Schedule 18

Appendix 18A – Process Functional Requirements

Table of Contents

SECTION A. AREA Y – YARD

A.1 Interceptor Junction Chamber System

A.1.1 Process Function Overview and Objectives

A.1.1.1 Design Builder shall design and construct the interceptor junction chamber(s) to receive raw sewage from the influent sewer system and divert it to the raw sewage pumping station by gravity.

A.1.1.2 Any extensions to an interceptor sewer shall not have a smaller diameter than the existing interceptor sewer to which the extension is attached.

A.1.1.3 Design Builder shall design the Infrastructure such that the hydraulic capacity of the interceptors is as follows:

(a) Northwest interceptor: no less than 2.7 m^3/s;

(b) Northeast interceptor: no less than 3.4 m^3/s; and

(c) Main Street interceptor: no less than 9.0 m^3/s.

A.1.2 Special Studies

A.1.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

A.1.3 Basis of Design and Performance Requirements

A.1.3.1 Design Builder shall design and construct the interceptor junction chamber(s) to:

(a) convey all range of flows from the interceptor junction chamber(s) to the raw sewage pumping station by gravity, without increasing the hydraulic grade line in the interceptor sewers;

(b) provide a capacity of 1250 ML/d; and

(c) split flows between each raw sewage pumping station wet well, based on number of pumps running.

A.1.4 Site Planning Requirements

A.1.4.1 Design Builder shall locate the interceptor junction chamber(s) such that the future NW interceptor, as described in Section A.1.5.1(e) does not pass underneath existing structures such as conduits, interceptor sewers or outfall.

A.1.5 Process Design Requirements

A.1.5.1 Design Builder shall design and construct the interceptor junction chamber(s) to meet the following requirements:

(a) provide open/close actuated isolation gates on all lines entering the interceptor junction chamber, with means to open or close from PCS;

(b) provide a minimum of 2 pipes to the raw sewage pumping station for redundancy purposes. As a minimum provide 1 pipe from each interceptor junction chamber to each wet well;

(c) equally split raw sewage from the interceptor junction chamber(s) between the 2 wet wells to within a tolerance of 5 percent when both wet wells are in service and the pumped flow in each wet well is equivalent to the other;

(d) provide means for the plant automation system to continuously monitor the raw sewage level in the interceptor junction chamber(s); and

(e) make provision for a future 1800 mm diameter interceptor. The future interceptor will be located north of the Northwest interceptor and shall connect into the interceptor junction chamber(s) east of the NW interceptor. The invert of the future interceptor shall be the same as the existing Northwest interceptor. Provide an 1800 mm pipe stub, with a manually operated slide gate.

SECTION B. AREA H – HEADWORKS

B.1 Headworks Facility

B.1.1 Process Function Overview and Objectives

B.1.1.1 The headworks area shall include the following:

(a) raw sewage pumping station;

(b) raw sewage overflow system;

(c) fine screening system;

(d) screenings washing and compaction system;

(e) headworks channel aeration system;

(f) grit removal system;

(g) grit effluent overflow system;

(h) grit washing and dewatering system;

(i) odour control system; and

(j) all auxiliary equipment.

B.1.2 Special Studies

B.1.2.1 Several special studies and models are required for the headworks area as detailed in this Appendix 18A and Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.1.3 Basis of Design and Performance Requirements

B.1.3.1 Design Builder shall develop basis of design criteria and performance requirements for the ancillary systems to meet the overall performance requirements of the headworks facility.

B.1.3.2 All flows listed within this Appendix 18A are nominal flows and exclude recycle and return flows. Design Builder shall take account of these recycle and return flows in its design.

B.1.3.3 When designing the Infrastructure, Design Builder shall select equipment that is low-maintenance, minimizes plant staff involvement and should avoid selecting equipment that requires daily attention.

B.1.3.4 Design Builder shall provide screening equipment and screenings washing and compacting equipment from the same manufacturer.

B.1.3.5 Design Builder shall provide grit removal equipment and washing and dewatering equipment from the same manufacturer.

B.1.4 Site Planning Requirements

B.1.4.1 Design Builder shall:

(a) locate the raw sewage pumping station, fine screening system, screenings washing and compaction system, grit removal system and grit washing and dewatering system in 1 building;

(b) locate the headworks facility on Site North East as defined in Schedule 12 – Lands, Site(s) and Facility(ies), and ensure the building does not extend further east than the easternmost point of the existing UV disinfection building;

(c) provide a below ground heated and ventilated tunnel connecting the headworks facility to the Administration Building sized for operator access and movement and replacement/repair of equipment. Design for vehicular traffic loading above the tunnel.

B.1.5 Process Design Requirements

B.1.5.1 Design Builder shall develop process design requirements for the ancillary systems to meet the overall performance requirements of the headworks facility.

B.2 Raw Sewage Pumping Station

B.2.1 Process Function Overview and Objectives

B.2.1.1 Design Builder shall design and construct a single raw sewage pumping station to convey raw sewage such that it flows through the fine screen system, grit removal system, and into the existing primary clarification system and overflows to the outfall by gravity without the need for further pumping. The raw sewage pumping station shall include the following:

(a) building superstructure;

(b) wet wells;

(c) dry wells;

(d) raw sewage pumps; and

(e) all ancillary equipment.

B.2.1.2 Design Builder shall ensure the raw sewage pumps are lineshaft coupled solids handling rotodynamic pumps. Design Builder shall not use dry well submersible pumps. No raw sewage pumps shall be installed in the wet well.

B.2.1.3 Design Builder shall locate the raw sewage pump motors above an elevation of 231.50 m and locate electrical feeds to the pump motors not lower than the pump motors.

B.2.1.4 Design Builder shall design the raw sewage pumps to operate in the event of the dry well flooding. It is understood that the City may have to replace the pump bearings after such a flooding event.

B.2.2 Special Studies

B.2.2.1 Design Builder shall carry out, as a minimum, the following special studies for the raw sewage pumping station:

(a) physical modelling of the raw sewage pumping station in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.2.3 Basis of Design and Performance Requirements

B.2.3.1 Design Builder shall design and construct the raw sewage pumping station to:

(a) pump all contents entering wet wells with a solids sphere size less than or equal to 178 mm, and discharge to the screen influent channel;

(b) provide a total pumping capacity greater than or equal to 1056 ML/d and a firm pumping capacity greater than or equal to 860 ML/d;

(c) facilitate an increase in total pumping capacity greater than or equal to 1250 ML/d and an increase in firm pumping capacity to greater than or equal to 1056 ML/d, without installing additional pumps;

(d) ensure that influent arriving via the 3 main interceptor sewers is conveyed to the wet well of the raw sewage pumping station,

(e) have a maximum high water level in the wet wells equivalent to an existing surge well water level of 221.77 m, adjusted for additional headloss by new piping to new wet wells;

(f) pump maximum month flow with 1 wet well out of service; and

(g) pump a flow less than or equal to 53 ML/d while remaining in the allowable operating region for the pump.

B.2.4 Site Planning Requirements

B.2.4.1 The raw sewage pumping station shall be integral to the headworks facility. Design Builder shall:

(a) provide a heated and ventilated building over the access hatches allowing removal of the raw sewage pumps from the dry wells from within the building; and

(b) provide truck access into the raw sewage pumping station building such that the pumps and valves can be loaded onto or unloaded off a flatbed truck directly from or to the dry well.

