

JHMC 300CMD
WASTEWATER TREATMENT PLANT
CONSTRUCTION, SUPPLY, AND INSTALL

TERMS OF REFERENCE

23 March 2023



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CONFIDENTIAL

A. PROJECT DESCRIPTION

Camp John Hay has a natural rolling terrain which will be utilized in creating a centralized STP for new wastewater sources located in various locations within John Hay Special Economic Zone.

The project shall cover the construction, supply, and installation of the proposed John Hay Management Corporation 300 m³/day wastewater treatment plant.

Project is located at HMC Office Complex John Hay Special Economic Zone, Baguio. Project site is located where the existing septic tank which accommodates domestic wastewater from JHMC Office Cottages.

Project design and execution will be created, managed, and supervised by JHMC and Anthroserve Inc.

B. SCOPE OF WORKS

B.1. Electromechanical Works

As specified by the design documents, the contractor shall:

- a. Supply, install, test, and commission necessary power distribution from the service entrance up to the STP's motor control center (MCC) as specified by the Design Document.
- b. Supply, install, test, and commission necessary treatment plant power distribution and control from the motor control center (MCC) to each process equipment as specified by the Design Document. *See Annex A.*
- c. Supply, install, test, and commission grounding system, including lightning arrester.
- d. Supply, install, test, and commission motor starters and motor protections.
- e. Supply, install, test, and commission lighting, convenience outlets, and switches.
- f. Supply, install, test, and commission all mechanical equipment specified by the Design Document. *See Annex B.*
- g. Supply, install, and test all supports and hangers for electromechanical articles as specified by the Design Document.
- h. Supply, install, and test all electrical conduits, mechanical pipes, and fittings as specified by the Design Document.
- i. Specifications as per notes in Design Drawings

B.2. Sanitary and Plumbing Works

As specified by the design documents, the contractor shall:

- a. Supply, install, test, and commission all sanitary and plumbing articles included in the works pertinent to the wastewater transfer between process tanks, including conveyance of existing septic tank overflow to the treatment plant and effluent discharge line.
- b. Supply, install, connect, test, and commission all potable water lines including all related appurtenances but not limited to faucets, water meter, and emergency showers.

B.3. Civil and Structural Works

The contractor shall:

- a. Supply and install slope protection as necessary
- b. Conduct necessary excavation and restoration to any area of the property as per design
- c. Construct, test, and commission concrete process tanks
- d. Construction of works including the Wastewater Treatment Plant, Blower Room, and Conveyance System.
- e. Painting of EE Room / MCC Room in accordance to the design document
- f. Water proofing of all process tanks
- g. Construction specifications as per notes in Design Drawings

B.4. Others

- a. Conduct site survey and gather necessary information for the execution of the project.
- b. Obtain and secure all necessary permits for the execution of the project (e.g. building permit, construction permits, necessary LGU permits, etc.)
- c. Dismantling, hauling, and disposal of any obstacles within the project site and access to the project site.
- d. Provide construction supervision by a duly licensed engineer
- e. Provide safety officer on-site
- f. Preparation and submission of four (4) hard copies and one (1) digital copy of the Electromechanical As-Built Plans.

- g. Supply and delivery on-site of process chemicals for commissioning
- h. Utility cost (water and power) during construction and commissioning
- i. Installation of temporary power and water utilities for construction. *See Annex A for Temporary Electrical Power Layout.*
- j. Submission of equipment brochures, certification, and calibration certificates

B.5. List of Key Professionals

Key Personnel	Minimum Requirements	
	No. of Personnel	Qualifications
1 Project Manager	1	<ul style="list-style-type: none"> • Bachelor Degree in Architecture, Engineering, or Construction Management • 5-Years of Project Management Experience in Wastewater Treatment Plant Construction
2 Construction Manager	1	<ul style="list-style-type: none"> • Bachelor Degree in Architecture, Engineering, or Construction Management • Licensed Professional • 5-Years of Construction Management Experience Wastewater Treatment Plant Construction
3 Project Engineer - Civil	1	<ul style="list-style-type: none"> • Bachelors Degree in Civil Engineering • Licensed Engineer • 3-Years of Experience in General Construction
4 Project Engineer – Mechanical	1	<ul style="list-style-type: none"> • Bachelors Degree in Mechanical Engineering • Licensed Engineer • 3-Years of Experience in General Construction
5 Project Engineer – Electrical	1	<ul style="list-style-type: none"> • Bachelors Degree in Electrical Engineering • Licensed Engineer • 3-Years of Experience in General Construction
6 Safety Officer Must be certified by BWC or DOLE	1	<ul style="list-style-type: none"> • Bachelor's Degree Graduate • Safety Officer 3 Certification • 3-Years of Experience in Wastewater OSH • Completed BOSH Training with additional 48 hour OSH Trainings

C. TERMS OF PAYMENT

Works Done	Percentage
Advanced Payment	15%
Progress Billing (periodically depending on contractor accomplishment)	75% total
Retention Payment	10%

*all payments are subject to deduction of Retention Payment

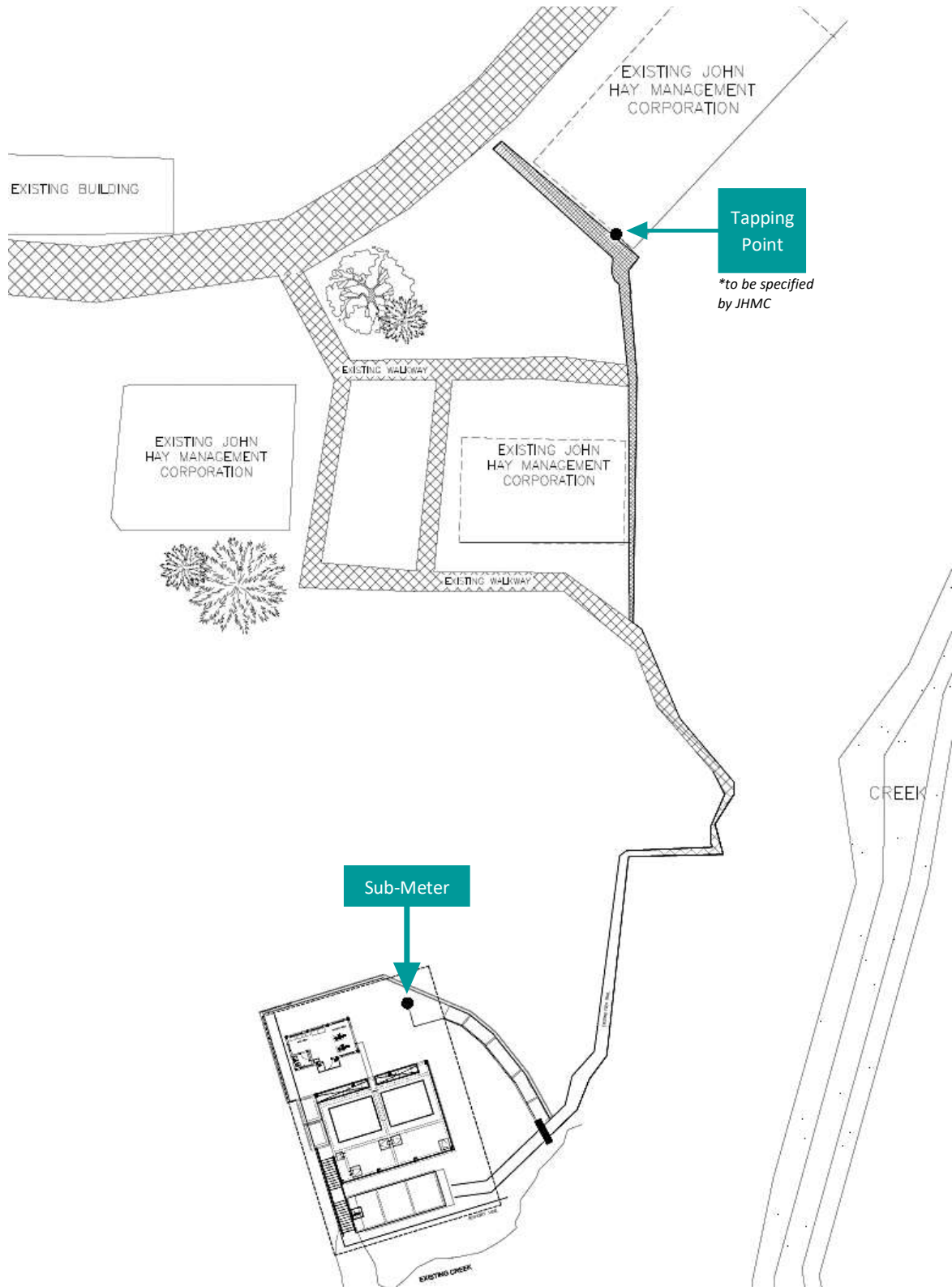
D. TERMS OF DELIVERY / COMPLETION

- D.1 Delivery schedule of materials and equipment should be with proper coordination with John Hay Management Corp.;
- D.3 . The contractor shall submit a **Program Of Work** within five (5) calendar days upon receipt of the Notice to Proceed or Award;
- D.4. The period between the program of work updates shall be every week
- D.5. Total Project Date from NTP to Construction Completion shall not exceed 180 days.

E. WARRANTY

- E.1. The contractor shall provide warranties of all structures and installations compliant to RA 9184 and its IRR.

ANNEX A
TEMPORARY POWER – ELECTRICAL LAYOUT





JHMC
Wastewater Treatment Plant
CONTROL PHILOSOPHY

JANUARY 2023



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Acronyms List

- EQT – Equalization Tank
- NRV – Non-Return Valve
- PCS – Process Control System
- PLC – Programmable Logic Control
- SBR – Sequencing Batch Reactor
- WWTP - Wastewater Treatment Plant

A. INTRODUCTION

The purpose of the document is to portray the complete scheme of process, control & operation of the JHMC Wastewater Treatment Plant (WWTP) which is designed to be automatic with minimal operator interface.

A.1 Control System

1. PLC based control system shall cater to the related inputs and outputs of the plant process stream.
2. Local control station shall be provided. It will contain the PLC, alarms and manual/auto and on/off button controls for all drives.

A.2. Operational Modes of Major Equipment

The equipment can be operated in one of the two operation modes.

1. Automatic Mode
The equipment are operated under full control of the process control system per pre-defined control system.
2. Manual Mode
The equipment are operated in manual mode through the Local Control Panel (LCP).

For all operational modes, the predefined interlocks have to be activated prior to operation to protect the system from potential mis-operation and malfunctioning.

A.3 Interlock Type

Interlocks refer to process control system (PCS) inputs or logic that will be used to control the operation of equipment. Two types of interlocks are provided- Hard Wired and Process Interlocks (Soft) to protect and ensure safe operation of drives in automatic and manual modes.

Hardwired interlocks

Hardwired interlocks are required for fundamental safety which means that these interlocks will work irrespective of mode of operation (Auto or Manual). These interlocks shall be wired directly to the circuit of the pump motor starter.

Process Interlock (Soft)

A process interlock input or logic shall be required for the normal operation of a device in the process. In manual mode, process interlocks shall be bypassed. In auto mode, all process interlocks shall be activated.

Permissive

A permissive is a special type of interlock. It is a predefined criteria which has/have to be satisfied before allowing the system to start. Once the system has been started, the permissive would become inactive. There shall be a possibility to override permissives and/or defeat them for reasons such as operational flexibility, maintenance and other unavoidable reasons.

B. GENERAL OPERATION OF THE FACILITY

The plant is a Sequencing Batch Reactor (SBR) system wherein wastewater is treated through pre-defined stages in batches. These stages are:

1. Fill-Mix
2. React
3. Settle
4. Decant

One Cycle is defined as a batch going through the four stages.

Each stage of the process is operated on a time basis. The timer should be adjustable and contain set default values. Prior to commissioning these values can be set as default:

Table 1. SBR Operations

SBR 1		SBR 2	
Stage	Time (hours)	Stage	Time (hours)
Fill-Mix	1	Fill-Mix	1
React	3	React	3
Settle	1	Settle	1
Decant	1	Decant	1

These values (i.e. number of hours and start and end times) may be changeable after commissioning for operations flexibility.

The SBR must operate using two modes: (1) **Low Flow** and (2) **Full Flow**. Note that at Low Flow mode, operating SBR must be interchangeable. Refer to the table below for a sample of the 24-hour sequence for both modes:

Table 2.1. SBR Sequence at **Low Flow** (SBR 1 and 2 should be interchangeable)

SBR Sequence		Phases	
Time Start	Time End	SBR1	SBR2
0:00	1:00	Fill-Mix	OFF
1:00	2:00	React	OFF
2:00	3:00	React	OFF
3:00	4:00	React	OFF
4:00	5:00	Settle	OFF
5:00	6:00	Decant	OFF
6:00	7:00	Fill-Mix	OFF
7:00	8:00	React	OFF
8:00	9:00	React	OFF
9:00	10:00	React	OFF
10:00	11:00	Settle	OFF
11:00	12:00	Decant	OFF
12:00	13:00	Fill-Mix	OFF
13:00	14:00	React	OFF
14:00	15:00	React	OFF
15:00	16:00	React	OFF
16:00	17:00	Settle	OFF
17:00	18:00	Decant	OFF
18:00	19:00	Fill-Mix	OFF
19:00	20:00	React	OFF
20:00	21:00	React	OFF
21:00	22:00	React	OFF
22:00	23:00	Settle	OFF
23:00	0:00	Decant	OFF

Table 2.2. SBR Sequence at **Full Flow**

SBR Sequence		Phases	
Time Start	Time End	SBR1	SBR2
0:00	1:00	Fill-Mix	React
1:00	2:00	React	Settle
2:00	3:00	React	Decant
3:00	4:00	React	Fill-Mix
4:00	5:00	Settle	React
5:00	6:00	Decant	React
6:00	7:00	Fill-Mix	React
7:00	8:00	React	Settle
8:00	9:00	React	Decant
9:00	10:00	React	Fill-Mix
10:00	11:00	Settle	React
11:00	12:00	Decant	React
12:00	13:00	Fill-Mix	React
13:00	14:00	React	Settle
14:00	15:00	React	Decant
15:00	16:00	React	Fill-Mix
16:00	17:00	Settle	React
17:00	18:00	Decant	React
18:00	19:00	Fill-Mix	React
19:00	20:00	React	Settle
20:00	21:00	React	Decant
21:00	22:00	React	Fill-Mix
22:00	23:00	Settle	React
23:00	0:00	Decant	React

At each stage, only certain equipment will operate. The rest will stop and return to their “off” state. The stages can be classified as Process Interlocks (soft) for the equipment which will not be operational.

Table 3. Operational Equipment Summary.

	SBR 1	SBR 2
Stage	Operational Equipment	Operational Equipment
Fill-Mix	Equalization Tank (EQT) Pump 1	Equalization Tank (EQT) Pump 2
	Anoxic Mixer 1	Anoxic Mixer 2
	EQT Pump Motorized Valve 1	EQT Pump Motorized Valve 2
React	Blower 1 or 2	Blower 1 or 2
	Aeration Blower Motorized Valve 1	Aeration Blower Motorized Valve 2
	PAC Dosing Pump 1	PAC Dosing Pump 2
Decant	Decant Pump 1	Decant Pump 2
	Chlorine Dosing Pump	Chlorine Dosing Pump

For the operation of the motorized valve for the EQT Pumps and the blowers, appropriate delays should be given such that the valves have already fully-opened prior to the operation of the pumps.

In case of shutdown and restart, the facility shall operate in during its intended phase at the time of restart. For example, if the SBR shuts down at 8:30AM, while it is on react stage, then restarts at 10:30AM, which is supposed to be settle stage, the SBR shall continue with the Settle stage, instead of continuing the phases that it has lost due to the shutdown.

C. CONTROL DESCRIPTION OF THE FACILITY

Table 5. Instrument List

Instrument Name	Instrument Tag	Interlock Type	Operating Level
EQT High Level Switch	I-1	Hardwired interlock	EQT level above 5.0m
EQT Low-Low Level Switch	I-2	Hardwired interlock	EQT level below recommended by pump supplier
SBR-A High Level Switch	I-3	Process Interlock	SBR-A level above 5.0m
SBR-B High Level Switch	I-4	Process Interlock	SBR-B level above 5.0m
SBR-A Low-Low Level Switch	I-5	Hardwired interlock	SBR-A level below 2.0m
SBR-B Low-Low Level Switch	I-6	Hardwired interlock	SBR-B level below 2.0m
SBR-A Low Level Switch	I-7	Hardwired interlock	SBR-A level below 3.50m
SBR-B Low Level Switch	I-8	Hardwired interlock	SBR-B level below 3.50m

C.1. Fill-Mix

During the fill-mix operation, the respective SBR tank will be receiving sewage from Equalization Tank. The sewage will be pumped by the Equalization Tank Pumps. The Anoxic Mixers inside the tank would be operational as well and would ensure proper de-nitrification while keeping the solids in suspension.

General Operating Conditions/ Permissives of Equalization Tank Pumps:

1. EQT High Level Switch is reached (level is high).
2. The respective SBR High Level Switch (I-3/I-4) is not reached (level is not high).

Table 6. Fill-Mix Interlocks.

Instrument Name	Instrument Tag	Interlock Type	Set Point	Action
EQT High Level Switch	I-1	Hardwired interlock	EQT level above 5.0m	Stop Pump Station Pump
EQT Low-Low Level Switch	I-2	Hardwired interlock	EQT level below recommended by pump supplier	Stop Equalization Tank Pumps 1, 2
SBR-A High Level Switch	I-3	Hardwired interlock	SBR-A level above 5.0m	Stop Equalization Tank Pumps 1
SBR-B High Level Switch	I-4	Hardwired interlock	SBR-B level above 5.0m	Stop Equalization Tank Pumps 2
SBR-A Low-Low Level Switch	I-5	Hardwired interlock	SBR-A level below 2.0m	Stop Anoxic Mixer 1
SBR-B Low-Low Level Switch	I-6	Hardwired interlock	SBR-B level below 2.0m	Stop Anoxic Mixer 2

In case that a pump malfunctions, the remaining EQT pump automatically runs in behalf of the malfunctioned pump.

C.2. React

During the React operation, the blower would operate and provide air to the SBR tank. In this stage, complete nitrification occurs through the continuous aeration. To maintain adequate micro-organism level, the DO is maintained around 3 ppm and the suspended solids at 3500-4000 ppm. During this phase, the blowers are operational with the respective aeration blower motorized valves.

One blower will run per react phase. However, the blower will alter daily to prolong the lifespan of each blower. For example,

Table 7. Alternating Blowers Configuration.

Day	Working Blower
1	Blower 1
2	Blower 2

In case that a blower malfunctions, the remaining blower automatically runs in behalf of the malfunctioned blower.

Dosing of PAC is active with the use of the respective PAC dosing Pump. It will start ten (10) minutes before the end of the aeration time and it will continue until the end of the React Phase.

C.3. Settle

In this phase, sludge formed during the biological process is allowed to settle to the bottom of the SBR tank. No equipment is operating at this stage.

C.4. Decant

Treated effluent is allowed to flow out of the tank during the decant stage. In the process, disinfection will take place as well via chlorine dosing. During this stage, the appropriate decant pumps will operate with the chlorine dosing pump. The chlorine dosing pump will start five (5) minutes before the decant time and continue until the end of the decant phase.

The Decant Pumps would transfer the treated water from the SBR to the chlorine dosing tank. The chlorine from the chemical storage tanks will be applied to the treated water by the chlorine dosing pumps.

Table 8. Decant Interlocks.

Instrument Name	Instrument Tag	Interlock Type	Set Point	Action
SBR-A Low Level Switch	I-7	Hardwired interlock	SBR-A level below 3.50m	Stop Decant Pump 1
SBR-B Low Level Switch	I-8	Hardwired interlock	SBR-B level below 3.50m	Stop Decant Pump 2

C.4. Summary

The table below is created for an overview of all the required interlock for the plant. This includes safety interlocks for the EQT Pump and the Decant Pump which are not part of the process.

Table 9. Overall Interlock list.

