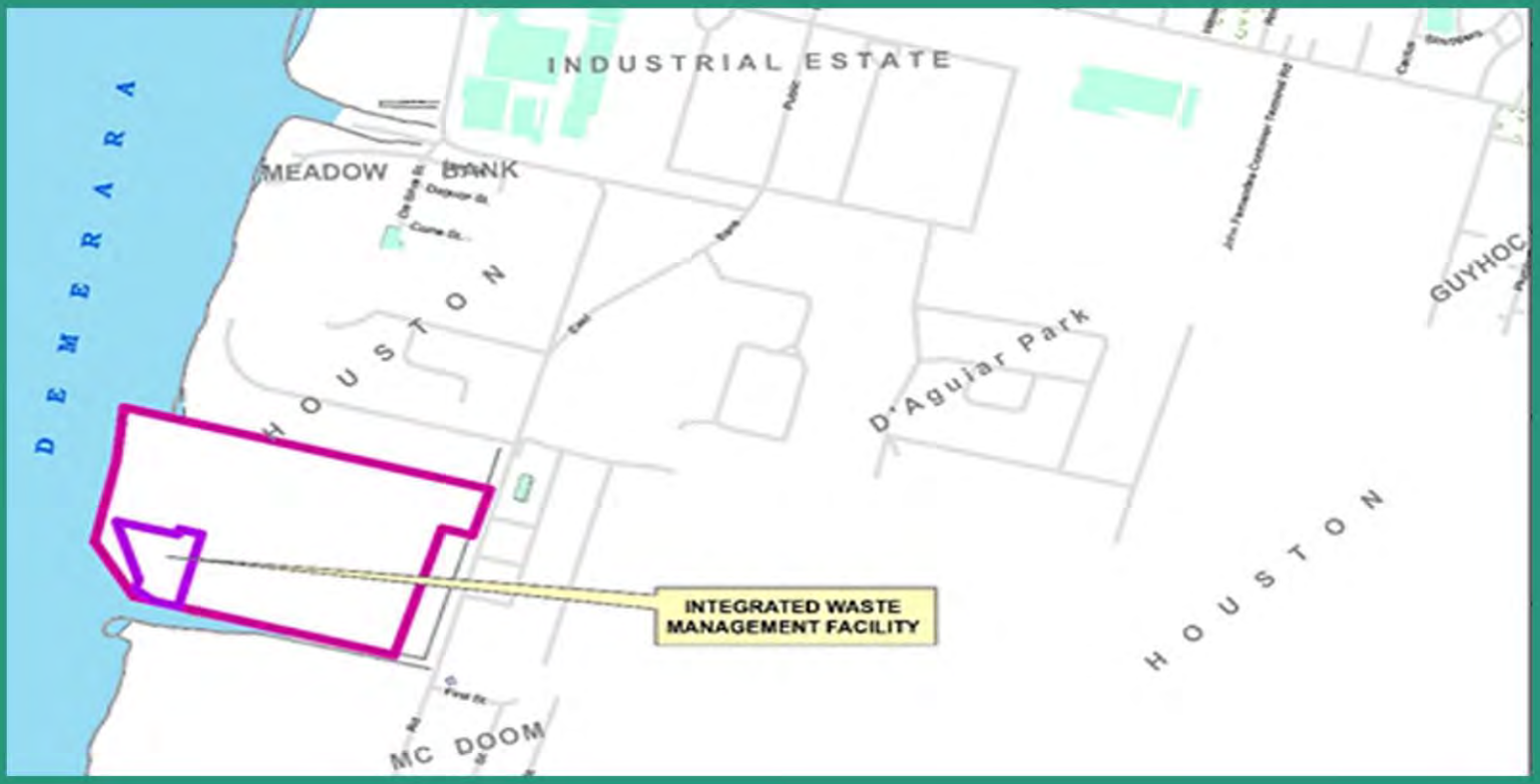
SUSTAINABLE ENVIRONMENTAL SOLUTIONS

ENVIRONMENTAL MANAGEMENT PLAN



Integrated Waste Management Facility

Prepared by:
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With support from:
Earth and Marine Environmental Consultants

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ACRONYMS

AoI	Area of Influence
BOD	Biological Oxygen Demand
CE	Conformitè Europëenne
CHPA	Central Housing and Planning Authority
CIDI	Caribbean International Distribution Inc.
COD	Chemical Oxygen Demand
CCU	Cargo Carrying Containers
DO	Dissolved Oxygen
EAME	Earth and Marine Environmental Consultants Limited
EEPGL	Esso Exploration and Production Guyana Limited
ELV	Emission Limit Value
EMC	Environmental Management Consultants Inc.
EMP	Environmental Management Plan
EMS	Environmental Management Systems
EPA	Environmental Protection Agency
ERP	Emergency Preparedness Plan
EU	European Union
GD	Georgetown Datum
GGMC	Guyana Geology and Mines Commission
GIS	Geographical Information System
GNBS	Guyana National Bureau of Standards
GoG	Government of Guyana
Go-Invest	Guyana Office for Investment
GPS	Global Positioning System
GPL	Guyana Power & Light
GT&T	Guyana Telephone & Telegraph

GUYSUCO	Guyana Sugar Corporation Inc.
GWI	Guyana Water Inc.
GYSBI	Guyana Shore Base Inc.
HSEQ	Health, Safety, Environment and Quality
HSSE	Health, Safety, Security and Environment
HTDU	Hot Oil Thermal Desorption Unit
IAST	Institute of Applied Science and Technology
IBC	Intermediate Bulk Container
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
IWMF	Integrated Waste Management Facility
M&CC	Mayor and City Council
MLGRD	Ministry of Local Government and Regional Development
MOPL	Ministry of Public Works
MSDS	Material Safety Data Sheets
NDC	Neighbourhood Democratic Council
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NORM	Naturally Occurring Radioactive Material
PLC	Programmable Logic Controller
PM	Particulate Matter
PSI	Pritipaul Singh Investments Inc.
PSV	Production Support Vessel
PTCCB	Pesticides and Toxic Chemicals Control Board
QHSSE	Quality, Health, Safety, Security and Environmental
RDC	Regional Democratic Councils

SBM	Synthetic Based Muds
SES	Sustainable Environmental Solutions (Guyana) Inc.
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant
WHO	World Health Organisation

1.0 INTRODUCTION

1.1 Background

In Guyana there are very limited facilities and infrastructure to safely manage and treat hazardous and non-hazardous waste. In addition, the development and implementation of an integrated waste management strategy for the country is still being considered. The emerging oil and gas sector and the commencement of production offshore has resulted in a greater need to develop facilities to safely receive, treat and dispose of waste generated by the sector.

Sustainable Environmental Solutions (Guyana) Inc. (SES) has responded to this need by pursuing the establishment of an Integrated Waste Management Facility (IWMF). This initiative is based on a request from Esso Exploration and Production Guyana Limited (EEPGL) for a facility to receive, treat and dispose of waste generated by its offshore operations. SES intends to design, build and operate an IWMF for EEPGL's generated hazardous and non-hazardous waste and which will have the ability to safely manage all waste generated offshore and onshore. The facility will be built and operated in accordance with EEPGL's corporate, social and environmental responsibilities and conform to local, national and international standards.

1.2 Background to the Environmental Assessment and Management Plan

The IWMF will be located within the Guyana Shore Base Inc. (GYSBI) Shore Base at Houston, East Bank Demerara. The GYSBI Shore Base is a significant logistics hub that serves EEPGL's offshore operations. GYSBI has obtained an Operation Permit from the Environmental Protection Agency (EPA) for the operation of the Shore Base. However, individual operations which may generate significant environmental impacts are required to be separately permitted by the EPA. In this regard, SES approached the EPA for Environmental Authorisation for its IWMF in June of 2020. The EPA subsequently granted a Construction Permit to SES to commence construction of the facility. In addition, the EPA informed the company that an Operation Permit will be issued for the project for the operational phase and an Environmental Management Plan (EMP) for the facility is required to be prepared and submitted to the Agency. This was communicated by EPA to SES through correspondence dated January 27, 2021 (attached as Appendix A).

1.3 Objective and Scope of the EMP

This EMP was prepared for the operational phase of the project only since a Construction Permit was already issued by the EPA for the construction phase. The scope of this EMP includes all activities within the redline boundary of the IWMF which is within GYSBI facility. For the avoidance of doubt, the scope does not include activities associated with the management and collection of wastes on the offshore facilities or off-loading facilities. These responsibilities rest with EEPGL and GYSBI respectively.

The focus of the EMP is to identify and assess potential impacts envisaged from the operation of the IWMF and, for those adverse impacts which cannot be avoided, to identify appropriate mitigation and management actions. Measures are also outlined for responding to unplanned events such as emergencies.

Specifically, the EMP:

- Presents a description of the project including its location, scale, components, phases and key activities.

- Assembles relevant baseline information on the project area including its soils, drainage, climate, biodiversity, water quality, etc.

- Assembles relevant socioeconomic baseline information on the project area including communities, land use, economic activities, availability of services, etc.

- Assesses the policy, regulatory and institutional framework for the project, including identifying the relevant national policies, legislation, standards and guidelines that define the implementation framework of the project, as well as the responsible institutions.

- Presents and addresses feedback and concerns of key stakeholders.

- Identifies, as far as is possible, and assesses the impacts of the IWMF on the physical, biological and socioeconomic environment, and also considers cumulative impacts.

- Provides measures to prevent or reduce adverse impacts to acceptable levels for the operation phase of the project.

- Outlines the company's Contingency and Emergency Response Plan.

- Describes an Implementation Framework for the EMP, including outlining roles and responsibilities, training of workers, grievances mechanism, monitoring and reporting requirements, etc.

1.4 Approach

Environmental Management Consultants Inc. (EMC) in partnership with Earth and Marine Environmental Consultants Limited (EAME) were engaged by SES to prepare the EMP. EMC and EAME commissioned a multidisciplinary team to prepare the EMP. The team composition is outlined in Appendix B. The team was well supported by SES personnel.

The EMP has been prepared in accordance with the EPA's Guidelines for the preparation of EMPs. Guidance on the areas to be addressed by the EMP were also provided by the EPA through its January 27, 2021 correspondence to SES (Appendix A).

Prior to the commencement of the EMP preparation process the consultancy team sought to gain an in depth understanding of the project and the project environment so as to determine the most appropriate methodology for preparing the EMP. The initiatives undertaken in this regard are outlined below:

- Meetings and discussions were held with key officials from SES to fully understand the project. These engagements with SES personnel continued throughout the EMP preparation process.

- Information was shared by SES on the project with the consultancy team and these were reviewed to gain a better understating of the project including on the facility and operational processes.

- An initial visit was conducted to the project site by the consultancy team during the early stage of the EMP preparation process.

These activities helped shape the methodology for the preparation of the EMP.

1.5 Methodology

The EMP preparation was done in phases. Early in the process a review of the national policies, strategies, plans and legislation, as well as international agreements was done to understand the regulatory and institutional framework within which the project will be developed and operate. Thereafter, the EMP preparation was conducted in three main phases as follows:

Phase 1 Establishing the Baseline
Phase 2 Impact Identification and Analysis
Phase 3 Mitigation and Management Planning

The preparation of the EMP was heavily dependent on Geographical Information System (GIS) to provide spatial data and analyses to aid in the conduct of field exercises, analyses of the data, and presenting information in the EMP report. GIS encompassed two types of data, namely primary data, which is data collected from field work; and secondary data, which is data extracted from existing datasets and databases. This allowed a mixed-method approach whereby both primary and secondary spatial data contained qualitative and quantitative components. Digital data was available and stored in both raster and vector models (as raster data and vector data). GIS was utilized for all phases of the EMP preparation.

For the preparation of the EMP it was essential to have a clear understanding of the Area of Influence (AoI) of the project. The primary AoI of the project is defined as the footprint of the actual IWMF, and a 50 meter fringe in all directions around the facility. The secondary AoI encompasses the area within which emissions could potentially manifest itself and which was determined to be one kilometre in a southwesterly direction for air emissions and one kilometre upstream and downstream of the Demerara River for waterborne emissions.

1.5.1 Establishing the Baseline

Collection of primary and secondary data on the physical and the socio-economic context of the project area formed an integral part of the EMP and was done over the period March to April 2021.

Some amount of secondary data for the project environment exists, such as demographic data from the National Census Report, weather data from the Hydrometeorological Department, Ministry of Agriculture and water quality data for the Demerara River from the State of the Environment Report. Where secondary data existed these were utilized.

To complement the existing data, to address gaps, and ensure updated data is available and utilized for the purpose of the EMP, the team conducted baseline surveys to collect primary data at the project site. Surveys were conducted to collect baseline data for the following environmental components:

- Ambient Noise Levels
- Ambient Air Quality
- Surface Water Quality
- Socioeconomic Environment

The methodologies employed for the execution of the baseline surveys are presented in the sections addressing the respective environmental components.

During this phase engagements with stakeholders was done to ascertain the concerns and recommendations of stakeholders so these can be addressed and included in the EMP. Details on the stakeholder engagements are presented in Chapter Five, including the methodology employed and feedback received. Additional details are included in Appendix D.

1.5.2 Impact Analysis

After establishing the baseline conditions of the project area, the potential environmental and social impacts of the project activities during the operational phase were assessed. This was done by establishing the potential interactions between the project's activities and the characteristics of the existing physical, biological and socio-economic environment and within the effective area of direct and indirect influence. The methodology employed for the impact identification and assessment is detailed in Chapter Six.

1.5.3 Mitigation and Management Planning

Mitigation and management planning was done to identify feasible and practical measures to reduce and mitigate the potential negative impacts and to maximise positive impacts. Arising from this process are measures to be implemented to prevent, manage and monitor possible environmental and social impacts which may be derived from the project. Procedures to be undertaken in the event of an emergency situation were also examined, and a framework proposed to implement, monitor and assess the effectiveness of the mitigation measures recommended. Mechanisms to engage with project stakeholders and address grievances were also developed.

1.6 Organisation of the EMP

The EMP is organized as outlined below**:**

- **Chapter One** – provides an introduction to the EMP, including its scope, and the approach and methodology employed in its preparation.
- **Chapter Two** – provides an introduction to the company and a description of the project.
- **Chapter Three** – provides a description of the project environment, including the physical, biological and socio-economic environment.
- **Chapter Four** – provides a description of the national policies relevant to the project, the various legislation the project will have to comply with, and the regulatory bodies which will have oversight of the activities.
- **Chapter Five** – documents the feedback and concerns from engagements with stakeholders.
- **Chapter Six** – assesses the potential impacts of the project on the physical, biological and socio-economic environments. In addition, it also outlines health and safety and cumulative impacts of the project.
- **Chapter Seven** – outlines recommendations for the management of potential environmental impacts and social issues relating to the project.
- **Chapter Eight** – addresses Contingency and Emergency Response.
- **Chapter Nine** – presents a framework for the implementation of the EMP.
- **Conclusion**
- **References**
- **Appendices**

2.0 PROJECT DESCRIPTION

2.1 Project Partners

A consortium comprising of Lamor, GAICO Construction and General Services Inc., and GYSBI was awarded a ten-year contract by EEPGL to build, own and operate a state-of-the-art IWMF in Guyana. Subsequently, through its joint venture, Lamor has established a local operating company Sustainable Environmental Solutions (Guyana) Inc. (SES) to operate the IWMF on a day-to-day basis.[1]

2.2 Roles and Responsibilities in the Waste Management Process

The inter-relationship between the partners and third-party contractors in this project determines their respective responsibilities for waste management. The IWMF will treat wastes generated by EEPGL and its various subcontractors associated with the offshore oil exploration and production activities. The SES operated IWMF will not initially be accepting wastes from other businesses and activities in Guyana and is primarily intended as a dedicated facility to Guyana's offshore hydrocarbon exploration and production industry. Once fully operational, however, SES may also offer its advanced waste treatment facilities to other third parties in Guyana. SES will provide the EPA with a declaration of those other waste types, their provenance, quantity and treatment prior to accepting such wastes.

GYSBI owns and operates the shore base facility and is responsible for receiving the wastes at its Production Support Vessel (PSV) berths, off-loading, and bringing the wastes to the reception area of the IWMF.

The management of wastes on the offshore production facilities and at the GYSBI off-loading operations is not covered in this EMP as SES has no control over these off-site activities. The governance of the wastes outside the IWMF is set out in the respective Environmental Permits of EEPGL and GYSBI.

The basic principles of the operation are as follows:

- Wastes generated on the offshore installations will be shipped to Georgetown and received at the GYSBI berths.
- GYSBI will off-load the wastes from the Production Support Vessels and transport the wastes to the IWMF reception gate. From this point onwards, SES becomes responsible for the wastes on-site and the operational provisions of this EMP become effective.
- Wastes treated and neutralized by the IWMF that are identified for disposal at the Haags Bosch Landfill will be collected from the IWMF by Purans Brothers Inc. From the point of departure from the footprint of the IWMF, Purans Brothers Inc. have the responsibilities for waste management and disposal.

2.3 Project Location

The project is located in the southwestern section of the GYSBI compound at Houston, East Bank Demerara (Figure 2-1).

[1] Lamor. 2021. Lamor Wins Major Waste Management Contract in South America

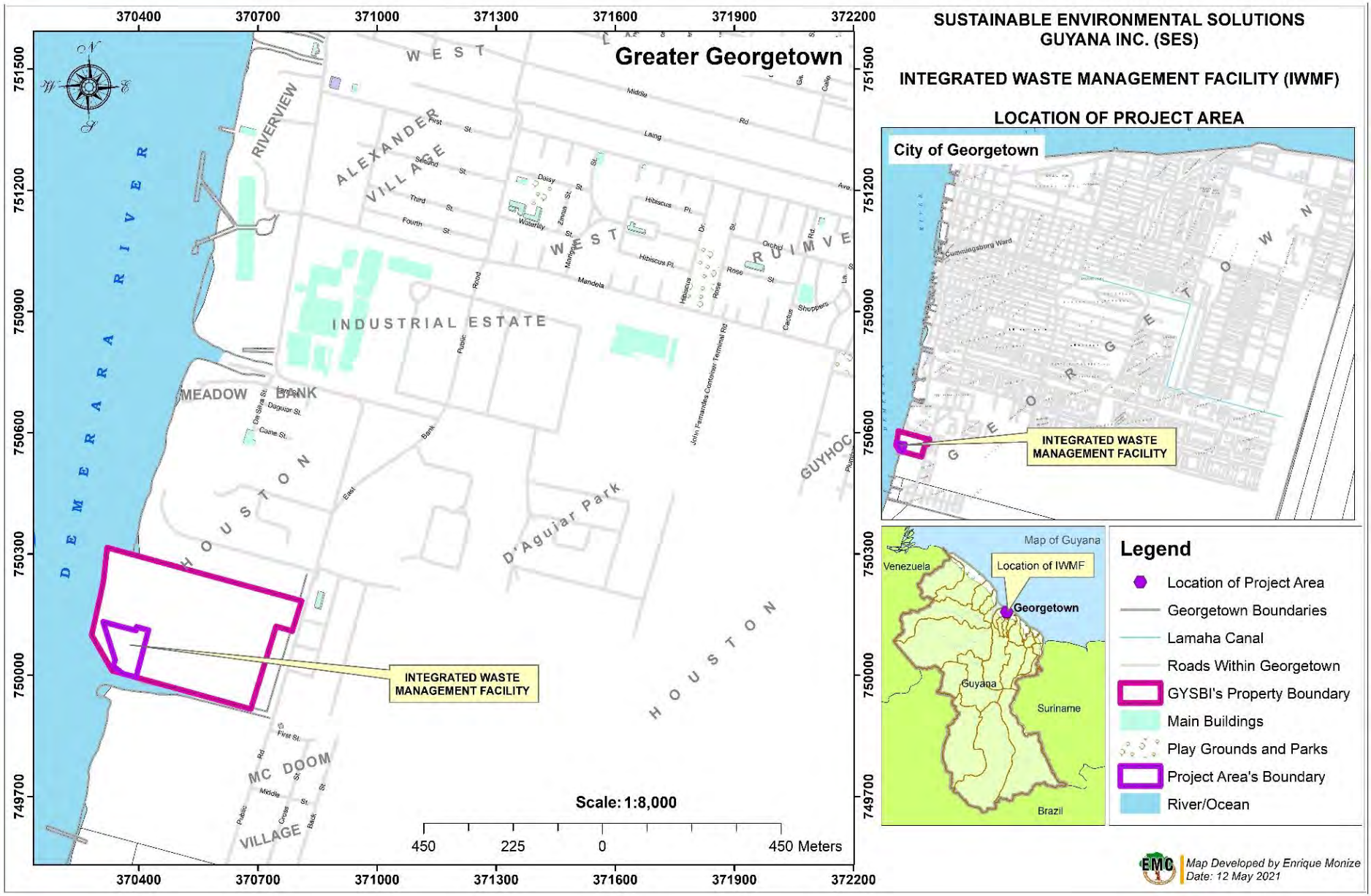

Figure 2-1: Location of the IWMF in the GYSBI Compound

2.4 Waste Streams

The following waste streams can potentially be received for treatment by the Integrated Waste Management Facility (Table012-1).

Table 2-1: Proposed Waste Streams (By Type)

Waste Category	Description
Non-Hazardous Wastes	General and domestic trash, incinerator ash and residue (once tested), production solids (scale, sand), dry filters, abrasive blast media, filter media, desiccant/drying agents.
Recyclable Materials	Wood, paper, cardboard, glass, aluminium cans, plastic, scrap metal including metal packaging, clean empty steel drums, empty/punctured aerosol cans.
Hazardous Waste (Liquids)	Used lube/motor oil, contaminated hydrocarbons (crude, diesel, etc.), oily water, contaminated water-based drilling fluid, non-aqueous drilling fluid, drilling slops, well treatment and completion fluids, waste brines, treatment chemicals, liquid paint waste, drum/container rinse, acid and caustic solutions, hydraulic fluid.
Hazardous Waste (Solids)	Production solids and sludges, oily trash/debris, oily/wet filters, drums/containers with chemical residues, dried paint waste, consumables (non-empty aerosol cans, oil filters, grease tubes, dope brushes).
Special Hazardous Wastes	Medical/biological waste, batteries (including alkaline, lead-acid, nickel-cadmium), fluorescent light bulbs and ballasts, mercury and mercury-containing equipment, radioactive waste including Naturally Occurring Radioactive Material (NORM), electronic waste.

These wastes will be transported in a variety of receptacles and containers which may vary, but will mostly be drums (barrels), skips (dumpsters) tanks and bulk bags. Wastes will include solids, liquids and sludges.

The rate of generation of these wastes and their provenance will vary as the offshore production activities expand and develop, but the general range of wastes that can be expected (as set out above) should not vary throughout the lifetime of the operation.

2.5 Project Infrastructure

The installation of the IWMF has progressed in accordance with the Construction Permit issued by the EPA. All project components will be located on hardstanding engineered pads. The general infrastructure elements of the facility are as follows:

- **Office Building and Laboratory**: Located in two 40-foot shipping containers. EEPGL will audit and approve labs used to analyze EEPGL's waste and other materials.
- **Incoming/Outgoing Waste Storage Area**: Constructed on hardstanding engineered concrete pad.

- **Workshop:** Maintenance and repair workshop to support on-site activities.
- **Non-Hazardous Waste Storage Area:** Storage, shredding and sorting of non-hazardous waste streams (wood, metal and plastic). Domestic wastes separated for off-site disposal.
- **Liquid Tank Farm:** A concreted, bunded area consisting of six above ground liquid storage tanks.
- **Incineration:** Incineration of mixed hazardous waste streams.
- **Hazardous Waste Treatment Area:** Storage and sorting of hazardous waste streams. Crushing and baling of clean/empty drums.
- **Container Storage Area:** Storage of waste containers.
- **Container Washing Area:** Automated drum and IBC washing equipment.
- **Decanter Centrifuge:** Treatment of slops and sludges to separate solid and liquid phase materials.
- **Wastewater Treatment Area:** Treatment of oily water residues and washings.
- **Hot Oil Thermal Desorption Unit (HTDU):** Treatment of drill cuttings to enable recovery of oil, water and separation of cuttings.

The layout of project infrastructure is presented in Figure 2-2.

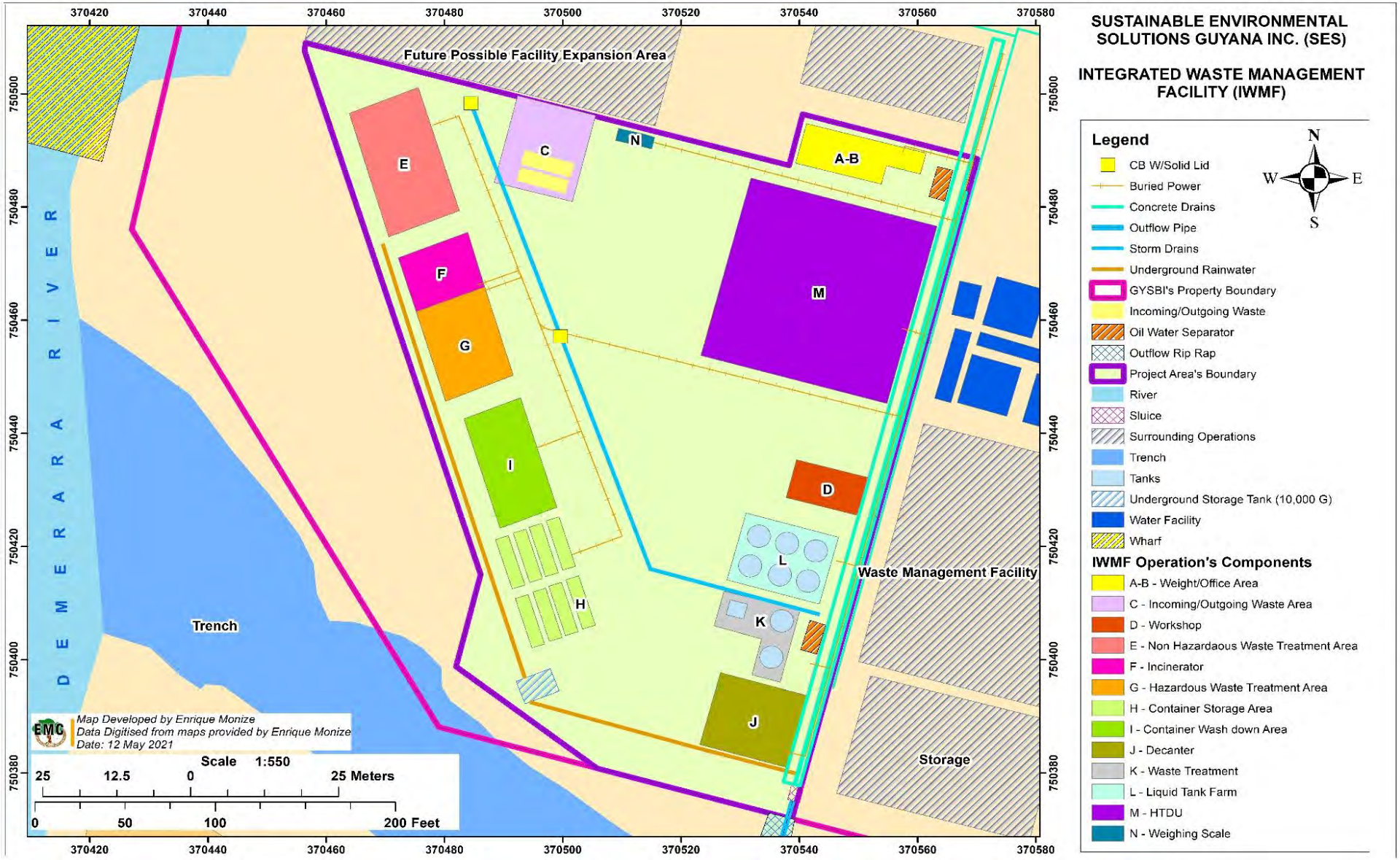

Figure 2-2: IWMF Site Layout

2.6 Pre-Acceptance of Waste

To prevent the acceptance of unsuitable wastes which may lead to adverse reactions or uncontrolled emissions, systems and procedures will be in place to ensure that wastes are subject to appropriate technical appraisal on the offshore facilities, prior to being shipped to GYSBI for treatment by the IWMF. This ensures their suitability for the proposed treatment route and ensures effective treatment.

It will be the responsibility of the waste managers on the offshore facilities to ensure that all wastes that are being sent to the IWMF are properly characterised and described. This will be based on generator processes and process knowledge, review of manufacturer's Material Safety Data Sheets (MSDSs), product specifications, and select laboratory testing and analysis, as required to ensure the hazards are known for each waste including whether they are flammable, corrosive (acid or base), reactive (oxidizer, pyrophoric, reducer), and/or toxic.

In addition, prior notice of this information is expected to be provided to SES before any decision is made to accept waste. Only known quantified waste streams will be accepted on to the site. Wastes will not be accepted without a clear method or defined treatment and disposal route. In other words, the site will not be used for storage of wastes that have no defined treatment path.

All waste consignments designated for treatment at the facility will have to be pre-notified to the facility so that SES is aware of which wastes are coming in with each consignment. Where necessary, samples of the proposed waste stream will also have to be sent to SES for analysis and treatment trials in the on-site laboratory before full consignments of the waste are allowed. Samples are expected to be packaged in appropriate containers and properly labelled. A chain of custody form (manifest) must accompany all samples during transport. The pre-acceptance process will also be used to confirm before shipping that there is sufficient storage and treatment capacity at the IWMF for the incoming wastes to avoid building up a backlog on the site.

There should, in theory, be no unauthorised or unidentified wastes arriving at the IWMF, but SES has no control or oversight of the production, management and loading of the wastes prior to it reaching the reception area. Consequently, there will be a waste quarantine procedure and designated storage area in the event of an unexpected, unidentifiable or mis-labelled waste consignment arriving at the IWMF.

2.7 Waste Acceptance Procedure

As the incoming waste streams are from a single source, the bulk of the characterisation work would have already been undertaken prior to shipping and the waste types, generally, are expected to be consistent. Nonetheless, a clear, robust Waste Acceptance Procedure will be in place to ensure proper Duty of Care in the management of the received wastes.

Prior to arrival at the IWMF waste loads shall be weighed using the weighbridge located within GYSBI, unless alternative reliable volumetric systems linked to specific gravity data are available.

Supporting analytical results are necessary to initially profile and characterize a waste stream. The following analytical tests will commonly be performed:

- Flashpoint
- pH
- Toxicity (Toxicity Characteristic Leaching Procedure [TCLP] metals, and in some cases volatiles)
- Reactivity (reactive sulphides, reactive cyanides)

Loads shall not be accepted into site unless sufficient storage capacity exists, and the site is adequately staffed to receive the waste. All transfer documents and container labelling will be checked for consistency with the pre-acceptance waste manifest and approved prior to off-loading. Any discrepancies will be resolved before the waste is accepted on to the site for either storage or processing. Arrival of unknown streams are considered highly unlikely but provision of a temporary quarantine area is to be provided to allow for further investigation (sampling, checking and testing).

Wastes that do not appear to be manifested or which appear to be unidentifiable or mis-labelled will be taken to the designated quarantine area and designated as hazardous until further testing fully characterises these wastes.

Any such non-conformances will be communicated forthwith to EEPGL's designated waste manager and, once properly characterised, the two parties (EEPGL and SES) will agree on an appropriate treatment strategy for this waste. If it is determined that the waste cannot be treated at IWMF, it will be sent on to an appropriate third-party waste processing facility and the EPA will be notified. A documentary record will be kept of all received, rejected and transferred wastes.

Once it has been determined that the waste is suitable for treatment at the IWMF, SES will utilise formal systems and procedures to ensure that wastes are transferred to appropriate storage arrangements in the respective treatment areas in a safe manner. Equipment available on-site will include electric forklift truck (1-ton), diesel forklift truck (5 ton), diesel forklift truck (16 ton). The fork-lift truck will have pallet and individual drum handling capabilities.

Spill response kits will be available at strategic locations across the facility and staff will be trained in their use.

It should be noted from the outset that the facility does not have the capacity to receive and treat Naturally Occurring Radioactive Material (NORM), which is often associated with the offshore exploration and production industry. The IWMF has the ability to monitor for the presence of NORMS in the waste streams, but the treatment of NORMS is not one of the contracted services with EEPGL. In the event NORMS do arise and require to be handled, this would be a separately negotiated contract and would involve the transhipment of such wastes to a third-party facility.

2.8 Waste Storage

All incoming waste streams shall be stored before treatment. The storage arrangements are outlined below.

2.8.1 Incoming/Outgoing Waste Storage Area

An engineered, stabilized, gravel waste reception and storage pad is located near to the site entrance. The pad will be used for the temporary storage of incoming (solid) wastes located within primary containers before further internal movements. The pad will also be used for the temporary storage of outgoing residual waste streams. The surface will be impermeable to rainwater and spillages. All drainage from this area will be directed to an interceptor with a penstock valve.

2.8.2 Non-Hazardous Waste Storage Area

A non-hazardous waste storage area is located wholly within a fully enclosed metal clad portal framed building located on the western side of the site. The building is constructed on a fully engineered concrete surface. Waste streams initially stored within this area could include:

- Scrap metal, including metal containers

- Scrap wood
- General and domestic trash including food wastes
- Barite, cement, or other bulk solids
- Paper
- Cardboard
- Glass
- Plastic, including plastic containers

2.8.3 Hazardous Waste Storage Area

A hazardous waste storage area is located wholly within a fully enclosed metal clad portal framed building located on the western side of the site. The building is constructed on a fully engineered concrete surface. The storage area has bunded bays to contain drips and spillages and flammable and non-flammable solids will be kept separate, as well as other identified hazardous waste streams where there may be compatibility concerns. This facility is also be used for bulking materials to gain volume efficiencies in advance of their treatment. Waste streams initially stored within this area include:

- Hydrocarbon contaminated liquids (waste oil, oily water, vessel tank cleaning liquids)
- Hydrocarbon contaminated solids (oily debris, filters, rags)
- Chemical contaminated liquids
- Chemical contaminated solids
- Used engine oil, lube oil, hydraulic oil and cooking oil
- Empty containers, metal and plastic (small kegs, IBC totes)
- Liquid brines or other liquid waste from or by-products created during liquid mud manufacturing, conditioning, and re-conditioning (process wastewaters) from third party liquid mud plant facilities located in Guyana
- Biohazardous waste (medical waste)
- Special hazardous waste (including fluorescent bulbs, batteries, aerosol canisters, electronics and asbestos)

It is important to note that bulk hazardous liquids will not be delivered to this area but rather be directed straight to the bulk storage arrangements.

2.8.4 Liquid Tank Farm

An engineered liquid tank farm (with secondary containment) is located near to the eastern site boundary. The tank farm consists of 6 x 20,000-gallon above ground liquid storage tanks. These are located within an engineered secondary containment system capable of holding 110 percent of the capacity of the largest tank.

2.9 Waste Treatment

Waste treatment involves a change in or modification to the characteristics of a substance to make it suitable for another means of disposal. A range of treatment techniques are utilised at the facility tailored to address the specific EEPGL waste streams. These are described below.

2.9.1 Drilling Muds – Hot Oil Thermal Desorption Unit

The Hot Oil Desorption Unit (HTDU) for treating drilling muds is located wholly within a partially enclosed metal clad portal framed building located on the eastern side of the site. The building is constructed on a fully engineered concrete surface. The operations of the HTDU are supported by a diesel tank and a water tank (15 cubic meters) for fire response.

Drilling wastes delivered to the IWMF will be stored in 11 pre-cast storage bins, fully bunded and separated by waste type. Provision has been made in the facility to store up to 322 cubic meters of waste in the storage bins. The materials to be processed are:

- Drilling slops, spent non-aqueous drilling fluids, and other fluids from offshore drilling activities (may include small volumes of cuttings).
- Non-aqueous fluid wet solids from fluids filtration activities.
- Non-aqueous centrifuge solids from drilling mud reconditioning activities.
- Other waste solids from or by-products created during liquid mud manufacturing, conditioning, and re-conditioning at third party liquid mud plant facilities located in Guyana.

The drill cuttings are fed into the processing chamber of the HTDU, where the rotating heat exchanger (rotor) heats up the cuttings via indirect heat. Indirect heating is accomplished through the circulation of heated oil, as well as using electrical heating elements. This design avoids the possibility of direct fire exposure to the equipment.

The first section of the rotor evaporates water from the cuttings, while the subsequent section evaporates oil from the cuttings at temperatures up to 500°C. A condenser liquidizes the evaporated water and oil which then flow into the water/oil separator. The solids are discharged at the end of the process, where they are then cooled and mixed with recovered water to avoid dust emissions when fed into a solids container. The management process for residual wastes generated by the HTDU is presented in Table 2-2.

Table 2-2: HTDU Residuals Management

Material	Treatment and Storage	Destination
Solids	Dry solids collected in skips. Loaded on to trucks for off-site disposal. Where necessary, some of the solid residues may be reused as a bulking agent for incoming wastes with a high moisture content but all off-site disposal will be to landfill.	Landfill
Recovered Water	Collected in 2 x 5-cubic meter settlement tanks. The materials are then moved to a 1 x 30-cubic meter storage tank before movement to the water treatment vessel.	Wastewater Treatment Plant
Recovered Oil	Collected in 2 x 5-cubic meter settlement tanks and then moved to a 1 x 30-cubic meter storage tank.	HTDU Heating, Incinerator

Appendices F-1 to F-3 provides further information on the operation of the HTDU as follows:

- Appendix F-1 – Summary of the key technical aspects of the HTDU Treatment Process.
- Appendix F-2 – Outlines the treatment technology and emission values.
- Appendix F-3 – Flow Diagram for the HTDU Process.

2.9.2 Drilling Muds – Decanter/Centrifuge System

In addition to the HTDU, drilling wastes could (if required) be treated using the standalone decanter/centrifuge system that will act as a back-up treatment solution to treat selective Synthetic Based Muds (SBMs), oily slops/sludges and muds that could not otherwise be treated via the Offshore Mechanical Cuttings Cleaner Hammermill System. The unit is a containerized SAS MIST 220 Decanter/Centrifuge system. A technical description of the SAS MIST system is provided in Appendix F- 4 and a simplified process flow is presented in Figure 2-3.

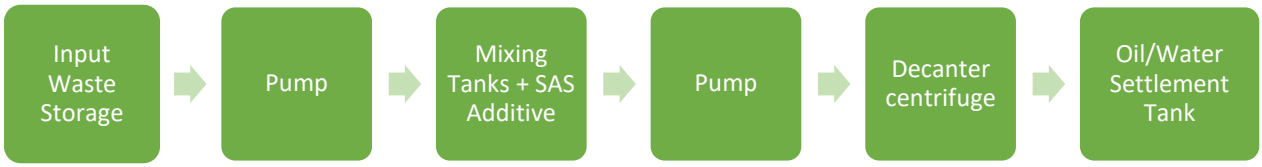

Figure 2-3: SAS MIST System Process Flow

The system is designed to provide optimum performance when combined with proprietary chemistries that allow wastes fed into the system to be separated and treated. The unit has a Programmable Logic Controller (PLC) System coupled with a sophisticated Human Machine Interface. The combination of these systems provides an efficient means of removing solids prior to centrifuging and reclaiming oil and water from drilling waste slops and tank bottom sludges.

The management process for residual wastes generated by the decanter/centrifuge system is presented in Table 2-3.

Table 2-3: Decanter/Centrifuge Residuals Management

Material	Treatment and Storage	Destination
Solids	Dry solids collected in skips. Loaded on to trucks for off-site disposal.	Landfill
Recovered Water	Taken to wastewater treatment plant for further treatment.	Wastewater Treatment Plant
Recovered Oil	Stored and recovered.	HTDU heating, Incinerator

2.9.3 Hazardous Waste Treatment – Incineration

The installation includes a standalone hazardous waste incinerator (Addfield C200) located wholly within an enclosed metal clad portal framed building located on the western side of the site. The building is constructed on a fully engineered concrete surface.

The unit has been selected to accept the following waste streams:

- Solids – Aerosol cans, chemical sacks, consumables (greases, tubes, dope, brushes), contaminated filters, medical waste, oily debris (rags, absorbent pads), paint.
- Liquids – Contaminated fuel, lubricants, cooking oil, hydraulic/transmission fluids, motor oil.

The incinerator includes a solid feed facility (comprising of a pneumatic driven ram feeder unit to direct solid waste materials into the incinerator combustion chamber on a continuous basis) and a waste oil burner and heat oil tank to deal with waste oils generated on-site. The C200 was designed and manufactured to meet and exceed many of the world's strictest regulations. It is Conformitè Europëenne (CE) certified and adheres to full European Union (EU) and World Health Organisation (WHO) standards. Appendix F-5 further information and schematics of the incinerator.

The incinerator is designed to process hazardous and clinical waste at a burn rate of up to 200 kilograms per hour. The cylindrical chamber with its four burners optimises airflow and directs the heat energy directly to the heart of the waste allowing this to be incinerated in an efficient manner. The primary chamber is rounded which helps to eliminate any cool spots and actively encourages the optimal circulation of energy inside the chamber. Additionally, the C200 benefits from a specially adapted floor which improves the air injection below the waste alongside having an additional air

curtain above the waste which circulates the oxygen throughout the chamber. This ensures a stronger burn cycle and reduces the amount of fuel required. The primary loading chamber for incinerating the waste leads to a secondary chamber, which further processes any gasses with a two-second retention time.

The flue gases would be ducted from the secondary chamber outlet plenums and directed via the hot gas duct into the Venturi reactor unit (filtration system). Particle and gas removal occurs in the diverging section as the inlet gas stream mixes with the plume of tiny liquid droplets. The inlet stream then exits through the diverging section, where it is forced to slow down. Venturi can be used to collect both particulate and gaseous pollutants. These are collected at the base of the scrubber in a settling tank. The tank is equipped with an automatic levelling system and a drain for wastewater. One directly mounted, self-supporting, chimney fabricated from rolled mild steel plate with a fully insulating internal refractory lining will be fitted to the building. The chimney would be designed to safely evacuate the incinerator flue gases and would be manufactured in four sections to provide an outlet height of eight metres from skid level.

The sorbent material, a liquid based caustic soda would be stored in an individual 500-litre tank that is located near to the Venturi. Caustic Soda would be controlled by a powered solenoid metering system. An inline feed would allow measured quantities of liquid to enter the Venturi tank. Metering would depend on the pH level of the tank water.

The C200 comes with the additional benefit of data-logging as standard. This enables the monitoring of performance and how it reacts to make sure that it is burning successfully. The PLC based control system is designed to provide the fully automated sequencing and individual control of the whole plant. The system would comprise of the main motor and burner control gear and a PLC unit interlinked to each other and other various plant wide signalling devices. The complete system would be housed within a single cubicle, which would be skid mounted adjacent to the material storage silo.

At the end of each cycle, the remaining ash residues (typically less than three percent of the original volume) can be safely removed prior to the next load being entered and the cycle repeated once again. The management process for residual wastes from the incinerator is outlined in Table 2-4.

Table 2-4: Incinerator Residuals Management

Material	Treatment and Storage	Destination
Solids	Dry solids collected in skips. Loaded on to trucks for off-site disposal.	Landfill

2.9.5 Wastewater Treatment Plant

The on-site wastewater treatment plant (WWTP) is designed predominantly for the treatment of oily water that contains variable amounts of oil. The process is designed to adapt automatically according to the oil level in the inlet water and the oil which is removed from the water can be recycled for other purposes. The schematics of the WWTP are presented in Appendix F-6.

The primary process stages as follows:

- **Coarse Screen**: In first phase a coarse screen is used for separating the mud and soil from the inlet water stream.
- **Oil/Water Separation**: In the second phase natural separation of the oil and water occurs in the inlet storage tank. On the bottom of the tank a Lamor industrial skimmer will skim the floating oil from the surface and this oil is discharged to the separation unit.

- **Flotation Unit**: In the third phase the water is led to the two-phase flotation unit where the oil is separated in two different flotation units. During this process phase the pH is adjusted to match the optimal coagulation pH-value. The oil from the first flotation phase will be discharged to the oil/water separator.

- **Final Polish**: After the flotation unit the pH will be adjusted (pH 6.5 to 9.0) and the water is directed through a reverse osmosis unit before discharge. Discharges will be routinely monitored.

Discharge from the WWTP will be to the local surface drainage system. The IWMF's drainage system is presented in Appendix E.

2.9.6 Waste Container Processing

A waste container processing area is located wholly within a fully enclosed metal clad portal framed building located on the western side of the site. The building is constructed on a fully engineered concrete surface. General waste containers; IBC's and 205-litre drums will be processed and CCUs will be washed. It will be configured to rinse and capture (via interceptor) all collected wastewater which in turn will be sampled and analysed to determine its treatment via the wastewater treatment facility.

The IBC Washing Unit is self-contained. IBCs are washed with chemical detergents. The rinse cycle collects the treated washdown water which will then be treated through the wastewater treatment process. A roller conveyor is attached to the pre- and post-wash cycle to aid the positioning of the IBC on and off the wash unit. The unit for washing the 205-litre drums is also a self-contained unit that utilises chemical detergents. The rinse cycle collects the treated washdown water which will then be treated through the wastewater treatment process. Appendix F-7 presents additional details and schematics for these washing units. The process for managing residual wastes from the waste container processing is set out in Table 2-5.

Table 2-5: Waste Container Residuals Management

Material	Treatment and Storage	Destination
Liquids	Wash water from drum and IBC cleaning.	WWTP
Solids	All cleaned containers.	All metal residues will be sent for recycling, other non-recyclable solid residues will be landfilled.

2.9.7 Shredder

The shredder is designed to receive bulk wood and plastics and will size reduce residual waste generated from the site activities in advance of transport to landfill. The shredder will be fitted with a hopper that can accommodate up to 1200 x 1000 millimeter waste materials. Materials will be passed through the shredder and conveyed into a standing Roro container for landfill. See Appendix F-8 for further information and schematics of the shredder.

2.9.8 Drum Crusher

The drum crusher is designed to accept drums and containers up to 210L and will be used to scrap metal and plastic drums once they have been washed out. See Appendix F-9 for further information and schematics of the drum crusher.

2.10 Project Design Life and Employment

The IWMF is expected to have a lifespan of 10– 5 years.

The operation will be 24 hours consisting of two 12 hour shifts. Each shift will require approximately 18 staff to support the operations.

3.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The IWMF project is required to be in compliance with Guyana's national environmental and energy related policies, strategies, plans, legislation and institutional framework. These are outlined in Table 3-1 below.

Table 3-1: Relevant Legislation, Policies and Strategies

Strategies and Plans	National Development Strategy (1997)
	National Environmental Action Plan (1994/2000)
	National Solid Waste Management Strategy (undated)
Legislation	The Constitution of the Cooperative Republic of Guyana
	Environmental Protection Act (1996)
	Environmental Protection Authorizations Regulations (2000)
	Environmental Protection Air Quality Regulations (2000)
	Environmental Protection Water Quality Regulations (2000)
	Environmental Protection Noise Management Regulations (2000)
	Environmental Protection Hazardous Wastes Management Regulations (2000)
	Environmental Protection (Litter Enforcement) Regulations (2013)
	EPA Guidelines for Environmental Management Plans
	Pesticides and Toxic Chemicals Control Act (2000)
	Pesticides and Toxic Chemicals Control Regulations (2014)
	Municipal and District Councils Act (1969)
	Public Health Ordinance (1934)
	Labour Act (1942)
	Occupational Safety and Health Act (1997)
Institutional Framework	Environmental Protection Agency (EPA)
	Georgetown Mayor and City Council
	Ministry of Local Government and Regional Development - Department of Solid Waste

3.1 Relevant Policies, Strategies and Plans

The importance of environment and energy to national development is reflected in the prominence and priority of these areas in several development policy documents and strategies over the last twenty plus years.

3.1.1 National Development Strategy

In 1997, the National Development Strategy (NDS) was launched and outlined objectives and fundamental policy conditions for the country's development process over the next decade. Volume 3 (Chapters 18 and 19) provided an overarching national policy framework and priorities for environmental management. The environmental policies promoted the sustainable management of natural resources and the preservation of a healthy environment as an integral part of Guyana's development agenda. Environmental protection was framed as a proactive undertaking in which natural resources would be managed sustainably and the Strategy incorporated guidelines for management of these resources including fisheries and forests. It also prioritised avoiding contamination and cleaning up of pollution.

Improved management of liquid wastes, solid wastes, and industrial and other wastes was one of the key environmental issues considered in the NDS. The Strategy recognizes that significant improvements are required for the management of industrial wastes, which may include hazardous

waste constituents, to improve monitoring and control of waste disposal measures. Waste streams and pollutant characteristics for several types of industrial activities were considered in the NDS. However, waste treatment facilities were not considered in the NDS. The Strategy prioritized pollution abatement that focused on maximum permissible limits over a specified time period. Limits were considered to be imposed by source, by environmental receptor or by characteristics of pollutants. In addition, the Strategy noted the important of direct controls over disposal of industrial wastes to reduce pollution and impacts on the environment. It also proposed the establishment of the EPA through the passage of the Environmental Protection Act.

The Strategy also covered the areas of liquid and solid waste management, coastal zone management, forest management, fisheries management, mining policies, Amerindian concerns, urban water supply, pesticide management, and protection of biodiversity, among others, as well as the institutional and legal aspects related to those issues.

3.1.2 National Environmental Action Plan

The Government of Guyana (GoG) outlined its environmental policy objectives for the sound management of the environment and natural resources in the National Environmental Action Plan (NEAP), developed in 1994 and updated in 2000. The NEAP outlined several policy objectives, one of which calls for the GoG to ensure that relevant parties conduct environmental assessments for proposed development activities that may significantly affect the environment. In keeping with this environmental policy objective, the Environmental Protection Act was introduced in June 1996 and established the legal framework for authorizing development activities. Further, the Act established the EPA and outlined the legal process for sustainable and effective management of the environment and its resources.

The NEAP recognised that environmental degradation, poor sanitation, public health risks and the negative impacts which have resulted from improper and ineffective integrated waste management strategies, are easily discernible along the heavily populated coastal belt, in all major towns, urban and rural areas, villages, and in unstructured settlement developments. These situations are further compounded by several factors including the absence of a national policy or strategy to effectively deal with integrated waste management and poor infrastructure and services for collecting, transporting, treating and disposing of waste including special hazardous waste. One of the actions recommended in the NEAP to improve waste management is to promote and encourage private sector investment initiatives in waste management and disposal. The implementation of SES IWMF supports this action.

3.1.3 National Solid Waste Management Strategy (undated)[2]

The National Solid Waste Management Strategy (2013 to 2024) aims to provide a roadmap for reducing and improving the management of wastes in Guyana. It sets out a vision for solid waste management in Guyana as "*Informed communities participating in a nation-wide, integrated, and financially self-sustaining waste management and resource recovery system that preserves public health and the environment, realises maximum value from resources, and minimises long-term costs to households, industry, and government."* In order to achieve this vision, the Strategy outlines several goals and targets that were designed to build on initiative already being implemented by the Government. The Strategy also developed a framework for monitoring and evaluating the success of its implementation and in this regard, has outlined key performance indications to track progress towards achieving its goals.

[2] Ministry of Local Government and Regional Development, undated. Putting Waste in its Place: A National Solid Waste Management Strategy for the Cooperative Republic of Guyana (2013 – 2024)

Although the Strategy has been adopted by Government, it cannot be fully implemented until the Solid Waste Management Bill is passed by the National Assembly. The Bill proposes the establishment of a Solid Waste Management Authority as a corporate body under the Ministry of Local Government and Regional Development to oversee and coordinate all policy, operational and licencing aspects of solid waste management in Guyana. As such, full implementation of the targets and achievement of key performance indicators outlined in the Strategy will require the Solid Waste Management Bill to give them effect.

3.2 Legislative and Regulatory Framework

Several laws guide the energy and environment sectors in Guyana. These include the Constitution of Guyana with amendments, the Environmental Protection Act, and Environmental Protection Regulation. Other natural resources legislation is important to this project such as the Occupational Safety and Health Act. This body of legislation offers a robust legal framework for the management of the environment and energy sectors.

3.2.1 The Constitution of the Cooperative Republic of Guyana (1980 and 2003 Reforms)

The Constitution of Guyana is the highest governing legal document and supreme law for the country. The importance of protection and management of the environment is also well recognized and given particular attention to environmental related principles. This is outlined as follows:

- Article 25: "*Every citizen has a duty to participate in activities to improve the environment and protect the health of the nation*."
- Article 36: "*The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals*."
- Article 149J: (1) "*Everyone has the right to an environment that is not harmful to his or her health or wellbeing*."
- Article 149(J): (2) "*The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:*
    - *Prevent pollution and ecological degradation;*
    - *Promote conservation;*
    - *Secure sustainable development and use of natural resources while promoting justifiable economic and social development.*"

3.2.2 Environmental Protection Act (1996 and 2005 Amendments)

The Environmental Protection Act establishes the basic institutional and regulatory framework within which all activities that may significantly impact on the natural, social, and cultural environments are assessed. The Act provides for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development on the environment and the sustainable use of natural resources. The Act also provides that the EPA will be the central coordinating agency for environmental management in the relevant sectors in Guyana. The Act outlines the environmental authorisation process for new or existing projects being modified. In 2020, the EPA issued a Construction Permit to SES for the IWMF at GYSBI. In 2021, the EPA indicated that an Environmental Management Plan is required to facilitate the issuance of an Operation Permit for the IWMF.

3.2.2.1 Environmental Protection Regulations

There are several subsidiary Environmental Protection Regulations to the Environmental Protection Act. These Regulations were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of both

new and existing activities to these Regulations by issuing the required authorizations and monitoring their operations.

Environmental Protection Authorizations Regulations (2000)

The Environmental Protection Regulations outline the requirements for applications for an environmental authorisation and the rules governing the issuance of such authorisation. Environment authorisations typically have specified conditions which with Permit Holders must comply so as to avoid, minimise, and mitigate environmental impacts.

Environmental Protection Air Quality Regulations (2000)

The Air Quality Regulations apply to operations that emit any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or other institutional activity. Under these Regulations, such operations are required to apply to the EPA for an environmental authorization at least ninety days before the date on which the emission is to commence. In accordance with the Regulations the EPA shall establish the desirable air pollution limits. Currently, there are no nationally determined or established air quality standards. However, the Agency is guided by and utilises air quality guidelines reputable international organisations from the World Health Organisation (WHO) and United States Environmental Protection Agency (USEPA) among others. Table 3-2 below shows the WHO Air Quality Guidelines.

Table 3-2: WHO Air Quality Standards

Element	Averaging Period	Acceptable Limit
Particulate Matter (PM 10)	24-hour	50 g/m^3
Particulate Matter (PM 2.5)	24-hour	25 g/m^3
Sulphur Dioxide	24-hour	20 g/m^3
Ozone (O_3)	8-hour	100ug/m^3
Nitrogen Dioxide	1-hour	40ug/m^3

However, SES has proposed to utilise Directive 2000/76/EC of the European Parliament and of the Council of December 04, 2000 for the incineration of waste. This guideline is to be used for indication purposes only. The emission limits for each waste types are presented in Tables 3-3 and 3-4.