B.2.5 Process Design Requirements

B.2.5.1 Design Builder shall design and construct the raw sewage pumping station wet wells to meet the following requirements:

(a) provide 2 independent wet wells each of equal volume that meet the following requirements:

(i) can be isolated with electrically operated gates. Gates shall be manually operable in the event of a power outage;

(ii) use a self-cleaning trench style system for solids-bearing liquids designed and constructed to meet ANSI/HI Standard 9.8;

(iii) equally split raw sewage from the collection system and between the 2 wet wells with a tolerance of 5 percent when both wet wells are in service;

(iv) have a suction configuration with sufficient piping and isolation valves to pump maximum month flow with any single wet well in service; and

(v) wet well elevation shall be configured such that the normal minimum water level in the wet well is no lower than the top of the volute of the highest pump. This minimum water level shall be lower than an elevation of 217.2 m;

(b) provide means to isolate upstream of wet well influent gates so that gates can be maintained;

(c) provide geometry to minimize floatables and solids accumulation by promoting the suspension and passage of solid material to the end of the trench to ensure that the last pump is able to remove any material;

(d) provide an ogee ramp to create a hydraulic jump to effectively flush all particles sieve size 25 mm and smaller to the end of the trench and achieve a minimum Froude number of no less than 3.5 for cleaning;

(e) provide a means to prevent entrainment of air;

(f) provide inlet baffles, flow splitters, fillets, hydrocones with vanes and other means as needed in order to prevent the formation of vortices, both free surface and submerged, entrainment of air, and excessive pre-swirl entering the pump;

(g) ensure velocities in the entrance pipe upstream of each ogee ramp does not exceed 0.9 m/s under any design condition, except for cleaning;

(h) each wet well shall be equipped with electrically actuated engineered gates with lockout device to isolate the wet well from the influent flow and facilitate the wet well cleaning cycle;

(i) provide the ability to directly observe each wet well during pump operation;

(j) provide stairwell access to the interior of each wet well from the exterior of the building to a viewing platform a maximum of 2.4 m above the wet well high water level. Provide a 38 mm diameter flushing water hose outlet with hose and reel, suitable for the environment, at each end of each wet well, to clean the wet wells. Minimum flow at the nozzle shall be 4.5 L/s at 600 kPa;

(k) provide access to the floor of the wet well for personnel access, washing and the ability to remove items with a solids sphere size greater than 178 mm;

(l) Provide sufficient volume within the wet well and/or the interceptor junction chamber and/or the influent sewer system to accommodate the volume of raw sewage that would accumulate under peak flow conditions of 1056 ML/d in the time required to bring the raw sewage pumping station to design total capacity after a power failure;

(m) provide dual-redundant level transmitters in each wet well in accordance with Schedule 18 – Technical Requirements Section C.12.18; and

(n) ventilate the wet well to the headworks facility odour control system. Provide independent ventilation of the wet wells to allow person access to either wet well with increased air exchange in that particular wet well only.

B.2.5.2 Design Builder shall design and construct the raw sewage pumping station dry wells to meet the following requirements:

(a) provide 2 independently isolated dry wells to house raw sewage pumps, suction and discharge piping, valves and all ancillary equipment;

(b) provide an elevator or elevators with a minimum usable floor surface area of 3.15 m^2 and a load rating of 1360 kg to allow access to all dry wells. The elevator or elevators shall be operable in the event that either or both of the dry wells are flooded. If only 1 elevator is provided, it shall be designed such that either dry well can be accessed from the elevator while either of the dry wells are flooded without having to pass through the flooded dry well. Ensure elevator shaft(s) drain water that may accumulate due to seepage or flooding;

(c) Design Builder shall provide an isolation method to prevent the flooded dry well from flooding the elevator. The isolation method shall be actuated and automatically controlled through the PCS upon receiving a flooding alarm in the dry well. Provide a design such that the isolation method can be mobilized between the time of alarm and the time that the flood water reaches the elevator access;

(d) elevator or elevators shall be interlocked with the level sensors in the elevator shaft to prevent submerging the occupants in the event of flooding in the elevator shaft;

(e) provide stair access to both drywells. Ensure stairwells do not flood in the event the drywells flood;

(f) design the raw sewage pumping station to function continuously with the dry well flooded, without impacting operation under automation system control;

(g) provide overhead openings in the dry well to facilitate the removal of pumps, valves and appurtenances using a permanently installed, dedicated lifting device;

(h) size each overhead opening to be large enough to remove the largest pieces of equipment with a minimum of 400 mm clearance on all sides; and

(i) provide a minimum of 1 duty and 1 standby sump pump per dry well that are sufficiently sized to dewater the dry wells into the screen influent channel.

B.2.5.3 Design Builder shall design and construct the raw sewage pumping station raw sewage pumps to meet the following requirements:

(a) provide raw sewage pumps, all of which are from the same manufacturer, with the following characteristics:

(i) pump manufacturer shall sign an affidavit with the Design Builder accepting unit responsibility for the complete pumping unit including driver, shafting, and pump;

(ii) provide factory, witness performance tests to 1U tolerance, in accordance with ANSI/HI Standard 14.6 on each of the raw sewage pumps;

(iii) demonstrate each pump has no vortices or excess vibration throughout its operating region via field acceptance testing as required in Schedule 18 – Technical Requirements – Appendix 18B – Specifications;

(iv) provide a maximum of 2 different capacities of pumps to allow for interchangeability of parts;

(v) a minimum of 3 installed pumps per wet well;

(vi) a minimum of 2 duty pumps per wet well;

(vii) a minimum of 1 standby pump per wet well; and

(viii) each pump to be equipped with an adjustable speed drive.

(b) provide pump foundations having mass and rigidity in accordance with ANSI/HI Standard 1.4 and as per manufacturer’s recommendations;

(c) pump suction piping shall be designed in accordance with ANSI/HI Standard 9.6.6.

(i) each wet well suction pipe shall use a long radius reducing bend with flared inlet; and

(ii) each pump inlet pipe shall use a long radius reducing bend. A reducer followed by an elbow shall not be used;

(d) locate the pumps so that the pump invert is no higher than the existing surge well floor elevation;

(e) turn down capabilities to achieve a minimum continuous flow of 53 ML/d with 1 pump at reduced speed and operating within its acceptable operating region, as defined by ANSI/HI Standard 9.6.3;

(f) conduct hydraulic analysis demonstrating suitability of the pumps throughout the entire range of design flows with sufficient overlap, including both low and high flow at minimum static head and both low and high flow at maximum static head, and using a pipe Hazen-Williams C-factor of both 120 and 150, representing old and new installations;

(g) the ability to operate within the preferred operating region, as defined in ANSI/HI Standard 9.6.3, for flows between 53 ML/d and 1056 ML/d;

(h) provide pumps that have a wire-to-water efficiency of at least 75 percent across the preferred operating region. Wire-to-water efficiency to include pump, shaft, motor and adjustable speed drive;

(i) a downstream pump with suction bell at lower elevation than other pumps in each trench to accommodate trench cleaning requirements in accordance with ANSI/HI Standard 9.8;

(j) the design must include rigid support for intermediate bearings;

(k) provide permanent accesses to the intermediate bearings and the driveshaft couplings for maintenance;

(l) provide shaft segment lengths sized to allow removal and replacement of the shaft segments without disassembling the structure;

(m) laser align the shaft to within 0.05 mm angular and perpendicular or better if required by pump manufacturer;

(n) as a minimum provide pump suction submergence for the raw sewage pumps over the entire range of design operating levels in accordance with ANSI/HI Standard 9.8;

(o) provide balance quality grade G2.5 for rotating equipment as per American Petroleum Institute (API) 610 or equivalent in ISO 21940-11:2016, with expected bearing life prescribed in Schedule 18 – Technical Requirements – Appendix 18B – Specifications;

(p) provide a control strategy to clean the pumps and discharge piping by regularly ramping pump speeds to 100% and backflushing discharge piping;

(q) ensure vibration data is recorded and trended on the PCS to allow predictive maintenance. Provide baseline testing, and recommended alarm and trip settings; and

(r) provide an isolation valve on the suction side of each raw wastewater pump as follows:

(i) valve shall be bonneted knife gate or knife gate with transverse seal that can be repacked under pressure. A standard open knife gate shall not be used; and

(ii) provide permanent easy access for operation and maintenance.

B.2.5.4 Design Builder shall design and construct the raw sewage pumping station discharge piping to meet the following requirements:

(a) provide individual discharge pipes from each raw sewage pump, with piping arranged so that each pump performs in isolation from each other;

(b) provide a discharge configuration that eliminates backflow conditions, other than draining of water column back into the wet well, when the pump is off;

(c) provide a siphon break assembly on each pump discharge to prevent siphon from occurring when the pump is off and allow pump operation at the reduced static head of the headworks influent channel water level once the discharge pipe has been pressurized. Provide fail-safe valve operator for the anti-siphon valve;

(d) a check valve on the discharge side of each raw wastewater pump is not required;

(e) provide suction and discharge pressure gauges complete with the ability to unclog their taps, calibrated and installed as per Hydraulic Institute Standard 14.6;

(f) provide means of manually draining each pump’s suction and discharge piping with minimum drain size of 50 mm; and

(g) raw sewage pumping is to be automated and monitored by the PCS to pump raw sewage without operator intervention and shall include at a minimum:

(i) an automatic control strategy for raw sewage pumps that prevents pump operation outside of its acceptable operating region with influent flows ranging from 53 ML/d to 1056 ML/d;

(ii) an automatic control strategy at start up, shut down and at an operator selectable duration to mitigate pump plugging;

(iii) a manually-initiated automatic cleaning sequence using the raw sewage pumps to clean the wet well in accordance with the ANSI/HI Standard 9.8.4.2.3.5.;

(iv) a flow measurement device with easy access for maintenance and designed for use with raw wastewater, having a minimum 1.0 percent of reading accuracy throughout each pump's design operating range on the discharge side of each raw wastewater pump. Do not locate the flow measurement device in the wet wells; and

(v) alarming to alert plant staff of abnormal operation.

