TROPICAL SUGAR COMPANY LIMITED (TSCL) ENVIRONMENTAL IMPACT ASSESSMENT FOR A NEW SUGAR FACTORY IN LIONEL TOWN, CLARENDON

JUNE 2025

Prepared by:

Environmental & Engineering Managers Ltd.

Unit #7, Phoenix Central, 2 Phoenix Avenue, Kingston 10, Jamaica
Tel: (876) 622-4193, (876) 622-4745
Email: eem@environmanagers.com • www.environmanagers.com

TABLE OF CONTENTS

APPENDICES

ANNEXES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation		Meaning
ACF	-	Activated Carbon Filter
AEI	-	Air Emissions Inventory
AIA	-	Archaeological Impact Assessment
AIJCFA	-	All-Island Jamaica Cane Farmers' Association
AOP	-	Advanced Oxidation Process
BOD	-	Biochemical Oxygen Demand
CCAM	-	Caribbean Coastal Area Management Foundation
CDL	-	Clarendon Distillers Limited
CI	-	Cast Iron
CMR	-	Compact Multi-Roller
COD	-	Chemical Oxygen Demand
CPDO	-	Clarendon Parish Development Order
CSO	-	Civil Society Organisations
DM	-	Demineralization Plant
DMF	-	Direct Membrane Filtration
EEM	-	Environmental and Engineering Managers Limited
ESL	-	Environmental Solutions Limited
ESP	-	Electrostatic Precipitator
ETP	-	Effluent Treatment Plant
FDA	-	Food and Drug Administration
FSSC	-	Food Safety System Certification
GBVH	-	Gender Based Violence and Harassment
GCV	-	Gross Calorific Value
GOJ	-	Government of Jamaica
HACCP	-	Hazard Analysis Critical Control Points
HEC	-	Hydrologic Engineering Center
ISO	-	International Organization for Standardization
JMD	-	Jamaican Dollars
JNHT	-	Jamaica National Heritage Trust

Abbreviation		***Meaning***
JPSCo.	-	Jamaica Public Service Company Ltd.
JSIF	-	Jamaica Social Investment Fund
kcal/kg	-	kilocalories per kilogram
KII	-	Key Informant Interviews
KLD	-	kilo litres per day
km	-	kilometre
kt	-	knots
L	-	litres
MBBR	-	Moving Bed Biofilm Reactor
MCC	-	Motor Control Centre
MCR	-	Maximum Continuous Rating
MEGJC	-	Ministry of Economic Growth and Job Creation
MGD	-	Mines and Geology Division
MGI	-	Mona Geoinformatics Institute
MLSS	-	Mixed Liquor Suspended Solids
MLSS	-	Ministry of Labour and Social Security
MMI	-	Modified Mercalli Intensity
mph	-	Miles per hour
MT	-	Metric Tons
MW	-	Mega-Watts
NHT	-	National Housing Trust
NRCA	-	National Resources Conservation Authority
NSWMA	-	National Solid Waste Management Authority
NWA	-	National Works Agency
OUR	-	Office of Utilities Regulation
PBPA	-	Portland Bight Protected Area
PES	-	Polyethersulfone
PIOJ	-	Planning Institute of Jamaica
PPA	-	Power Purchase Agreement
PPE	-	Personal protective Equipment
PPM	-	Parts Per Million

Abbreviation		***Meaning***
PRDS	-	Pressure Reducing And De-Superheating System
PSF	-	Pressure Sand Filter
RADA	-	Rural Agricultural Development Authority
RO	-	Reverse Osmosis
SCJH	-	The Sugar Company Jamaica Holdings Limited
SDI	-	Silt Density Index
SIA	-	Sugar Industry Authority
STP	-	Sewage Treatment Plant
TCD	-	Tons of cane crushed per day
TDS	-	Total Dissolved Solids
THM	-	Trihalomethane
TRF	-	Three Toothed Roller Feeders
TSCL	-	Tropical Sugar Company Limited
TWST	-	Treated Water Storage Tank
UASBR	-	Up-Flow Anaerobic Sludge Blanket Reactor
UF	-	Ultra Filtration
UNDP	-	United Nations Development Program
USAID	-	United States Agency for International Development
UTC	-	Universal Time Coordinated
UV	-	Ultra violet
UWA	-	Underground Water Authority
WRA	-	Water Resources Authority
WWTP	-	Wastewater Treatment Plant

1 EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) thoroughly details the proposed establishment and comprehensive operation of a new sugar factory by Tropical Sugar Company Limited (TSCL). Incorporated on June 23, 2023, TSCL's ambitious project is envisioned as a fully vertically integrated sugarcane cultivation and sugar production entity, encompassing the manufacturing, local distribution, and export of diverse downstream products including sugar, molasses, cane liquor, retail water, and pharmaceutical products. The strategically chosen project site is situated in Monymusk, Lionel Town, Clarendon, Jamaica, historically a hub for sugar production, and is located in close proximity to the defunct Monymusk Sugar Factory and the currently operational Clarendon Distillers Limited. The surrounding land use primarily consists of sugarcane cultivation, with residential areas to the southwest and southeast of the proposed factory, approximately 1.2 km east of Lionel Town. A location map showing the project site can be seen below.

A pivotal component of the new facility will be a 12.5 MW Co-Generation Plant. This plant is designed to be powered by bagasse, a fibrous byproduct of sugarcane processing, underscoring the project's commitment to utilizing renewable energy sources and enhancing operational sustainability. The project's development schedule outlines a one-year construction, installation, certification, and testing phase, projected to commence in January 2025. This timeline highlights the meticulous planning involved in bringing such a large-scale industrial facility to fruition. Furthermore, the project necessitates adherence to a comprehensive set of environmental regulations and the acquisition of multiple permits and licenses from Jamaican regulatory bodies, including those specifically for agro-processing activities, storage of hazardous materials, bottling operations, power generation, and water treatment facilities. This robust regulatory compliance framework ensures that the project's environmental footprint is managed in accordance with national standards. The EIA itself was a mandatory requirement from the National Environment and Planning Agency (NEPA), with its detailed Terms of Reference approved in March 2025. The entire development is firmly aligned with Jamaica's Vision 2030 National Development Plan, contributing significantly to national energy security through renewable resource utilization and fostering internationally competitive industrial structures via advanced agro-processing and substantial rural economic development.

KEY ENVIRONMENTAL CONSIDERATIONS AND COMPREHENSIVE MITIGATION STRATEGIES:

The EIA meticulously identifies and assesses potential environmental impacts across all project phases—construction, operation, maintenance, and decommissioning—and proposes robust mitigation measures to address them.

AIR QUALITY

During the construction phase, activities are expected to generate dust and emissions from heavy equipment operation. During the operational phase, the primary sources of air emissions will emanate from the bagasse boiler, the diesel generator, and bagasse storage areas, with key pollutants identified as particulate matter (PM), sulphur dioxide (SO_2), and nitrogen oxides (NO_x). Potential volatile organic compound (VOC) emissions from the storage of hazardous materials and odours from wastewater/sewage treatment plants are also noted.

Mitigation: To control particulate matter from the boiler, a highly efficient **Electrostatic Precipitator (ESP)** will be utilized. Comprehensive measures to reduce dust and fugitive emissions during construction include covering haulage vehicles transporting materials, covering and/or wetting onsite stockpiles, regularly wetting cleared land areas, and employing water sprays. All vehicles and equipment will be well-maintained to minimize emissions. The project commits to green cane harvesting, explicitly avoiding sugarcane burning, a common source of air pollution. Regulatory compliance includes applying for and abiding by environmental permits and licenses issued by NEPA.

NOISE

Noise nuisance and the potential for temporary or permanent hearing impairment are anticipated from construction machinery (e.g., site preparation, heavy equipment), operational equipment (e.g., power generators, sugar house machinery, treatment plant equipment), and various vehicular movements (e.g., fuel delivery, sugarcane transport).

Mitigation: Proactive measures include providing workers with necessary Personal Protective Equipment (PPE) such as hearing protection. Community engagement involves sensitizing local residents about the types of activities and scheduling noisy works during standard working hours (7:00 a.m. to 7:00 p.m.). Strict noise limits will be set for the operational phase, not to exceed 75 dB at the fence line, with continuous monitoring of sound levels. Heavy equipment transport during off-peak traffic hours (10:00 p.m. to 4:00 a.m.) will be coordinated, potentially with police outriders.

WATER QUALITY AND EFFLUENT DISCHARGE

Potential impacts include soil erosion and sedimentation during land clearing and slope modification in the construction phase, groundwater, soil, and surface water contamination from fuel and chemical spills/leaks, and the discharge of industrial trade effluent and domestic sewage effluent during the operational phase.

Mitigation: To manage water quality, two dedicated treatment plants will be constructed and meticulously operated: a **Wastewater Treatment Plant (WWTP)** specifically for treating industrial trade effluent from agro-processing, juice, molasses, and sugar house operations, and a **Sewage Treatment Plant (STP)** for managing domestic sewage from the facility. The treated industrial effluent will be beneficially recycled for sugarcane field irrigation. Pending approval from the Ministries of Health and Agriculture, sewage sludge will undergo dewatering for reuse as soil conditioning material on cane fields. For spills, fuel and chemicals will be stored in facilities with secondary (spill) containment infrastructure, and proper dispensing equipment will be utilized. Comprehensive spill containment and cleanup equipment will be readily available on-site, with workers trained in spill management. An Emergency Preparedness and Response Plan will be developed. Erosion and sedimentation during construction will be controlled by avoiding unstable slopes, minimizing vegetation clearance, designing runoff control features, re-vegetating disturbed areas, and utilizing sediment traps. All relevant activities will adhere to environmental permits and licenses from NEPA and the Water Resources Authority (WRA).

SOLID WASTE MANAGEMENT

The project will generate various solid waste streams, including construction debris, general garbage, filter press mud, bagasse ash (grate and fly ash) from power generation, bagacillo from bagasse handling, sludge from treatment plants, and packaging waste from the sugar house.

Mitigation: A robust solid waste management strategy will ensure that all garbage and construction debris are **properly contained for disposal at the approved dumpsite at Martins Hill**. The burning of solid waste on project sites is strictly prohibited. Disposal of large decommissioning parts will require explicit approval from the National Solid Waste Management Authority (NSWMA). Proper stockpiling and storage are emphasized for all solid waste materials.

RESOURCE MANAGEMENT (WATER DEPLETION)

The significant water demands of the project, including for power generation, water treatment, and processing, raise concerns about the depletion of local water resources.

Mitigation: The project will implement measures such as utilizing low water consumption equipment and practicing onsite water reuse and recycling where technically feasible and practical. Crucially, TSCL plans to rehabilitate 43 wells and four pumps that were previously part of the defunct Monymusk Sugar Factory infrastructure. This strategy will ensure that the project meets its water requirements by utilizing existing infrastructure, thereby avoiding new demands on public potable water supplies. Compliance with WRA permits for water abstraction will be maintained.

BIODIVERSITY AND HABITAT PROTECTION

Potential impacts include vegetation loss and disturbance of biological communities during site preparation and land clearing, as well as potential habitat disturbance from noise.

Mitigation: Strategies include minimizing vegetation clearance to only areas absolutely necessary for development, undertaking re-vegetation exercises in disturbed areas not converted to permanent land uses, and replanting trees on the project site or in other designated areas. Any archaeological artifacts found during site preparation will be immediately reported to the Jamaica National Heritage Trust and NEPA, with safeguarding measures implemented.

TRAFFIC MANAGEMENT

Increased vehicular movements during construction (construction vehicles, heavy equipment) and operational phases (cane haulage, fuel delivery, molasses transport) are anticipated to cause traffic congestion, potential vehicle-vehicle/vehicle-pedestrian conflicts, and delayed movements.

Mitigation: During construction, measures include erecting traffic signs along main transportation routes and in sensitive areas (e.g., near schools), deploying traffic assisting devices (mirrors, flagmen), and advising schools and residents of the construction schedule to gain their support.

HEALTH AND SAFETY / RISK OF HAZARDS & ACCIDENTS

Potential impacts include injuries or fatalities due to accidents during construction, maintenance, and decommissioning work, as well as risks associated with fire and explosion (e.g., bagasse piles, fuel storage) and improper handling of hazardous materials.

Mitigation: Comprehensive health and safety protocols will be implemented across all phases. This includes erecting clear safety signs, providing workers with appropriate Personal Protective Equipment (PPE), and conducting thorough training for all personnel in good safety practices and emergency preparedness and response measures. An Emergency Preparedness and Response Plan will be developed and implemented, particularly for managing fuel and chemical spills/leaks, which also addresses broader hazard risks.

KEY SOCIAL CONSIDERATIONS AND SUBSTANTIAL BENEFITS:

Beyond environmental aspects, the EIA delves into the project's social implications. The project is poised to deliver substantial positive social and economic benefits, notably generating widespread employment opportunities—an aspect strongly emphasized by stakeholders (96.5% of those consulted) and confirmed by survey respondents (83.7%). The job created are expected to significantly contribute to increased household incomes and broader economic development within the region. Furthermore, the project is anticipated to play a role in poverty reduction (supported by 81.4% of respondents) and foster community renewal. Stakeholders also identified broader national benefits, including increased tax revenue, enhanced export capabilities, foreign exchange earnings, and vital diversification within the agricultural sector. While the primary focus is on positive impacts, the EIA acknowledges potential minor to moderate negative social impacts, particularly related to noise, air quality, road access, and waste management during the construction phase. Crucially, occupational health and safety concerns, alongside issues of gender-based violence and sexual harassment, are explicitly recognized as major negative social impacts that require dedicated and robust mitigation strategies.

CONCLUSION

In conclusion, this EIA for TSCL's agro processing development, provides a detailed look at the environmental and social impacts associated with developing a new sugar factory in Monymusk, Clarendon. The report highlights the fact that while there is the potential for negative environmental impacts associated with the project, these can be mitigated. Once the mitigation strategies identified are correctly implemented by TSCL, negative environmental and social impacts associated with the project will be minimised. This will allow TSCL's new sugar factory to provide significant socio-economic benefits, contributing positively to both the local community and the national economy of Jamaica.

2 PROJECT DESCRIPTION

Tropical Sugar Company Limited (TSCL) was incorporated on June 23rd, 2023, and proposes to establish a new sugar factory and associated wastewater treatment plants, power generation plant and water treatment plant at Monymusk, Lionel Town, Clarendon. The sugar factory will be operated as a vertically integrated sugarcane cultivation and sugar production company. In addition to sugar, the company expects to manufacture, distribute locally and export downstream products inclusive of molasses, cane liquor, water for retail consumption and pharmaceutical products, among others, when fully operational and equipped (TSCL Development Project Brief, July 2024). TSCL also intends to incorporate a 12.5 MW Co-Generation Plant into the facility that will be powered by bagasse, which is a by-product of sugarcane processing and is considered a renewable resource.

Figure 1 shows the location of TSCL's proposed new factory. As seen in Figure 1, the proposed location is in close proximity to other industrial operations, namely the now defunct Monymusk Sugar Factory, and Clarendon Distillers Limited, which is still in operation.

The majority of the farming land surrounding the property is sugarcane, with some residential areas to the southwest and southeast of the proposed factory. Lionel Town is approximately 1.2 km east of the property.

Based on the scale of the project it requires the submission of several environmental permit and licence applications regulated under the Natural Resources Conservation (Permits and Licences) (Amendment) Regulations 2015, as well as the Natural Resources Conservation (Wastewater and Sludge) Regulations 2013.

Permit applications under the following categories were submitted to NEPA online on December 17, 2024 and the hard copies on January 17, 2025.

<u>Permit Application Categories</u>

1. Construction and operation of agro-processing facilities (including sugarcane)
2. Construction and operation of facilities for the storage of hazardous materials, toxic chemicals and other similar substances
3. Construction and operation of bottling facilities and boxing plants
4. Construction and operation of power generation plants 200kW or above using renewable sources of energy
5. Construction and operation of water treatment and storage facilities, including desalination plants and water supply plants

<u>Licence applications are to be submitted to the Agency under the following categories.</u>

<u>Licence Application Categories</u>

1. Licence to construct a sewage treatment plant

2. Licence to operate a sewage treatment plant
3. Licence to construct a wastewater treatment plant
4. Licence to operate a wastewater treatment plant for the discharge of trade effluent
5. Licence to discharge sewage effluent into the environment
6. Licence to discharge trade effluent into the environment

Following the submission of the permit applications to NEPA, the project proponent was advised that an Environmental Impact Assessment (EIA) would be required for the processing of the applications. The Terms of Reference (TOR) for the EIA were submitted to NEPA by Environmental and Engineering Managers in March 2025 and it was approved on March 17, 2025. The approved TOR and the approval letter are included in **Annex 1**.

The project is expected to take advantage of significant local and regional market opportunities for a new, efficiently run and technologically equipped player. There are currently only two (2) sugar factories in Jamaica, Pan Caribbean Sugar Company (Frome) and Worthy Park Estate.

Sugar cane remains Jamaica's single most important agricultural crop and earns approximately US$70-80 million in foreign exchange annually (an estimated 50% of the total value of agricultural exports). Jamaica currently produces approximately 38,000 metric tonnes of sugar per annum and currently exports the bulk of its sugar and sugar products to the USA (80%), the Cayman Islands (6%) and Canada (3%).

Like the rest of the Caribbean, a characteristic feature of the Jamaica market is a huge sugar production versus consumption imbalance, as the existing operations together produce approximately 40,000 tonnes of brown sugar annually, whereas annual consumption approximates 75-80,000 tonnes of brown sugar, plus an additional 60,000 tonnes of refined sugar, which is mainly utilized by the food manufacturing sector.

3 PROJECT LOCATION AND SITING

The Factory Site is approximately 24 kilometres south of May Pen, the parish capital and 74 km west of Kingston, the country's capital city. Geographical Co-ordinates are Latitude: 17.806539° and Longitude: -77.253846°. The topography of the area is flat to gently undulating with the site elevation ranging from 8 to 13m. The area will be made uniform, considering natural slopes for drainage and the site for the factory will be elevated to be level with the existing road. The wind blows in a north-westerly direction and the soil is mainly Quaternary Alluvium.

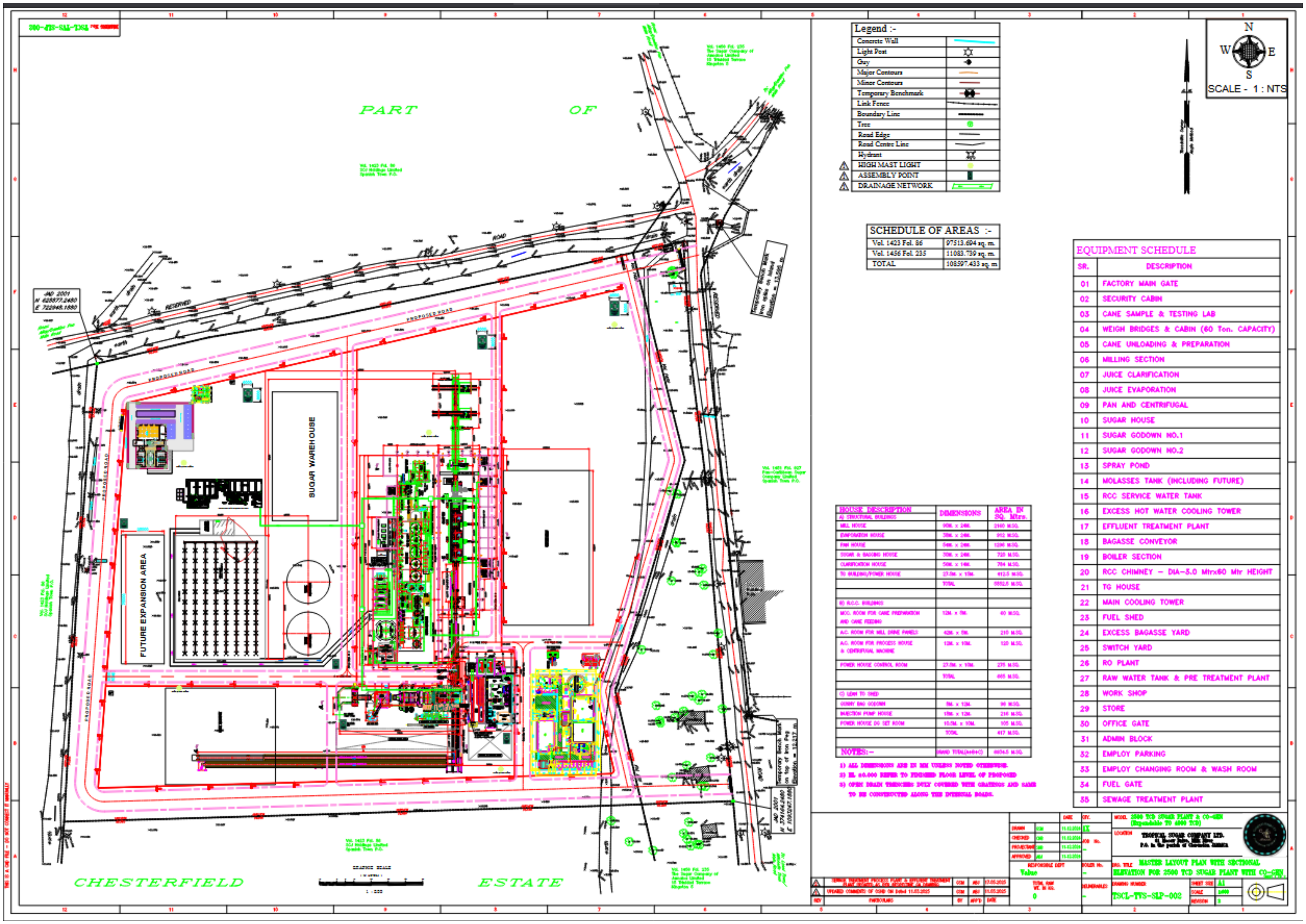
The site is bordered by roads on 3-sides and it has 3 main access points; 1) Monymusk Entrance Road, 2) The road from Lionel Town to Gayle/Amity Hall and 3) Monymusk Cane Road from the North.

The majority of the land is covered by shrub vegetation with a section having cultivated canes. There are former employee old rotten houses along the Monymusk Main Road heading north from the entrance which will be demolished to create a green area along the road side areas.

The new sugar factory will be situated in the area on the left of the Main Entrance of the old redundant Monymusk Sugar Factory. Within this proposed boundary, the former old rotten board employee houses, long since vacated, will give way to create green areas along the existing Monymusk Road Entrance. Figure 2 shows the proposed factory layout.

Figure 1: Location Map Showing TSCL Property Boundary and Area for New Factory

Figure 2: TSCL Facility Layout



3.1 LAND USE AND ZONING

Being in Clarendon, the project area is within the Clarendon Provisional Development Order. The proposed area for the new sugar factory is directly west of the Lionel Town Local Planning Area as mentioned in the Town and Country Planning (Clarendon Parish) Provisional Development Order, 2017. The location of the project area in relation to the Clarendon Provisional Development Order and Lionel Town Local Planning Area can be seen in Figure 3 and Figure 4. These maps show that the project area is predominantly surrounded by agricultural land, industrial land to the west of the project site and recreational and residential land to the southwest of the project site.

Aerial photos taken in December 2024, which can be seen in Figure 5 through Figure 8 show that the project site is comprised mostly of sugarcane that has been left to grow wild, grasses and shrubs in the intervals within the fields and trees and other vegetation surrounding the property boundaries.

Figure 3: Clarendon Parish Development Order (Map 1) (The Jamaica Gazette Supplement, 2017)

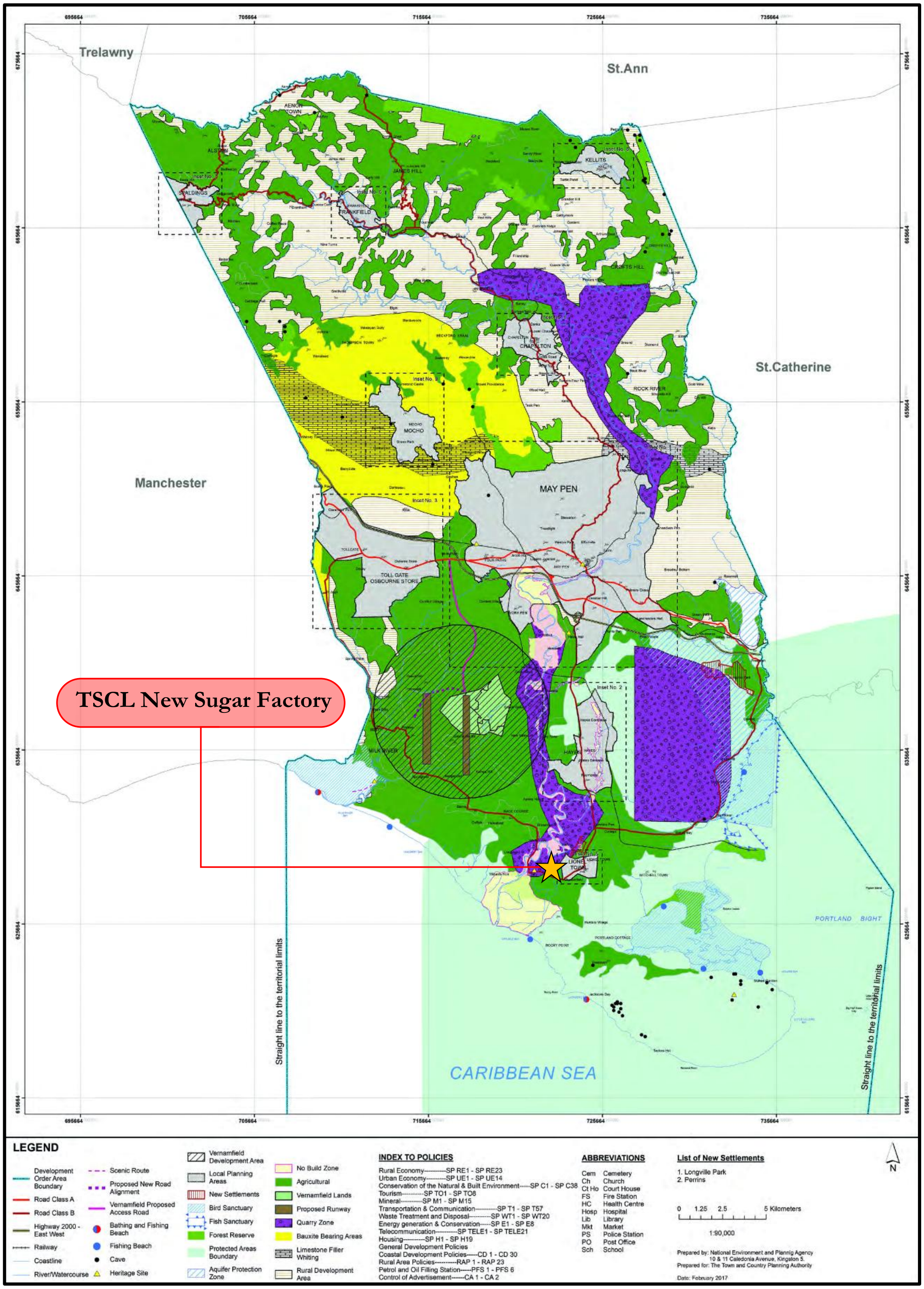


Figure 4: Lionel Town Local Planning Area Map (The Jamaica Gazette Supplement, 2017)

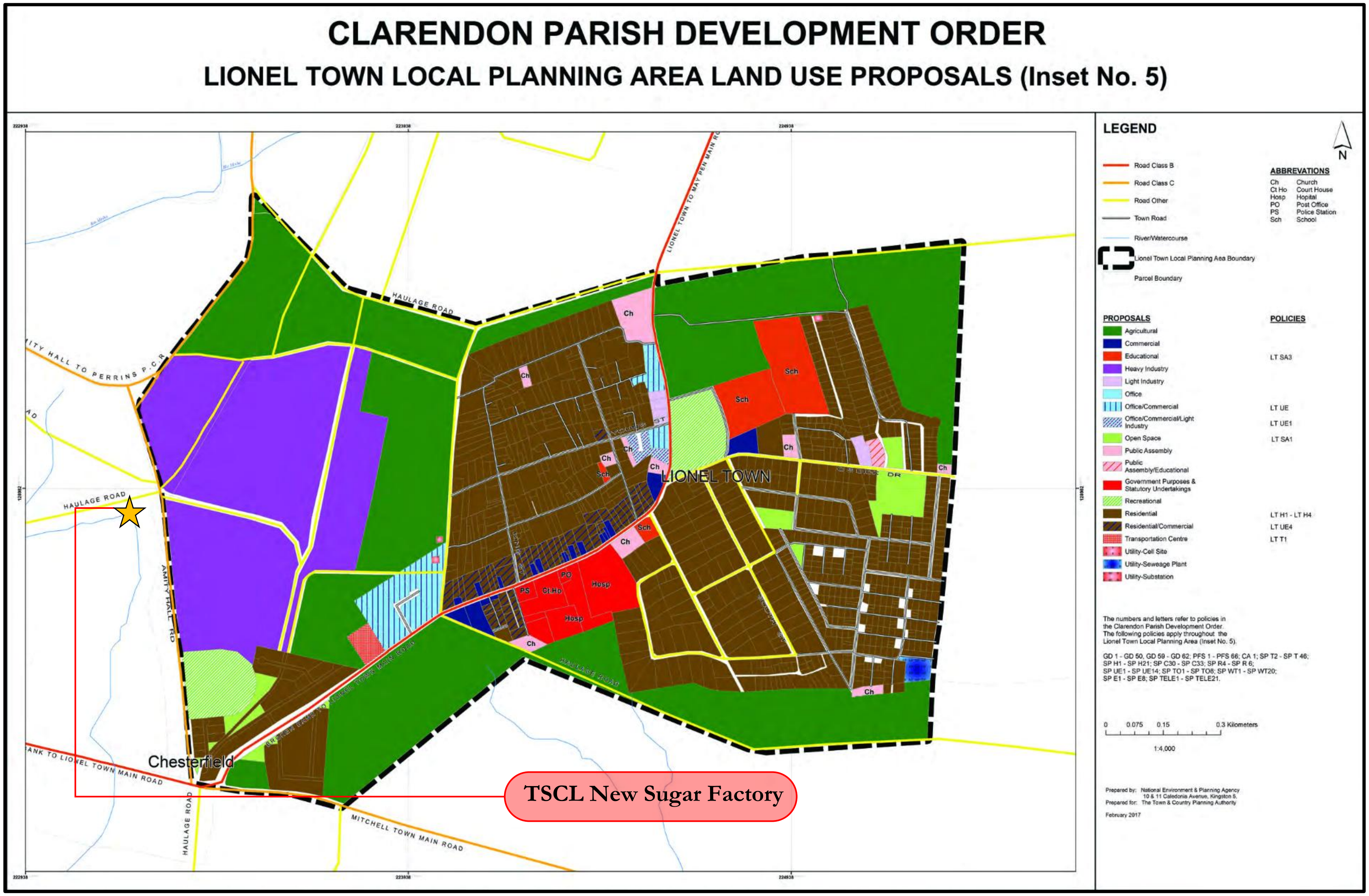


Figure 5: Aerial Photo Showing TSCL Site for Proposed Sugar Factory (1 of 4)

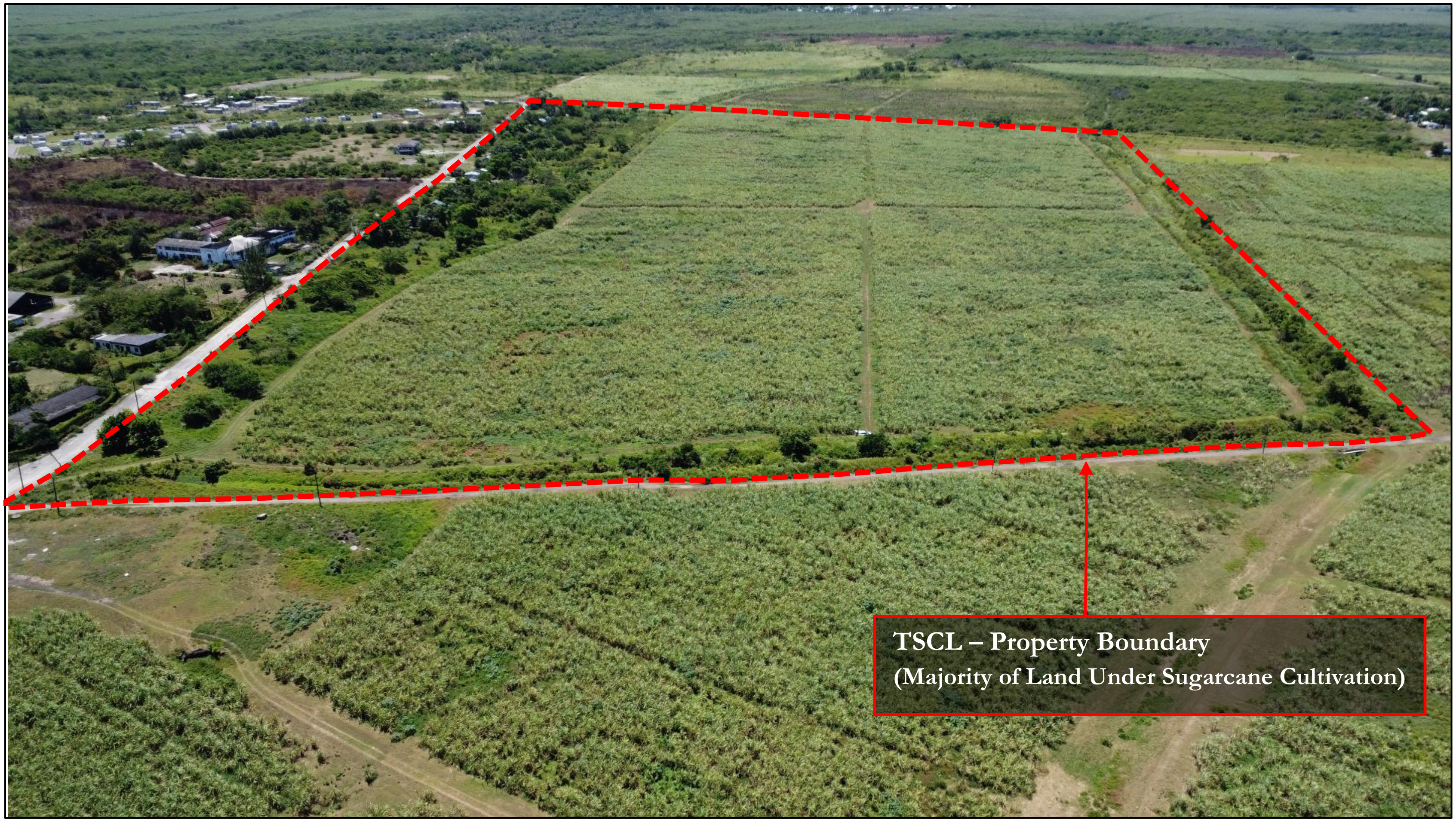


Figure 6: Aerial Photo Showing TSCL Site for Proposed Sugar Factory (2 of 4)

Figure 7: Aerial Photo Showing TSCL Site for Proposed Sugar Factory (3 of 4)

Figure 8: Aerial Photo Showing TSCL Site for Proposed Sugar Factory (4 of 4)

3.2 PROJECT DESIGN ELEMENTS & FOOTPRINT

The project will include the following:

1. Construction and operation of agro-processing facilities (sugar factory)
2. Construction and operation of facilities for the storage of hazardous materials, toxic chemicals and other similar substances
3. Construction and operation of bottling facilities and boxing plants
4. Construction and operation of power generation plants 200kW or above using renewable sources of energy
5. Construction and operation of water treatment and storage facilities, including desalination plants and water supply plants
7. Construction and operation of a wastewater treatment plant (WWTP) and discharge of treated effluent to the environment
8. Construction and operation of a sewage treatment plant and discharge of treated effluent to the environment

The new factory installation, certification and testing project is expected to take one (1) year to complete, as detailed in the work plan below (Figure 9).

Figure 9: Gantt Chart - Factory Implementation Plan

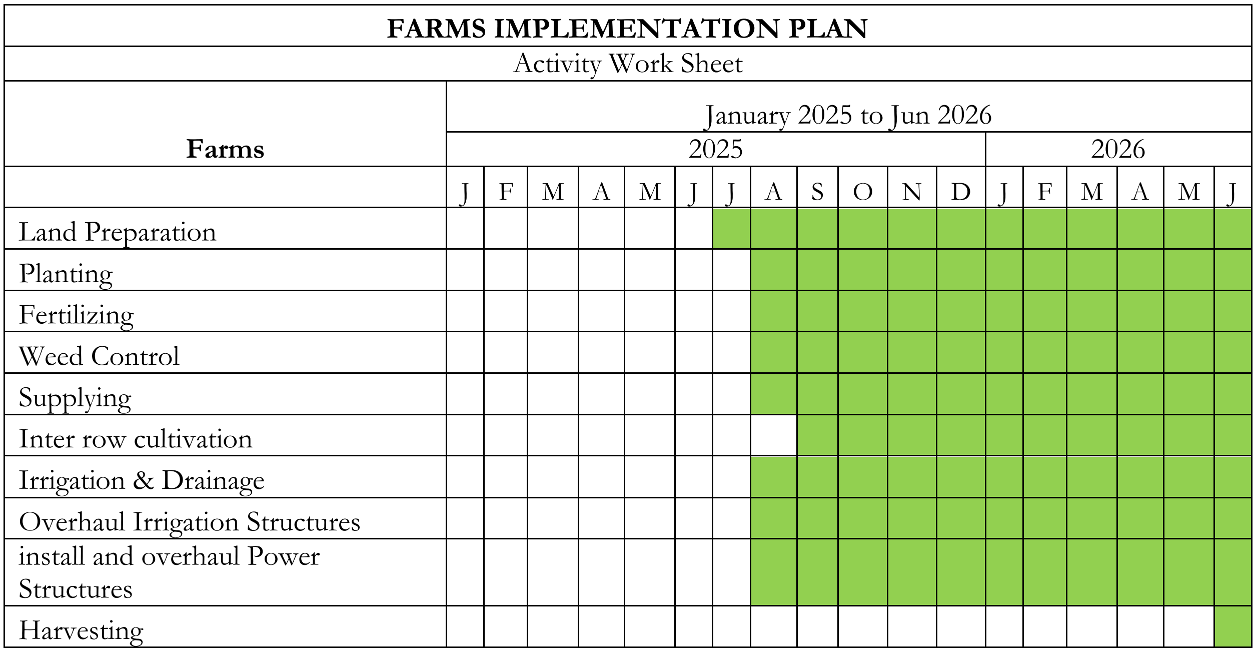
FACTORY IMPLEMENTATION PLAN

Activity Work Sheet

Modern Processing & Power Plant Construction	January 2025 to Jun 2026																	
	2025												2026					
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Procure modern Processing Plant					■	■												
Receival of Factory layout and design Drawings	■	■	■															
Duty Concessions	■	■	■	■	■	■												
Approval of Drawings				■	■	■												
Mobilization of Plant							■	■	■	■								
Civil Works							■	■	■	■								
Construction and Installation of Plant							■	■	■	■	■	■	■	■	■	■	■	■
Install Utilities termination at Site (Electricity and Water)							■	■	■	■								
Quality Control and Assurance Checks							■	■	■	■	■	■	■	■	■	■		
Safety Compliance Checks							■	■	■	■	■	■	■	■	■	■		
Electrical Work							■	■	■	■	■	■	■	■	■	■	■	
Approval of Government Regulatory Permits						■	■	■		■	■	■	■	■	■			
Training of Staff																■	■	■
Testing and Commissioning																	■	■

The workplan for the farms is shown in Figure 10.

Figure 10: Gantt Chart - Farms Implementation Plan



3.3 WASTEWATER TREATMENT PLANT DESIGN CRITERIA

Two (2) treatment plants will be constructed; a sewage treatment plant and a wastewater treatment plant to treat trade effluent.

3.3.1 SEWAGE TREATMENT PLANT (STP)

TSCL will construct and operate a sewage treatment plant (STP) for the factory, which will be situated to the northwestern corner of the facility (Figure 11 & Figure 12). The STP will be a prefabricated plant, with an average flow of 15,000 L/d (15 KLD) and a peak flow of 40,000 L/d (40 KLD). The STP will serve approximately 200 people working during crop days and with average water consumption of 65 to 70 L per person). The treatment of sewage will be performed over three stages as described below. The sizes of the components that make up the STP are shown in Table 1. The process flow diagram illustrating the treatment process is shown in Figure 13. Drawings showing the arrangement of the STP are shown in Figure 14 and Figure 15. Additional technical details for the equipment are provided in Appendix 2.

1. Pre-Treatment

- Bar Screen Chamber: Influent coming into the STP will be screened to arrest and remove large or floating materials contained in suspension. This will be done to prevent the blockage or choking of downstream equipment. This will be facilitated within the bar screen chamber. The arrested material from the bar screen will be removed and disposed of at an NSWMA-approved disposal site.

- Oil & Grease Chamber: Influent coming into the STP may contain oil and grease. The oil and grease if not removed may create the problem of scum accumulation and affect the performance of the microbes in the aeration tank. To avoid this, an oil & grease chamber is provided after the bar screen, where oil and grease will be arrested prior to entry into the STP. Accumulated oil will then be collected for disposal by a NEPA approved waste oil collector.

2. Primary Treatment

- Equalization Tank: To absorb the variation in quantity and quality of sewage and to provide uniform flow at the downstream treatment process, an equalization tank will be used. This will avoid shock loading and process upsets of the treatment plant. Air agitation will be performed within the tank to prevent the settling of suspended solids.

- Secondary Treatment

- Moving Bed Biofilm Reactor (MBBR)/Aeration Tank: Biological treatment of the sewage occurs within the MBBR Tank. This is the main section of the plant where degradation of organic pollutants with the help of aerobic micro-organisms takes place. To provide higher surface area for micro-organisms, floating media is provided, on which micro-organism growth takes place. The bio reactor is based on a hybrid concept in which both suspended growth as well as attached growth of micro-organisms are achieved. Due to the higher population of micro-organisms, the effective volume of the bioreactor is reduced drastically as compared to conventional aeration tanks.

  To maintain the aerobic condition within the MBBR, external air supply is provided by means of aeration equipment, which has high oxygen transfer efficiency.

- Tube Settler: Gravity overflow from the MBBR is collected in the tube settler tank. In this settling tank, sludge generated from the bioreactor undergoes gravity settling.

  To reduce the plan area of the setting tank, tube modules are placed in this tank to increase the settling area within the tank. Since this tank is a hopper bottom tank, no sludge scraping mechanisms are required.

- Sludge Drying Beds: Settled sludge from the tube settler will be removed by pumping to the sludge drying beds. Sludge drying beds are used for dewatering sludge. It is comprised of a layer of sand and gravel that acts as a filter and the sludge is spread as a thin layer (up to 300 mm) over the porous bed. The bed allows the liquid to drain under gravity through the permeable medium. Once the moisture content has been reduced the treated sludge will be reused for soil conditioning of the cane fields.

- Tertiary Treatment

➢ Filtration: Treated water from the secondary treatment stage, will be further treated after being passed through the pressure sand filter (PSF) followed by the activated carbon filter (ACF). Backwash from the filters will be sent back to the equalization tank.

➢ Disinfection: Filtered water will be collected in the Treated Water Storage Tank (TWST) where it will undergo disinfection by a hypochlorite solution. This will disinfect the harmful bacteria in the treated water as well as remove the refractory organics from the treated water. The effluent will then be used for gardening and flushing toilets as the quantity will be small.

Table 1: Size of Components of STP

No.	**STP Components**	**Size/Capacity (m)**	**Volume (m^3)**	**Quantity**
1.	Bar Screen Chamber	0.8 x 1.9	0.3	1
2.	O&G Chamber	0.8 x 1.3	6.24	1
3.	Equalization Tank	3.4 x 2.7	9.18	1
4.	MBBR	1.7 x 1.5	6.88	1
5.	Tube Settler	1.14 x 1.5	4.44	1
6.	Intermediate Storage Tank	0.6 x 1.5	2.25	1
7.	Pressure Sand Filter (PSF)			1
8.	Activated Carbon Filter (ACF)			1
9.	Treated Water Storage Tank	2.25	10	1
10.	Sludge Drying Beds	1.5 x 1.5	3.37	2

Sewage Effluent

The design basis for the STP is shown in Table 2. The treated effluent will be used for gardening and flushing toilets.

Table 2: Raw and Treated Sewage Characteristics

Parameters	**INLET**	**OUTLET**	**Standards for Sewage Effluent to be used for Irrigation**
pH	6.0 – 7.5	7-8	No Standard
Biochemical Oxygen Demand mg/L	250-300	< 10	15
Chemical Oxygen Demand mg/L	450-500	< 60	<100
Total Suspended Solids mg/L	150-200	< 5	1.5
Oil & Grease mg/L	≤30	< 5	10
Residual Chlorine mg/L	1.0	0.5	0.5
Faecal Coliform MPN/100mL	20	<10	12

Sludge Management

The STP will produce a minute amount of sludge, which will be mixed in with the sludge produced at the ETP and applied to sugarcane fields, as a soil conditioner. The sludge will meet the National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be applied to Agricultural Land (Table 3).

Table 3: National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be applied to Agricultural Land

Pollutant	**Maximum Concentration mg/kg (dry weight basis)**	**Design Value mg/kg (dry weight basis)**
Arsenic	65	50
Cadmium	75	70
Copper	230	200
Lead	90	85
Mercury	0.045	0.04
Molybdenum	9	0.8
Nickel	180	175
Selenium	14	10

Pollutant	Maximum Concentration mg/kg (dry weight basis)	Design Value mg/kg (dry weight basis)
Zinc	400	350
Chromium	830	800
Pathogens	<1000 MPN/g of total solids (oven dried mass) where Viable Helminth Ova <1 per 4g of Total Solids (Dry Weight); Salmonella <3 MPN/4g; Faecal Coliform <1000 MPN/g	<1000

Figure 11: Location of Proposed STP in Relation to Rest of Facility

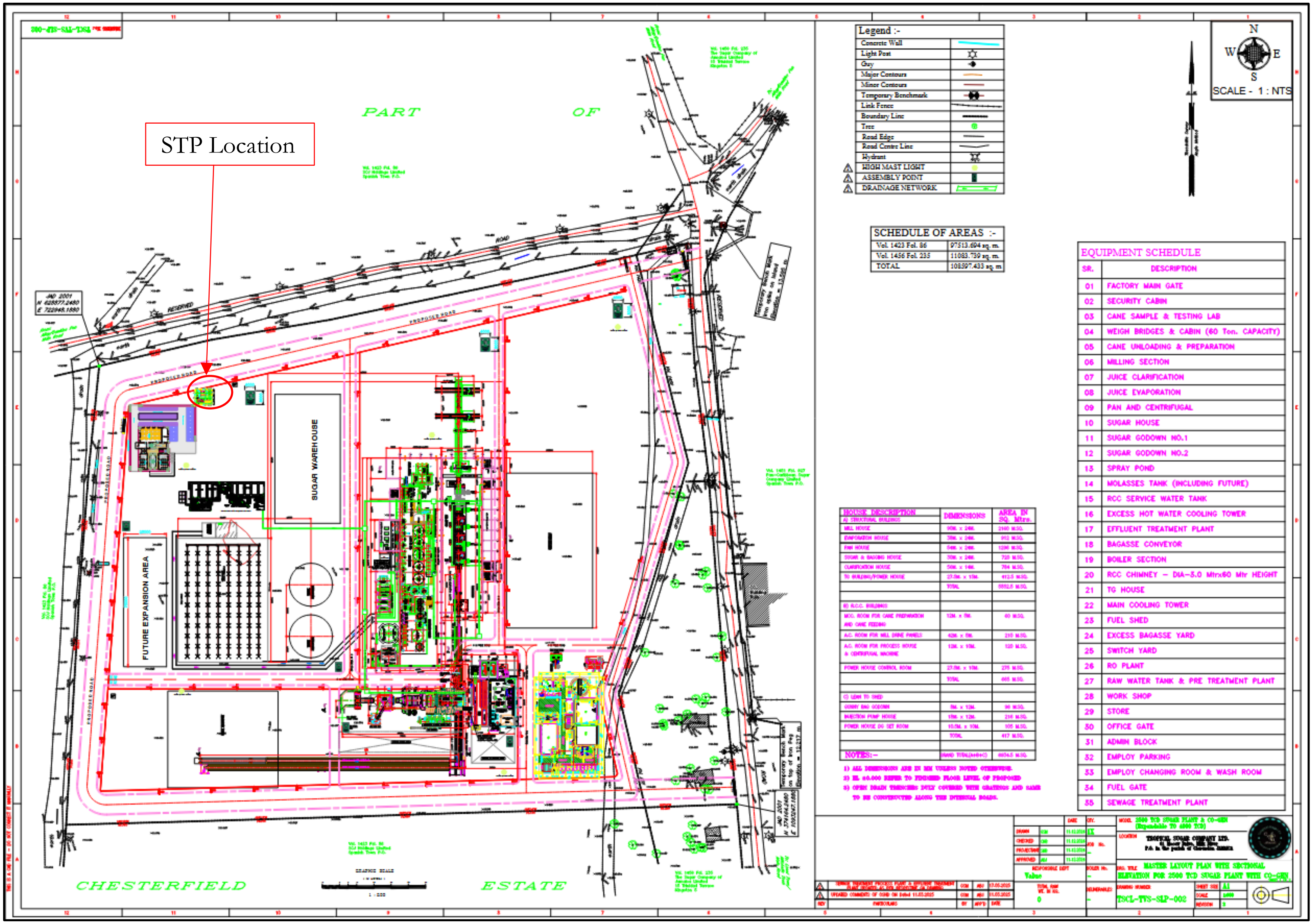


Figure 12: Magnified View of STP

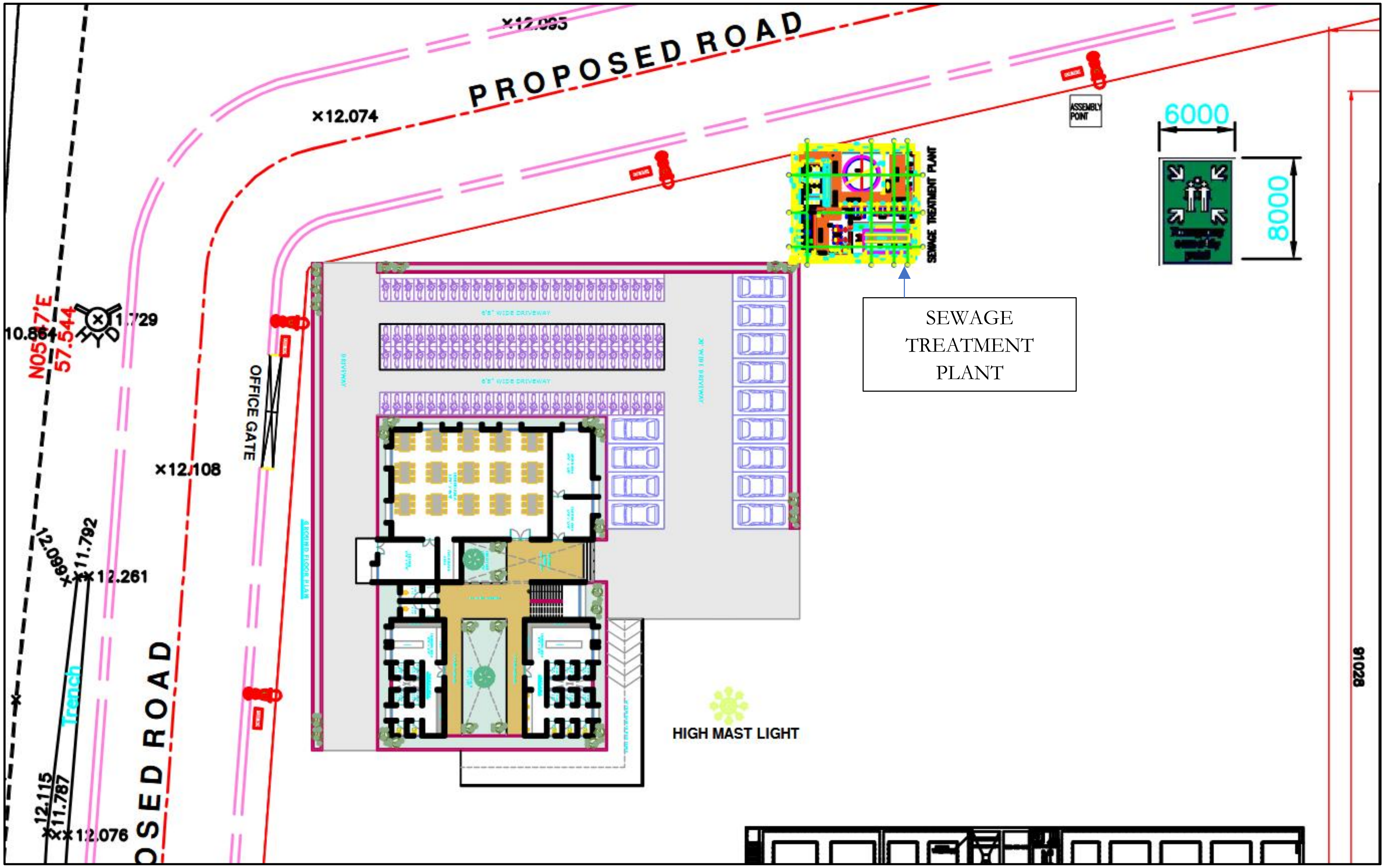


Figure 13: Sewage Treatment Process Flow Diagram

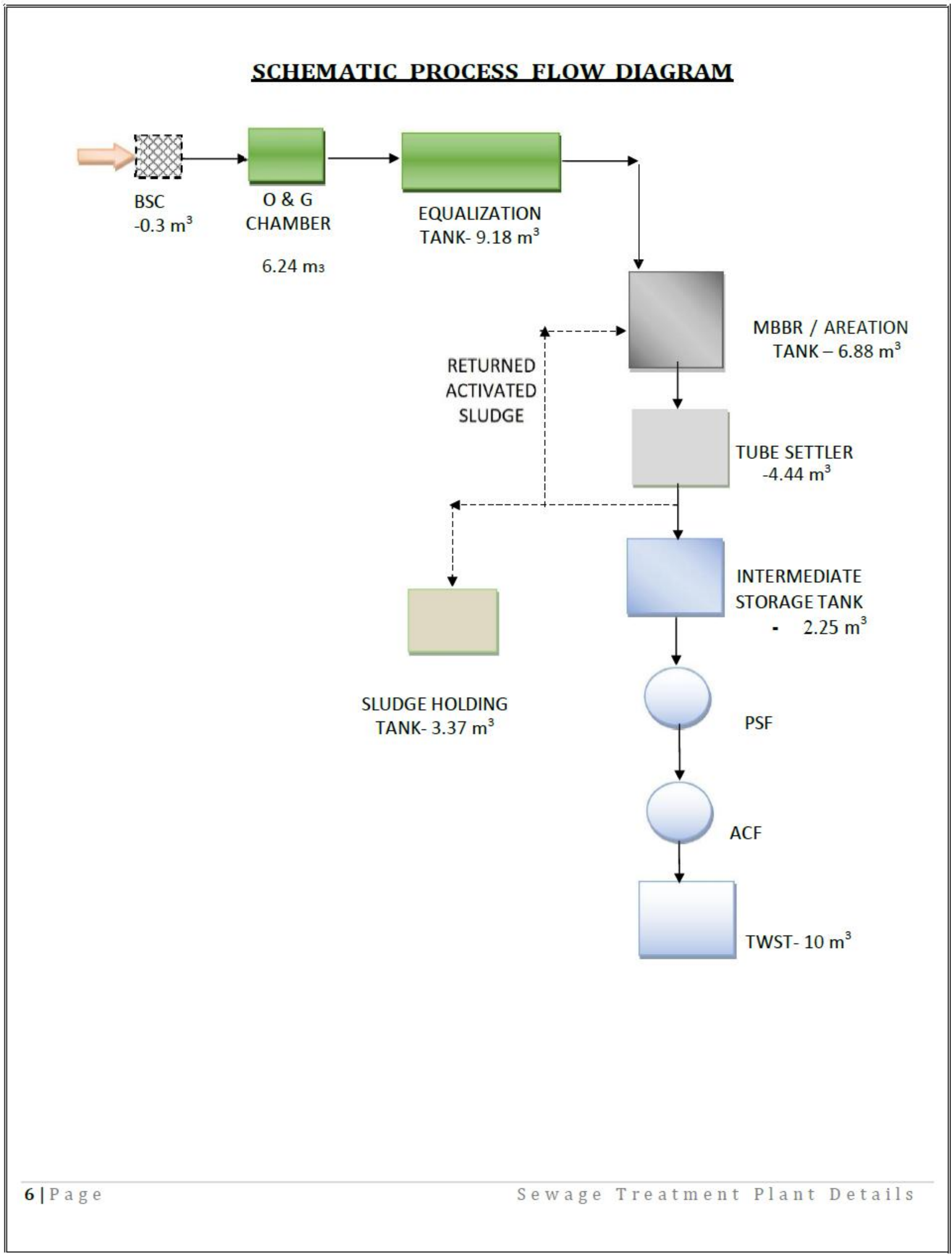


Figure 14: General Arrangement of STP

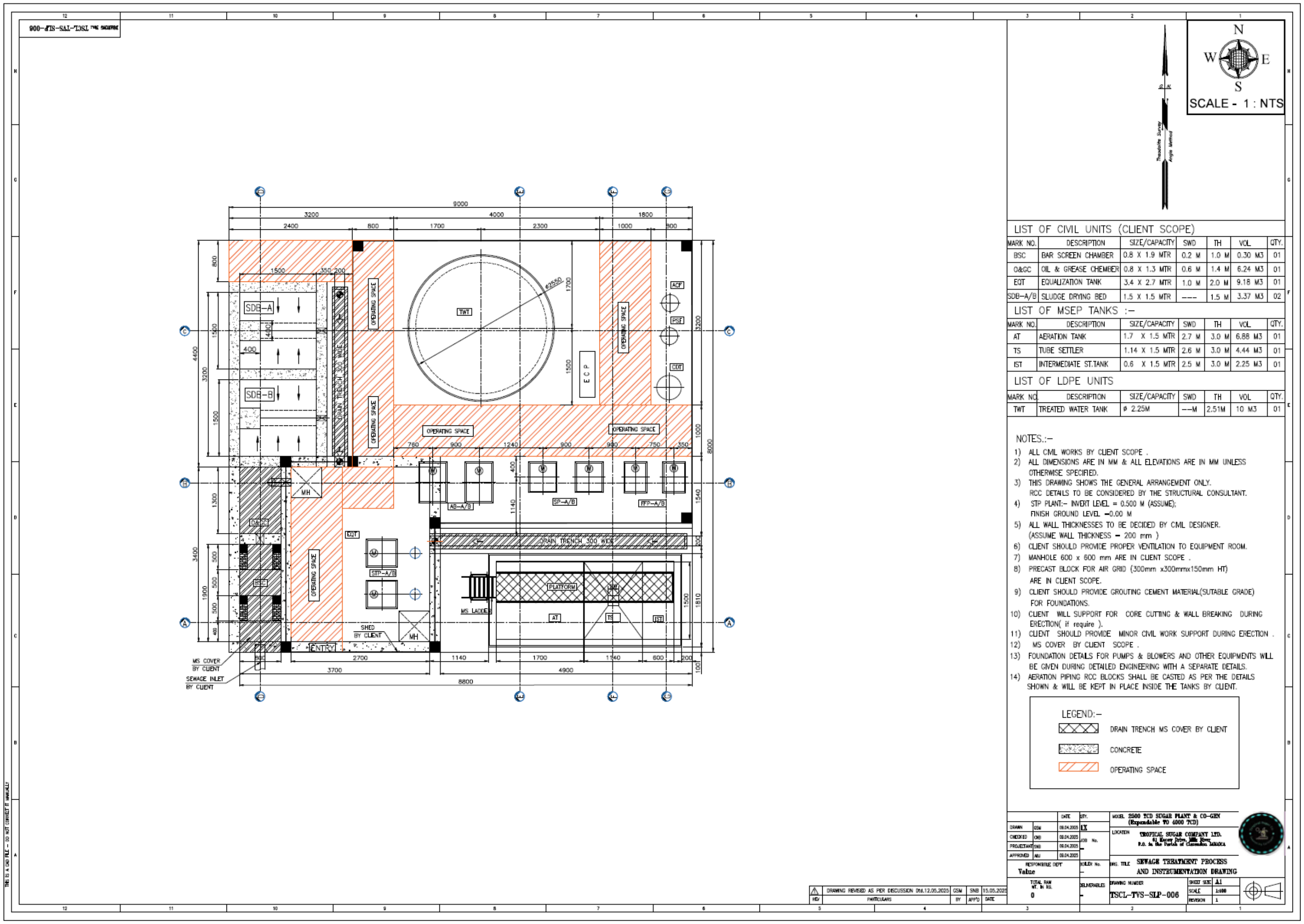
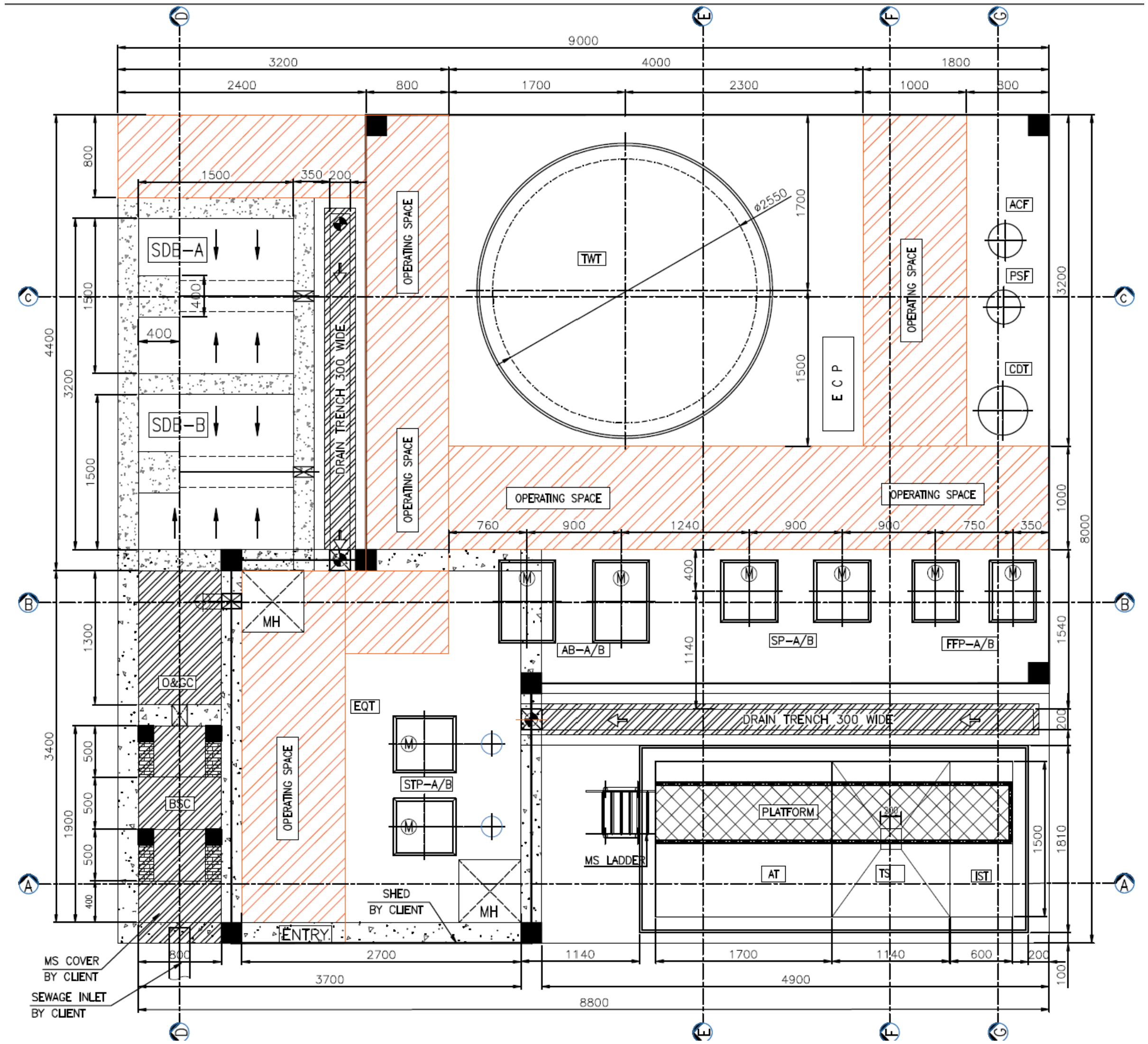


Figure 15: General Arrangement of STP - Magnified



3.3.2 EFFLUENT TREATMENT PLANT – OVERVIEW

The effluent generated by the operation of the proposed sugar factory will be collected and treated in an effluent treatment plant (ETP). The ETP will be sized to handle the processing of 42,500 TCD. The ETP has been designed with a capacity of 600,000 L/d (600 KLD). The average flow will be 500,000 L/d (500 KLD) and a peak flow of 550,000 L/d (550 KLD). The influent flows for the various contributing sources are as follows (Sugar Processing Facility – 300 m^3/d; Spray Pond and DM Plant 500 m^3/d). The treated effluent after recycling will then be reused for the irrigation of sugarcane lands, with a maximum discharge rate of approximately 200 m^3/day and average flow rate of 100 m^3/day. The sugarcane lands leased from the SCHJ, that are available for the irrigation of sugarcane are shaded in blue on the map (Figure 105), with their land sizes listed in Table 25.

The location of the proposed ETP is shown at Figure 16.

Figure 16: Location of Proposed ETP in Relation to Rest of Facility

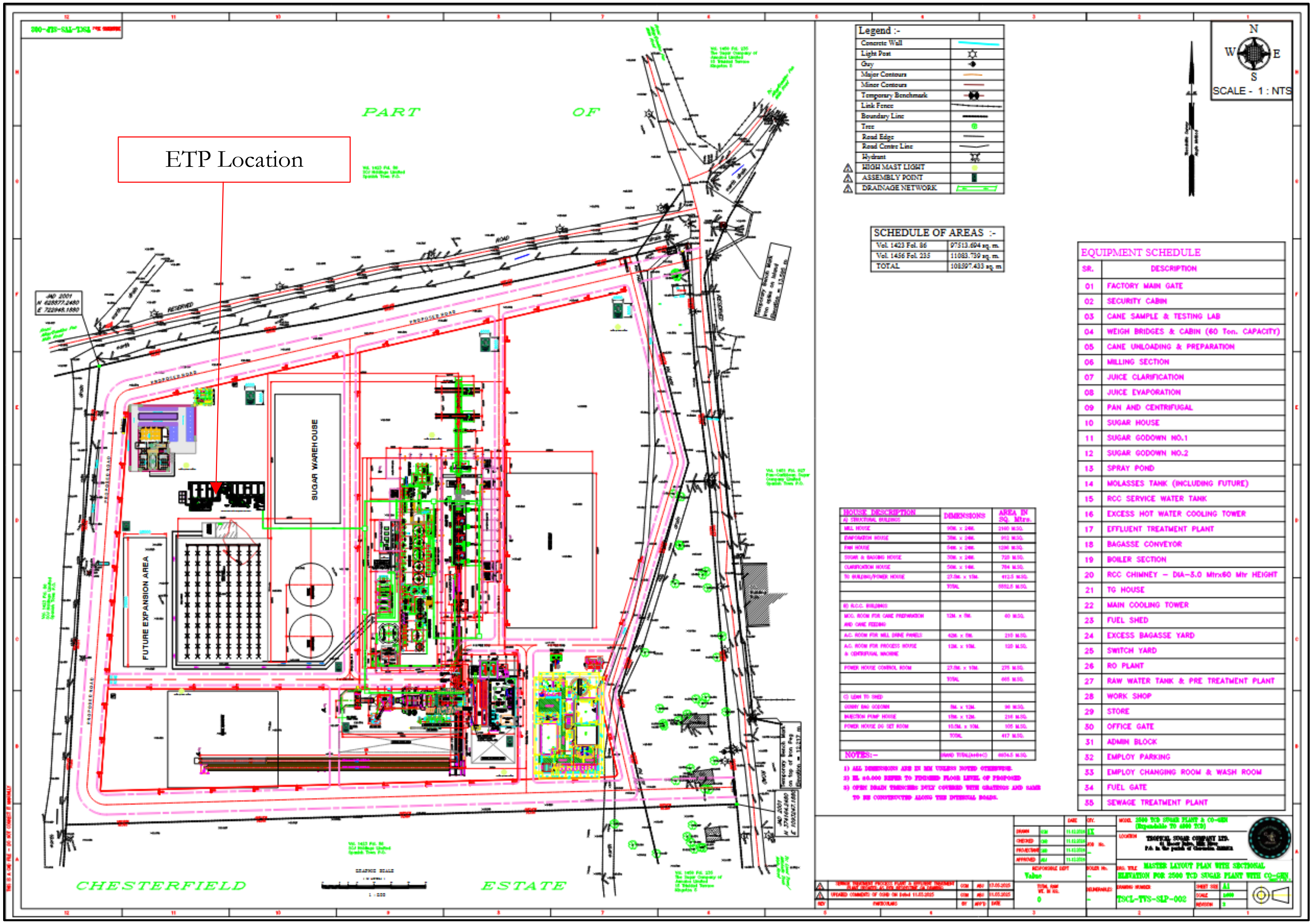
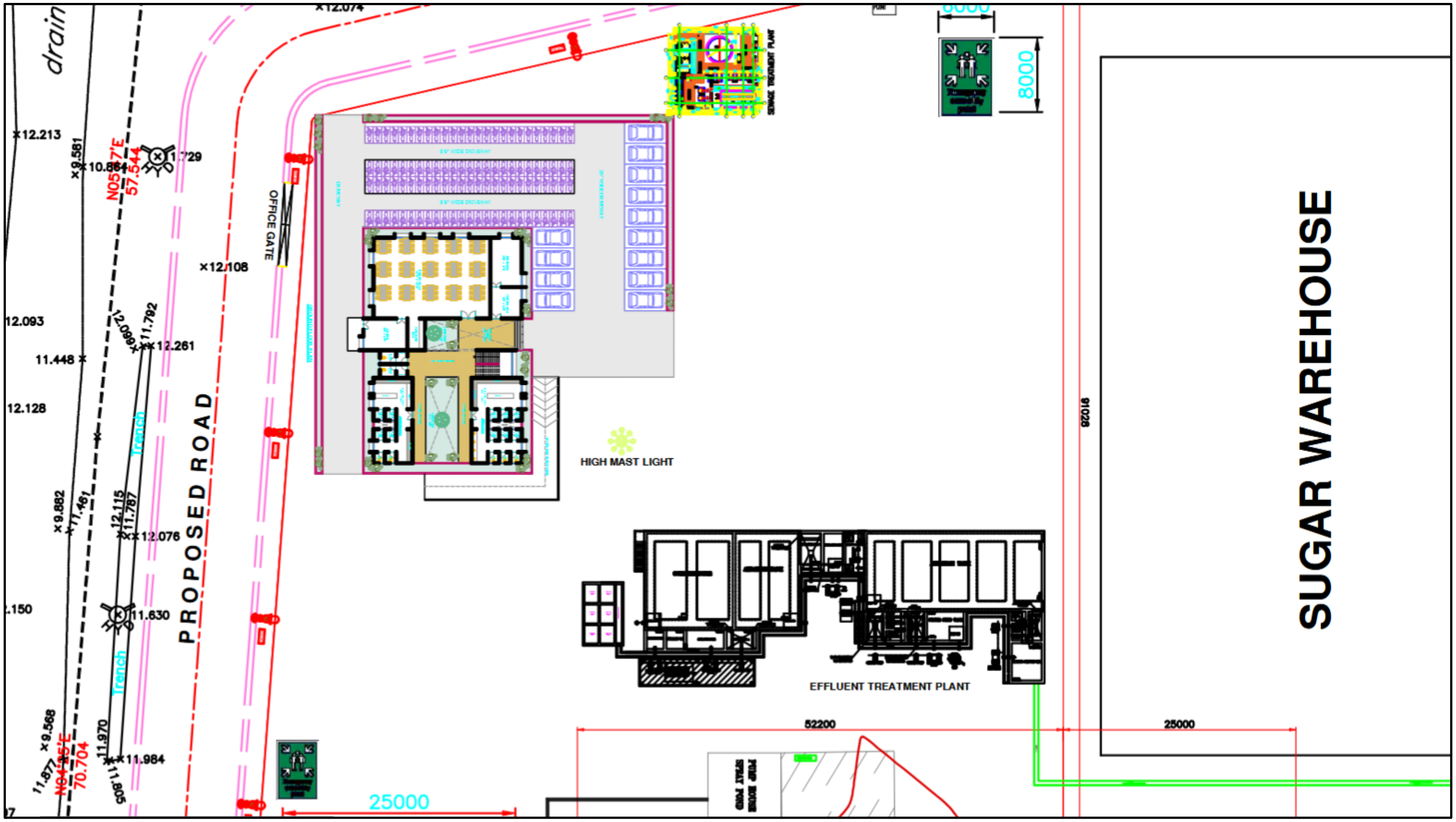


Figure 17: Magnified View of ETP



3.4 EFFLUENT TREATMENT PLANT – DESIGN PARAMETERS

The design assumptions for the ETP are as follows:

A. The plant is designed to operate at ± 10% variation in raw effluent parameters.
B. No other parameters other than those mentioned Table 5 are present in the influent wastewater which is beyond pollution control norms and hazardous to microorganisms.
C. Treated effluent quality will be achieved if the influent wastewater quality is as per the raw water quality mentioned as well as no other pollutant than those mentioned are present or exceed the limit or are hazardous in nature, which otherwise may affect the biological treatment process.
D. The temperature required at the ETP collection tank from the effluent should not be more than 35° Celsius.

Table 4 - Table 6 below contains the design basis and expected influent and effluent design parameters of the ETP. Table 7 below contains the target sludge limits for the application of treated sludge to agricultural lands as a soil conditioner. Note the expected sludge quantity generated per annum is approximately 1,800 kg.