Table 3-3: Air Quality Guidance Limits for Hazardous and Medical Waste

Parameters	Limits (half hour average)	Measured
Total dust	30 mg/m3	12 mg/m3
Sulphur dioxide (SO2)	200 mg/m3	2,4 mg/m3
Nitrogen monoxide (NO) and nitrogen dioxide (NO2), expressed as nitrogen dioxide	400 mg/m3	60 mg/m3
Carbon monoxide (CO)	100 mg/m3	98,3 mg/m3

Table 3-4: Air Quality Guidance Limits for General Waste

Parameters	Limits (half hour average)	Measured
Total dust	30 mg/m3	17,8 mg/m3
Sulphur dioxide (SO2)	200 mg/m3	7,5 mg/m3
Nitrogen monoxide (NO) and nitrogen dioxide (NO2), expressed as nitrogen dioxide	400 mg/m3	88,3 mg/m3
Carbon monoxide (CO)	100 mg/m3	84.00 mg/m3

Environmental Protection Water Quality Regulations (2000)

The Water Quality Regulations require all operations that will discharge effluents during construction, installation, operation, modification or extensions to obtain environmental authorization. The Regulations also outline the requirements and guidelines on the discharge of effluents and disposal of sludge. Moreover, the Guyana National Bureau of Standards (GNBS), in collaboration with the EPA and other relevant stakeholders, have developed *Interim Guidelines for Industrial Effluent Discharges into the Environment*[3]. Currently, these Guidelines provide maximum allowable limits for 16 parameters and are used by the EPA to inform permissible limits for effluents discharged into the environment. These guidelines may be supplemented by additional surface water quality guidelines including Mining (Amendment) Regulation[4] and from reputable international agencies such as the USEPA. The maximum allowable limits for parameters outlined in the standards which are deemed relevant to the project are outlined in Table 3-5.

Table 3-5: Parameters and Maximum Allowable Limits

Parameters	Maximum Allowable Limits
pH	5.0 to 9.0
Temperature	<40°C
Dissolved Oxygen	5 mg/L
Total Suspended Solids (TSS)	<50 mg/L
Biological Oxygen Demand	<50 mg/L
Chemical Oxygen Demand	<250 mg/L
Oil and Grease	<10 mg/L

Environmental Protection Noise Management Regulations (2000)

Under the Noise Management Regulations, operations that emit noise in the execution of various activities such as construction, transport, industry, commerce and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction and other areas. The EPA may grant authorization for noise emission unconditionally or subject to conditions and may require environmental audit procedures. The GNBS, in collaboration with the EPA and together with other relevant institutions, developed a standard that provides *Guidelines for Noise Emissions into the Environment*[5] as shown in Table 3-6.

Table 3-6: Decibel Limits for Various Activities

Type of Activity	Day Time Limit (dB)	Night Time Limit (dB)
Residential, Institutional, Educational	75	60
Industrial, Transportation	100	80
Commercial	80	65
Construction	90	75
Recreational	100 (18:00 to 01:00hrs)	75 (01:00 to 08:00hrs)

3 Guyana National Bureau of Standards, 2002. GYS 207:2002. Interim Guidelines for Industrial Effluent Discharge into the Environment.
4 The Mining (Amendment) Regulation is the only national guideline that establish permissible effluent limits for Turbidity.
5 Guyana National Bureau of Standards, 2010. GYS 263:2010. Guyana Standard. Guidelines for Noise Emissions into the Environment.

Environmental Protection Hazardous Waste Management Regulations (2000)

The Hazardous Waste Management Regulations outline the rules and procedures for transport, storage, treatment and disposal of hazardous waste and are intended to ensure, through the environmental authorization process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. Hazardous waste is defined as are several different categories of hazardous wastes (including clinical wastes, flammable waste, incinerator wastes and liquid industrial wastes). A schedule of materials considered hazardous is provided in the Regulations.

For new operations, the regulations states that "*Any person who proposes to operate a facility that generates, transports, treats, stores or disposes of hazardous waste, shall, before commencing any action related thereto, submit an application to the Agency for an environmental authorisation within three years of the commencement of these Regulations or such other time as the Agency may determine*". SES has submitted an application to the EPA in June 2020 for Environmental Authorisation of the IWMF. The Agency can refuse to grant an environmental authorisation if it determines that:

I. The transportation arrangements, whether by land, sea or air are inadequate and present a serious risk of injury or damage to human health or the environment;
II. The storage, treatment, operation or disposal methods present a serious risk of injury or damage to health or the environment; or
III. The staff or contractors engaged in the handling of such wastes are not technically trained to perform the relevant tasks.

An Emergency Preparedness Plan is required for any hazardous waste facility. This plan must identify the mechanisms that would be implemented to minimize hazards from fires, explosions or accidental releases of hazardous waste. The emergency preparedness plan must be communicated to staff and contractors of the facility and should include the information on accident prevention procedures; first person response; notification procedures; location of clean-up equipment; an analysis of potential accidents and responses; materials safety data sheets for all materials which could be spilled.

These Regulations also apply to any activity that generates hazardous wastes.

Environmental Protection (Litter Enforcement) Regulations (2013)

These Regulations provide for the enforcement against litter offences. It is an offence under these regulations to place litter in a public place, permit or cause another person to litter a public place or have litter on private premises that pose a health risk. The fine for an individual found littering in a public place is GYD $50,000, while for body corporate it is GYD$100,000. A fixed penalty of fifteen thousand dollars (GYD $15,000) is offered to offenders who accept liability for the offence committed. Under the Litter Prevention Regulations, the Neighbourhood Democratic Councils (NDCs) and Regional Democratic Councils (RDCs) are to provide receptacles in public places. Further, every Council shall make appropriate provision for the prompt, efficient and regular emptying of the contents of the receptacles and for the removal and disposal of those contents.

3.2.2.2 Environmental Management Plan (EMP) Guidelines[6]

The EPA has established Guidelines for the Preparation of Environmental Management Plans (EMP). An EMP seeks to identify and assessment potential impacts of project and provide methods and procedures for mitigating and monitoring impacts. According to the Guidelines, an EMP can be defined

[6] Environmental Protection Agency, 2013.Environmental Guidelines for the Preparation of an EMP. Pages 2 to 3.

as *"an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented, and that the positive benefits of the projects are enhanced*". An EMP is recognised as a tool that can be used to provide assurance that developers make suitable provisions for counteracting negative impacts that occur through project implementation and operation, and contains environmental objectives/targets which the developer needs to accomplish in order to reduce or eliminate negative impacts.

The objectives of the EMP are to:

- Place the proposed or existing activity in the context of the local and regional environment.
- Adequately describe all components of the proposed/ existing activity, so that the Agency can consider approval of a well-defined project, and prescribe relevant and adequate Permit Conditions for the monitoring of the activity.
- Identify the environmental issues/risks associated with the proposed/existing activity.
- Provide the basis of the developer's environment management program, which shows that the environmental impacts resulting from the proposed/existing activity, including cumulative impacts, can be acceptably managed.
- Provide a document that clearly sets out the reasons why the proposed/existing activity should be considered environmentally acceptable.

3.2.3 Pesticides and Toxic Chemicals Act (2000)

The Pesticides and Toxic Chemicals Control Act regulates the manufacture, importation, transportation, storage, sale, use and disposal of pesticides and toxic chemicals. The Act establishes the Pesticides and Toxic Chemicals Control Board (PTCCB). Under the Act, the manufacture, import, advertisement, sale, use, storage or transport of controlled products must be registered with the PTCCB. The premises where controlled products are stored is also to be registered. Further, persons who manufacture or sell controlled products must be licenced to do so. The Act also provides for the maintenance of a standard for controlled substances. Under the Act, the Minister may appoint analysts, inspectors or medical examiners who may enter vehicles, lands or premises where controlled products are stored or used, open and examine packages, and take samples among others.

The Act defines toxic chemicals as "any disinfectant or any other substance known to be poisonous, corrosive, irritating, sensitsing or harmful to man or animal that is used in agriculture, that arts, commerce or industry, or for any domestic or other purpose, other than any antiseptic, drug or pesticide". With respect to the IWMF project, this Act would be applicable to materials to be used during waste processing that meet the definition of "toxic chemicals" under the Act including, but not limited to, sulfuric acid, polyaluminium chloride solution, sodium hydroxide, Houghto-Therm 617, and compressor oil among others.

3.2.4. Pesticides and Toxic Chemicals Regulations (2014)

The Pesticides and Toxic Chemicals Regulations were established to supplement the provisions in the Pesticides and Toxic Chemicals Act. The Regulations deem pesticides or toxic chemicals as prohibited if they are a contravention of any known requirement of the laws of the country in which it was manufactured or produced or banned by the United Nations Food and Agriculture Organisation, or is listed as one that should be banned or severely restricted in the International Register of Potentially Toxic Chemicals, Prior Informed Consent, the United Nations Environment Programme or the World Health Organisation. As such, the Regulations expressly state that a prohibited pesticide or toxic chemical is prohibited from importation, manufacture, distribution, use or sale in Guyana. After consultation with the Board, the Minister may also specify the prohibited pesticides which shall not be brought into or used in the country. For other pesticides and toxic chemicals, all importers must maintain appropriate records and inventories.

Part IV of the Act restricts a person from manufacturing, importing, advertising, selling, using, storing or transporting any controlled substance unless it is registered in the prescribed manner and that a licence is obtained for the manufacturing and importing, and all conditions in the licence are complied with. Additionally, transportation of 100 kilograms or 100 litres or more of a pesticide or toxic chemical whether by air, land or water requires informing the Registrar, police and fire services of the type and amount of pesticide or toxic chemical transported, time, route, destination and vehicle/vessel number before commencing transportation. Moreover, in the case of any accident or spillage involving an individual transporting pesticide or toxic chemical, the nearest police authority, fire officials, Registrar, EPA and health authorities should be immediately informed and details regarding the quantity and names of the pesticides or toxic chemicals involved should also be provided.

3.2.5 Municipal and District Councils Act (1969)

The Municipal and District Councils Act makes provisions for and empowers that municipalities of Georgetown, New Amsterdam and other areas in Guyana. The Act makes provisions for the election, composition and functioning of the Municipal Council for the City of Georgetown including the Mayor, Deputy Mayor and City Councillors. Under the Act, the Georgetown Mayor and City Council is empowered to let any land it owns and to levy rates. The Act outlines several functions for the municipality including drainage and irrigation, constructing roads and controlling traffic, supplying water and controlling animals. The City Council also has the power to establish Council buildings, residences for local government officers, hostels, social centres, recreation grounds and information centres among other infrastructure and services. The Council is also empowered to make by-laws and have made by-laws regarding collection and disposal and management of wastes from within the municipality (EMC Personal Communication 03).

Regarding waste management the Mayor and City Council handles waste disposal matters by enforcing the provisions of the City of Georgetown (Collection and Disposal of Waste) and Offensive Matter (Removal) By-laws and the Public Health Ordinance. The M&CC has a duty to establish, maintain and carry out sanitary services and remove and destroy all kinds of waste. Private householders and corporate bodies must also fulfill certain obligations, for example:

- Householders must have receptacles to place waste.
- Industrial entities must store commercial waste separately from non-commercial waste.

SES has engaged the Georgetown Mayor and City Council on the project.

3.2.6 Public Health Ordinance (1934)

The Public Health Ordinance makes provisions for promoting public health concerns in Guyana. The Ordinance is dated and was enacted during Guyana's colonial past. The Ordinance makes provisions for central and decentralised and local administration of health including the prevention of infectious, epidemic, endemic and venereal diseases, as well as management of public health facilities and services. The Ordinance also makes provisions for regulating 'offensive trades', that is, a trade that can be damaging to the health of the persons engaged in the trade. The Ministry of Health has convened a Committee for the management of offensive trades and this Committee is chaired by the Chief Medical Officer and is aimed at regulating activities that can damage the health of employees during their routine duties. The Government's COVID-19 measures introduce several social restrictions with which the project must comply while they remain in effect. These were made under this Ordinance. A draft Public Health Bill has been drafted to supersede the Ordinance.

3.2.7 Petroleum (Exploration and Production) Act, 1986

The Petroleum (Exploration and Production) Act makes provisions with respect to prospecting for and the production of petroleum and the conduct of activities related to petrochemical development. It has a general mandate for the conservation and prevention of the waste of petroleum and other natural resources.

3.2.8 Occupational Safety and Health Act (1997)

The Occupational Safety and Health Act 1997 defines the responsibilities of management and workers with respect to safety and health and applies to every workplace in Guyana. The Act makes provisions for the registration of industrial establishments, the establishment of an Occupational Safety and Health Authority, the establishment of a National Advisory Council on Occupational Safety and Health, the duties of employers, workers and other persons, treatments of accidents and occupational diseases, and occupational safety and health regulations. The Act authorises Occupational Health and Safety Inspectors to enter and inspect workplaces.

Under this Act, a joint workplace safety and health committee has to be established at operations where more than 20 persons are regularly employed. For workplaces with fewer than 50 persons, the committee should consist of at least four persons of which at least half the numbers should be workers who do not exercise managerial functions and should be selected by the workers themselves. Employers also have duties of providing protective devices for workers, providing instructions and supervision to ensure the safety of workers, maintaining a medicine chest and establishing an occupational health service for workers.

The Act requires all industrial establishments to keep a General Register containing the particulars of workers younger than the age of eighteen; particulars as to the washing, white washing or odor washing; painting or varnishing of the workplace; and particulars on every accident and industrial disease. Specifically, with respect to the Accident Register, notice should be submitted using the Form in the First Schedule of the Act within four days of the Accident. If the accident results in death, notice of death should be sent to the Authority, the joint workplace safety and health committee, and trade unions if applicable, as soon as the employer becomes knowledgeable of the death.

Under the Act, the employer is required to maintain an inventory of hazardous chemicals and physical agents including: toxic properties, including acute and chronic health effects in all parts of the body; chemical or physical characteristics including flammable, explosive, oxidizing and dangerously reactive properties; corrosive and irritant properties; allergenic and sensitizing effects; carcinogenic effects; teratogenic and mutagenic effects; and effects on the reproductive system. Further, employers shall keep readily accessible a floor plan showing the names of all hazardous chemicals and their locations and shall post a conspicuous notice of where the floor plan is kept. The Act also further details responsibilities of employers in the identification of hazardous chemicals.

3.2.9. Guyana Standard for Occupational Health and Safety Management Systems (2018)

The GNBS, in collaboration with relevant stakeholders, released a standard for *Occupational Health and Safety Management Systems*[7]. This standard specifies the requirements for an Occupational, Health and Safety management system to enable an organization to formulate policies and objectives. This takes into account legislative requirements and information regarding significant hazards and risks which the organization can control and over which it can be expected to have an influence to protect its employees and others whose health and safety may be affected by the activities of the organization.

[7] Guyana National Bureau of Standards, 2004. GYS 259:2018. Guyana Standard for Occupational Health and Safety Management Systems – Requirements with Guidance for Use.

3.2.10 Labour Act (1942)

The Labour Act specifies the conditions that an employer must observe in the contracting of employees. Part V specifies that the entire wages of the employee must be paid as money and not otherwise. However, in occupations where it is customary to make a partial payment of allowances in the form of food, toiletries, housing etc. these are acceptable and not considered illegal if both the employer and employee are agreed on such terms. Within the framework of this Act, SES will be required to ensure workers are adequately paid as prescribed by the laws of Guyana and is also required to ensure the workers are not mistreated and have representation.

3.3 Institutional Framework

3.3.1 Environmental Protection Agency

The EPA oversees the effective management, conservation, protection and improvement of the environment and takes the necessary measures to ensure the prevention and control of pollution, assesses the impact of economic development on the environment and the sustainable use of natural resources. The Agency was established in 1996 by the Environmental Protection Act and is responsible for the enforcement of national environmental legislation and Regulations as well as the development and implementation of environmental policies and standards. It also undertakes the inspection and enforcement of matters dealing with the environment, conservation and natural resources and administers the environmental permitting process in Guyana. The Agency is governed by a Board of Directors.

Under the Act, the EPA is mandated to "*take such steps as are necessary for the effective management of the natural environment so as to ensure the conservation, protection and sustainable use of its natural resources*" (section 4 (1) (a)). The Act also provides for the EPA to have overall responsibility to ensure management of the natural environment to ensure conservation, protection and sustainable use of its natural resources; assess any developmental activity, which may cause an adverse effect on the natural environment before such activity commences; and coordinate and maintain a programme for the conservation of biological diversity and its sustainable use. The EPA is mandated to ensure that any operation that may have a significant impact on the environment must acquire Environmental Authorisation from the EPA. Projects are considered to have an environmental impact when they threaten the health, safety and natural life supporting systems of humans and other living things.

The EPA will be responsible for the issuance of the Operation Permit to SES, and is expected to monitor the operation to ensure compliance with the environmental requirements, including the conditions of the Operation Permit.

3.3.2 Ministry of Local Government and Regional Development, Waste Management Department

The Waste Management Department within the Ministry of Local Government and Regional Development (MLGRD) was established following the dissolution of a Sanitation Management Unit which was established under a solid waste management programme funded by the Inter-American Development Bank (IDB). The Waste Management Department has oversight and supervision for all landfills and dumpsites around the country. The Department provides funding for the operation of two of the largest sites namely the Haags Bosch Landfill and the Lusignan Landfill. The Waste Management Department, through the MLGRD, hires and supervises a contractor to manage the Haags Bosch Landfill. The Department also designs and supervises implementation of operational procedures for the Haags Bosch Landfill.

3.3.3 Georgetown Mayor and City Council

The project is located within the boundaries of the City of Georgetown and this municipality is managed by the Georgetown Mayor and City Council. SES has engaged the municipality on the development of the IWMF project and is awaiting the formal issuance of a No-Objection letter. The municipality has an important role to play as a key stakeholder to be engaged in the planning and implementation of the project. The MLGRD has responsibility for overseeing Local Government, which also includes interfacing with the Georgetown Mayor and City Council.

3.3.4 Pesticide and Toxic Chemicals Control Board

The Pesticides and Toxic Chemicals Control Board falls under the Ministry of Agriculture and regulates the manufacture, importation, transportation, storage, sale, use and disposal of pesticides and toxic chemicals in Guyana. Pesticides and toxic chemicals which are controlled by the Board are firstly required to be registered for use in Guyana, and secondly, for each importation, an Import License is to be obtained. Some of the chemicals which are utilized by the IWMF falls under the control of the Board and therefore the company is obligated to satisfy the Board's requirement in the importation and use of these chemicals.

4.0 PROJECT ENVIRONMENT

4.1 Physical Environment

The IWMF will be located within the GYSBI facility at Houston, East Bank Demerara. GYSBI is a significant logistics hub that serves EEPGL's offshore operations. The location of the IWMF in relation to the project environment is shown in Figure 4-1.

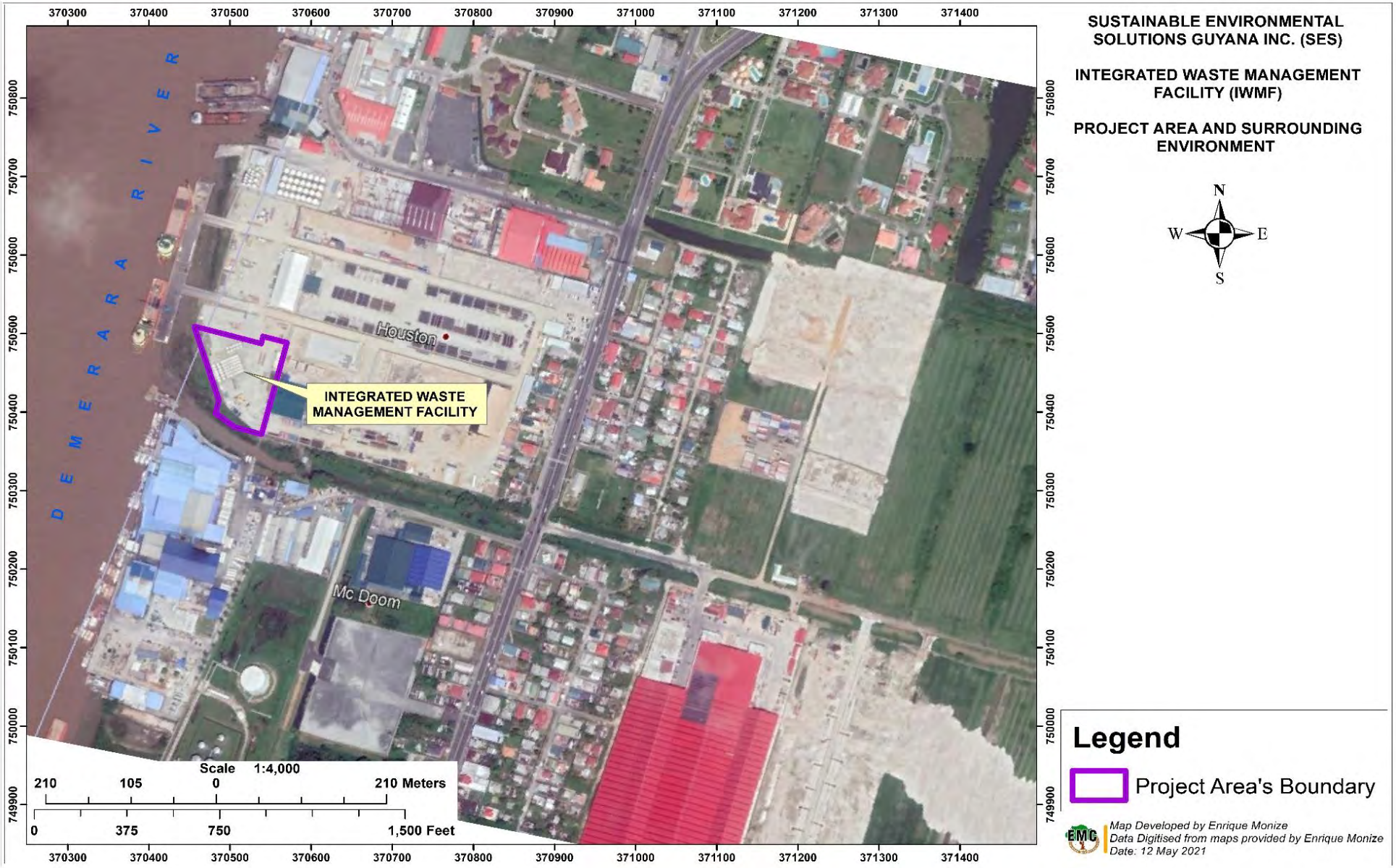

Figure 4-1: SES IWMF within the General Project Area Setting

4.1.1 Soils and Geology

4.1.1.1 Geology and Soils

The project site is located on the Coastal Plain of Guyana where the soils are predominantly alluvial deposits over organic material and silts comprising the Demerara Clay with localized pockets of peat (pagesse). According to the mapping by the Guyana Geology and Mines Commission (GGMC), the site is underlain by gneissose syntectonic granite, diorite, migmatites[8].

The clayey soils on which the facility sits is characterized by four main clay types:

- **Mara Clay:** This is a poorly drained soil type that was developed from old marine sediments. Likely, this clay type was also formed from rising sea levels under Rhizophora vegetation. Mara Clay can be found at several levels from below to slightly above the mean sea level.[9]

- **Brickery Clay:** This soil type is also poorly drained and would have been developed by alluvium deposits over fluviomarine sediments. It is characterized by a thin dark grey surface over grey clay subsoil moulted with brownish yellow, yellow red and brown. This soil type is very acidic and contains partially decomposed organic matter with a moderate level of fertility.

- **Tuschen Clay:** Poorly drained soil developed in river alluvium. It is characterized by a thin dark grey clay surface over a grey to greenish clay subsoil with mottles of brownish yellowish red and brown. The soil is strongly acidic with a moderate level of fertility.

- **Lama Muck:** A very poorly drained organic soil occurring in depressions along flood plains and riverbanks. This soil type is characterized by a 20 to 40 centimetres thick layer of black peat (muck) which is sometimes overlain by a layer of peat with dark reddish-brown peat under this layer. This soil is very acidic and may be underlain at depths over 90 to 100 centimetres with grey to light grey clay or sand.[10]

4.1.1.2 Soil Profile

A site-specific soil investigation was conducted by GYSBI adjacent to the project site. The investigation detailed the following geotechnical soil profile[11]:

- Approximately one-meterthick sand top layer followed by clay layers with different consistencies varying from soft to stiff and very stiff or firm clay.
- Around a depth between Georgetown Datum (GD) +6.0 to +5.0 meters, a stiff or firm clay layer was encountered.
- Around a depth between GD -4.5 to -7.0 meters, a clayey sand layer was encountered with varying thickness of 1.5 to 2.5 meters.
- Below that level, a sandy clay layer with firm or stiff consistency was encountered.

4.1.1.3 Soil Quality

GYSBI conducted a soil quality assessment in 2018 of various locations within the Shore Base to determine the presence of any environmental contaminant. One of the locations sampled was within

[8] Guyana Geology and Mines Commission. 2010. Geological Map of Guyana.
[9] Brinkman, R; and Pons, LJ, 1968. A Pedo-Geomorphological Classification and Map of the Holocene Sediments in the Coastal Plain of the Three Guianas. Page 21
[10] Kekem, A.J; Pulles J.H.M and Khan, Z, 1996. Soils of the Rainforest in Central Guyana. Page 51
[11] MOS Grondmechanica B.V. 2018. Geotechincal Advice Cargo Marshalling Area Infill and Revetment Project at GYSBI Georgetown, Guyana. Page 9

SES project site. At the project site samples were retrieved at depths of 0.61 meter (2 feet) and 3.66 meters (12 feet) and were analysed by a laboratory for several parameters. These results of the soil quality analyses of the project site is presented in Table 4-1. Based on the results obtained, most of the parameters were within the acceptable limits at both soil depths. However, the soil at the lower depth had a greater level of contamination than the upper level.

Table 4-1: Soil Quality Assessment Results for SES Site

Parameters	Results (mg/kg)		Acceptable Limits*
	0.61 Meter Depth	3.66 Meters Depth	
Ammonical Nitrogen	0.21	29.9	Not Applicable
Oil and Grease	1340	1700	Not Applicable
Total Petroleum Hydrocarbon	<500	<500	Not Applicable
Total Arsenic	<2.0	4.4	3.0
Total Barium	<15.0	15.5	160
Total Cadmium	<2.0	<2.0	0.8
Total Chromium	3	20.2	100
Total Lead	1.1	36.7	85
Total Zinc	11.3	37.5	140
Total Nickel	<2.0	10.5	35
Total Silve	<1.0	<1.0	Not Applicable
Total Copper	<2.0	18.2	36
Total Mercury	<0.009	0.171	0.3

**In accordance with the Dutch Environment Standard – Fourth Edition - 2002*

4.1.2 Hydrology and Drainage

The project site is located directly adjacent to the eastern bank of the Demerara River. The Demerara River is an important natural resource for potable water, recreation, water transportation and fisheries. The Riverine Ecosystem comprises tidal wetlands which occur along river banks. These are subject to periodic or continuous inundation. The Demerara River separates Regions 3 and 4, and extends into Region 10. Its source is found in the Maccari Mountains and it flows northwards for 346 kilometers to the Atlantic Ocean at Georgetown. Its narrow estuary and rapid flow carves a direct channel of five to six meters depth to the Atlantic Ocean.

The hydrology of the project area is largely controlled by its location on the low coastal plain and its proximity to the Demerara River. The soils within the general area are clay rich, with poor internal drainage. Much of the area can be described as highly developed with industrial activities and as such, there is a network of drainage facilities. Generally, drainage of the industrial premises located along the East Bank Demerara is done by canals and trenches which ultimately discharge into the Demerara River.

Surface runoff and effluent from the project site will be collected and drained by a series of internal drains. Figure 4-2 shows the construction of the main drain which is located along the eastern boundary of the facility. The facility is designed to have a sloping gradient which would allow stormwater to flow into the drain at the eastern boundary. This drain will discharge into a canal located south of the facility (Figure 4-3). All effluent will be channelled through oil-water separators prior to discharge into the canal. The canal discharges into the Demerara River. Figure 4-4 shows the drainage network within and around the project area.

The canal south of the site flows in an east to west direction and discharges into the Demerara River in the vicinity of the project site. The canal drains sections of the wider project area of Houston and McDoom. Given its location the canal is prone to tidal influence from the Demerara River, which means

that during high tides brackish water fro the River flows into the canal and the water level raises, while during low tides the water level receeds, and drainage occurs. A sluice (koker) is installed along the canal to prevent the inflow of river water during high tidges, and to facilitate drainage during low tides.

Figure 4-2: Main Internal Drain under Construction

Figure 4-3: Drainage Canal located at the Southern Boundary of the Project Site

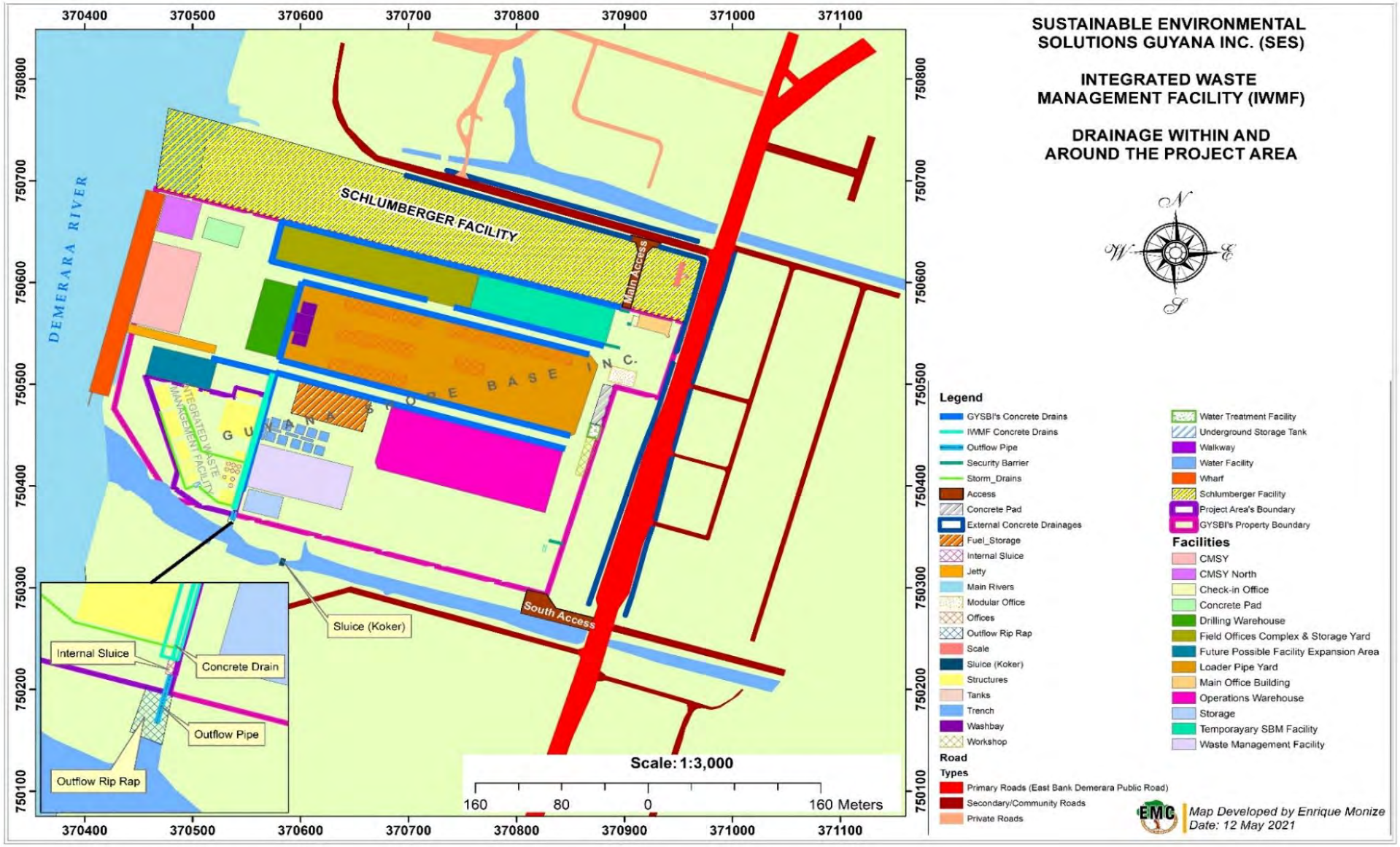

Figure 4-4: Drainage Network within and around the Project Area

4.1.3 Hydrogeology

The hydrogeology of the Guyana coast, including Georgetown, consists of three main sand layers, typically referred to as the A, B, and C sands. Each layer is separated by clay layers. These layers trend downwards from east to west. The A sands occur at a depth of 150 meters and the B sands at a depth of approximately 245 meters. Within the study area, drinking water is supplied by Guyana Water Inc. (GWI) from groundwater pumped via wells. The groundwater supplied to Georgetown and Greater Georgetown is abstracted from the “A” and “B” sands aquifer.

Average shallow (perched) groundwater depth is between one to two metres of the ground surface. At the project site groundwater was encountered at a level of GD +12.24 meters during soil investigations conducted by GYSBI. However, this is considered as a single instantaneous recording and, as such, has only small reliability and is expected to change based on influences of weather seasons and water levels of the Demerara River.[12]

4.1.4 Climate

Guyana is located in the equatorial trough zone and has a wet tropical climate characterized by year-round warm temperatures and abundant precipitation. Guyana’s climate, particularly its precipitation patterns, is influenced primarily by the seasonal migration of the Inter-Tropical Convergence Zone (ITCZ) which is a cloud and rain-bearing belt of rising air where south-easterly and north-easterly trade winds converge. Guyana’s coastal regions experience a bimodal annual cycle of precipitation with distinct wet seasons. The primary wet season commences from mid-April to the end of July and the secondary wet season occurs from mid-November to January. The intervening periods are known as the primary and secondary dry seasons respectively. Rainfall occurs in all seasons but typically more frequently and intensely during the primary and secondary wet seasons. Average annual rainfall ranges between 1,600 to 2,800 millimetres with spatial variability across the country.[13]

Rainfall data obtained for the Botanical Gardens Weather Station from the Hydrometeorological Department over the last ten years shows that the annual rainfall for the general area is approximately 2000 to 2500 millimetres. Rainfall data from 2010 to 2020 is presented in Table 4-2 and Figure 4-5. The wettest periods are the primary and secondary wet seasons occurring May to June and December to January respectively.

[12] MOS Grondmechanica B.V. 2018. Geotechincal Advice Cargo Marshalling Area Infill and Revetment Project at GYSBI Georgetown, Guyana. Page 9
[13] Government of Guyana, 2012. Second National Communication to the United Nations Framework Convention to Climate Change. Page 53

Table 4-2: Rainfall (mm) for Georgetown (January 2010 to December 2020)

Years	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2010	21.6	26.7	44.0	303.0	385.3	252.5	476.1	162.2	168.0	109.4	363.0	331.4
2011	137.6	415.9	499.2	38.0	274.9	184.4	189.9	126.3	39.8	204.4	178.4	245.6
2012	380.4	349.0	35.2	114.7	320.6	244.6	374.8	144.7	40.7	36.9	201.0	321.3
2013	83.7	118.3	30.7	133.2	352.0	288.2	425.9	297.1	126.9	127.2	347.2	295.5
2014	276.3	149.6	64.2	71.5	130.1	230.1	155.9	202.0	30.6	59.3	385.2	139.3
2015	207.8	120.8	99.9	68.4	458.5	395.1	517.8	90.1	85.4	62.2	134.1	163.0
2016	28.3	40.5	37.0	234.5	208.9	257.3	230.4	186.7	182.4	32.9	104.5	407.3
2017	293.0	234.0	172.4	100.6	313.2	415.5	256.7	102.8	122.7	96.2	228.5	391.1
2018	174.9	164.7	105.9	346.4	245.0	321.1	320.6	156.4	166.7	35.9	201.1	105.2
2019	63.1	98.6	15.3	124.0	338.1	342.2	456.6	287.0	247.9	72.4	175.1	207.0
2020	49.8	27.3	67.1	54.4	320.0	274.9	273.4	155.5	154.1	19.2	543.2	432.1

Source: Hydrometeorological Department

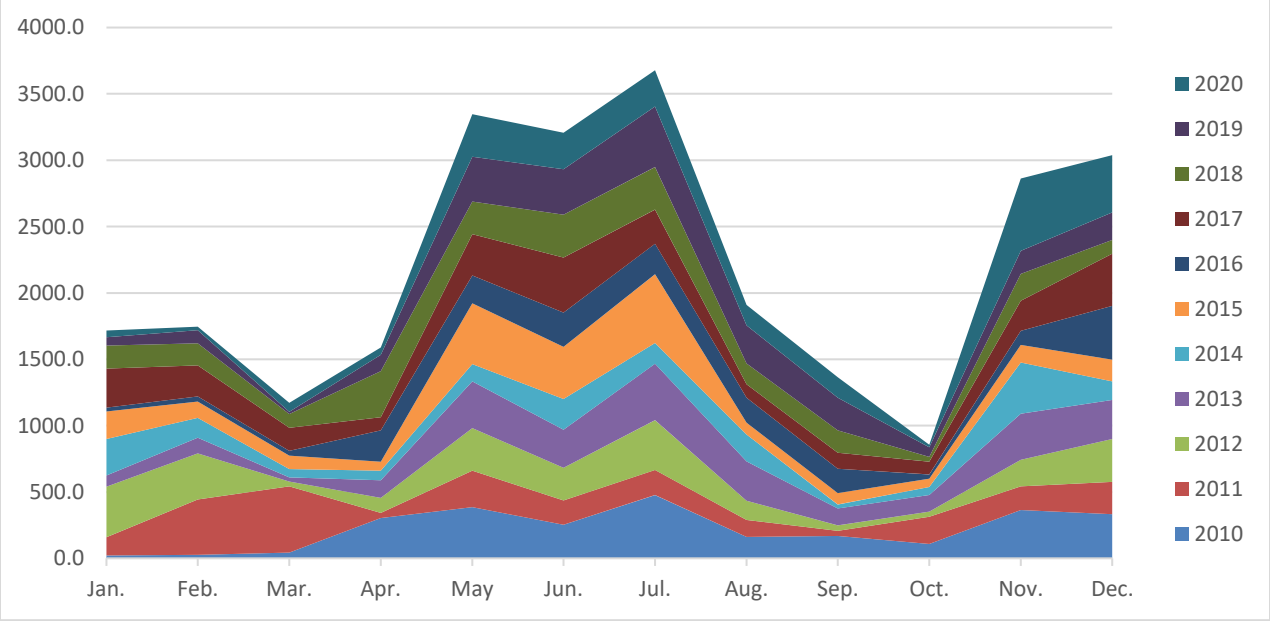

Figure 4-5: Rainfall Patterns for Georgetown (January 2010 to December 2020)

4.1.5 Surface Water Quality

To gain a better understanding of the quality of water of the receiving environment water quality analyses were conducted and existing information was also utilised. Water quality sampling and analyses were conducted for the drainage canal flowing south of the project site while existing information on the water quality for the Demerara River was utilised.

4.1.5.1 Drainage Canal Water Quality

Methodology

Surface water grab samples were collected upstream and downstream of the canal located along the southern boundary of the project site into which treated effluent will be discharged. Three sets of samples were collected for each location and were analysed as follows:

- The first set of samples were analysed *in-situ* by EMC for pH, Temperature, Turbidity, Total Suspended Solids (TSS) and Dissolved Oxygen (DO).
- The second set of samples were sent to the Institute of Applied Science and Technology (IAST) Laboratory for analysis of Biological Oxygen Demand (BOD)
- The third set of samples were sent to the Guyana Sugar Corporation Inc. (GUYSUCO) Laboratory for analyses and were tested for Total Dissolved Solids (TDS), Conductivity, Oil and Grease, Chemical Oxygen Demand (COD), Zinc (Zn), Iron (Fe), Copper (Cu), Aluminium (Al) and Lead (Pb). However, TDS and Conductivity were inadvertently not analysed by the laboratory.

The date, time and weather conditions at the time of sampling are presented in Table 4-3 and the location of the water quality sample collection points are shown in Figure 4-8.

Table 4-3: Description of Surface Water Sample Locations and other Sampling Details

Sample ID	Location	Coordinates	Time Collected	Date	Weather
SW1	Drainage Canal Upstream of IWMF	N 06°47'13.0" W 58°10'17.4"	14:57 hrs	April 13, 2021	Sunny
SW2	Drainage Canal Downstream of IWMF	N 06°47'14.2" W 58°10'19.8"	15:05 hrs		Sunny

The instruments utilized to conduct the water quality analyses onsite are described below:

- **pH, Temperature and DO –** These parameters were analysed using a Hach HQ40D Multimeter - Portable two-channel multimeters for pH, temperature and DO. The digital meter/electrode system combines reliability, flexibility and ease of use. Interchangeable Intellical electrodes are recognized automatically and store all relevant data. Rugged, nearly indestructible outdoor versions with multiple cable lengths enable measurements even at previously inaccessible locations. The degree of accuracy for the parameters are pH ±0.02 and DO of ±0.1 from 0 to 8 mg/L ±0.2 for greater than 8 mg/L.
- **TSS –** TSS was analysed utilising a TSS Portable Hand-held Turbidity, Suspended Solids, and Sludge Blanket Level Instrument. The Hach TSS Portable Hand-held Turbidity, Suspended Solids, and Sludge Blanket Level Instrument has a unique multi-beam alternating light method with an infrared diode system that gives it a broad measuring range for both turbidity and suspended solids in one portable handheld instrument. It stores up to four different calibration curves for suspended solids and one for turbidity. There is no need for constant re-calibration for different locations. The accuracy of the measurement of the TSS is lower than 4 percent ± 0.001 g/L.
- **Turbidity** - Hach's Portable Turbidimeter, the 2100Q, provides ease of use and accuracy. With an intuitive user interface, the 2100Q makes it easy to take measurements and perform

calibration and verification. This device is calibrated before every field visit. It has a degree of accuracy of ±2 percent.

Field measurements were guided by EMC's Standard Operating Procedures for sample collection and field testing of samples including:

- EMC 001 – Procedure for Selecting and Cleaning Sample Bottles
- EMC 002 – Procedure for Water Quality Analysis – pH and Temperature
- EMC 004 – Procedure for Water Quality Analysis – Conductivity and Total Dissolved Solids
- EMC 005 – Procedure for Water Quality Analysis – Dissolved Oxygen
- EMC 006 – Procedure for Water Quality Analysis – Total Suspended Solids
- EMC 007 – Procedure for Water Quality Analysis – Turbidity
- EMC 008 – Procedure for Water Sample Collection – Biochemical Oxygen Demand and Chemical Oxygen Demand
- EMC 009 – Procedure for Water Sample Collection – Oil and Grease
- EMC 013 – Procedure for Water Sample Collection – Metals

Sample collection and analysis of water samples can be observed in Figure 4-6 and Figure 4-7 respectively.

Figure 4-6: Water Sample Collection

Figure 4-7: Water Quality Analyses

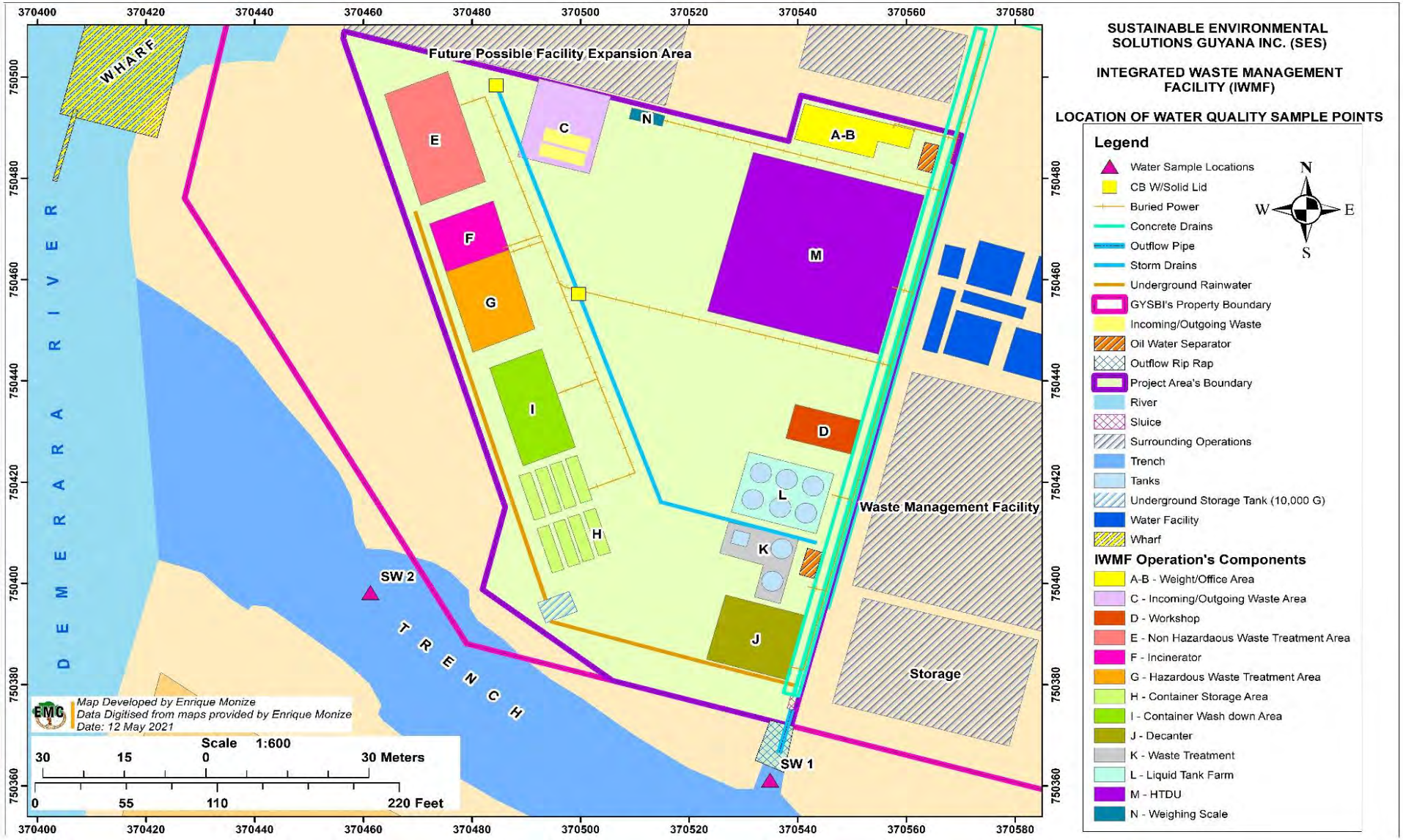

Figure 4-8: Surface Water Sample Location

Results

The results for the water quality analysis were compared to the limits prescribed in the GNBS Interim Guidelines for Industrial Effluent Discharge into the Environment for pH, temperature, TSS, BOD, COD and Oil and Grease. Turbidity levels were compared with the limit prescribed in the Mining (Amendment) Regulation 2005[14]. The prescribed levels of TDS and Copper were compared to the limits of the National Recommended Water Quality Criteria – Human Health Criteria Table of the United States Environmental Protection Agency[15] (US EPA). The prescribed levels of Zinc, Iron, and Lead were compared to the limits for freshwater of the National Recommended Water Quality Criteria – Aquatic Life Criteria Table of the US EPA[16]. The Aluminium levels were compared to the Notice by the US EPA for Ambient Water Quality Criteria for Aluminium in Freshwater[17]. The results of the water quality analyses are presented in Table 4-4 and 4-5. The laboratory analyses report is attached as Appendix C.

Table 4-4: Results of Physiochemical Water Quality Analyses

Parameters	Sample ID	
	SW 1	SW 2
pH 5-9	6.81	6.79
Temperature (^{0}C) <40	32.1	32.2
DO (mg/L) >4	4.53	3.47
Turbidity (NTU) <50	366	456
TSS (mg/L) <50	178	209
Iron (µg/L) <1,000	14.7	12.6
Copper (mg/L) <1.3	Not Detected	Not Detected
Zinc (µg/L) <120	Not Detected	Not Detected
Aluminium (µg/L) 0.63 to 3,200	11.5	13.6
Lead (µg/L) 65	Not Detected	Not Detected
Oil & Grease (mg/L) <10	Not Detected	Not Detected

** According to the US EPA, values for aluminium will vary depending on different water chemistry conditions specially for pH, total hardness and dissolved organic carbon.*

[14] The Mining (Amendment) Regulations 2005 is the only national guideline to specify a limit for turbidity.
[15] United States Environmental Protection Agency. 1986. National Recommended Water Quality Criteria – Human Health Criteria Table.
[16] United States Environmental Protection Agency. 1986. National Recommended Water Quality Criteria – Aquatic Criteria Table.
[17] United States Environmental Protection Agency. 2018. Aquatic Life: Ambient Water Quality Criteria for Aluminium in Freshwater.

Based on the findings of the water quality analysis, most of the parameters were either not detected or were within acceptable limits. Turbidity and TSS levels were high, which indicates that the presence of sediments, and which is also expected given the sample location being in close proximity to the Demerara River. This may have also influenced the DO levels, which were a bit low.

Table 4-5: Results of the Biological and Chemical Oxygen Demand Analyses

Parameters	Sample ID	
	SW 1	SW 2
COD (mg/L) <250	56	40
BOD (mg/L) <50	0.06	0.07

Based on the results presented in Table 4-5, the levels of BOD and COD were well within the acceptable limits.

4.1.5.2 Demerara River

The Demerara River is prone to considerable tidal influence which means that during high tides brackish water flows upstream, and freshwater issuing from the River mouth during low tides. The project site is located close to the River mouth, where the water quality constantly changes based on the tides, as well as the river flow.

Despite not having extensive information, there is a good understanding of the quality of water in the Demerara River. The EPA in 2006, in preparing the State of the Environment Report for the Demerara Watershed[18] conducted water quality testing along the course of the Demerara River. The section of the River with proximity to project site consists of brackish/estuarine water.

In brackish waters pH averaged 6.2 due to the mixing of freshwaters with ocean waters, which is at pH 8.0 or higher. DO averaged 4.8 mg/L throughout. At the time of the survey, water temperatures ranged from a low of 27°C to a maximum of 30°C. Conductivity levels averaged 620 µS/cm. Average salinity for brackish water, measured after slack tide was 0.4% (Ocean water is 3.5%). In brackish waters, turbidity ranged from 2.0 to 82.0 NTU indicating the presence of algae, sediments, suspended solids and domestic and industrial wastes. Alkalinity averaged 34.7 mg/L. Carbon dioxide (CO_2) was 5.8 mg/L in brackish waters. Hardness averaged 0.5 mg/L. Total ammonia was 0.2 mg/L in the brackish section. Anomalies with high ammonia values were measured at many stations, tributaries and point sources. Such values were all due to anthropogenic inputs (from non-point sources and point sources), which were run-off from agricultural fields, and municipal and industrial discharges along the river. Total ammonia concentrations in these cases were likely beyond what is considered acceptable for the protection of aquatic life. Phosphate averaged 0.0 mg/L (i.e. non-detectable with the test method utilized) while silica averaged 3.0 mg/L throughout the Demerara.[19]

More recent data is available, collected by EMC on behalf of Noble House Seafoods Limited, a shrimp and fish processing operation located within one km upstream from the project site. Monitoring of the water quality in the Demerara River done twice yearly (June and December) from 2016 to 2020 indicates that the pH averaged 6.89, DO averaged 6.05 mg/L, Conductivity levels averaged 7.77 µs/cm and Turbidity averaged 247.54 NTU.

18 The project site is located within the Demerara River Watershed.
19 The information presented in this paragraph was gathered from pages ES- and ES-2 of the State of the Environment Report for the Demerara River Watershed.

4.1.6 Groundwater Quality

The groundwater supplied to Georgetown and Greater Georgetown is abstracted from the “A” and “B” sands aquifer. The untreated groundwater is slightly acidic with a pH range of 6.5 to 8.5. The water contains a low chloride content, low alkalinity and hardness, but high levels of iron. Water from the “B” sands has a higher temperature and chloride content and contains hydrogen sulphide.

4.1.7 Noise

In order to determine the baseline noise level measurement of decibel levels were conducted within the project site.

4.1.7.1 Methodology

Decibel levels were measured at four locations around the facility at the property boundaries. Both day-time and night-time noise levels were measured. The locations where noise levels were monitored can be observed in Table 4-6 and Figure 4-10.

Table 4-6: Noise Measurement Locations

Location ID	Locations	Coordinates
N1	Southwestern Boundary	N 06°47’15.3” W 58°10’18.9”
N2	Southeastern Boundary	N 06°47’14.0” W 58°10’17.2”
N3	Northeastern Boundary	N 06°47’17.3” W 58°10’16.4”
N4	Northwestern Boundary	N 06°47’17.0” W 58°10’19.7”

The measurement was done using a Reed Instrument R 8080 meter. This is a quick responding triple range sound level meter with a backlit display, analogue bar graph and built-in memory to data log up to 64,000 points. This data logging sound level meter can record samples on internal memory and keep track of registered readings with a time and date stamp. The R8080 features user-selectable sampling rates and the option to track live measurements via the included PC interface software. The meter has a ± 1.4 dB degree of accuracy with real-time logging of data which can be transferred onto an excel datasheet for further analysis.

For the noise measurements, the windscreen was installed on the microphone of the meter and the meter was then turned on following the manufacturer’s guidelines. Thereafter, noise measurement readings were conducted for 15 minutes at each sampling point. The maximum and minimum readings obtained were recorded on data sheets along with the locations ID, coordinates, time, date, weather conditions and any other observations for each sample point. Field measurements of noise levels were guided by EMC’s Standard Operating Procedure for Noise Level Monitoring (*EMC 016 – EMC Procedure for Noise Monitoring).* Field measurements of noise levels during the day and night can be observed in Figure 4-9.