B.3 Raw Sewage Overflow System

B.3.1 Process Function Overview and Objectives

B.3.1.1 Design Builder shall design and construct the raw sewage overflow system to convey flows up to 1250 ML/d to the outfall downstream of the effluent sampling building under emergency situations.

B.3.2 Special Studies

B.3.2.1 Design Builder shall, as a minimum, carry out the following special studies for the raw sewage overflow system:

(a) computational fluid dynamics modelling of flow split between screens influent channel and raw sewage overflow in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.3.3 Basis of Design and Performance Requirements

B.3.3.1 Design Builder shall design and construct the raw sewage overflow system to:

(a) automatically overflow upstream of the fine screen system when the total pumped flow of raw sewage is greater than 860 ML/d with 2 fine screens out of service; and

(b) provide the ability for operations staff to manually initiate bypass of the plant and conveying the total pumped raw sewage flow directly to the outfall downstream of the effluent sampling building by gravity.

B.3.4 Site Planning Requirements

B.3.4.1 The raw sewage overflow shall be integral to the headworks facility.

B.3.5 Process Design Requirements

B.3.5.1 Design Builder shall design and construct the raw sewage overflow system to:

(a) completely drain any overflow channels following an overflow event;

(b) provide ability to manually flush the entire overflow channel with flushing water following an overflow event. Provide a 38 mm diameter flushing water hose outlet with hose and reel, suitable for the environment, where necessary. Minimum flow at the nozzle shall be 4.5 L/s at 600 kPa; and

(c) be automated and monitored by the PCS to overflow raw sewage without operator intervention and shall include at a minimum:

(i) measurement of the volume of flow that overflows to the outfall with an accuracy of 2 percent; and

(ii) alarming when in use, both under normal and abnormal operation.

B.4 Fine Screening System

B.4.1 Process Function Overview and Objectives

B.4.1.1 Design Builder shall design and construct the fine screen system to receive raw sewage and return flows and remove debris with an effective size of 6 mm and larger from the raw sewage. The screening system shall include, as a minimum, a single stage screening system with screens operating in parallel, including the following:

(a) automatically cleaned screens with opening of less than or equal to 6 mm in all directions; and

(b) all ancillary equipment.

B.4.2 Special Studies

B.4.2.1 Design Builder shall, as a minimum, carry out the following special studies for the fine screening system:

(a) computational fluid dynamics modelling of flow split between screen influent channels to demonstrate flow splitting and solids entrainment in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.4.3 Basis of Design and Performance Requirements

B.4.3.1 Design Builder shall design and construct the fine screen system to:

(a) receive and handle wastewater from a combined sewer system;

(b) remove all debris with an effective size of 6 mm or larger from the raw sewage;

(c) provide a fine screens systems that maintains removal performance under 860 ML/d conditions with 2 screens out of service and accounting for blinding in accordance with Good Industry Practice;

(d) provide a fine screen system that allows the ability to pass the total pumped flow of 1056 ML/d if all screens are in service; and

(e) provide a screen that is structurally capable of operating with 100 percent blinding of the screen.

B.4.4 Site Planning Requirements

B.4.4.1 The fine screen system shall be integral to the headworks facility. Design Builder shall:

(a) locate the fine screen system within a heated and ventilated building; and

(b) provide a green space beside the screen system room to facilitate future expansion of the screen system to treat 1056 ML/d with 2 screens out of service. Future expansions shall not compromise operation of the screen system incorporated in the Infrastructure.

(i) Design Builder shall not install any equipment or construct any buildings in this space; and

(ii) Design Builder shall indicate the reserved space on the relevant drawings and submit with the relevant Design Submittals.

B.4.5 Process Design Requirements

B.4.5.1 Design Builder shall design and construct the fine screen system to meet the following requirements:

(a) provide each fine screen with the provision to swing the submerged screen section above the channel level with a pivot arrangement for inspection and maintenance;

(b) provide actuated engineered slide gates upstream and downstream of each influent screening channel. Provide stop logs and stop log channels such that the slide gates can be isolated for maintenance. Provide a mechanical lifting system to assist in the installation and removal of the stop logs. Provide a storage system for the stop logs when not in use;

(c) monitor the level upstream and downstream of the screens as well as the differential level, and link to PCS;

(d) provide the ability to use either flushing water or non-potable hot water for the hard-piped wash water connection to each screen. Provide means for operator to manually select whether flushing water or non-potable water is to be used;

(e) provide screens that are fully enclosed and with a foul air connection to discharge to the headworks facility odour control system;

(f) provide covers over the screen channels and ventilate the foul air from the channel headspace to the headworks facility odour control system. Provide removable covers or hatches for access;

(g) arrange the screen covers or hoods with access panels and doors that can be removed for maintenance and inspection;

(h) include plexiglass inspection covers to allow visual inspection of the screens without opening any access doors or panels. Provide mechanism such that the plexiglass can be cleaned while the screen is in service;

(i) arrange the screens with space and access provisions for the initial installation and for replacement in the future from inside the building; and

(j) design screen channels to operate in a manner to prevent settlement of grit while minimizing the need for aeration.

B.5 Screen Effluent Overflow System

B.5.1 Process Function Overview and Objectives

B.5.1.1 Design Builder shall design and construct the screen effluent overflow system to convey flows up to 390 ML/d to the outfall downstream of the effluent sampling building.

B.5.2 Special Studies

B.5.2.1 Design Builder shall, as a minimum, carry out the following special studies for the screen effluent overflow system:

(a) computational fluid dynamics modelling of flow split of screened wastewater between grit influent and overflow to outfall in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.5.3 Basis of Design and Performance Requirements

B.5.3.1 Design Builder shall design and construct the screen effluent overflow system to:

(a) automatically overflow upstream of the grit influent conveyance system when the flow through the grit removal system exceeds 860 ML/d; and

(b) convey the screen effluent flow directly to the outfall downstream of the effluent sampling area by gravity.

B.5.4 Site Planning Requirements

B.5.4.1 The screen effluent overflow system shall be integral to the headworks facility.

B.5.5 Process Design Requirements

B.5.5.1 Design Builder shall design and construct the screen effluent overflow system to:

(a) completely drain any overflow channels following an overflow event;

(b) provide ability to manually flush the entire overflow channel with flushing water following an overflow event. Provide a 38 mm diameter flushing water hose outlet with hose and reel, suitable for the environment, where necessary. Minimum flow at the nozzle shall be 4.5 L/s at 600 kPa; and

(c) screen effluent overflow shall be automated and monitored by the PCS to overflow screen effluent without operator intervention and shall include at a minimum:

(i) measurement of the volume of flow that overflows to the outfall with an accuracy of 2 percent; and

(ii) alarming to alert plant staff of abnormal operation.

B.6 Screenings Washing and Compaction System

B.6.1 Process Function Overview and Objectives

B.6.1.1 Design Builder shall design and construct the screenings washing and compaction system to receive screening material from the fine screen system and wash, compact, and convey it to the screenings storage bins for removal from the Infrastructure. The screenings washing and compaction system shall include the following:

(a) screenings conveyance system(s);

(b) screenings washer/compactor system(s);

(c) screenings storage bin(s), provided by a City contractor; and

(d) all ancillary equipment.

B.6.1.2 Design Builder shall ensure the screenings washing and compaction system:

(a) uses fully-enclosed sluice troughs or shaftless screw conveyors for screening conveyance; and

(b) includes a screenings washer/compactor.