Instrument Name	Instrument Tag	Interlock Type	Operating Level	Action
EQT High Level Switch	I-1	Hardwired interlock	EQT level above 5.0m	Stop Pump Station Pump
EQT Low-Low Level Switch	I-2	Hardwired interlock	EQT level below recommended by pump supplier	Stop Equalization Tank Pumps 1, 2
SBR-A High Level Switch	I-3	Hardwired interlock	SBR-A level above 5.0m	Stop Equalization Tank Pump 1
SBR-B High Level Switch	I-4	Hardwired interlock	SBR-B level above 5.0m	Stop Equalization Tank Pump 2
SBR-A Low-Low Level Switch	I-5	Hardwired interlock	SBR-A level below 2.0m	Stop Anoxic Mixer 1 Stop WAS pump 1
SBR-B Low-Low Level Switch	I-6	Hardwired interlock	SBR-B level below 2.0m	Stop Anoxic Mixer 2 Stop WAS pump 2
SBR-A Low Level Switch	I-7	Hardwired interlock	SBR-A level below 3.50m	Stop Decant Pump 1
SBR-B Low Level Switch	I-8	Hardwired interlock	SBR-B level below 3.50m	Stop Decant Pump 2



JHMC Wastewater Treatment Plant
Design Consultancy

Process Data Sheets

JANUARY 2023





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JHMC WWTP

Process Data Sheet for Major Equipment

No.	Parameter	Specifications								
	Equipment Name	Equalization Tank Pump	WAS Pump	Decanter Pumps	Combined Blower	Anoxic Mixer	PAC Dosing Pump	Chlorine Dosing Pump	Raw Sewage Pump	Reuse Water Pump
	Equipment Tag	E-1A/B	E-5/E-6	E-7/E-8	E-2A/B	E-3AB/E-4AB	E-9/ E-10	E-11	E-17	E-19
	Type	Submersible, open-impeller	Submersible, open-impeller	Floating Decanter with submersible pump	Roots-type blower	Submersible Mixer	Positive-Displacement Pump	Positive-Displacement Pump	Submersible, open-impeller	Centrifugal, Stainless steel impeller for chlorinated water
	Fluid	Raw Sewage	Sludge	Treated Water	Air	Sewage	PAC (liquid)	Sodium Hypochlorite	Raw Sewage	Chlorinated Water
	Capacity	38.75 m3/h	0.4 m3/h	38.75 m3/h	10.57 m3/min	0.14 kN	45.75 lph	5.24 lph	38.75 m3/h	38.75 m3/h
	TDH required	6.5 m	6.5 m	5 m	6.5 m				6.5 m	20 m
	Accessories	Quick Discharge Connector, Guide Rail	Quick Discharge Connector, Guide Rail	Quick Discharge Connector, Guide Rail, VFD	Silencer, Filter, Stand or Concrete Foundation, Vibration Isolators, VFD, Discharge Pressure Gauge	Guide Rail	Y-Strainer, Air Bleeding point	Y-Strainer, Air Bleeding point	Quick Discharge Connector, Guide Rail	Foot Valve, Stand or Concrete Foundation, Vibration Isolators, Discharge Pressure Gauge
	Quantity	2 Duty	2 Duty	2 Duty	2 Duty	4 Duty	2 Duty	1 Duty	1 Duty	1 Duty
	Assumed voltage and phase in drawings	Three Phase/ 2.2 kW	Three Phase/ 0.4 kW	Three Phase/ 2.2kW/ VFD	Three Phase/ 17 kW/ VFD	Three Phase/ 1.5 kW	Three Phase/ 0.75kW	Single Phase/ 12 Watts	Three Phase/ 2.2 kW	Three Phase/ 11 kW/ VFD
	Assumed discharge size in drawings	80 mm	50 mm	80 mm	125 mm				80 mm	50 mm
	IP Rating	Submersible	Submersible	Submersible	IP 55/ IP 65 if area is susceptible to flooding	Submersible Mixer	Outdoor-Rated/ IP55	Outdoor-Rated/ IP55	Submersible	Outdoor-Rated/ IP55

Process Data Sheet for Minor Equipment

No.	Parameter	Specifications								
	Equipment Name	Manual Screen	SBR Diffuser	ASD Diffuser	EQT Diffuser	Prelim Diffusers	PAC Storage Tank	Chlorine Storage Tank	EQT Motorized Valve	Blower Motorized Valve
	Equipment Tag	E-16	E-14/E-15	E-13	E-12	E-18			V-2A/B	V-5/ V-6
	Quantity	1	54 for 7.2 m3/min	Quantity for 2 m3/ min	Quantity for 1 m3/ min	Quantity for 1 m3/ min	1	1	2	2
	Type	Fabricated Bar or Basket Screen, 15 mm spacing	12 inch diffusers Fine-bubble	Coarse-bubble	Coarse-bubble	Coarse-bubble	Vertical Cylindrical	Vertical Cylindrical	Motorized, outdoor-rated	Motorized, outdoor-rated
	Material	SS-304					UV- resistant FRP/ HDPE	UV- resistant FRP/ HDPE with PP lining		
	Fluid	Sewage	Air	Air	Air	Air	PAC (liquid)	Sodium Hypochlorite	Sewage	Air
	Volume						1.83 m3	1.26 m3		
	Accessories						Fill point, dosing pump	Fill point, dosing pump suction		

							suction connection and inverted u-vent	connection and inverted u-vent		
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Process Data Sheet for Safety and Operability

No.	Parameter	Specifications								
	Equipment Name	Buoy	Fire Extinguisher	Portable Ladder for Tank Access	Movable Lifting Davits					
	Type		ABC Type	Steel						
	Quantity	1	1	1	1					
	Capacity		10 lbs	Over 6 meters	as determined by heaviest equipment					

Process Data Sheet for Safety and Operability

No.	Parameter	Specifications								
	Equipment Name	Buoy	Fire Extinguisher	Portable Ladder for Tank Access	Movable Lifting Davits					
	Type		ABC Type	Steel						
	Quantity	5	1	1	1					
	Capacity		10 lbs	Over 6 meters	as determined by heaviest equipment					



JOHN HAY MANAGEMENT CORPORATION
300 CMD WASTEWATER TREATMENT PLANT
DESIGN CONSULTANCY

ENVIRONMENTAL MANAGEMENT PLAN
WW-20-JHMC-DC-05

20 January 2023





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A. METHODOLOGY

To develop the Environmental Management Plan (EMP), the following steps were made.



B. ENVIRONMENTAL PROPERTIES AND THEIR SIGNIFICANCE

Environmental Property	Environmental Issue	Significance	Remarks
1. LAND			
Land Use and Classification	Change/Inconsistency in Land Use	Irrelevant	Camp John Hay is a government-owned area for commercial use and government office space.
	Encroachment in Environmentally Critical Areas (ECAs)	Significant	Camp John Hay contains parks, historic places/establishments, and other recreational areas which are considered as ECAs.
Flora/Fauna	Vegetation removal and loss of habitat	Significant	Area is highly vegetated
	Threat to existence of important local species	Insignificant	No endangered species present
	Hindrance to wildlife access	Irrelevant	Not a site observation area
2. Water			
Hydrology/Hydrogeology	Change in drainage morphology	Insignificant	The natural drainage basin system will not be altered by the new sewerage system to be installed.
	Change in stream, lake water depth	Insignificant	Very small changes in water depth of nearby creek will be made.
	Reduction in stream volumetric flow	Insignificant	Flow will most likely increase.
	Inducement of flooding	Significant	Effluent will be discharged on a nearby creek. Mismanagement or accidents can result to flooding.

	Water Resource competition	Irrelevant	The nearby creek is not a source of important natural resources.
	Reduction/Depletion of groundwater flow	Irrelevant	No groundwater will be affected.
Oceanography	Change in circulation pattern	Irrelevant	No ocean or sea nearby
	Change in bathymetry	Irrelevant	No ocean or sea nearby
Water Quality	Stream Water Pollution	Significant	Mismanagement of operations or accident resulting from operations of the proposed plant can damage nearby creek.
Freshwater Ecology	Threat to abundance, frequency, and distribution of species	Significant	Effluent will be discharged to the nearby creek.
	Loss of important species	Significant	Some local species of fish are present in the area.
3. Air			
Meteorology/Climatology	Change in local climate or temperature	Insignificant	Little to no changes to temperature will be induced by the proposed plant.
	Contribution to global greenhouse gas	Significant	Sludge and sewage treatment release trace amounts of methane (CH ₄) and carbon dioxide (CO ₂).
Air Quality	Air pollution	Significant	Construction and operations of the proposed plant can increase concentrations of Total Suspended Particulate (TSP), NO _x , and other air pollutants.
Noise Levels	Noise pollution	Significant	Construction and operations of the proposed plant can increase noise levels due to the use of heavy equipment.
4. People			
Population/Demography	Displacement of settlers	Irrelevant	No settlers will be displaced.
	Right-of-way Conflict	Irrelevant	No ROW acquisition is needed.
	Presence of Indigenous People	Irrelevant	No Indigenous People residing on the area
Public Health and Safety	Health and Safety Hazards	Significant	Construction and operations of the proposed plant pose

			health and safety hazards to the public.
	Threat to delivery of basic services like food, water, and power	Insignificant	Little to no effects in delivery of basic services
	Traffic Congestion	Significant	Large vehicles and equipment are expected to move in and out of the area during construction.
Government and Others	Permits and Clearances	Significant	Permits and clearances are needed for the construction and operations of the proposed plant.

C. BASELINE OR CURRENT STATE OF THE AREA BEFORE THE PROJECT

Environmental Property	Environmental Issue	Qualitative/Quantitative Baseline
Land Use and Classification	Encroachment in Environmentally Critical Areas (ECAs)	Camp John Hay contains public parks, a butterfly sanctuary, and historic establishments like Bell House. The condition of these areas should be preserved and should not be affected by the project.
Flora/Fauna	Vegetation removal and loss of habitat	The area is covered with various trees and plants.
Hydrology/Hydrogeology	Inducement of flooding	Flooding occurs only on the area during heavy rain or tropical storm due to overflowing of the creek.
Water Quality	Stream Water Pollution	The nearby creek has a Water Body Classification of Class C based on DENR Administrative Order 2016-08.
Freshwater Ecology	Threat to abundance, frequency, and distribution of species	The nearby creek contains local fish species.
	Loss of important species	
Meteorology/Climatology	Contribution to global greenhouse gas	Very small amounts of air pollutants and greenhouse gases are assumed to be emitted in the current state of the area, mostly coming from gas emissions from vehicles of tourists and locals, and from power generators of commercial establishments.
Air Quality	Air pollution	
Noise Levels	Noise pollution	Ambient background noise can range from 45-60 dB which is the average for suburban and quiet metropolitan areas.
Public Health and Safety	Health and Safety Hazards	There are no existing health and safety hazards in the area. All construction and other projects are

		being handled properly by the Project Manager and/or Safety Officer of the corresponding project.
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The goal of the Environmental Management Plan is to prevent, mitigate, or enhance the changes that may happen to the set baseline of each environmental aspect listed in Table 2. The EMP contains the necessary actions to preserve or enhance the quality and condition of the affected area.

D. ENVIRONMENTAL MANAGEMENT PLAN

Environmental Aspect	Environmental Component	Potential Impact	Options for Prevention, Mitigation, or Enhancement	Responsible Entity/ies	Cost	Guarantee/ Financial Arrangements
1. Encroachment in Environmentally Critical Areas (ECAs)						
Construction Phase						
Mud tracking of vehicles coming in and out of the construction site	Land	Aesthetics	Provision of wash bays Regular cleaning of surroundings by Contractor's cleaners	Contractor	Part of management cost	TOR with Contractor
Oil spills or leaks from heavy equipment Washing of cement mixers Generation of other hazardous wastes	Land	Discharge of oily wastes and cement-containing residues Improper disposal of hazardous wastes	Restrict maintenance of construction vehicles and equipment onsite to prevent oil spill Provision of secondary container Properly implement Sanitation Plan for appropriate disposal of hazardous wastes Prohibit washing of cement mixers onsite	Contractor	Part of construction cost	TOR with contractor
Generation of construction debris, packaging materials, empty containers,	Land	Solid waste generation	Collection and recycling of construction wastes	Contractor	P10,000 per month	TOR with Contractor

excavated soil, and other solid wastes			To be offered to junk shops as scrap material Properly implement Sanitation Plan for appropriate disposal of solid wastes			
Operation Phase						
Sludge Generation	Land	Land Contamination	Collection and transport of generated sludge by DENR-accredited sludge hauler/treater	JHMC	Part of Operation Cost	Monitoring Reports Contract with sludge hauler
Screenings and solid waste generation	Land	Solid Waste	Implementation of solid waste management system in accordance with LGU plan and programs Establish a service-level agreement with the LGU or its approved waste hauler to ensure proper disposal of solid waste and screenings	JHMC	Part of Operation Cost	Contract with LGU/ hauler
Hazardous waste (busted lamps, batteries, empty chemical containers, used oil, etc.) generation	Land	Hazardous Waste	Require temporary HW storage area Require labeling and segregation of hazardous wastes with SDS Collection of Hazardous Waste by a DENR-recognized transporter and treater	JHMC	Part of operation cost	Contract with TSD facility HW Waste Registration ID
2. Vegetation Removal and Loss of Habitat						
Pre-Construction						

Site Clearing	Land	Removal of affected trees	Secure permit to cut/earthball trees	JHMC/ Contractor	Part of Pre-Planning Cost	Permit to cut/earthball trees
3. Inducement of landslides and other geological hazards						
Pre-Construction						
Geological Hazards and Emergencies	Land	Geological Hazards resulting from earthquakes, liquefaction, and settlement	The structural design of the project shall consider the seismic engineering design and analysis, and findings and recommendations of the geotechnical assessment	Designer	Part of Design Cost	Structural Design
3. Inducement of Flooding						
Construction Phase						
Erosion and Surface soil run-off	Water	Clogging of canals	Construction of temporary works such as silt traps, deviation channels mounting, barriers, and trenches around the stock piles	Contractor	P50,000	TOR with Contractor
Operation Phase						
Flooding due to heavy rainfall or typhoon	Water	Flooding inside STP Clogging of Sewer pipes Overflowing of nearby creek	Implement climate-proof measures on the design such as: appropriate amount and location of manholes, proper plumbing and drainage design, provision for overflow pipes on tank designs, and using design safety factor on tank sizes Riverbank protection and earth filling of	Designer/ Contractor	Part of Design Cost and Construction Cost	Sewer Conveyance Design Plumbing and Drainage Design Landscaping Plan Building Permit

			site up to current street level Planting of tress and other vegetation			
4. Stream Water Pollution						
Construction Phase						
Wastewater from worker's camps	Water	Discharge of untreated wastewater to creek	Portable toilets shall be provided to avoid contamination of nearby creek. Regular disposal shall be observed.	Contractor	P20,000 per month	TOR with Contractor
Operation Phase						
Improper discharge of wastewater which can contaminate nearby creek	Water	Water Pollution	Regular inspection and maintenance of the treatment plant STP effluent shall comply with DENR Standards for Class C water bodies Secure Discharge Permit from DENR-EMB	JHMC	P50,000 per month	Discharge Permit Self-Monitoring Reports
Reduced domestic pollution load of the river	Water	Improvement of water quality	Monitoring of water quality of creek (upstream and downstream of effluent discharge)	JHMC	P30,000 per month	Self-Monitoring Reports Effluent Laboratory Results
Accidental release of chlorine	Water	Hazardous chemical	Provision of chlorine storage facility Implementation of an emergency response plan for chlorine leak Training of workers on safety and emergency procedures	JHMC	Part of operation cost	Emergency Response Plan Employee Training Plan
5. Freshwater Ecology: Threat to abundance, frequency, and distribution of species; Loss of important species						

Construction Phase						
Activities and materials that can affect the nearby creek like cement, debris, and chemicals	Water	Loss of habitat of local fish and dying of local fish living in the nearby creek	Contractor to follow proper disposal and storage of materials used for construction	Contractor		TOR with contractor
6. Contribution to global greenhouse gas; Air Pollution						
Construction Phase						
Dust and smoke emissions from civil works and movement of vehicles	Air	Air pollution	Dust control at the stockpile of aggregates through regular water sprinkling Driving speed on unpaved roads shall be at a maximum of 25kph Avoid excavation and grading activities during periods of strong winds Schedule bulk deliveries of construction materials to avoid frequent coming in and out of vehicles	Contractor	Part of Construction Management Cost	TOR with Contractor
Operation Phase						
Odor from waste processing	Air	Odor Generation	The plant shall include an odor-control system Planting of trees around the periphery to act as buffer against potential odor	Designer/ Contractor	Part of Design Cost and Construction Cost	Plans of Odor Control System Landscaping Plan
Emission from operation of standby generator unit	Air	Air Pollution	Secure Permit to Operate from DENR-EMB	JHMC	Part of operation cost	Permit to Operate Test Result from 3 rd party DENR-accredited laboratory
7. Noise Pollution						

Construction Phase						
Increase in noise and vibration due to construction activities	Air	Noise Pollution	Proper scheduling of construction works Inform all establishments in the area about the construction schedule	Contractor	Part of Construction Management Cost	TOR with Contractor
Operation Phase						
Increase in noise and vibration due to operation of blowers	Air	Noise Pollution	Soundproofing of blower room	Designer/ Contractor	Part of Design Cost and Construction Cost	Blower Room Design
8. Health and Safety Hazards						
Construction Phase						
Threat to safety of locals and tourists	People	Health and Safety Hazards	Barricades and steel plate covers shall be provided in open excavations Warning signages and flashing boards shall be posted at excavation sites Implement construction hazard rules and regulations	Contractor	Part of Construction Management Cost	TOR with Contractor
Threat to safety of workers, employees and visitors of the project	People	Health and Safety Hazards	Wearing of PPE such as hard hats, gloves, rubber shoes, goggles, etc. will be a mandatory requirement for all. Safety signs and reminders will be posted in strategic places within the construction area Sufficient lighting shall be installed.	Contractor	Part of Construction Cost	TOR with Contractor
9. Traffic Congestion						

Construction Phase						
Traffic along nearby roads due to frequent moving of vehicles	People	Medium to heavy traffic	Develop a diversion road in coordination with the LGU Schedule deliveries of construction materials at night Deploy local traffic aides around the project site, especially during peak hours	JHMC/ Contractor	Part of Construction Management Cost	TOR with Contractor
Accidental spill of materials during hauling	People	Traffic accidents	Require haulers to cover materials with canvass	Contractor	Part of Construction Management Cost	TOR with Contractor
Operation Phase						
Transport of sludge	People	Traffic caused by sludge hauler	Schedule transport of sludge during non-peak hours to avoid causing traffic	JHMC	Part of operation cost	Contract with sludge hauler Log reports of sludge hauler
10. Permits and Clearances						
Pre-Construction						
Acquisition of clearances, approvals, and permits	People	Public concern on environmental and social impacts of the project	Conduct of Information and Education Campaign (IEC) regarding the project Inform LGU and commercial establishments in the area about the project Secure ECC, permits, and clearances from relevant government agencies	JHMC	Part of pre-planning cost	IEC Reports, Barangay and City Permits



JOHN HAY MANAGEMENT CORPORATION
300 CMD WASTEWATER TREATMENT PLANT
DESIGN CONSULTANCY

QUALITY PLAN
WW-20-JHMC-DC-05

9 February 2023



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A. INTRODUCTION

To achieve the appropriate quality of products/systems/services in a project, it is important to develop a practical and realistic Quality Plan and follow it to manage the overall project quality. In order to meet the specific requirements of the quality assurance system for this project, the contract scope of work will be planned to ensure that no significant deviations are expected during the delivery of the project. The Quality Plan also includes the types of resources to be used to deliver the contracted scope of work, including various work methods. The Consultant will also review the contract at appropriate stages of project execution in terms of timely and quality completion of all activities related to the contracted scope of work.

B. OVERVIEW

B.1. Quality Planning

The purpose of a quality management system is to establish and maintain a documented methodology that includes quality procedures, inspection and test procedures, and quality plans. Quality Management is responsible for conducting planned process audits and identifying the necessary records that must be kept to monitor performance.

B.2. Quality Audits

The purpose of quality audits is to establish procedures and responsibilities for conducting quality audits of various processes and procedures to verify that quality activities are in accordance with the quality plan and to determine the effectiveness of the quality system.

Internal quality audits are conducted according to the quality audit scheme. Deviations/deficiencies from established procedures will be recorded. These findings also include agreed corrective actions and implementation data. Actions not taken long-term will eventually come to the attention of management at the appropriate stage. Necessary follow-up measures will be initiated accordingly.

B.3. Quality System Review

The main purpose of a quality system review is to establish and maintain a quality system so that it is effective and acceptable to all. The Quality Manager is responsible for the timely checking of the quality system and taking corrective action if necessary.

Annual quality system reviews are conducted regularly with senior management of the organization to assess and verify the following:

1. Adherence to quality plans and procedures.
2. Compliance with relevant standards.
3. Effectiveness of the quality system.
4. Results of internal and external quality audits.
5. Outstanding corrective actions related to previous reviews.
6. Product and process performance (target vs. actual)

7. Customer complaints.

C. QA/QC IN DESIGN & ENGINEERING

The purpose of this procedure is to define appropriate mechanisms to ensure that the output design meets the client's requirements or meets the specifications stipulated.

C.1. Quality Planning

The Project Manager reviews the basic package of assignments received. Based on the specialty and complexity of the jobs involved, he, then, assigns the details to the concerned Design Engineer(s).

The Design Engineers then would assign the AutoCAD Operators / Draftsmen to complete the drafting work on the job. The Draftsmen (AutoCAD Operators) would work under the supervision and guidance of the concerned Design Engineer.

C.2. Design Inputs

Anthroserv ensures that the design input provided by clients as a result of awarding work is accurate and complete. The Designer Engineers check all specifications and data sheets obtained for correctness and adequacy. If there are any doubts or conflicting requirements, Anthroserv will clarify them in writing by comparing and collating all the details and Client's information available in the TOR document, Bidder's offer/proposal, and subsequent correspondence submitted prior to contract award.

Therefore, any incomplete, ambiguous, or conflicting requirements are clarified in a timely manner and the final correct specification/datasheet is prepared and provided to the Design Engineers.

C.3. Design Outputs

Designer Engineers calculate various design parameters so that the design will satisfy the client and meet the equipment requirements. In doing so, designers use all applicable standards to ensure consistency and conformance to standard specifications.

