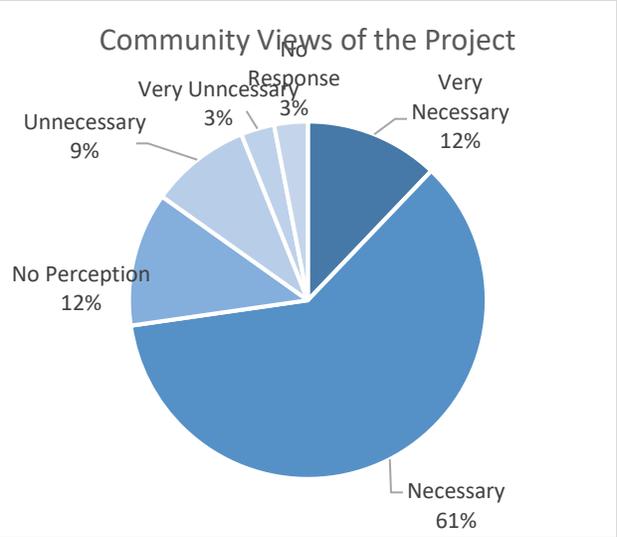
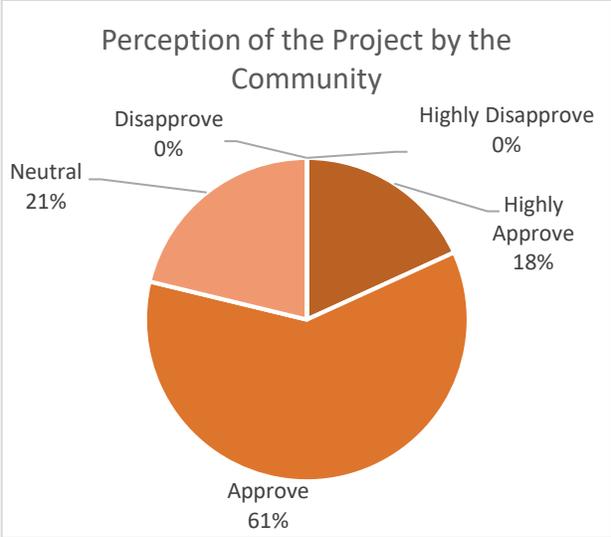
NEW HARBOUR VILLAGE II

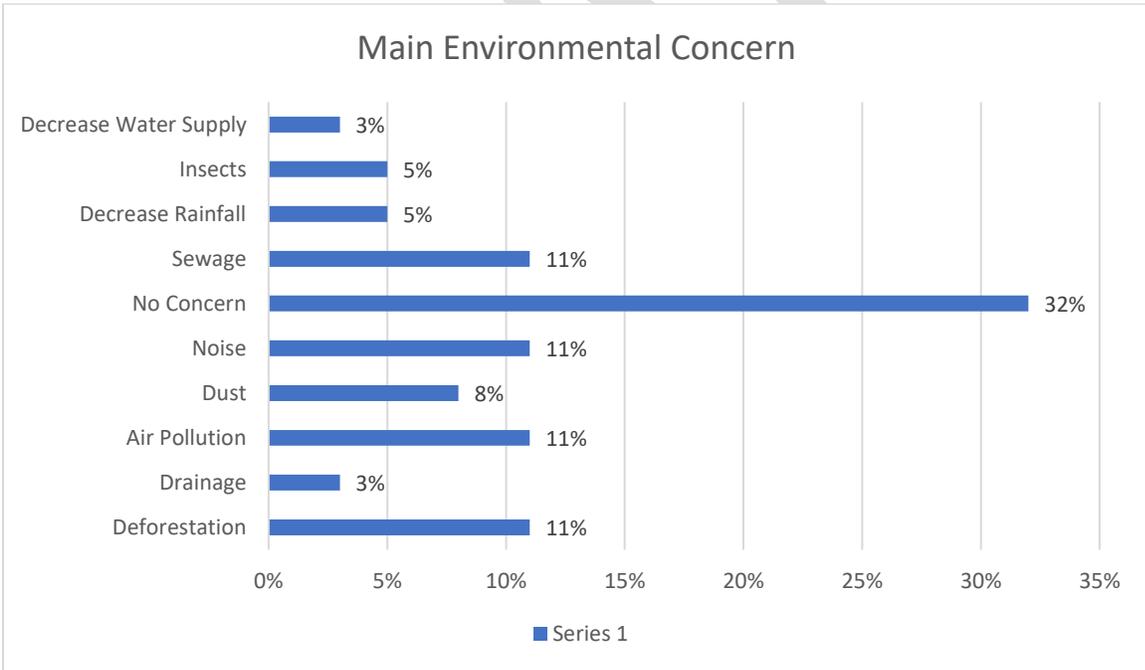
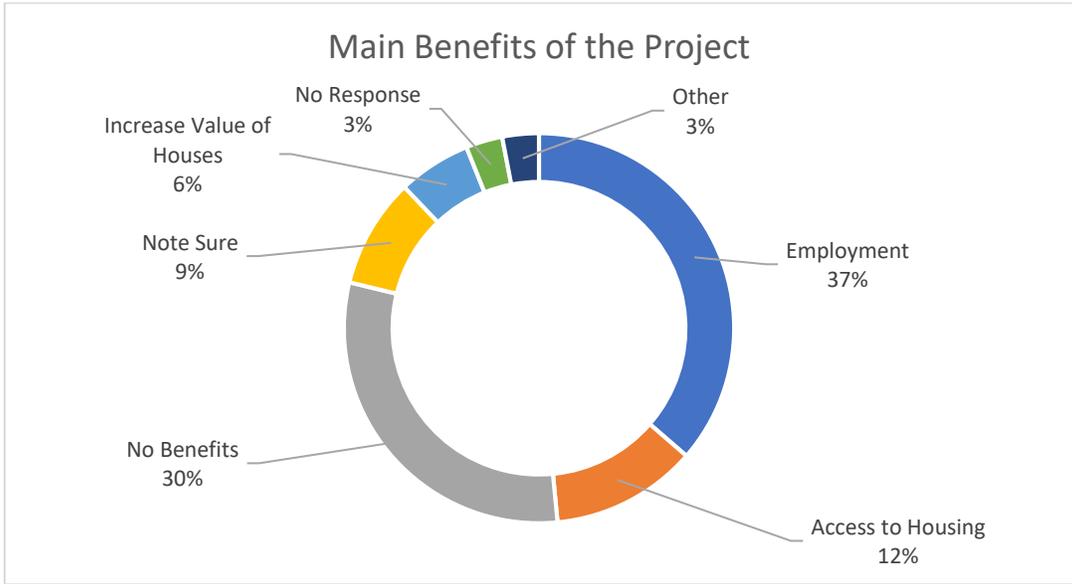