B.6.2 Special Studies

B.6.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.6.3 Basis of Design and Performance Requirements

B.6.3.1 Design Builder shall design and construct the screenings washing and compaction system to:

(a) handle the amount and type of screenings produced from the screening of wastewater from a combined sewer system;

(b) provide capacity to collect, convey, grind, wash and compact screenings while the screens are treating 1056 ML/d;

(c) produce screenings with a minimum dry solids content of 50 percent;

(d) produce screenings with a minimum volume reduction of 50 percent;

(e) provide enough washing/compactor and conveying equipment to avoid single-point-of-failure inhibiting the facility from handling the screenings produced from treating 860 ML/d;

(f) provide a minimum of 1 duty and 1 standby washer/compactor unit for the fine screen system, or provide a dedicated washer/compactor for each fine screen;

(g) provide a minimum of 1 duty and 1 standby sluice troughs or shaftless screw conveyors for screening conveyance;

(h) produce compacted screenings with a slump < 150 mm and suitable for solid waste disposal in accordance with *Environment Act License No. 3081 R* (April 23, 2014);

(i) provide a design that includes a minimum of 1 duty and 1 standby screenings roll-off bin, with the duty bin providing a minimum of 1 day storage at peak flow conditions. Design Builder shall use standard roll-off bin sizes in its design of the building structures. The bins will be provided and removed by an external contractor; and

(j) provide a bin system that allows bins to be removed by an external contractor without assistance by the plant staff.

B.6.4 Site Planning Requirements

B.6.4.1 The screenings washing and compaction system shall be integral to the headworks facility. Design Builder shall:

(a) locate the screenings storage bins at ground floor level with truck access for bin removal;

(b) locate the screening washing and dewatering system within a heated and ventilated room separated from the screenings room to prevent odour migration between the 2 rooms; and

(c) provide a green space beside the screenings washing and compaction system room to facilitate future expansion of the screenings washing and compaction system to process screenings captured by a fine screening system sized to treat 1056 ML/d with 2 screens out of service and 1250 ML/d with all screens in service. Future expansion shall not compromise operation of the screenings washing and compaction system incorporated in the Infrastructure.

(i) Design Builder shall not install any equipment or construct any buildings in this space; and

(ii) Design Builder shall indicate the reserved space on the relevant drawings and submit with the relevant Design Submittals.

B.6.5 Process Design Requirements

B.6.5.1 Design Builder shall design and construct the screenings washing and compaction system to meet the following requirements:

(a) arrange the screenings conveyor, as applicable, to be supported independent of the screen;

(b) equip each washer/compactor unit with an automatically controlled flushing water connection(s);

(c) convey the liquid discharge from each washer/compactor unit to a point upstream of the fine screens, but downstream of the discharge from the raw sewage pumps;

(d) provide a means to flush and drain each conveyor;

(e) provide a screenings storage bin room with sufficient space and all necessary systems to accommodate the use and replacement of roll-off container bins for screenings storage and off-site removal. The room for screenings bins shall be separate from the room for grit bins;

(f) provide ability to convey washed and compacted screenings to both the duty and standby screenings storage bin from any washer/compactor unit;

(g) provide a visual indication outside the building to indicate which bin is full and which bin is in service for the external bin removal contractor;

(h) provide a system that automatically distributes screenings throughout the bins such that when full there is less than 20 percent free space in the bins;

(i) provide a system that automatically notifies the external bin removal contractor when a bin is ready to be removed;

(j) provide a system that allows an external bin removal contractor to alternate the bin in service during bin change out including interlocks:

(i) such that when a bin is removed from service, all operating screens and washer/compactors remain in operation and all screenings are conveyed to the bin(s) in service; and

(ii) that ensures the bin is not in service before it can be removed by the external bin removal contractor;

(k) provide training to the external bin removal contractor on operation of the system. Training shall be provided in general accordance with Schedule 18 – Technical Requirements – Appendix 18G – Training Requirements;

(l) screen washing, compaction and conveyance to be automated and monitored by the PCS to wash, compact and convey screenings without operator intervention and shall include as a minimum:

(i) provide level monitoring at the bin discharge locations; and

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

(m) ensure the screenings bin storage room includes the following, at a minimum:

(i) guiding and mechanical systems to facilitate the positioning of the roll-off containers to be placed in service or for removal;

(ii) steel imbedded plates in the floor to prevent damage to concrete floor;

(iii) barriers to delineate loading locations and to avoid loading/unloading trucks from hitting any structures or equipment;

(iv) mechanical overhead doors that are electrically actuated from the exterior or interior of the building with opening dimensions to facilitate the removal and replacement of the roll-off containers;

(v) able to facilitate the use of all sizes of roll-off container bins up to 25 m^3;

(vi) easily accessed to facilitate removal and replacement of the roll-off containers at all times;

(vii) slope floors in the screenings bin room to a common trench or trenches;

(viii) provide a system that automatically distributes screenings throughout the bins such that when full there is less than 20 percent free space in the bins;

(ix) provide a drain for each bin, that returns upstream of the screens; and

(x) slope the roadway entrance for the roll-off bin away from the screenings bin room.

B.7 Headworks Channel Aeration System

B.7.1 Process Function Overview and Objectives

B.7.1.1 Design Builder shall design and construct the channel aeration system to provide assistance to the channel design and operating strategy to prevent grit and other solids from settling in the screen channels and grit channels. The channel aeration system shall include the following:

(a) air plenum;

(b) positive displacement type channel aeration blowers;

(c) air distribution system;

(d) coarse bubble diffusers; and

(e) all ancillary equipment.

B.7.2 Special Studies

B.7.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.7.3 Basis of Design and Performance Requirements

B.7.3.1 Design Builder shall design and construct the channel aeration system to:

(a) provide enough blowers so that the required maximum flow of air can be provided with minimum 1 blower out of service;

(b) provide air to the screen influent channels, screen channels, screen effluent channels and grit influent channels and grit effluent channels, where deposition of grit and other solids can occur due to low velocities;

(c) maintain grit greater than 75 micron and non-grit suspended solids in suspension under all flow and loading conditions; and

(d) provide a minimum mixing air flow rate of 0.6 L/s/m^2 of channel.

B.7.4 Site Planning Requirements

B.7.4.1 Design Builder shall:

(a) locate the channel aeration system blowers within the headworks facility, but in a room separate from the screens, screenings washing and compactor system, screenings storage bins, grit washing and dewatering system, grit storage bins, electrical room, and automation room.

B.7.5 Process Design Requirements

B.7.5.1 Design Builder shall design and construct the channel aeration system to meet the following requirements:

(a) provide channel aeration blowers with the following performance characteristics:

(i) sufficient blower system turndown capacity to meet the minimum air demand at the design minimum flow conditions without having to waste air under any loading condition;

(ii) each blower to be equipped with an adjustable speed drive to facilitate blower turndown requirements;

(iii) each blower to have minimum 40 percent turndown; and

(iv) each blower to have an isolation valve on its suction and discharge;

(b) provide air headers, valves and pressure gauges that allow the airflow rate to be individually controlled to each channel from the deck level;

(c) arrange the diffusers in the channels to provide mixing and to prevent solids deposition and plugging of diffusers;

(d) provide an isolation valve on each aeration branch to a channel;

(e) provide unions on each aeration branch to a channel; and

(f) channel aeration to be automated and monitored by the PCS to aerate channels without operator intervention and shall include as a minimum:

(i) flow monitoring of the channel aeration discharge header; and

(ii) alarming to alert plant staff of abnormal operation.

B.8 Grit Removal System

B.8.1 Process Function Overview and Objectives

B.8.1.1 Design Builder shall design and construct the grit removal system to receive screened raw sewage and remove grit upstream of the existing primary clarification system. The grit removal system shall include the following:

(a) grit removal tanks; and

(b) all ancillary equipment.

B.8.1.2 Design Builder shall provide grit removal units that use a stacked tray system with tangential flow.