The designer warrants compliance with relevant safety standards applicable to the class of equipment being designed, even if not expressly emphasized in the customer's specifications. Whenever a critical design is involved, the design engineer puts a specification on the drawing that must be strictly controlled. A materials list and drawings prepared by the designer clarify any special instructions. All of these items are also part of the final bill of material to be submitted to the client. This document includes detailed specifications.

C.4. Design Verification & Review

All new drawings made by Draftsmen/CAD Operators are verified by a Design Engineer for correctness and the verifying authority puts signatures with a date on the drawing in the "CHECKED BY" Column. Any new Drawing after having been checked will have the approval of the Design Engineer. The Design

Engineer will sign in the "APPROVED BY" column with a date after verifying that the drawing meets the intended design requirements.

Wherever required, the Project Manager would hold a review meeting for reviewing a new design. The decisions taken at such review meetings shall be recorded in the form of Minutes of the Meeting (MOM) or other suitable measures clearly specifying the action to be taken. If felt necessary by the Project Manager, outside expert help may be sought to review a particular design aspect for which in-house expertise is not available.

C.5. Design Changes

Changes in design or drawings could be necessitated by any of the following:

1. Agreed Client's comments on the drawings/data sheets
2. Revision in process and or product specifications by the Client
3. Improvements in designs based on feedback from Filed Services on similar equipment
4. Improvements in designs necessitated by new or better materials/processes
5. Changes in design necessitated by cost-effectiveness/value engineering methods.

Any changes in the Material List, Drawings, Data Sheets, or Specifications will take effect only after the concerned Design Engineer has approved such changes. These changes are recorded on the respective documents along with the date of changes and the name of the Design Engineer/Draftsman, who is effecting these changes. The changes are identified indicating a suitable revision number. Immediately after the change has been effected, copies of the revised design documents are issued to all recipients of the original release.

D. QUALITY SYSTEM IN PROCUREMENT

After all engineering drawings and documents have been summarized, audited/reviewed, and passed various quality checks, the next critical step is procurement. The procurement process is essential for putting the right equipment in the right place and in the right system. The main steps involved in standardization and quality control in the Procurement function include the following:

1. Freezing of Technical Specifications, drawings & documentation including data sheets
2. Preparation of Bid Documents and/or inquiry documents for Vendors on impaneled list for supply or client's approved List of Vendors
3. Receipt of above Bids / Offers / Proposals and seeking clarifications
4. Techno-Commercial evaluation
5. Discussions and negotiations with the Vendor
6. Finalization of Order
7. Issuance/release of Purchase Orders on successful Vendors

The selection of a vendor for the project will be based on the project requirements and as per commitments made during the Bid stage. The selection of vendors is being met in line with the following criteria:

1. Conformance to the project requirement to meet project objectives

2. Product Quality
3. Price competitiveness
4. Delivery Schedules

Moreover, once an order is released, it becomes even more important to closely monitor the production of various stages of fabrication/ manufacture of equipment/items/materials. In this context, QC engineers play a key role in performing aspects of quality control and quality assurance at various stages of manufacturing with specific reference to inspection & testing as part of an overall Quality Assurance Plan (QAP).

E. QUALITY ASSURANCE PLAN (QAP) FOR TESTING AND INSPECTION

QAP serves as a useful tool to assure the quality of the items/materials procured and acts as a very important link between the client and the Vendor and/or Vendor's Sub - Vendor(s) / Fabricator(s). In general, QAP is an inspection procedure by all concerned aimed at streamlining the inspection of materials, items, Plant & Equipment, and various bought-outs. On the other hand, QAP, in particular, has the following main aspects associated with inspection activities:

1. Visual Inspection.
2. Dimensional Checks.
3. Review of Test Certificates / Performance Reports etc.
4. Conductance of Performance Tests as applicable or needed.
5. Pre-Dispatch instructions/advice.
6. Inspection Waiver.

The project will be brought under a very tight schedule of completion, and as a contract. In light of this, the Project Quality approach is to be defined to achieve the following objectives:

1. To Select Vendor with Repute
2. To Meet the Timeline of the Project
3. Factory Inspection of Items that are being specifically designed to meet certain process requirements.

It is assumed that the project will be having certain items/equipment which will be specially manufactured for this project based on project-specific design. On the other hand, there would be many components/ equipment, which would be taken from the manufacturer/dealer/other channel and not being designed & manufactured for this project only. This procedure is covering basic guidelines to ensure adherence to quality during manufacturing/supply of both types of project supplies.

Table 1. Proposed Inspection Requirement for Sample Major Items

No.	Item/Equipment	Inspection Req.	Contractor Role	Client/Consultant Role
1	Screens	Review of Trade Contract (TC)/Supplier; Visual Inspection at Site; Vendor Inspection and Test Plan (ITP)	Review and Approval of Documents before dispatch; Site Inspection	Site Inspection and Acceptance
2	Blowers	Review of TC/Supplier; Visual Inspection at Site;	Review and Approval of Documents before	Site Inspection and Acceptance

		Vendor ITP	dispatch; Site Inspection	
3	PLC and MCC Panels	Review of TC/Supplier; Factory Acceptance Test (FAT) at Vendor works; FAT Procedure	Review and Approval of Documents before dispatch; Joint Site Testing	Joint Site Testing
4	Submersible Pumps	Review of Compliance Certificate; Visual Inspection at Site	Review and Approval of Documents before dispatch; Site Inspection	Site Inspection and Acceptance
5	Dosing Pumps	Visual Inspection at Site; Vendor ITP	Review and Approval of Documents before dispatch; Site Inspection	Site Inspection and Acceptance
6	Cables, Valves, Pipes, and Fittings	Review of Compliance Certificate/ Copy of the TC	Document Review	Site Acceptance
7	Other Materials	As applicable	As applicable	As applicable

E.1. Inspection Procedure

Inspection procedure has been classified into the following basic four categories, details are already covered in the previous point for applicability in various items:

1. Witness final Inspection (WFI): For critical & project specific items
2. Review Test Certificates (RTC): For standard products/items being procured as bought-outs.
3. Inspection Waiver (IW): For standard products/items in regular and routine production of the manufacturer.

Subsequent to the above categorization, various Inspection codes and Inspection Requisition/Dispatch Clearance procedures are given in the next section.

E.2. Inspection Codes

Based on the above classification of the four basic categories for inspection, the various inspection codes used in the QAP as discussed in this Document are as below:

1. WFI: Witness Final Inspection
Pre-Dispatch and final Inspection of some items are conducted by Contractor or Third-Party Consultant at Vendors' works wherever applicable and agreed.
2. RTC: Review Test Certificates
Client/Client's Consultant reviews test certificates and Inspection Report(s) by Vendor's QC department and/or Contractor (in case QA inspection has been done by Contractor).
3. IW: Inspection Waiver

Vendor/UEM may dispatch certain item(s)/equipment without any Inspection. No submission of test certificates will be required in this case. This will be done as per Project Requirements & after review of T.C. if applicable.

E.3. Inspection Requisition/Dispatch Clearance Procedure

Once the inspection procedure and codes are finalized, the next step is to evolve and devise suitable plans for item tagging and formatting the various documentation involved to have a well-defined inspection program ultimately leading to the QAP as applicable to the inspection activities. The dispatch clearance shall be issued by UEM based on the review of TCs / Inspection Release Note issued by Third Party

1. Item Tag: WFI
The contractor will arrange a Third-Party/Contractor Representative for this purpose. If at any place the Client/Consultant wishes to attend any inspection, they have to inform well in advance.
2. Item Tag: RTC
UEM will submit relevant test certificates to the Client / Client's Consultant for information and review.
3. Item Tag: IW
Materials are dispatched to the Project site under this category directly.

E.4. QC/QA Documentation Formats

The following procedure will be followed for the document formats of the reports generated for the above procedure.

- a. Inspections call to Third-Party – By Email.
- b. Inspection Report – Standard Third-Party report format.

F. NON-CONFORMING PRODUCTS

The main objective of control on the non-conforming products is to have a well-defined procedure and to maintain it in order to ensure that these products are not Dispatched and installed at the project site. Such non-conforming products include various fabricated and manufactured equipment/item(s)/material(s) including bought-outs and thus system component(s)/ special assemblies fabricated at the site.

The QC department of the Contractor with the help of the Inspection Department of the Vendor identifies such non-conforming products subsequent to which proper Identification Tags are given. Such a step ensures that these items are not mixed with those, which conform to the specifications. As a next step, the non-conforming products are segregated and classified as:

- workable
- usable

In the above context, all records corresponding to the above non-conforming products and their disposal action are maintained with the Vendor, Manufacturer, and other Agencies. The non-conformity

(NC)/deficiencies observed during the stage of the product are recorded and resolved suitably. Effective corrective and preventive action is implemented for all the repetitive NCs including deficiencies.

The above checks ensure that only serviceable products are dispatched for use and installation at the Project site.

Stage Inspection by Contractor:

Contractor stage inspection Report in the form of MOM signed between the Vendor & Contractor records points of deficiency to be rectified before the next/final Inspection.

Final Inspection by Contractor/Third Party (As may be applicable):

Contractor Final inspection Report is made only after verification & acceptance of rectification as per Stage inspection MOM outlining the required rectification/corrective action.

G. STORAGE, HANDLING, PACKING, & DISPATCHES

The main purpose of the above activity is to formalize and maintain a documentary procedure necessary for safe site deliveries for the consignment for the Project. Such a procedure applies to all the equipment/materials/items and other bought-outs, as required. The following procedures are to be adopted.

G.1. For Packing

1. Suitable packing to be done for land transport
2. Suitable packing to be done for air shipment as applicable – Vendor standard packing.
3. Suitable wooden packing to be done for Sea Shipment for all loose/light structures.

G.2. For Goods Receipt Site

A Goods Receipt Note will be made after receipt of goods at the site. The Client/Consultant will be offered for site inspection. Along with the inspection call, a set of all documents related to the respective material will be attached for the consultant's quick reference. For example, in a site inspection of a pump, the following document will be given

1. Pump Vendor Datasheet & Drawing
2. Pump Compliance/Test Certificates
3. Pump Inspection Report – only in case of Effluent Transfer Pump
4. Packing List

G.2. Site Storage (For Project Electromechanical Items/Equipment)

No.	Item/Equipment	Storage
1	Metallic Items	
1.1	Carbon Steel – Unpainted/Uncoated	To be kept in a box/shed, or if stored outdoors, to be protected from direct contact with water/earth; To be cleaned before use, and duly painted/coated upon

		final installation
1.2	Carbon Steel – Painted/Coated	Can be stored outside, on the wooden plank; Should not be stored where it will be in contact with the earth.
1.3	Stainless Steel Items	Can be stored outside, on the wooden plank; Should not be stored where it will be in contact with the earth.
2	Non Metallic Pipes/Other Items	To be stored outside if suitable for sun exposure; Otherwise, should be covered to protect it from direct sun rays.
3	Instrument Items	Should be kept under a covered shed
4	Electrical Items	Those items which are suitable only for indoor application are to be stored inside the store room or inside the shed. Best efforts are to be done to maintain the original packing boxes. The Electrical Items like cables/ cable trays, etc. which are suitable for outdoors, can be stored outdoors. Any metallic items like cable tray should be kept in such a way that it is not in direct contact with the earth.
5	Major Equipment	
5.1	Pumps	Can be stored outside; any direct contact with Earth should be avoided; to be kept in original box as much as possible
5.2	Vessels	Can be stored outside
5.3	GFST tank Material	Can be stored outside in the original box
5.5	Filters	Metallic filters – can be stored outside; contact with the earth is to be avoided; Should be kept in the original box. Non-metallic filters – to be kept in a shed or to be kept covered if stored outside
5.6	Resin	To be kept under a shed; Supplier storage instructions to be followed
5.7	Air Compressor	To be kept under a shed
5.8	Blowers	Can be stored outdoors in a box or under a cover
5.9	Valves	Can be stored outdoors; non-metallic valves are to be kept under a shed
6	Loose Items	Kept under a shed or as per requirements
7	Spare Items	Kept under a shed or as per requirements
8	Others	As per requirement & suitability



JOHN HAY MANAGEMENT CORPORATION
300 CMD WASTEWATER TREATMENT PLANT
DESIGN CONSULTANCY

SAFETY PLAN
WW-20-JHMC-DC-05

9 February 2023



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A. INTRODUCTION

The safety of all workers and visitors on a construction site is of utmost importance. This safety plan outlines the measures that will be taken to minimize the risk of accidents and injuries and to ensure that the construction site complies with all relevant safety regulations. The key objectives of this Safety Plan are the following:

1. To identify and manage risks and hazards associated with the project
2. To ensure a system is implemented to properly manage emergencies and incidents
3. To ensure that communication and interfaces between stakeholders are properly managed and defined
4. To ensure worker and public health and safety are protected.

B. RISK MANAGEMENT AND COMMUNICATION

B.1. Risk Assessment

The Contractor's project management shall identify all environmental aspects and impacts as well as hazards and risks associated with the project execution prior to project commencement. This will highlight control measures to mitigate the identified impacts on the environment and the risk associated with all the activities, processes, products, and services which will be the basis of preventing accidents and incidents.

For all significant aspects and hazards, safety objectives and programs will be developed in addition to the risk assessment in the form of a Job Safety Analysis (JSA) which will be raised as may be required on the project. The JSA will be raised by the Project Manager of the proposed activity. The relevant Work Method Statement will form the basis for the JSA. After the initial draft copy is produced, the JSA will be submitted to the Client for review on the safety considerations of the specified tasks. Copies of the approved JSA's will be submitted for inclusion on the Permit to Work System and the Client as may be required.

B.2. Site Conditions

Site layout will be designed to mitigate all perceived hazards, including provision for a Material Recovery Facility, proper storage of materials and chemicals, access and egress, locations of emergency assembly area, equipment, and tools, provision of adequate lighting for dark-hours work/ occupancy and provision of suitable back-up systems.

B.3. Main Kick-off Meetings

Prior to the commencement of the main activity and larger sub-activities, a kick-off meeting will be held, which all relevant personnel (including subcontractors) shall attend. The Project Manager is responsible for the coordination of this meeting. At this meeting, the sequential operations and relevant safety risks and measures will be discussed.

B.4. Toolbox Meetings

Daily toolbox meetings will be held by supervisory personnel at each individual worksite/location before the commencement of the day/night activities so that the on-coming shift is aware of the day/night planning. Relevant safety risks and measures must be discussed. If any non-routine activities are foreseen a JSA shall be carried out and comply with the Permit to Work System.

If Supervisory personnel are leaving the project site, their replacement shall spend time with them to ensure that operations and safety-related matters are discussed and the replacement personnel are properly briefed about the activity.

B.5. Worksite Safety Meetings

To safeguard the cooperation and communication between personnel on site, regular safety meetings shall be held. These meetings are aimed at maintaining and improving safety on site. The meetings shall be organized by the Project Manager and Safety Officer. The minutes of the meeting shall be properly documented for future reference.

The following meeting subjects may be discussed, but not limited to:

1. The safety of the work and the workplace;
2. Specific point(s) raised at the project/site meetings;
3. Accidents, incidents, or near misses which have occurred;
4. Workers' feedback and concerns.

B.5. General Progress Meetings

Communication between the Client and Contractor will be conducted through regular meetings. The Contractor shall ensure that during the proposed weekly site progress meetings with site management and supervisory personnel, the standing agenda among others shall include safety matters.

Safety matters to be discussed shall as a minimum include the following:

1. Accidents/ Incidents/ Near Misses (Project statistics)
2. Health-related Issues
3. Review current performance
4. Seek ways of eliminating unsafe practices
5. Convey safety information to all personnel
6. Obtain contributions from all personnel
7. Encourage communication
8. Resolve any concerns or problems that have emerged.

B.6. Permit to Work System

An operational Permit to Work system will include, but not limited to the following:

1. Permit to Work
2. Hot Work Permit
3. Confined Space Entry Permit

4. Lock and Tag Out
5. Critical Lifting Plan
6. Scaffolding and temporary working platform

Permit shall be conspicuously posted on-site and must be updated when the need arises.

B.7. General Safe Work Practices

The Contractor shall implement safety procedures and precautions required by the Client set in the following sections.

B.7.1. General Safety Practices

1. The Contractor shall abide by all construction guidelines mandated by the Employer and other regulatory requirements.
2. The safety rules applying to their trade shall be explained to the workforce on site prior to their commencing of work.
3. Safe Working Practice shall be applied to the following areas:
 - a. Fall Protection
 - b. Excavation
 - c. Scaffolding and Safe Working Platforms
 - d. Concreting & Structural
 - e. Masonry & Formworks
 - f. Welding & Hot works
 - g. Lifting and Rigging
 - h. Machine Guarding
 - i. Electrical Power Tools
 - j. Abrasive Wheels
 - k. Demolition works

B.7.2. Personal Protective Equipment Requirements

All personnel employed on or visiting the site shall wear the approved appropriate personal protective equipment and site clothing.

1. Head Protection

Approved safety helmets must be worn at all times by all persons on site. The only exception to this rule is whilst persons are in offices, amenities blocks, and mobile plants with built-in overhead protection. All supervisors are responsible for taking appropriate steps to ensure that personnel on the site comply with this requirement.

2. Safety Footwear

Bare feet, sandals, gym shoes, thongs, or any other soft-soled shoes are not acceptable. All personnel (including visitors) must wear approved safety boots or shoes whilst on site. Workers will not be permitted to commence work if the appropriate footwear is not worn. Appropriate safety footwear is

defined as a boot or shoe with a steel toe cap and stout deep tread. If there is any doubt about this requirement, assistance or adjudication shall be sought from the Project Manager or Safety Officer.

3. Eye Protection

All personnel working on or entering the site must wear approved eye protection with side shields or prescription safety glasses with side shields as may be required. In addition, high-impact eye protection such as goggles/face masks must be worn for work such as; grinding of materials, welding or chipping, use of explosive power tools, etc.

4. Hand Protection

All personnel must wear gloves when performing manual tasks that may cause injury to the hands.

5. Clothing

Minimum clothing requirements for the site are long pants and long/short sleeve shirts (standard company uniform). Employees involved in hot work such as welding, cutting, electrical work, or exposure to any heat source, must wear as a minimum, cotton long trousers and a long sleeve shirt or the equivalent, e.g. overalls, aprons, and/or jackets.

6. Others

The use of other forms of PPE such as ear protection, respiratory protection, fall protection, etc.; will be determined through Method Statement and Job Safety Analysis.

B.7.3. Personal Protective Equipment Requirements

All personnel employed on or visiting the site shall wear the approved appropriate personal protective equipment and site clothing.

B.8. Safety Management System Review

To ensure the requirements of the contract have been implemented and effectively maintained and subject to continuous improvement, the Contractor shall observe the following:

1. Reviews of the Project Safety Management System shall be covered by the Project Management Team to ensure the systems continuing suitability and effectiveness. The initial review meeting shall be convened within three months of implementation of the Project Construction Safety and Health Program and thereafter at intervals not exceeding six months.
2. As a minimum, the scheduled review meeting attendees shall consist of:
 - a. The Project Manager
 - b. Safety Officer
 - c. Department Heads, Engineers, Superintendents/Supervisors as required

Additional attendees may be invited at the discretion of the Project Manager and/or Safety Officer as required.

3. The Review shall as a minimum address the following:
 - a. Adequacy of resources allocated,

- b. Audit results
 - c. Non-compliance and corrective actions
 - d. Adequacy of training
 - e. Suggestions for improvement.
4. The Project Manager or his nominee shall minute the review and a copy maintained on file. The minutes need not be exhaustive but shall provide an accurate record of the items discussed.

C. DUTIES AND RESPONSIBILITIES

C.1. Project Manager

The Project Manager has the overall responsibility for all safety matters on the project including the following:

1. Ensuring that all relevant safety programs, procedures/work instructions, and other safety requirements are integrated into their respective functions;
2. Ensuring that adequate resources are available to incorporate safety into their operations.
3. Ensure that all equipment on site or places of work is safe, guarded, and equipped with appropriate safety devices.
4. Ensure that periodic tests, inspections, and maintenance works are carried out in a safe and environmentally friendly manner.
5. Appraise the effectiveness of the safe working methods of all engineers and supervisors under his control.
6. Ensure that defective equipment is repaired and that dangerous equipment is removed from the site.
7. Visit their worksites to inspect safety conditions regularly, as advised by the Site Safety Engineer/Officer/Inspector.
8. Ensure that all incidents are fully investigated and that the required corrective measures are implemented.

C.2. Site Safety Engineer/Officer/Inspector

The Site Safety Engineer/Officer/Inspector is responsible for providing service and advice to the top project management of all functions and activities involving safety but not limited to:

1. Report to Project Manager to ensure that the Project Safety Plan is implemented.
2. Determine the necessary personal protective equipment, and clothing and approve safety articles to be purchased and supplied.
3. Provide a written report of inspections made on the construction site, storage areas, office, and other areas relevant to the project and subcontractor operation.
4. Lead in the investigation of accidents resulting in serious injuries and report them to appropriate the Contractor's personnel promptly.
5. Ensure employee safety awareness by conducting safety meetings, toolbox talks, or training.
6. Stop any operation or action that is judged an imminent hazard until the hazardous condition is rectified.
7. Assessing and implementing ways to improve safety on the Project.