Table 4: ETP Design Basis

Raw Water Source	Sugar Factory Effluent (including reject from DM Plant and spray pond overflow)
Working Hours	24
Plant Capacity	600 KLD (600,000 Liters per Day)

Table 5: Inlet Parameters - Combined

No.	Parameters	Units	Value
	Flow	m^3/d	500
1	pH	-	5.0-7.5
2	Total Dissolved Solids	mg/L	1,200-1,500
3	Total Suspended Solids	mg/L	400-500
4	Chemical Oxygen Demand	mg/L	3,500-4,000
5	Biological Oxygen Demand	mg/L	1,500-2,000
6	Oil & Grease	mg/L	10-30

Table 6: Outlet Parameters - Combined

No.	Parameters	Units	Design Value	NRCA Standards for Sewage Effluent to be used for Irrigation	NRCA Trade Effluent Standards
	Flow	**m^3/d**	**500**	**-**	**-**
1	pH	-	6.5-8.5	-	6.5-8.5
2	Total Dissolved Solids	mg/L	<2,100	-	1000
3	Total Suspended Solids	mg/L	<30	1.5	50[1]/<150[2]
4	Chemical Oxygen Demand	mg/L	<250	<100	<100
5	Biological Oxygen Demand	mg/L	<30	15	<30
6	Oil & Grease	mg/L	<10	10	10
7	Residual Chlorine	mg/L	0.4	0.5	-
8	Faecal Coliform	MPN/100 ml	10	12	<100
9	Sodium	mg/L	100	-	100
10	Chloride	mg/L	250	-	300

Table 7: National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be applied to Agricultural Land

Pollutant	Maximum Concentration mg/kg (dry weight basis)	Design Value mg/kg (dry weight basis)
Arsenic	65	50
Cadmium	75	70
Copper	230	200
Lead	90	85
Mercury	0.045	0.04
Molybdenum	9	0.8
Nickel	180	175
Selenium	14	10

[1] TSS maximum monthly average
[2] TSS maximum daily average

Pollutant	Maximum Concentration mg/kg (dry weight basis)	Design Value mg/kg (dry weight basis)
Zinc	400	350
Chromium	830	800
Pathogens	<1000 MPN/g of total solids (oven dried mass) where Viable Helminth Ova <1 per 4g of Total Solids (Dry Weight); Salmonella <3 MPN/4g; Faecal Coliform <1000 MPN/g	<1000

3.5 EFFLUENT TREATMENT PLANT – PROCESS DESCRIPTION & FLOW CHART

To have eco-friendly and natural treatment, the ETP is designed based on the biological treatment concept. This refers to the process by which microbes are utilized to remove or degrade the organic matter present in the effluent to a set standard to achieve the desired discharge, in this case for the irrigation of sugarcane fields. The description of the treatment process is outlined below, and reference should be made to Figure 19, which shows the ETP process flow diagram. The layout of the ETP is shown in Figure 20. Additional technical details for the ETP equipment are provided in Appendix 3**.**

A. Pre-Treatment

- **V Notch Chamber:** The V-notch chamber uses a V-notch weir to measure the flow rate of the incoming effluent. This device is installed in an open channel, and as the flow passes over the V-notch, the rise in water level is measured, which is directly related to the flow rate. This information is then used for monitoring and control purposes within the WWTP.

- ***Bar Screen Chamber:*** Screening of the influent to the ETP will occur within the bar screen chamber. Within the chamber large or floating materials gets arrested on a bar screen, thereby preventing the blockage or chocking of the downstream plant equipment. The arrested material will be removed manually where it will be disposed of suitable at an NSWMA approved disposal site.

- ***Oil & Grease Chamber:*** The effluent being released from the sugar factory may contain oil and grease. The oil and grease if not removed may create the problem of scum accumulation and affect the performance of the microbes in the aeration tank. To avoid this, an oil & grease chamber is provided after the bar screen, where oil and grease will be arrested prior to entry into the plant. Accumulated oil will then be collected for disposal by a NEPA approved waste oil collector.

B. Primary Treatment

- ***Equalization Tank:*** The equalization tank will absorb the variation in quantity and quality of effluent and provide uniform flow at the downstream treatment process. Its installation will avoid shock loading and process upsets at the ETP.

- ***Neutralization Tank:*** Neutralization of the incoming influent will be conducted within the neutralization tank, by using lime slurry (10%) or soda ash. The lime slurry will be prepared within the lime preparation tank.

C. Secondary Treatment

- ***Up-Flow Anaerobic Sludge Blanket Reactor (UASBR):*** Wastewater is pumped into each UASBR reactor through a specially designed distribution pipe. The multiple distributions ensure uniform distribution of flow throughout the sludge blanket making maximum rises to the top of the anaerobic reactor along with bio-gas generated and also some sludge particles. A unique three-phase (gas/solid/liquid) separator is provided at the top to separate out the gas, liquid and the sludge particles.

  The wastewater flows upward through a sludge blanket composed of biologically formed granules or particles. Treatment occurs as the wastewater comes in contact with the granules. The gases produced under anaerobic conditions (principally methane and carbon dioxide) cause internal circulation, which helps in the formation and maintenance of the biological granules. Some of the gas produced within the sludge blanket becomes attached to the biological granules. The free gas and the particles with the attached gas rise to the top of the reactor. The particles that rise to the surface, strike the bottom of the degassing baffles, which causes the attached gas bubbles to release. The degassed granules typically drop back to the surface of the sludge blanket. The free gas and the gas released from the granules are captured in the gas collection domes located in the top of the reactor. Liquid containing some residual solids and biological granules passes into the settling chamber, where the residual solids are separated from the liquid. The separated solids fall back through the baffle system to the top of the sludge blanket.

  Gas will be collected in the domes provided at the top. The liquid overflows through the gutters and then separated suspended solids are allowed to settle down in the sludge blanket thereby retaining valuable bacterial population.

- ***Aeration Tank (Activated Sludge Process):*** This is the main section of the plant where degradation of organic pollutants with the help of aerobic micro-organism takes place.

In the aeration tank, activation biomass is developed in such a way that certain mixed liquor suspended solids (MLSS) is maintained for continuous effluent flow which goes to the aeration basin. The effluent is degraded in the given retention time and the activated sludge is returned to the clarifier and recycled as per requirement. The sludge, which is not required after recirculation, is passed to sludge drying bed.

To maintain the aerobic condition in the bioreactor, the air supply arrangement is provided by means of aeration equipment which has high oxygen transfer efficiency.

- ***Secondary Clarifier:*** In the secondary clarifier, effluent passed from aeration tank along with biomass (MLSS) gets settled here. The settled biomass is recycled back to the aeration tank as per requirement and the excess is transferred to the sludge drying bed. The effluent from the secondary clarifier then flows into the Intermediate Storage Tank.

- ***Sludge Drying Beds:*** Settled sludge from the clarifier will be removed by pumping to the sludge drying beds. Sludge drying beds are used for dewatering sludge. It is comprised of a layer of sand and gravel that acts as a filter and the sludge is spread as a thin layer (up to 300mm) over the porous bed. The bed allows the liquid to drain under gravity through the permeable medium. Once the moisture content has been reduced the treated sludge will be reused for soil conditioning of the cane fields.

D. Tertiary Treatment

- Chlorine Dosing: Chlorine dosing will occur within the Intermediate Storage Tank, by way of a dosing system. The dosing system will add a hypochlorite solution to disinfect the harmful bacteria in the treated effluent as well as to remove refractory organics.

- ***Pressure Sand Filter (PSF):*** Secondary treated effluent from the Intermediate Storage Tank will be first passed through a Pressure Sand Filter (PSF) to reduce the suspended solids present in the effluent. Backwash water from the filters will be returned to the equalization tank.

- ***Activated Carbon Filter (ACF):*** The effluent from the PSF will then be passed through an Activated Carbon Filter (ACF), to allow for the de-chlorination of filtered water, where the excess chlorine will be removed along with the undesired colour and odour. Backwash water from the filters will be returned to the equalization tank.

- ***Treated Water Storage Tank (TWST):*** The effluent will then flow to the Treated Water Storage Tank (TWST). The treated water in the TWST will be used for the irrigation of sugar cane fields.

Figure 18: Size of Components for ETP

No.	STP Components	Size/Capacity (m)	Volume (m^3)	Quantity
1	V-Notch Chamber	1.4 x 1.5	0.84	1
2	Bar Screen Chamber	8.1 x 1.5	4.8	1
3	Oil & Grease Chamber	9.7 x 1.5	20.3	1
4	Equalization Tank	Area: 160 m^2	400	1
5	Lime Preparation Tank	1.5 x 1.5	3.30	1
6	Neutralization Tank	3 x 3	20.7	1
7	UASBR Tank	13.x 12	712	1
8	Aeration Tank	14 x 12	705	1
9	Secondary Clarifier	Dia: 8.5	174	1
10	Intermediate Storage Tank	3.5 x 6	52.5	1
11	Treated Water Tank	7 x 6	105	1
12	Sludge Drying Bed	4 x 4	24	5

Figure 19: Process Flow Diagram for the Proposed ETP

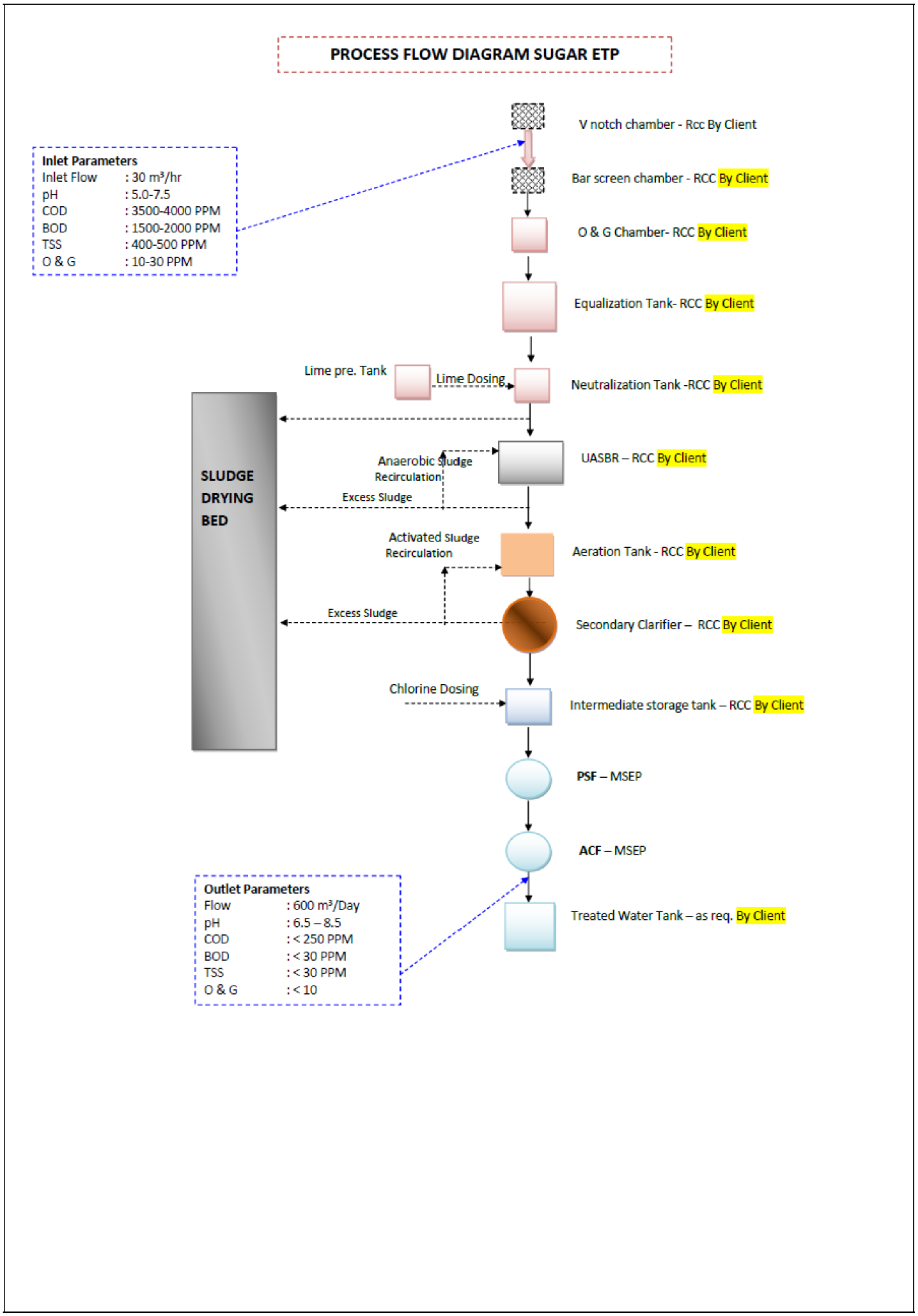


Figure 20: General Layout of ETP

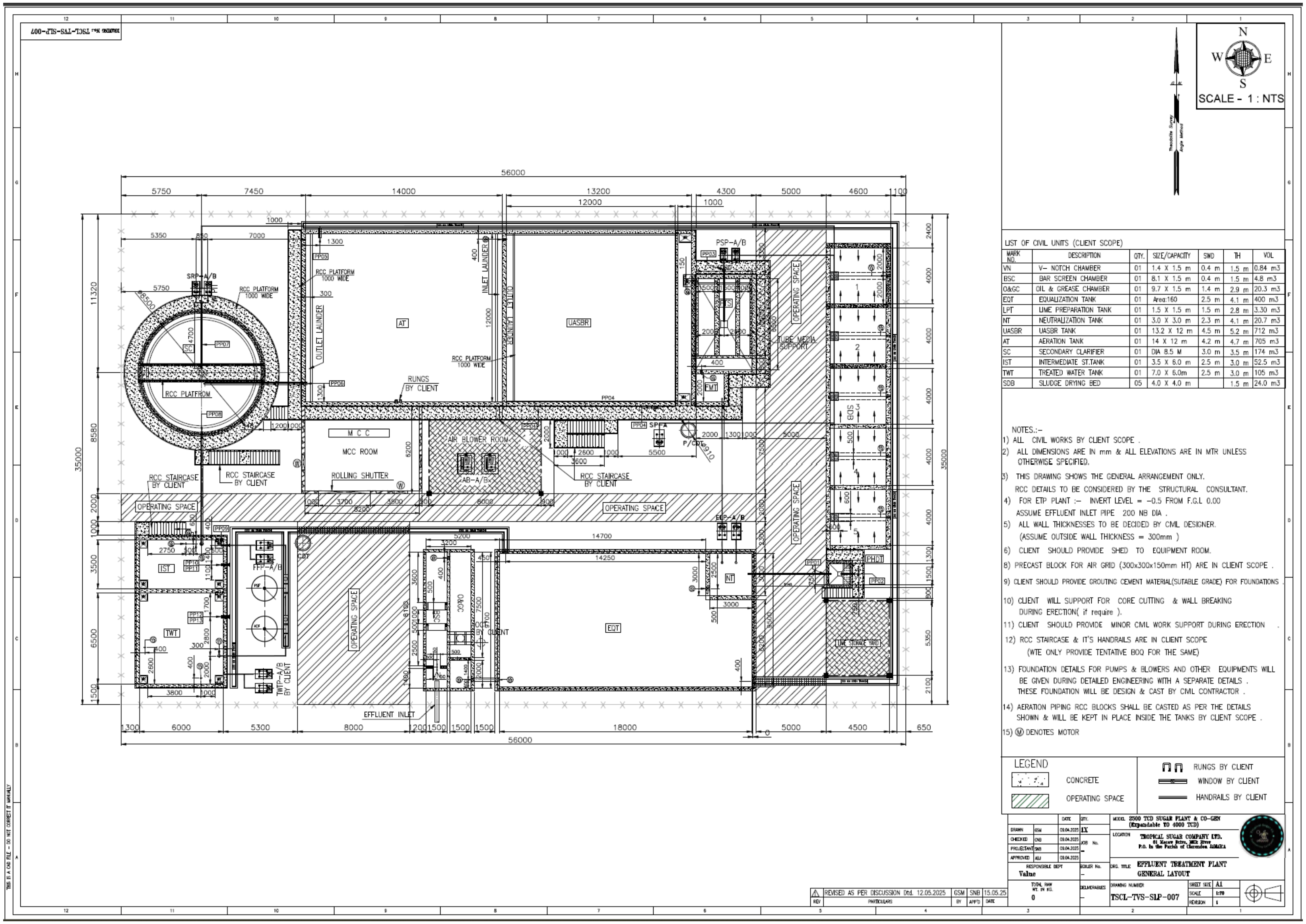
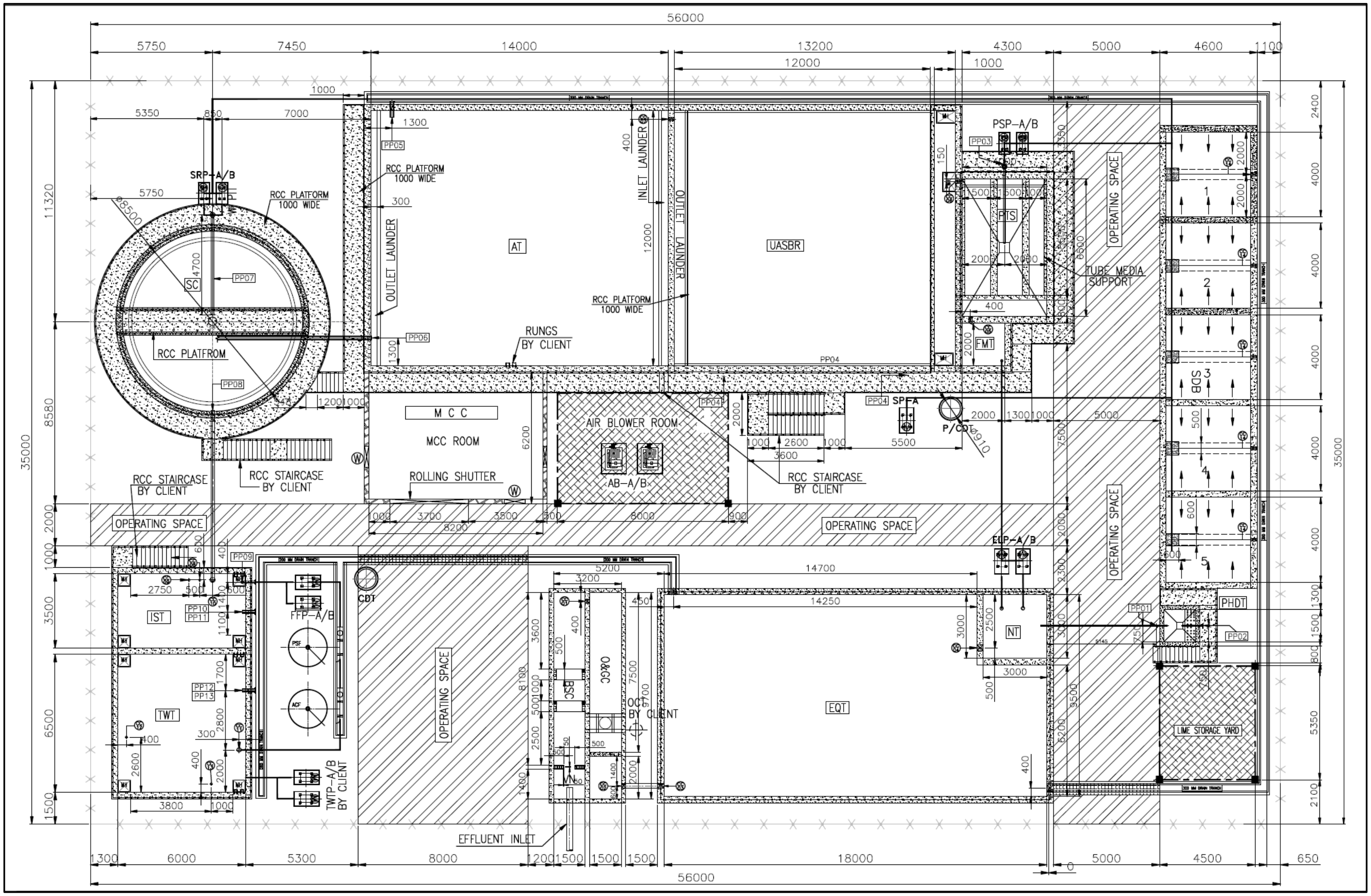


Figure 21: General Layout of ETP - Magnified



4 POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK

This section on the regulatory framework highlights the policies, legislation and standards that are applicable to the proposed project.

4.1 APPLICABLE POLICIES

The national policies applicable to this project are the National Energy Policy and the National Renewable Energy Policy. The National Energy Policy was approved by Cabinet in October 2009. The National Renewable Energy Policy is still awaiting Cabinet approval. Additionally, the project aligns with the Vision 2030 Jamaica – National Development Plan, which sets out long-term goals for sustainable development.

4.1.1 VISION 2030 JAMAICA

Vision 2030 Jamaica is the nation's first long-term strategic development framework, designed to guide the country towards achieving sustained economic growth and improved quality of life by the year 2030. Central to the plan are national goals and outcomes that support sustainable development through the integration of economic, social, environmental, and governance priorities. The proposed development of TSCL's sugar factory aligns closely with several key objectives of Vision 2030, particularly:

- **National Outcome 10 – Energy Security and Efficiency**

  This outcome focuses on reducing Jamaica's dependence on imported petroleum by diversifying the national energy mix and promoting the use of indigenous and renewable energy sources such as wind, solar, hydro, and biomass. Energy efficiency and conservation across sectors, along with the development of modern and secure energy infrastructure, are key priorities under this outcome.

- **National Outcome 12 – Internationally Competitive Industry Structures**

  This outcome supports the growth of efficient and competitive industries by modernizing traditional sectors like agriculture, manufacturing, and energy. It emphasizes the integration of value-added production, innovation, and the adoption of modern technologies to boost productivity and export potential. Key focus areas include strengthening rural development through agri-business and agro-processing and creating an enabling environment for sustainable industrial growth.

This project aligns with the vision outcomes, as the facility proposes to use bagasse - a renewable by-product of sugar cane processing - for electricity generation. The overall operations also add value to agricultural output, promotes industrial modernization, and supports rural economic activity through agro-processing, in keeping with the objectives of Outcome 12.

4.1.2 RESETTLEMENT POLICY (2021)

The Ministry of Economic Growth & Job Creation (MEGJC) authored a guideline policy, 'Guidelines for Dealing with Informal Settlers', dated November 27, 2021, which provides policy guidelines on the relocation of informal settlers, which is summarized below.

Relocation (voluntary or involuntary), where feasible, should be used as an alternative means of addressing the squatting issue as opposed to eviction. The Government is expected to provide land and housing for relocation as these are central to the process.

Consideration ought to be given to temporary accommodation until permanent accommodation can be arranged. It is important that dialogue be held with persons who will be affected so that they may become adequately aware of the terms of the relocation and have the opportunity to be a part of the relocation exercise. A clear assessment of the current situation including the number of persons to be relocated and the number of lots needed, must be clearly identified. The agent undertaking the removal exercise may, if they can afford to do so, offer assistance to affected persons to help with the relocation.

Sites for relocation must be selected in accordance with Government site selection criteria. All relocation must include the involvement and/or approval of local planning authorities as well as the other approval agencies (such as NEPA, Office of Disaster Preparedness and Emergency Management and National Water Commission). Consultation with the agencies that have responsibility for the development of infrastructure, especially roads, water and sewage and electricity, is required.

The SCHJ is to relocate/resettle, the squatters that have taken possession of the derelict and condemned buildings located along the main entrance road to Monymusk which is also along the eastern boundary of the proposed sugar factory site.

4.1.3 NATIONAL SQUATTER MANAGEMENT POLICY (2023)

The National Squatter Management Policy was developed by the Ministry of Economic Growth and Job Creation (MEGJC). Its purpose is to establish a national framework to prevent, regulate, manage and curtail the incidence of squatting in Jamaica. The policy contains measures to address all forms of squatting in Jamaica (residential squatting, commercial squatting, agricultural squatting and industrial and other types of squatting), wherever it occurs – on government or privately owned lands, on beaches or on cays.

The SCHJ is to relocate/resettle, the squatters that have taken possession of the derelict and condemned buildings located along the main entrance road to Monymusk which is also along the eastern boundary of the proposed sugar factory site.

4.1.4 AGRICULTURAL POLICIES

4.1.4.1 THE JAMAICA COUNTRY STRATEGY FOR THE ADAPTATION OF THE SUGAR INDUSTRY (2006-2020)

The Jamaica Country Strategy for the Adaptation of the Sugar Industry (2006-2020), approved in 2008, aimed to maintain a sustainable private sector-led sugar cane industry and enhance economic diversification, social resilience, and environmental sustainability in sugar-dependent areas. The focus was on diversifying beyond processed raw sugar into biofuel, rum, and other cane-derived products.

In 2007, the Sugar Transformation Unit (STU) was created to implement this strategy, funded by the European Union (EU). From 2008 to 2018, the STU managed the EU-funded Sugar Transformation Programme, with capital expenditures of over 6 billion JMD (approx. US$ 45 million). The Cane Expansion Fund (CEF) started in 2008 to provide loans and grants to boost productivity and competitiveness. Between 2008 and 2015, it disbursed about 2 billion JMD in concessionary loans and grants to cane farmers, continuing until 2019 despite concerns about inefficiencies.

Exporting raw sugar requires SIA licenses, while refined sugar imports for retail are heavily taxed and handled by the SIA. Local prices of refined sugar are set based on historical prices, whereas manufacturers can import duty-free refined sugar for their products.

From 2015-2019, the sugar subsector received substantial public support through budgetary and price transfers. Despite high support and arguments based on social welfare—affecting around 200,000 people—the policy has become costly and failed to stop the industry's decline.

4.1.4.2 OTHER AGRICULTURAL POLICIES

In 2006 the Ministry of Agriculture commenced work on the preparation of a comprehensive Agricultural policy with technical assistance from the Food and Agricultural Organisation (FAO). The objective of the policy is to achieve a comprehensive framework for rural and agricultural development, to promote investment, job creation and rural prosperity. To date this policy has not been finalised. However, there are several policies being pursued by the Ministry and the ones applicable to this agro industrial development are outlined below.

Policies approved by Parliament include:

1. National Food Safety Policy, January 2013 - This policy aims to implement programmes that promote high standards of food hygiene and maintain systems of surveillance and control to ensure compliance with those standards.

2. National Plant Health Policy, 2011 - This policy aims to establish a coordinated, sustainable and international compliant plant health system that enhances Jamaica's plant health status, thus fostering consumer, plant and environmental health and food security.

3. National Food and Nutrition Security Policy - The food and nutrition security policy will: (i) Define the food and nutritional goals that are to be met so that the country's agriculture and food systems can deliver adequate and nutritionally appropriate quantities of food, especially to low-income and vulnerable groups; (ii) Make prescriptions for a structured food import replacement program and a re-orientation of food imports and the food distribution system, to increase the availability of good quality-nutritious foods in Jamaica.

Policy still in the developmental stage and undergoing public consultations include:

4. Agricultural Land Utilisation Policy - This policy has been developed in response to the national imperative to guide proper administration and management of land for sustainable use that will foster agricultural growth, encourage opportunities for investment and income generation, satisfy the demand for lands for agricultural production, re-generate livelihoods for farming communities, and promote overall economic development of the country. The Policy was approved by way of Cabinet Decision No. 25/11 dated 13 June 2011 pending adjustments that are now being addressed.

4.1.5 THE NATIONAL ENERGY POLICY (2009-2030)

Jamaica has an Energy Policy because of the country's:

- Heavy oil dependence
- High demand for foreign exchange
- Underdeveloped indigenous energy sources
- Inefficient use of energy
- Increasing pollution contributing to climate change

The policy seeks to, among other things:

- Manage the energy supply,
- Diversify the energy base,
- Encourage conservation and efficiency in energy production and use,
- Make electricity available and affordable to customers
- Establish the regulatory framework to protect consumers and investors and minimise environmental effects and pollution.

The National Energy Policy 2009-2030 contains seven (7) goals two of which relate specifically to the use of renewable energy as follows:

Goal 3: Jamaica realizes its energy resource potential through the development of renewable energy sources and enhances its international competitiveness, energy security whilst reducing its carbon footprint

Under this goal, opportunities for further development of indigenous renewable energy resources such as solar, hydro, wind and biofuels will be explored with the goal of increasing the percentage of renewable sources in the energy supply mix. This will reduce the country's dependence on imported oil. Increased use of renewable sources will also result in lowering the level of air pollution, a smaller carbon footprint for Jamaica and better enable compliance with international conventions on climate change.

The projected targets for increasing the percentage of renewable sources in the energy supply mix were originally set as follows:

- 11% by 2012,
- 12.5% by 2015 and
- 20% by 2030

The Ministry of Science, Technology, Energy & Mining reviewed and adjusted the target for increasing the percentage of renewable sources in the energy supply mix from 20% in 2030 to 30% in 2030. In October 2018, the Prime Minister announced a further revision to the 2030 target of 50% renewables. Renewable energy sources now account for 17% of Jamaica's energy consumption.

Another goal of the National Energy Policy relevant to the proposed project is Goal 4, which is outlined below.

Goal 4: Jamaica's energy supply is secure and sufficient to support long-term economic and social development and environmental sustainability".

Under this goal, Jamaica will seek to reduce the percentage of petroleum in the country's energy supply mix from the current 95% in order to protect the country from disruptions in oil supply and price volatility. The National Renewable Energy Policy will effectively contribute to fuel diversification to achieve this goal.

This policy is applicable to this project since it proposes to generate electricity primarily from an alternate, renewable source, in this case bagasse.

The accumulation of large volumes of bagasse which is a by-product generated during the crushing of sugar cane at the sugar factory (2500 TCD), will be taken advantage of, by using this material as a renewable source of fuel for the operation of boilers to generate steam, which will drive turbines to produce 12.5 MW of electricity.

TSCL intends to enter into a Power Purchase Agreement with the JPSCo., in accordance with the Office of Utilities Regulation (OUR), Regulatory Policy for the Addition of New Generating Capacity to the Public Electricity Supply System (Figure 22), which will facilitate the sale of excess electricity generated (approximately 5MW).

Figure 22: Procedure for Generation Capacity Additions

Schedule 1 - Procedure for Generation Capacity Additions

PLANT/ENERGY TYPE	GENERATION SIZE/ CAPACITY	CAPACITY AUTHORIZATION	PROCEDURE	LICENCE TYPE	CONTRACT TYPE	INTERCON-NECTION AGREEMENT	PREMIUM APPLICATION	POWER PURCHASE TARIFF
Conventional Technology	Greater than 15 MW	LCEP	Competitive	Schedule 10	PPA	Yes	No	Avoided cost
	Less than 15 MW	LCEP	Competitive/ Non-competitive	Schedule 10	PPA	Yes	No	Avoided cost
Co-Generation	All sizes	N/A	Unsolicited/ Non-competitive	Schedule 10	PPA	Yes	Only if renewable energy source	Avoided cost discounted for shared benefits
Renewable Energy	Greater than 15 MW	Annual cap in LCEP	Competitive packages	Schedule 10	PPA	Yes	Yes	Avoided cost plus premium
	Less than 15 MW/Greater than 100 KW	Annual cap in LCEP	Competitive Packages/Non-competitive	Schedule 10	PPA	Yes	Yes	Avoided cost plus premium
	Less than 100 KW	N/A	Unsolicited/ Non-competitive	Schedule 11	Standard Offer	Standard Terms & Conditions	Yes	Avoided cost plus premium (Based on net billing)
Excess (Dump) Energy	All sizes	N/A	Unsolicited/ Non-competitive	Schedule 10	PPA	Yes	Only if renewable energy source	Avoided cost

<u>Notes</u>

1. All new generation supply are subject to grant of Licence from the Minister having responsibility for electricity matters
2. LCEP – Least Cost Expansion Plan
3. PPA – Power Purchase Agreement (If JPS is the owner of the facilities, a "virtual" PPA will be executed with the OUR)
4. Competitive – Public tendering for generation capacity addition
5. Non-competitive – Sole source or direct negotiations for power purchase
6. Unsolicited – May be submitted for consideration at any time
7. Renewable Energy – Energy source which is continually regenerated
8. Co-generation – Generator process heat used for dual purpose
9. Excess (Dump) Energy – Energy exported in excess of power producers' need

Regulatory Policy for the Addition of Generating Capacity 29
Ele 2005/08.1

Source: OUR, Regulatory Policy for the Addition of New Generating Capacity to the Public Electricity Supply System , June 2006

4.1.6 THE NATIONAL RENEWABLE ENERGY POLICY (2009-2030)

The policy seeks to provide affordable and accessible energy supplies with long-term energy security. The primary focus is the deployment of wind, the emerging potential and deployment of biomass and biofuels, the development of energy-from-waste initiatives, exploratory work on ocean energy and the deployment of other technologies such as solar and hydro-technologies.

There are five (5) goals of the National Renewable Energy Policy, and these are as follows:

Goal 1: Support the economic, infrastructural and planning conditions conducive to the sustainable development of all of Jamaica's renewable energy resources

Goal 2: Create an enabling environment that facilitates the introduction of key policy instruments (financial and fiscal) for the promotion of renewable energy (by re-directing national resources and investments to Renewable Energy Technologies (RET)

Goal 3: Develop a dynamic legislative and regulatory environment, responsive to growth and development in the renewable energy sector

Goal 4: Enhance technical capacity and public awareness of renewable energy through effective support of training programmes, information dissemination strategies and ongoing government communication

Goal 5: Sustained Research and Development (R&D) and innovation in existing and emerging RETs

The 2009-2030 National Renewable Energy Policy's primary objective is the achievement of Goal 3 of the National Energy Policy 2009-2030 which will be used to guide the development and introduction of specific measures to achieve the targets outlined for renewable energy (generation capacity) in the National Energy Policy.

This policy is applicable to this project since it proposes to generate electricity primarily from a renewable source, in this case bagasse.

4.2 APPLICABLE LEGISLATION

The legislation applicable to this project include:

- Electricity Act, 2015
- The Office of Utilities Regulation Act, 1995 [Last Amended 2015]
- The Natural Resources Conservation Authority (NRCA) Act, 1991 [Last Amended 2017]
- The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996

- The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) (Amendment) Order, 2015
- The Natural Resources Conservation (Permits and Licences) Regulations, 1996
- The Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015
- The Natural Resources Conservation (Wastewater and Sludge Regulations), 2013
- The Natural Resources Conservation, (Air Quality) Regulations, 2006
- National Solid Waste Management Act, 2001 [Last Amended 2017]
- Town and Country Planning Act, 1958 [Last Amended 1999]
- The Town and Country Planning (Clarendon Parish) Confirmed Development Order, 2019
- The Building Act, 2018
- The Wildlife Protection Act, 1945 [Last Amended 1991]
- Factories Act, 1943 [Last Amended 2009]
- Water Resources Act, 1996 [Last Amended 2017]
- Watersheds Protection Act, 1963 [Last Amended 1991]
- The Rural Agricultural Development Authority Act, 1900 [Last Amended 2002]
- The Sugar (Reserve Funds) Act, 1947 [Last Amended 2003]
- The Sugar Cane Farmers (Incorporation and Cess) Act, 1941 [Last Amended 1983]
- The Sugar Industry Control Act, 1937 [Last Amended, 1994]

4.2.1 THE ELECTRICITY ACT, 2015

The Office of Utilities Regulation regulates the electricity sector in Jamaica, which includes the Jamaica Public Service Company Limited (JPS) and other Independent Power Producers (IPPs). JPS and IPPs are regulated by the OUR through the provisions of the Electricity Act, 2015 and the Electricity Licence, 2016.

The Act:

a. Provides for a modern system of regulation of the generation, transmission, distribution, supply, despatch and use of electricity;
b. Promotes transparency in the identification and allocation of costs and revenues within and between participants in the electricity sector;
c. Promotes clarity in relation to the respective roles and responsibilities of the stakeholders in the electricity sector;
d. Facilitates the achievement of the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure, supported by adequate levels of investment;
e. Promotes energy efficiency and the use of renewable and other energy sources;
f. Prescribe the required standards for the electricity sector;
g. Ensures the protection and safety of consumers of electricity and the public;

h. Ensures that the regulation of the electricity sector is transparent and predictable.

Under this Act, the Minister shall plan the system and issue licences for the various activities and the OUR shall regulate the electricity sector generally.

TSCL intends to enter into a Power Purchase Agreement with the JPSCo., in accordance with the Office of Utilities Regulation (OUR), Regulatory Policy for the Addition of New Generating Capacity to the Public Electricity Supply System (Figure 22), which will facilitate the sale of excess electricity generated (approximately 5MW).

4.2.2 THE OFFICE OF UTILITIES REGULATION ACT, 1995 [LAST AMENDED 2015]

This Act and the Amendment indicate that the functions of the Office of Utilities Regulation (OUR) include:

a. Regulating the provision of prescribed utility services by licensees or specified organisations;
b. Receiving and processing applications for a licence to provide a prescribed utility service and make such recommendations to the Minister in relation to the application as the Office considers necessary or desirable;
c. Conducting such research as it thinks necessary or desirable for the purposes of the performance of its functions under this Act;
d. Advising the responsible Minister on such matters relating to the prescribed utility service as it thinks fit or as may be requested by that Minister; and
e. Carrying out, on its own initiative or at the request of any person, such investigations in relation to the provision of prescribed utility services as will enable it to determine whether the interests of consumers are adequately protected.

4.2.3 THE NATURAL RESOURCES CONSERVATION AUTHORITY (NRCA) ACT, 1991 [LAST AMENDED 2017]

This Act gives the Natural Resources Conservation Authority [NRCA](now embodied within the National Environment and Planning Agency [NEPA]) the power to take the necessary steps for the effective management of the physical environment of Jamaica so as to ensure the conservation, protection and proper use of its natural resources among other things. In performing its functions, it may among other things, formulate standards and codes of practice to be observed for the improvement and maintenance of the quality of the environment generally, including the release of substances into the environment in connection with any works, activity or undertaking. Based on the powers and functions of the NRCA, this proposed project falls within their jurisdiction.

Sections 9 and 10 of the NRCA Act stipulate than an Environmental Impact Assessment (EIA) may be required for new projects and existing projects undergoing expansion. Communication with NEPA indicated that an EIA is required for this project, hence this EIA is being done to meet the requirements of this NRCA Act and to support the required permit and licence applications.

4.2.4 THE NATURAL RESOURCES (PRESCRIBED AREAS) (PROHIBITION OF CATEGORIES OF ENTERPRISE, CONSTRUCTION AND DEVELOPMENT) ORDER, 1996

This regulation requires that effective January 1, 1997, a permit be obtained for the construction and operation of certain types of projects.

4.2.5 THE NATURAL RESOURCES (PRESCRIBED AREAS) (PROHIBITION OF CATEGORIES OF ENTERPRISE, CONSTRUCTION AND DEVELOPMENT) (AMENDMENT) ORDER, 2015

This regulation expands the list of categories of enterprise, construction and development contained in the 1996 Order and states that a permit is required for the construction and operation of the listed types of projects regardless of when they were constructed and/or became operational. This removes the exemption for projects previously "grandfathered" which existed prior to January 1, 1997.

4.2.6 THE NATURAL RESOURCES CONSERVATION (PERMITS AND LICENCES REGULATIONS, 1996 AND THE NATURAL RESOURCES CONSERVATION (PERMITS AND LICENCES) (AMENDMENT) REGULATIONS, 2015

A Permit Application along with supporting documentation are to be submitted to NEPA in accordance with this regulation for the construction and operation of prescribed activities, as set out in the Second Schedule, Part A – Permits and Part B - Licence

Based on the nature of the proposed project, permit applications will need to be submitted to the NEPA for the following categories of enterprise, construction or development.

1. Construction and operation of agro-processing facilities (including for coffee, citrus, cocoa, coconut and sugarcane)
2. Construction and operation of facilities for the storage of hazardous materials, toxic chemicals and other similar substances
3. Construction and operation of bottling facilities and boxing plants
4. Construction and operation of power generation plants 200kW or above using renewable sources of energy
5. Construction and operation of water treatment and storage facilities, including desalination plants and water supply plants

4.2.7 THE NATURAL RESOURCES CONSERVATION (WASTEWATER AND SLUDGE) REGULATIONS, 2013

These regulations govern the quality of the effluent that is discharged from facilities to public sewers and surface water systems and require that facilities meet the outlined trade effluent and sewage effluent quality standards set out by the NRCA.

Based on the nature of the proposed operations, the regulations indicate that licence applications are required for the following

- Licence to Construct Treatment Plant
- Licence to Operate Treatment Plant for the Discharge of Sewage Effluent
- Licence to Operate Treatment Plant for the Discharge of Trade Effluent
- Licence to Discharge Sewage Effluent into the Environment
- Licence to Discharge Trade Effluent into the Environment

The operation of the sugar factory will require licences to construct and operate a sewage and trade effluent treatment plant, as well as discharge licences for the sewage and trade effluent treatment plants.

Section 5 (3) (c) of the regulation mandates that an application shall be accompanied by an environmental impact assessment, which thereby mandates the preparation of Environmental Impact Assessments (EIAs) for all new applications for environmental licences.

4.2.8 NATURAL RESOURCES CONSERVATION AUTHORITY (AIR QUALITY) REGULATIONS, 2006

These regulations stipulate that every owner of a major facility or a significant facility shall apply for an air pollutant discharge license.

The Natural Resources Conservation Authority (NRCA) Air Quality Regulations, 2006 defines a "major facility" as any facility having any air pollutant emitting activity or source with the potential to emit:

i. >100 MT/yr of one or more of the following parameters: SO_2, PM, CO and NO_x
ii. >5 MT/yr lead
iii. >10 MT/yr of any priority air pollutant (PAP)
iv. >25 MT/yr of any combination of priority air pollutants (PAPs)

and a "significant facility" as any facility having any air pollutant emitting activity or source with the potential to emit:

i. ≥ 25 but < 100 tonne/y of any one of PM, SO_2, CO or NO_x
ii. ≥ 1 but < 5 tonne/y of Pb
iii. ≥ 1 but < 10 tonne/y of any single priority air pollutants (PAPs)
iv. ≥ 5 but < 25 tonne/y of any combination of priority air pollutants (PAPs)

To determine if an air pollutant discharge license is required for the operation of the sugar factory, an air emissions inventory (AEI) was conducted (April 2025) to highlight the main air emission sources at TSCL and to evaluate the average and maximum expected air emissions at TSCL. The AEI conducted for the proposed operations at TSCL has classified it as a major facility as defined in the Natural Resources Conservation Authority (NRCA) Air Quality Regulations, 2006

These regulations also set the acceptable limits for common air pollutants in ambient air. Since this project proposes to construct a sugar factory and supporting infrastructure, controls will need to be in place to ensure that fugitive dust and heavy-duty vehicular emissions during the construction phase do not contribute negatively to ambient air quality.

4.2.9 NATIONAL SOLID WASTE MANAGEMENT ACT, 2001 [LAST AMENDED 2017]

This Act gives the National Solid Waste Management Authority (NSWMA) the power to take all steps as are necessary for the effective management of solid waste in Jamaica in order to safeguard public health, ensure that waste is collected, stored, transported, recycled, reused or disposed of in an environmentally sound manner and promote safety standards in relation to such waste. Solid waste generated as a result of construction activities will need to be collected, stored, and appropriately disposed of at an approved municipal disposal site in accordance with the Act. This Act will also apply to solid waste generated during the operation phase as well as from decommissioning activities in the event of closure of the facility.

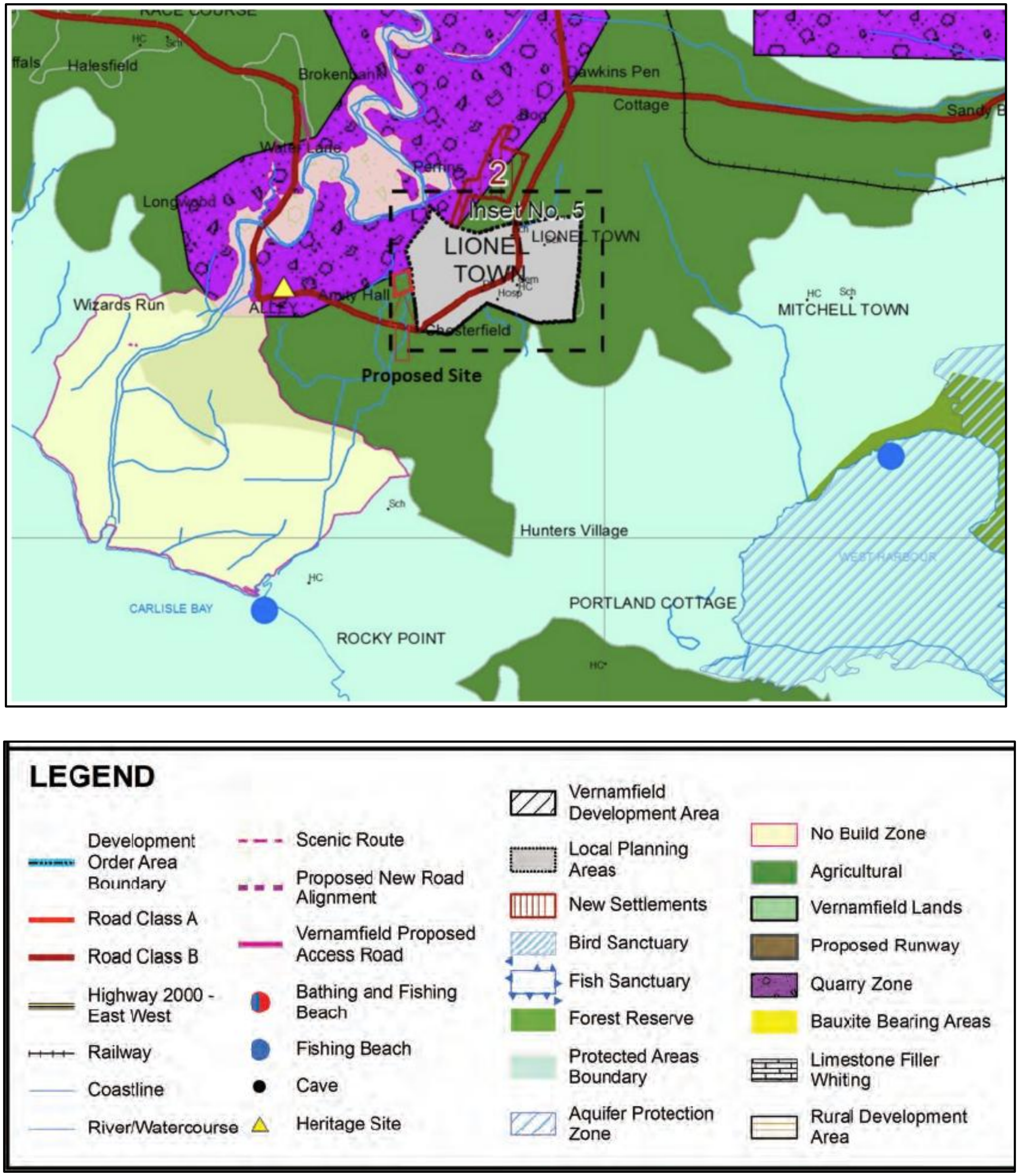
4.2.10 THE TOWN AND COUNTRY PLANNING ACT, 1958 [LAST AMENDED 1999] AND THE TOWN AND COUNTRY PLANNING (CLARENDON PARISH) CONFIRMED DEVELOPMENT ORDER, 2019

This legislation stipulates that in areas for which a Development Order has been prepared, planning permission is required from the Local Planning Authority before "development" as defined by the Act can be undertaken. In those areas for which no development orders have been prepared, no planning permission is required to undertake development. The Development Order is therefore the legal document guiding development in Jamaica. These orders are prepared by the Town and Country Planning Authority in consultation with the Local Planning Authority (Municipal Corporations & KSAC).

The Town and Country Planning Authority, which is a body established under the Act can "call in" an area for which a development order has been prepared. In this instance the Town and Country Planning Authority has the jurisdiction to oversee all development applications if it so desires within the area.

This Act is currently administered by NEPA and is applicable to the proposed project. An excerpt of the Clarendon Parish Development Order Map 1 (Figure 23), shows the site to be just outside of the Lionel Town Local Planning Area (LPA) Boundary, with the area being zoned for Agriculture.

Figure 23: Excerpt from Clarendon Parish Development Order Map 1



Source: Town and Country Planning (Clarendon Parish) Provisional Development Order (2017)

4.2.11 THE BUILDING ACT, 2018

Parliament passed the Building Act, 2018 which came into effect January 15, 2019, in a means to have a more modern building code in Jamaica, as well as for appropriate legislation to better enforce the building code to ensure safety. This Act repealed the Kingston and St. Andrew Building Act and the Parish Councils Building Act and makes provision for the regulation of the building industry in Jamaica.

The Act generally applies to building work (which refers to the design, construction, erection, alteration, repair, extension, modification, demolition or removal of a building and all activities relating thereto) and the change of building use (includes activities done in or on a building) in Jamaica, whether the building was constructed before or after the date that the Act came into force.

The Act establishes a National Building Code of Jamaica, which is comprised of a series of regulations for different categories of building work. Under the Act, the International Building Code together with 11 documents which have been declared by the Bureau of Standards to be standards of specification, are prescribed as the National Building Code of Jamaica. The Act identifies the Bureau of Standards as the body responsible for making recommendations to the Minister with respect to the National Building Code, determining the extent to which the International Building Code applies to Jamaica and recommending accreditation standards relating to building work, building material or products, construction methods, design, building components and building systems connected with building work.

Under the Act, the municipal corporation for each parish is designated as the local building authority and is generally responsible for the administration and enforcement of the provisions of the Act, the National Building Code and any regulations made under the Act. The Act gives the local authority the power in the event of a building breach to serve notice on the responsible party requiring that person to remedy the breach, whether by cessation of the building work or otherwise. The Act also gives powers for the issuing of stop notices and enforcement notices if the building work is deemed as unauthorised or a danger to the public, as well as the power to apply to the Court for an injunction against any further breach in the event that the stop order of enforcement notice is not abided.

In effect, the Act is intended to better handle construction permits, provide a framework through the National Building Code for greater resilience of buildings to both man-made and natural disasters and establish the necessary controls for a reduction in informal housing in Jamaica.

4.2.12 THE WILDLIFE PROTECTION ACT, 1945 [LAST AMENDED 1991]

The Wildlife Protection Act (1945) makes provision with respect to the management of wildlife, including fish, in Jamaica.

The Act makes provision for the protection of animals and birds and the protection of fish. Other provisions deal with the appointment of officers, regulations, power to enter lands, power of search, arrest without warrant, persons found offending, penalty for assaulting game warden, fishery inspector or constable, penalty for offences generally, jurisdiction over offences committed at sea, power to exempt from provisions of the Act, and forfeiture of things seized.

The Act specifies Game Sanctuaries and deals with hunting, etc. in a Game Sanctuary, prohibits the hunting of protected animals and protected birds, prohibits the hunting of animals and birds in and taking of eggs from the exclusive economic zone without a licence. Taking or killing of immature fish is declared an offence, and the use of explosives or other noxious materials in fishing is prohibited. It seeks to protect waters containing fish from trade effluents and industrial waste. Every person who knowingly buys, sells or has in his possession fish taken, killed or injured in contravention of the provisions of this Act or of any associated regulations shall be guilty of an offence against this Act.

The Wildlife Protection Act and Regulations are administered by the National Environment and Planning Agency.

4.2.13 FACTORIES ACT, 1943 [LAST AMENDED 2009]

This Act is the primary legislation governing safety and health in workspaces defined as "factories". It outlines regulations for registration, supervision and worker safety within these premises. The act also includes regulations regarding the use of machinery, equipment and processes that could pose safety or health risks. The Factories Act is often seen as outdated because it is limited in scope and excludes vital sectors and groups, such as the financial sector, shops and offices, agriculture and the public sector. The Occupational Safety and Health Bill when passed is expected to replace the Act. The Bill has been developed to set and improve standards for safety and security in the workplace for employees and employers.

The sugar factory meets the definition of a "factory", which in accordance with the Act is so defined as:

- any premises in which, or within the close or curtilage or precincts of which (a) acetylene, steam, water, wind, electric, internal combustion or other mechanical power is used; or (b) ten or more persons are employed in manual labour.
- In any process for or incidental to any of the following purposes namely: (a) the making of any article or part of any article.; being premises in which, or within the closure or curtilage or precincts of which, the work is carried on by way of trade or for purposes of gain.
- Any (whether or not they are factories by reason of the foregoing definition) the expression "factory" also includes the following premises, that is to say: (iii) any premises in which mechanical power is used or in which ten or more persons are employed in manual labour in connection with the business of washing or filling bottles or containers or packing articles, carried on incidentally to the purpose of any factory; (xvi) any premises used for undertakings in connection with the generation of electric current by way of trade or for purposes of gain;

will need to be registered under this Act and abide by its regulations.

4.2.14 WATER RESOURCES ACT, 1996 [LAST AMENDED 2017]

This Act establishes the framework for managing and conserving Jamaica's water resources. It gives the Water Resources Authority (WRA) the primary responsibility for regulating, allocation and managing water resources. Abstraction of water from springs, rivers and underground resources require a licence from the WRA. TSCL will utilise water from SCJH wells that have been assigned to them (Appendix 4) as water sources for its domestic needs as well as for its factory and farm operations and will have to obtain the requisite water abstraction licences.

4.2.15 WATERSHEDS PROTECTION ACT, 1963) [LAST AMENDED 1991]

This Act serves as the law governing watersheds in Jamaica and is administered by the Natural Resources Conservation Authority. The primary focus of the Act is the conservation of water resources by protecting land in or adjoining the watersheds. The Act is intended to ensure proper land use in vital watershed areas; reduce soil erosion; maintain optimum levels of groundwater and promote regular flows in waterways.

4.2.16 RURAL AGRICULTURAL DEVELOPMENT AUTHORITY ACT, 1990 [LAST AMENDED 2002]

This Act established the body known as the Rural Agricultural Development Authority (RADA) as the main agency for agricultural development and extension services in rural Jamaica. Its primary role is to promote agricultural growth, enhance rural livelihoods and improve the quality of life for farming families.

4.2.17 THE SUGAR (RESERVE FUNDS) ACT, 1947 [LAST AMENDED 2003]

This Act established provisions for the establishment, out of the proceeds of sale of sugar exported from Jamaica by an exporter (i.e. holder of an export licence under the Sugar Industry Control Act), of four reserve funds to support the sugar industry. These being the Sugar Price Stabilization Fund, a Sugar Industry Capital Rehabilitation Fund, a Sugar Industry Labour Welfare Fund and a Sugar Workers Pensions Fund for providing pensions and other superannuation benefits, subject to such conditions as may be prescribed, to workers, including casual workers, in the sugar industry in Jamaica.

As a proposed exporter of sugar, TSCL will abide by this Act.

4.2.18 THE SUGAR INDUSTRY CONTROL ACT, 1937 [LAST AMENDED 1994]

This Act provides the framework for regulating the Jamaican sugar industry. It established the Sugar Industry Authority (SIA) to control and oversee the industry, including marketing, research, and dispute resolution. This Act also allows for the establishment of individual factory quotas and manages the supply of sugar to meet local and export demand.

TSCL will abide by the Act.

4.2.19 THE SUGAR CANE FARMERS (INCORPORATION AND CESS) ACT, 1941 [LAST AMENDED 1983]

This Act incorporated the All-Island Jamaica Cane Farmers' Association (AIJCFA) and established a framework for a cess (i.e. a tax) on cane delivered to sugar factories. The AIJCFA's main goals include promoting cane farming, settling disputes, and acting as an agent for its members. The cess, imposed by the Minister on the recommendation of the of the Association, is deducted from cane farmer's payments and collected by the Sugar Industry Authority (SIA). The SIA has oversight of the industry through functions like arbitration, monitoring, planning, research and development, as well as overseeing the marketing of sugar and molasses.

As a sugar factory, the cess will be collected by TSCL by deducting the cess amount from payments made to the cane farmers and paying it over to the Authority, according to the Act, to be used in supporting the sugar industry.

4.3 APPLICABLE STANDARDS

Standards applicable to this project include:

- Jamaica Standard for White Sugar (JS 101:2017)
- Jamaica Standard for Brown Cane Sugar (JS 102: 2016)
- The Compulsory Standards (Declaration of Standard Specification) (Brown Sugar [Revised] Order, 2016).

4.3.1 JAMAICA STANDARD FOR WHITE SUGAR (JS 101: 2017)

Established by the Bureau of Standards Jamaica, this standard outlines the specific requirements for white sugar produced and sold in Jamaica, including its composition, quality and labelling, ensuring consumers received a safe, hygienic and properly labelled product.

4.3.2 JAMAICA STANDARD FOR BROWN CANE SUGAR (JS 102: 2016)

Established by the Bureau of Standards Jamaica, this standard outlines the specific requirements for brown sugar produced and sold in Jamaica, including labelling packaging and food safety. It aims to ensure the sugar is safe for consumption, free from foreign matter and properly labelled with essential information like net weight, storage conditions, and the manufacturer's details.

4.3.3 THE COMPULSORY STANDARDS (DECLARATION OF STANDARD SPECIFICATION) (BROWN SUGAR [REVISED] ORDER, 2016)

This standard signed by the Ministry of Industry, Commerce, Agriculture and Fisheries, dictates that all brown sugar in the local retail market be adequately packaged and labelled, by the establishment of a new labelling system. The revised standards which revoke the 1985 Order, also seeks to address concerns of impurities in brown cane sugar and are in line with a strategy to move Jamaica's sugar industry towards world class operation.

5 ENVIRONMENTAL DESCRIPTION

5.1 BIOLOGICAL BASELINE

The biological baseline was determined by the collection of primary data which entailed a flora and fauna survey in the area of interest. **Annex 3** contains the full report.

The property of interest is predominately a sugar cane (*Saccharum officinarum*) field; however, sections of the property were overgrown with vegetation. For the purpose of the study, the property was zoned into two categories: Secondary Forest, and Open Fields and Crops (Figure 24).

Figure 24: The Location of the Project Site; the Area Zoned as Open Fields and Crops (boundary highlighted in yellow) and Secondary Forest (highlighted in green)

5.1.1 SECONDARY FOREST

The area zoned as Secondary Forest consists of areas with large trees (Figure 25) and areas with buildings (Figure 26). Activities such as small scale subsistence farming, animal husbandry and gathering/drying of castor oil beans (Figure 27) were observed in the area; a charcoal kiln was also observed in the area (Figure 28).

Figure 25: A Section of the Area on the Property Zoned as Secondary Forest

Figure 26: A House Observed on the Property

Figure 27: Castor Oil Beans Harvested in a Bag in the Cane Field and Been Dried at one of the Houses on Property

Figure 28: Charcoal Kiln Observed in the Area Zoned as Secondary Forest

5.1.2 OPEN FIELD AND CROP

The area zoned as Open Fields and Crops consists of mainly sugar cane field (Figure 29). On the boundary of the cane field, earthen canals with water (Figure 30) were observed; it should be noted that the water was black at the time of the visit and had a foul odour. There was also vegetation along the banks of the canals that ran along the boundary of the property (Figure 31). Aerial photos highlighting the vegetation at the project site can be seen in Figure 32 and Figure 33.

Figure 29: The Remnant Sugar cane Field located in area zoned as Open Fields and Crops within the project area.

Figure 30: The Canal Located along the Northern Boundary of the Property

Figure 31: Vegetation Along the Canal Located Along the Boundary of the Property

Figure 32: Aerial Photo Showing Sugarcane at the Project Site

Figure 33: Aerial Photo Showing Sugarcane and Trees Around Property Boundary at the Project Site

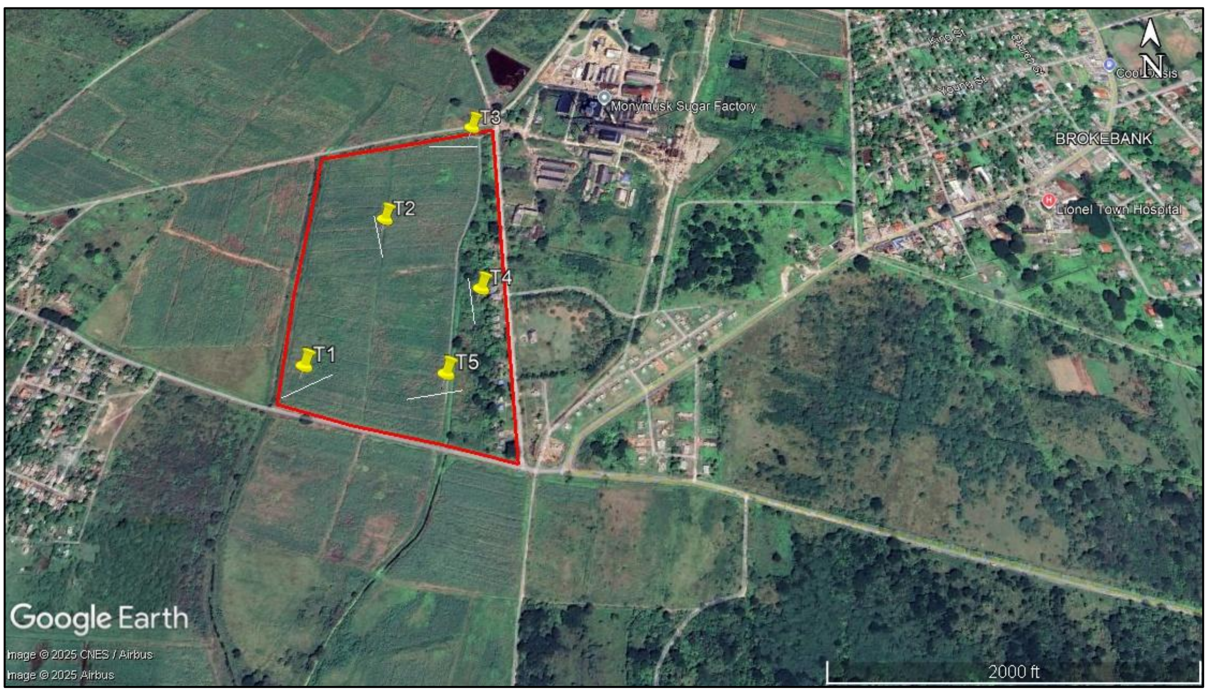
5.1.3 METHOD: FLORA AND FAUNA ASSESSMENTS

The team conducted an extensive walkthrough of each sample site. The surveys, particularly fauna assessments, were conducted along the trails and footpaths to and within the sample sites. The surveys were carried out from March 29 to April 22, 2025, using the methods outlined in each section below. For each species observed, the name and the perceived dominance using the DAFOR scale (**D**ominant, **A**bundant, **F**requent, **O**ccasional and **R**are) were noted.

5.1.4 FLORA ASSESSMENT

The vegetation on site was assessed by utilising a series of randomly distributed transects (100m x 5m each), 5 in total (T1–T5), within the boundaries of the development site (Figure 34.). All plant species encountered within each transect were recorded.

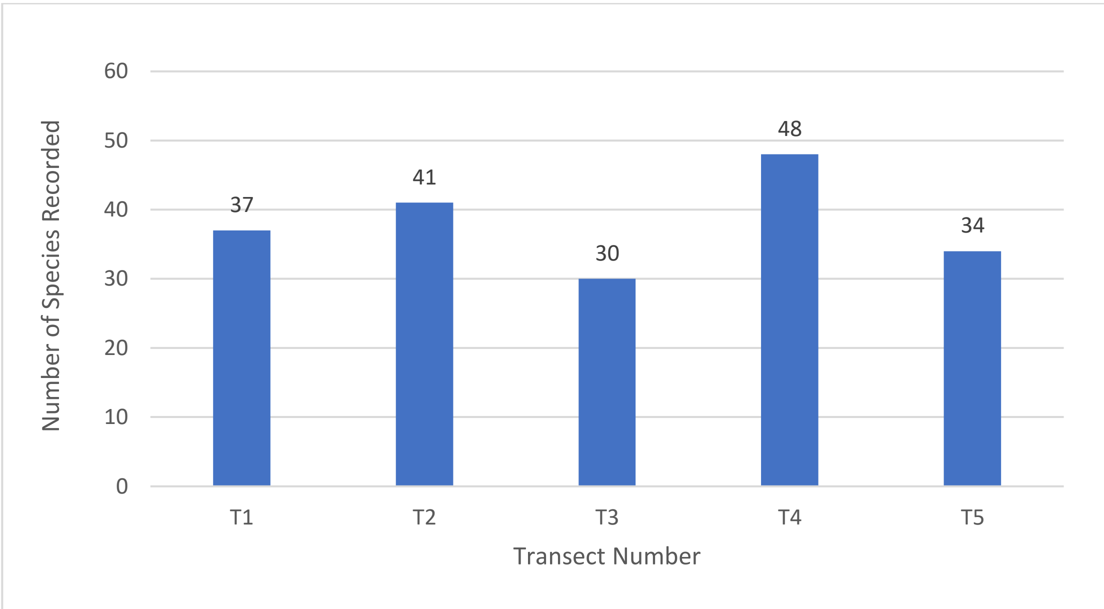
Figure 34. The Location of the Transects used for the Flora Assessment.



The common names of most of the species sighted were assigned in situ. Regarding the unknown species, voucher specimens were collected and identified at the University of the West Indies (UWI) Herbarium. All plants were identified at the species level by examining morphological features such as leaf arrangement, leaf pattern, and pattern of branching and morphology of floral and fruiting structure in conjunction with the use of Flowering Plants of Jamaica (Adams, 1972) and preserved reference specimens of the herbarium.

A total of 87 plant species from 36 families were recorded across the entire project area with relatively high diversity (Table 8). The highest number of species (48) were recorded along T4 and T2 (41), followed by T1 (37) and the lowest number of species recorded in T5 (34) and T3 (30) (Figure 35).

Figure 35. Graph Showing the Number of Plant Species Recorded Across Each Transect.



No endemic plant species were recorded during the assessment of the vegetation on the property. Only 2 species that are classified as Invasive Alien Species (IAS) were recorded within the study area; these were Guinea Grass (*Panicum maximum*) and Lead Tree (*Leucaena leucocephala*). It should be noted that no species with special conservation status (endangered/protected/threatened) were recorded within the study area.

Most plant species encountered during the assessment are described by Adams (1972), as commonly found in thickets, wastelands, and secondary woodlands. Most of the plant species can be classified as plants associated with anthropogenic disturbances, ornamentals, and crops. Transect 4 (T4), the area in which the most plant species were encountered, was heavily influenced by agricultural crops, as people live and do small scale farming within that area (Figure 36).

Figure 36. A Section of the Property, Along T4, that is used for Subsistence Barming; Plants in Photo include: Banana (Musa sapientum), June Plum (Spondias dulcis) and Cassava (Manihot esculenta).

Several pieces of infrastructure (such as building foundations, derelict canals and trails/farm roads) were scattered across this area. There was evidence of past and current agricultural activities (irrigation system and the fact that the land had been furrowed).

Table 8: List of Plant Species Identified along each Transect within the Project Area; Along with the DAFOR Ranking for each Plant Species for the Respective Transect

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Malvaceae	*Abelmoschus esculentus*	Okra	Common in cultivation				R	R
Malvaceae	*Abutilon hulseanum*		Locally common, a weed of waste ground	R		R		
Mimosaceae	*Acacia tortuosa*	Wild Poponax	Locally very common, along the south coast and on some cays, on arid limestone and at salina margins		R			R
Amaranthaceae	*Achyranthes indica*	Devil's Horsewhip	Common as a weed of cultivation and disturbed waste places	F		F		O
Amaranthaceae	*Amaranthus spinosus*	Wild Calaloo	Common as a weed of pastures, lawns and waste places		O			O
Poaceae	*Andropogon citratus*	Fever Grass	Common in cultivation in gardens and along path sides				R	
Annonaceae	*Annona muricata*	Sour Sop	Commonly cultivated				R	
Annonaceae	*Annona squamosa*	Sweet Sop	Commonly cultivated				R	
Polygonaceae	*Antigonon leptopus*	Coralita	Common in cultivation and escaping on to fences and hedges at low elevations	O		F	A	A
Asteraceae	*Bidens pilosa*	Spanish Needle	A common weed of roadsides and waste places	D	O	A		F
Sapindaceae	*Blighia sapida*	Ackee	Commonly cultivated and naturalized			R		
Nyctaginaceae	*Boerhavia coccinea*	Hog Weed	Common, as a weed of rough disturbed pastures, waste places and sand dunes	F				O
Nyctaginaceae	*Boerhavia erecta*		Rather common, a weed of disturbed ground, roadside banks in open areas and river gravel		O	O	R	
Nyctaginaceae	*Bougainvillea peruviana*		Common ornamental				R	
Fabaceae	*Cajanus cajan*	Gungo Pea	Common in cultivation				R	
Asclepiasaceae	*Calotropis procera*	French Cotton	Locally common, in arid sandy or gravely waste places			O		O

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Euphorbiaceae	*Caperonia castaneifolia*		Rather uncommon, in swamps, wet meadows and rice fields	R				
Solanaceae	*Capsicum baccatum*	Bird Pepper					R	
Caesalpiniaceae	*Cassia javanica*	Pink Cassia	Common ornamental				R	
Poaceae	*Chloris barbata*		Very common as a weed along roadsides and in waste places	O	F	A	O	
Sapotaceae	*Chrysophyllum cainito*	Star Apple	Common, mostly along roadsides and in pastures and yards were planted				R	
Vitaceae	*Cissus sicyoides*	Soldier Wiss	Very common, on trees, walls, fences and in thickets			R		
Rutaceae	*Citrus aurantifolia*	Lime	Commonly cultivated				R	
Fabaceae	*Clitoria ternatea*	Blue Pea	Common in cultivation as ornamental, and escaping into waste places	F	O		O	
Arecaceae	*Cocos nucifera*	Coconut	Commonly cultivated				R	R
Commelinaceae	*Commelina diffusa*	Water Grass	A common weed of cultivations, waste places and pastures		O			O
Asteraceae	*Conyza canadensis*	Canada Fleabane	Common on roadside banks and rough pastures	F	O	R	O	F
Boraginaceae	*Cordia dentata*	Duppy Cherry	Locally abundant on gravelly alluvial plains		R			R
Cucurbitaceae	*Cucumis anguria*	Wild Cucumber	Locally common, in rough waste places		O	R		R
Cucurbitaceae	*Cucurbita pepo*	Pumpkin	Commonly cultivated				R	R
Asteraceae	*Cyanthillium cinereum*		Very common, a weed of pastures and waste places	O	R		R	
Fabaceae	*Desmodium incanum*		Common in pastures and on banks			F		
Fabaceae	*Desmodium scorpiurus*		Rather common, a weed of sandy pastures and roadsides and rocky or stony waste ground	O	R			O
Verbenaceae	*Duranta repens*		Common on roadside banks and in thickets, also cultivated for ornament				R	

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Poaceae	*Echinochola colonum*		Widely distributed and locally common in ditches, low-lying open ground and pond margins		O			
Euphorbiaceae	*Euphobia heterophylla*	Japanese Poinsettia	Occasional in central and eastern parishes, a weed of roadside banks and open waste places		R			R
Euphorbiaceae	*Euphorbia hirta*		Very common, a weed of roadsides, waste places, lawns, pastures and cultivated grounds	F	O	O	F	F
Euphorbiaceae	*Euphorbia hypericifolia*		Common and abundant locally as a weed of waste places	O	R	O	O	O
Moraceae	*Ficus benjamina*	Chinese Banyan	Cultivated shade and ornamental tree				R	
Malvaceae	*Gossypium barbadense*	Sea Island Cotton	Annual forms cultivated; perennial forms naturalized in moist sheltered places.				R	
Sterculiaceae	*Guazuma ulmifolia*	Bastard Cedar	Very common along roadsides, in pastures and open secondary woodlands		R	O		R
Boraginaceae	*Heliotropium indicum*	Wild Clary	Common as a weed of pastures, cultivated ground and waste places	F	R		O	
Malvaceae	*Hibiscus sabdariffa*	Sorrel	Common in cultivation				R	
Euphorbiaceae	*Jatropha curcas*	Physic Nut	Frequent, mostly near habitations	O	O			R
Verbenaceae	*Lantana camara*	Wild Sage	Very common in rough pastures, waste places and thickets	O	R	R	O	O
Verbenaceae	*Lantana trifolia*		Common in rough pastures and waste places	R	R			
Lamiaceae	*Leonotis nepetifolia*		Rather common, a weed of fields, roadsides and waste ground	R				
Mimosaceae	*Leucaena leucocephala***	Lead Tree	Common along roadsides and in sandy waste places and thickets	F	O	O	A	O
Cucurbitaceae	*Luffa aegyptiaca*			R				

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Malvaceae	*Malachra alceifolia*	Wild Okra	Locally common, mainly in south-eastern parishes, a weed of roadsides and low-lying waste places	R		R		
Malvaceae	*Malvastrum coromandelianum*		Common weed of cultivated ground, pastures and waste places		O			
Anacardiaceae	*Mangifera indica*	Mango	Cultivated and naturalized				O	
Euphorbiaceae	*Manihot esculenta*	Cassava	Cultivated locally on the heavier soils				R	
Sapindiaceae	*Melicoccus bijugatus*	Guinep	Common along roadsides and in secondary thickets and woodlands				O	R
Convolvulaceae	*Merremia dissecta*	Know You	Cultivated and widely escaped on fences and in thickets and waste grounds	O				
Convolvulaceae	*Merremia umbellata*		Common on fences and in thickets and waste places			O	R	
Rubiaceae	*Morinda citrifolia*	Noni	Locally common in open areas near the sea, cultivated inland				R	
Musaceae	*Musa paradisiaca*	Plantain	Commonly cultivated				R	
Musaceae	*Musa sapientum*	Banana	Commonly cultivated				R	
Poaceae	*Panicum maximum***	Guinea Grass	Very common in rough pastures, ditches and sheltered thickets	D	F	D	D	A
Asteraceae	*Parthenium hysterophorus*	Dog-flea Weed	Common along roadsides and in shady or open waste places	O	R			O
Poaceae	*Paspalum dilatatum*		Introduced and cultivated	F	O		O	
Passifloraceae	*Passiflora foetida*		Common in thickets, hedgerows and waste places	O	R			
Caesalpiniaceae	*Peltophorum linnaei*	Braziletto	Locally common, in coastal areas of the central and western parishes, in thickets and open woodlands on arid limestone		R			
Fabaceae	*Phaseolus lunatus*	Broad Bean	Cultivated at the lower elevations				R	
Portulacaceae	*Portulaca oleracea*	Pussley	Very common, a weed of cultivated ground and waste places	F		O		O

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Verbenaceae	*Priva lappulacea*	Velvet Bur	A common weed of cultivations, roadsides and waste places	F	O	R	F	O
Mimosaceae	*Prosopis juliflora*	Cashaw	Locally common, in low pastures in arid areas and on sand and shingle dunes	R	O	R		R
Myrtaceae	*Psidium guajava*	Guava	Common in pastures and wayside thickets, sometimes cultivated				O	
Commelinaceae	*Rhoeo spathacea*	Mosses in the Bulrushes	Common, on limestone banks and in rocky thickets and woodland margins				O	
Fabaceae	*Rhynchosia minima*		Common in waste places and cultivated land	F		R	F	
Euphorbiaceae	*Ricinus communis*	Castor Oil	Common as cultivated plant and on waste ground	O	R	O	R	R
Acanthaceae	*Ruellia tuberosa*	Duppy Gunshot	Very common in pastures and waste places and on roadside banks		O			O
Poaceae	*Saccharum officinarum*	Sugar Cane	Abundantly cultivated, mostly at low elevations on level ground in deep soils	D	D	D		D
Mimosaceae	*Samanea saman*	Guango	Common in inhabited areas and in old pastures where planted, naturalized in riparian forest and in secondary communities on level ground		R	R	F	
Malvaceae	*Sida acuta*	Broom Weed	Very common in pastures, waste places and cultivations		O			O
Malvaceae	*Sida spinosa*		Common, as a weed of cultivations and in pastures and sandy waste places	F	O	R		O
Solanaceae	*Solanum torvum*	Susumber	Common in woodland clearings, thickets and waste places				O	R
Poaceae	*Sorghum halepense*	Johnson Grass	Locally common, gregarious and forming colonies, a persistent weed of some pastures and stony waste ground	R	R			
Anacardiaceae	*Spondias dulcis*	June Plum	Occasional in cultivation				R	

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Key: **- Invasive Alien Species (IAS), DAFOR Scale: D=Dominant, A= Abundant, F= Frequent, O=Occasional and R=Rare								
Poaceae	*Sporobolus pyramidatus*		Locally common, in drier southern coastal areas in salina margins and sandy waste places near the sea		R			
Bignoniaceae	*Tabebuia rosea*	Pink Poui	Cultivated				R	
Caesalpiniaceae	*Tamarindus indica*	Tamarind	Cultivated and naturalized				R	
Asteraceae	*Tithonia diversifolia*	Mexican Sunflower	Locally common, naturalized on roadside banks and in cultivations		R	R		
Asteraceae	*Wedelia gracilis*		Rather common, especially in rough damp low-lying pastures	O	F	O		
Rhamnaceae	*Ziziphus mauritiana*	Coolie Plum	Established and common in some waste places, occasionally forming thickets	O	R			
Poaceae	*Zoysia tenuifolia*		Cultivated for lawns	F				

5.1.5 AVIFAUNA ASSESSMENT

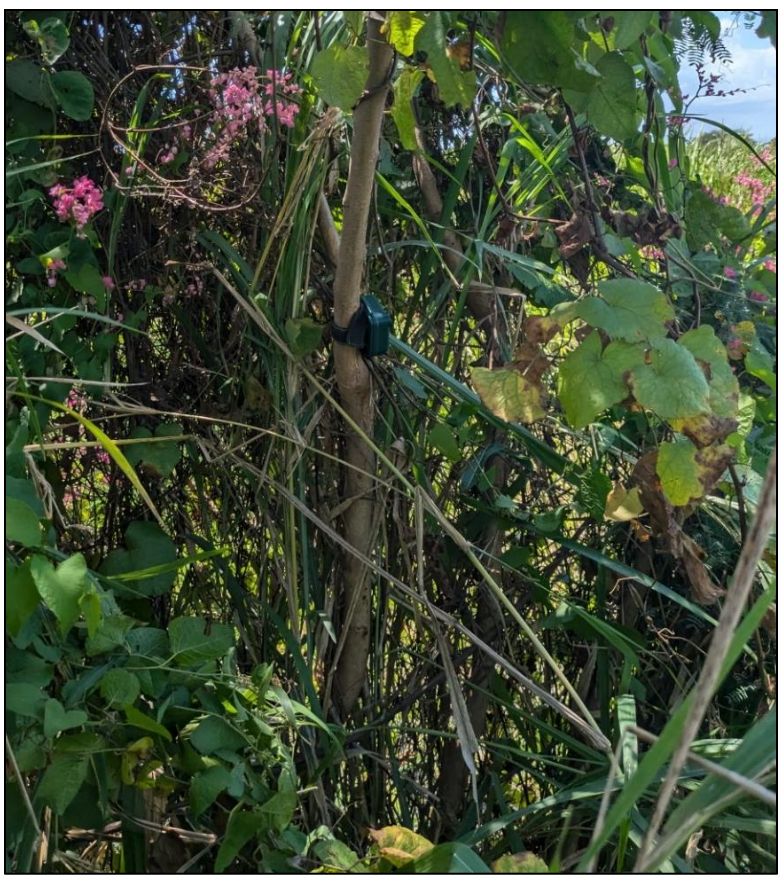
The line transect method was selected for the avifauna assessment, and it entailed walking slowly along the extensive roads and trails networks on the property, noting all the birds seen or heard in the area (Bibby, Jones, and Marsden, 2000). The birds encountered for the first time were added to the list while conducting other assessments in the area.

