Baffinland Iron Mines Corporation : Mary River Project
H337697
Waste Water Treatment / PM403

ATTACHMENTS FORMING PART OF THIS SPECIFICATION:

SECTION		REV.	TITLE OF SECTION
01 10 00	E	E	Specification Index
01 11 00	E	E	Summary of Work
46 25 00	E	E	Equipment Specification

DRAWINGS FORMING PART OF THIS SPECIFICATION:

DRAWING NO.	REV.	TITLE

REGISTERED PROFESSIONAL ENGINEER J.W. CASSON LICENSEE NT/NU 24/1/12

NT/NU

2012-01-19	E	Approved for Use – Type A Water Licence	R.Kapadia	A. Zlatic	J. Cleland	
2011-11-07	D	Approved for Use – Environmental Permit	R.Kapadia	A. Zlatic	J. Cleland	
2011-08-16	C	Approved for Enquiry	R.Kapadia	A. Zlatic	J. Cleland	
2011-08-12	B	Approved for Enquiry	R.Kapadia	A. Zlatic	J. Cleland	
2011-08-01	A	Issue for Review	R.Kapadia	A. Zlatic	J. Cleland	
DATE	**REV.**	**STATUS**	**PREPARED BY**	**CHECKED BY**	**APPROVED BY**	**APPROVED BY**
			HATCH			**CLIENT**

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1. Introduction

Baffinland Iron Mines (BIM), the Owner, has initiated the development of the Mary River project, which consists of an iron ore mine and associated infrastructure located in Baffin Island, Nunavut.

This equipment specification provides the requirements for all labour, materials and services for the design, fabrication, testing, preparation for and technical site assistance of two (2) wastewater treatment plants (WWTP) to be located at the Mary River Mine Site and Steensby Port permanent camps. The table below identifies the different packages to be supplied.

Table 1-1: Wastewater Treatment Plant (WWTP) Package Numbers

ID	Package Title	Camp Type
Package No. WWTP1	Mary River (Mine Site) WWTP	Construction/Permanent
Package No. WWTP2	Steensby (Port) WWTP	Construction/Permanent

The wastewater treatment plants are required to treat wastewater generated from the mine's operation to meet the wastewater discharge criteria. This criteria is based on several appropriate guidelines including Nunavut territorial guidelines as well as Canadian federal guidelines.

Once the bid is awarded, the successful party is known as the Supplier.

2. Scope of Work

The Bidder shall provide an appropriate system, based on all information contained herein, including: new, complete, fully operational equipment, with all necessary auxiliary equipment and accessories, except if excluded from scope of work.

All exceptions to this specification shall be clearly informed in the proposal, so as to characterize an alternative supply. Nevertheless, compliance to specification does not exempt the Bidder from its responsibilities in furnishing reliable and safe equipment.

2.1 Equipment List

The following equipment are the major components of the wastewater treatment plants. Minor components are not listed, however these shall be in the Bidder's scope in order to provide a complete package.

Table 2-1: Wastewater Treatment Plant (WWTP) Equipment Numbers

Equipment Title	Quantity	Equipment Tag No.
Settling Basin/Sump	TBD	TBD
Oil/Water Separator	TBD	TBD
Oil Storage Tank	TBD	TBD
pH Neutralization System	TBD	TBD
Fine Filtration System (if required)	TBD	TBD
Secondary Organic Removal System (if required)	TBD	TBD
Air-compressor system (if required)	TBD	TBD
Containers (if applicable)	TBD	TBD

2.2 Reference Materials:

The following Wastewater Treatment Plant drawings can be used as reference:

Table 2-2: Process Flow Schematics for Wastewater Treatment Plants (WWTP)

Camp/Site	Reference Schematic
Mary River (Mine Site)	Appendix B.1 – Wastewater Treatment Plant Schematic
Steensby (Port)	Appendix B.1 – Wastewater Treatment Plant Schematic

The following specifications are also applicable to the design of the wastewater treatment systems:

Table 2-3: Applicable Project Specifications

Drawing Title	Document Number
Design Basis – Wastewater Treatment Plant	H337697-4000-10-109-0003
Instrumentation Requirements for Packaged Equipment	H337697-S250050
Electrical Requirements for Packaged Equipment	H337697-S260050
Mechanical Design Criteria (not published)	XXX-TBD

2.3 Work Included:

The Bidder's scope of work includes, but is not limited to, the following components:

- Fully operational wastewater treatment systems including all required pumps, piping, valves, instruments and controls that meets the specification described herein;
- Supervision of system installation, erection, commissioning and factory acceptance test by a supplier representative;
- Air-compressor systems (if required) for each site;
- Laboratory test equipment, including one year's supply of all reagents
- Access platforms and ladders (as required);
- All required nozzles, manual valves for isolation and draining;
- Interconnecting piping and supports;
- Instruments required for safe operation and control (Intelligent type Smartbus or 4-20 mA HART, to be determined once the control system has been selected);
- One full set of special tools, gaskets and sealants and all nuts and bolts required for field assembly and erection;
- Shop assembly, testing, disassembly, match marking for field erection;
- Prime and finish painting (including paint for field touch-up after installation) as per Section 46 25 00 : Equipment Specification;
- Equipment tagging and identification;
- Lubrication/protection for equipment before shipment;
- Preparation and crating for shipment;
- Recommended spare parts;
- Data requirements, drawings, manuals, and other documentation per Section 01 32 19 : Vendor Data Requirements;
- Indicate the availability of workers at per diem for the Erection/installation supervision;
- Indicate the availability (at per diem) of qualified personnel for instructing and training of the Owner's personnel in plant operation and maintenance, start-up and commissioning of the supplied equipment;
- Electrical terminal boxes and instrument and control terminal boxes;
- All internal electrical and instrumentation wiring and cabling, cable trays, conduits;
- Loop drawings;
- Motor schematics;

- Interconnection diagrams;
- Location drawings;
- Power distribution panel, feeders and breakers;
- Small instrument air system (if required) includes the air compressors, filters and air dryer suitable for the control valves and instrumentation requirements of the packaged equipment. The instrument air delivery pressure will be designed at approximately 600 kPag and the dewpoint temperature will be designed at –65° C;
- All instruments and control devices supplied by the vendor including dedicated equipment controllers, PLC and HMI as part of the mechanical packaged equipment shall be capable of seamless integration with the Owner's PCS;
- Control system configuration hardware and software as defined by the project standard;
- All motor starters will be fitted with a smart electronic overload protection of suitable rating; and
- Approval of configuration and acceptance testing of system.