B.8.2 Special Studies

B.8.2.1 Design Builder shall, as a minimum, carry out the following special studies for the grit removal system:

(a) computational fluid dynamics modelling of flow split between grit influent channels to demonstrate flow splitting and solids entrainment in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.8.3 Basis of Design and Performance Requirements

B.8.3.1 Design Builder shall design and construct the grit removal system to:

(a) receive and handle wastewater from a combined sewer system;

(b) remove grit from the screened raw sewage;

(c) remove at least 95 percent of particles at 860 ML/d with effectives sizes greater than or equal to 125 micron and a specific gravity greater than or equal to 2.6 with minimum 1 grit removal unit out of service;

(d) remove at least 95 percent of particles at 705 ML/d with effectives sizes greater than or equal to 106 micron and a specific gravity greater than or equal to 2.6 with minimum 1 grit removal unit out of service;

(e) remove at least 95 percent of particles at 705 ML/d with effectives sizes greater than or equal to 125 micron and a specific gravity greater than or equal to 2.6 with minimum 2 grit removal units out of service;

(f) remove at least 95 percent of particles at 236 ML/d with effectives sizes greater than or equal to 75 micron and a specific gravity greater than or

equal to 2.6 with minimum 50 percent of grit removal units out of service; and

(g) provide Firm Capacity of860 ML/d.

B.8.4 Site Planning Requirements

B.8.4.1 The grit removal system shall be integral to the headworks facility. Design Builder shall:

(a) split flow and solids evenly among all grit removal tanks to within a 5 percent tolerance;

(b) locate any mechanical equipment, with the exception of gates and actuators, within a heated and ventilated building; and

(c) provide green space beside the grit removal system to facilitate future expansion of the grit removal system to remove 95 percent of particles at 1056 ML/d with effective sizes greater than or equal to 125 micron and a specific gravity greater than or equal to 2.6, with 1 grit removal tank out of service. Future expansion shall not compromise operation of the grit removal system incorporated in the Infrastructure;

(i) Design Builder shall not install any equipment or construct any buildings in this space; and

(ii) Design Builder shall indicate the reserved space on the relevant drawings and submit with the relevant Design Submittals.

B.8.5 Process Design Requirements

B.8.5.1 Design Builder shall design and construct the grit removal system to meet the following requirements:

(a) provide covers over the grit influent and effluent channels and ventilate the foul air from the channel headspace to the headworks facility odour control system. Provide removable covers or hatches for access;

(b) provide the ability to automatically isolate each grit removal unit from grit influent and grit effluent;

(c) equip each grit removal unit with a flushing water connection and actuated on/off valve and locate at the bottom of the tank to fluidize grit that accumulates at the bottom of the unit;

(d) cover each grit tank and ventilate to the headworks odour control system;

(e) provide removable covers over each grit removal tank such that the entire tank is accessible for cleaning or equipment removal from the top of the tank with the covers removed;

(f) provide a permanent lifting device capable of removing any grit removal tank cover and any grit removal tray;

(g) provide non-freeze utility stations at the top of the grit tanks such that a hose can be connected for cleaning the grit removal tanks;

(h) provide inspection hatches over the grit removal tanks and grit effluent channel; and

(i) grit removal is to be automated and monitored by the PCS to remove grit without operator intervention and shall include as a minimum:

(i) alarming to alert plant staff of abnormal operation.

B.9 Grit Effluent Overflow System

B.9.1 Process Function Overview and Objectives

B.9.1.1 Design Builder shall design and construct the grit effluent overflow system to convey flows up to 575 ML/d to the outfall downstream of the effluent sampling building.

B.9.2 Special Studies

B.9.2.1 Design Builder shall, as a minimum, carry out the following special studies for the grit effluent overflow system:

(a) computational fluid dynamics modelling of flow split of de-gritted wastewater between primary influent and overflow to outfall in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.9.3 Basis of Design and Performance Requirements

B.9.3.1 Design Builder shall design and construct the grit effluent overflow system to:

(a) automatically overflow upstream of the existing primary influent conveyance system when the flow through the high purity oxygen reactors exceeds 380 ML/d and the excess flow cannot be bypassed through the existing primary effluent bypass; and

(b) convey the grit effluent flow directly to the outfall downstream of the effluent sampling area by gravity.

B.9.4 Site Planning Requirements

B.9.4.1 The grit effluent overflow system shall be integral to the headworks facility.

B.9.5 Process Design Requirements

B.9.5.1 Design Builder shall design and construct the grit effluent overflow system to:

(a) completely drain any overflow channels following an overflow event;

(b) provide ability to manually flush the entire overflow channel with flushing water following an overflow event. Provide a 38 mm diameter flushing water hose outlet with hose and reel, suitable for the environment, where necessary. Minimum flow at the nozzle shall be 4.5 L/s at 600 kPa; and

(c) grit effluent overflow shall be automated and monitored by the PCS to overflow grit effluent without operator intervention and shall include at a minimum:

(i) measurement of the volume of flow that overflows to the outfall with an accuracy of 2 percent; and

(ii) alarming to alert plant staff of abnormal operation.

B.10 Grit Washing and Dewatering System

B.10.1 Process Function Overview and Objectives

B.10.1.1 Design Builder shall design and construct the grit washing and dewatering system to collect grit from each grit removal tank, convey it to the grit washing and dewatering units, wash it, dewater it, and convey it to the grit storage bins for disposal. The grit washing and dewatering system shall include the following:

(a) grit removal pumps;

(b) grit washing units;

(c) grit dewatering units;

(d) grit conveyors;

(e) grit storage bin(s), provided by a City contractor; and

(f) all ancillary equipment.

B.10.1.2 Design Builder shall provide:

(a) grit removal pumps of the recessed impeller type.

B.10.2 Special Studies

B.10.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

B.10.3 Basis of Design and Performance Requirements

B.10.3.1 Design Builder shall design and construct the grit washing and dewatering system to:

(a) handle the amount and type of grit produced from treatment of wastewater from a combined sewer system;

(b) provide Firm Capacity to collect, convey, wash, and dewater all grit from the grit removal system based on Design Builder's assessment of the worst-case governing flow and loading conditions for dewatering;

(c) produce washed and dewatered grit with a slump < 150 mm that is suitable for solid waste disposal in accordance with Environment Act License No. 3081 R (April 23, 2014);

(d) continuously remove all grit collected in the grit removal system under all flow and loading conditions;

(e) capture, for dewatering, at least 95 percent of particles with effectives sizes greater than 75 micron and a specific gravity greater than or equal to 2.6 through the grit washing process across the entire design flow range;

(f) deliver to the grit bins at least 95 percent of particles with effectives sizes greater than 75 micron and a specific gravity greater than or equal to 2.6 through the grit dewatering process across the entire design flow range;

(g) wash the grit to remove any residual organics and produce an inert grit with a volatile suspended solids content of 20 percent or less;

(h) dewater the grit to a minimum dry solids content of 60 percent on a per weight basis;

(i) provide a design that includes a minimum of 1 duty and 1 standby grit roll-off bin; and

(j) provide a bin system that allows bins to be removed by an external contractor without assistance by the plant staff. The bins will be provided and removed by an external contractor.

B.10.3.2 Design Builder shall provide a design that can accommodate at least 2 fully loaded 25 m^3 grit bins. Design Builder shall use the longest, standard 25 m^3 roll-off bin size in its design of the building structures. The bins will be provided and removed by an external contractor.

B.10.4 Site Planning Requirements

B.10.4.1 The grit washing and dewatering systems and storage bins shall be integral to the headworks facility. Design Builder shall:

(a) locate the grit washing and dewatering system on Site North East;

(b) locate the grit washing and dewatering system within a heated and ventilated building;

(c) locate the grit storage bins at ground floor level to facilitate truck access for bin removal; and

(d) determine the green space beside the grit washing and dewatering system room required to facilitate future expansion of the grit washing and dewatering systems and storage bin room to process grit captured by the grit removal system sized to treat 1056 ML/d. Future expansion shall not compromise operation of the grit washing and dewatering systems and storage bins incorporated in the Infrastructure;

(i) do not install any equipment or construct any buildings in this space; and

(ii) indicate the reserved space on the relevant drawings and submit with the relevant Design Submittals.

