FACILITIES CIVIL ENGINEERING STANDARD – WASTEWATER SYSTEMS

MX-FAE-STD-C002

Facilities Architecture & Engineering
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METROLINX

Facilities Civil Engineering Standard – Wastewater Systems

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Metrolinx,

an Agency of the Government of Ontario

Preface

This is the first edition of the Facilities Civil Engineering Standard—Wastewater Systems (MX-FAE-STD-C002). The purpose of this standard is to provide minimum civil engineering requirements and design guidance to designers for Metrolinx-owned assets.

This standard is to be followed by Engineering and Design Consultants working on Metrolinx projects and internal Metrolinx staff.

The technical content within the Facilities Civil Engineering Standard—Wastewater Systems (MX-FAE-STD-C002) was developed by the Metrolinx Facilities, Architecture, and Engineering's Civil Engineering Team within the Asset Management and Maintenance Division, which includes specialized subject matter experts.

This Standard is available for external users to download via the Metrolinx public download site at https://www.metrolinx.com/en/metrolinx-technical-standards

Suggestions for revision or improvements can be sent to Metrolinx Facilities, Architecture, and Engineering (FAE) Civil Engineering Team, Attention: Senior Manager, FAE Civil Engineering, who will introduce the proposed changes to Metrolinx FAE Civil Engineering. The Senior Manager, FAE Civil Engineering, ultimately authorizes the changes. A description of the proposed change shall be included along with information on the background of the application and any other useful rationale or justification. Proposals for revisions or improvements shall include your name, company affiliation (if applicable), email address, and phone number.

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1. General

1.1 Purpose

1.1.1 This standard outlines the requirements for wastewater systems. These are underground pipe networks that collect and convey wastewater from Metrolinx stations to a municipal conveyance system. The municipal system, outside the scope of this standard, then transports the wastewater to treatment facilities.

1.2 Scope

1.2.1 This standard applies to wastewater systems and associated appurtenances transporting wastewater that typically extend from the buildings on Metrolinx sites and connect to the municipal right of way.

1.2.2 This standard also applies to standalone conveyance and treatment systems, installed on Metrolinx stations and facilities where there is no available connection to a municipal system.

1.2.3 The following items are excluded from this standard:

a) Systems that are installed within a rail corridor, outside the stations and/or facility footprint;

b) Systems that cross the rail corridor at a station and/or facility (the portion of the system that is installed underneath the rail corridor);

c) Systems within a Bus Rapid Transit (BRT) or Light Rail Transit (LRT) corridors, excluding those within the boundaries of BRT and LRT stations (e.g., this standard applies to station assets only, not trackways or transit roadways);

d) Rail maintenance and storage facilities; and

e) Mechanical systems located within buildings, tunnels, and/or other structures at Metrolinx stations and facilities.

1.2.4 The requirements in this standard are specific to Metrolinx assets and are intended to supplement the requirements that are dictated by the Authority Having Jurisdiction (AHJ), which is typically the municipality where the site is located. Where the AHJ has standards that are specific to private site plans, and they contradict Metrolinx standards, the standards of the AHJ are to be followed.

1.2.5 This document shall be read in conjunction with the Metrolinx Facilities Civil Engineering and Building Envelope Standard – General (MX-FAE-STD-C001).

2. Definitions & Abbreviations

2.1 Definitions

2.1.1 The capitalized terms used in this standard shall have the meaning prescribed in Table 1.

Table 1: List of Definitions

Term	Definition
Drop Structure	A vertical pipe or structure within a maintenance hole that reduces wastewater velocity to prevent erosion.
Forcemain	A pressurized sewer pipe used to transport wastewater when gravity flow is not possible.
Gravity Sewer	A wastewater pipe system that relies on natural slope and gravity for flow.
Grinder Pump	A pump that grinds solid waste into slurry before moving it through small-diameter pipes.
Hydraulic Assessment	A study to determine the capacity of downstream sewer infrastructure.
Inverted Siphon	A wastewater pipe that dips below an obstacle, requiring sufficient velocity to prevent sediment accumulation.
Maintenance Hole (MH)	A structure providing access to underground wastewater pipes for inspection and maintenance.
On-Site Sewage System	A wastewater treatment system, such as a septic system, used where municipal sewers are unavailable.
Pump Station	A facility that lifts wastewater to higher elevations when gravity flow is not feasible.
Sanitary Sewer	A pipe that transports wastewater from buildings to treatment facilities.
Tracer Wire	A conductive wire placed alongside non-metallic pipes to aid in locating underground infrastructure.