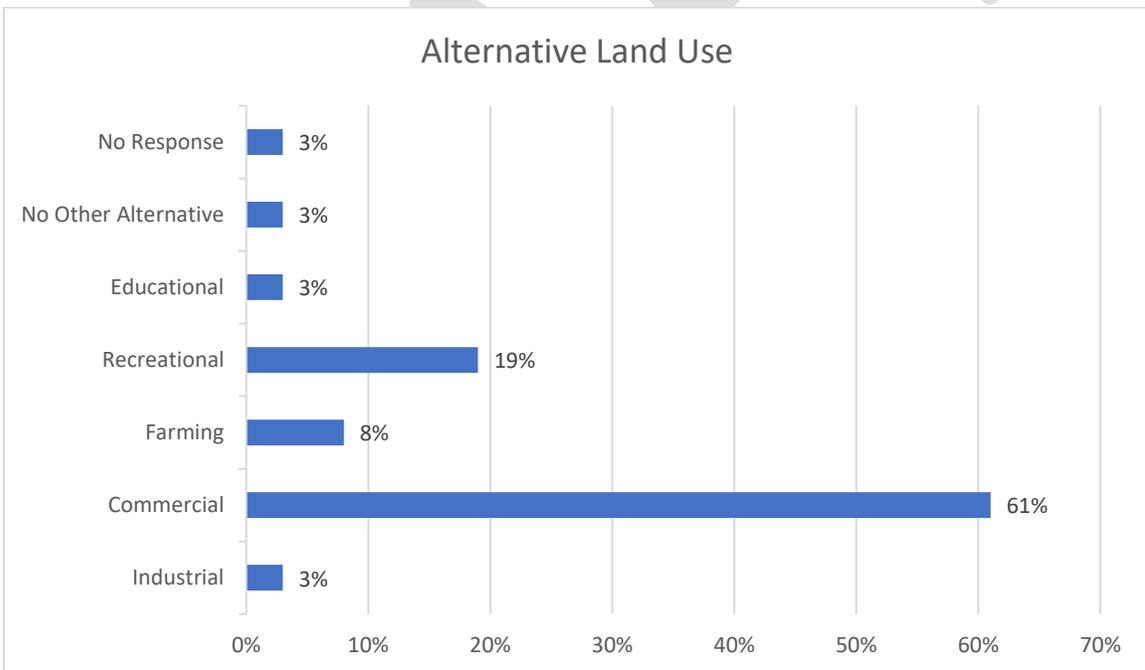
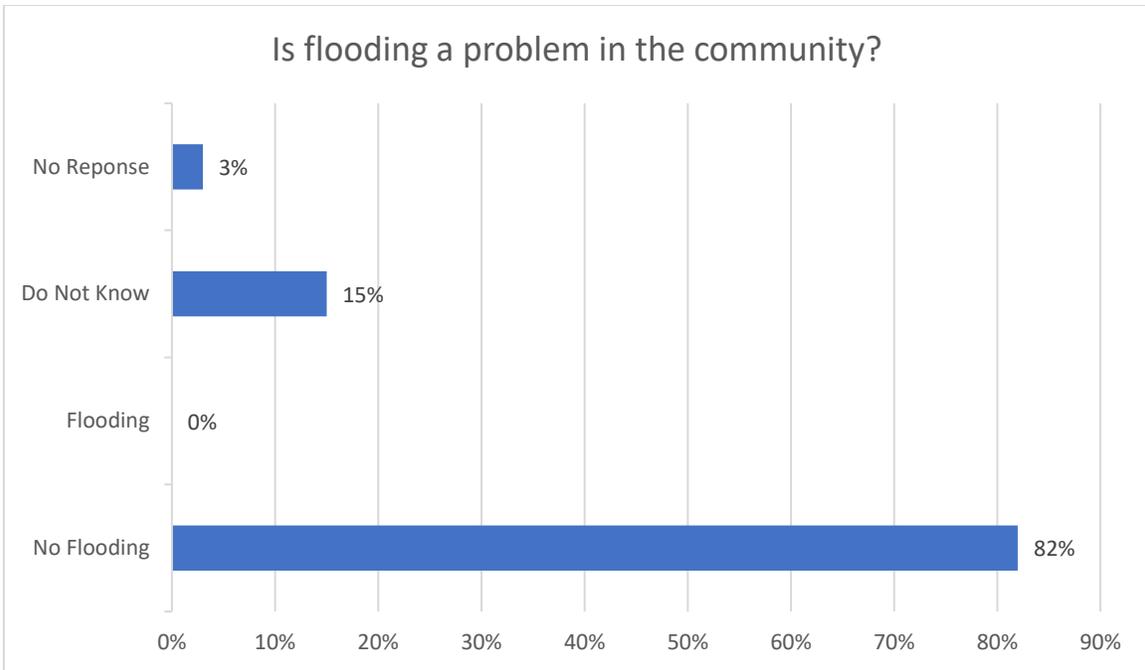


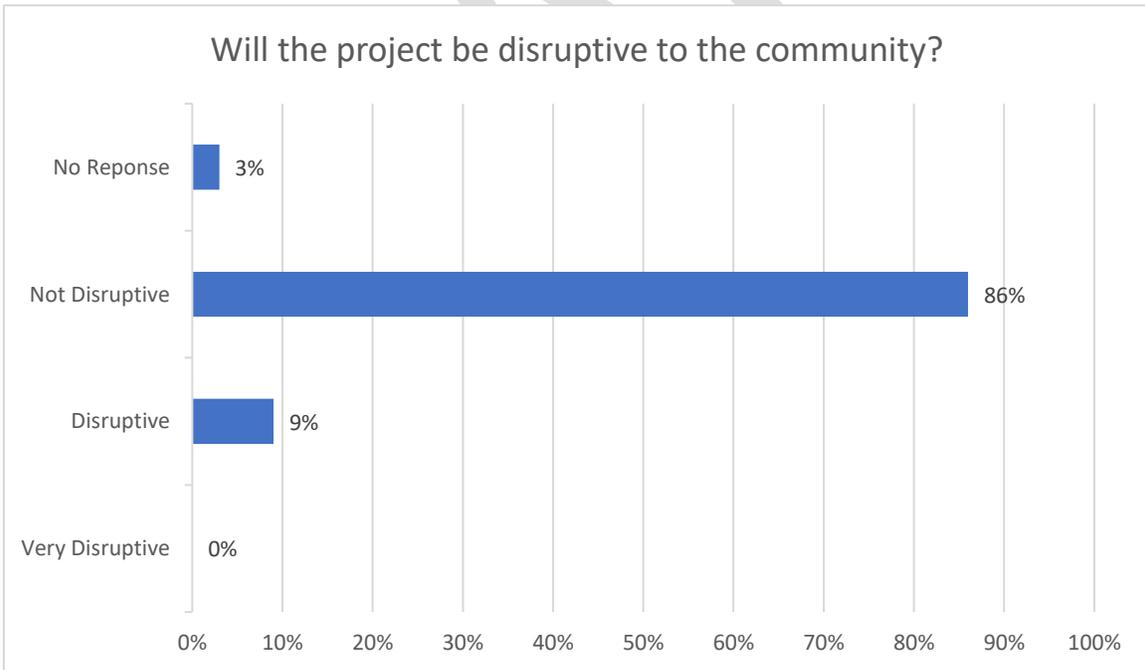
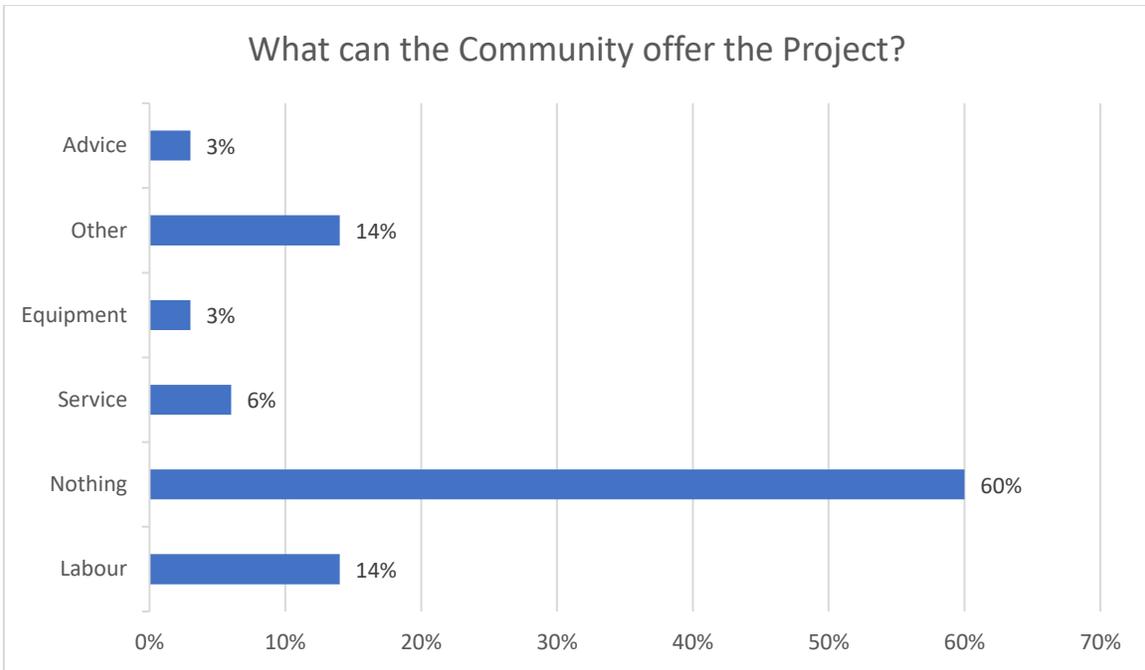