8. Ensure that the applications of the Client's safety procedures are implemented.
9. Ensure that job site Fire Prevention Rules and Evacuation Procedures are understood.
10. Attend all safety meetings when required.
11. Keep all files or copies of important documents regarding the project's safety.
12. Submit regular safety reports to Government institutions and Clients when required.
13. Carry out inspections of Plant/Equipment in accordance with the Client's standards prior to their use on-site.
14. Check the validity and ensure maintenance of all test certificates and records.
15. Ensure that the permit system is strictly implemented prior to the start of work including a review of all countermeasures for such hazardous operations.
16. Conduct Safety Orientation training courses and regular briefing sessions with all personnel.
17. Advise and coordinate all activities and responsibilities of the personnel with regard to safety issues.
18. Monitor the frequency of Supervisor/Foreman Tool Box Meetings and advise/suggest topics for these meetings.

C.3. Foreman

1. Incorporate safety instructions in their routine orders and see that they are obeyed
2. Prevent their men from taking any undue risks to their safety and health.
3. Ensure that any necessary protective equipment is used in the correct manner.
4. Report defects in Plant/Equipment promptly to their superior.
5. Ensure that all incidents are fully investigated and that the required corrective measures are implemented.

C.4. All Employees

1. Report all incident/accident on time and make safe of the working area.
2. Use only the correct materials, tools, equipment, and methods for their work
3. Report defective Plant/Equipment promptly to their superiors.
4. Use the protective clothing and safety equipment provided in the correct manner
5. Make sure that they understand the job site and barracks Fire Prevention rules and evacuation procedures.
6. Attend safety toolbox meetings and training when required.

C.5. Sub-Contractors

Subcontractors shall participate in all relevant elements of the Project Safety Management Plan. Subcontractor staff and employee/personnel will adopt the same responsibilities noted in this document for the Contractor personnel. In addition, all subcontractors must report to one of the following on all matters relevant to the Project:

1. Any Accident /Incident including near misses
2. Waste Management
3. Permit to Work System
4. Any hazardous/unsafe condition

D. ACCIDENT AND INCIDENT REPORTING

D.1. Accident & Incident Prevention & Control

All of the following measures can make a significant contribution toward the prevention of accidents:

1. Adequate protection and guarding of working places, platforms, machinery, tools, plant, and equipment
2. Implementation of an adequate system for the maintenance and repair of plant, equipment, and tools
3. The provision of appropriate training, instruction, and information at all levels, including safety training
4. The implementation of safe systems of work and procedures
5. Provision of adequate supervision and control
6. Displaying the appropriate notices and warning signs
7. Planning, siting, and/or stacking materials and equipment to allow safe access or egress of site plant, vehicles, and equipment
8. Pre-planning and organization of site layout which will provide maximum efficiency, safety, and progression of the work sequences and operations
9. The provision of adequate resources and equipment to protect and maintain the health and welfare of all personnel
10. Producing, declaring, maintaining, and supporting a safety policy, updating it as appropriate to accommodate advancement and development
11. Bringing about and maintaining an awareness of, and compliance with, all safety legislation and information relating to systems and procedures of work.

D.2. Accident/Incident Reporting

This procedure details the requirements for managing, reporting, and investigating of incidents.

D.2.1 Definition

1. **Accident/Incident**

An incident is an unplanned event or chain of events, which has, or could have caused injury or illness and/or damage (loss) to people, assets, the environment, or reputation.

2. **Injury**

An injury such as a cut, fracture, sprain, amputation, etc. results from a single instantaneous exposure.

3. **Lost Time Accident (LTA's)**

Lost time injuries are the sum of Fatalities, Permanent Total Disabilities, and Lost Workday Cases but excluding Restricted Work Cases.

4. **Medical Treatment Case (MTC)**

A Medical Treatment Case is any work-related injury that involves neither Lost Workdays nor Restricted Workdays but which requires treatment by or under the specific order of, a physician or could be considered as being in the province of a physician. Medical treatment does not include First Aid even if a physician or registered professional personnel provides this.

5. **Near Miss**

A Near Miss is an Incident that potentially could have caused injury or Occupational illness and/or damage (loss) to people, assets, the environment, or reputation, but which did not.

6. **Permanent Disability**

Permanent Total Disability is any work-related Injury that permanently incapacitates an employee and results in termination of employment.

7. **Regular Job**

A Regular Job has not been established to accommodate an injured employee. It shall be an existing job or task within the consortium's organization, that the injured person is deemed competent to perform.

8. **Restricted Work Cases (RWC)**

A Restricted Work Case is any work-related Injury, which results in a work assignment after the day the incident occurred that does not include all the normal duties of the person's Regular Job. The restricted work assignment must be meaningful and pre-established or a substantial part of a Regular Job.

9. **Reportable Cases**

A Reportable Case is any of the following:

- a. Fatality
- b. Permanent/Total Disability
- c. Permanent/Partial Disability
- d. Lost Workday Case
- e. Restricted Workday Case
- f. Medical Treatment case

D.2.2 General Requirements

Reporting and recording of accidents (i.e. events which result in death, serious, body injury, incapacity, or requiring medical treatment or first aid and dangerous occurrences, in which specific damage to materials and/or property is sustained) shall be designed to satisfy both statutory and contractual obligation and shall apply to all lower tier subcontractor engaged on the project.

An immediate oral report shall be made to the Project Manager, Site Safety Engineer/Officer/Inspector, and Client Representative in the case of:

1. All fatal injuries
2. All serious injuries
3. All damage to plant equipment and materials, which involved a "Near-miss/Dangerous Occurrence."
4. Dangerous occurrences
5. All fires
6. Serious environmental incidents

Initial oral/verbal reports of such incidents shall be followed up by a written report within 24 hours detailing circumstances, corrective action taken, and recommendations to prevent a recurrence using the Safety report and its relevant supporting documents.

A final report shall be submitted within 72 hours. The Site Safety Engineer/Officer/Inspector shall keep records of all injuries and damage to property. At the end of each month, a general report shall be submitted to the Project Manager and the Client Representative as may be required.

D.2.3 Responsibilities for Carrying Out Investigations

The investigation of incidents shall be in line with Company's requirements.

1. Supervisor/Foreman

- a. The Supervisor or Foreman shall carry out an immediate investigation of every accident, which occurs within his area of responsibility. He shall complete an Accident Report form as soon as possible and submit it to the Site Safety Engineer/Officer/Inspector with a copy to the Project Manager.

2. Site Safety Engineer/Officer/Inspector

- a. The Site Safety Engineer/Officer/Inspector shall verify the findings of the Supervisors/Foremen and carry out an independent investigation of every serious or potentially serious Occurrence;
- b. When required, the Site Safety Engineer/Officer/Inspector shall submit his report to the Project Manager with a copy to the Client Representative as may be required within 24 hours of the incident and a final report within 72 hours.

3. Project Manager

- a. Ensure that the incident report has been properly investigated and approves the incident report before circulation to the Client.
- b. He shall arrange for Client's Administrative Officer prior to making any disclosure of incident details to proper authorities.

D.2.4 Reporting and Documentation

1. All significant accidents/incidents, which may have had significant potential, will be investigated as soon after the event as possible.
2. For some minor first-aid injuries, where the potential of the accident and the injury was minimal, the details recorded in the first-aid injury register may be sufficient without further investigation or reporting. *(NOTE: When a conscious decision is made NOT to investigate an injury/incident any further by the Project Manager and/or Safety Officer, an entry, to this effect, shall be made in the first aid register with brief reasons to support this decision.)*
3. A flowchart summarizes the accident and incident investigation and reporting process.

D.2.5 Notification of Injury or Incident

1. Fatalities shall be immediately notified to the Client, to the relevant GOVERNMENT DEPARTMENT responsible for occupational health and safety, the POLICE, the EMPLOYER, and the project insurer.
2. Injuries or incidents of a SERIOUS NATURE may require reporting to the GOVERNMENT DEPARTMENT responsible for occupational health and safety. This requirement is to be verified and the necessary details completed where appropriate.
3. Injuries or incidents of a SERIOUS NATURE shall be immediately notified to the Contractor's Project Manager, the INSURER, and the LOCAL AUTHORITY as may be required.
4. It is the responsibility of the Project Manager to ensure that the victim's family is immediately notified in the event of an employee being seriously injured or killed.

D.2.6 Incident Reporting Format

1. The first information shall be brief and to the point as to the nature and seriousness of the incident.
2. The Project Manager and/or Site Safety Engineer/Officer/Inspector shall ensure that the Contractor's Standard Incident Reporting format is used in all cases of accidents or incidents.

D.2.7 Statutory Reporting Requirements

1. All reportable accidents must be reported to the Regional Labor Office on or before the 20th day of the month following the day of occurrence of the accident using the form DOLE/BWC/OSHD-IP-6. In fatal cases, the Regional Labor Office shall be notified immediately within 24 hours after the occurrence using the fastest available means of communication.
2. The Contractor's insurance company may need to be informed of the accident for insurance claims.
3. Reportable Incidents include:
 - a. Fatal cases;
 - b. All work accidents or occupational illnesses in places of employment, resulting in disabling conditions;
 - c. Dangerous occurrences.

D.2.8 Legal Issues

1. Where an accident/incident results in criminal or litigation, access to accident/incident investigation reports may be required and entitled by other parties.
2. Access by external parties to any of the Contractor's documents must be authorized by the Project Manager.

E. CONTROLLING SIGNIFICANT SITE RISK AND OPERATIONAL MANAGEMENT

E.1. Plants and Equipment Process Control

This section details the Safety system practices and procedures established to provide an acceptable standard of plants' safety performance on the project. Some of the plants used in projects are:

1. Earthmoving plant and equipment
2. Concrete plant and equipment
3. Lifting equipment

Control of Plant:

1. A register shall be maintained for all rolling stocks detailing:
 - a. Plant Name, Model, Registration & Body number;
 - b. Manufacturer & Year of manufacture;
 - c. Certification status.
2. The Project Manager and Safety Officer shall ensure that only approved and certified plants are utilized for the operations. The plant shall be operated as specified by the Manufacturer's Instructions/Manuals ensuring:
 - a. Plant is equipped with approved rear-end markings;
 - b. Each plant is equipped with approved fire equipment;
 - c. Personnel are qualified and certified to operate/do rigging of the plant;
 - d. Loading ratings on the plant are within specified limits to prevent overloading;
 - e. Plant is operated to specified speed limits;
 - f. Under the supervision of a competent and authorized person;
 - g. In accordance with the manufacturer's and Client's requirements;
 - h. Tested and duly certified safe for its use by a third party.
3. All vehicles and mobile equipment used on the site shall be maintained in a roadworthy condition.
4. All drivers of site vehicles must be trained and experienced to drive carefully, and respect the site speed limits and other site traffic regulations as may be instigated by the Employer.
5. All persons required to drive/operate a vehicle/equipment on the site must have a current driver's license endorsed for the type of vehicle they are required to drive.
6. All site vehicles and mobile construction vehicles with restricted rear-view vision must be fitted with visual and audible devices for reversing. Passengers shall not be carried unless the vehicle is designed for that purpose.
7. Vehicle movement along populated areas shall, wherever practicable be limited to daytime hours.
8. Mobile equipment that are idle or not being operated for some time shall be moved out of the site to avoid congestion and to provide clear access to the site.
9. A traffic/signalman shall assist the operator when needed.

E.2. Concrete, Formworks, and Shoring

Some of the hazards associated with concrete installations are:

1. Failure of inadequately designed/installed forms and shoring.
2. Awkward confined workspace while forming and placing
3. Rebar, wire mesh tie wires pose punctures and cutting hazards.
4. Falling or flying concrete and grout while placing.

Pre-stressed concrete includes the use of exposed steel bars or strands with much latent energy. Safety for the installation of a finished concrete structure starts with its design. A competent Engineer shall design the formwork for all structures requiring the use of shoring and for large pours to be made at and below ground level.

1. Provide adequate bearing capacity, (a function of soil conditions), for formwork vertical support members.
2. Provide bracing of formwork lateral for loads to be imposed during form erection and pour.
3. Provide support for anchor reinforcing steel as it is installed.
4. Adequate work platforms with guardrails shall be provided for workmen during form erection. Use safety belts/body harness when platforms cannot be provided.

Failure of stressed strands or bars employed in pre-stressed concrete presents a serious hazard. Precautions to minimize this hazard are:

1. Protect strands and bars from external damage and corrosion from the time of manufacture until installation is completed.
2. Provide barriers to contain possible whip action and ban all people from the area while stressing standards and bars.
3. Prohibit welding and burning in the vicinity of strands and bars to be stressed until the concrete is set and tensioning is completed.

For placing concrete on approved forms:

1. Provide adequate means of access for equipment and men to be used for placing and finishing concrete.
2. If buckets are used for pouring, riding on the bucket shall be prevented as much as possible, however, if the need arises, fall protection for workers must be provided and shall be accompanied by a rigger during operation;
3. Electric-powered trowels, floats and vibrators shall be double insulated or grounded for operator protection.
4. Eye protection is required for labor crews placing concrete.

Removal of forms and shores shall follow the approved scheme of the structural designer. All nails, exposed tie wire, etc., are to be removed or bent over as forms are removed. Form materials shall be neatly stacked for re-use or disposal.

E.3. Site Traffic Requirements

1. All persons required to drive a vehicle on the site must have a current driver's license endorsed for the type of vehicle they are required to drive;
2. Vehicles and Equipment
 - a. All vehicles and equipment must be inspected prior to mobilization on-site.
 - b. The regular operator of each vehicle will complete the inspection checklist and then forward the completed forms to the Safety Officer. The Safety Officer will keep a register of all vehicle and equipment checklists.
 - c. All defects detected during the inspection of the regular operator shall be reported to the Safety Officer to implement necessary corrective actions.
 - d. All vehicles on-site shall be in roadworthy condition and be maintained to a standard that will ensure the vehicle is able to pass a weekly inspection.
3. Access and Public Safety around the Work Site
 - a. All project personnel shall ensure that safe access is continually monitored around the work areas adjacent to public thoroughfares and egress is maintained at all times.
 - b. Entry and exit to and from the work site shall only be via designated routes, which will be clearly signposted.
 - c. Entry/exit to the work site must be monitored to prevent unauthorized access by the public.
 - d. Speed limit for all equipment on-site will be 10 kph.

E.4. Housekeeping

1. Housekeeping is to be considered an extension of every activity on the project. Good housekeeping practices contribute to the prevention of injuries and have a positive impact on the overall project health, safety, and environment.
2. Officers shall be responsible for ensuring that vehicles and work areas within their control are maintained in a tidy and safe manner and that materials and equipment not in use are neatly stored away from the work area and clear of access ways.
3. All office, meal, and toilet facilities are to be cleaned daily. The Project Manager and the Safety Engineer/Officer/inspector are to monitor the cleanliness of all facilities during daily work routine around the site.

E.5. Electrical Equipment – Inspection Procedure

1. All portable electrical equipment including 220-volt tools and equipment and all flexible extension cords must be inspected and tagged (quarterly color coding shall be used) by a qualified electrician prior to their first use and thereafter at three (3) monthly intervals or as may be required by the Client.
2. Whenever they are subjected to the damage they will be withdrawn from service, repaired, inspected, and re-tagged;
3. All hand-held electrical equipment shall be double-insulated.

E.6. Fire Prevention and Control Measures

1. Dry Chemical Powder portable fire-fighting equipment will be provided in all site offices, sheds, and storage areas. Portable fire extinguishers shall be provided on all moving plant on the site.
2. All fire extinguishers are to be checked by a competent person on a monthly basis and a register of inspections is kept by the Project Manager or Safety Officer.
3. Smoking is prohibited in the project area.
4. Portable fire-fighting equipment must be positioned adjacent to a work area where Hot Work is being undertaken;
5. Any hot work activities shall be done only with an approved Hot work permit which shall be posted on the work area;
6. Combustible and flammable materials shall be stored properly.

E.7. Hand and Powered Equipment/Tools

1. Hand Tools
 - a. Determine and use the right tool for the job;
 - b. Inspect tools prior to use;
 - c. Make sure the tool handle is maintained;
 - d. Make sure the impact/work surfaces of tools are maintained;
 - e. Follow safe work practices;
 - f. If for use in electrical work or where the potential for contact with electrical components, insulated tools shall be required;
 - g. Use only the tools that you have been trained to use;
 - h. Wear the appropriate PPE.
2. Powered Equipment/Tools
 - a. All Tools and equipment shall be maintained in good condition and have current certificates as required by law.
 - b. Equipment shall be inspected daily before use by an operator. Formal, documented inspections of all tools are required on a quarterly basis. Copies of inspections must be made available to the Client when required.
 - c. An Equipment "red tag" program that clearly identifies equipment taken out of service due to maintenance problems or issues shall be documented. No equipment shall be used if red tagged.
 - d. PPE shall be defined for use with each class or type of powered equipment and/or tool and provided for use.
 - e. Stationary tools or grinding machines shall be securely mounted to prevent movement and/or injury.
 - f. All portable electrically powered tools need to be grounded or double-insulated to prevent electrical shock.
 - g. All pinch points and other machine hazards shall be guarded. All guards as provided by the manufacturer of the tool shall be in place at all times. No equipment shall be used or customized for work other than for its originally intended purpose.
 - h. Assured grounding program shall be in place for temporary construction power use.

- i. Ground plug must be present on all electrically powered tools unless double insulated.

E.8. Temporary Electrical Installation

1. The Philippine Electrical Code is to apply to all temporary electrical installations.
2. The following requirements shall apply to the sub-distribution system and electrical:
 - a. All portable tools, hand lamps, and other portable apparatus must be connected to the system by means of plugs and sockets. The plugs must be such that they can only be inserted in the correct outlet for any particular voltage.
 - b. All electrical tools (and other equipment) shall be maintained in a safe efficient state, in efficient working order, and in good repair.
 - c. All portable electrical tools and equipment must comply with local regulations, must be in good condition, and suitably protected against mechanical damage.
 - d. Care must be taken at all times to protect cables from damage. Damaged cables or components must be either withdrawn from service or be repaired by competent personnel.
 - e. Supplies for welding equipment must be specially arranged. The connections must be in sufficient size for the duty to be performed, properly protected against mechanical damage, and in good condition.
 - f. All electrical cables must be elevated at least 7 feet from the ground or floor or laid down away from walkways/passageways and stairways to prevent personnel from being in contact with it.
 - g. Proper grounding system shall be observed.

E.9. Hot Work

1. The major hazards associated with burning and welding operations are:
 - a. Heat and Fire
 - b. Electrical Shock
 - c. Toxic gases and fumes
 - d. Intense light, ultraviolet or infrared rays
 - e. Restricted visibility while working.
2. Hot work includes any of the following work activities:
 - a. All forms of welding
 - b. Oxyacetylene cutting
 - c. Grinding or cutting using abrasive tools
 - d. Stress relieving
3. Persons undertaking Hot Work must be accompanied by an assistant whose duties will include that of fire watcher and monitoring of the work area after the work has been completed.
4. Qualified welders only are authorized to use welding equipment.
5. In preparing for welding and burning, it shall be ensured that:
 - a. Hot work permit must be complied with prior to any hot work activities;

- b. Sparks or molten metal must not fall on people or combustible materials particularly from work at an elevated location. Warning signs must be posted for proper precautions or to secure the area with barricades. Watchmen are required when hot work is elevated.
 - c. Hot works area must be secured from any combustible materials 35 ft. in radius. If not applicable, spew water on floors or cover/ catch molten metals with a fire blanket.
 - d. Work is screened or isolated to preclude exposure of adjacent workmen to welding flash
 - e. Work is properly grounded for electric welding. Pipes containing oil, gas, or other combustible material and conduits and structures for electricity transmissions shall not be used for grounds.
 - f. Fire extinguisher is available within reach of the welder.
 - g. Work location is adequately ventilated. For welding or burning materials containing Zinc, Lead, Cadmium, or Beryllium, respirators or fresh air mask are required for poorly ventilated or confined work spaces.
 - h. Workpieces shall be properly supported for the operation to be done.
 - i. Flashback arrestor is required on gas cylinders.
6. Proper care of welding and burning equipment is a requisite for minimizing the hazards.
- a. All gas cylinders shall have their contents clearly labeled
 - b. Gas cylinders shall always be stored, transported, used, and secured in an upright position. Valve keys must be on the cylinder when not in use.
 - c. Never use grease or oil on equipment (cylinders, hoses, and torches) handling oxygen.
 - d. Oxygen shall not be used for ventilation or cooling, blowing dust, or cleaning work.
 - e. Frames of electric welding machines are to be grounded.
 - f. Welders shall check welding equipment regularly for defects or damages to the equipment and tools.
 - g. Compressed gas cylinders shall be closed and secured with protection caps except when in use.
 - h. All compressed gas cylinders must be secured in an upright position by a chain or its equivalent to prevent it from falling down. Far from any hot surface and free from any falling objects.
 - i. Do's and Don'ts on Gas cylinders:
 - i. It shall be lifted only with an approved cage.
 - ii. Don't strike fire near cylinders.
 - iii. Use appropriate equipment to transport cylinders.
 - iv. Compressed gas cylinders must be properly stored in a covered area with enough ventilation, and properly segregated and a fire extinguisher must be installed near the area.
 - v. While doing the work, welders and burners must use the personal protective equipment required for the job. Normally this will include tinted eye protection, which greatly restricts the user visibility. For this reason, thorough preparation for the job is important before starting work. Hand or power tools are frequently used in conjunction with welding and burning operations requiring additional protective equipment.