2.4 Work Excluded:

The Bidder's scope of work specifically excludes the following:

- Chemicals (if required);
- Lubricants other than initial fills and what is needed for shop testing and assembly;
- Area lighting;
- Interface to the Owner's Process Control System;
- Wiring of alarm signal to the Owner's control centre from treatment plant control panel;
- Instrument cabling and wiring;
- Site preparation, concrete, foundations, grouting and anchor bolts;
- Building enclosure/Outdoor shed for control system and chemical storage;
- Receiving, unloading and storage of equipment at the plant site;
- Site touch-up painting; and
- Installation labour and incident materials.

2.5 Battery Limits:

Battery Limit: The Bidder's equipment will be mounted on foundations or structural steel that will be designed by the Owner to match the Bidder's support and load requirements. Other specific battery limits are listed in Table 2-4.

All plant services and interface requirements at the Bidder's battery limits of the work are to be defined in the bid response.

Table 2-4: Battery Limits

	Item	Battery Limits	Exclusions
1	Wastewater Treatment Plant	Flanged Inlet to Sump/ reservoir	Upstream pumps and wastewater collection system.
2	Clean Well (Treated Water)	Flanged outlet of Clean Well.	Piping from flanged outlet to the final discharge point.
3	Oil Barrel (Separated Oil Storage)	Flanged outlet of Oil Barrel.	Piping from flanged outlet of oil barrel to the final discharge point.
4	pH Neutralization	Bulk Chemical Feed to Day Tank	Chemical Supply
5	Polishing Treatment (Filtration/Organic Removal – if required)	Flanged inlet and outlets to supplier system	Piping from flanged outlet of system
5	Electrical Supply	Incoming 575 V terminals for the three permanent locations 600 V generators of suitable size for the five temporary locations	Field cabling only for the three permanent facilities
5	Local Control (only if required)	At the Instrument Terminals	
6	Civil Works	Underside of base plate	Foundation design and construction. Anchor bolts.

3. Process Conditions

3.1 General

For design requirements and conditions, refer to the equipment datasheets attached to this specification. Additional specific requirements are provided below.

The wastewater treatment equipment and components shall be the Supplier's standard design for the service specified, with readily available replacement parts. No new technology shall be

applied to the design of the equipment without examples of operating equipment using the technology in similar design conditions.

The wastewater treatment equipment shall be suitably insulated or heated to be suited to the climatic conditions as outlined in 0: Meteorological and Seismic Data. The equipment shall have a dedicated area within the maintenance shop building, or will be an add-on structure. Larger equipment designed for indoor storage will be housed in heated enclosures (supplied by others) with protection from precipitation and wind. The internal temperature will be approximately 10 °C. The supplier must specify which equipment is designed for indoor storage as well as equipment dimensions.

3.2 Process Description

The permanent facilities are to be constructed at the following locations:

- Mary River (Mine Site); and
- Steensby (Port).

Each wastewater treatment plant (WWTP) will have a sump located in close proximity to the maintenance facilities. Wash water produced in the maintenance facility (truck washing, equipment and floor washdown) will flow by gravity and be collected in the local sump. Suspended material in the wastewater will settle in the sump. If required, additional filtration shall be incorporated to remove dust and particulates prior to recycle or discharge. Oil in the wastewater will be removed by an oil/water separator system in order to meet the required oil discharge limits. Further treatment by activated carbon or other organic removal process may be required to meet other specific parameters. The effluent will then be pH adjusted to meet discharge criteria.

Treated effluent from the wastewater treatment plant will be discharged from the sump by vacuum truck and then taken for discharge, or recycled and reused as washdown water at the maintenance shops.

The separated oil waste will be collected in the Oil Storage Tank. Periodically this tank will be emptied and the waste oil sent for disposal or incineration.

The WWTP will be designed to treat peak daily wastewater production while operating 24 hours/day and 365 days/year. Accumulated suspended solids will be periodically removed by bucket loader vehicle and sent for disposal.

The design of the sump will consider sufficient retention capacity to be able to handle peak wastewater generation rates.

Wastewater concentrations and flows will vary through the day. The settling basin/sump will be sized to equalize the incoming flow sources.

For the purpose of this project the wastewater treatment facilities will be designed to meet the peak construction and operation period requirements.

3.3 Site Conditions

Site conditions are identified in 0: Meteorological and Seismic Data

3.4 Duty and Operational Requirements

The equipment shall be designed and constructed to operate continuously, 24 hours per day, 365 days per year without excessive maintenance. The design and automation shall consider minimum operating supervision of two hours/day. It is however anticipated that a dedicated operator (24/7) will be provided for each site.

The control system shall allow for manual and fully automated operation. Manual operation shall be used only for trouble-shooting, maintenance and repair situations, otherwise, the system shall always be in full automation mode.

All equipment will be of the Supplier's best quality and construction to ensure a minimum equipment design life of 25 years (exceptions to be noted). The expected life of the project is 25 years .

3.5 Material Characteristics

The Supplier shall fabricate the equipment using only new materials of first grade quality, free from defects impairing strength, durability and appearance.

After the Purchase Order is issued, the Supplier shall not substitute materials, without prior written approval from the Owner.

Materials of construction shall be suitable for the specified duty and operating conditions.

Use the lowest material density for volumetric capacity calculations. Use this volume and the highest material density for power calculations.

All materials of construction shall be identified by the Supplier by the current ASTM specification number(s) on the data sheets provided.

Design all equipment components such that corrosion and wear are minimized.

