Schedule 18A

Appendix 18A – Process Functional Requirements

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SECTION A ODOUR CONTROL

A.1. Biological Odour Control Systems

A.1.1 Process Function Overview and Objectives

A.1.1.1 Design Builder shall meet the Odour Standards for the Infrastructure.

A.1.1.2 Design Builder shall design a minimum of 1 and a maximum of 2 biological odour control systems, not including the activated carbon odour treatment unit dedicated to the THP system. Foul air with the most odour shall be deodorized in odour treatment units before discharge to stack(s). Foul air with a reduced odour may be discharged to the stack(s) directly. As a minimum, Design Builder shall deodorize the following sources/locations using biological odour treatment units on Construction Site Parcel B:

(a) phosphorus release tanks;

(b) sludge screenings bins;

(c) intermediate centrate tanks;

(d) screened sludge equalization tanks;

(e) intermediate dewatering centrifuges;

(f) intermediate dewatered sludge hoppers;

(g) liquid sludge receiving station (from SEWPCC and WEWPCC);

(h) hauled liquid sludge equalization tanks;

(i) final dewatering centrifuges;

(j) return lift station;

(k) final dewatering centrate tanks;

(l) final biosolids storage hoppers;

(m) final biosolids truck loading chutes;

(n) phosphorus recovery reactors;

(o) thermal hydrolysis process (THP) (could be either part of a biological odour control system or have a dedicated activated carbon system);

A.1.1.3 The odour control systems shall include the following as a minimum:

(a) odour treatment units that shall be based, as a minimum, on a two-staged biological system in series, comprised of a biotrickling filter and biofilter;

(b) each odour control system shall consist of two parallel trains, with each designed for a minimum of 50% peak capacity.

(c) the odour treatment system must be designed to pass the full foul air flow through a single treatment train with one train out of service, resulting in reduced removal rates;

(d) the system shall bypass to the exhaust stack if both odour control systems are out of service;

(e) exhaust fans;

(f) exhaust stack(s) and

(g) all ancillary equipment.

A.1.1.4 The odour control systems shall meet the Odour Standard and the minimum removal efficiencies in Section C.3.2.5(c) of Schedule 18 – Technical Requirements for each odour treatment system. Design Builder shall provide the selected treatment systems as part of the Infrastructure;

A.1.1.5 Provide the odour treatment system in Area T to be easily expandable for the future WAS thickening and fermentation areas.

A.1.1.6 At a minimum, locate all ancillary equipment and control panels indoors.

A.1.1.7 The odour treatment units shall be above grade concrete tanks, if not located in a heated and ventilated building.

A.1.1.8 Design the odour control systems such that the media is under negative pressure to prevent fugitive odour emissions.

A.1.2 Basis of Design and Performance Requirements

A.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design and construct the odour treatment units to:

(a) provide a minimum odour unit removal efficiency of 95 percent during both average and peak loading conditions. Design Builder shall determine minimum, average and peak odour emission rates;

(b) provide a minimum hydrogen sulphide reduction efficiency of 99.5 percent during both average and peak loading conditions. Design Builder shall determine minimum, average and peak emission rates of hydrogen sulphide; and

(c) provide a minimum total reduced sulphur compounds (definition consistent with Ontario Regulation 419/05 removal efficiency of 90 percent during both average and peak loading conditions. Design Builder shall determine minimum, average and peak emission rates of total reduced sulphur compounds;

(d) Design odour control systems to be operated at all times so that biological activity does not decline.

A.1.2.2 Design Builder shall provide odour dispersion stacks for all foul air emissions, whether deodorized at the odour treatment units first or vented directly from the process areas. Stacks shall convey the treated air to meet the following requirements:

(a) provide stacks of sufficient height to meet the Odour Standard as demonstrated by air dispersion modeling in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models;

(b) stacks shall be a minimum height of 30 m, a minimum of 5 m above the tallest building on Construction Site Parcel B, and meet odour control modelling requirements in Appendix 18K;

(c) provide stacks that are free standing and do not use guy wires;

(d) provide dual wall stacks constructed of stainless steel exterior and fiberglass flue; and

(e) provide stacks with sufficient exit velocity to prevent icing.

A.1.1.2 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design each odour control system to meet the following requirements:

(a) provide a minimum of 1 duty and 1 standby foul air fan for each odour control system;

(b) provide proper humidification of the air prior to entering the odour treatment units;

(c) If utilizing activated carbon following the biofilter, provide moisture control to prevent saturating the activated carbon media;

(d) provide liquid supply, recirculation, and drainage as required for the odour treatment units;

(e) If the drainage is low or high in pH, the conveyance piping must be designed for this condition.

(f) provide a plant nutrient water supply connection and nutrient water recirculation connection to each biotrickling filter equipped with flow control valves, strainer, diaphragm valve and flow measurement;

(i) provide duty and standby recirculation pumps;

(ii) use non-potable flushing water as a water source;

(iii) provide nutrient source to be added to the nutrient water; and,

(iv) provide flow measurement, actuated valves and isolation valves for the non-potable water.

(g) provide heating system to maintain recirculation water at a minimum of 8°C;

(h) provide an overflow drain on each biofilter vessel equipped with p-trap and electrically actuated trap primer sized to maintain the seal at 125% of the maximum design pressure in the air distribution plenum beneath the media. Do not use plant effluent water (flushing water) for the trap primer fluid;

(i) provide heat tracing and insulation on all outdoor, exposed process water and drain lines;

(j) provide platforms and handrails at the top of the vessels to facilitate operations and maintenance of equipment and replacement of media and equipment;

(k) provide stairs to access the top of the vessels;

(l) ensure all equipment within vessels can be removed without entering the vessel;

(m) provide easily accessible hatches for any media removal or replacement;

(n) any media for the biological systems used shall be designed to be replaced no more than once every 15 years at the 2050 operating conditions;

(o) any media for the activated carbon systems (if required) shall be designed to be replaced no more than once every 2 years at the 2050 operating conditions;

(p) if activated carbon system is required provide moisture control so that the activated carbon bed is not saturated;

(q) provide a foul air emergency bypass to the stack for the treatment units. Fully redundant odour treatment units are not required;

(r) for biofilter vessels, provide the following:

(i) irrigation system including valving and piping to maintain humidity in the bed. Provide flow control valve, strainer and flowmeter;

(s) for activated carbon systems (if required) located downstream of the biological systems, provide vessels that do not need manual handling of activated carbon by shoveling, raking, mixing or similar manual intervention for filling and removal of activated carbon;

(t) for the truck loading chutes odour source in Section A.1.1.2(m), provide automated ventilation whenever the chutes are in use.

A.2. Activated Carbon Odour Control System

A.2.1 Process Function Overview and Objectives

A.2.1.1 Design Builder shall provide an activated carbon odour treatment system dedicated to the THP system if the biological odour control system is not sized for THP. The intent of this dedicated activated carbon system is to treat odour emission spikes that result during periodic maintenance activities when the THP system is taken offline.

A.2.1.2 The odour control systems shall include the following as a minimum:

(a) each odour control system shall consist of two parallel trains, with each designed for a minimum of 50% peak capacity.

(b) the odour treatment system must be designed to pass the full foul air flow through a single treatment train with one train out of service, resulting in reduced removal rates;

(c) the system shall bypass to the exhaust stack if both odour control systems are out of service;

(d) exhaust fans;

(e) exhaust stack(s) and

(f) all ancillary equipment.

A.2.1.3 The odour treatment units shall be located in a heated and ventilated building such that it is ready for intermittent use without risk of freezing when not in use.

A.2.2 Basis of Design and Process Performance Requirements

A.2.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design and construct the activated carbon odour treatment system to:

(a) provide a minimum odour unit removal efficiency of 95 percent during both average and peak loading conditions. Design Builder shall determine minimum, average and peak odour emission rates;

(b) provide a minimum total reduced sulphur compounds (definition consistent with Ontario Regulation 419/05 removal efficiency of 90 percent during both average and peak loading conditions. Design Builder shall determine minimum, average and peak emission rates of total reduced sulphur compounds;

(c) provide a minimum of 1 duty and 1 standby foul air fan for each odour control system;

(d) provide moisture control to prevent saturating the activated carbon media if required;

(e) provide stairs to access the top of the vessels;

(f) ensure all equipment within vessels can be removed without entering the vessel;

(g) provide easily accessible hatches for any media removal or replacement;

(h) any media for the activated carbon systems shall be designed to be replaced no more than once every 2 years at the 2050 operating conditions;

(i) provide a foul air emergency bypass to the stack for the treatment units. Fully redundant odour treatment units are not required;

(j) provide vessels that do not need manual handling of activated carbon by shoveling, raking, mixing or similar manual intervention for filling and removal of activated carbon;

(k) provide 6 air changes per hour to declassify the THP area;

(l) design system for intermittent use for maintenance, repairs, and inspections; and

(m) provide ability to focus odour mitigation at high release areas.