E.10. Cranes and Lifting Equipment

1. Cranes shall be inspected and duly certified by a third party prior to use and every year thereafter;
2. All persons required to operate any mobile crane or any lifting equipment shall be trained in the operation of the equipment. Only certified operators and riggers shall be assigned to crane and lifting activities;
3. All lifting equipment/gears used on the site are to be inspected daily before use by the assigned rigger. All rigging equipment shall be inspected quarterly by a competent person and must be tagged

according to the quarterly inspection and tagging program or as may be required by the Client. Unsuitable rigging equipment must not be used and disposed of off-site accordingly;

4. All critical lifts in accordance with the critical lifting procedures shall be accompanied by a permit to work system and critical lift plan as and when necessary.
5. All lifting equipment such as spreader bar, chain block, lever block, etc., must have Safe Working Load (SWL) clearly and visible on the unit.

E.11. Excavations

1. All excavations in excess of 1 meter will be barricaded at least 1 meter back from the edge on both sides of the excavation using rigid barricading. Excavations within the construction site less than 1 meter in depth shall be protected or made visible by using barricade tape.
2. If access is required to excavations deeper than 1 meter a secured ladder or steps will be provided and the excavation will be battered, stepped, or shored to prevent the collapse of any loose materials.
3. Where possible, all excavations shall be backfilled on the same day they are opened. If this is not possible, the excavation is to be barricaded using an approved system of rigid barricading, erected 1 meter back from the edge;
4. Excavation greater than 6.6 meters such as at the Inlet Pumps Station shall be shored, shielded, and protected from cave-ins/collapse which shall be designed and approved by the Structural Engineer.

E.12. Working at Heights

Persons working at heights (6 ft. or above) shall have adequate supervision and be issued with instructions to ensure safe work practices are observed.

1. All work at height shall conform to the requirements of the project requirements. Positive fall protection includes:
 - a. Scaffolding with handrails
 - b. Elevated work platforms.
 - c. Safety full body harness and static line or appropriate anchorage.
 - d. All scaffolding shall be erected under the supervision of a competent scaffolding erector.
2. Falling object protection shall be installed which shall include the following:
 - a. No simultaneous work shall be allowed as much as possible;
 - b. Isolation of working areas using barricades and warning signs;
 - c. Safety Nets installation to catch small debris;
 - d. Street cover shall be provided designed and approved by the structural engineer;
 - e. Canopy to deflect falling objects.

E.13. Scaffolding and Ladders

1. The major hazards associated with the use of scaffolding and ladders are falling men, materials, or tools.

2. Scaffolds are generally classified by the loading of work platforms as light, medium, or heavy duty with design platform loading of 25 (122), 50 (224), and 75 (366) psf (kg/m²) respectively.
3. The following requirements are applicable to all scaffold work platforms:
 - a. A guardrail shall enclose all working platforms more than 6 ft. (2m) above ground or floor level. The top rail must be installed 42" in height, a mid-rail and a toe board must also be installed.
 - b. Work platform shall be completely decked with no openings.
 - c. Adequate access to each working platform shall be provided. If ladders are used, they shall be securely tied to scaffolding.
 - d. Planks shall be fastened/secured and kept clean.
 - e. Scaffolding plan shall be provided with load computations and approved by structural engineers for more than 6 meters in height. As applicable, continuous scaffolding are to be tied and secured to the structure at least 25 ft. intervals horizontally and 25 ft. vertically.
 - f. All materials to be used for scaffolding shall be periodically inspected to confirm conditions satisfactory for continued use.
 - g. Suitable footings shall be provided to prevent uneven settlement and loading of vertical support for scaffolding.
 - h. If adjusting screws are used, they shall be installed only at baseplates. They shall never be used on scaffolds with casters.
 - i. When erecting or using rolling scaffolds, casters shall be locked in position. Personnel are not permitted on the rolling scaffold while it is being moved. Any tool or materials on the scaffold to be moved shall be removed or secured.
 - j. Straight or extension ladders shall be used at an angle of about 75 degrees with the horizontal with the top extending at least 3 ft. above the point of top support and securely tied at that point.
 - k. Personnel shall have both hands unencumbered when climbing ladders. All climbing and descending shall be done facing the ladder.
 - l. Metal ladders shall not be used in the vicinity of electrical equipment's or circuits.
 - m. When using stepladders, consideration shall be given to tying off or holding to stabilize.
 - n. Scaffolds must be plumb and level at all times.
4. Scaffolding shall only be erected by certified scaffolders. The competent person must be available on-site to direct and supervise scaffolders during the erection and dismantling of scaffolds. Competent persons shall inspect and tag all scaffolding prior to use.

E.14. Barricading and Safety Signages

E.14.1 General Guidelines

1. All imminent danger areas must be barricaded using a red "Danger Tape" identifying the reason for the barricade, the date and time of installation, and responsible supervisor and crew. These areas include the following:
 - a. Confined areas without overhead protection where there are overhead erection works.
 - b. High Voltage electrical works.
 - c. Deep excavations in the absence of physical barricades (temporary).
 - d. Accident area involving injury to personnel and property damage.

2. Permanent barricades shall surround permanent hazard areas. Gates shall be provided. Permanent warning signs shall be used to adequately mark the hazard.
3. Physical hazard areas shall be barricaded using appropriate "CAUTION" yellow tape. Personnel may go through these areas with caution after they have recognized the hazard.
4. Protective barricades provide physical protection from falling as well as serving as a warning. The barricades are generally made from wooden 2- by 4-inch material, but can be tube-log scaffold parts or 1/2-inch cable stretched tight between steel and turnbuckles. The barricade must be capable of supporting 200 pounds of force.
5. A sign must be used to provide personnel outside of a barricaded area with important safety information. The sign must be posted by the supervisor responsible for the area so that it can be read from all potential access points.
6. The swing radius of equipment will be barricaded as an imminent danger area when the superstructure is capable of rotating.

E.14.2 Wood Guardrails

1. The top rail must be made from a 2-inch by 4-inch board arranged in a manner such that the top of the 2-inch by 4-inch board is 42 inches from the floor or platform level.
2. A mid-rail made from a 2-inch by 4-inch board must be located at the midpoint between the top rail and floor or platform level.
3. A toe plate must be used on all guardrails for floor holes, floor Openings, or wall openings. It shall be made from a 1-inch by 4-inch or 2-inch by the 4-inch board, or their equivalent, and shall be installed to prevent material from passing.

E.14.3 Metal Guardrails

1. Metal handrail material for a guardrail must be 2 inches nominal.
2. The top rail must be located 42 inches from the top of the rail to the platform level.
3. The mid-rail must be 2 inches nominal size or larger and located midway between the top rail and floor or platform level.
4. A toe board made from ¼ -inch by-4-inch metal plate or its equivalent must be installed at the floor or platform level.
5. Vertical support posts must be 2-inch nominal size or larger and located at distances not to exceed 8 feet.

E.14.4 Erection of Barricades

1. The employees initiating the work are responsible for erecting the barricades around the area. All employees working inside a barricade are responsible for maintaining the barricade.
2. If employees erecting the barricade vacate the area, they shall make sure that the remaining employees know that they are now responsible for the barricade.
3. Barricades shall be 42-inches high. If proper construction stanchions are used, this height will be achieved. Barricade tape shall be tied to stanchions, not to instrument lines, valves, etc.

4. Barricades must be complete. The work area shall be entirely isolated and identified. Permanent structures that prevent entry may be used as part of the barricade. The barricaded area will be of sufficient size to afford appropriate protection. If this condition cannot be met, consideration must be given to keeping materials from falling or protruding outside of the barricaded area.
5. A barricade shall not block emergency equipment, such as fire extinguishers, safety showers, etc. Where this is not possible, provisions must be made with area personnel.
6. The blocking of a fire door with a barricade is prohibited.
7. Separate construction barricades are not required when working within a permanent barricade. However, appropriate barricade signs will be posted.

E.14.5 Road Barricades

Barricades across or next to a roadway will be semi-permanent board-ups and signs, or equivalent. Flashing lights or reflectorized materials will be required at barricades left after dark to alert vehicle traffic to their presence.

E.15. Materials Handling and Storage

1. Proper storage will reduce potential loss or damage and assist in the safe handling of materials:
 - a. Materials must be properly filed and stored which did not obstruct the access of men and equipment. Access must be free from all obstruction.
 - b. Materials must be stored off the ground by using pallets, chocks, or dunnage.
 - c. Flammable or combustible materials must be properly segregated. The storage area must have enough ventilation free from any potential ignition sources.
 - d. Segregate materials that will be needed again from scrap materials.
2. Mobile Equipment is frequently used for handling materials
 - a. When moving, materials must be secured to the vehicle.
 - b. During transportation, any overhanging materials must have tagged for easy visibility.
 - c. For heavy and bulk materials, routes of movement shall be checked for clearance and load-carrying adequacy.
3. Uncrating of Materials
 - a. Care must be exercised in removing straps or bands by using the proper tools and protective equipment.
 - b. When dismantling wooden crates, nails must be removed; bend down and lumber must be neatly stacked.
4. Safety Signages and Equipment:

Since safety signs are one of the most effective ways to prevent accidents. This must also have proper care to make this last through the projects. When it is required to put safety signs in the assigned work area, Safety signs done in standard color and dimension shall be provided.

E.16. Civil Works

1. Regular inspection, testing, and maintenance checks of the plant used on the project are performed by authorized personnel and documented in Plant Maintenance checklists.
2. Where registered laboratories perform testing the test reports shall be issued on a laboratory test report signed by an authorized signatory for the test concerned.

E.17. Work Over and Near Water

E.17.1 Safe System of Work

1. A task-specific risk assessment for work over/near water shall be conducted and reviewed periodically by a competent person.
2. All potential hazard(s) involved in the work over/near water, e.g. drowning, overturning of mobile plant/equipment into the water, and collapse in confined spaces, shall be identified, listed out, and addressed.
3. A safety plan for work over/near water, including but not limited to the following, shall be established:
 - a. Planning of work;
 - b. Formulation of method statements/safe working procedures;
 - c. Emergency preparedness, e.g. contingency plans, rescue/evacuation arrangements, and drills.

E.17.1 Safe Use of Lifejackets/Buoyancy Aids

1. Lifejackets/buoyancy aids shall be provided to and worn by workers with the risk of falling into the water.
2. Lifejackets/buoyancy aids shall conform to BS EN ISO 12402-1, 2, 3, or 4, or other equivalent international standards according to working conditions.
3. Lifejackets shall be thoroughly checked by the user before each use.
4. A lifebuoy with a sufficient lifeline (not less than 30 meters) shall be provided and the locations of the lifebuoys shall be at less than 50-meter intervals along the edges of places where work is being carried out overside or in an exposed position on vessels where there is a reasonably foreseeable risk of falling or being washed overboard. To avoid any delays to rescue operations, lifebuoys shall not be tightly tied to posts.
5. At least one life-saving skiff shall be immediately available at locations where employees are working over or adjacent to water.

E.18. Dismantling/Demolition Works

The Contractor shall ensure that only qualified employees shall be involved in demolition works. All employees not involved in dismantling and/or demolition works shall be protected from exposure to falling materials, flying debris, and other hazards by isolating and controlling access to all affected areas. Dismantling and/or demolition and clearing activities shall be conducted only after appropriate work controls have been identified and implemented.

A qualified supervisor shall be liable at work sites during all activities. Proper personal protective equipment shall be used and properly maintained. If outside contractors are used, the company shall ensure all Consortium employees have been properly trained and have been issued proper equipment and protective gear.

Hazard Controls:

1. Prior to permitting employees to start demolition works, an engineering survey of the structure shall be made to determine the condition of the framing, floors, walls, and the possibility of an unplanned collapse of any portion of the structure. A demolition methodology shall be prepared to ensure that no accident or damage to the equipment shall take place.
2. All electric, gas, water, and other service lines shall be shut off, capped, or otherwise controlled outside the lines before demolition is started. If it is necessary to maintain any power or other utilities during demolition, such lines shall be temporarily relocated or protected.
3. It shall be determined if any hazardous chemicals, gases, explosive flammable materials, or dangerous substances have been used in any pipes, tanks, or other equipment on the property. When any such substance is apparent or suspected, testing and purging shall be conducted to eliminate hazards before demolition is started.
4. All personnel involved in demolition works shall wear all required personal protective equipment.
5. Mechanized equipment and tools that shall be used in demolition works shall be checked for good condition. Defective equipment shall be removed from service and repaired only by qualified mechanics/electricians.
6. Only those persons in the demolition works shall be permitted in the area at any other time.

F. SPECIFIC MANAGEMENT TO SAFETY REQUIREMENTS

F.1. Pre-Task Activities

1. Work shall be secured with an approved Method Statement (MS) and Job Safety Analysis (JSA)/Hazard Identification Risk Assessment (HIRAC) prior to execution. This will be the prerequisite for a Permit to Work (PTW) prior to approval.
2. Permits and other Legal requirements, as needed, shall be provided and be part of PTW as well.
3. PTW shall be secured as stated by the Construction Safety and Health Program. Strictly "NO PTW NO WORK" shall be implemented.
4. All necessary inspections of tools and equipment to be used must be done by competent personnel. No tools/equipment shall be allowed to use without inspection.
5. Emergency equipment such as a fire extinguisher and First aid kit/station must be provided on site premises as a minimum requirement.
6. Prior to the commencement of work the Engineer/Supervisor together with the Safety Personnel shall discuss the MS & JSA/HIRAC with all personnel involved prior to deployment.
7. Toolbox Talk shall be done on a daily basis by the Engineer/Supervisor of the activity to ensure that all necessary precautions including checking of necessary PPE and pre-used inspection of tools/equipment.

F.2. Dewatering Works

1. Work shall be done by authorized personnel/team with the supervision of the Engineer/Supervisor/Lead Man.
2. Isolation by means of a physical barricade shall be installed to define boundaries of activity control the jobsite to unauthorized personnel.
3. Location of dewatering equipment must be located on a strategic location.
4. All access must be free from any obstruction at all times.
5. All necessary PPE must be worn at all times. Damaged and wearing PPE must be prohibited.
6. The engineer/supervisor must ensure that no drainage will be clogged during the course of the activity. In case a nearby inlet will be affected, necessary protection must be in place.
7. Excessive overflowing and/or flooding must be mitigated immediately.
8. Provision of necessary lighting shall be provided during night time.
9. The safety personnel must conduct a regular inspection to ensure full compliance.

F.3. De-sludging Works

1. Work shall be done by authorized personnel/team with the supervision of Engineer/Supervisor/Lead Man.
2. Isolation by means of a physical barricade shall be installed to define boundaries of activity control the job site to unauthorized personnel.
3. Location of dewatering equipment must be located in strategic location.
4. All access must be free from any obstruction at all times.
5. All necessary PPE must be worn at all times. Damaged and wearing PPE must be prohibited.
6. Traffic Management shall be implemented in accordance with the approved traffic management plan to prevent congestion of equipment/vehicles within the site premises.
7. Loading points must be identified to minimize sludge/mud on road pavements.
8. All hauling trucks must be inspected to ensure covers are in place and wheels were free from sludge/mud prior to dispatching. Necessary permits/clearance must be checked to ensure compliance.
9. The provision of necessary lighting shall be provided during nighttime.
10. The Safety personnel must conduct a regular inspection to ensure full compliance.

F.4. Bored Piling Works

1. During boring operations and final depth checking, only the drilling team shall be allowed to go to the vicinity of the equipment.
2. Personal Protective Equipment (PPE) such as a hard hat, safety boots/ shoes, etc. shall be provided at all times during the course of the operation.
3. The lifting connections shall be adequately checked to ensure a proper and safe hoisting operation.
4. Personnel shall maintain a safe distance from the lifting zone until the steel cage is set near the bored pile shaft
5. The Site supervisor shall be at the site to direct the hoisting and installation of the tremie pipes.
6. The lifting hooks shall be checked constantly.
7. Transit Mixers shall be guided in the direction of the prepared platform for the concreting operations.
8. No personnel shall be allowed to stay around the approach route of the Transit Mixers near the bored pile shaft.

F.5. Anchoring Works

1. During the operations and final depth checking, only the drilling team shall be allowed to go to the vicinity of the equipment.
2. Personal Protective Equipment (PPE) such as hard hat, safety boots/ shoes, etc. shall be provided at all times during the course of the operation.
3. The lifting connections shall be adequately checked to ensure a proper and safe hoisting operation.
4. Personnel shall maintain a safe distance from the lifting zone.

F.6. Confined Space

1. When work is to be performed in a confined space, or area, which has limited means of access and egress and restricted natural ventilation the appropriate precautions shall be taken to ensure that employees are not put at risk.
2. All work performed within a confined space must be covered by a permit to work.
3. Breathing apparatus shall be worn unless a competent person has certified that the area is adequately ventilated, that no substances are present that will generate dangerous fumes, and that the atmosphere has been tested and cleared of dangerous fumes and oxygen deficiency immediately prior to an entry.
4. No spraying, painting, or coating of substances hazardous to health is to be undertaken in any confined space unless adequate precautions are in place to eliminate the health risk.
5. No smoking, naked lights, torches, arcs, flames, or other sources of ignition is to be allowed within a confined space unless the atmosphere has been tested and proven safe.
6. Adequate means of access and egress shall be provided for all confined or enclosed spaces.
7. Watchers must be present at all times during the course of confined space activity. He/ she must have established good communication with the team inside.
8. The Safety personnel must conduct a regular inspection to ensure full compliance.

F.7. Pipelaying Works

1. Work shall be done by authorized personnel/team with the supervision of Engineer/ Supervisor/Lead Man.
2. Isolation by means of a physical barricade shall be installed to define boundaries of activity control the job site to unauthorized personnel.
3. Spotters shall be provided to guide operators during the course of the activity.
4. Pipe laying crew must establish a safe distance on all moving equipment. Communicating to the spotter /operator first when personnel will go near the equipment. All equipment must be in full stop safety lock engaged during this time.
5. All lifting works must be in compliance with the Construction Safety & Health Program.
6. Trench/ Excavation must be inspected by the in charge at least once a day.
7. Trench/ Excavation shall have at least one (1) ladder in every 16.6 m. (50 ft.) of length or fraction thereof, of a length, which shall extend at least 0.83 m. (2'6") above the top of the excavation to provide a firm handhold when stepping on or off the ladder.

F.8. Post Task Activity

1. Housekeeping must be done before leaving the site premises.
2. Upon completion of each shift site engineer/ supervisor must turn over the areal balance works to the next shift in charge.
3. Closed out/renewal of PTW shall be done by the engineer/supervisor in charge and must be submitted to the Project Manager or Safety Officer for proper filing.

G. FIRST AID AND EMERGENCY RESPONSE

G.1. First Aid

In case of an accident on the site, the initial response will be the responsibility of the Contractor. For this response the following resources should be available:

1. First aiders;
2. First Aid box(es);
3. Stretchers;
4. Emergency rescue vehicle as may be required.

G.2. Overall Emergency Response

The Contractor should provide a work instruction named "Emergency Response". This Work Instruction should include clear instructions which should be posted at strategic locations on the project accompanied by emergency telephone numbers. Planning for emergency situations is an important part of Safety Management. Provision of efficient response in the event of an emergency is only possible with good planning and preparation.

Emergency arrangements should be identified to provide a working place with clear instructions and information on the actions to be taken in the event of an emergency in order to minimize injury, loss, or damage to:

1. Personnel;
2. Property/equipment;
3. Environment.

As the project develops, Emergency Response arrangements shall be set up for each separate working location. Telephone numbers will also be included on the project telephone list. Emergency Drills will be carried out to ensure envisioned response arrangements are efficient and reliable.

An emergency situation occurs whenever one of the following questions is answered with "yes":

1. Are there any fatalities?
2. Is the situation (potentially) life-threatening?
3. Has serious environmental damage occurred or is it likely to occur?
4. Is the situation (potentially) sensitive to the press and/or public opinion?
5. Has serious damage to the plant occurred or is it likely to occur?

G.3. Emergency Contact List

The following telephone numbers, as a minimum, must be displayed for project employees and visitors to handle emergency situations efficiently:

1. Project Manager
2. Safety Personnel
3. Health personnel (doctor, nurse, etc.)
4. Ambulance
5. Police
6. Fire-brigade
7. Hospital
8. Client
9. Relevant authorities

The emergency contact list shall be distributed over the various project locations (office, workshop, etc.) and placed with great visibility on strategic positions. The Project Manager will ensure that employees are familiar with the emergency contact list and that the document is updated when needed.

The Project Manager will ensure that local authorities are aware of the Project's existence. Furthermore, he will arrange communication lines with emergency services and make preparatory arrangements for emergency situations.

G.3. Evacuation Plan

If the Project Manager or his delegate indicates the need for an evacuation, the Project Emergency Response Team will initiate evacuation based on Contractor's existing standard Emergency Preparedness and Response Procedure and established resources.