For the nocturnal birds, the line transect methods were conducted along the roads/trails used for the day surveys. In addition, AudioMoth recorders were used for the nocturnal bird survey (Figure 37). The devices were active from 17:30 to 06:30. The audio files were analysed using the Kaleidoscope Pro software from Wildlife Acoustics.

People encountered in the project area were informally interviewed about the birds they observed, emphasising nocturnal birds on the property.

Reference material used in species identification (pictures and calls) included the Merlin App (Merlin, 2024), Ebird (Fink, et al. 2018), and Bird of the West Indies.

Figure 37: One of the AudioMoth Devices Deployed in the Field for the Assessment of Nocturnal Birds, Frog, Vocal Reptiles and Bats.



Forty-eight (48) species of birds were identified during the assessment, including 7 residents (endemic), 28 residents (non-endemic), 1 introduced and 12 migrants (see Table 9). Of the 7 endemic birds observed in the project, none of the species was viewed as a forest specialist.

Table 9: The Birds Observed During the Assessment of the Project Area.

#	Common Name	Scientific Name	Range	IUCN	Open Field and Crop	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare IUCN Rating (LC = Least Concerned, VU – Vulnerable and NT= Near Threatened)						
1	American Kestrel	*Falco sparverius*	*Resident*	LC	R	R
2	American Redstart	*Setophaga ruticilla*	*Migrant*	LC	R	R
3	Antillean Nighthawk	*Chordeiles gundlachii*	*Migrant*	LC	R	R
4	Antillean Palm-Swift	*Tachornis phoenicobia*	*Resident*	LC	O	R
5	Bananaquit	*Coereba flaveola*	*Resident*	LC		R
6	Black-and-white Warbler	*Mniotilta varia*	*Migrant*	LC	R	
7	Black-faced Grassquit	*Melanospiza bicolor*	*Resident*	LC	R	
8	Black-throated Blue Warbler	*Setophaga caerulescens*	*Migrant*	LC	R	
9	Cape May Warbler	*Setophaga tigrina*	*Migrant*	LC	R	
10	Cattle Egret	*Bubulcus ibis*	*Resident*	LC	O	R
11	Cave Swallow	*Petrochelidon fulva*	*Resident*	LC	R	
12	Common Ground Dove	*Columbina passerina*	*Resident*	LC	O	R
13	Common Yellowthroat	*Geothlypis trichas*	*Migrant*	LC	R	R
14	Glossy Ibis	*Plegadis falcinellus*	*Resident*	LC	R	
15	Gray Kingbird	*Tyrannus dominicensis*	*Migrant*	LC	R	R
16	Great Blue Heron	*Ardea herodias*	*Resident*	LC	R	
17	Great Egret	*Ardea alba*	*Resident*	LC	R	
18	Greater Antillean Grackle	*Quiscalus niger*	*Resident*	LC	R	R
19	Greater yellowlegs	*Tringa melanoleuca*	*Migrant*	LC	R	
20	Green Heron	*Butorides virescens*	*Resident*	LC	R	
21	Jamaican Euphonia	*Euphonia jamaica*	*Endemic*	LC		R
22	Jamaican Lizard-Cuckoo	*Coccyzus vetula*	*Endemic*	LC		R
23	Jamaican Mango	*Anthracothorax mango*	*Endemic*	LC		R
24	Jamaican Oriole	*Icterus leucopteryx*	*Resident*	LC		R
25	Jamaican Parakeet	*Eupsittula nana*	*Endemic*	NT		O
26	Jamaican Vireo	*Vireo modestus*	*Endemic*	LC	R	
27	Jamaican Woodpecker	*Melanerpes radiolatus*	*Endemic*	LC		R
28	Killdeer	*Charadrius vociferus*	*Resident*	LC	R	
29	Little Blue Heron	*Egretta caerulea*	*Resident*	LC	R	
30	Loggerhead Kingbird	*Tyrannus caudifasciatus*	*Resident*	LC	R	O

#	Common Name	Scientific Name	Range	IUCN	Open Field and Crop	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare IUCN Rating (LC = Least Concerned, VU – Vulnerable and NT= Near Threatened)						
31	Mourning Dove	*Zenaida macroura*	*Resident*	LC	R	
32	Northern Mockingbird	*Mimus polyglottos*	*Resident*	LC	R	R
33	Northern Parula	*Setophaga americana*	*Migrant*	LC	R	
34	Palm Warbler	*Setophaga palmarum*	*Migrant*	LC	R	R
35	Prairie Warbler	*Setophaga discolor*	*Migrant*	LC	R	
36	Red-billed Streamertail	*Trochilus polytmus*	*Endemic*	LC	R	R
37	Rock Pigeon	*Columba livia*	*Resident*	LC	R	
38	Smooth-billed Ani	*Crotophaga ani*	*Resident*	LC	F	O
39	Tricolored Munia	*Lonchura malacca*	*Introduced*	LC	F	
40	Turkey Vulture	Cathartes aura	*Resident*	LC	O	O
41	Vervain Hummingbird	*Mellisuga minima*	*Resident*	LC	R	R
42	White-crowned Pigeon	*Patagioenas leucocephala*	*Resident*	NT		R
43	White-winged Dove	*Zenaida asiatica*	*Resident*	LC	R	O
44	Yellow Warbler	*Setophaga petechia*	*Resident*	LC	R	R
45	Yellow-crowned Night-Heron	*Nyctanassa violacea*	*Resident*	LC	R	
46	Yellow-faced Grassquit	*Tiaris olivaceus*	*Resident*	LC	R	O
47	Yellow-throated Warbler	*Setophaga dominica*	*Migrant*	LC	R	
48	Zenaida Dove	*Zenaida aurita*	*Resident*	LC	R	R

Twelve (12) migrants were identified in the study area, including 8 winter migrants, 2 summer migrants and a Greater Yellowlegs. The winter migrants generally arrive in Jamaica as early as September and begin to depart in April. The winter migrants in the study mainly consist of wood warbler. The summer migrants include the Gray Kingbird and Antillean Nighthawk. The Nighthawks were heard calling during the nocturnal study.

A few wetland birds were observed in the cane field such as the Greater yellowlegs, Great Egret, Cattle Egret, Yellow Crowned Night Heron and Little Blue Heron. The Greater Yellowlegs were encountered in the canal on the property. The Yellow Crowned Night Heron was encountered foraging in the cane field during the nocturnal assessments.

Large flocks of the Tricolored Munia, an introduced species, was observed in the cane field during the study.

Two species with special conservation status, the Jamaican Parakeet and the White-Crowned Pigeon, were recorded in the assessment and are both listed as Near Threatened by the IUCN.

5.1.6 HERPETOLOGY

The amphibian and reptile surveys were conducted across the different microhabitat types within the project area. The habitat search included trees, stone piles, abandoned structures and other debris. All specimens seen were identified, and a DAFOR ranking was assigned to reflect their relative dominance; pictures were taken for further study if necessary.

Herpetofauna which could not be identified in the field were collected and identified using Amphibians and Reptiles of the Caribbean Islands Keys (Caribherp, 2015) and Amphibians and Reptiles of the West Indies (Schwartz & Henderson, 1991).

The AudioMoth devices used for the bird surveys were also used for the amphibians and vocal reptiles survey. The devices were active from 17:30 to 06:30. The audio files were analysed using the Kaleidoscope Pro software from Wildlife Acoustics. The acoustics were identified using expert identification and reference material (Hedges, 2023).

Amphibian. The introduced species included the Lesser Antillean Whistling Frog (*Eleutherodactylus johnstonei),* which was the only amphibian recorded on the property (Table 10). The introduced Cuban Tree Frog (*Osteopilus septentrionalis*) and the Cane Toad (*Rhinella marina*) have been reported in the Lionel Town area, however, they were not encountered on the project site. There was a water channel (earthen canal) on the boundary of the property but there were no signs of amphibians in the waterbody. It is believed that the chemical state of the water in the canal is the reason for no fauna being present in the waterbody

Reptiles: Four anoles were encountered in the study area. This included 3 endemic Anoles and one introduced species, *Anolis sagrei*. The anoles were mostly observed in the secondary forest. No snakes and galliwasps were observed in the project area. No species listed in the survey are of any special conservation status.

Table 10: The Amphibians and Reptiles Recorded in the Project Area

#	Type	Family	Scientific Name	Common Name	Range	IUCN Status	Open Fields	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare IUCN Rating (LC = Least Concerned, VU – Vulnerable and NT= Near Threatened)								
1	Amphibia	Eleutherodactylidae	*Eleutherodactylus johnstonei*	Lesser Antillean Frog	Introduced	LC	R	O
2	Reptilia	Dactyloidae	*Anolis lineatopus*	Jamaican Brown Anole	Endemic	LC	R	F
3	Reptilia	Dactyloidae	*Anolis grahami*	Jamaican Turquoise Anole	Endemic	LC	R	R
4	Reptilia	Dactyloidae	*Anolis opalinus*	Jamaican Opal-bellied Anole	Endemic	LC		R
5	Reptilia	Dactyloidae	*Anolis sagrei*	Brown Anole	Introduced	LC	R	

Figure 38: A Jamaican Turquoise Anole

5.1.7 INVERTEBRATE ASSESSMENT

The invertebrate assessment consisted of a series of walkthroughs within the project area and the examination of microhabitats within the project area, these included tree trunks, leaves, dry wood, and sticks. A sweep net was also used to sample insects from the foliage and insects in flight were recorded. The arthropods encountered in the field were identified on the spot; however, arthropods which could not be identified in the area were later identified using Insects Keys (Triplehorn, Johnson and Borror 2005), iNaturalist App and collections at the University of the West Indies if necessary.

For the nocturnal insects, a light trap (bucket trap) was used to attract and collect specimens in the project area (Figure 39). The species were identified using the reference material stated above. It should be noted that the study is focussed on macro-invertebrates. Micro invertebrates such as micro lepidopterans were not classified.

Figure 39: A Bucket Light Trap used in the Study for the Nocturnal Assessment of Insects.

Twenty-one (21) butterfly species were observed in the study area. Of the 21 species, 19 native and 2 endemic subspecies were identified in the study (Table 11). None of the butterfly species identified is of any special conservation needs.

Table 11: The Butterfly Species Observed During the Assessment of the Area

#	Family	Scientific Names	Common Names	Status	Cane Field	Woodland
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare						
1	Crambidae	*Spoladea recurvalis*	Hawaiian Beet Webworm Moth		O	R
2	Hesperiidae	*Burnsius oileus*	Tropical checkered skipper	Native	R	R
3	Hesperiidae	*Cymaenes tripunctus*	three-spotted skipper	Native	R	
4	Lycaenidae	*Hemiargus ceraunus*	The Hanno Blue	Native	O	
5	Lycaenidae	*Leptotes cassius*	Cassius Blue	Native	O	O
6	Lycaenidae	*Strymon istapa*	mallow hairstreak	Native	O	R

#	Family	Scientific Names	Common Names	Status	Cane Field	Woodland
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare						
7	Noctuidae	*Utetheisa ornatrix*	Bella Moth	Native	O	
8	Nymphalidae	*Agraulis vanillae insularis*	Gulf Fritillary	Native	R	R
9	Nymphalidae	*Anartia jatrophae*	White Peacock	Native	O	R
10	Nymphalidae	*Dione vanillae*	The Tropical Silverspot	Native	R	
11	Nymphalidae	*Dryas iulia delilah*	Julia	Endemic subspecies	R	R
12	Nymphalidae	*Heliconius charithonia simulator*	Zebra butterfly	Endemic subspecies		R
13	Nymphalidae	*Junonia evarete*	Tropical Buckeye	Native	R	R
14	Nymphalidae	*Siproeta stelenes*	The Antillean Malachite	Native	R	
15	Pieridae	*Anteos maerula*	yellow angled sulphur	Native	R	
16	Pieridae	*Ascia monuste*	Great Southern White; Antillean Great White	Native	O	
17	Pieridae	*Eurema elathea*	Cramer's Barred Sulphur	Native		R
18	Pieridae	*Phoebis sennae*	Cloudless Sulphur	Native	R	
19	Pieridae	*Pyrisitia lisa*	Little yellow	Native	O	
20	Psychidae	*Bog worm*	Bog worm Moth		O	
21	Satyrinae	*Calisto zangis*	Jamaican satyr	Native	R	

Regarding the arthropods (non-butterfly), there were 40 species (1 millipede, 5 spiders, and 34 insects) (Table 12). The low number of species could be as result of the area being under cultivation for several years.

None of the arthropod species identified is of any special conservation needs.

Table 12: The Arthropods (Non-butterfly) Observed During the Assessment

#	Order	Family	Scientific Names	Common Names	Status	Open Fields	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare							
1	Araneae	Araneidae	*Argiope trifasciata*	Banded garden spider	Native	O	
2	Araneae	Araneidae	*Gasteracantha cancriformis*	Black Crab spider	Native	R	
3	Araneae	Sparassidae	*Heteropoda venatoria*	Pantropical Huntsman Spider	Native	O	R
4	Araneae	Tetragnathidae	*Leucauge argyra*	Orb weavers	Native	R	
5	Araneae	Cheiracanthiidae	*Cheiracanthium inclusum*	yellow sac spider	Native	R	
6	Blattodea	Blattoidae	*Periplaneta australasiae*	Australian Cockroach	Introduced	F	
7	Blattodea	Blattoidae	*Periplaneta americana*	American Cockroach	Introduced	O	F
8	Blattodea	Pseudophyllodromiidae	*Species 1*			R	
9	Blattodea	Termitidae	*Nasutitermes sp*	Termites, Duck Ants	Native	R	R
10	Coleoptera	Chrysomelidae	*Disonycha glabrata*	Pigweed Flea Beetle	Native	O	
11	Coleoptera	Cerambycidae	*Oxymerus aculeatus*		Native	R	
12	Coleoptera	Scarabaeidae	*Strategus simson*		Native	R	
13	Diptera	Dolichopodidae	*Condylostylus sp*	Green Fly	Native	R	
14	Diptera	Muscidae	*Musca domestica*	Housefly	Native	R	O
15	Hemiptera	Pyrrhocoridae	*Dysdercus andreae*	Cotton Stainer Bugs	Native	O	
16	Hemiptera	Rhopalidae	*Niesthrea sp*			R	
17	Hempitera	Pentatomidae	*Ascra sp*	Stink bug			R
18	Hempitera	Pentatomidae	*Nezara viridula*	Stink bug	Native	R	
19	Hymenoptera	Apidae	*Apis mellifera*		Native	F	O
20	Hymenoptera	Formicidae	*Camponotus*	Carpenter and Sugar Ants	Native		**O**

#	Order	Family	Scientific Names	Common Names	Status	Open Fields	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare							
21	Hymenoptera	Formicidae	*Camponotus hannani*	Red Ants	Native	F	
22	Hymenoptera	Vespidae	*Polistes crinitus*	Caribbean Paper Wasp	Native	F	O
23	Hymenoptera	Vespidae	*Polistes major*		Native	O	R
24	Hymenoptera	Xylocopinae	*Xylocopa mordax*		Native	R	
25	Isopetera	Termitidae	*Nasutitermes costalis*	Termites, Duck Ants	Native	O	O
26	Odonata	Lestidae	*Lestes sp*		Native	R	
27	Odonata	Libellulidae	*Enallagma coecum*	Antillean Bluet	Native		R
28	Odonata	Libellulidae	*Erythemis vesiculosa*	Great Pondhawk	Native	O	R
29	Odonata	Libellulidae	*Erythrodiplax fervida*	Red-mantled Dragonlet	Native	R	
30	Odonata	Libellulidae	*Dythemis rufinervis*	Red Setwing	Native	O	
31	Odonata	Libellulidae	*Erythrodiplax umbrata*	Band-winged Dragonlet	Native	O	R
32	Odonata	Libellulidae	*Erythrodiplax justiniana*	Antillean Dragonlet	Native	R	
33	Odonata	Libellulidae	*Orthemis macrostigma*	Red Dragonfly or Tropical King Skimmers	Native	R	
34	Odonata	Tettigoniidae		Green Katydids		R	
35	Orthoptera	Acrididae	*Abracris flavolineata*		Native	R	
36	Orthoptera	Acrididae	*Orphulella punctata*	Green and Brown Grasshopper	Native	O	
37	Orthoptera	Acrididae	*Schistocerca pallens*		Native	O	
38	Orthoptera	Acrididae	*Schistocerca serialis*	Short-horned Grasshoppers	Native	R	
39	Orthoptera	Gryllidae	*Gryllus assimilis*	Jamaica Field Cricket	Native		O
40	Spirobolida	Rhinocricidae	*Anadenobolus monilicornis*	Yellow-banded millipede	Native	O	

Figure 40: Mallow Scrub-Hairstreak (Strymon istapa)

Figure 41: Oxymerus aculeatus Observed on the Property

5.1.8 BAT STUDY

The bat survey was carried out during the day and at night. During the day all possible bat roosting areas, including manmade structures and trees, were searched. Special emphasis was placed on finding the endemic Jamaican Fig-eating Bat (*Ariteus flavescens)*. The bat survey was also conducted by deploying 2 AudioMoth acoustic detectors and 1 Song meter bat mini recorder (SMB1) bat detector in selected areas on the property for 25 nights (Figure 42). The AudioMothts were configured to start recording before sunset from 17:30 to 06:00. The sample rate was 384 kHz, and the gain was set at medium. The sleep duration was 5 seconds, and the recording duration was 10 seconds. The devices were placed at a height of 3 m. The SMB1 was set to record half hour before sunset and stop at half hour after sunrise (Figure 43).

The Kaleidoscope Pro software from Wildlife Acoustics was used to ID the bat call from both acoustic devices. The software is generally used to cluster and visualise recordings, automatically identify bats, and analyse sound. The bat call library within the software only accounts for 10 of the 21 species found in Jamaica. Other bat calls were obtained from acoustic material from Windsor Research Centre (Koenig 2015), personal library, and from Google as needed.

Figure 42: Location of the Acoustic Recorders used in the Study

Figure 43: SMB1 Bat Recorder Deployed in the Field

Five species of bats were recorded and identified using the Kaleidoscope Pro Analysis Acoustic software (Table 13).

The bat species trophic guild of the detected species includes Frugivores (n=1), and Insectivores (n=4). Insectivorous bats include aerial hunters and other species that glean insects from the vegetation especially from the sugar cane. A few trees that were fruiting were encountered at the time of the study; this is likely where the Jamaica fruit bats forage for food.

There were no endemic bats or bats with special protection or deemed endangered observed/identified. No caves were reported on the property. The endemic Jamaican fig-eating bat (*Ariteus flavescens*) was not observed roosting in the project area or detected in the acoustic study.

Table 13: The Bat Species Identified in the Study

#	Scientific Name	Common Name	Diet	Roost	Foraging Behaviour
1	*Artibeus jamaicensis*	Jamaican Fruit Bat	Frugivore	Cave, man-made structure, foliage	Fruit Feeder: trees in forested and disturbed area
2	*Molossus milleri*	Pallas' Mastiff Bat	Insectivore	Cave, man-made structures	Open-space, aerial awking
3	*Moormops blainvillei*	Antillean Ghost-faced Bat	Insectivore	Obligate cave	semi-cluttered space; fluttering hunter
4	*Pteronotus macleayii*	MacLeay's Mustached Bat	Insectivore	Obligate cave	Background-cluttered space; fluttering hunter
5	*Pteronotus parnellii*	Parnell's Mustached Bat	Insectivore	Obligate cave	Highly cluttered space; fluttering hunter

5.1.9 OTHER FAUNA

Three mammals were observed while carrying out the fauna study (Table 14).

Table 14: The Mammals Encountered During the Assessment of the Property

#	Order	Family	Scientific Name	Common Name	Range	IUCN Status	Open Fields	Secondary Forest
DAFOR Scale D=Dominant, A= Abundant, F= Frequent, O=Occasional & R=Rare IUCN Rating (LC = Least Concerned, VU – Vulnerable and NT= Near Threatened)								
1	Carnivora	Herpestidae	*Herpestes auropunctatus*	Indian Mongoose	Introduced	LC		R
2	Carnivora	Felidae	*Felis catus*	Cats	Introduced	LC	R	
3	Artiodactyla	Bovinae	*Bos taurus*	Cow	Introduced	LC		O

Figure 44: Cows Observed on the Property

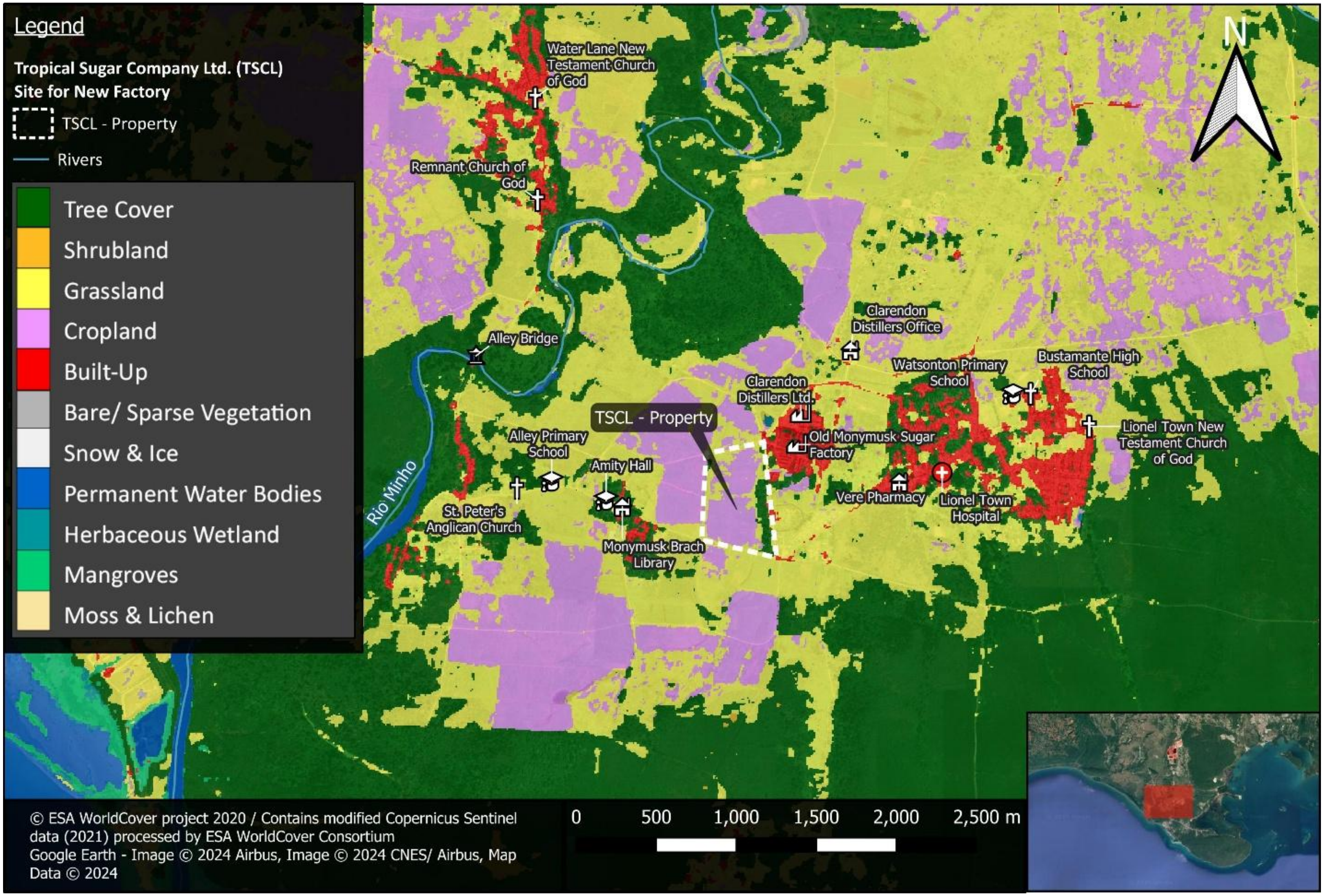
5.2 AGRICULTURE & FORESTRY

The land for the project site was leased by TSCL from the SCJH. The land has historically been used for sugarcane cultivation. Satellite imagery from Google Earth (Figure 45) show the land being tilled for agriculture from 2003. The Land Cover Map using 2021 data from the European Space Agency (Figure 46) shows that the project site is dominated by cropland, with grasslands and tree cover around the periphery of the site. Drone photos (Figure 32 and Figure 33) from site visits to the project site show sugarcane growing on the property and the grassland and secondary tree cover around the property's boundary.

In addition to the sugarcane cultivation, some community members farm informally, producing castor seeds, charcoal, growing fruit trees and rearing cattle.

Figure 45: Historical Satellite Imagery from 2003

Figure 46: Land Cover Map (2021) of TSCL Factory Location and Surrounding Area



5.3 PHYSICAL SETTING

The physical setting was compiled using secondary data primarily form the Mines and Geology Division (MGD) in the Ministry of Agriculture, Fisheries and Mining.

5.3.1 GEOLOGY

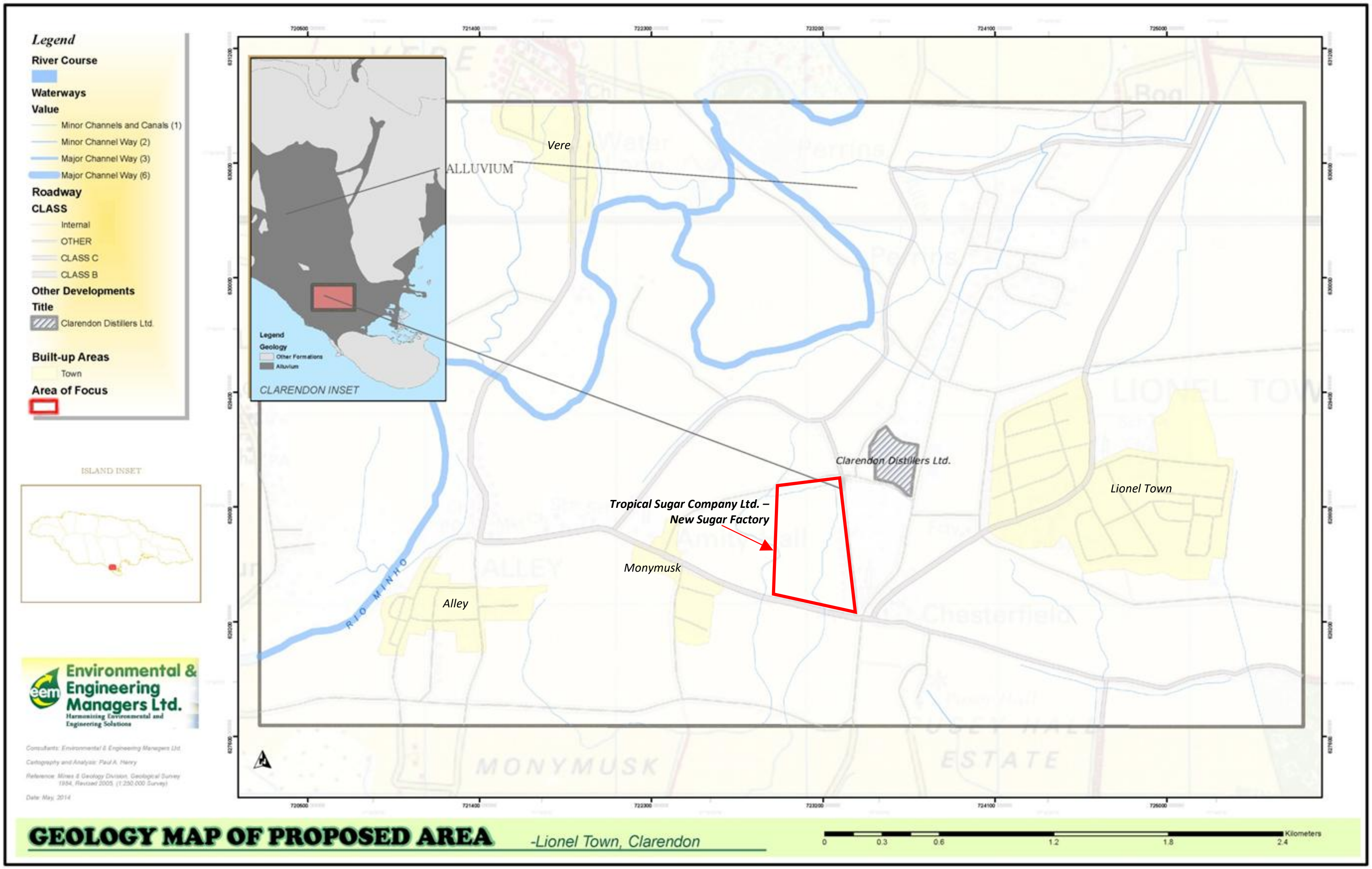
The Rio Minho floodplain owes its origins to the denudation of the Cretaceous outcrops which define the Central Inlier as well as the subsequent deposition of sediments so derived from the base of the Main Ridge Mountain that rises southerly towards the coast. The majority of this mass is comprised of Volcanics; with lesser portions of Volcaniclastics and Limestones. Also extending from the base of this mountain rise towards the sea is the Newport Limestone Formation (Miocene times), on which the Rio Minho deposits were originally laid during Quaternary times. Borehole data reveals that Rio Minho deposits extend from its base at depth of 150m to the current land surface (MGD[3] Geological Survey 1984). A detailed map of the geology of the TSCL factory location and its surrounding area is shown in Figure 47.

Field research as well as documents accounts from the MGD Geological Survey all indicate that Rio Minho Alluvia deposits are defined by varying proportions of Clay, Sand, Gravel and Pebble sized deposits which occur as interspersed lenses and/or extensive laminations underground. Field observations confirmed the presence of cobble stones within the channel of the river course, which may even be found towards the coast, as far as the mouth of the river system.

The area of focus is located within the South-central reaches of the wider Rio Minho Basin and in keeping with the depositional profile of the wider basin, is underlain by primarily Sandy to Gravelly deposits. Despite the absence of any estuary or tributary transecting the area, it is located approximately 6km southeast of a relic section of the Rio Minho course which was truncated subsequent to the 1986 Storm Event that overwhelmed the meander loop located within the quadrant defined by Easting 722250m – 722300m and Northing 630300m – 0630600m.

[3] Mines and Geology Division

Figure 47: Map showing the Geology of TSCL and its Surroundings



5.3.2 TOPOGRAPHY & DRAINAGE

The project site is situated on the Vere Plains in Clarendon and the landscape of the project site is characterised by flat land with a gentle slope to the south of the property. The elevation of the site is approximately 8 m – 10 m above sea-level. The Rio Minho is located approximately 2 km away from the centre of the property. A topographic map of the project area can be seen in Figure 48, while a cross-section through the property showing the associated elevation profile can be found in Figure 49.

It should be noted that there are earthen drains that carry water that were previously used by the old sugar factory and Clarendon Distillers Ltd (CDL). These drains, which will be further discussed in Section 5.5, run along the northern, eastern and western boundaries of the property to be developed and extend down to the sugarcane fields south of TSCL's property.

Figure 48: Topographic Map Showing TSCL Property

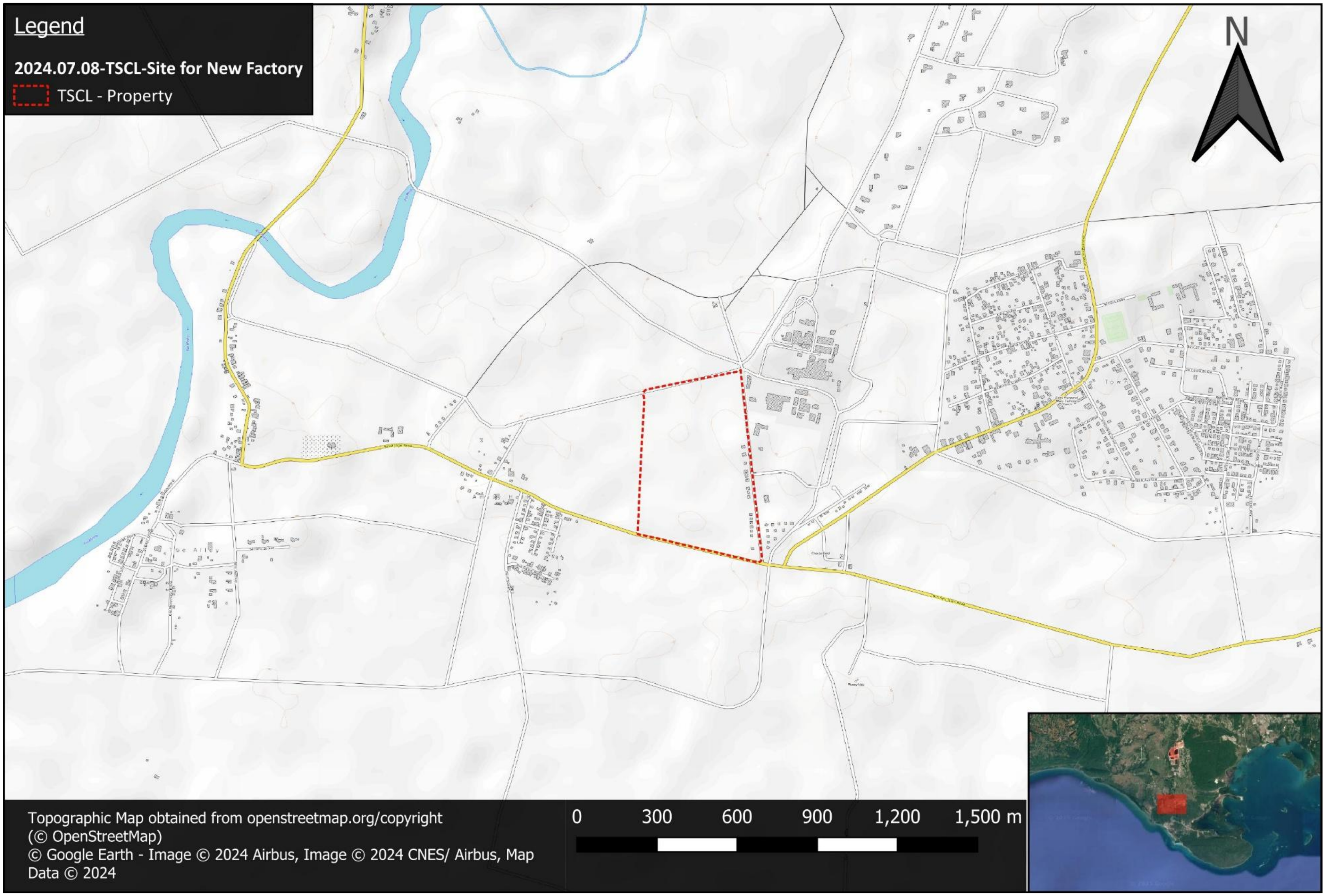
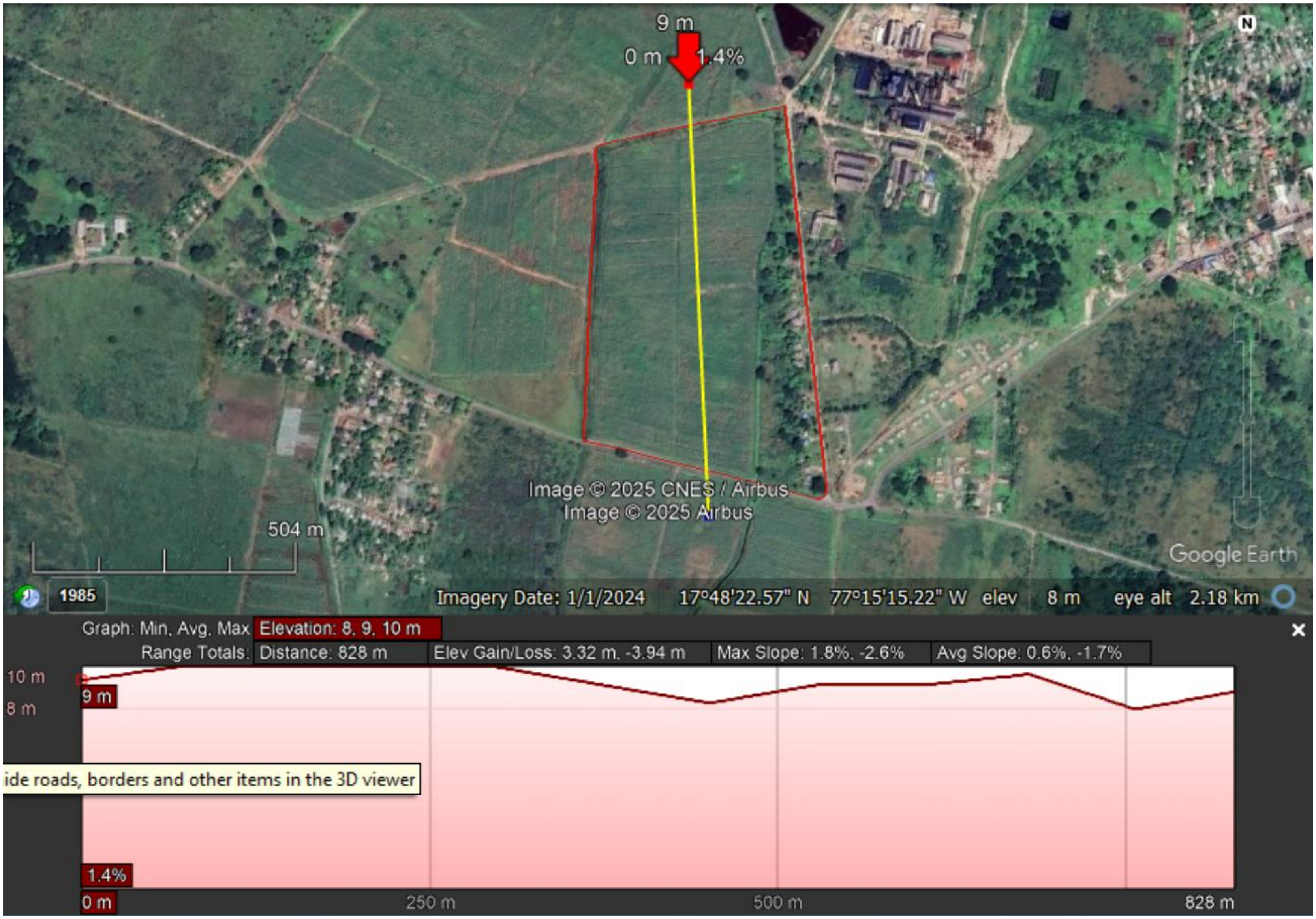


Figure 49: Google Earth Cross-Section & Elevation Profile of Project Site



5.3.3 SOILS

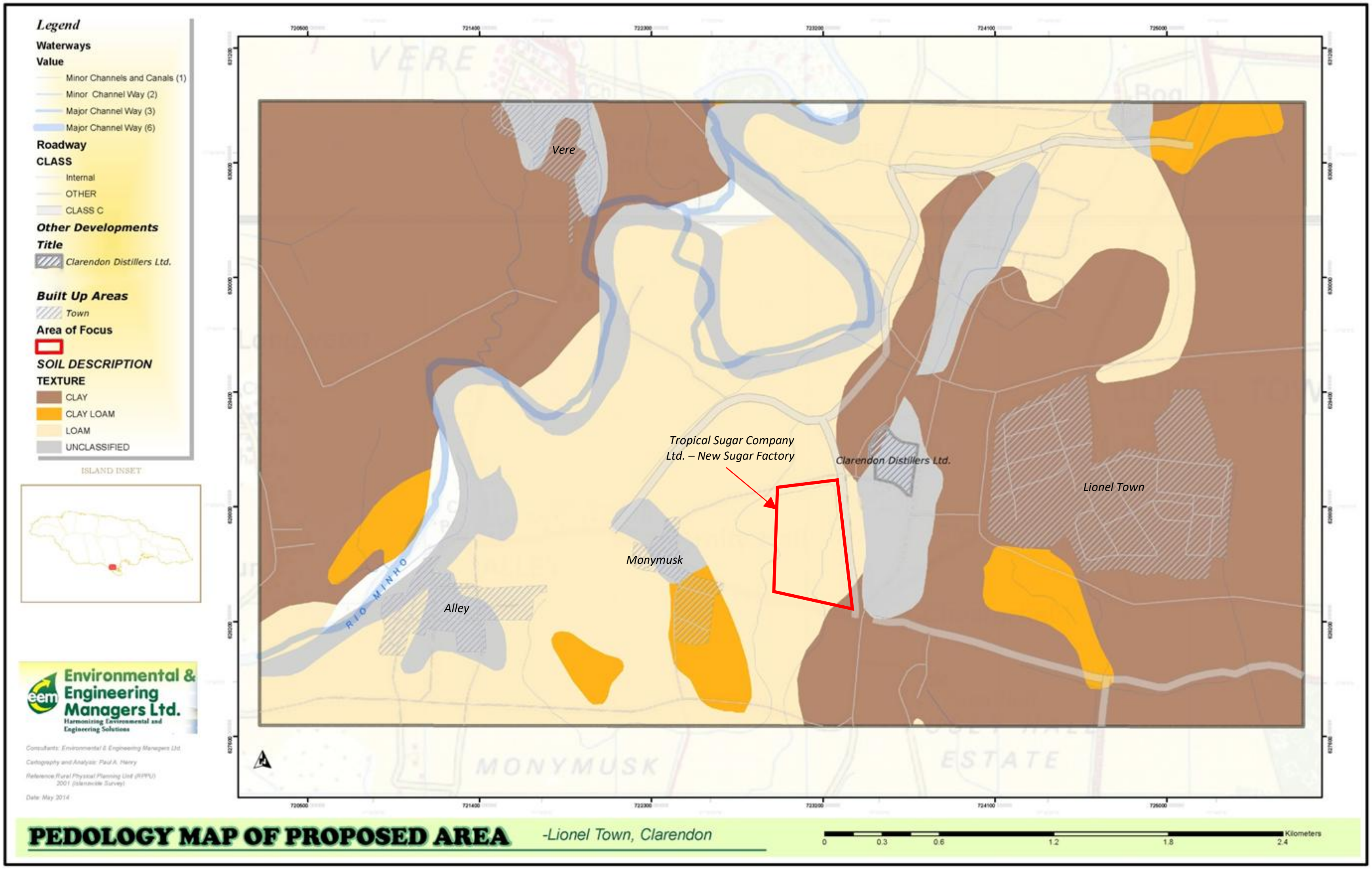
Soil coverage within this locality (as is common to all tropical soils) is a derivative of the wider environment and considers the biogenic (organic inter-relationships), hydrospheric (climatic and terrestrial water transmissivity) and lithological (rock and mineral derivation processes). However, for the engineering consideration of soils, this description of the pedology is primarily based on the geology of the area.

Within this context it should be noted that the area is entirely comprised of alluvial deposits which have been historically via erosion, transport and depositing cycles, created by various storm events.

As indicated in the section about the geology of the study area, the alluvial deposits consist of rock fragments which have been denuded and transported from the northern watersheds. The particle diameters outlined in the geology section, are deposited in a manner that results in clay to gravel sized particles existing in modal proportions, while pebble to cobble sized particles exist in minor proportions. This grading of particles is characteristic of Rio Minho Alluvial Plain, which is a highly developed drainage system, manifested by a 5^{th} order mainstream and a network of over 1,200km of channels (aggregate length of all channel ways).

As illustrated by Figure 50 there is an abundance of clay soil formations with lesser proportions of loams and sandy clays. The presence of three (3) soil units (derived by texture) bears geospatial significance when correlated to the morphometric regime of the Rio Minho River course. Here, the clay portions when laid were typically the last particles to "fall out" of the depositional water columns during storm events. As a result, the sandy type soils, which are heavier, are always located in isolated confines closer to the channel; loams which represent an equal mix of sandy, silty and clay soils closer to the course and the clays always furthest away owing to their characteristics to remain entrained for longer distance and time.

Figure 50: Map showing the Pedology of TSCL and its Surroundings



5.3.4 HYDROLOGY AND HYDROSTRATIGRAPHY

The hydrological significance of this area is highlighted by the hydrological regime of the wider Rio Minho Watershed/Basin which receives approximately 2,300 mm of rainfall annually, translating to a net surface runoff of 255×10^6 m^3. Closer to the vicinity of the TSCL factory location, the Rio Minho channel exists as an approximately 350m wide bed bound by banks ranging from 2m to 3m in height to create an approximate hydraulic radius of 700m^2 upon bank-full discharge. Further, the culmination of the floodplain's characteristics (alluvial in nature) and the system's propensity to transmit water underground, results in the Rio Minho delta being an alluvial aquifer, as seen in Figure 51. The base of this reservoir is defined by alluvial deposits at depths which have been compressed beyond their allowance to transmit water. This hydrological regime is confined by reference information compiled by the Water Resources Authority (WRA) in its hydrological profile of Jamaica.

The hydrostratigraphy map obtained from the WRA indicates that the project site is located in an alluvium aquifer with an alluvium aquiclude directly to the south of the property (Figure 52).

Analysis of groundwater data provided by the WRA indicates the presence of nine (9) wells within the frame of study. It was noted the compiled readings from these wells also included depth to water resource readings. Despite the provision of this information, there has been no clear derivation of the extent or orientation of the water table. This analysis therefore presents the groundwater data in an analytical framework to demonstrate the interpreted water table, reference to the land surface and baseline (Sea Level).

In doing so, the wells outlined in Table 15 were selected from a North-South transect taken as AA' along the western section of the frame of interest as seen in Figure 53.

Table 15: List of Wells Analysed to Plot Inferred Water Table

Name of Well	Land Surface Elevation (Above Sea Level)		Depth of Well (Below Land Surface)		Inferred Water Surface (Relative to Sea Level)	
	Feet (ft.)	Meters (m)	Feet (ft.)	Meters (m)	Feet (ft.)	Meters (m)
Gordon Store	51.9	17.0	80.0	24.3	-28.1	-7.3
Building #3	33.2	10.1	90.0	27.4	-56.8	-17.3
Church	31.2	9.4	100.0	30.4	-68.9	-21.0
Alley Market	30.3	9.2	128.0	38.9	-97.7	-29.7
Monymusk	23.8	7.2	101.0	30.7	-77.2	-23.5
AVERAGE	***34.1***	***10.6***	***99.8***	***30.3***	***-65.7***	***-19.7***

Figure 53 illustrates the plot of the inferred water table was derived from the well depth data which principally revealed an average depth of 30m below the surface and a general trend of the surface of the water table being generally parallel to the slope of the land surface. Data from the WRA database shows the direction of groundwater flows to the SSE toward the sea.

Figure 51: Map Showing the Hydrology of TSCL and its Surroundings

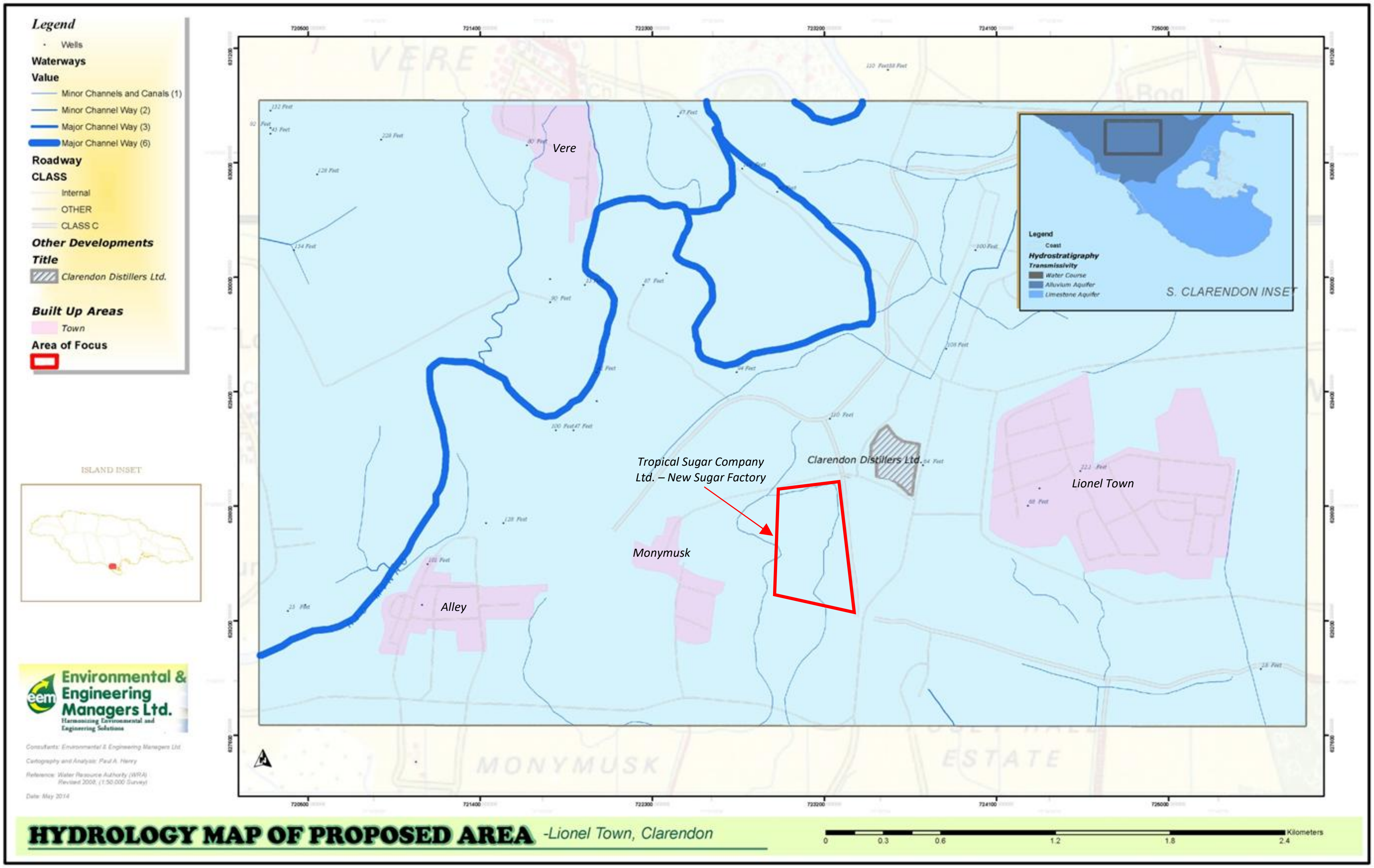


Figure 52: Map Showing the Hydrostratigraphy at the TSCL Project Site

Figure 53: Transect Taken Across Profile

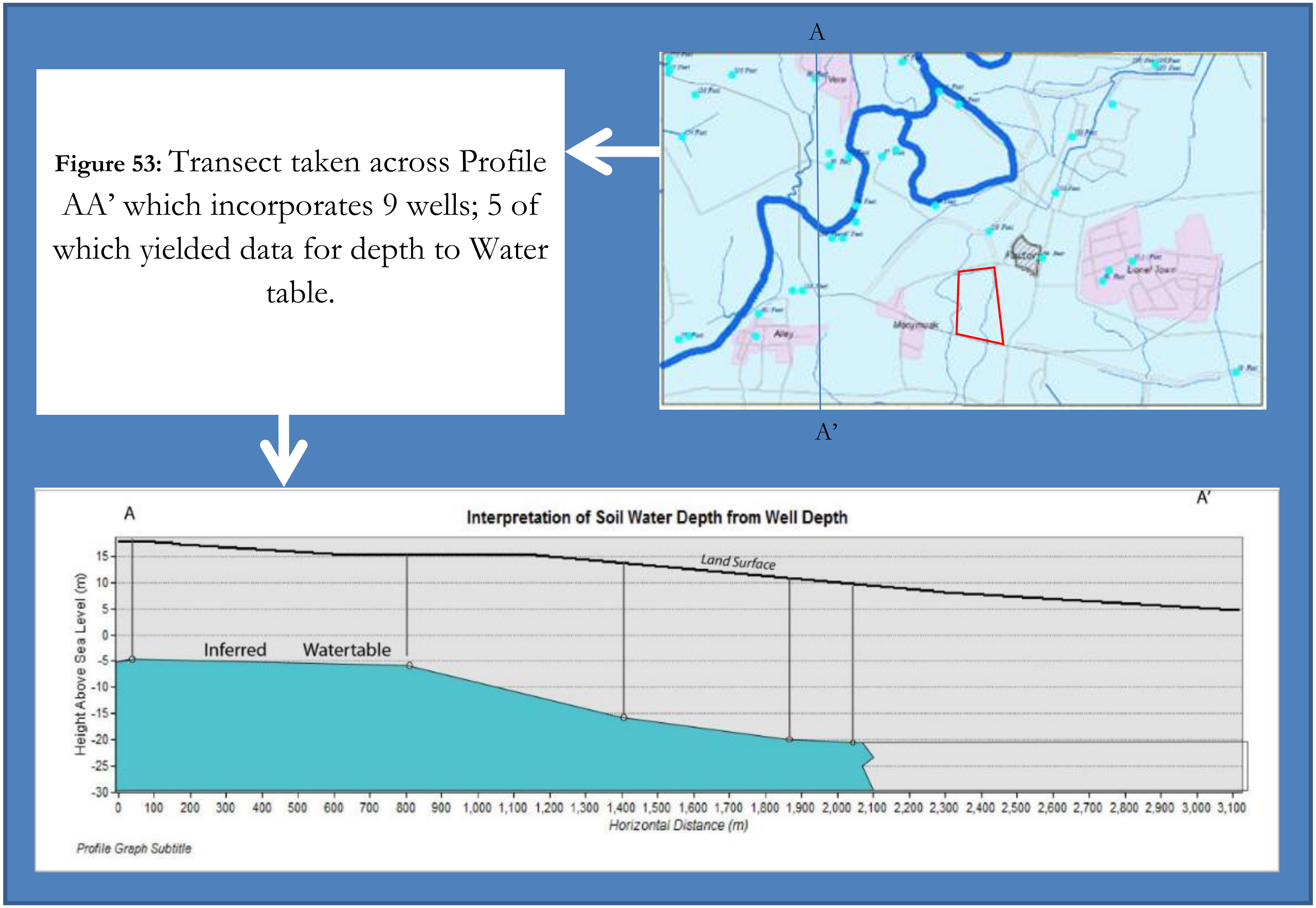


Figure 53: Transect taken across Profile AA’ which incorporates 9 wells; 5 of which yielded data for depth to Water table.

5.4 WATER QUALITY

Water quality refers to the physical, chemical, and biological characteristics of surface and groundwater within an area. Physical conditions include the water temperature and the presence of particulate matter. Chemical conditions include the presence and concentration of various chemicals such as dissolved salts, minerals and pollutants whereas the biological conditions encompass the presence and types of microorganisms, including bacteria, algae, and other organisms, which can affect its sustainability for different purposes.

To assess the quality of the surface and underground water resources in the area surrounding the proposed project site, TSCL received permission from Clarendon Distillers Limited (CDL), a neighbouring entity, to utilize data obtained from water quality analysis conducted as a part of their regulatory requirements. The 2024 data was obtained for three (3) wells and one (1) river, namely:

- Top (McLeod Well), Middle (Perrins Well) and Bottom (Greenwich 1 Well) (Figure 54).
- Three (3) monitoring points along the Rio Minho River, located west of TSCL and CDL and which flows in a south westerly direction from TSCL and CDL to the sea; Top, Middle and Bottom Surface (Figure 67 - Figure 73 and Figure 54).

Note: As of March 2019, only one well remains operational. In November 2018, all three wells contained water, however, by December 2018, the Bottom Well had dried up, followed by the Top Well in March 2019.

The ambient water quality at the monitoring locations, Top Surface, Middle Surface, Bottom Surface and Middle Well (Figure 54) were compiled and the average monthly values presented with the months highlighted in red being out of compliance with the "Draft Jamaica National Ambient Water Quality Standard – Freshwater, 2009". The Environmental Solutions Limited (ESL) Laboratory conducted the analyses and the water quality results for 2024 are presented in Table 16 – Table 19 and the corresponding Certificates of Analysis are available in Annex 6.

Figure 54: Map showing the Ambient Water Monitoring Locations

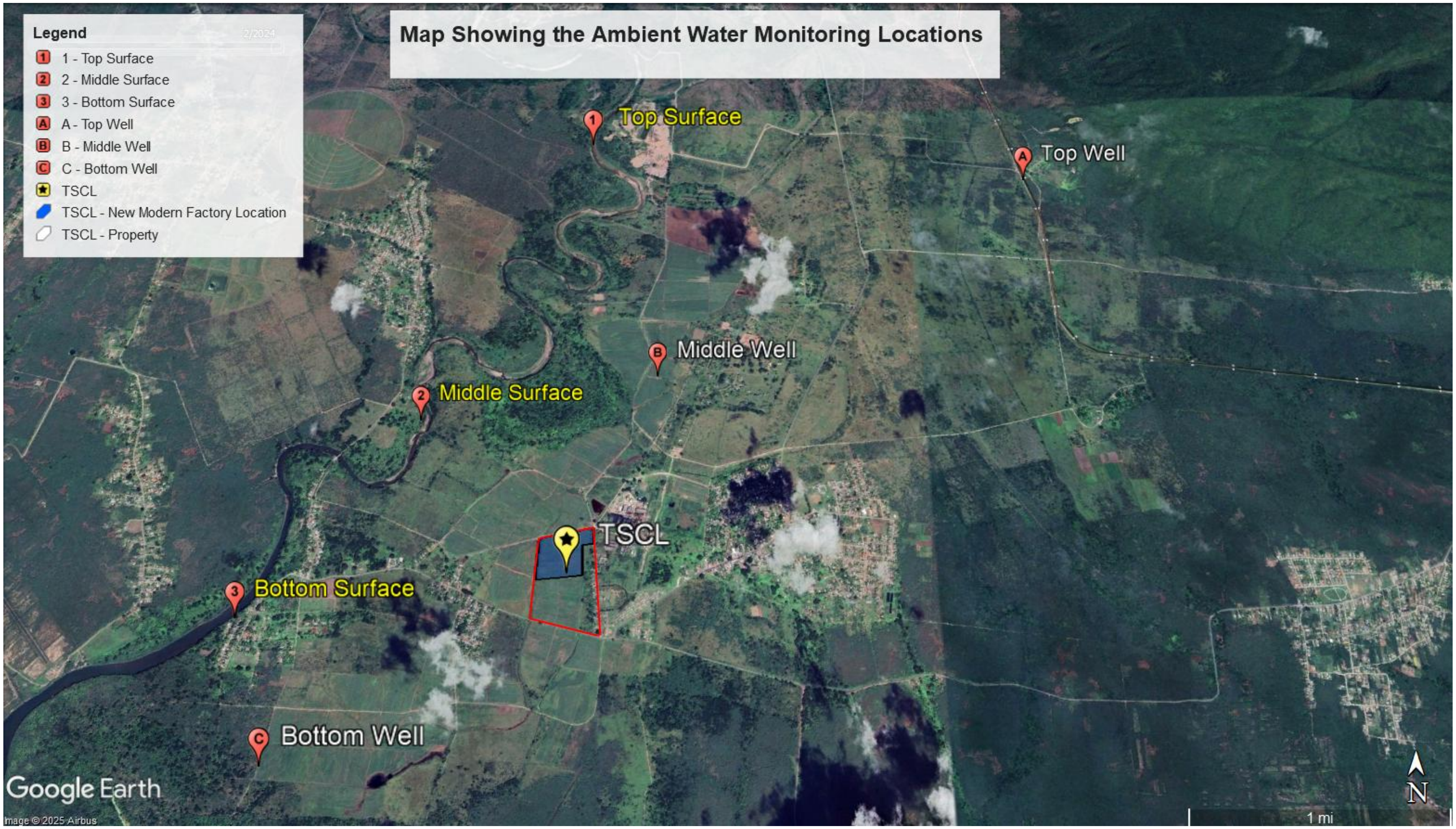


Table 16: Top Surface Water Quality (Sand Mine) 2024

Parameters	Method	NRCA AMBIENT WATER STANDARD	January	February	March	April	May	June	July	August	September	October	November	December
Total Dissolved Solids (mg/L)	DR	120-300	259.00	244.00	284.00	261.00	142.00	187.00	274.00	298.00	161.00	272.00	-	304.00
Chemical Oxygen Demand (mg/L)	H-8000	-	21.00	10.00	<3	12.00	14.00	14.00	11.00	15.00	56.00	23.00	-	12.00
Biochemical Oxygen Demand (mg/L)	H-8043	0.8 - 1.7	1.60	2.80	1.50	3.40	2.30	4.60	5.40	2.30	3.40	4.90	-	0.70
Total Suspended Solids (mg/L)	SM-2540D	-	3.90	2.10	4.20	2.60	8.00	4.40	3.70	14.40	66.00	13.70	-	18.00
Nitrates (mg/L)	H-8039	0.1-7.5	4.80	<1.3	1.30	5.70	0.90	<1.30	2.20	1.30	<1.30	<1.30	-	<1.3
Nitrate as Nitrogen (mg/L)	H-8039		1.10	<0.3	0.30	1.30	0.20	<0.30	0.50	0.30	<0.30	<0.30	-	<0.3
Phosphate (mg/L)	H-8048	0.01 - 0.8	0.04	<0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.31	0.22	-	0.12
Chloride (mg/L)	H-8206	5.0 -20.0	40.10	40.00	56.40	40.3	18.30	25.90	16.70	29.70	8.20	12.00	-	16.90
Sulphate (mg/L)	H-8051	3.0-10.0	25.00	31.00	28.00	23	26.00	23.00	21.00	27.00	14.00	20.00	-	19.00
Potassium(mg/L)	FAAS	0.74 - 5.0	1,229.00	1.093	1.012	1.969	1.598	1.976	2.39	2.442	2.697	2.30	-	1.002
Oil & Grease(mg/L)	SM-5520 B	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	-	<5.0

Table 17: Middle Surface Water Quality 2024

Parameters	Method	NRCA AMBIENT WATER STANDARD	January	February	March	April	May	June	July	August	September	October	November	December
Total Dissolved Solids (mg/L)	DR	120-300	22,900.00	29,100.00	24,500.00	28,800.00	30,100.00	30,600.00	3,393.00	5,040.00	192.00	364.00	224.00	368.00
Chemical Oxygen Demand (mg/L)	H-8000	-	20.00	105.00	85.00	65.00	15.00	30.00	16.00	36.00	40.00	13.00	9.00	150.00
Biochemical Oxygen Demand (mg/L)	H-8043	0.8 - 1.7	2.30	2.30	9.30	1.20	1.20	1.50	2.60	2.20	3.40	2.70	7.80	2.40
Total Suspended Solids (mg/L)	SM-2540D	-	12.90	15.80	7.60	11.20	5.60	14.00	4.00	5.50	124.00	10.1	87.70	14.00
Nitrates (mg/L)	H-8039	0.1-7.5	6.60	10.10	8.80	7.50	10.60	10.10	22.70	41.20	<1.30	<1.30	<1.30	<1.30
Nitrate as Nitrogen (mg/L)	H-8039		1.50	2.30	2.00	1.70	2.40	2.30	5.10	9.40	<0.30	<0.30	<0.30	<0.30
Phosphate (mg/L)	H-8048	0.01 - 0.8	0.04	<0.02	<0.02	0.02	0.02	0.02	0.03	0.05	0.25	0.27	0.32	0.13
Chloride (mg/L)	H-8206	5.0 -20.0	11,600.00	16,400.00	13,800.00	16,080.00	15,100.00	18,100.00	1,456.00	2,180.00	21.40	47.40	11.00	38.10
Sulphate (mg/L)	H-8051	3.0-10.0	1,200.00	2,425.00	2,350.00	2,000.00	2,550.00	2,350.00	220.00	350.00	11.00	29.00	12.00	26.00
Potassium(mg/L)	FAAS	0.74 - 5.0	236.086	337.861	262.004	277.977	311.448	327.684	28.097	39.077	2.26	2.819	2.27	1.526
Oil & Grease(mg/L)	SM-5520 B	-	<5	<5	<5	<5	<5	<5	8.40	11.10	12.20	<5.0	<5.0	<5.0

Table 18: Bottom Surface Water Quality 2024

Parameters	Method	NRCA AMBIENT WATER STANDARD	January	February	March	April	May	June	July	August	September	October	November	December
Total Dissolved Solids (mg/L)	DR	120-300	30,400.00	32,600.00	32,800.00	34,300.00	34,600.00	34,400.00	18,980.00	15,820.00	279.00	4,660.00	-	4,220.00
Chemical Oxygen Demand (mg/L)	H-8000	-	80.00	135.00	270.00	90.00	165.00	85.00	30.00	60.00	59.00	20.00	-	115.00
Biochemical Oxygen Demand (mg/L)	H-8043	0.8 - 1.7	1.60	2.40	13.30	2.10	6.50	1.50	4.30	1.80	2.10	3.10	-	1.00
Total Suspended Solids (mg/L)	SM-2540D	-	8.10	17.80	8.10	7.50	8.40	7.50	8.90	7.00	35.10	18.70	-	9.60
Nitrates (mg/L)	H-8039	0.1-7.5	8.40	13.60	10.10	10.60	11.40	10.60	9.20	1.30	<1.30	7.50	-	34.40
Nitrate as Nitrogen (mg/L)	H-8039		1.90	3.10	2.30	2.40	2.60	2.40	2.10	0.30	<0.30	1.70	-	7.80
Phosphate (mg/L)	H-8048	0.01 - 0.8	0.03	0.02	0.02	0.02	0.13	<0.02	0.02	0.03	0.34	0.24	-	0.11
Chloride (mg/L)	H-8206	5.0 -20.0	16,200.00	18,500.00	18,600.00	15,760.00	17,200.00	18,600.00	9,280.00	7,840.00	55.60	2,360.00	-	1,840.00
Sulphate (mg/L)	H-8051	3.0-10.0	1,600.00	2,650.00	3,200.00	2,800.00	2,950.00	2,600.00	1,440.00	1,050.00	18.00	320.00	-	290.00
Potassium(mg/L)	FAAS	0.74 - 5.0	337.715	389.315	381.979	393.368	364.525	388.54	198.158	141.352	2.943	202.55	-	40.89
Oil & Grease(mg/L)	SM-5520 B	-	<5	7.50	<5	<5	<5	<5	7.40	10.20	<5	5.70	-	<5.0

Table 19: Middle Well 2024

Parameters	Method	NRCA AMBIENT WATER STANDARD	January	February	March	April	May	June	July	August	September	October	November	December
Total Dissolved Solids (mg/L)	DR	120-300	1,252.00	1,233.00	1,246.00	1,244.00	1,233.00	1,229.00	1,207.00	1,216.00	1,234.00	1,244.00	1,327.00	1,238.00
Chemical Oxygen Demand (mg/L)	H-8000	-	15.00	14.00	<3	7.00	11.00	6.00	8.00	8.00	11.00	43.00	-	10.00
Biochemical Oxygen Demand (mg/L)	H-8043	0.8 - 1.7	0.50	0.60	0.90	1.10	1.00	1.20	2.20	1.80	4.80	1.20	0.60	1.20
Total Suspended Solids (mg/L)	SM-2540D	-	<1.60	2.00	2.40	1.70	<1.60	<1.60	3.30	<1.6	2.70	<1.6	-	2.80
Nitrates (mg/L)	H-8039	0.1-7.5	9.70	7.70	10.10	17.50	10.10	7.40	7.70	8.30	8.50	7.20	4.40	8.60
Nitrate as Nitrogen (mg/L)	H-8039		2.20	1.80	2.30	4.00	2.30	1.70	1.70	1.90	1.90	1.60	1.00	1.90
Phosphate (mg/L)	H-8048	0.01 - 0.8	0.12	0.12	0.10	0.13	0.13	0.11	0.13	0.14	0.12	0.14	-	0.13
Chloride (mg/L)	H-8206	5.0 -20.0	356.00	348.00	408.00	438.00	260.00	285.00	337.00	286.00	318.00	328.00	416.00	328.00
Sulphate (mg/L)	H-8051	3.0-10.0	73.00	68.00	84.00	80.00	90.00	75.00	94.00	70.00	88.00	83.00	75.00	55.00
Potassium(mg/L)	FAAS	0.74 - 5.0	4.144	4.299	4.17	4.042	3.847	4.396	3.654	3.728	3.878	0.809	3.23	3.673
Oil & Grease(mg/L)	SM-5520 B	-	<5	<5	<5	<5	<5	<5	<5	<5	6.00	5.20	-	<5.0

5.4.1 TOTAL DISSOLVED SOLIDS

The results for Total Dissolved Solids (TDS) were within the standard at Top Surface for the year 2024 except for December. December recorded an average concentration of 304 mg/L exceeding the limit by 4mg/L. All results exceeded the standard for Middle Well for the year (Figure 55). All results exceeded the standard at Middle and Bottom Surface for the year 2024 except for September and November at Middle Surface and September at Bottom Surface. There was no result for the month of November 2024 (Figure 56).

Table 16, Table 17, Table 18 and Table 19 show the TDS averages recorded for Top, Middle, Bottom Surface and Middle Well for the months of 2024 respectively.

Figure 55: Total Dissolved Solids for Top Surface and Middle Well 2024

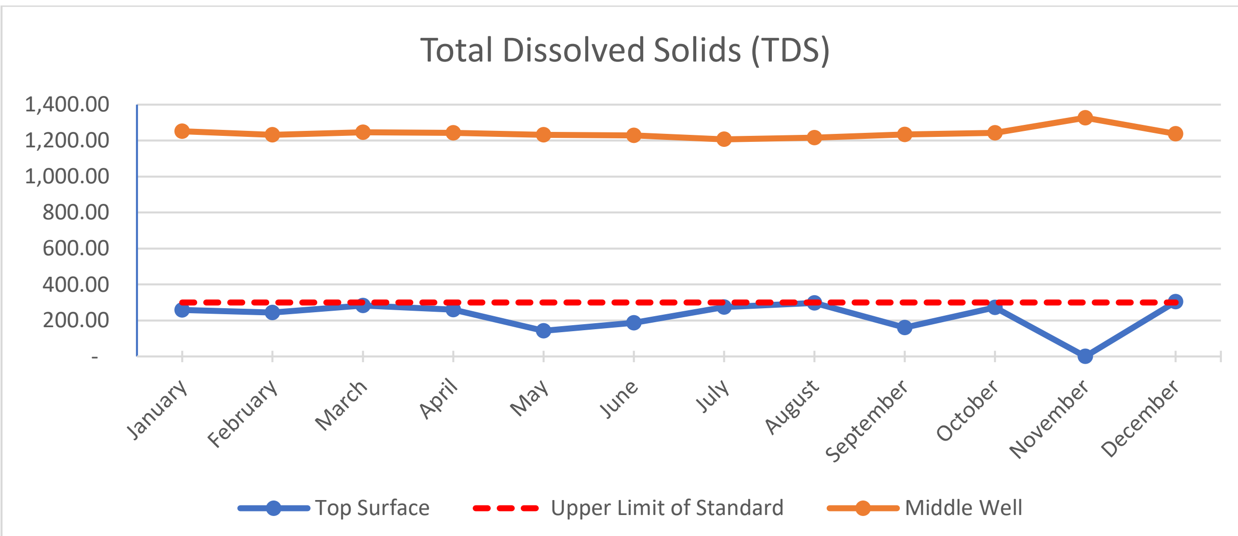
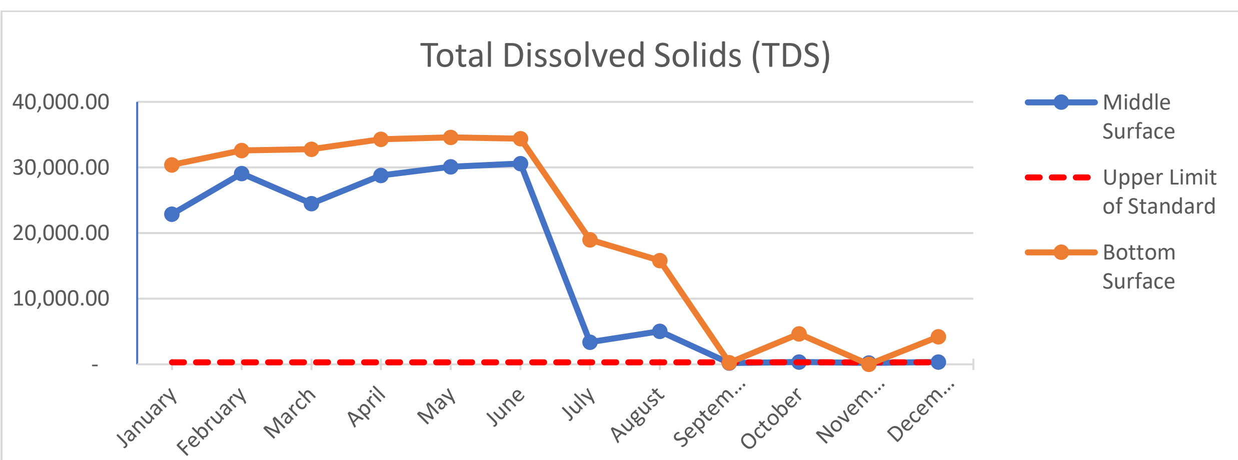


Figure 56: Total Dissolved Solids for Middle and Bottom Surface 2024



5.4.2 BIOCHEMICAL OXYGEN DEMAND

All results for Biochemical Oxygen Demand (BOD) exceeded the standard at Top Surface for the year 2024 with the exception for January and March. BOD was withing the standard for 6 months (March, April, May, June, October and December) at Middle Well (Figure 57). All results for BOD exceeded the standard at Middle Surface except for the second quarter (April, May and June). Only 3 months (January, June and December) for the year of 2024 were within the standard at Bottom Surface (Figure 58). Table 16, Table 17, Table 18 and Table 19 show the Chemical Oxygen Demand averages recorded for Top, Middle, Bottom Surface and Middle Well for the months of 2024 respectively.