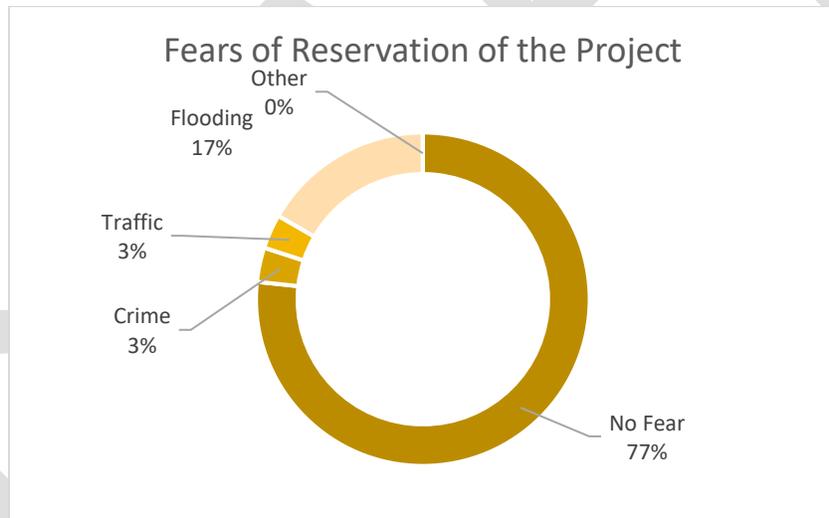
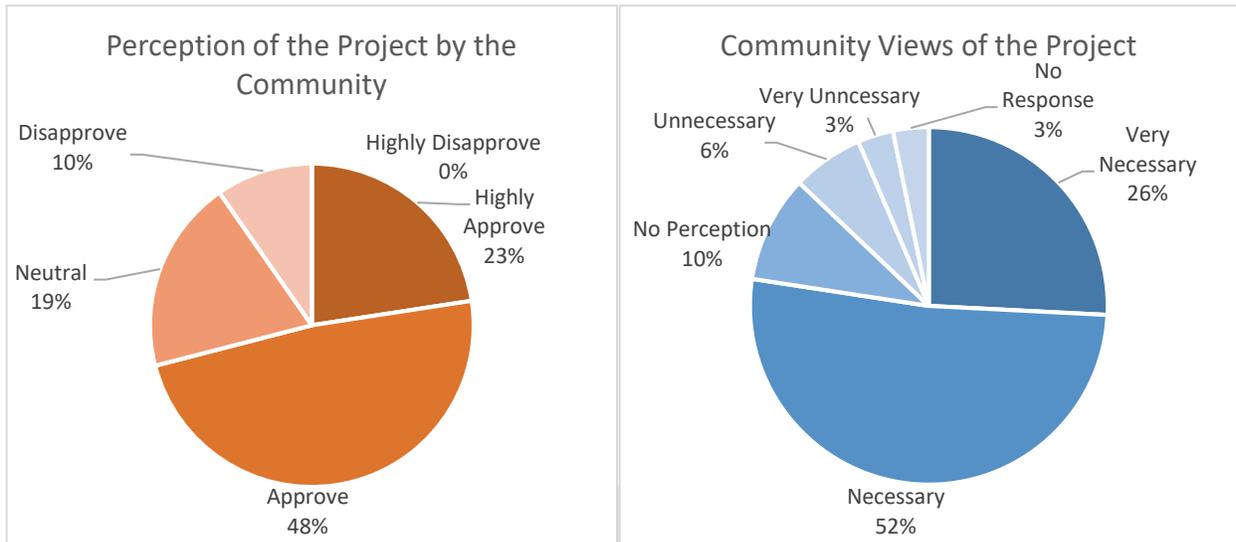


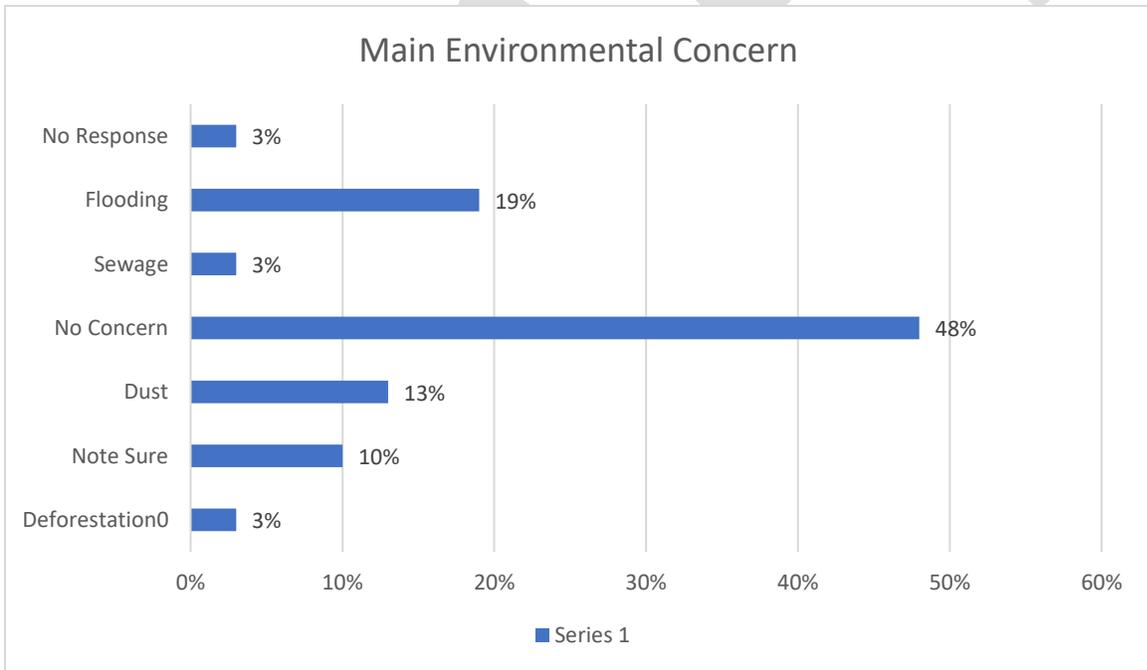
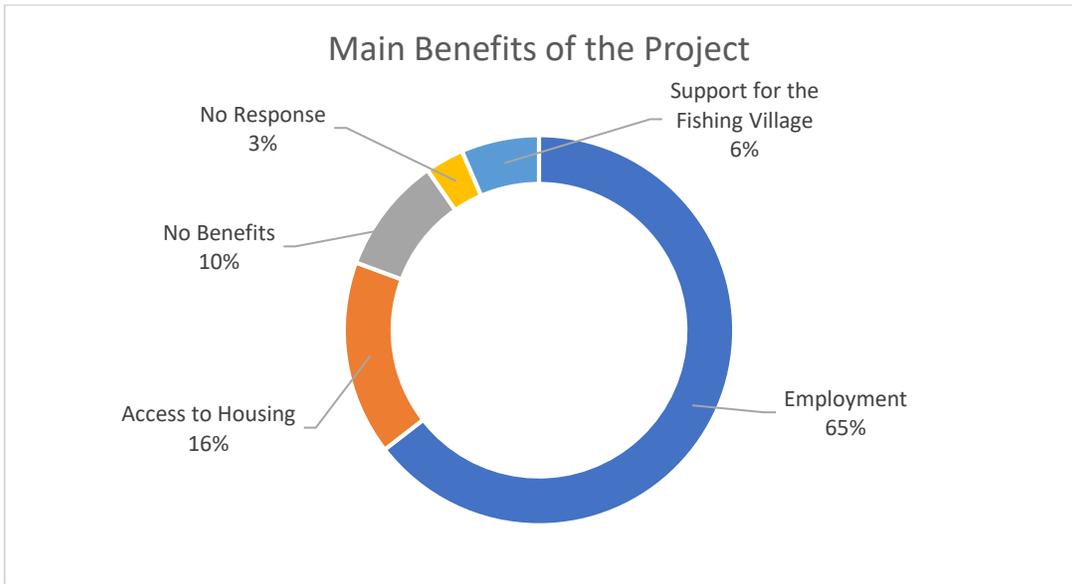


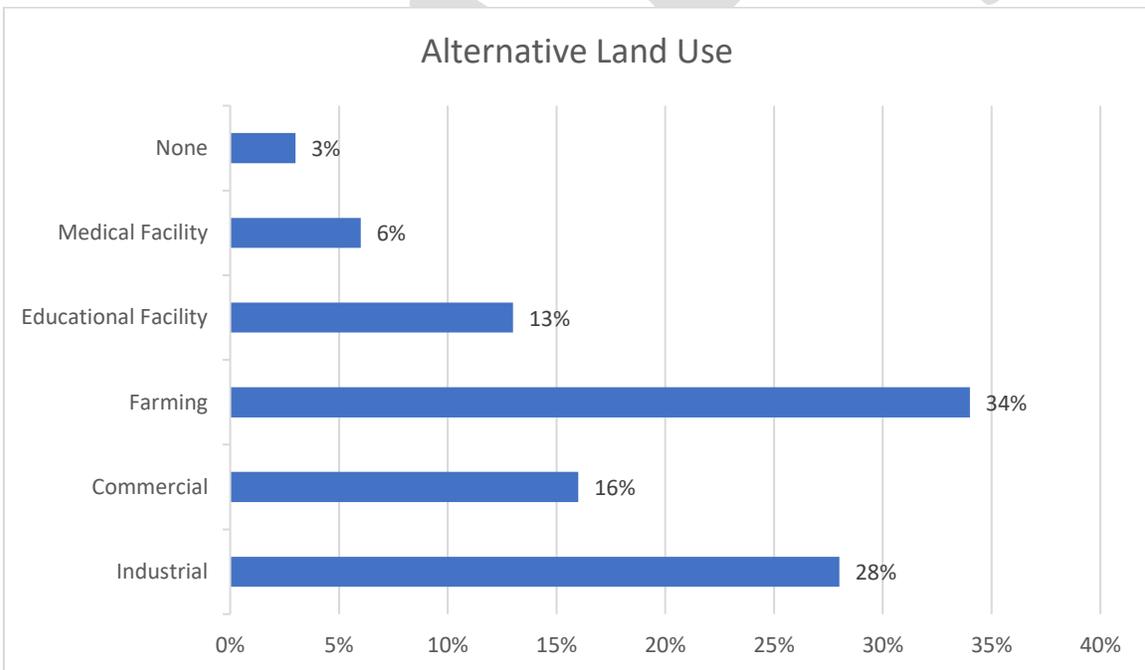
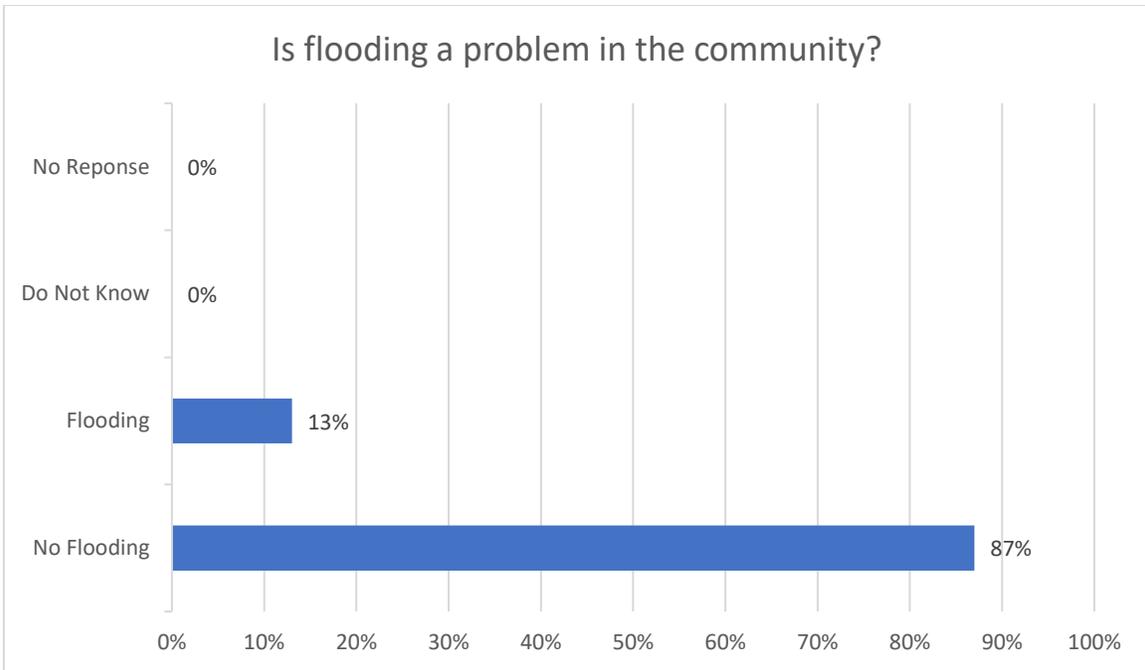


