Ontario

Design Criteria for
Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval

Ministry of Environment, Conservation and Parks

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Version History

Version	Date	Comments
1.0	April 22, 2022	Initial Publication
2.0	May 31, 2023	Updates and additions to provide clarification of requirements. • Minor administrative updates • Updates to Appendix I and addition of Appendix II to provide additional guidance regarding source protection. • Removed 2.1.1(2), peaking factor, as it is now covered by 2.1.6 • Update to 2.1.2(1) and 2.1.4(1) to gross ha/dy. • Update to 2.1.4(2) to increase the upper range from 0.5 to 0.64 gross ha. • Addition of 2.1.6 (Peaking Factors) • Removed 8.2.3(1) • Addition of 8.2.5 (visual inspection of maintenance holes) • Addition of 8.3.4 (replacements of existing sanitary sewers with active service connections that cannot be plugged to complete leakage testing)

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Preface

The Design Criteria establish the minimum design requirements for Alteration to an existing Municipal Sewage Collection System and Municipal Stormwater Management System by adding, modifying, replacing, or extending Sanitary Sewers, forcemains, or Storm Sewers to satisfy one of the conditions imposed by the Director in Municipal Sewage Collection System ECA and Stormwater ECA authorizing future Alterations. Compliance with this Criteria and other conditions of the ECA negates the need for the Owner of the Municipal Sewage Collection System and Municipal Stormwater Management System to apply for an amendment to the ECA for the Alteration of Sanitary Sewers, forcemains or Storm Sewers within the collection system.

The existence of these Criteria does not preclude Alteration of Sanitary Sewers, forcemains or Storm Sewers that are not designed in accordance with these Design Criteria. However, any Alterations to collection systems that are either not designed in accordance with this Design Criteria or does not satisfy the conditions of the ECA are subject to the requirement to obtain an amendment to the ECA prior to proceeding with the undertaking.

Other approving authorities, such as municipalities in which the works are constructed or regional governments, may have servicing standards or criteria that are more stringent than the requirements outlined in the Design Criteria and they shall be considered acceptable for the purposes of complying with the requirements of the Design Criteria.

The Design Criteria document reflect program decisions that would be routinely made by the approving Director that issues ECAs under the authority of the *Ontario Water Resources Act, R.S.O. 1990, c. O.40* and the *Environmental Protection Act, R.S.O. 1990, c. E.19*. The Design Criteria may be updated from time to time by the Director or in order to conform to any future changes to the provincial policy, regulation or legislation that apply to Sanitary Sewers, forcemains or Storm Sewers.

Definitions

For the purpose of this Design Criteria, the following definitions apply:

“Adverse Effect(s)” has the same meaning as defined in section 1 of the EPA.

“Alteration(s)” includes the following, includes the following, in respect of the Authorized System, but does not include repairs to the system:

a) An extension of the system,

b) A replacement of part of the system, or

c) A modification of**,** addition to or enlargement of the system.

“Appurtenance(s)” has the same meaning as defined in O. Reg. 525/98 (Approval Exemptions) made under the OWRA.

“Authorized System” means the Sewage Works authorized under an Environmental Compliance Approval for a Municipal Sewage Collection System or an Environmental Compliance Approval for a Municipal Stormwater Management System.

“Collection System Overflow(s)” means a discharge (SSO or CSO) to the environment at designed location(s) from the Authorized System.

“Combined Sewer(s)” means pipes that collect and transmit both sanitary Sewage and other Sewage from residential, commercial, institutional and industrial buildings and facilities and Stormwater runoff through a single-pipe system, but does not include Nominally Separate Sewers.

“Combined Sewer Overflow(s)” or “(CSO)” means a combined sewer overflow which is a discharge to the environment at designated location(s) from a Combined Sewer or Partially Separated Sewer that usually occurs as a result of precipitation when the capacity of the Sewer is exceeded. An intervening time of twelve hours or greater separating a CSO from the last prior CSO at the same location is considered to separate one overflow Event from another.

"CWA" means the *Clean Water Act*, R.S.O. 2006, c.22.

“Design Criteria” means the design criteria set out in the Ministry’s publication “Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval”, (as amended from time to time).

"Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA.

“ECA” means an Environmental Compliance Approval.

"Emergency Situation" means a structural, mechanical, electrical failure, or operational health and safety incident, that causes a temporary reduction in the capacity, function or performance of any part of the Authorized System or an unforeseen flow condition that may result in:

a) Danger to the health or safety of any person;

b) Injury or damage to any property, or serious risk of injury or damage to any property;

c) Adverse Effect to the Natural Environment; or;

d) Spill.