Figure 57: Biochemical Oxygen Demand for Top Surface and Middle Well 2024

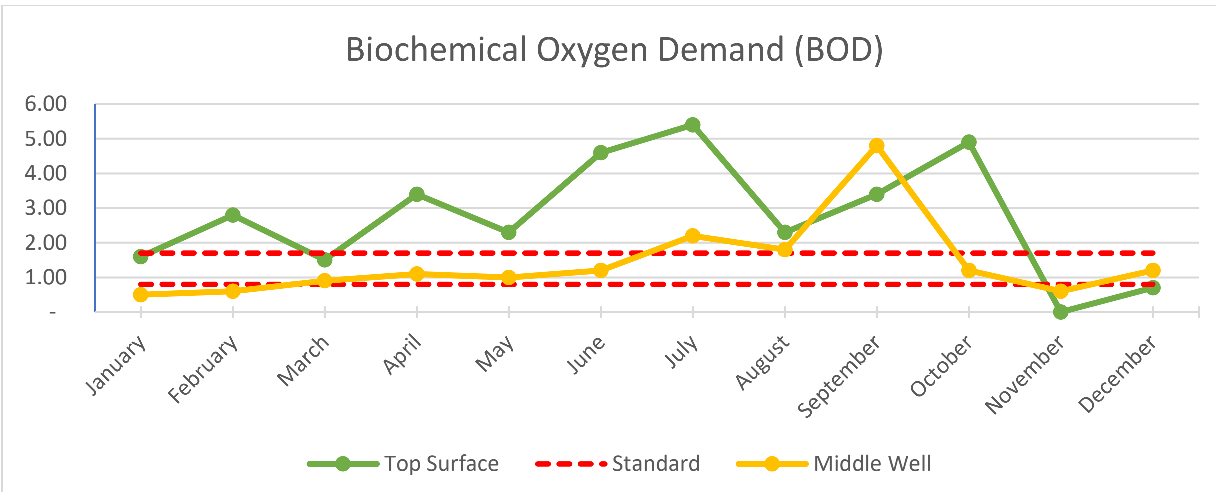
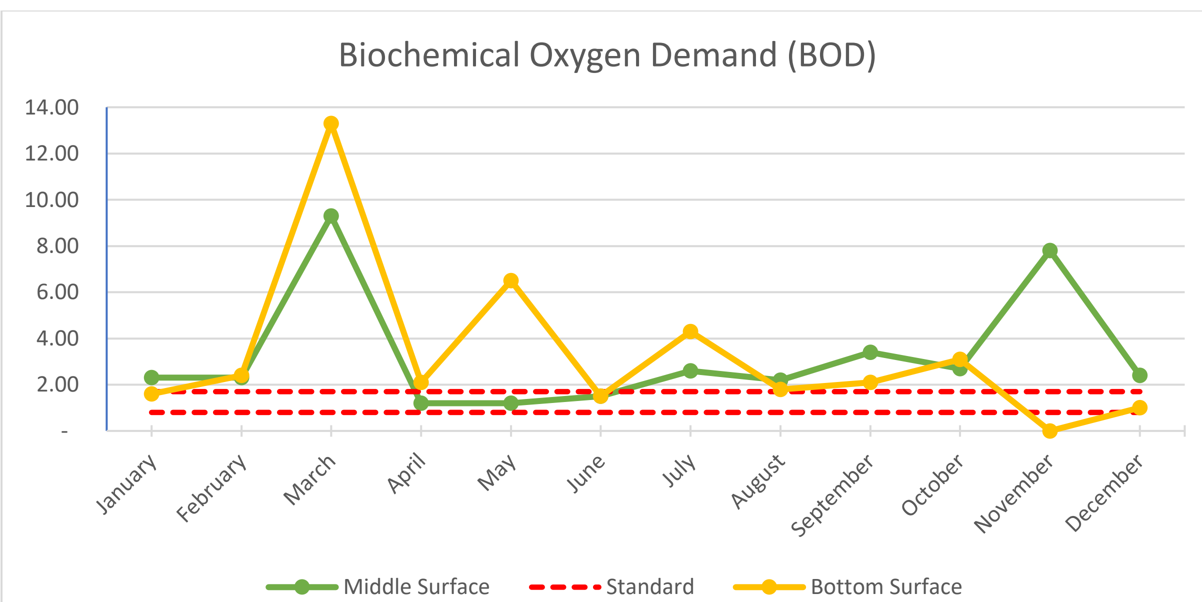


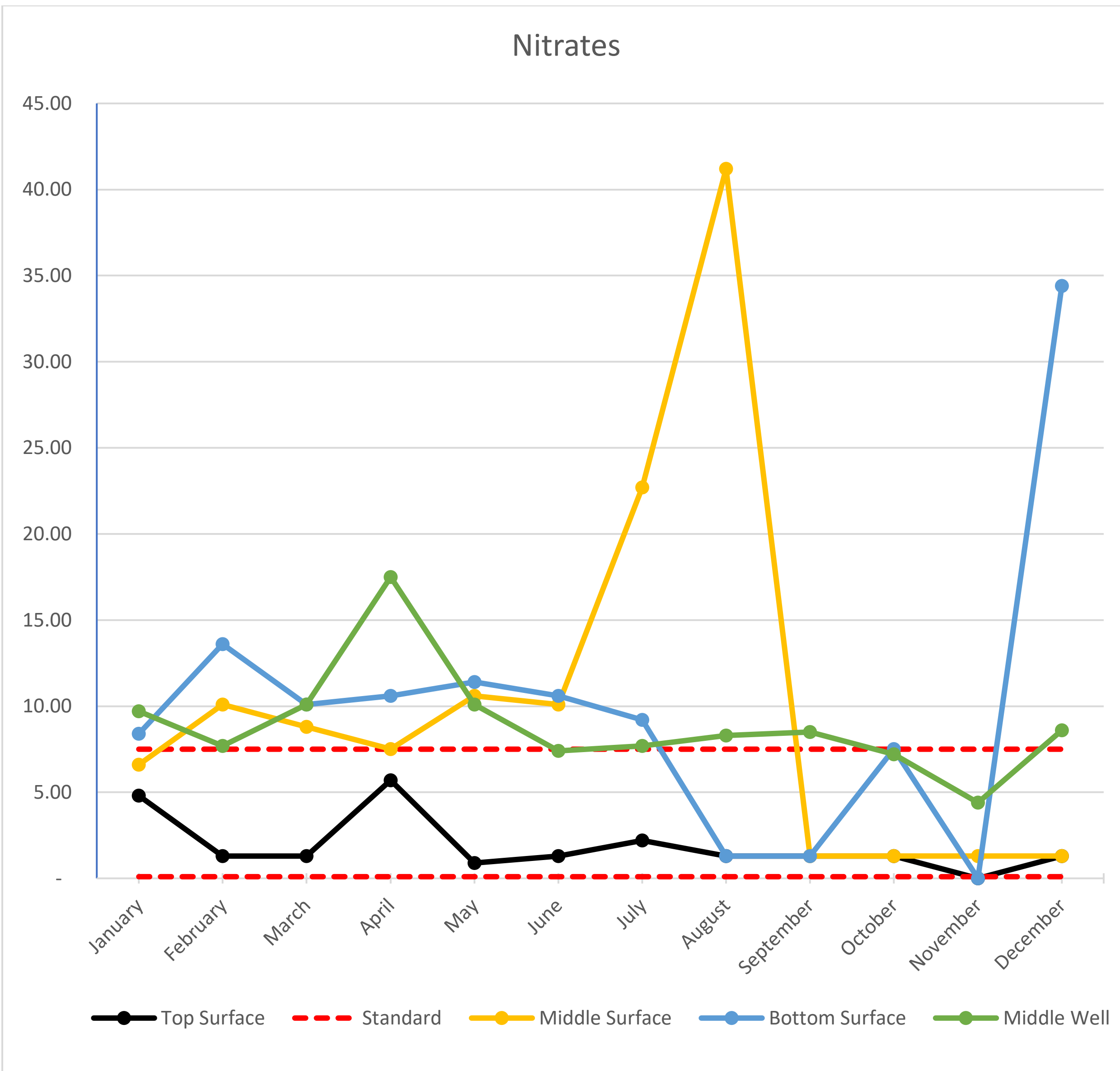
Figure 58: Biochemical Oxygen Demand for Middle and Bottom Surface 2024



5.4.3 NITRATES

All results for Nitrates at Top Surface for the year 2024 were within the standard. For the Middle Surface, results for 6 months exceeded the standard (February, March, May, June, July and August while results for 3 months (August, September and October) at Bottom Surface were within the standard. Nitrates for 3 months (June, October and November) were within the standard at Middle Well (Figure 59). Table 16, Table 17, Table 18 and Table 19 show the Nitrate averages recorded for Top, Middle, Bottom Surface and Middle Well for the months of 2024 respectively.

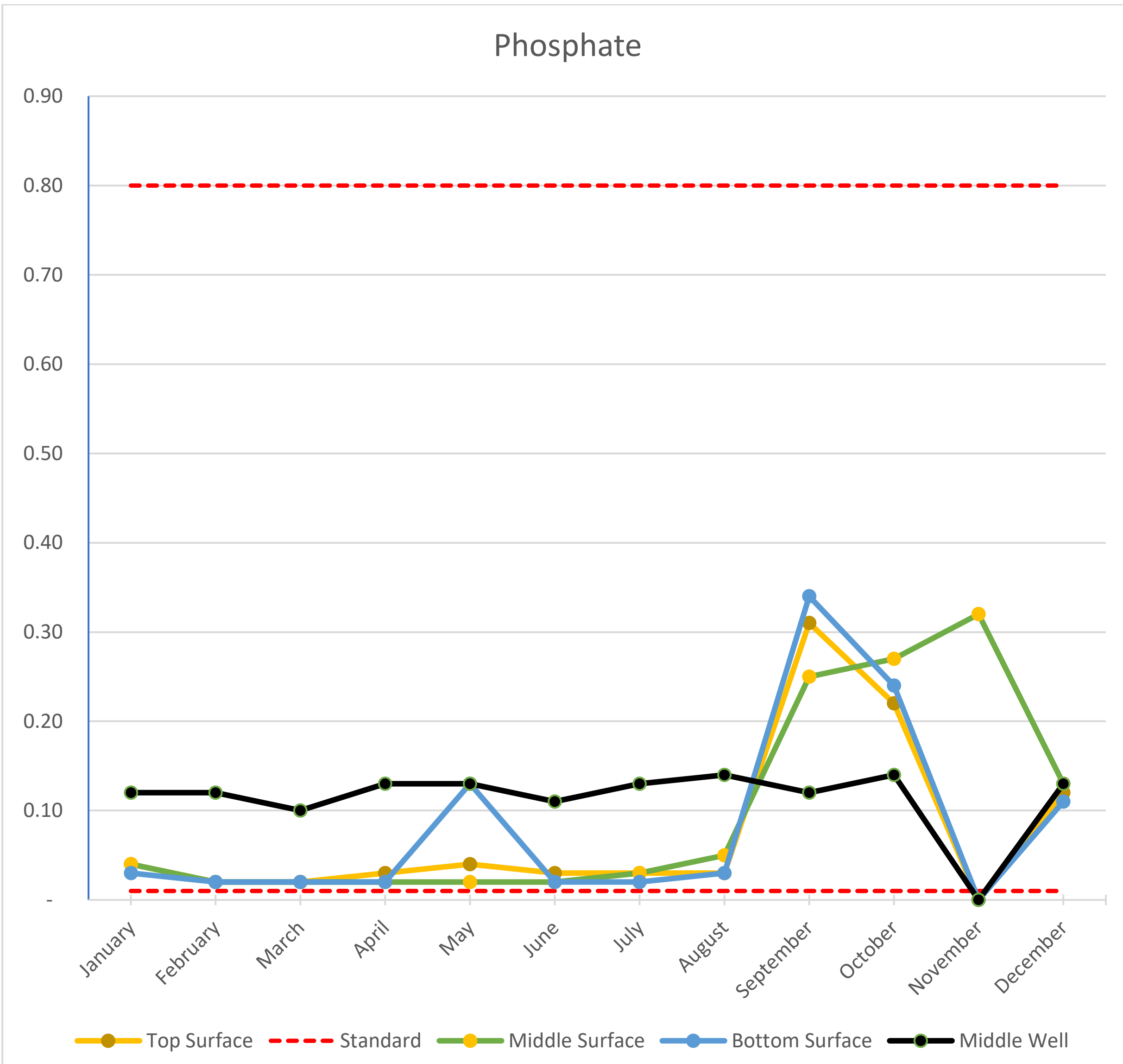
Figure 59: Nitrates for Top, Middle and Bottom Surface 2024



5.4.4 PHOSPHATES

All results for Phosphates were within the standard for Top, Middle and Bottom Surface and Middle Well for the year 2024 (Figure 60). Table 16, Table 17, Table 18 and Table 19 show the average results for Phosphate for Top, Middle, Bottom Surface and Middle Well for the year 2024 respectively.

Figure 60: Phosphate for Top, Middle & Bottom Surface and Middle Well 2024



5.4.5 CHLORIDES

Results for 5 months (May, July, September, October and December) were within the standard at Top Surface for the year 2024. No result was collected for the month of November (Figure 61). Only 1 month (November) for 2024 was within the standard at Middle Surface. All results exceeded the standard at Bottom Surface and Middle Well for 2024 (Figure 62). Table 16, Table 17, Table 18 and Table 19 show the average results for Chloride for Top, Middle, Bottom Surface and Middle Well for the year 2024 respectively.

Figure 61: Chloride for Top Surface 2024

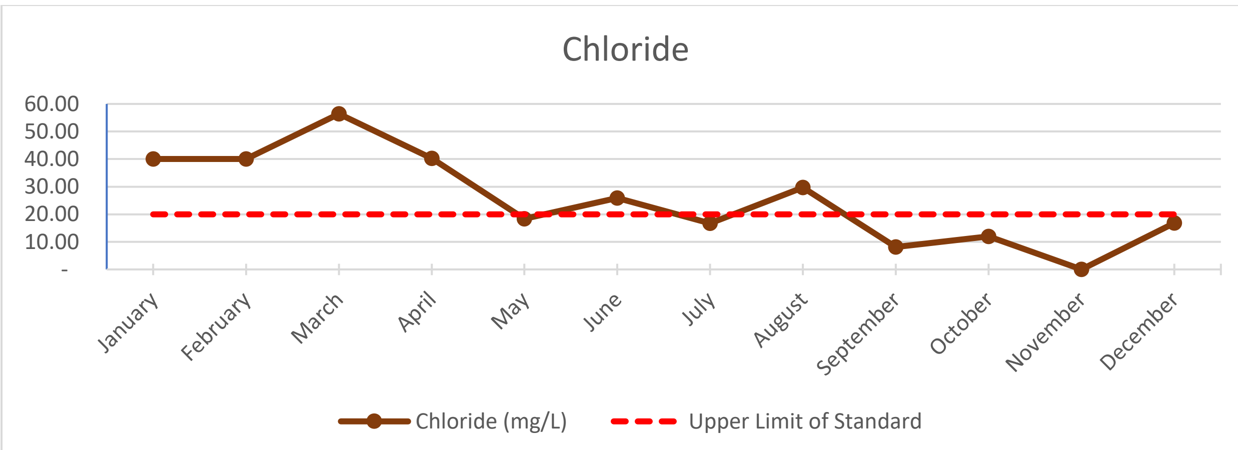
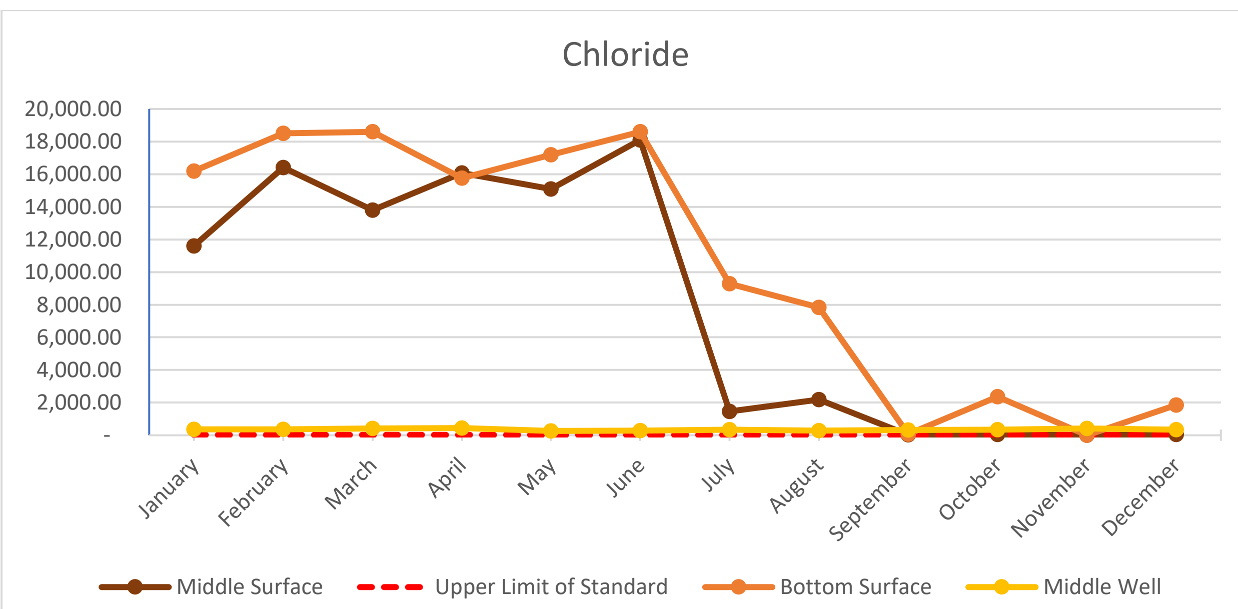


Figure 62: Chloride for Middle, Bottom Surface and Bottom Well 2024



5.4.6 SULPHATES

All results for Sulphates exceeded the standard for Top, Middle, Bottom Surface and Middle Well (Figure 63 and Figure 64) for the year 2024. No result was recorded for the month of November for Top and Bottom Surface. Table 16, Table 17, Table 18, and Table 19 show the average monthly results for Top, Middle, Bottom Surface, Middle Well and Middle Well for the year 2024 respectively.

Figure 63: Sulphate for Top Surface and Middle Well 2024

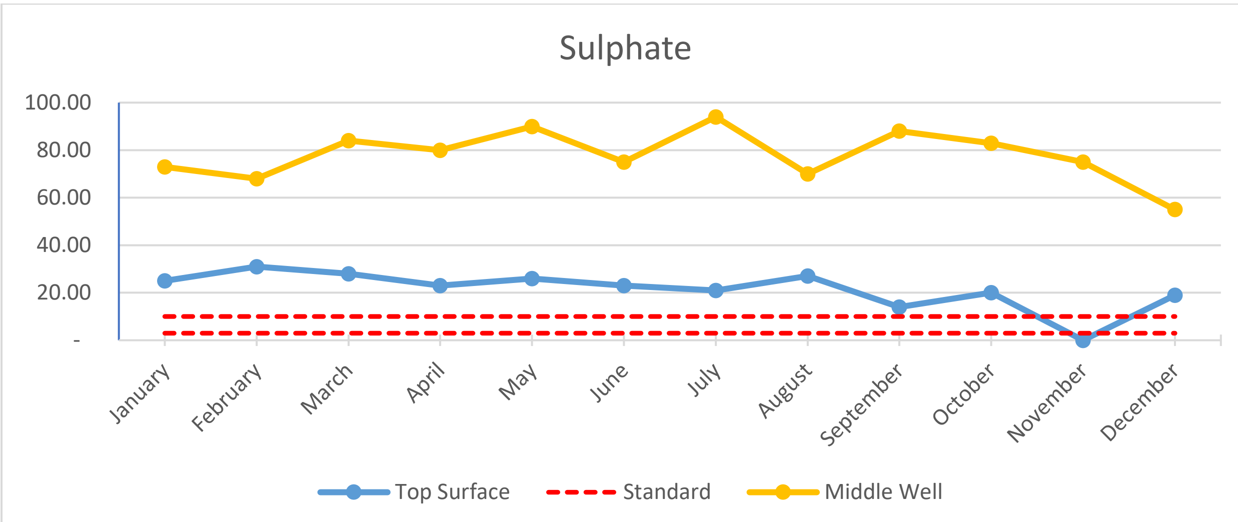
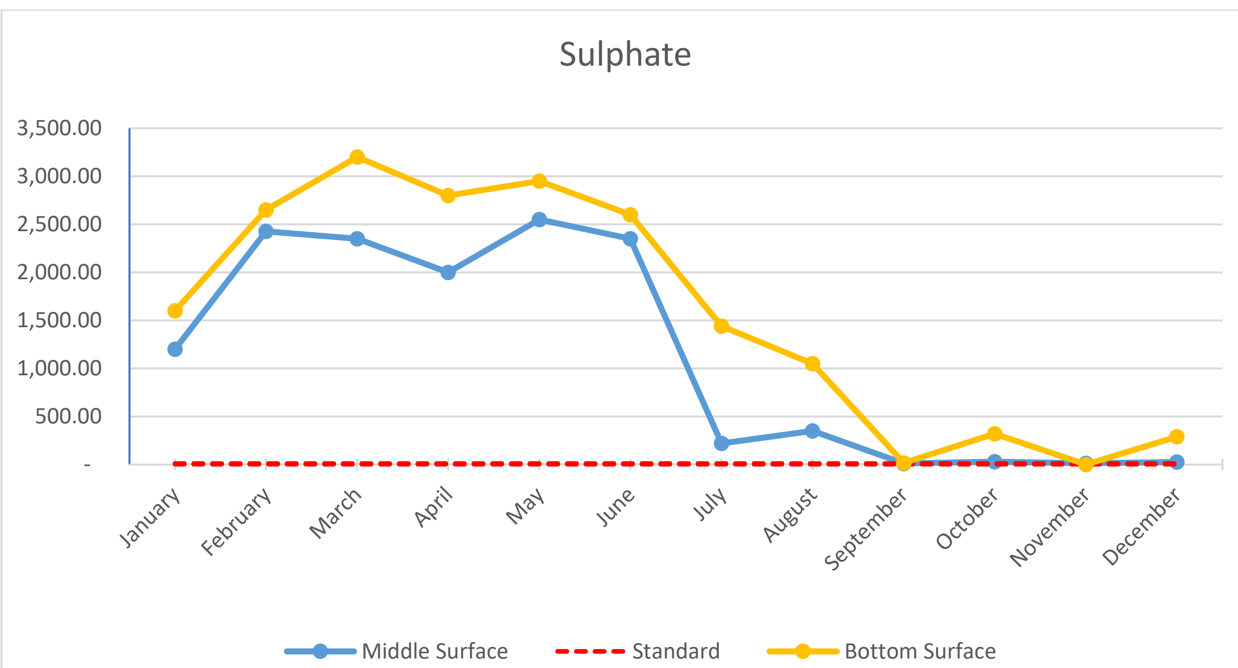


Figure 64: Sulphate for Middle and Bottom Surface 2024



5.4.7 POTASSIUM

All results for Potassium were within the standard for Top Surface for the year 2024 except for January. January recorded an average of 1229mg/L exceeding the NRCA ambient water quality by 1,224mg/L. Only 4 months (September, October, November and December) were within the standard at Middle Surface while only 1 month (September) was within the standard for Bottom Surface (Figure 65). All results were within the standard for Middle Well (Figure 66). No result was recorded for the month of November for Top and Middle Surface for the year. Table 16, Table 17, Table 18, and Table 19 show the average Potassium results for Top, Middle, Bottom Surface and Middle Well for the year 2024.

Figure 65: Potassium for Top, Middle and Bottom Surface 2024

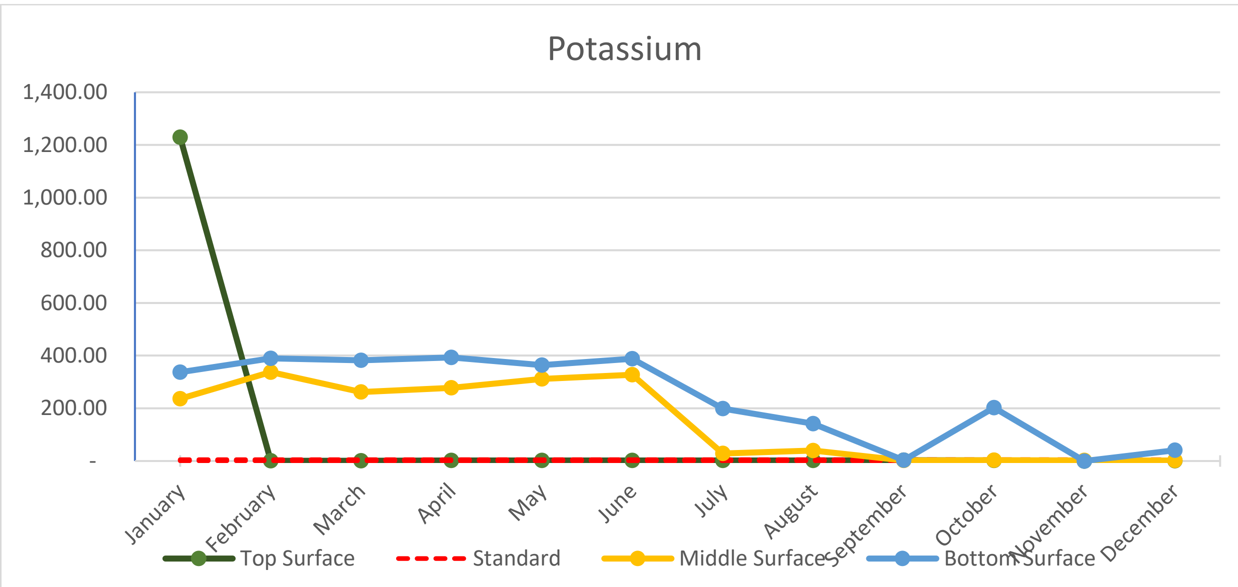


Figure 66: Potassium for Middle Well 2024

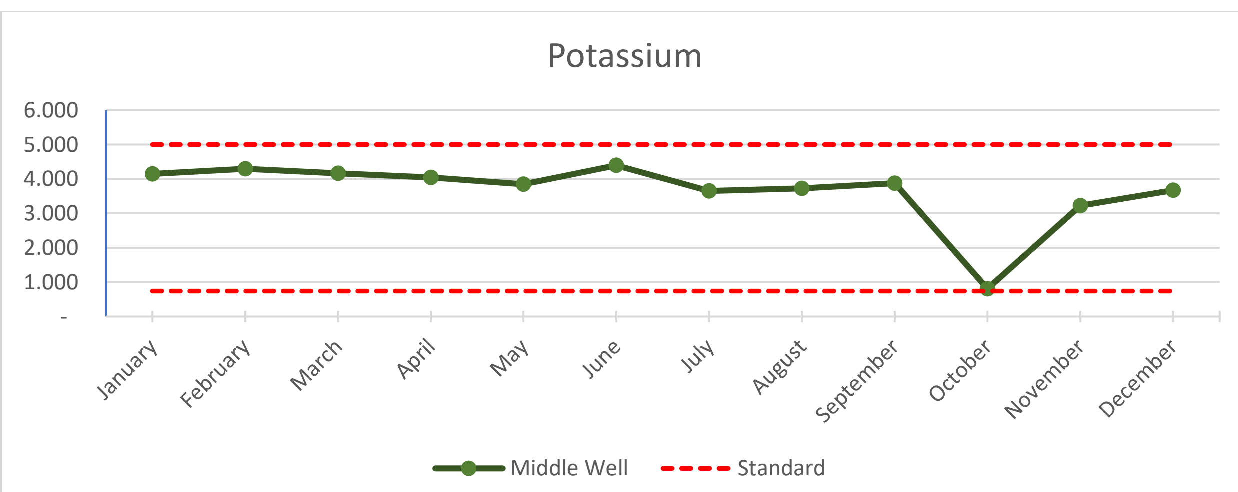


Figure 67: Top Surface (1 of 2) - Picture taken April 16, 2025

Source: EEM April 2025

Figure 68: Top Surface (2 of 2) - Picture taken April 16, 2025

Source: EEM April 2025

Figure 69: Middle Surface (1 of 3) - Picture taken February 25, 2022

Source: EEM February 2022

Figure 70: Middle Surface (2 of 3) - Picture taken February 25, 2022

Source: EEM February 2022

Figure 71: Middle Surface (3 of 3) - Picture taken February 25, 2022

Source: EEM February 2022

Figure 72: Bottom Surface (1 of 2) - Picture taken April 16, 2025

Source: EEM April 2025

Figure 73: Bottom Surface (2 of 2) - Picture taken April 16, 2025

Source: EEM April 2025

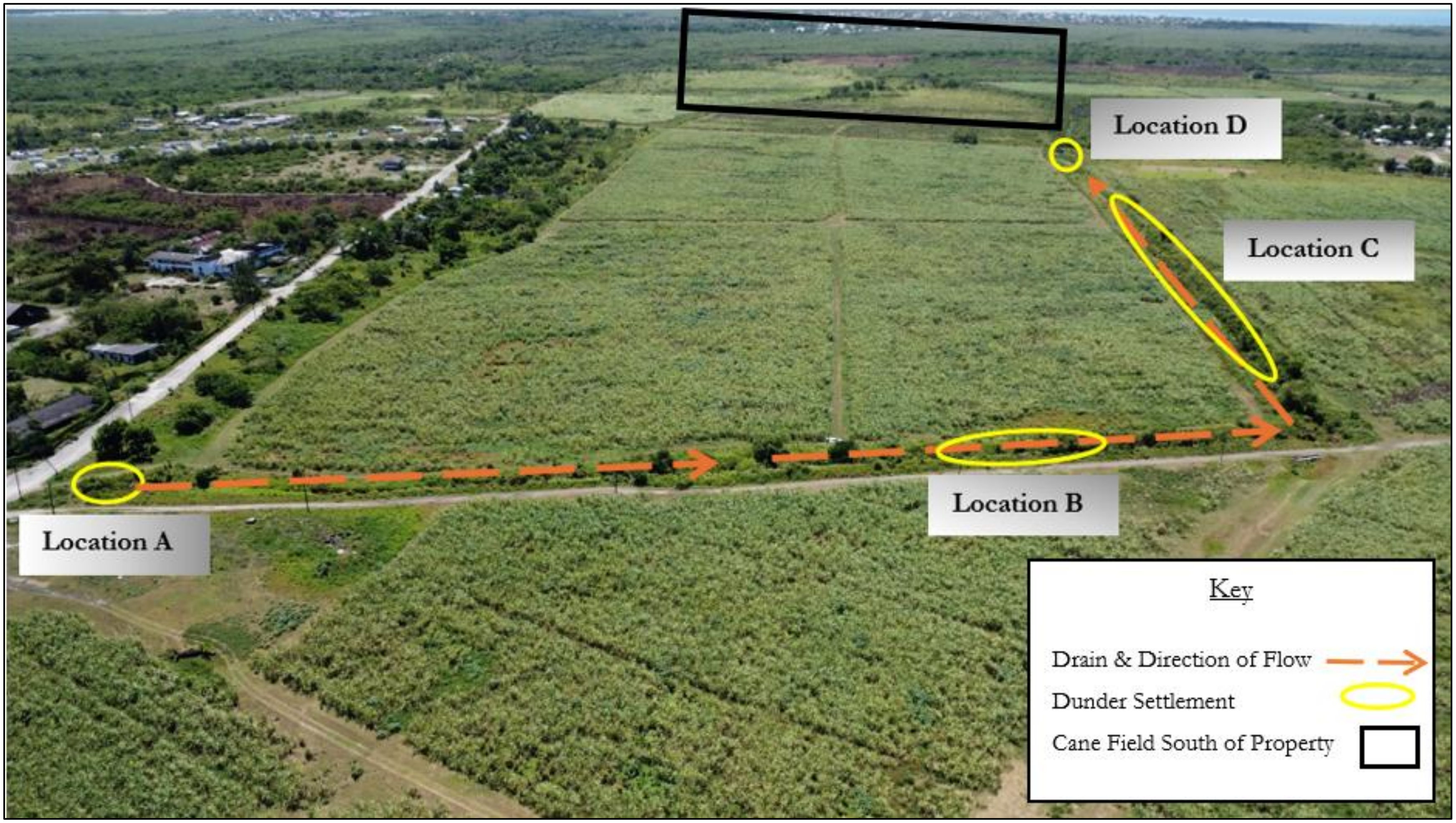
5.5 POLLUTION

During the visit to the site, a strong, unpleasant and foul odour was detected. The odour, particularly concentrated at the western section of the property (location C -D in Figure 74), poses not only a nuisance but also a potential risk to community health. A detailed investigation was subsequently conducted to determine the source of this pollution. The investigation revealed dunder or diluted dunder mixed with rainwater, visible at several locations on the property, specifically in the earthen drain that runs along the perimeter of the property (Figure 74). The dunder had settled at specific points due to the uneven gradient in the earthen drain along the perimeter of the property. Several photographs taken on an April 16, 2025 site visit document the extent and distribution of the pollution (Figure 74 - Figure 81). These images clearly show the accumulation/pooling of dunder in the earthen drain.

Figure 80 shows a hydrant used for the distribution of dunder to the cane fields for fertigation, in the middle of the field on the western end of the property surrounded by a pool of stagnated dunder. This was confirmed with CDL as the source of the pollution. It should be noted that the site proposed for the sugar factory is a cane field in an area called Chesterfield previously fertigated with dunder from CDL. Fertigation of these fields have reportedly ceased for some time. CDL has taken steps to address the situation and clean up the area.

While the full extent of the contamination has not be ascertained, it is suspected from the aerial photographs taken that the dunder may have also entered the earthen drain surrounding the perimeter of the cane field in the plot directly south of the proposed development site in an area called Greenwich (Figure 74).

Figure 74: Image showing Locations where Dunder was observed



Source: EEM April 2025

Figure 75: Location A

Source: EEM April 2025

Figure 76: Location B

Source: EEM April 2025

Figure 77: Location C (1 of 4)

Source: EEM April 2025

Figure 78: Location C (2 of 4)

Source: EEM April 2025

Figure 79: Location C (3 of 4)

Source: EEM April 2025

Figure 80: Location C (4 of 4)

Source: EEM April 2025

Figure 81: Location D

Source: EEM April 2025

6 WEATHER, CLIMATE & NATURAL HAZARDS

6.1 LOCAL METEOROLOGICAL CONDITIONS OF SITE

Meteorological data were requested from the Meteorological Service of Jamaica, which provided hourly readings from the Automatic Weather Stations (AWS) in Clarendon closest to the project site. The Monymusk AWS (2013–2024), located approximately 1.1 km west of the site, was identified as the most relevant station.

Temperature and wind speed data were analysed from the Monymusk AWS. Additionally, rainfall data for the period 2020–2024 were obtained from meteorological monitoring conducted by Clarendon Distillers Limited (CDL), located approximately 650 km northeast (17°48'41.41"N, 77°15'1.04"W) from the proposed site, to further support the assessment.

6.1.1 RAINFALL

The hourly rainfall recorded at Clarendon Distillers between the five (5) year period of 2020-2024 was analysed and the monthly average rainfall was plotted in Figure 83. The heaviest rainfall was observed from July to November, with the highest being 525mm in August, and the next highest being in July and October at 309 and 229mm, respectively.

Data for the 30-year mean rainfall (1971-2000) categorised by station was retrieved from the Meteorological Service of Jamaica. Of the listed stations, the data from the nearest station[4] (i.e. Amity Hall, Clarendon) was retrieved and is presented in Table 20. A graphical plot of this data is shown in Figure 82. The data follows the expected trend of an increase in rainfall in May followed by another between August to November, with a peak in October.

Notably, the recent rainfall data (2020–2024)(Figure 83) indicates higher peak monthly totals compared to the historical averages, suggesting an increase in short-term rainfall intensity.

Table 20: 30 Year Mean Rainfall (mm) for Amity Hall Rainfall Station in Clarendon (1971-2000)

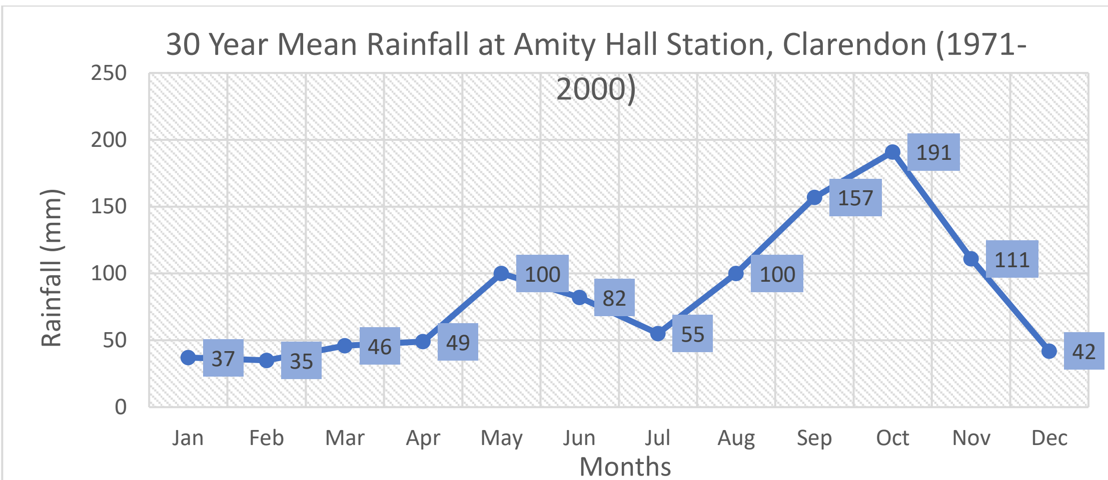
Month	Amity Hall (mm)
January	37
February	35
March	46
April	49
May	100
June	82
July	55

[4] Data from the Mitchell Rainfall Station was not shown which prevented a direct comparison.

Month	Amity Hall (mm)
August	100
September	157
October	191
November	111
December	42

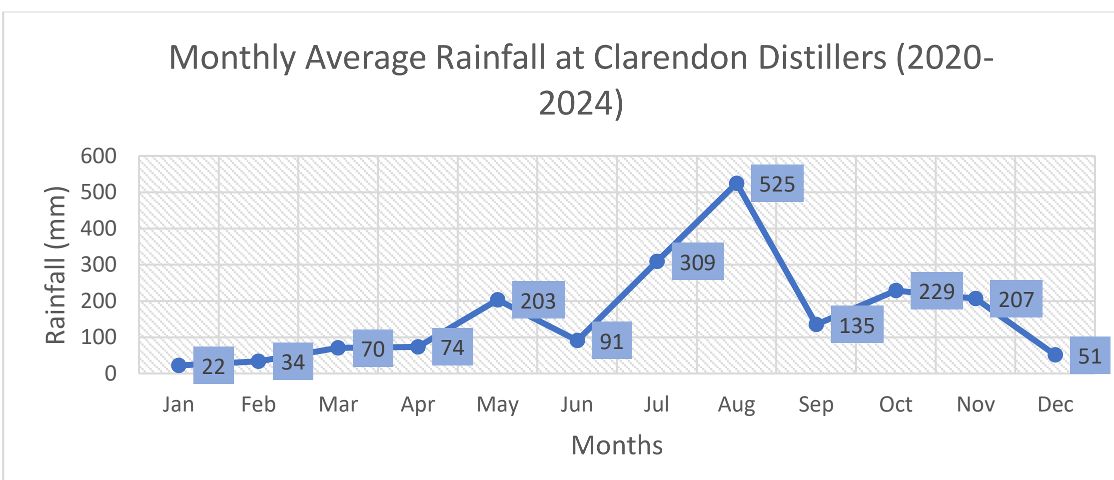
Source: Meteorological Service of Jamaica, Accessed at: https://metservice.gov.jm/30-year-mean-rainfall-by-station-in-mm/

Figure 82: 30 Year Mean Rainfall at Amity Hall Weather Station, Clarendon (1971 - 2000)



Source: Meteorological Service of Jamaica, Accessed at: https://metservice.gov.jm/our-data/

Figure 83: Monthly Average Rainfall at Clarendon Distillers Limited (2020 - 2024)

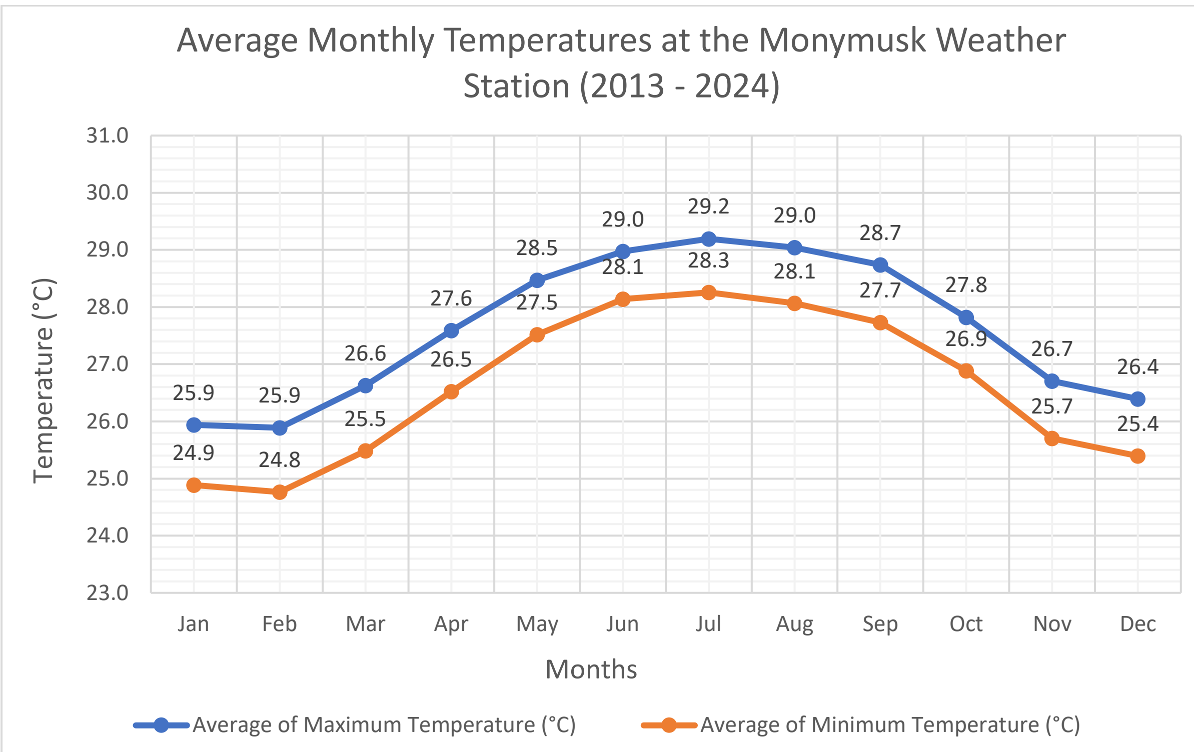


Source: Data Retrieved from the Clarendon Distillers Limited.

6.1.2 TEMPERATURES

The hourly maximum and minimum temperatures recorded at the Monymusk AWS between the twelve (12) year period 2013 – 2024, were analysed and their monthly average was plotted in Figure 84. The data shows that the temperatures in Monymusk follow the expected typical pattern seen throughout Jamaica, with the highest temperatures being experienced during the summer months of June, July, and August. The highest monthly average for maximum temperature was in July at 29.2 °C. The lowest monthly temperatures were recorded from December to March, with the lowest monthly average being in January and February at 24.8 °C.

Figure 84: Average Monthly Temperatures (°C) at Monymusk Automatic Weather Station (2013 - 2024)



Source: Data Retrieved from the Meteorological Service of Jamaica

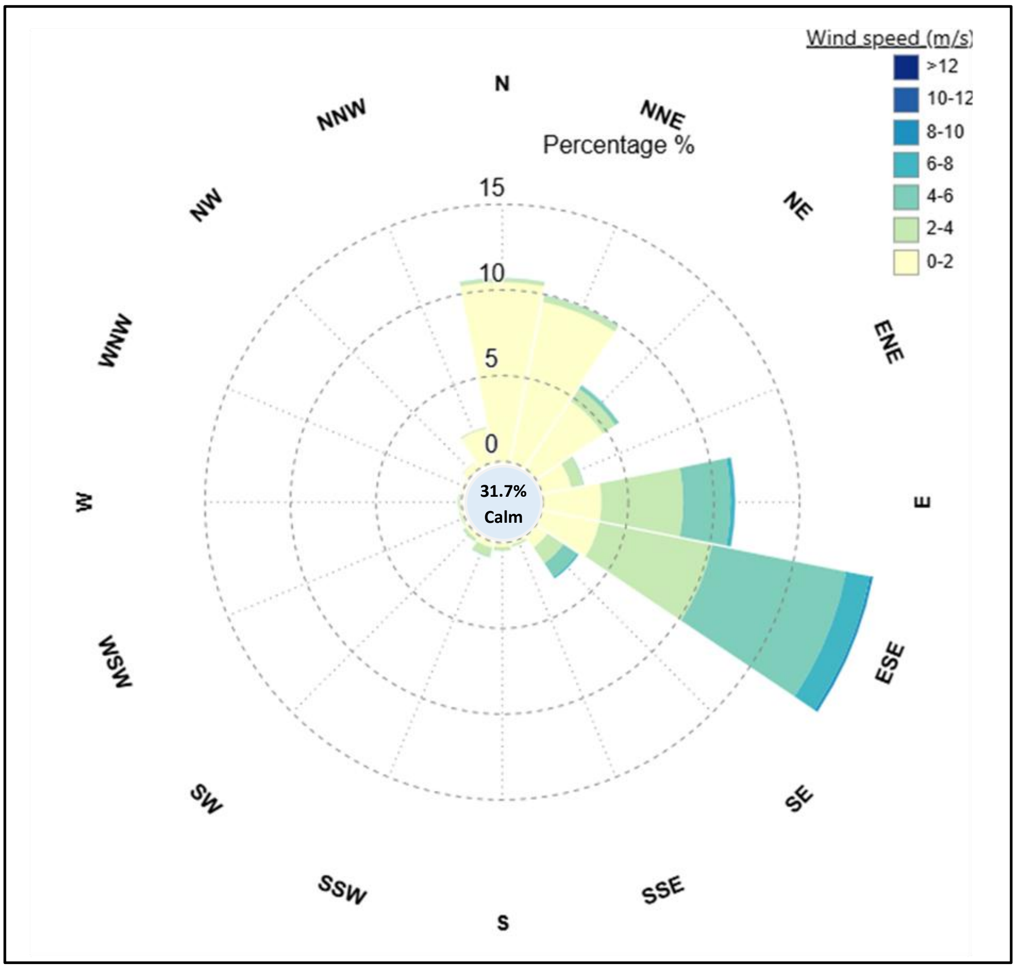
6.1.3 WIND

The hourly wind speeds and directions recorded between the twelve (11) year period 2013 – 2023, were analysed to produce the wind rose presented in Figure 85. A wind rose is a graphical chart that depicts the wind speed and direction at a given location, based on a historical collection of wind speed and direction data. The wind rose is presented in a circular format showing the direction the winds come from and the length of each 'spoke' around the circle shows how often the wind blows from that direction. The different colours along the spokes provide details on the speed in knots of the wind from each direction.

The wind rose reveals that the dominant/prevalent winds in Monymusk during the given period (2013 to 2024) predominantly blow from the East-Southeast (~20% of the time) and East (~11% of the time). Further analysis of wind direction data shows that wind speeds of 0–2 m/s occurred ~38% of the time, making calm and light air the most common conditions. Wind speeds of 2–4 m/s occurred ~16% of the time, followed by 4–6 m/s at ~12%, 6–8 m/s at ~2%, and 8–10 m/s at less than 0.2%. Speeds above 10 m/s were essentially absent, indicating that high-wind events were extremely rare in this area and particularly limited to tropical storm/hurricane events.

Lower wind speeds were most frequently from the north and north-northeast (N, NNE), while stronger winds came predominantly from the east and east-southeast (E, ESE). ESE was the primary direction during higher-speed events, despite not being the most common overall.

Figure 85: Wind Rose - Showing Wind Speed and Direction (2013-2024)



Source: EEM. Data Retrieved from the Meteorological Service of Jamaica

6.2 NATURAL HAZARDS – HURRICANE

Hurricanes usually lead to the widespread destruction of physical infrastructure, including roads, buildings, and pipelines. Biological habitats are usually threatened by hurricane events particularly in the coastal zones, where storm surges can rise up to 2 – 3 metres. Areas with dense vegetation cover are sometimes destroyed because of the impact of wind on plant species.

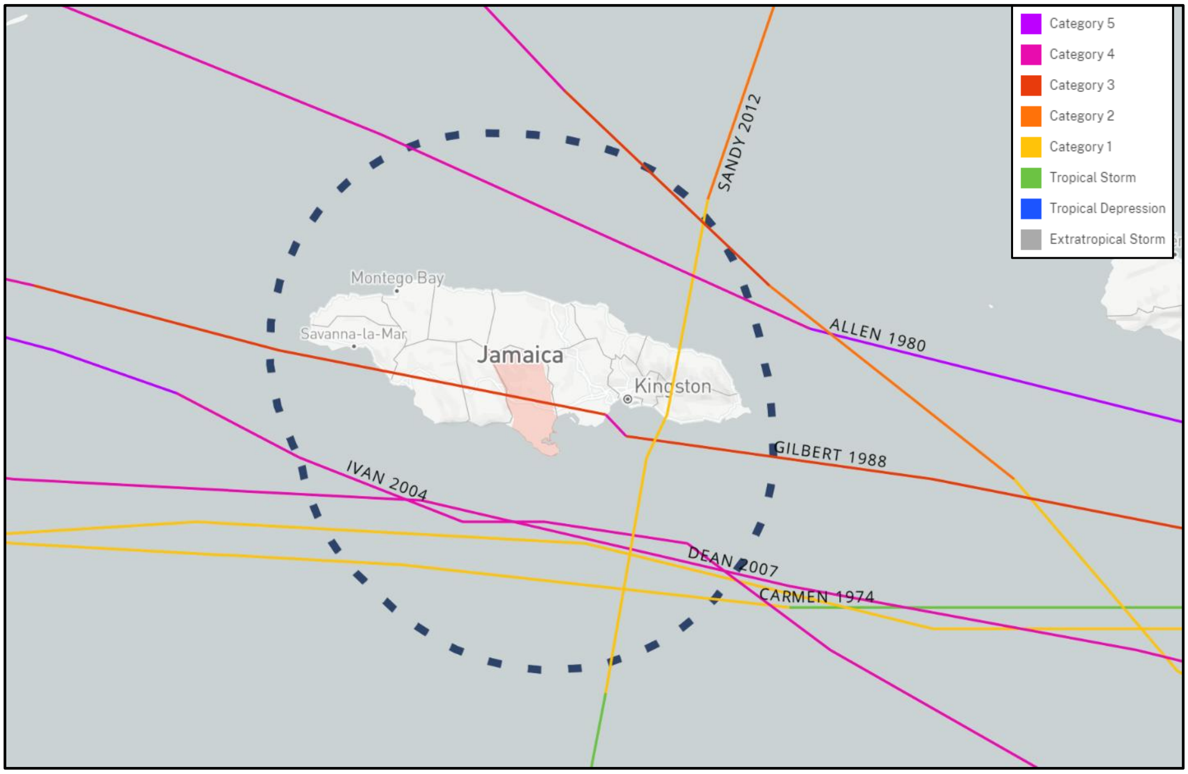
Hurricanes within 60 nautical miles (111.12 km) of Jamaica that occurred between 1962 and 2023 have been retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Historical Hurricane Database. A map showing the paths of these hurricanes is shown in Figure 86 and the listing of the 8 named hurricanes is shown in Figure 87. Within the parish of interest, Clarendon, Hurricane Gilbert (1998) had a hurricane track that passed through southern Clarendon (Figure 88).

6.2.1 HURRICANE BERYL

Due to the limitation of the NOAA Historical Hurricane Database, no hurricane data post-2023 was available. Of significance, however, is Hurricane Beryl, which became the earliest category 5 (on the Saffir-Simpson Hurricane Wind Scale) hurricane of record in the Atlantic Basin at 145 knots (kt) (166.86 mph) peak maximum sustained winds. Its track passed through the Windward Islands as a major hurricane and passed approximately 22.22-37.07 km (12-20 nautical miles) south off the coast of Jamaica, before continuing NW to the Yucatan Peninsula of Mexico and then the coast of Texas (Figure 89). In Jamaica, hurricane conditions brushed portions of the southern coast and tropical storm conditions were experienced over the rest of the island. The strongest reported sustained winds were 57 kt (65.59 mph) at the Newcombe Valley Primary School in St. Elizabeth Parish at 23:00 (Universal Time Coordinated (UTC) July 3, 2024, with a peak gust of 107 kt (123.12 mph). Rainfall totals in Jamaica were generally in the 203.2 – 304.8 mm (8-12 inches) range, with a storm total of 345.95 mm (13.62 inches) reported at Knockpatrick in Manchester Parish.

Media reports indicate that three people died in Jamaica due to Hurricane Beryl. Two of these deaths were due to wind, while the third was from freshwater flooding. The storm caused damage to homes, crops, and infrastructure, including minor damage at the Norman Manley International Airport in Kingston. The damage estimate is $41.6 million USD (6.5 billion JMD). (Benven II, J., et al, 2025).

Figure 86: NOAA-Hurricane Paths within 60 Nautical Miles of Clarendon, Jamaica (1962-2023)



Source: NOAA Historical Hurricane Tracks, accessed from: https://bit.ly/4iQHwOD

Figure 87: List of Hurricanes Within 60 Nautical Miles of Clarendon, Jamaica Between (1962-2023)

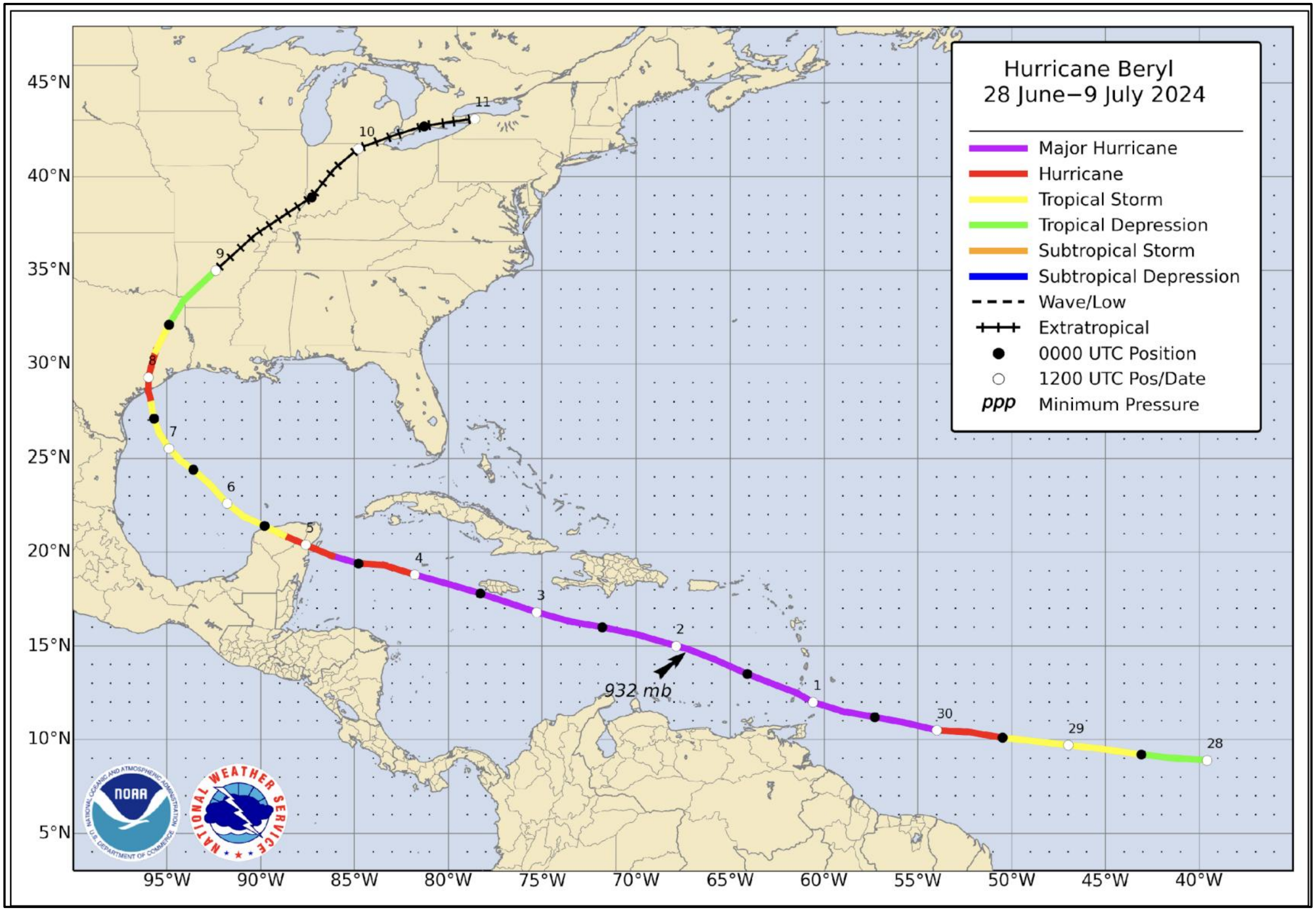
STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
SANDY 2012	Oct 21, 2012 to Oct 31, 2012	100	940	H3
DEAN 2007	Aug 13, 2007 to Aug 23, 2007	150	905	H5
DENNIS 2005	Jul 04, 2005 to Jul 18, 2005	130	930	H4
IVAN 2004	Sep 02, 2004 to Sep 24, 2004	145	910	H5
IRIS 2001	Oct 04, 2001 to Oct 09, 2001	125	948	H4
GILBERT 1988	Sep 08, 1988 to Sep 20, 1988	160	888	H5
ALLEN 1980	Jul 31, 1980 to Aug 11, 1980	165	899	H5
CARMEN 1974	Aug 29, 1974 to Sep 10, 1974	130	928	H4

Source: NOAA Historical Tracks, accessed from: https://bit.ly/4iQHwOD

Figure 88: Hurricane Track for Hurricane Gilbert (1988)

Source: NOAA Historical Tracks, accessed from: https://bit.ly/4iTbhhM

Figure 89: Hurricane Track for Hurricane Beryl (2024)



Source: National Hurricane Center Tropical Cyclone Report, accessed from: https://www.nhc.noaa.gov/data/tcr/AL022024_Beryl.pdf

6.3 NATURAL HAZARDS – FLOODING

The flood maps have been retrieved from the Water Resources Authority of Jamaica, ArcGIS Flood Mapping of Jamaica, which shows the flood boundaries and floodplains for select rivers delineated based on past flood events. The flood plain study based upon the HEC 2 model, was delineated under the Hydrological Support Unit Project 1990-1994 in partnership with the United Nations Development Program (UNDP), United States Agency for International Development (USAID), Government of Jamaica (GOJ) and the Underground Water Authority (UWA), now the Water Resources Authority (WRA).

Figure 90 and Figure 91 show the 5, 10, 25, 50 and 100-year floods associated with riverine-induced flooding from the Rio Minho River located approximately 2 km to the west of the proposed location of the Sugar Factory. Based on the WRA's assessment of the Rio Minho River, the northern portion lies within the 25-year flood demarcation and the southern portion lies within the 50-year flood demarcation.

There is also correlation of this classification, as seen in the Flood Risk Map presented in Figure 92, which classifies the area as having a high to very high flood risk.

Instances of known historical floods near to the project site are shown in Figure 93. A listing of these floods near Lionel Town is shown in Table 21. Of note, the 1986 flood event was reported to have caused significant damage and loss of life, with at least 50 reported deaths. Flooding was also reported in Lionel Town due to the Rio Minho breaking its banks. A picture of Lionel Town during that event is shown in Figure 94.

The listing was retrieved from the Mona Geoinformatics Institute (MGI) which maintains a database of historical floods as reported in the media and verified by external bodies, such as the National Works Agency (NWA). The database is retrieved from the Natural Hazard Atlas of Jamaica, which was developed by MGI and outlines the historical flooding events in Jamaica.

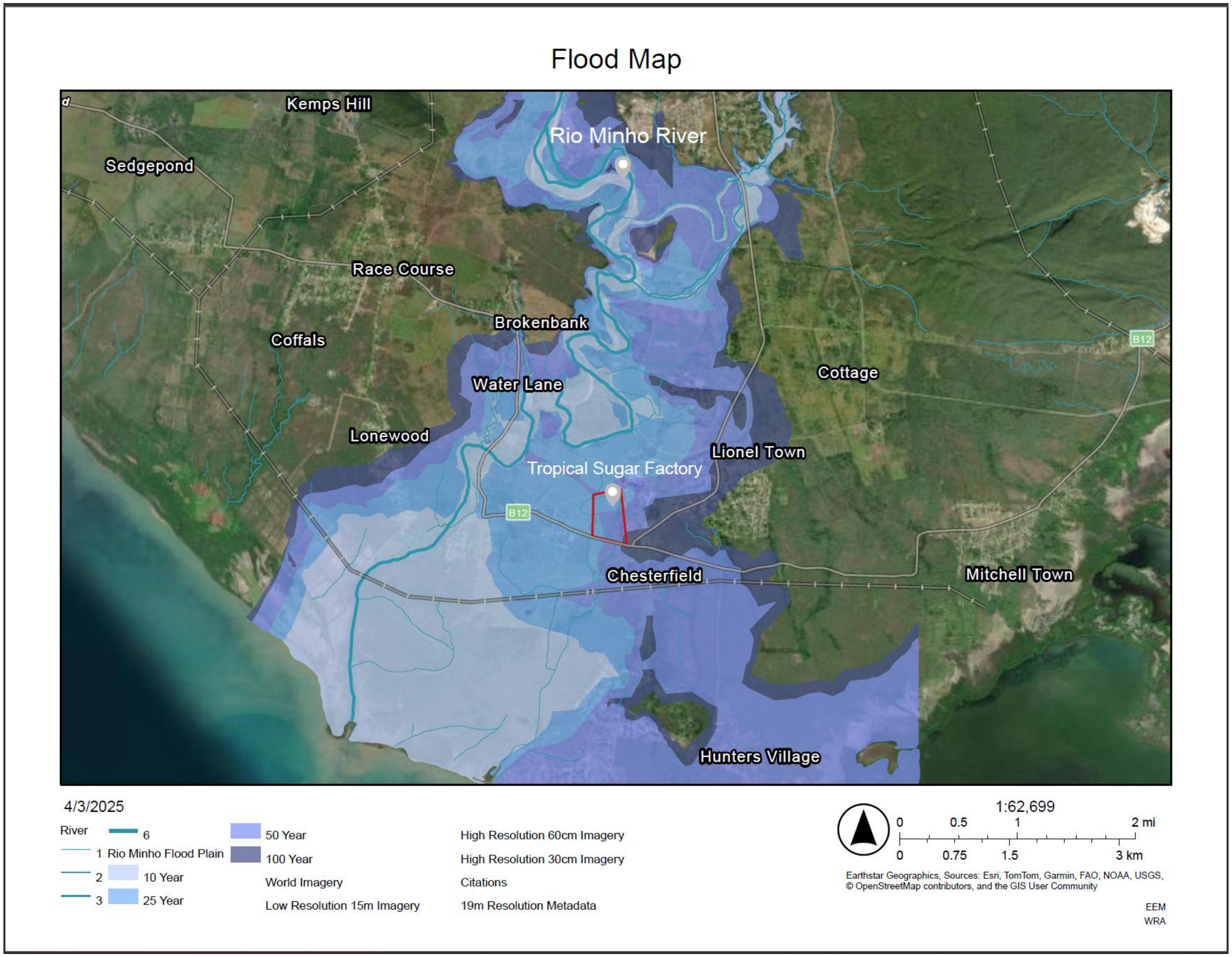
It should be noted that the Natural Hazard Atlas of Jamaica, has some inherent limitations in that the historical floods shown in the flood map are representative of data between the years 1834 and 2023. Data prior to 1834 is unavailable as that is the extent of the Gleaner archives. The database is limited to historical flood data from these sources because there is a general lack of an alternative. Additionally, media reports of historical flooding which the database relies on, is not normally reported on in unoccupied areas since there is generally no threat to human or animal life and is considered merely natural or physical events. As such most of the reported historical floods are in areas of human habitation.

Table 21: Listing of Historical Floods – Lionel Town

YEAR	Map GIS Flood ID No.	ADDRESS	SOURCE
1960	961	Lionel Town Main Road	-
1987	423	Lionel Town Main Road	-
1958	1,022	Lionel Town Main Road	-
1986	422	Lionel Town Main Road	-
1986	421	Lionel Town Main Road – Young St	-
2017	0	Lionel Town – Bustamante Drive	NWA
1999	2,094	Lionel Town – near Lionel Town Pharmacy and Health Store on Bustamante Drive	ODPEM
1998	2,037	Lionel Town – Church St	OPDEM
2021	0	Lionel Town – near Lionel Town Hospital	Observer
2017	0	Lionel Town – McWinnie ST	NWA

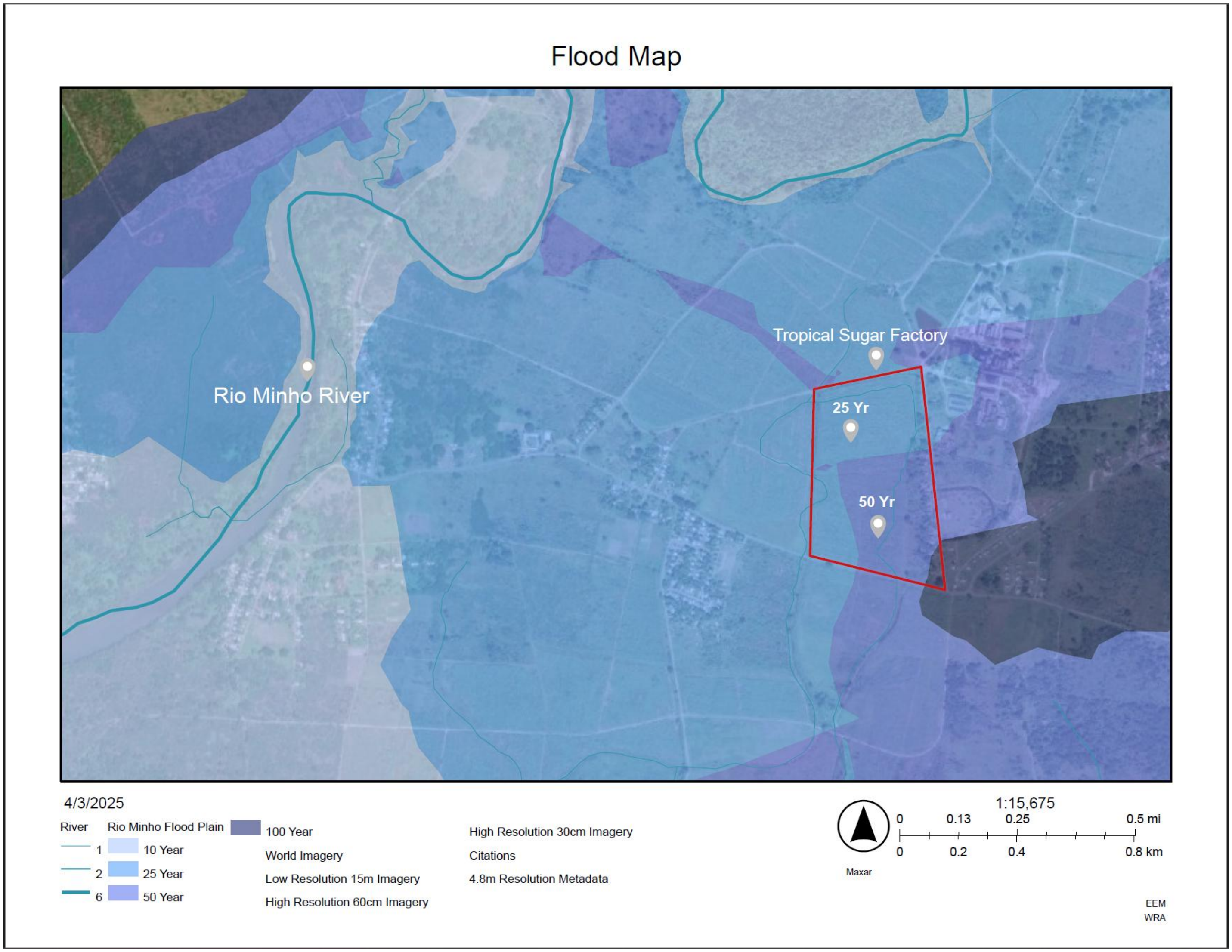
Source: Mona Geomatics Institute (MGI). Assessed at https://main.monagis.com/hazard-online-map/

Figure 90: Flood Map of the Rio Minho Flood Plain (RP= 10,25,50,100 Year Flood Events)



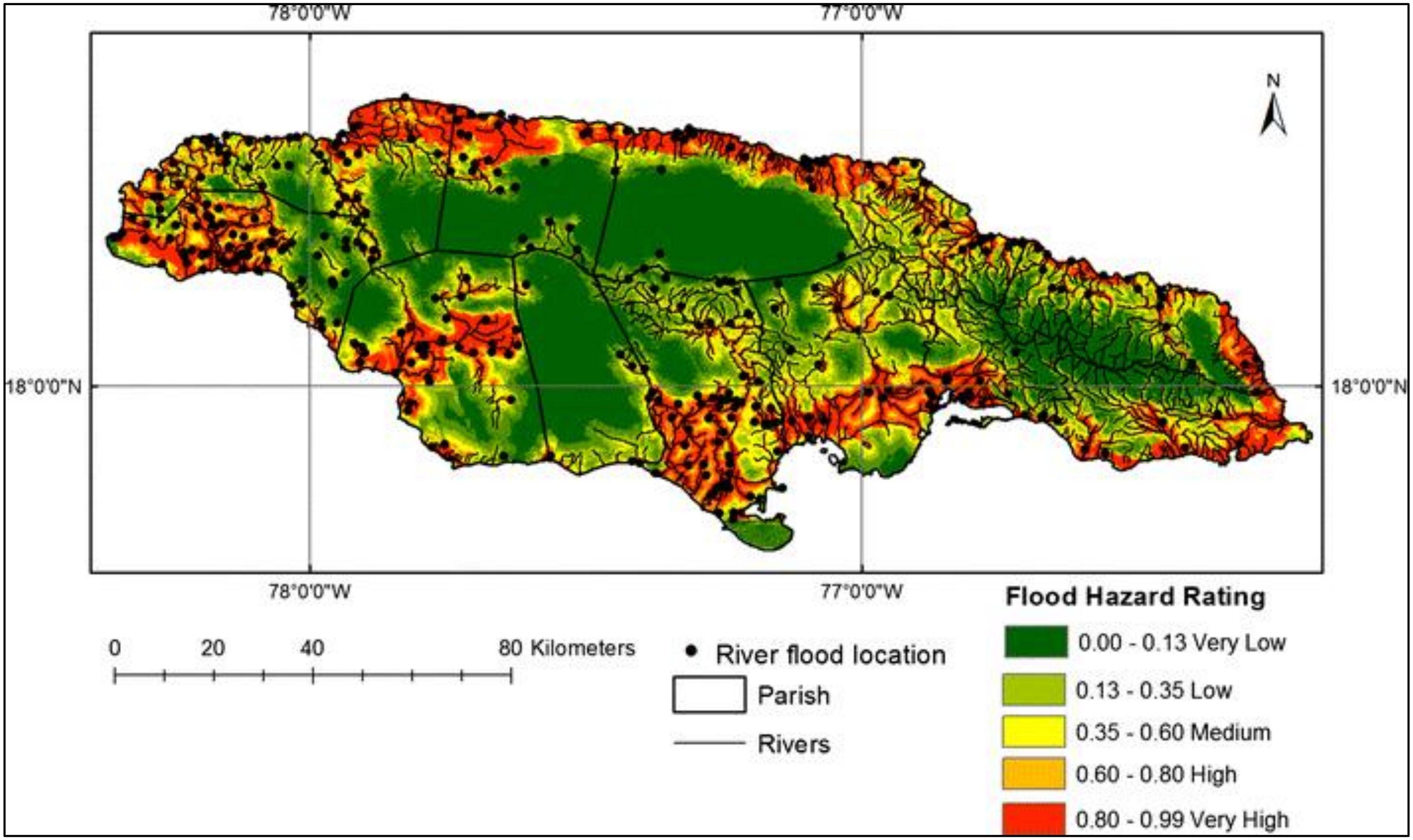
Source: WRA Jamaica Flood Map. Accessed at https://arcg.is/1n0T5O0

Figure 91: Flood Map of the Rio Minho Flood Plain (RP= 10,25,50,100 Year Flood Events)



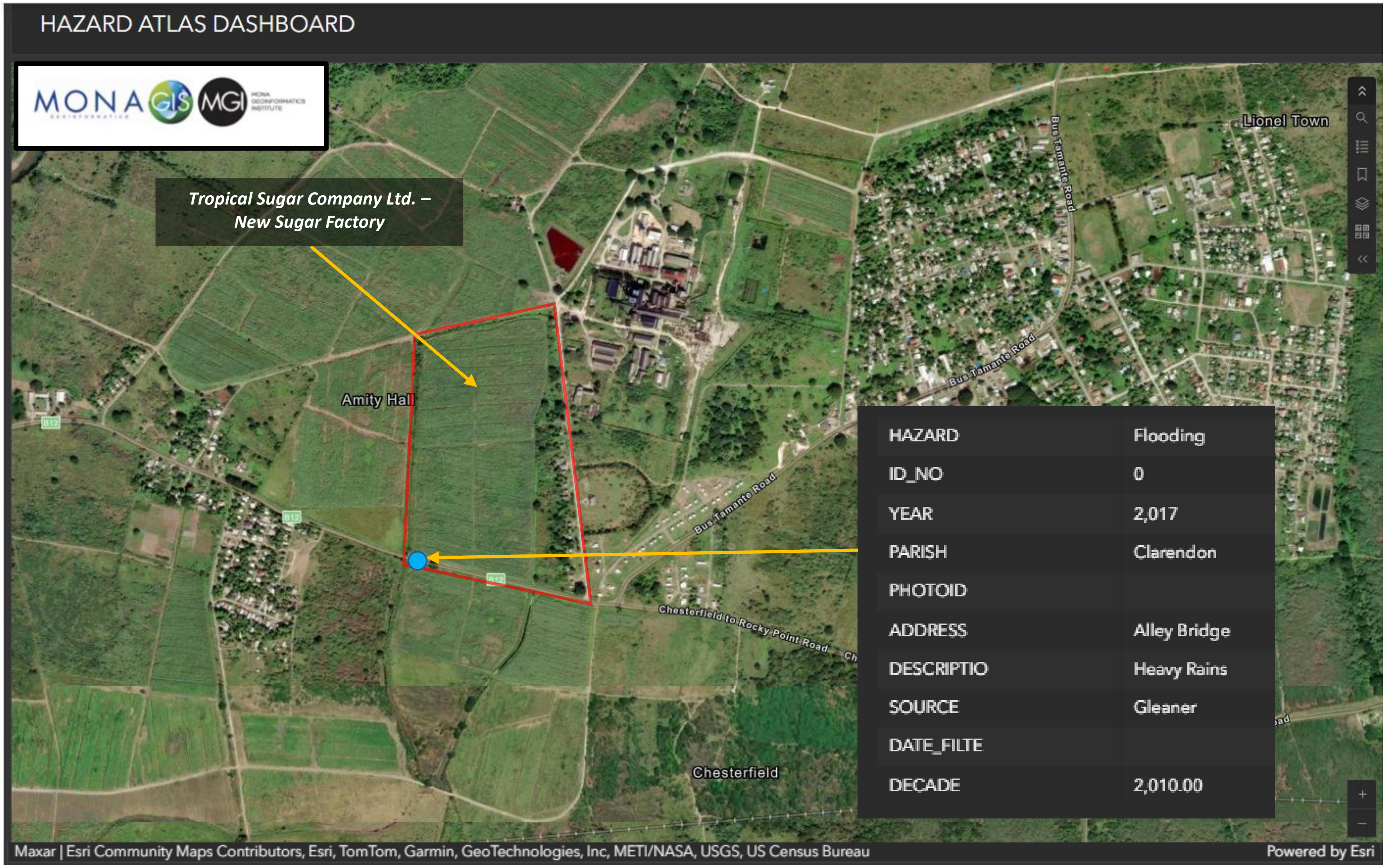
Source: WRA Jamaica Flood Map. Accessed at https://arcg.is/1n0T5O0

Figure 92: Flood Hazard Map of Jamaica



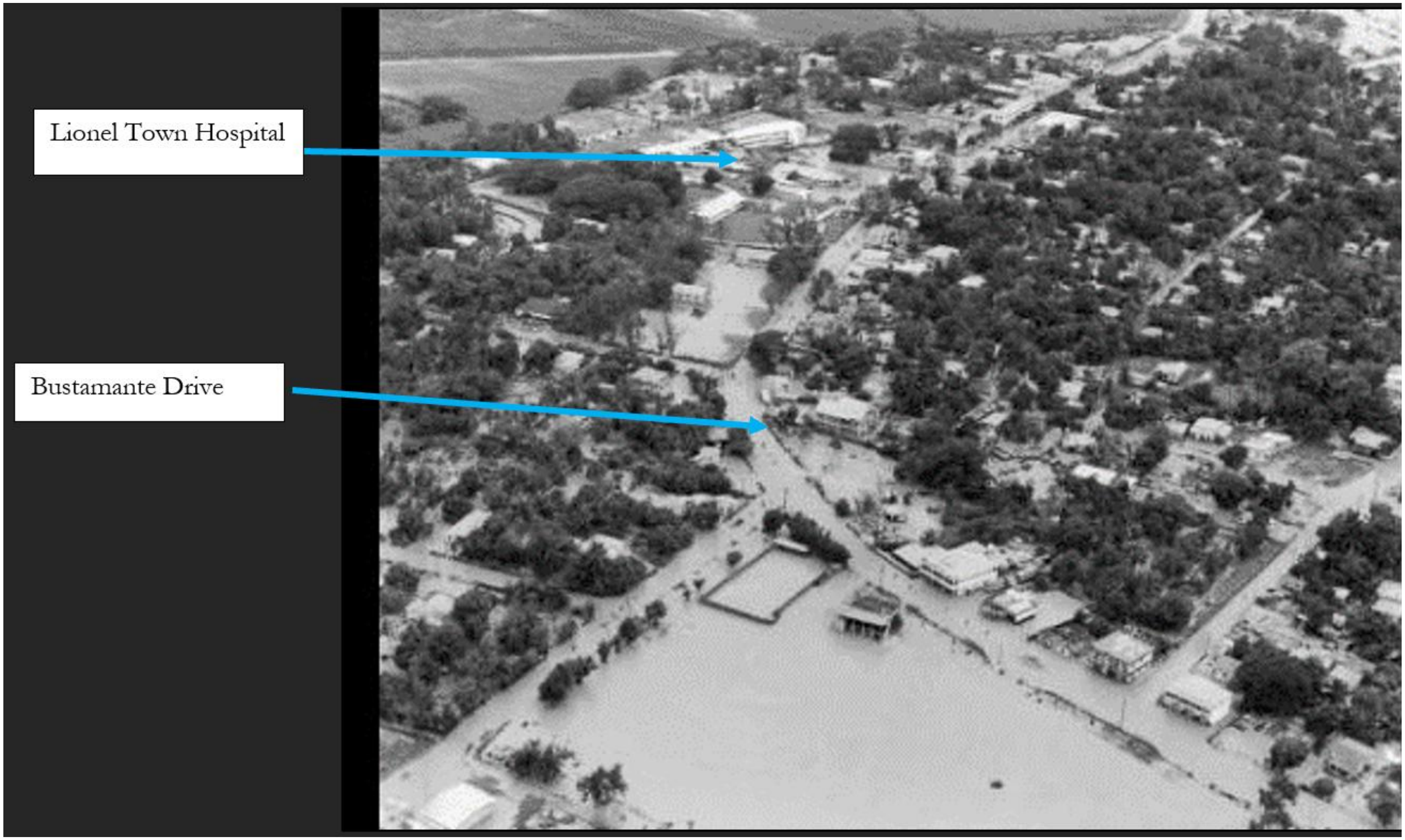
Source: Nandi, et al., 2016

Figure 93: Recorded Instances of Flood Events Near the Proposed Solar Site



Source: Mona Geomatics Institute (MGI). Assessed at https://main.monagis.com/hazard-online-map/

Figure 94: Historical Picture of Lionel Town Flood - June 1986



Source: Gleaner, Photo Flashback: The June 1986 Floods

6.4 NATURAL HAZARDS – EARTHQUAKE

Earthquakes occur periodically in Jamaica. In addition to the destruction of buildings, earthquakes can trigger landslides on steep slopes and cause hillside roads to fail. The breaking of dams and other protective flood barriers can also become destabilized following an earthquake event. Data retrieved from the United States Geological Survey Earthquake Database shows that, eighty-one (81) earthquakes have been recorded in Jamaica between January 1, 1900 and April 3, 2025 of magnitude ≥M2.5. A graphical representation of the location of their epicentres is shown in Figure 95. As seen in Figure 95, the vast majority of Jamaica's earthquakes have been confined to the eastern section of the island. St. Thomas, Portland and Kingston have experienced the most earthquake activity, with the Blue Mountains and John Crow Mountains experiencing more frequent earthquake events.