Figure 4-9: Noise Measurement Exercise during the Day (Left) and Night (Right)

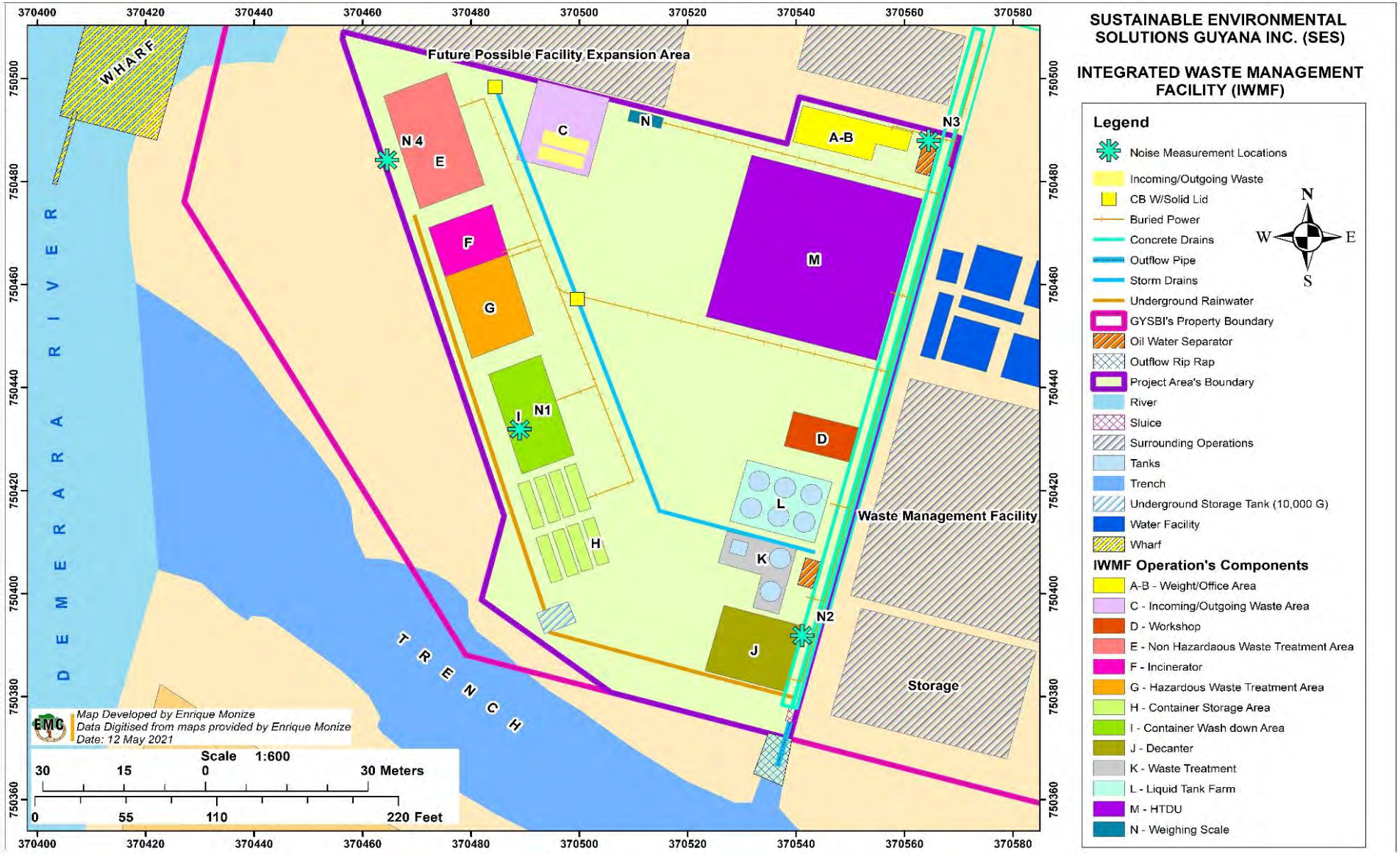

Figure134-10: Noise Measurement Locations

4.1.7.2 Results

The results of the day-time and night-time noise level measurement exercise are presented in Table 4-7 and Table 4-8 respectively.

Table 4-7: Day-Time Results of Noise Level Measurement

Location ID	Weather Conditions	Time (hrs)		Reading (dB)		Background Noise
		Start	End	MAX	MIN	
N1	Sunny	11:44	11:59	74.9	65.7	PSI operations and construction work at the project site
N2	Sunny	12:02	12:17	80.5	67.5	PSI operations, Tiger Rentals operations and construction works at the project site
N3	Sunny	12:21	12:36	77.3	71.3	Generator, small AC unit, and equipment from Tiger Rentals
N4	Sunny	12:37	12:52	72.1	61.8	PSI operations, activities at GYSBI wharf and construction works at project site

Table 4-8: Night-Time Results of Noise Level Measurement

Location ID	Weather Conditions	Time (hrs)		Reading (dB)		Background Noise
		Start	End	MAX	MIN	
N1	Clear, Windy	20:07	20:23	78.1	66.0	PSI operations and construction works
N2	Clear	20:25	20:40	77.1	67.6	PSI operations, Tiger Rentals operations and construction work at project site
N3	Clear	20:44	20:59	80.6	74.5	Construction works at project site
N4	Clear	21:01	21:16	70.1	62.7	PSI operations and activities at GYSBI wharf

The GNBS Noise Guidelines stipulates day-time limits of and 90dB and night-time limits of 75dB for construction sites. All day-time noise measurements were well within this limit. However, minor exceedances were recorded for the maximum night-time measurements at three of the measurement points and these were attributable to construction activities at the project site as well as to noise generated by nearby operations namely Pritipaul Singh Investments Inc. (PSI), Tiger Rentals and GYSBI. However, all minimum night-time measurements were within the permissible limit.

4.1.8 Air Quality

An air quality assessment was conducted downwind of the IWMF project site. Particulate Matter ($PM_{2.5}$, PM_{10}) and Total Suspended Particulates (TSP) were assessed over 24 hours. Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), Volatile Organic Compounds (VOCs) and Methane (CH_4) were assessed for 15 minutes each during the day and nighttime.

4.1.8.1 Methodology

Particulate Matter

Particulate Matter and Total Suspended Particles were recorded using an Aerocet 831 Aerosol Mass Monitoring Meter. The Aerocet 831 is a completely portable, full-featured, battery-operated, handheld mass monitor which measures five mass ranges (PM_1, $PM_{2.5}$, PM_4, PM_{10} and TSP). The meter has a ±10 percent degree of accuracy with real-time logging of data which can be downloaded into MS Excel for further analysis.

For the exercise, $PM_{2.5}$, PM_{10} and TSP were measured. The meter was turned on following the manufacturer's guidelines and placed within a weather-resistant box for the 24-hour monitoring exercise. The data obtained were recorded on data sheets along with the location ID, Global Positioning System (GPS) coordinates, time, date, weather condition and any other observations for the sample point. The meter recorded samples one data point per minute and all points are data logged. This data was then extracted and analysed on a computer where an average figure was produced and a graph generated. Field measurements were guided by EMC's Standard Operating Procedure for measurement of particulates namely, *EMC 014 – Ambient Air Sampling of Particulate Matter and Total Suspended Particles*.

Gases

SO_2, NO_2, CO, VOCs and CH_4 were measured using the Aeroqual Series 500 Portable Air Quality Monitor. This air quality monitor and sensors enable accurate real-time surveying of common outdoor air pollutants, and is typically used for short- and long-term air quality studies and carrying out checks on pollution "hot spots". The device has a ±0.2 percent degree of accuracy with real-time logging of data which can be downloaded into MS Excel for further analysis.

For the exercise, the sensor heads of the gas to be monitored were inserted into the meter on an alternating basis. For each measurement, sensor heads were allowed to warm up for 3 minutes as per the manufacturer's guidelines after which sampling was conducted for 15 minutes for the gases. Five gases were measured SO_2, CO, CH_4, NO_2 and VOCs. The location ID, GPS coordinates, time, date, weather condition and any other observations for each sample point were recorded on a data sheet. Field measurements were guided by EMC's Standard Operating Procedure for the measurement of gases, *EMC 015 – Ambient Air Sampling of Gases Volatile Organic Compounds, Sulphur Dioxide, Carbon Monoxide, Nitrogen Dioxide and Methane*. The air quality assessment can be observed in Figure 4-11.

Figure 4-11: Ambient Air Quality Assessment Downwind of the Project Site in the Day-Time (Left) and Night-Time (Right)

The location and other details on the air quality assessment is presented in Table 4-9 and the location where the measuring was conducted is shown in Figure 4-12.

Table 4-9: Details on Air Quality Assessment Locations and Assessment

Location ID	Locations	Coordinates	Time (hrs)	Date	Weather Condition
AQ1	South Western Boundary	N 06°47'15.6" W 58°10'19.0"	11:28	April 13, 2021	Sunny

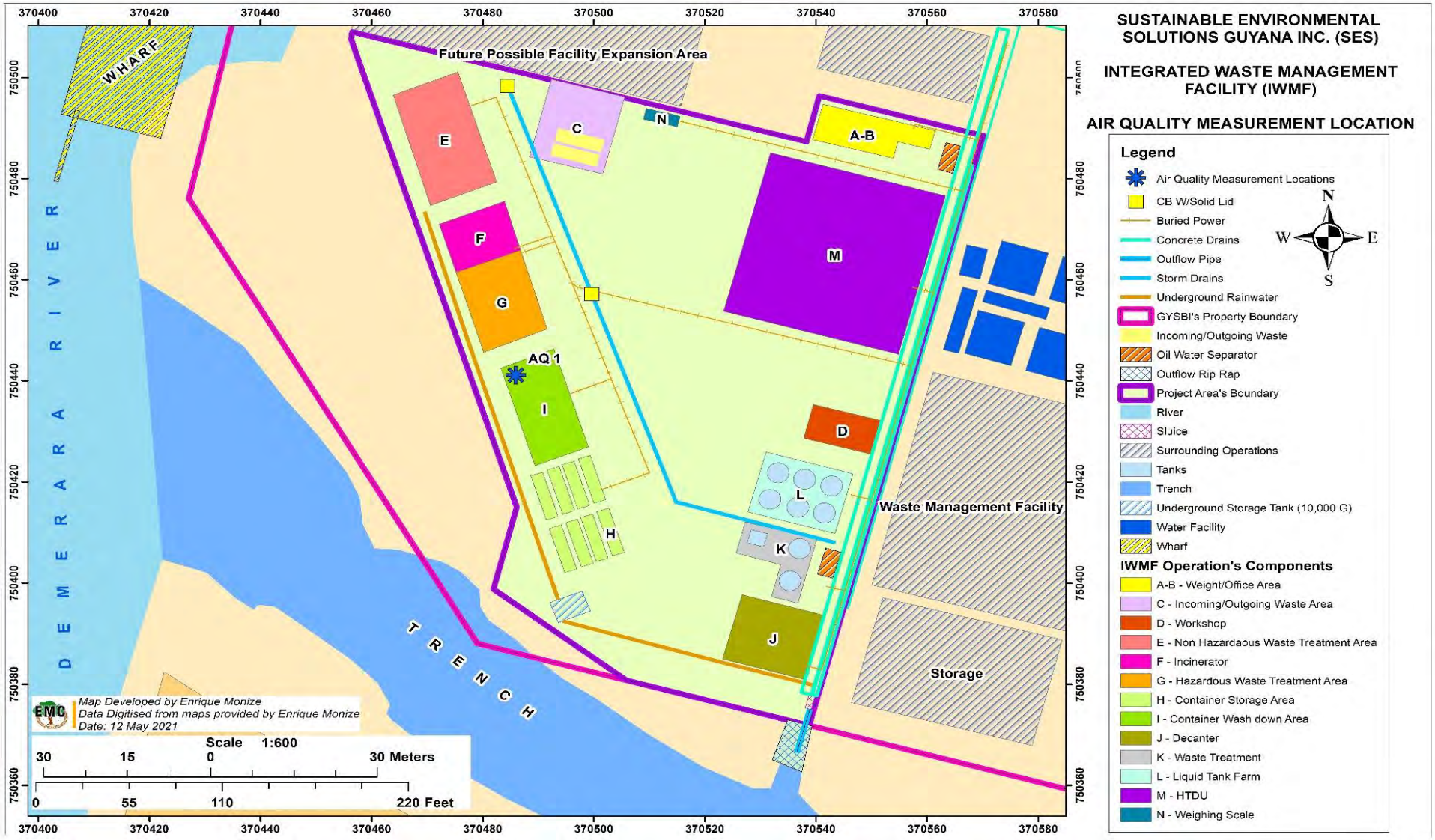

Figure 4-12: Air Quality Measurement Location

4.1.8.2 Results

Particulate Matter

Permissible levels were compared to the guidelines set by the World Health Organization (WHO) and Alberta Government. The results of the measurement for particulate matter and total suspended particles are presented in Table 4-10 and Figure 4-13.

Table 4-10: $PM_{2.5}$, PM_{10} and TSP Results

Location ID	Locations	24-hour Mean (µg/m³)		
		$PM_{2.5}$	PM_{10}	TSP
AQ1	South Western Boundary	39.1	246.6	271.7
WHO AQG[20]		**25**	**50**	**-**
Alberta Ambient AQG[21]		**-**	**-**	**100**

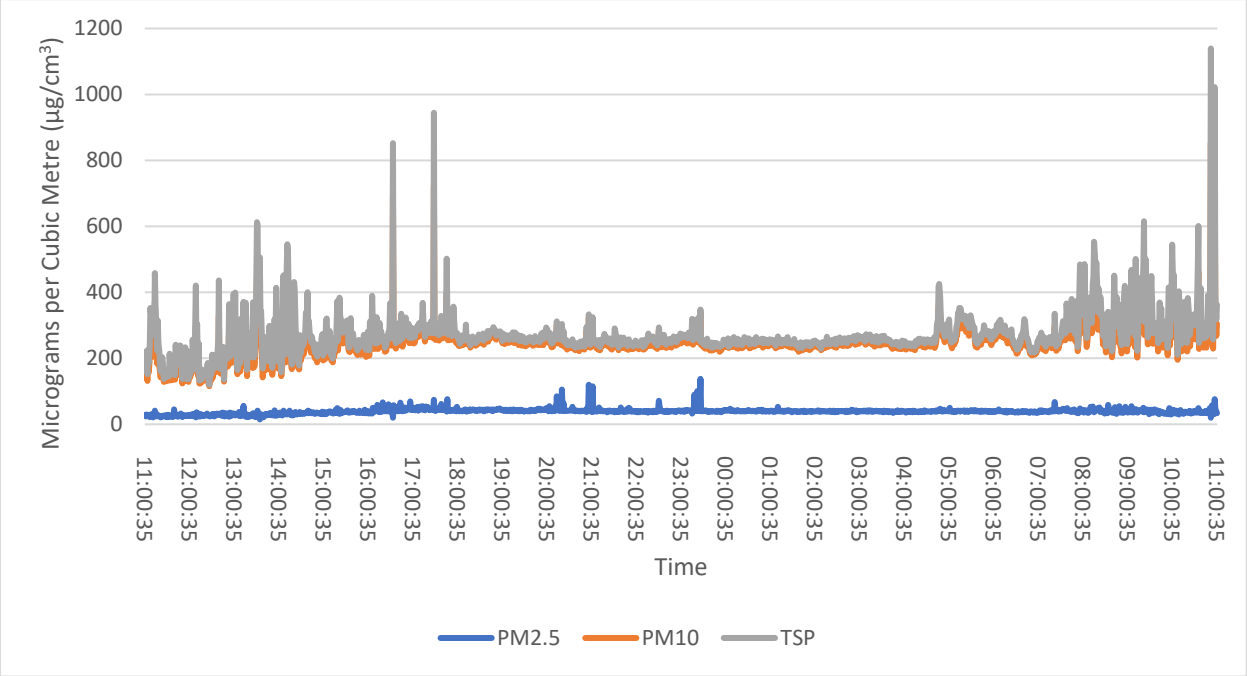

Figure 4-13: Particulate Matter and TSP Levels During the 24-hour Measurement Period

The permissible levels were exceeded for all particulate matter measured and can be attributed to activities occurring within the project site and its immediate environs. As seen in Figure 4-13, PM_{10} and TSP were generally above 400 micrograms per cubic metre from 08:0 to 18:00 hrs and this can be attribute to emissions associated with construction activities at the project site as well as from neighbouring operations within GYSBI, particularly Tiger Rentals. Night-time levels were generally lower and could be due to reduced activities including less movements of vehicles and less intense activities at neighbouring facilities. Nonetheless, the highest $PM_{2.5}$ values were observed between

[20] World Health Organization, 2005. WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. Page 9.
[21] Alberta Government, 2017. Alberta Ambient Air Quality Objectives and Guidelines Summary. Page 5.

20:00 hours and 00:00 hrs, consisting of intermittent spikes. During this period these was a visible plume from the Tiger Rentals emission stack (Figure 4-14).

Figure 4-14: Visible Plume from Tiger Rentals Emission Stack

Gases

The results from the measurement for gases are presented in Tables 4-11 and 4-12.

Table 4-11: Measurement of Carbon Monoxide, Methane and Volatile Organic Compounds

Parameters (mg/m^3)	Start Time (hrs)	End Time (hrs)	Weather Conditions	Concentrations (mg/m^3)	EPA Victoria, Australia[22] (mg/m^3)
CO (15-minute mean)	12:14	12:29	Sunny	0.0	<34.46**
	20:41	20:56	Clear	0.0	
CH_4* (15-minute mean)	12:32	12:47	Sunny	12	-
	21:00	21:15	Clear	4	
VOCs* (15- minute mean)	12:50	13:05	Sunny	338.5	-
	21:18	21:33	Clear	176.5	

** There are no air quality guidelines for CH_4 and VOCs.*
*** Based on the Air Quality Index prepared by the Environmental Protection Agency of Victoria, Australia where measurements lower than 34.46 mg/m^3 is an indicator of good air quality. Measurements ranging from 34.46 to 80.19 mg/m^3 is an indicator of poor air quality.*

[22] EPA Victoria State, 2020. Carbon Monoxide in the Air.

Table 4-12: Measurement of Sulfur Dioxide and Nitrogen Dioxide

Parameters (mg/m^3)	Start Time (hrs)	End Time (hrs)	Weather Conditions	Concentrations (mg/m^3)	WHO AQG[23] (mg/m^3)
SO_2 (15-minute mean)	11:38	11:53	Sunny	0.0	0.5
	20:05	20:20	Clear	0.0	
NO_2 (15-minute mean)	11:56	12:11	Sunny	0.013	0.2
	20:23	20:38	Clear	0.106	

All values for the gases were within the internationally prescribed levels from the WHO and the EPA Victoria Australia. SO_2 and CO were not detected during testing.

4.2 Biological Environment

The project site is located in close proximity to the Demerara River where many aquatic organisms dwell. Species such as the *Trichechus manatus* (West Indian Manatee*)* which is deemed threatened by the International Union for Conservation of Nature (IUCN) have been spotted along the Demerara River. Organisms belonging to the Subclass Elasbrobranchii (Sharks and Rays) are also frequent visitors of the rivers system along with other threatened fishes such as the *Epinephelus itajara* (Jewfish). During the visit, *Anableps anableps* (Four eye) were observed in the southern canal. Based on the muddy nature of the aquatic environment near the IWMF it is expected that many fishes belonging to Ariidae family would inhabit muddy bottoms. In addition, PSI's would be an attractant of fishes and birds which would come to feed on the waste generated from its seafood processing operations.

Birds such as the *Egretta garzetta* (lesser egret) and *Eudocimus ruber* (Scarlett ibis) are expected to be present at this facility to feed on materials contained in the effluents. Other birds such as the *Ardea alba* (great egret), and *Crotophaga ani* (anis) would also visit the area to feed. Other birds expected within the wider project area includes *Pitangus sulphuratus* (kiskadee), *Columbia sp* (dove), *Icterus, nigrogularis* (yellow plantain) and Strigidae (owls). Species belonging to the family Falconidae (Hawks) were also observed.

Other expected fauna in the area includes insects such as butterflies, wasps, beetles and grasshoppers.

Fishes such as Cichlids including patwas (Aquendens and Cichlasoma genus) are expected to be present in the upper part of the southern canal.

The project site is devoid of vegetation. However, bordering the site are patches of mangroves (Figure 4-15) consisting of a combination of white mangrove (*Laguncularia racemosa*) and black mangoves (*Avicenna germinans*). These mangroves may also serve as an attractant to birds and some fish species. A mangrove fringe forest is located 1.3 kilometers km west of the project site, on the western (opposite) bank of the Demerara River.

[23] World Health Organization, 2005. WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. Pages 16 and 18.

Figure 4-15: Mangroves and Mudflats bordering the Site

4.3 Socio-Economic Environment

4.3.1 Overview

The IWMF is located within the GYSBI compound located at Houston, East Bank Demerara, approximately three kilometres from the heart of Georgetown. Houston falls within the municipality Georgetown which is under the control of the Georgetown Mayor and City Council. The Houston area has gone through several developmental changes over the last ten years.

Houston can be separated into two main parts. The industrial area lies west of the East Bank Public Road and the residential area lies to the east of the road.

The industrial area was purchased by the consortium Guyana Shore Base Inc. (GYSBI) which is comprised of Muneshwers Limited, Pacific Rim Constructors, TotalTec Oilfield Services and LED Offshore Limited.[24] GYSBI purchased most of the lands in 2014 from various private entities to establish a shore base facility that would support the growing offshore oil industry. The area previously housed a forestry processing and shipping operation. In 2019, the Government of Guyana, through the Central Housing and Planning Authority, and in collaboration with the Georgetown Mayor and City Council, announced that the Houston area would be redeveloped as part of the Georgetown Development Master Plan to service the oil and gas industry.[25] Since the development of GYSBI, several oil and gas related companies now occupy the industrial complex. Immediately north of GYSBI is the Schlumberger facility.

The residential area of Houston has a total of 296 households. The closest residences are located approximately 378 meters east of the project site The area also comprises two schools the Houston Nursery School, and the Houston Secondary School. The Secondary School is located approximately 404 meters east, and the Nursery School approximately 671 meters south east of the project site. Several shops and other stores are located along the public road passing through the Houston community. The area east of the residential area which was previously used for surgar cane cultivation are now also being developed to provide services to the oil and gas sector.

4.3.2 Land Use

The immediate surroundings of the IWMF include mainly industrial activities based in GYSBI, with a berthing facility to the west (operated by GYSBI), and industrial facilities to the north and east, including

[24] Guyana Shore Base Inc. undated. About Us.
[25] Over US$100M invested by oil services firm Guyana Shore Base Inc. (2019, September 14). Retrived from https://www.stabroeknews.com/2019/09/14/news/guyana/over-us100m-invested-by-oil-services-firm-guyana-shore-base-inc/

Tiger Rentals (Guyana) Inc. waste management facility. To the south is the Houston drainage canal followed by PSI's seafood processing operations. The land uses of the wider project area is shown in Figure 4-16. Southeast are Farm Supplies Limited which is involved in agriculture machinery sale, and Caribbean International Distribution Inc. (CIDI) which is involved in food and beverage distribution.

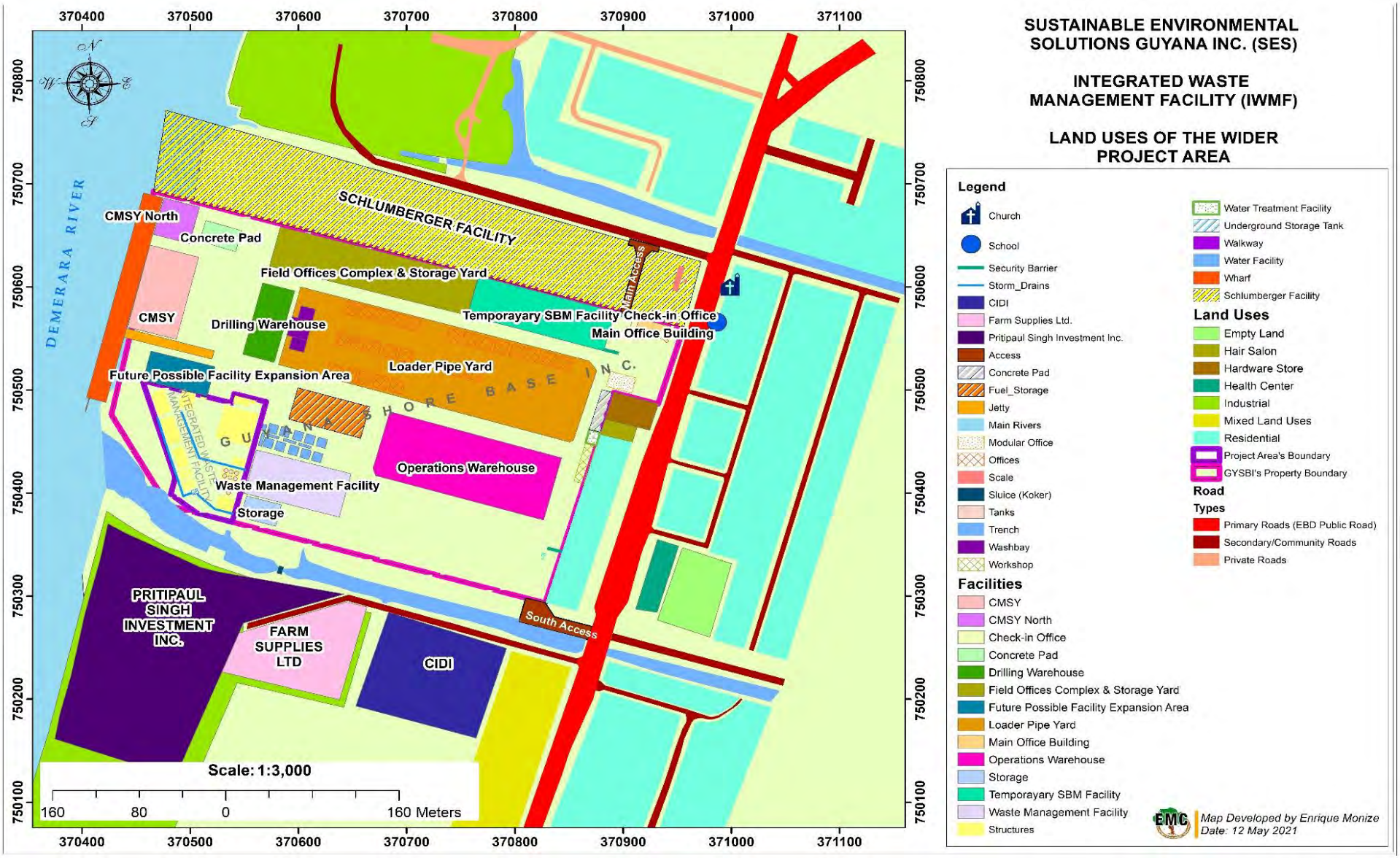

Figure 4-16: Land Uses Around the Wider Area

4.3.3 Population, Livelihoods and Services

Houston is part of the city of Georgetown. Georgetown covers an area of 78 square kilometers and has a total population of 118,363[26]. The residential area that immediately surrounds the Houston area compromises of a mixture of mainly upper-income housing heading north of GYSBI. Middle-income settlements are located within Houston sourth of GYSBI, and also in the neighbouring community of McDoom. The population and number of households in Houston and its neighbouring communities are presented in Table 4-11 below.

Table 4-13: Population and Number of Households in Houston and Neighbouring Communities

Village	Number of Households	Population
Meadow Bank	156	517
Houston	296	999
McDoom	360	843
Total	812	2,359

Source: National Census (2012)

The immediate waterfront properties along the eastern bank of the Demerara River comprises of several wharves which are mainly used by the shipping industry and fishing sector. In recent years, there has been further development in the Houston and McDoom area for the development of industrial megacomplexes such as GYSBI in Houston, and the Gafoors Complex and GYSBI Annex in McDoom. Significant investments in surrounding area, particularly in McDoom, is expected to continue with the establishment of the Special Area Redevelopment Scheme.

At the time of the 2012 National Census the major industry within the area was manufacturing. Other significant industries included wholesale and retail trade, transport, storage and administrative and support activities. As a result, the largest source of livelihoods within the area was self-employment. In addition, many villagers were employed in some type of trade including masonry, carpentry, mechanics or were employed in other privately-owned businesses.

There are two schools in the immediate area, namely the Houston Secondary School and the Houston Nursery School. The Our Lady of the Mount Church and a mosque are located east of the public road in Houston and McDoom respectively.

4.3.4 Utilities

The area is serviced through key utilities. Specifically, the following are provided:

- Electricity (Guyana Power and Light – GPL).
- Water (GWI).
- Telephone (Guyana Telephone & Telegraph - GT&T & Digicel).
- Internet (GT&T and other private providers).
- Roads (the Town Council is responsible for repairing all internal streets & roads. The Ministry of Public Works is responsible for the East Bank Demerara Public Road).

[26] Guyana National Bureau of Statistics. 2012. National Census

4.3.5 Protected Sites and Buildings

The nearest UNESCO World Heritage Site, the City Hall, is located approximately 3 kilometers north of the Site. As classified by Guyana's National Trust, the nearest national monument, the 1763 Monument, is located 3.29 kilometers northeast of the Site and the nearest regional monument, the Demerara Harbour Bridge, is located 2.02 kilometers southwest of the Site.

It should be noted that the UNESCO World Heritage Sites within Guyana remain on their tentative list and are yet approved. Nonetheless they are of significant cultural significance to Guyana.

5.0 STAKEHOLDER ENGAGEMENTS

5.1 Stakeholder Engagement Approach

Timely, inclusive and broad-based stakeholder engagement is vital in preparing an EMP. It enhances the effectiveness, efficacy and accountability of the environmental assessment process and supports implementation of the proposed project. Feedback garnered from stakeholders can help identify and assess potential impacts, and support the identification of measures to mitigate and manage them. Stakeholder engagement is also a key component of managing project risks. Transparent and balanced stakeholder engagement can improve project design, reduce conflicts, increase social acceptability, and strengthen the project's sustainability. It also familiarizes local and regional stakeholders with the planned project activities; provides a platform for the community to share knowledge, give feedback and raise concerns; and sets the foundation for a positive relationship between the project and the local communities and stakeholders.

The overall objective of the stakeholder engagements conducted as part of preparing the EMP for the SES IWMF was to build awareness of the project among stakeholders, provide a platform to share local knowledge, concerns, and recommendations, and receive feedback.

The specific objectives included:

- Inform stakeholders about the IWMF including its location, components, and planned activities.
- Initiate open dialogue to clarify the project elements and activities, and provide a platform for stakeholders to discuss the project, ask questions, raise concerns, share expectations and give recommendations in a documented and acknowledged format.
- Receive feedback from stakeholders on environmental and social concerns associated with the project components and activities.
- Document stakeholder feedback to ensure all issues and concerns are duly considered in the EMP preparation process.

The stakeholder engagement approach for the EMP consisted of the following key elements:

- Stakeholder identification, analysis, mapping, and prioritization.
- Stakeholder engagement method and tools.
- Documenting of stakeholder feedback.

5.2 Stakeholder Identification

Stakeholders identified for engagement are those who could be negatively or positively affected by or can affect the outcome of the IMWF project. The stakeholders with whom the consultants engaged generally comprised of land users located close to the project site, and national and local government authorities, and institutions. These include:

- Guyana Office for Investment
- Guyana Police Force - Traffic Department
- Georgetown Mayor and City Council
- Ministry of Local Government and Regional Development - Waste Management Department
- Ministry of Public Works
- Central Housing and Planning Authority
- Pritipaul Singh Investments Inc.
- Farm Supplies Limited
- Guyana Shore Base Inc.

5.3 Stakeholder Engagement Method and Tools

The stakeholder engagement strategy was designed so as to utilize appropriate methods and tools to engage with stakeholders effectively and efficiently. The overarching objective was to employ methods that facilitate meaningful consultations with stakeholders and encourage the open sharing of information and views about the project.

One-on-one engagements were determined to be the most appropriate tool to effectively and transparently engage the stakeholders identified in Section 5.2. At the outset of each one-on-one meeting, the consultant team delivered a presentation on the IWMF Project to stakeholders so to enhance their understanding of the planned activities. An interactive session then followed to provide the stakeholders with opportunities to ask questions, share knowledge, raise concerns, provide feedback and recommendations and share their expectations of the project.

In addition, one-on-one engagements also allow stakeholder engagements to comply with the public health restrictions associated with the COVID-19 pandemic. In most instances, stakeholders were available for virtual discussions with the consulting team through the use of internet-based communication tools (Zoom). However, the consultants were also willing to engage with stakeholders in person, if such meetings were preferred by the stakeholder. Table 5-1 shows the schedule of the stakeholder engagements and the type of meetings that were facilitated.

Table 5-1: Schedule of One-on-One Engagements with Stakeholders

Stakeholders	Date
In-Person Engagements	
Guyana Police Force - Traffic Department	April 06, 2021
Farm Supplies Limited	April 15, 2021
Engagements via Zoom	
Guyana Office for Investment (Go-INVEST)	April 06, 2021
Georgetown Mayor and City Council	April 08, 2021
MLGRD, Waste Management Department	April 08, 2021
Ministry of Public Works (MOPW)	April 08, 2021
Central Housing and Planning Authority (CHPA)	April 13, 2021
Pritipaul Singh Investments Inc. (PSI)	April 14, 2021
Guyana Shore Base Inc. (GYSBI)	April 20, 2021

5.4 Stakeholder Feedback

The critical concerns, questions and recommendations identified by participants during the stakeholder engagement include potential impacts of the project particularly regarding potential impacts on air quality, and operational aspects of the IWMF. Detailed notes of the feedback provided by stakeholders is presented in Appendix D. Table 5-2 presents a summary of the feedback received.

Table 5-2: Summary of Stakeholder Feedback

Themes and Issues	Stakeholder Questions, Concerns and Recommendations
Haags Bosch Landfill	*MLGRD, Waste Management Department* ▪ The Haags Bosch Landfill has sufficient capacity to manage waste requiring disposal by the IMWF. ▪ The Landfill recently expanded its capacity to accept waste streams like derelict materials, scrap metals, and soils. ▪ The Landfill only accepts inert substances and does not dispose of any hazardous wastes. ▪ The Department will soon implement a new system for receipt of all waste originating from GYSBI that will require advance notice of each waste load, separation of waste streams and documentation accompanying waste loads heading to the Landfill. *Georgetown Mayor and City Council* ▪ Waste management at the Haags Bosch Landfill should be improved as it poses public health risk in its present condition. ▪ The Government should develop solid waste management legislation and waste management plans to improve waste management in the country as a whole.
Environmental Management	*GO-INVEST* ▪ The development should be sustainable and take precautions to protect the environment. ▪ GO-INVEST ensures that all potential investments are compliant with environmental laws and regulations. ▪ The EPA's environmental authorization process is lengthy and delays in permit issuance can result in delays in processing Investment Agreements. ▪ In order to process Investment Agreements in a timely manner GO-INVEST has resorted to requesting companies to submit the EPA Application Fee receipts, instead of waiting for the Environmental Authorisation. GO-INVEST may also consider asking companies for a copy or summary of the EMP to expedite the processing of Investment Agreements.
Water Quality	*Farm Supplies Limited* ▪ Will effluent be discharged into the canal between PSI and the IWMF?
Air Quality	*Pritipaul Singh Investments Inc.* ▪ PSI has had significant issues with emissions like fumes, dust and odour from the existing Tiger Tanks incinerator. PSI workers have had to terminate work and remove from work areas, particularly along the PSI waterfront, as a result of these emissions. There were also instances of workers complaining that emissions were triggering asthma attacks. ▪ PSI has significant concerns about a similar situation arising from SES IWMF. ▪ PSI must adhere to strict international standards to meet certification requirements and conditions set by the Ministry of Agriculture,

Themes and Issues	Stakeholder Questions, Concerns and Recommendations
Air Quality	Veterinary, and Public Health Department. The emissions pose a high risk of contaminating the food processed by PSI. ▪ There are risks of losing certification if PSI is located within proximity of a facility like the IWMF. *Farm Supplies Limited* ▪ There were significant issues with emissions from the existing Tiger Tanks incinerator. The emissions burned eyes and made breathing difficult. The odour also contributed to breathing difficulties. These emissions also affected workers at neighbouring operations (PSI and CIDI). ▪ The company reported these issues to the EPA and remedial measures were taken. Tiger Tanks was required to raise the height of the emissions stack and which should only be used when prevailing wind conditions will transport the pollutants to over the Demerara River. ▪ Pungent odours from incineration of some waste streams may be inevitable. *Guyana Shore Base Inc.* ▪ GYSBI's neighbours, particularly PSI, have had significant complaints about emissions from the Tiger Tanks incinerator and subsequently, corrective measures were implemented. ▪ PSI concerns about IWMF operations are well noted and the sensitivity of their operations as a food processing facility is also acknowledged. ▪ PSI has plans in place to relocate the processing plant in the near future but their concerns should be adequately addressed in the interim.
Road and Marine Traffic	*Guyana Police Force - Traffic Department* ▪ GYSBI is located in a traffic 'hotspot' and several measures have been implemented to manage traffic in this area. ▪ The Traffic Department, once consulted, is willing to work in collaboration with developers to find solutions to any traffic management challenges. *Pritipaul Singh Investments Inc.* ▪ PSI queried whether ships bringing waste to the IWMF will cause a blockage of the canal at the site.
Expected Project Benefits	*Georgetown Mayor and City Council* ▪ The Project is aligned with the vision for Greater Georgetown and is expected to bring positive contributions to economic development and job creation. *GO-INVEST* ▪ GO-INVEST welcomed investments in Guyana.
Stakeholder Engagement and Grievance Redress	*Georgetown Mayor and City Council* ▪ The M&CC may invite the developer to present further information on the IWMF Project to the entire Council. ▪ The M&CC will decide to issue its No-Objection to the Project after it is discussed by the Council and based on advice from the M&CC's technical personnel.

Themes and Issues	Stakeholder Questions, Concerns and Recommendations
Stakeholder Engagement and Grievance Redress	*The Central Housing and Planning Authority* ▪ The CHPA team welcomed the consultative approach and hoped for more engagement in the future. *Guyana Shore Base Inc.* ▪ GYSBI should be considered a primary stakeholder in the IWMF project. ▪ A copy of the Operation Permit issued by the EPA should be shared with GYSBI by SES up-front. ▪ A mechanism to facilitate official and immediate communication with GYSBI should any complaints be received about the IWMF's operations should be developed.
GYSBI	*Guyana Shore Base Inc.* ▪ GYSBI has no committed use for the land west of the IWMF project site that was reclaimed. The company anticipates that IWMF will increase its demand for storage space, and the most likely future use of the land will be to facilitate an expansion of the IWMF. *Farm Supplies Limited* ▪ Queried if the IWMF is being constructed on the mudflat reclaimed by the Guyana Shore Base Inc. (GYSBI). *The Georgetown Mayor and City Council* ▪ The M&CC has received complaints from residents regarding chemicals, exposure risk, and tremors in and around the GYSBI area. *Ministry of Public Works* ▪ The developers should engage with the Sea and River Defence Board so as to obtain all approvals required to operate their facility in proximity to the shoreline.
IWMF Operations	*Georgetown Mayor and City Council* ▪ Queried whether the facility will only handle waste from the oil and gas industry or will accept waste from other sources. *Farm Supplies Limited* ▪ Queried if the facility will process similar offshore waste streams as Tiger Tanks. ▪ Queried if the IWMF will it have a greater processing capacity than Tiger Tanks.

6.0 IMPACT ASSESSMENT

6.1 Introduction

SES is pursuing the establishment of an Integrated Waste Management Facility to receive, treat and dispose of waste generated by EEPGL's offshore operations. The EPA has granted a Construction Permit to SES to commence construction of the facility. Construction has commenced and has progressed significantly. SES anticipates operation of the IWMF will start by July 2021.

SES has been required by the EPA to prepare an EMP for the operation of the IWMF. The impact assessment conducted as part of the EMP preparation process therefore focused on the operation phase of the project and includes all activities within the boundaries of the IWMF which is within the GYSBI facility. For the avoidance of doubt, the scope does not include activities associated with the management and collection of wastes on the offshore facilities or off-loading facilities. These responsibilities rest with EEPGL and GYSBI respectively.

The assessment methodology has been adapted from the UK Environment Agency's (EA's) environmental permit generic risk assessment process, and which has been used successfully to assess the environmental risks associated with permitted facilities such as waste treatment plants.

The scope of the assessment covers all activities and processes undertaken within the site boundary as described in Chapter 2 of this EMP. For each of the activities the following assessment approach has been followed:

- Identify the hazards associated with the site activities.
- Identify pathway and receptor(s) of potential harm.
- Assess the risks (considering proposed/existing mitigation measures).
- Choose appropriate (additional) mitigation measures (if required).
- Present the assessment of overall residual risk (post-mitigation).

The nature of the potential environmental impacts has been determined in consideration of the following conditions:

- **Impact** – Beneficial, Negligible/Neutral, Adverse.
- **Nature of the change** – Temporary, Reversible, Permanent.
- **Geographical** – Localised, Site-wide, District, Regional, National, Trans-national.
- **Timescale** – Short-term, Medium-term, Long-term.
- **Frequency** – Frequent, Infrequent, Rare.

The impact assessment methodology has used a qualitative scoring mechanism whereby scores are assigned to:

- The likelihood of the hazard occurring (Very Low, Low, Medium, High).
- The consequence of the hazard on the environment (Very Low, Low, Medium, High).

The descriptions for likelihood and consequence are outlined within Table276-.

Table 6-1: Likelihood and Consequence Descriptions

Category	Likelihood	Consequence
VERY LOW	Rarely encountered, never reported or highly unlikely within sector.	Slight environmental effect but does not exceed a regulatory standard.
LOW	Infrequent, occasional, very few occurrences within sector.	Minor environmental effect which may reach a regulatory standard, localised to point of release with no significant impact on the environment or for health.
MEDIUM	Occurs several times per year within sector.	Moderate, localised effect on ecosystems and people in the vicinity of an incident or release.
HIGH	Repeated occurrences at a location.	Major environmental incident resulting in damage to ecosystems and or harm to health.

The impact assessment has been completed by scoring the hazards outlined above using a risk matrix (**Error! Reference source not found.**).

Table 6-2: Risk Matrix

		Consequence			
		High	Medium	Low	Very Low
Likelihood of Occurrence	High	HIGH	HIGH	MEDIUM	MEDIUM
	Medium	HIGH	MEDIUM	MEDIUM	LOW
	Low	MEDIUM	MEDIUM	LOW	VERY LOW
	Very Low	LOW	LOW	VERY LOW	VERY LOW

6.2.1 Area of Influence

It is also important to consider the potential zone of influence of the facility in terms of how far the impacts, if they occur, could manifest themselves. Given that this is a relatively small facility handling predominantly solids and liquids through a variety of waste treatment plant, the primary Area of Influence (AoI) is defined as the footprint of the actual IWMF, and a 50-meter fringe in all directions around the facility. The secondary AoI encompasses the area within which emissions could potentially manifest itself. This was considered to be one kilometre in a southwesterly direction for air emissions and one kilometer upstream and downstream of the Demerara River for waterborne emissions. The AoI of the project can be seen in Figure 6-1.

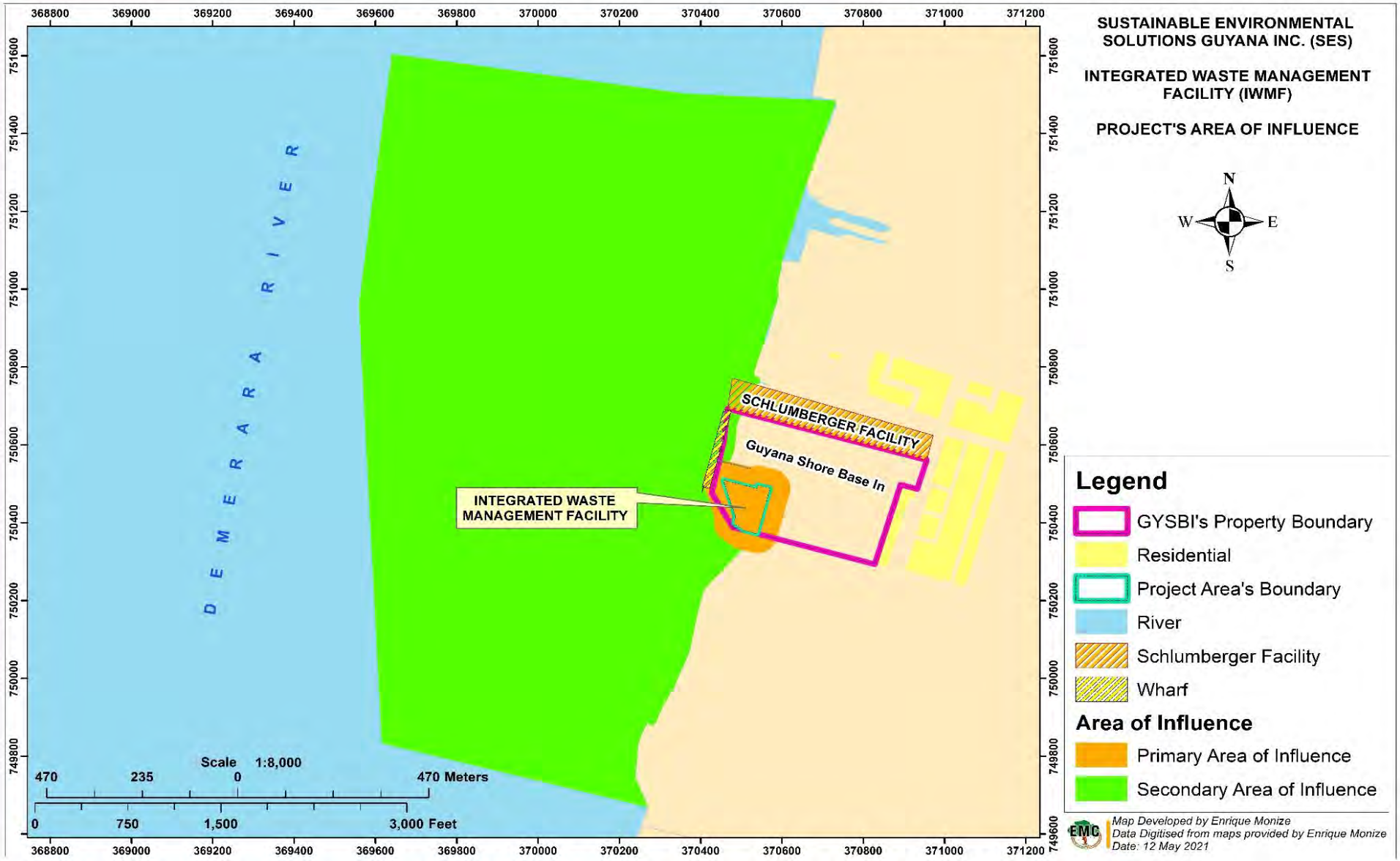

Figure 6-1: Area of Influence of the IWMF Project

6.2 Environmental Risk Assessment

A fundamental aspect on any predictive impact assessment is to define the activities or events that pose a risk to the environment or which could alter the baseline conditions. The consultant team has assessed the proposed site activities and reviewed the potential of these to impact the environment as characterised in the baseline assessment.

Impact risk assessment is based on consideration of three factors that must be present for a risk to be realised:

- **Source:** what are the pollutants that could be introduced to the environment or activities that could change the baseline conditions.
- **Receptor:** which elements of the project environment are vulnerable or sensitive to inputs that could negatively affect them.
- **Pathway:** what is the mechanism by which the receptor could be exposed to the source.

If any of these three elements do not exist in any given scenario there is no risk.

The impact assessment has considered the following potential impact scenarios:

- Planned and unplanned emissions to **Air**.
- Planned and unplanned emissions to **Water**.
- Planned and unplanned emissions to **Soils**.

The assessment has considered the following range of potential impacts on receptors:

- Direct human health impacts from exposure to harmful substances.
- Indirect human health impact from changes to the environment.
- Direct ecosystem impacts due to loss of or damage to habitat.
- Indirect ecosystem impacts due from changes to the environment.
- Direct built environment impacts from exposure to deleterious materials or events.
- Indirect built environment impacts from changes to baseline conditions.

6.2.1 Environmental Fate of Wastes

An important consideration in the assessment of any waste management and treatment facility is the ultimate environmental fate of all of the waste streams. In other words what are the emissions and residues from the operation of the site and where do these emissions, discharges and residues go when they leave the installation boundary.

Table 6-3 below provides a summary of the waste materials treated and the respective residues, emissions and discharges and their fate. The impact assessment has considered the impact of these emissions, discharges and residues on the environment that receives them.

Table 6-3: Environmental Fate of Emissions, Discharges and Residues

Incoming Waste	Quantity	Treatment Process	Air Emissions	Solid or liquid Residues	Fate of Air Emissions	Fate of Solid or Liquid Residues
Hazardous Waste – Drill cuttings, muds and slops	1070 total quantity per year (MT)	Hot-oil Thermal Desorption Unit (HTDU)	Per one metric tonne of cuttings: SO2 – 42g NOx – 142g CO2 – 180 kg (1 loaded truck discharges 80 – 100 kg of CO2 per hour)	Recovered oils, water and solids	Atmosphere	**Dry Solids** – Reuse in front-end HTDU or disposal via Landfill **Recovered Water** – Water treatment plant before discharge to either sewage or canal. Surplus water may be sent to the mud plant **Recovered Oil** – Recovered base oils will be reused as both secondary fuels for firing in the incinerator as well as for reuse in the manufacture of drill muds. Oils will also go to the Mud plant.
Incinerable Solids – Aerosol cans, Chemical sacks; Consumables (greases, tubes, dope and brushes), Contaminated filters, Medical waste, Oily debris (rags, absorbent pads), Paint	30 MT per year	Incineration	Sulphur Dioxide Carbon Dioxide Nitrous Oxides Particulates	Ash	Atmosphere	**Residual Ash** - Landfill
Incinerable Liquids - Contaminated fuel, Lubricants, Cooking oil, Hydraulic/Transmission Fluids, Motor oil	20 MT per year	Incineration	Sulphur Dioxide Carbon Dioxide Nitrous Oxides Particulates	Ash	Atmosphere	**Residual Ash** - Landfill

Incoming Waste	Quantity	Treatment Process	Air Emissions	Solid or liquid Residues	Fate of Air Emissions	Fate of Solid or Liquid Residues
Petroleum and Chemical contaminated water	500 MT (contaminated water) per year	Wastewater Treatment		Recovered water	N/A	**Discharge to surface water**
Empty IBC's; Drums; Containers	435 units per year	Container washdown area	None	Metal, plastic	N/A	**Shred & Bale** – Landfill **Wastewater** – to WWTP
Non-hazardous waste – wood, plastic, domestic	571 total quantity per year (MT)	Shredder	None	Non-hazardous waste – wood; plastic; domestic	N/A	**Shred** – Landfill
Scrap Metal	300 MT per year	Recovery and Recycling	None	Scrap Metal	N/A	**Scrap Metal Recycling Facility**

6.2.2 Potential Risks of Planned and Unplanned Emissions to Ambient Air

The point source emissions that can be expected from the facility are outlined within Table 6-4.

Table 6-4: Point Source Emissions to Air

Source	Emissions
A1	**Hot Thermal Desorption Unit (HTDU)** ▪ Combustion of recovered diesel or diesel fuel within HTDU. ▪ Fuel combustion emits Nitrogen oxide (NOx), Carbon monoxide (CO), Sulphur dioxide (SO_2), Carbon dioxide (CO_2) and particulates. ▪ No monitoring of the emission is proposed.
A2	**Hazardous Waste Incinerator** ▪ Abatement system fitted prior to emission (Venturi Filtration System) ▪ Single emission point to air 8.0 metres above ground level. ▪ Stack fitted with a continuous emission monitoring system (CEM) for the measurement of the Oxygen within the flue gas. ▪ Stack fitted with a 360° platform area accessible via a vertical ladder to enable the periodic sampling of the flue gas for full emissions analysis.

No other point source air emissions are anticipated at the facility.

With respect to air emissions, it is important to not only recognise the emissions, but also how the concentrations of these emissions compare to the likely Emission Limit Values (ELVs) for each of the respective emissions (Table 6-5).

Table 6-5: Comparison of Predicted Emissions to ELVs

Parameter	ELV (30-min Mean)	Predicted Emissions (Hazardous and Medical Wastes)	Predicted Emissions (General Wastes)
Particulate Matter	30 mg/m3	12 mg/m^3	17.8 mg/m^3
SO_2	200 mg/m3	2.4 mg/m^3	7.5 mg/m^3
NO and NO_2, expressed as NO_2	400 mg/m3	60 mg/m^3	88.3 mg/m^3
CO	100 mg/m3	98.3 mg/m^3	84.00 mg/m^3

As can be seen, compliance with Emission Limit Values from the incinerator and HTDU is expected to be achieved by the plant. This is particularly important because of challenges where neighbouring operations have reported to have experienced significant adverse impacts to human health and productivity from emissions from the Tiger Rentals incinerator. Ultimately, these issues were addressed following intervention from the EPA which required implementation of additional mitigation measures including raising the height of the emission stacks and using the incinerator when prevailing winds will transport emissions over the Demerara River (EMC Personal Communications 07, 08 and 09).

Given this adverse experience, some of the neighbours to the IWMF, in particular PSI, have expressed concerns that another incinerator may result in negative impacts to their operations (EMC Personal Communication 07). However, the IWMF has been engineered to include mitigation measures which are already being implemented by Tiger Rentals. The IWMF will also deploy more effective waste management technologies. In particular, hazardous waste streams comprising of drill cuttings, slops and sludges will be treated in the HTDU and not the incinerator.

A comprehensive analysis of potential risks from planned and unplanned emissions to the air is detailed in Table 6-6.

Table 6-6: Assessment of Potential Risks of Planned and Unplanned Ambient Air Emissions

Data and Information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
Incineration of waste within an Addfield C200 unit.	Planned air emissions	Air	On-site operators, neighbours (including PSI, Farm Supplies and CIDI), and residential areas	Exposure to harmful particulates, respiratory irritants and toxic chemicals.	MEDIUM	LOW	**MEDIUM**	The air emissions are associated with high temperature incineration and designed to meet low impact performance standards. Neighbours report to have experienced challenges with emission from Tiger Rentals incinerator emission stack but these issues have been adequately addressed by the installation of mitigation measures. The SES IWMF has been engineered to surpass these standards.	CEM for oxygen to assess incinerator performance. Preventive maintenance. Stack fitted with a 360° platform area accessible via a vertical ladder to enable the periodic sampling of the flue gas for full emissions analysis. Abatement system fitted prior to emission (Venturi Filtration System) Single emission point to air 8.0 metres above ground level.	**LOW**

Data and Information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Releases of particulate matter (dusts) and micro-organisms (bioaerosols).	Air dispersion then inhalation.	Local human population including neighbouring operations (including PSI, Farm Supplies and CIDI)	Harm to human health - respiratory irritation and illness.	LOW	MEDIUM	**MEDIUM**	The site will be handling dry and potentially dusty materials or generating them as residual wastes (such as incinerator ash), which could become airborne if uncontrolled.	Emissions Management Plan. Containerisation and covering of wastes. Where practicable, lids will be kept on vessels containing volatile compounds and loose material to minimise fugitive emissions. Procedure for handling of potentially dusty materials. Routine monitoring of air emissions including particulates.	**VERY LOW**
General storage, handling and processing of waste streams on the site.	Releases of particulate matter (dusts) and micro-organisms (bioaerosols).	Air dispersion then settling.	Local human population, built environment and habitats	Nuisance - dust on vehicles, clothing, plants, etc.	LOW	LOW	**LOW**			**VERY LOW**
General storage, handling and processing of waste streams on the site.	Litter.	Air transport then deposition.	Local human population	Nuisance, loss of amenity.	LOW	LOW	**LOW**	The site is remote from residential areas and fenced with a 24-hour site presence.	Regular site inspections and litter picking. Containerisation and covering of loose wastes.	**VERY LOW**

Data and Information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Odour	Air dispersion then inhalation.	Local human population including neighbouring operations (including PSI, Farm Supplies and CIDI)	Nuisance, loss of amenity.	LOW	LOW	**LOW**	Whilst there may be odorous substances arriving at the facility, these will be containerised and treated promptly which will eliminate the odour.	Inspection and monitoring of all incoming wastes. Containerisation of wastes with regular checks on containers and their management. Use of the HTDU for treatment of drill cuttings, slops and sludges. Routine emission monitoring.	**VERY LOW**
General storage, handling and processing of waste streams on the site.	Scavenging animals especially scavenging birds and pests such as flies.	Air transport and over land.	Local human population	Harm to human health - from waste carried off site. Nuisance and loss of amenity.	LOW	LOW	**LOW**	The proportions of putrescible wastes that are likely to be attractive to scavengers and pests will be low and well containerised, and for the majority of time (other than transit across the facility) kept indoors limiting opportunities for infestation. Containerisation of putrescible wastes is especially important because scavenging	Site reception procedures. Containerisation of wastes. Site audits and monitoring.	**VERY LOW**

Data and Information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
								birds are expected in the zone of influence from PSI operations.		