A.2.2.2 The odour control systems shall meet the Odour Standard and the minimum removal efficiencies in Section C.3.2.5(c) of Schedule 18 – Technical Requirements for each odour treatment system. Design Builder shall provide the selected treatment systems as part of the Infrastructure;

A.2.2.3 Design Builder shall provide odour dispersion stacks for all foul air emissions, whether deodorized at the odour treatment units first or vented directly from the process areas. Stacks shall convey the treated air to meet the following requirements:

(u) provide stacks of sufficient height to meet the Odour Standard as demonstrated by air dispersion modeling in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models;

(v) stacks shall be a minimum height of 30 m, a minimum of 5 m above the tallest building on Construction Site Parcel B, and meet odour control modelling requirements in Appendix 18K;

(w) provide stacks that are free standing and do not use guy wires;

(x) provide dual wall stacks constructed of stainless steel exterior and fiberglass flue; and

(y) provide stacks with sufficient exit velocity to prevent icing.

A.2.2.4

A.3. Special Studies

A.3.1.1 Provide air dispersion modeling in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

A.4. Site Planning Requirements

A.4.1.1 All odour sources in the same Area Code shall be directed to a common odour control system, as a minimum. Odour sources in multiple Area Codes may be directed to a common odour control system provided the foul air ducting is below-grade to minimize heat loss during the winter months.

A.4.1.2 Design Builder shall assign an Area Code to each odour control system in accordance with C.1.1.10 Area Codes in Schedule 18 – Technical Requirements.

A.4.1.3 Design Builder shall locate all odour control systems at ground floor level to facilitate access for media replacement.

A.4.1.4 Design Builder shall provide road access to the odour control system with sufficient space for laydown, storage and placement for all equipment, trucks, products and media necessary to facilitate the removal and replacement of media and filling of each individual odour treatment unit.

SECTION B AREA P – PRIMARY CLARIFICATION

B.1. Primary Sludge Pumping System

B.1.1 Process Function Overview and Objectives

B.1.1.1 Design Builder shall develop basis of design criteria and performance requirements for the primary sludge pumping system to convey primary sludge from the existing primary clarifiers to the proposed sludge screens.

B.1.1.2 Discharge shall be configured to allow primary sludge pump discharge pipe to be modified to ultimately discharge to the future fermenters, and the future fermenters sludge pumps to discharge to the sludge screens. The future fermenters are expected to be built to the east of the existing centrate treatment sequencing batch reactors (SBR) in Area C.

B.1.1.3 Provide a minimum of 1 duty pump and 1 standby pump dedicated to primary clarifiers (PC) 1, 2, and 3 combined.

B.1.1.4 Provide 1 duty pump and 1 standby pump dedicated to PC 4 and 5 combined.

B.1.1.5 Provide sufficient control valves and flow meters to facilitate sludge withdrawal rates proportional to the flow through each clarifier as a function of surface area and configuration, as follows:

(a) PC 1 and 2: withdrawal rate "A"

(b) PC 3: withdrawal rate "B"

(c) PC 4 and 5: withdrawal rate "C"

B.1.1.6 Design Builder shall design the piping system to facilitate redirection of primary sludge to future destinations (specifically to and from future fermenters).

B.1.2 Basis of Design and Process Performance Requirements

B.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the primary sludge piping to meet the following two conditions. The pumps are to be designed for Condition 1, and the Design Builder shall check if it will meet Condition 2.

(a) Condition 1: Primary clarifiers to sludge screens

(i) Flow rate: Minimum 18 L/s per pump

(ii) Primary sludge solids content: 3-5 %

(iii) Elevation: determined by Design Builder’s Design

(iv) Type: centrifugal recessed impeller

(b) Condition 2: Primary clarifiers to future fermenters

(i) Flow rate: Minimum 45 L/s per pump

(ii) Primary sludge solids content: 1 %

(iii) Total Dynamic Head: 20 m

(iv) Type: centrifugal recessed impeller

B.1.2.2 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the primary sludge pumping system to:

(a) prevent settlement of suspended solids under low flow conditions;

(b) maximize pipe diameter and minimize fittings to discourage solids accumulation;

(c) provide the ability to reuse pipe and reconnect/redirect flows after the fermenters are constructed and commissioned;

(d) provide an adequate number of duty and standby pumps and piping to allow a pump to be taken out of service while maintaining 100% operational capacity at maximum month conditions;

(e) due to location, provide two pumping systems, with one system serving primary clarifiers 1, 2 and 3 and second serving primary clarifiers 4 and 5;

(f) piping from both pumping systems shall join and extend to Construction Site Parcel B sludge screens;

(g) provide 1 duty and 1 standby primary sludge conveyance pipes between the primary sludge pumps and Construction Site Parcel B sludge screens;

(h) pumps shall have:

(i) motor with adjustable speed drive;

(ii) turndown to at least 50 percent of design VFD;

(iii) the minimum flow and head requirements to achieve its designated performance under all flow and loading conditions

(i) provide an automated flush system for each pump, using flushing water on the suction in between the pump isolation valves;

(j) sludge pumping and conveyance is to be automated and monitored by the PCS to pump and convey sludge without operator intervention and shall include as a minimum:

(i) flow monitoring for sludge;

(ii) total solids measurement for sludge;

(iii) pressure monitoring on the suction and discharge of each pump;

(iv) abnormal operation alarms;

(k) Provide sample taps on each sludge discharge line;

(l) Provide manual sample taps on common discharge headers

B.2. Special Studies

B.2.1.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.3. Site Planning Requirements

B.3.1.1 Design Builder shall replace all discharge piping, valves, controls, power supply and associated equipment within 5 metres of the new primary sludge pumps.

B.3.1.2 Design Builder shall align piping to minimize the number of abrupt direction changes to minimize friction losses and potential for solids accumulation and clogging.

B.3.1.3 Design Builder shall route the new primary sludge discharge piping through Tie-in Sites Parcel A, through the existing tunnels, East-West gallery, and Construction Site Parcel A in accordance with Schedule 12 – Lands, Site(s) and Facility(ies). Design Builder shall maintain walking space, as well as operations and maintenance access to existing equipment, throughout the tunnels and galleries.

B.3.1.4 Design Builder shall route the new primary sludge discharge piping through the utilidor in order to cross the CPKC railway in accordance with Schedule 18 – Technical Requirements.

SECTION C AREA C – CENTRATE TREATMENT

C.1. Centrate Conveyance System

C.1.1 Process Function Overview and Objectives

C.1.1.1 Design Builder shall install piping to convey effluent from the phosphorus recovery system on Construction Site Parcel B to the existing Centrate Treatment Facility in Area C. A new tie-in to the Centrate Distribution Chamber will be required.

C.1.2 Basis of Design and Performance Requirements

C.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the phosphorus recovery system effluent conveyance system to:

(a) convey treated phosphorus recovery system effluent by gravity to the centrate distribution chamber under all conditions;

(b) design the conveyance system to by-pass the phosphorus recovery system and be conveyed directly to the to the centrate distribution chamber for instances when the phosphorus recovery system is out of service;

(c) provide new piping to convey maximum hour flow by gravity from the phosphorus recovery system;

(d) provide a second conveyance line with 100% capacity for redundancy at maximum month conditions;

(e) connect conveyance lines to the existing centrate distribution chamber without impacting operation of the existing centrate treatment facility;

(f) provide a minimum of two automated flushing water connections;

(g) provide isolation valves;

(h) provide in-line flow measurement.

C.1.2.2 Design Builder shall replace the existing inlet gates to SBR 1 and SBR 2 in the centrate distribution chamber.

C.2. Special Studies

C.2.1.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

C.3. Site Planning Requirements

C.3.1.1 The treated/bypassed phosphorus recovery effluent shall be conveyed to the centrate distribution chamber.

C.3.1.2 The tie-in to the distribution chamber should be scheduled for when the plant switches between SBR tanks (usually in the summer).

C.3.1.3 Design Builder shall route the phosphorus recovery effluent piping through Tie-Ins Sites Parcel A, and Construction Site Parcel A in accordance with Schedule 12 – Lands, Site(s) and Facility(ies).

C.3.1.4 Design Builder shall route the phosphorus recovery effluent piping through the utilidor in order to cross the CPKC railway in accordance with Schedule 18 – Technical Requirements.

SECTION D AREA F – FERRIC CHLORIDE RECEIVING AND STORAGE FACILITY

D.1. Ferric Chloride Pumping System

D.1.1 Process Function Overview and Objectives

D.1.1.1 Design Builder shall develop basis of design criteria and performance requirements for the ferric chloride pumping system to convey ferric chloride from the existing ferric chloride storage tanks to the proposed chemical storage system in Area D.

D.1.1.2 Provide a minimum of 2 duty pumps and 1 standby pump.