G.3. Injury Management

All injuries must be managed from the time of reporting. This is the joint responsibility of the project management team, the respective safety personnel, and the immediate supervisor of the injured employee.

G.3. Return to Work Plan

The Return-to-Work plan includes, but is not restricted to:

1. Provided it is safe and practicable to do so and is consistent with professional medical advice, any injured or ill person is to be returned to work in the shortest possible time,;
2. If this is not possible, the injured person will be returned to a suitable alternative or selected duty that does not jeopardize his/her well-being;
3. All personnel are required to assist the project management team in meeting these responsibilities, this includes where practicable the requirement to immediately report all injuries to their immediate supervisor;

4. The project management shall assist the project personnel to their home for rehabilitation in such a case of injury (once the employee has returned to their home (city or province), the project manager will designate a staff member to keep in contact and monitor the employee's rehabilitation).

H. PROJECT SAFETY ORIENTATION

H.1. Workers

1. All persons required to work on the project shall attend a project pre-start safety orientation. The orientation Coordinator shall be trained to the required level of competency to deliver the required safety training;
2. A project orientation based on the specific contractual requirements will be established for the project. All personnel, who work on the project full-time, must complete this orientation prior to commencing on-site. The Safety Officer or his nominated representative will conduct all orientation training.
3. The project orientation training will cover all relevant safety matters which will address all relevant aspects from the following:
 - a. Contractual requirements
 - b. Legislative requirements
 - c. Client's safety policy
 - d. Identified Environmental Aspects and Hazards, Risk Assessment, and Controls;
 - e. Permit to Work System
 - f. Project House Rules and Procedures;
 - g. Personal Protective Equipment importance and its limitations;
 - h. Housekeeping.
4. A record of persons completing an orientation session shall be recorded on the safety orientation register by the person delivering the training and kept or filed by the Project Manager or Safety Officer.
5. All personnel attending a project safety orientation will sign an orientation acknowledgment form to confirm his or her understanding of the project safety requirements.

H.2. Visitors

All visitors to the project must notify the Client and/or Contractor prior to arrival. On arrival, all visitors must report to the main gate/entrance and shall undergo a visitor safety orientation. Visitors must remain in the company of the person they intend to visit for the duration.

I. MONITORING AND REVIEW

I.1. Inspection

The purpose of safety inspections is to monitor and ensure compliance with the site safety rules and regulations and relevant authority requirements. Prior to the start of the project, the PM (or nominated

staff) or Safety Officer will inspect the work area and all equipment by means of the safety checklist. Approved forms shall be used when necessary during safety inspections.

I.2. Safety Audits

Safety audits will be carried out on a monthly basis in order to ensure that all activities performed are in compliance with the procedures including regulations and permits.

The results of these audits together with the regular workplace inspections will be used in the overall evaluation of the project's safety and environmental performance. Both audits and inspections will be logged in the Safety Management Register.

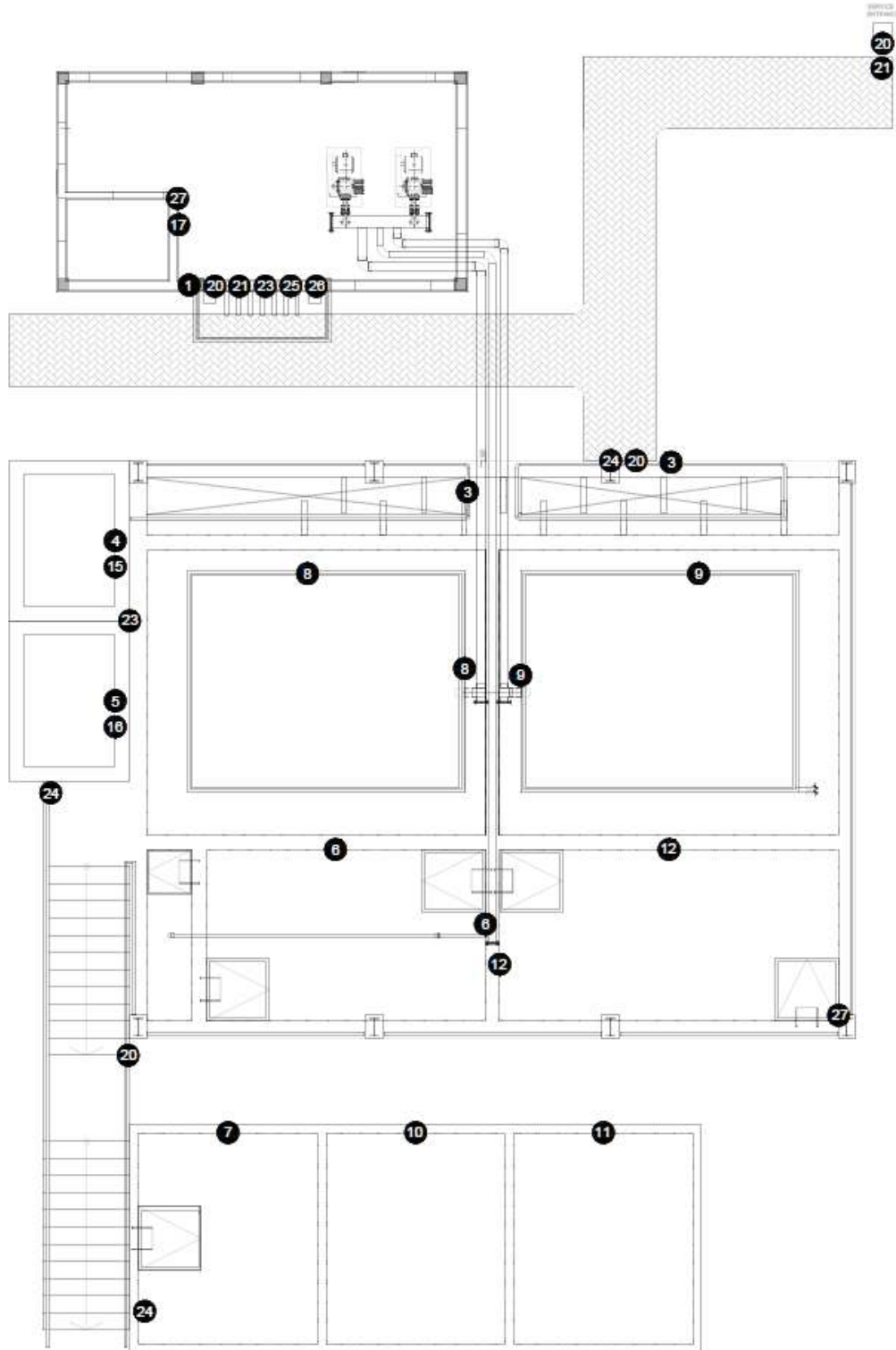
I.3. Safety Plan Review and Revision

This safety plan shall be reviewed on a regular basis throughout the project to ensure its effectiveness. The review meeting should be attended by the following:

1. Project Manager
2. Safety Officer/Engineer/Inspector
3. Contractor supervisors/engineers, and other employees as needed

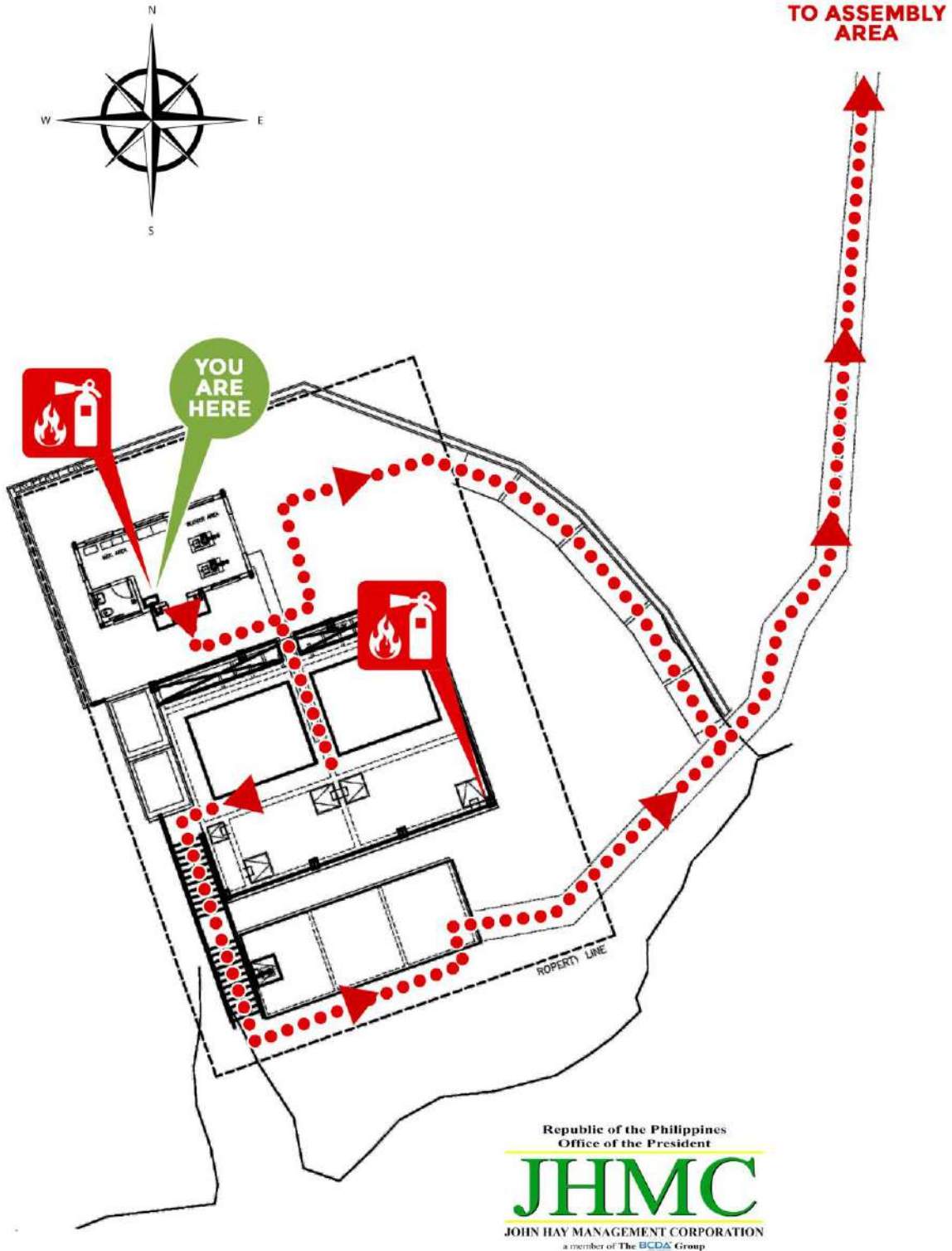
This Safety Plan shall be revised when it is needed and once a thorough review was done. The new/revised Safety Plan shall be implemented immediately once approved.

ANNEX A SAFETY SIGNAGES LOCATION



#	Signage	Material	Size (cm)	Qty	Installation Location
1	Control Room	Sintra Board	40x10	1	Indoor
2	Effluent Sampling Point	Acrylic	60x30	2	Outdoor
3	Chlorine Contact Tank	Acrylic	60x30	2	Outdoor
4	Chlorine Tank	Outdoor Sticker	60x30	2	Outdoor
5	PAC Tank	Outdoor Sticker	60x30	2	Outdoor
6	Equalization Tank	Acrylic	60x30	2	Outdoor
7	Pump Station	Acrylic	60x30	1	Outdoor
8	SBR Tank 1	Acrylic	60x30	2	Outdoor
9	SBR Tank 2	Acrylic	60x30	2	Outdoor
10	Septic Tank 1	Acrylic	60x30	1	Outdoor
11	Septic Tank 2	Acrylic	60x30	1	Outdoor
12	Sludge Holding Tank	Acrylic	60x30	2	Outdoor
13	Hazardous Waste	Sintra Board	50x30	2	Outdoor
14	Methanol	Outdoor Sticker	50.5x30.5	2	Outdoor
15	Chlorine	Outdoor Sticker	50.5x30.5	2	Outdoor
16	PAC	Outdoor Sticker	50.5x30.5	2	Outdoor
17	Process and Instrumentation Diagram	Sintra Board	75x50	1	Indoor
18	Potable Water	Sintra Board	40x10	1	Indoor
19	Sludge Treatment	Acrylic	40x10	1	Outdoor
20	PPE Area	Acrylic-Reflective	50.5x45.5	4	Outdoor
21	Restricted Area	Acrylic-Reflective	50.5x30.5	2	Outdoor
22	Smoking Area	Acrylic-Reflective	40x10	1	Outdoor
23	No Smoking	Acrylic-Reflective	50x30	2	Outdoor
24	Watch Your Step	Outdoor Sticker - Reflective	50x30	3	Outdoor
25	Electrical Hazard Authorized Personnel Only	Acrylic-Reflective	50.5x35.1	1	Indoor
26	Fire Exit	Acrylic-Luminous		1	Indoor
27	Fire Extinguisher	Acrylic-Reflective	20.8x28	2	Outdoor

ANNEX B EVACUATION PLAN





JOHN HAY MANAGEMENT CORPORATION
300 CMD WASTEWATER TREATMENT PLANT
DESIGN CONSULTANCY

SANITATION PLAN
WW-20-JHMC-DC-05

9 February 2023





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A. Purpose

The purpose of this plan is to outline the steps that will be taken to ensure proper sanitation and hygiene on the construction site. This plan is designed to protect the health and safety of all workers, as well as to prevent the spread of illness and disease.

B. Scope

This plan applies to all workers on the construction site, as well as to any visitors or contractors who may be present.

C. Responsibilities

The Project Manager and/or Safety Officer will be responsible for implementing and enforcing this plan. All workers will be responsible for following the guidelines set forth in this plan, and for reporting any concerns or violations to the site supervisor.

D. Handwashing Stations

Handwashing stations will be placed at strategic locations throughout the construction site, including near the entrance, in common areas, and near restrooms. These stations will be stocked with soap, water, and paper towels at all times, and hand sanitizer will also be available for use. Signs will be posted near handwashing stations to remind workers to wash their hands frequently.

E. Restroom Facilities

A minimum of two restrooms will be provided on the construction site, located in convenient locations for all workers. Restrooms will be cleaned and restocked with toilet paper, soap, and paper towels at least twice daily. Signs will be posted in restrooms to remind workers to wash their hands after using the facilities.

Restrooms shall be temporarily connected to the existing septic tank during the course of the construction period.

F. Waste Management

A designated area will be set up for the storage of construction debris and any hazardous materials. This area will be clearly marked and easily accessible to workers. Hazardous materials will be stored in appropriate containers and labeled according to safety guidelines. Waste materials will be disposed of in a responsible manner, in accordance with all applicable regulations. Proper storage and disposal of each type of waste is summarized in the Appendix.

G. Personalized Protective Equipment (PPE)

All workers will be provided with appropriate PPE, including gloves, masks, and goggles, as needed for the tasks they are performing. Workers will be trained on how to properly use and care for their PPE. PPE will be inspected regularly to ensure that it is in good condition and fit for use.

H. Cleaning and Disinfection

High-touch areas, such as handrails, doorknobs, and surfaces in common areas, will be cleaned and disinfected at least twice daily. Disinfectant products will be used according to the manufacturer's instructions. Workers will have access to disinfectant wipes, and will be trained on how to use them properly.

Cleanliness standards:

- Restrooms must be cleaned and stocked with soap, paper towels, and toilet paper at least twice a day, in order to maintain a hygienic and pleasant environment for all users.
- Lunchrooms must be kept clean at all times, with tables and countertops wiped down after each use, in order to promote a healthy and safe eating environment.
- First aid stations must be kept clean, organized, and fully stocked at all times, in order to ensure that they are ready for use in case of emergencies.
- All other areas of the construction site must be kept free of debris and clutter, in order to reduce the risk of accidents and injuries.

Cleaning schedule:

- Restrooms: Cleaned and stocked every morning and afternoon.
- Lunchrooms: Wiped down after each use.
- First aid stations: Checked and organized daily.
- Other areas of the construction site: Kept clean and clutter-free at all times.

I. Communication

This plan will be communicated to all workers and posted in a visible location on site. Workers will know how to report any concerns or violations of the plan to the site supervisor. Regular meetings or training sessions will be held to review the plan and address any questions or issues.

J. Training

All workers will receive training on proper hygiene practices, including handwashing and the use of PPE. Visual aids, such as posters or videos, will be used to reinforce the importance of good hygiene on the construction site.

K. Implementation

This plan will be put into effect immediately upon approval. A supply closet will be designated for storing cleaning supplies and equipment, and a list of necessary items will be compiled and kept up to date.

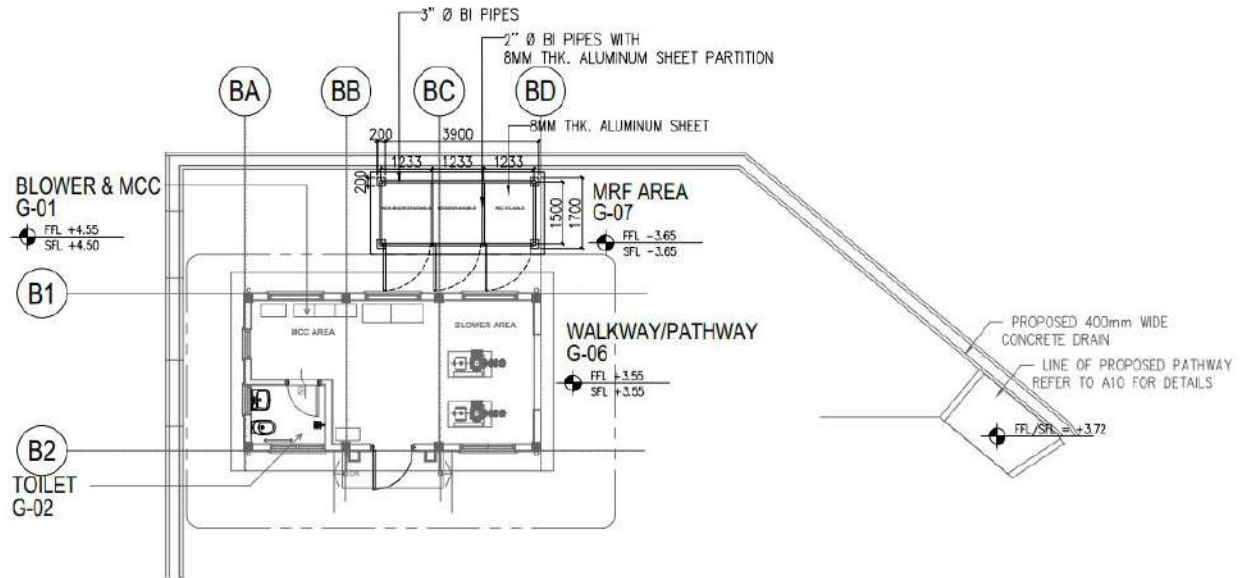
L. Monitoring and Evaluation

The Project Manager and/or Safety Officer will conduct daily inspections of the construction site to ensure that the plan is being followed and that all areas are being kept clean and safe. Any issues or concerns regarding the cleanliness of the construction site should be reported to the Project Manager and/or Safety Officer. The plan will be reviewed and updated as needed to ensure its effectiveness in maintaining the highest standards of cleanliness and safety on the construction site.