4. Design Conditions

4.1 Raw Wastewater Characteristics

The main water quality parameters of the all raw water sources are as follows:

Table 4-1: Mine Site and Steensby Site Raw Wastewater Quality

Parameter	Units	Design Value
Benzene	mg/L	<0.035
Toluene	mg/L	<0.020
Ethylbenzene	mg/L	< 0.440

Parameter	Units	Design Value
Lead	mg/L	< 0.025
Oil and Grease	mg/L	< 1300
Total Suspended Solids	mg/L	< 3500
pH	---	7.1 – 12.5
Iron	mg/L	< 1.4

For additional information, The raw wastewater quality information can be found in the document: Design Basis – Wastewater Treatment Plant, Doc. No. H337697-4000-10-109-0003

4.2 Wastewater Generation

The wastewater design flow rates are summarized in .Table 4-2.

Table 4-2: Wastewater Design Flow Summary

Parameter	Mine Site	Steensby Port Site
Average Wastewater Flowrate (m3/hr)	6.5	8.25
Peak Wastewater Flowrate (m3/hr)	17	20.5
Minimum Settling Tank Retention Time (hr)	0.5	0.5

The minimum settling tank retention time shown above shall be used by the Supplier in sizing the sediment chamber portion of the settling tank/sump. The retention time given is based upon the average wastewater flowrate. The sump will be designed to accommodate the peak flow such that the WWTP will only be required to treat the average flow.

4.3 Treated Wastewater Requirements

The wastewater treatment plant effluent shall meet the applicable site discharge limits as listed in the following table:

Table 4-3: Wastewater Effluent Discharge Limits

Parameter	Design Value (mg/L)
Grease, Fat, Oil	<15
Iron	<1
Lead	<0.001
pH Range	6 – 9.5
Suspended Solids	<15
Benzene	0.37
Toluene	0.002
Ethylbenzene	0.090

Note: Discharge limits also exist for other parameters not listed in the table above. It has been assumed that the level of these parameters in the raw feed water will already meet the discharge limits. This will be reviewed during the detailed design phase as more detailed feed water quality information becomes available. The raw wastewater quality information can be found in the document: Design Basis – Wastewater Treatment Plant, Doc. No. H337697-4000-10-109-0003.

5. Performance Requirements

5.1 Guarantees

The supplied equipment shall be guaranteed as follows:

Table 5-1: Guarantees

Parameter	Guarantee Requirement
Flows	As per Table 4-2: Wastewater Design Flow Summary
Various	As per Table 5-3: Wastewater Effluent Discharge Limits

5.2 Warranty

The Seller shall warrant the equipment's manufacture is free of defects or workmanship for the greater period of 18 months from delivery or 12 months from commissioning. All components deemed to be defective shall be replaced to the Owner at no cost (supply and delivery). Installation or consequential damages costs shall not be the responsibility of the Seller.

In case of assistance delay by the Seller, the Owner reserves the right to perform the necessary maintenance at Seller's full expense.

5.3 Test Methods and Procedures

All test method details, timing, sampling protocols and procedures and tolerances shall be developed by the Seller, submitted with the bid package and agreed upon with the Owner before issue of a purchase order.

6. Other Requirements

The Seller shall provide all chemical and reagents for commissioning and start-up.

The Seller shall be responsible to include any required additional equipment, not mentioned in this specification, if any, required to meet the specified treated water quality.

End Of Section

Appendix A

Meteorological and Seismic Data

Client: Baffinland	Data Sheet	HATCH
Project: Baffinland Iron Ore	Title: **Meteorological & Seismic Data**	
Doc #:	Date: **May 20, 2011**	
Issue:	Prepared by: CSA	Rev. B

Site	Latitude	Longitude	Comment
Mary River Mine Site	71˚20' N	79˚ 14' W	160 km south of Pond Inlet
Milne Inlet	71˚53' N	80˚57' W	105 km north-west of Mary River Mine Site
Steensby Inlet Port Site	70˚18' N	78˚30' W	130 km south of Mary River Mine Site

TEMPERATURE		Winter	Summer	Notes
Average	˚C	-	-	All Mines
Maximum	˚C	-	+ 21	
Minimum	˚C	-50	-	
Design Outdoor Temp. (2.5% basis)	˚C	-43	+ 14	All Mines
Design Outdoor Temp. (1% basis)	˚C	- 45	-	
Design (MDMT and LAST)	˚C	-	-	

WIND PROBABILITY	Mary River Mine Site		Milne Inlet		Steensby Inlet Port Site		Notes
	Wind Pressure, q (KPa)	Wind Velocity (m/sec)	Wind Pressure, q (KPa)	Wind Velocity (m/sec)	Wind Pressure, q (KPa)	Wind Velocity (m/sec)	
1 / 10	-	-	-	-	-	-	
1 / 50	1.17	42	0.94	38	0.66	32	Note 3
1 / 100	-	-	-	-	-	-	

EARTHQUAKE		Mary River Mine Site	Milne Inlet	Steensby Inlet Port Site	Notes
Spectral Acceleration for 5% damping (based on 2% probability of exceedance in 50 yrs)	S_a (0.2)	0.407	0.386	0.253	
	S_a (0.5)	0.207	0.172	0.151	
	S_a (1.0)	0.098	0.077	0.077	
	S_a (2.0)	0.031	0.024	0.024	
	PGA	0.257	0.256	0.121	
Site Class		C	C	C	Note 1

SNOW		Mary River	Milne Inlet	Steensby Inlet Port Site	Notes
Average Annual	mm	-	-	-	
Greatest in 24 hrs Annual	mm	-	-	-	
Ground Snow Load (S_s) (1/50 year)	KN/m^2	2.9	2.1	1.7	
Ground Snow Load (S_r) (1/50 year)	KN/m^2	0.2	0.2	0.2	
Unit weight of snow, γ	KN/m^3	2.2	2.2	2.2	

FROST		All Mines/ Sites	At Global Warming	Notes
Perma Frost	Yes/ No	YES		
Perma Frost Depth		Down to Rock		
Depth of Active Layer:		0.6 – 3.0 m		Note 2
- Till		1.0 m	0.5 m max.	
- Sand and Gravel		1.5 – 2.5 m	1.0 m max.	