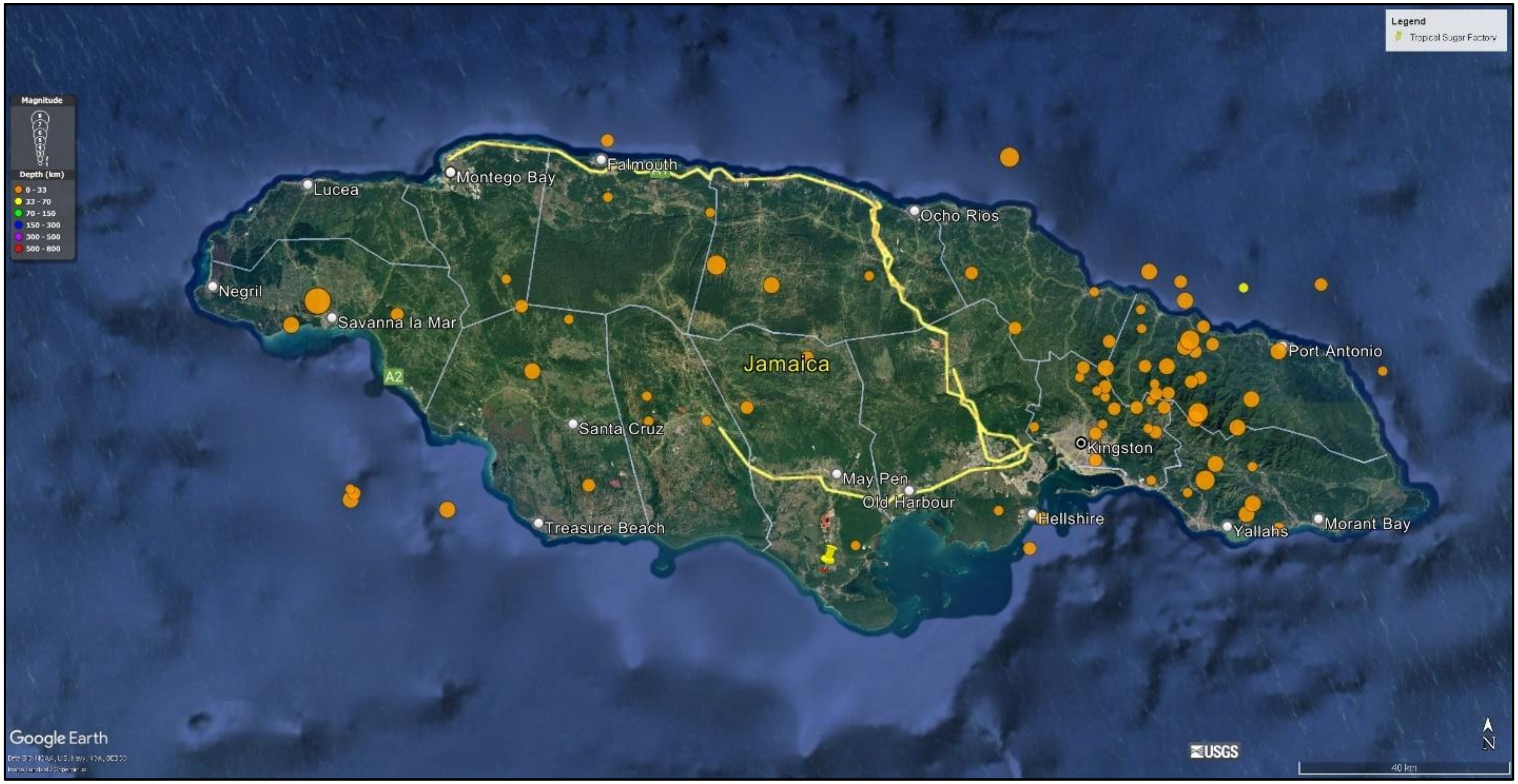
Within the parish of interest, there have been three (3) recorded earthquakes with their epicentre in Clarendon, of which one (1) had its epicentre recorded in southern Clarendon, measuring a magnitude of 2.5 which occurred in October 1991.

The largest earthquake within the past two (2) years experienced in Jamaica was a magnitude 5.4 which was recorded 4km WSW of Hope Bay, Portland with a reported depth of 10km, that occurred on October 30, 2023. The earthquake caused shaking across the island, with strong intensities around the epicentre (MMI 6.5) and intensity of MMI 3.5 in Clarendon. The Modified Mercalli Intensity (MMI) Contour Map for this earthquake event is shown in Figure 96. Other recent earthquakes experienced in Jamaica include:

a. August 16, 2024 – Magnitude 4.5 – 7 km NNE of Stony Hill
b. June 18, 2024 – Magnitude 4.0 – 4 km S of Maggotty
c. May 2, 2024 – Magnitude 4.1 – 5 km ENE of Buff Bay
d. November 28, 2023 – Magnitude 3.8 – 2 km NW of Hope Bay

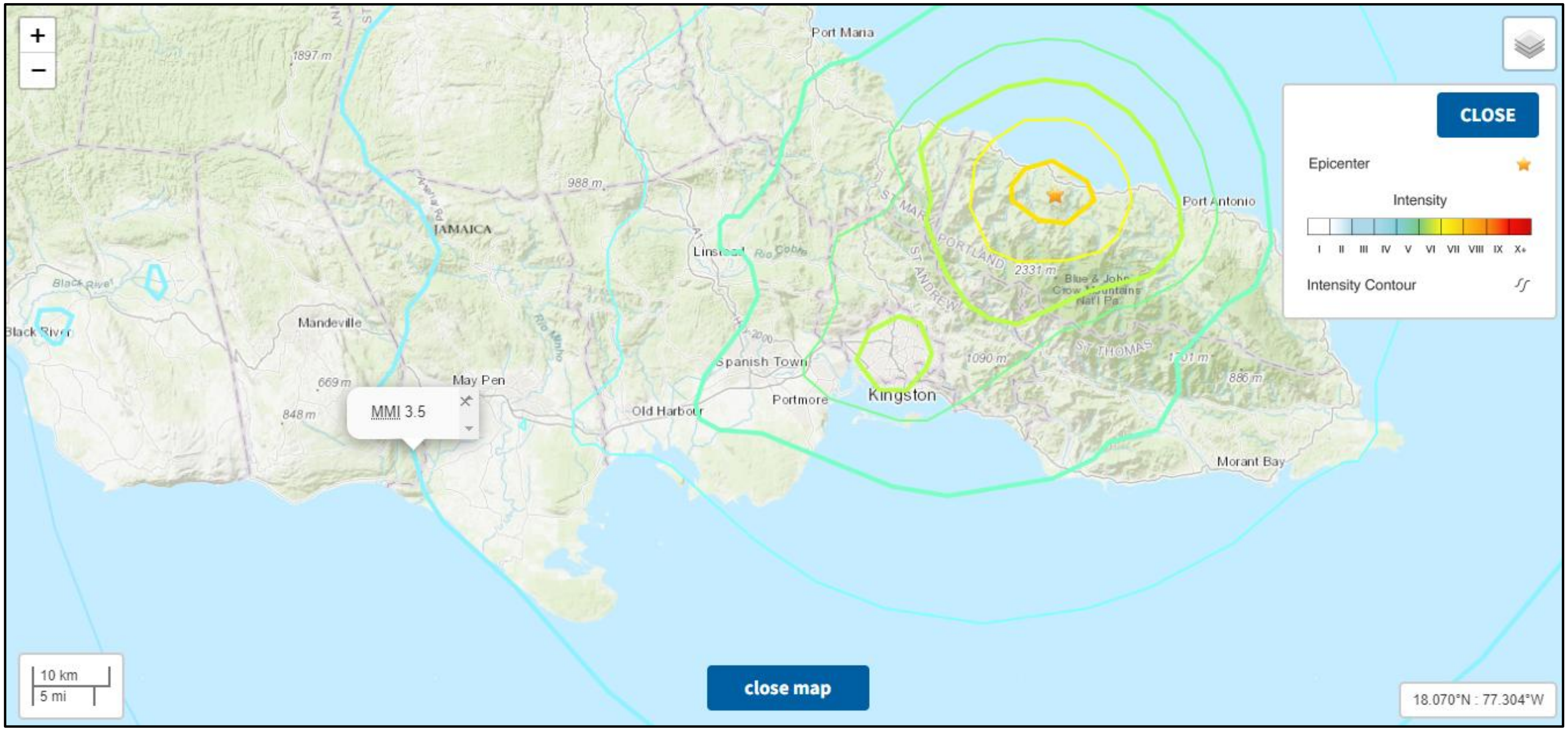
Intensity refers to the shaking experienced at a specific location and is measured based on the modified Mercalli intensity scale (Figure 97).

Figure 95: USGS-Earthquake Data for Jamaica (1900-2025) Magnitude ≥M2.5



Data sourced from the USGS, Accessed at*:* [*http://earthquake.usgs.gov/earthquakes/map*](http://earthquake.usgs.gov/earthquakes/map)

Figure 96: Modified Mercalli Intensity (MMI) Contour Map for October 30, 2023 M5.4 Earthquake



Source: USGS, Accessed at: https://earthquake.usgs.gov/earthquakes/eventpage/us7000l7jv/map

Figure 97: Modified Mercalli Intensity (MMI) Scale - Description of Shaking Intensities

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS. Accessed at https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale

The major documented earthquakes that have affected Jamaica over the years are summarized in Table 22.

Table 22: Historically Significant Earthquakes in Jamaica

Date	Location	Magnitude	Brief Impact
June 7, 1962	Port Royal	7.5	The liquefaction of Port Royal resulted in a large portion of land falling into the sea. At least 5000 dead and 300 buildings were destroyed and the outbreak of yellow fever.
January 14, 1907	Kingston	6.2	The death of 800 to 1000 people. Fire destroying 56 acres of commercial land in Kingston.
March 1, 1957	Kingston	-	3 deaths. Disruptions to electrical services, transportation and communication services.
January 13, 1993	Kingston	5.4	2 deaths. Damage to houses, buildings and infrastructure. Estimated economic loss of 15 million JMD.

Source: OUR, accessed at https://our.today/four-major-earthquakes-in-jamaicas-history/ and NLJ, accessed at https://nlj.gov.jm/wp-content/uploads/2017/03/Earthquakes-of-Jamaica.pdf

6.4.1 SEISMICITY

Jamaica is located in the north-central Caribbean and is bisected by the Caribbean Plate to the South and the Gonave Microplate to the North. These plates are bounded by the Enriquillo-Plantain Garden Fault Zone, the Walton Fault Zone, the Oriente Fault Zone and the Cayman Spreading Center.

The movement of the Caribbean Plate and the Gonave Microplate plates across the Enriquillo-Plantain Garden Fault Zone to the east of the island and the Walton Fault Zone to the west of the island is the primary source of seismic activity which is transmitted across the Jamaica Fault system. The major fault trends of the Jamaica Fault system are oriented in the E-W (i.e. *fat hog quarters fault, duanvale fault, Rio Minho-Crawle river fault and plantain garden fault*) and the NNW-SSE directions (i.e. *montepelier-newmarket fault zone and wagwater fault zone*) (Salzar et. al., 2013).

The major plates and fault zones in the region are illustrated in Figure 98.

Figure 98: Regional Map of Tectonic Plates

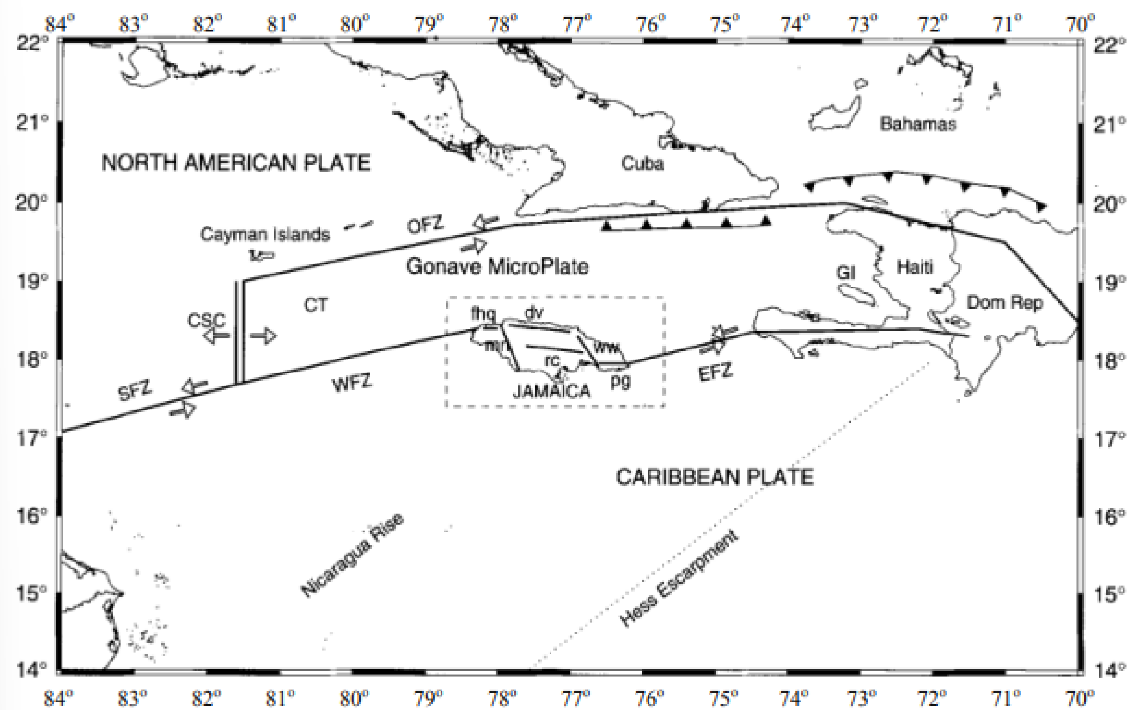


Fig. 3 Jamaica region tectonics: SFZ—Swan fracture zone; CSC—Cayman Spreading Center; CT—Cayman Trench; OFZ—Oriente fracture zone; WWF—Walton fault zone; EFZ—Enriquillo fault zone; Dom Rep—Dominican republic; GI—Gonave Island; fhq—Fat hog quarters fault; dv—Duanvale fault; ww—Wagwater fault; pg—Plantain garden fault; mn—Montepelier—Newmarket fault zone; rc—Rio Minho-Crawle river fault, reproduced with the permission of Seismological Society of America and Wiggins-Grandison [22].

Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

About 200 earthquakes occur in and around Jamaica per year most of which are minor, having magnitudes less than 4.0. The most seismically active areas are the Blue Mountain block in eastern Jamaica and the Montpelier-Newmarket belt in western Jamaica. Other areas of notable seismicity include the near offshore southwest of Black River on the south coast, and offshore Buff Bay on the northeast coast. *(https://www.mona.uwi.edu/earthquake/jaequake.php)*

6.4.2 SEISMIC HAZARD MAPS

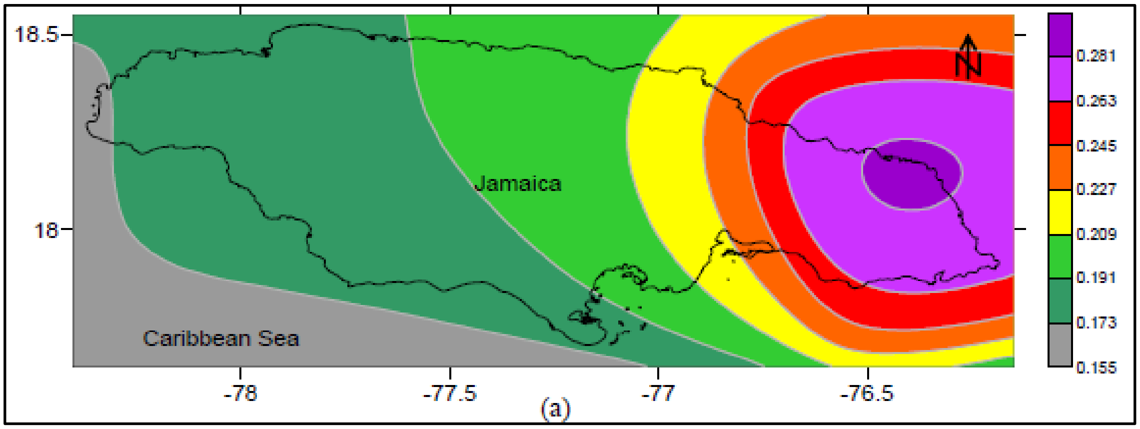
Probabilistic seismic hazard maps for Jamaica were retrieved from a paper titled "Probabilistic Seismic Hazard Assessment of Jamaica" written by W. Salzar et al., 2013. The maps show the seismic hazard contour maps in terms of the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years (RP= 475 years) and the spectral acceleration at 0.2s and 1.0s with a 2% and 1% probability of exceedance in 50 years (RP=2,475 and 4,975 years) for rock site conditions. The peak ground acceleration is the maximum ground acceleration that occurs during an earthquake at a location. The spectral acceleration is the maximum acceleration in an earthquake that an object (i.e. a building or other structure) will experience for a given time period. The spectral acceleration gives a closer approximation to the motion of a building or other structure in an earthquake than the peak ground acceleration. These values are given in terms of probable exceedance, that is the likelihood of a given horizontal acceleration being exceeded during a particular period. The range of PGA and SA values for the site location based on Figure 99 - Figure 103, are presented in Table 23.

Table 23: PGA and SA Probability Values for Site

Return Period (Year)	PGA (g)	SA (0.2s) (g)	SA (1.0s) (g)
475	0.173-0.191	-	-
2,475	-	0.794-0.868	0.23-0.255
4,975	-	1.116-1.204	0.314-0.346

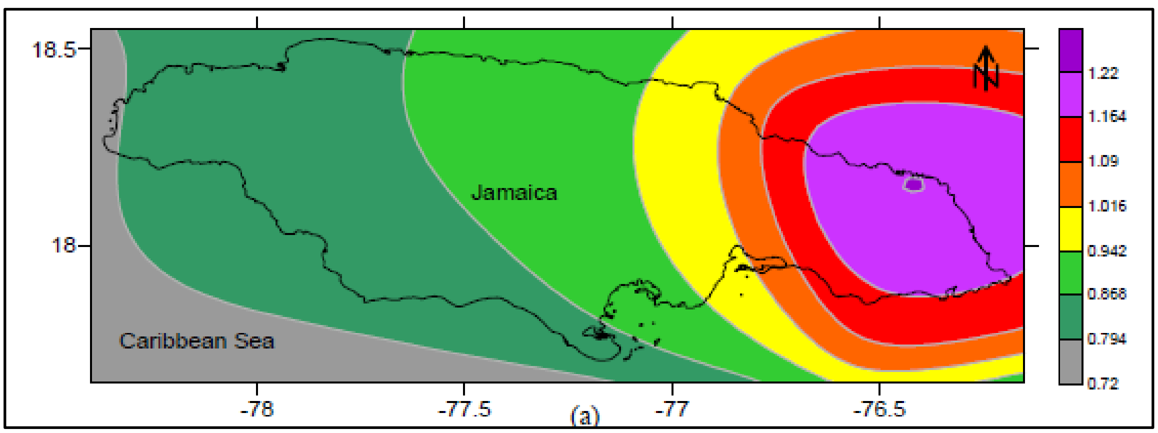
Source: Data inferred from Seismic Hazards Maps, Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

Figure 99: Seismic Hazard Map for the Peak Ground Acceleration (g) and 475 years Return Period



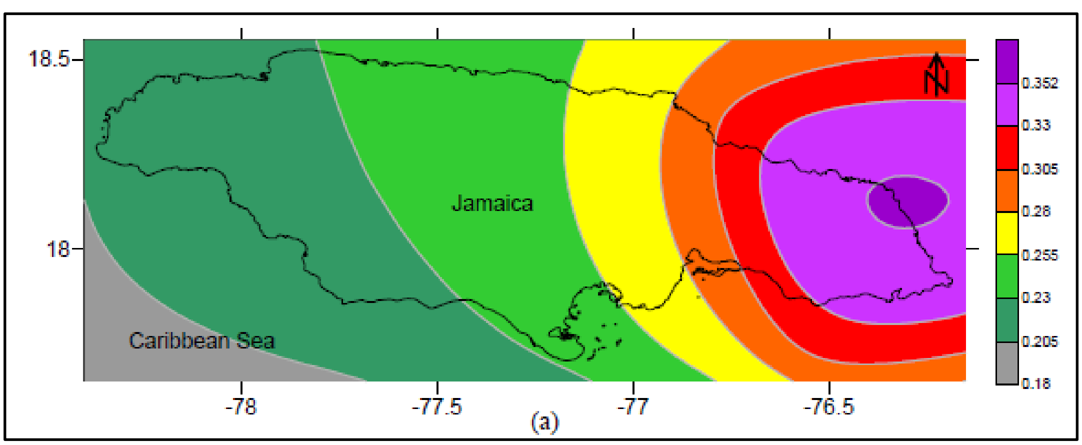
Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

Figure 100: Seismic Hazard Map for Spectral Acceleration (g) at the period of 0.2s and 2,475 years Return Period



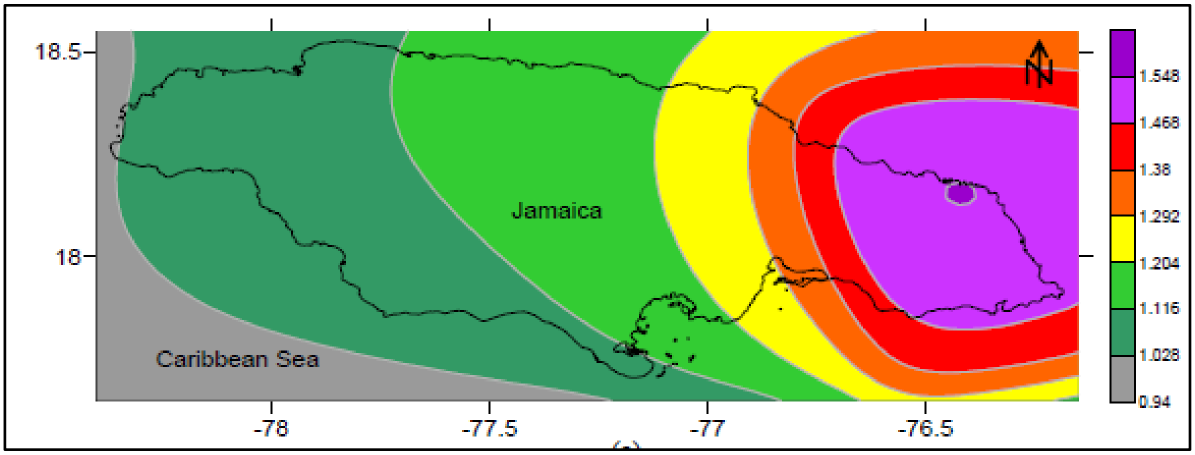
Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

Figure 101: Seismic Hazard Map for Spectral Acceleration (g) at the period of 1.0s and 2,475 years Return Period



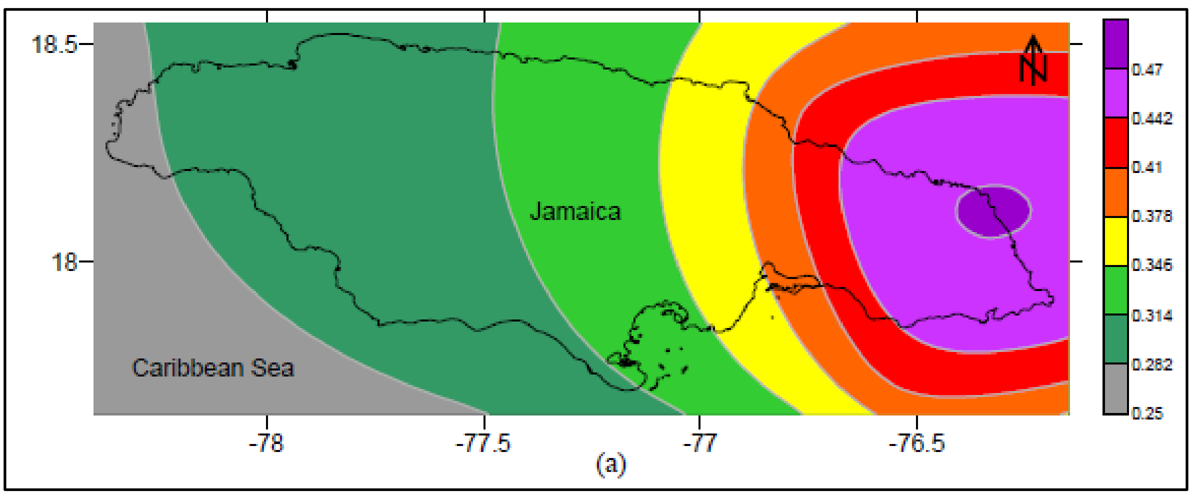
Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

Figure 102: Seismic Hazard Map for Spectral Acceleration (g) at the period of 0.2s and 4,975 years return period



Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

Figure 103: Seismic Hazard Map for Spectral Acceleration (g) at the period of 1.0s and 4,975 years return period



Source: Probabilistic Seismic Hazard Assessment of Jamaica, Salzar et al., 2013

6.5 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA)

The Jamaica National Heritage Trust (JNHT) assessed the proposed site for the sugar factory and determined that an AIA will not be required.

6.5.1 HISTORICAL, ARCHAEOLOGICAL SITES AND BUILDINGS

Clarendon has a rich heritage with several monuments and historical sites in the parish which are worthy of preservation. Within the Lionel Town Area, however, there are no listed heritage sites or national monuments. There are however buildings such as the Watsonton Methodist Church which was founded in 1838 and is located approximately 1.5 km to the north-east, which can be considered for preservation as a historical building, however, has not been designated as such.

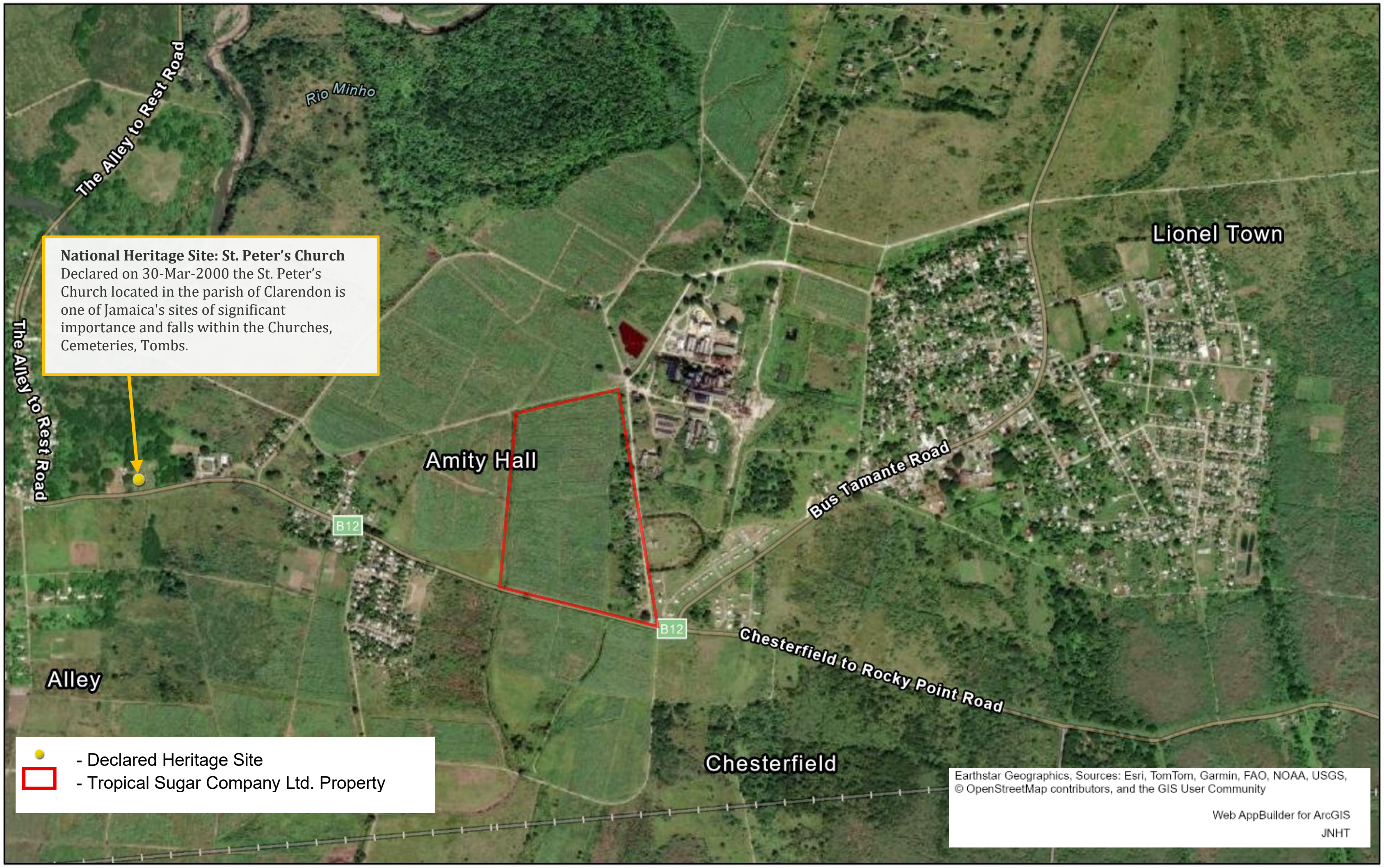
Table 24 lists the declared national sites and monuments by the Jamaica National Heritage Trust in Clarendon. Of the declared sites, the nearest is the St. Peter's Church in Alley, located approximately 1 km to the West of the proposed site for the sugar factory (Figure 104).

Table 24: Declared National Sites and Monuments in Clarendon

National Sites and Monuments	Date Declared
Buildings of Architectural and Historic Interest	
Halse Hall Great House	28/11/2022
Suttons Railway Station	02/10/2003
Churches, Cemeteries and Tombs	
St. Peter's Church, Alley	30/03/2000
St. Paul's Anglican Church, Chapelton	17/03/2016
Natural Sites	
Milk River Spa	13/09/1990
Mason River Botanical Station	28/11/2002
Clock Towers	
May Pen Clock Tower	13/05/1999
Chapelton Clock Tower	28/03/2017
Statues and other Memorials	
Bust of Cudjoe, Chapelton	28/03/2017
Claude McKay Marker, James Hill	05/03/2019

Source: Town and Country Planning (Clarendon Parish) Confirmed Development Order (2019) & http://jnht.com/documents/Protected_Sites_11-2019.pdf

Figure 104: Map Showing Nearest National Heritage Site



Source: Jamaica National Heritage Trust, Interactive Map

7 ANALYSIS OF ALTERNATIVES (INCLUDING 'DO NOTHING' ALTERNATIVE)

The "Do Nothing" alternative would leave Lionel Town in its current state of low economic activity and limited job opportunities for persons living in surrounding communities. Lionel Town and the surrounding communities were hit hard by the closure of the Old Monymusk Sugar Factory in 2018 and has experienced notable social and economic decline since then. The project therefore presents an opportunity to address the many socio-economic issues plaguing the area by stimulating economic activities both directly though jobs at the facility and indirectly though the establishment of other business to provide outsourced goods and services to the new sugar factory. This investment is therefore important to the local community, the Agricultural sector and the country.

TSCL had explored the option of rehabilitating the closed Monymusk Sugar Factory but decided against doing that after a careful evaluation was done. The reasons included:

1. The structural buildings and equipment at the Old Monymusk Sugar Factory had rotted down
2. All departments within the Factory site were scrap.
3. The layout and safety of the Plant were not in accordance international standards.
4. Factory assets had minimal to zero value
5. The asset value was too low and could only be attributed to the value of the land on which the old factory stands.

Based on the above findings TSCL found that the rehabilitation cost would be too high and would require higher annual maintenance costs and therefore it would be in the interest of all parties involved to build a state of the art and efficient Sugar Factory with a Power Plant that would require minimal maintenance for at least 15 years and achieve the international standards for consumer export. A new vertically integrated Plant with multi-revenue streams will be able to compete on the world market with lower production costs.

Also the owners of the Property were not willing to sell.

8 ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

8.1 AGRO-PROCESSING FACILITY (SUGARCANE PROCESSING)

Designed for maximum output, the facility will operate 24 hours a day, seven days a week, for approximately 210 to 240 days annually, depending on cane availability. It is projected to produce an impressive 50,000 tons of sugar and 1,750 tons of molasses annually, reinforcing its role as a significant contributor to the agro-processing sector. A workforce of 200 employees will operate the plant, providing valuable employment opportunities in the region and contributing to the local economy.

A permit application under the category **Construction and Operation of Agro-Processing Facilities (including sugarcane)** was submitted to NEPA for this activity.

8.2 LAND PREPARATION, CANE HARVESTING AND POST-HARVESTING PRACTICES

TSCL will lease cane lands for the cultivation of cane which will supply the factory with the raw material input to the sugar factory operations. The lands outlined in blue in Figure 105 and listed in Table 25 are those that will be leased from the SCJH. The cane lands and residential lands to be leased total some 5,163.50 Ha. The lands will be assigned/leased to farmers to cultivate sugar cane and irrigation water will be provided by wells and pumps assigned to TSCL by SCJH (Appendix 4) in addition to treated effluent that meets the NRCA standards.

Figure 105: Cane Lands Leased from SCJH by TSCL

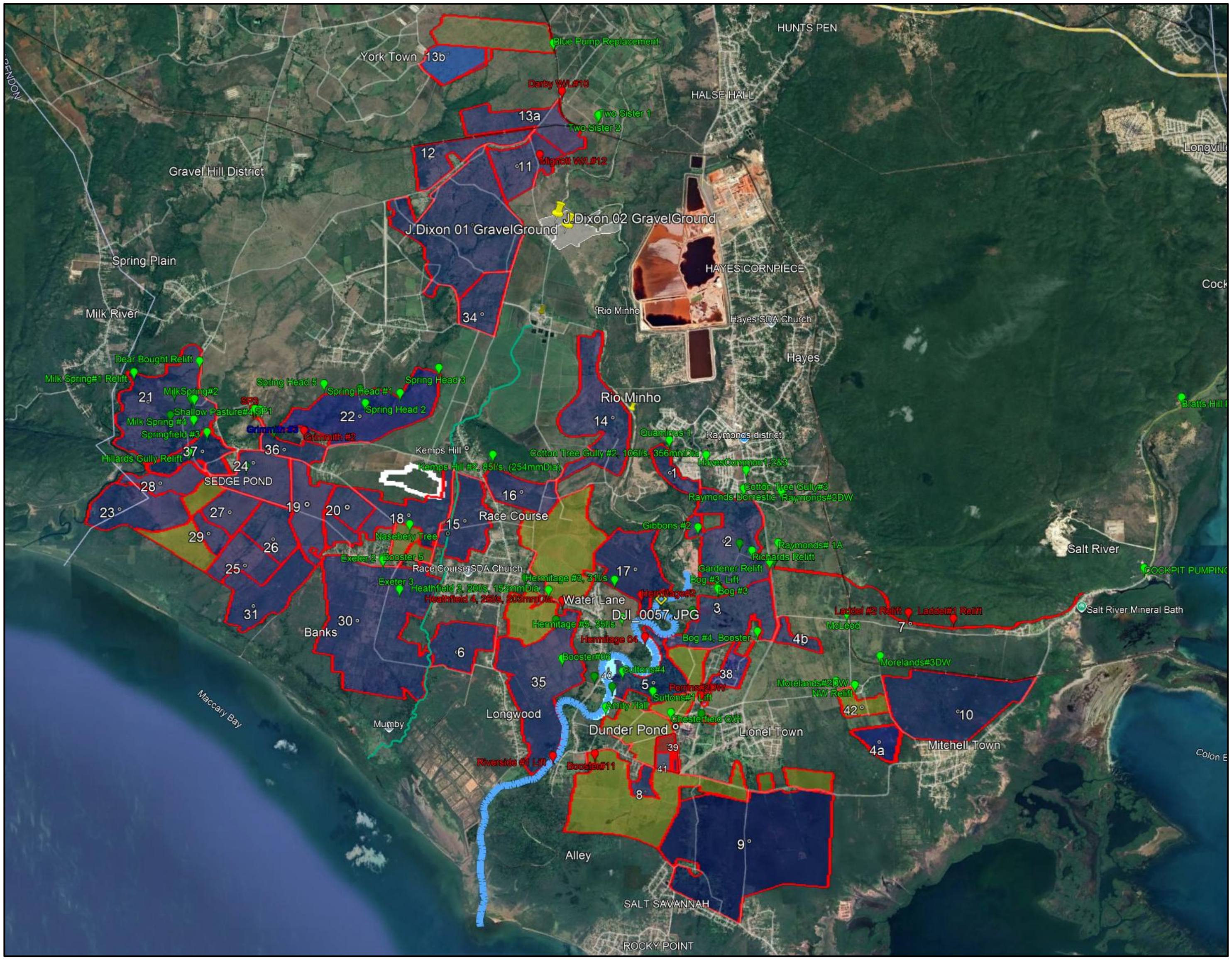


Table 25: Sugarcane Land Leased from SCJH

Item	Location	Parcel	Area		Vol	Folio
			Acres	Hectares		
1	Quaminus		85	34.4	1270	91
					1424	22
2	Bog	Vacant	495	200.32	1425	462
3	Bog	Vacant	380	153.78	1425	426
4a		Surrendered by TMG Omega	100	40.47	1456	156
4b	Dawkins Pen	Vacant	58	23.47	1424	22
					1456	156
5	Suttons	Caribamboo (Vacant)	218	88.22	1456	221
					1452	795
					1085	898
6	Haylesfield	Vacant	216	87.41	1304	620
7	Hillside	Cockpit Canal Lands	20	8.09	1424	13
8	Amity Hall & Pusey Hall	Lincoln Weir (Vacant)	46	18.62	1273	445
9	Salt Savannah	Vacant	1,422.00	575.48	1456	366
					1270	547
					1423	86
					1273	445
10	Morelands	AIC - Proposed (Castor)	644	260.62	1456	156
11	Parnarsus / Crooks Gate	Vacant/Adjacent to Mignott	235	95.1	1278	24
12	Parnarsus/ Sandy Gully	Vacant	215	87.01	1278	24
13a	Parnassus # 2 Cooks Gate	Vacant	272	110.08	1278	23
13b	Parnassus	Vacant	165	66.77	1278	23
14	Caswell Hill	Vacant	470	190.21	1456	270
15	Waterwell	Vacant	259	104.82	1452	269

Item	Location	Parcel	Area		Vol	Folio
			Acres	Hectares		
16	Ashley Hall	N/A	183	74.06	1456	270
17	Needham	Vacant	330	133.55	1424	22
18	Paradise (Sedge Pond)	Vacant	342	138.41	1452 1270 1273	269 569 446
19	Sedge Pond	N/A (Prev. John Plummer)	247	99.96	1270	543
20	Sedge Pond	Lanceford Dyer & Nicheal Dadzie	116	46.94	1270 1273	569 446
21	Milk Spring	Vacant	641	259.41	1423 1270	82 543
22	Spring Head	Vacant	541	218.94	1288	445
23	Springfield	Shirjonro	323	130.72	1270	543
24	Springfield	Vacant	246	99.55	1270	543
25	Springfield	John Plummer	182	73.65	1270	543
26	Springfield	Courtney Williams	191	77.3	1270 1270	543 545
27	Springfield	Siri	142	57.47	1270	543
28	Springfield	Stanford Reid	128	51.8	1270	543
29	Springfield	Siri	70	28.33	1270	543
30	Exeter	Vacant	1,121.00	453.66	1304 1452 1270	620 269 544
31	Beauchamp	Vacant	314	127.07	1270	544
32	St. Jago	Vacant	195	78.92	1431	58
33	Vernamfield	Vacant	936	378.79	1416	219
34	Vernamfield	Charoo	190	76.89	1416	219
35	Vizzard Run /Longwood	Vacant	653	264.27	1304	620

Item	Location	Parcel	Area		Vol	Folio
			Acres	Hectares		
36	Grimmith	Vacant	102	41.28	1270	543
37	Springfield/ Milk Spring	Vacant	174	70.42	1270	543
38	Perrins	Perrins Compound	92		1456	236
39	Chesterfield	Factory	27	10.93	1456 1423	235 86
40	Hermitage	Sand Mining	26	10.52	1456 1452	221 795
41	Chesterfield	Corporate Space	36	14.57	1456 1423	235 86
42	Braziletto	Limestone Mining	16	6.48	1424	13

SUMMARY & TOTALS	Acres	Hectares
Cane Farming & Residential (Lease)	12,759.00	5,163.50
Factory Site (Sale)	27	10.93
Corporate Space (Lease)	36	14.57
Mining - Sand (Lease)	26	10.52
Mining Limestone (Lease)	16	6.48
GRAND TOTAL	**12,864.00**	**5,205.99**

The process of rehabilitation and development of the land through to harvesting will be systematic and will involve the following processes:

1. Land clearing and cutting of access roads.
2. Ripping and ploughing of soil.
3. Land levelling.
4. Harrowing and furrowing of the soil.
5. The positioning of pumping stations and irrigation of the soil.
6. The installation/connection of the power supply.
7. The installation of solar-powered pumps at a remote location.
8. The installation of wind powered pumps at a remote location.
9. The installation of the net metering system by JPS.
10. Nursery & Seed development.

11. Sampling plantation.
12. Pest management.
13. Weed management.
14. Intercrop development.
15. Harvesting and transportation.

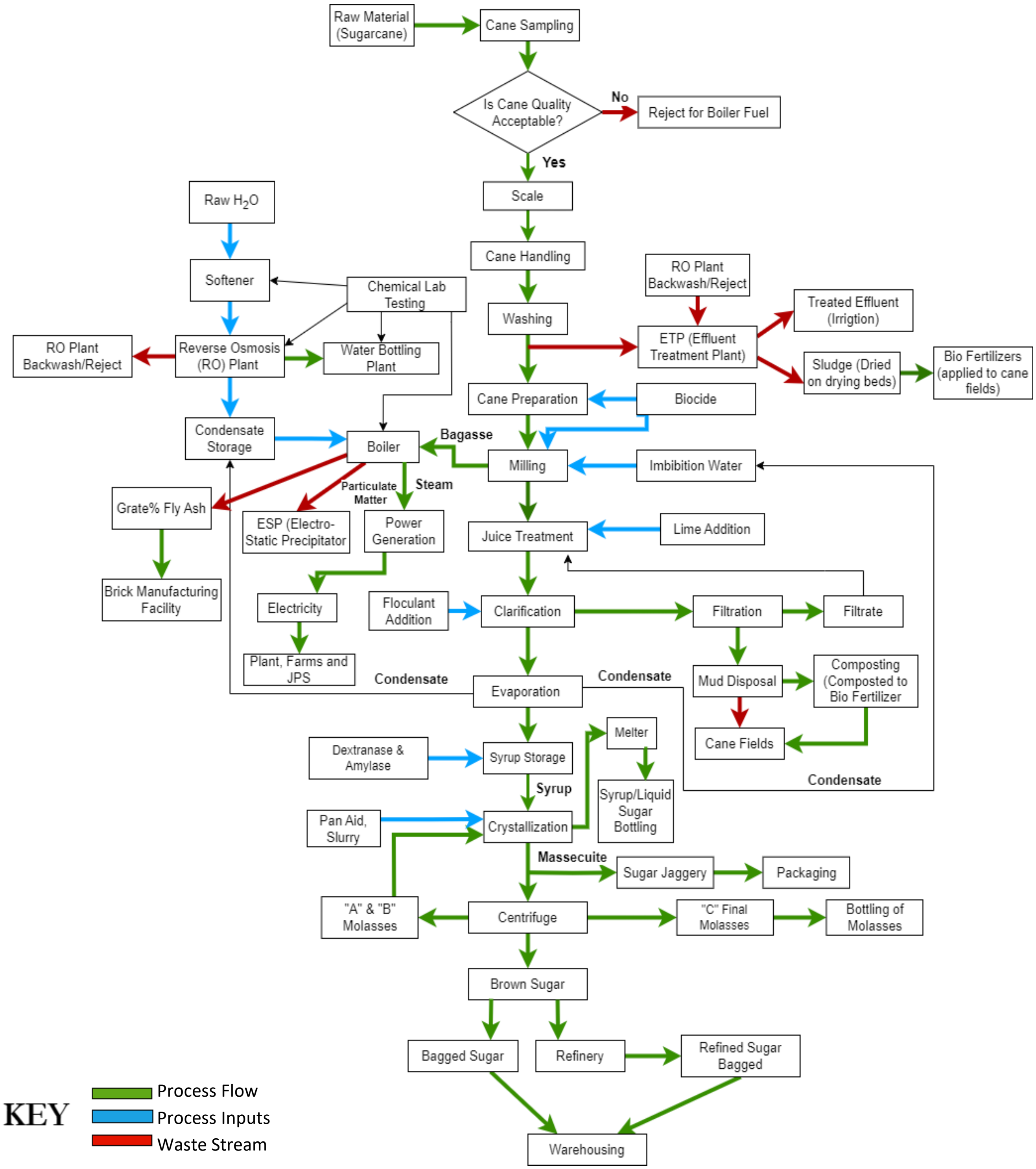
The agro-processing facility emphasizes sustainability and efficiency in its operations, beginning with cane harvesting. Modern mechanical harvesters will replace manual labour to enhance productivity while significantly reducing reliance on traditional methods. This approach will eliminate the need for burning cane, preserving soil health and reducing environmental pollution. Additionally, the facility will employ green cane harvesting, an eco-friendly technique that eliminates the need for water during the cleaning process and prevents sugar loss, thus ensuring optimal yield. Post-harvest practices will include sugar plantation techniques optimized to support the green harvesting approach, promoting environmental sustainability and resource conservation.

8.3 OVERVIEW OF MAIN AGRO-PROCESSING OPERATION

The agro-processing facility is extensive and consists of multiple interconnected systems designed to ensure efficiency and product quality (Figure 106). The key operations involved are as follows:

1. Sugarcane Unloading and Handling
2. Sugarcane Preparation
3. Sugarcane Milling
4. Bagasse Handling System
5. Juice Clarification
6. Evaporation and Boiling
7. Cooling and Curing
8. Sugar House
9. Steam and Power Generation
10. Pressure Reducing and De-Superheating System (PRDS)
11. Demineralization (DM) Plant
12. Effluent Treatment Plant (ETP)
13. Electrical Distribution, Switchyard & Automation System

Figure 106: Tropical Sugar Agro-Processing Facility - Process Flow Diagram/Chart



8.3.1 SUGARCANE UNLOADING AND HANDLING OPERATIONS

This step involves receiving the sugarcane at the facility, weighing, and transferring it to storage or directly into the processing lines. The unloading operations for sugarcane processing involve sophisticated machinery and well-engineered components to ensure efficient handling of incoming materials. The main machinery includes a cane unloader and two (2) feeder tables.

The cane unloader includes two bridges, each with two trolleys and a 5 MT grab-type lifting system. The crane bridge is made of strong steel in a box-like design, while its gantry columns are shaped for stability, with extra reinforcement on the end columns. Tie beams add further support, and the wheels are equipped with durable bearings to ensure smooth operation.

The feeder tables are placed at right angles to the cane carrier and help to move the cane more efficiently. Each table is 6 meters wide and 7 meters long, made of sturdy steel, and equipped with eight heavy-duty chains capable of handling large loads. They include strong sprocket wheels, shafts, and bearings for durability and are supported by a robust steel structure designed to absorb shocks. Installed horizontally, the tables ensure smooth and reliable material flow.

8.3.2 SUGARCANE PREPARATION

This step involves receiving the sugarcane at the facility, weighing, and transferring it to storage or directly into the processing lines. The sugarcane is cleaned and chopped into smaller pieces to facilitate the extraction of juice and includes removing trash and stones to prevent damage to machinery. The relevant machinery consists of the main cane carrier, rake elevator, prepared cane belt conveyor, magnetic tramp iron separator, cane chopper, cane leveller, and swing hammer fiberizer, all working together to ensure efficient sugarcane handling and preparation for milling.

The main cane carrier, 1,525 mm wide and 30 meters long, is built entirely of steel and equipped with durable chains for transferring cane to the next stage. A rake elevator lifts the prepared cane using sturdy steel flights, which then transfers to a 1,600 mm wide belt conveyor, designed to feed the first mill seamlessly. To ensure safe processing, a magnetic tramp iron separator removes metal debris from the cane stream.

The cane preparation system includes a chopper with 24 knives and a leveller with 36 knives, both mounted on strong forged steel shafts to cut and even out the cane for uniform feeding. Finally, a swing hammer fiberizer with 96 hammers processes the cane into fine fibres, optimizing it for milling. Together, these devices streamline the movement and preparation of sugarcane for efficient and consistent milling operations.

8.3.3 SUGARCANE MILLING PLANT

The milling plant at the facility has been designed to maximize efficiency, durability, and operational productivity through cutting-edge engineering and technology. It features four Ulka Compact Multi-Roller (CMR) mills, each with a two-roller configuration of size 30" x 60" and powered by 350 kW foot-mounted drives. The prepared sugarcane passes through mills where rollers extract the juice. This patented design eliminates conventional trash plates and closed pressure chutes, ensuring smoother operation and reduced maintenance needs.

Each mill is equipped with stainless steel juice trays securely welded/bolted to the headstocks and five rollers, including a top cast iron (CI) roller and a bottom CI roller, complemented by three toothed roller feeders (TRF) and a Donnelly-type stainless steel chute for smooth material flow. These feeders streamline the feeding process and ensure uniform crushing. The top roller is free-floating, pivoted at one end, and utilizes hydraulic loading to maintain optimal pressure, improving sugar extraction efficiency. A rotary drum with a wedge-type screen is integrated into the system to continuously screen and clarify the extracted juice, ensuring high-quality output while bagasse (fibrous residue) is separated for subsequent utilization.

8.3.4 BAGASSE HANDLING SYSTEM

Bagasse (fibrous residue) generated from the milling process is either stored or directly fed into the boilers for steam/power generation. The system incorporates a steel rake-type elevator (1,200 mm wide) and bagasse-cum-return carrier, engineered to optimize the transportation of the material. Bagasse is solid biomass and will be stored in the open yard as mounds, ensuring adequate ventilation and accessibility for utilization. An example is shown in Figure 107.

Figure 107: Typical Bagasse Storage

8.3.5 JUICE CLARIFICATION (BOILING HOUSE)

The boiling house is a key part of the facility, designed with advanced systems for efficient juice clarification, heating, and treatment. The clarification plant employs a robust defecation process where the raw juice is treated with chemicals and heated to remove impurities and prepare juice for further processing. It includes a 26ft diameter mild steel clarifier and juice defecator ensures effective separation of impurities while maximizing juice quality. A coriolis-type mass flow meter is attached for precise juice flow measurement, along with a stainless-steel phosphoric acid dosing tank for enhancing juice clarity and stability. There are four **juice heaters** (vertical tubular units) each with a 170m² heating surface, made from stainless steel for raw juice pipelines and mild steel for treated juice lines, ensuring thermal efficiency.

Bagacillo, fine fibre byproduct of juice clarification, will be collected using a **cyclone system** (high chimney and a fan and ducting system) and added to the bagasse stockpile to ensure a clean working environment.

8.3.6 EVAPORATION AND BOILING

In this step, the juice is concentrated by boiling under reduced pressure, removing water, and converting it into thick syrup, which undergoes crystallization. The facility features a range of advanced systems for sugar processing, including a quadruple effect evaporator set, syrup and molasses tanks, crystallizers, vacuum pans, a spray pond, and other essential components to ensure efficiency and quality.

The evaporator set plays a vital role in concentrating the juice by removing water through multiple stages of evaporation. It has leak-proof valves and a condensate flash vessel to optimize the process by recovering heat and minimizing energy loss. The addition of caustic soda from the tank (20,000L) and the use of a syrup sulphitation unit ensures that the juice is properly treated and clarified, removing impurities and stabilizing the product for further processing.

Once concentrated, the syrup is transferred as necessary and undergoes additional treatment, including molasses conditioning, using specialized conditioners to enhance the quality of the byproduct. The setup includes a 40,000L syrup receiver fabricated from mild steel, along with 11 syrup and molasses tanks, each with a 20,000L capacity, interconnected for efficient storage and transfer.

8.3.7 COOLING AND CURING

After processing, the syrup is cooled to allow sugar crystals to form. The vacuum pans, located at elevated levels, facilitate the crystallization of sugar by controlled evaporation and cooling under vacuum, ensuring the formation of high-purity sugar crystals. Crystallization is further refined in seed/vacuum crystallizers to achieve the desired crystal size and consistency. These crystals are then separated and conditioned using horizontal and vertical crystallizers, where the massecuite (sugar-molasses mixture) undergoes cooling and air circulation to ensure a high-quality finalized product.

The condensers and spray pond work in tandem to manage cooling water efficiently. The condensers recover heat from the evaporators, while the gravity-type spray pond ensures effective cooling of water, enabling its reuse within the system.

8.3.8 MOLASSES STORAGE

For molasses management, a mass flow meter, rated at 10T/hr, ensures precise measurement as the molasses is conveyed via a molasses line from the molasses pump to a final storage tank, made of mild steel, with a capacity of 5,000 L initially and space for future expansion with another 5,000 L tank. A water conservation system recirculates cooling water used in various processes, such as mills, crystallizers, and compressors, promoting resource efficiency. Additionally, service water tanks with robust construction provide sufficient water supply for auxiliary operations.

8.4 AGRO PROCESSING OPERATIONS - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the agro-processing (sugar manufacturing) operations are presented in Table 26.

Table 26: Agro-Processing Operations – Aspects & Impacts

ASPECT	IMPACT
Trade effluent	Land and water pollution
Solid Waste • Filter press mud	Land and water pollution
Solid waste • Garbage	Land and water pollution
Noise	• Noise pollution • Health impacts
Spills & Leaks • Molasses	• Land and water pollution

8.5 STORAGE AND HANDLING OF HAZARDOUS MATERIALS

For the various processes at the sugar factory, several chemicals will be utilised. Bulk chemicals will be stored with appropriate impermeable secondary containment with no apertures.

- Secondary containment for solitary aboveground storage tanks of a large capacity (4,000L or more) will be 1.1 times (110%) the volume of the tank
- For tank farms containing large above ground tanks (4,000L or more), the bund will contain 100 % of the capacity of the largest tank in addition to 10% of the aggregate capacities of the other tanks.

Where there is centralized storage of hazardous materials in smaller containers, these will be stored in an impermeable area with secondary containment designed to contain 25% of the total volume of the containers.

A permit application under the category **Construction and Operation of Facilities for the Storage of Hazardous Materials, Toxic Chemicals and other Similar Substances** is being submitted to NEPA for this activity.

A list of the chemicals (inclusive of cleaning chemicals) and their uses are as follows:

1. **Evaporator antiscalant -** Helps to prevent scale formation in the evaporator, which improves heat transfer and reduces the need for chemical cleaning
2. **Juice clarifiers-** Used to adjust pH, clarify, and settle suspended solids in the juice clarification process
3. **Biocide -** Used to prevent microbial development and regulate sucrose loss
4. **Flocculants -** Used to aid in the clarification of cane juice, which affects the quality and production cost of sugar
5. **Boiler water chemicals -** Used to remove or modify substances that could damage the boiler, such as scale, corrosion, or foaming
6. **Antifoaming agent -** Used in industrial fermentation to prevent microbial contamination and substrate losses
7. **Decolorizing agent -** Used to clarify refinery sugar liquors, syrups, and juices, and to manufacture very low colour sugar

Some chemicals are in 200 L Barrels and 20 L jars.

In addition to the secondary containment, appropriately rated fire prevention and response equipment will be in place.

Bulk chemicals include caustic soda that will be stored in bags in the form of flakes and will be used in the evaporation and boiling plant. This plant will also contain 11 No. syrup (future addition, none needed during commissioning as the focus will be on sugar production) and molasses rectangular tanks made of mild steel, initially one (1) 5,000L molasses tank will be installed, with space retained for a future molasses tank also of 5,000L.

Other bulk chemicals to be stored in drums and bags include:

- Hydrochloric acid (HCl)
- Caustic Soda Flakes
- Hydrogen Peroxide
- Sodium hydroxide
- Alum – Stored in bags
- Salt – Stored in bags
- Lime – Stored in bags

The Safety Data Sheets (SDSs) for the chemicals will be included in the EIA report.

8.6 HAZARDOUS MATERIALS - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the storage of hazardous materials are presented in Table 27.

Table 27: Hazardous Materials Storage and Handling – Aspects and Impacts

ASPECT	IMPACT
Hazardous waste	• Land and water pollution • Health impacts
Solid waste • Garbage	Land and water pollution
Spills & Leaks • Chemicals	• Land and water pollution

8.7 FUEL STORAGE

The details on the fuel storage tank that will be installed at the facility is described in Table 28 below. Since this tank is below the threshold of 4,000 L for requiring a permit from the Agency, no application will be submitted. However, the tank will have secondary containment with capacity at least 110% of the capacity of the fuel tank, made of impermeable material and with no apertures in the bund.

Table 28: Fuel Storage Tank Description

Contents	Capacity (L)	End User	Location	Bund Capacity
Diesel Tank	990	Diesel Generator	Above-ground	• At least 110% of the capacity of the tank. • Details are to be provided when the drawings are completed

8.8 FUEL STORAGE - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the storage of fuel are presented in Table 29.

Table 29: Fuel Storage and Handling – Aspects and Impacts

ASPECT	IMPACT
Solid waste • Garbage	• Land and water pollution
Spills & Leaks • Fuel	• Land and water pollution

8.9 SUGAR HOUSE (BOTTLING AND BOXING FACILITIES)

The sugar house operations are engineered to handle large volumes of product with precision. The final sugar product is processed, dried, graded, and packed in this stage with the facility equipped to handle various types of sugar grades as required. A permit application under the category **Bottling Facilities and Boxing Plants** is being submitted to NEPA for this activity.

Key components include batch centrifugal machines for separating sugar crystals and molasses, supported by pug mills and molasses runoff tanks. The massecuite is fed into a centrifuge which spins at high speeds, using centrifugal force to push the heavier sugar crystals outward while allowing the lighter molasses to drain through a perforated basket/mesh. The sugar crystals are retained for further processing, while the molasses is collected as a byproduct. Once separated, the molasses undergoes conditioning to ensure uniform consistency and quality. It is stored in tanks before bottling as needed.

To manage sugar handling, the facility includes a grass hopper conveyor for moving sugar from the centrifugal machines and a sugar elevator, capable of transporting 15 tons per hour to the grading system. Sugar is then stored in bins with a durable construction for hygienic containment before being packaged. Automatic sugar weighing machines and stitching machines with slat conveyors facilitate efficient packaging, enabling the facility to process up to 600 bags per hour. The operation is expected to have 5 persons/ shift.

In the future, liquid sugar will be bottled and also placed in sachets of various sizes (10g, 500 g, 1,000 g, 5kg) packets for retail distribution. Packets of refined and brown sugar cubes will also be produced.

HACCP, ISO and FSSC/FDA Standards will be implemented.

The expected waste streams from this activity include:

- Waste sugar
- Packaging material

8.10 SUGAR HOUSE - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the sugar bagging operations are presented in Table 30.

Table 30: Bagging Operations – Aspects and Impacts

ASPECT	IMPACT
Solid waste • Packaging • Sugar	Land and water pollution

8.11 POWER GENERATION USING RENEWABLE FUEL A SOURCE

A permit application under the category **Power Generation: Construction and operation of power generation plants of 200kW** or above using renewable sources of energy is being submitted to NEPA for this activity.

TSCL intends to produce 12.5 MW of power from 100 % Bagasse and the power generated will be allocated as follows:

- Milling 2,500 tons of cane crushed per day (TCD)
- Consumed for Factory 3.50 MW
- Export to Farms 3.0 MW
- Excess of 5.0 MW for National Grid.

TSCL will use electricity from the Jamaica Public Service Company Ltd. (JPSCo.) initially to run the required pumps and power the factory during installation. During factory operations it plans to sell excess power to JPSCo.

In its strategy to utilise "green fuel" for sustainability, TSCL plans to have a cogeneration facility for the generation of electricity as shown in Figure 108 and Figure 109. The advantages of co-generation include:

1. Better power quality
2. Improved reliability and run ability
3. Lower energy costs
4. Reduction of CO_2 emissions in the environment
5. Conservation of natural resources
6. Support to grid infrastructure

    - Fewer Transmission and Distribution (T & D) constraints
    - Defers costly grid upgrades

- Price stability

A Power Purchase Agreement (PPA)/ Wheeling permission is under consideration. A meeting with the Minister is to be scheduled for further discussion since power generated is green and reducing the carbon footprint significantly. As a country, Jamaica will save lot of foreign currency in terms of reduction in the use of fossil fuels.

Figure 108: Co-generation in Sugar Mills

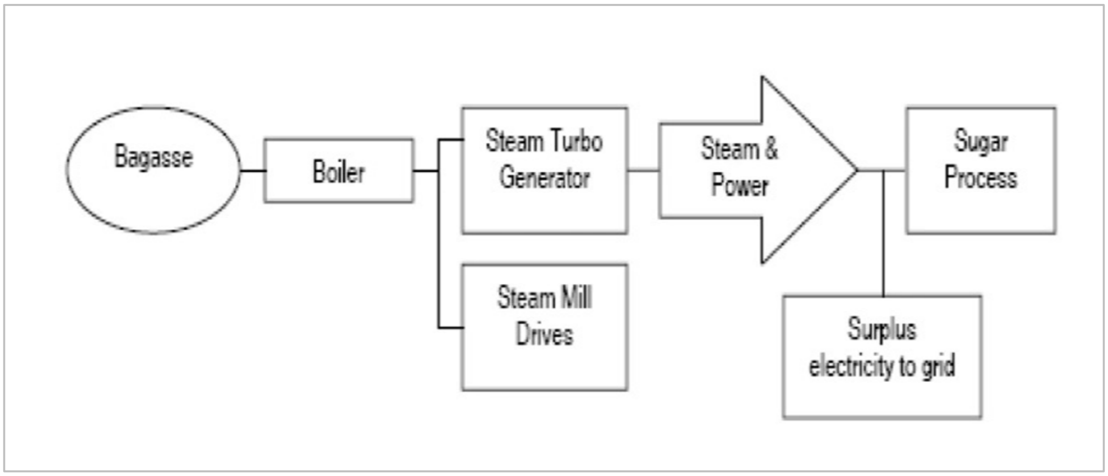
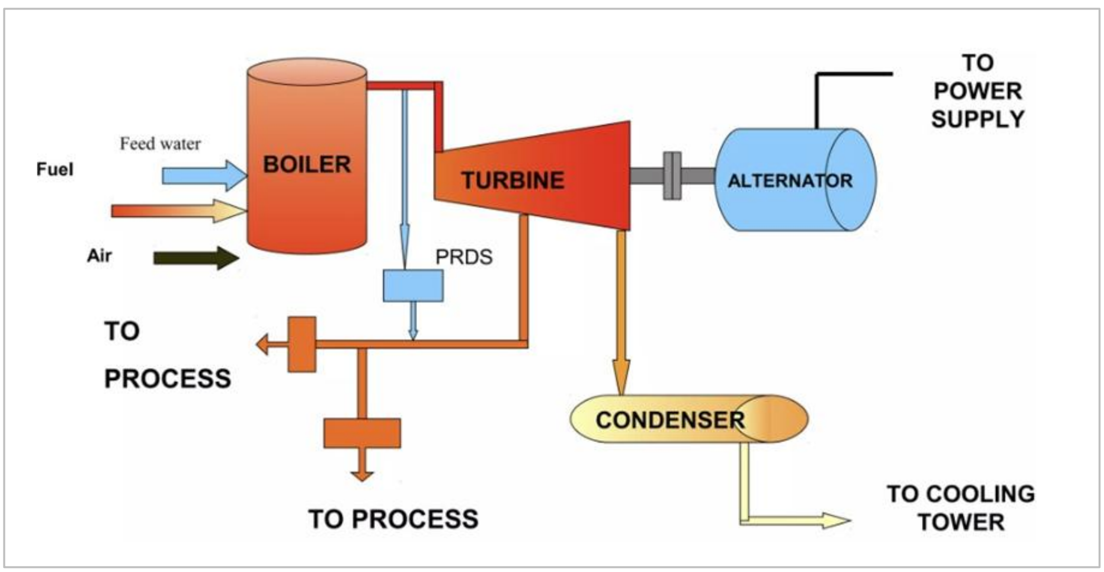


Figure 109: Co-generation Plant Layout



The calculations for the power and steam balance are presented in Table 31.

Table 31: TSCL 2500 TCD Sugar Plant Steam & Power Balance

Tropical Sugar 2500 TCD Sugar Plant Steam & Power Balance			
DETAILS	UNIT	QTY.	REMARK
Cane Crushing per Hour	TONS	114	
Bagasse produced @28% per Hr	TONS	32	
GCV of bagasse @ 50% moisture	Kcal/kg	2170	
Boiler Parameter- Pressure	Kg/Cm^2	67	Multi fuel Trava grate
- Temperature	Deg C	510	
- Flow	TPH	60	
Steam consumption for Sugar plant @40%	TPH	45.5	
Steam to Condenser	TPH	14.5	
TOTAL STEAM TO BE PRODUCED	TPH	60.0	
POWER GENERATION IN THIS STEAM	MW	12.00	12 MWE DEC Turbine
Power required for Sugar Mill	MW	3.4	
Power required for Irrigation	MW	3.6	
TOTAL POWER REQUIRED	MW	7.0	
Power Available for Sale	MW	5.0	Net Export to JPS
Bagasse saving per Day	TPH	109.1	
Bagasse Savings per Annum	Tons	26182	
Power plant operation during off season	No of Days	90	
Bagasse Required for Off season	MT	21600	
Power Generation during Off Season	MWe	5.0	Net Export to JPS
Bagasse available for Next season Start-up	MT	4582	
Total No of Days Power Export to JPS	No of Days	330	Green Power @ 5.0 MWe

The facility's boiler system is designed to burn bagasse, a byproduct of sugar production, as fuel. The travelling grate boiler ensures efficient combustion and energy recovery, while components such as the steam drum, mud drum, economizer, and superheaters enhance performance while turbines convert some of this energy into electricity to meet the factory's power demands. A fly ash collection system, which includes electrostatic precipitators is be used to ensure compliance with relevant environmental standards.

The proposed plant of capacity 2,500 TCD is integrated with the Juice Extraction Plant, Process Plant, Steam & Power Generation Plant, Pressure Reducing and De-Superheating System (PRDS), Effluent Treatment Plant (ETP) Plant and Demineralization Plant (D. M.) Plant.

The process has been neatly designed to achieve the lowest steam and power consumption, targeted crushing rate, maximum extraction and optimum boiling house efficiencies for a hassle-free continuous operation. The main parameters that form the basis for the design are outlined in Table 32.

Table 32: Main Design Parameters for Proposed Sugar Factory

1.0	Normal Crushing Capacity	2,500 TCD
2.0	Site Conditions	
2.1	Location	Lionel Town, Jamaica,

3.0	Milling Plant And Boiling House	
3.1	Pol % Cane	Average 12.00%
3.2	Fiber % Cane	12% to 18%.
3.1.3	Extraneous Matter	Fresh, Clean, Mature cane harvested manually and having extraneous matter not more than 2% by weight.
4	Instrumentation Voltage Phase	230 V ± 10% AC Single Phase ; 50Hz AC
5	Filed transmitter	24 V DC
6	Cooling Water Quality	At temperature of 32°C or ambient temperature whichever is lesser.

The boiler will be provided with all required base frame, steel work of sufficient height with required foundation bolts, etc. The steel supporting structure for the boiler, economiser, air heater will be from the operating floor level. The required structural columns, frame work for the economiser, ducting and piping, equipment, staircases up to boiler drum level (one side of boiler) will be provided with stairs and walkways. The steam drum ends will be provided with an independent local platform. In addition, pipe supports, hangers, duct supports, etc. will be provided for the complete system covered in this specification.

The boiler will be operated according to the following design parameters:

- Boiler fuel for load carrying is Bagasse at 100% maximum continuous rating (MCR)
- Fuel size at both the inlet and outlet is bagasse milled free from foreign materials

The fuel (bagasse) analysis is presented in Table 33.

Table 33: Bagasse Composition

Fuel (Bagasse) Composition	% by Weight as Fired Basis
Moisture	50.00
Ash	01.25
Carbon	23.50
Hydrogen	03.25
Nitrogen	00.00
Sulphur	00.00
Oxygen	22.40
Gross Calorific Value (GCV) (Kcal/kg)	2,272

Note: Fuel will be reasonably pure and free from impurities such as clay, rock, stone, nails, etc.