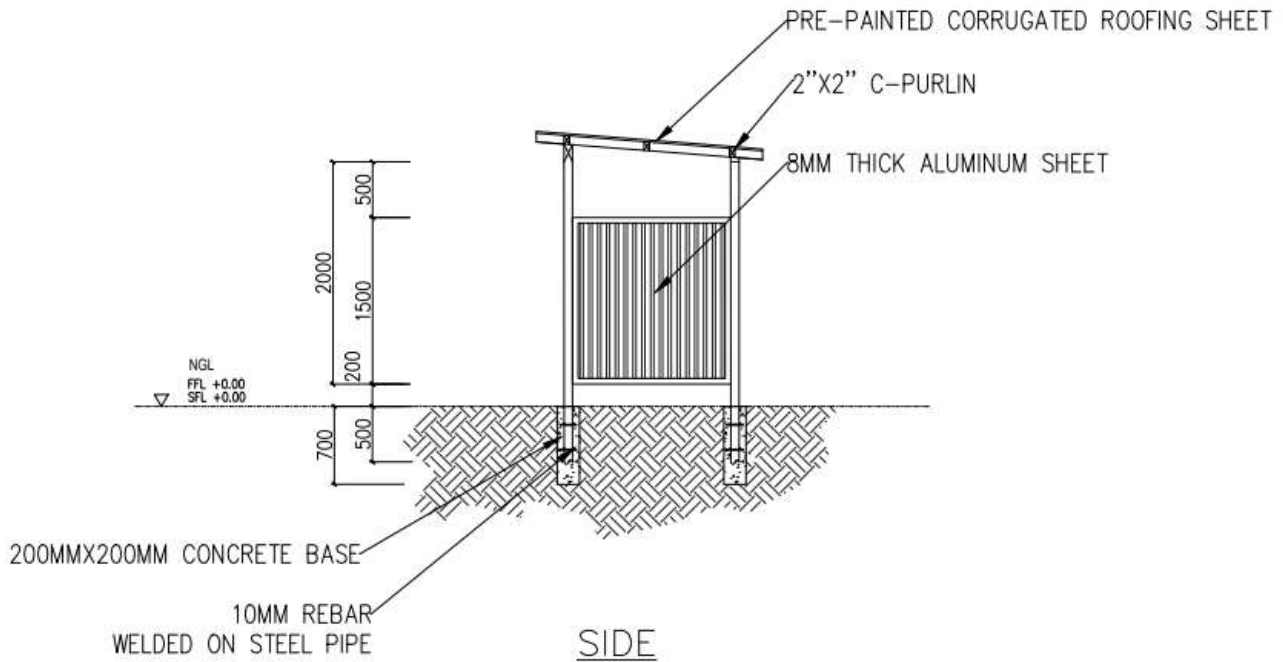
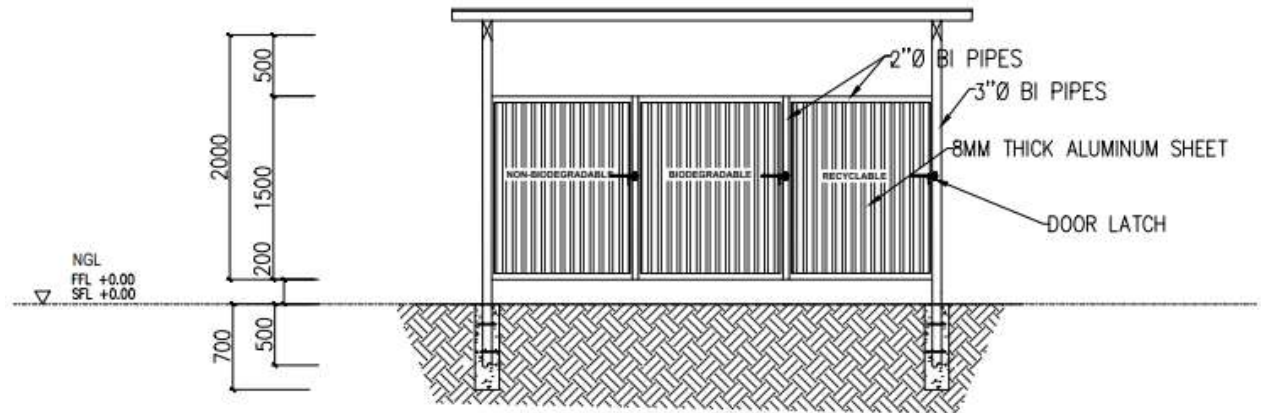
Waste type	Source	Collection/Storage Procedure	Disposal Procedure
Construction Debris	Construction Activities	Construction debris should be properly sorted into the following: wood, metal, brick, cardboard, and concrete, and then stored in designated areas on site.	Follow the LGU's protocol regarding collection and disposal of each type of material
Hazardous Wastes	Construction Activities	Hazardous wastes should be properly sorted into the following: used oil, busted lights, used batteries, and empty chemical containers and then stored in designated areas on site. All waste types should be labeled and have corresponding Safety Data Sheet (SDS).	Hazardous wastes should be transported to a DENR-accredited hazardous waste treatment, storage, and disposal facility (TSDF) chosen by JHMC.
Organic Wastes	Food, Green Waste	Organic waste should be properly sorted and composted if possible. This will help to reduce the amount of waste that ends up in landfills and can also provide a useful source of compost for landscaping or other applications.	If composting is not an option, follow the LGU's protocol regarding collection and disposal of organic wastes.
Recyclable Materials	Construction Activities	All recyclable materials, such as cardboard, paper, and metal, should be properly sorted and recycled. This will help to conserve resources and prevent these materials from ending up in landfills.	If composting is not an option, follow the LGU's protocol regarding collection and disposal of each type of material.
Wastewater	Portable Toilets, Temporary Facilities	Contractor should provide enough storage for wastewater during construction phase.	Untreated wastewater should be hauled by a DENR-accredited hauler regularly.
Sludge	Sequencing Batch Reactor Operations	Can be stored in the sludge holding tank and hauled as necessary.	Alternatively, this can be dried and mixed as an additive (10%) to fertilizer/soil.

Appendix A: Waste Management Plan

Appendix B: MRF Plan and layout



1 MRF PLAN
 PLAN SCALE 1:100



2
MRF ELEVATION
 PLAN SCALE 1:50



JHMC Wastewater Treatment Plant
Design Consultancy
OPERATIONS AND MAINTENANCE
MANUAL

January 2023



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A. INTRODUCTION

The purpose of the document is to portray the operation and maintenance of the Asian Pantry Wastewater Treatment Plant (WWTP). This will serve as a guide for the general activities around the plant and should be used in conjunction with the O&M manuals specific to the equipment.

A.1 Description

The WWTP makes use of the Sequencing Batch Reactor (SBR) system. The SBR system provided in this project is designed to operate as a fill and draw system wherein a predetermined batch volume of wastewater is fed to the reactor for treatment prior to discharge. Organic loading removal, biomass separation and effluent withdrawal are carried out sequentially in one single basin, through a cyclic operation of the process equipment.

In the SBR system, the microorganisms contained in the wastewater agglomerate and form a biomass which feeds on particulate and soluble substrates. The substrates consisting primarily of carbonaceous biochemical oxygen demand (BOD), phosphorus and ammonia, represent an energy source for biomass. The use of these substrates by the biomass allows the treated wastewater water to meet government regulation on effluent standards.

The SBR technology is logically operated through a Programmable Logic Control (PLC) system that initiates the sequence of the treatment process cycle. The system is also provided with operator selector switches when manual operation is required.

A.2. Design Criteria

The WWTP is designed for an average flow of 310 cubic meters per day (CMD). The quality and quantity used for the design are client identified.

Table 1. Design Characteristics

Parameters	Unit	Influent	Effluent
Design Capacity	m ³ /day		310
pH		6.5-8.5	6.5-8.0
Total Suspended Solids	mg/L	50	50
Nitrates	mg/L	10.0	10.0
Ammonia	mg/L	24	4.0
Phosphates	mg/L	10.0	4.0
BOD	mg/L	200	30
Surfactants	mg/L	15	15
Oil & Grease	mg/L	50	5
Temperature	Deg. Celsius	20	20
Fecal Coliform	MPN/100 mL	1.0E+06	400

A.3 Process Flow Diagram

The WWTP consists of one (1) Pump Station, one (1) Preliminary Chamber, one (1) Equalization Tank, two (2) Sequencing Batch Reactor, one (1) Aerobic Sludge Digester, and one (1) Chlorine Contact Tank.

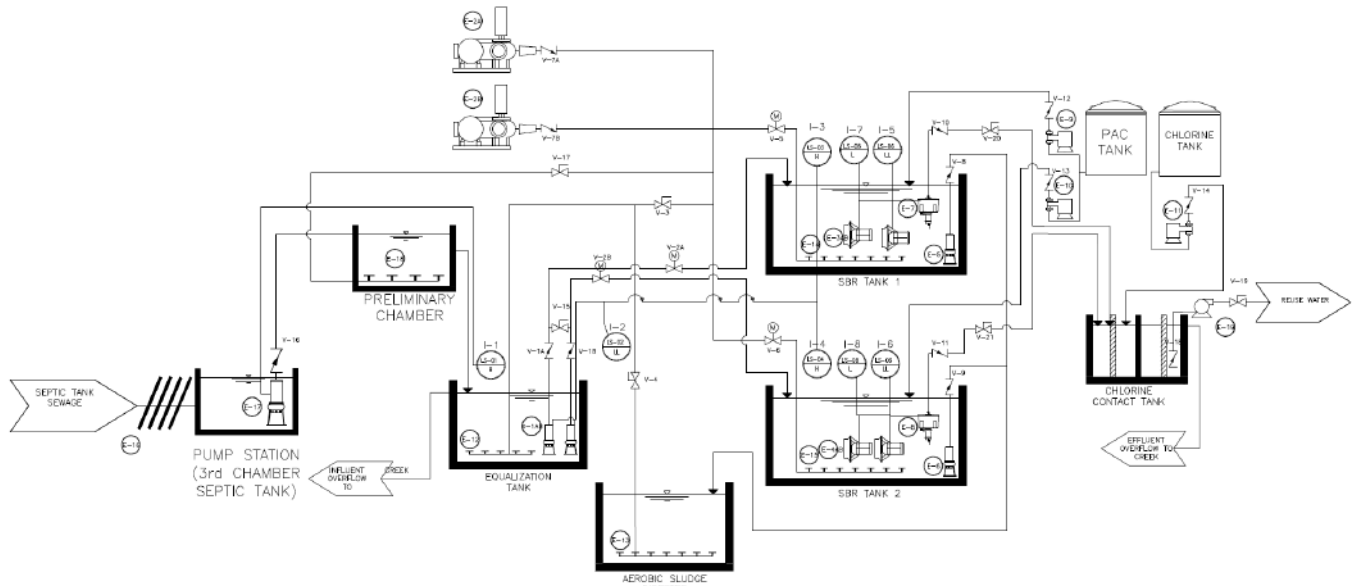


Figure 1. Process Flow Diagram.

B. PROCESS DESCRIPTION

The plant is a Sequencing Batch Reactor (SBR) system wherein wastewater is treated through pre-defined stages in batches. Each tank with its process and purpose is discussed briefly for a general understanding of each component and process stage.

B.1 Pump Station (3rd chamber Septic Tank)

Wastewater from the various served establishments enters the septic tank located adjacent to the wastewater treatment plant. The septic tank provides preliminary treatment for the wastewater and lowers the overall pollution load; this lowers the total cost of operating the plant in terms of both power and chemical consumption. The third chamber of the septic tank is converted to a pump station which delivers the raw wastewater to the treatment plant.

B.2 Preliminary Chamber

Raw wastewater enters the equalization tank from the central septic tank. The tank acts as a grit and grease chamber and works to separate the FOGs (fats, oils, and grease) and the sediments from the wastewater.

The wastewater then flows into the Equalization Tank for collection.

B.3 Equalization Tank

The Equalization tank is aerated to prevent sedimentation and to keep the wastewater homogenous. Wastewater usage across establishments vary in an hourly basis. As such, the quality and quantity of wastewater also varies throughout the day; at extreme conditions this can cause shock loading to the plant and result in sludge death and septicity. To make the quality of the wastewater consistent prior to entering the plant, wastewater throughout the day is stored and mixed in the equalization tank.

The wastewater is then pumped to the operational Sequencing Batch Reactor tank for further treatment.

B.4 Sequencing Batch Reactor (SBR)

The sequencing batch reactor is an activated sludge process for treating wastewater. The SBR treats wastewater using anoxic and aerobic processes and chemical dosing. The activated sludge produced reduces organic matter and biodegrades pollutants along with the unwanted nutrients

These stages are as follows:

1. Fill-Mix- Wastewater fills the tank, mixing with the biomass that settled during the previous cycle, in this stage, a submersible mixer is used to suspend the sludge and promote an anoxic environment for nitrogen-removal. This is also the stage where Polyaluminum chloride (PAC) is dosed for phosphorus removal.
2. React- Air is added to the tank to promote biological growth and pollutant degradation. In this stage, motorized valves are used to direct the flow of air into the respective SBR tank.
3. Settle - Aeration is discontinued and the solids are allowed to settle leaving only the treated effluent above the sludge blanket. No equipment is operational in the SBR tank at this stage to avoid disruption of the fluid.
4. Decant – After separation of the mixed liquor from the treated effluent, this liquid is transferred to the effluent holding tank with the use of the decanters. A portion of the treated effluent is kept in the tank depending on the design level. This will mix with the next cycle.

Each batch or full cycle lasts for 6 hours. The default settings can be found below:

Table 2. SBR Operations

SBR 1		SBR 2	
Stage	Time (hours)	Stage	Time (hours)
Fill-Mix	1	Fill-Mix	1
React	3	React	3
Settle	1	Settle	1
Decant	1	Decant	1

Table 3. SBR Sequence

SBR Sequence		Phases	
Time Start	Time End	SBR1	SBR2
0:00	1:00	Fill-Mix	React
1:00	2:00	React	Settle
2:00	3:00	React	Decant
3:00	4:00	React	Fill-Mix
4:00	5:00	Settle	React
5:00	6:00	Decant	React

6:00	7:00	Fill-Mix	React
7:00	8:00	React	Settle
8:00	9:00	React	Decant
9:00	10:00	React	Fill-Mix
10:00	11:00	Settle	React
11:00	12:00	Decant	React
12:00	13:00	Fill-Mix	React
13:00	14:00	React	Settle
14:00	15:00	React	Decant
15:00	16:00	React	Fill-Mix
16:00	17:00	Settle	React
17:00	18:00	Decant	React
18:00	19:00	Fill-Mix	React
19:00	20:00	React	Settle
20:00	21:00	React	Decant
21:00	22:00	React	Fill-Mix
22:00	23:00	Settle	React
23:00	0:00	Decant	React

B.5 Chlorine Contact Tank

The treated effluent is dosed with sodium hypochlorite for further disinfection and kill-off pathogenic microorganisms before it is discharged. The sodium hypochlorite solution will be dosed by the chlorine dosing pump as the effluent passes through. A reuse water pump is installed for use by the client.

B.6 Aerobic Sludge Digester

Excess sludge produced from the SBR tank is pumped into the Aerobic Sludge Digester. In this tank, the excess sludge is aerated to avoid generation of foul odors. Once the tank is full, it is recommended to be scheduled for sludge siphoning.

For a detailed reference for the operation of the facility and the plant, please refer to the Control Philosophy and the Process and Instrumentation Diagram.

C. TANK, EQUIPMENT AND INSTRUMENT LIST

Table 4. Tank Schedule and Dimensions

Tank List	Materials	Tags	Water Volume (m ³)	Water Depth (m)	Tank Depth (m)	Length (m)	Width (m)	Diameter (m)
Pump Station	Concrete	T-8	7	1	1.2	2	3.5	-
Preliminary Chamber	Concrete	T-1	3.5	1	1.3	3.0	1	-
Equalization Tank	Concrete	T-2	80	5	5.3	3	5	-
SBR Tank	Concrete	T-3A/T-3B	318	5	5.3	10	6	-
Aerobic Sludge Digester	Concrete	T-4	95	5	5.3	3	6	-

Chlorine Contact Tank	Concrete	T-5	28	5	5.3	12	1	-
PAC Storage Tank	PE or equivalent	T-6	2	-	-	-	-	-
Chlorine Storage Tank	PE or equivalent	T-7	2	-	-	-	-	-

Table 5. List of Equipment & Valves

Equipment List	Tag	Valve List	Tag
EQT Pump A/B	E-01AB	EQT Pump A/B NRV	V-1AB
Air Blower A/B	E-02AB	EQT Pump A/B Raw Sewage Motorized Valve	V-2AB
Anoxic Mixer 1A/B	E-03AB	EQT Air Line Butterfly Valve	V-3
Anoxic Mixer 2A/B	E-04AB	SHT Air Line Butterfly Valve	V-4
WAS Pump 1	E-05	SBR-1 Air Line Motorized Valve	V-5
WAS Pump 2	E-06	SBR-2 Air Line Motorized Valve	V-6
Decanting Pump 1	E-07	Combined Blower A/B NRV	V-7AB
Decanting Pump 2	E-08	WAS Pump 1 NRV	V-8
PAC Dosing Pump 1	E-09	WAS Pump 2 NRV	V-9
PAC Dosing Pump 2	E-10	Decanting Pump 1 NRV	V-10
Chlorine Dosing Pump	E-11	Decanting Pump 2 NRV	V-11
EQT Diffusers	E-12	PAC Dosing Pump 1 NRV	V-12
ASD Diffusers	E-13	PAC Dosing Pump 2 NRV	V-13
SBR-1 Diffusers	E-14	Chlorine Dosing Pump NRV	V-14
SBR-2 Diffusers	E-15	EQT Pump Isolation Valve	V-15
Manual Basket Screen	E-16	Raw Sewage Pump NRV	V-16
Raw Sewage Pump	E-17	Prelim Air Line Valve	V-17
Prelim Diffusers	E-18	Reuse Water Pump Foot Valve	V-18
Reuse Water Pump	E-19	Reuse Water Pump Flow Regulation Valve	V-19
		Decanting Pump 1 Flow Regulation Valve	V-20
		Decanting Pump 2 Flow Regulation Valve	V-21

Table 6. Instrument List

Instrument Name	Instrument Tag	Interlock Type	Operating Level
EQT High Level Switch	I-1	Hardwired interlock	EQT level above 5.0m
EQT Low-Low Level Switch	I-2	Hardwired interlock	EQT level below recommended by pump supplier
SBR-A High Level Switch	I-3	Process Interlock	SBR-A level above 5.0m
SBR-B High Level Switch	I-4	Process Interlock	SBR-B level above 5.0m
SBR-A Low-Low Level Switch	I-5	Hardwired interlock	SBR-A level below 2.0m
SBR-B Low-Low Level Switch	I-6	Hardwired interlock	SBR-B level below 2.0m
SBR-A Low Level Switch	I-7	Hardwired interlock	SBR-A level below 3.50m

D. CONTROL OF OPERATION

D.1 Start-up

From the Main Control Panel of the WWTP, activate all process equipment by following these procedures:

1. Set the main and branch circuit breakers to “OFF” position.
2. Set all equipment selector switches to “OFF” (“0”) position.
3. Set the main circuit breaker to “ON” position.
4. Set all branch circuit breakers into “ON” position.
5. Set all equipment selector switches to “AUTO” (“A”) position.
6. Switch on the PLC to start the automatic operation of the system. The sequence will proceed with the process set at the current time.

D.2 Normal Operation

Under normal operation conditions, ensure the following are observed:

1. PLC is in automatic operation.
2. Check the mixed liquor suspended solids (MLSS) SSV30 of the SBR after one to two days of operation.
3. If the SV30 of the SBR reaches above 300 mL/L from a graduated cylinder, switch the waste activated sludge pump selector to “Hand” mode during “React” period and turn the pump ON for a maximum of 5 minutes, or until SV30 reaches 300 mL/L
4. If the drying bed is already full, filtrate recycling can be done. To do this, the leachate pump can be used to pump the clear water back to the equalization tank.

D.3 Routine Plant Control Procedure

1. Check chlorine tank and PAC tank for level of solution. Determine whether resupply is necessary.
2. Perform SSV30 test for the WWTP. Monitor findings then refer to D.2.3 for the wasting procedure as needed.
3. Fill out the log book and log sheet with your findings.

D.4 Sludge Wasting Process

1. Once the SV30 is greater than 300 mL/L, wait for plant to turn to its Settle Phase.
2. Switch IR Pump to Manual.
3. Close the IR Pump Valve.
4. Open the WAS Valve slightly
5. Turn on IR Pump for 30 seconds
6. Turn off IR Pump then close WAS valve completely.
7. Open IR Pump valve slightly then switch IR Pump to Auto.
8. At the next cycle, check SV30 in the react phase if level is adequate.

D.5 Emergency Shutdown

Should the need arise for an emergency shutdown. Shut-off the main breaker.

E. RELIABILITY TEST AND PERFORMANCE MONITORING

Performance Monitoring shall be done by a skilled operator. Testing labs are ideally DENR- accredited for the consistency of results.

Process Control Parameters

Activated Sludge

Activated sludge is a biological floc coagulated with aerobic microorganisms that has biochemical activities for treatment of organic wastewater.

Bacteria are the most important microorganisms in the activated sludge and responsible for the decomposition of the organic material in the influent.

In the aeration tank, a portion of organic waste matter is used by aerobic and facultative bacteria to obtain energy for the synthesis of the remainder of the organic material into new cells. Only a portion of the original waste is actually oxidized to low-energy compounds, such as NO_3 , SO_4 and CO_2 , the remainder is synthesized into cellular material.

BOD (Biochemical Oxygen Demand)

The most widely used parameter of organic pollution applied to both wastewater and surface water is the 5-day BOD (BOD_5). This determination involves the measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter.

DO (Dissolved Oxygen)

Dissolved oxygen is required for the respiration of aerobic microorganisms, called activated sludge, as well as all other aerobic life forms.

The measuring of the DO is used for the operation of the air volume to diffuse the aeration tank. Generally, the DO value in aeration tank is adjusted between 2 mg/L and 3 mg/L. The DO is measured with DO meter.

Excess Sludge

The activated sludge multiplies (growth) when treats wastewater. As a result of the multiplication, the concentration of activated sludge in the aeration tank increases.

A part of the activated sludge is disposed as excess sludge to keep the concentration of activated sludge to the design value.

MLSS (Mixed Liquor Suspended Solids)

This index is defined as the weight of suspended solids in milligrams occupied by the mixed-liquor sample (taken at the outlet of the aeration tank) of 1000 mL.

This index is shown the quantity of activated sludge in the aeration tank, and generally this value shows between 3000 mg/L and 5000 mg/L.

SV30 (Settled Sludge Volume)

This index is defined as the percentage volume occupied by the sludge in a mixed-liquor sample (taken at the outlet of the aeration tank) after settling for 30 minutes in a 1000 mL graduated cylinder.

Generally, the value of SV30 shows between 200 to 300.

Apparatus: 1000 mL graduated cylinder

F. MAINTENANCE

For specific operation and maintenance procedures please refer the O&M manual and equipment brochures provided by the supplier.