6.2.3 Potential Risks of Planned and Unplanned Emissions to Surface Water

The anticipated point source emissions from the IWMF operations are outlined within Table6-7.

Table 6-7: Point Source Emissions to Surface Water

Source	Emissions
W1	**Hot Thermal Desorption Unit (HTDU)** ▪ Recovered water from HTDU treated (settled) within 2 x 5-cubic meters day tanks, water transferred to 1 x 30-cubic meters storage tank before passing through the water treatment vessel. ▪ Treated water will be discharged to the drainage system.
W2	**Wastewater Treatment Plant (WWTP)** ▪ Treatment of oily waste, pH adjustment followed by RO. ▪ Discharge to the surface water system via an oil water interceptor.

These are the only process related water that will be generated by the IWMF. However, there will also be sewage from the toilet block facilities and washrooms and surface water run-off. Sewage water from the site facilities and washrooms will be contained in septic tanks and transported off site under local contract for treatment.

Surface water run-off will be discharged into a canal south of the site leading to the Demerara River through the surface water discharge system (through interceptors with a shut-off valve) across the central yard area and through underground pipe from roof discharges. The detailed site drainage system is shown in Appendix E. The canal into which effluent from the project site will be discharged is currently used by neighbouring operations particularly Tiger Rentals, a waste treatment facility located east of the IWMF, for discharge of effluent (Figure 6-2). The canal is also used by the seafood processing operations PSI. A dry dock operated by PSI is located at the mouth of the canal at the junction with the Demerara River. Given the proximity of the canal to the Demerara River, it is expected that there will be tidal influences of the Demerara River that may also influence the quality of water in the canal.

Figure 6-2: Tiger Rentals Effluent Discharge Point

There are no planned discharges to injection wells on the site, therefore there will be no discharges to groundwater. The surface area within the project site will also be impermeable, thus preventing infiltration into the soil and subsequently groundwater.

In addition to discharges surface water can become contaminated if the site is flooded. The Coastal Region of Guyana, which varies from approximately 8 to 65 kilometres in width, is mostly below sea level. Approximately 90 percent of Guyana's population, most of the country's infrastructure, agriculture and industry are located on the coast. Due to the area being below mean sea level it is vulnerable to both coastal and riverine flooding, especially during the wet seasons from April to August and November to January and during high tides[27].

According to Think Hazard[28], the IWMF is located within an area classified as having high risk from river flooding. This means that potentially damaging river floods are expected to occur at least once in the next ten years.

A comprehensive assessment of potential risks from planned and unplanned emissions to surface water and flooding of the project site is detailed in Table 6-8.

6.2.4 Potential Risks of Planned and Unplanned Emissions to Soils

The project site is hard surfaced (impermeable) consisting of polymeric bound gravel and underlain by a substantial thickness of low permeability clay. The gradient of the site ensures that all surface runoff is channeled to the internal drainage system and is not left stagnant on the surface.

A comprehensive assessment of potential risks from planned and unplanned emissions to lands within the project site is detailed in Table 6-9.

6.2.5 Potential Risks of Noise and Vibrations

The operations of the IWMF will contain several noise generating equipment and machinery. However, the IWMF is located in the GYSBI facility which has been zoned for industrial activities. The immediate neighbours to the project location are commercial and industrial activities. The closest residential activities are located more than 350 meters from the project site to the east. Project workers will be the main receptors of the potential noise impacts. According to the standard from the US Department of Labour, Occupational Safety and Health Administration, workers are at risk of adverse effects of noise exposure, including hearing loss, when noise exposure is at or above 85 decibels averaged over 8 working hours, or an 8-hour time-weighted average[29]. However, risks of occupational exposure to high noise levels may be mitigated with the use of appropriate hearing protection.

An assessment of the potential risks of noise and vibrations is presented in Table 6-10.

[27] US Army Corps of Engineers, December 1998, Water Resources Assessment of Guyana.
[28] ThinkHazard! is a web-based tool enabling high-level assessment of impacts on new development projects developed by the World Bank Group and the Global Facility for Disaster Reduction and Recovery (GFDRR). ThinkHazard! can be publicly accessed at thinkhazard.org/en/
[29] US Department of Labour, Occupational Safety and Health Department, undated. Occupational Noise Exposure.

Table 6-8: Assessment of Potential Risks of Planned and Unplanned Emission to Water and Site Flood Risk

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
Site yard (movements and storage of waste)	Leaks and spills and general run-off.	New discharge channel within site (located at eastern site boundary), which flows in a south direction.	Discharge via rip rap channel into canal which then immediately enters the Demerara River.	Water quality and ecological impacts in the Demerara River.	LOW	MEDIUM	**MEDIUM**	All surface run-off is channeled to the two oil-water separators along the eastern site boundary. A penstock is provided that can isolate the site discharge. A final oil-water separator is provided (post-penstock) before discharge into the waterway.	Procedure for operation and management of the penstock. Procedure for maintenance of the oil-water separators and penstock. Waste handling equipment and procedures. Spill response kits located around the site.	**VERY LOW**
Storage and handling of Naturally Occurring Radioactive Material (NORM) waste stream at the site(in the exceptional circumstances that NORMs are received on site, which	Routine discharges of NORM into the local environment.	Exposure to low level dispersed radioactivity through direct contact with contaminated materials or ingestion of fish/crustacea from contaminated waters.	Local human population and environment (including surface water, fish and crustacea)	Increased radiation dose.	VERY LOW	MEDIUM	**LOW**	The occurrence of NORM is possible in all drilling operations, but is expected to be at low levels and resides in sludges and solids which will be containerised and managed to prevent spills and leaks. Releases from the site into the environment should not occur.	Devices to detect NORM will be installed. Waste handling procedures including quarantine of wastes that cannot be treated. Identification, classification, storage, pending shipment out of country to	**VERY LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
is not planned).									nominated treatment/disposal site. Trans-frontier shipment controls employed.	
Storage and handling of NORM waste stream at the site (in the exceptional circumstances that NORMs are received on site, which is not planned).	Accidental release of NORM waste	Exposure to dispersed radioactivity through direct contact with contaminated materials or ingestion of fish/crustacea from contaminated waters as the result of an uncontrolled spillage of NORM contaminated materials.	Local human population and environment (including surface water, fish and crustacea)	Increased radiation dose.	VERY LOW	MEDIUM	**LOW**	The occurrence of NORM is possible in all drilling operations, but is expected to be at low levels and resides in sludges and solids which will be containerised and managed to prevent spills and leaks. Releases from the site into the environment should not occur.	Waste handling procedures including quarantine of wastes that cannot be treated at the site. Identification, classification, storage, pending shipment out of country to nominated treatment/disposal site. Site containment engineering and emergency response procedures in place. Trans-frontier shipment controls employed.	**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Flooding of the site	Flood waters	Local human population and local environment/ habitats	If waste is washed off site it may contaminate natural habitats and local populations downstream.	LOW	LOW	**LOW**	The site has not flooded historically, has been built up for the development and is above the highest astronomical tide level.	The site is hard-surfaced with a controlled drainage system. Procedure for operation and management of the penstock. The main waste storage areas are bunded.	**LOW**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Direct run-off from site across ground surface, via surface water drains, ditches etc.	All surface waters close to and downstream of site (Demerara River).	Acute effects effecting flora and fauna including oxygen depletion, fish kill etc.	LOW	LOW	**LOW**	Wastes are segregated and containerised and held within containment areas. The entire facility is hard-surfaced with controlled drainage. Gradient of the facility channels all runoff to the internal drainage system.	Regular inspections and audits. Site reception checks and monitoring. Secondary containment and spill kits. Emergency Response Plan.	**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Direct run-off from site across ground surface, via surface water drains, ditches etc. Indirect run-off via the underlying soil layer.	All surface waters close to and downstream of site (Demerara River).	Chronic effects leading to the deterioration of water quality.	LOW	LOW	**LOW**	.		**LOW**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Direct run-off from site across ground surface, via surface water drains, ditches etc. Abstraction and/or use surface water of water.	Surface waters - abstraction from watercourse downstream of facility (for agricultural or potable use).	Acute effects - loss of resource (closure of abstraction intakes). Human health and livestock health effects.	LOW	LOW	**LOW**	Wastes are segregated and containerised and held within containment areas. The entire facility is hard-surfaced with controlled drainage. Gradient of the facility channels all runoff to the internal drainage system.	Regular inspections and audits. Implementation of all waste management strategies and procedures. Bunding all of the main waste storage areas.	**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Direct run-off from site across ground surface, via surface water drains, ditches etc. Discharge channel within site (located at eastern site boundary), which flows south. Direct contact or ingestion.	Discharge via rip rap channel into canal which then immediately enters the Demerara River. Surface waters used for recreational use. Local human population.	Loss of recreational use. Water quality impacts in the Demerara River leading to harm to human health - skin damage or gastro-intestinal illness.	LOW	LOW	**LOW**	All surface runoff is channeled towards the two oil-water separators along the eastern site boundary. A penstock is provided that can isolate the site discharge. A final oil-water separator is provided (post-penstock) before discharge into the waterway. Facility is in an industrial zone where there is no local recreational use of the river.	Periodic inspections of the site. Emergency Response Plan. Procedure for operation and management of the penstock. Procedure for maintenance of the oil-water separators and penstock. Spill kits and spillage response training in use.	**VERY LOW**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Transport through underlying soil and groundwater then abstraction at a borehole.	Shallow groundwater. Abstraction for agricultural or potable use.	Acute effects - loss of resource (closure of abstraction intakes). Human health and livestock health effects.	VERY LOW	LOW	**VERY LOW**	The main groundwater body beneath the site is at considerable depth and overlain by a substantial thickness of low permeability stiff clay. The entire site surface is sealed and wastes are stored in containment areas.	Incoming wastes inspection. The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system. Routine inspections and monitoring.	**VERY LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
									Spill kits available at strategic locations and training in their use is provided.	

Table 6-9: Assessment of Potential Risks of Planned and Unplanned Emissions to Soils

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
Storage and handling of NORM waste stream at the site (in the exceptional circumstances that NORMs are received on site, which is not planned)..	Accidental release of NORM waste	Exposure to dispersed radioactivity through direct contact of soils below hard-surface with subsurface soils.	Soils	Increased radiation dose.	VERY LOW	MEDIUM	**LOW**	The occurrence of NORM is possible in all drilling operations, but is expected to be at low levels and resides in sludges and solids which will be containerised and managed to prevent spills and leaks. Releases from the site into the environment should not occur.	Waste handling procedures including quarantine of wastes that cannot be treated at the site. Identification, classification, storage, pending shipment out of country to nominated treatment/disposal site. Site containment engineering and emergency response procedures in place. The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system.	**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Indirect surface run-off via the underlying soil layer.	Soils below hard-surfaced area of the IWMF	Chronic effects leading to the deterioration of soil quality	LOW	LOW	**LOW**	Wastes are segregated and containerised and held within containment areas. The entire facility is hard-surfaced with controlled drainage.	Regular inspections and monitoring. The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system. Site reception checks and monitoring. Secondary containment and spill kits. Emergency Response Plan.	**LOW**

Table 6-10: Assessment of Potential Risks of Noise and Vibrations

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Noise and vibration	Noise through the air and vibration through the ground.	IWMF personnel; local human populations	Nuisance	MEDIUM	LOW	**MEDIUM**	Most of the equipment is housed in buildings and will need to meet occupational health standards (indoor noise) so is less likely to cause off-site noise nuisance. The site is in an industrial port zone and the main residential areas are on the other side of the main highway which is busy and noisy.	Regular monitoring. Ensuring workers use adequate PPEs. Preventative maintenance programmes will keep nuisance noise sources from malfunctioning equipment.	**VERY LOW**

6.3 Climate Change Risk Assessment

Principle 2 of the recently updated version of the Equator Principles (EP4) introduces the need for a climate change risk assessment (for certain projects) that aligns with the Task Force on Climate-Related Financial Disclosures (TCFD) Risk Assessment for Physical and Transition Risks.

Climate change and environmental degradation are sources of structural change that could affect economic activity or critical infrastructure and, in turn, the financial system and associated investments. Climate-related and environmental risks are commonly understood to comprise two main risk drivers:

- **Physical Risk** refers to the financial impact of a changing climate, including more frequent extreme weather events and gradual changes in climate, as well as of environmental degradation, such as air, water and land pollution, water stress, biodiversity loss and deforestation. Physical risk is therefore categorised as "acute" when it arises from extreme events, such as droughts, floods and storms, and "chronic" when it arises from progressive shifts, such as increasing temperatures, sea-level rises, water stress, biodiversity loss and resource scarcity. This can directly result in, for example, damage to property or reduced productivity, or indirectly lead to subsequent events, such as the disruption of supply chains.

- **Transition Risk** refers to an institution's financial loss that can result directly or indirectly, from the process of adjustment towards a lower-carbon and more environmentally sustainable economy. This could be triggered, for example, by a relatively abrupt adoption of climate and environmental policies, technological progress or changes in market sentiment and preferences.

Within the assessment, the life of the plant has been assumed to be 25 years (without modification). Extension of plant life will be limited based on:

- Life of expiry of major components.
- Degradation of performance.
- Decline in plant reliability.
- Obsolescence of equipment.
- Inability to comply with changing regulatory requirements.

The Climate Change Risk Assessment has thus considered the various climate risk scenarios over a 25-year time span and assumed that all investment obligations and returns will have been settled within that period.

6.3.1 Transition Risks

Transition risks for a project primarily relate to a change of technology to lower carbon practices. This is not relevant to the IWMF as there is limited opportunity for change of power source for example and the waste treatment technology is fit for purpose and unlikely to be replaced by low-carbon technologies in the life-time of the project. The gas and oil exploration project will also last the lifetime of the project.

Guyana's transition to a low carbon economy is unlikely to affect plant operations or power consumption, but it is expected that Heavy Fuel Oil and Diesel fuel generation will generally be replaced by Natural Gas and Renewable Energy during the lifetime of the facility.

6.3.2 Physical Risks

6.3.2.1 Methodology

The high-level physical risks for the site location have been derived from a variety of sources, these include:

- **ThinkHazard!** - A web-based tool enabling high-level assessment of impacts on new development projects. Users of ThinkHazard! can assess the level of river flood, earthquake, drought, cyclone, coastal flood, tsunami, volcano, and landslide hazard within their project area to assist with project planning and design. The tool provides the maximum hazard level within each district, province, or national administrative unit (administrative level 2, 1, and 0, respectively). It does not provide the hazard level at specific locations. This tool is a starting point to increase awareness of the hazards present in an area and has been developed by The Global Facility for Disaster Reduction and Recovery (GFDRR) in partnership with, amongst others, the World Bank Group.

- **World Bank Group Climate Change Portal** – This is an online portal to explore historical and projected climate data, climate data by sector, impacts, key vulnerabilities and what adaptation measures are being taken. It has been used to explore the overview for a general context of how climate change is affecting Guyana. The Coupled Model Intercomparison Project (CMIP), Phase 5 (CMIP5) models are included in the International Panel on Climate Change Fifth Assessment Report (AR5).

6.3.2.2 Assessment

The following data presented is sourced from World Bank Group Climate Change Portal using the following criteria:

- **Scenario** - Representative Concentration Pathway (RCP) 6.0 (Medium-high emission).

- **Model** – An ensemble collection of models used to explore the uncertainty in climate model simulations.

- **Period:** 2020 – 2039 (unless stated otherwise).

Projections of key climate variables using the Portal is presented in Figure 6-3 to Figure 6-6.

Precipitation

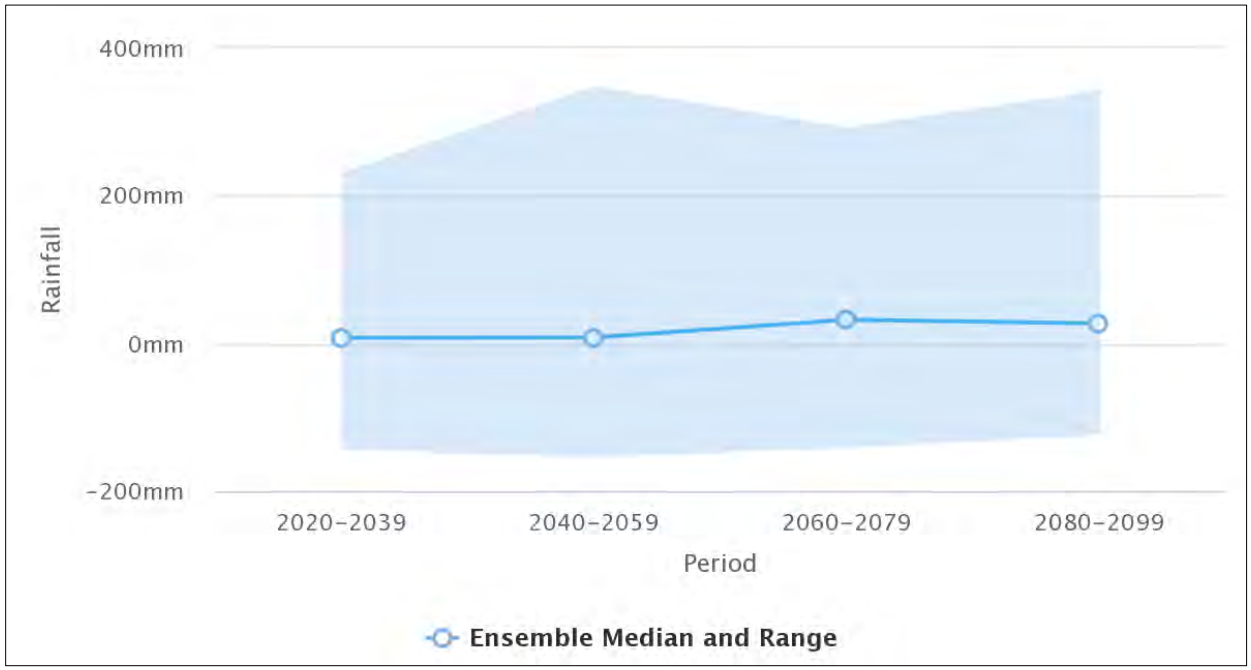

Figure 6-3: Projected Change in Annual Rainfall

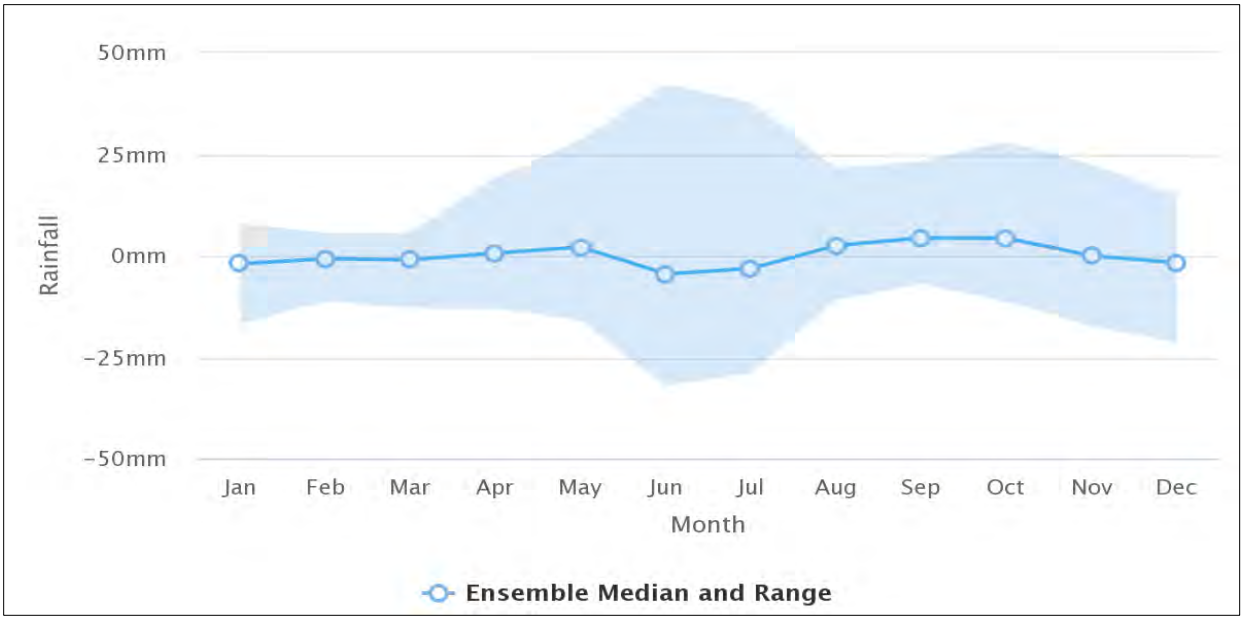

Figure 6-4: Projected Change in Monthly Rainfall

Temperature

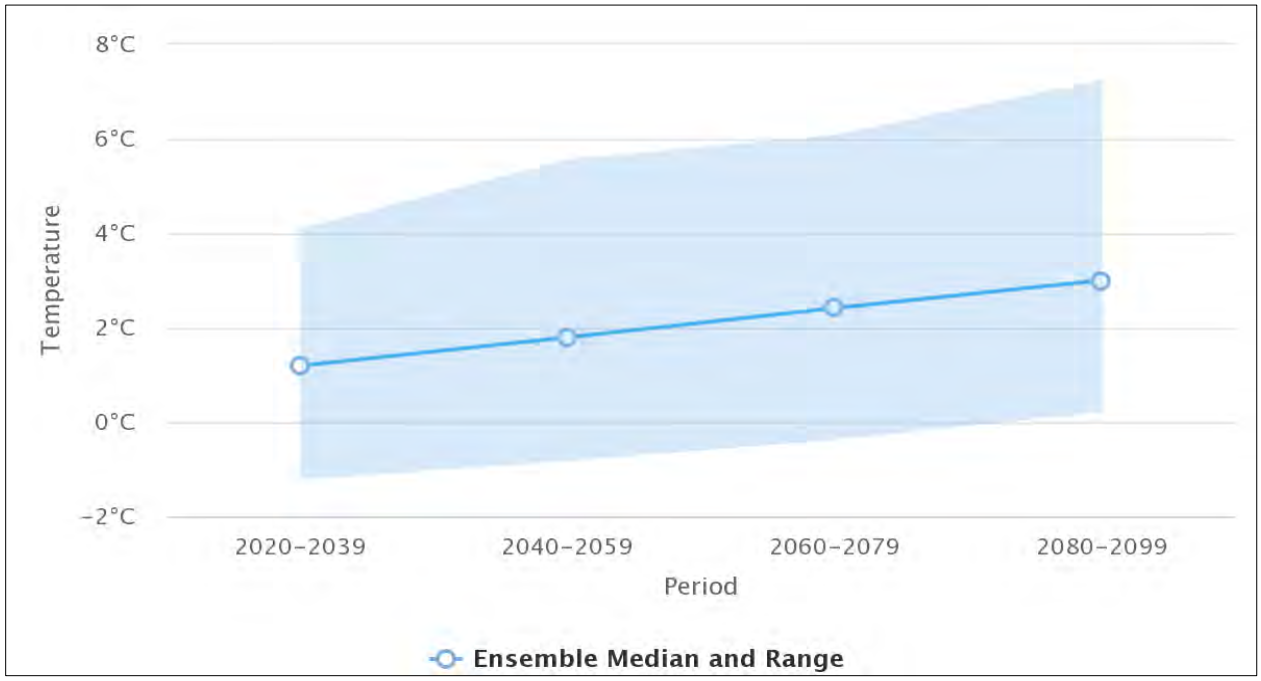

Figure 6-5: Projected Change in Daily Maximum Temperatures

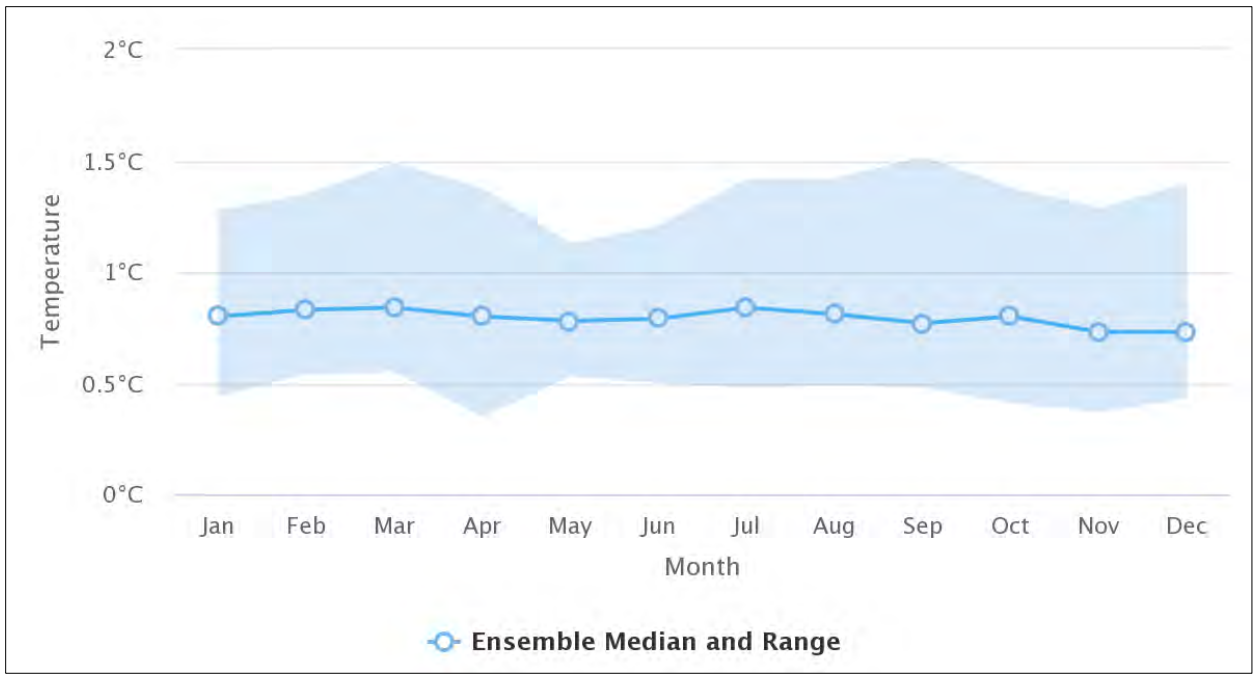

Figure 6-6: Projected Change in Monthly Temperatures

The physical risks are outlined and assessed at a high-level, within Table 6-10.

Table 6-10: Physical Risk Assessment

Hazard	Discussion	Risk Level
River Flood	The topography is typical of a coastal delta, flat and low-lying (in many places lying significantly below high tide levels). The coastal protection is provided by a combination of built seawalls and natural mangrove forests complemented by a network of canals and kokers (sluices and pumps first developed by the Dutch) that act to drain flood waters during heavy rainfall events. The ThinkHazard! assessment of the area concludes that the river flood hazard is classified as high (based on currently available information). This means that potentially damaging and life-threatening river floods are expected to occur at least once in the next 10 years. Project planning decisions, project design, and construction methods must consider the level of river flood hazard. On the eastern bank of the Demerara River the commercial wharves provide the current flood defence line.	**HIGH**
Coastal Flood	Astronomical tides in Guyana are diurnal with two high and two low tides each day in Georgetown. The tidal range averages about 2 metres with the tidal influence extending a considerable distance inland (as far as 80 km to 100 km inland along the Demerara River under surge conditions. The ThinkHazard! assessment of the area concludes that the river flood hazard is classified as high (based on currently available information). This means that potentially damaging and life-threatening river floods are expected to occur at least once in the next 10 years. Project planning decisions, project design, and construction methods must consider the level of river flood hazard. On the eastern bank of the Demerara River the commercial wharves provide the current flood defence line.	**HIGH**
Extreme Heat	The ThinkHazard! assessment of the area concludes that the extreme heat hazard is classified as medium (based on currently available information).	**MEDIUM**

Hazard	Discussion	Risk Level
Precipitation	The annual meridional migration of the Intertropical Convergence Zone (ITCZ) northward generally brings heavy rainfall between mid-April and the end of July, with a major peak rainfall in June. During the southward migration of the ITCZ, a second wet season is observed between mid-November and the end of January with peak rainfall in December. Large interannual variability in rainfall is driven by El Nino (typically higher rainfall) /La Nina (typically lower rainfall) cycles; although this cycle is not a 'perfect' indicator of the likely seasonal rainfall.	**MEDIUM**
Water Scarcity	According to ThinkHazard! water scarcity is classified as very low or non-existent according to the available information.	**VERY LOW**

The primary concern in terms of climate change risks is the enhanced risk of flooding of the site which could float or spread waste materials if they are loose in the flooded area. This can be mitigated by holding wastes in designated containment storage areas, suspending site operations during flood periods and use of preventative flood barriers or raised storage platforms in the event of a likely imminent flood.

6.4 Potential Risks of Occupational Health and Safety

Occupational health and safety is a key concern at the IWMF. Some activities at the IWMF, and within the GYBSI compound as a whole, can result in serious accidents, some of which can be fatal if established guidelines and practices are not properly communicated or complied with. Some of the principal risks to occupational health and safety are:

- Employees operating machines and equipment at risk from accidents.
- Prolonged exposure to noise emitted from continuous operation of generators and noisy equipment.
- Direct contact with hazardous materials and wastes.
- Inhalation of harmful fumes or dust.
- Risks associated with fire, chemical spills and explosion.

The health and safety of workers are therefore major concern of project operations. However, these risks can be entirely controlled by training and compliance with a Health, Safety, Security and Environment management system.

The potential risks of occupational health and safety are assessed in Table 6-11.

6.5 Potential Risks of Public Health and Safety

Given the nature of IWMF operations, and the proximity to other commercial and industrial activities as well as its relative proximity to residential areas public health and safety is also an important consideration for the company. Several potential impacts to local human populations have been addressed in the previous sections including:

- Exposure to harmful particulates, respiratory irritants and toxic chemicals.

- Releases of particulate matter (dusts), odour and micro-organisms (bioaerosols) resulting in potential harm to health and nuisance.
- Increased radiation doses from routine or accidental releases of NORM.
- Noise and vibrations from project activities.
- Attraction of scavenging animals and pests to the IWMF and its immediate environs.
- Contamination of surface or ground waters utilized by human populations.

Additional public health and safety risks relate to:

- Injury to trespassers on the IWMF site.
- Accidents during the transport of treated waste off site for disposal.
- Risks associated with fire.

The potential risks to public health and safety from IWMF's operations are also assessed in Table 6-11.

6.6 Potential Risks Associated with COVID-19

The possibility of a COVID-19 outbreak remains high and as of May 2021 the number of cases continued to increase nationally. In addition, Region 4 is considered a hotspot and is the Administrative Region with the highest rate of infections. The incidence rate in Houston on the East Bank of Demerara is not known. The Government has launched a national vaccination programme against COVID-19 and a large number of persons may be immunized by the time the project is operational. As of May 17, 2021, approximately 35 percent of Guyana's adult population has received a first dose of vaccination against the virus nationally. The risks of COVID-19 transmission may be managed by the implementing safety measures including mandatory wearing of masks on-site. SES may also opt to only employ persons who have been inoculated.

The potential risks of COVID-19 transmission are also assessed in Table 6-11.

6.7 Potential Beneficial Impacts of Employment

The IWMF will directly provide permanent employment for several full-time employees. The recruitment process is fair and free of any and all biases. In addition, the company does not discriminate based on race, colour or gender. Operations of the IWMF will also contribute to indirect employment including key stakeholders (GYSBI) and third-party contractors (Puran's Brothers Inc.)

Overall, the project is expected to have a **Beneficial Impact** to employment in the local workforce.

Table 6-11: Potential Risks of Health and Safety for Workers and the Public

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Waste, litter and mud on local roads.	Vehicles entering and leaving site.	Local human population	Nuisance, loss of amenity, road traffic accidents.	LOW	LOW	**LOW**	The site is hard surfaced and vehicles will not be tracking through loose mud, etc.	Site traffic management protocols.	**VERY LOW**
General storage, handling and processing of waste streams on the site.	On-site hazards e.g. wastes, machinery, confined spaces and vehicles.	Direct physical contact.	Trespassers	Bodily injury.	LOW	LOW	**LOW**	The IWMF is located in secure perimeter of the GYSBI facility and has its own security perimeter.	Site security guards and cameras. Staffed 24/7. Regular audits and inspections.	**LOW**
General storage, handling and processing of waste streams on the site.	Arson and/or vandalism causing the release of polluting materials to air (smoke or fumes), water or land.	Air transport of smoke. Spillages and contaminated firewater by direct run-off from site and via surface water drains.	Local human population and local environment.	Respiratory irritation, illness and nuisance to local population. Injury to SES staff, firefighters or arsonists/vandals. Pollution of water. Contamination of land.	LOW	LOW	**LOW**			**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	Accidental (localised) fire causing the release of polluting materials to air (smoke or fumes), water or land.	Air transport of smoke. Spillages and contaminated firewater by direct run-off from site and via surface water drains.	Local human population and local environment.	Respiratory irritation, illness and nuisance to local population. Injury to SES staff, firefighters. Pollution of water. Contamination of land.	LOW	LOW	**LOW**	Wastes are segregated according to compatibility and only relatively few of the wastes would be regarded as potentially flammable.	Regular inspections and audits. Ensuring fire suppression and fire-fighting equipment is available onsite. Providing training for staff in basic fire response and establishing a relationship with the Guyana Fire Service. Implementation of the Emergency Preparedness Plan.	**LOW**
General storage, handling and processing of waste streams on the site.	Serious fire	Air transport of smoke. Spillages and contaminated firewater by direct run-off from site and via surface water drains.	Local human population and local environment.	Respiratory irritation, illness and nuisance to local population. Injury to SES staff, firefighters. Pollution of water. Contamination of land.	LOW	MEDIUM	**MEDIUM**			**LOW**

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
General storage, handling and processing of waste streams on the site.	On-site hazards.	Wastes, chemicals, machinery, confined spaces and vehicles.	IWMF staff	Bodily harm or injury; mental stress	LOW	MEDIUM	**MEDIUM**	The IWMF will require workers to manage hazardous wastes and frequently work with heavy machinery. It is also located within an industrial complex with several hazards.	Implement and comply with a QHSSE System Comply with all of GYSBI's HSSE protocols.	**LOW**
General storage, handling and processing of waste streams on the site.	COVID-19 virus	Person to person interactions	IWMF staff; GYSBI staff. local human populations	Illness or death	MEDIUM	HIGH	**HIGH**	The COVID-19 virus is considered to be highlight transmittable in person-to-person interactions.	Mandatory wearing of masks. Compliance with safety measures required for entrance to GYSBI. Optional measure of only employing inoculated persons	**MEDIUM**

6.8 Cumulative Risks

6.8.1 Air Quality

As previously discussed, some of the neighbours to the IWMF, in particular, PSI have expressed concerns that another incinerator may result in negative impacts to their operations based on previous experience of significant negative impacts from emissions of Tiger Rentals incinerator (EMC Personal Communication 07 and 08). The incinerator exhaust stack from the IWMF will be within a 300 metre radius of the Tiger Rentals facility and may contribute to an increased cumulative emission loading when both incinerators are operating at the same time.

The design of the IWMF has incorporated several features to control emissions from its operations. The IWMF will also deploy more effective waste management technologies. In particular, hazardous waste streams comprising of drill cuttings, slops and sludges will be treated in the HTDU instead of the incinerator. SES will also ensure that there is periodic monitoring of emission from the incinerator stack and air quality downwind of the operations. No further controls are anticipated to be required.

An assessment of the risks of increased emissions loading leading to adverse air quality is presented in Table 6-12.

6.8.2 Water Quality

Effluent from the IWMF will be discharged from a single point into a canal located south of the facility. This canal then discharges into the Demerara River. Tiger Rentals also discharges effluent directly into this canal and PSI has established a dry dock at the mouth of this canal. It is likely that other upstream activities, including commercial and residential activities in Houston, also discharge effluent in to this canal.

The discharge of effluent from the IWMF will contribute to the cumulative loading of the canal. Given that all effluent to be discharged by the IWMF will be treated and channeled through oil-water separators, the operations are not expected to lead to a deterioration of the water quality of this canal. As such, no additional controls are required to reduce this potential cumulative risk.

An assessment of the risks of increased emissions loading leading to contamination of the canal is presented in Table 6-12.

6.8.3 Potential Beneficial Impacts of Increased Waste Management Capacity

Currently, there are very limited facilities and infrastructure to safely manage and treat hazardous and non-hazardous wastes in Guyana. With the emerging oil and gas sector and the commencement of production offshore, there is now a greater need to develop facilities to safely receive, treat and dispose of waste, particularly hazardous wastes, generated by the sector. SES has entered the local markets to design, build and operate an IWMF for EEPGL generated hazardous and non-hazardous wastes which will have the ability to safely manage all wastes generated offshore and onshore thereby positively increasing capacities that are locally available for the treatment of these wastes. This is expected to result in a **Beneficial Impact** to local content and future expansion of the oil and gas and other sectors in country. The IWMF will provide an additional facility to receive, treat and dispose hazardous and specialised waste.

Table 6-12: Potential Cumulative Risks

Data and information		Significance Assessment							Mitigation and Residual Risks	
Activity	**Source**	**Pathway**	**Receptor**	**Potential Harm**	**Likelihood**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Additional Control Measures**	**Residual risk**
Incineration of waste within an Addfield C200 unit.	Planned air emissions including odour	Air dispersion and inhalation	On-site operators, neighbours (including PSI, Farm Supplies and CIDI), and residential areas	Exposure to harmful particulates, respiratory irritants and toxic chemicals from cumulative effect of IWMF and Tiger Rentals operations	MEDIUM	MEDIUM	**MEDIUM**	The air emissions are associated with high temperature incineration and designed to meet low impact performance standards. The IWMF has been engineered to surpass these standards and will deploy new technologies like the HTDU for hazardous waste treatment.	No additional controls required	**LOW**
General storage, handling and processing of waste streams on the site.	Spillage of liquids, leachate from waste, contaminated rainwater run-off from waste.	Direct run-off from site across ground surface, via surface water drains, ditches etc.	All surface waters close to and downstream of site (Demerara River).	Cumulative pollutant loading from upstream and neighbouring activities affecting water quality, flora and fauna, and local human populations.	LOW	MEDIUM	**LOW**	All effluent discharged from the site will be treated and channeled through oil-water separators prior to discharge. Surface water will also be channeled through oil-water separators.	No additional controls required	**LOW**

7.0 MITIGATION AND MANAGEMENT MEASURES

The operation of the IWMF will be carried out in a manner which is in compliance with the legislation and guidelines outlined in Chapter 3. The project will also be required to comply with the terms and conditions of the Environmental Authorisation which is expected to be issued by the EPA for the operation phase, and the requirements of an ISO: 14001 Environmental Management System (EMS).

SES, in designing the project, have taken the following into consideration:

- Proximity Principle – managing wastes as close to their point of production
- Environmental Compliance – making sure that the facility operates in compliance with international standards and national requirements
- Safety of Operation – that all management and personnel operate in a safe working environment
- Stakeholder Management – that all stakeholders, including the wider Georgetown community, are not adversely affected by our operations
- Transportation Efficiencies – that we have due regard for the safe and efficient transportation of all wastes, both within the facility and on the highway

The waste management facility is being integrated into the GYSBI Shore Base operations and SES is ensuring that all its policies and procedures applicable to maintaining the highest of waste operating standards are integrated with the entire Base policies and procedures. The GYSBI Shore Base is a significant logistics hub that serves EEPGL offshore oil and gas operations and it is therefore fitting that the waste management facility is located within the Shore Base on an area of land close to the quayside. This will allow for minimal transport of waste once brought onshore, thus avoiding any potential impacts relating to temporary storage and transport to treatment facilities.
This EMP has been prepared to guide the project's activities by setting out measures and strategies to address the environmental, health and safety issues related to the operation of the IWMF. In this regard, the EMP identifies activities to be undertaken in an effort to control the principal adverse effects of project operations and describes the way in which the main potential environmental and safety impacts of the project can be managed. The control measures will prevent, minimize and manage the adverse impacts discussed in Chapter 6. The cost for the implementation of the management and control measures are catered for in the project implementation costs.

7.1 Control Measures for Environmental Risks

7.1.1 Ambient Air Emissions

The following measures will be implemented to prevent on-site operators, neighbouring operations and residential areas from exposure to harmful particulates, respiratory irritants and toxic chemicals as a result of incineration of waste in an Addfield C200:

- Continuous Emissions Monitoring (CEM) for oxygen to assess incinerator performance.
- Periodic monitoring of ambient air quality downwind of the incinerator emissions stack.
- Preventive maintenance activities of the Addfield C200 on a fixed maintenance schedule.
- Stack fitted with a 360° platform area accessible via a vertical ladder to enable the periodic sampling of the flue gas for full emissions analysis.
- Abatement system fitted prior to emission (Venturi Filtration System)
- Single emission point to air 8.0 metres above ground level.

The following measures will be put in place to prevent harm to human health (respiratory irritation and illness) and nuisance (dust on cars, clothing, plants, etc.) to local human populations from the general storage, handling and processing of waste streams on the site:

- Development of an Emissions Management Plan.
- Containerisation and covering of wastes. Where practicable, lids will be kept on vessels containing volatile compounds and loose material to minimise fugitive emissions.
- Implementation of procedure for handling of potentially dusty materials.
- Routine monitoring of air emissions including particulates.

Potential air transport of litter from the IWMF to surrounding land uses that causes nuisance of loss of amenity will be controlled by the implementation of the following measures:

- Regular site inspections and litter picking.
- Containerisation and covering of loose wastes.

Potential odours that cause nuisance or loss of amenity to local human population particularly neighbouring operations (including PSI, Farm Supplies and CIDI) as a result general storage, and handling and processing of waste streams at the IWMF that causes nuisance will be controlled by the implementation of the following measures:

- Inspection and monitoring of all incoming wastes.
- Conterisation of wastes with regular checks on containers and their management.
- Use of the HTDU for treatment of drill cuttings, slops and sludges.
- Routine emission monitoring.

Potential transportation of wastes from the IWMF to local human populations by scavenging birds such that there is harm to human health or loss of amenity, will be controlled by the following measures:

- Implementation of procedures to receive waste and quarantine wastes which cannot be treated by the IWMF.
- Containerisation of putrescible wastes.
- Site audits and monitoring to ensure all waste management strategies and procedures are being fully implemented.

7.1.2 Surface Water, Groundwater and Flood Risk

The following measures will be implemented to prevent potential risks to the water quality and ecology of the Demerara River from leaks and spills and general run-off being discharged from the IWMF via rip rap channel into canal which then immediately enters the Demerara River:

- Installation of a drainage system to collect all runoff and channel to one main drain which is equipped with two oil water separators.
- Installation of a penstock which is equipped with a manually controlled shear gate to control any discharges from the site.
- Development and implementation of a procedure for operation and management of the penstock.
- Implementation of a procedure for cleaning and maintenance of the oil-water separators.
- Implementation of all waste management strategies.
- Spill response kits located around at strategic locations around the site.
- Training in the use of spill kits (including practical training).
- Monitoring of the quality of discharges from the operation.

Potential risks that routine and accidental emissions of NORM result in increased doses of radiation to local human populations will be controlled by the following measures:

- Installation of equipment to detect NORM.
- Waste handling procedures including quarantine of wastes that cannot be treated.
- Identification, classification and storage pending shipment out of the country to a nominated treatment or disposal site.
- Employing controls for trans-frontier shipment controls.
- Site containment engineering and emergency response procedures in place.

The following measures will be implemented to prevent waste being washed off site resulting in contamination of natural habitats and local populations downstream during a flood event:

- Hard-surfacing of the site and the installation of a controlled system for site drainage.
- Development and implementation of a procedure for operation and management of the penstock.
- Bunding all of the main waste storage areas and fuel storage tanks.
- Adequate land fill to build up site above normal flood levels.

Potential risks of spillage of liquids, leachate from waste, contaminated rainwater run-off from waste resulting in acute effects (oxygen depletion, mortality) or chronic effects (deterioration of water quality) to flora and fauna in the Demerara River as well as adverse impacts to upstream and downstream human populations will be controlled by the following measures:

- Installation of the penstock which will be manual controlled and can be closed in a timely manner to prevent any release from the site.
- Development and implementation of a procedure for operation and management of the penstock.
- Implementation of a procedure for cleaning and maintenance of the oil-water separators and penstock.
- Implementation of all waste management strategies and procedures.
- Bunding all of the main waste storage areas.
- Periodic inspections of the site.
- Spill response kits located at strategic locations around the site.
- Training in the use of spill kits (including practical training).
- Implementation and training in the Emergency Preparedness Plan.

Potential risks of spillage of liquids, leachate from waste, contaminated rainwater run-off from waste resulting in contamination of shallow groundwater such that there are acute effects (loss of resource by closure of abstraction intakes) or adverse impacts to human health and livestock health will be controlled by putting the following measures in place:

- Implementing procedures for incoming wastes inspection.
- The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system.
- Routine inspections and monitoring.
- Spill kits available at strategic locations and training in their use is provided

7.1.3 Soils

Potential risks that routine and accidental emissions of NORM (which although not planned to be received at the site, could be temporarily accepted under exceptional circumstances) result in increased doses of radiation to soils will be controlled by the following measures:

- Implementation of all waste handling procedures including quarantine of wastes that cannot be treated at the site.
- Identification, classification and storage pending shipment out of the country to a nominated treatment or disposal site.
- Site containment engineering and emergency response procedures in place.
- The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system.

Potential risks of surface runoff contaminated by spills of liquids, leachate from waste, contaminated rainwater run-off from waste resulting in chronic effects of deterioration of soil quality will be controlled by the following measures:

- Routine inspections and monitoring.
- Bunding all of the main waste storage areas.
- Periodic inspections of the site.
- Spill response kits located around at strategic areas around the site.
- Training in the use of spill kits (including practical training).
- Implementation and training in the Emergency Preparedness Plan.
- The site is hard-surfaced with a gradient that channels all surface runoff to a controlled drainage system.
-

7.1.4 Noise and Vibrations

Potential noise and vibrations from operation of the IWMF resulting in a nuisance for workers and neighbours will be controlled by the following measures:

- Regular monitoring of noise levels.
- Ensuring workers use adequate PPEs.
- Periodic maintenance of equipment to prevent noise nuisance from malfunctioning equipment.
- Adequate enclosure of noisy equipment and installation of sound attenuation devices.
- Siting of noisy activities away from neighbours and workers area.

7.2 Control Measures for Climate Change Risks

The following measures will be implemented to prevent risks to property and health arising from climate change:

- Landfilling and revetment of areas south and west of the project site by GYSBI.
- Building awareness of the workforce of the signs and symptoms of heat stresses and measures to bring relief.
- Establishing cool areas for rest for workers who work in hot conditions and around heat generating equipment.

7.3 Control Measures for Socio-Economic Risks

7.3.1 Traffic

The following measure will be implemented to prevent nuisances, loss and amenity and accidents from litter and mud on local roads during transportation of wastes from the IWMF to the Haags Bosch Landfill:

- Site traffic management protocols.
- Compliance with rules governing the use of public roadways.

7.3.2 Health and Safety

The following measures will be implemented to ensure that the site is secured against the entry by unauthorised personnel and vandalism:

- Site security guards and cameras both from GYSBI and the IWMF.
- The IWMF will be operational and staffed 24/7.
- Regular site inspections.

The following measures will be implemented to prevent risks associated with small accidental fires or serious fires:

- Regular inspections and audits.
- Ensuring fire suppression and firefighting equipment is available onsite.
- Providing training for staff in basic fire response and establishing a relationship with the Guyana Fire Service.
- Implementation of the Emergency Preparedness Plan.

The following measures will be put in place to manage risks associated with the occupational exposure to hazards at IWMF and the GYSBI facility:

- Implement and comply with a QHSSE System. The QHSSE System will include provisions for:
    - Assigning the QHSSE Advisor with designated duties for Health, Safety, Security and Environmental (HSSE) monitoring and compliance.
    - Employee orientation to environment, safety and health practices established.
    - Providing employees with all PPEs relevant to their job.
    - Providing training in First Aid and a First Aid Kit with the requisite drugs and equipment to cater to emergencies.
    - Ensuring that all waste management strategies and procedures are implemented.
    - Placing fire extinguishers placed strategically onsite.
    - Installing fire alarm systems.
    - Installing emergency eye-was stations and showers in operational areas.
    - Installing warning signs and notices that are easy to read and are placed in visible and strategic areas.
    - Locating Material Safety Data Sheets strategically for use if necessary.
    - A muster point will be established.
    - Routine emergency drills will be conducted.
    -
- Comply with all of GYSBI's HSSE protocols.

The following measures will be implemented to manage risks associated with COVID-19:

- Mandatory wearing of masks on site.
- Compliance with safety measures required for entrance to GYSBI.
- Optional measure of only employing inoculated persons (under consideration).

7.3.3 Employment

The following measures would be implemented to further enhance the beneficial impacts of employment:

- Wages offered to local staff would be in keeping with Guyana's labour laws or higher set standards which will be competitive in all categories of workers.
- Local workers would work for standard working hours and be fairly remunerated.
- The opportunities of employing women would also be explored and considered so as to ensure that there are opportunities for both genders.

7.3.4 Resolution of Complaints

SES will develop a mechanism outlining the procedures to be followed should any complaints about the operations of the IWMF be received. This mechanism will allow any reported complaints to be documented, analysed and responded to efficiently and effectively.

Any complaint received by SES regarding IWMF operations will trigger the following actions.

- SES will share the complaint with GYSBI.
- SES will investigate reported grievances to ascertain whether cause of the complaint is associated with the operation of the IWMF.
- If the IWMF is determined to be the cause of the complaint, SES will implement corrective action immediately.
- SES, in consultation with GYSBI and other relevant stakeholders, will identify a corrective course of action. A report would be prepared, including supporting materials such as photographs. If necessary, a clear list of tasks and outcomes in order to have the grievance resolved in a timely manner.
- SES will monitor the situation and determine whether the problem is likely to recur and put measures in place to prevent recurrence.

SES will also maintain a register of complaints received by the company outlining the date of complaint, by whom the complaint was made, the nature of the complaint, date investigated and by whom, validity of the complaint, any corrective action required and undertaken, timeline for implementation of corrective action, and whether or not the issue was satisfactorily addressed.

8.0 EMERGENCY PREPAREDNESS PLAN

In accordance with the provisions of the Hazardous Waste Management Regulations, SES has prepared an Emergency Preparedness Plan (ERP) describing the general types of emergency and actions to be followed should an emergency occur. This ERP is a living document and will be subject to revisions and updates in the period leading to operationalization of the IWMF as well as during the lifetime of the operation. Updates will be done to the Emergency Preparedness Plan as the response procedures are developed and implemented, and will incorporate mechanisms as it relates to both EEPGL and GYSBI such as a clear and concise communications procedure, chain of command and emergency services.

This ERP outlines:

- Emergency Contact Details.
- Emergency Procedures.
- Description of an Emergency.
- Authority of Control.
- Emergency Equipment.
- Scenario Description and Response.
- Incident Reporting.

The information contained in this ERP would be provided to employees and placed at strategic locations within the compound such as the office. It is critical that the workers are adequately trained on safety and there is practical application of the emergency procedure, including periodic emergency drills.

8.1 Emergency Response Philosophy

The ERP is based on ensuring that the following priority objectives for action are met in IWMF operations:

- Protection of human health and safety.
- Protection and minimization of existing and potential impacts on the environment.
- Containment of the spread of any spilled materials.
- Commencement of clean-up activities and site remediation as soon as possible following an emergency.

Emergencies are unexpected and can result in injury to a person resulting in the need for emergency response. Due to their very nature, emergency response procedures deal with events that were not anticipated or were considered to occur only rarely. Since emergencies are not a planned part of an operation but a risk that can occur it is necessary to cater for such events and take into consideration worst case scenarios. The principal objective of the ERP is the protection of the company's personnel and the environment in the general area of influence of the operation through the development of emergency response skills and systems. Some crises may have severe impacts and may require a response mechanism well beyond the capacity of what the company can deliver and as such, support from other entities, including Government agencies, would be required.

8.2 Emergency Contact Details

There are key institutions and agencies that would need to be contacted in the event that an emergency occurs. Table 8-1 outlines the contact information for key institutions relevant to this operation.

Table 8-1: Emergency Contact Information

Institutions	Telephone Number
Environmental Protection Agency	225-5467-68 225-6044 225-6048
Georgetown Public Hospital Corporation	227-8241
Guyana Fire Service (Water Street, Georgetown)	226-2411 226-2413
Guyana Police Force – Brickdam, Georgetown	225-6940
Ministry of Labour	227-3133

8.3 Emergency Procedures and Responsibilities

All personnel must be aware of potential risks and take the necessary steps to effectively mitigate and manage hazards in their work area. In addition, all personnel are expected to raise an alarm if they discover an accident, fire or spill, in keeping with the procedures set out in this Plan. Only duly trained personnel should respond to fires or spills, or administer First Aid. Workers would respond differently depending on the type of emergency and training. Response procedures will be posted at strategic points in all work areas.

8.4 Authority and Control

The IWMF management has the authority to take control of any incident or accident. Management can make a decision to close down any part of the operation or the entire operation following an incident or accident. The type of emergency should determine the level of response required.

Updates to the Emergency Preparedness Plan will include a clear and concise communications procedure and chain of command both within the facility and with external stakeholders (e.g. GYSBI and EEPGL) and emergency services. In addition, communication channels with emergency services and other relevant authorities will be established, and available for use in the event of an incident.

8.5 Emergency Scenarios

An environmental emergency would involve widespread actual or potential destruction or contamination of the environment that calls for immediate action. Some events that would be considered emergencies and require the instigation of an emergency response procedure at IWMF include:

- **Fires:** Fire risk can be associated with arson or serious fires arising from operations of the facility.

- **Minor and major accidents:** Both minor and major accidents can occur at the IWMF operation and response procedures are in place to address both situations if they occur. Minor accidents at the facility can include cuts, scrapes, tripping and bruising while major accidents can include slipping and falling, broken bones and burns among others.

- **Unplanned emissions of hazardous materials or wastes into the environment:** The IWMF will have a suite of coordinated preventative measures to prevent unplanned environmental emissions. However, emergency preparedness and response measures will also be put in place to respond to any spills which may occur.

8.6 Emergency Response

Emergency response measures are applied to all potential emergency scenarios. Adequate information and equipment will be maintained onsite to respond to emergencies. Given the location of the company there is easy access to communication and emergency services. The following sections detail the emergency equipment, training and emergency procedures relating to the types of emergencies which can occur at the IWMF.