The fly ash collection system consists of electrostatic precipitators (ESPs) comprising a number of dust collecting plates - rows in parallel forming a multi-parallel gas path and with discharge electrode freely suspended within this path. These are all housed in a mild steel casing complete with hoppers properly lagged with insulating material to avoid radiation losses and condensation. The ESPs are to control particulate matter below 50mg. The burning of bagasse in the boiler generates grate and fly ash and the ash density of each is presented in Table 34.

Table 34: Ash Density

Description	Density (kg/m³)	
	Capacity Calculations	Load Calculations
Bagasse Grate ash	150	200
Bagasse Fly Ash	150	200

Utility data is presented in Table 35.

Table 35: Utility Data

Cooling water Temperature	°C	32
Quality	-------	Filtered water
Noise level		
For individual rotating equipment only.	dB(A)	85 at 1.0 m distance from the equipment outer surface except boiler feed pump will be 110 dB(A) at 1 m distance from the equipment outer surface
For individual safety valves and start up vent with silencers		110 dB(A) at 3 m distance
Surface temperature of thermal insulation		20°C differential temperature with respect to ambient temperature with wind velocity of 1 m/s (Except for refractory covered surface & surfaces exposed to direct sunlight)
Dust emission at ESP outlet (at actual O_2) (for 100% bagasse firing and analysis as furnished above)	Mg/Nm³	50 mg/Nm³ (With all fields in service)

The recommended boiler requirements are presented in Table 36.

Table 36: Recommended Feed and Boiler Requirements

DESCRIPTION	UNIT	FEED WATER	BOILER WATER
Total Hardness (Max.)	ppm	Nil	Nil
pH Value at 25°C		8.5-9.5	9.1-10.1
Oxygen (Max.)	ppm	0.005	NT
Iron (Max.)	ppm	0.02	Nil
Copper (Max.) ppm	ppm	0.02	Nil
Silica (Max.)	ppm	0.02	5.0

DESCRIPTION	UNIT	FEED WATER	BOILER WATER
Total CO_2 (Max.)	ppm	Nil	Nil
Permanganate (Max.)	ppm	Nil	Nil
Total Dissolved Solids (Max.)	ppm	0.1	200
Total Suspended Solids (Max.)	ppm	Nil	5
Oil (Max.)	ppm	Nil	Nil
Specific electric conductivity at 25°C	ppm	0.2	400
Residual Phosphate (Max.)	------	10 – 20	

NT – Not Traceable. Note: Condensate return should meet the above feed water quality.

Table 37 describes the Air Compressor specifications.

Table 37: Air Compressor Specifications

PARAMETERS	UNIT	VALUE
Type		Non lubricated reciprocating air compressor
Applications		For Instrumentation, Service & pneumatic equipment
No. of compressor	Nos.	2
Discharge Pressure	kg/cm^2 (a)	7-8
Medium to compressed		Atmospheric Air
Air Drier		
Type		Refrigerant
Nos.		2 x 100%
Capacity	Cubic feet per minute (CFM)	As per system requirement
Pressure Dew point Temperature		+3°C
Air Receiver		
Nos.		One for Instrument & one for service.
Volume	m^3	As per system requirement

Appendix 1 presents the piping material considered for the proposed sugar plant as well as the latest design codes and standards for the power generation plant.

8.11.1 PRESSURE REDUCING AND DE-SUPERHEATING SYSTEM (PRDS)

This system regulates the pressure and temperature of steam before it is used in various operations, ensuring safety and process efficiency.

8.11.2 TURBO ALTERNATOR (TURBINE)

The facility's steam turbine is a multi-stage, nozzle-governed condensing turbine, engineered for high efficiency and reliability. It includes an integral steam strainer and hydraulically operated stop and emergency valves for operational safety.

8.11.3 INSULATION AND CLADDING

To enhance energy efficiency and safety, all equipment and pipelines in the sugar plant operating above 55°C (except where heat dissipation is desirable) will be insulated with factory-made glass wool or mineral wool. Aluminium cladding will be added to provide additional protection, ensuring long-term durability.

8.11.4 ELECTRICAL DISTRIBUTION, SWITCHYARD & AUTOMATION SYSTEM

This system manages the distribution of electricity across the facility, integrating automation to enhance operational control and efficiency. Key features include:

- **Busbar trunking** for efficient power distribution.
- **Main distribution panels** fabricated from cold-rolled steel for durability and protection against dust and moisture.
- **Motor Control Centres (MCCs)** for zone-specific load management, ensuring operational efficiency across the plant. This system guarantees uninterrupted power supply, enabling continuous operation.

8.12 POWER GENERATION - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the power generation facility are presented in Table 38.

Table 38: Power Generation Plant – Aspects and Impacts

ASPECT	IMPACT
Use of water	Depletion of water
Use of renewable resource (bagasse) to generate electricity	Avoidance of the use of fossil fuels (no-renewable resource)
Air emissions • Stack emissions from boiler • Bagacillo from bagasse handling and storage	• Air pollution • Health impacts

ASPECT	IMPACT
Noise	• Noise pollution • Heath impacts
Solid Waste • Grate and fly ash • Bagacillo	• Land and water pollution • Health impacts

8.13 DEMINERALIZATION (DM) PLANT/WATER TREATMENT PLANT

TSCL will establish a water treatment facility to purify water for operations at the factory. TSCL will abstract fresh water from wells/streams licenced to SCJH/NIC/WRA as part of lease and licenced thereafter. The proposed well for potable water supply to the sugar factory is the Raymonds Domestic well (Appendix 4).

180 m^3 of water per day (this includes both recycled and abstracted water) will be treated and purified in the DM Plant for use in the boilers to meet the recommended feed and boiler requirements in Table 39 below. Purification involves removing dissolved salts and minerals.

The treated water will be distributed to the Sugar Manufacturing process (80%) and to the Co-Generation Plant (20%).

Table 39: Recommended Feed and Boiler Requirements

DESCRIPTION	UNIT	FEED WATER	BOILER WATER
Total Hardness (Max.)	ppm	Nil	Nil
pH Value at 25^0C		8.5-9.5	9.1-10.1
Oxygen (Max.)	ppm	0.005	NT
Iron (Max.)	ppm	0.02	Nil
Copper (Max.) ppm	ppm	0.02	Nil
Silica (Max.)	ppm	0.02	5.0
Total CO_2 (Max.)	ppm	Nil	Nil
Permanganate (Max.)	ppm	Nil	Nil
Total Dissolved Solids (Max.)	ppm	0.1	200
Total Suspended Solids (Max.)	ppm	Nil	5
Oil (Max.)	ppm	Nil	Nil
Specific electric conductivity at 25^0C	ppm	0.2	400
Residual Phosphate (Max.)		--------	10 – 20

NT – Not Traceable. Note: Condensate return should meet the above feed water quality.

The process involves the following steps which are presented in Figure 111.

1. Advanced Oxidation Process (AOP)
    a. The goal of any AOP design is to generate and use hydroxyl free radical (HO•) as a strong oxidant to destroy compounds that cannot be oxidized by conventional treatment. The AOP is characterized by the production of OH• radicals and selectivity of attack which is a useful attribute for an oxidant
    b. Generation of HO• is commonly accelerated by combining O_3, H_2O_2, ClO_2, TiO_2, UV
    c. Radiation, electron-beam irradiation and ultrasound. Of these, O_3 + ClO_2 + UV hold the greatest promise to oxidize wastewater. 70% BOD and COD reduction in final effluent will be achieved to meet UF and RO feed water parameters with 100% microbial destruction.
    d. The system comprises of Ozone Generator, Oxygen Concentrator, ClO_2 Generator, Ozone + ClO_2 + UV irradiation contact reactor.

2. Clarified Water Tank
    a. After the AOP, the clarified water tank stores water temporarily for further treatment.

3. Multi-grade Sand Filter
    a. Filtering with special quartz filters is also known as depth filtration. The filter performs the filtration of water through a thick layer of graded particles. These particles are quartz sand and gravels. The filtration rate depends on the effective size of the bedding and the velocity through filter bed. When suspended matter comes in contact with media particles, it adsorbs on to it. Clean water then goes via the filtration nozzles through the filter outlet. Cleaning of the filter bed is done by backwashing. Water is inserted in reverse direction from the nozzle upwards, causing suspension of the filter bed, thus releasing the suspended matter from the bedding and it is flushed out through a backwash valve. This backwash water can be drained into the tube settler for water recovery.
    b. Chlorine is usually added before the sand filters. Under these conditions trichloramines will be produced. Trichloramines are formed by the reaction between ammonium and chlorine at a pH less than 5. The biofilm on the sand grains is acidic and is the principal location for trichloramine production.

4. Sand Filters
    a. Sand Filters will remove organic matter and solids from the water, but by acting as biofilters they also convert soluble nutrients back into organic matter in the form of bacteria cell biomass, which is then discharged back into the water supply. The bacterial cell biomass, alginates and waste products are now available to react with chlorine to form Trihalomethanes (THMs). Rapid gravity and pressure sand filters behave as

biofilters, but the high water flow rates and backwash regime results in an unstable system. Bacteria cells are constantly being scoured off the media. If insufficient bacteria are eroded, the biofilm will become unstable, anaerobic zones develop, and methane and hydrogen sulphide are produced. The filters can then dump a slug of bacteria and waste trapped in the biofilm back into the product water. Eventually the bacteria will cause channelling of water through the filter bed providing a conduit for the passage of oocysts and at the same time the filter will discharge bacteria and organics back into the product water which increases the chlorine forming THM level. All of the inherent problems of sand filters could be eliminated if biofouling of the sand is prevented. Unfortunately, this is neither easy nor practical for Large Volume Water Treatment systems. One possible solution is to use an alternative disinfection that actively rejects biofouling.

5. Ultra Filtration (UF)
   a. The Ultra filtration membrane has been specifically selected and designed to pre-treat the sea water, process effluent, surface water, bore well water for Reverse Osmosis membrane systems.
   b. The membrane is made of modified Polyethersulfone (PES), hydrophilic, chemically stable polymer that enables a higher permeate flux when handling various feed streams. It also enables the UF membrane to be more resistant to chlorine, chloramines and sodium hypochlorite – oxidants typically used during membrane cleaning and maintenance.
   c. The outer dense layer and asymmetric structure of the hollow fibre improves the flux, ensures removal efficiency and provides its mechanical strength and long-term reliability.
   d. Thousands of fibres are integrated into well- engineered housings. These modules boast large membrane surface areas with a relatively small footprint. The membrane operates in an "outside-in" mode of filtration. This allows for higher solids loading tolerance as compared to membranes operating in an "inside-out" mode.
   e. The UF is a skid mounted membrane system, which comprises mainly of the hollow fibre UF membrane modules, re-circulation and pneumatically actuated valves. All these are neatly interconnected into a compact and modular train, which comes complete with control system.
   f. The UF permeate can achieve the following parameters, ideal feed water conditions for RO systems:
      1. SDI: < 3
      2. Turbidity : < 0.5 NTU
      3. BOD: < 5 mg/L
      4. COD: < 10 mg/L

5. Oil & Grease: < 0.5 ppm

6. Reverse Osmosis System
    a. The phenomenon of osmosis occurs when pure water flows from a dilute saline solution through a membrane into a higher concentrated saline solution. A semi-permeable membrane is placed between two compartments. "Semi- permeable" means that the membrane is permeable to some species, and not permeable to others. Assume that this membrane is permeable to water, but not to salt. Then, place a salt solution in one compartment and pure water in the other compartment. The membrane will allow water to permeate through it to either side. But salt cannot pass through the membrane.
    b. As a fundamental rule of nature, this system will try to reach equilibrium. That is, it will try to reach the same concentration on both sides of the membrane. The only possible way to reach equilibrium is for water to pass from the pure water compartment to the salt-containing compartment, to dilute the salt solution. Osmosis causes a rise in the height of the salt solution. This height will increase until the pressure of the column of water (salt solution) is so high that the force of this water column stops the water flow. The equilibrium point of this water column height in terms of water pressure against the membrane is called osmotic pressure. If a force is applied to this column of water, the direction of water flow through the membrane can be reversed. This is the basis of the term reverse osmosis. Note that this reversed flow produces a pure water from the salt solution, since the membrane is not permeable to salt.

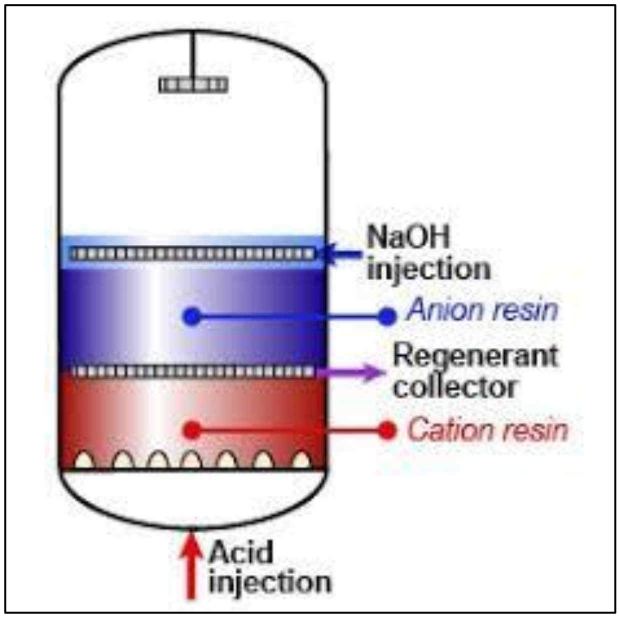
7. Mixed Bed Exchanger

A mixed bed exchanger (Figure 110) is a water treatment device that uses a combination of cation and anion resins to remove trace amounts of dissolved solids from water. The process is called mixed bed ion exchange, and it is used to produce demineralized water for a variety of applications. The Mixed Bed exchanger works as follows:

a. Water flow - Water passes through a resin bed that contains both cation and anion resins.
b. Ion exchange - The resins exchange cations (positive ions) and anions (negative ions) from the water with hydrogen (H+) and hydroxyl (OH-) ions from the resin.
c. Regeneration - The resin is separated into its cation and anion components and then regenerated using hydrochloric acid (HCl) and sodium hydroxide (NaOH).
d. Rinse - The resins are rinsed, and the unit is ready for use again.

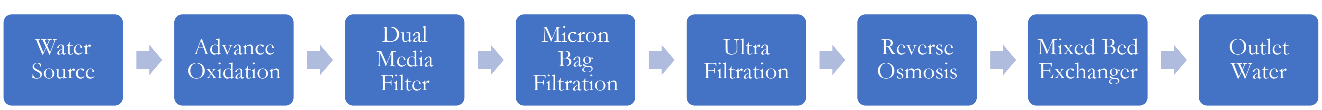
Mixed bed exchangers are often used as a final polishing step after another demineralization process. They can also be used to demineralize water that is already partially demineralized.

Figure 110: Typical Mixed Bed Exchanger



8. Outlet Water after entire process.
   a. After the entire process, the outlet water quality for use in the factory is as presented below:
      - pH – 8.5 to 9
      - TDS - < 0.10 mg/l.
      - Conductivity - < 0.01 mg/l
      - Turbidity – 0.1 NTU
      - Total Hardness – Nil
      - Silica as SiO_2 - Nil

Figure 111: Water Treatment Process Flow



A robust water conservation system has been integrated into the facility to ensure sustainable operations. The closed-loop system will recirculate water used in pumps, mill bearings, crystallizers, and compressors, reducing waste and conserving resources. The system is supported by three overhead tanks, each with a capacity of 20,000L ensuring a reliable water supply for all operations.

Reject water from the treatment plant will be sent to the wastewater treatment plant where it will be treated together with other wastewater streams form the sugar factory and supporting operations. The treated effluent is to be used for irrigation of sugarcane.

8.14 DEMINERALIZATION PLANT (DM)/ WATER TREATMENT FACILITY – ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the water treatment plant facility are presented in Table 40.

Table 40: Water Treatment – Aspects and Impacts

ASPECT	IMPACT
Use of water	Depletion of water
Trade effluent (reject)	Land and water pollution
Spills & Leaks • Chemicals	Land and water pollution

8.15 WASTEWATER TREATMENT PLANT

The operations of the WWTP are described in Section 3.3.2.

8.16 WASTEWATER TREATMENT PLANT - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the water treatment plant facility are presented in Table 41.

Table 41: Wastewater Treatment Plant – Aspects and Impacts

ASPECT	IMPACT
Use of water	Depletion of water
Trade effluent	Land and water pollution
Spills & Leaks • Chemicals	Land and water pollution
Noise	• Noise pollution • Health impacts
Sludge	Land and water pollution
Waste oil	Land and water pollution

8.17 SEWAGE TREATMENT PLANT

The operations of the STP are described in Section 3.3.1.

8.18 SEWAGE TREATMENT PLANT - ENVIRONMENTAL ASPECTS AND IMPACTS

The environmental aspects and impacts associated with the sewage treatment plant facility are presented in Table 42.

Table 42: Sewage Treatment Plant – Aspects and Impacts

ASPECT	IMPACT
Use of water	Depletion of water
Trade effluent	Land and water pollution
Spills & Leaks • Chemicals	Land and water pollution
Noise	• Noise pollution • Health impacts
Sludge	Land and water pollution

8.19 NOISE & NOISE NUISANCE

8.19.1 CONSTRUCTION

An increase in ambient noise levels is expected throughout the construction phase as site preparation and construction related activities are undertaken. Slope regrading and levelling and the use of heavy equipment are likely to be the main sources of noise emissions. A baseline noise survey conducted throughout the project area showed sound pressure level (SPL) readings in the 29.5 - 50.7 dBA range with the average SPL reading ranging from 30.60 - 45.90 dBA. MAX readings for the site were in the 54.6 – 76.3 dBA range while the overall average MAX readings were in the 57.23 - 73.47 dBA range. Overall, both the average SPL and maximum measurements confirm that ambient noise levels in the area range from those typically associated with quiet rural environments (30–40 dBA) to those resembling residential suburban settings at peak times (>65 dBA).

The use of heavy equipment for land clearing activities is likely to increase noise levels beyond 100 dBA, particularly during periods when several construction and site preparation activities are being undertaken simultaneously. Persons working on the site are likely to be the most impacted by the noise from construction related activities given their direct involvement with the activities. Current users of the site, which include informal settlers, and workers at CDL will also be affected by changes in ambient noise levels.

The project site is not directly near to any educational institutions which could be exposed to temporary noise nuisances. Furthermore, there are no historical landmarks, healthcare facilities, or other public service building in the vicinity that would be considered sensitive to elevated noise levels.

Construction noise impacts are considered temporary as heightened noise nuisances are expected to last only for the duration of the construction period. Noise emissions will be intermittent and will be confined to approved work hour periods.

8.19.2 OPERATION

The proposed sugar factory would be situated in an ago-industrial zone. The Jamaica National Noise Standards (1999), describes an Industrial Zone as:

> *Lands designated Industrial Zone shall generally be industrial where protection against damage to hearing may be required, and the necessity for conversation is limited. The land uses in this category would include, but not be limited to, manufacturing activities, transportation facilities, warehousing, mining, and other lands intended for such uses.*

The recommended noise limits for an Industrial Zone measured at the property line from which the sound is emitted or at the nearest point possible beyond that line are:

- 7 a.m. to 10 p.m. 75 dBA
- 10 p.m. to 7 a.m. 70 dBA

In sugar factories, noise levels can be high, potentially exceeding 85 decibels (dBA), which is considered the threshold for potential hearing damage after prolonged exposure, and some areas can reach levels above 100 dBA. High noise levels can be expected in the following areas and therefore the appropriate hearing protection will be required.

- **Milling operations:** These areas, involving crushing and processing sugarcane, are known for high noise levels.
- **Boiler soot blower:** Studies have shown that boiler soot blowers can generate noise levels as high as 110 dBA.
- **Air compressors:** These machines can also contribute significantly to noise levels.
- **Cooling tower pump station:** While some areas may have lower noise levels, such as cooling tower pump stations, they still exceed 78 dBA.

Occupational Safety and Health Administration (OSHA) sets permissible exposure limits (PEL) for noise exposure, with the PEL being 90 dBA for an 8-hour workday. Hearing conservation programmes and engineering noise control measures are crucial for protecting workers' hearing in sugar factories.

8.20 AIR EMISSIONS

8.20.1 CONSTRUCTION

Construction activities contribute significantly to air pollution, primarily through dust and particulate matter (PM) emissions, as well as pollutants from machinery and construction materials. These emissions can have negative impacts on human health and the environment such as respiratory problems and reduction in general visibility in some areas.

Key sources of air pollution during construction activities include:

- **Dust and Particulate Matter (PM):** Construction activities like clearance of vegetation, excavation, demolition, levelling, construction of access roads, the movement of heavy vehicles and equipment and material handling generate significant amounts of fugitive dust and particulate matter, including PM_{10} and $PM_{2.5}$ within the boundaries of the project area and the local surrounding areas.

- **Emissions from Equipment:** Construction machinery and heavy duty vehicles, often powered by diesel fuel, release pollutants like nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs). In addition to causing air pollution, vehicular emissions contain greenhouse gases, a contributor to global warming. While there are no vehicular emission standards, one criterion for motor vehicle fitness is that there are to be no visible emissions.

- **Construction Materials:** The production and use of materials like cement, steel, and aluminium have a significant carbon footprint.
- **Volatile Organic Compounds (VOCs):** VOCs are released during painting, sealing, and other activities involving solvents and chemicals.

This negative impact is considered short term and can be mitigated.

8.20.2 OPERATION

Sugar factories, particularly those relying on bagasse as fuel, release air pollutants like particulate matter (PM), sulphur dioxide (SO_2), and nitrogen oxides (NOx), which can negatively impact human health and the environment.

TSCL will construct a 2500 TCD Sugar Plant with 12.5 MW Co-Generation Plant at Lionel Town, Clarendon. The power generating plant will provide steam and electric power for the sugar manufacturing process at the factory. TSCL has several sources of air emissions.

The main air emissions sources include:

1. Bagasse Boiler
2. Diesel Generator

The significant fugitive air emissions sources include:

3. Bagasse Storage & Handling System

The insignificant fugitive air emissions sources include:

4. Sugar Production Process
5. Ash Storage & Handling System
6. Fuel Storage Tanks
7. Vehicle Engines
8. Paved & Unpaved Road Surfaces
9. Effluent Treatment Plant (ETP)
10. Sewage Treatment Plant

The boiler and generator will be the main air emission sources at TSCL. See Section 9 for more details on the expected emissions and classification of the facility.

8.21 GREENHOUSE GASES (GHG)

8.21.1 CONSTRUCTION

During construction, diesel-powered equipment and transportation vehicles are the main sources of CO_2 emissions. Additionally, the manufacture and transport of construction materials -particularly cement and steel - contribute significant embodied emissions. Though these emissions are temporary, they add to the overall carbon footprint of the project.

8.21.2 OPERATION

In the operational phase, the primary GHG source will be the bagasse-fired boiler used in the co-generation plant. While bagasse is considered a renewable fuel, its combustion still releases CO_2, however, its net GHG impact will be lower than fossil fuels. Diesel generators and vehicle operations will also contribute to ongoing CO_2 emissions. Methane and nitrous oxide may be emitted in small quantities from organic matter in the effluent and sewage treatment systems.

8.22 LOSS OF VEGETATION & DISTURBANCE OF BIOLOGICAL COMMUNITIES

8.22.1 CONSTRUCTION

Presently the lessee Clarendon Distillers Limited have mature canes on the property to be harvested. The Plans are as follows:

1. The harvesting of cane which would have usually commenced in March 2025 was delayed since the Salt River Road, the main transportation route from Monymusk to the Worthy Park Sugar Factory, was being rehabilitated.
2. Harvesting of those canes rescheduled for the week after the Easter Holidays in the week of April 28, 2025.
3. Owners of the land being Sugar Company of Jamaica (SCJ) Holdings Limited have agreed to sell the vacant land to TSCL.
4. Immediately after harvesting, the Sugar Company of Jamaica Holdings Limited will repossess the land and as agreed sell to TSCL for the construction of the new Sugar Factory.
5. The purchase and sale will be completed in April 2025.

The flora and fauna assessment of the proposed site for the sugar factory concluded that the area was very disturbed with low diversity. The majority of the proposed footprint of the new factory will be on land previously under cane cultivation for several decades, so the biological communities have been repeatedly disturbed due to the cycle of planting and reaping of cane Additionally, while small scale farming activities on the periphery of the cane field, have introduced some additional diversity by the cultivation of fruit trees, at the same time the anthropogenic activities including coal burning would have displaced original flora and fauna.

8.23 TRAFFIC

8.23.1 CONSTRUCTION

The construction of the new factory will require the transportation of building materials such as, aggregate and cement to the site as well as some large equipment. The movement of heavy duty trucks and equipment will require other road users to maintain safe distances and in some way yield (or provide the right of way) to oncoming transportation vehicles. Trucks carrying building materials will be required to observe the recommended load and speed limits. Traffic signs and flagmen will be required at strategic points to ensure the safety of road users. It will be especially important for trucks traversing the Hayes Main Road to be cautious in the vicinity of Vere Technical High School which is situated along the route from the East – West Toll Road to the Site (Figure 112). The Hayes Main Road is also the principal access road to Lionel Town. Pedestrians, taxis, school buses and private vehicles are currently the primary users of the roadway, with pedestrians being a visible and dominant part of the landscape.

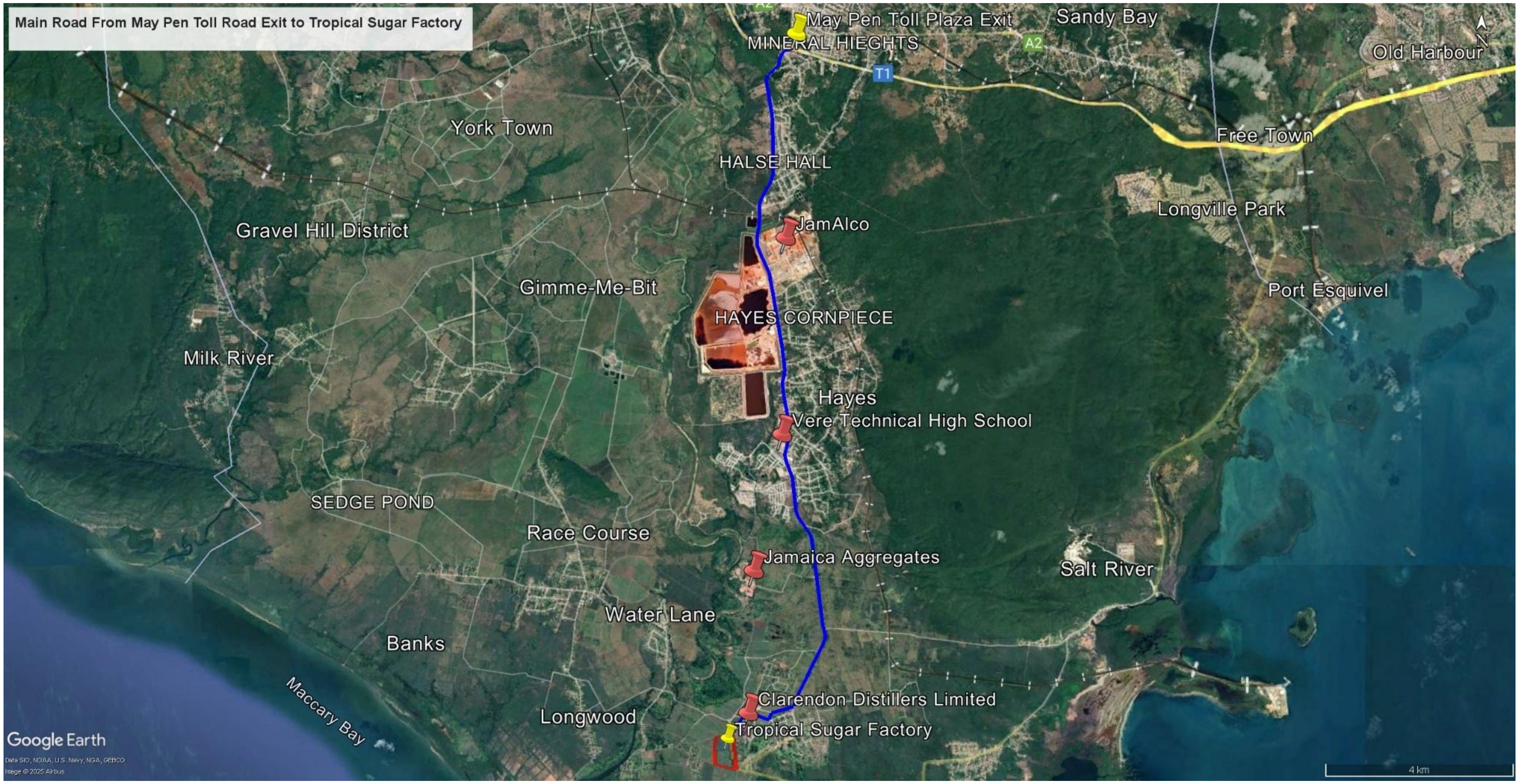
The potential risks for vehicular and pedestrian accidents will be significant due to:

- The dimension/layout of the road - the road is narrow and winding in some areas along the route
- The number of pedestrians, inclusive of school children utilising the roadways, particularly during the week at select hours
- The absence of public transportation infrastructure along the roadway e.g. bus stops and taxi-stands. Since there are no dedicated facilities for taxis and buses plying the main road public passenger vehicles utilise the main road and/or gateways to stop to pick up or let off passengers.

When trucking of large equipment is anticipated, this activity will take place during late night and early morning periods between 10:00p.m. - 4:00a.m in an effort to reduce vehicle-vehicle and vehicle-person conflicts. These will require assistance from the Police, the JPS and members of the contractor's team to safely traverse the designated route.

The potential risks and impacts can be mitigated.

Figure 112: Main Road from May Pen Toll Road Exit to Tropical Sugar Factory



8.23.2 OPERATION

The traffic changes expected during operation of the factory will consist of mainly of the transportation of harvested cane. Although this type of activity is not new to the surrounding communities, it has been several years since significant cane transportation activity has taken place.

Cane harvesting will be a mixture of manual and mechanical. Cut cane will be transported on the main thoroughfares by Trucks, Trailer bins and Tractor carts owned by Local Contractors/farmers. The existing road together a new approach/ access road to Tropical Sugar gate will be used.

Risks include vehicle-vehicle and vehicle -pedestrian conflicts which can lead to accidents resulting in property damage, motor vehicle damage, health impacts and death. Overloading of cane transportation vehicles can also increase the likelihood of accidents as it is more difficult to navigate overloaded trucks and cane spilling from the trucks can cause damage to other road users.

Negative impacts can be mitigated by driver adherence to speed limits, not overloading cane trucks and signage that warns other road users to exercise care at points where cane truck enter and exit the main thoroughfare.

8.24 LAND &WATER POLLUTION

8.24.1 CONSTRUCTION AND OPERATION

The following aspects could cause land and water pollution if not effectively managed:

- Fuel and chemical spills from storage and dispensing (construction and operation)
- Inappropriate containment and disposal of solid waste which could consist of:
  - Topsoil and vegetation from land clearing (construction)
  - Garbage associated with administrative and welfare activities (construction and operation)
  - Packaging waste (construction and operation)
  - Construction debris (construction and operation (maintenance activities))
- Inappropriate disposal of human waste (sewage) (construction and operation)
- Sediments in storm water from land clearing, erosion and aggregate stockpiles (construction)

The Rio Minho is a nearby water resource that could be negatively impacted if the various sources of waste are not managed. All risks can be mitigated.

8.25 RISK OF HAZARDS AND ACCIDENTS

8.25.1 CONSTRUCTION

Construction activities inherently carry a range of occupational health and safety risks due to the dynamic and physically demanding nature of the work environment. Workers may be exposed to hazards such as falling objects, unstable surfaces, sharp or heavy tools, heavy machinery, and electrical installations. Tasks like excavation, welding, and structural assembly often require working at heights or in confined spaces, increasing the risk of falls, or exposure to dust and harmful fumes. Open trenches and moving vehicles add further danger, particularly where safety measures are lacking. Resulting injuries may range from minor to severe, sometimes leading to long-term health issues or permanent disability, with wider economic and social impacts, especially for workers who are the main income earners in their households.

8.25.2 OPERATIONS

Workers may face occupational health and safety threats from the operation of the factory. Operation and maintenance activities for buildings, equipment/machinery and goods production requires workers, in some instances to function at heights and come in contact with dangerous and/or hazardous materials and substances e.g. heat, fire, caustic, oil sludge. Working at increased elevations increases the risk of severe bodily damage in the event of a fall or slippage, while exposure to dangerous substances, heat and fire can cause long-term health damage. There is also an inherent risk of injury when working with mechanical equipment/tools. Workers who become injured or suffer severe accidents, face temporary and/or permanent losses in terms of their earning potential, impacting their socio-economic livelihoods. Accidents and injuries also have the potential to lead to more fatal outcomes.

8.26 SUMMARY OF ENVIRONMENTAL ASPECTS AND IMPACTS

8.26.1 METHODOLOGY

In accordance with the TOR, the impact identified were associated with the following

1) Noise & Noise Nuisance
2) Traffic
3) Solid Waste
4) Sewage & Trade Effluent
5) Air Emissions
6) Greenhouse Gases (GHG)
7) Oil & Chemical Spills
8) Risks of Hazards and Accidents

These impacts were analysed in the context of the various project components based on whether they were positive or negative, their scale, their likelihood, whether or not they were cumulative and whether or not they had the potential for residual impacts. Table 43 shows a breakdown of how these attributes were categorized. The scores for each of these attributes were summed for each potential environmental aspect to produce an impact score (out of 10).

Table 43: Scoring Methodology for Environmental Aspect Impact Matrix

Attribute	Score	Meaning
+/-	+	Positive Impact
	-	Negative Impact
Scale	1	Impact on Small Area of Property
	2	Impact on Overall Property
	3	Impact Extends Beyond Property
Likelihood	1	Monthly or more frequently
	2	A few times per year
	3	Annually or less frequently
Cumulative	0	Impact not Cumulative
	2	Impact Cumulative
Residual	0	No Residual Impacts
	2	Potential for Residual Impacts

8.26.2 SUMMARY TABLE

Table 44 below summarizes the environmental aspects and potential impacts associated with the project.

Table 44: Environmental Aspects and Impacts Summary Table

Project Component/ Activity	Environmental Aspect	Potential Environmental Impact	+/-	Scale (1-3)	Likelihood (1-3)	Cumulative (0 -2)	Residual (0-2)	Impact Score
Agro-Processing	Energy Consumption	Air Emissions (Other Pollutants)	-	2	3	2	2	-9
	Energy Consumption	Greenhouse Gases (GHG)	-	2	3	2	2	-9
	Raw Material Usage	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Filter Press Mud	Solid Waste (Land & Water Pollution)	-	1	3	2	0	-6
	Wastewater Discharge	Surface Water Contamination	-	3	3	2	2	-10
	Vehicle Movements	Traffic	-	2	3	2	0	-7
	Machinery Operation	Noise & Noise Nuisance	-	1	3	2	2	-8
	Factory Operations	Risk of Hazards, Health Impacts & Accidents	-	1	1	0	2	-4
Bagasse (Handling & Storage)	Dust Generation	Air Emissions (Dust)	-	2	3	2	2	-9
	Bagasse Piles (Fire Risk)	Risk of Hazards, Health Impacts & Accidents	-	2	1	0	2	-5
	Storage Space	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
Construction & Design Operations	Site Preparation	Air Emissions (Dust)	-	2	3	2	2	-9
	Chemical and Fuel Storage	Groundwater Contamination	-	2	1	0	2	-5
	Site Preparation	Noise & Noise Nuisance	-	2	3	2	2	-9
	Accidents During Transportation	Risk of Hazards, Health Impacts & Accidents	-	3	1	0	2	-6
	Accidents During Construction	Risk of Hazards, Health Impacts & Accidents	-	3	1	0	2	-6
	Chemical and Fuel Storage	Soil Contamination	-	1	1	0	2	-4

Project Component/ Activity	Environmental Aspect	Potential Environmental Impact	+/-	Scale (1-3)	Likelihood (1-3)	Cumulative (0 -2)	Residual (0-2)	Impact Score
	Construction Waste	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Chemical and Fuel Storage	Surface Water Contamination	-	2	1	0	2	-5
	Construction Vehicle Traffic	Traffic	-	3	3	2	0	-8
Fuel Storage	Evaporation Losses	Air Emissions (Other Pollutants)	-	1	3	2	2	-8
	Evaporation Losses	Greenhouse Gases (GHG)	-	1	3	2	2	-8
	Tank Rupture/Leakage	Groundwater Contamination	-	2	1	0	2	-5
	Fire & Explosion Risk	Risk of Hazards, Health Impacts & Accidents	-	3	1	0	2	-6
	Tank Rupture/Leakage	Soil Contamination	-	1	1	0	2	-4
	Tank Rupture/Leakage	Surface Water Contamination	-	2	1	0	2	-5
	Fuel Delivery	Traffic	-	2	3	2	0	-7
Cane Juice (Processing & Storage)	Fermentation (if not controlled)	Greenhouse Gases (GHG)	-	1	2	0	2	-5
	Spillage	Soil Contamination	-	1	2	0	2	-5
	Spillage	Surface Water Contamination	-	2	2	0	2	-6
	Wastewater from Cleaning	Surface Water Contamination	-	2	3	2	2	-9
Land Preparation	Land Clearing	Air Emissions (Dust)	-	2	1	2	0	-5
	Heavy Equipment Operation	Air Emissions (Other Pollutants)	-	2	1	2	2	-7
	Heavy Equipment Operation	Greenhouse Gases (GHG)	-	2	3	2	2	-9
	Land Clearing	Noise & Noise Nuisance	-	1	1	2	2	-6

Project Component/ Activity	Environmental Aspect	Potential Environmental Impact	+/-	Scale (1-3)	Likelihood (1-3)	Cumulative (0 -2)	Residual (0-2)	Impact Score
	Fertilizer/Pesticide Application	Soil Contamination	-	2	2	0	2	-6
	Fertilizer/Pesticide Application	Surface Water Contamination	-	3	2	0	2	-7
	Heavy Equipment Operation	Traffic	-	3	1	2	0	-6
Molasses (Storage & Handling)	Spillage	Soil Contamination	-	1	2	0	2	-5
	Spillage	Surface Water Contamination	-	2	2	0	2	-6
	Tank Cleaning	Surface Water Contamination	-	2	2	2	2	-8
	Transportation	Traffic	-	2	3	2	0	-7
Power Generation	Combustion Emissions	Air Emissions (Other Pollutants)	-	3	3	2	2	-10
	Combustion Emissions	Greenhouse Gases (GHG)	-	3	3	2	2	-10
	Generator Noise	Noise & Noise Nuisance	-	1	3	2	2	-8
	Ash Disposal	Soil Contamination	-	2	2	2	2	-8
	Ash Disposal	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Ash Disposal	Risk of Hazards, Health Impacts & Accidents	-	1	1	0	2	-4
	Use of Water	Depletion of Water	-	2	3	0	0	-5
	Generate Electricity from a Renewable Resource	Avoids use of Fossil Fuels (Non-Renewable Resource)	+	2	3	0	0	5
Sewage Treatment Plant	Odor from Treatment	Air Emissions (Odors)	-	2	3	2	0	-7
	Equipment Noise	Noise & Noise Nuisance	-	1	3	2	2	-8
	Sludge Disposal	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Effluent Discharge	Surface Water Contamination	-	3	3	2	2	-10

Project Component/ Activity	Environmental Aspect	Potential Environmental Impact	+/-	Scale (1-3)	Likelihood (1-3)	Cumulative (0 -2)	Residual (0-2)	Impact Score
	Use of Water	Depletion of Water	-	2	3	0	2	-7
Storage of Hazardous Materials	Volatile Organic Compound (VOC) Emissions	Air Emissions (Other Pollutants)	-	1	2	0	2	-5
	Container Leakage	Groundwater Contamination	-	2	1	0	2	-5
	Improper Handling	Risk of Hazards, Health Impacts & Accidents	-	1	2	0	2	-5
	Container Leakage	Soil Contamination	-	1	1	0	2	-4
	Container Leakage	Surface Water Contamination	-	2	1	0	2	-5
	Hazardous Waste	Risk of Hazards, Health Impacts & Accidents	-	1	1	0	2	-4
Sugar House	Boiler Emissions	Air Emissions (Other Pollutants)	-	2	3	2	2	-9
	Boiler Emissions	Greenhouse Gases (GHG)	-	2	3	2	2	-9
	Machinery Operation	Noise & Noise Nuisance	-	1	3	2	2	-8
	Bagasse Disposal	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Process Water Discharge	Surface Water Contamination	-	2	3	2	2	-9
Sugarcane (cultivation & harvest)	Harvesting Machinery	Noise & Noise Nuisance	-	2	2	2	2	-8
	Pesticide/Herbicide Runoff	Soil Contamination	-	2	2	0	2	-6
	Pesticide/Herbicide Runoff	Surface Water Contamination	-	3	2	0	2	-7
	Transportation to Mill	Traffic	-	3	3	2	0	-8
Wastewater Treatment Plant	Use of Water	Depletion of Water	-	2	3	0	0	-5

Project Component/ Activity	Environmental Aspect	Potential Environmental Impact	+/-	Scale (1-3)	Likelihood (1-3)	Cumulative (0 -2)	Residual (0-2)	Impact Score
	Odor from Treatment	Air Emissions (Odors)	-	2	3	2	2	-9
	Equipment Noise	Noise & Noise Nuisance	-	1	3	2	2	-8
	Sludge Disposal	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Effluent Discharge	Surface Water Contamination	-	3	3	2	2	-10
Water Treatment Facility	Use of Water	Depletion of Water	-	2	3	0	0	-5
	Chemical Spills	Groundwater Contamination	-	2	1	0	2	-5
	Chemical Spills	Soil Contamination	-	1	1	0	2	-4
	Sludge Disposal	Solid Waste (Land & Water Pollution)	-	2	3	2	2	-9
	Chemical Spills	Surface Water Contamination	-	2	1	0	2	-5

8.26.3 COMBINED IMPACT SCORES & PROJECT COMPONENT IMPACT SCORES

Table 45 shows the total scores for the various impacts outlined in the TOR. The area for greatest environmental impact identified was for Surface Water Contamination, followed by Solid Waste (Land and Water Pollution) and Noise & Noise Nuisance.

Table 45: Combined Impact Scores

Environmental Impacts	Overall Impact Score
Surface Water Contamination	-102
Solid Waste (Land & Water Pollution)	-78
Noise & Noise Nuisance	-63
Greenhouse Gases (GHG)	-50
Air Emissions (Other Pollutants)	-48
Soil Contamination	-46
Traffic	-43
Risk of Hazards, Health Impacts & Accidents	-40
Air Emissions (Dust)	-23
Depletion of Water	-22
Groundwater Contamination	-20
Air Emissions (Odors)	-16
Avoids use of Fossil Fuels (Non-Renewable Resource)	+5

Table 46 shows the combined impact scores based on the various project components. The Agro-Processing and Construction & Design Operations were identified as having the greatest potential for environmental impact, followed by Power Generation and Land Preparation.

Table 46: Combined Impact Scores based on Project Components

Project Components/ Activities	Overall Impact Score
Agro-Processing	-62
Construction & Design Operations	-61
Power Generation	-49
Land Preparation	-46
Sugar House	-44
Fuel Storage	-43
Sewage Treatment Plant	-41
Wastewater Treatment Plant	-41
Sugarcane (Cultivation & Harvest)	-29
Storage of Hazardous Materials	-28
Water Treatment Facility	-28
Molasses (Storage & Handling)	-26
Juice (Processing & Storage)	-25
Bagasse (Handling & Storage)	-23

9 AIR EMISSIONS INVENTORY

TSCL will install a 12.5 MW Co-Generation Plant. The primary fuel source for the boiler will be bagasse, which when burnt produce steam. The steam from the boiler will be conveyed to turbines which will generate electric power for the sugar manufacturing process at the factory.

An Air Emissions Inventory (AEI) has been conducted to determine;

- The classification of the facility, that is a major, significant or neither.
- Whether the development of a new air dispersion model for the facility will be needed.
- To determine if an air pollutant discharge licence application will need to be submitted to NEPA pursuant to the Natural Resources Conservation, (Ambient Air Quality Standards) Regulations, 2006.

The AEI has identified the following sources of air emission, which has been categorized into main air emission sources, significant fugitive air emission sources and insignificant fugitive air emission sources.

- **Main Air Emission Sources**
  1. Bagasse Boiler
  2. Diesel Generator

- **Significant Fugitive Air Emission Sources**
  1. Bagasse Storage & Handling System

- Insignificant Fugitive Air Emission Sources
  1. Sugar Production Process
  2. Ash Storage & Handling System
  3. Fuel Storage Tanks
  4. Vehicle Engines
  5. Paved & Unpaved Road Surfaces
  6. Effluent Treatment Plant
  7. Sewage Treatment Plant

Information on the main air emission sources and the significant fugitive air emissions sources are presented below. Information on the insignificant fugitive air emission sources are presented in the full Air Emissions Inventory, shown in **Annex 2**.

9.1 MAIN AIR EMISSION SOURCES

A. Bagasse Boiler

One (1) bagasse fired boiler will be used in the process to produce steam and electric power for use in the sugar manufacturing facility. The Terravista Solutions P. Ltd boiler (BLR1) will be rated for the generation of 75 MT/hr steam at 485±5°C, 6.6 MPa (66 kg/cm^2). This bi-drum, natural circulation watertube type boiler has a traveling grate combustor.

The boiler will typically use bagasse as the main fuel source. However, wood chips may be used during the off-peak season when the bagasse supply is low.

The exhaust from the boiler passes through an electrostatic precipitator (ESP) for particulate removal before being conveyed to the boiler stack (BLR1STCK).

The combustion of the bagasse and wood chips by the boilers and the emission of the exhaust from the stack will be the main source of stack air emissions at TSCL.

B. Diesel Generator

There will be one (1) main standby diesel generator (TSCLGEN1) which generates power for the process as necessary when there is no power supply from the boiler. The generator will be rated at 1,010 kVA. The generator emits its exhaust from its individual stack (GEN1STCK).

The combustion of diesel by the generator and the emission of the exhaust from the diesel generator stack is a source of stack air emissions at TSCL.

9.2 SIGNIFICANT FUGITIVE AIR EMISSION SOURCES

A. Baggage Storage & Handling System

The bagasse storage and transportation system is mainly composed of 3 bagasse silos, a mechanized conveyor system, its supporting devices and an uncovered bagasse storage area (BAGASSE). The bagasse produced at the mills is either directly fed to the boiler via the bagasse silos or stored in stockpile(s) in the available space in the open yard (~ 10,000 m^2) before being fed to the boiler. The boiler will be fed from the bagasse silos using an overbed feeding system with a drum feeder below the bagasse silo and a bagasse extractor below the drum feeder.

The particulate matter generated by the crushing of the sugarcane and feeding the bagasse to the boiler occurs in enclosed areas. These activities are therefore insignificant sources of fugitive emissions at TSCL. However, the wind erosion of the particulate matter (PM) from the bagasse stockpile(s) is a significant source of fugitive air emissions at TSCL.

9.3 FINDINGS & RECOMMENDATIONS

The boiler and generator will be the main air emission sources at TSCL. The PM stack emission rates for the boiler due to the combustion of bagasse results in 354.5 g PM/MT bagasse input and therefore meets the 4,200 g PM/MT bagasse input emission standard for new sources. The boiler stack emission PM rates are well within compliance due to the use of the ESP to control the stack PM emissions. The facility has not yet received fuel certificates for the diesel oil, however, it is expected to meet the NRCA standard of 0.5% maximum sulphur content.

Table 47 and Table 48 summarize the average annual and maximum annual emissions inventory results respectively. The detailed emissions inventory results in g/s and kg/hr are shown in **Annex 2**.

The data shows that TSCL is classified as a major facility as defined in the 2006 NRCA Air Quality Regulations. The Natural Resources Conservation Authority (NRCA) Air Quality Regulations, 2006 defines a "major facility" as any facility having any air pollutant emitting activity or source with the potential to emit:

i. >100 MT/yr of one or more of the following parameters: SO_2, PM, CO and NO_x
ii. >5 MT/yr lead
iii. >10 MT/yr of any single priority air pollutant (PAP)
iv. >25 MT/yr of any combination of priority air pollutants (PAPs)

In the case of TSCL, Table 48 shows that the maximum annual PM, NO_x and CO emissions are each greater than 100 MT/yr and this results in its classification as a major facility.

As a major facility, TSCL should complete a detailed air dispersion model to predict the ambient concentrations due to these emissions and determine their compliance with Jamaica National Ambient Air Quality Standards (JNAAQS). An application should subsequently be completed and submitted to the National Environment and Planning Agency (NEPA) for a new Air Pollutant Discharge licence for the facility.

Table 47: Summary of TSCL Annual Average Air Emissions

Pollutant	Generator 1	Boiler 1-Bagasse & Wood Chips	Bagasse Storage	TOTAL
	GEN1STCK	BLR1STCK	BAGASSE	
	MT/yr	MT/yr	MT/yr	MT/yr
SO_2	0.095	2.592		2.69
PM	0.048	84.73	2.16	86.94
PM_{10}	0.039	4.15	1.08	5.27
NO_X	2.19	184.72		186.91
CO	0.58	62.21		62.79
VOC (as TOC)		1.874		1.87
Pb		4.98E-03		4.98E-03
CO_2	112.86	194,313.6		194,426
CH_4	6.16E-02			0.062
Benzene	5.31E-04			5.31E-04
Xylenes	1.32E-04			1.32E-04
Formaldehyde	5.40E-05			5.40E-05
Acetaldehyde	1.72E-05			1.72E-05
Acrolein	5.39E-06			5.39E-06

Table 48: Summary of TSCL Annual Maximum Air Emissions

Pollutant	Generator 1	Boiler 1-Bagasse & Wood Chips	Bagasse Storage	TOTAL
	GEN1STCK	BLR1STCK	BAGASSE	
	MT/yr	MT/yr	MT/yr	MT/yr
SO_2	0.150	5.00		5.15
PM	0.076	110.07	2.88	113.03
PM_{10}	0.062	8.00	1.44	9.50
NO_X	3.47	266.00		269.47
CO	0.921	120.000		120.92
VOC (as TOC)		3.54000		3.540
Pb		9.60E-03		9.60E-03
CO_2	178.76	257,400		257,579
CH_4	0.09750			0.098
Benzene	8.41E-04			8.41E-04
Xylenes	2.09E-04			2.09E-04
Formaldehyde	8.55E-05			8.55E-05
Acetaldehyde	2.73E-05			2.73E-05
Acrolein	8.54E-06			8.54E-06

10 SOCIAL IMPACT ASSESSMENT OF PROPOSED PROJECT

10.1 OBJECTIVES OF SOCIAL IMPACT ASSESSMENT

The objective of the social impact assessment (SIA) is to undertake the identification, assessment, evaluation and reporting of the potential socio-economic impacts associated with the construction and operation of a new agro-processing and manufacturing factory in Lionel Town, Clarendon, Jamaica. The assessment will provide a description of:

1. The social setting in which the proposed factory and supporting infrastructure are being considered for construction and operation
2. The potential impacts the proposed construction and operation of the factory are anticipated to have on the existing social setting in the short to long-term within the area of project occurrence
3. The mitigation measures recommended to prevent, reduce and/or eliminate potential adverse impacts, and enhance potential positive effects associated with the operation of the factory
4. The social monitoring programme(s) to be adopted in the management of associated and residential socio-economic effect

10.2 METHODOLOGY

This social impact assessment was conducted using a mixed-method approach, involving quantitative and qualitative research and participatory approaches. The methodology is in line with the general requirements of the Terms of Reference approved by the National Environment and Planning Agency (NEPA), the World Bank Environmental and Social Framework and standards for conducting environmental and social impact assessments, the International Finance Corporation (IFC) performance Standards on Environmental and Social Sustainability and the International Association of Impact Assessment (IAIA). Relevant data for the impact assessment was identified, reviewed and gathered using the following methods:

- Quantitative method involved the administration a socio-economic and beneficiary perception survey to households within the communities located in the designated project site study area.
- Qualitative methods included a desk review, focus group discussion and key informant interviews.

10.2.1 SPATIAL BOUNDARY

The spatial boundaries for the social impact assessment study area included a site study area and a local study area. For the assessment, the site study area, which is the anticipated area of direct social disturbance and influence associated with all phases of the agro-processing facility (sugar factory) project, was defined as all lands, water and valued social components within a 3km radius of the project site. The local study area, which encompasses the site study area, included all lands, water and valued social components located within a 10km radius of the site study area.

10.2.2 QUANTITATIVE APPROACH

The quantitative data collection consisted of the administration of a socio-economic and community perception survey (**Annex 5, Appendix 1**). The survey was executed in three phases:

1. Design and development of instrument and data collection procedures, including recruitment and training of interviewers.
2. Data collection and Processing
3. Analysis of data

The socio-economic and community perception survey was designed to capture data on key priority socio-economic variables and indicators related to respondents, their prior experiences and interaction with sugar manufacturing operations, project knowledge and attitude, as well as their overall perception of the proposed project.

10.2.2.1 SAMPLING AND TARGET POPULATION

The sample frame for the survey design was based on data from the 2011 Population and Housing Census. The target population for the study was households located within the defined spatial boundaries of the SIA. The perception survey was administered to household representatives (18 years and over, and who are usual residents) found in the communities located within the site study area.

10.2.2.1.1 SAMPLE SIZE (PERCEPTION SURVEY)

The sampling frame for the study was the 2011 Population and Housing Census. The census identifies 1,995 eligible households stratified by communities located within the site study area (Table 49). The targeted sample size for the study was 80 households calculated with a margin of error of 10.5% with a confidence level of 95%. The sampling allocation for the study was calculated proportional to the number of households in the communities located within the site study area. The survey data was collected using a convenience-based sampling technique.

Table 49: Distribution of Sample by Community

Community	Household	% of Total Households	Target Survey Distribution
Lionel Town	1,207	60	48
Perrins/Monymusk (Lionel Town)	136	7	5
Chesterfield (Lionel Town)	123	6	5

Community	Household	% of Total Households	Target Survey Distribution
Alley / Amity	529	27	22
TOTALS	**1,995**	**100**	**80**

10.2.2.1.2 SURVEY RESPONSE

The socio-economic and community perception survey was completed by 86 households, resulting in a survey response rate of 100 %. All respondent data was included in the analysis. Table 50 shows the number of surveys that were completed in each community.

Table 50: Surverys Completed by Community

Community	Total Survey Completed
Lionel Town	52
Perrins/Monymusk (Lionel Town)	5
Chesterfield (Lionel Town)	2
Alley / Amity	27
TOTAL	**86**

10.2.3 QUALITATIVE APPROACH

10.2.3.1 DESK REVIEW

A comprehensive literature review was conducted of national demographic, labour, economic, and parish/community specific research documents to review key socio-economic development indicators for communities in the project area to better understand existing the socio-demographic development context. The review also assisted in the identification of socio-economic development issues of concern.

10.2.3.2 FOCUS GROUP DISCUSSIONS

Although it is not intended to be representative of the general population, qualitative data must be adequate enough to provide an in-depth analysis of the varied dimensions related to beneficiaries' experiences and perceptions of the proposed project.

A focus group session was held with community members residing in the site and local study areas. Participants were recruited from communities outlined in Table 51. The FGD session was completed on April 11, 2025. A total of twelve (12) persons participated in the session from the following communities.

Table 51: Focus Group Discussion Participants by Community

No.	Community Name	Participants
1	Lionel Town	2

No.	Community Name	Participants
2	Amity Hall/Alley	2
3	Hayes	1
4	Hunter's Village	1
5	Longwood	1
6	Mitchell Town and Morelands	1
7	Portland Cottage	1
8	Race Course	1
9	Rocky Point	1
10	Salt Savanna	1
	Total	**12**

A focus group guide was used in steering the discussion with attendees. The FGD served to gather more detailed information and get deeper insights into the factory interactions and experiences of the resident population. Participants were engaged in discussions around ten main questions outlined in the guide. The themes explored from these questions included: livelihoods and employment, factory interaction and experiences, and project perceptions.

10.2.3.3 KEY INFORMANT INTERVIEWS AND CONSULTATIONS

Key informant interviews (KIIs) and consultations were held with government stakeholders, private sector entities, civil society organisations (CSOs), and non-governmental organisations (NGOs) to get a more comprehensive understanding of socio-economic and cultural landscape of communities within the project area. A total of thirteen (13) KII were conducted. The list of organisations and institutions participating in interviews is presented in **Annex 5, Appendix 1**. Consultations were held with representatives of the Lionel Town and Milk River Development Area Committees. Interviews and consultations were held to:

(i) identify and gain insights on organisational interactions and experiences with manufacturing operations within the project area
(ii) understand the role of the state machinery, including their capacities in facilitating the implementation and monitoring of project activities
(iii) identify opportunities and constraints associated with the proposed project, and
(iv) gather recommendations on measures and areas for intervention to ensure potential adverse impacts are mitigated and monitored.

10.2.3.4 GENDER ANALYSIS

A gender analysis was undertaken to assess the impact the proposed development activities may have on females and males. Using the Gender-Based Analysis Plus (GBA+) approach, the study assessed how females and males might be affected by proposed plans to restore sugar manufacturing in Southern Clarendon.

10.2.4 LIMITATIONS

10.2.4.1 SAMPLE SIZE AND REPRESENTATIVENESS

Due to financial constraints, the sample size for the survey data was not statistically representative. Project funding timelines also limited the data collection period for the assessment. Nevertheless, the data collected from the survey provided updated demographic and economic baseline data for residents in the site study area, and was essential given the absence of recent national demographic data for the communities in the project area. Key and meaningful insights were also gleaned regarding the proposed project. The data collected as part of the social assessment was also not limited only to survey data, but included interviews, consultations and focus group sessions to capture the full complexity of the project's potential impacts from the perspective of key stakeholders and groups.

10.3 HUMAN (SOCIAL) ENVIRONMENT SETTING

10.3.1 SOCIO-ECONOMIC BASELINE

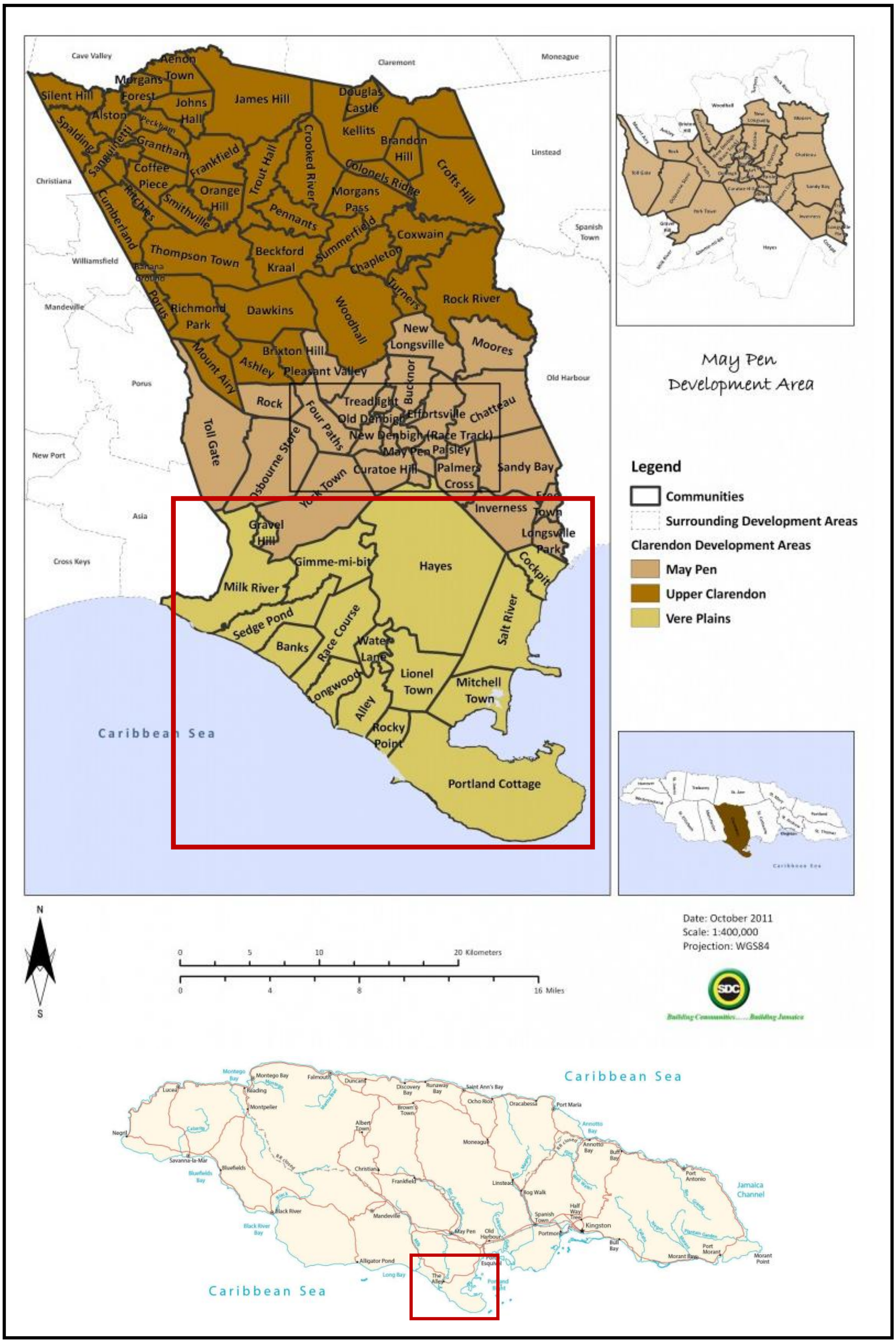
The project is located within the boundaries of the Vere Plains (Figure 113), which includes two Development Areas- Lionel Town and Milk River.[5] There are sixteen communities located within the boundaries of the project (Table 52).

Table 52: Communities Located within Project Boundaries

DEVELOPMENT AREAS AND COMMUNITIES		
LIONEL TOWN	**MILK RIVER**	**MAY PEN**
Alley	Gravel Hill	York Town
Halse Hall	Gimme Me Bit	
Hayes	Milk River	
Lionel Town	Race Course	
Mitchell Town	Longwood	
Portland Cottage		
Rocky Point		
Salt River		
Water Lane		

[5] Note: One parcel of cane field, located in the south-eastern section of the York Town community, falls within the project's boundaries. York Town is part of the May Pen Development Area. Some socio-economic baseline information is included in this report for the community.

Figure 113: Project Boundaries and Location



Source: Social Development Commission, 2011[6] with modifications by EEM, 2025

In 2011, the population of the Vere Plains was estimated at 50,591 people (STATIN, 2019) [Table 53]. Disaggregation of the population data by sex shows males represented 50.1 per cent of the total population within the project's boundaries. By age, the data shows children (0-14 years) accounted for approximately 28 per cent of the total population.

Table 53: Total Population by Community and Development Area

DEVELOPMENT AREA AND COMMUNITIES					
LIONEL TOWN		**MILK RIVER**		**MAY PEN**	
Alley	1,582	Gravel Hill	1,896	York Town	3,593
Halse Hall	5,089	Gimme Me Bit	1,675		
Hayes	11,241	Milk River	2,701		
Lionel Town	4,419	Race Course	5,195		
Mitchell Town	1,743	Longwood	999		
Portland Cottage	4,502				
Rocky Point	2,936				
Salt River	1,007				
Water Lane	2013				
Sub-total	34,532		12,466		3,593
Grand Total					**50,591**

Source: Statistical Institute of Jamaica and Planning Institute of Jamaica, 2019[7]

10.3.2 HOUSING

Housing statistics from the 2011 census showed the communities within the project's boundaries had 13,157 dwelling units and 14,312 households (Table 54).

Table 54: Overview of Housing Characteristics

DEVELOPMENT AREA	DWELLING UNITS	HOUSEHOLDS
Milk River*	3,505	4,956
Lionel Town	9,652	9,356
Total	**13,157**	**14,312**
*Includes York Town		

Source: Clarendon Municipal Corporation, 2016[8] and Planning Institute of Jamaica, 2025[9]

[7] https://statinja.gov.jm/pdf/Mapping%20Poverty%20Final%2013.5.2019%20-%20Disseminated.pdf
[8] Clarendon Local Sustainable Development Plan. https://ubwp.buffalo.edu/foodlab/wp-content/uploads/sites/68/2019/04/Clarendon-Local-Sustainable-Development-Plan-Clarendon-Parish-Jamaica-English_forwebsite.pdf
[9] https://goj.maps.arcgis.com/apps/StoryMapBasic/index.html?appid=3ec0ff9c25534912af0bef66d48f3d14

Small pockets of informal settlements are also situated within the project's boundaries in the communities of Lionel Town, Salt River, Hayes (Corn Piece and Raymonds), Rocky Settlement and Portland Cottage.

10.3.3 MUNICIPAL SERVICES

10.3.3.1 HEALTH

Residents in the Vere Plains are served by six (6) health centres and one hospital (1). The Lionel Town Hospital, a Type C facility, is a 47-bed facility providing services to more than 36, 000 persons in Clarendon.[10] There are four (4) health centres in the Lionel Town Health District and two (2) in the Race Course Health District.[11]

10.3.3.2 EDUCATION

There are fifteen (15) public educational institutions from the early childhood to the secondary educational level in the project Development Areas.

10.3.3.3 UTILITIES AND SANITATION

Communities in the project area are supplied with domestic water from groundwater sources. Water is supplied to the Development Areas via eight (8) systems, which include the Kemps Hill, Lionel Town and Hayes Treatment Facilities operated by the National Water Commission (NWC).[12] The NWC owns and operates six (6) sewage treatment plants in the Lionel Town Development Area.

Electricity to the communities is supplied by the Jamaica Public Service Company Limited via the Parnassus and Monymusk Substations. In 2016, 87 per cent of households in the Milk River Development Area had access to electricity and 71 per in the Lionel Town Development Area.[13]

10.3.3.4 PROTECTION AND EMERGENCY SERVICES

The Lionel Town Police Station and May Pen Fire Station provide policing and fire services for communities located in the project area.

[10] https://www.srha.gov.jm/chd.html
[11] Lionel Town, Mitchell Town, Raymonds, Rocky Point, Milk River and Race Course
[12] https://www.nwcjamaica.com/uploads/document/Draft%20%20Clarendon%20%20PPlan%20-%20October%2012%202011.pdf
[13] Clarendon Local Sustainable Development Plan. https://ubwp.buffalo.edu/foodlab/wp-content/uploads/sites/68/2019/04/Clarendon-Local-Sustainable-Development-Plan-Clarendon-Parish-Jamaica-English_forwebsite.pdf

10.3.4 ECONOMIC DEVELOPMENT: LABOUR MARKET AND ECONOMIC ACTIVITIES

Agriculture is the main economic activity in the project area. Other economic activities in the project area are linked to the mining, service, and retail and wholesale sectors.

10.3.4.1 AGRICULTURE AND FISHING

The agricultural and fishing sector accounted for 7.7 pr cent of Jamaica's gross domestic product (GDP) in 2023. The sector earned US$90.6 million in 2023, an increase of 11.4 per cent over 2022 earnings. An estimated 183,000 persons are employed in the sector (Planning Institute of Jamaica, 2024). Nearly three-quarters, 74.1 per cent, of all workers employed in the industry are males.

As of May 15, 2025, there were 5,259 farmers registered in the farming extension of Lionel Town, accounting for 12.9 per cent of Clarendon's registered farmers (Table 55). Males represented 58.1 per cent of the total share of registered farmers in the Lionel Town extension (Rural Agricultural Development Authority, 2025)[14].

Table 55: Farmer Registration by Sex

	Farmer Registration Information		
	Males	Females	Total
Clarendon	26,446	14,446	40,892
Lionel Town Extension	3,058	2,201	5,259

Source: Rural Agricultural Development Authority, 2025[15]

The Portland Cottage and Rocky Point communities located south of Lionel Town are major fishing villages in the parish of Clarendon. In 2021, there were 2,390 registered fishers in the parish of Clarendon, representing 9.8 per cent of the total number of registered fishers in Jamaica. The parish had 707 registered fishing vessels, accounting for 9.9 per cent of the total number of registered fishing vessels operating on the island (Wade et al., 2023). [16]

The most recent employment data for the development areas showed employment rates of 48 per cent in the Milk River Development Area, and 58 per cent in Lionel Town in 2016.

10.3.4.1.1 SUGAR INDUSTRY

In 2023, approximately 14,000 hectares of land was dedicated to sugar cultivation in Jamaica, a 41 per cent reduction compared to 2018, when 24,000 hectares of land area was cultivated. The

[14] https://abis.gov.jm
[15] https://abis.gov.jm
[16] https://link.springer.com/article/10.1007/s10745-023-00444-7#:~:text=The%20fishing%20industry%20is%20primarily,Authority%20of%20Jamaica%2C%202021).

industry earned US$4.4 million in 2023, a 56.8 per cent reduction compared to 2019 when the industry earned US$10.2 million.

10.3.4.2 MINING

The mining and quarrying sector accounted for 1.8 per cent of Jamaica's gross domestic product (GDP) in 2023. The sector earned US$ 551.5 million in 2023, a 68.2 per cent increase in export earnings over 2022 earnings (Planning Institute of Jamaica, 2024). Based on the industrial classification there are 3,200 people in the Mining and Quarrying industry labour force.[17] Males account for higher share of workers in the Mining and Quarrying Industry, accounting for 90.6 per cent of all workers

.

10.3.5 LAND USE

The Clarendon Local Sustainable Development Plan (2016/2030) estimates that 55 per cent of land use/ land cover in the parish of Clarendon is woodlands. Agricultural land uses accounted for 18 per cent of total land use, while residential land use accounted for close to 14 per cent of land use in the parish. Woodlands and agricultural land use account for an estimated 70-75 per cent of existing land use and land cover in the Development Areas of Milk River and Lionel Town. Residential land uses in the Development Areas comprise mainly of low-density residential land uses. There are also small pockets of industrial land uses in Lionel Town.

There are several recreational amenities and facilities within the study area. These are identified in Table 56.

Table 56: Recreational Centres in Project Area

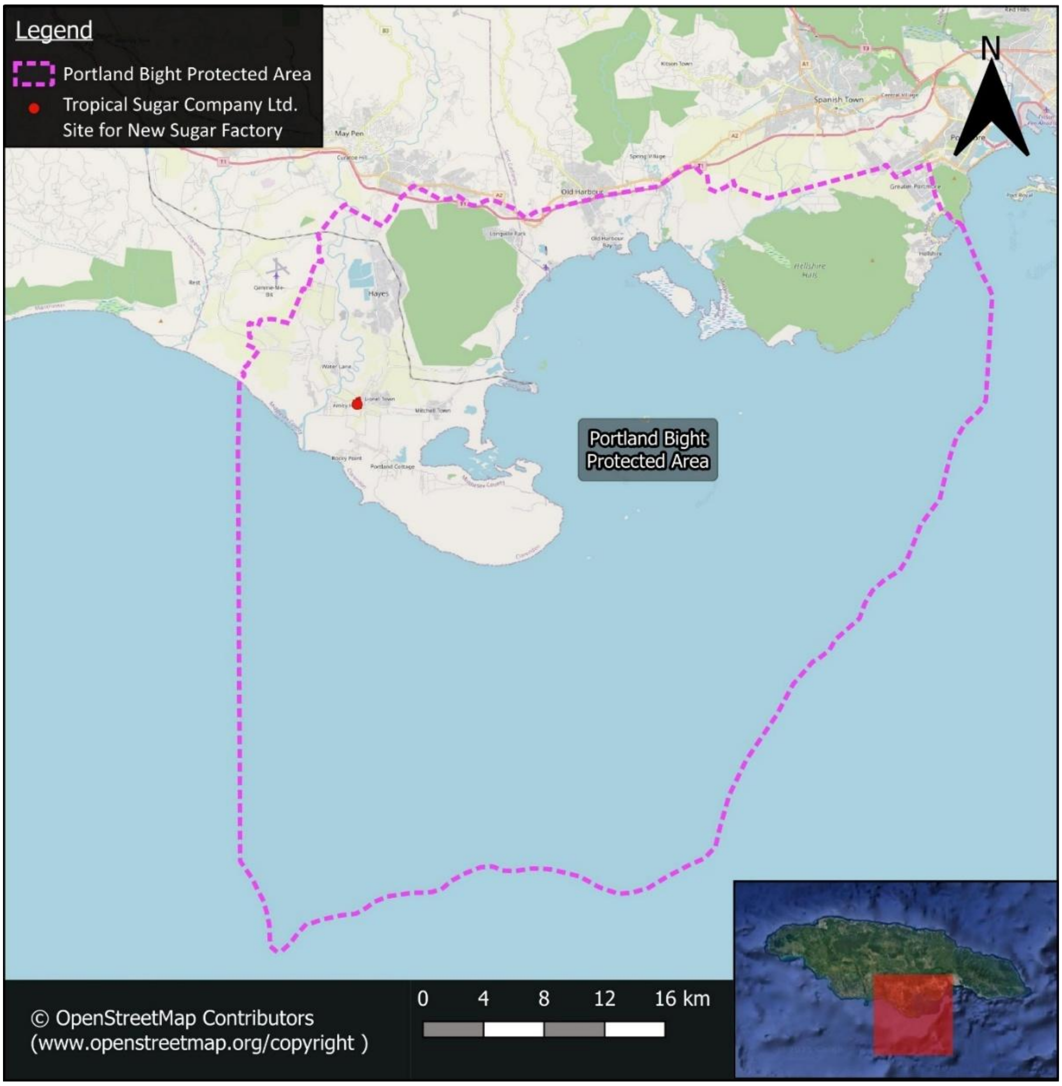
Name	Location	Areas Served
Pawsey Park Community Centre	Lionel Town	Alley, Gayle, Alley Downer, Amity Hall, Lionel Town, Bog, Morelands, Salt Savannah
Mitchell Town Community Centre	Mitchell Town	Mitchell Town
Rocky Point Community Centre	Rocky Point	Rocky Point, Rocky Settlement, Portland Cottage, Salt Savannah, Land Settlement, Coffee Piece, Red Ground
Rhymesbury Community Centre	Rhymesbury	Rhymesbury, Land settlement
York Town Community Centre	York Town	York Town, York Circle, Parnassus

[17] https://statinja.gov.jm/LabourForce/NewLFS.aspx

10.3.5.1 PROTECTED AREAS

The Portland Bight Protected Area (PBPA), the largest protected area in Jamaica, is located within the Lionel Town Development Area. The location of the new proposed sugar factory in relation to the PBPA can be seen in Figure 114 below.

Figure 114: New Sugar Factory Location in Relation to the Portland Bight Protected Area



10.3.5.2 PLANNED LAND USES

The Government of Jamaica has approved the development of the Lionel Town Community Park and Homework Centre Project. The parish's Local Sustainable Development Plan has outlined a list of proposed land use developments for the Lionel Town and Milk River Development Areas, which includes agricultural, industrial and tourism land use developments. The location of the new proposed sugar factory in relation to the 2018 Clarendon Development Order Proposed Land Use Zones can be seen below in Figure 115. The proposed location for the factory is within a zone designated for agriculture and directly adjacent to an industrial zone. Additionally, the factory location is adjacent and directly west of the Lionel Town Local Planning Area. Another map showing the factory's location in relation to the Lionel Town Local Planning

Area can be seen in Figure 116. The eastern border of the sugar factory's property is separated from the Lionel Town Local Planning Area by the Amity Hall Road. The western border of the Lionel Town Local Planning Area includes land designated for Heavy Industrial Operations, a recreational area (existing community centre) and residential area, which are currently the old houses left abandoned after the Monymusk Sugar Factory ceased operations.