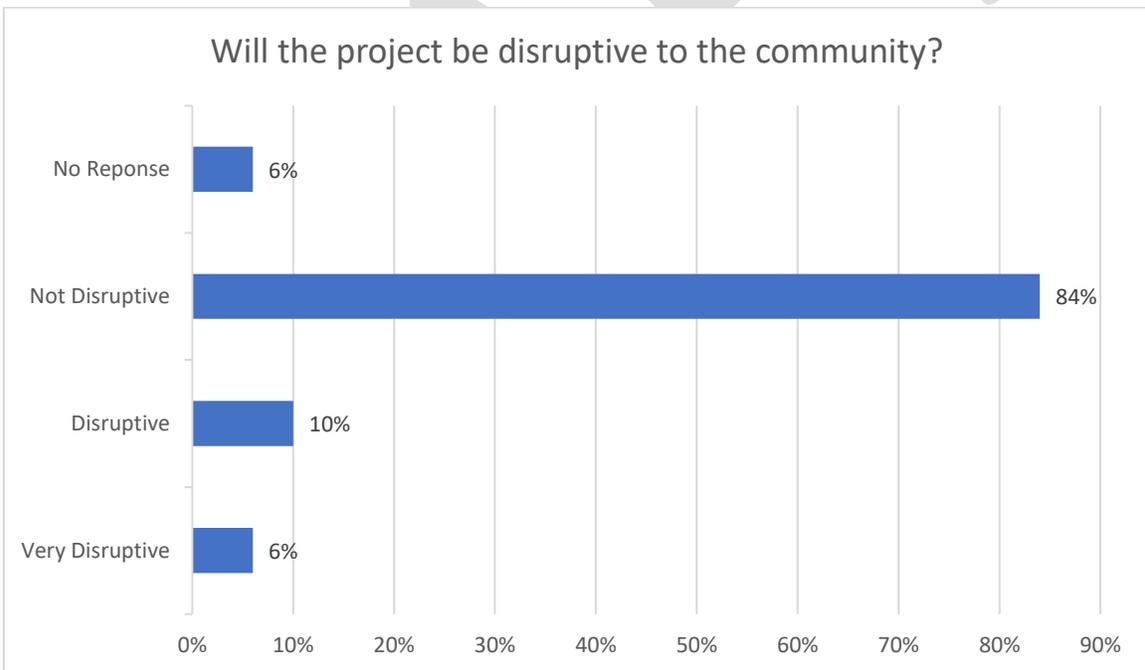
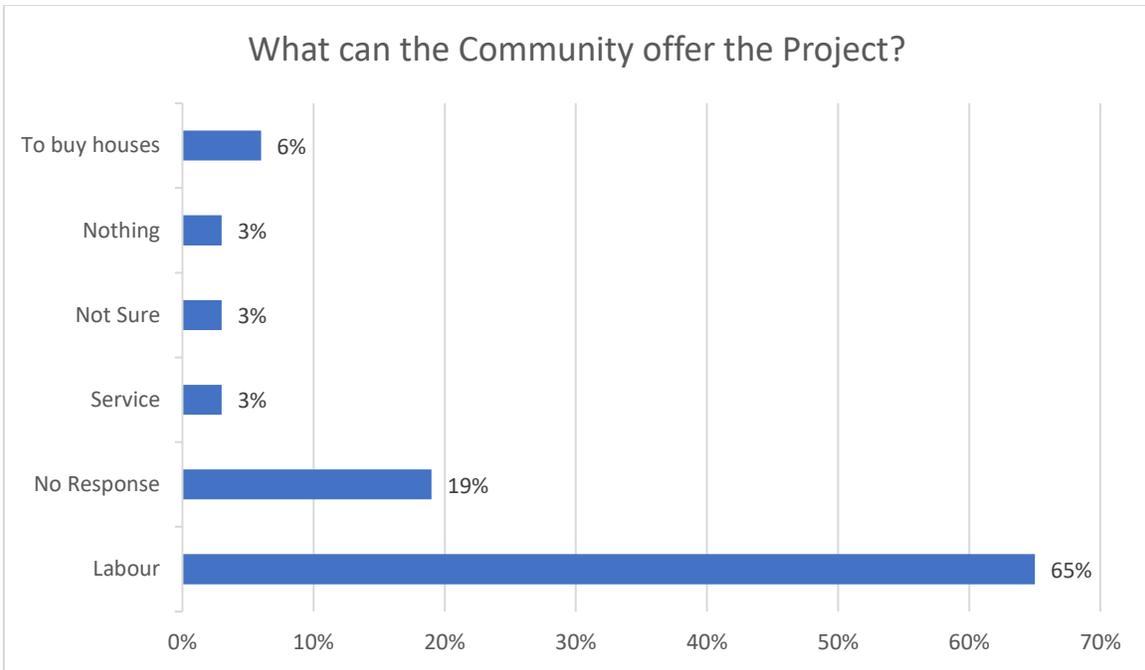