RAINFALL		Mary River Mine	Milne Inlet	Steensby Inlet Port Site	Notes
Average Total Annual Rainfall	mm	262	217	251	
Greatest in 24 hrs Annual (1/ 50 yr)	mm	46	35	45	
Design Max. rate – 15 min. (1/ 10 yr)	mm	4	3	4	

DEGREE - DAYS	Mary River Mine	Milne Inlet	Steensby Inlet Port Site	Notes
Heating – below 18.0 ˚C (65 F)	11,500	12,000	-	
Freezing – below 0.0 ˚C (32 F)	-	-	-	

SPECIAL PROVISION REQUIRED	Unit	Mary River Mine	Milne Inlet	Steensby Inlet Port Site	Notes
Lightning		-	-	-	
Dust Exposure	Yes/ No	YES	YES	YES	
Site Elevation above Sea level	m	630 m at Deposit # 1	15-25 m At stockpile area	15 m at stockpile area	
		670 m at Deposit # 2			
		180 m at Stockpile Area			
Atmospheric Pressure - Design	kPa	-	-	-	

MDMT – Minimum Design Metal Temperature
LAST – Lowest Anticipated Service Temp.

Note 1: Site class should be verified by Geotechnical Report
Note 2: Global Warming allowance for 50 years can be included by adjusting values for active layer thickness
Note 3: For Wind Roses see page 2 of 2

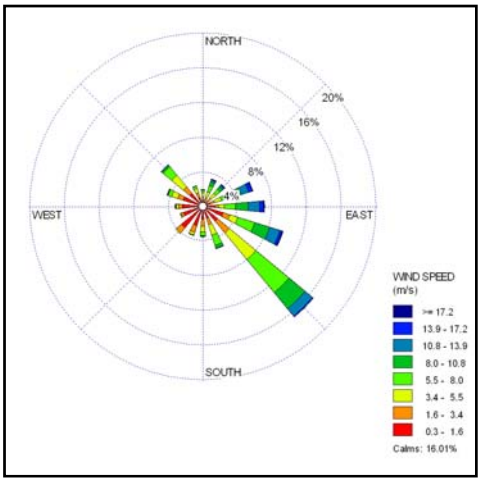


Fig: Wind Rose for Mary River Mine Site

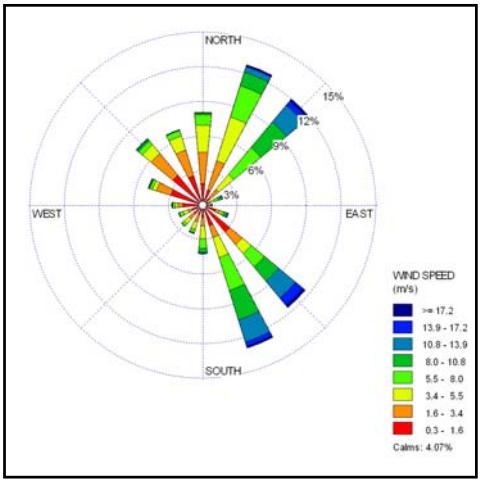


Fig: Wind Rose for Milne Inlet

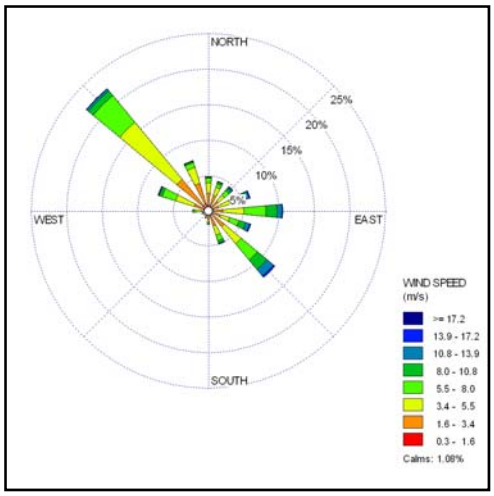
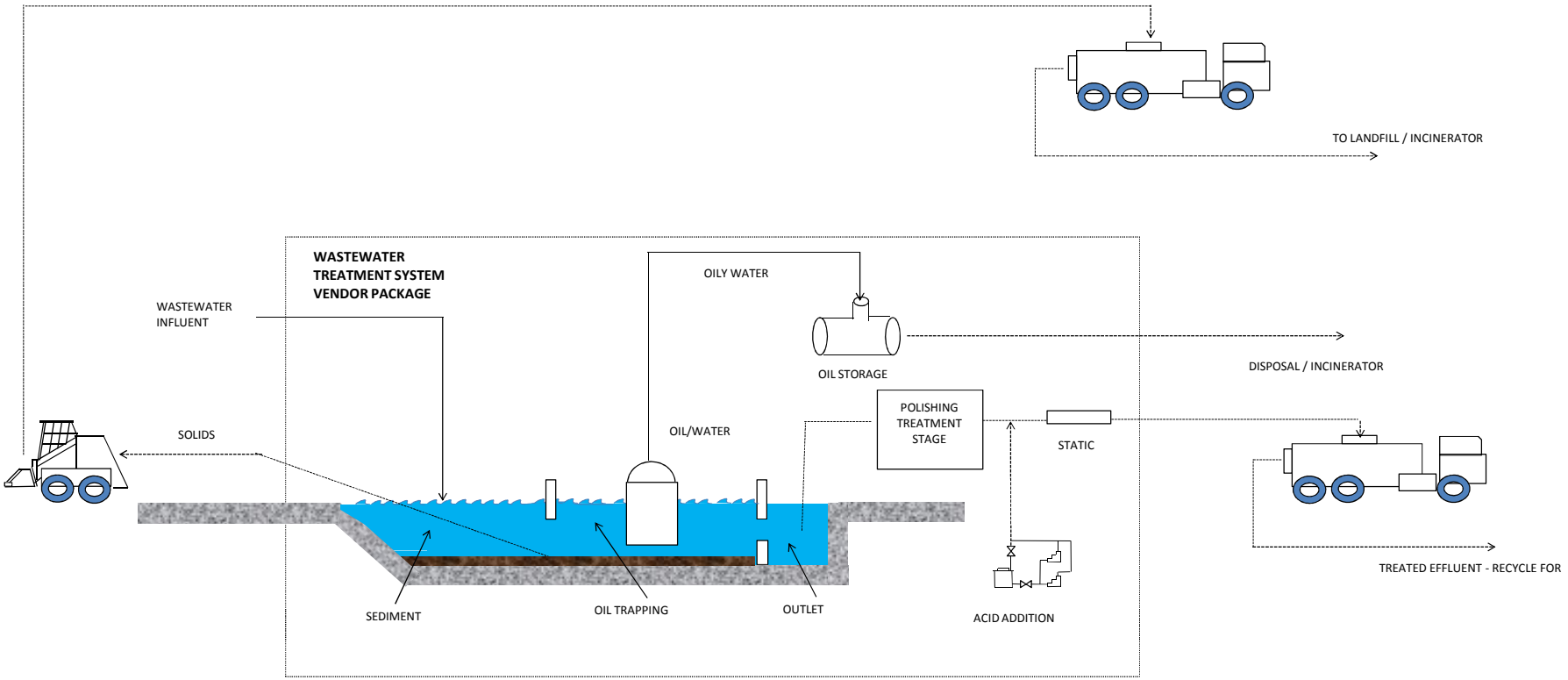