8.6.1 Fire

Equipment

The following fire response equipment and will be put in place:

- Fire extinguishers will be placed in strategic locations on the premises.
- A fire alarm system will be installed and employees would be made aware of the sound of the alarm.
- A “Muster Point” will be established for employees to gather in the event of a fire.

Training

SES will provide training of its staff to provide first response in the case of a fire. The following training will be conducted:

- Safe and effective use of fire extinguishers.
- Triggering the fire alarm system which will be installed.
- Fire drills for all staff conducted periodically.

Indicative Response Procedures

In the event of a fire, employees will initiate the following procedure which they would be familiar with as a result of fire drills:

- Immediately warn others, sound the fire alarm and evacuate work areas to assemble at the muster points.
- Inform Supervisors and Manager.
- Attack the fire if safe to do so with firefighting equipment provided but without taking personal risks.
- Take decisions on response and containment:
  - If it is a small fire, use fire extinguisher or sand buckets.
  - In the event of a fuel fire, move container from fire area, if possible without risk, cool containers that are exposed to flames with water from the side until well after fire is out and stay away from ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.
  - For large fires, immediately contact the Guyana Fire Service.

- Regulatory institutions and GYSBI will be formally informed of the event.
- Make entry into the Accident Register.

8.6.2 Accidents

Equipment and Training

- A first aid kit will be available onsite and stocked with essential items to provide first response to injuries from minor accidents.
- Staff will be provided with training to respond to basic emergencies. At least one staff member on duty will be certified in First Aid.

Response Procedures

In the event of an accident the following response procedures will be initiated:

- In the case of minor accidents, basic first aid will be administered at the facility.
- In the case of major accidents:
  - Supervisors and managers will be informed.
  - The degree of injury will be assessed to determine the extent of injury.
  - The injured person will be transportation to the Georgetown Public Hospital Corporation.
- An entry will be done into the Accident Register.
- The Ministry of Labour will be informed in accordance with the Occupational Safety and Health Act. If the accident results in a fatality, the Ministry will be notified within 24-hours.
- GYSBI will also be formally informed of the event.

8.6.3 Unplanned Environmental Emissions

Equipment and Training

- Appropriate secondary containment for all primary vessels and containers.
- Techniques and procedures in place to prevent overfilling of tanks.
- Spill contingency procedures in place to minimise accidental release of raw materials, products and waste materials and then to prevent their entry into water.
- Spillage prevention controls in place during the transfer of substances including ample provision of spill kits and drain blocking systems.
- Safe shutdown procedures will be in place.
- Security systems to prevent unauthorised access will be provided.

- Appropriate training on all waste management strategies and techniques will be provided to staff, including live training exercises.

Response Procedures

In the event of an unplanned environmental emission, employees will initiate the following procedure which they would be familiar with as a result of fire drills:

- Inform the Supervisors and Manager.
- Close the shear gate at the discharge point into the canal.
- Use spills kits available on-site to stop the flow, if possible.
- Restrict access to the area where the emission has occurred and prevent the movement of people or vehicles into the restricted area.
- Take actions to prevent the spill spreading and contaminating the waterways and soil.
- Collect absorbent materials and place in a secured area with an impervious base at a restricted zone.
- Make entry into the Accident and Emergency Record book.
- Inform EPA (for spills less than 2m x 2m the Agency will be informed via the Environmental Reports).
- Inform GYSBI.

8.7 Additional Preparedness and Response Techniques

The following measures will be employed by SES for emergency preparedness and response:

- Maintaining an up-to-date inventory of substances, present or likely to be present, which could have environmental consequences if they escape the site.
- Maintaining an up-to-date site plan showing the location of wastes having specific hazard characteristics with clear identification of the perimeters of the various designated storage areas and their maximum storage capacity.
- Ensuring compliance with procedures for checking and handling raw materials and wastes to ensure compatibility with other substances with which they may accidentally come into contact.
- Ensuring that storage arrangements for raw materials, products and wastes designed and operated to minimise risks to the environment.
- Physical protection shall be in place (where appropriate) to prevent damage to equipment from the movement of vehicles.

8.8 Incident Reporting

After every incident/accident a report will be prepared. The Supervisor and Manager will have direct responsibility for the preparation of such a report. All significant environmental related incidents will be reported to the EPA. This will be done within 24 hours.

In addition, the Ministry of Labour will be informed of any accidents involving personnel that occur onsite using the Accident Register format available in the Occupational Health and Safety Act. The Ministry must be notified of a fatality within 24-hours.

Formal systems will also be put in place to:

- Log and record near-misses, abnormal events, changes to procedures and significant findings of maintenance inspections.
- Learn from incidents and near-misses.
- Avoid incidents from occurring due to poor communications between staff at shift change or during maintenance or other engineering work.

9.0 EMP IMPLEMENTATION FRAMEWORK

9.1 Management Systems

At the forefront of any oil and gas operation is the management of health, safety, quality and standards and environmental compliance. SES recognizes the importance of ensuring that the waste management facility operation remains compliant and safe at all times during its operation. The proper handling of both hazardous and non-hazardous waste is both a legislative requirement and an obligation by SES and the Client's Health, Safety and Environmental Management Systems. SES has developed a Health, Safety, Environment and Quality (HSEQ) Policy which states that SES will give proper regard to the prevention of pollution and to the protection and conservation of the environment.

SES will operate the site under an ISO1:4001 certified Environmental Management System (EMS) that will set out a framework for policies, procedures and plans relating to all aspects of the business activity and their interaction with the environment. As a minimum, the EMS will include the following features:

- Establishment of a clear environmental policy committing to compliant performance, meeting of targets and objectives to address impacts and periodic management review.
- Assessment of the facility's environmental aspects (impacts) and setting targets and objectives for continual improvement.
- Environmental Management Procedures covering site governance, training and competence, working practices, monitoring, auditing, etc.
- Record keeping and documentation procedures.
- Auditing and corrective action procedures.
- Management Review.

9.2 Roles and Responsibilities for EMP Implementation

SES intends to have a dedicated QHSSE Advisor (Quality, Health, Safety, Security and Environmental Advisor) appointed who will be responsible for all implementation of and compliance with the EMS encompassing all environmental, health, safety and quality related matters. This will be a trained and certified individual with the requisite skills and experience to manage the day to day QHSSE requirements of the facility. The QHSSE Advisor will interface will all Company personnel and other stakeholders, as well as work closely with GYSBI to ensure that policies, procedures and safe working practices and standards are adhered to.

The QHSSE Advisor will coordinate the activities of the Health, Safety, Security and Environmental Team which shall be responsible for the provision of:

- Waste Management Strategy
- Waste Management Procedures
- Training of waste management personnel
- Health monitoring of waste management personnel
- Waste disposal monitoring and reporting
- Waste management awareness training to supply base personnel
- Evaluation of compliance of SES systems for waste management to national standards

- Audit and review of the EEPGL Supply Base Waste Management System
- Audit and review of waste management of sub-contractors processes, procedures and facilities.

However, as lead of the organisation, the ultimate responsibility of Health, Safety and Environment rests with the site General Manager, including the implementation of the EMP. The General Manager will be an experienced waste management professional who will assume full QHSSE responsibility for site activities and will be fully supported by the QHSSE Advisor. Together, they will guide, manage, instruct and motivate the team in the pursuit of safe, efficient and responsible work methods and ethics. The SES Organisation Chart is presented in Figure 9-1 below.

In addition, all Management and Supervisory personnel will be responsible for monitoring and promoting the correct waste management practices.

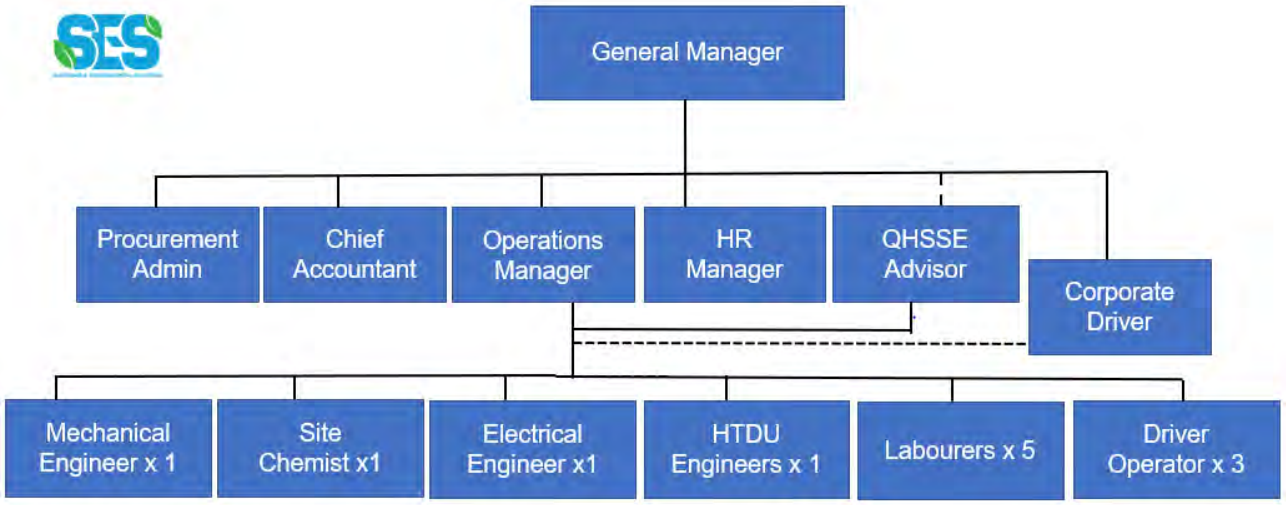

Figure 9-1: SES Organisation Chart

9.3 Organisation

SES policy and programmes will:

- Include a commitment to continual improvement and prevention of pollution;
- Include a commitment to comply with relevant legislation and other requirements to which the organisation subscribes; and
- Identify, set, monitor and review environmental objectives and key performance indicators independently of the EMP.

The company will have demonstrable procedures which incorporate environmental considerations into the following areas:

- The control of process and engineering change.
- Design, construction and review of new facilities and other capital projects (including provision for their decommissioning).
- Capital approval.
- Purchasing policy.

9.4 Training and Competence

All workers to be involved in the operation will be adequately trained in the required procedures and practices. SES will operate formalised training systems that will cover the following items:

- Awareness of the regulatory implications of the EMP for the activity and their work activities.
- Awareness of all potential environmental effects from operation under normal and abnormal circumstances.
- Awareness of the need to report deviation from the EMP.
- Prevention of accidental emissions and other accidents.
- Implementation of the Emergency Response Plan.

SES shall maintain records of all such training and track refresher training, where required, via the SES Training Plan and the SES Training Matrix.

9.5 Environmental, Health and Safety Monitoring

Monitoring of project activities would be conducted to ensure that the recommended controls and management practices identified in this EMP as well as the provisions of the EMS are being implemented effectively. Table 9-1 below identifies the various parameters to be monitored as well as the frequency and location of monitoring activities. Additional parameters may be added to those identified in the Table based on the Operation Permit to be issued by the EPA. The cost for the conduct of monitoring will be incorporated in the Company's annual operational budget.

Table 9-1: Environmental Monitoring during IWMF Operations

Parameters	Frequency	Locations
Air Quality ▪ $PM_{2.5}$ and PM_{10} ▪ SO_2 ▪ NO_2 ▪ CO ▪ CO_2	Quarterly	Downwind of the incinerator exhaust stack. Please see location in Figure 9-2.
Stack Emissions ▪ Evidence of stack emissions through visible observation ▪ $PM_{2.5}$ and PM_{10} ▪ SO_2 ▪ NO_2 ▪ CO ▪ CO_2	Quarterly	Incinerator Stack
Water Quality ▪ Temperature ▪ pH ▪ Turbidity ▪ Total Dissolved Solids ▪ Total Suspended Solids ▪ Oil and Grease ▪ Dissolved Oxygen	Quarterly	

Parameters	Frequency	Locations
▪ Chemical Oxygen Demand ▪ Biological Oxygen Demand ▪ Iron ▪ Copper ▪ Zinc ▪ Lead		IWMF discharge point. Please see location in Figure 9-2.
Noise ▪ Decibel	Quarterly	▪ South Western Boundary ▪ South Eastern Boundary ▪ North Eastern Boundary ▪ North Western Boundary Please see locations in Figure 9-2.
Health and Safety ▪ Use of protective gear by workers ▪ Adequate and appropriate signage ▪ Location of Emergency Procedures ▪ Availability of emergency response equipment ▪ Job Safety Assessments ▪ Tool box talks, Induction Training, etc. ▪ Health conditions of staff. ▪ Stocked First Aid Kit ▪ COVID 19 Preventative Measures	Daily and Weekly, as appropriate	Throughout the IWMF

The proposed locations for the monitoring of air quality, surface water quality and noise levels are shown in Figure 9-2.

This Monitoring Plan has focused on environmental and health and safety parameters to be monitored at the company's operation. In addition, there will be a routine schedule for equipment monitoring and maintenance in keeping with equipment and machinery design standards and specification. Monitoring will also be done to ensure compliance with the waste management procedures addressing the receiving, testing, storage, treatment and disposal of all waste types. This will also contribute to better environmental and health and safety compliance.

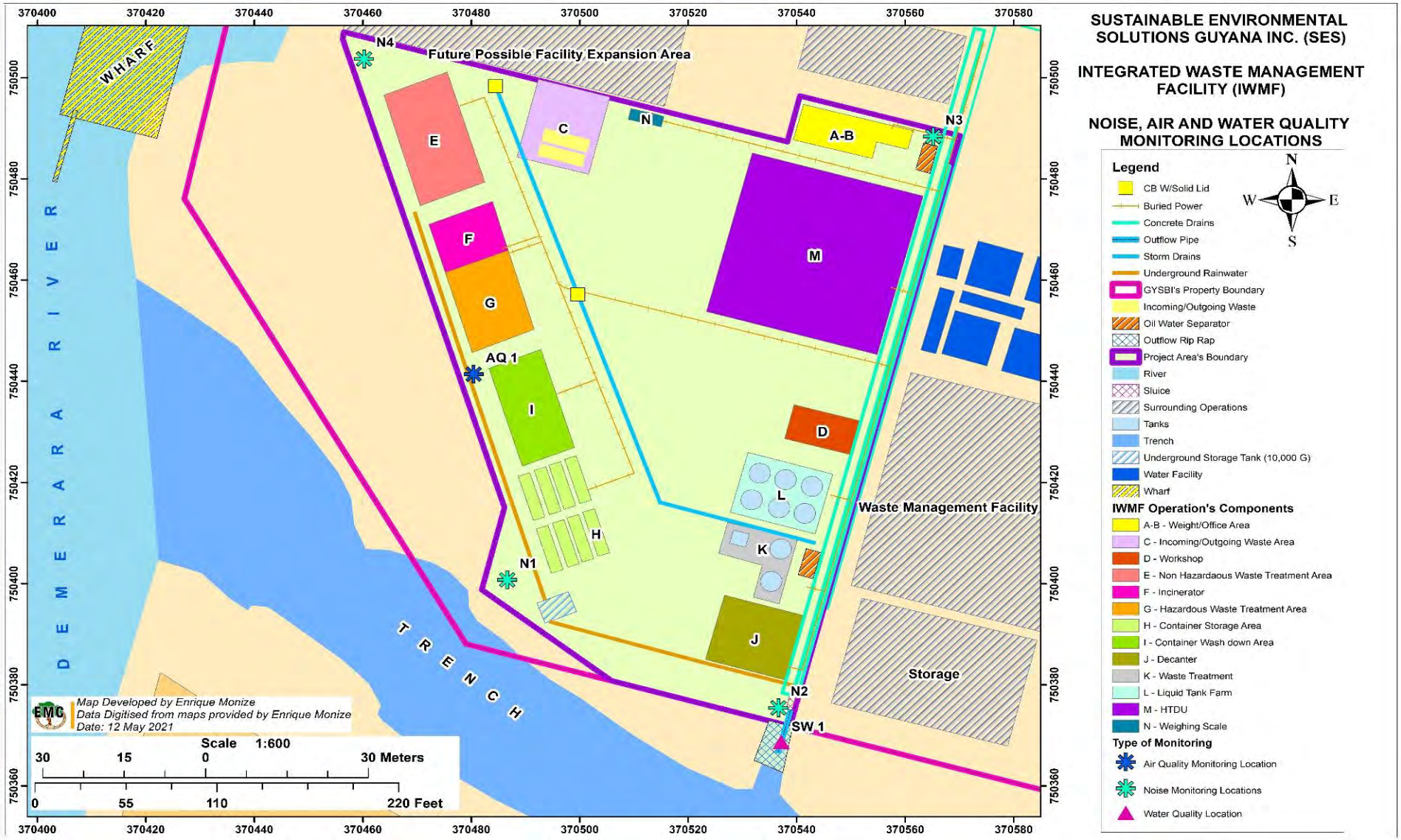

Figure 9-2: Proposed Sampling Locations for Monitoring Air Quality, Water Quality and Noise Level

9.6 Reporting and Record Keeping

Overall monitoring will be carried out by the QHSSE Advisor. All areas of concerns would be visited daily, or more frequently, if necessary. Operational related activities such as use of safety gears and compliance with health and safety procedures will be monitored on an ongoing basis.

Noise monitoring will be conducted using a noise meter. For water quality monitoring, samples will be collected from the discharge point and analysis will be done both *in-situ* and grab samples will be conveyed to an external laboratory. Air quality monitoring will be done utilizing meters which can measure particulate matter and gases.

Annual Environmental Reporting will be carried out and report submitted to the EPA. The Annual Environmental Reports will include environmental performance, objectives and targets, and future planned improvements. The results of monitoring activities conducted throughout the year will also be presented. Additional reporting requirements will be done in compliance with the Operation Permit to be issued by the EPA.

SES Management will conduct duty of care compliance audits on all waste management and associated facilities, ensuring that best practice is adopted and maintained. SES is committed to a 'cradle to grave' process that places a transparent duty of care on all those involved in the waste management process. The company will conduct audits, at least annually, to check that all activities are being carried out in conformity with the requirements of the Operation Permit and the internal EMS. An Environmental Compliance Report will be used as a means of identifying and rectifying existing or potential environmental problems. Incident Reports will be prepared for any incident which may occur. External environmental audits may also be done by a third party to ensure compliance with the environmental requirements and to ensure the mitigation measures are implemented effectively.

Records of monitoring will be kept by SES on-site and made available to the EPA or other regulatory authorities upon request. Monitoring results which exceed national standards will be reported to EPA.

The company will be willing to facilitate site monitoring activities to be conducted by regulatory bodies such as the EPA and the Ministry of Labour.

9.7 Waste Sampling

SES will from time to time carry out waste sampling, analysis and characterization in the facility's on-site laboratory if it deems certain waste materials to be non-conforming or miss-described, unidentified, or unknown. Any non-conforming wastes shall be dealt with as outlined below:

- A representative sample of the relevant waste streams is obtained.
- The waste is handled in such a way that it does not deteriorate or become contaminated.
- All samples are clearly labelled, to include date and time of sampling; point of origin; type of waste material and;
- A report is generated identifying where any wastes are known to be non-conforming so that corrective measures can be taken to isolate, consolidate and dispose in a correct manner.

Any wastes received that is deemed to be non-conforming will be quarantined at the IWMF. SES personnel shall then investigate the circumstances surrounding the non-conformity to identify corrective action. The waste generator shall be notified immediately, and agreement shall be reached on the most environmentally and cost-effective solution. New Waste Manifest/Consignment Notes will be prepared and the waste will be consigned to an SES approved treatment method.

CONCLUSION

SES is designing, building and operating a state-of-the-art Integrated Waste Management Facility at the GYSBI Shore Base. This venture was initiated by a request from EEPGL for a facility to receive, treat and dispose of hazardous and non-hazardous waste generated from its operations. The facility will be built and operated in accordance with EEPGL's corporate, social and environmental responsibilities and conform to local, national and international standards. SES will also establish an Environmental Management System that is consistent with the requirements of the ISO:14001 standard.

This EMP has identified potential impacts and risks which are anticipated to occur during the operation of the IWMF using the baseline conditions of the project site and the planned activities. This was done by establishing the potential interactions between the activities and the characteristics of the existing physical, biological and socio-economic environment. The control and management measures which can be incorporated into the project design and execution were considered in the assessment of potential impacts and this contributed to significantly reducing the risks associated with potential impacts of the project. The key findings from this assessment are that all residual impacts (after the application of control and management measures which were engineered into the project) are deemed to be Low or Very-Low. No High Risk project activities were identified.

Overall, the EMP places the project in the context of the local and regional environment and adequately describe all components of the proposed/existing activities so that the EPA can consider approval of a well-defined project, and prescribe relevant and adequate permit conditions for the monitoring of the project during its operational phase. The EMP also identifies the environmental issues/risks associated with the project activities and provides the basis of SES's environment management program, which shows that the environmental impacts resulting from the project, including cumulative impacts, can be acceptably managed. Further, it provides a document that clearly sets out the reasons why the project should be considered environmentally acceptable.

SES is committed to ensuring that its operations do not have significant adverse impacts on the environment in which it operates. Given the risks inherent to the nature of it's operations, occupational health and safety has always been one of SES's foremost concerns and the company adheres to a strict QHSSE policy to avoid and manage harm to people, the environment and property. SES will be taking on board the control and management measures identified in this EMP in the design and engineering of the IWMF so as to achieve this goal.

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EMC Personal Communications

EMC Personal Communication 01 – Interview with GO-INVEST.

EMC Personal Communication 02 – Interview with the Traffic Department, Guyana Police Force.

EMC Personal Communication 03 – Interview with the Mayor and City Council.

EMC Personal Communication 04 – Interview with the Solid Waste Department, Ministry of Local Government and Regional Development.

EMC Personal Communication 05 – Interview with the Work Services Group, Ministry of Public Works.
EMC Personal Communication 06 – Interview with the Central Housing and Planning Authority.

EMC Personal Communication 07 – Interview with Pritipaul Singh Investments Inc.

EMC Personal Communication 08 – Interview with Farm Supplies Limited.

EMC Personal Communication 09 – Interview with the Guyana Shore Base Inc.

Appendix A – EPA Letter requesting Preparation of EMP

Government of the Co-operative Republic of Guyana

Environmental Protection Agency

January 27, 2021 **Ref. No: 20200615-SEIWM**

Mr. Komal Singh,
Director & Company Secretary
Sustainable Environmental Solutions – Guyana Inc.
C/o GAICO Construction Inc.
225, New Market Street
Georgetown

ENVIRONMENTAL PROTECTION AGENCY
Ganges Street Sophia, Georgetown Guyana
01/02/2021

Dear **Mr. Singh,**

Re: Requirements for the Operation of Integrated Waste Management Facility

The Environmental Protection Agency (EPA) hereby refers to the operation of Sustainable Environmental Solutions – Guyana Inc.'s Integrated Waste Management Facility (IWMF) at Plantation 'A', Houston District, East Bank Demerara.

Kindly be informed that, the Agency has determined that the project does not require an Environmental Impact Assessment (EIA); however, the project will be authorised by the Agency through the issuance of an Operation Permit. An Application for the Operation Permit shall be submitted **at least six (6) months prior** to the expiration of the Construction Permit issued.

In order to facilitate the issuance of an Operation Permit, the following information shall be submitted with the aforementioned Application:

1. **Environmental Management Plan (EMP)** for the IWMF that includes the following:
   a. Verification testing of all treatment system.
   b. Cumulative Risk Assessment for the project taking into consideration the surrounding facilities.
   c. A procedure and/or plan that makes provisions for qualified and trained personnel to operate the treatment systems within the facility.
   d. Emergency Response Plan (ERP)
2. **A detailed Waste Acceptance Criteria (WAC)** *(refer to the format attached)*

Should you have any questions or need any clarifications, please do not hesitate to make contact with **Mr Rayner McAndrew, Environmental Officer** on telephone number 225-5468 (Ext. 2365) or email epa.brm@gmail.com.

Yours Sincerely,

ENVIRONMENTAL PROTECTION AGENCY

Sharifah Razack

Ms. Sharifah Razack
Executive Director (A.g)

Attached: Waste Acceptance Criteria Format

Ganges St., Sophia, Georgetown, GUYANA.
Tel: (592) 225-5467/5471-5472/6044/6048 | Fax: 225-5481
epa@epaguyana.org | www.epaguyana.org | Environmental Protection Agency - Guyana

"The Environment is Everybody's Business"

MINIMUM REQUIREMENTS FOR A TREATMENT STORAGE DISPOSAL FACILITY (TSDF) WASTE ACCEPTANCE CRITERIA (WAC)

Identify and list all wastes being accepted for storage and treatment and all wastes generated from onsite processes (i.e. systems maintenance activities), including those from treatment units (i.e. incinerator ash, treated wastewater, etc.)

- Identify which wastes are hazardous and which are non hazardous as per Guyana EPA and Basel Regulations
- There should be a system for characterizing any waste stream as "hazardous" or "non hazardous" and the system should include some laboratory analysis
- Waste identification must include but not be limited to the following information (see Hazardous Waste Profile):
    - Name given to identify waste while on site
    - Source / process generating the waste
    - Physical description
    - All chemical properties (i.e. acidic, basic, flammable, poisonous, etc.)
    - Hazardous waste characterization codes (Guyana EPA / Basel) if applicable

Identify and list the treatment technologies (incinerators, pug mills, settling tanks, etc.) and containment / storage systems used to treat any wastes; include:

- How wastes are stored: containers, buildings, piles, ponds, etc.
- Match the incoming and generated waste types to the treatment units
- Description of the waste treatment processes
- Provide processes and details to ensure that treatment technologies will perform to their designed operating standards and that they will be constructed, operated, and maintained as per their original design
- Define the specifications that wastes are treated to
- Provide any process / design limitations for waste treatment units

Describe facility waste acceptance identification and verification process for all incoming wastes and establish a Waste Analysis Plan (WAP)

- Define waste submittal requirements for clients who ship wastes to the facility, to include but not be limited to:
    - Profiles
    - Analytical data

  - Safety Data Sheets (SDS)
  - Generator knowledge
- Discrepancy procedures for those wastes that have conflicting documentation i.e. manifests or profiles
- Incoming waste inspection (visual) procedures
- Incoming waste screening procedures i.e. radiation, PCB, asbestos
- Explanations of any verification sampling and testing conducted on or off site to include:
  - Sampling methods and reasons
  - Testing parameters and rationale for parameters selected
  - Test methods
  - Test frequency
  - Identification of any off site laboratories used
  - Quality control and assurance measures for samples and data
- Rejection procedures for incoming wastes that are not approved for treatment and reasons for rejection

Describe hazardous waste post treatment procedures

- Sampling procedures and rationale
- Testing parameters & rationale
- Treated waste confirmation process and final disposal method
- Treatment failure contingency process
- Identification of any new hazardous wastes generated from treatment
- Identification of final disposal technology / facility for all generated wastes

Hazardous Wastes Recordkeeping / Document Control / Waste Tracking Procedures

Appendix B - Team Composition and Task Assignment

Name	Position	Task
Shyam Nokta	Team Coordinator, Natural Resources and Environment Specialist	Overall planning and coordination of activities as well as overseeing EMP preparation and technical review
Steve Rowan	Environmental and Waste Management Specialist	Technical input in the preparation of the EMP
Michael Sylvester	Environmental and Waste Management Specialist	Technical input in the preparation of the EMP
Khalid Alladin	Environmental Management Specialist	Responsible for taking the lead on baseline data collection and compiling of the EMP
Kandila Ramotar	Environment and Climate Specialist	Provided technical support to the preparation of the EMP and on stakeholders' engagement
Stella Madete	Social Specialist	Assisted with stakeholder engagements, preparation of a socio-economic profile and inputs to the social assessment component of the EMP preparation
Stephanie Qualls	Stakeholder Engagement and Communication Specialist	Provided support for stakeholders engagements
Michael Philander	Biologist	Assisted with the collection of baseline information on the project environment.
Latchmi Mukhlall	Environmental Assistant	Provided support in overall EMP preparation process
Enrique George Monize	GIS Specialist	Spatial layout of baseline information and maps preparations

Appendix C – Water Quality Laboratory Analyses Report

GUYSUCO Analysis Report

GUYANA SUGAR CORPORATION INC
CENTRAL LABORATORY
Research Centre, Agriculture Department, LBI Compound, E.C.D, Guyana, S.A.
Telephone #: 592- 220-2229 Email: riship@guysuco.com Fax #: 592-220-4027

CAEMS SOP/RF No.: 013.1	Version: 3	Revision Status: 2	Date of Issue: April 12, 2021	Expiry Date:

Analysis Report

Report Number: 0050/04/2021-C **Date:** 2021-05-18

To:
Mr. Shyam Nokta
60 Area H
Ogle
East Coast Demerara

Tele: 222-4565 **Fax #:** 222-3172

From:
Analyst

Central Laboratory
Agronomy and Analytical Services Department

Date Sample Received: 2021-04-15

Date Analysis Completed: 2021-05-12

SAMPLE TYPE: Water

Sample submitted by: Customer

SAMPLE DESCRIPTION	PARAMETER							
	O & G Ave (mg/L)	% R.S.D	COD Ave (mg/L)	% R.S.D	Al Ave (mg/L)	% R.S.D	Pb Ave. (mg/L)	% R.S.D
IWMF SW 1	N.d	0	56	0	11.5	0.17	N.d	0
IWMF SW 2	N.d	0	40	0	13.6	1.33	N.d	0
SAMPLE DESCRIPTION	**Fe Ave (mg/L)**	**% R.S.D**	**Cu Ave (mg/L)**	**% R.S.D**	**Zn Ave. (mg/L)**	**% R.S.D**		
IWMF SW 1	14.7	0.89	N.d	0	N.d	0		
IWMF SW 2	12.6	0.71	N.d	0	N.d	0		

Analysed by: Tessa Stewart

N.d-Not detected

Metals ; acid digestion by FAAS
COD, Dichromate reflux method
O & G, Saxhlet method

Verified by:

for Assistant Analyst

Approved by:

Analyst

C: Mr. Gavin Ramnarain-Head-Agric. Research
Mr. Ashley Adams-Agronomy Research Manager

IAST Result of Analyses

Institute of Applied Science and Technology

University of Guyana Campus. Turkeyen, Greater Georgetown, Guyana.
Phone: (592) 222-4213-5, 4218, 5864. Fax: (592) 222-4229
website: www.iast.gy

Result of Analyses

Client: Environmental Management Consultant
60 Area H, Ogle.
East Coast Demerara

Date Submitted: 2021-04-13 **Sample Matrix: Water.**

Date Completed: 2021-04-19

Parameters Tested	Result of Analysis	
	SW 1 IWMF	SW 2 IWMF
Biological Oxygen Demand (mg/L)	0.06	0.07

Note: ND- Not Detected

Method Reference: Standard Method 20th Edition

Mahendra Rampersaud
Mahendra Rampersaud
HOD BioProspecting/Analytical.

Deonarine Jagdeo
Deonarine Jagdeo
Director (a.g)

THANK YOU FOR CHOOSING I.A.S.T

INSTITUTE OF APPLIED SCIENCE & TECHNOLOGY

Appendix D – Stakeholders Engagement Minutes

EMC Personal Communication 01 – Interview with the Go-INVEST

Date: April 06, 2021
Time: 13:30 – 14:00 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Mr. Michael Philander
Ms. Stephanie Qualls

Go-Invest Representatives:

Mr. Samora Watkins	Director of Investment
Mr. Arvinda Ramcharran	Special Projects Officer

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.
- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Guyana Office for Investment (Go-INVEST) is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the Go-INVEST's perspectives.
- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- Go-INVEST is not aware of this project. However, investments coming into Guyana are welcome.
- Go-INVEST recognizes that the environment is important and also wants to ensure that development is done in a sustainable manner.
- A point-of-contact should be established between Go-INVEST and the EMC Team to ensure that any feedback after the meeting can be shared.

Detailed Discussions

- Go-INVEST is not aware of this project.
- Go-INVEST welcomes investments coming in to Guyana and is committed to working with investors to facilitate these investments in a seamless and smooth manner. However, Go-INVEST recognizes that the environment is important and also wants to ensure that development is done in a sustainable manner.
- Nexus between Go-INVEST and the Environmental Protection Agency (EPA):
    - Go-INVEST ensures that all potential investments are compliant with environmental laws and regulations so as to ensure that they are done sustainably. However, the

EPA's environmental authorization process is quite lengthy and Investment Agreements are delayed while companies await Permits from the EPA. To expedite processing of Investment Agreements, Go-INVEST now requires companies to submit receipts of their applications to the EPA.

- For a waste management project, it is expected that any company engaging with Go-INVEST should provide details as to the components of the facility and the developer's business plan. Go-INVEST may then explore whether any incentives can be provided to the company.
- However, it is important to Go-INVEST that projects are sustainably done and as such, Go-INVEST will try to promote a greater nexus with the EPA so that they may understand the environmental impacts of a Project before Investment Agreements are issued.
- Go-INVEST may also consider requesting that companies submit a copy or summary of their Environmental Management Plans with their applications.

- Go-INVEST Recommendation: A point-of-contact should be established between Go-INVEST and the EMC Team to ensure that any feedback after the meeting can be shared.
  EMC Team Response: We will follow-up to establish a point-of-contact via email

Next Steps

- Email to Go-INVEST to establish a point-of-contact with the EMC Team.

EMC Personal Communication 02 – Interview with the Traffic Department, Guyana Police Force

Date: April 06, 2021
Time: 15:00 – 16:00 hrs.
Venue: Traffic Department Headquarters, Eve Leary

EMC Team:
Ms. Kandila Ramotar
Mr. Michael Philander
Ms. Stephanie Qualls

Guyana Police Force Representative:
Mr. Ramesh Ashram Senior Superintendent, Traffic Department

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Traffic Department of the Guyana Police Force is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the Department's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- The Traffic Department was aware of this Project based on reports of the development in the newspapers.

- The primary concerns with the project relate to the traffic congestion on the East Bank of Demerara public road during peak hours.

- However, the Police Force recognizes that the Guyana Shore Base Inc. (GYSBI) has put some measures in place to reduce the impact of heavy traffic on traffic flow.

Detailed Discussions

- Traffic Congestion:
    - The section of the East Bank of Demerara from the Demerara Harbour Bridge (DHB) to Houston is considered a 'hotspot' for traffic congestion and the Gafoors junction is one of the critical areas. Traffic emanating from the West Demerara plays a major role in this congestion. Based on estimates from the Police Force, approximately 75 percent of the traffic on the road during the peak hours is due to vehicles crossing the DHB.
    - The Traffic Department has several special measures in place to manage this traffic including:
        - Placing ranks at all junctions along this section of the road to facilitate the smooth flow of traffic.

- Using traffic cones on either side of the outer boundaries of the road to prevent undertaking and line cutting. This measure also aims to protect pedestrians from dangerous driving.
- A dedicated third lane in the morning and afternoon peak hours. In the mornings, one of the two lanes leading south from Georgetown is dedicated to north bound traffic between 07:00 to 08:00hrs. Similarly, in the afternoons, one of the two lanes leading north is dedicated for south bound traffic and the time of this opening is generally determined by the flow of traffic.
- Double lane opening of the DBH has been rescheduled from 06:15 to 07:00 hrs in an effort to ease congestion on the East Bank public road.
- When the third lane is operational in the afternoons, traffic cones are placed at the junction between the north and south-bound lanes of the public road. This means that vehicles heading north cannot turn into the Gafoors junction and moreover, that vehicles exiting the Gafoors junction cannot turn right (to head north into Georgetown).
- Traffic ranks are instructed not to stop vehicles on the East Bank Demerara public road for document checks.
- Lorries and heavy vehicles heading north from the Soesdyke junction are stopped from travelling between the 06:00 to 09:00 AM. There may also be restrictions on the movement of heavy vehicles during afternoon peak hours but these are only instituted if deemed necessary based on the flow of traffic.

- Use of Roads at Nights:
  - Generally, lorries and other heavy vehicles are not allowed to use roads at nights. However, the Traffic Department may give special permission to use the roads if vehicles are properly lit. This approach has several positive advantages, foremost of which it will lessen traffic congestion from project vehicles.
  - The Traffic Department is willing to work in collaboration with developers once consulted to find appropriate solution.

- Road Condition:
  - Roads that are in poor condition contribute to traffic congestion because traffic flows at a slower pace. This is a challenge in some sections of the public road.

- Improving Traffic Management: Improving traffic management in the ‘hotspot’ area depends on several factors such as:
  - Construction of a new DHB which is non-retractable and uses different toll technology (such as fast pass, dashboard barcodes, etc).
  - More alternative road routes.
  - Improved conditions of the roads.
  - Safe alternatives from pedestrian crossings (such as overpass).
  - Collaborations with the Ministry of Human Services and Social Security to get vagrants off of the public road.

- EMC Team question: Is there any data on fatal accidents in McDoom in the vicinity of the project site.
  Traffic Department’s answer:
  - In 2020, there was one fatal accident on the public road in the vicinity of Houston and McDoom.
  - In general, the Traffic Department has found that most of the fatal accidents involve light vehicles in particular small cars. Lorries and heavy vehicles are only rarely involved in fatal accidents.

- EMC Team question: Are traffic counts available?
  Traffic Department's answer: No. The Ministry of Public Works may have this information.

- Capacity constraints:
  - The Department faces several constraints foremost of which are capacity constraints because there are too few traffic ranks. This means that officers work extended shifts, sometimes up to 14 or 16 hours. A doubling of manpower is required to support their work.
  - The capacity constraints became more pronounced when the Guyana Police Force was 'regionalized'. Previously, the Force was managed in 'Divisions' and A Division managed traffic from Georgetown to Dora (on the East Bank of Demerara).
  - Following the regionalization, the there are three different departments for Region 4: A, B and C. 'B' is responsible for managing traffic from Eccles to Moblissa (on the Soesdyke/Linden Highway) and this is a large and challenging range.

- The Department appreciates the EMC Team's effort to reach out to provide a briefing on the project.

EMC Personal Communication 03 – Interview with the Mayor and City Council

Date: April 08, 2021
Time: 13:00 – 14:00 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Mr. Khalid Alladin
Ms. Stella Madete
Ms. Stephanie Qualls

Mayor and City Council Representative:
Mr. Ubraj Narine Mayor of Georgetown

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Mayor and City Council (M&CC) is likely to have an interest. The purpose of the meeting is to provide information about the Project to the City Council and gather the Council's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- The Mayor was fully aware of the project but appreciated the detailed information provided by the EMC Team.

- The Mayor's primary concerns with the Project are linked to letters recently received by the M&CC rom residents complaining of chemical exposure risk and tremors in the area of the Guyana Shore Base Inc. (GYSBI). The Mayor agreed to allow the EMC Team to follow-up to obtain copies of the complaint letters.

Detailed Discussions

- The Mayor began by clarifying that approval for the Projects will have to be granted by the Central Housing and Planning Authority (CHPA) and suggested that the EMC Team should also engage with the CHPA on this Project.

- The Mayor indicated that the Project was aligned with the vision for Greater Georgetown and expected positive contributions to economic development and job creation.

- Question from the Mayor: Would the facility be handling waste from the oil and gas industry?
  EMC Team Response:
  - Yes, the facility will be handing waste from EEPGL.

- Question from the Mayor: Would the wood and plastic waste be from EEPGL only as well?
  EMC Team Response:

  - Yes. The facility will not be handling any municipal waste.

- The Mayor shared concerns about the project because of its proximity to residential areas in Houston, East Bank Demerara. The Mayor also indicated that he has received two letters of complaint regarding chemicals, exposure risk, and “tremors”.
  EMC Team Response:
  - The immediate neighbours of the project are industrial enterprises, not residential.
  - The EMC Team also requested copies of the complaint letters which were sent to the M&CC. The Mayor indicated that information received by the M&CC is confidential and he must first consult with the Council to determine whether they may be shared. However, he agreed that the EMC Team may follow up for summaries of the complaints or copies of the letter with the sender’s personal information redacted.

- The Mayor shared concerns about the existing circumstances regarding the disposal of solid waste. At a national level, he indicated that legislation and a solid waste management plan should be prepared by the Government to improve solid waste management. He also indicated that management of the Haags Bosch Landfill has to be improved and that in its present condition, the landfill may be a public health nuisance.

- The Mayor suggested that EMC should also engage with the CHPA to provide information on this Project.

- The Mayor suggested that the M&CC may invite the developer to present further information on the Project to the entire Council. The M&CC will decide to issue its No-Objection to the Project after it is discussed by the full Council and based on advice from the M&CC’s technical personnel.

Next Steps

- Follow-Up with the Mayor’s Office to obtain the key information in the complaint letters, so that the team can build assurances into the EMP that the new project will not exacerbate any existing issues.

EMC Personal Communication 04 – Interview with the Solid Waste Department - Ministry of Local Government and Regional Development

Date: April 08, 2021
Time: 14:30 – 15:30 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Ms. Stella Madete
Mr. Khalid Alladin
Ms. Stephanie Qualls

Solid Waste Department Representative:

Mr Lloyd Stanton Haags Bosch Sanitary Landfill Site Supervisor

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Ministry is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the Ministry's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- Mr. Stanton was aware of the Project and had a detailed presentation on the Project done by the developer to the Solid Waste Department recently.

- The Haags Bosch Landfill has sufficient capacity to manage wastes generated by the Project. However, the Landfill has encountered challenges in managing wastes generated by GYSBI and will be implementing new procedures which the Project will have to follow to manage different streams of waste.

- The team has permission to re-connect if further questions arise.

Detailed Discussions

- The Georgetown Solid Waste Management Pogramme was developed by the Inter-American Development Bank (IDB) in 2011. A Sanitation Management Unit was created under the Programme and this Unit eventually became the Waste Management Department located within the Ministry of Local Government and Regional Development.

- The Solid Waste Department has oversight and supervision for all landfills and dumpsites around the country. The Department provides funding for the operation of two of the largest sites namely the Haags Bosch Landfill Site and the Lusignan Landfill. The Haags Bosch Landfill is the largest in the country.

- Relationship between the Ministry of Local Government and Regional Development, Solid Waste Department and Haags Bosch Sanitary Landfill Facility:
    - The Ministry hires a contractor to manage the Haags Bosch Landfill under Government supervision.
    - The contract for landfill operations is presently expired, and the incumbent continues to operate the facility until a new contract is in place. The previous and interim contractor is a Joint Venture between Puran's Brothers Inc. and Cevons Waste Management.

- Forecasting, strategy, and future planning is the responsibility of the Ministry, consulting with the contractor and the public.
    - Forecast Plan for Haags Bosch Landfill demand assumed 50 percent growth in current demand. Currently, average disposal at the landfill is 400 to 600 tons per day. Daily peak volumes of 1,000 to 1,200 tons are expected at certain periods of the year such as the Christmas season. Mr. Stanton advised the team to follow-up with the Head of the Department to request a copy of the Forecasting Plan.
    - Recently, the landfill expanded its capacity to accept waste streams which were not previously accepted including derelict materials, scrap metals and soils. The landfill accepts only inert substances and does not dispose of any hazardous wastes.
    - The Landfill has a minimum lifetime of 20 years. Cell 2 was recently commissioned and is expected to have a lifetime of six to seven years. In addition, there were two additional cells to be developed upon closure of Cell 2.
    - The design of Cell 2 requires 1.5 to 2 million tons of soft wastes (domestic and market wastes) to be placed at the bottom before heavier wastes are added. It was designed with a structural overload capacity of 30 percent allowing wastes to be placed eight to ten meters above the existing ground level before the cell is closed.

- Mr. Stanton indicated that materials sent to the Landfill is mixed inclusive of soil, tires, and other materials that should not take space intended for municipal waste being dumped into the Cells. The Ministry will soon implement a process which will require characterization and quantification of each waste stream prior to its arrival at the landfill.

- The new process for segregation of wastes being sent to the Landfill is expected to require the following:

    - Each entity must inform the landfill ahead of time for each load.
    - Personnel will inspect each load to ensure that waste streams are segregated and establish a consignment note.
    - Consignment note must accompany load, allowing tracking of each truck's journey.

  According to Mr. Stanton, this will allow for separate disposal of each waste stream into the Cell. It will also optimize the use of available space in the Cell and identify waste streams such as soils which may be used in the future for covering filled Cells. These new procedures will be required in the near future.

- Question from Mr. Stanton: Will oil sludge be coming to the Landfill? In particular, will materials removed from the oil/water separators be treated prior to disposal?
  Team answer:
    - Any sludge will be treated before shipment to site; no waste sent to the Landfill will have hazardous properties.

- Team question: What are the costs of disposal?
  Mr. Stanton's answer:

  - These costs are difficult to estimate because there is no contract in place. In 2011 to 2012, costs were approximately USD$18-20 per ton.

- Team question: Is Cell 1 still operational?
  Mr. Stanton's answer:
  - Yes, Cell 1 is still operational but is expected to be closed in about two months.
  - Currently, bulky wastes are crushed and placed in Cell 1.

- Team question: May we talk to the operator to understand details of execution challenges?
  Mr. Stanton's answer:
  - The Contractor role is strictly execution and the contractor has no authority for decision making. However, there are no objections to talking to the Contractor's Site Manager, Mr. Hubert Urling.

Next Steps

- Call Mr. Satrohan Nauth to request forecast and plan for Haags Bosch. Mr. Stanton does not have authority to release the plan, but Mr. Nauth does.

EMC Personal Communication 05 – Interview with Works Services Group - Ministry of Public Works

Date: April 12, 2021
Time: 15:00 – 16:00 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Ms. Stella Madete
Ms. Stephanie Qualls

Ministry of Public Works Representative:
Ms. Shawn-Ann Greene Social and Environmental Officer, Works Services Group

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Ministry is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the Ministry's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- There were no concerns related to roadway access to GYSBI and traffic impact of the Project.

- There should be engagement with the Sea and River Defense Board given the proximity of the Project to the shoreline.

Detailed Discussions

- The developers should engage with the Sea and River Defence Board so as to obtain all approvals required to operate their facility in proximity to the shoreline.

- EMC Team question on access road: Who is responsible for the management and control of the access road connecting the East Bank Demerara public road to GYSBI.
  Ms. Greene's answer:
  - The Ministry does not manage this access road. The Central Housing and Planning Authority (CHPA) is likely to know who manages it. If it is not managed by the CHPA, then it is privately managed.
  - However, the connection to the public road is the responsibility of the Ministry. There are no current challenges because this junction have handled industrial traffic for a long period of time given that Gafoors historically operated in the area before GYSBI became operational.
  - If management of this junction becomes problematic in the future, the Ministry of Public Works will conduct a traffic study to determine whether any changes in management are required.

- EMC Team question on road strength: Is weight of vehicles a concern for the public road? Ms. Green's answer:
    - No. Public roads are typically designed for double and triple axel trucks. Ms. Green will enquire into specific weight limits for this section of the public road and share same with the EMC Team.

Next Steps

- Follow-up with Ms. Greene for public road weight limits.

EMC Personal Communication 06 – Interview with the Central Housing and Planning Authority

Date: April 13, 2021
Time: 15:00 – 16:00 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Ms. Stella Madete
Ms. Stephanie Qualls

CHPA Representatives:

Mr. Sherwyn Greaves	Chief Executive Officer
Ms. Germene Stewart	Chief Development Planner for Urban Planning
Ms. Fayola Azore	Senior Development Planner

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Central Housing and Planning Authority (CHPA) is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the CHPA's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- Currently, there were no concerns about the Project and information provided to-date has been adequate. The application for planning permission is being reviewed by waste specialists.

- The CHPA team stated that they are appreciative of this consultative approach, allowing all to collaborate for a successful solution. The CHPA was hopeful for more such engagements on the future.

Detailed Discussions

- EMC Team question: How does this project fit with CHPA's plans and zoning? CHPA's answer:
    - This project is located with the Guyana Shore Base Inc. (GYSBI) and which has been zoned "Heavy Industrial".
    - The CHPA is considering the developer's application and has also sought feedback from a waste specialist. The CHPA has no additional comments on this Project at this time.

EMC Personal Communication 07 – Interview Pritipaul Singh Investments Inc.

Date: April 14, 2021
Time: 10:45 – 11:15 hrs.
Venue: Zoom

EMC Team:
Ms. Kandila Ramotar
Mr. Khalid Alladin
Ms. Stella Madete
Ms. Stephanie Qualls

Pritipaul Singh Investment Inc. Representative:
Ms. Sabrina Singh Senior Quality Control Manager

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Kandila Ramotar.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Pritipaul Singh Investments Inc. (PSI) is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the PSI's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- Ms. Singh was not aware of the project prior to today's discussion, and expressed significant concern about it, in particular:

    - Potential incinerator discharge, based on fumes from existing industrial activities in the area that are causing issues for their workers and putting at risk the quality of their product.
    - Proximity of hazardous waste handling to their food processing facility, which could put their certification at risk.

- Ms. Singh appreciated the opportunity to participate in the consultation and is hoping concerns can be addressed before issues arise during project operations.

Detailed Discussions

- Ms. Singh said she was not aware of the Integrated Waste Management Facility Project prior to today's discussion.

- Use of the incinerator by the project was the main concern:
    - PSI processes fish and shrimp. The project is located adjacent to Tiger Tanks waste facility, and PSI has had significant issues with emissions (fumes, dust, odour) from Tiger Tanks incinerator.
    - PSI workers have had to terminate work because of Tiger Tanks emissions. No days away from work cases were caused, but workers had to remove themselves from work

areas. This is also a challenge for workers discharging produce from vessels docked at the PSI waterfront who reported having to stop work. There were also instances of workers complaining about having asthma attacks triggered by the emissions from the Tiger Tanks incinerator.
    - There is a risk to product quality being compromised because of potential contamination of the food processed by PSI by the emissions given that the chemical make-up of the emissions is not known. A particular concern in this regard is with sludge handling and incineration because of the risk that chemicals could be carried into PSI's processing plant.

- Possible certification risk because of distance to solid waste and hazardous waste treatment facility:
    - PSI is under certification by international standards and also has requirements with the Ministry of Agriculture, Veterinary and Public Health Department.
    - The certification specifies a minimum distance between the PSI facility and facility that is handling or disposing of solid wastes and hazardous wastes. If the facility is located within this radius, it could threaten their certification. Ms. Singh agreed to share the certification with the EMC Team.

- Question from Ms. Singh: Would ships cause a blockage of the canal at the site? EMC Team answer: No. All vessels transporting waste to the Integrated Waste Management Facility will land at the GYSBI wharf.

- Ms. Singh appreciated the opportunity to participate in the consultation and is hoping that concerns can be addressed before issues arise during project operations.

Next Steps

- Follow-up with Ms. Singh to find out whether reports of the Tiger Tanks fumes have been filed with the EPA.

- Follow-up with Ms. Singh to obtain the PSI certification for review of requirements of minimum distance to hazardous waste facilities

EMC Personal Communication 08 – Interview with Farm Supplies Limited

Date: April 15, 2021
Time: 14:15 – 14:30 hrs.
Venue: GENEQUIP, South Ruimveldt, Georgetown

EMC Team:
Mr. Khalid Alladin
Ms. Kandila Ramotar
Ms. Stella Madete

Farm Supplies Representatives:

Mr. Reneger Van Djik	Managing Director of Genequip and Farm Supplies Ltd.
Mr. Van Djik	Genequip and Farm Supplies Ltd.

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Khalid Alladin.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility for EEPGL in which the Farm Supplies Limited (FARMSUP) is likely to have an interest. The purpose of the meeting is to provide information about the Project and gather the company's perspectives.

- Kandila Ramotar presented an overview of the Project, including the status of the project and the role of this interview in developing the EMP.

Summary of Discussions

- There were significant issues in the past with emissions from the Tiger Tanks incinerator. FARMSUP reported the issue to the Environmental Protection Agency (EPA) and remedial measures were taken.

- Will the facility be processing similar types of offshore waste streams as Tiger Tanks and will it have a greater processing capacity than Tiger Tanks?

- Pungent odours from incineration of some waste streams may be inevitable.

Detailed Discussions

- Question from Mr. Van Djik: Is this the same waste management and disposal project which residents protested against at Peter's Hall?
  EMC Team response: No, this is not the same project.

- Question from Mr. Van Djik: Is this project being constructed on the mudflat which was reclaimed by the Guyana Shore Base Inc. (GYSBI)?
  EMC Team response: Yes. It is on the reclaimed mud flats located west of the existing Tiger Tanks waste management facility.

- Previous issues with incineration by Tiger Tanks:

  - There were significant issues in the past with emissions from the Tiger Tanks incinerator. The emissions burned eyes and made breathing difficult. The odour also contributed to breathing difficulties.
  - This issue was more pronounced at Pritipaul Singh Investments Inc. (PSI) where work was sometimes impossible in the production plant because it was an enclosed environment. It was also concerning because PSI is producing food.
  - CIDI, FARMSUP's eastern neighbour, was also affected by emissions from the Tiger Tanks incinerator.
  - Approximately 1,700 persons employed by these three operations were impacted by Tiger Tanks activities.
  - FARMSUP reported these issues to the Environmental Protection Agency (EPA) and remedial measures were taken. Tiger Tanks was required to raise the height of the emissions stack and is only used when prevailing wind conditions will take the pollutants over the Demerara River. The EPA also asked for permission to install air quality monitoring devices in FARMSUP's compound but never followed through.

- Question from FARMSUP: Will the facility be processing similar types of offshore waste streams as Tiger Tanks?
  EMC Team response: Yes, similar waste streams will be processed although methods of processing may vary.

- Question from FARMSUP: Will the facility have a greater processing capacity than Tiger Tanks?
  EMC Team response:
  - This is uncertain because Tiger Tanks processing capacity is not known.
  - However, the facility will be state of the art and will include mechanisms to prevent significant emissions and odour.

- Observation from FARMSUP: Pungent odours from incineration of some waste streams may be inevitable. FARMSUP was offered a tour of Tiger Tanks facility and saw some of the technologies they have in place including wet scrubbers on the incinerator to prevent odours.

- Question from FARMSUP: Will effluent be discharged into the channel?
  EMC Team response:
  - The facility will have a drainage system which requires all effluent to pass through oil water separators before being discharged. There will also be a shear gate which can be used to stop water discharge in the event of an emergency.

EMC Personal Communication 09 – Interview with Guyana Shore Base Inc.

Date: April 20, 2021
Time: 16:00 – 16:30 hrs.
Venue: Zoom

EMC Team:
Mr. Khalid Alladin
Ms. Kandila Ramotar
Ms. Stella Madete

Guyana Shore Base Inc. Representative:
Mr. Rabin Chandarpal Government Liaison and Local Content Manager

Introduction and Presentation

- Introductions were made by the EMC Team, including an introduction to EMC by Khalid Alladin.

- Meeting purpose: EMC has been contracted to develop the Environmental Management Plan (EMP) for the Integrated Waste Management Facility (IMWF), and Guyana Shore Base Inc. (GYSBI) is likely to have an interest. The purpose of the meeting is to provide information about the project and gather the company's perspectives.

Summary of Discussions

- GYSBI should be considered as a primary stakeholder in the IWMF project and included in any stakeholder engagement mechanism or grievance redress mechanism.

- A copy of the Operation Permit for the IWMF should be shared with GYSBI upfront.

- Development of a mechanism to facilitate official and immediate communication with GYSBI should any complaints be received about the IWMF's operations.

Detailed Discussions

- EMC Team question: From GYSBI's perspectives, what are the main expectations of the IWMF?
  Mr. Chandarpal's answer: Several lessons were learned in GYSBI's relationship with Tiger Rentals that would be applied to the IWMF particularly:
  - Initially, GYSBI did not receive a copy of Tiger Rentals Operation Permit which was issued by the EPA. Access to the EPA Permit should have been automatic, given that GYSBI is the landlord of the site and operates several sensitive facilities. The operation of the IWMF at GYSBI will influence the carrying capacity of the site and as such, GYSBI expected to receive a copy of Operation Permit upfront.
  - Complaints from neighbouring companies, primarily Pritipaul Singh Investments Inc. (PSI), about emissions from the incinerator were shared directly with Tiger Rentals. Tiger Rentals did not share these complaints with GYSBI and GYSBI was made aware through a third party, which is not ideal. Tiger Rentals did not view GYSBI as a concerned stakeholder who faced reputational risk from adverse impacts on neighbours. As such, GYSBI was not included in Tiger Rentals Grievance Mechanism. The IWMF would be required to have mechanisms in place to immediately inform GYSBI of any complaints which are received about their operations.

- Question from EMC: Were the complaints about the Tiger Rentals incinerator addressed?
  Mr. Chandarpal's response: Tiger Rentals implemented measures to address the issues raised by their neighbours but there is no certainty about whether these issues have been satisfactorily addressed.

- Question from EMC: Did GYSBI engage the neighbours to address any potential concerns about the IWMF project?
  Mr. Chandarpal's response: These are issues which should be addressed by statutory agencies. GYSBI is also not concerned about the IWMF project exceeding GYSBI's carrying capacity. With the exception of Tiger Rentals, none of the other activities in that section of the GYSBI compound generates any significant impacts. All other neighbours are GYSBI operation which involve fuel storage via a Sol pipeline and water storage. Both of these are closed systems.

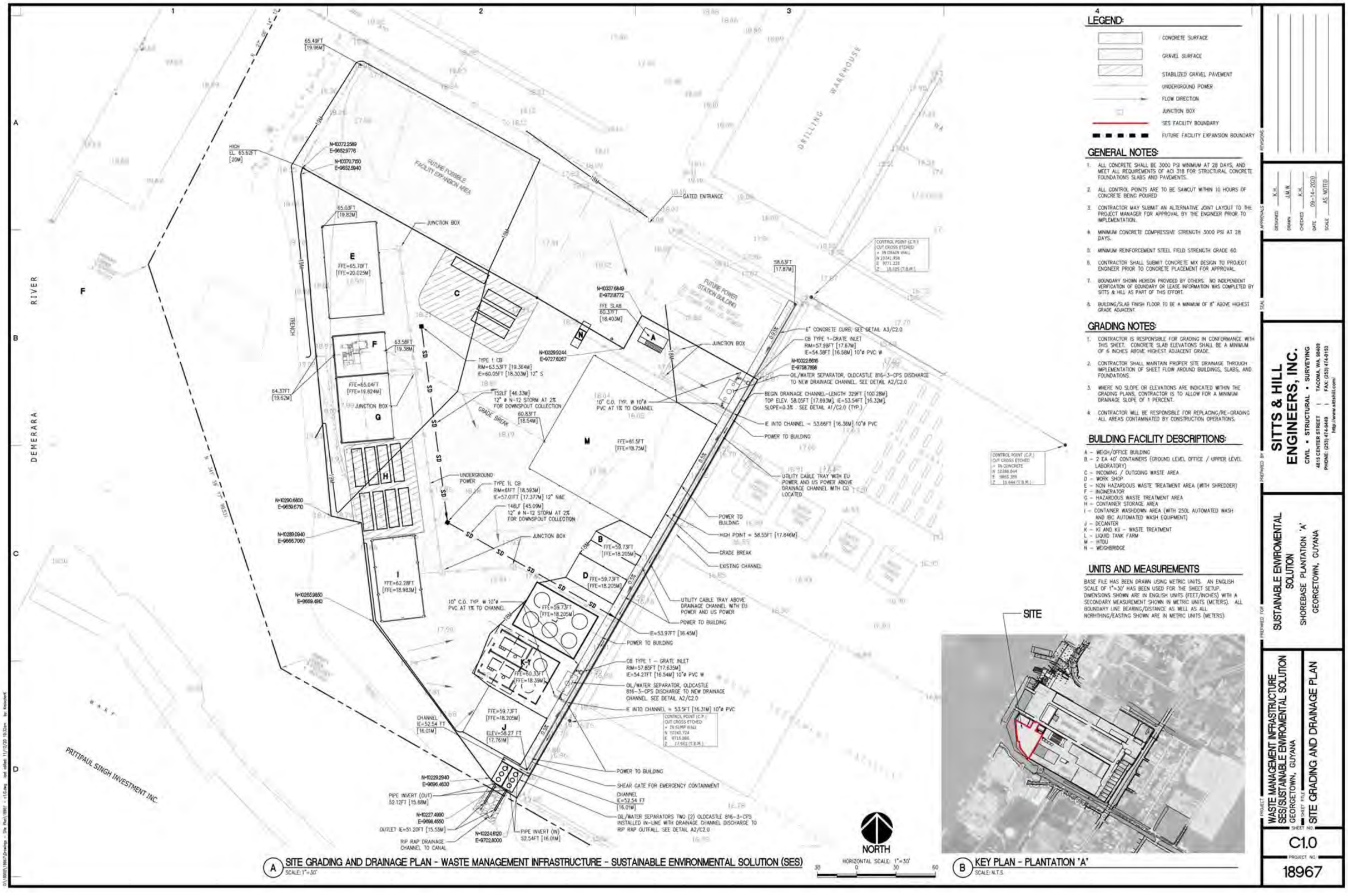
- Question from EMC: As part of the EMP preparation process, EMC engaged with PSI who shared reservations about the IWMF project given the impacts of Tiger Rentals operations. Does GYSBI have any recommendations about how this should be addressed?
  Mr. Chandarpal's answer:
    - PSI's concerns are well noted and the sensitivity of their operations as a food processing facility is also acknowledged
    - PSI has plans in place to relocate the processing plant in the near future. However, their concerns should be adequately addressed in the interim.

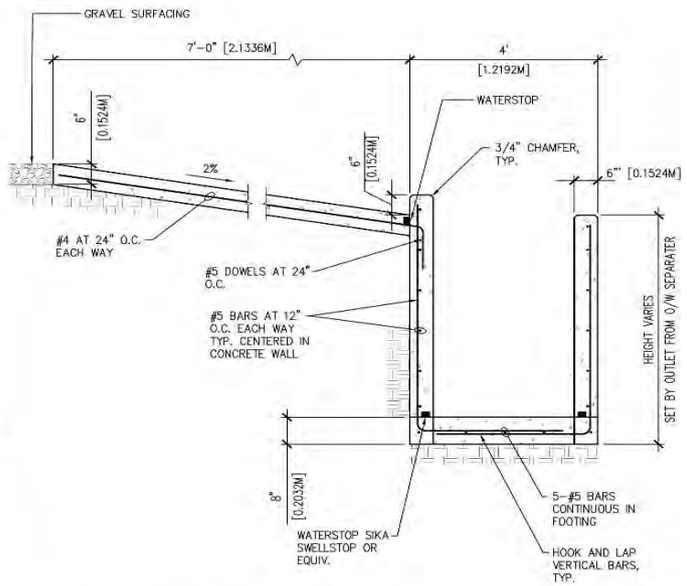
- Question from EMC: What are the respective roles of GYSBI and Sustainable Environmental Solutions Inc. (SES) in waste management onsite?
  Mr. Chandarpal's response:
    - GYSBI is responsible for moving the waste from the ship into the IWMF site. EEPGL will outline its work requirements once a vessel arrives with waste or returns offshore empty. The arrangement benefits GYSBI because of the increased coordination on the site due to EEPGL's reluctance to conduct simultaneous operations as long as it can be avoided.
    - Mr. Chandarpal has to confirm arrangements for liability and responsibility but suspects that SES responsibility kicks in when the waste is delivered to their facility.

- Question from EMC: The EMC team observed land reclamation and revetments west of the IWMF project site. What are the intended uses of this land?
  Mr. Chandarpal's response: GYSBI has no committed use for the land. The company anticipates that IWMF will increase its demand for storage space and the most likely future use of the land will be to facilitate an expansion of the IWMF.

- Question from EMC: Does GYSBI have any other expectations (such as security or health and safety) as a landlord?
  Mr. Chandarpal's response: All other expectations are included in the contract between GYSBI and SES.

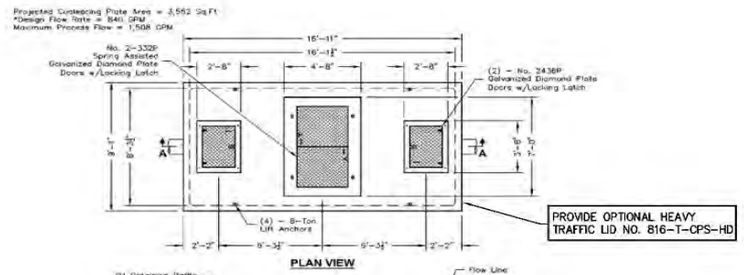
Appendix E – Site Drainage Plan





A1 DRAINAGE CHANNEL SECTION
SCALE: 1/2" = 1'-0"

816-3-CPS



*DESIGN FLOW RATE	EFFLUENT QUALITY	100% COLLECTED SIZE
840 GPM	10 ppm	60 Micron

*Basic Design Information per Washington State Department of Ecology. User to Adjust Estimates for Variations in Real Conditions.

Notes:
- Static Water Depth = 4'-0"
- Prior to "Startup" of system, fill with clean water to bottom of outlet pipe. For best results, fill to flow line.
- Follow Regular Inspection, Cleaning, & Maintenance Schedule (See Clean Out & Maintenance).

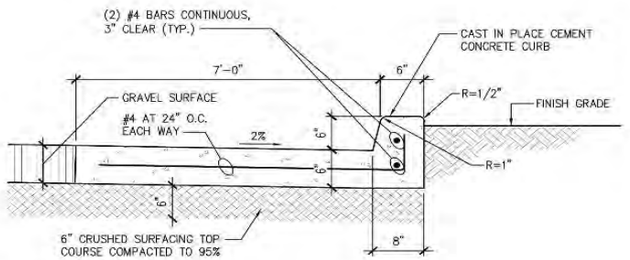
Basic Design Information:
- Influent Characteristics
- Oil Specific Gravity = 0.88
- Operating Temperature = 50°
- Influent Oil Concentration = 100 ppm
- Mean Oil Droplet Size = 130 Microns
- .033 ft/min. Critical Oil Droplet Predicted Rise Rate

Oldcastle Precast®
PO Box 323, Wilsonville, Oregon 97070-0323
Tel: (503) 682-2844 Fax: (503) 682-2657

816-3-CPS	816-3-CPS OIL / WATER SEPARATOR COALESCING - 840 GPM
File Name: 020-816CPS3	
Issue Date: 2018	
oldcastleprecast.com/wilsonville	

12.1

A2 OIL/WATER SEPARATOR COALESCING - 840 GPM
SCALE: 1/2" = 1'-0"



A3 6" CONCRETE CURB
SCALE: N.T.S.

PROJECT
WASTE MANAGEMENT INFRASTRUCTURE
SES/SUSTAINABLE ENVIROMENTAL SOLUTION
GEORGETOWN, GUYANA

SHEET TITLE
DETAILS

PROJECT NO. 18967
SHEET NO. C2.0

PREPARED FOR
SUSTAINABLE ENVIROMENTAL SOLUTION
SHOREBASE PLANTATION 'A'
GEORGETOWN, GUYANA

PREPARED BY
SITTS & HILL ENGINEERS, INC.
CIVIL ▪ STRUCTURAL ▪ SURVEYING
4815 CENTER STREET | TACOMA, WA. 98409
PHONE: (253) 474-9449 | FAX: (253) 474-0153
http://www.sittshill.com/

SEAL

APPROVALS
DESIGNED K.H.
DRAWN J.M.W.
CHECKED K.H.
DATE 09-14-2020
SCALE AS NOTED

REVISIONS

Appendix F – Additional Details on Project Components

Appendix F-1 – Summary of the Key Technical Aspects of the HTDU Treatment Process

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Guyana

Thermal Treatment of Synthetic Based Mud Cuttings; Effluent and Centrifuge Filtercake

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1. Cuttings and Effluents Collection and Transportation Services

1.1 Cuttings and Effluents Collection and Transportation Services at Each Rig Sites

Cuttings Skips

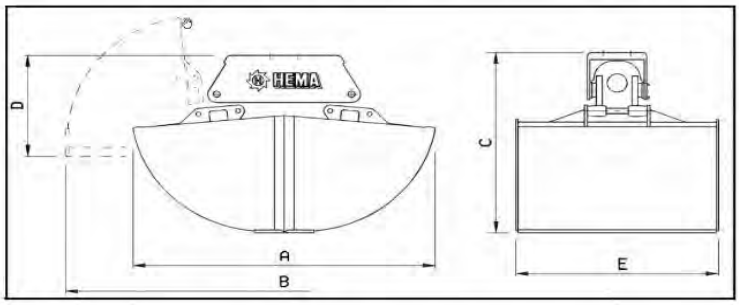
Skips with following specifications can be supplied

1.2 Cuttings and Effluents Collection and Transportation Services at Company Bases

Clam Shell

A suitable clam shell meeting the design requirements will be provided, following is an illustration

HEMA Jordgrab
HJ90-500



A = 1516 mm B = 2220 mm C = 975 mm
D = 550 mm E = 795 mm

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2. Treatment and Disposal Requirements

2.1 Solid Waste Treatment

SBM Cuttings Reception and Thermal Treatment at Facility

This section will give details on how to:

- Offloading of Cuttings Boxes Central Thermal Treatment Facility
- Cuttings Feed into Thermal Treatment Units

We suggest the collection of all SBM cuttings in 10 MT **???** cuttings boxes. The cuttings skips are fitted with lids to protect against monsoon rainfall and to avoid spillage during transportation and should not be discharged until they reach the treatment plant. The cuttings skips can be lifted by the 15 tons fork lift trucks available on the rig sites already.

Transportation to Thermal Treatment Facility

Every 40' flatbed trailer can transport a maximum of 30 MT payload. Four cuttings boxes loaded with cuttings can be loaded without exceeding the limits.

Normally (based on our experience) each skip will contain between 5-7 tons of cuttings. All skips will be secured to the flat bed for safe transportation. The same flatbed trailer will deliver up to 5 empty cutting skips upon arrival to the rig site. Every rig site will need one delivery/pick up per 24 hours during the seven days drilling campaign. Depending on distance to the MPT the number of turnarounds would be 2-4 per day (daylight only), servicing 2-4 rigs per flatbed trailer truck

Forklift at Skips loading of trailer truck *(for illustration purpose)*

40 Ton Flat Bed Trailer (3 x 16 ton axles)

NOV Wellbore Technologies

At the treatment plant a 11 tons forklift will offload full skips and reload empty skips. The full skips will be weighed at a dedicated skips scale and discharged by means of a cutting skip turner into the storage pit of the thermal treatment plant. After discharging the skips, the skips will be inspected and cleaned for further use.

Skips Weighing scale at treatment plant **(Optional)**

Automatic Cuttings skips turner at Thermal Treatment Plant **(Optional)**

Note for illustration only. In this particular case the skips turner will be positioned on top of a steel tank.

1 pc NOV Brandt Skip Turner Unit with the below mentioned features:

- Skips turner with drive mechanism, turning platform with motor vibrator
- Hydraulic Power Pack
- Wireless remote control for operating the skip turner
- Cuttings skips max gross weight 10.000 kg
- Instruction manual, spare parts list in English language and supplementary documents

1 pc NOV Brandt Traverse Frame for Skip Turner with below mentioned features:

- Traverse frame length 6 mts.

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Cuttings Storage Tanks

15 off 20 cbm Steel Tanks L: 6 x 2,4 x 1,8 m incl. gangway and handrails are being loaded with skips turner and distributed by traverse crane from the unloading pit.

The unloading pit will be adequately guarded to prevent trips and falls.

We suggest to using an overhead traverse crane with clamshell bucket for mixing and loading the thermal unit (HTDU). Using a traverse crane limits means the oily clamshell can never be moved outside the pit area, eliminating potential spills. The clamshell is used to move the waste sludge from the unloading pit to the main storage area for mixing / blending.

The sludge that is stored in the main storage pit is continually mixed via the traverse crane with clamshell bucket. It is critical for effective HTDU operation that cuttings are not subject to any water ingress and are blended into a semi-homogenous mix so the thermal system is not continually receiving different blends of liquid / solid ratios. The Steel tanks and whole HTDU operation is protected against tropical rain showers by a roof.

The Traverse Crane with hydraulic grab premixes and distributes the SBM cuttings either further into the pit and feeds the SBM cuttings into the feed hoppers of the Thermal Treatment Units (HTDU). The Traverse Crane is operating above the Steel Tanks on top rails. The design ensures no hazards as all moving equipment is inside the pit area. The top rails are mounted on a separate support structure installed on the concrete ground. The Traverse Crane will replace the traditional and hazardous excavator at the pit area.

Functional description of the Traverse Crane with clam shell bucket: (Optional)

The Gantry Crane operations area is over the full unloading and tank area. The HTDU feed hopper is integrated into 1 off the Steel Tanks to avoid spill by transition of cuttings. The Feed operator will control the Traverse Crane from the service platform along the full length of the Steel Tanks. On both sides of the feed hopper there is allowed for a service area of the Traverse Crane and the hydraulic Clam Shell bucket. The specification of the complete Traverse Crane is attached to this section. The specification is based on our long term experience on Traverse Cranes operating is this environment and under Tropical climate conditions.

4 MT Traverse Crane with hydraulic clam shell bucket suspended between top rail support structure. Note the blue TDU feed hopper on the left. Picture from our Gabon site.

Feeding the Thermal Processor

Loading into the HTDU inlet feed system will employ the same overhead crane with clamshell bucket used for the mixing requirements. The crane with dedicated operator can load the HTDU and keep the pits adequately premixed.

Site Layout

We are proposing the below site layout plan for review.
The drawing shows the expected HTDU layouts and the ancillary equipment that are required to operate these units *(The below drawing is attached as a separate file so that it is clearer)*

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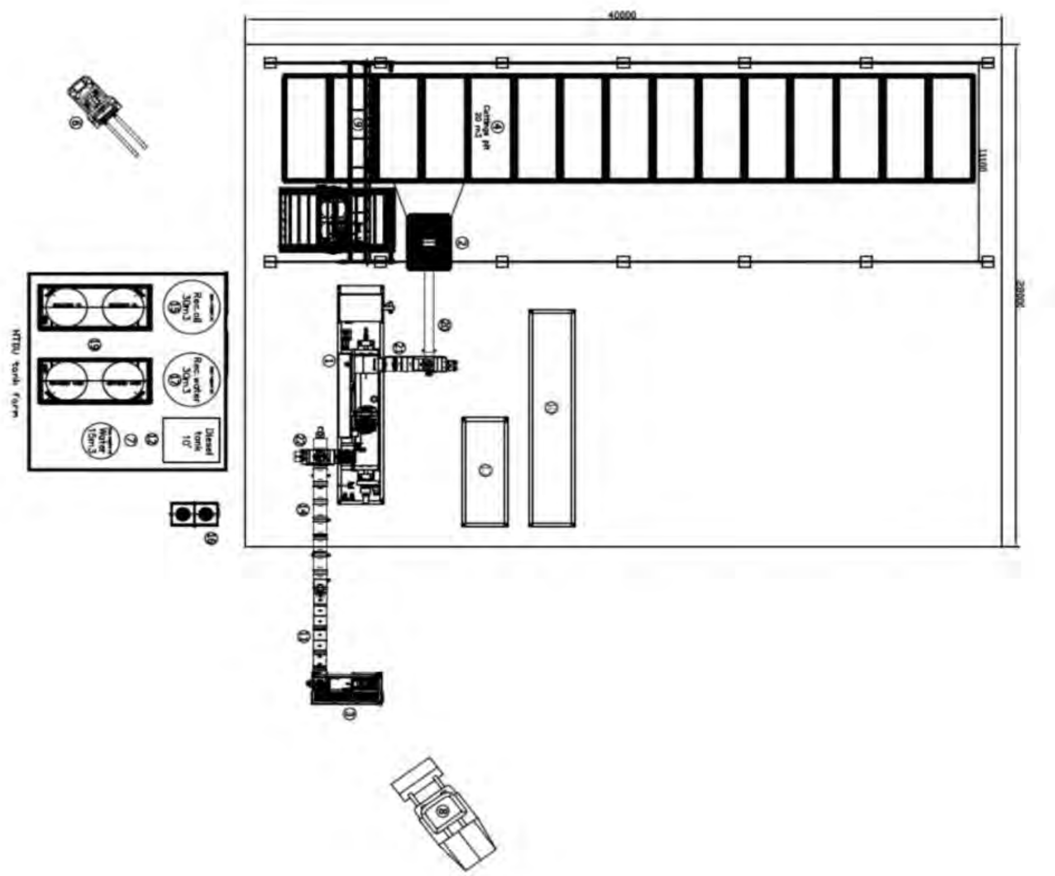

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Thermal Treatment, Recovery & Disposal

Thermal Treatment

Given the remoteness of the location, we believe that containerized HTDU thermal units would be the most cost effective option and offer greater waste management controls. They have the added advantage of returning 99+% of the base oil back to the mud plant.

Effective Thermal treatment ensures the solids discharge TPH levels are well below international discharge requirements. The treated solids will be disposed at the appointed landfill. The additional advantage of thermal is the recycling of the base oil and water phases of the waste stream.

Thermal Desorption Unit (HTDU)

The HTDU is Developed, Engineered and Manufactured by NOV Well Site Services since 1990 (and further refined and developed till current date).

The advantage of the HTDU technology over other thermal options (such as friction based thermal) for oil field operations is its unique ability to handle oily waste compositions ranging from near solid material up to 80% liquid content. The technology is also more tolerant to high water content. This allows the HTDU's to be used for treatment of all waste that is contaminated by base oil including:

- 99%+ recovery of base oil from drill cuttings at near virgin oil quality
- SBM Centrifuge waste.
- Separation of oil from contaminated sand and soil from SBM oil spills at the rig sites.
- Treatment of slops following SBM pit clean-up operations.
- Treatment of spent (ultra-fine solids laden) SBM

The HTDU process capacity can easily be scaled up (multiplied) using the same infrastructure and organization in order to meet increasingly treatment demands during the development phases of the oil field.

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The 40' HTDU processor skid at a Chinese installation, operating for Sinopec, Mainland China. The inserted picture shows a typical plant layout with cuttings feed, processor and solids discharge with a wet mixer (for solids rehydration to avoid dust emission between unit and disposal site).

General Description

NOV WSS supplies self-contained process packages HTDU built into standard size container dimensions for easy transport to site.

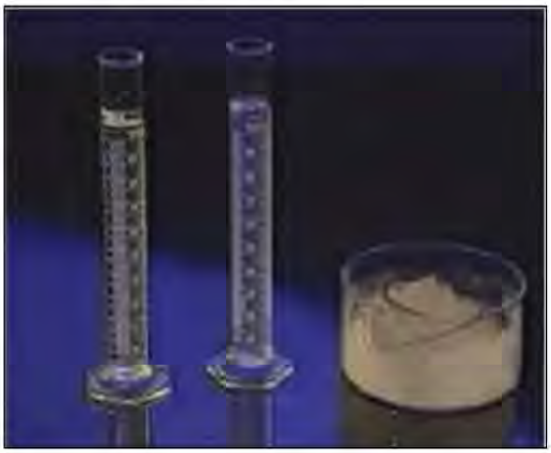
These units are ready for operation after installing the inlet conveyors and discharge equipment at the operational site. The auxiliary equipment fits in to 2 x 40' standard containers for transport. The normal installation time (per unit) until treatment can begin takes +/- 5-7 days depending on the site preparations. Additionally, there is a requirement for tankage for recovered oil, recovered water, process water etc.

Process Description

The HTDU technology has been designed to separate solids, oil, and water using desorption. Desorption changes the fluid such as base oil, emulsifier carrier fluids and water from an adsorbed state on the drill cuttings to a gaseous state that can be drawn off for recycling.

Desorption is achieved by heating and mixing the sludge in a deoxygenated atmosphere. The rotor inside the processor is heated to the required temperature. The HTDU technology is unique in that we use Heat Transmission Oil (HTO) to perform the bulk of the heating (efficient energy usage) and electrical heating elements at the last stage of the process for highly accurate temperature control (down to an accuracy of 1°C). This level of heat accuracy ensures the base oil properties and carbon chain are not altered, resulting in the recovery of near virgin base oil. Typically, we see little or no difference in a Gas Chromatography analysis between base oil and treated oil.

Recovered oil, water and solids



The separated products consist of solids with less than 1% oil on solids, recovered base oil for recycling back to the rig or Liquid Mud Plant, and industrial waste water to be recycled in the thermal process. Most of the recycled water is reused in the process for quenching and rehydration of the treated solids.

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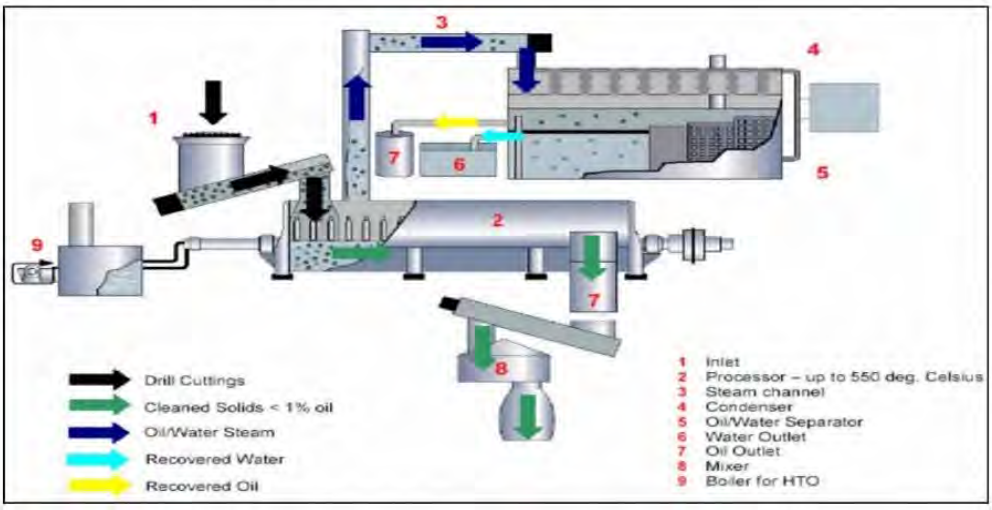
The total energy balance of the process including oil and generator power consumption for the TDU is approximately 50% of the volume of oil recovered based on average oil on cuttings of 10% by weight.
The flow diagram below shows in schematic form the flow and processes from cuttings intake to discharge of solids, oil, and water.



Recovered Liquid and Solids

Dry solids are between 320 °C and 450 °C at the discharge point of the thermal unit depending on the temperature required to desorb the base oil. To reduce the temperature prior to discharge and possible human contact a cooling screw conveyor and chain bucket system transports the solids to a wet mixer. In the wet mixer, the recovered waste water from the process is sprayed and mixed into the dry solids to reduce the temperature to ±60 °C and to create a more granular composition. Depending on the requirements from the Environmental Protection Agency the solids may be used for different applications. Most preferred option for global operators is disposal at engineered landfill.

Illustration 1

Illustration 2

Ill.1: Wet mixer and discharge with Back Hoe pick up for disposal.
Ill. 2: Solids granulates with approx. 10 % recovered water to minimizing dust emissions.

Recovered liquids (oil and water) from the HTDU process are pumped to 6 m³ Day Tanks for QC checks then on to the liquid storage tanks.

At times the base (cones) of these tanks will contain some sediment. To prevent contamination of the storage tanks the sediments are drawn off periodically and discharged into the cuttings storage tanks for recycling through the HTDU.

The picture to the left displays a set of Day Tanks with cone bottoms approx. 6 m³ each. Picture from Bangladesh operation.

Utility Requirements

The following table shows the utility requirements for 1 TDU for the project.

Description	One HTDU		Units
Electrical Consumption 400v/ 50 Hz Installed Power	240 350		KVA KVA
Recovered Oil Consumption for 800 kW Thermal Hot Oil Boiler	40-60		Kg/h
Portable Water (estimated*)	1		m^3/h
Nitrogen Demand (N_2 Generator is supplied)	0.2		m^3/h
Compressed Air @ 6.0 bar	4		m^3/h

**The estimate is based on using cooling convector technology as offered with this scope.*

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List of Treatment Site Equipment

Steel Cuttings Tanks:
15 pcs of 20 m³ Steel cuttings tanks; 6 x 2,6 x 1,8 mts. Incl. gangway w/ handrails.

Skips Turner: **(Optional)**
1 pc NOV Brandt Skip Turner Unit with 6 mts traverse Frame for lifting automatic discharge of cuttings skips. Installed on one of the steel tanks.

Traverse Crane with hydraulic clam Shell **(Optional)**:
1 pc 12 mts Spann 2 speed Traverse Crane with 2 speed wrench hoist and hydraulic pump and hydraulic clam shell bucket.
1 Support structure for Traverse Cranes, length 33 m, height 5 m.

Processor Units:
1 pc HTDU processor unit complete in 40' HC container frame.

Feed System Processor unit:
1 pc Feed hopper with vibrating mess (size 25 x 25 mm)
1 pc Feed auger and feed hopper with level indicator
1 pc. Multi-screw to inlet processor from feed hopper

Safety System processor units:
1 pc. Nitrogen unit with generator.

Cooling System processor unit:
1 pc. Cooling Tower with water cooling and circulation pump
1 pc. Circulation system for condenser and water cooling

Discharge Systems processor unit:
2 pc. Condensate pumps (Oil and Water)
1 pc. Processor outlet-discharge multi-screw (Solids)
1 pc. Cooling Auger
1 pc. Chain conveyor to Wet Mixer
1 pc. Wett Mixer for moisturizing the dry solids on Platform

Common Bonded Tank Farm for Oil and Water recovery System, Fire Water and Fuel:

4 pcs 6 m3 Upright Day Tanks for secondary treatment and quality check of recovered oil (3) and water (1)
1 set of complete piping, pumps & fittings between Day Tanks and Processor Units.
1 pc 15 cbm of Fire Water Tank
2 pcs 30 cbm Recovered Oil and Recovered Water Tank

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Secondary Water Treatment

1 pc 20' Dual Compartment Water Treatment Unit, incl. agitators, pumps and piping for chemical treatment of slops water.

1 x 20' Cabins fully equipped for HTDU control:

Process Control:
1 pc. PC Processor Control with two monitors and printer.
Retort Laboratory Equipment:
1 pc 50 ml Retort Machine with Scale and consumables.
PC for Day and Lab Reports and Communication

1 x 40' Workshop Containers with Auxiliary Equipment &Tools and Spare Parts
1 set of complete maintenance tools containing special tools, steam cleaner, compressor, scaffolding etc. for professional and safely maintenance of the TDU equipment and workshop inventory
1 stock of spare parts and contingency parts for the complete thermal treatment facility incl. PPE for staff for the duration of the 5-year contract

Inside of 40' Workshop Container

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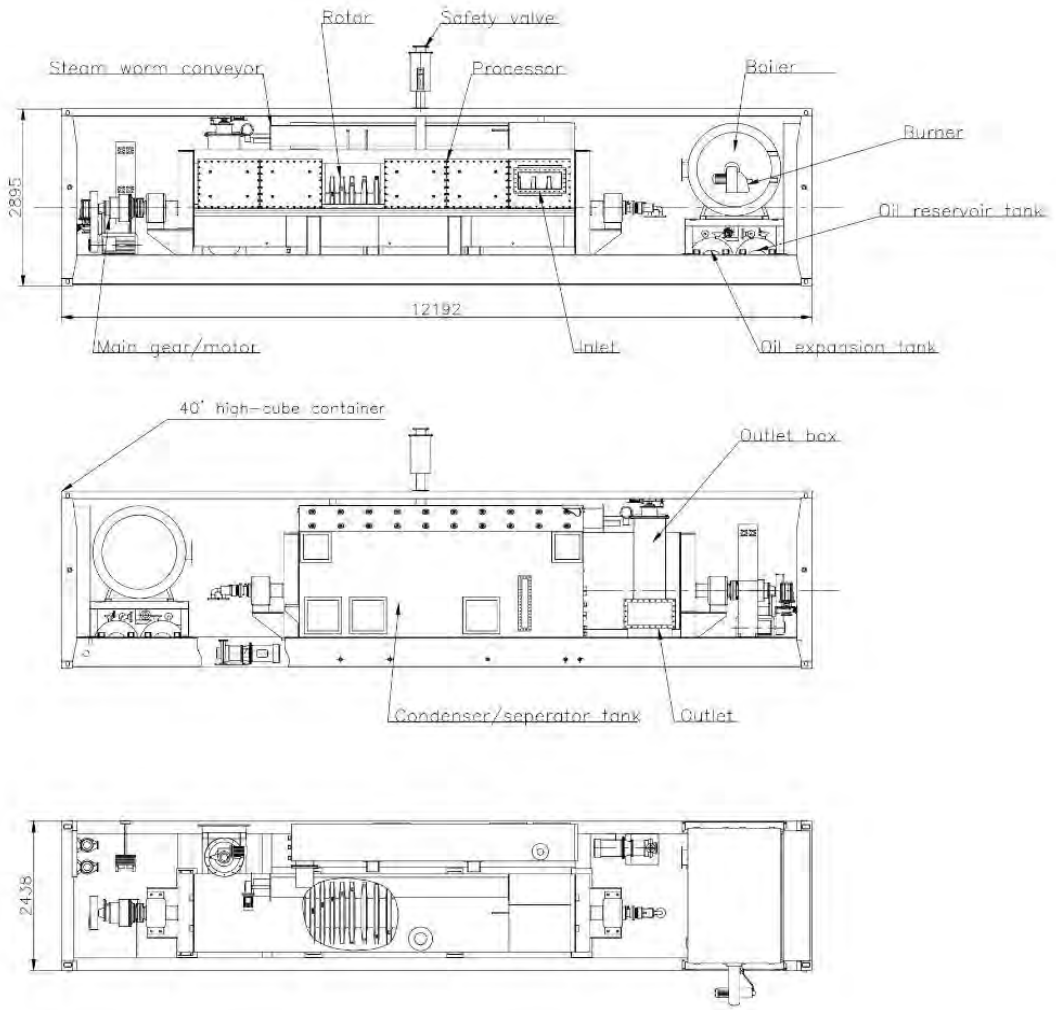
Equipment Maintenance Plan

This Paragraph summarises NOV maintenance scheduling. The full repair and maintenance manuals are internal controlled documents tabled in NOV's Maintenance Processes. It can be noted NOV has been operating and maintaining Thermal Treatment sites for more than 25 years. We have some specific sites with more than 20 years operational history.

Equipment Name	***Preventative Maintenance Frequency***	***Maintenance checklists Document References.***
HTDU Processor	90 days	INT-0801-0446-MT_rev09
Feed System Assy • Feed hopper with vibrating mess (size 25 x 25 mm) • Feed auger and feed hopper with level indicator • Multi-screw to inlet processor from feed hopper	90 days	INT-0801-0446-MT_rev09
Nitrogen unit with Tank and Generator	90 days	INT-0801-0446-MT_rev09
Cooling System • Double cooling tower with circulation pump • Circulation system for condenser and product cooling	90 days	INT-0801-0446-MT_rev09
Discharge Systems: • Condensate pumps (Oil and Water) • Processor outlet-discharge multi-screw (Solids) • Cooling Auger • Chain conveyor to Wet Mixer • Wet Mixer for quenching dry solids	90 days	INT-0801-0446-MT_rev09
Overhead Gantry Crane and Clamshell Bucket	30 days	3rd Party OEM Manual
Front Loader	500 hrs	3rd Party OEM Manual
Recovered Water Transfer Pump (Mission)	30 days	WI 222 Centrifugal Pump Check Sheet
Recovered Base Oil Transfer Pump (Mission)	30 days	WI 222 Centrifugal Pump Check Sheet
Generator 350 kW (includes standby unit)	500 hrs	350 kW User Manual
Electric Motors	60 days	WI 214 Electric Motor Checklist
All Tanks	180 days	Visual Inspection per check sheet.
Diesel Tank	180 days	Visual Inspection per check sheet.
Compressor		3rd Party OEM Manual
High Pressure Hot Water Wash Down System		3rd Party OEM Manual

Technical Description of the HTDU



Above illustration shows LH view, RH view and Top view of the HTDU processor skid. All measurements are metric. The processor is sized as a high cube 40' container skid.

Processor Design Data	HTDU model 500
Plant description	High Temperature Desorption Unit
Durability	24 h/day, app.90 % process time/year
Electric power	185 kW (installed power)
Electrical power – Combi Rotor	120 kW (installed power)
Thermal power-boiler	800 kW ~80 kg fuel oil per hour
Process temp.	Maximum 550°C
Product temp. for oil/el rotor part	280°C-320°C/450°C
Desorption Range Benzene	Max. C 32
Nitrogen demand	approx. 0,2 m^3/h
Burner	Diesel oil/recovered oil
Electric installation	400V 50 Hz
Container dimension	40` container HC
Total weight/Processing unit	36 MT

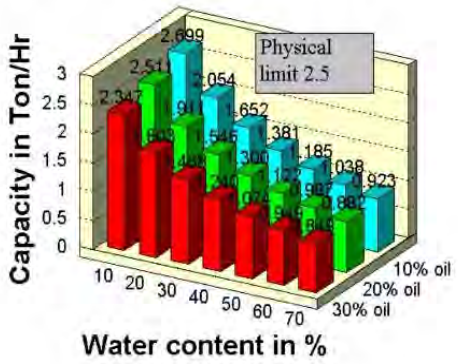
Process Capacity and Reliability

The plants are operated on a 24 hour/7days per week basis and we use regular scheduling for preventative maintenance, that is performed while the equipment is operational, and a major preventative maintenance process where the units are shut down for approx. 5-7 days every quarter. The HTDU will process around 2.0 MT of wet cuttings per hour. Even at full optional capacity (90,000 MT for the duration of the contract) when it is envisioned two HTDU's may be operating, the crane with dedicated operator can load the HTDU's and keep the pits adequately mixed. With a process capacity of ±1300 MT/month per unit we are proposing 1 (2) thermal units to be installed giving a total capacity of ±1300 (2600) MT/month.

As per any rotating equipment there is always some unplanned down-time. Due to the extensive operational history of the HTDU (from year 1990 to current) we have full operational and downtime reports on our HTDU equipment. Across our entire global fleet of HTDU's we have auditable documented operating histories of non-operation time including planned maintenance and unscheduled stoppages of around 500 - 540 hrs. / annum (22.5 days)

Therefore, our HTDU's on average are available 342.5 days out of the year to operate hence the availability is 342.5/365 = 93.8%. *In a separate document, we show our downtime registration from one of our treatment sites. This for documenting the extreme reliability of the HTDU.*

Treatment capacity 800 KW unit.



As the nature of the material to be treated is inhomogeneous and partly not known, there will be no guarantees on the plant capacity. The capacities are indicative and based on our experience on more than 25 sites around the world. However Total E&P has informed in the instruction to tenderer that the expected cuttings composition would be 20 % water, 10 % oil and 70 % solids (chart reference is giving an hourly capacity of 2.054 kg).

A) Intake of material

The plant is fed with the material by a feeding conveyor which in turn feeds into the **Inlet** box. The material in the inlet box and the feeding conveyor act as a material-lock against Ingress of atmospheric air into the processor the revolutions of the feeding conveyor are controlled from the switchboard. A level-meter (Ultrasonic) which is placed above the hopper will stop the feeding conveyor if the level is too low.

B) Processor

The **processor** consists of a stator, **rotor** and **outlet box**. The stator is a trough formed vessel with inlet of material at one end and a welded **outlet box** at the opposite end. The stator is gas-tight and all outer surfaces are electrically heated. Inspection covers have been placed along the long side.

The **rotor** consists of a shaft, mounted with 32 discs, which are heated by heat transmission oil (HTO). The rotor shaft is mounted with a **main gear and motor** at one end and a two-way clutch for HTO at the opposite end. Reamers are mounted between the discs in the stator to clear rotor material. The discs are fitted with blades at the outer peripheries for mixing and transporting.

The sludge is deposited through the feeding-conveyor to the stator. The rotor heats then mixes and transports the sludge through the stator to the **outlet box**. The oil and water evaporate in route and leave the stator through the top section of the stator at the inlet end.

C) Outlet of dry material

The dry material leaves the processor through an overflow to the **outlet box**. There is an extracting screw conveyor, mounted on the outlet box which is controlled by a microwave level controller. This ensures that there is always a "plug" of material in the **outlet box.** The outlet box is electrically heated. The conveyor for dry materials transports the hot dry material to the cooling conveyor where the dry material is cooled down and transported by chain-conveyor for moistening. The dry material is cooled down to a temperature which makes it possible to moisten it with water without producing a great amount of steam. The dry material is moistened because it gives a formation of dust after leaving the processor. The moistening takes place in an agitator mixer where process water is added.

D) Outlet of steam

Oil and water steam leave the processor through a dust trap (**steam worm conveyor**) and is condensed with cooled process water in the **condenser**. The dust trap is a horizontal pipe with a spiral for transporting trapped dust back to the processor. The process water is pumped up from the second chamber in the **separator** by the scrubber pump.

The **condenser** is a horizontal container with a slanting bottom and a number of nozzles mounted on the topside. The nozzles are activated and deactivated by signals from a manometer mounted on the condenser. In this way the pressure in the **processor** can be kept slightly positive. This prevents the ingress of atmospheric air.

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The **separator** is fixed below the condenser and is an oblong container with a number of chambers created of overflow walls. There is a slope at the bottom of the condenser which enables the water, oil and/or solvent to flow down into the first chamber of the separator. At this inlet point, a liquid lock is created which prevents the inlet of air to the condenser from the separator. The first chamber in the separator works as a liquid lock and also as a reception chamber for condensate from the condenser, cooled condensate also returns from the cooler.

The first and second chamber in the separator works as a sludge trap. The second chamber also delivers condensate for the coolers (cooling of separator) and condensate for the condenser nozzles. In the third chamber the separation between water, oil and/or solvent takes place. Separated water flows through an overflow to the condensate pump and separated oil and/or solvent flow to the condenser pump. The pumps are controlled by level switches. The level switch is an alarm switch in case of high level in the separator.

E) Non-Condensable Gases (NC gases)

Air/gas may accumulate in the condenser during the process. This gas/air comes from the raw material and/or from the oil "cracking" during the process. The non-condensable gases are let through a gas dryer and on the site of the condenser further into the **burner**.
The accumulation happens because the gases cannot be condensed. If NC-gases are not removed, the condenser might stop working because the NC-gases will obstruct the condensing of process steam and the pressure will increase.

F) The HTO System

The rotor discs and the stator house are heated by circulating hot transmission oil (HTO). The HTO is heated in the **boiler** with **burner** and circulated by the pump. The thermal expansion of the HTO is absorbed in the **expansion tank** placed on the bottom of the container below the **boiler**. The **expansion tank** is under pressure and covered with nitrogen to protect the hot HTO and to keep the HTO in the pipe system.

G) Controlling and Switchboard

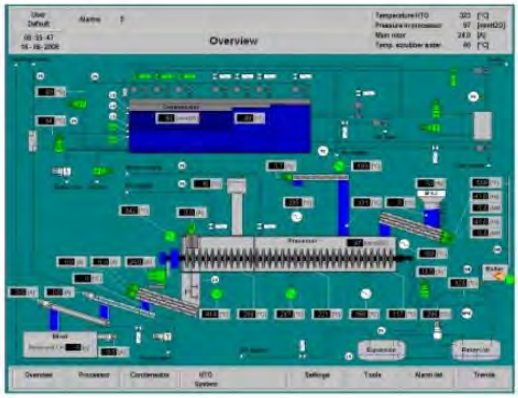
The plant has been designed to work continuously and primarily the operator has to supervise and take care of the flow of material.

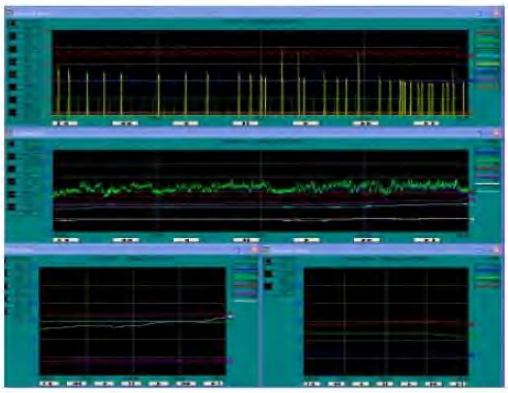
HTDU Plant Control

A PLC is integrated in the switchboard beside the boiler controls the process. The PLC is connected/controlled by a computer system. A software program called "Review" designed by NOV Brandt is installed in the computer. The plant control can be connected to a modem and the plant can be operated by remote control from any part of the world, if required.

Two monitors are provided for the plant control. One monitor for the process recording and another monitor for process overview and data input.

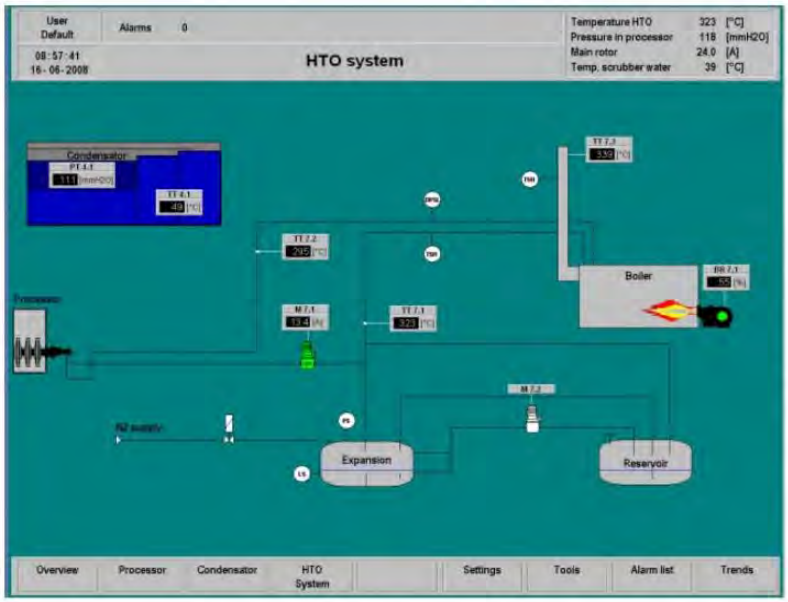
The Control system can run in manual and automatic mode. Start up and shut down procedures are done in manual mode. During running in of the thermal unit, the basic data is giving as input data into the records. The input data is based on the retorts from the cuttings received. The complete control unit has been running under full scale test conditions excl. cuttings before leaving the factory. The operating system RsView (3rd. Party software) is designed in a cooperation between NOV and RsView. Below are shown downloads from the Control Panel. The control has two monitors, and a pc with printer for day reports and other operational reports (maintenance, spare parts lists etc.) and during operation the below Overview and the Trends View will be monitored.



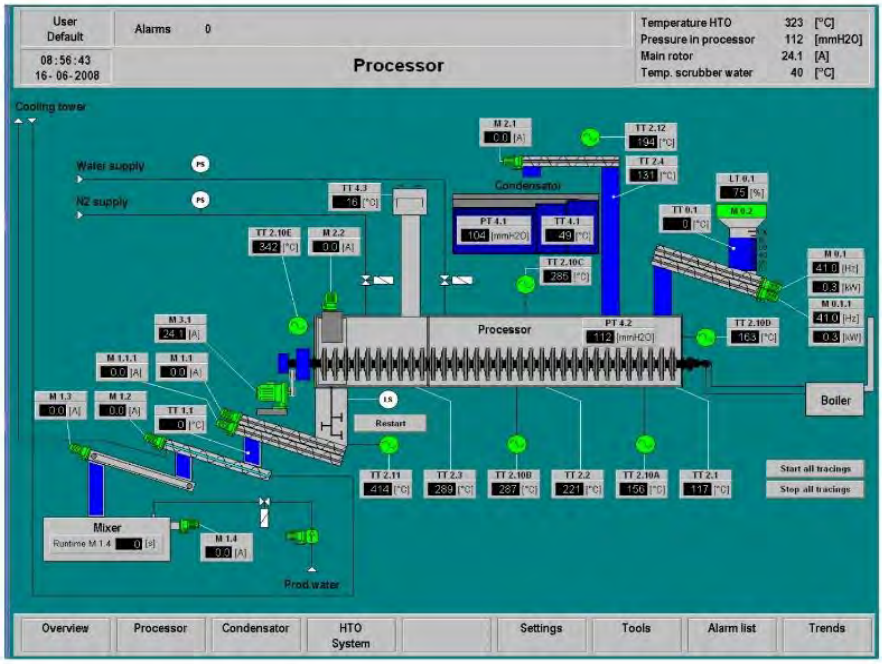


Overview

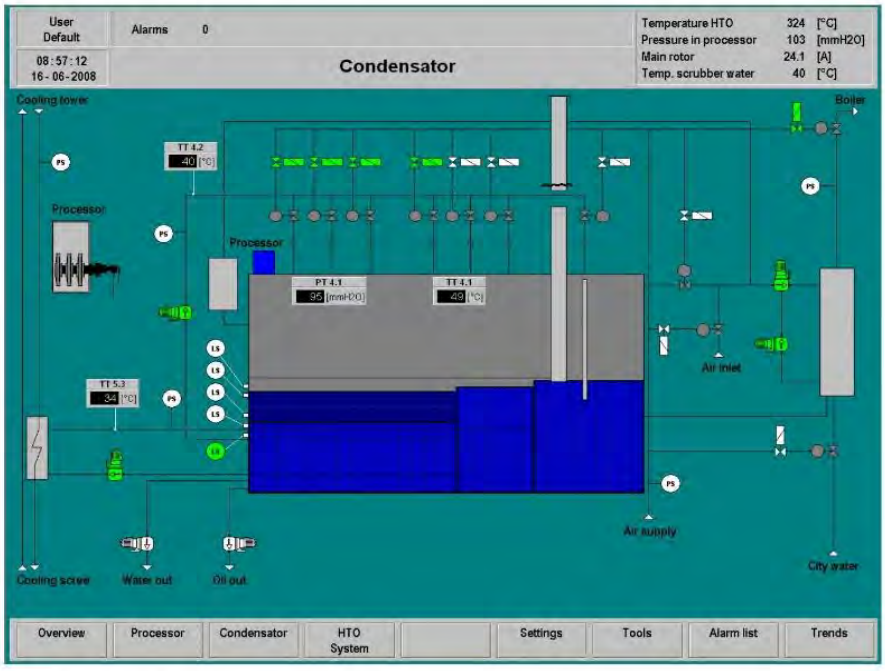
As the control is fully automatic the overview and trends gives a quick glance of the ongoing operation for the operator. Close up information can be found a click away from the overview.



The hot transmission oil (HTO) running conditions.

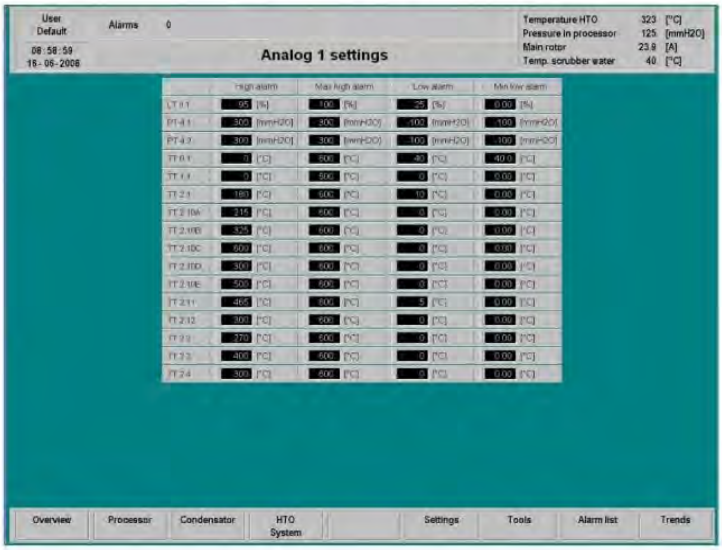


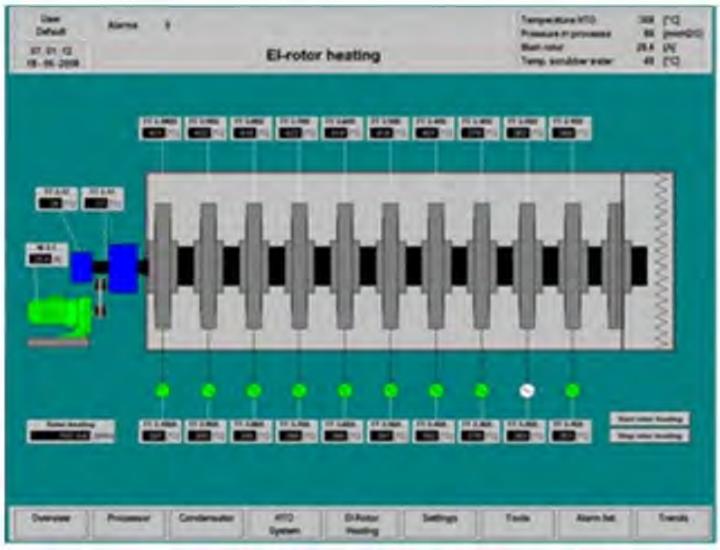
The Processor running conditions



The Condensator operation conditions

The 2 Screen dumps below show the individual temperature settings of each disk on the rotor and the combined view from the control panel. This enables the operator to fully control the thermal process depending on the type of base oil that needs to be evaporated.





NOV Well Site Services - Soil Recovery has a highly trained specialist workforce to help ensure safe and stable operations. Our specialists travel around the world to assist with installation, start-ups, commission tests, operations, training, repairs and maintenance. If assistance is instantly required on our thermal desorption units HTDU, they can be accessed via the internet (secured TCP/IP protocol) where our support engineers has access to the unit and communicate directly with the local operator of the unit.

Attachment 7 – Downtime Registration Example 1
Attachment 8 – Downtime Registration Example 2

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Daily Reports & Laboratory Test

Procedures for Daily Reports (Retort Test)

The following documentation and records are used for operation of the thermal plant:

- Daily 24 hour reports
- Monthly reports
- Operations handover between shifts

Filing of documentation and records related to the operations shall be performed by the Operator on the shift in accordance with the requirements contained in the filing matrix.

Daily Treatment Reports

The objective is to describe the guidelines for the performance and reporting of Retort Analysis of Processed Cuttings from the oil based mud residue. The processed material must have less than 1% TPH by weight. The retort test gives an indication of the amount of oil in the processed material. Beside this, the retort test also assists in the running/efficiency of the TDU. In daily operations the assigned operator of the unit is responsible for execution of this procedure.