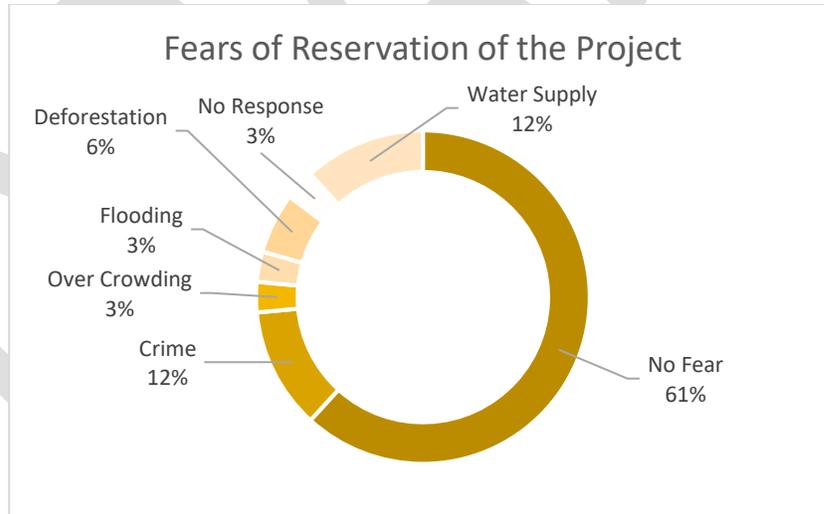
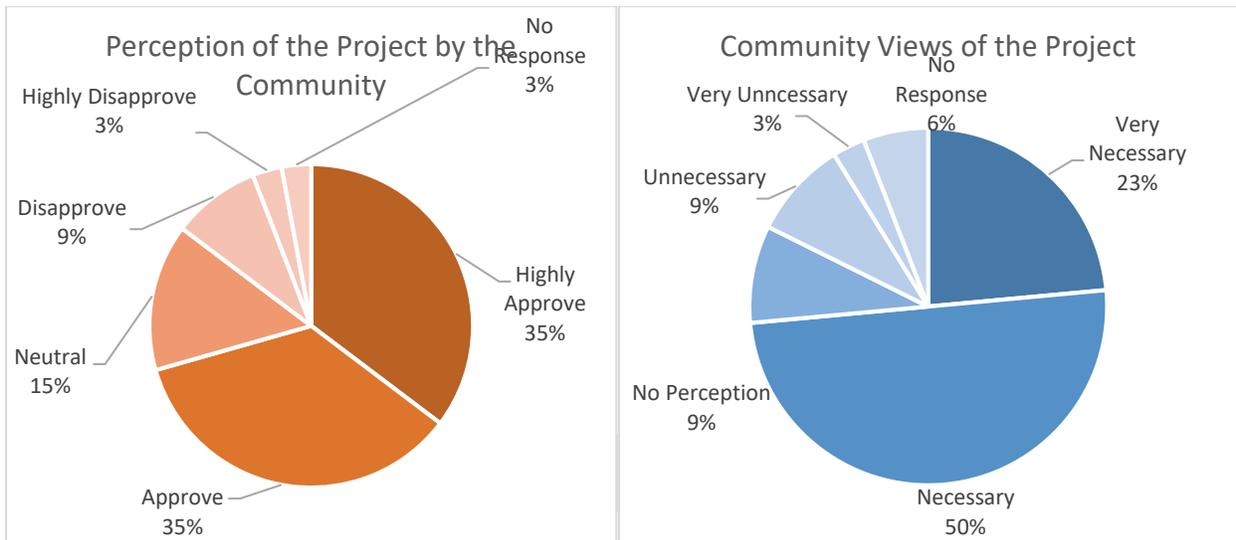
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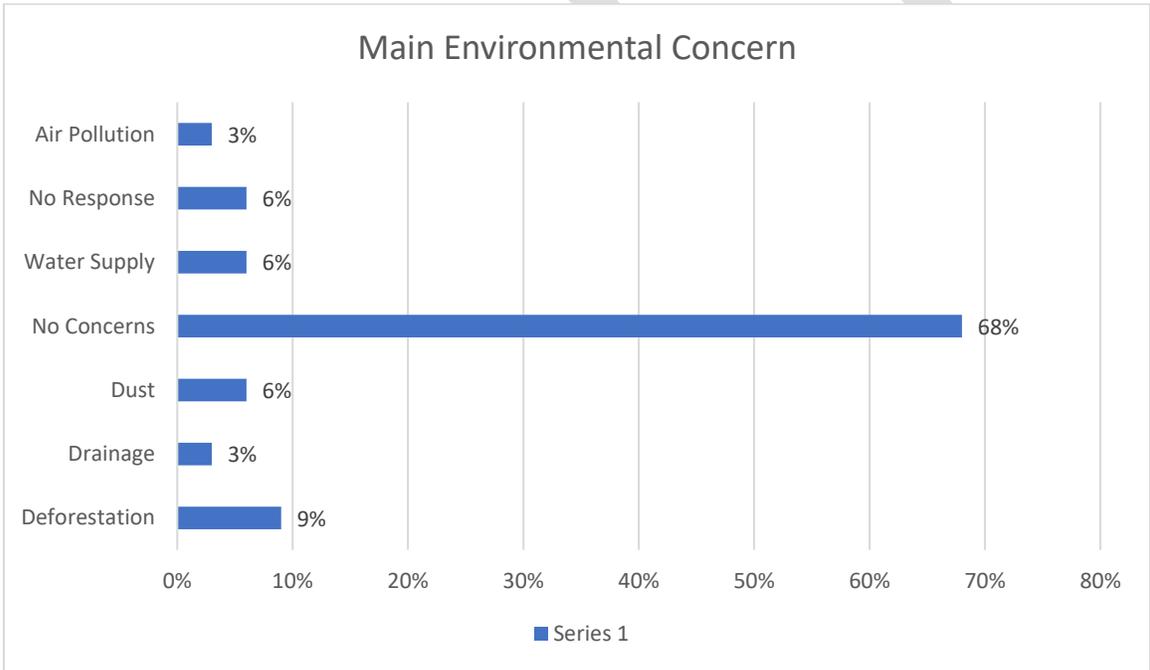
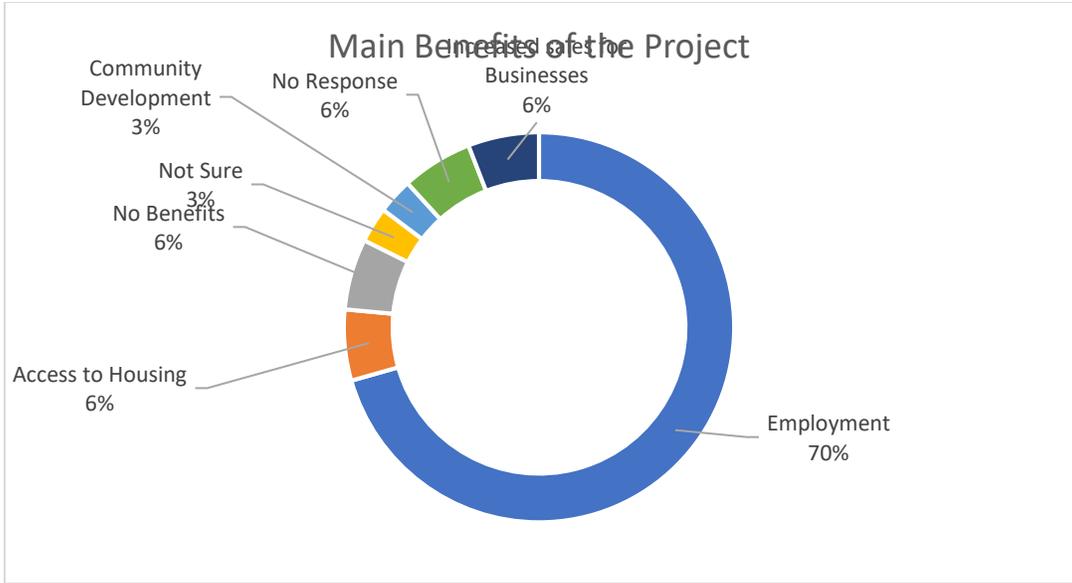


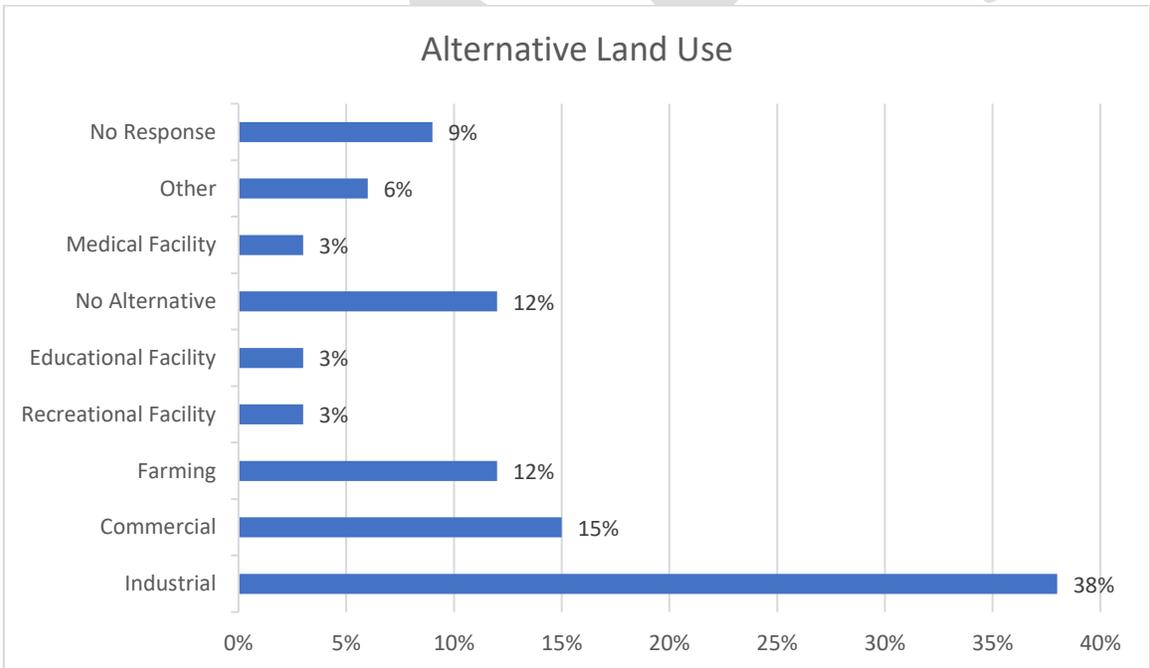
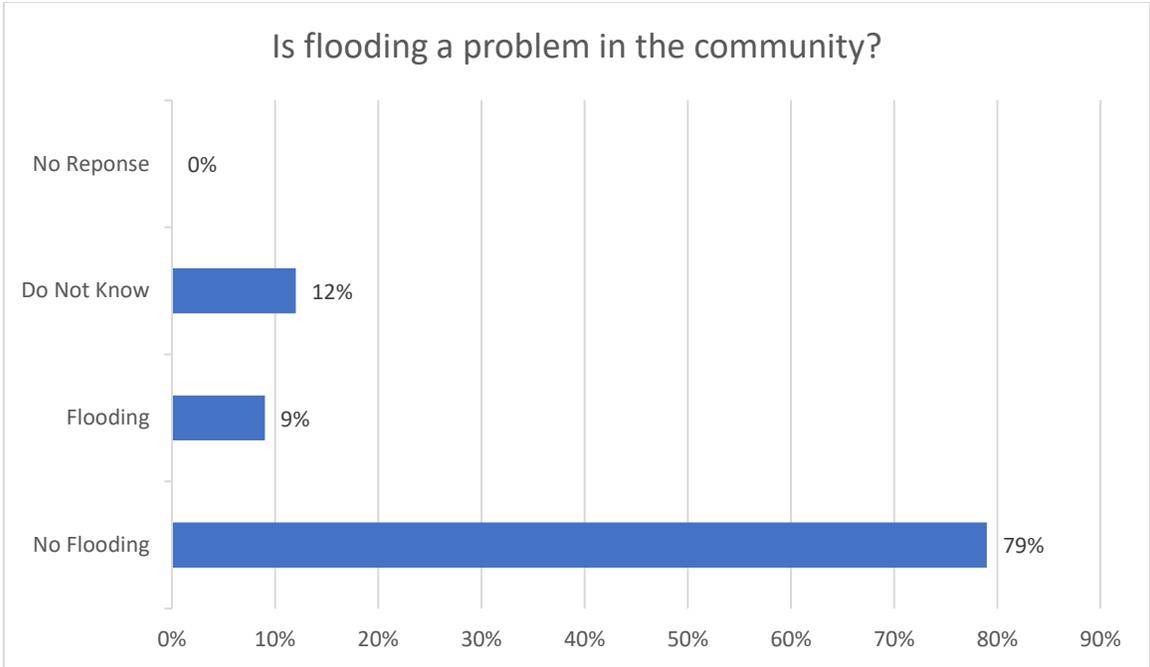