2.2 Abbreviations

2.2.1 The abbreviations used in this standard shall have the meaning prescribed in Table 2.

Table 2: List of Abbreviations

Abbreviation	Definition
AHJ	Authority Having Jurisdiction
CCTV	Closed-Circuit Television (for sewer inspections)
CSA	Canadian Standards Association
HDPE	High-Density Polyethylene
ICI	Standards for Industrial, Commercial, and Institutional Facilities
MH	Maintenance Hole
OBC	Ontario Building Code
OPSD	Ontario Provincial Standard Drawings
OPSS	Ontario Provincial Standard Specifications
PUDO	Pickup-Drop Off Area
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance / Quality Control

3. Wastewater Systems

3.1 Design Requirements

3.1.1 Design Responsibility

3.1.1.1 The design of wastewater systems shall be undertaken and sealed by a Professional Engineer licensed to practise in the Province of Ontario.

3.1.2 Design Flows

3.1.2.1 Design flows at Metrolinx sites shall be calculated based on the requirements of the AHJ, used to assess the downstream systems, and as a starting point for sizing sewers and appurtenances on site.

3.1.2.2 Actual sanitary flows at Metrolinx sites may vary from those calculated by AHJ Standards for Industrial, Commercial, and Institutional (ICI) facilities, and can often be significantly lower than that calculated. A comparison of the actual expected flow based on similar Metrolinx sites, or in reviewing the fixtures and furnishings proposed on the site, should be considered in sizing sewers and appurtenances to ensure that minimum velocities are maintained.

3.1.3 Downstream Sewer Capacity

3.1.3.1 Consultation with the AHJ regarding any connections to the municipal sewer, and the associated capacity of the downstream sewer(s) is required. A hydraulic assessment shall be performed to the standards required by the AHJ, if applicable.

3.2 Computational Requirements

3.2.1 Sewer Design Flows

3.2.1.1 Unless another method is required by the AHJ, the use of traditional sewer design sheets is acceptable in sizing sanitary sewers.

3.3 General Design Requirements

3.3.1 Sanitary sewer designs shall be supported by a geotechnical report stamped by a Professional Engineer, that includes the following minimum design elements:

a) Bedding requirements;

b) Trench backfill requirements;

c) Dewatering requirements;

d) Soil disposal requirements;

e) Mitigation of buoyancy in high groundwater tables; and

f) Construction methodologies.

3.3.2 Clearances between all watermains and sewers shall follow requirements by Ontario Procedure F-6-1, as amended.

3.3.3 Existing sanitary systems that will be abandoned or are already abandoned shall be removed where it is encountered. Any exceptions shall be supported by technical justifications that demonstrate a long-term cost benefit of abandoning in place, and be submitted for review and approval by the owner of this standard.

3.4 Asset Specific Design Requirements

3.4.1 Gravity Sewers

3.4.1.1 The pipe material and class shall be selected based on site conditions and ability to withstand all the combinations of loading to which the pipe is likely to be exposed, along with an appropriate safety factor.

3.4.1.2 The minimum allowable pipe slope is 0.5%; however, where technically feasible, a slope of at least 1.0% is preferred. The slope may need to be increased further to ensure a minimum flow velocity of 0.6 m/s, which is essential to achieve self-scouring conditions throughout the pipe. The pipe slope shall be set based on the actual expected flow to maintain this minimum velocity.

3.4.1.3 The minimum pipe diameter shall be 200 mm. If a smaller pipe diameter is required to maintain self-cleansing velocities, 150 mm diameter pipes may be installed with appropriate maintenance mitigation measures. Measures shall be approved by the Owner of this Standard and Operations staff.

3.4.1.4 Pipe insulation is not preferred, but may be used as required where adequate frost depth cannot be achieved. Insulation shall be designed as per OPSD 1109.030, unless technical justification of an alternative is provided.

3.4.1.5 For sanitary sewers installed in areas with a high water table, incorporate clay seals, subdrains or other mitigation measures to manage the impact of the water table on the system.

3.4.1.6 Maximum depth of cover for concrete pipes shall be in accordance with OPSD 807.010 for confined trench or OPSD 807.030 for embankment. For PVC gravity sewer pipes, the maximum cover shall be in accordance with OPSD 806.040 for trench or embankment.

3.4.2 Maintenance Hole Design

3.4.2.1 The minimum acceptable maintenance hole (MH) diameter is 1200 mm and shall be designed in accordance with OPSD 701.010 to 701.015 and 701.021. MH lids shall comply with OPSD 401.010, unless a technically justified alternative or custom structure and/or lid is submitted and approved by the Owner of this Standard.

3.4.2.2 Maintenance hole shall not be located in the following areas, where applicable, unless no alternatives are available:

a) Parking spaces;

b) PUDOs;

c) Within drive aisles at site entrances/exits;

d) Within 5 m of building entrances/exits;

e) Bus loops; and

f) Within any concrete surface.

3.4.2.3 Maintenance holes shall be positioned to minimize obstruction to both vehicular and pedestrian access when open for inspection or servicing. They shall be located in areas that facilitate ease of inspection and maintenance, while also minimizing disruption to customer experience and operations at any station or facility.

3.4.2.4 Maintenance holes shall be spaced no more than 90 m apart, and shall be located at all changes in direction, pipe size or slope.

3.4.2.5 Where sanitary sewers are installed within overland flow routes or areas subject to stormwater ponding, maintenance hole lids shall be equipped with watertight covers.