Fig: Wind Rose for Steensby Site

Appendix B

Process Schematic



Legend

Indicates Intermittent Flow.

Indicates Continuous Flow.

Appendix B.1

Wastewater Treatment System Schematic

1. Technical Requirements

The supplier shall supply a single train system such that the system can treat 100% of the feed wastewater flow. The supplier shall also include one (1) set of shelf spares for all components that include rotating parts.

1.1 Settling Tank/Sump

The settling tank/sump shall be an insulated tank, complete with grating. The insulation is to be designed to ensure the water temperature remains above 5 °C based upon a 0°C inlet water temperature as well as the climactic data found in Appendix A. The tank shall have all necessary connections and all necessary instrumentation, including level switches. The tank shall be preferably constructed to standard size shipping containers. Shippable one piece welded tanks, and bolted tanks, are also acceptable. If concrete construction is recommended the supplier is to design the settling tank to be constructed on-site by the buyer.

The size of the settling basin shall be based on the following criteria: A maximum surface loading rate of 1 m/hr is to be used and a minimum 12 hours detention time at average feed flowrate to allow agglomeration (see Section 00 11 00 Wastewater Design Flow Summary). The basin is to be rectangular and allow for the periodic removal of accumulated solids by the use of a bucket loader (tractor with a front mounted square wide bucket). A length : width ratio of 3 : 1 shall be used. A weir overflow rate of < 300 m3/m/day is to be used. Supplier to specify removal frequency of accumulated solids. The settling tank must be capable of settling fine sand, silt, clay and organic particles in addition to larger sand, gravel particles and small floatables.

The settling tank shall be sized to a specific particle size distribution that is identified in Table 4-4 below. The example below is a Fine Particle Size that is a common particle size distribution used in design of water quality devices to ensure proper design for capturing smaller particles and the high load of associated pollutants.

Table 1-1: Particle Size Distribution

Amount	Diameter (Micron)	Specific Gravity
20%	20	1.3
20%	60	1.8
20%	150	2.2
20%	400	2.65
20%	2000	2.65

The supplier is free to recommend that oil separation and solids settling occur in the same basin. In this case the supplier is to ensure that the design of the settling basin is in accordance with section 1.6 (Oil/Water Separator) and that the effluent meet the required effluent limits.

1.2 Chemical Addition System (if required)

If a chemical injection system is deemed necessary (for coagulation, pH adjustment, chemical oxidation or reducing agent addition) the following requirements shall be met. All metering pumps and components and necessary monitoring and controls shall be pre-assembled onto the skid-mounted system, which shall be composed of:

Metering pumps. Complete with the following:

- Duty/Standby, motor-driven, reciprocating, mechanically actuated diaphragm type, with de-gassing function.
- Stroke length control shall be adjustable manually by means of a stroke length knob, in increments of 1%, from 0% to 100% of stroke length. The stroke length shall be displayed on the pump LCD in 1% increments.
- Pump shall include XP, four-pole AC motor.
- Pump shall be able to be calibrated to display pump output in gallons/hour or litres/hour.
- Calibration columns.
- Piping and piping accessories (pulsation dampeners, basket strainers, backpressure and pressure relief valves, etc.)
- Pressure gauge and diaphragm isolators.
- Local control panel.
    - A local control panel shall be supplied with the skid to be mounted on or remote to the skid. The panel shall have a local speed potentiometer for 0-100% local speed command with a digital display of set point and actual pump output. The panel shall have a local/remote selector switch. Remote operation is accomplished by receiving a dry contact maintained for run enable and an analog 4-20 mA input for speed command. Alarm LED and Run LED illuminated selector are located on the control panel door.
    - The control panel shall provide a terminal strip for user interface to connect AC power from the source and terminal strip connection to metering pumps. All control input/output functions shall be located on a terminal strip for user interface.
    - Remote status contacts shall be available for Remote Selected, Run, Alarm, and analog feedback signal. The analog signal shall be a summation of both the pump stroke frequency and stroke length, giving actual pump output scaled over the 4-20 mA range.

Any chemical oxidation system shall include a chemical reduction system to ensure that all the oxidizing chemical has been reduced prior to effluent discharge. The chemical reducing system shall consist of metering pumps (1 duty + 1 standby) and a polyethylene storage tank with level switches. Supplier to specify chemistry (preference given to sodium bisulphite use as reducing agent).

Residual levels of chemical oxidant shall be measured on-line continuously using a chemical specific probe or ORP instrument.

The chemical oxidant shall be mechanically mixed as rapidly as possible. This may be accomplished by either the use of turbulent flow regime or a mechanical flash mixer.

The contact time shall be provided in a pipeline or a tank where plug flow conditions are closely approached.

All piping containing chemical oxidant shall be colour coded and labelled to distinguish it from other plant piping.

The reducing chemical shall be introduced at a point in the process where the hydraulic turbulence is adequate to ensure thorough and complete mixing. If no such point exists, mechanical mixing needs to be provided. Minimum dissolved oxygen levels in the final effluent after introduction of reducing agent shall be maintained at levels consistent with natural surface waters.