Figure 115: Sugar Factory Location in Relation to 2018 Clarendon Development Order Proposed Land Use Zones

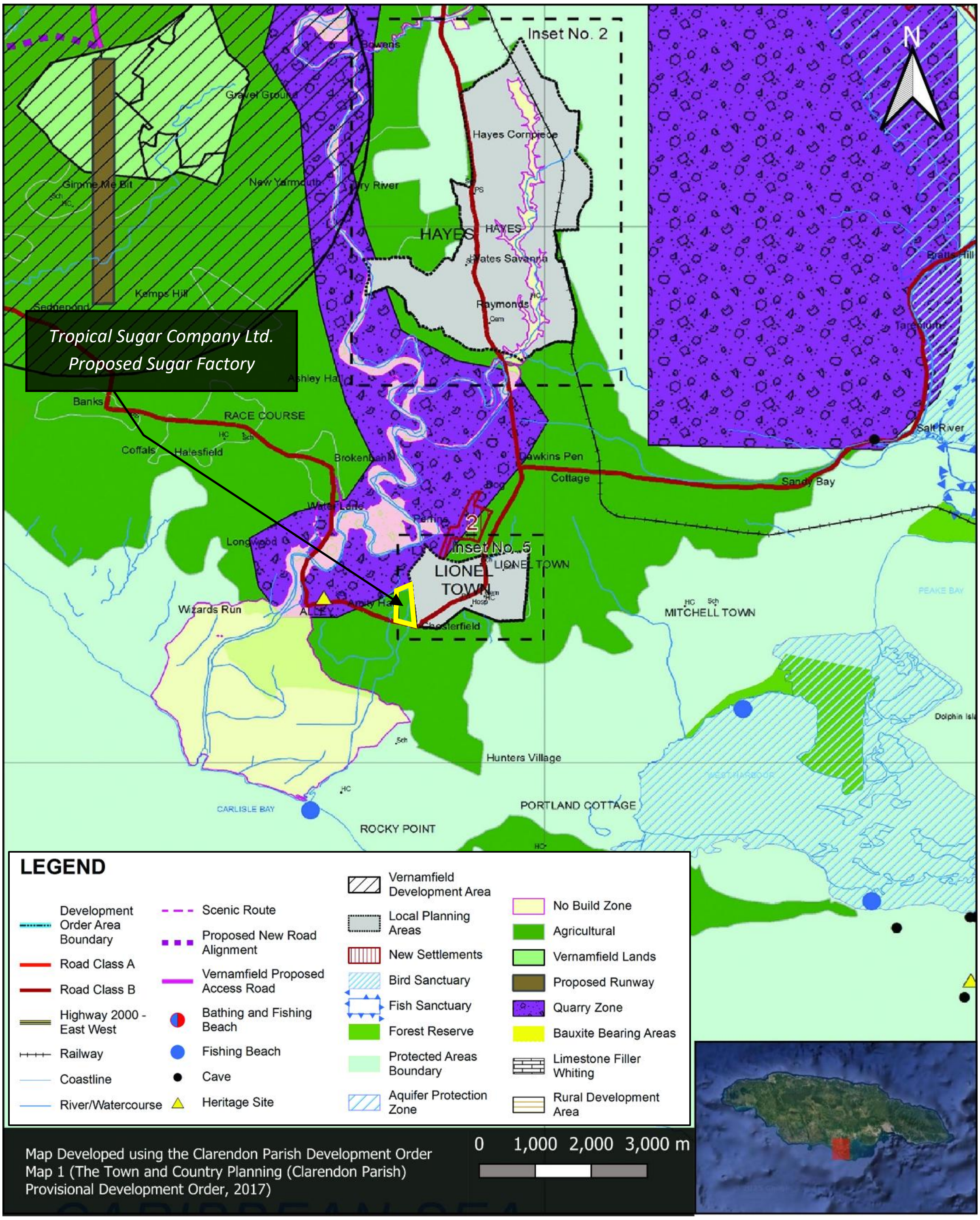
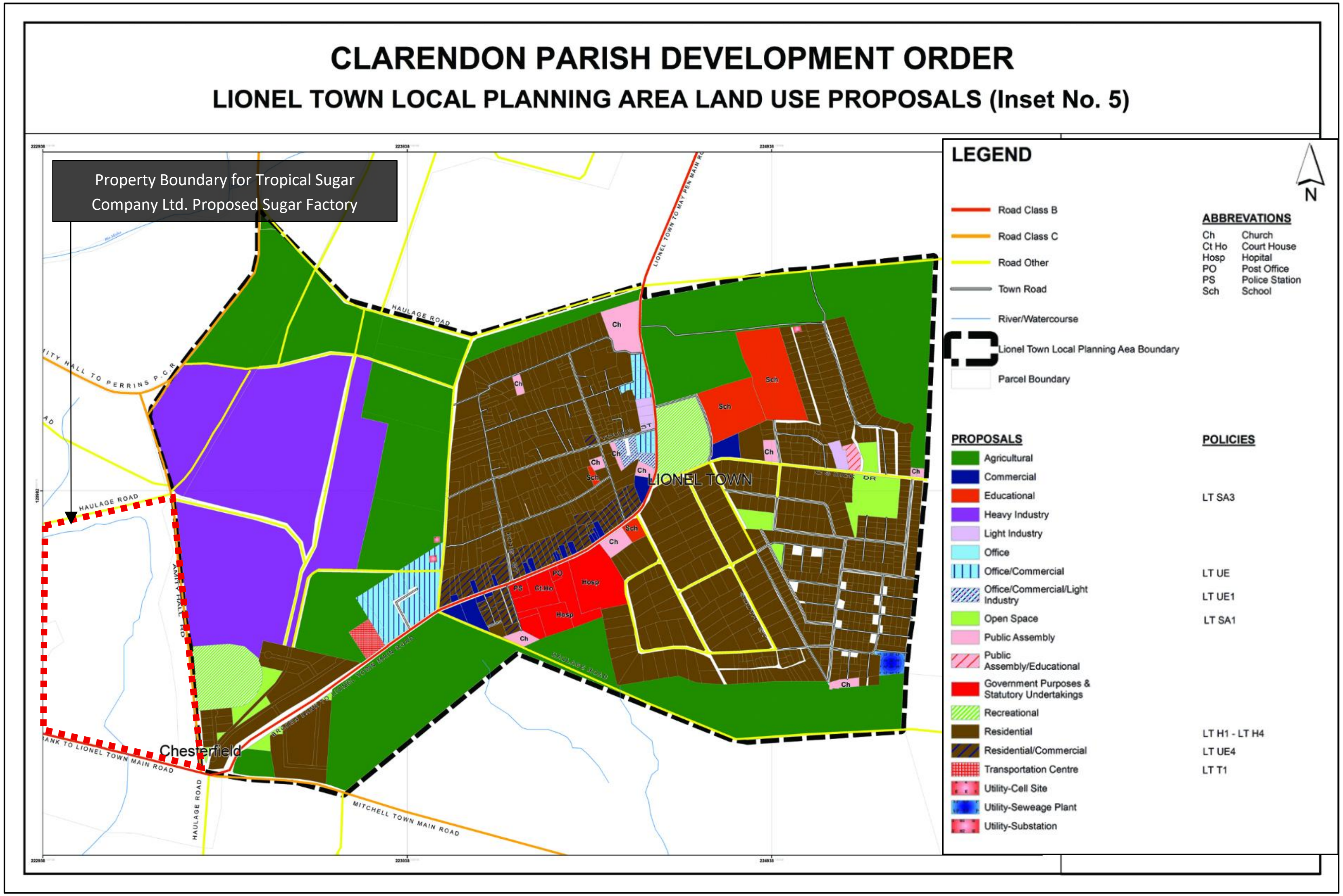


Figure 116: Sugar Factory Location in Relation to 2018 Clarendon Development Order Lionel Town Local Planning Area



10.3.6 HAZARDS

All communities in the project area, except Salt River, Gimme me bit and Gravel Hill, are flood prone. Rocky Point and Portland Cottage are also prone to coastal flooding. Droughts and bush fires also threaten the communities within the Development Areas.

10.3.7 SOCIAL CHALLENGES

High incidence of poverty is one of the main social challenges affecting the parish of the Development Areas of Lionel Town and Milk River. Prevalence poverty rates show, on average, an estimated 22 per cent of the population residing in these areas are poor (STATIN, 2019).[18]

The Lionel Town community, which includes the surrounding communities of Alley and Amity, has been identified by the Planning Institute of Jamaica as the 9th most vulnerable and 57th most volatile community in Jamaica. The community had a poverty rate of 16.1 per cent and 25.1 per cent in 2011 and 2016 respectively, and faces challenges related to squatting, literacy, child abuse and adolescent pregnancy, service and infrastructure accessibility and crime and violence, including presence of gangs.[19][20]

Court statistics show in the four-year period, 2020 and 2023, the Lionel Town Police Station accounted for the second highest share of criminal charges filed at police stations in the parish of Clarendon (Table 57). The percentage share of charges filed in 2023 (11.3%), have nearly doubled the percentage share recorded in 2017 (6.2%).

[18] Statistical Institute of Jamaica (2019). Mapping Poverty Indicators. Consumption based poverty in Jamaica. Accessed from https://statinja.gov.jm/pdf/Mapping%20Poverty%20Final%2013.5.2019%20-%20Disseminated.pdf

[19] http://lslandr.com/crp/wp-content/uploads/sites/6/2021/05/CRP-Community-Selection-Process_February-10-2021.pdf

[20] http://lslandr.com/crp/wp-content/uploads/sites/6/2021/01/Volatility-and-Vulnerability-index_Top-100-Communities.pdf

Table 57: Percentage distribution of Total Parish Criminal Charges Filed at Lionel Town Police Station

Year	Total (%)
2023	11.3
2022	15
2021	17.67
2020	14.8

Source: Court Statistics Unit, Supreme Court of Jamaica, 2020-2024

10.4 STAKEHOLDER ENGAGEMENT AND PERCEPTION FINDINGS

10.4.1 SOCIO-DEMOGRAPHIC PROFILE

10.4.1.1 SEX AND AGE

Males represented nearly two-thirds, 62.8 per cent, of survey respondents.

Disaggregation of the demographic data by age showed more than half, 59.8 per cent, of household respondents were aged 45 years and over. The highest share of respondents, 40.2 per cent, were aged 45 to 64 years, while the smallest share belonged to the youth age group category, 18-24 years, with a total share of 6.9 per cent (Table 58).

Table 58: Age of Respondents

AGE GROUP	TOTAL (%)
18-24	6.9
25-44	31.0
45-64	40.2
65 and over	19.5
No response	2.3
Total	**100.0**

Further disaggregation of age by sex showed the highest share of female household respondents (43.8%) were aged 25-44 years, while most male household respondents (44.4%) were aged 44-64 years.

10.4.1.2 EDUCATION AND TRAINING

More than two-thirds, 71 per cent, of respondents reported secondary education as the highest level of education they had completed- most at the upper secondary level (57%). Sixteen percent

(16%) reported completing some form of pre-primary (early childhood) or primary education, 1.2 per cent completed higher education at a university, and 10.5 per had not received any formal education (Table 59).

By sex, the findings on education show 78 per cent of women have completed secondary education, compared to 67 per cent of men. More women (12.5%) than men (9.3%) however reported not receiving any formal education. The data on trade certification revealed no household respondent had completed a formal trade certification programme.

While the data on respondents' educational attainment aligns with Jamaica's overall educational attainment distribution for the labour force[21], key stakeholders directly engaged in the communities[22] have expressed concerns about the populations' growing lack of proficiency in literacy and lower levels of skills, particularly among the youth aged population, which has created lower employment opportunities and outcomes for community members. Stakeholders also revealed that a significant share of the highly educated youth and adult population from the communities across the study area chose to, or were forced to migrate due to the lack of job opportunities.

Table 59: Education Level of Household Representative by Sex

EDUCATION LEVEL	TOTAL (%)	
	Female	Male
None	12.5	9.3
Early Childhood/ Pre-Primary	0.0	1.8
Primary (Grades 1-6)	9.4	18.5
Lower Secondary/High School (7-9)	15.6	13
Upper Secondary (10-11)	62.5	53.7
Bachelor's Degree	0.0	1.85

10.4.2 HOUSING AND HOUSEHOLD CHARACTERISTICS

10.4.2.1 HOUSEHOLD COMPOSITION AND PROFILE

Analysis of the demographic profile of households showed there were 275 people living in 86 households, revealing an average household size of 3.19. The average household size represents a marked decline when compared to the average size of 4.08 recorded by the Social Development Commission in 2016. The survey findings do, however, align with information gathered from key stakeholders who reported that migration of key population groups- youth, persons with higher education and job seekers- has led to overall changes in the composition and profile of households in the study area. Household sizes have, and continue to decline, and a growing share of households are being led by the elderly or comprise only the elderly.

[21] https://statinja.gov.jm/LabourForce/NewLFS.aspx
[22] Employers, political representatives and community development officers.

Based on the results of the survey, more than a third, 34.5 per cent, of households surveyed had no children living in them and adults accounted for a higher share of household occupants at 80 per cent. Less than a tenth of households (3.4%) reported having an occupant with a disability and less than a quarter (19.7 per cent) had a member who had a health problem or long-term condition.

10.4.2.2 HOUSING OWNERSHIP

Less than half, 48.8 per cent, of surveyed respondents reported that the dwelling in which they lived was owned by a member of their current household, while 18.6 per cent reported rent or lease as the tenure status of the dwelling occupied by members of their household. This data on ownership is in line with previous housing ownership data recorded for Lionel Town area (PIOJ and STATIN, 2012). The remaining households reported rent free (8.2 per cent), other-company house (3.5 per cent) or provided no response (3.5 per cent). The total share of dwellings owned among the households surveyed is below the national average of 55.6 per cent.[23]

10.4.2.2.1 INFORMAL HOUSING

From the consultations held with key community and local government representatives it was reported that informal housing and settlements are part of the housing landscape in the study area. These informal settlements are found primarily in vacant cane field areas. Local government figures estimate there are approximately 200 informal settlements in Lionel Town and an estimated 100 in the Mitchell Town community.[24]

10.4.3 VULNERABLE GROUPS

Groups identified as being vulnerable and/ or marginalized include:

- Youth age population (predominantly males)
- Elderly
- Children
- Small farmers

10.4.4 LABOUR MARKET

10.4.4.1 EMPLOYMENT

At the time of the survey, over half, 52.3 per cent, of respondents surveyed reported they were employed; either self-employed (33.7%) or working in paid employment (18.6 %). Nearly a third reported they were not in paid work and were seeking a job (30.2 per cent), while the remaining

[23] Planning Institute of Jamaica (2023. Jamaica Survey of Living Conditions 2021
[24] Winston Maragh, Councillor Rocky Point Division, and Former Mayor of May Pen, Personal Communication, 2025

respondents were not in paid work and not seeking a job (15.1 per cent), or did not provide a response (2.4%) [Table 60].

Table 60: Employment Status of Household Representative by Sex

Employment Status	Sex		Total (%)
	Female (%)	Male (%)	
No- not in paid work and looking for a job	40.6	24.1	30.2
No- not in paid work and not looking for a job	9.9	18.5	15.1
Yes- working in paid employment	18.8	18.5	18.6
Yes, self-employed	31.2	35.2	33.7
No response	0.0	3.7	2.4
Total	**100**	**100**	**100**

Disaggregated by sex, the data did not show any significant gender gap in labour force participation. By sex, the data showed 50 per cent of female respondents were engaged in paid employment (18.8%) or self-employed (31.2%), while 53.7 per cent of males were engaged in paid employment (35.2 per cent) or self- employed (18.5 per cent). However, there was a noted gap in the proportion of women seeking employment (40.6 per cent) compared to men (24.1%).

The high level of unemployment among respondents revealed in the survey has been identified by stakeholders as a wider socio-economic issue impacting a significant share of the population both within the study area, and the wider Vere Plains region. Stakeholders have linked the high levels of unemployment directly to the closure of the Monymusk Sugar Factory in 2018, which directly and indirectly provided employment and supported most households and businesses in the Vere Plains region, particularly in Lionel Town. At its peak, Monymusk Sugar Factory is said to have directly employed 3,000 workers, and provided indirect employment for an estimated 15,000 persons.[25]

10.4.4.2 OCCUPATION

The findings of the survey and stakeholder consultations revealed the majority of the working population in the study area is engaged in elementary and trade related occupations- agriculture, fishing, labourers (including construction workers), electrical and machinery workers, domestic workers, and drivers (taxi and truck). The survey results showed, at the time of the survey, all employed respondents were engaged in elementary, trade related or service and sales related occupations. The results also indicate a high proportion of respondents are part of the informal sector.

[25] Nigel Myrie, SCJ Holdings Limited, Manager Land and Lease Management Unit, Personal Communication 2025

Consultation participants from the parish and local area development committees[26] and political directorate[27] identified agriculture related occupations as the main occupational category to which most (between 75-80%) of the working age population of the communities in the study area belong. Occupational fields identified, include agriculture and livestock labourers (farmers) and fishers- most of whom are small farmers and fishers.

Although both men and women are involved in agriculture, key community stakeholders highlighted that more men are involved solely in agriculture related occupations compared to women, who, in addition to agriculture, are more likely to engage in other types of elementary occupations as domestic workers, vendors and labourers. Key insights from the consultations related to age group revealed there is a high level of disinterest among youths regarding careers in farming and fishing, with youth males in particular showing greater interest in construction and trade related occupations.

10.4.4.3 INCOME AND INCOME SOURCES

Surveyed households reported that the main sources of income for their household were 'money earned from own work (59%), remittances from friends and family (11.6%), support from family in Jamaica (7%) and pensions (3.5%). The remaining respondents reported their household had no main source of income (5.8%) or did not provide a response (7%).

From the total share of household respondents (66) that provided a response to the question asked on monthly income, 50 per cent reported a monthly income below $20,000 Jamaican dollars and nearly a quarter (23%) reported incomes ranging between $20,000-$39,000.00 monthly. Less than a tenth (3%) reported monthly income levels above $100,000.00 Jamaican dollars (Table 61). Among respondents who reported being employed, 44 per cent reported earning less than $40,000.00 Jamaican dollars monthly.

Table 61: Monthly Income of Household Representative by Sex

Income	Sex		Total (%)
	Female (%)	Male (%)	
Below $20,000	56	46.3	50
$20,000 - $39,999	24	22	22.7
$40,000 - $59,999	12	19.5	16.7
$60,000 - $79,999	8	2.4	4.6
$80,000 - $99,999	-	4.9	3
$100,000 to $199,999	-	4.9	3
Grand Total	**100**	**100**	**100**

[26] (1) Clarendon Parish Development Committee Benevolent Society (2) Lionel Town Development Area Committee, and (3) Milk River Local Development Area Committee
[27] Joel Williams- Mayor, May Pen; Winston Maragh, Member of Parliament; Kijana Johnson, Councillor

10.5 SUGAR INDUSTRY INTERACTION AND EXPERIENCES

Two-thirds, 66.3 per cent, of households surveyed had at least one member who was a previous employee at the Monymusk Sugar Factory (Table 62). This finding is consistent with information gathered from consultations, including the FGD, where stakeholders reported the Monymusk Sugar Factory directly and indirectly supported most, if not all, households in the communities located within the Southern Clarendon and Vere Plains region.

Nearly half, 46.2 per cent, of former employees had been employed at the factory for more than 10 years.

Table 62: Total Share of Households with at least one former employee of Monymusk Sugar Factory

	Female (%)	Male (%)	Total (%)
No	12.8	18.6	31.4
Not sure	1.2	1.2	2.3
Yes	23.2	43.0	66.3
Total	**37.2**	**62.8**	**100.0**

10.5.1 IMPACT OF FACTORY CLOSURE

See, my community, I love it very much. But it's kind of run down since the closure of the factory. We all are suffering down here now. Male participant, FGD

For many residents in the study area, the closure of Monymusk led to widespread adverse social and economic impacts- many of which are still being experienced today. The findings of the survey showed more than three-quarters, 76.7 per cent, of participating households reported a loss of income as the main impact the factory's closure had on their household. For nearly half, 46.5 per cent, the closure also impacted personal savings, housing expenditure on food, pension and overall livelihood security (Table 63). The loss of pension, in particular, was highlighted by participants in the FGD as one of the main challenges which adversely affected many households. Participants reported that many former Monymusk workers were not paid the pension that was commensurate with the length of their employment service following redundancy exercises and ultimate closure of the factory. It was revealed that some workers received pension payments for only a few years (1-2 years) due to potential administrative filing errors with the National Insurance Scheme (NIS), which left many without income security having entered retirement. Finding jobs have also proved challenging for former workers.

10.5.1.1.1 LACK OF EMPLOYMENT OPPORTUNITIES

The survey results also showed among the total share of households with former Monymusk employees, 44 per cent reported that former workers living in their households have been unsuccessful in finding employment since the closure of Monymusk. Among those able to secure employment following the factory's closure, the data showed 41.3 per cent did so in less than 12 months, 21 per cent in 1-2 years, for 27.5 per cent it took more than 2 years and for 10.3 per cent the length of time taken to secure employment was uncertain.

Table 63: Impact of Monymusk Sugar Factory Closure on Households

Types of Impacts	Total (%)
Loss of income	76.7
Loss of savings	46.5
Loss of livelihood security	46.5
Unable to feed family	46.5
Loss of pension	40.7
Unable to pay for child's/children's education	34.8
Emotional distress and anxiety	30.2
Loss home	15.1
Unable to pay mortgage	15.1
Loss business	5.8

A lot of people out here now, they are burning coal. Coal for fire coal. And quite a few guys go and do a little fishing, but you know, that's about it. Male participant, FGD

Many former labourers residing across the Vere Plains, including those formerly employed in non-farming roles, have engaged in animal husbandry/livestock farming (cattle, goat and pig), castor oil farming, fishing and charcoal burning to support themselves and their families. Others have migrated to other places locally (Ocho Rios and St. Mary) and overseas to gain employment in construction or other fields. Some workers have also found employment in the sugar industry in Clarendon.[28]

Burning of the fire coal…now gone down they don't have anybody coming in to buy the fire coals anymore. Female participant, FGD

However, stakeholders have noted the precarity of the economy and job market, which has made it difficult for community members to maintain stable employment. The impact of the COVID-19 pandemic further exacerbated economic and employment challenges.

10.5.1.1.2 BUSINESS LOSSES

In keeping with the findings of the survey (Table 64), FGD participants and key stakeholders reported that the closure of the factory led to a rapid decline in community development, as the closure triggered a torrent of negative social and economic impacts. In addition to the losses of employment and income, the consultations revealed the widespread closure of businesses and the loss of critical services across many of the communities, particularly in Lionel Town, where

[28] The Clarendon Chamber of Commerce estimates there are between 70-80 farmers involved in the cultivation and harvesting of sugar cane currently.

the impact was greatest. Stakeholders shared in the consultations that banking services and facilities, provided solely by the National Commercial Bank, were permanently relocated from the community to May Pen. Many locally owned businesses, which provided goods and services to workers and community members, including gas stations, restaurants, retail stores, grocery stores, and electrical and mechanic businesses, were all shuttered. Nearly nine in ten (87.2 per cent) survey respondents reported a significant decline in economic and business activities following the closure of the factory. In recent times, businesses that were able to withstand the initial shock of the factory's closure, are on the brink of closing or have closed due to the impact of COVID-19.[29]

Table 64: Impact of Monymusk Sugar Factory Closure on Community

TYPES OF IMPACTS	TOTAL (%)
Increase in Unemployment	94.2
Increase in poverty	77.9
Increase in crime	70.9
Non-resident factory workers left the community	37.2
Improvement in quality of water resources	10.4
Improvement in air quality	9.2

10.5.1.1.3 DECLINING QUALITY OF LIFE

But the community really need to be developed, you know? Really need to be developed. We can't go on living like this. We are, you know, people in the community are human beings like anybody else …We need people to come in and do something. You know? Look, the youth, they need something to do, you know? Male participant, FGD

The closure of the factory has had significant adverse impacts on health, educational attainment and outcomes, crime and community engagement and cohesion. Consultations held with health and business stakeholders in the community revealed key insights into the socio-economic challenges affecting residents. As unemployment and poverty levels have risen, health representatives have reported that the current levels of malnourishment observed in the population served at the Lionel Town Hospital is concerning.[30] Growing food insecurity has been identified by stakeholders as one of the challenges affecting community members, particularly children and the elderly, which has contributed to declining health status. As large segments of the population struggle with income inadequacies, their overall purchasing power

[29] Hanif Brown, Representative, Clarendon Chamber of Commerce. Personal Communication May 2025
[30] Nadine Preddie, Chief Executive Officer, Lionel Town Hospital. Personal Communication 2025

has impacted their spending on essential amenities and services such as food, health and education services.

This reduction in spending has, according to feedback from stakeholders, translated into unmet nutritional needs, infrequent healthcare check-ups, lower attendance rates at the primary and secondary level, higher secondary school dropout rates and low educational performance among the youth population[31] and an increase in criminal activities. In the communities of Lionel Town and Rocky Point gang violence, which continues to plague the area, has been linked to the challenging social and economic conditions faced by community members- driven primarily by the lack of employment opportunities and successes for residents. Education and training intervention efforts by the Government of Jamaica,[32] targeting the youth population in the Vere Plains region, have not had the desired impact, as the response to the tuition-free programmes have been described by stakeholders as 'underwhelming.'

Other community initiatives spearheaded by the private sector and various Non-governmental Organisations (NGOs) and Community Based Organisations (CBOs) have sought to address some of the socio-economic challenges affecting the communities, with varying levels of success. Welfare programmes have sought to address food security issues, training programmes have been developed to help tackle literacy challenges and ongoing community engagement programmes are focused on community development, youth empowerment and crime reduction.

10.5.2 PROJECT PERCEPTIONS AND POTENTIAL IMPACTS

10.5.2.1 PROJECT AWARENESS

All key stakeholders consulted were aware of the proposed project, although the level and depth of information known about the intended development varied among stakeholders. Most survey respondents, 82.5 per cent, also reported being aware of the proposed project to resume sugar factory operation. Most had been made aware by a fellow community member (91.5%).

10.5.2.2 PROJECT SUPPORT

The consultations demonstrated there is broad support for the proposed project, with no stakeholder raising an objection or opposition to the new construction and operation of the agro-processing facility (sugar factory). Stakeholders, instead, emphasised the necessity of the project in supporting the redevelopment of the local communities across the Vere Plains region, and highlighted the social and economic opportunities to be derived from the project.

The survey results showed all respondents supported the project and 99 per cent agreed the development was necessary. Overall, there was general consensus among stakeholders that the project will bring about an improvement in the quality of life for residents, create employment,

[31] Key stakeholders reported that Alley Primary and Bustamante High School in Lionel Town have reported declines in school attendance and overall student performance.

[32] The Government of Jamaica in 2023 removed all tuition and administrative fees for HEART-NSTA Trust programmes up to level four (associate degree). The programme became effective April 1, 2023.

provide opportunities for new business investments in the study area and wider parish, help to re-establish social cohesion, and rebuild the vibrancy of the Lionel Town area.

10.5.2.3 PROJECT IMPACTS AND CONCERNS

Analysis of the perception data on project impact showed while stakeholders associated mostly positive impacts with the proposed project, there were also a few concerns expressed about the project.

10.5.2.3.1 PERCEIVED PROJECT BENEFITS

For all groups engaged as part of the consultations, the proposed project represents hope and an opportunity for community renewal and development. Key stakeholders also noted the national development opportunity offered by the project, given its alignment with national development goals and priorities centred around job creation, economic diversification, modernisation of the agricultural sector and food security.[33]

Employment opportunities (96.5%) and potential increases in income (95.3%) were the two main community benefits survey respondents associated with the proposed project (Table 65). The project was also seen as likely to assist in the reduction of poverty (81.5%) and crime (79.1%) and lowering of the overall employment rate (59.3%).

Table 65: Expected Community Benefits from Proposed Project

BENEFITS	TOTAL (%)
Provide employment/create job opportunities	96.5
Increase in wages/income	95.3
Reduce poverty	81.4
Reduce crime	79.1
Lower employment rate	59.3
Support/stimulate growth of local businesses	62.8
Provide opportunities for re-establishment and growth of local small businesses	51.2
Influx of migrant workers	12.8

Most survey respondents also identified employment opportunities (83.7%) and potential increases in income (80.2%) as the main personal benefits they associated with the proposed project. More than half of all respondents also reported the project's potential impact in reducing poverty (74.4%) and emotional distress (66.2%). For 10.2 per cent of respondents, however, the project was not expected to have any personal impact or offer any personal benefits (Table 66).

[33] Marlene Porter, Manager Agribusiness and Investment Linkages, JAMPRO, Personal Communication, 2025

Table 66: Expected Individual/Personal Benefits from Proposed Project

BENEFITS	TOTAL (%)
Provide employment/create job opportunities	83.7
Increase in wages/income	80.2
Reduce poverty	74.4
Reduce emotional distress and anxiety	66.2
No benefit	10.2

In discussing the potential impacts of the proposed project, participants in the FGD shared that community members are anxious for the project to get started. Many shared their hope that the project would finally create job opportunities for people in their communities and support the re-establishment of businesses that have been shuttered in recent years. For others, the project presents a worthwhile opportunity for youth engagement, through the provision of training and job opportunities. Participants suggested that a successful youth engagement programme would help to keep the youth population out of illicit activities and ensure safety in the communities. With respect to community development and corporate social responsibility (CSR), many participants indicated their desire to see the new developers of the sugar factory contribute to the development of the communities by supporting local initiatives and collaborating on community projects and events.

Key stakeholders, when asked about potential impact of the project, identified similar social and economic benefits shared in the FGD and survey, including job creation, increased commercial activity, and opportunities for youth engagement. Stakeholders also reported the potential to reap broader national benefits, including generation of tax revenues, increase in exports and trade, generation of foreign exchange earnings and expansion and diversification of the agricultural sector.

It is also important to note that respondents to the survey and key stakeholders did not identify any marginalized or vulnerable groups that they believed would be disproportionately impacted by the project. Neither were any existing nor proposed industrial activity reported which could potentially conflict with the proposed development.

I think the opportunity for employment for persons in the area- that's a positive, but it has to be employment at a level that takes them out of poverty. it has to be something that has long lasting positive impact. C-CAM, consultation

Additionally, although stakeholders anticipated a number of positive outcomes from the project, for many it is important that the project offers long-term and sustainable opportunities for community members to ensure the achievement of tangible socio-economic and health outcomes for residents and potential workers.

10.5.2.3.2 PERCEIVED ADVERSE IMPACTS AND CONCERNS

The survey found only a small share of respondents, 2.3 per cent, were '*somewhat*' concerned about the adverse environmental impacts of the project. The findings showed air pollution was the main environmental concern for respondents. This finding was not particularly remarkable as when survey respondents were asked about the environmental impacts of Monymusk's operation in the community, 79.1 per cent, stated there had been none, while 95.3 per cent stated that the factory's operations had never impacted their own personal health or that of a family member.

When asked about other concerns or adverse impacts, 8.1 per cent of respondents expressed being '*slightly*' concerned about potential disturbances and disruptions from construction activities and the health and respiratory effects associated with the proposed project activities. Nearly a quarter of households, 23.2 per cent, reported that at least one member of their respective household suffers from a respiratory illness or disease.

Stakeholders engaged in the consultations however identified environmental areas of concern, along with or areas of key interest and concerns. Some of the main issues identified were:

- The potential for the project to pollute groundwater resources and increase saline intrusion
- Increase in air pollution sources during construction and operation of factory
- Proper management of waste generated from the factory
- The importance of providing adequate compensation for farmers to ensure the profitability of the venture for farmers, as well as the developers/operators.
- Displacement of livestock farmers and informal land occupants and threats to livelihoods and social cohesion
- The importance of developing innovative training and youth engagement strategies to attract and retain youth involvement.

Additional concerns provided by stakeholders are outlined in Table 67

Table 67: Summary of Stakeholder Feedback on Potential Impacts and Recommendations

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
Caribbean Coastal Area Management Foundation (C-CAM)	- Source of water for the project and the impact increased extraction of groundwater may have on increasing saline intrusion in the project areas - The impact of waste on water sources and water quality - The potential impact on wildlife, including birds and crocodiles - The impact of resettlement on informal settlers and potential disruption of livelihoods - The return of charcoal burning in the protected area due to reclamation of cane lands for project	- Create employment/job opportunities - Provides an opportunity to support community development - Opportunity to engage community and build community partnership	- Develop a comprehensive water quality monitoring programme to address water pollution - Workers should be provided with guaranteed job security, and liveable and attractive compensation packages - Consideration should be given to allocating marginal (fringe) cane lands to community members that support their livelihoods through the burning of charcoal and will be relocated as a result of the project - Develop tourism product by Converting the defunct Monymusk Factory and old housing barracks into a heritage museum or tour - Identify and outline mitigation and monitoring measures to address environmental impacts - Develop a community engagement strategy and programme
JAMALCO	- Concerned about the long-term sustainability of the proposed project	- Create employment/job opportunities	- Appoint a designated community liaison officer to manage community engagement and develop a

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
	- Impact of air pollution and proposed plans to address environmental and social impact of air pollution - Engagement of youth population in community	- Provide support for local initiatives and programmes, easing the burden on existing businesses - Provide training and upskilling opportunities for community members	community engagement strategy and programme
Lionel Town Hospital	- Handling, treatment and management of waste - Impact of air pollution and proposed plans to address environmental and social impact of air pollution - Engagement of young men in community	- Create employment/job opportunities - Provides an opportunity to support Improvement of health outcomes, particularly for children and the elderly - Provides an opportunity to support community development	- Train and recruit locals for job opportunities, particularly young men and women. - Provide support to local initiatives and collaborate with community on various programmes
Chamber of Commerce	- Concerned about the length of time taken for project to be approved and started - The importance of having proper security measures, protocols and mechanism in place to safeguard field and factory operations	- Create employment/job opportunities - Reduce poverty - Increase export and trade revenue (foreign exchange earnings) - Provide training and upskilling opportunities for community members - Provides an opportunity to support community development	- Local contractors in the community should be given priority during the contractor recruitment process - Develop a security management plan to safeguard field and factory operations - Mitigation and monitoring measures to address environmental impacts should be clearly outlined

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
Municipal Corporation (representatives)	- Concerned about the Impact and disruptions relocation of cattle farmers may have on their livelihoods - Handling, treatment and management of waste	- Create employment/job opportunities - Increase export and trade revenue (foreign exchange earnings) - Increase government revenue (taxes) - Provides an opportunity to support community development - Create linkages across various sectors e.g., transportation, tourism.	- Invest in community infrastructure, particularly those in the education and health sectors - Provide support to local initiatives and collaborate with community on various programmes - Train and recruit locals for job opportunities, particularly young men and women. - Establish grievance mechanisms, protocols and procedures to address community concerns during construction and operation - Develop a comprehensive relocation plan to limit disruptions of farming livelihoods
Clarendon Parish development Committee and Benevolent Society	- Potential influx and recruitment of workers from outside the community and 'shutting out' of locals - Pollution of water sources and overall impact on water quality	- Create employment/job opportunities - Provide training and upskilling opportunities for community members - Provides an opportunity to support community development - Provides the opportunity to improve and develop education	- Develop a detailed corporate social responsibility programme, - Develop procedures and strategy for field operations, which covers protocols, procedures, timelines and schedules for field and factory activities and operations

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
	- Impact of run-off on fauna and fish species in water ways - Concerned about soil contamination from use of fertilisers and pesticides - Impact of dust emission sources e.g., haulage trucks, burning of bagasse and foul odours from cane fermentation process on air quality - Displacement of local jobs in the long-term or reduction in wages - Occupational health and safety of field workers, including risk of loss, injury or death during construction and operation - The importance of offering proper compensation for farmers to ensure long-term sustainability of project - Initial start-up costs for farmers - Concerned about farmers and workers not being properly compensated for additional value-added products	programmes focused on sugar production and agricultural diversification	- Train and recruit locals for job opportunities - Workers should be provided with guaranteed job security, and liveable and attractive salary packages, which include healthcare, occupational health and safety and pension benefits - In the project's start-up phase, labourers/farmers should be assisted with initial start-up inputs e.g., fertilizer, tools - Appoint a designated community liaison officer to manage community engagement - Conduct 'walk-throughs' in communities where project activities will occur and engage in dialogue with residents - Develop a comprehensive water and soil contamination monitoring plan - Establish grievance mechanisms, protocols and procedures to address community concerns during construction and operation

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
	- Concerned about disaster management and safety of workers		- Ensure disaster management protocols, systems and services are extended to farmers and contractors - Partner with small businesses to support entrepreneurship, using mechanisms such as grants, training etc.
JAMPRO		- Create employment/job opportunities - Advances technological development and modernizes agricultural production - Create linkages across various sectors e.g., transportation, tourism. - Increase export and trade revenue (foreign exchange earnings) - Increase government revenue (taxes) - Support the diversification and expansion of agricultural sector - Provides the opportunity to improve and develop education programmes focused on sugar	- Identify and outline mitigation and monitoring measures to address environmental impacts

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
		production and agricultural diversification - Promotes energy efficiency and use of renewable energy technologies	
SCJ Holdings Limited	Concerned about the impact and damage nomadic cattle farming is having on cane lands	- Support bringing 15,000 acres of cane lands into productive agricultural use - Support redevelopment and rehabilitation of irrigation infrastructure and systems - Creates opportunity to introduce new approach for rearing and management of cattle - Supports diversification of sugar industry and agricultural sector with production of a range of value-added products - Supports expansion of new export markets for Jamaican made products - Promotes energy efficiency and use of renewable energy technologies	- Implement security systems and measures to address protection of cultivated areas and factory operations

ORGANISATION	ISSUES AND CONCERNS	BENEFITS AND AREAS OF OPPORTUNITY	RECOMMENDATIONS
		- No burning of cane fields, eliminating the main source of air pollution in field operations	

10.6 IMPACT IDENTIFICATION AND ASSESSMENT

This section identifies and assesses the potential and likely impacts and outcomes of the proposed project on the valued social-economic components[34] in the project area. Presented using the 'with' or 'without' scenario, the assessment examines the social baseline conditions that are likely to remain unchanged, the types of changes that are likely to occur and the resultant effects on the valued components and social receptors, including their communities, and the systems and services on which they depend, if the proposed project is implemented or there are no interventions in current baseline conditions (Table 68).

The impacts that are identified and assessed are based on the preliminary design concepts for the agro-processing and manufacturing facility. It is anticipated that final detailed designs, including detailed engineering works, may require amendments. Such amendments can be taken into account during the implementation of the proposed mitigation and monitoring measures, which should be responsive to changes in the project scope and activities.

[34] Valued social-economic components are classified as the fundamental social, economic, cultural/heritage, and environmental elements and features of a community, and its systems that are considered significant and/or valuable and may be affected by the proposed project.

Table 68: Social Impact Identification

<table>
<tr><th rowspan="2">VALUED SOCIAL AND ECONOMIC COMPONENT</th><th colspan="2">IMPACTS</th></tr>
<tr><th>Negative (Without & With)</th><th>Positive (With)</th></tr>
<tr><td colspan="3">POPULATION -PUBLIC HEALTH, SAFETY AND WELL-BEING</td></tr>
<tr><td>Population Dynamics-Migration</td><td>Without
• No change to existing baseline conditions. The findings of the consultations revealed ongoing community migration has been a key contributing factor to the shrinking, and unchanged population sizes observed in some communities across the study area. Migration from the communities has largely been driven by individuals- mainly belonging to the youth aged population- leaving in search of economic opportunities and improved standards of living.

With
• Based on the findings of the survey and information gathered from the consultations, most of the labour force in the communities are low-wage workers or workers without advanced formal educational training. The overall data suggests there is unlikely to be sufficient local capacity to fill both non-technical and technical roles during construction and for factory operations. However, it is anticipated that there will be sufficient local capacity to fill more than 50% of the roles required for field operations (cultivation, harvesting and transportation). It is therefore anticipated there will be an inflow of transient workers from outside the communities during the construction phase, mainly from across the island.</td><td>• <u>Construction and Operation</u>: The project presents an opportunity for local skill sets to be utilised, and local capacity developed through training and other capacity building programmes and activities. The project could therefore support talent retention in the community, and potentially slow or reduce the overall pace of migration.</td></tr>
</table>

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	This is likely to lead to increased demand for housing, and other local infrastructure and services within the Vere Plain region and other areas providing ease of access to the construction site. Transient workers can also change community and family structures, depending on the number of transient workers and their location of origin (i.e., foreigners and non-residents). During the operational phase an estimated 10 per cent of workers are expected to be foreigners. Locals from outside the study area are also likely to seek and benefit from employment and other business opportunities.	
Noise and Vibration	*Without* • No change to existing baseline conditions. anthropogenic sources (conversations, music etc.) and road traffic are the main noise emitting sources across the project area. The baseline noise assessment (Section 8.19 & Annex 4) results showed average ambient noise levels ranging between 30-74 decibels (dBA) during the daytime. Readings recorded at the project site above the 70dBA safe limit for environmental noise were associated with the intermittent movement of vehicles (cars and motorbikes) and elevated wind conditions. *With* • <u>Construction</u>: Given the rural nature of the project area, pre-construction and construction activities (excavation, earthworks, land stripping and clearance, road works and the	• <u>Construction</u>: The construction period of 14 months is relatively short, given the scale of the project. This will reduce social receptors' length of exposure to noise nuisances. Additionally, construction activities will not be concentrated or take place near community service facilities where vulnerable and key sensitive receptors are located e.g., schools, health centres, day cares etc. • <u>Operation</u>: Sound barrier walls will be erected along property boundaries bordering residential communities. Green

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	operation of construction vehicles and equipment) will generate noise emissions that exceed current ambient noise levels within the project area. • Construction related activities are expected to increase noise levels above the discomfort level of 80dBA, reaching between 115-120dBA, based on the typical noise measurement levels for construction vehicles and equipment. However, noise levels are expected to fall to approximately 55-60 dBA in areas located at least 100m from the central construction area. Construction workers are therefore expected to be the main social receptors to face direct exposure to construction related noise emitting sources for an extended period and are also the most likely to face the most severe public health threats such as hearing loss. Similarly, informal settlers located on the eastern boundary of the project site are also likely to be impacted by the increase in nuisance noise, if they are not relocated prior to the start of construction, along with the residential population of the Alley community situated on the immediate south and south-western boundary of the site. Sensitive receptors such as children, the elderly and persons with auditory sensitivities, are expected to be the most impacted by changes baseline noise levels in these areas. • Sensitive receptors that are users of community institutions e.g., schools and healthcare facilities (Alley Primary School, Lionel Town Hospital, Bustamante High School) are unlikely to be significantly impacted by noise pollution, given the distance of	spaces/areas will also be created along the roadsides and areas bordering the communities to help in deflecting and absorbing noise.

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**

	these institutions (>500m) from the central construction area, where ambient noise levels associated with construction activities are expected to decline below 50dBA at these locations. The Lionel Town Hospital's location along the main access route to the site is however likely to expose receptors using that facility to temporary noise nuisances caused primarily from the movement of equipment and materials during the construction period.
	• Noise emissions are not expected to pose long-term adverse risks to social (human) receptors in the residential and community facilities found within the project area given:
	    ▪ No blasting is anticipated to be required
	    ▪ The distance of the receptors from the construction site
	    ▪ The relatively short duration of the construction period (13-14 months)
	    ▪ The availability of noise mitigation and best practice options and techniques to minimise noise	

Air Quality	*Without* • No change to existing baseline conditions. There are no major existing sources that emit the main air pollutants of concern- particulate matter, carbon monoxide, sulfur dioxide and nitrogen dioxide. *With*	• <u>Operation</u>: The agricultural practice of sugarcane burning will not be used for the harvesting of cane. Green cane harvesting is the harvesting method that will be used, and will involve the use of mechanical harvesters. This approach will lead to the reduction in air pollutants and exposure

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	• <u>Construction:</u> Pre-construction and construction activities (excavation, earthworks, land stripping and clearance, vegetation clearance, the construction of road infrastructure, and the operation of construction vehicles and equipment) will increase the volume of particulate matter and chemicals of potential concerns in the project areas. Construction workers and other workers at the sites are expected to be the most affected by changes in air quality given their direct involvement in construction related activities, and general proximity to dust generating activities. Public health issues of concern associated with fugitive dust and reduced air quality may include irritation of eyes, asthma attacks and other respiratory induced effects such as wheezing, difficulty breathing and coughing. ▪ While no adverse health effects related to poor air quality are anticipated for the residential population located within the study area during pre-construction and construction, the increased presence of fugitive air emissions and air emissions from construction and land preparation activities (cane fields) may lead to negative health impacts, particularly for sensitive social receptors with existing respiratory health concerns. Other sensory emissions such as odours may also have a similar impact on vulnerable groups.	to air pollution by social receptors located within the study area.

<table>
<tr><th rowspan="2">VALUED SOCIAL AND ECONOMIC COMPONENT</th><th colspan="2">IMPACTS</th></tr>
<tr><th>Negative (Without & With)</th><th>Positive (With)</th></tr>
<tr><td></td><td><u>Operation</u>: During the operational phase, human exposure to air pollution emissions, including fugitive emissions will be primarily from the Bagasse Boiler, Diesel Generator and Bagasse Storage and Handling System. Particulate matter from the bagasse stockpile is expected to be the primary source of air pollution which may pose an adverse threat to human health. The use of electrostatic precipitators for particulate removal from the boilers (wood chip firing and bagasse firing) will reduce particulate matter from 2,200 mg/Nm^3 to 100 mg/Nm^3 (a 95.5% removal efficiency for PM/TSP), controlling the stack PM emissions. Air emission reduction measures will need to be put in place for the generator to ensure compliance with the legal requirements of 0.5% maximum sulphur content (Section 9: Air Emissions Inventory & Annex 2).</td><td></td></tr>
<tr><td>Occupational health and safety</td><td>Without
No change to existing baseline conditions.
With
<u>Construction:</u> There is the potential for work place and occupational risks and accidents during the undertaking of pre-construction and construction activities. It is expected that construction workers will face the greatest threats given their direct involvement in project related activities, and also the length of exposure time to potential safety risks during the construction period. Injuries from the operation of machinery</td><td><u>Operation</u>: The project is likely to support the introduction of improved operational health and safety standards in the sugar industry with the automation and adoption of advanced technology. Automation will help to reduce the use of manual labour in tasks and areas with increased exposure to occupational risks, such as harvesting and fertilization.</td></tr>
</table>

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	and equipment, working at elevated heights, handling various types of chemicals and waste materials and vehicular accidents are the occupational hazards and threats most likely to pose health risks to workers. Users of the roadways leading to the project site, which includes pedestrians, motorcyclists and cyclists, may also face potential health and safety risks. Road accidents can occur during the transportation and movement of construction materials and equipment. • <u>Operation</u>: Occupational accidents during field and factory operations are likely. Potential risks to workers may include, but are not limited to: ▪ physical injuries from the operation, maintenance and repair of machinery and equipment, and falls associated with working at elevated levels and heights, ▪ increased risks of chemical injuries due to exposure to chemical hazards e.g., chemical burns ▪ Increased risks of hearing loss due to exposure to high noise levels ▪ Increased risks of eye injury from exposure to bagasse and operation of machinery and equipment ▪ Biomechanical injuries associated with lifting heavy loads or overextending of muscles and ligaments in arms, legs, shoulders etc. during land preparation, harvesting etc.	

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	▪ Road accidents and risks of physical, and psycho-social injuries during transportation of sugar cane. • Members of the local population are also likely to face potential occupational health risks associated with the transportation of sugar cane and the movement of heavy equipment.	
Road Access and Safety	*Without* • No change to baseline conditions. Some of the roadways previously used by Pan Caribbean are overgrown, and/or in poor condition. *With* • During pre-construction and construction, all materials and equipment will be transported via existing access routes within the study area. Disruptions to the existing transportation service network are expected mainly in the community of Lionel Town- mostly in the main business centre. While periodic and temporary disruptions are expected for road users in the communities where cane fields are situated, these disruptions are not expected to be significant given the volume of traffic and users on the roadways, and the smaller volume of materials and equipment to be transported in those areas. The use of appropriate transportation equipment and adherence to safe loading standards must be met to reduce the likelihood of infrastructure deterioration, and ensure the safety of other users of roadways in the study area.	• <u>Operation:</u> Rehabilitation of access roads is expected to improve the overall capacity of the road infrastructure network to support the movement of materials and equipment. Additionally, upgrading of the road infrastructure can help to improve overall access for other users of the local roadways.

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
Gender based violence and human trafficking	*With* • Construction is considered a high-risk environment for gender-based violence and harassment (GBVH). The industry remains a largely male-dominated industry, and can attract significant numbers of foreign workers. Incidents of violence within the industry affect workers, community members and service users. Similarly, construction workers are also vulnerable to exploitation and harassment. • Labour trafficking remains a concern in Jamaica (US State Department Trafficking in Persons Report, 2024),[35] and therefore, keen attention will need to be paid to the recruitment and employment procedures used in securing workers.	• There is an opportunity for information to be disseminated throughout the communities via (i) workers who have undergone training in GBV, sexual harassment and trafficking as part of the project and (ii) the distribution of information leaflets. • Jamaica has also recently passed the Sexual Harassment (Protection and Prevention) Act (2021), mandating preventative policies in workplaces.
Population Health	*Without* • No change to baseline conditions. High unemployment rates, high prevalence of poverty and inadequate sources of income have significantly impacted the health outcomes of the resident population in the study area. Food insecurity, concerning levels of malnourishment among the elderly and child-aged population, and mental health challenges-mostly affecting the youth population- are likely to increase in the absence of comprehensive intervention measures and support mechanisms.	• <u>Construction & Operation</u>: The proposed project will create direct and indirect job opportunities and improve income for the resident population in the study area. This is expected to provide individuals and households, particularly vulnerable groups, with the resources to better afford food and healthcare services to meet their basic needs, improve health outcomes, and enhance their way of life.

[35] https://www.state.gov/reports/2024-trafficking-in-persons-report/jamaica/

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
Social Amenities and Services	*Without* No change to baseline conditions. Most of the residential population in the study area has access to basic social services and amenities including healthcare, education, and infrastructure. The provision of services and amenities are however inadequate and have not kept pace with the needs of the population. Issues of access and distribution, scarcity of varying types of resources and insufficient investments in the upgrading and expansion of social amenities, services and infrastructure have contributed to the inadequacy of current social services and amenities. *With* During the construction and operation phase there will be an increased demand on existing social amenities and services. Current inadequacies may impact the quality of life and well-being of some workers due to access constraints and other limiting factors. It is therefore important that the relevant services and support that maybe needed for workers be identified prior to the start of construction works and coordinating mechanisms put in place to ensure workers can readily access the relevant services, as may be required.	Operation: TSCL has made a commitment to work with local communities through their corporate governance support programmes to identify areas of priority and assist, where possible, in contributing to the sustainable development of the communities.
ECONOMY		

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
Socio-economic Livelihood and Security	*Without* • Lack of economic opportunities, inadequate income and increasing poverty have led to a deterioration of socio-economic livelihoods within the communities. The inadequacy of household and individual financial resources has also impacted access to food and key social services, including healthcare and education, which in turn, has adversely affected the well-being of the population. Based on the socio-economic survey 30% of respondents to the survey are seeking employment and more than a half of those employed, are in low-wage jobs, and in some instances vulnerable (informal) jobs. Without intervention, these existing baseline conditions are likely to be exacerbated.	• The project is expected to have a significant impact on the economy and labour force in the communities in the study area and is expected to directly support the socio-economic livelihoods of more than half of the population residing in the study area as a result of direct and indirect employment and business opportunities. • The resumption of sugar manufacturing and the inclusion of new value-added products will also provide an opportunity for diversifying and broadening the economic opportunities that can be derived from the project to support and sustain livelihoods. • In the first year of factory operations, TSCL has committed to providing some of the essential inputs needed by farmers to begin the cultivation of sugar cane. This will include such items as fertilizer and equipment, which will help to lower the start-up costs for farmers engaged indirectly.

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
Employment and Business Opportunities	*Without* • Unemployment, poverty levels and business closures are expected to continue rising sharply, if long-term and sustainable economic opportunities are not created. *With* • Construction projects generally attract a large number of migrant workers, which can limit the opportunities available for local labourers. Given the concerns regarding the literacy and skill level of the local population, it is unlikely, without training and capacity building, locals will be recruited for high-skilled jobs and may have to compete for low-skilled jobs.	• Employment is a major policy priority of the Government of Jamaica, and the project is expected to create employment and business opportunities for residents and other stakeholders across multiple sectors and industries during the construction and operational phases. The estimated 750 jobs to be supported in the operational phase will increase the employed labour force by 0.05%, based on current total employment nationally (1,473,900). While the impact of the development's operational phase on employment nationally is expected to be negligible, the impact on local employment is expected to have a more significant impact. A maximum of 200 persons will be employed directly at the factory and an estimated 500 labourers and other workers will be employed indirectly for field operations through third party contractor arrangements with four (4) contractors. Ninety percent. (90%) of all workers will be local. In the construction phase employment

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	Positive (With)
		opportunities will be created. Both skilled and unskilled workers are expected to benefit from employment opportunities. It is also expected that workers will be chosen on merit, with opportunities also offered/ extended to women and persons with disabilities. • Other Indirect employment opportunities will also be created as a result of the project during the construction and operation phase. Based on the magnitude of the impact of Monymusk's direct employment on indirect employment opportunities, it is anticipated that direct employment opportunities created by the project could lead to the creation of twice as many indirect employment opportunities. • Local businesses are expected to accrue revenues and other benefits as a result of the procurement of materials, goods and services. Local sourcing of various raw materials and equipment will ensure support for local suppliers, manufacturers and companies who produce and/or

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
		distribute construction materials, goods and services benefit from the project, and extend the socio-economic benefits of the project beyond the study area. Local community businesses are also likely to receive some benefits from the proposed project as workers on site are likely to patronize nearby community businesses.
Revenue and Tax	*Without* • No change to baseline conditions	• Operation: Increased economic activity resulting form the factory operation and other supporting business will generate more revenue for the Government of Jamaica
Skills Development and Training & Knowledge Sharing	*Without* • No change to baseline conditions.	• <u>Construction and operation</u>: TSCL has committed to providing training and capacity building opportunities aimed at equipping locals to benefit directly and indirectly from the project. This will include training for field and factory workers, which will be done in partnership with HEART-NSTA Trust. Commitments have also been made to implement knowledge sharing programmes aimed at engaging and

<table>
<tr><th rowspan="2">VALUED SOCIAL AND ECONOMIC COMPONENT</th><th colspan="2">IMPACTS</th></tr>
<tr><th>Negative (Without & With)</th><th>Positive (With)</th></tr>
<tr><td></td><td></td><td>teaching children about modern agricultural technology and practices.
• SCJH Limited as part of its relocation plans for livestock farmers, will undertake training with local farmers, introducing new, and more land efficient animal husbandry farming techniques and practices. Approximately 60-70 farmers will benefit from the training in the first phase of the relocation plan.</td></tr>
<tr><td colspan="3">LAND RESOURCES</td></tr>
<tr><td>Use, Rights and Access</td><td>Without
• No change to baseline conditions. SCJ Holdings Limited is the owner of all the lands designated for the proposed project. Presently, pockets of cane field lands are being used informally by farmers to rear animals and by locals to grow castor oil and burn coal. Small areas of land for the proposed project are also occupied by informal settlers.

With
• Informal users and occupants of lands designated for the project will be relocated. Relocation is expected to cause temporary disruption to the livelihood of farmers. However, there is expected to be no long-term access restrictions for farmers, who are currently engaged in stakeholder consultations</td><td>• Presently, there are no developments approved and/or being proposed on the lands designated for the project. There are also no existing commercial nor industrial land users and uses that are likely to create potential sources of conflicts.
• The project will not result in any significant changes to current land use activities and patterns within and immediately surrounding the project areas based on the current tenure status of the lands within the project areas. The use of</td></tr>
</table>

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	with the SCJH Limited regarding the use of other lands owned by the entity for animal rearing.	the lands for agricultural development is expected to continue in the long-term. • The proposed development aligns with the land use designation established by the Clarendon Parish Development Order (CPDO). The lands proposed as the location for the sugar factory has been designed for heavy industrial use in The Lionel Town Local Planning Area Land Use Plan. All land areas identified for sugar cane cultivation by the project are land areas designated for agricultural use in the CPDO.
INFRASTRUCTURE AND SERVICES		
Access Road infrastructure	*Without* • No change to baseline conditions *With* None	• Construction: The project will result in the rehabilitation of access roads within the study area, which could support and improve the overall accessibility and safety of the road network for other users of the local roadways.
Water Supply	*Without* • No change to baseline conditions	• Construction and Operation: There will be no demand on existing potable water supplies provided to the communities by the National Water Commission to support the operation of the factory.

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
		Forty-three (43) wells and four (4) pumps licenced to the SCJH Limited/National Irrigation Commission, and previously used by the defunct Monymusk Sugar Factory, will be rehabilitated to meet the water needs of the project in the construction and operation phases (factory and field operations).
Waste Management	*Without* No change to baseline conditions. *With* • Construction: During the pre-construction and construction phases of the project, varied types, and fairly moderate volumes of solid waste are likely to be generated. Solid waste will be generated as a result of civil construction/works, earth works and domestic activities. Solid waste is likely to include: Construction debris: vegetation, soil, rocks and other excavated materials; construction materials and packaging; cardboard, plastics, paper, wood, Styrofoam, metals etc.; food waste; Organics (food), recyclables and food packaging. Poor containment and stockpiling of solid waste can result in the pollution of land and water resources, which is also likely contribute to a reduction in the visual aesthetics of the landscape.	• Operation: Several treatment plants will be constructed and operated onsite at the factory. This will include: ▪ an effluent treatment plant to treat wastewater generated from the industrial processes ▪ sewage treatment plant to treat domestic wastewater This is expected to reduce the volumes of hazardous pollutants and contaminants released into the environment.

<table>
<tr><th rowspan="2">VALUED SOCIAL AND ECONOMIC COMPONENT</th><th colspan="2">IMPACTS</th></tr>
<tr><th>Negative (Without & With)</th><th>Positive (With)</th></tr>
<tr><td></td><td>The operation of construction facilities for workers e.g., shower and bathroom facilities, if put in place, will lead to the generation of wastewater, including sewage. Additionally, activities involving the use of water for equipment and vehicle (fleet) maintenance and dust control will lead to wastewater generation. Measures and facilities must be put in place to ensure wastewater is not released in any surface water sources.
Rehabilitation of access roads will require the use of hazardous materials. Petroleum products and other chemicals are expected to be the most utilised hazardous materials. Hazardous materials can also be generated as a result of the use of chemicals, oils and equipment e.g., oily rags, chemical and fuel containers, scrap metals etc. Spills and/or leaks from hazardous materials have the potential to result in contamination of soil and the terrestrial and marine environments, resulting in pollution of water and resources, and possibly public health impacts for community members.</td><td></td></tr>
<tr><td>Renewable Energy (Irrigation and Water Supply System)</td><td>With and without
No change to baseline conditions</td><td><u>Operation</u>: TSCL will undertake the rehabilitation of the irrigation and water supply system used previously by Monymusk. As part of the rehabilitation, the proponents will install wind and solar powered pumps. The use of renewable energy to support agricultural production is in line with previous policy</td></tr>
</table>

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
		commitments by the Government of Jamaica.[36] The construction and operation of solar and wind farms are also being considered for future investments in the project area.
Housing and Resettlement	*Without* • No change to baseline conditions. Former worker housing and accommodations (sugar barracks) remain in a desolate state, and have been deemed unsuitable for human occupation. *With* • Construction: The proposed project is expected to lead to the resettlement of seventeen (17) families from the community of Lionel Town. The community of Springfield, Clarendon, has been identified as the resettlement site, a former resettlement under the Sugar Barracks Relocation Programme. Limited access to critical services- water, electricity, transportation and education- and lack of economic opportunities have been identified by community members as challenges faced by families resettled in the community under the previous relocation programme. Faced with these challenges, some families returned to areas where they originally resided, leaving behind vacant houses- some of which have been subjected to	• Construction: SCJH Limited will be undertaking a relocation programme that is expected to result in the relocation of seventeen (17) families currently informally occupying lands which have been designated as the proposed site for the sugar factory. Inventory assessments conducted by the SCJH have shown restoration of the former sugar barracks are not cost-effective, and the dilapidated state of the houses (sugar barracks) have made them unsuitable for human occupation. SCJH Limited is seeking to partner with Food for the Poor to provide housing assistance and/or support to the families. Although relocation plans and arrangements have not yet been finalised, the resettlement

[36] https://www.moa.gov.jm/node/1332

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	**Positive (With)**
	vandalism. To support the successful integration of families to be resettled, mechanisms must be put in place to address issues related to service accessibility, economic opportunities and housing security.	exercise is expected to improve housing standards for the impacted families. Access to other essential services will be needed to ensure successful integration of the families. Operation: If necessary, TSCL has indicated a small number of housing units will be constructed and provided for technical staff at the factory.
Agriculture Infrastructure	*Without:* No change to baseline conditions	• Construction: The proposed project will see US$40 million invested in the development of the factory. This investment will serve to enhance and modernize agricultural facilities and infrastructure, increase food processing capacity, promote and diversify agri-businesses, create jobs, and build capacity and competitiveness of local small farmers.
SECURITY AND VIOLENCE		
Crime (gang activity)	*Without* Gang activity and incidents of violence are issues in the community of Lionel Town. Incidents of gang violence and crimes have been occurring with greater frequency in the community in the past 5	• Operation: The project provides an opportunity for additional corporate governance support in the communities. The overall support can assist in (i)

VALUED SOCIAL AND ECONOMIC COMPONENT	IMPACTS	
	Negative (Without & With)	Positive (With)
	years. High prevalence of poverty and high levels of unemployment have been identified as two of the factors driving the surge in criminal and gang-related activities.	improving and enhancing community engagement, (ii) increasing support for local initiatives that can address community needs (iii) increasing support for education and social service interventions and (iv) promoting sustainable development practices to benefit the long-term well-being of the community and its members. It also presents various social and economic opportunities that could support youth engagement.

Presented in Table 69 and Table 70 is a classification of the impacts in the construction and operational phases of the project. The impact analysis examined the relative importance of the issues through the application of an impact matrix, and presents the significance rating for each impact identified from the reference scenario.

There are three (3) major/high social negative impacts associated with the construction phase of the project and one in the operational phase. There are two (2) major/high positive impacts identified in the construction phase and five (5) in the operational phase.

Table 69: Significance of Social Impact & Classification in the Construction Phase

SOCIAL-ECONOMIC COMPONENT	DIRECTION	MAGNITUDE	GEOGRAPHIC EXTENT	DURATION	FREQUENCY	REVERSIBILITY	SIGNIFICANCE/IMPACT RATING
POPULATION -PUBLIC HEALTH, SAFETY AND WELL-BEING							
Population dynamics-migration	Negative	Low	Local	Short-term	Infrequent	Yes	Minor
Noise Nuisances & Emission	Negative	Low	Local	Short-term	Continuous	Yes	Minor
Air Quality	Negative	Moderate	Local	Short-term	Continuous	Yes	Minor to Moderate
Road Access and Safety	Negative	Medium	Local	Short-term	Continuous	Yes	Moderate
Waste	Negative	Medium	Regional	Short-term	Continuous	Yes	Moderate
Occupational Health and Safety	Negative	High	Local	Long-term	Continuous	No	Major
Gender-Based Violence and Sexual Harassment	Negative	High	Regional	Long-term	Infrequent	Yes	Major
Population Health	Neutral	low	Local	Short-term	continuous	Yes	Minor
ECONOMIC							
Socio-economic Livelihood and Security	Positive	Moderate	Local	Short-term	Continuous	Yes	Moderate (locally)

SOCIAL-ECONOMIC COMPONENT	DIRECTION	MAGNITUDE	GEOGRAPHIC EXTENT	DURATION	FREQUENCY	REVERSIBILITY	SIGNIFICANCE/IMPACT RATING
Employment and Business Opportunities	Positive	Moderate	Regional	Short-term	Continuous	Yes	Major (locally)
Skills Development and Training	Positive	High	National	Long-term	Continuous	No	Major
LAND AND RESOURCE USE							
Use, Rights and Access	Neutral	Low	Local	Short-term	Infrequent	Yes	Negligible
INFRASTRUCTURE AND SERVICES							
Water supply	Neutral	Negligible	Local	Short-term	Continuous	Yes	Negligible
Waste	Negative	Moderate	Local	Short-term	Continuous	Yes	Major
Housing and Resettlement	Neutral/Negative	Low	Local	Short-term	Infrequent	No	Minor to Moderate
SECURITY AND VIOLENCE							
Crime	Negative	Low to medium	Local	Short-term	Infrequent	Yes	Minor-Moderate

Table 70: Significance of Social Impacts & Classification in the Operational Phase.

SOCIAL-ECONOMIC COMPONENT	DIRECTION	MAGNITUDE	GEOGRAPHIC EXTENT	DURATION	FREQUENCY	REVERSIBILITY	SIGNIFICANCE/ IMPACT RATING
POPULATION -PUBLIC HEALTH, SAFETY AND WELL-BEING							
Population dynamics-migration	Positive	Low to moderate	Local	Medium term	Continuous	Yes	Minor to moderate
Noise Nuisances & Emission	Neutral	Low	Local	Long-term	Continuous	Yes	Minor
Air Quality	Neutral	low	Local	Long-term	Continuous	Yes	Minor
Road Access and Safety	Positive	Low	Regional	Long-term	Continuous	Yes	Minor
Waste	Negative	low	Local	Long-term	Continuous	Yes	Minor to Moderate
Occupational Health and Safety	Negative	High	Local	Long-term	Continuous	No	Major
Population Health	Positive	High	Local	Long-term	Continuous	Yes	Major
ECONOMIC							
Socio-economic Livelihood and Security	Positive	High	National and Local	Short-term	Continuous	-	Negligible (nationally) Major (locally)
Employment and Business Opportunities	Positive	High	National and Local	Long-term	Continuous	-	Negligible (nationally) Major (locally)
Revenue and Tax	Positive	Low	National	Long-term	Continuous		Minor to Moderate
Skills Development and Training	Positive	High	National and Local	Long-term	Continuous	-	Negligible (nationally) Major (locally)
INFRASTRUCTURE AND SERVICES							
Water supply	Neutral	Negligible	Local	Long-term	Continuous	Yes	Negligible
Waste	Negative	Low	Local		Continuous	Yes	Minor
SECURITY AND VIOLENCE							
Crime	Positive	High	National	Long-term	Continuous	Yes	Major

10.7 MITIGATION AND MONITORING

10.7.1 STAKEHOLDER ENGAGEMENT

Communication and information sharing with stakeholders is an extremely critical component of the project. Information regarding the project should be clear, concise and easily accessible. The information shared should include at a minimum, project activities to be undertaken, the potential negative and positive impacts of the proposed project, and the available mitigation options to address adverse impacts. This communication process is important in keeping stakeholders, and community members engaged throughout the project development process. A stakeholder engagement plan should be prepared for the pre-construction, construction and operational phase of the project to facilitate ongoing dialogue between the developers, key stakeholders, community members and the general public on the benefits and challenges of the project. The plan, in addition to describing the types of engagement strategies to be employed, the resources and responsibilities required for implementation, should also outline a grievance mechanism that will be implemented to receive, record and address complaints which may arise during construction of the project, and if required, the operational/maintenance phase.

Prior to the start of construction, a construction schedule should be made available to the public.

10.7.2 AIR QUALITY

To offset and alleviate public health threats associated with reduced air quality, steps must be undertaken to manage the various types of air emissions. Proposed measures to protect community members and workers against adverse threats should include at a minimum.

- The provision of approved personal protective equipment for workers e.g., N95 masks
- The use of dust screens to section off work areas and the covering and periodic wetting of excavated areas soil, aggregates and other earth and construction materials on site
- The covering of vehicles transporting aggregates and other earth materials to prevent exposure along the network of access routes leading to the project areas. During dry periods, the wetting of access roads and disturbed areas is recommended to reduce dust generation.
- Inspection of project construction vehicles to ensure engines and exhaust systems are functioning and have been properly maintained. It is recommended that vehicles and equipment showing excessive emissions of exhaust gases do not operate until repairs are carried out.
- Timely disposal of waste
- Suspension of construction activities during periods of excessive winds, if dust suppression measures are inadequate
- During operation, trucks transporting ash from the factory should be properly covered to minimize the erosion of fugitive dust along transport routes.

10.7.3 NOISE

Construction noises are expected to exceed baseline conditions and it is therefore proposed that noise barriers and/or temporary sound walls be erected to reduce noise nuisance exposure, where necessary. The construction schedule should take into consideration traditional sleep hours and aim to carry out construction activities during reasonable hours. This can be determined following further consultation with locals and based on the requirements outlined in local laws.

To protect workers, all requisite personal protective equipment (PPE) e.g., noise cancelling earphones and/or ear plugs must be provided. The contractor in charge should also ensure all PPE are worn properly and at all times.

During operation, factory operations should implement OSHA's recommended permissible exposure limits for noise to minimize hearing losses.[37]

10.7.4 WASTE MANAGEMENT

It is expected that site preparation and other construction related activities can result in the pollution of the physical and biological environment and the surrounding land areas within close proximity to project site. Increased run-off also has the potential to increase the presence of polluting agents within these environments, posing a direct public health threat to residents who are users of these resources.

Proper waste management is therefore crucial for limiting land and water pollution at the project sites. It is therefore recommended that a Waste Management and Pollution Control Plan be prepared. The plan should outline the methods and procedures that will be employed to address the proper containment and safe disposal of polluting agents that will be generated as a result of construction. This includes land clearance residue (soil and vegetation), solid waste (construction materials, packaging materials, food items etc.), liquid waste (wastewater) and hazardous waste (fuels/oils, chemicals, flammable materials etc.). Specific mitigation measures to be considered in protecting human health include:

- The separation of solid waste materials into organics, recyclables and garbage on site, prior to disposal. Recyclables can be disposed of at approved recycling centres, if available.
- Containment of garbage and construction debris onsite until disposal at an approved local disposal site using receptacles/bins with lids that can be secured to prevent unwanted intrusion by feral animals

[37] **OSHA PEL:** OSHA's permissible exposure limit for noise is 90 dBA averaged over an 8-hour workday. **NIOSH REL:** NIOSH recommends limiting noise exposure to 85 dBA over an 8-hour workday

- Periodic emptying of waste bins/receptacles to prevent the overflow of solid waste
- Prohibiting burning of solid waste on project site.
- Providing portable sanitary conveniences and showers onsite for workers. Portable toilets and showers should be connected to an onsite drainage system attached to temporary wastewater storage tanks or utilise the services of a reputable company that should only dispose of sewage at an approved municipal treatment plant. In the absence of approved treatment systems, alternative arrangements should be made with the local authorities for the safe disposal of effluent/liquid waste
- Clear labelling of all facilities designated for the storage of hazardous waste and separation and storage of hazardous according to manufacturing requirements.
- Training of all workers in the handling, use, care, storage and disposal of hazardous materials
- Hazardous materials must be separated and stored according to manufacturers' requirements
- Prior to construction and in consultation with residents and key government stakeholders, develop an Emergency Preparedness and Response Plan and training plan for all emergencies, including responding to spills

10.7.5 ROAD ACCESS AND SAFETY

Construction vehicles and equipment should aim to limit the use of the local roadway during peak periods when pedestrians are frequenting the roadways to ensure minimal disruption to community members. This includes early morning between 7:30-8:00am when children are walking to school and afternoons, between 3:00-4:00p.m. when children are leaving school. Persons who will be tasked with operating construction vehicles and equipment should be properly trained, with designated drivers and operators mandated to provide official proof of their qualifications to operate construction related vehicles and equipment before being hired. Speed limits of no more than 30 kilometres per hour should be implemented on controlled roads for construction to limit noise, fugitive dust, and reduce risks of accident. It is also recommended that safety and traffic signage be erected along access routes leading to the construction sites, alerting both locals and visitors of ongoing roadway use. Flag persons should also be designated to assist with coordinating vehicular and pedestrian movements. It is also recommended that safety and traffic signage be erected along the single access route leading to the construction site, alerting both locals and visitors of ongoing roadway use.

Finally, it is recommended that a road usage and safety plan be developed by the contractor and reviewed by the relevant authorities to support the project. The plan should outline safety measures and the type of alternative access routes which will be put in place to ensure there are access restrictions for current users and no threats to the overall safety of residents. The timing of construction activities and the utilisation of the roadways for the movement of materials and equipment should also be included.

10.7.6 EMPLOYMENT OPPORTUNITIES

A job recruitment programme should be developed for the project to identify locals who may possess the requisite skill sets required by the project. Though all qualified candidates should be considered under the programme, preference should first be given to qualified candidates who are residents within the study area. As part of a broader social responsibility platform, training and skills development opportunities being offered as part of the project, should also give first priority to residents in the study area. These requirements should be included in any agreement made between the agency with responsibility for project implementation and the selected contractor.

The programme should also prioritise diversity and inclusivity to reach a broader pool of candidates. Gendered descriptions which have traditionally been used within the construction industry should be eliminated. This will help to ensure locals and members of both sexes, including persons with disabilities are given priority consideration for job opportunities. It is proposed that locals, both men and women, with the requisite skill sets be offered, where possible, specialised training prior to the start of the project that can help them to secure employment in the construction phase of the project, and if required, for the monitoring and management phase of the coastal infrastructure.

10.7.7 TRAINING AND CAPACITY BUILDING

It is important that local skilled and unskilled labourers are actively recruited and engaged in capacity building exercises, which will provide them with an opportunity to benefit both directly, and indirectly from the proposed project.

10.7.8 SAFETY AND SECURITY

Security measures, procedures and protocols should be established to help safeguard field and factory operations, protect against threats and ensure the protection and safety of workers. Consideration should be given to the following security features:

- Surveillance systems for monitoring, including motion detectors, cameras
- Security fencing: gates and barriers
- Access control systems to control entry and exits
- Anti-climb devices, such as spikes and thorny bushes/shrubs
- Security guards

10.7.9 MONITORING PROGRAMME

It is the responsibility of the project manager and contractor to ensure all mitigation measures recommended during the pre-construction and construction phase are implemented and monitored to ensure compliance and reduction in the potential severity of negative impacts on social receptors, particularly vulnerable groups. Periodic audits of construction activities are to be undertaken, and identified issues resolved in a timely manner. During the operational phase of the project, Tropical

Sugar Company Limited, through its designated representative(s), has responsibility for the monitoring and management of factory and field operations to ensure continued functionality and safety for workers and community members. The representative(s) should develop a monitoring (follow up) Plan to monitor the effects of the project on the socio-economic conditions of residents in the study area as a result of field and factory operations, and where required, develop measures if any adverse effects of the project are noted. The results of all monitoring exercises should be communicated according to reporting procedures outlined in the communication plan established for project monitoring.

10.7.10 RESETTLEMENT

A resettlement plan and community engagement programme should be prepared, outlining the approach to managing the relocation of families in Lionel Town. The plan should include but not limited to: overview of persons to be impacted by relocation, compensation and rehabilitation measures, resettlement schedule, grievance mechanism and community engagement strategy. The plan should also be developed with a human rights and gender-sensitive approach to ensure the equitable treatment of marginalized and vulnerable groups.