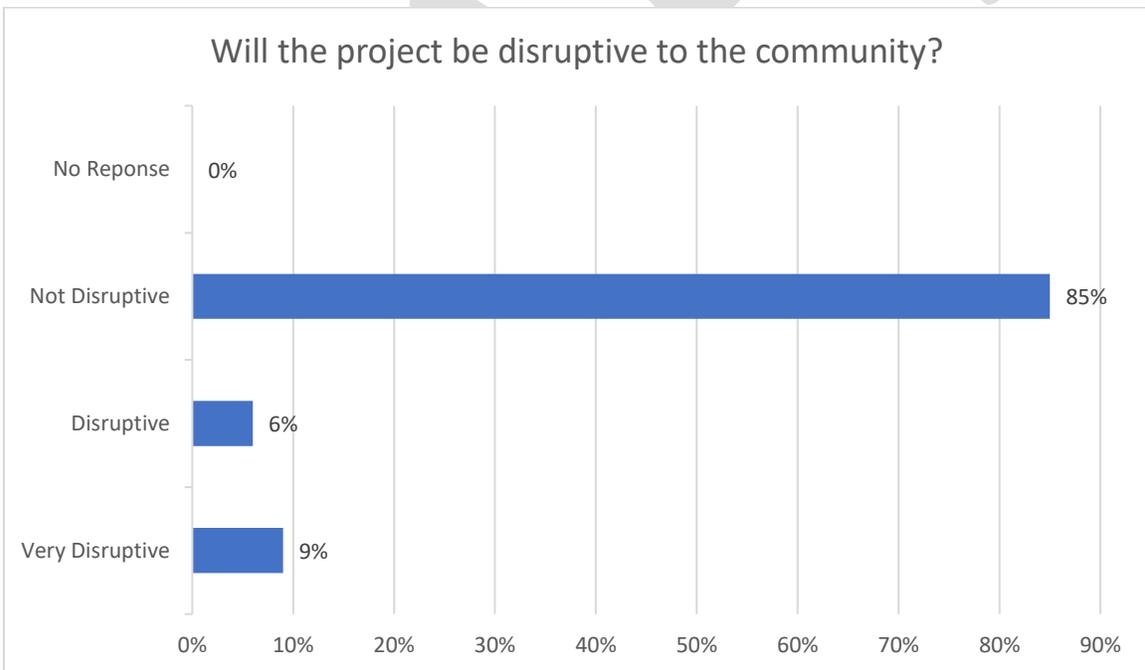
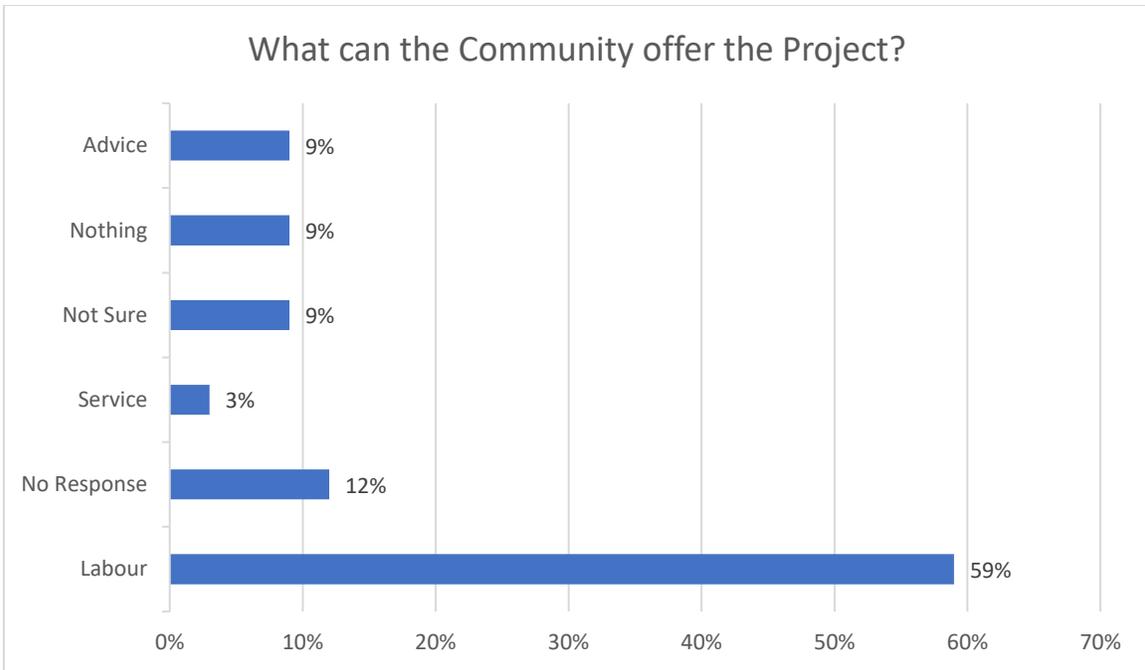