D.1.2 Basis of Design and Process Performance Requirements

D.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the ferric chloride pumping system to meet the following requirements:

(a) provide pumps to meet the following:

(i) Flow rate: 2,000 L/h total

(ii) Chemical type to be pumped: ferric chloride

(iii) Elevation: determined by Design Builder’s Design

(iv) Number of pumps: 3 minimum

(v) Controls: magnetic flow meter

(vi) Type: magnetic driven sealless centrifugal

(vii) Drive: VFD

(b) provide ability for feed pumps to draw from any storage tank; and

(c) provide discharge pipe interconnection such that any pumps can feed any conveyance pipe.

D.2. Chemical Conveyance System

D.2.1 Process Function Overview and Objectives

D.2.1.1 Design Builder shall design a new conveyance system to convey ferric chloride from the existing chemical storage tanks in Area F to new day tanks located on Construction Site Parcel B.

D.2.2 Basis of Design and Process Performance Requirements

D.2.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design and construct the chemical conveyance system to:

(a) provide new piping to convey maximum day flow from Area F to the chemical storage tanks located in Area D;

(b) provide two lines, each with 100% capacity for redundancy at maximum month conditions;

(c) provide minimum 25 mm conveyance pipe in a 50 mm containment pipe;

(d) provide drains at low points of each containment pipe;

(e) provide a minimum of two flushing water connections for each pipe;

(f) provide a minimum of two isolation valves; and

(g) prevent freezing or crystallization of chemical within the conveyance system.

D.3. Special Studies

D.3.1.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

D.4. Site Planning Requirements

D.4.1.1 Design Builder shall replace all discharge piping, valves, controls, power supply and associated equipment within 5 metres of the new ferric chloride pumps.

D.4.1.2 Design Builder shall align piping to minimize the number of abrupt direction changes to minimize friction losses.

D.4.1.3 Design Builder shall route the new ferric chloride discharge piping through the Tie-Ins Sites Parcel A, through the existing tunnels, East-West gallery, and Construction Site Parcel A in accordance with Schedule 12 – Lands, Site(s) and Facility(ies). Design Builder shall maintain walking space, as well as operations and maintenance access to existing equipment, throughout the tunnels and galleries.

D.4.1.4 Design Builder shall route the new ferric chloride discharge piping through the utilidor in order to cross the CPKC railway in accordance with Schedule 18 – Technical Requirements.

SECTION E AREA N – HAULED SLUDGE RECEIVING

E.1. Hauled Liquid Sludge Receiving System

E.1.1.1 Raw liquid sludge from the SEWPCC and the WEWPCC will be hauled by truck to the NEWPCC for unloading and processing.

E.1.1.2 Normal sludge hauling operation mode will be 24 hours per day, 7 days per week, 365 days per year (24/7/365).

E.1.1.3 The liquid sludge receiving system will be designed to accept liquid sludge and will include the following

(a) liquid sludge receiving system including sludge pumps

(b) sludge holding equalization and mixing tanks

(c) discharge pump to phosphorus release tanks

(d) flow meters to monitor deliveries and transfers

(e) all ancillary equipment

E.1.1.4 Raw liquid sludge from the SEWPCC and the WEWPCC will be unloaded at the liquid sludge receiving system. Liquid sludge will be pumped directly to the equalization tanks without dilution. Sludge will be pumped from the sludge equalization tanks to the phosphorus release tanks located in Area J. Include a washroom for the truck drivers within the building.

E.1.2 Process Function Overview and Objectives

E.1.2.1 The purpose of the liquid sludge receiving is to accept trucked liquid sludge (solids concentration between 3 and 6 percent) from the SEWPCC and West End Water Pollution Control Centre (WEWPCC).

E.1.2.2 Liquid sludge will be received at a minimum of two receiving systems via connections located at the liquid sludge receiving system. Liquid sludge receiving pumps will convey the liquid sludge from the trucks to the sludge equalization tanks.

E.1.3 Basis of Design and Performance Requirements

E.1.3.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the liquid sludge receiving system to:

(a) Receive all hauled sludge from WEWPCC and SEWPCC. At start-up, sludge from WEWPCC and SEWPCC will be hauled in liquid form with solids content of 3 to 6 percent.

(a) Allow at least two trucks to empty their contents simultaneously via cam lock connections.

(b) Provide sludge pumping and conveyance system to equalization tanks.

(c) Provide a means to measure volume pumped to the equalization basin.

(d) Provide a minimum of 1 duty and 1 standby positive displacement pumps with a minimum capacity of 150 m^3/h each to convey liquid sludge to the equalization tanks for each discharge connection.

(e) provide an adequate number of duty and standby pumps and piping to allow one pump or tank to be taken out of service while maintaining 100% operational capacity at maximum month conditions;

(f) provide a card lock system which will activate the liquid sludge receiving cam locks. System to be as per the *WWD Automation Design* Guide found in Appendix 18D – City, and NEWPCC preferences.

E.2. Hauled Sludge Equalization Tanks and Mixing System

E.2.1 Process Function Overview and Objectives

E.2.1.1 Hauled sludge will be stored in two mixed equalization tanks that will be circular reinforced concrete tanks. The tanks will have a concrete roof and a conical bottom.

E.2.1.2 The equalization tank mixing system shall provide homogeneous mixing for the stored sludge and be based on jet nozzles and dedicated pumping system.

E.2.2 Basis of Design and Performance Requirements

E.2.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the equalization tanks system to:

(a) provide a minimum of two equalization tanks;

(b) each tank shall be sized for 24 hours of retention time for the 2050 year design maximum week condition;

(c) each tank shall have a minimum active operating volume of 1,600 m^3;

(d) each tank shall be concrete with a cover;

(e) ventilate the headspace from each of the tank, the foul air shall be treated through an odour control system;

(f) provide makeup air to tanks to prevent collapse;

(g) provide equipment access hatches on top of the tanks;

(h) provide a minimum of one foul air connection on each tank with an adjustable dampner;

(i) provide minimum of one interconnection pipe between the two tanks with isolation valves; and

(j) provide a minimum of two level sensors in each tank.

E.2.2.2 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the mixing system to:

(a) provide adequate jet mixing inside both equalization tanks so that homogeneous sludge is discharged from the equalization tank and solids do not settle within the tank at all operating levels as it will vary during operation;

(b) provide nozzle system in each tank composed of minimum 6 nozzles in each tank;

(c) provide a minimum of 2 chopper mixing pumps (1 duty, 1 standby) per tank. The pumps shall be equipped with VFDs; and

(d) provide sample taps on each mixing line.

E.3. Hauled Sludge Transfer Pumping System

E.3.1 Process Function Overview and Objectives

E.3.1.1 Sludge from the equalization tanks will be conveyed to the phosphorus release tanks by the hauled sludge transfer pumps.

E.3.2 Basis of Design and Performance Requirements

E.3.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the hauled sludge transfer pumping system to:

(a) convey sludge to the phosphorus release tanks (WASSTRIP®) utilizing two pipes each with 100% capacity for redundancy at maximum month conditions;

(b) provide piping to convey sludge back to the hauled sludge equalization tanks;

(c) provide ability to pump to any one or all the phosphorus release tanks;

(d) provide a minimum of two duty sludge transfer pumps capable of removing sludge continuously from the tanks under all conditions;

(k) provide a minimum of 1 additional standby pump capable of removing sludge continuously from the equalization tanks under all conditions;

(l) provide sludge transfer pumps with the following performance characteristics:

  (i) minimum pumping capacity of 40 m^3/hr each;

  (ii) provide motors with VFDs;

  (iii) provide ability to turndown at least 50 percent;

  (iv) provide the minimum flow and head requirements for the transfer pumps to achieve its designated performance requirements under all flow and loading conditions; and

  (v) provide an automated flush system for each transfer pump, using flushing water;

(m) provide ability to drain one tank by pumping to either the second tank or the screens over a 24 hour period;

(n) provide an adequate number of duty and standby pumps and piping to allow one pump to be taken out of service while maintaining 100% operational capacity at maximum month conditions;

(o) provide automated sludge pumping and conveyance, monitored by the PCS to pump and convey sludge without operator intervention and shall include as a minimum:

(i) flow monitoring for sludge from transfer tanks pumped to either or both phosphorus release tank units. Do not install a bypass around the flow meters;

(ii) pressure monitoring on the suction and discharge of each sludge transfer pump;

(iii) alarming to alert plant staff of abnormal operation;

(p) Provide density meters on each line to the phosphorus release tanks.