Retort by OFI Testing Equipment

Test is carried out using a high temperature unit (Retort unit) as per **API 13b-2 procedures** (See attachment).

OFI 50 ml Retort Machine with digital temperature controller

Attachment 9 – API 13B-2 Procedures

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Procedure for Processed Material Testing

Material that has been processed by being fed through the HTDU (dry solids). Once the unit is fully operational, a retort analysis must be performed upon a sample of the processed material. This test must be performed tree times per shift. The sample that is obtained must now undergo the retort test procedure as follows:

- A sample is removed from the outlet skip and placed into a small container. This container is marked with the date, time and the name of the person taking the sample.
- A sample is then taken from the container and weighed; the weight is then recorded on the analysis form.
- The sample is then placed into a metal cylinder, which is in turn placed into the retort machine for a period of one hour at 350 degrees Celsius in some cases raise up to 500 degrees Celsius for one hour, so the total running time is two hours.

Due to this heating process, liquid is extracted from the sample. This liquid is in fact a mixture of oil and water. This sample of liquid, which is collected in a glass container, is then weighed. The glass has level markings in on the side in millimeters; it is possible to see the separated oil and water. Readings are taken from the glass container in order to determine the oil / water ratio. These are then used in assisting with calculations.

If a Retort Analysis indicates a surplus percentage of oil in the material (> 0.5% @ 350^0C) an additional Retort Analysis must be carried-out. If the result of the test is the same, the material must be processed again. The results are entered into the Daily Report and the average result of all the tests are entered into the Monthly Report.

At the beginning of each shift a Retort Analysis of Contaminated Cuttings in the Inlet box is taken (Wet Retort). Results are entered into the Daily Report and the average of all tests taken over a monthly period is entered into the Monthly Report. In order to obtain the correct analysis, the test sheet should be fully completed, and all calculations carried out thereafter.

The material that has been tested in the retort test shall be stored in suitable containers; this material will then be returned in the storage tank for processing. "Material" may mean any of the following:

- Dried mud cuttings
- Recovered oil
- Recovered water

The retort test equipment shall be cleaned using a domestic, non-hazardous detergent. The retort machine must be calibrated on an annual basis. The calibration certificate shall be retained in Calibration Certificates binder which is to be kept in the Control room. The HTDU Operator may carry out tests on the recovered solids at unspecified times during the day. These test results will be recorded directly into the daily report.

All retort forms shall be stored in the designated retort results binder on site control room. Retort reports shall be filed separately for each client.

Sample of Daily Treatment Report and 3rd. party Analysis (solids, water and oil)

Below is an example of a daily treatment report.

THERMAL TREATMENT DAILY REPORT

Date:	0-ene.-00	Place:	GYSBI	Amb. Temp.:	32	Current Activity:	Processing		No.#	30
	Retort Day		Retort Night		Time Sheet					
	Feed	Discharge	Feed	Discharge	Description	Day	Night	Hours Acum.	Hourly Ranges	
Temperature	500° C	450° C	500° C	450° C	Processing	12.0	12.0	435.0	00:00 to 24:00	
Water (%)	0.0	0.0	0.0	0.0	Heating / Cooling	0.0	0.0	24.0		
Oil (%)	0.0	0.0	0.0	0.0	Stand-by	0.0	0.0	0		
Solids (%)	0.0	0.0	0.0	0.0	Shut Down	0.0	0.0	0		
Density lb/g	0.0		0.0		Mobil / Demobil	0.0	0.0	360		
Tons / Shift	0.0	Received M° Tons Per Day	0.0	Tons / Day	40.0	Ton /Acum.	40.0	Est. Material in Tanks (Ton)	700.0	Ton/Day	Acum. Ton
Tons / Hora	0.0	0.00	0.0	Ash Ton/Day	0.0	Ash / Ton Acum.	0.0	Processed Material	LOT# 1	40.0	40.0
Transported Ash Ton /Day		0.00	Transported Ash Acum Tons		0.00						

Fluids Consumption (Liters)				Recovered Fluids (Liters)				Reused / Day	Reused Accum.
	Usado		Acum.		Day	Night	Acum.	0	0
	Day	Night	(Ltrs)	Recovered Fluid	0	0	0	Fluid On Hand (Liters)	
Diesel Generator	0.0	0	0.0	Recovered Fluid Sent	0	0	0	Tk. 30 m³	0
New Diesel Burner	0	0	0	Volume in Settleing Day Tanks		Tk.Sed. 1	0	Tk.Sed. 2	0
				Actual Diesel On Hand	10,648.0	Day	Night	Consumption Acum.	
Diesel Usage	Day	Accumulated		Front Loader / Backhoe	1	0.0	0.00	0	
Diesel Received	0	0		Forklift	1	0.0	0.00	0	
Diesel Used	0.0	0		Welder	1	0.0	0.00	0	
				Vehicle	2	0.0	0.00	0	

Fresh Water Consumption (Liters)											
Fresh H_2O (Day)	Fresh H_2O (Acum.)	Fresh H_2O irrigated (Day)	Fresh H_2O irrigated (Acum)	H_2O Recovered (Day)	H_2O Recovered (Day)	Treated H_2O (Day)	Treated H_2O (Acum)	H_2O to Process Cleaning (Day)	H_2O to Process Cleaning (Acum.)	H_2O to Mixer (Day)	H_2O to Mixer (Acum)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Personnel		
	Day	Night
Supervisors		
Technician		
Technician		
Technician		
Oper. Equip.		
HSEQ		

Comentarios:

Planned Activity:	0	Generator Hours #1	0	Generator Hours #2	0

HSEQ Reporting

Daily Safety Meet. Topic: Confined Spaces

	STOP Card Day	STOP Card Night	STOP Card Acum. (mensual)	Safety Drills	Incidents Day	Incidents Night	Incidents Acum Mensual	Daily Man Hours	Nightly Man Hours	Accumulated Man Hours	Days w/o LTI
STOP CARDS	0	0	0	0	0	0	0	0	0	0	0

Safety Commentary:

Cost Breakdown

Description	Quantity	Unit Cost	Total Cost	Accum. Cost	Description	Quantity	Unit Cost	Total Cost	Accum. Cost
Processed Metrics Tons									
HTDU Equipment Costs									
Total Day:					Total Accumulated:				

Client	NOV

NATIONAL OILWELL VARCO GUYANA INC.

NOV Wellbore Technologies

Eurofins Miljø A/S
Smedeskovvej 38
8464 Galten
Phone : 7022 4266
VAT: DK-2884 8196

ilac-MRA DANAK TEST Reg.nr. 168

eurofins

Soil Recovery A/S

Nederbyvej 12
5800 Nyborg

Att.: Jacob Svendsen

Registerno.: 848835/Rev.1
Client no.: 81218
Order no.: 604697
Sample no.: 84883501
Job number: maj-08
Recievedate: 2008.05.30

Page: 1 of 1

TEST REPORT

Client.....: Soil Recovery A/S
Nederbyvej 12, 5800 Nyborg
Sampling location: **Tørstof K57 (9102)**
Sample type.....: Soil ,
Sampling.....: 2008.05.29
Sampler.....: Rekvirenten
Customer inform..:
Test period.....: 2008.05.30 - 2008.07.10

Sample no.:	84883501			
Sample ID:		Detect.		RSD
Sample description:	29-05-2008	limit	Methods	(%)
Dry matter	88.6 %	0.0020	DS 204 mod.	10
Kulbrintefraktioner (pentan-ekstraherbare)				
Benzene-C10	9.4 mg/kg DM	2.5	GC/FID	25
C10-C25	2200 mg/kg DM	10	GC/FID	10
C25-C35	180 mg/kg DM	25	GC/FID	31
Sum (Benzene-C35)	2400 mg/kg DM		GC/FID	

Test comments:
Kromatogrammet viser indhold af komponenter med et kogepunktsinterval som kraftig nedbrudt gasolie eller lign.
Revideret analyserapport erstatter tidligere fremsendte: ændret certifikat.

Legend:
RSD : Relative Standard Deviation.
< : less than. n.d.: not detected.
> : greater than. n.m.: non-measurable.
: none of the parameters detected.

10 July 2008

Kundecenter: tlf.70224267 Hanne Jensen
Contact Quality assurance

NOV Wellbore Technologies

Eurofins Miljø A/S
Smedeskovvej 38
8464 Galten
Telefon: 7022 4266
CVR/VAT: DK-2884 8196

ilac-MRA DANAK TEST Reg.nr. 168

eurofins

Soil Recovery A/S

Nederbyvej 12
5800 Nyborg

Att.: Jacob Svendsen

Registernr.: 839217
Kundenr.: 81218
Ordrenr.: 430412

Modt. dato: 2008.04.17

Sidenr.: 1 af 1

ANALYSERAPPORT

Rekvirent.....: Soil Recovery A/S
Nederbyvej 12, 5800 Nyborg
Prøvested.....: **Soil Recovery A/S Klintholmvej 57 - /24490011**
Prøvetype.....: Spildevand
Prøveudtagning...: 2008.04.16 kl. 08:45 - 2008.04.17 kl. 08:45
Prøvetager.....: Miljølaboratoriet I/S for Eurofins Miljø A/S (XGR)
Kundeoplysninger.:
Analyseperiode...: 2008.04.17 - 2008.04.29

Prøvenr.: **24710051**

Prøve ID: / Prøvemærke:		Enheder	Kravværdier** Min.	Kravværdier** Max.	Detekt. grænse	Metode	RSD (%)
Suspenderede stoffer	**690**	mg/l		400	0,5	DS/EN 872	10
BI5	**1000**	mg/l			0,50	DS/EN 1899-1	10
COD, kemisk iltforbrug	**2700**	mg/l		5000	5.0	ISO 15705	10
Olie (upolær fraktion)	**26**	mg/l			5,0	*KTI2561-DS/R208	10

Oplysninger fra prøvetageren:

Prøvetagningsmetode	**Mgd.prop**		DS/ISO 5667
Vandmængde	**12.5**	m3/døgn	DS203
Prøvetagningsudstyr	**Aquasample**		

Analysekommentarer:
Stikprøve til olie udt. d. 17.04.08 kl.: 08.45
Kurver eftersendes.

*) Ikke omfattet af akkreditoringen.
**) Virksomhedens miljøgodkendelse / udledningstilladelse.

Tegnforklaring:
RSD : Relativ Analyseusikkerhed.
< : mindre end. i.p.: ikke påvist.
> : større end. i.m.: ikke målelig.
: ingen af parametrene er påvist.

29. april 2008

Kundecenter: tlf.70224231 Birgit Neess Fredslund
Kontaktperson Kvalitetssikring

Prøvningsresultaterne gælder udelukkende for de(n) undersøgte prøve(r).
Rapporten må ikke gengives, undtagen i sin helhed, uden prøvningslaboratoriets skriftlige godkendelse.

NOV Wellbore Technologies

AnalyCen

Soil Recovery A/S
Klintholmvej 49
5874 Hesselager

Att.: Jacob Haass Svendsen

Fredericia 28th of september 2004

Recovered oil (G204-04604.5) compared to virgin oil (G204-05038.1) by gas chromatography

Sample preparation:
100 mg of the two oil samles; virgin oil (Sample no.: G204-05038.1) and recovered oil (sample no.. G204-04604.5) are weighed into two 100 ml measuring bottles, and filled to the mark with n-pentane containing the two internal standards mono-bromobenzene and o-terphenyl. The n-pentane solutions were transferred into GC vials for further analysis.

Results:
The two chromatograms are showed on the following page 2.

Summary of the results are shown in the tabel below.

	Virgin oil G204-05038.1	Recovered oil G204-04604.5
Boiling point range (minutes)	10 - 19	10 - 18
Boiling point range (degrees Celcius)	210 - 390	210 - 380
Unresolved Complex matter (minutes)	10 - 19	10 - 18
Distribution of n-alkanes	High 13 to 19	High 11 to 19

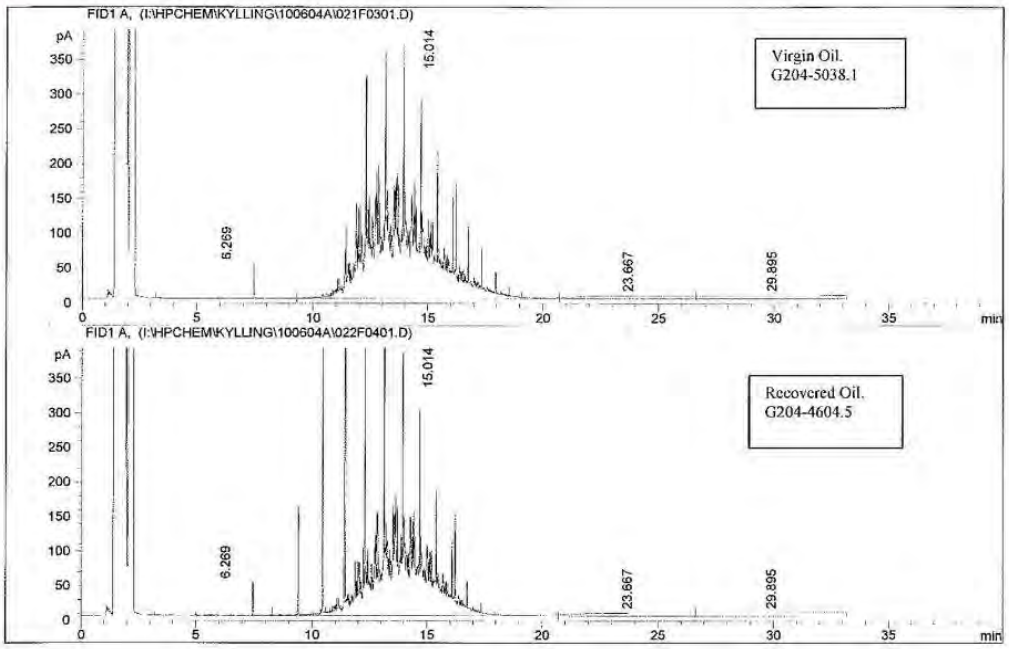
The unresolved complex matter (UCM) of the recovered oil is slightly more symmetric around the center at 14 minutes than the virgin oil.

The distribution and amount of the n-alkanes in the recovered oil in proportion to the UCM, compared to the distibution of the n-alkanes in the virgin oil indicate, that the recovered oil is somehow more "pure". The recovered oil contains a larger amount of the lighter n-alkanes C11, C12 and C13 than the virgin oil.

Sincerely

Karen Halling
(M. Sc. Chem)
A/S AnalyCen
kah@analycen.dk

Wellbore Technologies



Gaschromatic method:
The samles were analyzed by gaschromatography with a flame ionisation detector (GC-FID).
Coloumn: DB5, 25m, id 0,2 mm, film 0,33µm.
Injection temp.: 280°C, Detector temp.: 320°C.
Temp. Program: Column start temp. 35°C, hold 3 min, 15°C/min to 315°C, hold 9,5 min.

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Environmental Impact from Thermal Treatment Plant (excl. transportation and handling vehicles)

Due to the nature of thermal desorption there is no emissions from the cuttings due to the indirect heating process and the closed loop design of the equipment

Emissions are only created from the burner burning fuel for heating the Heat Transmission Oil (heating media) which heats up the rotating heat exchangers in the process chamber.

The Air Emissions from the thermal processor is restricted to burning the fuel for the single burner and the diesel running the 350 KVA Power Generators per HTDU.

Energy Balance per Metric Tons of cuttings treated:

Recovered Base Oil	: 120 liters (from the 10% oil on cuttings)
less	
Fuel for TDU burner	: 20-30 l (using recovered oil from the cuttings or virgin diesel)
Power Generator	: 20-30 l/80-100 kWh (using virgin diesel for the engine)
	= **Surplus 60-80 liter*** (as positive energy balance)

*Cuttings content = 10% oil by weight/20% water

Air Emissions from processing one Metric Tons of cuttings are:

- SO_2: 42 g
- NOx: 142 g
- CO_2: 180 kg (1 loaded truck discharges 80-100 kg CO2 per hour)

SO_2: Sulfur dioxide (acid rain); NOx: Nitrogen oxide (smog); CO_2: Carbon dioxide (global warming)
Alternatively using NG will have lesser emissions

The Fuel Burner at the TDU heater

Burner Stack

Wellbore Technologies

Summary of BP Serenja 3rd. Party Report (NOX, CO, O2, SO2, CO2):

Quote:

"There is little risk of significant Serenja ambient air quality deterioration as a result of Indirect Thermal Desorption (ITD) Unit operations as: ITD emissions concentrations are within specified by ITD oil-boiler manufacturers (Weishaupt) emission figures. Annual ITD mass emissions are below specified within EIA annual figures. ITD oil-burner stack emissions are far below the IFC (International Finance Corporationr under the World Bank Group) limits for stacks of incinerators, or other significant sources including boilers, furnaces and etc., "

Experience

Further we are attaching the following documents here of NOV's previous experience for reference.

Attachment– Case History – Asia
Attachment– Case History – Bolivia
Attachment– Case History – Gabon
Attachment– Case History – Africa

Appendix F-2 – Outline of the Treatment Technology and Emission Values

Document no.:	NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Page 1 of 10
Argentina_boiler_system.doc	General description of thermal oil heater for HTDU	Made by : JNM
Rev. No.: 1		Date : 2019.03.03.

General description of boiler/thermal oil heater for HTDU

BOILER

The boiler or thermal **oil heater** on the HTDU (High Temperature Desorption Unit) is a coiled tube heat exchanger with a maximum rate of 800 kW output capacity – ref. figure No. 1 for general design. The boiler heats up heat transfer oil used in the thermal process in the HTDU.

Figure No. 1 (TT BOILERS AB & Co, thermal oil heater, max. output 800 kW).

Figure No. 2 shows the exact type of boiler and diesel burner installed in the HTDU – here just shown in another type of installation.

Figure No. 2.

Document no.:	NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Page 2 of 10
Argentina_boiler_system.doc	General description of thermal oil heater for HTDU	Made by : JNM
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With reference to figure No. 3 the boiler is heated by a diesel oil burner (ref. figure No. 4). The blue arrow shows the inlet of 'cold' heat transfer oil and the red arrow the outlet of heated oil from the boiler. The orange arrow shows the exit of the flue gas.

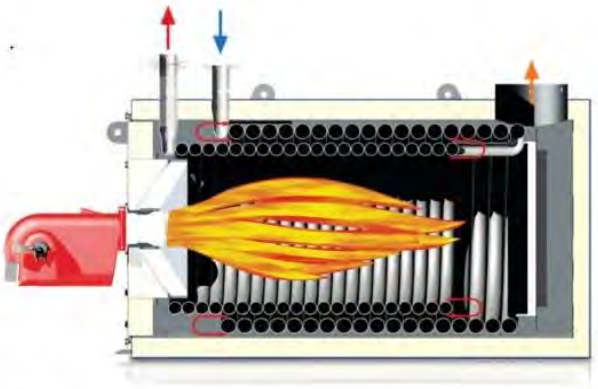

Figure No. 3.

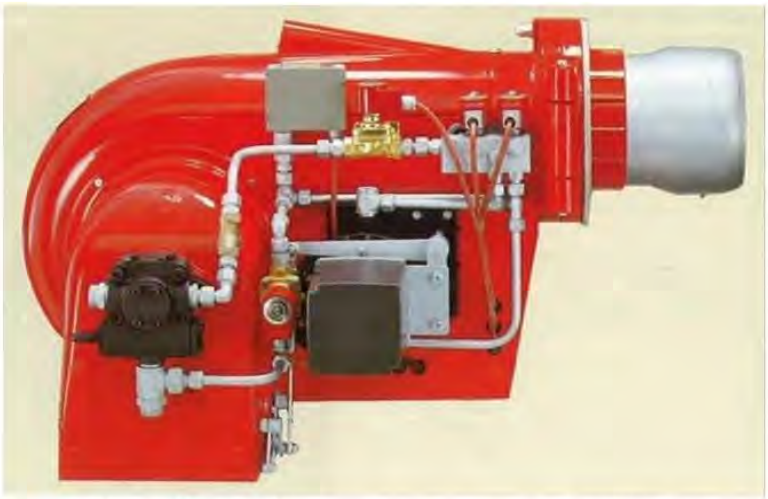

Figure No. 4 (WEISHAUPT diesel oil burner for HTDU boiler, type RL5, max. output 800 kW).

Boiler design criteria

The HTDU boiler is a three-pass well designed boiler according to:

ASME (American Society of Mechanical Engineers) Sec. 1:1995 TRD and design and pressure test verified by Lloyd's Register, ref. appendix No. 1.

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Argentina_boiler_system.doc	General description of thermal oil heater for HTDU	Made by : JNM
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Third party flue gas emission tests can be scheduled yearly to verify the content of the flue gas. Additional regular measurements can be done company internal with Testo 330-2LL flue gas analyzer equipment. Figure No. 5 shows an example of a flue gas emission tests done on a HTDU-boiler.

Brandt
Soil Recovery A/S

Measuring Sheet for Oil Tlf. +45 62251358 NR. 00.001

Date: 20-01-15 Signatur Michael Tolderlund
Installation:
Type of test: Adjustment

Burner:
Manufacture: Weishaupt Year
Model: RL5 ZMD
Size in kw: 180 to 1190 kw mm
Oil flow: 15 to 100 kg olie/h mm
Serial No.: 5265647
Nozzles Type: K3
Nozzles size: 70 kg/h
Nozzles angel: 50 v °
Oil flow meter:
Hours:

Boiler:
Manufacture:
Type:
Size in kw: ca. 800 kw kW (t Damp/h)
Combustion chamber: m Length
Combustion chamber: m Width
Combustion chamber: D Diameter

Fuel: restolie
Heating value: Ca. 10 kW/l
CO2 max.: Vol.-%

Primary pressure monitor: mbar
Secundary pressure monitor: mbar
Ignition gas: mbar

	Yes	No
Control / adjustment ignition electrodes:	☑	☐
Control / adjustment air damper rod with linkage:	☑	☐

Control safety time:
Prepurge time t1: 22 s
1. Ignition safety time TSA: 5 s
2. Ignition safety time: s
Safety time when running: 5 s

Control safety:	Yes	No
Flame monitor:	☐	☐
Limit switch:	☐	☐
Overheat / pressure:	☐	☐

Remarks: Control unit LAL 2.25 serie 02 Prepurge = 22,5 Safety time = 5 sek. Flame sensor QRB 1 A
Auxiliary switches in servomotor : 2 = Airdamper closed 10 gr. 3 = Ignition load 30 gr. 7 = min. Partial load 32 gr. 1 = Full load 120 gr.
Pressure switch return 5 bar.
Adjustment combustion head

	Fuel				Air						Flue gas									Boiler				
Load spring band no. / gr	Pump pressure bar	oil pressure return bar	oil throughput l/h	rated thermal input kw/h	prim luft mbar	prim diff mbar	sec air before air damper mbar	sec air after air damper mbar	Air Temperature °c	O2 Air %	O2 Display board %	O2 Testo %	O2 setpoint %	CO ppm	NO ppm	NOX by 3 % mg/m³	NOX by 10 % mg/m³	Temperature flue gas °c	Pressure Boiler end mbar	Smoke number	Forward temp. °c	Return temp. °c	Pressure comb. Chamber bar	Flame monitor µA	
30	20	5							39,3			4,9		17	63			343	-0,34	< 1					
40	20	5							41,3			5,3		16	64			357	-0,27	< 1					
60	20	8,5							43,6			4,7		12	70			383	-0,11	< 1					
80	20	10,5							42,3			5,4		17	70			409	0,16	< 1					
100	20	11,5							38,5			5,7		5	73			392	0,51	< 1					
120	20	12							36,1			4,9		13	77			404	0,62	< 1					

Figure No. 5.

Document no.:		NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Page 4 of 10
Argentina_boiler_system.doc		General description of thermal oil heater for HTDU	Made by : JNM
Rev. No.: 1			Date : 2019.03.03.

Appendix No. 1:

Certificate no: HAM 1045010/3
Page 1 of 2

Lloyd's Register

CEOC INTERNATIONAL

Certificate of Construction Inspection and First Pressure Test: For Pressure Vessel
Bescheinigung über die Erstmalige Prüfung eines Druckbehälters: Bauprüfung und Druckprüfung
Certificat de Vérification Initiale d'un Appareil a Pression: Surveillance de Construction et Essai Sous Pression
Certificato di Verifica Iniziale di Apparecchio a Pressione: Verifica di Costruzione e Prima Prova a Pressione
Certificado de Verificacion Inicial de Aparato a Presion: Control de Construcción y Primera Prueba de Presión

Works Order No: *Werksauftrag-Nr.* Réf. affaire usine: *N. Commessa-Ordine* Referencia de fábrica:	A 08035/10	Inspection No: *Prüf-Nr.* No de dossier: *N. Collaudo:* Certificado no:	HAM 1045010
Vessel Type: *Objektart:* Désignation: *Tipo di apparecchio:* Tipo de aparato:	Rohrschlange/tube coil	Vessel Duty: *Verwendungszweck:* Conditions d'utilisation: *Condizioni d'uso:* Condiciones de utilización:	Thermalöl-Wärmetauscher/thermal oil heat exchanger
Test Code: *Prüfgrundlage:* Code de contôle: *Norme di controllo:* Código de Inspección:	Zeichnung Nr. 879-010-0 Rev.02/drawing no. 879-010-0 rev.02		

Name Plate Marking - Kennzeichnung auf Fabrikschild - Indications Portées sur la Plaque du Constructeur - Dati Riportati Sulla Targa del Costruttore - Datos Sobre la Placa del Constructor

Manufacturer: *Hersteller:* Constructeur: *Costruttore:* Constructor:	ISW GmbH	Manufacturing No: *Herstell-Nr.* No de fabrication: *N. di fabbrica:* No de fabricación:	1118
Year of construction - *Herstelljahr* - Année de fabrication - *Anno di costruzione* - Año de construcción:			2010
Location: *Herstellort:* Lieu de fabrication: *Località:* Lugar de fabricación:	Heinrich-Schröder Strasse 6 D-25436 Uetersen	Manufacturer's trademark: *Herstellerzeichen:* Marque du fabricant: *Marchio del fabbricante:* Marca del fabricante:	
Chamber *Raum* Enceinte *Camera* Recinto	Rohrschlange/tube coil		
Permissible working pressure *Zulässiger Betriebsüberdruck* Pression de service admissible *Pressione di esercizio ammissibile* Presión de trabajo admisible	0/6,0 bar		
Permissible working temperature *Zulässige Betriebstemperatur* Température de service admissible *Temperatura di esercizio ammissibile* Temperatura de trabajo admisible	0/+350°C		
Capacity *Rauminhalt* Capacité *Capacità* Capacidad	433 L		
Contents (medium) *Inhalt (medium)* Contenu (fluide) *Fluido contenuto* Fluido contenido	Thermalöl/thermal oil		

Design Approval - Vorprüfung der Zeichnung - Approbation de la Conception - Approvazione del Progetto - Aprobacion de Diseño: Nicht anwendbar/not applicable — Date – Datum – Date – Data – Fecha:

Drawing No: *Zeichnungs-Nr.* Plan No: *Disegno N.* Planos no: Nicht anwendbar/not applicable

Approved by: *Vorgeprüft durch:* Approuvé par: *Approvato da:* Aprobado por: Nicht anwendbar/not applicable

Form 5586CEOC (2006.02)

Document no.:	NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Page 5 of 10
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Certificate no: HAM 1045010/3
Page 2 of 2

Construction Inspection – Bauprüfung - Surveillance de la Construction - Verifica di Costruzione - Verificación de Construcción

Date – Datum – Date – Data - Fecha: 21 May 2010

The main parts of the object have been manufactured in accordance with the approved drawings.
Die ausführung des Objektes entspricht in den wesentlichen Teilen der vorgeprüften Zeichnung.
La construction de l'appareil, dans ses parties principales, est conforme aux plans approuvés préalablement.
La costruzione dell'apparecchio è conforme ai disegni approvati.
La construcción del aparato, en sus partes principales, está conforme con los planos aprobados previamente.

Nicht anwendbar/not applicable

Material certificates: see annex - *Werkstoffzeugnisse: siehe Anlage* - Certificats des matériaux: voir annexes - *Certificati del materiale: vedere allegati* - Certificado de materiales: ver anexo

Erfüllt/satisfactory

Pressure Test – Druck Prüfung - Essai Sous Pression - Prova di Pressione - Prueba de Presión

Date – *Datum* – Date – *Data* - Fecha: 21 May 2010

Chamber / *Raum* / Enceinte / *Camera* / Recinto	tube coil
Test pressure / *Prüfüberdruck* / Pression d'essai / *Pressione di prova* / Presión de prueba	9,0 bar
Pressurising fluid / *Druckmedium* / Fluide utilisé / *Fluido utilizzato* / Fluido utilizado	Kaltes Wasser/cold water

The pressure test was satisfactory.
Die Druckprüfung verlief ohne Beanstandung.
L'essai sous pression a été satisfaisant.
Esito della prova soddisfacente.
La prueba de presión ha sido satisfactoria.

Erfüllt/satisfactory

Other Tests (e.g. Radiography) / *Andere Prüfungen (z.b. Durchstrahlungsprüfung)* / Autres Examens (par exemple, Radiographie) / *Altre Prove (per esempio, Radiografia)* / Otros Ensayos (por ejemplo, Radiografía):

Verfahrensprüfung: Erfüllt/welding procedure: satisfactory
Arbeitsprüfung: Erfüllt/production test: satisfactory
Schweisserzeugnisse: Erfüllt/welder's certificat: satisfactory

Remarks – *Bemerkungen* – Observations – *Osservazioni* - Observaciones
The fittings were not tested, it is therefore necessary to carry out acceptance test before commissioning.
Die ausrüstung wurde nicht geprüft, die abnahmeprüfung vor inbetrieb-nahme ist daher noch erforderlich.
Les organes de robinetterie et de sécurité n'ayant pas été controlés, l'appareil devra être soumis à un nouveau contrôle avant sa mise en service.
Gli accessori di controllo e sicurezza non sono stati verificati, l'apparecchio dovrà essere comunque ventilato sul luogo dell'impianto.
Los accesorios de control y seguridad no han sido probados, el aparato deberá someterse a nueva inspección antes de su puesta en servicio.

Purchaser/User - *Besteller/Betreiber* - Acheteur/Utilisateur - *Acquirente/Utilizzatore* - Comprador/Usuario:

To indicate the satisfactory examination the nameplate was stamped as follows:
Zum zeichen der bestandenen Prüfung wurde das Fabrikschild wie folgt gestempelt:
Les contrôles et essais ayant été satisfaisants, la plaque du constructeur a été poinçonnée comme suit:
Visto l'esito soddisfacente delle prove e verifiche, sono state applicate sulla targa del costruttore le punzonature come segue:
Habiendo sido satisfactorios los controles y ensayos efectuados, se ha grabado la placa del constructor de la manera siguiente:

LR-Stempelung auf Fabrikschild verschweisst mit Flansch DN 50/LR-stamp on the nameplate welded on flange DN 50

Enclosures – Anlagen – Annexes – *Allegati* - Anexos

Drawings / *Zeichnungen* / Plans / *Disegni* / Planos	siehe Hersteller-dokumentation/see documents of the manufacturer	Material certificates / *Werkstoffzeugnisse* / Certificats des matériaux / *Certificati del materiale* / Certificados de materiales	siehe Hersteller-dokumentation/see documents of the manufacturer	Other documents / *Andere Dokumente* / Autres documents / *Altri documenti* / Otro documentación	siehe Hersteller-dokumentation/see documents of the manufacturer

Location – *Ort* – Lieu – *Luogo* – Lugar: Uebersen

Date – *Datum* – Date – *Data* - Fecha: 21 May 2010

Name and signature - *Name und unterschrift* - Nom et signature - *Nome e firma* - Nombre y firma:

Holger Jargstorf
Surveyor to Lloyd's Register EMEA

A member of the Lloyd's Register Group

Form 5586CEOC (2008.01)

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Argentina_boiler_system.doc		NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Made by : JNM
Rev. No.: 1		General description of thermal oil heater for HTDU	Date : 2019.03.03.

Lloyd's Register

Lloyd's Register Marine Division

Lloyd's Register House 29 Wellesley Road, Croydon Surrey CR0 2AJ, UK
Telephone 0181 681 4040 Fax 0181 681 6814
Telex 28636 LRISCR G

Page	1 of 2
Document number	I-1620
Issue number	

DESIGN APPRAISAL DOCUMENT

Date	Quote this reference on all future communications
03 Jun 1997	PPD/770295 O-1434/MSF

Client: **Termo Trading A/S**
Manufacturer: **Termo Trading A/S**
Subject: **800 KW Output Coil**

1.0 The plans listed below have been examined for compliance with the design requirements of **ASME I:1995** for the design conditions stated on the plans and are assigned an appraisal status as indicated.

2.0

Plan No.	Rev	Status
17347-2 L67	0	A *
1010E	0	A *
#Calculation of VTO Boiler		N
Welding Procedure Specification (WPS) :SN3(S) #ASME-A		N

\# Single copy retained for our records.
* Copies of stamped plans were to returned to you with our DAD of 24/03/97.

Appraisal Status Key

A = Accepted provided the manufacture and testing comply with the requirements of the code stated above.

N = Noted, without comment, as supporting document for information only.

3.0 The following points are advised for information:-

3.1 It is noted that some DIN materials have been proposed.

3.2. It is concluded that no code stamp will be used.

3.3. The appraisal has not considered the following since the information submitted does not define:

i) Cyclic Service.
ii) Loads due to wind loading.
iii) Loads due to earthquake.
iv) Mechanical loads acting on nozzles.
v) Mechanical loads acting on attachments.

4.4. Data required for appraisal and not found on the plan has been taken from manufacturer's calculations.

4.5 The proposed throat thickness of the weld between the nozzle and the shell is unclear. This should comply with section PW-re. fig. PW-16.1(c).

FINAL ACCEPTANCE OF ACTUAL ITEM(S) DEPEND(S) ON SATISFACTORY SURVEY AND TESTING
NOTICE: This document is subject to the terms and conditions overleaf, which form part of this document.
FORM 5628 (04/96) Lloyd's Register of Shipping, registered office: 71 Fenchurch Street, London EC3M 4BS

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Rev. No.: 1		Date : 2019.03.03.

Lloyd's Register Marine Division
Lloyd's Register House 29 Wellesley Road,
Croydon Surrey CR0 2AJ, UK
Telephone 0181 681 4040 Fax 0181 681 6814
Telex 28636 LRISCR G

Page 2 of 2
Document number I-1620
Issue number

DESIGN APPRAISAL DOCUMENT

Date	Quote this reference on all future communications
03 Jun 1997	PPD/770295 O-1434/MSF

Authorised.....

M.S. FERNANDES
Surveyor
Pressure Plant Department Extn. 4749

Distribution:

Control No. CPN 9702023 .

LR Croydon - 1 Set
LR Copenhagen + Welding Procedure Specification

FINAL ACCEPTANCE OF ACTUAL ITEM(S) DEPEND(S) ON SATISFACTORY SURVEY AND TESTING

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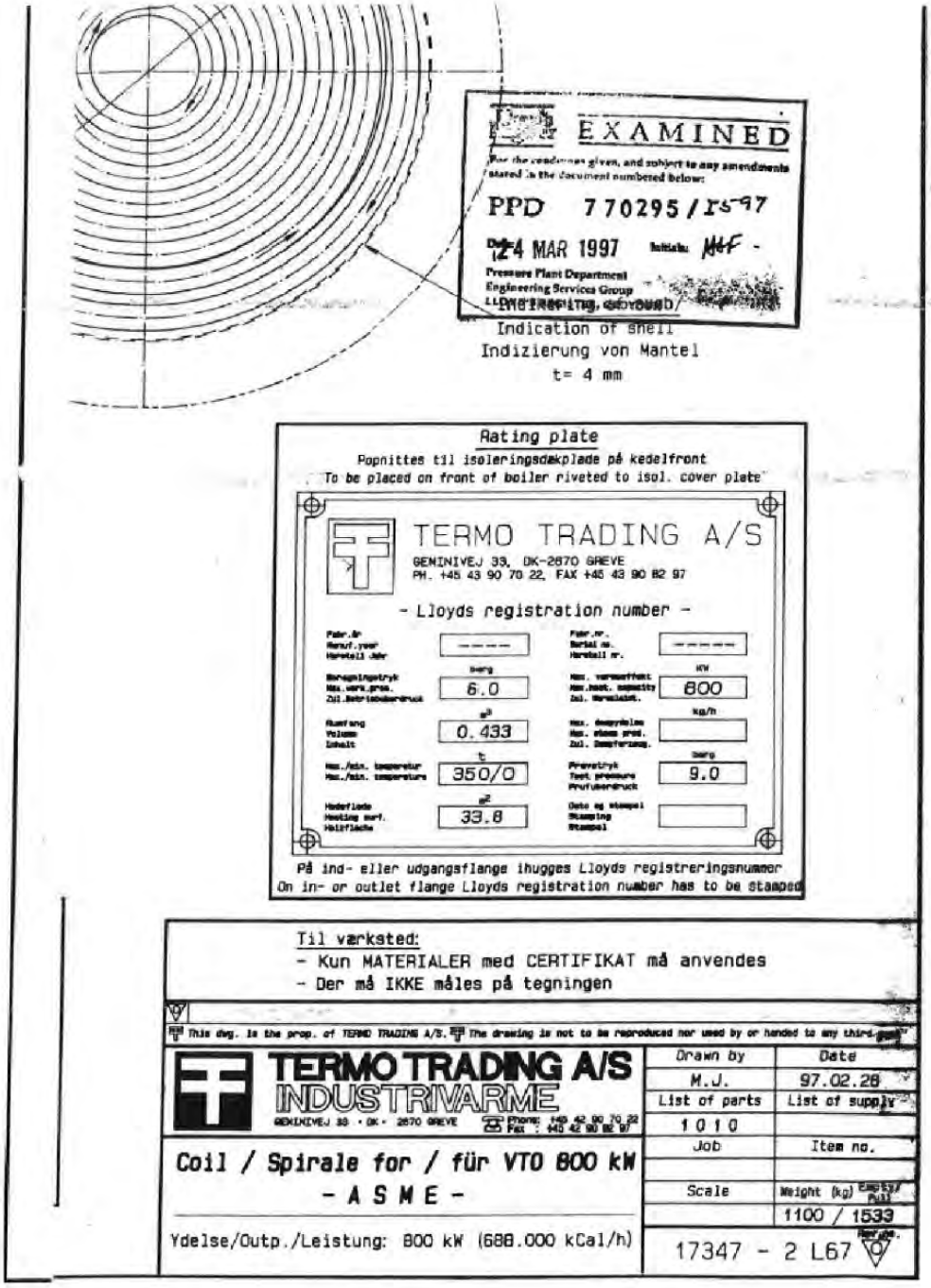

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TERMO TRADING A/S
INDUSTRIVARME

PROD.NO.: | MATERIALESTYKLISTE / LIST OF PART | NO.:1010E

GENSTAND/ITEM: Coil for VTO-boiler 800 kW - ASME/Lloyds Reg. of Shipping
SIGN.:M.J. 970303.REV.no/date:[0] .TEGN/DRWG.: .SIDE/PAGE: 1/1.

POS	ANT NOS	BENÆVNELSE-KOMMENTARER / PART-COMMENTS	NORM	MATR.	CERT. NO.
1	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 94 m Outer coil	ASME Ch.no.:	A106 GrB	3.1.B
2	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 78 m Inner coil	ASME Ch.no.:	A106 GrB	3.1.B
3	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 15 m End coil	ASME Ch.no.:	A106 GrB	3.1.B
4	3	Tube ø26.7x2.9 (3/4"xsch.40) ..... L= 135 Branch for sensor pocket	ASME/ASTM Ch.no.:	A106 GrB	3.1.B
5	1	Nipple t. ø13.7x2.2 (1/4"xsch.40) ..... L= 145 Branch for Flow switch / Cut in 45°	ASME/ASTM Ch.no.:	A106 GrB	3.1.B
7	3	1/2" muff Branch for sensor pocket	DIN 2986 Ch.no.:	St35.8/I	3.1.B
9	2	Flange C50/ø60.3 ..... PN 16	DIN 2633 Ch.no.:	C 22.8	3.1.B
12	1	Shell pl.4 ..... 170x3670	----- Ch.no.:	Rst.37-2	---
13	1	Shell pl.4 ..... 200x3060	----- Ch.no.:	Cor-ten	---
14	-	Ceramic felt pl.10 ..... ø(Adj.)	----- Ch.no.:	Keranap	---
15	2	Ceramic felt pl.10 ..... ø1165	----- Ch.no.:	Keranap	---
16	-	Fireproof casting type HASLE B1500	----- Ch.no.:	----	---
17	1	Round plate pl.4 ..... ø1165	----- Ch.no.:	Rst.37-2	---
--			Ch.no.:		
--			Ch.no.:		
--			Ch.no.:		
--			Ch.no.:		

Document no.:	NATIONAL OILWELL VARCO FluidControl Soil Recovery A/S	Page 10 of 10
Argentina_boiler_system.doc	General description of thermal oil heater for HTDU	Made by : JNM
Rev. No.: 1		Date : 2019.03.03.

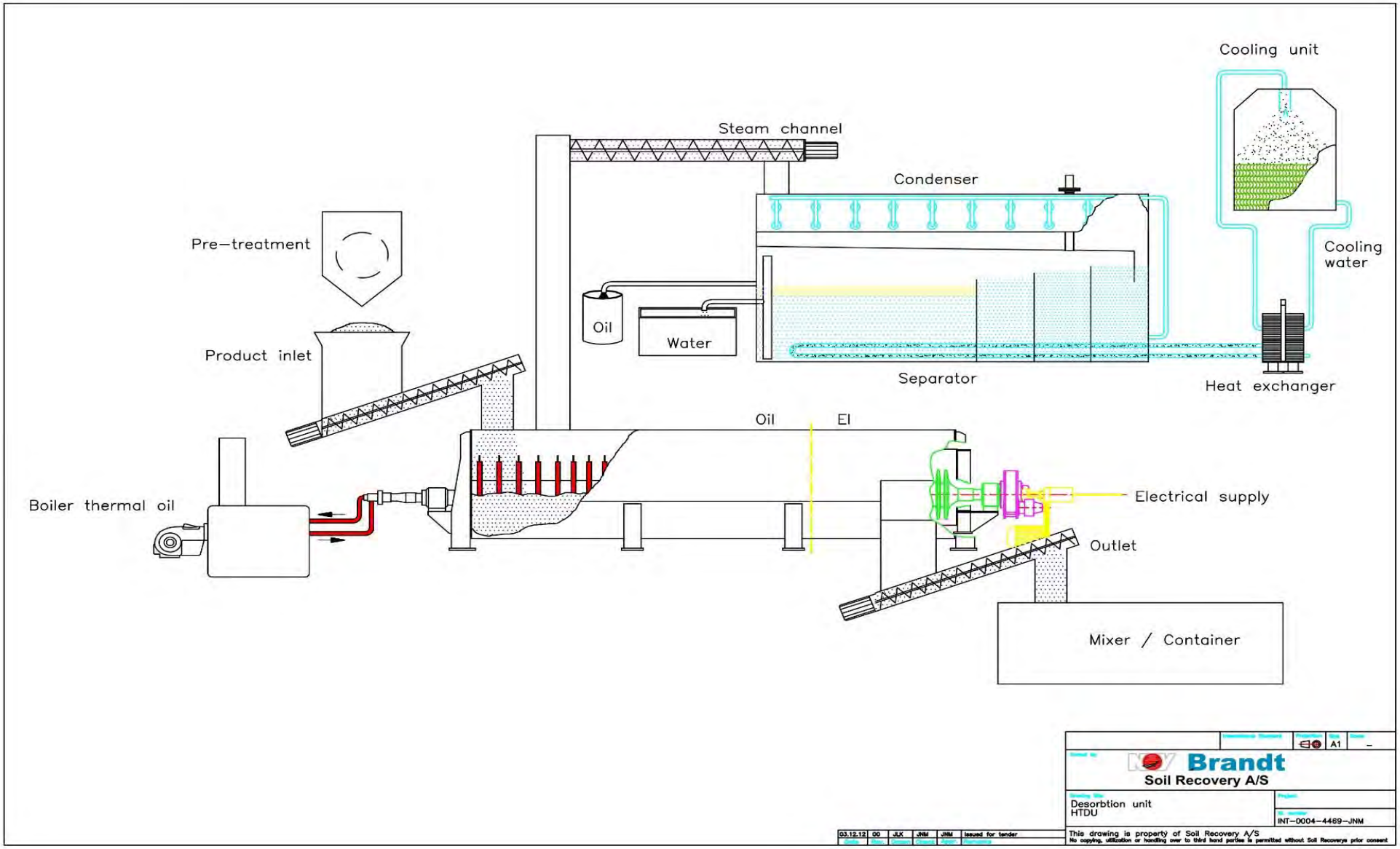
TERMO TRADING A/S
INDUSTRIVARME

PROD.NO.:	MATERIALESTYKLISTE / LIST OF PART	NO.:1010E

GENSTAND/ITEM: Coil for VTO-boiler 800 kW - ASME/Lloyds Reg. of Shipping
SIGN.:M.J. 970303.REV.no/date:[0] .TEGN/DRWG.: .SIDE/PAGE: 1/1.

POS	ANT NOS	BENÆVNELSE-KOMMENTARER / PART-COMMENTS	NORM	MATR.	CERT. NO.
1	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 94 m Outer coil	ASME Ch.no.:	A106 GrB	3.1.B
2	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 78 m Inner coil	ASME Ch.no.:	A106 GrB	3.1.B
3	1	Tube ø60.3x3.9 (1"xsch.40) ..... L= 15 m End coil	ASME Ch.no.:	A106 GrB	3.1.B
4	3	Tube ø26.7x2.9 (3/4"xsch.40) ..... L= 135 Branch for sensor pocket	ASME/ASTM Ch.no.:	A106 GrB	3.1.B
5	1	Nipple t. ø13.7x2.2 (1/4"xsch.40) ..... L= 145 Branch for Flow switch / Cut in 45°	ASME/ASTM Ch.no.:	A106 GrB	3.1.B
7	3	1/2" muff Branch for sensor pocket	DIN 2986 Ch.no.:	St35.8/I	3.1.B
9	2	Flange C50/ø60.3 ..... PN 16	DIN 2633 Ch.no.:	C 22.8	3.1.B
12	1	Shell pl.4 ..... 170x3670	----- Ch.no.:	Rst.37-2	---
13	1	Shell pl.4 ..... 200x3060	----- Ch.no.:	Cor-ten	---
14	-	Ceramic felt pl.10 ..... ø(Adj.)	----- Ch.no.:	Keranap	---
15	2	Ceramic felt pl.10 ..... ø1165	----- Ch.no.:	Keranap	---
16	-	Fireproof casting type HASLE B1500	----- Ch.no.:	----	---
17	1	Round plate pl.4 ..... ø1165	----- Ch.no.:	Rst.37-2	---
--			Ch.no.:		
--			Ch.no.:		
--			Ch.no.:		
--			Ch.no.:		

Appendix F-3 – Flow Diagram for the HTDU Process



Appendix F-4 - Technical Description of the SAS MIST System

SURFACE ACTIVE SOLUTIONS

Surface Active Solutions

SAS 20' Microemulsion Injection & Separations Technology (MIST) System

DOC Ref: SAS/07/021
Issue Date: June 2015
Issue No: 1

Page 0 of 13

SURFACE ACTIVE SOLUTIONS

General Description

SAS manufactures a host of mobile slops and sludge treatment systems designed to provide optimum performance when combined with proprietary SAS SlopTreat / SAS SludgeTreat chemistries. Each unit can be driven by a PLC System coupled with a sophisticated Human Machine Interface (HMI). The combination of these systems provides the operator the most efficient means of reclaiming oil and water from drilling waste slops and tank bottom sludges.

SAS 20' MIST System is packaged within a Standard Internationally-Rated, Hi-Cube, Shipping Container (9.5' x 8' x 20') for efficient and practical overseas and land shipping. The system includes all the standard slops and sludge treatment components, including a high-speed decanter centrifuge. SAS MIST systems can operate as a stand-alone device or be the cornerstone of a sophisticated closed-loop solids control and waste treatment and oil recovery system.

The heart of SAS MIST system is the proprietary SAS SlopTreat / SAS SludgeTreat chemistry manifolds, dosage systems, and mixing systems. These fully integrated systems are carefully engineered to provide optimum chemical delivery. The result is a SAS SlopTreat / SAS SludgeTreat-enhanced process that can be used to efficiently remove solids with a SAS decanter centrifuge whilst also enabling the recovery of high quality oil and water fractions at the same time.

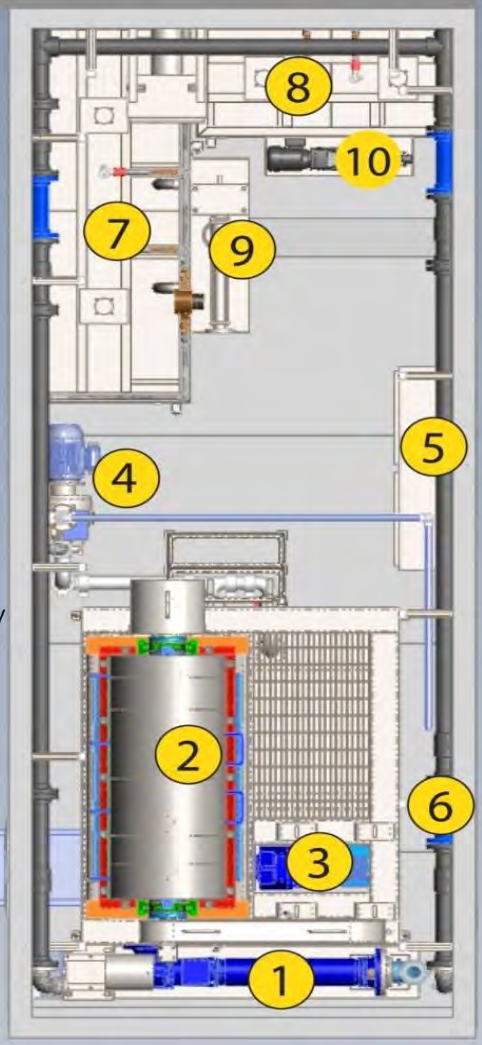
Without such a system, drilling operators and waste managers would be left with the accumulation of solids in the circulating system and the inability to recover high quality oil; ultimately leading to excessive logistics associated with large volumes of waste, and overall treatment and disposal costs. Similarly, waste treatment systems would be incapable of maximizing the recovery of oil from the waste, therefore making disposal of hazardous waste streams more costly and inefficient. SAS slops and sludge treatment experience spans the globe and includes historical installations in the UK and Europe with other successful projects delivered in North America, China and the Middle East:

SURFACE ACTIVE SOLUTIONS

SAS MIST System Components

20' MIST System Main Components

1. 200-GPM Progressive Cavity Feed Pump
2. Decanter Centrifuge
3. 14" Shafted Screw Conveyor Gear Box and Motor
4. Dilution Tank Manifold
5. Control Panel with Touch Screen Interface
6. Static In-line Mixer (3)
7. Additional Chemistry Partitioned Tank
8. SAS SlopTreat / SAS SludgeTreat Partitioned Tank
9. Additional Chemistry Progressive Cavity Feed Pump
10. SAS SlopTreat / SAS SludgeTreat Progressive Cavity Feed Pump
11. 14" Solids Discharge Screw Conveyor (Shipped Separately)



SURFACE ACTIVE SOLUTIONS

SAS MIST System Components

20' MIST System Main Components

1. 200-GPM Progressive Cavity Feed Pump
2. Decanter Centrifuge
3. 14" Shafted Screw Conveyor Gear Box and Motor
4. Dilution Tank Manifold
5. Control Panel with Touch Screen Interface
6. Static In-line Mixer (3)
7. Additional Chemistry Partitioned Tank
8. SAS SlopTreat / SAS SludgeTreat Partitioned Tank
9. Additional Chemistry Progressive Cavity Feed Pump
10. SAS SlopTreat / SAS SludgeTreat Progressive Cavity Feed Pump
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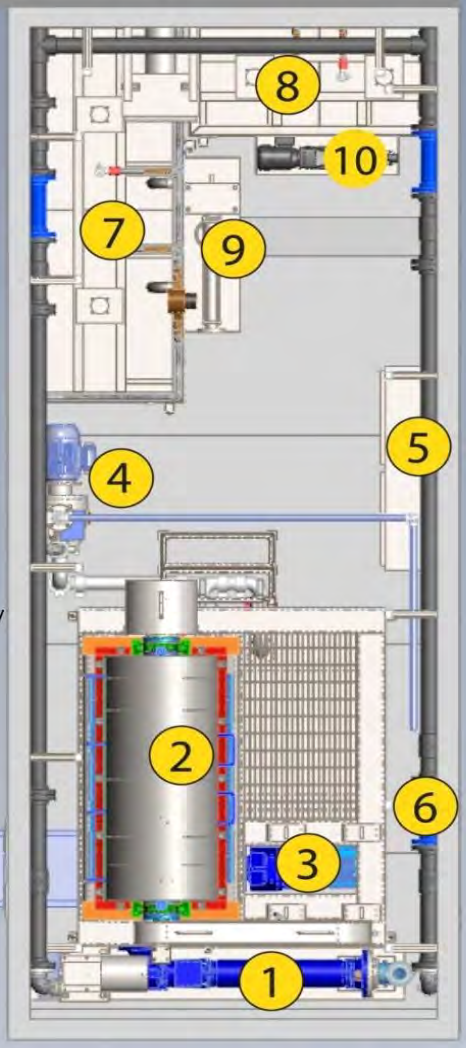


SURFACE ACTIVE SOLUTIONS

Chemical Dosing System

- Chemical storage tank T-101(1) is for diluting complimentary chemistries if required. Mixers M-106A(2) & M-106B(3) are directly mounted on the tanks to homogenously agitate the fluid. The PC Pump P-102(4) is attached with a by-pass line for injecting the chemistry into the Manifold(12). The fresh water inlet manifold is designed to deliver water into the chemical tanks for diluting concentrated products if required.
- Chemical storage tank T-102(6) is for diluting SAS SlopTreat / SAS SludgeTreat concentrate if dilution is required. Mixers M-102(5) & M-103(7) are directly mounted on the tanks to homogenously agitate the fluid. The PC Pump P-110(8) is attached with a by-pass line for injecting the coagulant into the Manifold(12). The fresh water inlet manifold is designed to deliver water into the chemical tanks for diluting SAS SlopTreat / SAS SludgeTreat products when necessary.

Progressive Cavity Feed Pump

Progressive Cavity Feed Pump P-101(10) transfers fluidized slops and sludges into the Manifold(12).