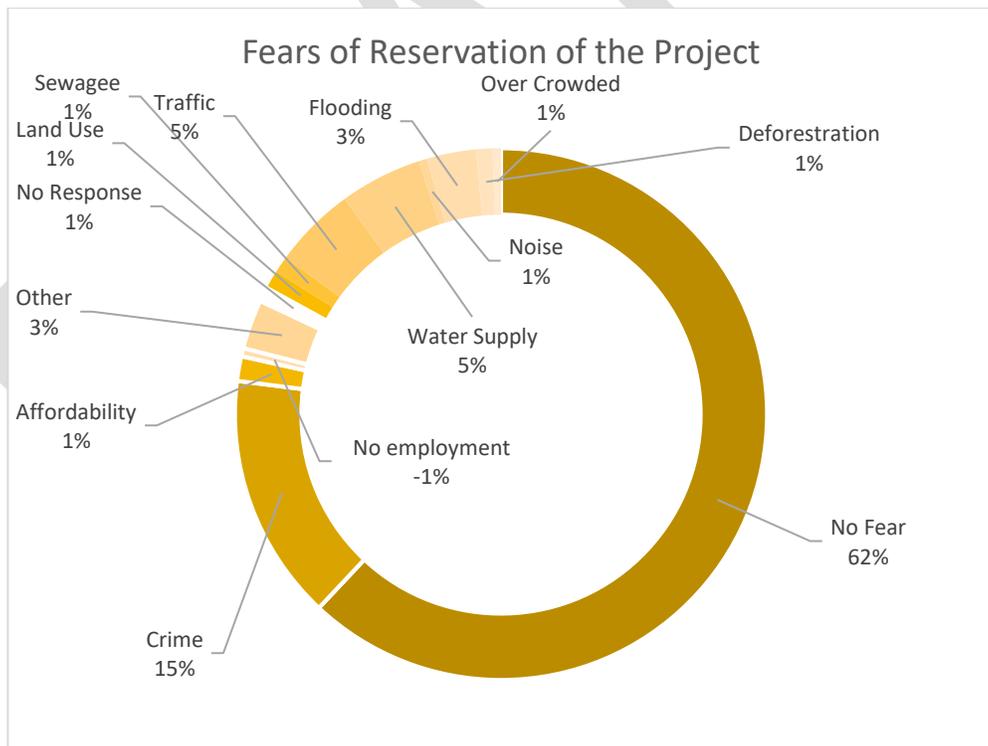
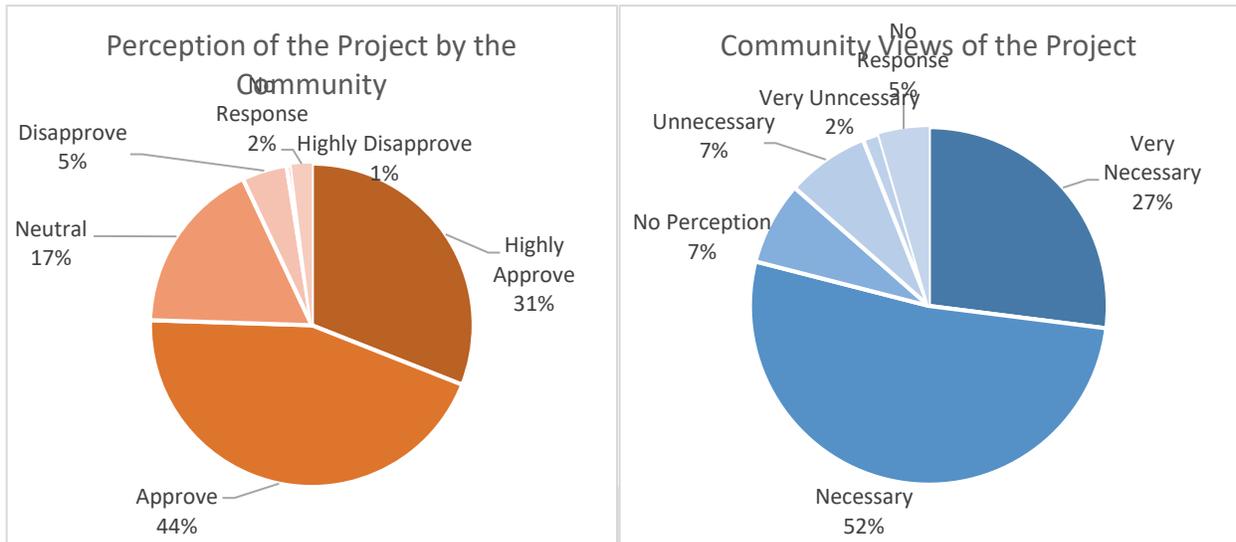


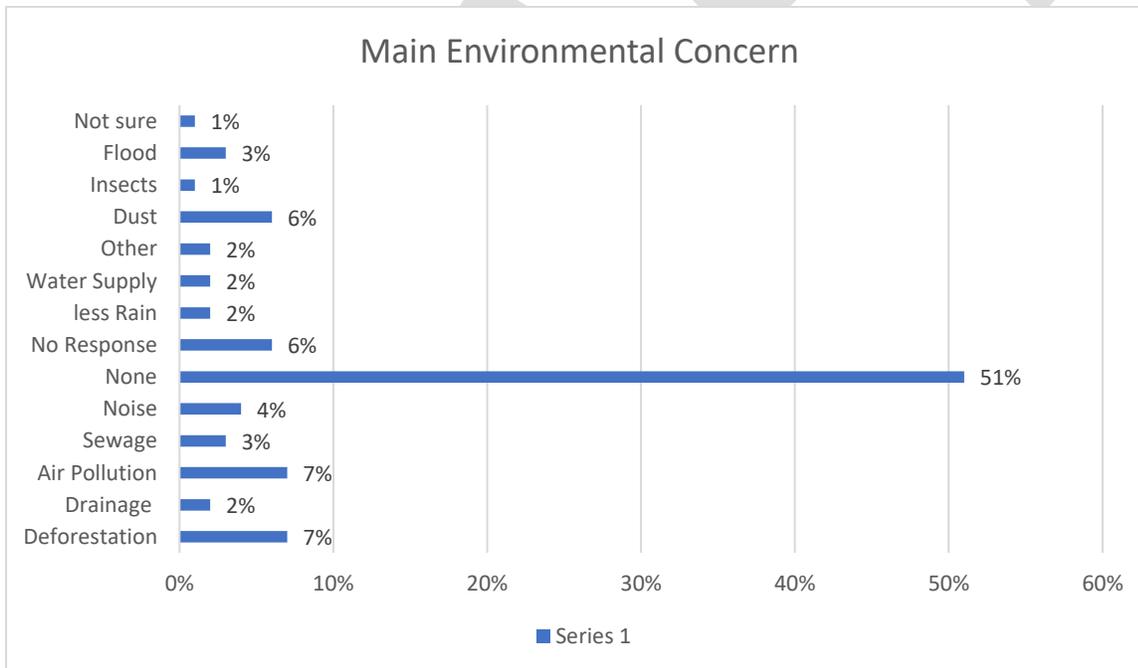
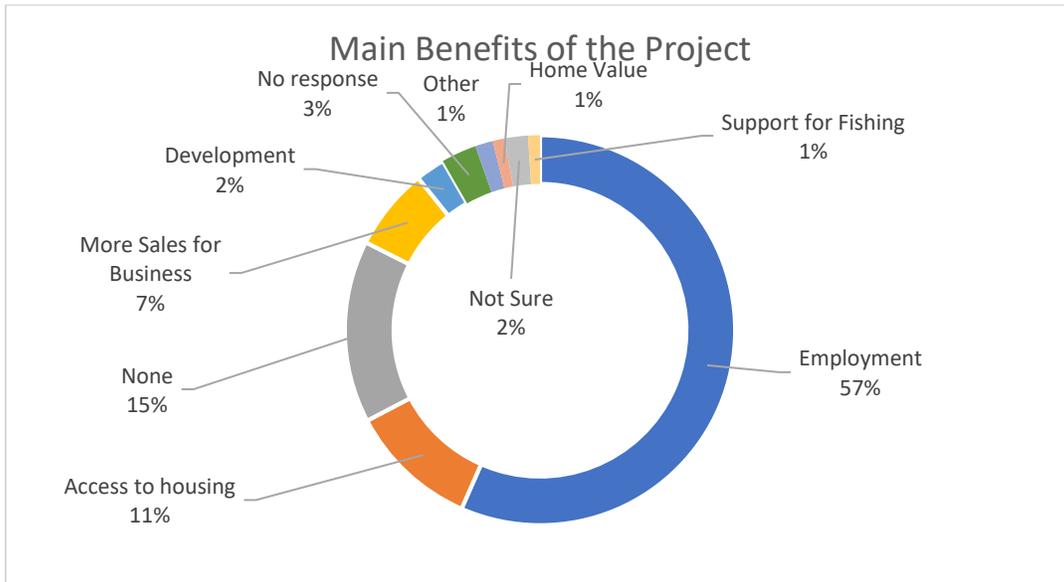