E.4. Special Studies

E.4.1.1 Provide CFD modelling of the hauled sludge equalization tanks and mixing system in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

E.4.1.2 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models

E.4.1.3 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

E.5. Site Planning Requirements

E.5.1.1 Design Builder shall:

(a) locate the hauled sludge receiving system on Construction Site Parcel B near Ferrier Street to minimize travel on site and minimize disturbance on Construction Site Parcel B. Truck access will be through Ferrier Street;

(b) provide space on the entry road into Construction Site Parcel B to allow two trucks to que before sludge drop off at Area N hauled sludge receiving station;

(c) Integrate the new liquid receiving station into the hauled sludge receiving system; and

(d) locate transfer pumps within a pump gallery in Area N.

E.5.1.2 The City is planning to dewater the sludge at the SEWPCC sometime in the future. Design Builder shall provide space for construction of a hauled dewatered sludge receiving station adjacent to the hauled liquid sludge receiving system, with the following minimum requirements:

(a) Design Builder shall leave a minimum of 700 m^2 of undeveloped, accessible land adjacent to the hauled sludge receiving and storage infrastructure on Construction Site Parcel B including space for truck access to Ferrier Street;

(b) Within the land outlined in E.5.1.2(a), there must be space allotted for a future dewatered sludge hauling vehicle driving lane (with provisions for drive through or backup access) and space for a 15 m by 35 m facility, to be piped to the hauled sludge equalization tank;

(c) Provide 40 L/s of additional intermittent flushing water capacity within the hauled sludge receiving infrastructure to service the future facility for sludge dilution; and

(d) Provide adequate space on Construction Site Parcel B such that the future infrastructure can reasonably be constructed without damage to surrounding buildings.

SECTION F AREA J – PHOSPHORUS RELEASE

F.1. Phosphorus Release Tanks

F.1.1 Process Function Overview and Objectives

F.1.1.1 Ostara’s WASSTRIP technology provides an environment for releasing phosphorus from the sludge upstream of intermediate dewatering and the digesters.

F.1.2 Basis of Design and Performance Requirements

F.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the phosphorus release tanks to meet the following requirements:

(a) Design Builder shall meet the requirements of Schedule 18W – Ostara Contract Documents.

(b) provide flexibility of adjusting the sludge retention time in the tanks for seasonal temperature fluctuation, the mixing and pumping system will allow operation with sludge level in the tank between 25 to 100 percent of the design active depth;

(c) cover the tanks and vent headspace to the odour control system;

(d) design for a solids concentration in the 3 to 6% range with 4% as an average;

(e) provide outside make-up air to the tanks;

(f) provide a minimum of two tanks;

(g) provide mixing system to maintain a homogeneous sludge concentration throughout the tank;

(h) provide a minimum of 1 metre freeboard;

(i) provide a minimum hydraulic retention time of 24 hours at maximum month flow at 4% solids with one unit out of service;

(j) provide the ability to drain tanks completely over a 24 hour period; and

(k) provide the ability to take a tank out of service and leave empty for a duration of more than 12 months.

A.1.1.3 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design phosphorus release pumps to meet the following requirements:

(a) provide a minimum of two duty and one standby progressive cavity sludge discharge pumps per tank, each equipped with VFDs to discharge into the sludge screens;

(b) provide an adequate number of duty and standby pumps and piping to allow one pump or tank to be taken out of service while maintaining 100% operational capacity at maximum month conditions;

(c) pump sludge to the sludge screens utilizing two pipes each with 100% capacity for redundancy at maximum month conditions;

(d) provide piping to pump sludge back to the other phosphorus release tanks; and

(e) provide capped pipe entrances of 400 mm diameter for future connection of thickened WAS and fermented sludge.

F.2. Special Studies

F.2.1.1 Conduct CFD modeling on phosphorus release tanks in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

F.2.1.2 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

F.2.1.3 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

F.3. Site Planning Requirements

F.3.1.1 Locate on Construction Site Parcel B.

SECTION G AREA T – PRE-DIGESTION SLUDGE TREAMENT

G.1. Waste Activated Sludge (WAS) Thickening

G.1.1.1 The City is planning to provide WAS thickening as part of a future project. Design Builder shall provide space for construction of the WAS thickening process, with the following minimum requirements:

(a) Design Builder shall provide a minimum of 800 m^2 of undeveloped, accessible land within 100 m of the phosphorus release tanks (WASSTRIP), on Construction Site Parcel B, and with road access for polymer delivery from Ferrier Street;

(b) Within the land outlined, there must be space allotted for a future 15 m by 35 m facility, to be piped to both the phosphorus release tanks and sludge screens;

(c) Provide 10 L/s of additional flushing water capacity within nearby infrastructure to service the future WAS thickening facility; and

(d) Provide adequate space such that the future infrastructure can reasonably be constructed without damage to surrounding buildings.

G.2. Fermentation

G.2.1.1 The City is planning to provide fermentation as part of future work. Design Builder shall provide space for construction of the fermentation process, with the following minimum requirements:

G.2.1.2 Design Builder shall provide a minimum of 4,000 m^2 of undeveloped, accessible land within 100 m of the sludge screening process, on Construction Site Parcel B, and within 100 m of Parcel A, with road access;

G.2.1.3 Within the land outlined, there must be space allocated to connect process lines and utilities from Parcel A through the utilidor to the sludge screens on Construction Site Parcel B.

G.2.1.4 Provide 30 L/s of additional flushing water capacity within nearby infrastructure to service the future fermentation facility; and

G.2.1.5 Provide adequate space on Construction Site Parcel B such that the future infrastructure can be reasonably constructed without damage to surrounding buildings.

G.3. Sludge Screens and Screening Bins

G.3.1 Process Function Overview and Objectives

(a) all sludge directed to the screened sludge equalization tanks must pass through 5 mm screens to remove debris prior to entering tanks for protection of downstream processes.

(b) sludge from the phosphorus release tanks shall not mix with the sludge from the primary clarifiers until it reaches the screened sludge equalization tanks;

(c) the City is planning to provide WAS thickening and primary sludge fermentation as part of a separate project, which impacts the sludge screen sizing and arrangement. The WAS will be pumped to the phosphorus release tanks and the fermented sludge will be pumped directly to the sludge screens.

G.3.2 Basis of Design and Performance Requirements

G.3.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the sludge screens and screenings bin system to meet the following requirements:

(a) sludge screens and piping;

(i) provide a minimum of 1 duty and 1 standby screw press screens dedicated to primary sludge, each with a minimum capacity of 20 L/s. These screens will be dedicated to fermented sludge once the fermenters are constructed as part of a separate project;

(ii) provide a minimum of 2 duty and 1 standby screw press screens dedicated to phosphorus released sludge, each with a minimum capacity of 20 L/s;

(iii) provide additional piping to allow one of the phosphorus released sludge screens to be utilized for primary sludge screening;

(iv) provide screens with a maximum opening size of 5 mm;

(v) design screens for a solids concentration of up to 8%;

(vi) design to provide screened solids concentration of greater than 35%; and

(vii) solids to meet Concrete Slump Test CSA A23.2-5C with a maximum of 75 mm slump, but with screenings rather than concrete;

(viii) convey screened sludge to the screened sludge equalization tanks with separate piping for the primary sludge (future fermented sludge) and the phosphorus released sludge as follows:

a. convey sludge from the primary sludge screens utilizing two pipes each with 100% capacity for redundancy at maximum month conditions;

b. convey sludge from the phosphorus released sludge screens utilizing two pipes each with 100% capacity for redundancy at maximum month conditions;

(b) screenings bins

(i) provide a minimum of 1 duty and 1 standby bin;

(ii) provide bins with a minimum active storage volume of 23 m^3 each;

(c) design system to allow for one screen, one feed pump and one bin to be taken out of service while maintaining the ability to treat all sludge generated under maximum month conditions.

G.4. Screened Sludge Equalization Tanks

G.4.1 Process Function Overview and Objectives

G.4.1.1 The purpose of the screen sludge equalization tanks is to provide equalization of screened sludge and allow the dewatering centrifuges to be fed at a controlled rate and to store sludge for up to a minimum of 15 hours at average flow.

G.4.2 Basis of Design and Performance Requirements

G.4.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the screened sludge equalization tanks to meet the following requirements:

(d) provide a minimum of 2 tanks each with a minimum freeboard of 1 m;

(e) provide flexibility to direct sludge to any of the tanks when one tank is removed from service;

(f) provide a minimum retention time of 10 hours under maximum month conditions with one tank out of service;

(g) provide a minimum of 2 duty and minimum 1 standby centrifugal chopper recirculation pumps; and

(h) provide mixing system to keep contents of the equalization tank homogeneous.

A.1.1.4 In accordance with Schedule 18 U, Design Builder shall design the intermediate dewatering feed pumps to meet the following requirements:

(a) provide a minimum of 6 (1 per centrifuge) progressive cavity pumps each equipped with VFDs;

(b) provide ability for feed pumps to draw from any equalization tank.

(c) provide pumps with a minimum capacity of 9 L/s each; and

(d) provide discharge pipe interconnection such that any two pumps can be taken out of service while still providing feed to any four centrifuges.

G.5. Intermediate Dewatering Centrifuge System

G.5.1 Process Function Overview and Objectives

G.5.1.1 The intermediate dewatering centrifuge system includes:

(a) intermediate dewatering centrifuges – dewater the sludge from the sludge equalization tanks and produce a consistent percent solids product for feed to the THP.

(b) Dry polymer make-up and pumps - prepare and dose polymer solution to enhance centrifuge efficiency.

(c) Polymer feed pumps are progressing cavity.

(d) dewatered sludge hoppers - provide storage for dewatered sludge and dispense these solids. See corrosion study in Schedule 18 for material selection.

(e) Progressing cavity THP feed pumps - convey dewatered sludge from the dewatered sludge hoppers to the thermal hydrolysis process.

(f) intermediate centrate storage tanks - provide equalization and short-term storage of centrate upstream of the phosphorus recovery process.

(g) intermediate recessed cavity centrifugal centrate pumps - convey the stored centrate to the phosphorus release process at a controlled rate.

G.5.2 Basis of Design and Performance Requirements

G.5.2.1 In accordance with Schedule 18 U, Design Builder shall design the intermediate dewatering centrifuges to meet the following requirements:

(a) provide a minimum of 4 duty and 2 standby centrifuges each equipped with VFDs

(b) provide the ability to feed any sludge hopper with any centrifuge.

(c) provide ability to take any one hopper and any one centrifuge out of service without impacting plant operation.

(d) design for maximum month conditions with 2 units out of operation

(e) design system for 24/7 operation

(f) design for a maximum month inflow of 3,250 m3/d

(g) design to provide a minimum solids capture efficiency of 97%

(h) design for an inlet solids concentration ranging from 3% to 5%

(i) design with a minimum bowl size of 0.67 m

(j) design to provide a minimum solids outlet concentration of between 16 and 18%, with target of 16.5%

(k) design for the following solids loading rates

(i) annual average (total): 100 T/d; and

(ii) maximum month (total): 150 T/d.

(l) units to be same manufacturer as final dewatering centrifuges

(m) provide ability to dilute the dewatered sludge if the percent solids is too high.

(n) Provide reliable instrumentation for real-time percent solids testing for control of dilution.

(o) Provide diverter gate to separate low percent solids during cleaning, startup, and shutdown events from dewatered solids chute. Incorporate into centrifuge controls.

G.5.2.2 In accordance with Schedule 18 – Technical Requirements Appendix 18J Room Data Sheets, Design Builder shall install a laboratory room adjacent to the intermediate dewatering centrifuges.

G.5.2.3 In accordance with the Process Mechanical Design Guide found in Schedule 18 U Design Builder shall design the intermediate dewatering polymer make-up system to meet the following requirements:

(a) provide a minimum of 1 duty and 1 standby dry polymer make-up systems

(i) design to accept a minimum of 1,000 kg polymer bags;

(ii) provide a minimum of 3 tanks per polymer system each with a minimum volume of 8 m^3;

(iii) design system for polymer doses ranging from 5-15 kg/dt;

(iv) provide a minimum of 1 duty pump for each centrifuge and 1 common standby positive displacement pump, each equipped with VFDs;

(v) provide two polymer dosing locations a minimum of 10 m apart upstream of each centrifuge;

G.5.2.4 In accordance with the Process Mechanical Design Guide found in Schedule 18 U Design Builder shall design the intermediate dewatered sludge hoppers to meet the following;

(a) provide a minimum of 3 hoppers and a maximum of 4 hoppers;

(b) provide a minimum storage retention time of 12 hours at maximum month conditions with one hopper out of service;

(c) provide leveling screws near the top of the hoppers to maintain active volume and even distribution;

(d) provide live-bottom augers for sludge mixing and conveyance;

(e) provide ability to convey solids to any hopper from any centrifuge; and

(f) provide ability to take any one hopper and any one centrifuge out of service without impacting plant operation.

(g) provide stainless steel or concrete tanks with cover and odour control;

G.5.2.5 In accordance with the Process Mechanical Design Guide found in Schedule 18 U. Design Builder shall design the THP feed pumps to meet the following requirements:

(a) provide a minimum of 6 (1 duty and 1 standby per THP train) progressive cavity pumps equipped with VFDs;

(b) provide ability for all progressive cavity pumps to feed any of the three THP units.; and

(c) provide pumps with a minimum capacity of 6 L/s each and 50% turndown.

G.5.2.6 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the intermediate centrate storage tanks to meet the following requirements:

(a) provide a minimum of 2 concrete tanks with access hatches;

(b) Select tank materials based on Schedule 18K Corrosion Study;

(c) design for a minimum annual average centrate production: 1,900 m^3/d;

(d) design for a maximum month centrate production: 2,900 m^3/d;

(e) provide a minimum retention time at maximum month with one tank out of service of 2 hours;

(f) provide flexibility to direct centrate to any of the tanks when one tank is removed from service;

(g) provide the ability to equalize instantaneous peaks prior to conveyance to the phosphorus recovery system;

(h) design the centrate piping to allow all centrate to flow to each storage tank or to be split between all storage tanks; and

(i) design the centrate piping to include a robust cleaning system utilizing citric acid and/or sulfuric acid.

G.5.2.7 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the intermediate centrate pumps to meet the following requirements:

(a) provide a minimum of 2 duty and minimum of 1 standby centrifugal centrate pump equipped with VFDs.

(b) provide pumps with a minimum capacity of 17 L/s each.

G.6. Thermal Hydrolysis Process

G.6.1 Process Function Overview and Objectives

G.6.1.1 Sludge from intermediate dewatering will be pumped to the Thermal Hydrolysis Process for high-temperature, high-pressure processing of the sludge. The purpose of the THP is to provide a Class A Biosolids for disposal.

G.6.1.2 The conditioned sludge from the THP will be sent to anaerobic digestion (Area D) via digester feed pumps.

G.6.2 Basis of Design and Performance Requirements

G.6.2.1 The THP system has been preselected by the City to be the Cambi model B6-4. Design Builder shall meet the THP requirements as per Schedule 18V – Cambi Contract Documents, including:

(i) Design Builder shall supply all components identified by Cambi that are not supplied by Cambi;

(ii) Design Builder shall install the THP system and all ancillary equipment; and

(iii) Design Builder shall supply a telescoping forklift capable of providing operations and maintenance access to the THP system, along with dedicated charging room in compliance with applicable codes.

G.6.2.2 Design Builder shall coordinate Inspection Technical Services (authority having jurisdiction) inspection of the boilers and steam plant and provide a certificate of inspection prior to Systems Operational Testing.

G.6.2.3 Design in accordance with the Process Mechanical Design Guide found in Schedule 18 U, and *WWD Wastewater Treatment Facilities Automation Design Guide* both found in Appendix 18D – City Standards.

G.6.2.4 Design Builder shall provide equipment and treatment processes that can achieve US EPA Class A Biosolids under 40 CFR Part 503.

G.6.2.5 Design Builder shall provide sufficient space for a telescoping forklift to maneuver between and around each THP train for periodic maintenance access.

G.7. Special Studies

G.7.1.1 Provide CFD analysis on screened sludge equalization tanks in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models

G.7.1.2 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

G.7.1.3 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

G.8. Site Planning Requirements

G.8.1.1 Locate on Construction Site Parcel B.

G.8.1.2 Future space requirements for WAS thickening and fermentation in accordance with G.1.1.1 and on Construction Site Parcel B.

SECTION H AREA D – ANAEROBIC DIGESTION

H.1. Anaerobic Digestion System

H.1.1 Process Function Overview and Objectives

H.1.1.1 Anaerobic digestion includes anaerobic digesters with associated mixing and transfer pumps. Anaerobic digestion process is the second step used to produce a Class A biosolids product as defined by the USEPA under CFR Part 503

H.1.1.2 Conditioned Sludge Recirculation Pumping System – In this system, conditioned sludge from the thermal hydrolysis process is pumped into a piping loop that serves as the feed header for the anaerobic digesters. The conditioned sludge is kept in a recirculation loop from Area T to Area D and back to Area T via recirculation pump.

H.1.1.3 Liquid biosolids recirculation and cooling system - Each anaerobic digester has a liquid biosolids recirculation system, which includes heat exchangers. Liquid biosolids are withdrawn from the digester at approximately 40°C and mixed with the conditioned sludge going into the digester as feed. Mixing these two streams serves to lower the temperature of the conditioned sludge from approximately 70°C to approximately 45°C.

H.1.2 Basis of Design and Performance Requirements

H.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the anaerobic digester system to:

(a) comply with CSA B149.6;

(b) provide concrete anaerobic digester system composed of a minimum of three digesters of equal size complete with 316 stainless steel appurtenances.

(c) operate in a temperature range of 37ºC to 40ºC

(d) provide minimum 14 days hydraulic retention time at maximum month conditions with one digester out of service;

(e) design for a maximum volatile solids loading rate of 5.4 kg/m3/d at the maximum month loading condition with one digester out of service.

(f) provide digester mixing system composed of a complete duty and standby centrifugal chopper pumps for each digester complete with conveyance piping, valving and instrumentation.

(g) provide liquid biosolids transfer system to holding tanks composed of a minimum of 1 duty progressive cavity pump and 1 standby progressive cavity pump for each digester complete with conveyance piping, valving and instrumentation;

(h) provide a minimum of 3 and a maximum of 5 digesters;

(i) provide a minimum floor slope of 35%;

(j) provide with a bottom sump;

(k) provide a height to width ratio between 0.7 and 1.0;

(l) provide flow monitoring on each digester gas line. Do not install a bypass around the flow meter;

(m) provide pressure monitoring on the discharge of each digester;

(n) provide ultrasonic level monitoring on each digester;

(o) provide piping conveyance system complete with all valving, flow meters and instrumentation within and around the digesters.

(p) provide modulating valve system to feed the digesters;

(q) provide digester gas collection and conveyance to digester gas treatment system;

H.1.2.2 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the digester mixing system to:

(a) minimum of 6 (3 duty and 3 standby) centrifugal chopper pumps equipped with VFDs. Minimum two pumps per digester (1 duty and 1 standby).

(b) time to turn over tank contents: maximum of 5 hours;

(c) minimum number of double sludge nozzles (each): 3;

(d) minimum number of single sludge nozzles (each): 4;

(e) minimum number of foam busters (each): 1

H.1.2.3 Design mixing and sludge withdrawal system to handle rapid rise events, resulting in high foam levels and digester upsets. Design digester feeding process to limit rapid rise foaming events. All operational digesters shall be fed consistently while avoiding batch filling.

H.1.2.4 Design mixing system to draw off both the top and bottom of the digester to provide flexibility.

H.1.2.5 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design liquid biosolids transfer pumping system to draw out of the digesters, to include:

(a) minimum of 6 (3 duty and 3 standby) progressive cavity pumps equipped with VFDs with minimum capacity of 10 L/s each. Minimum of two pumps per digester (1 duty and 1 standby).

H.1.2.6 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the sludge recirculation pumping after the THP system to:

(a) provide pumping and conveyance system for continuous recirculation of conditioned sludge from the THP system.

(b) provide a minimum of 1 duty and 1 standby centrifugal chopper pump equipped with VFDs with minimum capacity of 40 L/s each.

(c) provide an automated flush system for each recirculation pump, using flushing water on the discharge in between the pump isolation valve;

(d) provide flow monitoring on each line to the digesters. Do not install a bypass around the flow meter;

(e) provide pressure monitoring on the discharge of each pump;

(f) provide piping conveyance system complete with valving and instrumentation;

H.1.2.7 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the liquid biosolids recirculation and cooling system for each digester to:

(a) provide pumping and conveyance system for continuous recirculation of liquid biosolids from the anaerobic digesters;

(b) provide the liquid biosolids recirculation system with the ability to transfer the contents of the digester to one of the holding tanks so the digester can be cleaned and inspected;

(c) provide heat exchange cooling system that uses treated flushing water as the cooling medium;

(d) provide minimum of 6 (3 duty and 3 standby) centrifugal chopper pumps equipped with VFDs with minimum capacity of 40 L/s each. Minimum of two pumps per digester (1 duty and 1 standby).

(e) provide an automated flush system for each recirculation pump, using treated flushing water on the discharge in between the pump isolation valve;

(f) provide flow metering on each line to the digesters. Do not install a bypass around the flow meter;

(g) provide pressure monitoring on the discharge of each pump;

(h) provide piping conveyance system complete with all valving and instrumentation;

(i) provide minimum of 6 (3 duty and 3 standby) tube-in-tube heat exchangers. Minimum of two heat exchangers per digester (1 duty and 1 standby) with the following design:

- (i) no. of circuits per heat exchanger (HEX): 2;
- (ii) maximum sludge flow per HEX: 30 L/s;
- (iii) maximum sludge flow per Circuit: 15 L/s;
- (iv) sludge temperature in, ℃: 46-47;
- (v) sludge temperature out, ℃: 40;
- (vi) cooling water: flushing water; and
- (vii) estimated maximum cooling water rate per HEX: 24 L/s.

H.2. Biosolids Holding Tanks

H.2.1 Process Function Overview and Objectives

H.2.1.1 Following digestion, the biosolids are transferred to a minimum of two liquid biosolids holding tanks. Each tank will be mixed and hold up to 12 hours of liquid biosolids during maximum month conditions. Under normal circumstances, the tanks will be operated at lower levels or one tank taken out of service.

H.2.2 Basis of Design and Performance Requirements

H.2.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the Liquid Biosolids Holding Tanks as follows:

(a) provide a minimum of 2 concrete tanks with concrete cover and digester gas collection system and conveyance to digester gas treatment system;

(b) provide minimum 12 hours hydraulic retention time under maximum month conditions with one tank out of service;

(c) provide liquid biosolids holding tank mixing system composed of complete duty and standby centrifugal chopper pumps complete with conveyance piping, valving and instrumentation;

(d) provide liquid biosolids transfer system to final dewatering centrifuge composed of a complete duty and a standby progressive cavity pumps to feed each centrifuge, complete with conveyance piping, valving and instrumentation;

(e) each tank to have the following features:

- (i) cylindrical with a steep conical bottom and a fixed roof

(ii) stainless steel access zone on top of tank;

(iii) material of construction: concrete

(iv) roof type: flat

(v) floor slope: 30%

(vi) head space digester gas collection: vent to Area K

(f) Provide flow monitoring on each tank digester gas line. Do not install a bypass around the flow meter;

(g) Provide ultrasonic level monitoring on each tank and automatic high level alarms;

(h) Provide piping conveyance system complete with all valving and instrumentation within and around the digesters.

(i) In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the liquid biosolids holding tank mixing system as follows:

(i) provide a minimum of 4 (2 duty and 2 standby) centrifugal chopper pumps equipped with VFDs. Minimum of two pumps per tank (1 duty and 1 standby).

(ii) time to turn over tank contents: maximum 3 hours;

(iii) minimum number of double sludge nozzles (each): 2;

(iv) minimum number of single sludge nozzles (each): 1;

(v) nozzle assembly material: Glass-lined ductile iron; and

(vi) provide all piping, valves and instrumentation.

(j) In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the final dewatering feed pumping system as follows:

(i) number of duty progressive cavity pumps to match number of centrifuges. Provide additional standby unit.

(ii) equipped with VFDs with minimum capacity of 6 L/s each.

(iii) provide all piping, valves and instrumentation.

H.3. Chemical Storage System

H.3.1 Process Function Overview and Objectives

H.3.1.1 Design Builder shall design and construct a new chemical storage system to receive chemical pumped from the existing ferric chloride receiving and storage facility in Area F. New chemical storage tanks (minimum 2) shall be located on Construction Site Parcel B to dose chemical to the anaerobic digesters, biosolids storage tank, and dewatering system. The system must be compatible for ferric chloride, ferrous chloride, ferric sulphate, ferrous sulphate, or aluminum sulphate. Only one of these chemicals will be fed to the day tanks at any one time. Ferric chloride will be used initially.

H.3.2 Basis of Design and Process Performance Requirements

H.3.2.1 In accordance with Schedule 18 U, Design Builder shall design the chemical storage system to provide:

(a) a minimum of one day of storage for chemicals at maximum day flow with one tank out of service;

(b) provide FRP tank suitable for the storage of ferric chloride, ferrous chloride, ferric sulphate, aluminum sulphate;

(c) provide a minimum working storage volume of 20 m^3 for each tank;

(d) provide secondary containment of a minimum of 110% of the total storage volume;

(e) provide a minimum of one manway hatch;

(f) provide a minimum of one fill line from exterior;

(g) provide a minimum of one outlet line;

(h) provide venting to the outside;

(i) provide two top mounted instrumentation mounting flanges;

(j) provide site glass connections;

(k) provide viewing hatch;

(l) provide draining system for complete tank drainage;

(m) provide overflow pipe inside the tank;

(n) provide access ladder to the top of the tank; and

(o) provide two fill lines.

H.4. Chemical Pump Dosing System

H.4.1 Process Function Overview and Objectives

H.4.1.1 Design Builder shall design a chemical pumping system to dose chemicals as described in H.3.2.

H.4.2 Basis of Design and Process Performance Requirements

H.4.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design and construct the chemical dosing system to:

(a) pump chemical from the storage tank to the anaerobic digesters, biosolids storage tank, and dewatering system.

H.5. Special Studies

H.5.1.1 Provide CFD analysis on anaerobic digesters and biosolids holding tanks in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

H.5.1.2 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

H.5.1.3 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

H.6. Site Planning Requirements

H.6.1.1 Design Builder shall:

(a) locate Anaerobic digestion on Construction Site Parcel B;

(b) locate the liquid biosolids recirculation and cooling system in an area between the digesters and storage tanks and form a pump/pipe gallery in this area;

(c) Allow space for one additional digester of equal size to be constructed in the future; and

(d) Chemicals conveyed from Area F to Area D shall be routed to the maximum extent possible through existing tunnels and the utilidor crossing the CPKC railway.

SECTION I AREA V – BIOSOLIDS PROCESSING AND LOADING

I.1. Final Dewatering Centrifuge System

I.1.1 Process Function Overview and Objectives

I.1.1.1 Final dewatering includes the following:

(a) final dewatering centrifuges- the final dewatering centrifuges are required to concentrate biosolids for beneficial use and allow for nutrient recovery from the centrate.

(b) polymer system - polymer will be required to assist in the dewatering process and will be pumped to the inlet of the centrifuges where it will mix with the incoming liquid biosolids.

I.1.2 Basis of Design and Performance Requirements

I.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the final dewatering centrifuges to meet the following requirements:

(a) provide a minimum of three duty and two standby parallel variable speed decanter centrifuges to dewater the sludge from the biosolids holding tanks;

(b) design for maximum month conditions with 2 units out of operation

(c) operate 24 hours a day, 7 days a week;

(d) minimum solids capture: 97%;

(e) minimum cake concentration: 28%;

(f) minimum bowl size 0.67 m;

(g) solids loading;

(i) annual average (total): 54 t/d;

(ii) maximum month (total): 88 t/d; and

(iii) maximum month (each): 1,200 kg/h.

(h) drive: variable speed;

(i) provide diverter gate to separate low percent solids during cleaning, startup, and shutdown events from dewatered solids chute. Incorporate into centrifuge controls; and

(j) manufacturer to be the same as intermediate dewatering centrifuges.

I.1.2.2 In accordance with Schedule 18 – Technical Requirements Appendix 18J Room Data Sheets, Design Builder shall install a laboratory room adjacent to the final dewatering centrifuges.

I.1.2.3 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the polymer systems, complete with dry polymer receiving and handling, conveyance, tanks and pumps.

(k) provide for a minimum of one duty polymer make-up system to run continuously using three mixing tanks, and a minimum of one fully redundant system for standby.

(l) design system to provide a polymer dosage in the range of 12 to 24 kg/dt;

(m) mass of polymer per bag: 1,000 kg;

(n) polymer solution concentration: 0.25 %;

(o) minimum number of mixing tanks: 6 (3 duty/3 standby);

(p) minimum mixing tank volume (each): 10,000 L ;

(q) polymer is fed to each centrifuge by dedicated progressive cavity metering pumps each equipped with VFDs. Provide a minimum of one duty pump for each centrifuge, and minimum one common standby unit plumbed to feed all of the centrifuges;

(i) type: progressive cavity; and

(ii) drive: variable speed; and

(r) provide two polymer dosing locations a minimum of 10 m apart upstream of each centrifuge.

I.2. Final Biosolids Storage and Loading System

I.2.1 Process Function Overview and Objectives

I.2.1.1 The Final Biosolids Storage and Loading- the dewatered biosolids from the centrifuges will dropped into hoppers for storage until the biosolids are loaded into trucks for disposal.

I.2.2 Basis of Design and Performance Requirements

I.2.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U., Design Builder shall design the final biosolids storage and loading to meet the following requirements

(a) biosolids storage shall be based on an overhead hopper design sized for a minimum of three days of operations at the maximum month sludge production rate. Each hopper shall be sized for a minimum of one day of biosolids production at maximum month conditions from a single centrifuge;

(b) the system shall be designed to allow any centrifuge to discharge to any hopper;

(c) the system shall be designed to allow any centrifuge or any hopper to be taken out of service without any interruption to plant operations;

(d) the dewatered biosolids from the centrifuges will drop by gravity into hoppers directly beneath the centrifuges for storage;

(e) each hopper will be fitted with a minimum of two leveling screws at the top to evenly distribute biosolids across the entire length and width;

(f) each hopper will be fitted with three auger conveyors at the bottom to discharge the solids into trucks;

(g) hoppers shall be stainless steel with covers and odour control;

(h) design criteria for the biosolids storage hoppers are as follows:

  (i) minimum number of hoppers: 4;

  (ii) maximum number of hoppers: 6;

  (iii) minimum no. of leveling screws per hopper: 2; and

  (iv) minimum no. of live-bottom augers per hopper: 3.

(i) The dewatered biosolids storage hoppers shall be located above indoor truck bays with odour control, where the dewatered biosolids will be stored until it is loaded into trucks for hauling off site;

(j) There shall be a minimum of two drive-through truck bays running parallel to each other to provide a duty and standby arrangement;

(k) Each truck bay shall have a minimum of two truck loading zones from separate hoppers;

(l) There shall be one truck loading zone under each hopper, with four loading chutes per hopper. Each loading chute shall have a knife gate to control discharge to truck. When filling a truck, all four chutes will be open. The truck fill time shall be less than 10 minutes;

(m) The truck bays and loading zones shall be sized to allow four trucks to be filled simultaneously;

(n) the truck bays shall be sized to accommodate the WSTP hauling trucks used under the existing NEWPCC contract, including:

(i) coordinate exact location of chutes with WSTP hauling truck;

(ii) minimum truck clearance of 2 m on all sides of WSTP hauling truck and 1 m on top of truck;

(iii) Maximum length of the tractor/trailer units are not expected to exceed 20 m; and

(iv) Tanker trailers are expected to be sized to hold a minimum of 30,000 L, however actual loads are anticipated to be 24,000 L due to weight restrictions.

(o) Provide control system that can be operated by a truck hauler, indicating entry bay for the truck, and confirming location for the truck within the bay, that can be seen by the hauler without leaving the truck.

(p) Provide control system within the bay once truck is positioned, confirming hauler identification, readiness to load, positioning within the bay under the chutes and emergency stops.

(q) The mass of each hopper will be monitored with a minimum of 4 load cells so that the mass of biosolids can be monitored during truck filling. Truck filling to be accurate within a 0.1 tonne range.

(r) Selection of hopper used for filling will be controlled by the PCS, based on the mass of biosolids in the hopper, age of the solids and on which hoppers are in active use.

(s) Control system will take into account sludge being deposited into the hopper, if the hopper is being filled at the same time as filling the truck.

I.3. Centrate Storage and Pumping System

I.3.1 Process Function Overview and Objectives

I.3.1.1 The final centrate storage tanks function mainly as flow equalization; they are not intended to provide long-term storage as the phosphorus recovery reactors require continuous feed. The final centrate will be pumped from the storage tanks to the phosphorus recovery system.

I.3.2 Basis of Design and Performance Requirements

I.3.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U Design Builder shall design the final centrate storage tanks to meet the following requirements:

(a) provide a minimum of 2 concrete tanks with access hatches;

(b) the tanks shall be sized to provide a minimum of 2 hours of centrate storage at maximum month flow with one tank out of service.

(c) centrate flow to final centrate storage tanks:

(i) average month: 1,050 m^3/d;

(ii) maximum month: 1,700 m^3/d;

(d) minimum freeboard: 1 m;

(e) minimum volume (active, each): 150 m^3;

(f) minimum volume (active, total): 300 m^3

(g) design the system to equalize instantaneous flow peaks prior to conveyance to the phosphorus recovery system;

(h) design the centrate piping to allow all centrate to flow to each storage tank or to be split between all storage tanks; and

(i) design the centrate piping to include a robust cleaning system utilizing citric acid and/or sulfuric acid.

A.1.1.5 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the final centrate pumps to meet the following requirements:

(a) provide a minimum of 2 duty and minimum of 1 standby centrifugal centrate pump equipped with VFDs; and

(b) provide pumps with a minimum capacity of 10 L/s each.

I.4. Phosphorus Recovery System

I.4.1 Process Function Overview and Objectives

I.4.1.1 The purpose of the Phosphorus Recovery System is to recover phosphorus and nitrogen in the form of struvite from the contents in the final centrate storage tanks and the intermediate centrate storage tanks.

I.4.2 Basis of Design and Performance Requirements

I.4.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the phosphorus recovery system to meet the following requirements:

(c) Design Builder shall meet the requirements of Schedule 18W – Ostara Contract Documents, including:

(i) Design Builder shall supply all components identified by Ostara that are not supplied by Ostara; and

(ii) Design Builder shall install the phosphorus recovery reactors and all ancillary equipment.

(d) Design Builder shall design and install Infrastructure such that a second Ostara system inclusive of crystallizer, dryer and product storage and associated building can be constructed as part of a future project. This reactor will be sized for the identical model of the Ostara system as specified in this Agreement. Consider piping, layouts, and building ease of expansion for this future upgrade.

(e) the centrate from intermediate and final dewatering will be pumped into the bottom of the reactor's vertical conical up-flow tanks.

(f) Design Builder shall convey the effluent from the phosphorus recovery reactors to the existing centrate treatment SBRs on Parcel A;

(g) provide electric forklift capable of loading and maneuvering bags, including:

(i) adequate space to maneuver forklift throughout the phosphorus recovery area, including the struvite product bag storage room;

(ii) provide dedicated charging room in compliance with applicable codes.

(h) struvite product storage:

(i) bulk silos will be utilized.

(ii) [NTD: silo requirements to be provided]

(iii) [bag capacity: 907 kg; bag volume: 1 m^3;]

(iv) storage bag capacity within building: 14 days at annual average conditions (not including system storage capacity);

(v) provide a dedicated room for bag storage;

(vi) coordinate with Ostara for acceptable stacked shelf storage method; and

(vii) include 14 days storage space at annual average conditions for pallets, cardboard sheets, bags, labels as these will be delivered and consumed with each struvite product bulk bag;

(i) Provide a loading bay for bag pick-up with an overhead loading door. Loading bay shall have electric leveling capabilities to accommodate different truck heights;

(j) Provide method of controlling struvite product release onto the floor and ability for clean up to reduce slipping; and

(k) Provide low-slip walking surfaces in all Ostara process and storage rooms.

I.4.2.2 Ostara will provide chemical storage tanks with sufficient metering systems and pumps required to store and dose required chemical supplements in accordance with Schedule 18W – Ostara Contract Documents. All chemical tanks, pumps, and piping associated with cleaning shall be compatible with citric acid and sulfuric acid.

I.5. Special Studies

I.5.1.1 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

I.5.1.2 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

I.6. Site Planning Requirements

I.6.1.1 Locate on Construction Site Parcel B, near Ferrier Street to minimize truck travel on site and minimize disturbance on Construction Site Parcel B. Truck access will be through Ferrier Street.

I.6.1.2 Provide space on the entry road into Construction Site Parcel B to allow two trucks to que before entering Area V final biosolids loading bays.

I.6.1.3 Locate Ostara struvite product loading area in the same building as the Ostara chemical delivery area and in close proximity in order to minimize operator labour requirements.

I.6.1.4 Provide space for a future Ostara system, as described in Section I.4.

SECTION J AREA K – DIGESTER GAS TREATMENT

J.1. Digester Gas System

J.1.1 Process Function Overview and Objectives

J.1.1.1 The purpose of the digester gas conditioning system is to facilitate use of the gas generated in the digesters by removing impurities to produce a consistent product for use in boilers combustion engine generators for heat and electrical power.

J.1.1.2 Digester gas will be used mainly to generate steam for the THP process. When needed, any gas surplus to this demand can be used to fuel heating boilers to augment utility-provided natural gas. When heating demand is low and does not require the full amount of digester gas available, it will be burned off in flares. It is expected that the flares will operate full time during the summer.

J.1.1.3 The digester gas conditioning system for the boilers will remove hydrogen sulphide and moisture only. Space shall be allocated on Construction Site Parcel B for a siloxane removal system should the need arise in the future.

J.1.1.4 The gas conditioning system consists of hydrogen sulphide removal vessels, gas compression and moisture removal skids, glycol chillers, a digester gas storage sphere and waste gas burners.

J.1.1.5 Provide stub on conditioned biogas piping in an accessible area so that it can be conveyed back to Parcel A in the future.

J.1.2 Basis of Design and Performance Requirements

J.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design and construct the digester gas system to:

(a) be suitable for a maximum H_2S in the inlet of 800 ppmv;

(b) be suitable for an average H_2S in the inlet of 500 ppmv;

(c) to remove H_2S to below 10 ppm under the maximum conditions;

(d) treated digester gas to have a dew point below 0C;

(e) size system on future peak production plus a safety factor based on the following:

(i) annual average gas production: 1,800 m^3/hr;

(ii) minimum maximum month gas production: 2,600 m^3/hr;

(iii) peak design – conditioning (safety factor of 1.2): 3,120 m^3/hr;

(iv) peak design – gas safety (safety factor of 2.0): 5,200 m^3/hr;

(f) provide a minimum of 2 enclosed flares and 1 open candle stick flare; and

(g) comply with CSA B149.6;

J.1.2.2 Design Builder to provide overall gas balance indicating how much biogas will be used for the THP and heating Construction Site Parcel B and how much will be in excess for flaring. Provide gas quantity and information for summer and winter conditions and at average and peak flows. Estimate how much gas will be flared on a yearly basis. Refer to Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

J.1.2.3 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the H_2S removal vessels as follows:

(a) minimum no. of units: 4 (minimum 3 duty / minimum 1 standby);

(b) capacity (each): minimum 1,100 m^3/h;

(c) digester waste gas burners;

(d) minimum no. of units: minimum of 2 enclosed, minimum of 1 open; and

(e) capacity (each): 1,900 m^3/hr (enclosed burner); 2,000 m^3/hr (open burner).

J.1.2.4 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the digester gas storage as follows:

(a) minimum no. of units: 2;

(b) type: dual membrane;

(c) minimum active storage volume (as determined by manufacturer calculation) each: 1,800 m^3;

(d) minimum of 24 hours of storage under maximum month conditions with one unit out of service; and

(e) operating pressure: 2.5 kPa.

J.1.2.5 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the digester gas conditioning system as follows:

(a) minimum no. of units: minimum 4 (minimum 3 duty / minimum 1 standby)

(b) minimum capacity (each): 1,100 m^3/h

J.1.2.6 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the digester gas piping system as follows:

(a) maintain gas velocities below 3.7 m/s to reduce condensate transport and minimize pressure drops.

J.2. Special Studies

J.2.1.1 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements- Appendix 18K – Special Studies and Models.

J.2.1.2 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

J.3. Site Planning Requirements

J.3.1.1 Locate on Construction Site Parcel B.

J.3.1.2 The City may construct a cogeneration or renewable natural gas system utilizing conditioned digester gas sometime in the future. Design Builder shall provide space for construction of a cogeneration facility adjacent to the digester gas treatment system, with the following minimum requirements:

(a) Design Builder shall leave a minimum of 1000 m^2 of undeveloped, accessible land adjacent to the digester gas treatment infrastructure that is a minimum of 30 m away from the flares;

(b) Within the land outlined in E.5.1.2(a), there must be space allotted for a future 30 m by 30 m facility, to be piped to the digester gas treatment system; and

(c) Provide adequate space such that the future infrastructure can reasonably be constructed without damage to surrounding buildings.

SECTION K RETURN LIFT STATION

K.1. Return Lift Station

K.1.1 Process Function Overview and Objectives

K.1.1.1 A new Return Lift Station shall be provided to transfer process drain and other wastewater collected from the buildings on Construction Site Parcel B to the Headworks Facility on Parcel A.

K.1.2 Basis of Design and Performance Requirements

K.1.2.1 In accordance with the Process Mechanical Design Guide found in Schedule 18 U, Design Builder shall design the Return Lift Station to meet the following requirements

(a) transfer sanitary sewer and process drain streams collected from the buildings located on Construction Site Parcel B to the Headworks Facility on Parcel A [NTD: final location to be confirmed];

(b) all sanitary sewers and process drain streams on Construction Site Parcel B shall flow by gravity to the return lift station;

(c) all Construction Site Parcel B building's floor sumps, floor drains, process drains, and sanitary sewers shall flow into the gravity lines directed to the return lift station;

(d) stormwater will not be combined in the return lift station;

(e) design for the following conditions;

(i) average flow: minimum 10 ML/d;

(ii) peak flow: minimum flow to empty the largest tank on Construction Site Parcel B in 24 hours plus normal operating flows based on Design Builder's Design;

(iii) no. of wetwells: minimum 1;

(iv) number of pumps: minimum 2 (minimum 1 duty/minimum 1 standby);

(v) pump configuration: vertical turbine;

(vi) discharge flow meter; and

(vii) drive: VFD

(f) provide access, space, and overhead lifting for removal of pump for maintenance.

K.2. Special Studies

K.2.1.1 Select coatings and materials based on the Corrosion Study in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

K.2.1.2 Base equipment sizing and capacity with input from Process Calculations and Mass Balances in Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

K.3. Site Planning Requirements

K.3.1.1 Locate on Construction Site Parcel B.

K.3.1.2 Design Builder shall route the return lift station discharge piping through Construction Site Parcel A, and Tie-In Sites Parcel A in accordance with Schedule 12 – Lands, Site(s) and Facility(ies).

K.3.1.3 Design Builder shall route the phosphorus recovery effluent piping through the utilidor in order to cross the CPKC railway in accordance with Schedule 18 – Technical Requirements.