3.4.2.6 A drop structure is required where the incoming sewer is more than 610 mm above the outfall invert. All drop structures shall be internal to the maintenance hole. Maintenance hole sizes need to be reviewed and adjusted where drop structures may reduce the space required for access to the structure.

3.4.2.7 Obvert to obvert connections are preferred, but invert to invert connections can be designed where obvert to obvert connections are not feasible.

3.4.2.8 Benching should be provided to the obvert of the pipes connected to the maintenance hole in accordance with OPSD 701.021.

3.4.2.9 A cleanout for maintenance shall be located within 30 m of the building connection.

3.4.2.10 A maintenance hole shall be located before the connection point to the municipal sewer system. It shall be sized adequately to allow for the installation and future access of water quality testing and flow monitoring devices.

3.4.3 Inverted Siphons

3.4.3.1 Where gravity sewers are not feasible, inverted siphons are preferred over pumping stations.

3.4.3.2 All siphon designs shall be accompanied by a maintenance plan that explains how system maintenance will be completed while keeping the station and/or facility in service. Twinning the siphon to allow maintenance while the system remains operational is preferred.

3.4.3.3 Inlet and outlet chambers shall be sized to facilitate inspection and maintenance on each siphon. Control gates, valves, or suitable alternatives shall be installed where siphon twinning is required to isolate flow in each siphon for maintenance purposes.

3.4.3.4 Gravity drainage or alternative means of dewatering the siphon for maintenance shall be incorporated into the design.

3.4.4 Pump Stations and Forcemains

3.4.4.1 All proposed pump stations and/or forcemain systems shall be supported by an assessment of options, including inverted siphons and/or gravity sewers, which shows that a pump station and/or forcemain solution is the optimal solution for a site over a 50-year lifecycle. The assessment shall be submitted for review and approval by the Owner of this Standard.

3.4.4.2 Pump stations shall be housed in concrete maintenance holes or prefabricated fibreglass maintenance holes.

3.4.4.3 All pump designs shall include a capacity assessment that looks at both the pumping capacity and associated wet well storage volumes. The designer shall include wet well storage to manage onsite wastewater, with provisions for infiltration/inflow into the system during severe rainfall events.

3.4.4.4 A grinder pump shall be included in the system design to reduce the risk of clogging of the system.

3.4.4.5 All pumping station and force main designs shall be outfitted with cleanouts and other appurtenances, such as flushing ports and isolation valves that are necessary in performing inspection and maintenance of the system.

3.4.4.6 Pumping station and forcemain infrastructure shall be located in areas where maintenance of the system can be performed during operation, without impacting normal station operations.

3.4.4.7 Additional wet well storage and/or backup power shall be incorporated into the pumping system design as required, in order to ensure that the system will remain operational without risk of sewage backups during a power outage of 12 hours or more.

3.4.4.8 Redundancy in the forcemain design shall be incorporated to facilitate maintenance of the forcemain without the need for station shutdowns.

3.4.4.9 Forcemains shall be constructed from PVC or HDPE, unless technical justification for other materials is provided by the Design Consultant and accepted by the Owner of this Standard.

3.4.4.10 All non-metallic components of the force main shall be equipped with tracer wire for the purposes of locating the pipe.

3.4.5 On-Site Sewage Systems

3.4.5.1 An on-site sewage system, such as a septic tank system, shall only be designed when no municipal sewer connections are available, and/or where a cost-benefit analysis shows that septic tanks are the optimal solution from a total cost over a 50-year lifecycle.

3.4.5.2 A sanitary holding tank may only be used as an on-site sewage system when all other options, including septic systems, are explored and deemed infeasible, to the satisfaction of the Owner of this Standard.

3.4.5.3 On-site sewage systems shall be designed to allow easy decommissioning when a municipal system becomes available adjacent to the site.

3.4.5.4 On-site systems shall be designed as per the OBC Section 8 (<10,000L/day capacity) or Ontario Water Resources Act (>10,000L/day capacity) and other relevant local and provincial regulations.

3.4.5.5 All septic system designs shall be prepared by a Qualified Designer of Onsite Sewage Systems, as defined by the Province of Ontario.

3.5 Quality Assurance and Quality Control (QA/QC)

3.5.1 The following QA/QC activities shall be included in the project agreement to ensure proper documentation and certification by the Professional Engineer responsible for the design throughout construction. At project completion, all QA/QC documentation shall be submitted to the Owner of this Standard for review and approval.

a) Flushing and cleaning of all wastewater sewers;

b) CCTV inspections of all pipes and maintenance holes, with confirmation that all installed pipes are free from defects (e.g. cracks, sags, heaves, etc.). The repair method for any works completed after the original installation of pipe onsite shall be documented and certified by the Professional Engineer responsible for the design; and

c) Deflection testing of plastic pipe shall be completed in accordance with OPSS.MUNI 410. Any pipe failing the mandrel test shall be replaced.