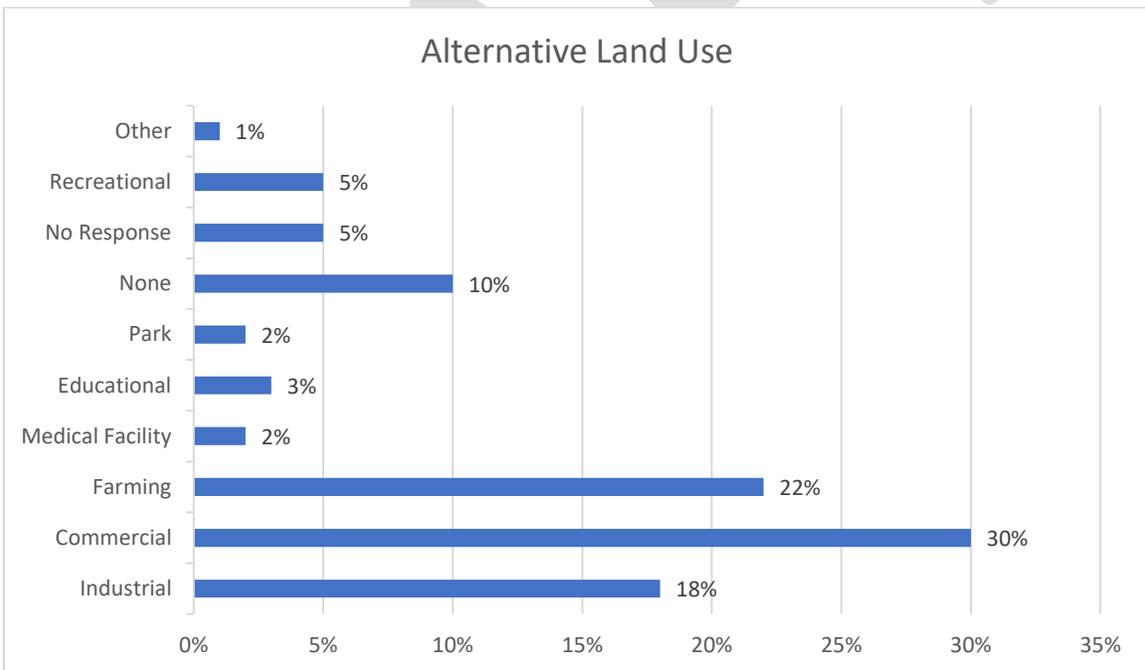
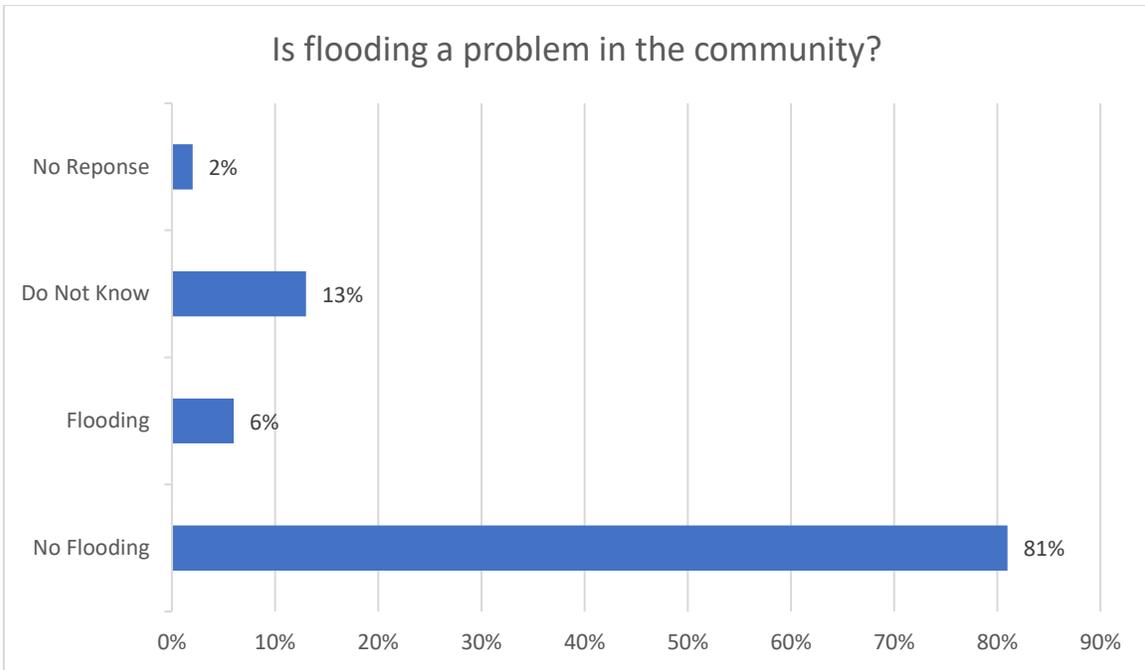


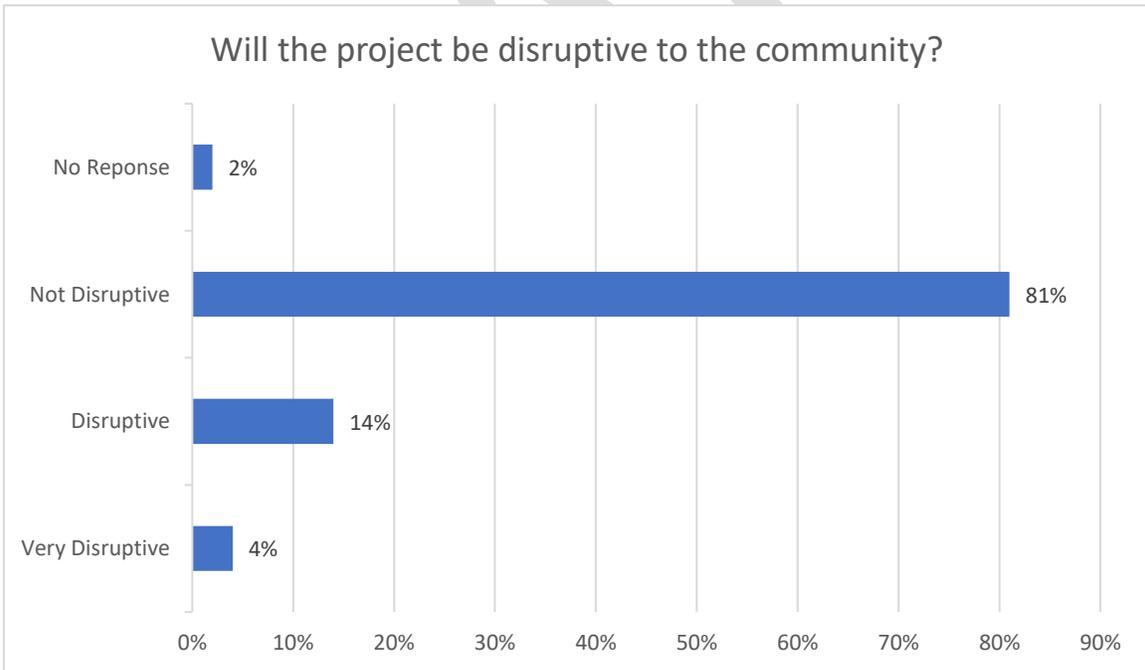
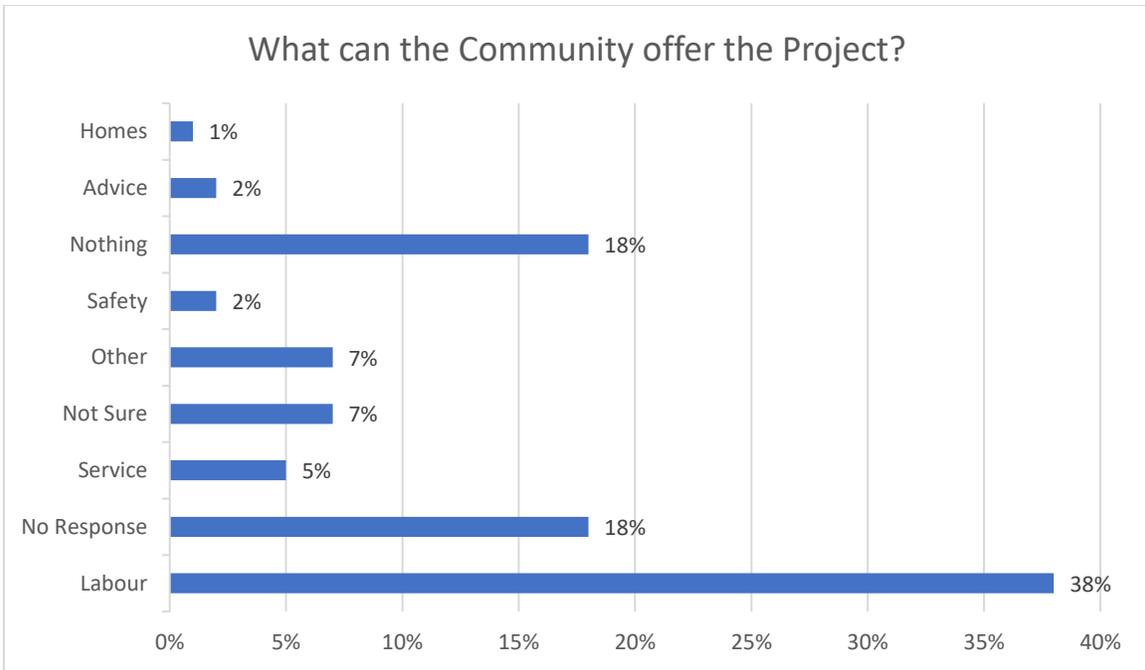


SUMMARY









14.13 Appendix XIII – Sign in Sheet from Meeting with NHV II Citizens’ Association



Whim Estates Residential Development
Stakeholder Consultation
July 17, 2018

	Name	Position within the Organization	Phone	Email
1	BRUCE DONALDSON	WHIM DEVELOPMENT CO. LTD	(76) 990-4763	bruce.stan7@gmail.com
2	Justin Donaldson	" " P.C		justin.t.donaldson@gmail.com
3	Richard Coutou	ESL	551-6056	rcoutou@eslcaribbean.com
4	Abigail McIntosh	ESL	(876) 550-6573	amcintosh@eslcaribbean.com
5	Christophe Rampant	NHV2 CA	876 530 8014	NHV2CADELINFO@gmail.com
6	Stephan Rampant	Premier Ind. water	876 908 3398	srampant@gmail.com
7	DELORIS MOLLISON	NHV2 Citizens Ass.	876 540-3315	nhv2-chairman@gmail.com
8	Dave A. Douglas	NHV 2 CA	876-540-3310	nhv2cairsec@gmail.com
9	Angella Reid	Executive Secretary	876-537-7059	nhv2caexecsec@gmail.com
10				
11				

DRAFT