Dilution System

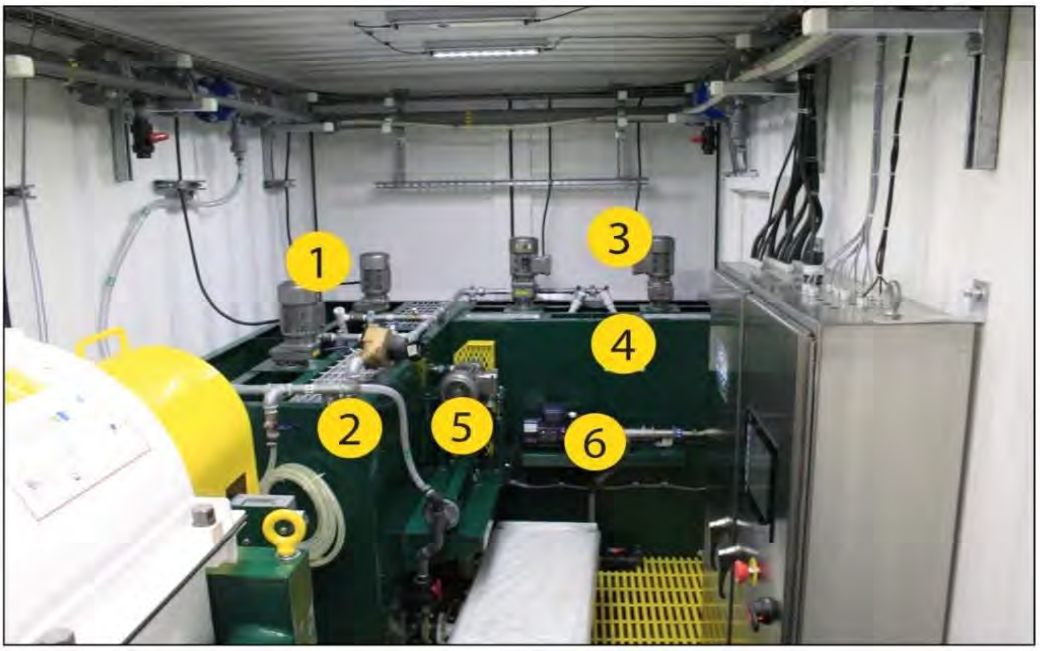
- Coupled with a flow meter, the Centrifugal Dilution Pump P-103(9) pumps from Dilution / Transfer Tank T-103(11). Dilution water is added back into the Manifold(12) to further dewater the fluid.
- Additional chemical tanks T-101 & T-102 with mixers M-106A, M-106B and M-102 & M-103 are for preparing complimentary chemical solutions if required and providing dilution where necessary. A totalizer is installed at the beginning of the manifold to accurately measure the amount of water being added to the dilution. Each tank contains a chemical educator / disperser for mixing chemistry in the tank.
- Progressive Cavity pump P-102 & P-110 injects the chemical solutions into the manifold.

Manifold

The Manifold(12) is for dilution in preparation for delivery to the Centrifuge. The manifold contains:

- Check valves to prevent slurry from contaminating pumps and tanks.
- Three static In-line mixers for chemical distribution throughout the feed stream.
- Sample ports before dilution, after dilution and after chemical injection.

SURFACE ACTIVE SOLUTIONS



1. Additional Chemistry Slow Speed Mixers
2. Additional Chemistry Two-Compartment Mixing Tank
3. SAS SlopTreat / SAS SludgeTreat Slow Speed Mixers
4. SAS SlopTreat / SAS SludgeTreat Two-Compartment Mixing Tank
5. Additional Chemistry PC Pump (1.0 to 10 Gallons Per Minute)
6. SAS SlopTreat / SAS SludgeTreat PC Pump (0.3 to 3.0 Gallons Per Minute)

Decanter Centrifuge

The standard decanter centrifuge is a high-speed decanting centrifuge with a 14" diameter bowl that is 48" long. Operating at speeds over 3,000 rpm, the SAS centrifuge produces a force 2,000 times that of gravity or 2,000 G's. Solid discharge is conveyed to one end where it drops from the machine into a conveyor. Liquid / centrate discharge is collected and flows to the dilution tank or mud tank by way of a large manifold.

The centrifuge has several safety devices. The planetary gearbox is pinion controlled. The pinion is attached to a trip arm that senses the torque on the internal screw (scroll). When the torque exceeds the preset maximum setting

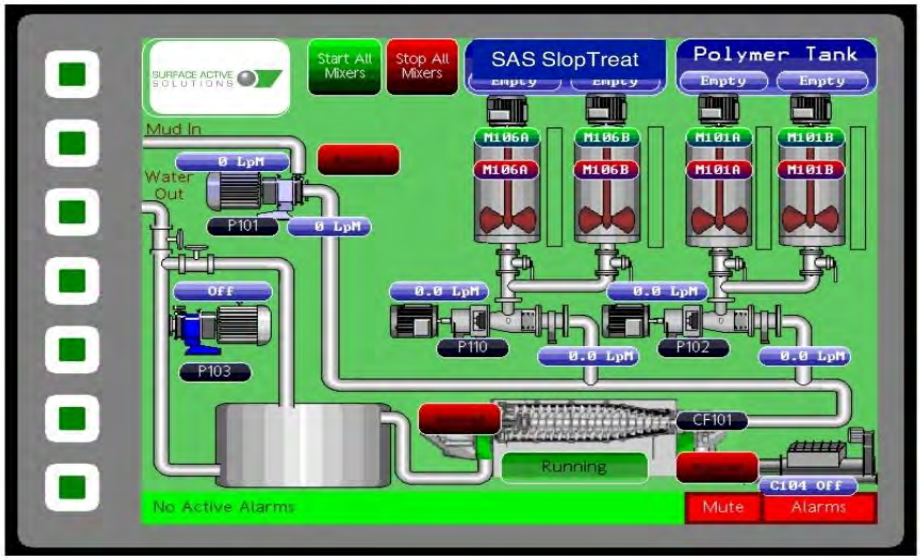
SURFACE ACTIVE SOLUTIONS

Electrical Systems

SAS MIST systems integrate the operating and control features within a centralized electrical panel. Voltage and frequency are dependent on the target destination of the equipment. Typical voltages are 460 or 360 volt (3 phase). Typical frequencies are 60 Hz or 50 Hz. Consequently, alternative voltage and frequency configurations are available upon request.

Electrical systems are either NEMA 4X weather proof fittings or NEMA 7X Explosion proof (depicted below), depending on the specific demands of the application. Explosion proof fittings must be managed carefully and only a qualified and / or licensed electrician should work with such system in order to maintain their explosion proof integrity.

a. Standard MIST System HMI Control Overview Interface



b. Standard MIST System HMI Control Main Menu Interface

SURFACE ACTIVE SOLUTIONS

MIST Technical Specifications

General Performance	
Maximum Flow Rate	**Cut Size**
See Attached Performance Chart	0-2 micron (With Chemistries)

Major Equipment			
Container Type		**Container Dimensions**	
20' Standard High-Cube Container		20' x 8' x 9.5'	
Control Room/Laboratory		**Centrifuge**	
N/A		1448	
Typical Processing Rates		**RPM**	**G's**
15-110 GPM	3.4-24.9m^3/Hr.	3,250	2,100
SAS SlopTreat / SAS SludgeTreat Tank		**Additional Chemical Tank**	
2 x 330 Gallon	1,212 Liters Each	2 x 160 Gallon (606 Liters Each)	
Mud Sludge Pump		**Auxiliary Tank**	
N/A	N/A	N\A	
Tank Agitators		**Dissolution / Transfer Tank**	
4 x 1 HP		160 Gallon	606 Liters
Electrical Rating		**Air Conditioning**	
460v/60hz		N\A	

SURFACE ACTIVE SOLUTIONS

MIST Technical Specifications

General Performance	
Maximum Flow Rate	**Cut Size**
See Attached Performance Chart	0-2 micron (With Chemistries)

Major Equipment			
Container Type		**Container Dimensions**	
20' Standard High-Cube Container		20' x 8' x 9.5'	
Control Room/Laboratory		**Centrifuge**	
N/A		1448	
Typical Processing Rates		**RPM**	**G's**
15-110 GPM	3.4-24.9m^3/Hr.	3,250	2,100
SAS SlopTreat / SAS SludgeTreat Tank		**Additional Chemical Tank**	
2 x 330 Gallon	1,212 Liters Each	2 x 160 Gallon (606 Liters Each)	
Mud Sludge Pump		**Auxiliary Tank**	
N/A	N/A	N\A	
Tank Agitators		**Dissolution / Transfer Tank**	
4 x 1 HP		160 Gallon	606 Liters
Electrical Rating		**Air Conditioning**	
460v/60hz		N\A	

SURFACE ACTIVE SOLUTIONS

SAS DC1448 Centrifuge General Description

Whether you are working towards maximizing solids recovery or looking to get the most out of your "zero-discharge" closed-loop system, SAS field proven solids control and slops / sludge treatment centrifuges are a perfect choice. SAS has installed a number of SAS DC1448 centrifuges worldwide operating in variety of slops and sludge treatment / oil recovery applications in both on-shore and offshore environments. It is this same experience that has granted SAS the necessary insight to supply centrifuges capable of meeting international electrical standards around the world.

The SAS DC1448 is fitted with a NEMA Premium, continuous duty, energy-efficient, poly-chain driven, 50hp main drive. The 50hp main drive can operate the centrifuge up to a maximum practical rotational speed of 3,250 rpm's, therefore generating 2,100 G's of force. Using an adjustable motor mount, motor and belt maintenance is made easy by the adjustment of two jack screws. No additional motor mounts, brackets or tensioning devices are required.

Assembled in an "offset field skid" configuration, the SAS DC1448 requires limited effort to install. Not only does the offset main-drive configuration allow direct access to the motor and belts for efficient maintenance, but it also achieves a shorter end-to-end centrifuge length and lower center of gravity, therefore providing a greater level of installation flexibility. General arrangement drawings are available upon request.

Specs	SAS DC1448
Equipment Image:	
Maximum G Force:	2,100
Maximum Speed:	3,250 rpm
Capacity:	200 gpm (11.7 lps)
Bowl Construction:	304 Stainless Steel
Bowl Diameter:	14" (356 mm)
Bowl Length:	48" (1,218 mm)
Gearbox Ratio:	125:1

Key Features and Benefits

- 50HP NEMA Premium main drive generates 2,100 G's at 3,250 RPMs.
- Offset motor configuration allows for easy unit maintenance and lowered center of gravity. Further maintenance is reduced through the use of the carbon-fiber poly-chain.

Key Wear Protection Considerations

- Entire conveyor flight fully lined with tungsten carbide wear inserts.
- Stainless steel bowl, scroll, and liquid-end discharge ports mitigate corrosion.
- Solids discharge ports are made from an erosion-resistant Delchome Alloy 90.
- Interior cover surrounding solids discharge head includes an additional metal liner to protect the top cover from erosion.

The SAS DC1448 also incorporates a completely redesigned set of machine guards. Unlike comparable units, the SAS DC1448 has tightened all machine guard tolerances therefore ensuring no incidental contact with rotating or moving parts while in operation. To ensure maximum equipment protection, the SAS DC1448 is equipped with a factory set vibration switch and torque-arm.

The SAS DC1448 centrifuge uses four, stainless steel, epicentric liquid-end discharge ports. Each port can be rotated to the desired setting therefore allowing the operator to make efficient changes in pool depth by simply loosening the set screws.

The SAS DC1448 utilizes a 360 degree discharge port arrangement that ensures smooth directed discharge of the solids. By using four, "wide-mouth", Delchrome Alloy 90 erosion-resistant discharge ports and plows, the SAS DC1448 is capable of handling large volumes of erosive solids without damaging the centrifuge.

The SAS DC1448 stainless steel rotating assembly is 14" in diameter and 48" in length. By using a length over diameter ratio of 4.0, SAS achieves an extremely stable centrifuge. The rotating assembly is given further stability by the use of two premium bearings. Both bearings are installed in precision-machined pillow blocks. Equipped with externally accessible grease ports, daily greasing can be performed without the removal of machine guards.

The internal flights are lined with tungsten carbide tiles along their entire length of both the clarification and the tapered section, extending the SAS DC1448's ability to manage erosive solids. To protect the upper cover from the radial discharge of solids, a 180 degree radial, protective deflector plate has been incorporated into the stainless steel centrifuge lid.

SURFACE ACTIVE SOLUTIONS

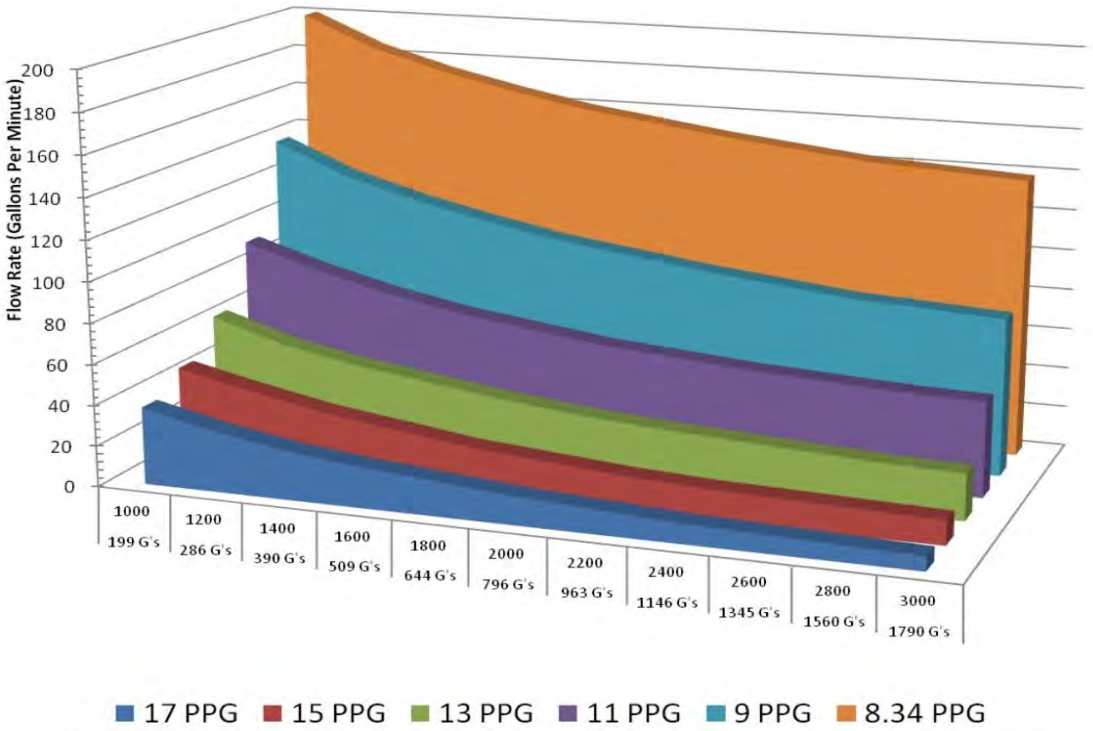
SAS DC1448 Centrifuge Technical Specifications

General Performance		
Maximum Hydraulic Flow Rate *(See Detailed Performance Curves on Following Page)*		**Cut Size**
200 GPM	12.6 lps	5 m (Without Chemistry)

Major Equipment			
Maximum G Force		**Maximum Practical Speed**	
2,100		3,250 rpm	
Bowl Construction		**Bowl Diameter**	
304 Stainless Steel		14”	35.6cm
Gearbox Ratio		**Bowl Length**	
125:1 (MIST System Configuration)		48”	121.8cm
Skid Dimensions (LxWxH)		**Weight**	
102” x 75” x 58”	2.59m x 1.90m x 1.47m	6,943 lbs	3,150 kgs
Main Motor		**Back Drive**	
50 HP 460v/60hz	3 Phase	N/A	N/A

SURFACE ACTIVE SOLUTIONS

Relative to Bowl Speed (G-Force), Specific Gravity and Feed Rates*



*Actual feed rates are affected by plastic viscosity, particle size distribution, drilling fluid inhibition, and pond depth. The target flow rates highlighted by the above graph should be considered maximum capacities. The curves provided are provided as a guide only. Field conditions will ultimately dictate performance.

Actual maximum flow rates may be lowered when utilizing a 125:1 gearbox due.

Appendix F-5 - Further Information and Schematics of the Incinerator

sales@addfield.com +44 (0)1543 571 280 www.addfield.com

Medical

CHAS defra Approved ISO9001 2015 ISO 14001 2015

The C200 is a high capacity clinical incinerator, designed to handle waste such as hazardous, laboratory or pharmaceutical. Having a front-loading design, enabling a safe and easy method for continuous loading of waste.

Biosecurity is a growing concern for hospitals across the globe, the implementation of an Addfield C200 can improve your ability to safely destroy contaminated waste.

The following information details the many features, specifications and optional equipment associated with our C200 incinerator.

Machine Specification

External L x W x H (mm)	3750 x 4955 x 3800/7400
Internal L x W x H (mm)	3035 x 1353 Ø
Chamber Volume (m^3)	4.35
Weight (approx tonnes)	12
Nominal Burn Rate	<200
Thermal Capacity (kW)	740
Power Supply 50/60 hz	220 - 250v
Door Aperture	1340 Ø
Control Panel	PLC
Fuel Types	Diesel, LPG, N-Gas
Fire Brick (Alumina)	42.5%
Insulation Fire Brick	Grade E23

*We reserve the right to change the specification, dimensions and quality of materials from time to time, so long as the alteration is minor or an improvement to the said product.

Primary Chamber

- Fully insulated internal refractory lining, constructed from high grade refractory brick ensuring a self-supporting, interlocking arrangement.
- Fully interlocked, manually operated, access door.
- Waste ignition burner, temperature controlled on-off, complete with internal air fans.
- Combustion burner, temperature controlled on-off, complete with internal air fans.
- Primary combustion burner air fans with automatically controlled distribution to their designated area.
- One temperature sensor mounting points.

Secondary Chamber

- Fully insulated internal refractory lining, constructed from low thermal mass insulation.
- Secondary chamber burnout burner, temperature controlled on-off, complete with internal air fans.
- Integrated combustion burner air fans with automatically controlled distribution to their designated area.
- All combustion fuel pipework.
- All electrical components.
- One temperature sensor mounting point at the base of the exit flue ensuring the chamber reaches the necessary 1100°C minimum.

Waste Type

Clinical Waste	✓
Treated Waste	✓
Anatomical Waste	✓
Cytotoxic & Cytostatic Waste	✓
Offensive/Hygiene Waste	✓
Medicinal Waste	✓
Domestic (municipal) Waste	✓

addfield Incinerate • Cremate

Addfield Environmental Systems Limited
Unit 9 | Zone 4 | Burntwood Business Park
Staffordshire | WS7 3XD | United Kingdom

MADE IN BRITAIN

sales@addfield.com +44 (0)1543 571 280 www.addfield.com

Medical

C200 The most robust reliable and efficient incinerators available anywhere.

Waste Loading and De-Ashing

The C200 incinerator is designed for front loading only through the main access door. At the end of every incineration process, ash should be discharged through the loading door into the supplied catcher tray prior to being loaded for the next burn. When de-ashing the machine, make sure that all of the correct PPE is worn, this is to protect yourself from the heat existing the machine.

The Addfield Difference

- Pre-fabricated 8mm & 10mm robust mild steel casing, seam welded and suitably stiffened/ braced where necessary.
- Lightweight resilient refractory fibre insulation door, providing a tight seal, giving excellent thermal efficiency.
- Primary & secondary chamber lining, rated at 1650°C.
- Built in chamber door viewing port for mid cycle and optimised viewing of waste during process.
- Paint finishing – The steel structures are painted using a two-pack high grade paint system.
- With a choice of an AI or PLC Controller, customisable programs can cut your operations times.
- A high quality module refractory lining, using fire bricks and insulation bricks, improving thermal efficiency.

Additional Operation Equipment

Waste Hopper

The optional hopper is perfect for offering a safe and continuous loading of waste equipped with an automatic operated door for loading waste into the centre of the primary chamber.

Bin Tipper

The safest way to load hazardous waste directly into top loading ram loaders. Hands free operation for up to 150kg, compatible with the majority of waste bins. Reliable hydraulically operated mechanism.

Venturi System

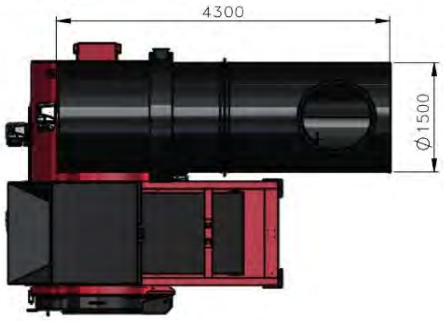
An advanced flue gas treatment system designed to further reduce dust, acid gasses, dioxins and furans. Highly effective the venturi is widely regarded as the leading treatment system in its field.

addfield Incinerate • Cremate

Addfield Environmental Systems Limited
Unit 9 | Zone 4 | Burntwood Business Park
Staffordshire | WS7 3XD | United Kingdom

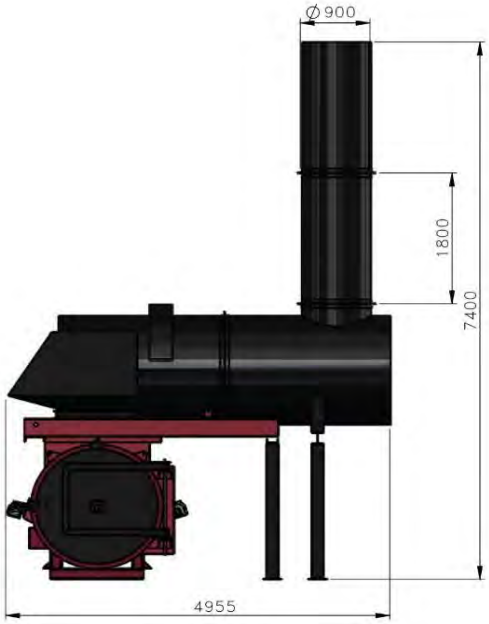
MADE IN BRITAIN

*SHOWN WITH OPTIONAL HOPPER

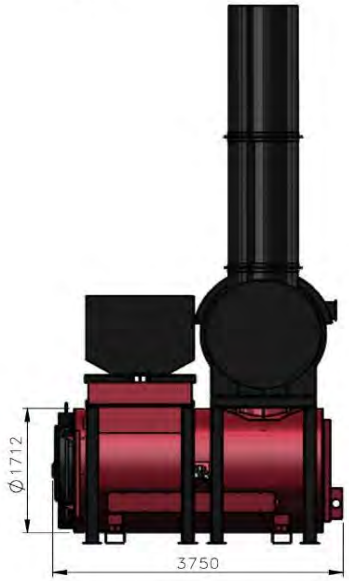


PLAN VIEW

ISOMETRIC VIEW



FRONT VIEW



SIDE VIEW

	DATE	DRAWN	CHECKED	APPROVED	COMMENTS
D					
C					
B					
A	21/08/2019	KJ			ADDED CHIMNEY EXTENSION AND UPDATED DIMENSIONS
—	21/05/2019	A.Singh	H.B	H.B	

THIRD ANGLE PROJECTION (UNLESS STATED OTHERWISE)

MATERIAL: N/A

FINISH: N/A

TOLERANCES (UNLESS STATED OTHERWISE)
WHOLE NUMBERS ±1.00
1 DECIMAL PLACE ±0.10
2 DECIMAL PLACE ±0.05
ANGLES ±0.50°

WEIGHT:

addfield
Incinerate • Cremate

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Addfield Environmental Systems LTD
Unit 9, Zone 4
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Staffordshire
WS7 3XD

DRAWN BY: AS

DATE CREATED: 21/05/2019

PROJECT:
C200 WITH TOP LOADER

TITLE:
C200 WITH TOP LOADER GA

DRAWING No. 43–001–1

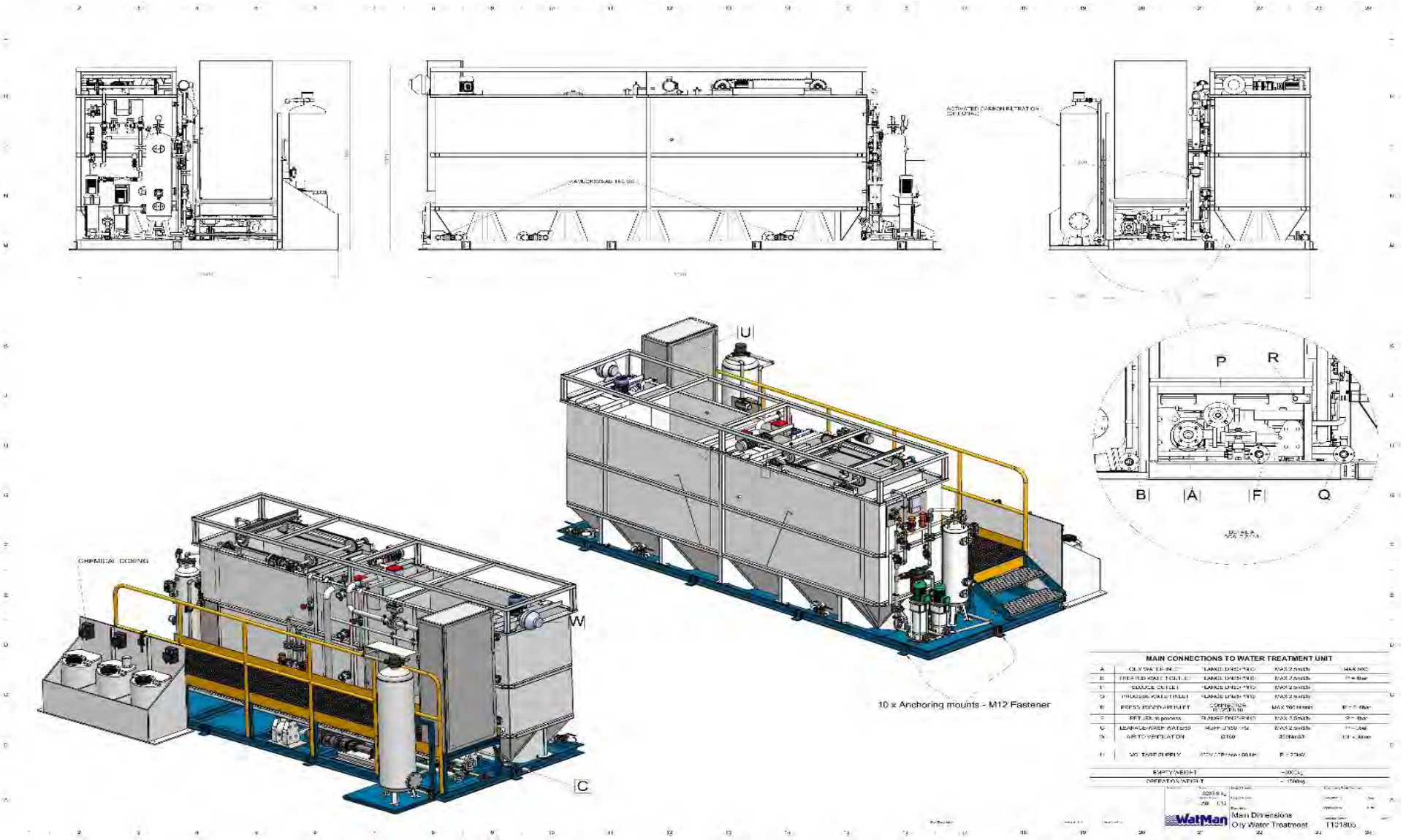
REV A

SHEET No. 1 OF 1

SCALE: 1:60

A3

Appendix F-6 - Schematics of the Wastewater Treatment Plant

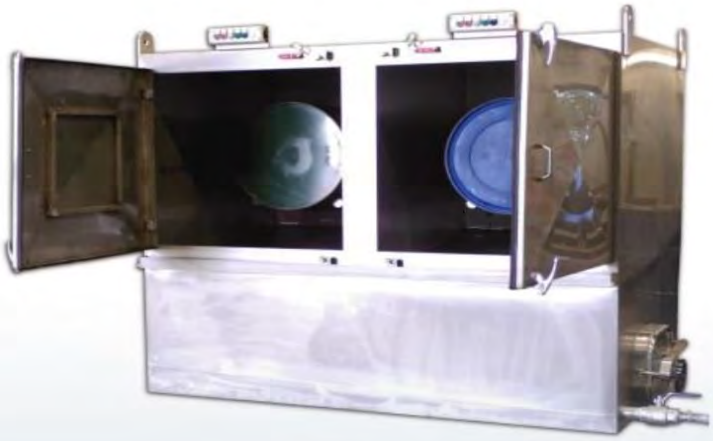


Appendix F-7 - Additional Detail and Schematics Containers Washing Units

Drums

ROTAJET
CONTAINER WASHING

RJ-DW Series



The RJ-DW Series of Drum Washers

Features

- Modular, batch system for easy expansion
- Optional rinse and drying stages.
- Cleans internally and externally
- Throughputs of up to 300 drums in an 8 hour day
- Efficient and safe for operators

Cleaning Agents

- Detergent and water
- Alternative "green" solvents
- Caustic Solutions
- Flammable solvents

Rotajet Systems Ltd.
14 Flanshaw Way
Wakefield
West Yorkshire
WF2 9LP

ROTAJET
CONTAINER WASHING

Drum Washers - RJ-DW Series

The RJ-DW Series have been manufactured to clean and decontaminate drums quickly and easily. Each are fitted with high pressure spray nozzles that achieve complete coverage, ensuring complete decontamination

During the standard cleaning operation, fresh water at ambient temperatures, although heating and chemical dosing are available as an optional extras.

The RJ-DW series contains four distinct models to account for our customers varying needs. Ranging from the RJ-DW1, for cleaning a single drum up to the RJ-D60-DW that is capable of cleaning four drums at a time or a selection of machine parts, tools and small containers

The flexibility of the RJ-DW Series allows Rotajet to provide the idea solution to your drum washing needs no matter the volume or the level or type of contamination

Fig. 1: Drum Washer Series RJ-DW2

Fig. 2 & 3: Drum Washer Series RJ-DW1

	RJ-DW1	RJ-DW2	RJ-DW4	RJ-D60-DW
Throughput	10 p/h	20 p/h	40 p/h	40 p/h
Drums per Batch	1	2	4	4
Available Cleaning Solutions				
Aqueous Solution	✓	✓	✓	✓
Green Solvents	✓	✓	✓	✓
Caustic Solution	✓	✓	✓	✓
Flammable Solvents	✓	✓	✓	✓

Specifications are not binding and are subject to change

ROTAJET
CONTAINER WASHING

RJ-DW1

This drum washer is an ideal choice for companies using less than 80 drums per day. The drums are loaded vertically into the machine over a rotating spray.

As standard cold fresh water is sprayed at a nominal 5 – 6 BAR. The rotating "vee" spray pattern ensures complete coverage of the drum.

Depending on your typical contamination it may be necessary to introduce heating, wash liquors or additional wash stages to achieve your desired cleaning standards.

RJ-DW2

This two position drum washer is a great choice for companies using up to 160 drums per day with multiple types of contaminates.

The two independent wash chambers allow our customers two drums simultaneously with different cleaning specifications. Whether you need to wash with two different wash liquors, cycle times or different drum sizes the RJ-DW2 is the ideal machine for you.

RJ-DW4

Washing four drums in the same wash chamber increases the throughput capacity to 320 drums cleaned by one operator in an 8 hour shift.

The drums are loaded horizontally, reducing manual handling hazards and decrease load times. Rotating spray nozzles ensure complete coverage of the internal surfaces of the container.

Heating, chemical dosing and additional wash stages are available to account for hard-to-clean contaminants.

RJ-D60-DW

This washing station has been specifically designed for companies who have a mix of container sizes, machine parts and tools that are coated in similar contaminants.

The items to be washed are loaded in a basket which can be simply pushed into the wash chamber. With the standard basket size of 1220mm² four 200L may be washed in one cycle or a mix of container sizes.

Wash liquor recirculation is fitted as standard with this drum washer as well as integral sump, course and fine filtration. These additional features extend the life of your solutions and thereby reduce your operating costs.

Specifications are not binding and are subject to change

Optional Extras				
	RJ-DW1	RJ-DW2	RJ-DW4	RJ-D60-DW
Additional Wash	✓	✓	✓	✓
Chemical dosing	✓	✓	✓	✓
Extraction Fan	✓	✓	✓	Std.
External timer	✓	✓	✓	Std.
Additional basket	✓	✓	✓	✓
Auto lift	✓	✓	✓	
Scissor Lift				✓

Automated Solutions

If you require a higher throughput rate Rotajet Systems also manufacture automated drum washers that have the option to not only wash but rinse, dry, pressure test and crush drums.

The drums can be manually loaded onto a walking beam which walks the drums through the machine. The smallest machine, a single track drum washer, will clean up to 60 drums per hour. Rotajet can increase the number of stations, increasing the throughput to 100 drums per hour. Due to the transfer times, after 100 drums per hour, we recommend that a multi-track machine is used.

Fig. 4: Schematic Drum Washer RJ-DW200

ATEX Certified Solutions

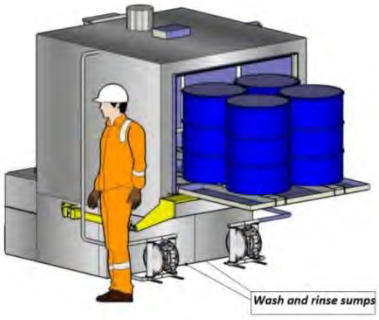
When cleaning with flammable solvents it is important to safeguard the operator by reducing the risk of combustion. Each product in the RJ-D-DW Series is available as an ATEX certified machine.

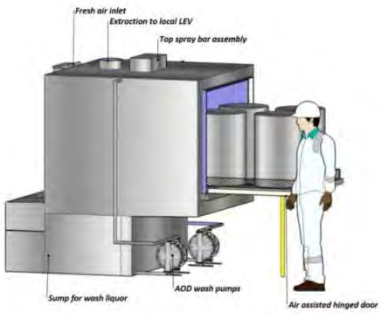
The ATEX parts washing can be supplied as a single stage or two stage machine, where the second stage uses a clean solvent for the final rinse. Typically in a two-stage ATEX machine, the final rinse solvent is discharged into the wash solvent for reuse. The dirty solvent in the wash tank, when spent, is normally pumped out and processed in a distillation unit prior to being reused.

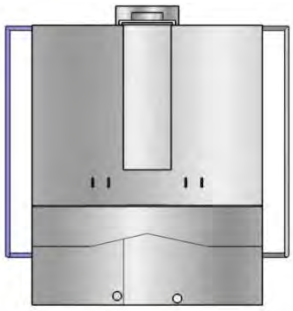
The Rotajet ATEX parts washers and Bucket washers are fitted with an integral solvent sump, coarse filtration, cycle timers, wash pump, clean-out doors and extraction. To ensure the safety of your operator the machine is fully interlocked when cycles are running.

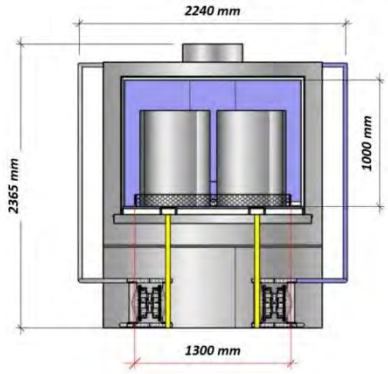
The typical users of these machines are:

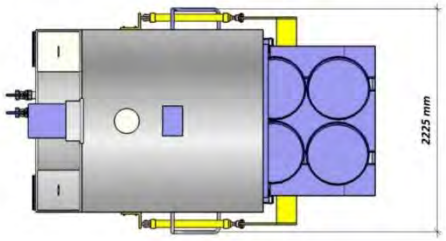
- **Paint manufactures:** Solvent washing machine parts, valves and mixing heads contaminated with paint.
- **Ink manufacturers:** Solvent washing machine parts, valves and mixing heads contaminated with ink.
- **Printing companies:** Solvent washing, press parts, plate washing, press cylinders, anilox and gravure roller cleaning.

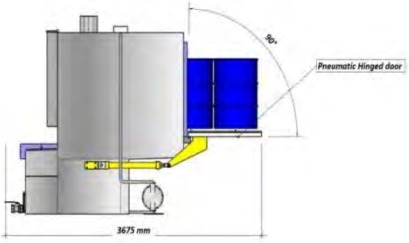












Our Products Range

- Plastic Washers
- Plastic Dryers
- Sink Float Tanks
- Granulators
- Shredders
- Feed Hoppers
- Conveying systems

Rotajet Systems Ltd.
14 Flanshaw Way
Wakefield
West Yorkshire
WF2 9LP
United Kingdom
(+44)1924 271446
Email: info@rotajet.co.uk
www.plasticwashing.co.uk

IBCs

ROTAJET
CONTAINER WASHING

RJ-IW/1

IBC Washing Line – RJ-IW/1

Features

- 360° High Pressure Spray Nozzles
- 11L/min Flow Rate
- Variable Cycle Time
- Additional Rinse Stage Available
- Filtration and Recirculation Available

Rotajet Systems Ltd.
14 Flanshaw Way
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West Yorkshire
WF2 9LP

RJ-IW/1 – IBC Batch Washer

The RJ-IW/1 is a high pressure internal washer that strips contaminates from the inside of the IBC. Typically an RJ-IW/1 is used for both internal wash and rinse.

During the wash stage either uses caustic solution or aqueous detergents depending on the typical contaminants present. To ensure complete coverage an electric driven, high pressure nozzle is used. The nozzle is fitted with pencil jets which rotate 360°on both the X and Y axis, delivered at 180 BAR with a flow rate of 11L/min.

The machines can either wash with heated wash liquor or ambient liquor for the IBC or Tote cleaning operation. Usually, the ambient solution is used for water-based residues, and heated caustic liquor for non-water based residues

To reduce operating costs, as an optional extra, it is possible to add a 500L recirculating tank, allowing the wash solution to be filtered and reused.

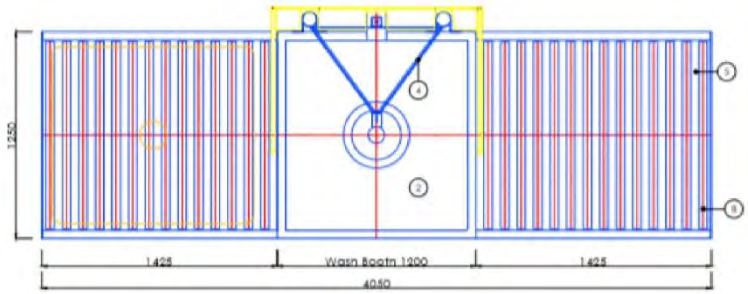
Pressure	180 BAR
Flow Rate	11L/ min
Power	2.9kW
Test Time	2 min
Test Pressure	5 min

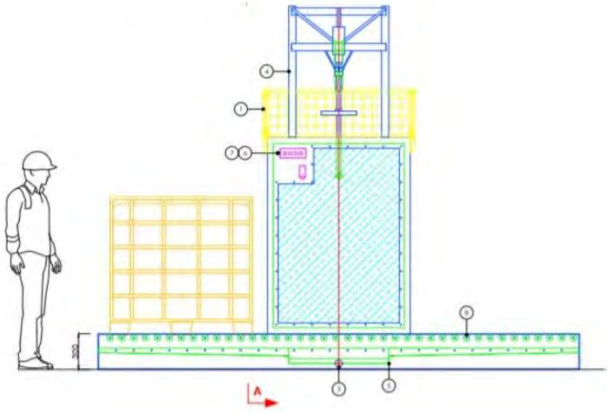
RJ-IW/2 – IBC Batch Washer

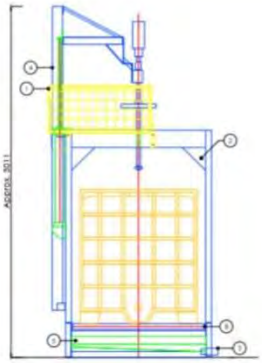
Depending on both the contaminants present and the desired end use of the IBC it may be necessary to add an additional rinse stage to your batch IBC washer. This can be delivered through the same high pressure nozzle with either heated or ambient fresh water.

Specifications are not binding and are subject to change

ROTAJET
CONTAINER WASHING







Our Products Range

- Plastic Washers
- Plastic Dryers
- Sink Float Tanks
- Granulators
- Shredders
- Feed Hoppers

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Appendix F-8 - Further Information and Schematics of the Shredder

Soluzioni per l'Ambiente

San Vittore Olona, 26th August 2020

Offer n. 2057-00_2020

Company
LAMOR CORPORATION Ab
Rihkamatori 2

06100 PORVOO
FINLAND

To the kind attention of Mr. Timo Pylkka.

OFFER FOR :	**SHREDDER MODEL**	**SINGLE SHAFT SA1 – 1300S**
MACHINE CONDITIONS		**NEW FROM FACTORY**

Material to be treat	**Different waste material without metals**
Input size	**Maximal 1200 x 1000 mm**
Output size	**not regulated between 15 to 100 mm**
Throughput per hour	**Up to 3000 Kg/h variable material specific weight and loading system**
Loading system	**Unknow**

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Ufficio operativo – Operative office
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20028 San Vittore Olona (MI) – **ITALIA**
Tel. 0039 0331 517489

Soluzioni per l'Ambiente

DESCRIPTION

The single shaft model SA1 – 1300S is an electrically powered fixed shredding machine.

Its strong steel structure makes it suitable to refine a great diversity of waste materials. A single shaft positioned on the front shreds the material. Differentiation of plastic waste is carried out by means of a grate (PVC, polyethylene, urban solid waste, wood, etc.)

The machine is divided into upper hopper, for the introduction of the material, and grinding chamber. Material is ground by means of a feeding pusher, which is powered by hydraulic pistons. Thanks to the piston any size of material can be shredded; which otherwise won't be possible considering sizes of the hopper and the position of the shredding shaft, which will have difficulties in grabbing the material.

The screen is particularly made to let through only materials with the right size. An easy manual opening to substitution of the element in case it becomes necessary its substitute with another having holes with different sizes.

The whole machine has been built in accordance with the rigid norms on safety rule on workplace and it is delivered together with a CE certificate.

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Soluzioni per l'Ambiente

TECHNICAL CHARACTERISTICS		
Shredding chamber		
Chamber size	mm	1.300 x 1.130
Number of shafts	n.	1
Model of shaft		Flat shaft
Shaft diameter	mm	460
Shafts speed	rpm	80
Number of blades	n.	32
Size of the blades	mm	60 x 60
Model of screen		Zig Zag screen
Gearbox	n.	1
Shafts drive system		Belt drive
Drive system		
Kind of system		Electric
Electric motor	n.	1
Installed power	kW	55
	HP	Total 75
Voltage	V	400
Frequency	Hz	50
Control cabinet	n.	1
Function control system		By PLC
Feeding Hopper	n.	1
Hopper size	mm	1.330 x 1.550 x 900
Hopper capacity	m^3	2 ca.
Machine size		
Total Length	mm	3.300 ca.
Total Width	mm	2.170 ca.
Total Height	mm	2.490 ca.
Machine Weight	Kg	5.000

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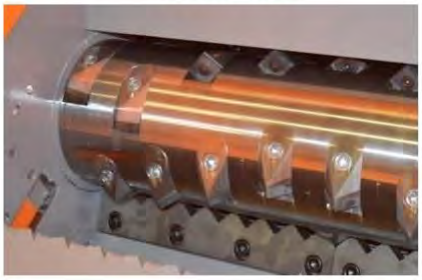
Soluzioni per l'Ambiente

DETAILED SPECIAL CHARACTERISTICS

General shredder View (with special hydraulic unit)

Rotor view (V – rotor additional accessories)

Flat rotor view



Zig ZAG screen
with hydraulic opening

The above described machine on the following configuration with:

- Shredder SA1 – 1300S complete with:
  - ⇒ Shredding chamber length 1.300 mm fitted with:
    - N. 32 teeth size 60 x 60 mm
    - N. 1 motor 37 Kw = 50 HP
    - Manual greasing system
    - Control panel rated 380/400 V 50 Hz
- Hopper for material feed

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Soluzioni per l'Ambiente

SALES CONDITIONS

***Transport*:**	Ex works Italy
Start up and installation	Not included
***Delivery time*:**	14 Weeks from the order confirmation and payments receipt * COVID-19 The delivery time for the preparation or delivery of the supply are indicative with reference to the normal conditions and operative possibilities of SA Eng and his suppliers. In case of force majeure or delay due to slowdown of the production activities direct or from suppliers of SA Eng caused from the SARS-Cov-2 pandemic, delivery can be accordingly delayed.
***Guarantee*:**	12 months from the delivery except for - wearing parts (blades, bearings, etc…) - Damage occurred from lack of maintenance and not care from the operators. - Damage occurred from non-proper use of the machine (shredding of not confirm material)
***Payment terms*:**	30% as down payment at order confirmation 70% before dispatch of the machine

SA Eng. S.r.l.
De Pieri Luca

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Soluzioni per l'Ambiente

GENERAL SALES CONDITIONS
Unless otherwise agreed between the parties
and / or otherwise indicated in the order:

Art. 1 - Proposals, confirmation, down-payments. – For the buyer signing the purchase proposal, this is binding and irrevocable. The Supplier, in its unquestionable judgement, has the right to accept it or not, except for its obligation to return the amount paid in advance if the proposal should be refused.
Commitments made by our Representatives, Agents, Employees and those Appointed and purchase proposals are only binding for us after we have explicitly confirmed them in writing. Proposals must always be accompanied by a down payment. The Supplier retains said payment as indemnity, if the buyer should cancel the order, any further request for damage excepted. Down-payments are always non-interest-bearing.
Art. 2 - Prices – Prices are net, ex factory works. The price established is the one in force at the time of delivery. If payment should be made in instalments, the Purchaser shall be liable for the cost of any bills, interest in the percentage agreed on and all other expenses.
Art. 3 - Delivery - a) Delivery of our goods is agreed at our premises. b) Delivery terms indicated are purely indicative: the Supplier shall have no liability if the goods are shipped after the aforementioned terms. c) Delivery is considered as executed for all purposes through notice (even by simply sending the invoice) that the goods are available for the Purchaser, or when they have been handed over to the shipper to be delivered to their destination. From the time of delivery, the Purchaser is liable for all relative risks and expenses. d) A peremptory, basic term of 15 days from when the goods are made available is established for the Purchaser to collect the goods. If goods should not be collected by that term, the Supplier has the right to consider the agreement as terminated through Purchaser default with all legal consequences and the down-payment made will be retained by the Supplier as indemnity, all further damage excepted. e) In any case of cancelation of a contract, the Supplier shall be obligated exclusively to refund the payments previously cashed.
Art. 4 - Payments. - Payments are considered as made to the Supplier's place of business. The Purchaser must pay the full amount for goods invoiced to him to the Supplier directly before the products are delivered and shipped, in currency and modes agreed on. Any acceptance by the Supplier of payments made to its representatives shall not be derogation to the principle of payment to be made to the Supplier's place of business. In case of late payments, shall be applied interest and its starting date, with no prejudice to all other SA Eng Srl rights. Non payment, in compliance with contractual terms established, shall terminate all guarantee obligations for SA Eng Srl and gives it the right to demand, with no need for declaratory judgement, immediate payment of the entire amount due. The Purchaser will lose all term benefits for any bills that have not yet expired which shall thus become fully collectable by right: or immediate lawful termination of the agreement with the application of the lien clause and the Purchaser's obligation to return machines supplied.
Art. 5 - Shipments. – Shipments are made at risk and expenses of Purchaser.
Art. 6 - Testing and installation. – Machines are tested by SA Eng Srl before delivery or shipment. The Purchaser may attend at personally or through its representative. If it does not avail itself of said chance, the Purchaser unconditionally accepts the supply, guarantees established in article 8 excepted.
On request, SA Eng Srl may make its specialised personnel available for the Purchaser at its premises, at conditions established. The Purchaser must enable said specialist to carry out his job without stopping and supply him with labour, help and all means required. Furthermore, it must foresee suitable premises to take care of material and equipment's required for the installation. The fitters are provided with a weekly report that the Purchaser is required to sign.
Art. 7 - Modifications during construction. – After the order there is no obligation for the Supplier to make any modifications to products that have been built or are in progress.
Art. 8 - Guarantee. – New machinery and new equipment's are guaranteed for a maximum of twelve consecutive months (or for the agree period in case of used equipment) from delivery date through replacement or free repairs, at manufacturer's discretion, of parts found defective following tests carried out by the Purchaser. The guarantee excludes: normal wear and tear, defects due to mishandling caused by wrong treatment or non-observance and negligence by not reliable conductors to items specified in the maintenance handbook delivered with the supply, and in case of damage caused by accidents, or unauthorized modifications and applications. For parts supplied by other manufacturers, the guarantee will only be supplied within limits granted by the manufacturers themselves. Shipment cost for replacement parts under warranty, costs of labour, travel, board and lodging and daily allowance are charged to the Purchaser. The guarantee will cease if the first Purchaser should sell it to outside parties as the guarantee is specifically meant for the first Purchaser; it will also cease in a case of payment default. Replacement parts and repairs do not interrupt the guarantee period; the overall machine guarantee period is also valid for new pieces.
In none of the cases foreseen in this article may the Purchaser demand termination of this agreement or compensation for damage for the period in which the machine is not operational. Unless established otherwise in writing, no guarantee is granted on used machines; if a guarantee should be granted, any parts to be replaced will be done so using used or reconditioned ones.
Art. 9 - Taxes, duties or other charges. – Taxes, duties and other charges and all present or future expenses concerning this sale, use of goods sold, are exclusively the Purchaser's liability. Registration costs, transcription and all other expenses concerning and resulting form the agreement are the Purchaser's liability.
Art. 10 - Complaints. – Any Purchaser complaints and contentions must be notified to SA Eng Srl by registered letter within eight days of receiving the goods, under penalty of cancellation. Any compliant, protest or report on defects shall not give the Purchaser the right to stop or delay payments.
Art. 12 – Retention of title. – The seller reserves title to the Products delivered to the Buyer until the Seller receives full payment of the price of the Products. The Buyer, in pursuance of the above retention of title, shall refrain from any conduct or act, which may have the effect of impairing exercise thereof. The Buyer shall not resell, assign, pledge, nor place any lien on the Products until the price thereof has been paid in full to the Seller; the Buyer shall immediately notify the Seller any executive proceedings undertaken by third parties which regards or affects the Products. In case of infringement of the Buyer's obligations provided herein, the Seller shall be entitled to cancel forthwith any supply of the Products that has not been performed.
Art. 13 –Early termination. – Either party shall be entitled to immediately terminate these general conditions of sale, as well as any contract of sale of the PRODUCTS which has not been performed, should the other party be in material breach hereof. In particular the Seller shall be entitled to terminate this Agreement in the following cases: in the event the Buyer becomes subject to insolvency or bankruptcy proceeding or liquidation proceeding, or its financial conditions reasonably allow the Seller to assume that the Buyer will become insolvent; in the event the shares representative of the majority or the control of stock of capital of the Buyer are directly or indirectly sold, assigned, transferred or pledged or the like.
Art. 14 -Competent law. – Italian law shall be exclusively competent for any dispute arising from this agreement or due to it in any way, also in a case of continence or connection of suits with the Supplier as respondent. Even sale through drafts or bills does not change said competence.

THE PURCHASER

(stamp and signature) ……

After ample, thorough discussion, the parties declare their approval of the following clauses: Art. 1 (Proposals, confirmation, down payments), Art. 2 (Prices), Art. 3 (Delivery), Art. 4 (Payments - Early Termination clause - Seizure of pre-payments), Art. 5 (Shipping), Art. 6 (Testing and Assembly), Art. 7 (Modifications during construction), Art. 8 (Guarantee), Art. 9 (Taxes, duties and other charges), Art. 11 (Insurance), Art. 12 (Lien), Art. 13 (Privilege), Art. 14 (Competent Law even for drafts and bill).

THE PURCHASER

(stamp and signature) ……

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Appendix F-9 - Further Information and Schematics of the Drum Crusher

ROTAJET
CONTAINER WASHING

RJ-DSC

Features

- Capable of washing 210L drums
- Small footprint
- ATEX solution Available
- Efficient and safe for operators

The RJ-DSC is a fast and reliable way of increasing the mass density of your scrap drums when sending them for safe disposal. This machine has been designed to hold a 210L drum however is suitable for crushing cans and canisters of smaller dimensions.

These machines are used all over the world to crush drums, buckets and pails. The system uses a hydraulic ram to crush containers down to a maximum height of 200mm. The Ram is fitted with penetration lugs to perforate the container and allow any trapped gases to escape.

Many containers are used to transport and store hazardous chemicals. Depending on contaminates that are present it may be necessary to use an ATEX certified machine to ensure the safety of your operator.

Discharge of fluid is phased into a channel leading to a 20mm diameter pipe outlet, 200mm long at the front of the base plate. The Rotajet Drum Crushers crush the drums down to approx. 100mm to 160mm, ideal for skips or transport.

Unit 14
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ROTAJET
CONTAINER WASHING

info@rotajet.co.uk
www.drumwashing.com

(+44) 1924 271446

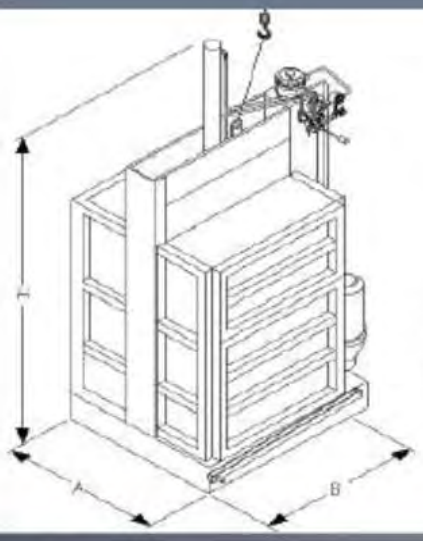
ROTAJET
CONTAINER WASHING

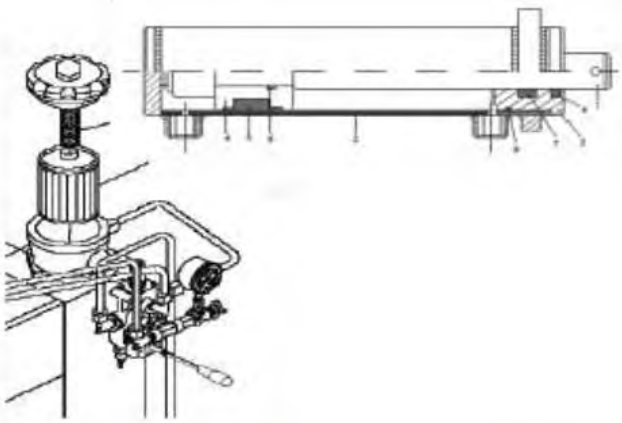
RJ-DSC - Drum Crusher

We use only high-quality components to ensure the RJ-DSC are built to handle the highest demands in the industry. We make ure that your operators are protected with all the safety features required to use and maintain the machine including safety interlocks and emergency stop circuit.

Our range includes pneumatic models with wither a 9 or 15 tonne pressing force. Each model can be manufactured to ATEX standards for use in flammable atmosphere. We also manufacture a combi drum washer and crusher for those interested in washing drums for safe disposal.

Height (H)	2300mm
Width (A)	1000mm
Length (B)	1030mm
Chamber Height	920mm
Chamber Width	650mm
Chamber Length	650mm
Force at 160BAR	15000Kgf





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