1.3 Media Filters (if applicable)

The media filters shall include automated backwash control valves, back-wash pumps, differential pressure control and gauges. The pressure vessel to be designed in accordance with ASME.

As a minimum the system should provide flow signal for service and backwash flow, pressure indication on the feed and product lines as well as differential pressure control to initiate backwash.

Filters should be capable of independent operation and backwashing.

During the backwashing of one filter the hydraulic flowrate through the remaining in service filters should not increase by more than 10%.

For traditional dual media filter designs, the media should consist of a lower level of silica sand, not less than 200 mm deep, and an upper layer of anthracite coal or GAC not less than 450 mm deep. The media selection should ensure fluidization of each layer of media during backwashing and subsequent re-stratification of the media.

For traditional dual media filter designs, a maximum filtration rate of 12 m/h.

A sufficient volume of water should be available for backwashing all filters every 24 hours. The backwash rate should be variable, with the maximum rate designed to provide 50% expansion of the filter media bed at the highest water temperature.

The design should allow for a backwash duration of at least 15 minutes.

A flow regulator, flow meter and flow indicator should be provided on the main backwash header.

If an air scour step is included the air flow for air scouring the filter prior to backwashing should be minimum of 0.9 m3/(min·m2) of filter area when the air is introduced into the underdrain. A lower air rate should be used when the air scour distribution system is placed above the underdrains. The air should be free from contamination. Oil-free compressors should be used. Air scouring should be followed by a fluidization wash sufficient to restratify the media. An air release valve should be placed at the high point of the header.

For filters 900 mm or more in diameter an access hatches to facilitate inspection and repairs should be provided.

All filters should be equipped as follows:

- Means for obtaining influent and effluent samples;
- Indicating flow meter and flow control to each filter/filter train;
- Continuous effluent turbidity measuring and recording device;
- All required filter media, including support media and media traps, to remove suspended solids to a nominal rating of 10 micron;
- Air scour blower assembly (if air scour step is included);
- Internal flow distributors;
- Underdrain collector system (if required);
- Automated flow control valves;
- Air release valves (if air scour step is included);
- Ventilation ducts;
- Pressure gauges;
- Differential pressure transmitter;
- Flow meters;
- Indicating loss of head gauge;
- Filter backwash pump;
- Provisions for filtering-to-waste with appropriate measures for backflow prevention or operational procedures to achieve the same water quality results;
- Head room to permit normal inspection and operation;
- Minimum water depth over the surface of the filter media of 1 m (1.5m for high rate filtration) to prevent air binding due to dissolved air coming out of solution in the filter bed
- Effluent piping designed to prevent backflow of water and air to the bottom of the filters and to provide minimum operating conditions for flow meters;
- The system should control the flow to each individual filter, apportion the total flow among the individual filters and accommodate rising head loss through each individual filter run.

1.4 Activated Carbon Filters (if applicable)

If sterilization of activated carbon is deemed necessary this shall be by chlorination using a sodium hypochlorite dosing system designed in accordance with section 1.2. Supplier to indicate sterilization frequency and chemical consumption.

For removal of organics the flowrate through the carbon filter is not to exceed 0.61 m3/hr/m2.

Supplier to indicate the originating material (coal, etc.), uniformity coefficient and mesh size.

As a minimum the system should provide flow signal for service flows, pressure indication on the feed and product lines as well as differential pressure control.

All filters should be equipped as follows:

- Means for obtaining influent and effluent samples;
- Indicating flow meter and flow control to each filter/filter train;
- Internal flow distributors;
- Underdrain collector system (if required);
- Automated flow control valves;
- Pressure gauges;
- Flow meters;
- Indicating loss of head gauge;
- Provisions for filtering-to-waste with appropriate measures for backflow prevention or operational procedures to achieve the same water quality results;

1.5 Cartridge/Bag Filters (if applicable)

If additional filtration is deemed necessary and cartridge or bag filters are proposed the following requirements shall be met. Generally, the use of cartridge/bag filtration processes is limited to raw water supply sources (or influent water after pre-treatment) having turbidity of less than 5 NTU and color less than 5 TCU.

Cartridge and bag filters are made from fibre, and unlike membranes, have a broad range of pore/opening sizes which allow penetration of a few larger sized particles than the filter rating. This small penetration rate by oversized particles shall be taken into consideration along with the quality of the raw water supply.

System shall ensure that differential pressures across the filter medium does not exceed manufacturer's rating.

Pressure gauges shall be installed before and after the bag/cartridge filter.

A slow opening and closing valve shall be included upstream of the filters to reduce flow surges. Frequent start and stop operation of the bag or cartridge filter shall be avoided.

For surface cartridge filters the maximum allowable flowrate per 10″ of cartridge length is 10 gpm. The maximum allowable flowrate per 10″ of cartridge length for depth filters is 5 gpm.

1.6 Oil/Water Separator

Oil and water separators remove oil and other water-insoluble hydrocarbons and settleable solids from wastewater. Oil and water separators are typically the American Petroleum Institute (API) (also called baffle type) (American Petroleum Institute, 1990) or the coalescing plate (CP) type using a gravity mechanism for separation. If coalescing plates are proposed the design of the plates shall ensure ease of removal for cleaning with high-pressure rinse or equivalent.

Standard gravity separators, are liquid containment structures that provide sufficient hydraulic retention time to allow oil droplets to rise to the surface. The oil forms a separate layer that can then be removed by skimmers, pumps, or other methods. The wastewater outlet is located below the oil level so that water leaving the separator is free of the oil that accumulates at the top of the unit. The inlet is often fitted with diffusion baffles to reduce turbulent flow that might prevent effective separation of the oil and might re-suspend settled pollutants.

Enhanced gravity separators allow the separation of smaller oil droplets within confined spaces. These separators use a variety of coalescing media and small diameter cartridges that enhance laminar flow and separation of smaller oil droplets that accumulate on the separator surface for removal.

The typical device comprises a concrete tank with three chambers: sediment chamber, oil trapping chamber, and outlet chamber. Flow between the chambers may be controlled by orifices, weirs, and inverted elbows or other proprietary products for collecting sediment, trapping floatables, and controlling flows.