B.10.5 Process Design Requirements

B.10.5.1 Design Builder shall design and construct the grit washing and dewatering system to meet the following requirements:

(a) process, at all times, the grit loads generated by the grit removal tanks. Determine the grit load to be processed by the grit washing and dewatering system and increase by a factor of 1.25. Submit the design calculations for the grit loading with the relevant Design Submittal;

(b) provide a dedicated grit removal pump for each grit removal unit capable of removing grit continuously from the grit removal units under all conditions;

(c) provide a minimum of 1 standby grit removal pump per pair of duty pumps;

(d) provide grit removal pumps with the following performance characteristics:

(i) motor with adjustable speed drive;

(ii) turndown to at least 50 percent;

(iii) the minimum flow and head requirements for the grit washing unit to achieve its designated performance requirements under all flow and loading conditions; and

(iv) provide an automated flush system for each grit removal pump, using flushing water on the suction and discharge side of the pump, in between the pump isolation valves;

(e) provide a dedicated grit washing unit for each grit removal unit sized to match the maximum discharge capacity of a grit removal pump;

(f) provide a mechanism to direct separated water from the grit washing unit to a point upstream of the grit removal tanks;

(g) provide an overflow and drain for each grit dewatering unit that returns to a point upstream of the grit removal units;

(h) convey washed and dewatered grit to the grit storage bins;

(i) if mechanical means are used to convey the washed and dewatered grit to the storage bin provide a duty and standby unit and equip each unit with a drain;

(j) provide a system that automatically distributes grit throughout the bins such that when full there is less than 20 percent free space in the bins;

(k) slope the roadway entrance for the roll-off bin away from the grit bin room;

(l) provide a storage bin room with sufficient space and all necessary systems to accommodate the use and replacement of roll-off container bins for grit storage and off-site removal;

(m) provide a visual indication outside the building to indicate which bin is full and which bin is in service for the external bin removal contractor;

(n) grit pumping, washing, dewatering and conveyance is to be automated and monitored by the PCS to pump, wash, dewater and convey grit without operator intervention and shall include as a minimum:

(i) flow monitoring for grit slurry pumped to each washing and dewatering unit;

(ii) pressure monitoring on the discharge of each grit pump;

(iii) torque, level or pressure monitoring on the conveyor to provide indication of plugging;

(iv) ability to automate grit dewatering unit belt speed;

(v) provide level monitoring at the bin discharge locations; and

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

(o) The grit bin storage room shall include the following at a minimum:

(i) guidance and mechanical systems to facilitate the positioning of the roll-off containers for service and removal;

(ii) steel imbedded plates in the floor to prevent damage to concrete floor;

(iii) sufficient space for the use of all size roll-off container bins up to 25 m^3;

(iv) barriers to delineate loading locations and to avoid loading/unloading trucks from hitting any structures or equipment;

(v) mechanical overhead doors, electrically actuatable from the interior and exterior of the building, with opening dimensions to facilitate the removal and replacement of the roll-off containers and trucks;

(vi) a system that allows an external bin removal contractor to alternate the bin in service during bin change out including interlocks:

(A) such that when a bin is removed from service, all operating grit removal tanks, washers and dewatering units remain in operation and all dewatered grit is conveyed to the bin(s) in service; and

(B) that ensures the bin is not in service before it can be removed by the external bin removal contractor;

(vii) provide training to the external bin removal contractor on operation of the system. Training shall be provided in general accordance with Schedule 18 – Technical Requirements Appendix 18G – Training Requirements;

(viii) provide a system that automatically notifies the external bin removal contractor when a bin is ready to be removed;

(ix) a bin washing station;

(x) easily accessed to facilitate removal and replacement of the roll-off containers at all times; and

(xi) floor slope, minimum 300 mm diameter drains and solids traps to manage any grit bin overflows or drippings.

B.11 Odour Control System

B.11.1 Process Function Overview and Objectives

B.11.1.1 Design Builder shall design and construct a centralized odour control system to treat foul air from the following sources/locations as a minimum:

(a) raw sewage pumping station wet wells;

(b) screen enclosures and screening channels; and

(c) grit system.

B.11.1.2 The odour control system shall be based, as a minimum, on a two-staged biological system in series and shall include the following as a minimum:

(a) odour control units;

(b) exhaust fans;

(c) exhaust stacks; and

(d) all ancillary equipment.

B.11.1.3 If the two-staged biological system in series cannot meet the Odour Standard or the minimum removal efficiencies in Section C.3.2.5(c) of Schedule 18 – Technical Requirements, Design Builder shall provide an additional treatment stage based on activated carbon adsorption technology.

B.11.1.4 At a minimum, locate all ancillary equipment and control panels indoors, within the headworks facility.

B.11.1.5 The odour control units shall be above grade concrete tanks, if not located in a heated and ventilated building.

B.11.2 Special Studies

B.11.2.1 Provide air dispersion modeling in accordance with Schedule 18 – Technical Requirements – Appendix 18 K – Special Studies.

B.11.3 Basis of Design and Performance Requirements

B.11.3.1 Design Builder shall design and construct the odour control system to:

(a) provide a minimum odour removal efficiency of 95 percent during both average and peak loading conditions;

(b) provide a minimum hydrogen sulphide reduction efficiency of 99.5 percent during both average and peak loading conditions;

(c) provide a minimum total reduced sulphur compounds removal efficiency of 90 percent during both average and peak loading conditions;

B.11.3.2 Design Builder shall provide an odour dispersion stack for the treated air to meet the following requirements:

(a) Provide a stack 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;

(b) Provide a stack that is free standing and does not use guy wires;

(c) Provide a stack that does not use painted steel; and

(d) Provide a stack with sufficient exit velocity to prevent icing.

B.11.4 Site Planning Requirements

B.11.4.1 Design Builder shall locate the odour control system at ground floor level to facilitate access for media replacement.

(a) provide 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 control unit.

B.11.5 Process Design Requirements

B.11.5.1 Design Builder shall design and construct odour control to meet the following requirements:

(a) as a minimum, provide odour control units to treat:

(i) foul air from each raw sewage pump station wet well;

(ii) foul air continuously from the screen enclosures and headspace of screening channels;

(iii) foul air continuously from the headspace of grit channels and all grit tanks;

(iv) foul air continuously from the headspace of other wastewater channels and chambers located in buildings; and

(v) spare capacity of 500 l/s to allow connection of future odourous sources;

(b) provide a minimum of 1 duty and 1 standby foul air fan;

(c) provide proper humidification of the air prior to entering the odour control units;

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

(e) 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;

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

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

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

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

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

(k) any media for the biological systems used shall be designed to be replaced no more than once every 5 years at the 2037 operating conditions;

(l) any media for the activated carbon systems (if required) shall be designed to be replaced no more than once every 2 years at the 2037 operating conditions;

(m) provide a foul air emergency bypass to the stack for the odour control system; and

(n) provide a nutrient supply system for the biofilter vessels that includes the following at a minimum:

(i) a nutrient tank, mixer, feed pumps, valving and piping to supply nutrient water to each biofilter unit. Provide a flow control valve, strainer, diaphragm valve, and flow meter;

(ii) a nutrient water supply recirculation system that collects nutrient water from each biofilter and returns it to a nutrient recirculation tank and pumps it back to the biofilters;

(iii) flow measurement, actuated valves and isolation valves for the non-potable water; and

(iv) a connection from the nutrient supply system to supplement the nutrient recirculation tank;

(o) for activated carbon systems (if required) located downstream of the biological systems, provide the following:

(i) air heaters to increase the temperature to reduce the relative humidity of the air before the carbon system, to prevent water adsorption by the carbon and prolong carbon life; and

(ii) 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.

SECTION C. AREA P – PRIMARY CLARIFICATION FACILITY

C.1 Primary Influent Conveyance System

C.1.1 Process Function Overview and Objectives

C.1.1.1 Design Builder may reuse or modify the existing primary influent conveyance system to convey grit effluent and sidestream return flows from the existing centrate treatment facility to the existing primary clarifiers.

C.1.2 Special Studies

C.1.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

C.1.3 Basis of Design and Performance Requirements

C.1.3.1 Design Builder shall design the grit effluent conveyance system to convey flow up to 705 ML/d to the primary influent system.

C.1.3.2 Design Builder shall not use channels open to the atmosphere, to minimize odour.

C.1.4 Site Planning Requirements

C.1.4.1 Design Builder may reuse or modify the existing primary influent conveyance system.

C.1.5 Process Design Requirements

C.1.5.1 Design Builder shall design and construct the grit effluent conveyance system to meet the following requirements:

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

(b) as a minimum keep the existing air piping and diffusers in the primary influent conveyance system.

SECTION D. AREA C – CENTRATE TREATMENT FACILITY

D.1 Treated Centrate Conveyance System

D.1.1 Process Function Overview and Objectives

D.1.1.1 Design Builder shall modify the existing treated centrate conveyance system to return the treated centrate from the existing centrate treatment facility's equalization tank to a point upstream of the existing primary clarifiers but downstream of the raw sewage sampler.