General and Safety Reminders

1. Operator assigned for this project must be aware of the preventive maintenance monitoring guidelines.
2. A copy of a comprehensive guideline should be posted visibly in the plant room.
3. Conduct daily, weekly, and monthly monitoring report on the status of all equipment.
4. Only authorized and trained operators shall have access to the plant room and operate the WWTP.
5. Only equipment manufacturer's authorized representative shall conduct necessary repairs of all process equipment during the warranty period.
6. Only authorized and trained personnel shall conduct necessary repairs after the warranty period.
7. When carrying out necessary repairs, disassembly and assembly, always refer to procedures found in the individual instruction manual of each process equipment.
8. Appropriate tools shall be available when conducting repairs.
9. All equipment repair activities shall be recorded and shall have the following information:
 - Date of incident report on equipment failure
 - Name and serial number of equipment
 - Brief description of the cause of breakdown
 - Nature of repair conducted
 - List of parts replaced
 - Name of authorized personnel who conducted the report
 - Status of repair
 - Date when the equipment is re-commissioned

G. PLANT SAFETY PROCEDURES AND REMINDERS

Personal Protective Equipment (PPE)

Hand gloves are to be worn whenever contact with process chemicals and water will occur. Workers are always required to wear hand protection; however, gloves should not be used near rotating tools or moving machinery.

Safety goggles are to be worn at site, especially when working with process chemicals. Eye protection shall be used where the processes or operations present hazards of liquids, injurious radiation, glare or a combination of these hazards.

Gas mask/Respiratory protections are required in areas where health hazards exist due to accumulation of fumes or toxic gases and vapors and when working with process chemicals.

H. TROUBLESHOOTING COMMON OPERATING PROBLEMS

Common problems in the operation of the WWTP with their possible causes and/or suggested solutions are shown below.

H.1 Blowers

TROUBLE	POSSIBLE CAUSES	REMEDY
Does not rotate	Faulty motor or bad connection	Carry out inspection of the motor and connections
	Rotor sticking	Rotate by hand
	Inclusion of foreign objects	Remove foreign objects
	V-Belt is slipping	Re-tension or replacement of the V-belt
	Insufficient gear oil	Add oil
	Insufficient grease	Add grease
	Attachment of foreign matter	Clean internals
	Contact between internal components	Carry out inspection of internal components
Strange noise of vibrations	Pressure abnormality	Remove source of pressure abnormality
	Safety valve operation	Investigate whether safety valve operates at set pressure
	Contact between belt cover and pulley	Tighten cover or remove contacting area
	Looseness in fixing area	Tighten loose components
	Insufficient gear oil	Add oil
	Insufficient grease	Add grease
	Attachment of foreign matter	Clean internals
	Contact between internal components	Carry out inspection of internal components
Abnormal heat emission	Pressure abnormality	Remove source of pressure abnormality
	Contact between belt cover and pulley	Tighten cover or remove contacting area
Oil leakage	Looseness in fixing area	Tighten loose components
	Insufficient room ventilation	Provide better ventilation to lower temperature
	Blockage of air filter	Clean air filter
	Too much oil added	Adjust to the middle of the level gauge while blower is stopped
	Looseness in the fixing area	Tighten the loose component

	Damaged gasket	Replace gasket
Discharge pressure increase	Discharge side valve closed	Fully open the valve
	Increase in sludge density or sedimentation	De-sludge the tank
Abnormal heat emission	Insufficient room ventilation	Provide better ventilation to lower temperature
	Blockage of air filter	Clean air filter
Oil leakage	Too much oil added	Adjust to the middle of the level gauge while blower is stopped
	Looseness in the fixing area	Tighten the loose component
	Damaged gasket	Replace gasket
Discharge pressure increase	Discharge side valve closed	Fully open the valve
	Increase in sludge density or sedimentation	De-sludge the tank

H.2 Submersible Pumps and Mixers

TROUBLE	POSSIBLE CAUSES	REMEDY
Motor not functioning/Protector trips	Open circuit	Check circuit line voltage
	Poor power source	Check circuit line wires and cable
	Low voltage	Check line wires and source voltage
	Broken or inner cable issue	Replace cable
	Locked impeller	Remove obstruction from impeller housing or check rotating parts (disconnect power source when conducting this inspection)
	Wrong power phase	Check power source phase and wires
Insufficient water flow	Wearing out of impeller	Replace impeller and base cover
	Locked impeller or clogged with rags or other material	Clean up and remove trapped materials
	Broken pipe or leakage	Repair pipe
	Low power voltage	Check power voltage, wires and cable condition
Abnormal sound	Reverse running	Change one phase with the phase of the power line
	Worn-out bearing	Replace bearing
	Broken impeller	Replace impeller or have it repaired
	Reverse running	Change one phase with the phase of the power line
Water leakage into motor case	Broken case	Repair or replace with new one
	Worn-out mechanical seal	Replace with new one
	Displacement of mechanical seal	Adjust to proper position
	Broken cable joint	Replace with new one
	Worn-out oil seal or ring	Replace with new one

H.3 Dosing Pumps

TROUBLE	POSSIBLE CAUSES	REMEDY
Motor not functioning	Open circuit	Check circuit line voltage

	Poor power source	Check circuit line wires and cable
	Low voltage	Check line wires and source voltage
	Wrong power phase	Check power source phase and wires
Insufficient water flow	Wearing out of diaphragm	Replace diaphragm
	Clogged suction tubing or discharge tubing	Clean up and remove trapped materials
	Low power voltage	Check power voltage, wires and cable condition
	Reverse running	Change one phase with the phase of the power line

H.4 Motor Control Center (MCC)

TROUBLE	POSSIBLE CAUSES	REMEDY
Indicator bulbs failure	Open circuit	Check circuit line voltage
	Busted bulb	Replace bulb
No monitor display	Dust particle accumulated at the CPU	Vacuum-clean the CPU
	Power supply fluctuation	Check power source
	Busted fuse	Replace fuse

H.5 Influent and Screening

TROUBLE	POSSIBLE CAUSES	REMEDY
Influent wastewater color abnormal (i.e. not gray or has different odor)	Unusual upstream operations	Shutdown influent pump and conduct upstream investigation
Low Flow	Clogged influent line	Declogging
Odors and/or insects	Accumulation of screenings/ solids	Remove accumulated debris more frequently
Grit accumulation in Screen Chamber	Significantly high solids in influent due to accumulation of silts upstream	Desilt upstream
High water level in screen chamber	Clogged screen	Remove accumulated debris more frequently
	Grit accumulation in Screen Chamber	Desilting of chamber
	Pump surging	Adjust pump controls to control inflow

H.6 Grit and Grease/ Equalization Tank

TROUBLE	POSSIBLE CAUSES	REMEDY
Rotten egg odor	H ₂ S formation	Chlorination at the chamber
Accumulated grit in chamber	Less frequent cleaning	Increase frequency of grit removal
Dead spots	Diffusers clogged with grit	Clean diffusers
Grit carry-over	Bottom scouring	Reduce flow

	Over aeration	Reduce aeration
	Accumulated grits in chamber	Increase frequency of grit removal
Septic waste with greasy bubbles	Accumulated sludge on bottom of chamber	Increase frequency of grit removal
Scum build-up	Scum removal frequency low	Increase frequency of scum removal
	Unusual upstream operations	Shutdown influent pump and conduct upstream investigation
Foaming	Unusual upstream operations	Shutdown influent pump and conduct upstream investigation

H.7 Primary Treatment

TROUBLE	POSSIBLE CAUSES	REMEDY
Poor suspended solids removal	High flow	Reduce flow
	Low frequency of primary sludge removal; high sludge level	Increase frequency of primary sludge wasting
	Unusual upstream operations	Shutdown influent pump and conduct conveyance investigation
Short circuiting flow	Uneven weir levels	Level weirs
	Damaged or missing baffles	Repair baffles
Floating sludge	Black floating sludge	Increase frequency of primary sludge wasting
	Primary sludge pump malfunction	Repair pump
	High Flow	Reduce flow
	Damaged or missing baffles	Repair baffles
Primary sludge solids too high	Excessive grit carryover	Troubleshoot Grit & Grease chamber
	Lack of wasting of sludge	Increase frequency of wasting
	High influent TSS	Increase frequency of wasting
Excessive growth of debris on surfaces and weirs	Poor housekeeping	Increase frequency of cleaning

H.8 Sequencing Batch Reactor

PHASE	TROUBLE	POSSIBLE CAUSES	REMEDY
AERATE	Dark, stiff tan foam on aeration tank	Old sludge	Increase wasting
	White, sudsy foam on aeration basin	Young sludge	Decrease wasting
		Unusual upstream operations	Shutdown influent pump and conduct conveyance investigation
	Dark aeration tank	Old sludge	Increase wasting
		Insufficient aeration	Increase blower settings
	Air boiling or rising large bubbles in aeration tank	Clogged or broken diffusers	Repair or clean diffusers
Dead spots in aeration tank	Clogged or broken diffusers	Repair or clean diffusers	
	Low DO	Increase blower settings	
SETTLE	Rising Sludge	Young Sludge	Suspend wasting

			Add Chlorine until chlorine becomes visible dense
		Black Septic Sludge/ Old Sludge	Increase frequency of sludge removal
	Pinpoint Flocs in Effluent	Under aeration	Increase blower settings
		Unusual upstream operations	Shutdown influent pump and conduct conveyance investigation
		Sludge height too high	Increase wasting
DECANT	High solids in effluent	High sludge concentration	Increase wasting
GENERAL	Equipment not working	Out of sequence	Restart sequence
		Level Switch not working	Fix Level Switch
		Equipment Malfunction	Reactive Maintenance

I. Recommended Operator’s Logbook, Operation Expenses Estimate, and Preventive Maintenance Schedule

To properly maintain the operation of the WWTP, the assigned operator shall fulfill dutifully the responsibilities stated in the Daily Plant Operator Checklist.

This serves as a guide for which should be checked daily in the plant. Each question can be answered by YES or NO. If the answer is NO to any of the questions, it is indicative of either a process upset or a maintenance issue. These observations shall be recoded in a logbook which will include the time and date of the incident. Steps taken to resolve the issue shall also be recorded along with the time and date of the implementation of the solution.

Other than the operational issues, the following daily activities shall also be recorded in the logbook:

Site	Parameters	Possible Observations
Equalization tank	Color	Gray, Black, Others
	Odor	Pungent, Unusual
	Flow	Average, Surged
	Aeration	Mixing, Dead Spot
Primary Treatment	Floating Solids	With, Without
SBR	Sequence	On schedule
	Sludge Color	Brown, Gray, Black, Light Brown
	SV ₃₀	Within 200 – 300 mL/L
	Foam	Brown, White, Dark Brown, Others
	Aeration	Mixing, Dead Spot
Chlorination	Floating Solids (Settle Phase)	With, Without
	Floating Solids	With, Without
	Accumulated solids at the bottom	With Without
Effluent	Residual Chlorine	Odor (Qualitative), Value
	Color	Yellowish, Clear
	Solids	With solids, None
	SV ₃₀	For Hauling/Dewatering, For Recycling

Sludge Management	Biosolids Dryness Filtrate	Wet, Dry Clear to Yellowish, Sticky, With Solids
Others	Equipment Status	Working, Noise
	Maintenance Schedule	Due date
	Chemical Tanks	Full, For Replenishment

The logbook shall include the following pertinent details as well:

Activity	Details of entry
Effluent Sampling	Time and date of sampling Name of Sampler (DENR, third-party laboratory, etc.)
Sludge hauling	Time and date of hauling Amount of sludge hauled
Chemical delivery	Time and date of delivery Amount of chemicals delivered
Equipment breakdown	Time and date of breakdown Equipment name, tag, serial number Reason for equipment failure Steps taken for repair Parts Replaced Maintenance Personnel who executed the repair (in-house, third-party, etc.) Current status of equipment Time and date of equipment repair

OPERATING EXPENSE QUANTITY / COST APPROXIMATION

Items considered	Value per year considering max operations	Remarks
Electricity Cost	Php 1,682,226.91	Rate used is 8.61 Php/kWh kWh is based on treatment at maximum influent values (542 kWh per day)
Chemical Cost	Php 2,079,118.30	Based on actual chemical costs procured in bulk (48 kg PAC per month, 30 kg NaOCl per month)
Manpower Cost	Php 530,000.00	Assuming 2 operators
Maintenance Cost	Php 216,000.00	Considering equipment maintenance, bi-annual

sludge hauling, and
quarterly lab analysis

PREVENTIVE MAINTENANCE SCHEDULE

Inspection Parameters	Monthly	Quarterly	Semi-annual	Yearly	4 years	Remarks
AERATION BLOWER						
Safety Valve		X				Confirm with discharge side valve operation
Insulation Resistance/ Megger		X				At least above 2 MΩ
Tightness of all connection points		X				Blower, piping, etc.
V-Belt Replacement			X			
Bearing grease supply		X				Replenishment of specified grease
Gear bearing smoothness		X				Check looseness by manual operation
Gear oil change			X			Complete oil change
Cleaning of suction filter		X				
Bearing oil seal replacement				X		
Replacement of all wearables					X	
A. Submersible Pumps						
Current	X					
Voltage	X					
Insulation Resistance/ Megger		X				At least above 2 MΩ
Change Oil		X				
Mechanical Seal		X				
B. Chemical Dosing Pump						
Suction tubing replacement				X		
Discharge tubing replacement				X		Check for sediments
C. Decanter Solenoid Valve						
Check O-rings		X				
Check solenoid assembly				X		
D. Main Control Panel						
Check electrical controls		X				Tighten terminals



JOHN HAY MANAGEMENT CORPORATION
300 CMD WASTEWATER TREATMENT PLANT
DESIGN CONSULTANCY

TESTING AND COMMISSIONING PLAN
WW-20-JHMC-DC-05

9 February 2023



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1.0 INTRODUCTION

- 1.1 This document defines the methods and guidelines for conducting testing & commissioning of installed equipment and constructed structures during construction phase.
- 1.2 The Project Manager is responsible for implementation and management of this plan.

2.0 INSPECTION FOR ELECTROMECHANICAL EQUIPMENT INSTALLATION

- 2.1 Prior to installation, equipment shall be inspected for any dents, flaws, damage and paint scratch.
- 2.2 Check the equipment against the approved design drawings to ensure correct installation locations.
- 2.3 Verify the foundation materials and dimensions on which the equipment is to be mounted with the approved design drawings.
- 2.4 Check that all scale, dirt, grease and foreign matter is thoroughly cleaned from the contact surface before mounting the equipment.
- 2.5 After mounting is completed, check that all foundation bolts/nuts are firmly tightened.
- 2.6 Check that the rotating equipment and driver shaft are free to drive to ensure correctness of coupling alignment.
- 2.7 Check the shaft alignment in conjunction with driven shaft.
- 2.8 For any auxiliary equipment, verify that each on is correctly installed in accordance with the approved design drawings.
- 2.9 Take note of all issues and nonconformances using the **Punchlisting Form**. These shall be confirmed with and rectified by the Contractor.

3.0 TANK LEAK TEST

- 3.1 Inspect the tank for any cracks, dents, flaws and damage.
- 3.2 Fill the tank with water up to 50% of its design water level.
- 3.3 Allow the tank to sit for 1 hour.
- 3.4 Inspect the foundation and all the tank walls for any visible leaks or “wet spots”.
- 3.5 If 3.4 is satisfactorily completed, fill the tank with water up to its design water level.
- 3.6 Allow the tank to sit for 24 hours.
- 3.7 Repeat 3.4.
- 3.8 Take note of all issues and nonconformances using the **Punchlisting Form**. These shall be confirmed with and rectified by the Contractor

4.0 ELECTROMECHANICAL EQUIPMENT DRY TEST

- 4.1 The tests under this section are performed after the equipment has been permanently installed and with its breaker turned off (no power supply).
- 4.2 The **motor winding resistance test** is performed to ensure that:
 - 4.2.1 the lines are continuous and have no cuts;

- 4.2.2 resistance of the lines is not excessive (higher resistance entails higher voltage drop);
- 4.2.3 winding resistance of the lines of the load side are equal or close to each other (unequal resistances can cause imbalance);
- 4.2.4 the lines at the load side are not shorted with the ground.
- 4.3 A multimeter is used for this test. The instrument probes are connected in series with the lines being tested.
- 4.4 Measure each line-to-line resistance at the load side. Record the readings in the **Testing and Commissioning Form**.
- 4.5 Winding resistance values with deviation less than 5% are considered conforming.
- 4.6 The **insulation resistance test** is performed to check whether the lines have sufficient insulation. Poorly insulated lines may cause short circuit, which in turn could harm the equipment.
- 4.7 Since insulation deteriorates over time, high value of insulation resistance is required for new equipment to ensure the longevity of the wiring.
- 4.8 An insulation resistance tester is used for this test. The test voltage of the instrument is set at 500V when testing electromechanical equipment with power supply rating of 440V-460V.
- 4.9 Measure each line-to-line insulation resistance at the load side. Measurements are taken after the 60 seconds or after the reading has stabilized, whichever comes first. Record the readings in the **Testing and Commissioning Form**.
- 4.10 Insulation resistance values of greater than 100MΩ are considered conforming.
- 4.11 Take note of all issues and nonconformances using the **Punchlisting Form**. These shall be confirmed with and rectified by the Contractor

5.0 ELECTROMECHANICAL EQUIPMENT WET TEST

- 5.1 This test refers to the measurement of:
 - 5.1.1 non-operating voltage
 - 5.1.2 rated voltage
 - 5.1.3 rated current
- 5.2 The recorded values are compared to the nameplate ratings of the equipment to ensure that its operation is within the manufacturer's design values. The nameplate ratings of the equipment are gathered from the equipment nameplate and recorded in the **Testing and Commissioning Form**.
- 5.3 For voltage measurements, a multimeter at voltmeter setting is used.
- 5.4 The probes of the instrument are connected in parallel with the lines being measured to record the line-to-line voltages. Voltages are first measured with the equipment not running; then the equipment is operated (at full load, if possible) to get rated voltage readings.

- 5.5 For current measurements, a clamp meter is used. The instrument is clamped to the line being measured.
- 5.6 Record the readings in the **Testing and Commissioning Form**.
- 5.7 Measured values with deviation less than 10% from the nameplate values are considered conforming.
- 5.8 Take note of all issues and nonconformances using the **Punchlisting Form**. These shall be confirmed with and rectified by the Contractor

6.0 VARIABLE LOAD TEST

- 6.1 This is part of electromechanical equipment wet testing, as applicable.
- 6.2 For equipment installed with flow and/or motor control provision (e.g. valves, VFD), the equipment must be tested at different settings. Discharge flow, pressure (if flow and pressure reading instruments are provided) and running current must be recorded.
- 6.3 If not flow/motor control features are not present, the tests described in 5.0 and 6.0 are sufficient.

7.0 PIPE PRESSURE AND LEAK TEST

- 7.1 This is part of electromechanical equipment wet testing, as applicable.
- 7.2 This test shall validate the mechanical stability of the pipes as well as the withstanding working pressure on joints.
- 7.3 For pump installations, the source tank shall be filled with clean water.
- 7.4 The pump shall run continuously until the tank reaches it's Low-Low interlock water level.
- 7.5 The discharge pressure will be varied by throttling the valve at the discharge line.
- 7.6 For installations with a pressure reading instrument, the valve can be closed until the pressure reaches 1.5 times of the design pressure.
- 7.7 For those with none, the valve can be set up to 25% opening.
- 7.8 While the pump is running, the stability of the pipes and pipe supports shall be checked visually.
- 7.9 The whole piping system shall also be checked for leaks during and after the pump operation.
- 7.10 Take note of all issues and nonconformances using the **Punchlisting Form**. These shall be confirmed with and rectified by the Contractor

PUNCHLISTING FORM

Project Title : _____ Contract No. : _____
Date of Inspection : _____ Punchlist Page : _____ of _____

EQUIPMENT SPECIFICATION

Item No.	Description	Location	Date Rectified/Signature

REMARKS

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Prepared by: _____
Signature over Printed Name
Contractor Representative
Date:

Approved by: _____
Signature over Printed Name
Client Representative
Date:

TESTING & COMMISSIONING FORM

Project Title : _____ Contract No. : _____
 Equipment Name : _____ Equipment Tag : _____
 Date of Testing : _____ T&C Report Page : _____ of _____

EQUIPMENT SPECIFICATION

Unit Brand		Unit Model Number		Motor Brand		Motor Model Number	
Power	Rated V	Rated FLC	RPM	Frequency	Phase	Capacity	TDH

EQUIPMENT FUNCTIONALITY

Insulation Resistance @ 500V _{DC}	T1-G/U1-G (Ω)	T2-G/V1-G (Ω)	T3-G/W1-G (Ω)
Motor Winding Resistance	T1-T2/U1-V1 (Ω)	T2-T3/V1-W1 (Ω)	T3-T1/W1-U1 (Ω)
Voltage Check	L1-L2 (V)	L2-L3 (V)	L3-L1 (V)
Non-operating			
At rated			
FLC Check			
	At rated		

INSTRUMENT CALIBRATION

INSTRUMENT	Brand	Model	Calibration Date

REMARKS

Prepared by:

Approved by:

 Signature over Printed Name
Contractor Representative
 Date:

 Signature over Printed Name
Client Representative
 Date: