CLEARVIEW
TOWNSHIP

Appendix F – Sewage Pumping Station (SPS) Design Guide

SPS Design Guide

Figures 1 to 5

Table of Contents

Appendix F – Sewage Pumping Station (SPS) Design Guide

F1.00 Introduction

The Township Sewage Pumping Station Design Guide is intended to provide an engineering basis for Sewage Pumping Station (SPS) design, to establish uniform criteria of minimum standards, and to improve the processing of engineering design submissions for development related works. Alternatives that improve or maintain the quality of design will be considered for acceptance subject to the approval of the Township's Public Works Department.

F2.00 General

SPSs must be designed in accordance with the more stringent version of applicable codes and regulations, industry standards, and Clearview's standards.

Some of the applicable external standards and guidelines include:

- MECP Design Guidelines for Sewage Works.
- MECP Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300).
- MECP's Standard Operating Policy for Sewage Works.
- National Fire Protection Association (NFPA) 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
- Hydraulic Institute Standards.
- Canadian Standards Association (CSA) B139 – Installation Code for Oil Burning Equipment: as adopted by the Technical Standards and Safety Authority (TSSA).
- Ontario Building Code (OBC).
- Ontario Electrical Safety Code (OESC).
- Ontario Provincial Standards Specifications (OPSS) and Drawings (OPSD).
- Occupational Health and Safety Act (OHSA).

Prior to the commencement of the design of the SPS, a pre-design meeting shall be arranged with Township staff and their operators to confirm design flows, station design type, and any other pertinent items dealing with the facility.

Prior to the commencement of detailed design of the SPS, the designer / Developer is to submit a preliminary design report that identifies, at a minimum, the following:

- Design criteria.
- System head curves.
- Pump curves.

- Site Plan layout.
- Forcemain alignment.
- Station layout.

Selection of equipment, technology, materials, and other design solutions should consider a life cycle cost (LCC) approach that includes factors beyond the initial purchase price of an asset. Typical LCC costs include energy consumption, installation costs, maintenance costs, operational costs, replacement costs, and decommissioning costs.

The design should incorporate a sufficient level of redundancy (e.g., pumps, primary and backup level control systems, etc.) such that failure of one single component does not result in a total system failure. Selection of process equipment should consider overall reliability and suitability to handle all potential operating conditions.

F3.00 Design

F3.01 System Head Curve

The calculations of the system head curve shall include static head loss as well as head losses through valves, fittings, pipes inside the station, and forcemains, as well as entrance and exit losses. System head curves shall be calculated under the following conditions:

Table 1: System Head Curves Calculation Conditions

C Value	Liquid Level / Flow Condition
120, 130, 140	Low liquid level, static head
120, 130, 140	Mid-point between low liquid and high liquid level, static head
120, 130, 140	Overflow conditions, static head

Pumps shall be capable of operating satisfactorily over all the conditions above.

F3.02 Station Layout

Pumping station configuration shall be based on the most efficient layout of pumps and equipment for safe and cost-effective O&M of the facility. The designer shall select pumps and equipment from the Township's Equipment and Material List included in this document or the Township's Approved Product and Equipment List based on the optimal combination of pump efficiency, capital, and O&M costs. Where discrepancies exist, the Equipment and Material List included in this document shall take precedence. All pump station control,

monitoring, and alarm equipment shall be integrated with the Township's SCADA system.

The general station design and layout shall include the following:

- An outdoor, self-contained, standby generator complete with automatic transfer switch shall be provided at all pump stations. Generators should be designed to meet air and noise emission and vibration requirements, in accordance with provincial regulations.
- Grinders shall be provided at all pump stations complete with a guide rail system and lifting device for removal and maintenance. In smaller stations, grinder pumps or pumps with "chopper style" impellers may be considered in lieu of grinders.
- Influent pipe to be positioned to ensure that wastewater does not flow directly over the pump suction, or over the pumps. Influent pipe for in-ground pumping stations shall have a minimum distance of two-volute diameters away from the pump centre line.
- Inlet sewer shall include an isolation valve, stainless steel stem extension, and 50 mm square operating nut at a level to avoid confined space entry to open or close the valve.
- Benching in wetwell shall be sloped towards pump inlet to prevent sediment buildup. Benching at 60º or greater is preferred but shall not be less than the MECP guidelines of 45º. For larger wetwells, provide steps within the benching, at the bottom of the access ladder, to enable staff to safely access pumps.
- A bypass connection for the forcemain, complete with isolation valves, shall be provided and located outside the wetwell. The bypass shall be 150 mm in diameter, flanged, and complete with a quick connector extending 450 mm above finished grade. The bypass should include valves to allow:
  - The permanent wetwell sewage pumps to pump to a haulage truck.
  - Portable pumps to pump from the wetwell or upstream MH into the forcemain.
- A 50 mm dia. water service and frost-free hydrant (or valved hose connection at the control building) as per Township Standards shall be provided for flushing purposes. If there is not a control building, the water service shall be protected with a double check valve type backflow preventer, equivalent to a Watts Series 7, located in an underground chamber, as per Township standards. If there is a control building, the water service shall be protected

with a reduced pressure zone assembly type backflow preventer, equivalent to a Watts Series 9, located in the building.

- Personnel entry access and equipment hatches shall be "Safe Hatch" style by Xylem (Flygt), Bilco, or MSU, made of construction grade aluminum with stainless steel hinges, secondary fall protection grating, be spring assisted, include associated accessories, and be lockable by padlock. Lockport shall be recessed and equipped with a drainage pipe. The hatch shall include a hold open arm, that locks in place (e.g., a locking channel), to keep the cover in the vertical position while open. Personnel entry access hatches shall have a minimum clear opening of 750 mm by 900 mm. Equipment hatches shall be adequately sized for the installation and removal of pumps and other equipment.
- Vertical access ladders shall be non-slip aluminum complete with telescopic side rail (ladder up) extensions located beneath personnel entry access hatches.
- An emergency overflow pipe shall be provided for Types 3 and 4 Stations unless location and topography prohibit installation. A backflow and shut off valve are required on the overflow pipe.
- Pressure gauges shall be provided at each pump discharge pipe, located above the flood line.
- Locate all controls and electrical devices above the flood line except local pump control hand switches, which are to be submersible.
- All valves, flow meters, pressure gauges, and other appurtenances to be in a separate chamber or drywell depending on station type. Locating this equipment in the wetwell is not acceptable.
- Provide equipment for the safe retrieval of personnel in confined spaces. This shall include davit posts; portable davit complete with hand crank winch and self-arresting Sala block dedicated to the station.
- Provide lifting and lateral transfer devices for the removal and installation of equipment including removal from the station. The following equipment shall be provided and dedicated to this station:
  - For wetwells and underground valve chambers:
    - Davit post / sockets and portable lifting davit.
    - Portable electric chain or wire rope hoist.
  - For drywells in basement areas:
    - Trolley beam, trolley, and hoist.
- Provide a minimum of 1 m of clear space around equipment for servicing within drywells and SPS buildings.

- Ensure backflow preventers are installed on potable water lines complete with isolation valves and testing ports. Related equipment must not be installed in the wetwell.
- To ensure safe access, provide a minimum of 1 m concrete or paved area as a level walking area around two sides of openings for tanks and hatches.
- All electrical equipment in wetwell to be Class 1 Zone 1 explosion proof in accordance with NFPA 820, OESC, and other applicable codes and / or standards.
- Provide a combustible gas detection system, where appropriate within buildings and drywells accessed via stairs.
- In general, the station is to be sized based on pumps sized to handle instantaneous peak flow.
- Firm capacity of an SPS is defined as the pumping capacity of the facility when both the largest pump and largest forcemain (where more than one forcemain exists) are out of service.

F3.03 Site Considerations

The following must be included as part of the site design:

- All structures, including electrical and mechanical equipment, shall be protected from physical damage by the 100-Year or regional design flood event (whichever is greater). SPSs shall remain fully operational and accessible during the 100-Year or regional flood event. Regulations / requirements of municipalities, provincial, and federal agencies regarding flood plain obstructions must be considered.
- All buildings, wetwells, and valve chambers shall be designed to meet post-disaster requirements in accordance with the OBC.
- Buildings shall be designed to blend in with the aesthetics of the surrounding environment (e.g., neighbouring houses, etc.)
- 1.8 m high chain link security fencing and inward swinging lockable access gate, with sufficient space to temporarily park in front of the gate without obstructing traffic on roadway or sidewalk. In residential areas, the fencing shall be black vinyl coated.
- Exterior lighting for illumination of the Site, panels, and building exterior (if applicable) with zero spill of light beyond the property line, and dark sky compliant.
- A dedicated paved access road and sufficient parking for maintenance and operation vehicles. Access roads shall have a minimum paved surface width of 4.6 m.

- Adequate access for:
  - Emergency vehicles, including fire trucks.
  - Operations personnel access to all hatches, valves, and chambers.
  - Sewer flushing truck access to inlet maintenance hole, grinder chamber, wetwell, and emergency and maintenance storage tanks.
  - 22 m^3 capacity vacuum truck for access and cleaning of wetwell and emergency sewage haulage.
  - Forcemain inspection and cleaning.
  - Bypass pumping equipment (temporary pumps, generator, and piping to tanker trucks).
  - Fuel delivery truck for access to fuel fill station.
  - Large mobile cranes for stations with equipment weights that would require such vehicles for installation or removal.
- Site drainage graded away from all structures with a minimum 2% slope.
- Adequate space for snow storage and snow clearing on-site.
- Use protective bollards or other suitable devices around structures that could inadvertently be damaged by vehicles.
- Authorized entry alarms with signal transmission to local authority.

F3.04 Health and Safety

In addition to all current health and safety guidelines and regulations, the following requirements for SPSs shall apply:

- A general requirement to design facilities to eliminate confined spaces. Where the design cannot eliminate all confined spaces, all reasonable efforts must be made to reduce the quantity of confined spaces and hazards within any confined space. For valves located in confined spaces, valve stem extensions and operating nuts are to be provided at top of chamber ceiling slab level. Ensure operating nuts are in accessible locations. The space must be designed for ease of ingress, prompt egress, and have appropriate fall arrest and retrieval safeguards. As part of the design, identify all confined space areas, the equipment housed within the areas, and the rating of the space.
- Access hatches to be designed with secondary fall protection grating.
- Designs must address travel restriction, fall restriction, and fall arrest for Work that may be required while working at heights. Design to include engineered 2 m +/- tall post(s) as required. Post to be equipped with D-ring anchor points to which operators (wearing harnesses) can connect their safety lanyards.

- Designs must identify how the Township's O&M staff will be protected.
- Hazardous gas monitoring in potentially hazardous areas shall be conducted using personal, portable devices in areas where permanent monitoring systems are not required.
- Electrical safety considerations must be made according to all applicable acts, codes, standards, and guidelines.
- Adequate designs must integrate lock-out / tag-out requirements for all sources of energy. The location of disconnects shall be in the most logically safe location for access and operation.
- Designs must mitigate excessive noise to the environment and to workers.
- Where possible designs must identify atmospheric hazards, assess these hazards with respect to incompatible emissions, and provide adequate ventilation.
- Emergency eyewash and deluge shower stations shall be provided in the vicinity of any chemical storage areas or where there are other potential exposure risks. The water supply should be tepid water and be compliant with American National Standards Institute (ANSI) Standard Z358.1. The water supply and eyewash / shower facilities shall be protected from freezing.
- With respect to the area and function of the environment, designs must provide adequate illumination for worker safety.

F3.05 Sewage Pumping Station Design

Table 2: Sewage Pumping Station

Design Type	Typical Station Flow (Peak)	General Layout	On-site Emergency Storage Capacity (Minimum)	Number of Pumps and Type of Starter
1	4.7 L/s or less[1]	Submersible pumping station, valve chamber and above-grade electrical panel, outdoor, self-contained standby generator, single forcemain	Two-hour peak flow on-site storage	Minimum of two constant speed pumps (one duty, one standby) with consideration for soft starters
2	Between 4.7 L/s and 30 L/s	Submersible pumping station with separate building for controls and motor control centre (MCC). Outdoor, self-contained standby generator, single forcemain	Two-hour peak flow on-site storage	Minimum of two constant speed pumps (one duty, one standby) with consideration for VFDs
3	Between 30 L/s and 60 L/s	Submersible pumping station, separate building for controls, MCC and a basement (drywell) to house valves, with outdoor, self-contained standby generator, two forcemains each sized for peak flow	One-hour peak flow storage on-site, total two-hour peak flow storage when combined with available system storage	Minimum of two pumps (one duty, one standby) with consideration for VFDs.
4	60 L/s or greater	Wetwell / Drywell with divided wetwell and with building above the drywell to house controls, MCC, etc. with outdoor, self-contained generator, two forcemains each sized for peak flow	One-hour peak flow storage on-site, total two-hour peak flow storage when combined with available system storage	60 to 100 L/s; Minimum of three pumps (lead, lag, and standby), with VFDs Greater than 100 L/s; Minimum of four pumps (three duty, one standby), with VFDs

Notes: 1 – Flows for Type 1 Station based on achieving a minimum self-cleansing velocity of 0.6 m/s in a 100 mm diameter forcemain.

F.3.05.1 Type 1

Type 1 pumping stations are generally small in-ground submersible stations. Refer to Attachment A for a schematic of the pumping station type and a general arrangement drawing.

In addition to all other applicable design criteria set out in this guide, Type 1 stations, with peak flows 4.7 L/s or less, shall include the following:

- Combined wetwell and on-site emergency storage capacity of two hours (minimum) retention, based on peak flow. Emergency storage shall be in addition to peak operating storage requirements.
- Two constant speed pumps in a single wetwell configuration, each sized for peak flow. In no case shall the minimum designed discharge velocity be less than 0.6 m/s.
- Concrete or asphalt surface with a minimum of 1.5 m width shall be installed around the top of the wetwell. Surface mounted sockets or posts for davits to enable equipment hoisting and personnel retrieval shall be provided.
- Provide weatherproof outdoor standby generator sized for all connected loads with appropriate sound attenuation, including 24-hour subbase double wall diesel fuel tank.
- Electrical Junction Boxes:
  - Provide separate lockable boxes for different voltages.
  - Electrical and process controls to be located above grade in stand-alone panel, a minimum of 1.5 m away from wetwell or venting system to ensure the area is not classified according to NFPA 820. Bottom of panel to be a minimum of 0.5 m above-grade.
  - EYS seals and any other related components shall be installed between junction boxes and control panels.
- Provide junction box equipped with terminal strip immediately adjacent to the wetwell to facilitate changes of the floats. Provide separate junction box for grinder / pumps power supply and to enable the removal and installation of the grinder / pumps.
- Provide weatherproof NEMA 4X lockable enclosures for outdoor panels. Enclosure shall include LED lighting and general-purpose receptacles. For VFD and PLC panels, heating, and cooling should be provided.
- Valve / meter chamber to be separate from the wetwell. Valve / meter chamber shall include pump isolation and check valves, discharge flow meter, emergency bypass piping connection, and forcemain connection piped to the exterior. All pump discharge and forcemain piping isolation valves shall

include valve stem extensions and 50 mm square operating nuts to the top of the chamber ceiling for valve operation without confined space entry. Locate valve operators to allow valve to be operated using standard watermain valve key. All electrical devices to be located above the valve chamber's flood level or waterproof rated. Valve chamber to be equipped with means of automatic drainage back to the wetwell should any water accumulate within the chamber.

- Exterior lighting is to be considered, for illuminating both the wetwell access area, if site location permits, and the electrical panel. The light switch to be mounted inside the electrical panel. Lighting shall not spill past site property lines.
- Provide paved vehicular access to wetwell and generator. Minimum 4.6 m wide driveway that can accommodate a vehicle with hammerhead style turnaround for pickup truck sized vehicles. Driveway geometry and thickness must be designed to accommodate a fully loaded 22 m^3 sewage haulage truck to the wetwell and a 17 m^3 diesel fuel truck to the generator location. Site Plan to show truck turning movements dimensions for largest vehicle to be accommodated to prove that truck can back in from main road to point adjacent to camlock connection point.
- For water service to station, install meter pit with backflow preventer on-site to Township standards. Backflow preventer to be double check valve style equivalent to a Watts Series 7. Chamber to be accessible via access hatch for annual backflow preventer testing.

F.3.05.2 Type 2

Type 2 pumping stations are generally small to mid-size submersible stations complete with a control building. Refer to Attachment A for a schematic of the pumping station type and a general arrangement drawing.

In addition to all other applicable design criteria set out in this guide, Type 2 stations, with peak flows greater than 4.7 L/s and less than 30 L/s, shall include the following:

- Combined wetwell and on-site emergency storage capacity of two hours (minimum) retention, based on peak flow. Emergency storage shall be in addition to peak operating storage requirements.
- Depending on flows, a minimum of two submersible pumps shall be provided in a single wetwell configuration, each sized for peak flow. In no case shall the minimum designed discharge velocity be less than 0.6 m/s.

- Provide paved vehicular access to wetwell, building, and generator. Minimum 4.6 m wide driveway that can accommodate a vehicle off the road with hammerhead turnaround for pickup truck sized vehicles. Driveway geometry and thickness must be designed to accommodate a fully loaded 22 m^3 sewage haulage truck to the wetwell and a 17 m^3 diesel fuel truck to the generator location. Site Plan to show truck turning movements dimensions for largest vehicle to be accommodated to prove that trucks can back in from main road to point adjacent to camlock connection point.
- Concrete surface with a minimum 1.5 m width shall be installed around the top of the wetwell. Surface mounted sockets or posts for davits to enable equipment hoisting and personnel retrieval shall be provided.
- Provide outdoor, self-contained standby generator sized for all connected loads with appropriate sound attenuation, including 24-hour subbase double wall diesel fuel tank.
- The electrical and process controls to be located in a building with the following design requirements:
  - Sized to include incoming site water service, water meter, backflow preventer, mop sink with hot and cold running water, space for storage of portable hoisting equipment, heating and ventilation equipment, and sized to permit safe maintenance work. Building shall include floor and plumbing fixture drainage via a sanitary service back to the wetwell equipped with trap seal primer.
  - Include facility power feed, pump starters, automatic transfer switch (ATS), pump controls, SCADA and networking hardware, and location for a hydro meter. Station incoming power main breaker, pump starters, VFDs, and ATS to be housed in a floor mounted MCC configuration.
  - Building to be a minimum distance of 1.5 m from the wetwell. Ensure exhaust vent from wetwell is not pointing towards building and air intakes for the building are not near this exhaust. Ventilation for the building shall be on the opposite side of the building from the wetwell.
  - No windows.
- Provide junction box equipped with terminal strip adjacent to the wetwell to facilitate changes of the floats. Provide separate junction box for grinder / pumps power supply adjacent to the wetwell to enable the removal and installation of the grinder / pumps. Located junction boxes in accordance with the latest edition of NFPA 820.
- Valve / meter chamber to be separate from the wetwell. Valve / meter chamber shall include pump isolation and check valves, discharge flow meter,

emergency bypass piping connection, and forcemain connection piped to the exterior. All pump discharge and forcemain piping isolation valves shall include valve stem extensions and 50 mm square operating nuts to the top of the chamber ceiling for valve operation without confined space entry. Locate valve operators to allow valve to be operated using standard watermain valve key. All electrical devices to be located above the valve chamber's flood level or waterproof rated. Valve chamber to be equipped with means of automatic drainage back to the wetwell should any water accumulate within the chamber.

F.3.05.3 Type 3

Type 3 pumping stations are generally mid-sized submersible stations complete with a control building and a drywell. Refer to Attachment A for a schematic of the pumping station type and a general arrangement drawing.

In addition to all other applicable design criteria set out in this guide, Type 3 stations, with peak flows greater than 30 L/s and less than 60 L/s, shall include the following:

- On-site emergency storage of one hour (minimum) retention, based on peak flow and a total combined wetwell and system emergency storage capacity of two hours, based on peak flow. On-site emergency storage shall be in addition to peak operating storage requirements.
- A minimum of two submersible pumps in a single wetwell configuration.
- Provide variable frequency drives(s) where there is a need for continual flow from one pumping station to the next pumping station or to a wastewater treatment plant. The final design decision shall be based on good engineering practice. In no case shall the minimum designed discharge velocity be less than 0.6 m/s.
- Provide paved vehicular access to wetwell, building, and generator. Minimum 4.6 m wide driveway that can accommodate a vehicle off the road with hammerhead turnaround for pickup truck sized vehicles. Driveway geometry and thickness must be designed to accommodate a fully loaded 22 m^3 sewage haulage truck to the wetwell and a 17 m^3 diesel fuel truck to the generator location. Site Plan to show turnaround dimensions for the largest vehicle to be accommodated.
- Concrete surface with a minimum 1.5 m width shall be installed around the top of the wetwell. Surface mounted sockets or posts for davits to enable equipment hoisting and personnel retrieval shall be provided.

- Provide outdoor, self-contained standby generator sized for all connected loads with appropriate sound attenuation, subbase double wall fuel tank.
- Electrical and process controls to be located in a building with a dedicated room at ground floor level adjacent to but not directly above the drywell with the following design requirements:
  - Sized to include incoming site water service, water meter, backflow preventer, mop sink with hot and cold running water, space for storage of portable hoisting equipment, heating and ventilation equipment, and sized to permit safe maintenance work. Building shall include floor and plumbing fixture drainage via a sanitary service back to the wetwell equipped with trap seal primer.
  - Include facility power feed, pump starters, ATS, pump controls, SCADA, and networking hardware, and location for a hydro meter. Station incoming power main breaker, pump starters, VFDs, and ATS to be housed in a floor mounted MCC configuration.
  - Building to be a minimum distance of 1.5 m from the wetwell. Ensure exhaust vent from wetwell is not pointing towards building, and air intakes for the building are not near this exhaust. Ventilation for the building shall be on the opposite side of the building from the wetwell.
  - No windows.
- Provide junction box equipped with terminal strip adjacent to the wetwell to facilitate changes of the floats. Provide separate junction box for grinder / pumps power supply adjacent to the wetwell to enable the removal and installation of the grinder / pumps. Located junction boxes in accordance with the latest edition of NFPA 820.
- Drywell to be separate from the control room with separate entrance doors for each area. A superstructure shall be above the drywell, to provide access. This drywell area shall include pump isolation valves, discharge flow meter, and forcemain connection piped to the exterior. The drywell shall be accessible by stairs. All electrical devices to be located above the drywell's flood level or be waterproof rated.
- Provide a trolley beam, manual trolley, and manual chain hoist above the drywell area for removal of drywell equipment.

F.3.05.4 Type 4

Type 4 pumping stations are typically large and possibly complex stations with a wetwell / drywell configuration. Typically, wetwells for large stations have two or more cells and the drywell is located beneath a control building. Refer

to Attachment A for a schematic of the pumping station type and a general arrangement drawing.

In addition to all other applicable design criteria set out in this guide, Type 4 stations, with peak flows greater than or equal to 60 L/s, shall include the following:

- Sink with hot and cold water located in the drywell.
- Operator work surface area and desk located in control room.
- Washroom at main floor level adjacent to the control room.
- On-site emergency storage of one-hour (minimum) retention, based on peak flow and a total combined wetwell and system emergency storage capacity of two hours, based on peak flow. On-site emergency storage shall be in addition to peak operating storage requirements.
- A minimum of three pumps in a single drywell configuration.
- For the 3-pump operating system, determine the most efficient pumping configuration for the station based on:
  - Three equally-sized pumps.
  - Three unequally-sized pumps.
  - Combination of the above with variable speed pump(s).
- In no case shall the minimum designed discharge velocity be less than 0.6 m/s.
- Provide paved vehicular access to wetwell, building, and generator. Minimum 6.5 m wide driveway that can accommodate a vehicle off the road with hammerhead turnaround for pickup truck sized vehicles. Driveway geometry and thickness must be designed to accommodate a fully loaded 55 m^3 sewage haulage truck to the wetwell and a 17 m^3 diesel fuel truck to the generator location. Site Plan to show turning movements dimensions for largest vehicle to be accommodated.
- Concrete surface with a minimum 1.5 m width shall be installed around the top of the wetwell. Surface mounted sockets or posts for davits to enable equipment hoisting and personnel retrieval shall be provided.
- Provide a weatherproof, self-contained, standby generator sized for all connected loads with appropriate sound attenuation, including 24-hour subbase double wall fuel tank and spill containment.
- Electrical and process controls to be located in a building at ground floor level adjacent to but not directly above the drywell with the following design requirements:

  - Sized to include incoming site water service, water meter, backflow preventer, mop sink with hot and cold running water, space for storage of portable hoisting equipment, heating and ventilation equipment, and sized to permit safe maintenance work. Building shall include floor and plumbing fixture drainage via a sanitary service back to the wetwell equipped with trap seal primer.
  - Include facility power feed, pump starters, ATS, pump controls, SCADA, and networking hardware, and location for a hydro meter. Station incoming power main breaker, pump starters, VFDs, and ATS to be housed in a floor mounted MCC configuration.
  - Building to be a minimum distance of 1.5 m from the wetwell. Ensure exhaust vent from wetwell is not pointing towards building, and air intakes for the building are not near this exhaust. Ventilation for the building shall be on the opposite side of the building from the wetwell.
  - No windows.
- Two celled wetwell with isolation gate on dividing wall. The top of the wetwell dividing wall is to be located at least 0.2 m above station emergency overflow. The inlet shall be designed to feed both wetwells evenly and shall contain an arrangement of gates to permit isolation of either one of the wetwell cells for cleaning and maintenance.
- Provide junction box equipped with terminal strip in the wetwell to facilitate changes of the floats. Provide separate junction box for grinder power supply and to enable the removal and installation of the grinder.
- Provide drywell area containing pumps, process piping, valves, and metering equipment. A superstructure shall be provided above drywell, to provide access. Access to the drywell area shall be via stairs.
- Drywell superstructure area to be separate from the control room area with separate entrance doors for each area. Provide motorized crane and motorized hoist within building above the drywell for lifting and removing pumps and drywell equipment.
- All drywell equipment shall be rated for Class 1, Zone 2 hazardous environment as well as any rooms not physically separated from the space (e.g., room directly above if there are access hatches, stairwell areas). The room above the drywell must have a dedicated exterior door. Do not provide continuous ventilation for the purpose of reducing the classification of the area.

F4.00 Wetwell Design

The wetwell and associated equipment shall include the following:

- Wetwell shall be provided with only one inlet sewer. Multiple upstream sewers shall converge in a common collector MH with only one outlet sewer travelling into the wetwell.
- Wetwell should be designed to suit the pump capacity which should, in turn, be matched to the station design flow rate and flow variation. The size of the wetwell, in relationship to the suction pipe(s), shall be in accordance with the Hydraulic Institute to prevent hydraulic interference. The depth of the wetwell shall be sufficient to ensure adequate control bands for each pump.
- Where VFDs are provided, ensure the minimum speed is sufficient to provide minimum self-cleansing velocity required in the discharge forcemain(s).
- Configuration to prevent turbulence and vortex formation to not adversely impact pump operation.
- Access to wetwell to be directly from outdoors.
- Benching in the wetwell shall be steep and close to the pump inlet to prevent sediment buildup on the wetwell floor.
- Where possible, provide benching at a 60^0 slope or greater around the pump suctions to prevent buildup of solids in the wetwell. As a minimum, adhere to the Ministry standard of 45^0.
- Benching of a lesser slope may be provided where additional means of solids resuspension are provided, such as pump recirculation valves or piping, or alternate mixing systems.
- Within the benching, for larger wetwells, provide steps within the concrete, at the bottom of the access ladder, to enable staff to safely reach the pump level.
- Ensure that, with the selected benching, the station still has sufficient vertical working space for the level transmitter and back up floats to operate properly.
- Use corrosion resistant materials, Type 316L SS, FRP, or aluminum in the wetwell.
- Where sluice gates or fabricated slide gates are used, provide provisions to isolate gates for maintenance.
- In no case shall the wetwell be sized to have the submersible pumps cycling more than six times per hour for a station with pumps 40 HP or less. In no case shall the number of pump starts exceed the manufacturer's recommendations but, in all cases, the more stringent criteria shall apply.

For submersible pumps with motors greater than 40 HP, the number of starts per hour shall not exceed the manufacturer's recommendations. If VFDs are employed and the control system modulates the speed of the VFD in response to wetwell level, the number of starts per hour can be reduced but shall not exceed the number of starts recommended by the pump manufacturer.

- Wetwells are classified as Class 1, Group D, Zone 1 Hazardous Locations and the requirements of the OESC must be satisfied with respect to electrical installations within these spaces.
- Ultrasonic equipment is to be used for the primary pump controls system. Provide float control, complete with anti-sway hardware, as a backup.
- Provide adequate pump operating range within the wetwell, as per Ministry guidelines as well as the following:
  - Minimum distance between start and stop levels for each pump must be at least 0.3 m.
  - As the backup pump control, a full set of floats (equivalent to the primary level transducer set points) above and below the normal ultrasonic operating range are to be provided. A minimum distance of 0.2 m shall be provided between the primary pump start level and the backup float.
- All wetwells shall be provided with a water service to enable flushing or cleaning of the wetwell. The water service shall be provided with a backflow preventer, sized no smaller than 50 mm and shall be metered. For Station 1 Type provide a yard hydrant adjacent to the wetwell. For Station Types 2, 3, and 4, the water service shall be plumbed into the building.
- Wetwells shall be equipped with LED lighting rated for the space. Lighting shall be installed in an accessible location to allow for maintenance.
- Top slab of wetwell shall be located at least 200 mm above surrounding ground, with grade sloped away from the chamber.

F4.01 Access Hatches

- All hatches must be construction grade aluminum with removable stainless steel pin hinges for ease of greasing and removal.
- Personnel entry access and equipment hatches shall be "Safe Hatch" style by Xylem (Flygt), Bilco, or MSU.
- Provide guards, as required, under various regulations.
- Provide secondary fall protection with grating.
- Hatches must be spring assisted and be lockable by padlock.

- Hatches must include a hold-open arm that locks in place (e.g., a locking channel) to keep the cover in the vertical position when open.
- Hatches shall be a minimum size of 750 mm by 900 mm or sized adequately to allow for equipment maintenance and personnel retrieval.

F4.02 Wetwell Vertical Access Ladders

- Vertical access ladders shall be anodized, non-slip aluminum and designed to the requirements of OHSA. All other components, such as mounting hardware, must be at least 304/316 stainless steel.
- Ladder, for access to the wetwell, shall be mounted on the wall of the structure.
- Provide ladder with telescopic side rail (ladder up) extensions that can extend above the platform and chamber for safe entry and can be lowered when not in use. Extensions are to be located beneath personnel entry access hatches.
- Ladder, for access to or through a service platform, shall extend from bottom of wetwell through the service platform with hinged platform grating to the underside of hatch, or other grating section. The ladder shall be continuous and travel vertically from the bottom of wetwell to the top. There shall be no offsets in the ladders which could impede emergency retrieval of an entrant.
- Locate ladder a suitable distance away from inlet sewer to allow entrant to use ladder without being splashed by sewage.

F4.03 Service Platform

- Design service platform for wetwell at a maximum of 300 mm above the top of the influent sewer. All others shall be located to meet operating, servicing, or safety requirements. Platforms to be installed at 5 m intervals in deeper wetwells (e.g., 15 m deep station would require two grating platforms).
- Provide anodized aluminum grating in all areas requiring grating.
- Design grating to support a uniform live load of 4.8 kPa and a concentrated load of 2.5 kN over an area of 300 mm x 300 mm. Grating shall also be capable of withstanding the impact of 3.0 kN, with permanent deflection due to this impact loading not exceeding 1/150 of the span. Provide all opened edges of the service platform with 1.1 m high anodized aluminum handrail, complete with toe boards in accordance with the OBC.

F4.04 Storage

- Emergency storage is to be considered as part of design. Emergency storage shall be in addition to peak operating storage requirements.

- Emergency overflow pipe shall be provided for Types 3 and 4 Stations unless prohibited by location or topography.
- Provide on-site wetwell storage for two hours (minimum) for Types 1 and 2 Stations at peak inflow rate.
- Provide on-site wetwell storage for one hour (minimum) for Types 3 and 4 Stations at peak inflow rate and total combined wetwell and system emergency storage for two hours (minimum) at peak inflow rate.
- The hydraulic grade line and its relation to the lowest connected basement elevation shall be provided with the design package.
- Emergency storage is to be located above the standby pump start level but below the lowest basement level in the catchment area or where applicable, the overflow pipe.

F4.05 Solids Handling

- As dictated by the characteristics of the wastewater flowing into the pumping station, an appropriately-sized grinder(s) shall be placed at the inlet or upstream of the wetwell in all pump stations.
- All pumps shall be capable of handling 75 mm solids.
- Grinder pumps or pumps with "chopper style" impellers may be considered by the Township for Types 1 and 2 Stations.

F4.06 Pump Design

Design and selection of pumps and associated equipment shall include the following:

- Pumps should be of a capacity and in sufficient numbers to allow maximum operating flexibility and optimum performance of the station components through the range of flows expected during the service life of the facility. This requirement is most critical during the initial years of operation when actual flows are normally less than ultimate design flows.
- Pumps shall be high efficiency, explosion-proof, submersible, a non-clog impeller type suitable for the fluid to be pumped.
- The use of grinder pumps or pumps with "chopper style" impellers is only acceptable for flow rates less than 30 L/s and must be approved by the Township first on the basis of wastewater characteristics.
- Drywell pumps shall be provided with an inspection port to check impeller condition or unclog the pump.
- Provide pipe flushing connections to facilitate the cleaning of plugged lines or pumps.

- Provide an air vent pipe from the high point on the submersible pump volute discharging back to the wetwell above the emergency overflow level to facilitate priming after wetwell pump down. Air release piping from pump discharge pipe shall not be PVC. For dry pit pumps, a manually activated backflow actuator shall be provided on the pump discharge check valve to allow backflow from the discharge forcemain to reprime the pump.
- Submersible pumps shall include a hydraulic flush valve.
- Vibration and harmonic analysis must be conducted for pumps if installed in drywells.
- Harmonic analysis must be conducted for all VFDs.
- Pumps shall be equipped with thermal and leak detection devices.
- For a Type 4 configuration, provide piping and valves to allow recirculation of pumped wastewater into wetwell cells to prevent solids build up at the bottom.
- For submersible pumps, pumps must be removable from the surface utilizing guide rails. Provide guide rails as per pump manufacturers requirements. Guide rails extending more than 6 m shall have intermediate guide brackets to prevent separation.
- Pumps shall have mechanical seals.
- Lifting equipment shall be provided for all pumps. For larger drywell stations, a crane rail and explosion proof hoist shall be provided.
- The firm capacity of the station should be based on a pumping rate with the largest pump out of service.

F4.07 Piping and Valve Design

Process piping shall be designed in accordance with the most current Hydraulic Institute Standards.

Design of the process piping and valves shall include the following:

- Stainless steel 316L shall be used for discharge piping within the station and shall have a minimum wall thickness of Schedule 10.
- Forcemains to be CSA Certified HDPE DR11 or PVC Class 235 DR18.
- Butterfly valves shall not be used for forcemains.
- Isolation valves shall be plug valves.
- Sluice gates shall be 316L stainless steel, with operators located at ground level.
- Check valves on pump discharge shall be horizontal and not vertical. Check valves to be anti-slam.

- Design piping layout with T configuration.
- Isolation valves shall be in the horizontal position, if possible.
- Provide air / vacuum valves where required.
- Provide flushing connections to facilitate cleaning of pipes, where required. Flushing connections shall be a minimum of 50 mm diameter.
- Provide isolation valves on discharge header prior to leaving the pumping station.
- Provide facility / station bypass connections.
- Provide surge control on main discharge header.
- Valves must be located in a separate watertight valve chamber or valve room.
- Valves located in the wetwell are not acceptable.
- All valves shall be supplied with fully restrained dismantling coupling (i.e., Victaulic grooved coupling) on the adjacent spool pipe.
- Each pump will be provided with a separate air release valve on its discharge pipe.
- A means for draining the forcemain into the wetwell is required. Drain connection is to be located prior to the isolation valve on the forcemain.
- Flow metering shall be provided on all forcemains.
- All flow metering to be magnetic and shall be independently grounded. Provide flanged by flanged spool pipe of same length as magnetic flow meter installed for use when meter is removed from service for maintenance.
- All appurtenances and connectors shall be corrosion resistant and compatible with the piping material.
- All process piping shall be provided with colour coded labels to comply with the latest edition of the ANSI/ASME A13.1 Pipe Labelling Requirements.

F4.08 Odour Control

All SPSs shall be designed to minimize the escape of odours from the wetwell. The designer should provide engineering calculations of potential for hydrogen sulfide generation in the forcemain and provide recommendations to prevent generation of odours and for odour control.

For pumping stations located in residential areas, or areas that are within 100 m of residential dwellings or commercial / institutional establishments, an adequately sized odour control system shall be provided.

The Township prefers passive odour control systems; however, if circumstances dictate a larger active odour control system is required based on proximity of receptors, the size of the station, or the wastewater composition being received

at the station, the Township may consider it on a case-by-case basis. Passive odour control is to be provided for the wetwell vent pipes and should be installed at an elevation that is reasonable for maintenance.

F4.09 Heating and Ventilation

Provide heating and ventilation as per the requirements set out in the current version of MECP Design Guidelines for Sewage Works, NFPA 820 and OESC documents. If there are discrepancies between requirements, the more stringent shall apply.

All non-classified areas shall be suitably separated from classified areas. No portion of the SPS facility shall be de-energized due to a loss of ventilation (refer to OESC Section 22, Clause 22-708-5).

F4.10 Equipment and Material List

The following is a list of acceptable major equipment / manufacturers:

- The standby generator shall be diesel fuel powered, and radiator cooled. The generator set supplied shall be a Cummins diesel engine / generator unit or a Caterpillar diesel engine / generator unit, complete with sound attenuating weatherproof enclosure and double walled subbase fuel tank.
- Pumps: Xylem (Flygt).
- Mechanical Process Piping: 316L Stainless Steel.
- Plug Valve: Val-Matic, Clow, Dezurik, Pratt.
- Gate Valve: AVK, Clow, Dezurik, Mueller.
- Knife Edge Gate Valve: Stafsjo, Orbinox, Trueline, Dezurik.
- Check Valve: Val-Matic Surgebuster, PSI-Pratt Surge Inhibitor.
- Access and Equipment Hatches: Xylem (Flygt), Bilco, MSU (Aluminum Construction).
- Magnetic Flow Meter: Endress & Hauser, ABB, Khrone, Rosemount.
- Slide / Sluice Gates: Fontaine, Orbinox, Dynamic, Armtec, Whipps.
- Floats: Xylem (Flygt) (EMN-10).
- Chemical Feed Equipment: ProMinent.
- Eyewash: Haws.
- Electric Actuators: Rotork, Auma, Limitorque.
- VFD: Schneider / Square D, Allen Bradley, ABB, Eaton.
- Soft Starters: Schneider / Square D, Allen Bradley, Benshaw, Eaton.
- Motor Control Centre: Allen Bradley, Eaton (Cutler Hammer), Schneider / Square D, General Electric.
- Automatic Transfer Switch: ASCO (Schneider / Square D).

- Hazardous Gas Detection / Monitoring Equipment: Armstrong AMC.
- Ultrasonic Level Transducer: Siemens Milltronics.
- Odour Control:
  - Passive: Robert Wager, Camfil.
  - Active: To be determined on a site-by-site basis.
- The SPS shall be equipped with SCADA and the SCADA system shall communicate with the applicable local Water Pollution Control Plant (WPCP) and current operating authority.
- The PLC to be provided for the pumping station shall be an Allen Bradley unit and shall be connected to the Township's sewage SCADA. Include capability to monitor and control equipment at the SPS from two remote locations.
- Plant equipment shall be controlled / monitored through field adjustable PLC(s). The PLC(s) shall allow operator field adjustment of process equipment variables (e.g., transducer level set point control of raw sewage pumps) through a graphical user operator interface terminal without the need for an external laptop computer. Any PLC or operator interface equipment shall include non-proprietary programming. Equipment control panels shall include isolated outputs wired to terminals for all discrete and analog process variables, control status, and fault indication for connection to a central PLC monitoring panel. Programming and integration shall be completed by ARO Technologies Inc. of Collingwood.

Please refer to the Township's Approved Product and Equipment List for additional items.

F4.11 Commissioning

Commissioning of pumping station equipment is to be supervised by the design consultant and the equipment manufacturer representatives. The equipment manufacturer representatives shall be present to inspect and certify the installation of the equipment, provide assistance during commissioning and startup, and provide training to operations personnel.

Commissioning shall be followed by a minimum 14-day period of satisfactory operation prior to the station receiving wastewater and being put into service. After the design consultant has successfully proven out all operational aspects of the station, a demonstration session shall be provided to the Township operators and engineering staff.

F4.12 Asset and Maintenance Data

For all new equipment included within the design, the design consultant or developer must provide the Township with the required asset and maintenance data.

The following data is required for all new assets where possible: Asset ID, manufacturer, make, model, serial number, year installed, estimated service life, along with any other fields deemed necessary by the Township.

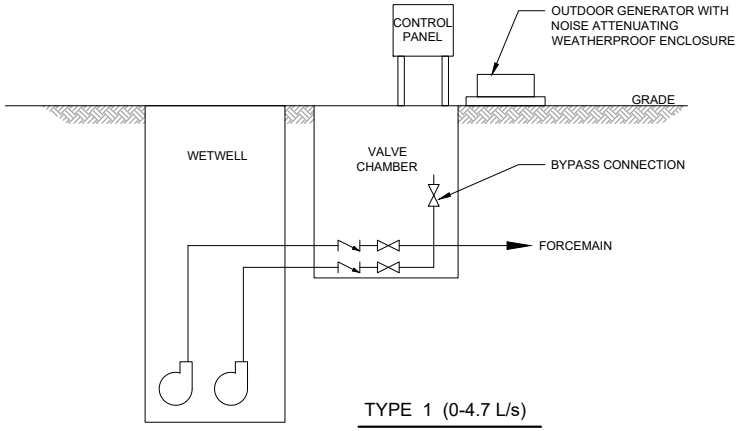
F4.13 Final Deliverables

Prior to the Township allowing the stipulated maintenance period to begin and the Township assuming operational duties of the pumping station, the following deliverables must be provided to the Township:

- "Record Drawings" consistent with the requirements noted in the Subdivision Agreement in an electronic format acceptable to the Township.
- A Facility Operations Manual for the pumping station. The format of the Operations Manual shall follow the MECP's "Master Model Operations Manual for Water Supply Systems", 1992 or approved equivalent. The Manual shall be prepared using the latest version of Microsoft Word in the format provided by the Township. Two hard copies and one electronic copy (in Microsoft Word and PDF) shall be provided. A sample manual showing the required format and content will be provided by the Township upon request.
- A "Record" Process Control Narrative (PCN) for the pumping station. The PCN shall describe the operation of the station including monitoring and control of all associated equipment. Specifics regarding equipment controlled and / or monitored by a Process Logic Controller (PLC), SCADA system, or autodialer shall be included. Two hard copies and one electronic copy (in Microsoft Word and PDF) shall be provided.
- A complete set of final shop drawings for all pumping station materials and equipment. Two hard copies in appropriately labelled 3-ring binders shall be provided along with one digital copy (in PDF format).
- An Equipment O&M Manual for all pumping station equipment. The equipment data shall be organized into applicable sections consistent with the project specification divisions. The information shall be contained within a 3-ring binder with labelled tabs. Information including process description, operation, and maintenance instructions shall be provided. This shall also include a complete equipment list and spare parts list as well as a manufacturer's recommended spare parts list and lubricants. Equipment

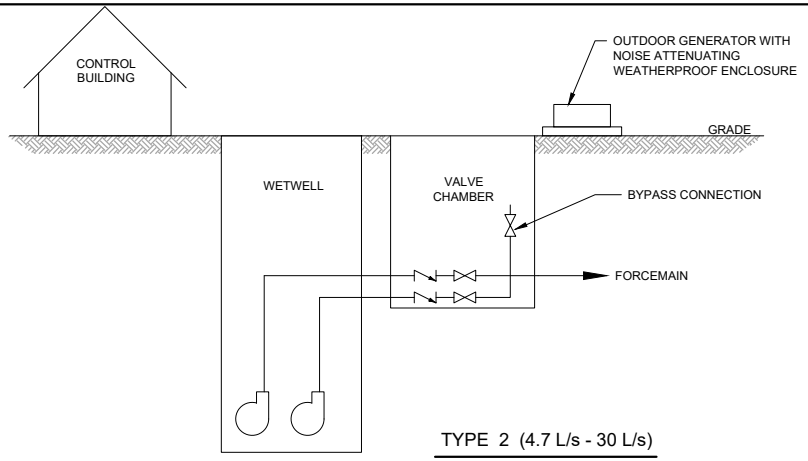
information such as make, size, capacity, and serial number shall be indicated along with contact information for applicable subcontractors and suppliers. Any equipment guarantees and warranties shall be included ensuring information including commencement date, duration, and remedial action to be taken under the guarantee / warranty is clearly defined. Two hard copies of the binders are to be provided along with a digital version (in PDF format).

- Provide copies of all software and control programs for any SCADA, PLC, or Human Machine Interface (HMI) equipment on a USB memory stick or another format acceptable to the Township.



TYPE 1 (0-4.7 L/s)

SCALE N.T.S.



TYPE 2 (4.7 L/s - 30 L/s)

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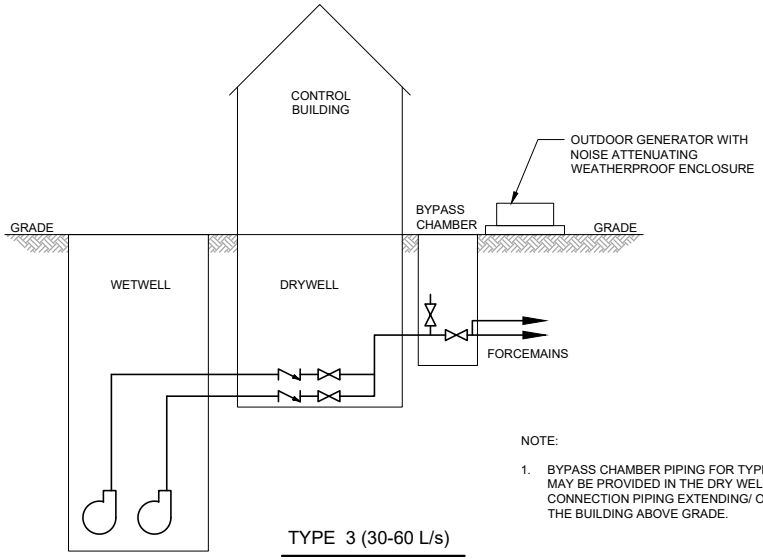
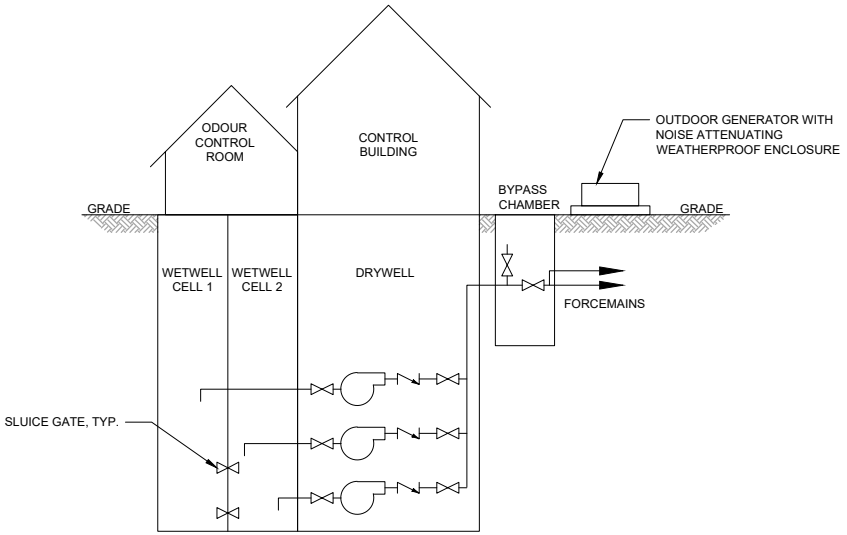


TYPE 3 (30-60 L/s)

SCALE N.T.S.

NOTE:

1. BYPASS CHAMBER PIPING FOR TYPES 3 AND 4 MAY BE PROVIDED IN THE DRY WELL WITH CONNECTION PIPING EXTENDING/ OUTLETTING THE BUILDING ABOVE GRADE.



TYPE 4 (60 L/s or GREATER)

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CLEARVIEW TOWNSHIP

Figure Title

SEWAGE PUMP STATION DESIGN GUIDE

PUMPING STATION TYPES

Date: SEPTEMBER 2025

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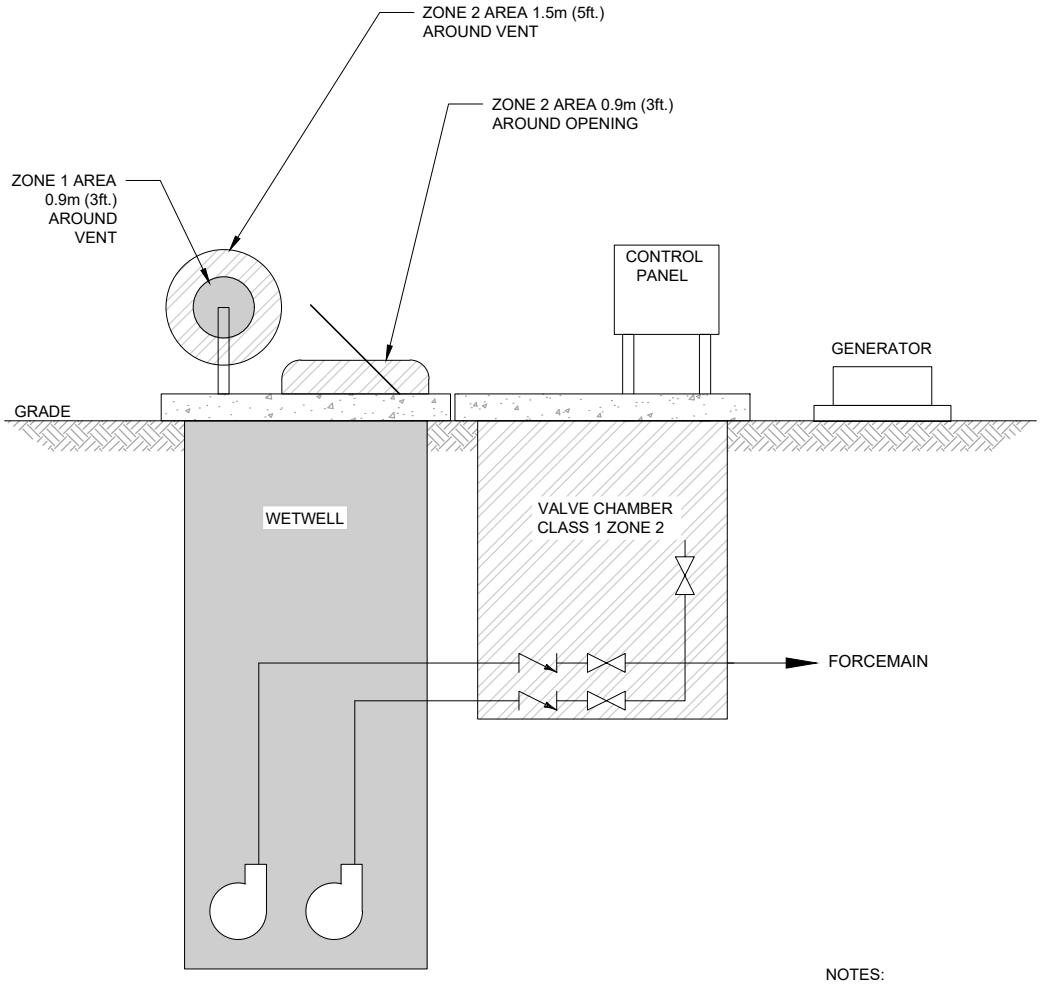
Figure No. 1



NOTES:

1. AREA / SPACE CLASSIFICATIONS DEFINED AS PER THE CANADIAN ELECTRICAL CODE, NFPA 820 AND SECTIONS 18 AND 22 OF THE OESC.

HAZARDOUS AREA - CLASS 1 ZONE 1

HAZARDOUS AREA - CLASS 1 ZONE 2

2. LOCATE CONTROL PANEL AND GENERATOR OUTSIDE OF HAZARDOUS AREAS.

TYPE 1 PUMPING STATION ARRANGEMENT

SCALE N.T.S.

CLEARVIEW TOWNSHIP

Figure Title

SEWAGE PUMP STATION DESIGN GUIDE

TYPE 1 PUMPING STATION ARRANGEMENT

Date	Figure No.
SEPTEMBER 2025	**2**
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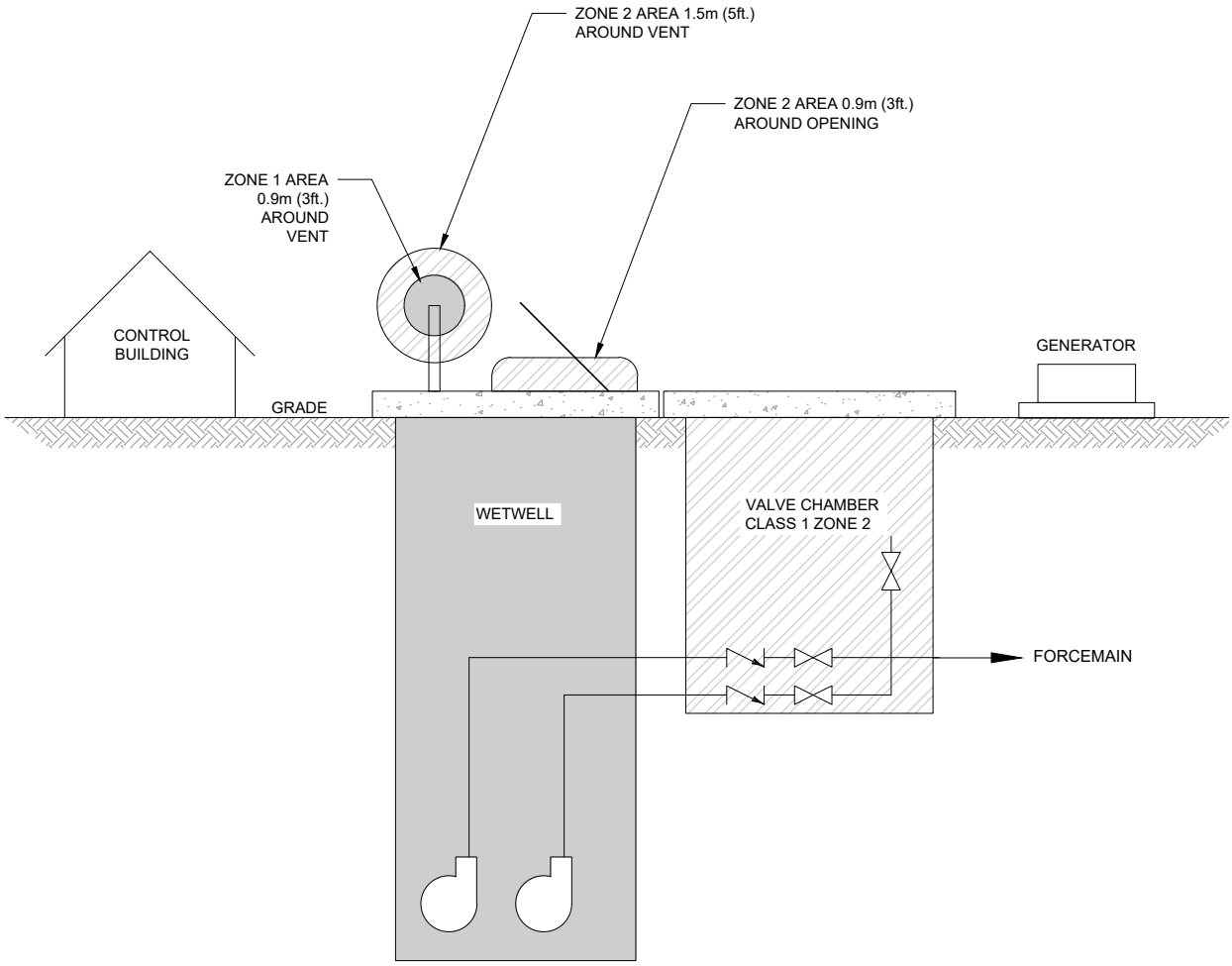

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1. AREA / SPACE CLASSIFICATIONS DEFINED AS PER THE CANADIAN ELECTRICAL CODE, NFPA 820 AND SECTIONS 18 AND 22 OF THE OESC.

   HAZARDOUS AREA - CLASS 1 ZONE 1

   HAZARDOUS AREA - CLASS 1 ZONE 2

2. LOCATE CONTROL BUILDING AND GENERATOR OUTSIDE OF HAZARDOUS AREAS.

TYPE 2 PUMPING STATION ARRANGEMENT

SCALE N.T.S.

CLEARVIEW TOWNSHIP

Figure Title

SEWAGE PUMP STATION DESIGN GUIDE

TYPE 2 PUMPING STATION ARRANGEMENT

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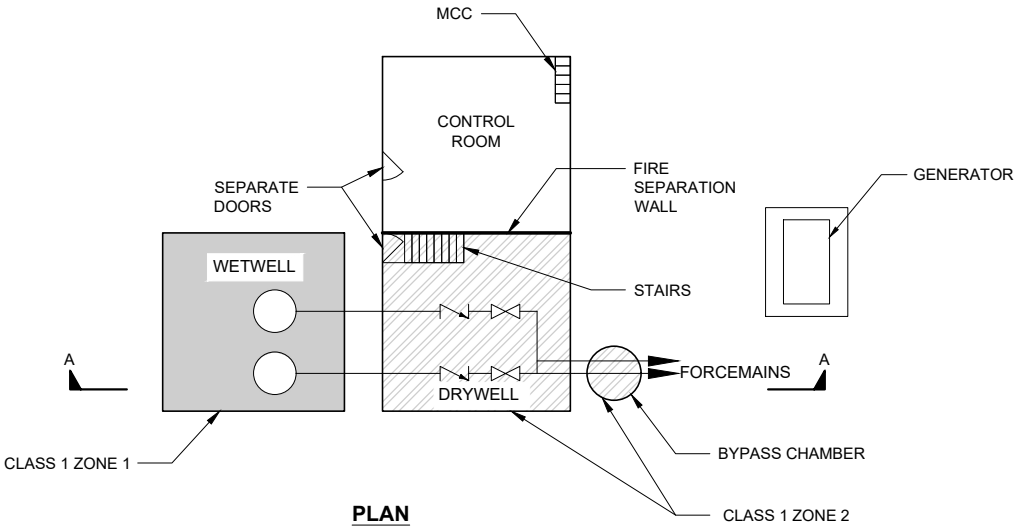
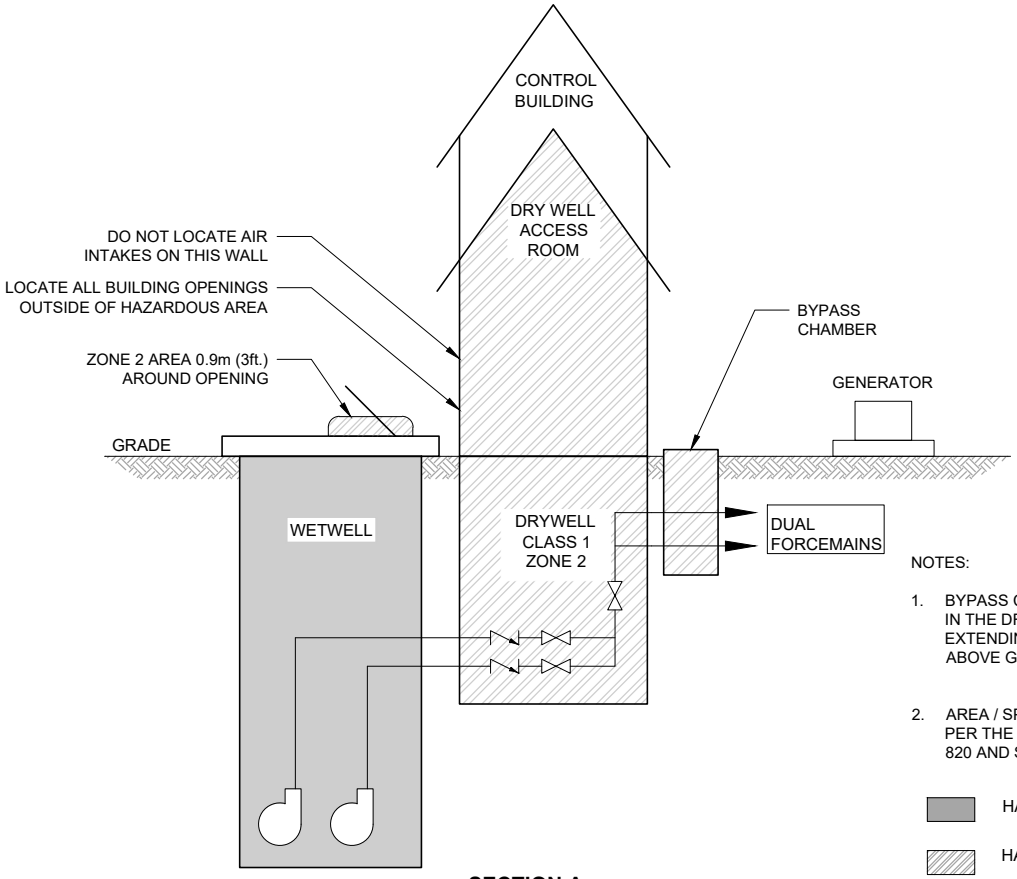


PLAN



SECTION A

NOTES:

1. BYPASS CHAMBER PIPING MAY BE PROVIDED IN THE DRYWELL WITH CONNECTION PIPING EXTENDING/ OUTLETTING THE BUILDING ABOVE GRADE.
2. AREA / SPACE CLASSIFICATIONS DEFINED AS PER THE CANADIAN ELECTRICAL CODE, NFPA 820 AND SECTIONS 18 AND 22 OF THE OESC.

HAZARDOUS - CLASS 1 ZONE 1

HAZARDOUS - CLASS 1 ZONE 2

3. LOCATE GENERATOR OUTSIDE OF HAZARDOUS AREAS.

TYPE 3 PUMPING STATION ARRANGEMENT

SCALE N.T.S.

CLEARVIEW TOWNSHIP

Figure Title

SEWAGE PUMP STATION DESIGN GUIDE

TYPE 3 PUMPING STATION ARRANGEMENT

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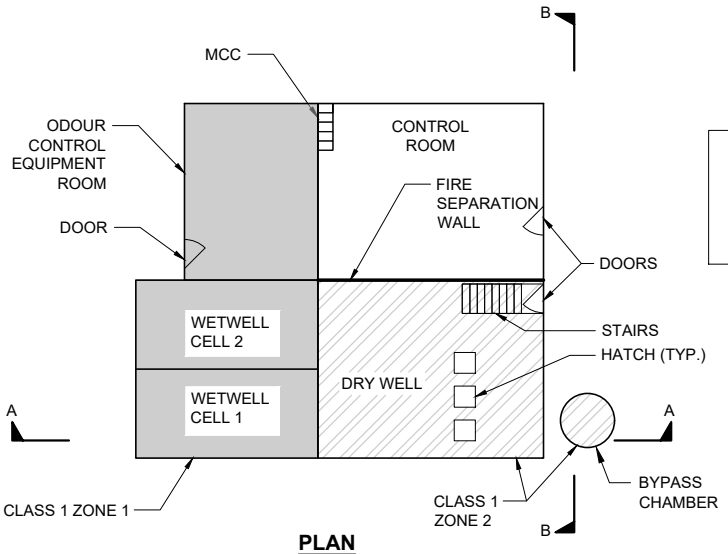

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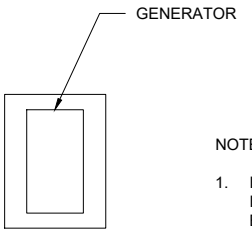


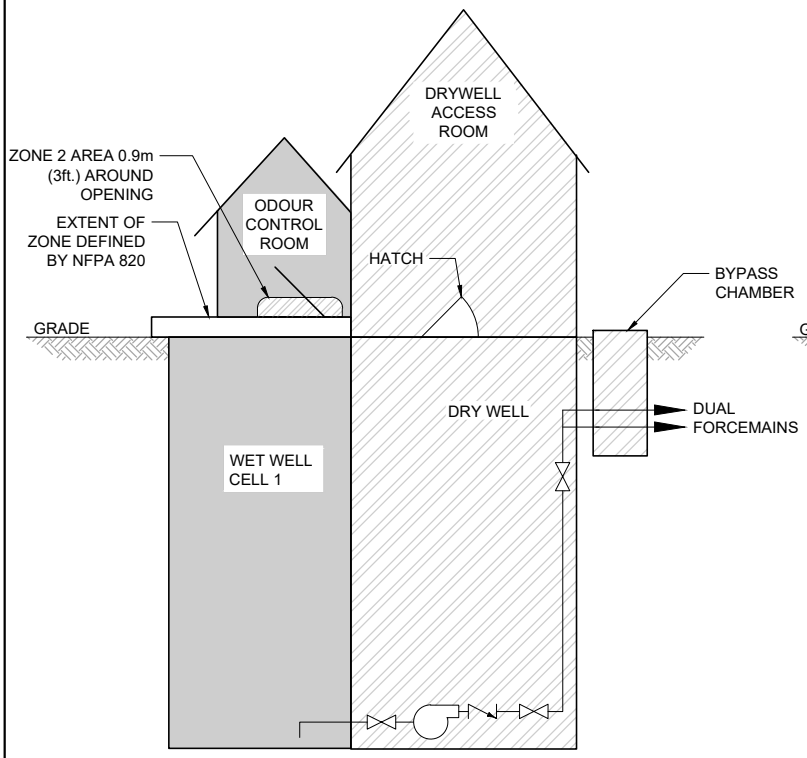
NOTES:

1. BYPASS CHAMBER PIPING MAY BE PROVIDED IN THE DRYWELL WITH CONNECTION PIPING EXTENDING/OUTLETTING THE BUILDING ABOVE GRADE.
2. AREA / SPACE CLASSIFICATIONS DEFINED AS PER THE CANADIAN ELECTRICAL CODE, NFPA 820 AND SECTIONS 18 AND 22 OF THE OESC.

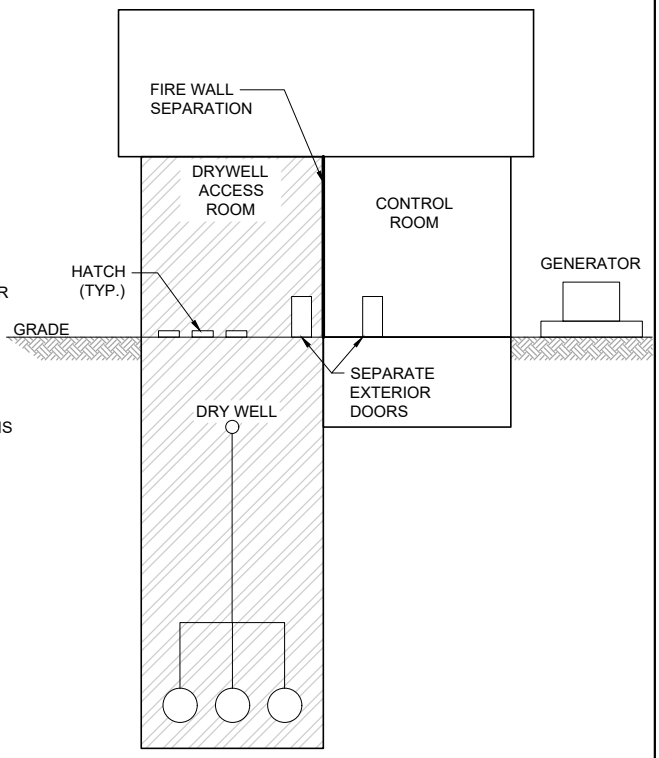
HAZARDOUS AREA - CLASS 1 ZONE 1

HAZARDOUS AREA - CLASS 1 ZONE 2

3. LOCATE GENERATOR OUTSIDE OF HAZARDOUS AREA.



SECTION A



SECTION B

TYPE 4 PUMPING STATION ARRANGEMENT

SCALE N.T.S.

CLEARVIEW TOWNSHIP

Figure Title

SEWAGE PUMP STATION DESIGN GUIDE

TYPE 4 PUMPING STATION ARRANGEMENT

Date	Figure No.
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