D.1.2 Special Studies

D.1.2.1 No special studies required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

D.1.3 Basis of Design and Performance Requirements

D.1.3.1 Design Builder shall design and construct the treated centrate conveyance system to:

(a) convey treated centrate to a point upstream of the existing primary clarifiers but downstream of the raw sewage sampler under all conditions.

D.1.4 Site Planning Requirements

D.1.4.1 The treated centrate shall be returned to a point upstream of the existing primary clarifiers but downstream of the raw sewage sampler.

D.1.5 Process Design Requirements

D.1.5.1 Design Builder shall design and construct the treated centrate conveyance system to meet the following requirements:

(a) provide new piping with a diameter no smaller than the existing treated centrate piping;

(b) provide a composite sampler in accordance with Schedule 18 – Technical Requirements – Appendix 18B – Specifications to sample the treated centrate if Design Builder does not use the existing sampler;

(c) provide flushing water connections;

(d) provide in-line flow measurement if Design Builder does not use existing flow meter;

(e) Design Builder shall replace the existing (duty/standby) treated centrate pumps to account for the new higher system head of the modified forcemain:

(i) new pumps to operate at the best efficiency point at 80.6 L/s;

(ii) The static lift component of the total dynamic head shall be calculated using a minimum equalization tank water elevation of 224.41m and a maximum equalization tank water elevation of 227.98m;

(iii) pumps to operate in accordance with existing pump control protocol;

(iv) replace all related infrastructure, as necessary, to accommodate the new pumps, including:

(A) adjustable speed drives;

(B) guide rails;

(C) discharge elbows;

(D) valves; and

(E) instruments;

(v) ensure new pumps can be removed from the equalization tank through the existing hatches using existing davit cranes.

SECTION E. AREA G – STANDBY GENERATION FACILITY AND EXISTING GRIT REMOVAL FACILITY

E.1 Flushing Water Pumping Station

E.1.1 Process Function Overview and Objectives

E.1.1.1 Design Builder may reuse the existing flushing water pumping station to supply flushing water to the Infrastructure, but only after the Design Builder has satisfied the City that there will be no detrimental effect on the City's existing NEWPCC flushing water demands.

E.1.2 Special Studies

E.1.2.1 No special studies are required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

E.1.3 Basis of Design and Performance Requirements

E.1.3.1 Design Builder shall design and construct the Infrastructure such that there is no detrimental effect on the City's existing NEWPCC flushing water demands:

(a) if there is a detrimental effect on the City's existing NEWPCC flushing water demands, Design Builder shall:

(i) modify the existing flushing water pumping station to mitigate such effects; or

(ii) provide a dedicated flushing water pumping station for the Infrastructure.

E.1.4 Site Planning Requirements

E.1.4.1 The existing flushing water pumping station is located in the east basement of the existing pre-aeration and grit removal building.

E.1.5 Process Design Requirements

E.1.5.1 Design Builder shall design and construct the flushing water piping to service the Infrastructure and shall meet the following requirements:

(a) flow and pressure demands of the installed process equipment and any other flushing water demands such as hose bibs; and

(b) provide inline flow and pressure measurement, connected to the PCS, at the point where the flushing water enters the Infrastructure.

E.2 Waste Activated Sludge

E.2.1 Process Function Overview and Objectives

E.2.1.1 The waste activated sludge (WAS) from the high purity oxygen activated sludge plant is currently discharged into the common channel for the effluent from the grit removal tanks, for subsequent co-thickening in the primary clarifiers.

E.2.1.2 Design Builder shall ensure that the WAS continues to discharge upstream of the primary clarifiers by reuse of existing infrastructure or by construction of new infrastructure.

E.2.2 Special Studies

E.2.2.1 No special studies are required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

E.2.3 Basis of Design and Performance Requirements

E.2.3.1 Design Builder shall design and construct the Infrastructure such that there is no detrimental effect on the City's ability to co-thicken WAS with the primary sludge.

E.2.4 Site Planning Requirements

E.2.4.1 The WAS currently discharges into the channel located on the west side the existing pre-aeration and grit removal building.

E.2.5 Process Design Requirements

E.2.5.1 If Design Builder does not reuse the current WAS discharge location, Design Builder shall make modifications to the WAS pumps and piping, as necessary, to maintain existing pump capacity and co-thickening.

E.3 Primary Influent Conveyance System Aeration

E.3.1 Process Function Overview and Objectives

E.3.1.1 The existing pre-aeration and grit building includes 3 blowers for aeration of the grit removal tanks as well as aeration of the primary influent conveyance system. On completion of the Infrastructure, there will be no need for aeration of the existing grit removal tanks. However, the primary influent channels will require continued aeration using the existing aeration piping and diffusers using dedicated new blowers. Design Builder shall design and construct the channel aeration system to:

(a) have a minimum of 1 duty and 1 standby blower;

(b) provide air to the existing channel aeration system by connecting the blower discharge to the existing 150 mm air pipe; and

(c) provide a minimum mixing air flow rate of 0.6 L/s/m^2 of channel.

E.3.2 Special Studies

E.3.2.1 No special studies are required in accordance with Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models.

E.3.3 Basis of Design and Performance Requirements

E.3.3.1 Design Builder shall design and construct the Infrastructure such that there is no detrimental effect on the operation of the City's existing channel aeration system.

E.3.4 Site Planning

E.3.4.1 Design Builder shall:

(a) locate the new blowers in the same room as the existing 3 blowers in the existing pre-aeration and grit removal building; and

(b) decommission and remove existing blowers and related systems. To avoid having no redundancy on existing blowers, decommission only after receiving the Certificate of Performance Testing Completion.

E.3.5 Process Design Requirements

E.3.5.1 Design Builder shall design and construct the channel aeration system to meet the following requirements:

(a) provide channel aeration blowers with the following performance characteristics:

(i) sufficient blower system turndown capacity to meet the minimum air demand at the design minimum flow conditions without having to waste air under any loading condition;

(ii) blowers to be equipped with an adjustable speed drive to facilitate blower turndown requirements;

(iii) blowers to have minimum 40 percent turndown; and

(iv) blowers to be by the same manufacturer as those provided for channel aeration in the headworks facility; and

(b) blowers to be automated and monitored by the PCS to aerate channels without operator intervention and shall include as a minimum:

(i) alarming to alert plant staff of abnormal operation.

E.4 Standby Power Generation Facility

E.4.1 Process Function Overview and Objectives

E.4.1.1 Design Builder shall design and construct a standby power generation facility to provide generator power to the NEWPCC in the following modes:

(a) standby mode, which means utility power is not available from 1 or more of the normal utility service points of delivery;

(b) peak shave mode, which means the utility demand is reduced by use of local generation in parallel with the utility in either of the following scenarios:

(i) the Utility Company requests load curtailment to assist with utility load management; or

(ii) as a precautionary measure because the perceived risk of utility interruption is increased, or because the consequences of loss of continuity of power supply would cause significant system impacts. Peak shave mode would be used in conjunction with fast load shedding if the utility supply is lost during operation;

(c) test mode, which means for generator and transfer system testing purposes.

E.4.1.2 The generators, transfer control system and auxiliary systems, shall be operated automatically. In addition, the system shall be capable of remote operation, by way of plant staff control via the PCS. The transfer system shall allow manual operation by plant staff in the event of transfer control system failure. The PCS shall monitor operating modes.

E.4.2 Special Studies

E.4.2.1 Design Builder shall, as a minimum,

(a) include the standby power generation system in the power study model as required by Schedule 18 – Technical Requirements – Appendix 18K – Special Studies and Models; and

(b) perform acoustic/sound analysis to ensure that sound levels are in accordance with the Technical Requirements.

E.4.3 Basis of Design and Performance Requirements

E.4.3.1 The supplied standby power system shall have a rating of not less than 6 MW at a power factor of 0.8 lag, and the capability of being expanded to a capacity of 16 MW. The standby power system will operate at 12.47 kV.

E.4.3.2 The facility shall include all equipment, systems and facilities as necessary for a full and functioning system, including:

(a) a climate-controlled building to accommodate generators and associated equipment;

(b) diesel fueled generators, cooling and exhaust systems

(c) bulk fuel tanks, day tanks, fuel cooling systems, fuel pumping systems, and fuel conditioning systems;

(d) HVAC systems;

(e) MV and LV switchgear and MCCs, transformers, neutral-grounding resistors;

(f) cabling, ductbanks and raceways;

(g) generator transfer control systems;

(h) PCS equipment; and

(i) fire alarming and suppression.

E.4.3.3 The system shall permit operation of the standby generators individually, and in parallel.

E.4.3.4 The system shall permit generator operation in an islanded configuration, as well as operation in parallel with utility services for short durations or extended periods, as required.

E.4.4 Site Planning Requirements

E.4.4.1 The generator building and fuel tanks shall be constructed in an area north of the existing pre-aeration and grit building and east of the existing electrical building (Area E).

E.4.4.2 Design Builder shall provide a green space beside the generator building to facilitate future expansion of the generator system.

(a) the site shall allow for up to 16 MW of generation to be installed, assuming future generators are of identical size and rating to those installed under this DBA;

(b) layout to be planned such that future expansion does not compromise operation of the generator system provided under this DBA;

(c) Design Builder shall not install any equipment or construct any buildings in this space; and

(d) Design Builder shall indicate the reserved space on the relevant drawings and submit with the relevant Design Submittals.

E.4.4.3 Road access shall be provided for fuel delivery vehicles and for vehicle access for maintenance and re-fueling activities including future removal and replacement of complete generator units.

E.4.5 Process Design Requirements

E.4.5.1 Design Builder shall meet the following generator rating and configuration requirements:

(a) provide the requisite number of diesel generator units (minimum of 3) to provide a minimum total of 6 MW of electrical power at a power factor of 0.8 lag;

(b) each individual generator, and generators operating in parallel shall be designed to operate with up to 0.15 per unit leading kVA reactive;

(c) routine on-load testing of individual generators can be carried out while operating in parallel with the utility, without the need for load banks;

(d) include peak shave functionality; and

(e) the system shall be designed such that it is not classified as an emergency system. However, the system shall be used to provide additional power to emergency systems that have battery backup power supplies to extend their supply indefinitely in the event of utility power loss, such as emergency lights and fire alarm systems.

E.4.5.2 Design Builder shall meet the following interconnection requirements:

(a) meet the interconnection requirements of the utility and secure all necessary permits and approvals for intended modes of operation;

(b) the generator facility electrical system shall be configured in a 2-bank configuration at all voltage levels, with generators capacity distributed as evenly as practical between the 2 banks;

(i) the intent is that a minimum of 2 MW generator capacity shall be available to a minimum of 1 switchgear line-up, SGR-E7110 or SGR-E7120, with any 1 piece of equipment, including busbars, out of service;

(c) the 2-banks shall be interconnected by tie breakers at each voltage level;

(i) the intent is that generators will normally all operate in parallel but can operate as 2 separate banks, should it be required;

(d) each 12.47 kV switchgear bus shall be rated to include the ability to serve up to 4 generators of identical size to those installed under this DBA;

(i) the 12.47 kV switchgear installed under this DBA shall include breakers to serve the number of generators installed under this DBA, with 1 additional equipped spare. It shall be possible for addition of circuit breaker cells to each bank in future, without expansion of the electrical rooms, for up to 4 generators per bank;

(e) provide two-bank 600 V and 120/208 V electrical distribution in the standby power generation building;

(i) redundant dry type 12.47 kV-600 V transformers shall provide 600V power from the generator building 12.47 kV switchgear; and

(ii) redundant dry type 600 V – 120/208 V transformers shall provide 120/208 V power from the generator building 600 V switchgear;

(f) generators shall be connected to the 12.47 kV switchgear in the existing electrical building and shall be capable of directly powering either SWGR-E7110, SWGR-E7120, or both, without the use of the existing electrical building (Area E) 12.47 kV switchgear tie breakers;

(g) the connections to SWGR-E7110 and SWGR-E7120 shall be made from separate banks of generator 12.47 kV switchgear; and

(h) hardwired and software interlocking shall be provided to ensure that the 2 utility sources are not paralleled at any time by the generator switchgear.

E.4.5.3 Cabling, concrete duct banks, pull chambers and raceways shall be provided for connections between generator building and other required locations including the existing electrical building (Area E).

E.4.5.4 Breaker tie-ins have been allocated as part of the existing electrical building (Area E) design for the terminations from the standby power generation facility. Design Builder shall be responsible for all required modifications to the existing electrical building, including structure, switchgear, protection, controls, and PCS logic.

E.4.5.5 Design Builder shall meet the meet the requirements in Schedule 18 – Technical Requirements Section C.11.5.21 and Schedule 18 – Technical Requirements Section C.11.5.23 and the following for design of the fuel system:

(a) provide a minimum of 2 above ground fuel storage tanks, with a combined usable capacity to operate all generators at full capacity for 48 hours, plus additional space and connection provisions for a future additional 24 hours of fuel storage. The fuel storage tanks shall be designed to allow refueling while generation is in use; and

(i) provide a sump pump in the containment structure of all fuel tanks with instrumentation to detect leaks and transmit information to PCS;

(ii) provide crossover fuel lines to share fuel between main fuel tanks; and

(iii) provide permanent stairs and platform(s) for access to top of tanks for operation, maintenance and inspections;

(b) provide 1 or more day tanks for each installed generator located within the room housing the standby diesel generator units. Day tanks shall have a minimum storage capacity of 4 hours at rated full load of the unit;

(i) provide a minimum of 1 duty and 1 standby fuel supply pump to convey fuel from the main diesel storage tank system to each day tank; and

(ii) provide a return fuel supply line from each standby diesel generator unit to the day tanks. Provide cooling system for recirculated fuel.

E.4.5.6 Design Builder shall meet the following requirements for the design of the standby power transfer control system:

(a) transfer control system shall be PLC based, with hardware and software in accordance with the WWD Electrical Design Guide. The control system

shall be dedicated for the standby power control system and may not be used to control unrelated building or process systems;

(b) transfer system shall include UPS power supplies, and interconnection with PCS system for monitoring and control;

(c) transfer control system shall be a two-bank configuration for redundancy, with a minimum of 2 control panels, 1 located in each generator building electrical room;

(i) the normal operating configuration is that the control system operates all generators in parallel as a single system; and

(ii) a minimum of 1 bank (minimum 2 MW generator capacity) shall be automatically available to a minimum of 1 switchgear line-up SGR-E7110 or SGR-E7120, with any 1 transfer control system control panel, or any one component, including potential transformers and current transformers, out of service;

(d) the control system shall be expandable to serve up to 4 generators of identical size to those installed in this DBA on each bank, for a total of up to 8 generators;

(i) it shall be possible to add generators in future without affecting continuous availability of 1 bank of generation for standby power requirements;

(e) transfer of loads between generators and utility supplies shall be carried out by soft-transition to reduce transients on the utility system;

(f) the system shall include rapid load shedding and demand management so that the generator system stability is maintained;

(g) the control system will interact with existing circuit breakers to control paralleling with the utility, in addition to control of circuit breakers supplied under this DBA; and

(h) the control system will interact with reference voltage, current and status signals from existing switchgear, in addition to switchgear supplied under this DBA.

E.4.5.7 Design Builder shall meet the following requirements for the design of the standby power generation building:

(a) as a minimum, provide the following rooms with the building:

(i) generator room;

(ii) electrical rooms, one each for Bank 1 and Bank 2; and

(iii) battery room;

(b) provide necessary lighting, heating, ventilation and air conditioning equipment, and security systems;

(c) provide automated louvers for combustion air and cooling requirements of each standby diesel generator unit;

(d) provide an automatic fire protection system with remote isolation of fuel supply within the standby power generation system building;

(e) provide 125 VDC batteries and chargers for the switchgear and protection systems;

(f) provide carbon monoxide, nitrogen dioxide, and any other gas detection as required, fire extinguishers, closed circuit television monitoring and fire alarm detection devices within the standby power generation system building;

(g) provide NOx quenching using urea, if required by the Governmental Authority; and

(h) include attenuation in the generator and building system to maintain sound pressure levels in accordance with Section C.3.2.1(a) of Schedule 18 – Technical Requirements;

(i) noise testing shall be performed during commissioning to confirm compliance with the Technical Requirements.