Baffles shall be constructed from a noncorrosive material, such as concrete, stainless steel, or a fibreglass reinforced plastic. Baffle height to water depth ratios shall be 0.85 for top baffles and 0.15 for bottom baffles.

Design inlet flow distribution and baffles in the separator bay to minimize turbulence, short-circuiting, and channelling of the inflow. The Reynolds Number through the separator bay shall be < 500 (laminar flow). The maximum allowable velocity of feedwater through the inlet shall be of 50 m3/hr.

Oil Water Separators shall also meet the following requirements:

- If oil absorbent material is used the replacement frequency and cost is to be provided by the supplier.
- Ball valves to be used for any solids or sludge line from the oil separator.
- The Supplier shall indicate the required inspection and cleaning frequency if required.
- A shutoff valve is to be included on the separator outlet
- Separator to be designed for a water temperature of 5 degrees Celsius and a petroleum specific gravity of 0.81 – 0.88;

- Emulsions caused by surfactants (detergents and soaps) from the pressure wash facility may be present and shall be a design consideration.

1.7 Air Compressor System

Air compressor systems are to be provided for each site.

Air compressor system shall be reciprocating (piston) type, electric motor, rated for commercial duty, oil-fee air, complete with air receiver tank, intake air filters, air regulator, air dryer, and local control panel. Air shall be oil free (< 0.01 ppm oil) have a maximum dew point of -65°C and be filtered to 40 micron.

Air receiver to be epoxy coated , carbon steel, and designed and constructed to meet CSA B51 and registered with a valid CRN. The air receiver tank is equipped with a pressure relief valve, pressure gauge, automatic drain, and source isolation valve.

The local control panel shall be NEMA 4X rated complete with motor starters, control wiring, Hand-Off-Auto selector switch, push-buttons, indicator lights and main disconnect switch, complete with a local operating controller and display.

1.8 Tanks (General)

Tanks shall be carbon steel, polyurethane or epoxy coated, closed top, vented with air filters, and in accordance with API.

Container shall be designed for seismic conditions that prevail onsite in accordance with API and IBC.

Attachments for anchor bolts shall be by the Seller; anchors by others.

Tanks shall include all necessary flanged, nozzle connections.

Tanks shall include all level switches, including mounting attachments.

Each tank shall be shipped as one complete piece, including coatings, if possible. If each tank is not possible to ship as one piece, the tanks shall then be designed as knock-down tanks and shipped to a modular yard for final erection, including coatings, prior to shipment to site. Bolted tanks are also acceptable.

1.9 Containers (General)

All wastewater treatment plant components shall be shipped in a standard 12 m (40 ft) shipping container where possible.

If the proposed wastewater system comes containerized the containers shall be heated, ventilated, insulated, watertight, complete with lighting system, smoke and security alarm system and lockable doors and gaskets.

Containers for containerized systems shall be manufactured of carbon steel, epoxy coated. Dimensions shall be according to ISO standards and designed for seismic and wind conditions, in accordance with IBC with attachments for anchor bolts; anchors by others.

2. Pumps, Valves and Piping Requirements

All necessary pumps, valves and piping, shall be supplied by the Seller, fully assembled, and installed, within the containerized system.

Pipe supports and pump base plates shall be provided.

Pump motors shall be rated for VFD, where required; VFDs by Seller.

All installed pumps, piping and valves shall be accessible, and shall have sufficient surrounding space for the purposes of maintenance and repair.

The Seller shall also supply the pumps, valves and piping required for the water tanks, and for the connection between the container and water tanks.

Pneumatic actuators are to be used for valves installed in-doors. Alternatively electric actuators/with heater may to be used for remote locations, where an instrument air supply is not available.

For control valves, on/off and modulating (throttling), refer to Instrumentation Requirements for Packaged Equipment.

Check valves shall be located to prevent unintended reverse flow where necessary.

Refer to standard specifications for Piping Materials Specifications, document number to be confirmed, for materials of construction for piping and valves for details.

Pipe connections to be Victaulic type with EPDM seals where possible.

3. Mechanical Requirements

Standard Mechanical requirements are identified in the Mechanical Design Criteria, Document No. H337697-0000-50-122-0001.

All equipment and all components shall be the Seller's standard heavy-duty design and fabrication and shall have been proven effective and reliable under similar operating conditions. No new or unproven design is acceptable.

Not all parts and materials are specified in this specification. For those that are not specified, the Seller shall use their standard parts and materials, which will be subject to the approval of the Owner.

The Seller shall notify the Owner if any specific requested component is unsuitable for the required service and present alternatives, along with the technical justifications.

4. Electrical Requirements

Electrical design shall comply with the following:

- H337967-S260050 – Electrical Requirements for Packaged Equipment.

All electrical panels, transformers, lighting panel, MCCs, including starters, circuit breakers, and VFDs shall be provided by the Seller.

All lighting system, and power outlets, shall be included by the Seller.

All wiring, cabling conduits, and cable trays to be included by the Seller.

Electrical equipment may be exposed to an accumulation of explosive vapours and as such should be designed to be suited for installation in hazardous area classification Class 1, Div. 2.

5. Instrumentation and Controls Requirements

Instrumentation and controls design shall comply with the following:

- Instrumentation Requirements for Packaged Equipment, H337967-S250050

The local control system for the water treatment plant shall be supplied by the seller.

The Owner shall approve all exceptions or deviations from these requirements.

The following instruments shall be included, but not limited to, in the supply of the equipment by the Seller:

- Flow meters
- Pressure indicating transmitters, switches and gauges
- Level Switches (High High, High, Low, and Low Low)
- Limit switches for valve (open and close)
- Temperature sensors and transmitters
- Chlorine analyzers (free chlorine)
- Dissolved Oxygen probes

Seller shall include additional instruments, if required, for the safe operation of supplied equipment.

Pressure gauges to be provided on all pump discharges

The Seller shall provide a list of signals (alarms, monitoring and interlocks) to be monitored and/or controlled from the Owner's Plant Control System.

The Owner shall provide a written narrative functional description of all process control requirements as per project standard template.

Enclosure of local control panel shall be NEMA 4X.

Seller shall be responsible for the development of the sequence of operation, and the programming for the PLC.

Flow meters shall be magnetic type, and shall be installed on the main feed, feed to each train, effluent, sludge line to digester, as a minimum

All water tanks, and chemical storage tanks, to have level switches.

All control wiring within the battery limits shall be provided by the Seller.

Shelf spares to be provided for all critical instruments

All instruments to be smart bus or 4-20mA HART.

Motors communication protocol (i.e: DeviceNet, Profibus, Modbus TCP) to be announced in later in the project

Communication protocol with Owner's network shall be Ethernet.

6. Structural Requirements

Structural design shall comply with the following:

- Appendix A: Meteorological and Seismic Data
- Document No. to be confirmed, Structural Design Criteria.

The container and water tanks shall be designed for seismic and wind conditions in accordance with local codes, API and IBC.

The container and water tanks shall be anchored. Anchor attachments by Seller; anchors by others.

All equipment, including piping and electrical equipment, shall be secured by base plates, supports, or other means, to withstand seismic or wind loads.

The Seller shall supply certified design data showing dimensions, loadings, locations and sizes of all steel members which will allow others to design concrete foundations, inserts, and anchor bolts to receive Seller's equipment.

All stairs, ladders, platforms and walkways shall be supplied by the Seller.

7. Painting Requirements

All exterior metallic surfaces shall be primed and painted/coated with a suitable polyurethane, or epoxy product capable of withstanding the noted site conditions, especially temperature variations without cracking chipping or peeling.

All interior carbon steel surfaces shall be primed and painted/coated or lined, with a suitable polyurethane, or epoxy product, and shall be in accordance with NSF61.

Painting shall not be required for parts of equipment that are manufactured of or coated with corrosion resistant materials, that are machine finished or normally left unpainted.

Machine finished parts that are not manufactured of corrosion resistant materials and are not painted, shall be given a heavy coat of rust-inhibiting compound that can be easily removed at installation by the use of solvents and hand wiping.

8. Regulations, Standards, and Codes

The International System (SI) will be used for all design calculations and on all drawings.

The equipment shall comply with the latest version of all appropriate regulations, standards and codes, including, but not limited to, those listed below:

Table 8-1: Applicable Regulations, Standards and Codes

Number/Acronym	Title
AWWA	*American Water Works Association*
IBC	*International Building Codes*
NSF	*National Sanitation Foundation*
GCWQ	*Guidelines for Canadian Drinking Water Quality*
NWT Reg 108-2009	*Northwest Territories Water Supply System Regulations*
Ontario Reg 170/03	*Safe Drinking Water Act, 2002*
Nunavut Waters and Nunavut Surface Rights Tribunal Act, SC 2002, c 10	
Northwest Territories Water Act	
Northwest Territories Water Regulations (SOR/93-303)	
Ontario Drinking Water Quality Standards	
NSF/ANSI Standard 61	Drinking Water System Components
AWWA Standard B100	Filtering Material

AWWA Standard B604	Granular Activated Carbon
OSHA	*Occupational Safety and Health Administration*

9. Health, Safety, Environment and Community Requirements

Protection designed for the valid codes and standards shall be installed in order to avoid operator injury. Minimum required protection as follows:

- Operation point protection.
- Moving parts protection.
- Power transmission and gyratory parts protection.
- Hot spots protection.
- Dust emission protection.
- Tools protection.
- Fire protection and detection system.

10. Assembly and Testing

10.1 Critical Dimensions

All critical dimensions shall be checked prior to shipment. All ancillaries shall be assembled and all motions tested in accordance with manufacturers standard procedures. Prior to disassembly all components shall be match marked, where practical, for ease of field assembly. The Seller shall describe the extent of field assembly required.

10.2 Equipment Assembly

All equipment shall be shipped assembled to the maximum extent possible consistent with shipping limitations indicated below. The Owner shall be consulted prior to the shipment of large components.

10.3 Pre-Assembly

All pre-piped and pre-assembled lube oil and hydraulic oil systems shall be tested for their output pressures and motions to the maximum extent possible.

10.4 Specific Testing Requirements

Water tanks to be hydrostatically tested.

10.5 Control System Components

At the Owner's option, Seller-furnished control systems components shall be subject to Owner-witnessed Factory Acceptance Test (FAT) in accordance with test procedures that shall be

submitted by the Seller and reviewed by the Owner. All input/output signals and control functions shall be simulated. If required, the Seller-furnished components may be subject to integration testing with the main project PCS system.

The Seller shall submit a Site Acceptance Test procedure that will be subject to the Owner's review and permission to proceed. Items such as proper equipment grounding, powering up, checking for correct software installed, etc. shall be included in the procedure.

Wherever possible instruments shall be pre-wired and pre-installed to controller.

11. Shipping, Construction, Commissioning and Operator Training

11.1 Shipping

The equipment will be shipped to an assembly site in the largest feasible sections that allow transportation by road. Protective coatings and coverings shall be applied to ensure that the equipment is not damaged during shipment. The Seller shall provide match-marking of all parts to facilitate field assembly and shall provide shipping dimensions and weights of all components and assemblies.

11.2 Construction Supervision, Testing and Commissioning

The Seller shall make available qualified personnel to advise and assist with on-site supervision of construction and assist with testing and commissioning. The Seller's expense policy shall be outlined in the bid document. The Owner, and/or his representative and any Authorities having jurisdiction over the equipment shall witness all tests.

11.3 Operator Training

If requested, the Seller shall train operators and supervisors in the operation of the supplied equipment. Such training shall include:

- Training lectures and lecture notes.
- On-the-job training during commissioning and plant operation.

The Seller will supply rates and terms for such training.

12. Spare Parts

The Seller shall supply lists of recommended spare parts.

13. Quality Assurance

The Seller shall prepare a quality assurance and inspection/test plan and submit for Owner's approval. No changes to the plan will be allowed during implementation without prior consent from the Owner. Refer to Section S01 43 00 – Quality Management for the requirements of this plan.

Appendix A:
Meteorological and Seismic Data

Appendix B:
Process Schematics