The SCJH and TSCL should conduct post-relocation monitoring where the livelihood and household satisfaction of the resettled households are assessed periodically; initially after a few months and then a year and more. The relocation could be audited by a 3rd party for fairness and adherence to commitments to reduce risk of long-term grievances or person potentially returning to the site.

10.8 RECOMMENDATIONS

- Conduct community walk-throughs/walk abouts and engage residents in dialogue regarding the proposed project. This is important to get buy in and local support, and to gain a more in-depth understanding of community structures, priorities and areas for further development. It is also recommended that dialogue and consultations be held with other business operators in the area to garner additional insight on community structures, dynamics, decision-making processes, and development initiatives, interventions and challenges.

- Develop a corporate social responsibility framework and policy to guide operations and establish a committee to manage and oversee social risks and opportunities

- Appoint a designated community engagement/liaison officer to help drive CSR efforts in surrounding communities.

- Develop a Security Management Plan

11 MITIGATION ACTIONS TO REDUCE ADVERSE ENVIRONMENTAL & SOCIAL IMPACTS

Negative environmental impacts can be mitigated by implementing measures during the construction, operating, maintenance and decommissioning phases to eliminate or significantly reduce them. Mitigation measures to address the potential negative impacts, significant or not, associated with this project are presented in Table 71.

Table 71: Mitigation Measures

	Impacts	Mitigation Measures
Construction Phase		
1.	Noise Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)	• Provide workers with the necessary Personal Protective Equipment (PPE) e.g. hearing protection and ensure that they are worn • Sensitise residents in the area to the types of activities that will take place ahead of the works and assign a liaison person with whom the residents can relate • Ensure project activities are scheduled during working hours of 7:00 a.m. to 7:00 p.m. • Operate well maintained vehicles and equipment
2.	Emissions and Fugitive Dust • Health impacts e.g. respiratory problems • Air pollution	• Cover haulage vehicles transporting aggregate, soil and cement • Cover and/or wet onsite stockpiles of aggregate, soil etc. • Ensure proper stock piling/storage and disposal of solid waste • Wet cleared land areas regularly • Use water sprays to minimise dust • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. dust masks and ensure that they are worn • Operate well maintained vehicles and equipment
3.	Vegetation Loss / Disturbance of Biological Communities • Air Pollution • Habitat destruction • Disruption of ecosystems	• Only areas that are absolutely necessary for clearance should be cleared • In areas where vegetation has been removed and the lands have not been converted to permanent land uses (construction of infrastructure), re-vegetation exercises should be undertaken. • Replant trees in the same area of the project site or other areas • Bring to the attention of the Jamaica National Heritage Trust and the NEPA immediately if any artefacts are found and safeguard same
4.	Soil erosion and sedimentation due to land clearing and slope modification • Disruption of ecosystems • Land slippages • Blocked drainage channels • Loss of soil • Water pollution	• Identify and avoid areas with very steep and unstable slopes and near to sinkholes • Minimise, where possible the clearance of vegetation and removal of top soil • Place or design access roads to follow natural topography and minimize hill side cuts. • Design runoff control features to minimise soil erosion • Re-vegetate areas that will not be used for the placement of permanent features • Place berms around stockpiles of top soil and aggregate (sand, gravel, marl) • Avoid steep cuts and where there are steep cuts they must be shored up • Utilise sediment traps to minimise sediment runoff

	Impacts	Mitigation Measures
5.	Land pollution and displeasing aesthetics due to solid waste	• Contain garbage and construction debris onsite until disposal at the approved municipal disposal site • Prohibit burning of solid waste on project sites
6.	Traffic Congestion • Immobility Vehicle-vehicle conflicts • Vehicle-pedestrian conflicts • Delayed traffic movements • Damage to road infrastructure • Alteration of private property	• Erect traffic signs along main transportation route and in sensitive areas such as schools for haulage of construction material and large equipment • Erect traffic assisting devices at the entrance/exit of construction sites and corners e.g. mirrors, flagmen, etc. • Transport heavy equipment during off-peak traffic hours (between (10:00p.m. to 4:00 a.m.) with police outriders and JPS to raise electrical wires, if required • Trucks transporting construction material should be advised to comply with the speed limits • Advise schools and residents of the proposed project construction schedule and seek their buy-in and support
7.	Land and water pollution • Human Waste • Fuel and Chemical Spills	• Use a reputable company to provide portable toilets for workers on site • The company should only dispose of sewage at an approved municipal treatment plant • Store fuel and chemicals with secondary (spill) containment infrastructure • Utilise proper dispensing equipment • Have spill containment and cleanup equipment on site and dispose of waste in accordance with best practices • Develop an Emergency Preparedness and Response Plan and train workers accordingly
8.	Depletion of water resources	• Utilise low water consumption equipment • Practice onsite water reuse and recycling where possible and practical
9.	Injury and/or death due to accidents during construction work	• Erect signs during construction activities • Provide workers with the necessary Personal Protective Equipment (PPE) • Train construction personnel in good safety practices and emergency preparedness and response measures
Operational Phase		
1.	Noise • Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)	• Noise limits should be set relative to existing background noise levels and should not exceed 75 dB at the fence line. • Monitor sound levels to ensure that they are within acceptable limits

	Impacts	Mitigation Measures
2.	Land and water pollution • Oil Spills/leaks • Solid Waste • Wastewater/ Effluent Discharge • Sewage Management	• Ensure that spill and oil cleaning kits and equipment are onsite • Ensure that workers are trained in spill management • Properly contain garbage and construction debris for disposal at the approved dumpsite at Martins Hill • Utilize the project's Wastewater Treatment Plant (WWTP) to manage industrial effluent discharges. • Utilize the project's Sewage Treatment Plant (STP) to manage domestic sewage discharges.
3.	Air Pollution, • Stack Emissions	• Utilize an Electrostatic Precipitator (ESP) for stack emissions
Maintenance Phase		
1.	Land and water pollution • Solid waste • Oil spills/Leaks	• Properly contain garbage and construction debris for disposal at an approved municipal disposal site • Have spill containment and clean up equipment on site and dispose of waste in accordance with best practices
2.	Accidents due to maintenance work	• Erect signs during maintenance activities • Provide workers with the necessary Personal Protective Equipment (PPE) • Train construction personnel in good safety practices and emergency preparedness and response measures
Decommissioning Phase		
1.	Land and water pollution • Solid waste	• Properly contain garbage and construction debris for disposal at an approved municipal disposal site • The disposal of large parts will need to be done with the approval of the National Solid Waste Management Authority (NSWMA)
2.	Noise • Nuisance to persons • Habitat disturbance • Hearing impairment (temporary, permanent)	• Advise community members of the times that decommissioning activities will take place • Ensure that decommissioning activities are undertaken within the stipulated times • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. hearing protection and ensure that they are worn
3.	Land and water pollution • Human Waste • Fuel and Chemical Spills	• Use a reputable company to provide portable toilets for workers • The company should only dispose of sewage at an approved municipal treatment plant • Store fuel with secondary spill containment infrastructure • Utilise proper dispensing equipment

	Impacts	Mitigation Measures
		• Have spill containment and cleanup equipment on site and dispose of waste in accordance with best practices • Develop an Emergency Preparedness and Response Plan and train workers accordingly
4.	**Accidents/Injury due to Decommissioning work**	• **Erect signs during decommissioning activities** • **Provide workers with the necessary Personal Protective Equipment (PPE)** • **Train construction personnel in good safety practices and emergency preparedness and response measures**

12 ENVIRONMENTAL MANAGEMENT PLAN AND MONITORING PROGRAMME

This Environmental Management Plan (EMP) has been prepared to ensure that all activities undertaken during the construction and operations of the proposed development are done in a manner that will reduce and/or eliminate the identified adverse impacts associated with the proposed project. The EMP serves to outline the prevention methods and procedures that should be adopted by the developers and operators of this development to ensure that the physical, biological and social environments are protected. This plan will therefore cover the following:

i. Management Objectives during Construction and Operational Phases
ii. Management and Monitoring Actions to be implemented
iii. Persons responsible for the implementation and management of monitoring actions
iv. Performance targets and specifications
v. Implementation Schedule

12.1 ENVIRONMENTAL MANAGEMENT OBJECTIVES

1. Construction Phase

a. Establish controls for contractors to ensure that the proposed mitigation measures are implemented in a timely and effective manner. This includes provisions for worker safety, road safety, waste and materials management.
b. Effectively minimise risks and negative environmental effects of natural disasters and hazards (hurricanes, fires, earthquakes, oil spills and accidental leaks).
c. Reduce and manage predicted waste-streams.
d. Minimise construction nuisances to other land users, including adjoining land users throughout the development phase of the project.

2. Operational Phase

a. Develop and implement comprehensive environmental management plans, which clearly identify targets for environmental performance.
b. Develop and implement safety procedures and operation and maintenance training that must be undertaken by all staff members and visitors to the site.
c. Ensure that staff is trained in environmental management and monitoring procedures.
d. Conduct maintenance operations in a way that is compliant with environmental and equipment manufacturer requirements.
e. Properly maintain the project area to ensure that the adjacent ecosystems and their aesthetic appearance are not negatively impacted.

12.2 HEALTH AND SAFETY IMPACTS AND MITIGATION MEASURES

12.2.1 *CONSTRUCTION & DECOMMISSIONING PHASES*

The contractor shall comply with safety rules and regulations that are enforced at the site in accordance with local and international safety standards such as Occupational Health and Safety Administration (OHSA) and the provisions of the draft Jamaica Occupational Safety and Health Act (JOSHA).

a. The contractor shall be solely responsible for the safety of his subcontractor's employees. It is mandatory that all personnel required to perform work at the site be fitted with approved PPE such as safety helmet, glasses and boots at minimum while on site. Additional PPE must be worn based on the hazards identified. Failure to comply with these requirements will result in the expulsion of the offending individual(s) from the site. A pre-start site conference meeting on safety will be held by the Project Manager to advise the contractor of the safety standards and requirements expected.
b. The contractor shall promptly correct any unsafe conditions brought to his attention.
c. In the event of an accident, the contractor shall provide the Project Manager with a written report of all pertinent details of the accident within twenty-four (24) hours of its occurrence. This report shall include recommended actions to prevent future occurrence.
d. The contractor shall provide protection and storage for his equipment, general property, vehicles and personnel during all phases of the work.
e. The contractor shall be responsible for his sub-contractors' compliance with safety regulations.
f. The contractor shall provide a first-aid station and people who can administer first aid on site.
g. The contractor shall ensure that his on-site work force is fully equipped with the required safety gears, e.g. hats, boots, gloves, overalls, goggles, equipment for working at high elevations etc.

12.2.2 OPERATIONS

Industrial facilities which utilise machinery, equipment and hazardous substances may pose safety risks to personnel working and visiting the facility.

Health and safety are important to safeguard the most valuable asset which are the employees and contractors. All Contractors/Visitors/staff must attend Environment, Health and Safety (EHS) orientation. At these orientation sessions, the applicable personal protective equipment (PPE) and safety procedures that apply to the facility and specific jobs will be presented.

New Contractors will be oriented prior conducting their business at the facility. Thereafter they will be oriented annually. Permits will be required for high-risk jobs and must be signed off by a company representative. These include activities such as working at heights, working in a confined space and hot work (welding). Safety signage, directions and warnings including PPE guidelines will also be erected in clear view of all onsite personnel.

Fire extinguishers, fire alarms, smoke detectors and other safety equipment will be placed in strategic locations across the property. Operation and Maintenance Staff will be trained in the use of all safety equipment. Emergency assembly sites will be clearly labelled and communicated to visitors to the TSCL sugar factory.

Table 72 presents some of the key health and safety impacts associated with the operations at the factory.

Table 72: Key Health and Safety Impacts and Mitigation Measures (Operations)

	Aspect	Impacts	Mitigation
1.	Accidents: Working at heights; working in confined spaces; handling specialized equipment	Injury or death	Follow established procedures; attend EHS orientation, obtain requisite permits for specialised jobs
2.	Loud noises	Temporary or permanent hearing loss	Assess decibel level and duration of exposure and wear ear plugs or earmuffs as appropriate
3.	Working with chemicals and hazardous substances	Burns, asphyxiation, death (short term) Long term illnesses (cancer)	Identify the most effective chemicals with the lowest health and environmental impacts; become familiar with the safety data sheet (SDS) and utilize the recommended PPE and observe stipulated exposure limits.
4.	Lifting heavy objects	Short term or long-term injury	Utilise the appropriate equipment for lifting; utilize back braces
5.	Exposure to excessive heat/fire	Injury, burns, death	Observe the "No Smoking" and "No Naked light" signs

12.2.3 OCCUPATIONAL HEALTH & SAFETY PLAN

An Occupational Health and Safety Plan for the construction, operation, maintenance and decommissioning phases will be developed covering the key areas listed below:

- Safety policy statement
- List of responsible personnel
- Safety and emergency contact information
- Details regarding the job site's location and condition
- Description of the project scope from a safety perspective
- List of identified hazards
- Hazard control policies

Other information to be included in the plan are as follows:

1. Personal protective equipment

Personal protective equipment (PPE) that workers should use while on the job site will be listed and will include but not be limited to hard hats, protective eyewear, facemasks, earplugs, gloves, and steel toe boots.

2. Construction site/Factory rules and regulations

The objective will be to have a hazard-free workplace by including a list of rules to address safety issues. For example, no smoking in designated with high risk of fires.

3. List employee roles and expectations

Maintaining a list of on-site personnel and ensuring that workers have a clear understanding of their role in the project and how to be effective without compromising the safety of themselves and others. This is particularly beneficial in emergency situations.

4. Operating procedures and safety precautions

Establishing documented standard operating procedures (SOPs) and training workers in these SOPs as an effective way to manage risk on construction sites as well as for factory and maintenance operations. Also posting safety precautions and warning signage in areas with hazardous materials or where accidents could occur.

5. Extreme weather conditions

The safety manual will note whether or not workers can safely operate specific equipment during different weather conditions such as high winds or a rainstorm. Considerations for extreme weather emergencies such as hurricanes, earthquakes, or flooding will be included.

6. Emergency contact information

Maintaining an emergency contact list in more than one location and making sure it is accessible to all workers, contractors, and other construction personnel.

7. Reporting instructions and procedures

Establishing a reporting procedure for accidents and steps to take in the event of a safety incident. The Ministry of Labour and Social Security (MLSS), Occupational Health and Safety Department has strict requirements for documenting accidents and injuries, including detailed instructions for managers and employees to follow.

12.3 POST PERMIT DOCUMENTATION REQUIREMENTS

12.3.1 *EMERGENCY PREPAREDNESS RESPONSE PLAN*

An Emergency Preparedness and Response Plan (EPRP) will be prepared under separate cover.

The goal of this plan is to prevent where possible and minimise the effects of emergencies, disasters and accidents on the operations of the facility. Emergency preparedness will help to reduce human suffering and economic losses that could arise. The specific objectives of the plan are to:

a. Identify risks
b. Implement measures to minimise the likelihood of emergencies that can adversely impact humans and the environment.
c. Provide an immediate and effective response to incidents that represent a risk to human safety, public health and the environment.
d. Ensure that the sugar factory can be operational as quickly as possible after the occurrence of an emergency and/or disaster situation.

The approach taken to emergency response planning is four-fold:

a. Prevention: actions to reduce exposure to or eliminate the hazard. Reducing the degree, extent and magnitude of hazards can be achieved through the proper scaling, designing and redesigning of elements of the project.
b. Preparedness: actions to plan, equip and train for the event, which includes the education of both visitors and staff utilising the premises through drill and other information dissemination methods.
c. Response: action to save lives and property during the event. This includes safety procedures, methods and equipment required.
d. Recovery: actions taken to resume pre-event conditions.

The EPRP will be prepared to cover the construction and operation of the agro processing facility, in accordance with the requirements of the NEPA and the Office of Disaster Preparedness and Emergency Management (ODPEM) as per each Agency's Guidance document.

12.3.2 *CLOSURE PLAN*

This project is expected to have a life of 50 years. As such a Closure Plan will be developed under separate cover to govern the decommissioning activities with the objective of minimising adverse environmental impacts. The Plan will be prepared in accordance with the NRCA Guidelines for Closure Plans for Industrial Projects.

12.4 MITIGATION AND MONITORING PROGRAMME

Table 73 presents the Environmental Management and Monitoring Plan for the construction and operation of the sugar factory to be developed and operated by TSCL.

Table 73: Management and Monitoring Plan

	Management Plan	Monitoring Programme
Construction phase		
1.	Fugitive dust emissions & vehicular emissions • Cover haulage vehicles transporting aggregate, soil and cement • Cover and/or wet onsite stockpiles of aggregate, soil etc. • Ensure proper stock piling/storage and disposal of solid waste • Wet cleared land areas regularly • Use water sprays to minimise dust • Blasting should be done in accordance with the requirements of Mines and Geology Department • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. dust masks and ensure that they are worn • Operate well maintained vehicles and equipment	• TSCL is to ensure that the contractor implements the required mitigation measures by conducting periodic audits • The Contractor's monthly report to provide details of the mitigation measures implemented
2.	Noise • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. hearing protection and ensure that they are worn • Sensitise residents in the area to the types of activities that will take place ahead of the works and assign a liaison person with whom the residents can relate • Ensure project activities are scheduled during working hours of 7:00 a.m. to 7:00 p.m • Operate well maintained vehicles and equipment	• TSCL is to check periodically with the schools and residents to find out if they have any complaints • TSCL is to respond promptly to correct confirmed complaints related to the project • The Contractor's monthly report to provide details of the mitigation measures implemented
3.	Loss of Vegetation and Disturbance of Biological Communities • Only areas that are absolutely necessary for clearance should be cleared • In areas where vegetation has been removed and the lands have not been converted to permanent land uses (roadways and siting of infrastructure), re-vegetation exercises should be undertaken. • Replant trees in the same area of the project site or other areas	• TSCL is to ensure that contractors only clear vegetation that has been identified for removal during the construction phase of the project • TSCL is to ensure that replanting exercises are undertaken following the completion of road works

	Management Plan	Monitoring Programme
	• Bring to the attention of the Jamaica National Heritage Trust and the NEPA immediately if any artefacts are found and safeguard same	
4.	Land pollution due to solid waste (top soil, vegetation, construction debris, garbage) • Contain garbage and construction debris and dispose of at the approved municipal disposal site • Landscape project sites with top soil excavated	• TSCL is to obtain verification that the contractor has disposed of solid waste at an approved municipal disposal site • The Contractor's monthly report to provide details of the mitigation measures implemented
5.	Land and water pollution due to human waste • Contract a reputable company to provide portable toilets for workers	• TSCL is to verify that waste is being taken to an approved wastewater treatment facility
6.	Soil erosion and sedimentation • Only clear top soil from areas to be used • Place berms around stockpiles of top soil and aggregate • Shore up unstable soils	• TSCL is to conduct periodic audits of contractor operations • The Contractor's monthly report to provide details of the mitigation measures implemented
7.	Increased traffic movement • Erect signs along main transportation route and in sensitive areas such as schools • Advise contractor of the need for their drivers to obey speed limits • Transport heavy equipment and during off-peak traffic hours (between 10:00 p.m. to 4:00 a.m.) with police outriders • Notify relevant communities of the transportation of heavy equipment through their communities • Use traffic signals or flagmen to manage traffic flows where road improvement works are being undertaken	• The Contractor's monthly report to provide details of the mitigation measures implemented
8.	Construction work • Erect signs during construction activities • Provide workers with the necessary Personal Protective Equipment (PPE) • Train construction personnel in good safety practices and emergency preparedness and response measures	• Conduct periodic audits of contractor operations • The Contractor's monthly report to provide details of the mitigation measures implemented
9.	Fuel and oil spills • Store fuel with secondary spill containment infrastructure • Utilise proper dispensing equipment • Have spill containment and clean up equipment on site	• TSCL is to conduct periodic audits of contractor operations • The Contractor/TSCL is to respond and clean up spills in accordance with emergency preparedness and response plans

	Management Plan	Monitoring Programme
	• Train personnel in spill management procedures	• The Contractor is to report to TSCL on emergencies • TSCL is to report to NEPA in accordance with permit requirements • The Contractor's monthly report to provide details of the mitigation measures implemented
Operation Phase		
1.	Noise	• TSCL is to maintain equipment in accordance with manufacturer's requirements • After commissioning of the sugar factory and power plant, TSCL is to assess noise levels at its fence line to have a record of noise levels during operations • All workers must be attired in the appropriate PPE based on the expected level of exposure to noise • TSCL is to develop an operations, maintenance and contingency plan
Maintenance Phase		
1.	Solid waste • Contain garbage and construction debris and dispose of at the approved municipal disposal site at Myersville	• TSCL is to obtain verification that solid waste is disposed of at an approved municipal disposal site
2.	Maintenance work • Erect signs during construction activities • Provide workers with the necessary Personal Protective Equipment (PPE) • Train construction personnel in good safety practices and emergency preparedness and response measures	• TSCL is to develop an operations, maintenance and contingency plan • TSCL is to maintain preventive and unscheduled/emergency maintenance records • TSCL is to maintain records of near misses and accidents
Decommissioning phase		
1.	Land pollution from solid waste • Contain garbage and construction debris and dispose of at the approved municipal disposal site	• TSCL is to obtain verification that contractor has disposed of solid waste at an approved municipal disposal site
2.	Noise from equipment • Advise schools and residents in the surrounding communities of decommissioning dates and times • Ensure that decommissioning activities are undertaken within the stipulated times • Provide workers with the necessary Personal Protective Equipment (PPE) e.g. hearing protection and ensure that they are worn	• All workers must be attired in the appropriate PPE

	Management Plan	Monitoring Programme
3.	Land and water pollution from human waste and oil spills/leaks • Contract a reputable company to provide portable toilets for workers • Store fuel with secondary spill containment infrastructure • Utilise proper dispensing equipment • Have spill containment and cleanup equipment on site	• TSCL is to obtain verification that waste is being taken to an approved wastewater treatment facility • TSCL is to conduct periodic audits of contractor operations • The Contractor/TSCL is to respond and clean up in accordance with emergency preparedness and response plans • The Contractor is to report to TSCL on emergencies • TSCL is to report to NEPA in accordance with permit requirements

12.5 REPORTING

During the construction phase:

1. The contractor will submit monthly reports to TSCL outlining work progress including environmental mitigation measures that are implemented, accidents, incidents requiring activation of the emergency response plans and breaches in environmental requirements, if any.
2. TSCL will submit monthly reports to NEPA outlining work progress including environmental mitigation measures that must be implemented, accidents, incidents requiring activation of the emergency response plans and breaches in environmental requirements.

During the operating and maintenance phases TSCL will submit the following reports to NEPA

1. Annual report outlining general operations and status of compliance with permit conditions
2. Reports on accidents and incidents requiring activation of emergency response plans within 48 hours of occurrence.
3. Emergency preparedness and Response Measures
4. Environmental Incidents
5. Maintenance activities, in particular those associated with mitigation measures to prevent environmental incidents e.g. non-destructive integrity tests on fuel and hazardous material tanks

13 WASTEWATER AND SEWAGE EFFLUENT TREATMENT PLANT MAINTENANCE & OPERATIONAL PLAN/MANUAL

13.1 SEWAGE TREATMENT PLANT

This Operation and Maintenance (O&M) Plan outlines the procedures and guidelines from the routine operation, monitoring, and maintenance of the sewage treatment plant (STP). The STP includes the following components.

- Bar Screen Chamber
- Oil and Grease Chamber
- Equalization Tank
- Moving Bed Biofilm Reactor (MBBR) / Aeration Tank
- Tube Settler
- Pressure Sand Filter
- Activated Carbon Filter
- Treated Water Storage Tank
- Sludge Drying Beds

This plan aims to ensure that the STP operates efficiently and in compliance with environmental regulations, minimizing the environmental impact of the sugar factory's wastewater treatment.

Operational & Maintenance Tasks

The STP will operate 24 hours a day and serve approximately 200 persons (inclusive of visitors). Different components of the plant will have different operational and maintenance requirements, which are listed below in Table 74.

Table 74: STP Operational & Maintenance Tasks

Component	Operational Tasks	Frequency	Maintenance Tasks	Frequency
Bar Screen Chamber	Trap or removing the floating particles from sewage	Daily	Cleaning of the screen	Daily
Oil and Grease Chamber	Remove the floating oil	Daily	Observation of oil for removal	Daily
Equalization Tank	Collection of incoming sewage	Daily	Observation	Daily

Component	Operational Tasks	Frequency	Maintenance Tasks	Frequency
Moving Bed Biofilm Reactor (MBBR) / Aeration Tank	Purpose of develop healthy Culture	Daily	Observation	Daily
Tube Settler	Settling of sewage	Daily	Observation	Daily
Pressure Sand Filter	Removal of suspended particles	Daily	Replacement of sand media	Yearly
Activated Carbon Filter	Removal of smell and colour	Daily	Replacement of Carbon Media	Yearly
Treated Water Storage Tank	Storage of treated water		Periodical cleaning	Every three months
Sludge Drying Beds / holding tank	Collection & Dring of settled sludge	Weekly	Cleaning	Every three months

Record Keeping and Documentation

Operators of the STP should maintain the following records:

- Daily log sheets documenting the operational activities and incidents.
- Maintenance log sheets documenting scheduled and unscheduled maintenance, repairs and replacements.
- Calibration records for monitoring instruments, gauges and other equipment.
- Sludge handling and disposal records.
- Spare parts inventory.

13.2 EFFLUENT TREATMENT PLANT

This Operation and Maintenance (O&M) Plan outlines the procedures and guidelines from the routine operation, monitoring, and maintenance of the effluent treatment plant (ETP). The ETP includes the following components.

- V Notch Chamber
- Bar Screen Chamber

- Oil and Grease Chamber
- Equalization Tank
- Neutralization Tank
- Up-Flow Anaerobic Sludge Blanket Reactor (UASBR)
- Aeration Tank
- Secondary Clarifier
- Pressure Sand Filter
- Activated Carbon Filter
- Treated Water Storage Tank
- Sludge Drying Beds

This plan aims to ensure that the ETP operates efficiently and in compliance with environmental regulations, minimizing the environmental impact of the sugar factory's wastewater treatment.

Operational & Maintenance Tasks

The ETP will operate 24 hours a day and serve approximately 200 persons (inclusive of visitors). Different components of the plant will have different operational and maintenance requirements, which are listed below in Table 75.

Table 75: ETP Operational & Maintenance Tasks

Component	Operational Tasks	Frequency	Maintenance Tasks	Frequency
V Notch Chamber	Trap or removing the floating particles from incoming effluent	Daily	Cleaning of the chamber	Daily
Bar Screen Chamber	Trap or removing the floating particles coming out from V notch chamber	Daily	Cleaning of the screen	Daily
Oil and Grease Chamber	Remove the floating oil & grease	Daily	Observation of oil removal	Daily
Equalization Tank	Collection of effluent	Daily	Observation	Daily

Component	Operational Tasks	Frequency	Maintenance Tasks	Frequency
Neutralization Tank	Correction of effluent PH to the neutral	Daily	Dosing pump maintenance	Every three months
Up-Flow Anaerobic Sludge Blanket Reactor (UASBR)	Sludge digestion	Daily	Replacement of media	To be checked Yearly, replacement frequency is every three years
Secondary Clarifier	Clarification of effluent & settling of sludge	Daily	Stirrer mechanism maintenance	Every 6 months
Pressure Sand Filter	Removal of suspended particles	Daily	Replacement of sand media	Yearly
Activated Carbon Filter	Removal of smell and colour	Daily	Replacement of Carbon Media	Yearly
Treated Water Storage Tank	Storage of treated water		Periodical cleaning	Every three months
Sludge Drying Beds	Collection & Dring of settled sludge	Weekly	Cleaning	Every three months

Record Keeping and Documentation

Operators of the ETP should maintain the following records:

- Daily log sheets documenting the operational activities and incidents.
- Maintenance log sheets documenting scheduled and unscheduled maintenance, repairs and replacements.
- Calibration records for monitoring instruments, gauges and other equipment.
- Sludge handling and disposal records.
- Spare parts inventory.

14 SEPTAGE & SLUDGE MANAGEMENT PLAN

The Septage and Sludge Management Plan outlines the procedures for the handling, treatment and disposal of septage and sludge generated by the STP and ETP to be operated by TSCL. The proper management of septage and sludge is required to prevent environmental impacts, while ensuring regulatory compliance with the NRCA (Wastewater and Sludge) Regulations as well as optimizing efficiency of the plant.

Management of Sludge

A key part of sludge treatment is the reduction of its volume by reducing the water content. This will be achieved through the use of sludge drying beds. Sludge drying beds operate on a relatively simple principle, which involves the separation of solids from the liquid contained in the sludge, by percolation through different filter media and then allowing the water content to evaporate, to leave behind dried solids that can be disposed or repurposed.

Since the quantity of sludge to be generated by the STP is small, it will be mixed with the sludge generated from the ETP. The stabilised and dried sludge removed from the sludge drying beds will be re-used for application to sugarcane fields. The sludge will be tested against the pollutants listed in Table 76. In accordance with Part III of the Fifth Schedule of the NRCA (Wastewater and Sludge) Regulations, the sludge to be applied to cane fields will be tested not less than every six months; or whenever any change in the characteristics of the treated sludge occur as a result of changes in the treatment process; or the wastewater being tested.

Table 76: National Treated Sewage Sludge Standards for Fully Treated Sewage Sludge that can be Applied to Agricultural Land

Pollutant	Maximum Concentration mg/kg (dry weight basis)
Arsenic	65
Cadmium	75
Copper	230
Lead	90
Mercury	0.045
Molybdenum	9
Nickel	180
Selenium	14
Zinc	400

Pollutant	Maximum Concentration mg/kg (dry weight basis)
Chromium	830
Pathogens	<1000 MPN/g of total solids (oven dried mass) where Viable Helminth Ova <1 per 4g of Total Solids (Dry Weight); Salmonella <3 MPN/4g; Faecal Coliform <1000 MPN/g

<u>Transportation of Sludge to Sugarcane Fields</u>

The transportation of sludge to sugarcane fields will not result in the spillage, odours or contamination of the sludge being transported. Loads will be covered and dust control procedures implemented to prevent the loss of fine material. Vehicles used will not allow for any drainage to occur (if sludge is not dry). If cleaning of vehicles becomes necessary, careful consideration will be put into the location where the vehicle is cleaned to prevent wash down water from entering any storm water system or surface water sources.

The operator of the vehicle transporting the sludge to the sugarcane fields will carry a manifest which will state the vehicle registration number, time, date and location where the sludge was collected and the amount loaded, as well as the time, date and location where the sludge is offloaded and the amount offloaded. For proper document control, the signatures of the operator of the facility from where the sludge is collected, the driver and the relevant personnel form the recipient location will be affixed to the manifest. Copies of the manifest will be retained at TSCL.

<u>Considerations for Sludge Application</u>

The focus of sludge application will be with respect to the beneficial effects for agricultural crops. As such the suitability of the land for the application of sludge and the crops for which the sludge will be applied will be determined in consultation with the Ministry of Agriculture and the Rural Agricultural Development Agency (RADA). The maximum application rates should be determined and outlined in a Nutrient Management Plan and thereafter should not be exceeded.

Generally sludge should not be applied to sugar cane fields in the following instances:

- to slopes in excess of 10% (6 degrees)
- during rainfall
- waterlogged soil
- slowly permeable soils
- highly permeable soils
- land where depth to bedrock is less than 60 cm

- within 50 m of surface waters (on flat land)
- within 100m of surface waters (downslope)
- within 5 m of surface waters (upslope)
- contaminated sites
- to land if it is likely to adversely affect a threatened or endangered species

15 STAKEHOLDER AND PUBLIC INVOLVEMENT

From the surveys and Focus Group Discussion (FGD) conducted it was apparent that all key stakeholders knew about the proposed project, though their knowledge varied. Most survey respondents (82.5%) were aware of the plan to resume sugar factory operations, primarily informed by fellow community members (91.5%).

The consultations demonstrated strong support for the proposed project, with stakeholders highlighting its necessity for community redevelopment and social-economic benefits. Survey results showed unanimous support, with 99% agreeing on the importance of the project for improving residents' quality of life, creating jobs, attracting new business investments, fostering social cohesion, and revitalizing Lionel Town.

The analysis showed that while stakeholders recognized the positive impacts of the proposed project, they also expressed some concerns.

15.1 PERCEIVED PROJECT BENEFITS

Key stakeholders view the proposed project as an opportunity for community renewal and national development. Employment opportunities (96.5%) and potential increases in income (95.3%) are seen as primary benefits. The project is also expected to help reduce poverty (81.4%) and crime.

Survey respondents identified employment opportunities (83.7%) and increases in income (80.2%) as major personal benefits of the proposed project. The project is also expected to reduce poverty (74.4%) and emotional distress (66.2%). However, 10.2% of respondents felt the project would not provide any personal benefits.

The survey and FGDs revealed strong support for the proposed sugar factory project, highlighting potential benefits such as job creation, youth engagement, and community development. Key stakeholders emphasized the project's importance for social and economic revitalization, tax revenue generation, and agricultural sector expansion. Despite recognizing positive impacts, some concerns were expressed regarding environmental issues, including air pollution, groundwater contamination, and waste management. However, no marginalized or vulnerable groups were identified as being disproportionately affected by the project.

Although stakeholders anticipated many positive outcomes from the project, it is crucial that the project offers sustainable, long-term opportunities for community members. This would ensure tangible socio-economic and health benefits for residents and potential workers.

15.2 PERCEIVED ADVERSE IMPACTS AND CONCERNS

The survey found minimal concern about environmental impacts, with air pollution being the primary issue. Only 2.3% of respondents were somewhat concerned. Additionally, 23.2% of households noted respiratory illnesses within their members.

Stakeholders emphasized several potential environmental issues, notably groundwater pollution, air pollution during construction, and waste management. Concerns also included adequate compensation for farmers, displacement of livestock farmers, and the importance of innovative youth engagement strategies.

15.3 KEY RECOMMENDATIONS FOR STAKEHOLDER INVOLVEMENT

As presented in Section 10.8, key recommendations for the proposed sugar factory project include conducting community walk-throughs to engage residents, developing a corporate social responsibility (CSR) framework, appointing a community engagement officer, and creating a Security Management Plan. These recommendations would be best managed by developing a Stakeholder Engagement Plan to cover the project implementation and post project feedback from key stakeholders.

16 WASTE MANAGEMENT PLAN

16.1 CONSTRUCTION PHASE

During the construction phase of the project, several waste streams will be generated. These waste streams will be managed in accordance with the management and mitigation measures and disposal methods outlined below in Table 77.

Table 77: Waste and Environmental Management Plan for the Construction Phase of Project

No.	Expected Waste Streams	Description	Management/Mitigation Measures	Disposal Methods
1	Solid Waste - Cleared Vegetation & Farm Waste	Vegetation cleared from sugarcane fields	Only vegetation required for the development will be cleared. There will be a section of the property that will be re-vegetated and developed into a green area. This section of the property currently has abandoned, derelict houses.	Wherever possible cleared vegetation that can be used elsewhere on the property for example as fertilizer will be utilized. If waste cannot be utilised, a NSWMA approved solid waste management company will be contracted to collect and dispose of the waste at an approved NSWMA disposal site.
2	Solid Waste - Scrap Metal	Scrap metal	Scrap metal will be sold to a NEPA approved scrap metal collector.	Scrap metal will be sold to a NEPA approved scrap metal collector.
3	Other Solid Waste	Other solid waste such as packaging, empty containers, food waste, paper material etc.	Solid waste will be properly containerised and stored in a designated storage area on the property	All other solid waste will be disposed of at an approved NSWMA disposal site
4	Excavated Soil & Rubble	Soil may need to be excavated. Rubble may also be generated during this process, depending on the material unearthed.	• Soil will only be excavated in areas that are absolutely necessary for the project. • The natural drainage of the property will not be impeded. • Soil and rubble that are excavated will be used to backfill areas once construction is completed. • Excess soil will be used in landscaping	Any soil and rubble left over after backfilling will be spread across the fields on the property

No.	Expected Waste Streams	Description	Management/Mitigation Measures	Disposal Methods
			activities around the facility. • Stockpiles of soil and aggregate will be bermed or covered to prevent entrainment of sediments in stormwater	
5	Sewage	Sewage in the form of human waste will be generated by workers during the construction phase of the new sugar factory and associated facilities	Portable toilets will be provided for workers by a reputable company.	The company that provides the portable toilet facilities will safely transport the sewage generated to an approved wastewater treatment facility
6	Stormwater	Stormwater is expected to be generated during the construction phase from run-off from rain	• The site's natural drainage will not be impeded, to reduce the likelihood or excess erosion and flooding. • Stockpiles of soil and aggregate will be bermed or covered to prevent entrainment of sediments in stormwater • Sediment traps will be utilised to restrict the movement of entrained sediments from the construction activities from being transported to other locations	Stormwater run-off from rain will be released to the environment
7	Air Emissions	Air emissions are expected from gasoline and diesel-	• Vehicles and equipment will not be left idling for long periods when they are not being used.	Air emissions will be released to the environment

No.	Expected Waste Streams	Description	Management/Mitigation Measures	Disposal Methods
		powered equipment during the construction phase of the operation. There is also expected to be fugitive dust generated during the construction as well as during the transport of materials.	• Roadways and areas that are particularly dusty during the construction phase can be sprayed with water periodically to reduce the likelihood of fugitive dust. • Cover haulage vehicles transporting aggregate, soil and cement • Cover and/or wet onsite stockpiles of aggregate, soil etc. • Ensure proper stock piling/storage and disposal of solid waste • Operate well maintained vehicles and equipment	
8	Hazardous Waste	Spent fuel in the form of waste oil may be generated during the construction phase of the project.	• Hazardous waste is not likely to be generated, however, any that is generated will be kept in a secure location in drums, ideally on an impermeable surface with spill containment infrastructure until they can be collected and disposed of. • Utilise proper equipment when dispensing fuel.	Hazardous waste generated will be collected by a NEPA approved hazardous waste contractor.
9	Noise	Excessive noise generated by equipment used in construction phase of the project.	• Provide workers with the necessary Personal Protective Equipment (PPE) e.g. hearing protection and ensure that they are worn • Sensitise residents in the area to the types of activities that will take	Not applicable

No.	Expected Waste Streams	Description	Management/Mitigation Measures	Disposal Methods
			place ahead of the works and assign a liaison person with whom the residents can relate • Ensure project activities are scheduled during working hours of 7:00 a.m. to 7:00 p.m. • Operate well maintained vehicles and equipment	

16.2 OPERATIONAL PHASE

Two (2) solid waste streams are to be recycled to produce useful products. This is in the interest of environment and will save foreign exchange. These include fly ash from the boilers and filter press mud from the sugar manufacturing operations.

These processes are presented below and the requisite permit applications will be submitted post commissioning of the sugar factory and prior to the start of the respective production processes.

16.2.1 BRICK/PAVER MAKING

Fly ash bricks, made from fly ash, are lighter in weight and stronger than common clay bricks. The number of workers required for this operation is 10- 12 persons. The facility consists of:

- Materials Automatic Single Feeder for production of Fly Ash Bricks.
- Pan Mixer: 500kg Capacity - 2 Pcs.
- Conveyer Belt: 24 Feet x 2.5 Feet
- Power Pack With Oil Cooling System: 400 L Oil Capacity, H-68 (hydraulic grade oil for hydraulic press)
- Number of Bricks in 1 Stroke: 08/10/ 12 Pcs

Figure 117 shows the picture of a typical fully automatic fly-ash brick making machine.

The manufacturing process for fly ash bricks involves the following steps:

1. Mixing

Fly ash, water, lime, and gypsum are mixed to achieve the desired consistency. The mixing process is critical to ensure the uniform distribution of materials.

2. Moulding

The mixture is fed into mould boxes within the fly ash brick making machines. The moulds shape the paste into bricks of uniform size and shape.

3. Curing

The bricks are cured to harden. Autoclaving can be used to increase the hardness of the block by promoting quick curing of the cement.

4. Drying

The bricks are taken out of the moulds and given time to dry.

Figure 117: Fully Automatic Fly-Ash Brick Making Machine

16.2.2 COMPOSTING

Press mud compost is a nutrient-rich organic material that is made from the residue left over after extracting juice from sugarcane. It contains a variety of elements, including:

- Major plant nutrients: Nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur
- Minor elements: Iron, zinc, manganese, copper, boron, and molybdenum
- Organic matter: 25–30%
- Other components: Cellulose, lignin, protein, sugar fiber, cane wax, albuminoids, inorganic salts, and soil particles

16.2.2.1 FILTER PRESS MUD (CAKE) COMPOST FERTILIZER MANUFACTURING PROCESS

The composition of press mud compost can vary depending on the quality of the cane, the soil condition, the time of year, and the geographical location. Press mud compost will be used as a soil amendment to improve soil structure, texture, and quality. It can also help to improve the soil's water holding capacity. Composting press mud can help to prevent pollution and reduce the need for inorganic fertilizers. Figure 118 outlines the process flow.

Figure 118: Filter Press Mud Process Flow

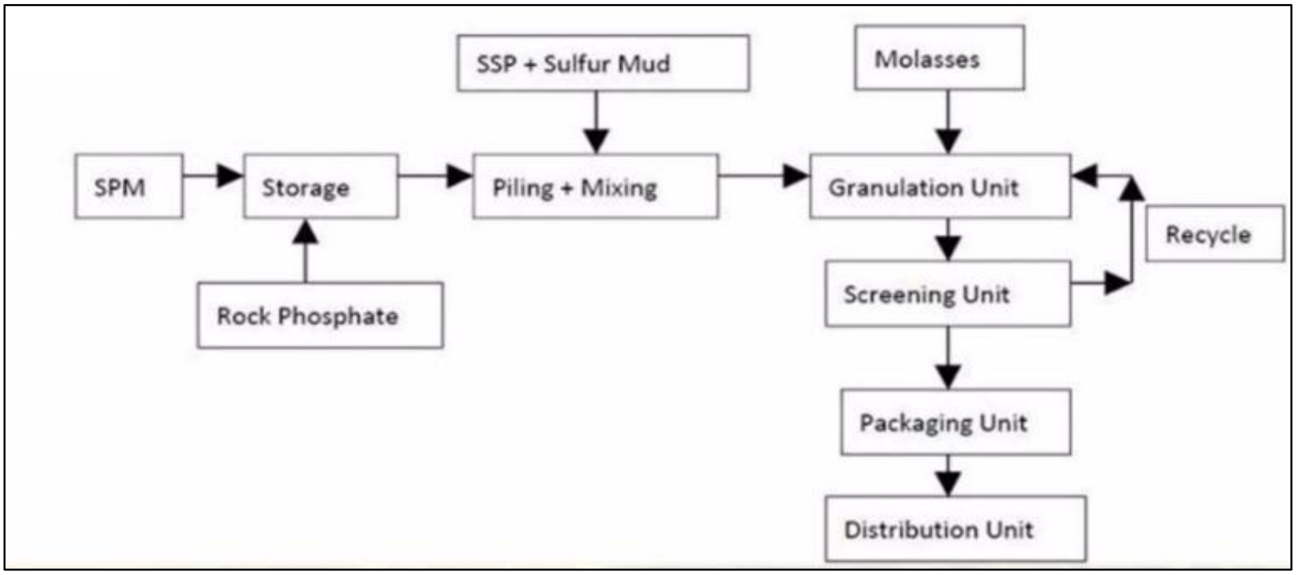


Table 78 outlines the waste streams to be generated during the operational phase along with management and mitigation measures and disposal methods.

Table 78: Waste Management Plan for the Operational Phase of the Project

No.	Expected Waste Streams	Description	Mitigation Measures	Disposal Methods
1	Solid Waste - Cleared Vegetation & Farm Waste	Farm waste generated from maintaining the sugarcane fields and processing the sugarcane	Only material necessary to the factory's operations will be cleared and cut from the fields.	Wherever possible cleared vegetation that can be used elsewhere on the property for example as fertilizer. If waste cannot be utilised and poses a hazard, a NEPA approved solid waste management company will be contracted to carry the waste to an approved NSWMA disposal site.
2	Solid waste - bagasse	Bagasse is waste product from sugarcane processing	Will be used to power boilers at the facility to generate power.	Not applicable
3	Solid Waste - Scrap Metal	Scrap metal generated from maintaining the facility, broken parts and obsolete equipment	Scrap metal will be sold to a NEPA approved scrap metal collector.	Scrap metal will be sold to a NEPA approved scrap metal collector.
4	Other Solid Waste	Any other solid waste generated during the operational phase of the project such as packaging, empty containers, food waste, paper material etc.	Other solid waste will be stored in skips in a designated storage area on the property during the construction phase of the project.	All other solid waste will be disposed of at an NSWMA disposal site by a NSWMA approved solid waste management company.

No.	Expected Waste Streams	Description	Mitigation Measures	Disposal Methods
5	Sewage	Sewage in the form of human waste generated while the facilities are in operation.	TSCL will apply for licences to construct and operate a sewage treatment plant and to discharge effluent	The treated sewage will be used for gardening and flushing toilets. The small amount of sludge produced by the STP will be mixed with the sludge produced by the ETP and applied to fields.
6	Stormwater	Stormwater is expected to be generated from run-off from rain	The site's natural drainage will not be impeded, to reduce the likelihood of excess erosion and flooding.	Stormwater run-off from rain will be released to the environment
7	Trade Effluent	Trade effluent is expected to be generated from the processing of the sugarcane and other operations at the facility.	Trade effluent will be sent to the wastewater treatment plant, where it will be treated to meet the regulatory standards. TSCL will apply for licences to construct and operate a wastewater treatment plant and to discharge effluent.	Treated effluent will be used to irrigate the farms
8	Sludge	Sludge will be generated from the wastewater treatment facility and the sewage treatment facility	Sent to Sludge Drying Beds	Reuse on farms as soil conditioner

No.	Expected Waste Streams	Description	Mitigation Measures	Disposal Methods
9	Press mud	Filter press mud will be generated from the processing of the sugarcane	Composting	To be used as bio fertilizer on the farms
10	Vehicular Emissions	Emissions generated by vehicles used in day-to-day operation of the facility.	• Operate well maintained vehicles and equipment • Vehicles and equipment will not be left idling for long periods when they are not being used.	Not applicable
11	Stack Emissions	Emissions generated from stacks at the facility.	• ESPs will be fitted to the stack to reduce particulate emissions • Maintenance activities will be conducted on equipment according to the manufacturer's recommendations	Released to the environment
13	Hazardous Waste	Hazardous waste is expected to be generated from any spills or leaks of chemicals that are required while the facility is operating. If the chemicals cannot be safely recovered and used, and they are not appropriate for regular disposal, they will be	• Hazardous Materials will be stored designated locations at the facility on impermeable surfaces with spill containment infrastructure to prevent any spills or	Hazardous waste generated will be collected by a NEPA approved hazardous waste contractor.

No.	Expected Waste Streams	Description	Mitigation Measures	Disposal Methods
		categorised as hazardous waste.	leaks from entering the environment. • The materials will be purchased in small individual containers not exceeding 990 L. • Personnel will be trained in spill management • Spill kits will be maintained on site	
14	Boiler (fly) ash	Generated from boiler operations	Used to make fly ash brick/pavers blocks near to the sugar factory	Not applicable
15	Waste oil	Generated from the wastewater treatment plant	Stored for collection by a NEPA approved waste oil contractor	Stored for collection by a NEPA approved waste oil contractor

17 REFERENCES

1. Adams, C. D. 1972. *Flowering Plants of Jamaica*. University of the West Indies.
2. Benven II, J. et. al., (2025). National Hurricane Center Tropical Cyclone Report, Hurricane Beryl (AL022024), 28 June – 9 July 2024. https://www.nhc.noaa.gov/data/tcr/AL022024_Beryl.pdf
3. Bibby, Colin, Martin Jones, and Stuart Marsden. 2000. "Expedition Field Techniques BIRD SURVEYS Together for Birds and People." www.rgs.org.
4. Hedges, S Blair. 2023. "Caribherp: Amphibians and Reptiles of Caribbean Islands." http://www.caribherp.org/index.php?p=i&val=m.
5. http://ww.jamaica-star.com/article/news/20191002/monymusk-closure-killing-us-ex-employees-suffering-clarendon-factory-ceased
6. https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Sugar+Annual_Kingston_Jamaica_JM2023-0001.pdf
7. https://jis.gov.jm/pm-announces-new-policy-for-transitioning-jamaica-to-inclusive-growth/
8. https://goj.maps.arcgis.com/apps/StoryMapBasic/index.html?appid=3ec0ff9c25534912af0bef66d48f3d14
9. IDB 2021. Gachot, S; Paolo de Salvo, C; Rondinone, G. Analysis of Agricultural Policies in Jamaica (2015-2019)
10. Jamaica National Heritage Trust. National Heritage Sites of Jamaica. Accessed at https://goj.maps.arcgis.com/apps/webappviewer/index.html?id=27e6223b095642e5ac2736f08619c166
11. Jamaica Water Resources Authority. Flood Map. February 2023. Accessed at https://www.arcgis.com/apps/mapviewer/index.html?webmap=645025797e0947c68388adcd8c455995
12. Jamaica Water Resources Authority. Water Information System. Accessed at https://webmapjam.dyndns.pro/webmap/app/db/index.php
13. Merlin. 2024. "Merlin Bird ID – Free, Instant Bird Identification Help and Guide for Thousands of Birds – Identify the Birds You See." 2024. https://merlin.allaboutbirds.org/.
14. Meteorological Service of Jamaica. 30-year Mean Rainfall by Station (in mm). Accessed at https://metservice.gov.jm/our-data/
15. Ministry of Education Jamaica (2020). Statistics Digest 2018-2019.
16. Nandi, A. & Mandal, Arpita & Wilson, Matthew & Smith, David. (2016). Flood hazard mapping in Jamaica using principal component analysis and logistic regression. Environmental Earth Sciences. 75. 10.1007/s12665-016-5323-0.
17. Mona Geomatics Institute. Hazard Online Map. Accessed at https://main.monagis.com/hazard-online-map/
18. National Land Agency (NLA). ElandJamaica Interactive Map. Accessed at https://elandjamaica.nla.gov.jm/elandjamaica/interactivemap.asp
19. National Library of Jamaica. History of Earthquakes in Jamaica, March 2016. Accessed at https://nlj.gov.jm/wp-content/uploads/2017/03/Earthquakes-of-Jamaica.pdf
20. National Oceanic and Atmospheric Administration. Historical Hurricane Tracks. Accessed at https://bit.ly/3T59Gvu.

21. Office of Utility Regulation, Regulatory Policy of the Electricity Sector, Guidelines for the Addition of Generating Capacity to the Public Electricity Supply System, June 2006. Accessed at https://our.org.jm/wp-content/uploads/2021/02/regulatory_policy_addition_new_generating_capacity_public_electricty_suppy_system.pdf.
22. Office of Utility Regulation (OUR) Today. Four major earthquakes in Jamaica's history, January 2023. Accessed at https://our.today/four-major-earthquakes-in-jamaicas-history/
23. Planning Institute of Jamaica (2023). Economic and Social Survey of Jamaica- Overview of Select Indicators. Kingston, Jamaica
24. Planning Institute of Jamaica (2022). Economic and Social Survey of Jamaica. Kingston, Jamaica
25. Rural Agriculture Development Authority. ABIS. 2023
26. Statistical Institute of Jamaica (STATIN): Population and Housing Census 2011, General Report Volume I, 2012.
27. Salazar, et al, September 2013. Probabilistic Seismic Hazard Assessment for Jamaica. Accessed at https://www.davidpublisher.com/Public/uploads/Contribute/5551bef3b5d74.pdf.
28. The Gleaner, Photo Flashback: The June 1986 Floods. Accessed at: https://jamaica-gleaner.com/article/esponsored/20230602/photo-flashbacks-june-1986-floods#slideshow-1
29. The Jamaica National Noise Standards; Extracted from the Recommendations for National Noise Standards for Jamaica, 1999
30. The Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013
31. The Town and Country Planning (Clarendon Parish) Provisional Development Order, 2017. Accessed at https://www.nepa.gov.jm/sites/default/files/2020-06/Town%20and%20Country%20Planning%20%28Clarendon%20Parish%29%20Confirmed%20Development%20Order%20%282017%29.pdf
32. TSCL Development Project Brief
33. TSCL-TVS-SLP-002_ REV.0_Master Plan for 2500 TCD Sugar Plant with Cogen_27.11.2024 SHEET 1
34. United States Geological Survey (USGS). Recent Earthquakes Worldwide. Accessed at *http://earthquake.usgs.gov/earthquakes/map*
35. United States Geological Survey (USGS). The Modified Mercalli Intensity Scale, Earthquake Hazards Program. Accessed at https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale
36. University of Buffalo Food Systems Planning and Healthy Communities Lab. (2016). *Clarendon Local Sustainable Development Plan, Clarendon Parish, Jamaica | Food Systems Planning and Healthy Communities Lab*. Buffalo.edu. https://foodsystemsplanning.ap.buffalo.edu/gsfp-policy/clarendon-local-sustainable-development-plan-clarendon-parish-jamaica/
37. Wade, E. et. al., (2023). Exploring the Relationship Between Fishing Actors and Network Prominence in information-sharing Networks in Jamaican small-scale Fisheries. Retrieved from https://link.springer.com/article/10.1007/s10745-023-00444-7#:~:text=The%20fishing%20industry%20is%20primarily,Authority%20of%20Jamaica%2C%202021).

18 APPENDICES

Appendix 1: Power Generation Equipment Specifications

Power Plant Integral Piping

AREA	MATERIAL PROVIDED
For the temp. above 510 °C	SA 335 Gr. P22 / Eq.
For the temp. above 426 °C up to 510 °C	SA 335 Gr. P11 / Eq.
For temp. 426 °C & below	SA 106 Gr. B
For Cooling water, Raw water, service water, Safety / Relief valve	IS 1239 / IS 3589 ERW / IS: 2062
For service air application	IS 1239 Medium Class
For instrument air application	GI Pipe as per IS 1239 Part I

Design Codes for Power Generation Plant

ITEM	CODE
Pressure part design (for Tube, Pipes and Drums)	ASME /IBR 1950
Boiler integral and external piping	ASME /IBR 1950
Other auxiliaries and non-pressure parts including Air heater	Indian Standard
Structural design and material including stack	Indian standard
Pressure parts material selection (for Tube, Pipes and Drums)	ASTM
Performance testing of the Boiler (Efficiency) 2008 by Indian heat loss method	ASME PTC 4.0
Pipe fitting and flanges	ANSI – B 16.5, B16.11, B16.9
Code for general construction in steel	I.S. 800
Criteria of Earth quake structures	I.S. 1893 – 2002I.S. 875 part 3
Turbine Generator	IEC / ASME PTC 6 / DIN 1943
Gear Box	AGMA / eq.
Instrument	ISA
Electrical	IEC / IS / IEEE EOT
Crane	IS: 3177 / IS: 807
Other Auxiliaries	Vendor Standard / Relevant Indian standard

Appendix 2: Sewage Treatment Plant – Equipment Technical Details

1. BAR SCREEN

Qty	1 No.
MOC	MSEP
Type	Bar Type
Size	10 mm
Make	WTE

2. SEWAGE TRANSFER PUMP

Qty	2 Nos (1W+1S)
Type	Self-priming, Centrifugal
Duty	To Transfer Sewage
Capacity	1 m^3/hr @ 10 m head
MOC	CI

3. AIR BLOWER WITH MOTOR

Qty	2 Nos (1W + 1SB)
Capacity	30 m^3/hr @ 0.5 kg/cm^2
Type	Twin Lobe, Root Blower
Duty	Air supply to AT, EQT, SHT
MOC	CI

4. AIR GRID WITH DIFFUSER MEMBRANES

Air Grid	1 Lot
MOC	UPVC, Sch 40
Diffuser Membrane's location	For AT
Diffuser Membranes MOC	EPDM
Diffuser membrane Type	Disc
Duty	Uniform air distribution & oxygen transfer
Quantity	1 Lot as per design

5. AIR BLOWER PIPING

MOC	Under water piping-UPVC Air blower header-MS
Valves	1 Set
Type	Ball, Butterfly

6. MEDIA FOR BIOREACTOR (MBBR)

Shape	Cylindrical
Surface area	400 m^2/m^3
MOC	PP
Qty	1 Lot

7. TUBE MEDIA FOR TUBE SETTLING

Quantity	1 lot
Size of tube	55x55 mm
Angle of Tube	55-60^0
Thickness	1.0 To 1.2 mm
Working Temp	50^0C
Shape of Tube	Square
MOC	PVC

8. SLUDGE PUMP

Qty	1 No.
Capacity	0.5 m^3/hr @ 10 m head
Type	Self-priming, Centrifugal
Duty	To transfer slurry sludge to SHT
MOC	CI

9. FILTER FEED PUMP

Qty	2 Nos (1W+1S)
Capacity	1.0 m3/hr @ 30 m head
Type	Centrifugal, Horizontal
Duty	To pump water from IST to filter
MOC	CI

10. CHLORINE DOSING SYSTEM

Qty	1 No.
Capacity	0 - 3 LPH @ 2.5 Kg/cm2
Type	Electronic Diaphragm
MOC of Pump	PP
Dosing tank	60 Lit
Tank MOC	LDPE

11. PRESSURE SAND FILTER

No. of Units	1 No

Capacity	1 m^3/hr.
Material of Construction	FRP
Diameter	13”
Height	54”
Pipeline size	20 NB
Operating/Working Pressure	2.5 Kg/cm^2
Filter media	Fine sand, Gravels & Pebbles
Media Quantity	1 Lot
MOC of frontal piping	UPVC
Valve Type	Manual Multiport Valve
Valve size	20 NB
Operation	Manual

12. ACTIVATED CARBON FILTER

No. of Units	1 No
Capacity	1 m^3/hr
Material of Construction	FRP
Diameter	13”
Height on straight	54”
Pipeline size	20 NB
Operating/Working Pressure	2.5 Kg/cm^2
Filter media	Sand, Pebbles +Activated carbon
Media Quantity	1 Lot
MOC of frontal piping	UPVC
Valve Type	Multiport Valve
Valve size	20 NB
Operation	Manual

13. INTERCONNECTING PIPING & FITTINGS

No. of Quantity	1 Lot as per requirement.
MOC	UPVC Sch. 40
Piping Supports	1 Lot as required
MOC	MSEP
Accessories	Valves, bends, elbows, reducers, clamps, Fittings etc.
Flanges	BS 10 Table D

14. INSTRUMENTS

Pressure Gauges	1 Lot as per requirement
Location	At common discharge side of Pumps & Blowers, Inlet and outlet of equipment's
Level Switches	1 Lot
Sampling Valves	1 Lot as per requirement
Flowmeter	1 No
Type	E-Mag
Location	At the outlet of ACF

15. ELECTRICAL

No. of Unit	1 No
Panel Make	WTE
MOC	MS Powder coated
Type	Non-Compartmentalized non-drawn-out type, Fuse protected
On/Off/Trip Indication	1 Lot as per requirement
Cabling	1 Lot - within the battery limit
Type	Flexible
Entry	Bottom/Top
Cable Tray & cable Supports	1Set
Operation	Semi-Automatic (Level Switch based)

16. FABRICATED TANKS

Thickness	5 mm
Stiffeners	As per requirement
Ladder and Nozzles	As per requirement
Railing & Platforms	1 No.
MBBR Tank	1 No. – 6.6 m^3 – MSEP tank
Tube Settling Tank	1 No. - 2.5 m^3 – MSEP tank
Intermediate Storage Tank/Filter Feed Tank	1 No. – 1.5 m^3 – LDPE tank
Sludge Holding Tank	1 No. - 1.0 m^3 – LDPE tank
Total No of Tanks	4 Nos.

Appendix 3: Effluent Treatment Plant – Equipment Technical Details

1. BAR SCREEN

Quantity	2 No.
Location	At Screen Chamber near ETP
Application	Removal of large size floating and suspended particles from effluent
MOC	MSEP
Size of screen	Suitable to screen chamber
Mounting of Screen	At 45 degrees in screen chamber
Bar spacing	10 & 20 mm
Make	WTE

2. OIL SKIMMER

Quantity	1 No.
Location	Oil and Grease Trap
Type	Vertical Belt type
Capacity	20 LPH
Supporting Structure MOC	MSEP
Skimmer Belt	Oleophilic Neoprene Rubber
Drive	Gear Motor
Type of Motor	TEFC
Quantity	1 No.
Oil Receiving Tank	1 No
Tank Capacity	500 Liter
MOC	HDPE

3. AIR GRID FOR EQT

Air grid	1 Lot
Under water MOC	uPVC Sch 40
Location	Equalization Tank
Size	As per requirement
Valves	1 Lot
Type	Butterfly valves

4. EFFLUENT LIFTING PUMP

Quantity	2 Nos. (1W+1SB)
Capacity	30 m^3/hr. @ 15 m head
Type	Self-Priming, non-clog, centrifugal Horizontal
MOC	CI with SS304 Impeller

5. NEUTRALIZATION TANK MIXER

No. of unit	1 No.
Agitator with motor and gearbox	1 No.
Type of Agitator	Turbine Type
Impeller RPM	100 - 150
MOC of mixer	MSEP
Mixer Mounting Frame	1 No.
MOC	MSEP
Accessories	As Required

6. ALKALI DOSING SYSTEM

Preparation Cum Dosing Tank	1 Nos.
MOC	RCC- By purchaser
Capacity	1000 lit.
Chemical	Hydrated lime
Dosing Pump	0-250 LPH at 1.5 kg/cm2
Qty	2 Nos (1W+1SB)
MOC	CI
.	
Tank Mixer	1 No.
MOC	MSEP
Gear Box with motor	1 No.
Speed	100-120 RPM
Mounting Skid	1 No.

NOTE:

- The purchaser will provide caustic on a continuous basis.
- Purchaser will maintain industrial grade Lye / flakes for dilution at tank

7. TUBE MEDIA FOR PRIMARY TUBE SETTLER

Shape of Tube	Square
Size of tube	55X55 mm
Angle of Tube	60 Degree
Thickness	1.0 mm to 1.2 mm
MOC	PVC

Quantity	1 lot

8. SLUDGE PUMP FOR PRIMARY TUBE SETTLER

Quantity	2 Nos. (1W+1SB)
Capacity	5 m^3/hr. @ 10 m head
Type	Centrifugal Horizontal, Non-Clog, Semi-Open impeller
MOC	CI

9. NUTRIENT DOSING SYSTEM

Dosing Pump Quantity	2 Nos (1W+1SB)
Chemical	UREA/DAP
Type	Diaphragm Operated
Pump Capacity	0-25 LPH @ 2.5 kg/cm2 pressure
MOC	PP
Dosing tank	1 No.
Capacity	500 liters
MOC	HDPE

10. UASBR FEED PUMP

Quantity	2 Nos (1W+1SB)
Type	Horizontal, Centrifugal
Flow Rate	30 m^3/hr. @ 20 m head
MOC	CI
Accessories	1 Set

11. UASBR DETAILS (ANAEROBIC DIGESTER)

Tank	1 No.
MOC	RCC – By Purchaser
Volume of tank	800 m3 effective volume.
GLSS System	1 set
MOC	FRP
Collecting troughs	1 set
MOC	FRP
Supporting Structures for hoods & troughs	1 set
MOC	MSEP
Valves	1 Lot
Bottom Distribution System	1 set
MOC	uPVC/HDPE
Gas piping	1 set
Inlet, outlet piping	1 lot
MOC	uPVC/MSEP

Flare Stack	1 No
Type	Water Sealed Type, Manual Ignition
Flame Arrestor	1 No
Moisture Trap	1 No

12. TUBE MEDIA FOR SECONDARY TUBE SETTLER

Quantity	1 Lot
Shape of Tube	Square, 55X55 mm
Angle of Tube	60^0
Height	520 mm
Thickness	1.0 To 1.2 mm
Working Temp	50^0C
MOC	PVC

13. SLUDGE PUMP FOR SECONDARY TUBE SETTLER

Quantity	2 Nos. (1W + 1SB)
Capacity	10.0 m3/hr. @ 10 m head
Type	Centrifugal Horizontal, Non-Clog, semi-Open impeller
MOC	CI

14. AIR BLOWERS FOR EQ & AERATION TANK

Quantity	2 Nos. (1W+1SB)
Capacity	1000 m^3/hr. @ 0.5 kg/cm^2
Type	Roots blower, Twin Lobe
Accessories	1 Set

15. BLOWER PIPING

Quantity	1 Set
MOC	Above water – MSEP- B Class
Valves	1 Set
Type	Butterfly / Ball valves

16. DIFFUSER MEMBRANES SYSTEM FOR AT

Quantity	1 Lot
Shape	Tubular
Installation	Retrievable with SS304 Drop

MOC	EPDM

Picture: Retrievable diffuser with SS304 Drop assembly.

ADVANTAGES –

- Easily removable, no need to stop aeration.
- No Need to Empty tank (no loss of MLSS)
- Long life.
- No Need to change Pipes as we change rope (damaged by Sunlight)

A single set of diffusers can be maintained, etc.

17. SECONDARY CLARIFIER MECHANISM

Quantity	1 No.
Flow	25 m3/hr.
Location	After Aeration tank
Size	7.5 m Dia. X 3.0 m SWD + 0.3 m FB
Type of Gearbox	Planetary Gear box.
Drive	Centre Drive
Scraping	MS Epoxy two scrapper arm with neoprene squeezes
Feed Well	MS Epoxy Painted with Baffle Plate
Bridge	Half bridge walkway
MOC of Bridge	MSEP

18. SLUDGE PUMP – SECONDARY CLARIFIER

Quantity	2 Nos. (1W + 1SB)
Capacity	8 m^3/hr. @ 10 m head
Type	Self-Priming, centrifugal.
MOC	CI

19. HYPOCHLORITE DOSING SYSTEM

Quantity of Pump	2 Nos. (1W +1SB)
Pump Capacity	0 – 4 LPH at 2.5 kg/cm^2
Type	Electronic diaphragm operated
Dosing tank	1 No.
Dosing Tank Volume	100 Lit
MOC	LDPE

20. FILTER FEED PUMP

Quantity	2 Nos. (1W+1SB)
Capacity	30 m^3/hr. @ 28 m head

Type	Centrifugal, closed impeller
MOC	CI

21. PRESSURE SAND FILTER

Quantity	1 No.
Capacity	30 m^3/hr.
MOC	MSEP
Make	WTE
Operating Pressure	2.0 kg/cm^2
Design Pressure	3.5 kg/cm^2
Diameter	1600 mm
Height on straight	1500 mm
Pipe line size	100 NB
MOC of frontal	MSEP
Filter media	Supporting media & fine sand
Media Quantity	1 Lot
Valve	Butterfly Valves
Valve Size	100 NB
Operation	Manual

22. ACTIVATED CARBON FILTER

Quantity	1 No.
Capacity	30 m^3/hr.
MOC	MSEP
Make	WTE
Operating Pressure	2.0 kg/cm^2
Design Pressure	3.5 kg/cm2
Diameter	1600 mm
Height on straight	1500 mm
Pipe line size	100 NB
MOC of frontal	MSEP
Filter media	Supporting media & activated carbon
Media Quantity	1 Lot
Valve	Butterfly Valves
Valve Size	100 NB
Operation	Manual

23. INTERCONNECTING PIPING, FITTINGS & VALVES

Quantity	1 lot within the Battery Limit
MOC	Filter frontal – MSEP All Interconnecting Piping- uPVC /MSEP- as required

Page **15** of **22**

Accessories	Valves, Flanges, Reducers, Joints, Bends etc.
Piping support	1 Lot
Piping Supports MOC	MSEP
Fittings & Valves	1 set
Flanges	BS 10 Table D

24. INSTRUMENTATION

Pressure Gauges	1 Lot
Location	At pump & blower common discharge side
Level switch	3 Nos.
Location	At neutralization tank, buffer tank, filter feed tank
Flow Meter	1 No.
Type	E-Mag
Locations	UASBR Feed Line
pH meter	1 No.
Location	At Neutralization tank

25. ELECTRIC CONTROL PANEL

MCC Panel	1 No.
Type	Non-Compartmentalized, fixed, non-draw out type
Mounting	Floor / Skid
Panel Type	IP 54
Panel Make	WTE
MCB with OLR for each Contactors	1 lot
ON/OFF/Trip button	1 lot
Cabling	1 Lot
Type of cable	Flexible
Energy Meter	1 No.
Cable entry	Bottom / Top
Cable Trays	1 lot
MOC	GI
Operation	Semi-Automatic (Level Based Automation)

Appendix 4: Water for Irrigation of Cane Fields and Domestic Use

Name		Equipment	Assigned	Well	Pump
Parnassus Pumps					
	Mignot W/L #12	Well	TSCL	1	
	Darby W/L # 10	Well	TSCL	1	
Farm 4 Pumps -Monymusk					
	Morelands #3 DW	Well	TSCL	1	
	McLeod	Well	TSCL	1	
	Raymonds #4	Well	TSCL	1	
	Raymonds #2 DW	Well	TSCL	1	
Farm 3 Pumps					
	Hayes Common #1, #2, #3 (3 Sisters Pumps)	Well	TSCL	1	
	Raymonds Domestic	Well	TSCL	1	
	Quaminus #1	Well	TSCL	1	
	Perrins #2 DW	Well	TSCL	1	
	Bog #3, Lift	Pump	TSCL		1
	Gibbons #2	Well	TSCL	1	
	Cotton Tree Gully #3	Well	TSCL	1	
	Amity Hall	Well	TSCL	1	
	Chesterfield O/H	Well	TSCL	1	
	Bog #2	Well	TSCL	1	
	Bog #3	Well	TSCL	1	
Farm 2 Pumps					
	Kemps Hill #2, 85l/s, 254mm Dia	Well	TSCL	1	
	Vizzard Run #1, 31l/s, 203mm Dia	Well	TSCL	1	
	Hermitage #2	Well	TSCL	1	
	Heathfield #4, 26l/s, 203mm Dia	Well	TSCL	1	
	Hermitage #4	Well	TSCL	1	
	Hermitage #3, 31l/s,	Well	TSCL	1	
	Building #3, 36l/s, 203mm Dia	Well	TSCL	1	
	Booster #6	Pump	TSCL		1
	Booster #5	Pump	TSCL		1
	Exeter #3	Well	TSCL	1	
	Exeter #2	Well	TSCL	1	
	Nasebery Tree	Well	TSCL	1	

Name		Equipment	Assigned	Well	Pump
Farm 1 Pumps					
	Hillards Gully Relift				
	Grimmith #3	Well	TSCL	1	
	Grimmith #2	Well	TSCL	1	
	Grimmith #1	Well	TSCL	1	
	Springfield #3	Well	TSCL	1	
	Shallow Pasture SP #1	Well	TSCL	1	
	Shallow Pasture SP #2	Well	TSCL	1	
	Shallow Pasture SP #3	Well	TSCL	1	
	Shallow Pasture SP #4	Well	TSCL	1	
	Spring Head #1	Well	TSCL	1	
	Spring Head #2	Well	TSCL	1	
	Spring Head #3	Well	TSCL	1	
	Spring Head #4	Well	TSCL	1	
	Spring Head #5	Well	TSCL	1	
	Milk Spring #5	Well	TSCL	1	
	Milk Spring #4	Well	TSCL	1	
	Milk Spring #3	Well	TSCL	1	
	Milk Spring #2	Well	TSCL	1	
	Milk Spring #1 Relift	Pump	TSCL		1
	TOTAL			**43**	**4**

Appendix 5: The EIA Team

Ianthe T. Smith, M. Eng. Environmental Engineering, P.E., Member JIE, Member JIEP
Principal Consultant/ Director Environmental & Engineering Managers Ltd.

Ianthe Smith is a Jamaican national and an Environmental Engineering Consultant. She has a BSc. in Civil Engineering (1986) from the University of the West Indies, St. Augustine, Trinidad. In 1994 she graduated from the University of Toronto, Canada, with a Master of Engineering degree in Environmental Engineering. She has been an environmental engineering consultant since 1999 and is currently a Director of Environmental & Engineering Managers Ltd. (EEM).

Her expertise includes Environmental Impact Assessments, Environmental Audits, Indoor Air Quality Assessments, Water and Wastewater Engineering, Solid Waste Management, Implementation of Environmental Management Systems (EMS) and Planning and Controlling Construction. Ianthe Smith was the overall coordinator for the EIA.

Andre Marcel Smith, EEM Chief Technical Officer, Environmental Scientist and Marine Specialist
Andre graduated from the University of the West Indies, Mona, Jamaica in 2013 with the BSc. Marine Biology (Major) and Conservation Biology (Minor) and Master of Environmental Management with Distinction from Massey University, New Zealand in 2018. Andre has been working at EEM in this capacity since 2013. Andre played a lead role in coordinating the EIA and compiling the document and he conducted the environmental impact assessment.

Dominic Neita, EEM Environmental Engineer, P.E.
Dominic is an Environmental Engineer who holds a BSc. Degree (Second Class Honours) in Civil with Environmental Engineering from the University of the West Indies, St. Augustine, Trinidad (2019). He has been working at Environmental and Engineering Managers Ltd. for the past six years on several projects. He is a registered professional engineer, under the category (Environmental – PE/11/01386). He assisted with the EIA and focused on the sections pertaining to the sewage and wastewater treatment plants.

Brenton Bartley, EEM Environmental Engineer
Brenton holds a BSc. Degree (First Class Honours) in Civil Engineering from the University of the West Indies, Mona Campus (2022). He joined Environmental and Engineering Managers Ltd as an Environmental Engineer in 2022. Brenton led the baseline noise assessment with assistance from other EEM Team members.

Javell Johnson, EEM Environmental Engineer
Javell holds a bachelor's degree in civil engineering from the University of the West Indies, Mona Campus and has been working at Environmental and Engineering Managers Ltd. (EEM) since December 2023. Javell compiled the water quality data.

Kamille Dwyer-Thomas, Urban Planner and Environmental Consultant
Kamille holds a M.Sc. in Planning and Development (University of the West Indies, St. Augustine – Distinction) and a B.A. in Geography (University of the West Indies, Mona –Second Class Hons.). Over the past 14 years, she has worked on several research projects, land use surveys, and environmental and social impact assessments in the Caribbean, including Jamaica, Trinidad and Tobago, Antigua and Barbuda, and St. Kitts. She has worked with several public sector agencies in Jamaica, including the Planning Institute of Jamaica and the Ministry of Water and Housing, conducting socio-economic, land use and environmental surveys in various rural and urban communities. Kamille conducted the social impact assessment.

Damion Whyte, Terrestrial Biologist
Damion's qualifications include:

- 2016 PhD (pending) Zoology, "To Evaluate the Goat Islands for the Re-introduction of the Jamaican Iguana", University of the West Indies (UWI), Mona, Jamaica
- 2014 Post Graduate Diploma in Environmental Management for Developing and Emerging Countries, Centre for International Postgraduate Studies of Environmental Management, Dresden University of Technology, Germany.

Damion conducted the flora and fauna assessment.

Kimballe Campbell

Kimballe Campbell is an Air Quality Specialist Consultant for Environmental and Engineering Managers Ltd (EEM). She obtained a Bachelor of Science degree in Chemical Engineering in May 2005 from Yale University and a Master of Engineering degree in Engineering Management in May 2010. She has held various Engineering roles both locally and internationally. In 2012, she successfully completed training in Air Dispersion Modeling. Within the last 12 years, in partnership with EEM, she has completed 20+ Air Emissions Inventories and Air Dispersion Model Reports for Jamaican companies in various industries, primarily those within the sugar and rum industries. These AEIs and ADMs have all successfully resulted in Air Pollutant Discharge Licences being granted to our clients. Her specific expertise for this EIA is in the area of Air Emissions Inventory.