"EPA" means the Environmental Protection Act, R.S.O. 1990, c.E.19;

"Event(s)" means an action or occurrence, at any given location within the Authorized System that causes a Collection System Overflow. An Event ends when there is no recurrence of a CSO or SSO in the Collection System at the same location in the 12-hour period following the last Collection System Overflow.

"Facility" means the entire operation located on the property where the Sewage Works is located;

"Licensed Engineering Practitioner" means a person who holds a licence, limited licence, or temporary licence under the *Ontario Professional Engineers Act R.S.O. 1990, c. P.28.*

"LID" means "low impact development" a Stormwater management strategy that seeks to mitigate the impacts of increased runoff and Stormwater pollution by managing runoff as close to its source as possible. LID comprises a set of site design strategies that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration, and detention of Stormwater.

"MTD" means manufactured treatment device;

"Minister" means the Minister of the Ministry or such other member of the Executive Council as may be assigned the administration of the EPA and OWRA under the *Executive Council Act*, R.S.O. 1990, c. E.25;

"Ministry" means the Ministry of the Minister and includes all employees or other persons acting on its behalf;

"Municipal Sewage Collection System" means all Sewage Works located in the geographical area of a municipality that collect and transmit sanitary Sewage and are owned, or may be owned pursuant to an agreement with a municipality entered into under the *Planning Act, R.S.O. 1990, c. P.13* or *Development Charges Act, 1997, S.O. 1997, c. 27*, by:

a) A municipality, a municipal service board established under the *Municipal Act, 2001, S.O. 2001, c. 25* or a city board established under the *City of Toronto Act*, 2006; or;

b) A corporation established under sections 9, 10 and 11 of the *Municipal Act, 2001, S.O. 2001, c. 25* in accordance with section 203 of that Act or under sections 7 and 8 of the *City of Toronto Act*, 2006 in accordance with sections 148 and 154 of that Act;

"Municipal Stormwater Management System" all Sewage Works, located in the geographical area of a municipality, that collect, transmit, or treat Stormwater and are owned, or may be owned pursuant to an agreement entered into under the *Planning Act, R.S.O. 1990, c. P.13* or *Development Charges Act, 1997, S.O. 1997, c. 27*, by:

a) A municipality, a municipal service board established under the *Municipal Act, 2001, S.O. 2001, c. 25* or a city board established under the *City of Toronto Act, 2006*; or

b) A corporation established under sections 9, 10 and 11 of the *Municipal Act, 2001, S.O. 2001, c. 25* in accordance with section 203 of that Act or under sections 7 and 8 of the *City of Toronto Act, 2006* in accordance with sections 148 and 154 of that Act.

"Natural Environment" has the same meaning as defined in section 1 of the EPA;

"Nominally Separate Sewer(s)" mean Separate Sewers that also have connections from roof leaders and foundation drains, and are not considered to be Combined Sewers;

"Operating Authority" means, in respect of the Sewage Works, the person, entity or assignee that is given responsibility by the Owner for the operation, management, maintenance or Alteration of the Sewage Works or a portion of the Authorized System;

"Owner" means the owner of the Authorized System.

"OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40;

"Partially Separated Sewer(s)" means Combined Sewers that have been retrofitted to transmit sanitary Sewage but in which roof leaders or foundation drains still contribute Stormwater inflow to the Partially Separated Sewer;

"Procedure F-5-5" means the Ministry document titled "F-5-5 Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer System" (as amended from time to time);

"Sanitary Sewer(s)" means pipes that collect and transmit wastewater from residential, commercial, institutional and industrial buildings;

"Separate Sewer(s)" means pipes that collect and transmit sanitary Sewage and other Sewage from residential, commercial, institutional, and industrial buildings;

"Sewage" has the same meaning as defined in section 1 of the OWRA;

"Sewage Works" has the same meaning as defined in section 1 of the OWRA*;*

"Sewer" has the same meaning as in O. Reg. 525/98 under the OWRA;

"Significant Drinking Water Threat" has the same meaning as defined in section 2 of the CWA*;*

"Source Protection Plan" means a drinking water source protection plan prepared under the CWA;

"Spill(s)" has the same meaning as defined in subsection 91(1) of the EPA;

“Standard Operating Policy for Sewage Works” means the standard operating policy developed by the Ministry to assist in the implementation of Source Protection Plan policies related to Sewage Works and providing minimum design and operational standards and considerations to mitigate risks to sources of drinking water, as amended from time to time;

"Storm Sewer" means Sewers that collect and transmit, but not exfiltrate or lose by design, Stormwater resulting from precipitation and snowmelt;

“Stormwater” means rainwater runoff, water runoff from roofs, snowmelt and surface runoff;

“Stormwater Management Facility(ies)” means a Facility for the treatment, retention, infiltration or control of Stormwater;

“Stormwater Management Planning and Design Manual” means the Ministry document titled “Stormwater Management Planning and Design Manual”, 2003 (as amended from time to time);

“Stormwater Treatment Train” means a series of Stormwater Management Facilities designed to meet stormwater management objectives (e.g., Appendix A of ECA) for a given area, and can consist of a combination of MTDs, LIDs and end-of-pipe controls**;**

“Third Pipe Collection System” means Sewage Works designed to collect and transmit foundation drainage and/or groundwater to a receiving surface water or dry well;

“Uncommitted Reserve Hydraulic Capacity” means uncommitted reserve capacity as described in MECP’s Procedure “D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants” (as amended from time to time);

1.0. INTRODUCTION

The Design Criteria establish the minimum design requirements for Alteration to a Municipal Sewage Collection System and Municipal Stormwater Management System to satisfy one of the conditions imposed by the Director in Environmental Compliance Approval (ECA) for a Municipal Sewage Collection System and ECA for a Municipal Stormwater Management System, authorizing future Alterations. The designers and proponents of such works are responsible to ensure that all the applicable federal and provincial requirements are incorporated in the design and construction of Sanitary Sewers, Storm Sewers, and forcemains. Where regulations and standards are referenced in this document, most recent version shall be used.

1.1. General Requirements

1.1.1. Alteration to an existing Municipal Sewage Collection System by adding, modifying, replacing, or extending existing sanitary or forcemains, and/or Appurtenances, is not permitted when such works;

1. Results in exceedance of hydraulic capacity of the downstream Municipal Sewage Collection System including Sewage pumping stations and Uncommitted Reserve Hydraulic Capacity of the receiving Sewage treatment plants;
2. Causes an Adverse Effect;
3. Any increase in Collection System Overflows and or deterioration of quality of the overflow discharge, that is not offset by measures; or
4. Adversely impacts the approved effluent quality of Sewage treatment Facilities, or its bypasses or overflows.

1.1.2. The existing Municipal Sewage Collection System may be altered by adding, modifying, replacing, or extending existing Sanitary Sewers or forcemains, Appurtenances, and other components of these systems that are pre-authorized in the ECA, subject to the following conditions;

1. The design for addition, modification, replacement, or extension of Sanitary Sewers, forcemains and/or Appurtenances;
    a. Has been prepared by a Licensed Engineering Practitioner;
    b. Has been designed to transmit but not to treat wastewater; and
    c. Satisfies or exceeds the minimum requirements specified in the Design Criteria.
2. Uncommitted Reserve Hydraulic Capacity calculations for the downstream Municipal Sewage Collection System and treatment Facilities including allowances for infiltration and inflow has been prepared and submitted by the proponent to the Owner with the supporting documentation as required by the Owner.
3. The Owner has a plan and process to forecast and track Uncommitted Reserve Hydraulic Capacity and verify the proposed Alteration of the system can be accommodated.
4. All required documentation detailed in this Design Criteria and/or in the ECA has been completed.

1.1.3. Alteration to an existing Municipal Stormwater Management System by adding, modifying, replacing, or extending existing Storm Sewers, and/or Appurtenances, is not permitted when such works;

1. Results in exceedance of hydraulic capacity of the downstream;
    a. Conveyance system;
    b. The receiving treatment / Stormwater Management Facilities;
2. Causes an Adverse Effect; or
3. Adversely impacts the approved effluent quality of Stormwater works.

1.1.4. The existing Municipal Stormwater Management System may be altered by adding, modifying, replacing, or extending existing Storm Sewers, Appurtenances, and other components of these systems that are pre-authorized in the ECA, subject to the following conditions;

1. The design for addition, modification, replacement, or extension of Storm Sewers, and/or Appurtenances;
    a. Has been prepared by a Licensed Engineering Practitioner;
    b. Satisfies or exceeds the minimum requirements specified in the Design Criteria; and
    c. Has been planned, designed and built to be consistent with the MECP's Stormwater Management Planning and Design Manual (March 2003).
2. All required documentation detailed in this Design Criteria and/or in the ECA has been completed.
3. Municipal Stormwater Management System should be designed using an integrated Stormwater Treatment Train approach used to minimize Stormwater management flows and reliance on end of pipe controls through measures including source controls, lot level controls, and conveyance techniques.

1.2. Design Considerations

1.2.1. All Sanitary Sewers, Storm Sewers, forcemains, maintenance holes, and chambers, shall be designed considering all relevant soil and hydrogeological conditions including groundwater elevations.

1.2.2. The design of all maintenance holes, chambers, and structures shall conform to all applicable requirements including, but not limited to: *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*, Ministry of Labour Confined Space Guidelines and *Fire Protection and Prevention Act, 1997, S.O. 1997, c. 4*.

1.2.3. All new maintenance holes and chambers shall be designed with explicit and documented consideration for future inspection, operation, and maintenance requirements.

1.2.4. All precast structures installed in frost-susceptible soils shall include necessary hardware to prohibit heave due to frost action unless alternative methods are employed to mitigate frost heaving.

1.2.5. Sewers, maintenance holes, and/or Appurtenances shall be avoided where possible in

areas subject to flooding or in areas of high groundwater (regular and seasonal).

1.2.6. If Sewers, maintenance holes and/or Appurtenances are located in areas subject to flooding/high groundwater, Inflow and Infiltration reduction, and flotation prevention measures shall be included in the design.

1.2.7. The design shall include in the project specifications requirements for;

1. Mandatory inspection and testing as per Section 8 of this document; and
2. Adequate control of siltation and erosion during construction.

1.3. Protection of drinking water sources

1.3.1. An assessment of the proposed works shall be completed to determine if the works pose a Significant Drinking Water Threat and if they are, the design shall incorporate features that mitigate the threat to sources of drinking water, such as those included in:

1. Ministry's Standard Operating Policy for Sewage Works as amended from time to time; and
2. Source Protection Plan policies pertaining to the works.

Refer to Appendix I for Understanding Risks to Sources of Drinking Water.

1.4. Protection of Water Supplies

1.4.1. Sanitary Sewers, Storm Sewers, forcemains, and all associated Appurtenances and structures shall be designed with provisions to provide the required protection for drinking water supply systems in accordance with;

1. The MECP's F-6-1 Procedures to Govern Separation of Sewers and Watermains; and
2. Section 15 of the MECP's Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit.

2.0. DESIGN OF SANITARY SEWERS

2.1. Design Flows

2.1.1. Residential Flows

1. The average daily residential flows of 225 to 450 L/cap/day shall be used in the design for sizing the pipe.

2.1.2. Commercial Flows

1. The minimum allowance for commercial flows shall be 28 m^3/gross ha/day. Actual flow monitoring data (covering at least 2 years) at the subject site or a similar site observed locally can be used.
2. The Sewage flows listed on Table 1 may be used in the design for individual commercial facilities, provided that the minimum flow capacity listed in 2.1.2.1 are maintained for the development.

2.1.3. Institutional Flows

1. Historical water use data at the subject site or a similar site (covering at least 2 years) of the facility or other similar facilities can be used to calculate average institutional flows. Where historical water use data is not available, the unit values for institutional flows listed in Table 1 can be used. The designer shall use professional judgement to select appropriate flow rate within the range.

2.1.4. Industrial Flows

1. Where available, actual sanitary flow monitoring data at the subject site or a similar site (covering at least 2 years) shall be used for accurate prediction of industry specific wastewater flows. Where actual flow data is not available, an average flow from 0.2 to 0.64 L/s/ gross ha can be used.

2.1.5. Extraneous Flow (I&I)

1. A long-term (end-of-pipe life) peak inflow and infiltration (I&I) rate allowance of up to 0.28 L/s/ha shall be used in pipe sizing to maintain capacity throughout the designed life of the sewers.

2.1.6. Peaking Factors

1. Peaking factor for residential flows can be calculated using either the Harmon Formula or Babbitt Formula. At minimum, a peaking factor of 2.0 shall be used in the design.
2. The peaking factors for sewage flows from individual commercial and institutional establishments can be determined using peak water usage rates for these facilities. At minimum, a peaking factor of 1.5 shall be used in the design.
3. The Peaking factor for sewage flows from industrial areas vary greatly depending upon variety of factor including types of industries present, and the individual processes within the industries. Actual sanitary flow monitoring data at the subject site or a similar site (covering at least 2 years) shall be used to determine industry specific peaking factors. Where such data is not available, at minimum a peaking factor of 2 can be used in the design.

Table 1 - Common Sewage Flowrates for Commercial and Institutional Uses

Description	Unit Sewage Flow (L/d)	Flow Unit Per
Shopping Centre (floor area in m^2)	2.5 – 5.0	Total floor area in m^2
Hospitals	900 – 1,800	Bed
Schools	70 - 140	Student
Travel Trailer Parks	340	Space (without water hook-ups)
	800	Space (with individual. water hook-ups)
Campgrounds	225 - 570	Campsite
Mobile Home Park	1,000	Parking space
Motels	150 - 200	Bed space
Hotels	225	Bed space

2.2. Friction Factors

2.2.1. Sanitary Sewers shall be designed using either the Chézy- Kutter, Darcy Weisbach, or Chézy-Manning's formula. Appropriate roughness coefficient shall be used according to the type of pipe used. The friction loss coefficient must be appropriate to the installed pipe, but not less than the equivalent of a Manning's equation "n" of 0.013 for all new smooth-wall Sewer pipes.

2.3. Pipe Diameters

2.3.1. The minimum size of the gravity Sewer in a Municipal Sewage Collection System shall be 200 mm in diameter (nominal pipe size). Sewer pipe 150 mm in diameter can be used if it is demonstrated in the design that there is no risk of clogging and the design is accepted by the Owner.

2.4. Flow Velocity

2.4.1. Gravity Sewers shall be designed with uniform slopes between the maintenance holes.

2.4.2. All gravity Sanitary Sewers shall be designed and constructed with slopes to provide at least 0.6 m/s of flow velocity, when flowing full to maintain solids in suspension.

2.4.3. In certain circumstances, such as rehabilitation/replacement of an existing Sewer where deepening of individual Sewer section will not be possible, design flow velocities of less than 0.6 m/s may be considered provided that appropriate measures are taken to facilitate frequent flushing and maintenance needs and the Owner accepts the increased maintenance requirements.

2.4.4. The maximum velocity in all Sanitary Sewers shall be less than or equal to 3.0 m/s at peak flows to minimize erosion.

2.5. Anchors/Restraints

2.5.1. Sanitary Sewers on 20 percent slope or greater shall be anchored securely with concrete anchors or equal.

2.5.2. Anchors and anchorage spacing shall be designed by a Licensed Engineering Practitioner based on Sewer material, anchor type and site conditions. Recommended maximum anchorage spacing is 11 m on grades between 20 percent and up to 35 percent, 7.3 m on grades between 35 percent and up to 50 percent, and 4.9 m on grades that exceed 50 percent.

2.5.3. Where velocity in the Sanitary Sewers approaching or exceeding 3 m/s due to steep grades and providing a drop maintenance hole is not possible, receiving sewers shall be designed for protection against maximum scouring velocity and erosion control measures, that are acceptable to the Owner shall be taken.

2.6. Pipe Material

2.6.1. All material used in the addition, modification, replacement, or extension of Sanitary Sewers including pipes, fittings, valves, devices, and materials used for the rehabilitation shall meet all applicable quality conditions adopted by the Ontario Provincial Standards for Roads and Public Works and/or local municipal standards. Where applicable standards conflict, the more stringent standard shall apply.

2.6.2. Prior to specifying pipe material, soils shall be assessed for contamination and for the presence of compounds that may negatively impact the suitability of the proposed materials. Nitrile gaskets or equivalent shall be specified for soils contaminated with hydrocarbons unless soil remediation prior to construction provides satisfactory results.

2.6.3. If the material is used based on specific site conditions, the reasons for material selection shall be stated and location shall be identified in the record / as-built drawings.

2.7. Pipe Strength

2.7.1. The Sanitary Sewer pipe material selected for a particular application shall be able to withstand all the combinations of loading conditions to which the pipe is likely to be exposed, along with an appropriate safety factor.

2.8. Pipe Cover and Frost Protection

2.8.1. Sanitary Sewers shall be installed at sufficient depth (greater than local frost penetration) to prevent freezing. If this is not achievable, the Sewer shall be insulated to provide the required protection. Insulation must be designed or verified by a Licensed Engineering Practitioner or where available as per the local municipal standards acceptable to the Owner.

2.8.2. For Sanitary Sewers subject to traffic load, a loading factor in accordance with the regulations, codes, and by-laws of authorities having jurisdiction shall be considered for selecting depth of pipe cover. This includes but not limited to: Highway Bridge Design Code (for vehicular traffic), Railway Safety Act, and Transport Canada Act. Appropriate structural support shall be provided to the pipes as required.

2.8.3. Maximum pipe cover should be as per the manufacturer recommendations.

2.9. Sanitary Sewers and Maintenance Holes Installed Below Seasonally High Groundwater Table

2.9.1. Sanitary Sewer systems which are installed lower than 0.6m below the Seasonally High Groundwater Table (SHGWT) shall be designed to minimize infiltration.

2.9.2. Where the SHGWT level is determined and supporting record is available, the Sewer pipes, pipe joints, and connections shall be designed to withstand a pressure of at least 1.25 times the pressure exerted by the groundwater above the sewer without leakage.

2.9.3. Where the SHGWT is unknown and/or the supporting record is not available, the Sewer pipes, pipe joints, and connections shall be designed to withstand a pressure based on the equivalent of at least 1.25 times the pressure exerted by the groundwater being at the ground surface elevation above the Sewer without leakage.

2.9.4. The sanitary maintenance holes shall be externally wrapped with Waterproof membrane placed externally around all precast joints, including joints below the maintenance hole frame and cover, with a minimum 300mm wide strip.

2.9.5. Buoyancy of Sewers and maintenance holes shall be considered in the design, and where required, adequate provision shall be made to prevent flotation.

2.10. Sanitary Maintenance Holes

2.10.1. Maintenance holes shall be provided at the end of each Sewer line; at all changes in grade, size, or alignment; at all pipe intersections and/or at a distance not greater than 120 m for Sewers up to 400 mm in diameter, and 150 m for Sewers between 450 mm to 750 mm in diameter.

2.10.2. In circumstances where maintenance holes cannot be provided, an upstream maintenance hole is required at 30 m (max) from where a maintenance hole could not be placed to facilitate maintenance.

2.10.3. An additional straight-through maintenance hole with similar upstream and downstream sloped Sewers shall be provided between new subdivisions and the Municipal Sewage Collection System, or at other appropriate location(s) for the purposes of flow monitoring from new subdivisions. The maintenance hole must either include or allow for the insertion of flow monitoring equipment.

2.10.4. The minimum drop across maintenance holes shall be minimum 25 mm for straight runs and 50 mm for 90-degree bends. Alternately, Sewer grade may be maintained across maintenance holes provided minimum required flow velocity is maintained (as outlined in this document).

2.10.5. Where a smaller diameter Sewer line joins a larger one, the invert of the larger Sewer shall be lowered where practical, to maintain the same energy gradient, or the pipe obverts are matched.

2.10.6. A drop structure shall be provided for Sewers entering a maintenance hole at an elevation of 610 mm or more above the maintenance hole outlet pipe invert;

1. An external drop structure is recommended for all new maintenance holes. An internal drop structure can be used if;
    a. Accepted by the Owner;
    b. There is adequate space to allow for internal drop structure and unobstructed maintenance access; and
    c. The structure is provided with restraint straps or equivalent.
2. Where drop structure is not feasible, alternative methods of energy dissipation from falling flow and minimizing air entrainment and odors problems shall be specified.

2.10.7. Maintenance holes shall be located away from any route or ponding area. Grading around maintenance holes shall be benched to direct water away from the maintenance hole.

2.10.8. In cases where the sanitary maintenance hole cannot be located away from an overland flow route for a 25-year storm event or cannot be benched, an analysis must be completed to verify;

1. If the overland flow will submerge the maintenance hole. Watertight design, including water-tight covers, shall be specified for submerged sanitary maintenance holes, and
2. Where more than one consecutive sanitary maintenance hole requires sealing due to exposure to overland flow, appropriate ventilation shall be provided.

2.10.9. Frost straps (internal or external) shall be provided to hold maintenance hole sections together (at least two (2) between each section). External straps to extend vertically from top to bottom and for deep maintenance holes extended at least 1 m below frost depth.

2.10.10. Joints between maintenance hole sections, and inlet and outlet pipes shall be sealed with gasketed flexible watertight connections. Where works are cast-in-place, sealing is required only at the point of connection between individual components of the maintenance hole structures.

2.10.11. Maintenance holes shall be designed based on the pipe size, alignment, and inspection and maintenance needs. The minimum diameter of maintenance holes shall be 1200 mm (48 in). A minimum access diameter of 610 mm (24 in) shall be provided.

2.10.12. Safety platforms or alternate safety measures shall be employed for deep maintenance holes as per *Occupational Health and Safety Act, R.S.O. 1990, c. O.1* requirements and inspection, operation, and maintenance needs. Multiple platforms may be required based on the depth of the maintenance holes.

2.11. Inverted Siphons

2.11.1. Inverted siphons shall be designed with consideration of potential siltation, grease and debris accumulation, air locking, maintenance, and odor issues.

2.11.2. The minimum pipe size for inverted siphons shall be nominally 200 mm in diameter.

2.11.3. Pipes shall be sized such that a Self-Cleansing velocity between 1.1 m/s to 1.3 m/s is achieved at least once per day. Where the required velocities cannot be achieved alternate means of flushing shall be incorporated in the design.

2.11.4. Gravity drains or any other means of draining or dewatering the inverted siphon shall be incorporated to facilitate inspection and maintenance.

2.11.5. Air jumpers shall be sized to carry the required air flow between the inlet and outlet chambers. Maintenance measures for air jumpers shall be incorporated as required.

2.11.6. Inverted siphons shall be designed with at least two (2) parallel barrels to accommodate flow variations. If a double barrel siphon is not feasible, a single barrel inverted siphon is acceptable provided that additional arrangements are incorporated in the design to facilitate inspection, operation, and maintenance.

2.11.7. Inverted siphons shall be equipped with inlet and outlet chambers sized to facilitate inspection, operation, and maintenance.

2.11.8. Control valves/sluice gates shall be installed in inlet and outlet chambers especially on multi-barrel siphons to isolate or divert flows to each pipe.

2.11.9. Inverted siphons shall not be designed with sharp vertical or horizontal bends. The slope for the upward vertical leg shall be limited to 2:1 (H:V).

2.11.10. Ventilation is required at the Inlet and Outlet chambers.

2.12. Service Connections (Service Laterals)

2.12.1. All service connections shall be constructed to be watertight.

2.12.2. The minimum diameter for a service connection to main Sewer for gravity flow shall be 100 mm in diameter. Sanitary Sewer pipes shall be colour coded green to avoid cross connections. Color coding method includes pipe color, wrapping, demarcation tape, or stenciling.

2.12.3. Sanitary laterals and sanitary service connections shall be specified with a minimum 1% slope (2% slope is recommended).

2.12.4. Where required, the riser pipe on the sanitary service pipe should be installed at a maximum 1:1 slope where feasible, before transitioning to a nominally horizontal installation. The transition from the nominally horizontal section to the steep section should be completed with a long radius bend.

2.12.5. Cleanouts if installed, should be located at or near the property line to facilitate inspection, or as required by the local municipal standard.

2.12.6. Maintenance hole should be provided for commercial service connections, or residential service connection servicing more than five (5) buildings.

2.12.7. Tracer wire is recommended for service connections where feasible as determined by the design engineer.

3.0. DESIGN OF FORCEMAINS

3.1. Pipe Diameters

3.1.1. The minimum size for a Sewage forcemain shall be 100 mm in diameter.

3.1.2. A smaller diameter forcemain may be acceptable if it is used to maintain the minimum velocity in the forcemain (as outlined in this document). A grinder pump or equivalent shall be provided for such applications and Design Brief including detailed hydraulic calculations shall be prepared by a Licensed Engineering Practitioner.

3.2. Friction Factors

3.2.1. Forcemains shall be designed using Hazen-Williams formula or Darcy -Weisbach equation. Hazen- Williams formula is recommended for design of forcemains. Where data are not available, the forcemains shall be designed using the equivalent to Hazen-Williams C-factors listed in Table 2 for pipes made of traditional materials or their equivalent.

Table 2 - Hazen-Williams C-Factors

Material	C-Factor
Unlined Steel pipe, Concrete pipe	100
PVC, HDPE, lined ductile iron	120

3.3. Flow Velocity

3.3.1. Forcemains shall be designed for a cleansing velocity of at least 0.6 m/s.

3.3.2. The maximum velocity in the forcemains shall not exceed 3.0 m/s.

3.4. Anchors/Restraints

3.4.1. Restrained joints shall be installed at all tees, bends, end of forcemains, and connections for all forcemains. A Licensed Engineering Practitioner shall complete the calculation to determine the number of joints to be restrained beyond the bend, fitting, tee, etc.

3.4.2. In the case of non-restraining mechanical and/or slip-on joints, restraint shall be provided by adequately sized thrust blocks positioned at all plugs, caps, tees, line valves, reducers, wyes, and bends deflecting 22.5 degrees or more.

3.4.3. In designing thrust blocks or other restraint systems, transient pressures shall be added to the normal operating pressures when calculating the thrust forces.

3.5. Pipe Material

3.5.1. Forcemain material used in the addition, modification, replacement, extension, or rehabilitation including pipes, fittings, valves, devices, and other materials used shall meet the more stringent of quality standards adopted by Ontario Provincial Standards for Roads and Public Works or local Municipal standards.

3.5.2. Prior to specifying pipe material, soils shall be assessed for contamination and for the presence of compounds that may negatively impact the suitability of the proposed materials. Nitrile gaskets or equivalent shall be specified for soils contaminated with hydrocarbons.

3.5.3. If the material is used based on specific site conditions, the reasons for material selection shall be stated and location shall be identified in the record drawings.

3.6. Pipe Strength

3.6.1. The forcemain pipe material selected for a particular application shall be able to withstand, with a margin of safety, all the combinations of loading conditions to which the forcemain is likely to be exposed.

3.7. Pipe Cover and Frost Protection

3.7.1. Forcemains shall be installed at sufficient depth (greater than frost penetration) to prevent freezing. If this is not achievable, forcemains shall be insulated/or heat traced. Insulation/heat tracing shall be designed/verified by a Licensed Engineering Practitioner.

3.7.2. For forcemains subject to traffic loading, a loading factor in accordance with the regulations, codes and by-laws of authorities having jurisdiction shall be considered for selecting depth of pipe cover. This includes but not limited to: Highway Bridge Design Code (for vehicular traffic), Railway Safety Act, and Transport Canada Act. Appropriate structural support shall be provided to the pipes as required. If a protective sleeve is used, appropriate sleeve material shall be selected based on the site conditions.

3.7.3. Maximum pipe cover should be as per the manufacturer recommendations.

3.8. Termination

3.8.1. All forcemains shall be discharged to maintenance holes.

3.8.2. For flows greater than 30 L/s, transition maintenance holes shall be provided at forcemain discharge points to provide smooth flow transition into the receiving gravity Sewers.

3.8.3. The transition maintenance hole shall be designed based on the pipe size, alignment and inspection and maintenance needs. The minimum diameter of maintenance holes shall be 1200 mm (48 in). A minimum access diameter of 610 mm (24 in) shall be provided.

3.8.4. The forcemains shall enter the transition maintenance hole at a point not more than 0.3 m above the flow line. No other gravity Sewers shall enter the transition maintenance hole.

3.8.5. Protective coatings or corrosion resistant material shall be used in the maintenance holes to prevent deterioration due to presence of hydrogen sulfide or other corrosive chemicals.

3.8.6. The Sewer connecting the transition maintenance hole to downstream maintenance hole shall be sized to flow at half depth to ensure a smooth flow.

3.8.7. Safety platforms or alternative safety measures shall be incorporated in the designed for deep maintenance holes per *Occupational Health and Safety Act, R.S.O. 1990, c. O.1* and any other municipal requirements.

3.9. Identification

3.9.1. A Tracer Wire shall be installed for all non-metallic forcemains regardless of the size, identifier codes, or markings can be added to identify the use of pipe in conformance with local municipal standards. Where metallic pipe is used tracer wire shall be provided at the material transition point to ensure electrically conductive connection point for future detection.

3.10. Maintenance

3.10.1. All new forcemains longer than 150 m shall be provided with swab launching ports and/or flushing ports. Swab catching ports may be required.

3.10.2. Isolation valves shall be provided as required to facilitate maintenance. Non-return valves may be required when forcemains are connecting into a common forcemain.

3.10.3. Cleanouts/drain chambers shall be provided at low points of a forcemain.

3.11. Transient Pressures

3.11.1. A hydraulic transient analysis shall be undertaken as part of the design process considering the worst-case failure scenario involving the most critical pump and forcemain-in-service combination. The analysis shall be completed using hydraulic models based on the final sizes and layout of pumps and forcemains including locations of air/vacuum release valves. Based on the hydraulic transient analysis, provide devices, if necessary, to protect the forcemain such as, but not limited to, surge valves, surge tanks, etc.

3.11.2. The forcemains shall be designed so that pipes and joints are able to withstand the maximum operating pressure plus the surge pressure that would be created by stopping a water column moving at the higher of 0.6 m/s or the theoretical velocity in the forcemain.

3.11.3. The forcemains shall be designed such that pipes, joints, fittings, and valves are able to withstand full vacuum pressure.

3.12. Air and Vacuum Relief Valves

3.12.1. A combination of Sewage air and vacuum relief valves shall be placed at all high points in the forcemain to relieve air locking and to relieve negative pressures on forcemains.

3.12.2. At minimum, the Air/Vacuum relief valves shall conform to AWWA standard C512-15 Air Release, Air/Vacuum and Combination Air Valves for Water and Wastewater Service, as amended from time to time.

3.13. Drain Valves

3.13.1. Drain valves shall be placed at all low points in the forcemain to facilitate draining/cleaning.

3.13.2. Drain valves on the forcemain are to be flanged connections in valve chambers. Where possible, the valve chamber may be drained to the closest gravity Sanitary Sewer or maintenance hole or drained back into the wet well.

3.14. Service Connections

3.14.1. Minimum diameter of a forcemain for a service connection without grinder pumps shall be 100 mm in diameter.

3.14.2. A smaller diameter forcemain may be used for low flow applications provided that the grinder pump or equivalent is specified and the design brief including detailed hydraulic calculations are prepared by a Licensed Engineering Practitioner.

4.0. COMBINED SEWERS

4.1. Rehabilitation of Existing Combined Sewers

4.1.1. The design and rehabilitation of the Combined Sewer systems shall meet the requirements of the Ministry's Procedure F-5-5, Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems.

4.1.2. Sewers shall be planned, designed, installed, and operated to minimize or eliminate Combined Sewer Overflows.

4.1.3. New Combined Sewer systems are not permitted.

4.1.4. Addition or extension of an existing Combined Sewer is not permitted.

4.1.5. Rehabilitation, repair, and replacement of an existing Combined Sewer is permitted as per the conditions listed in the ECA.

4.1.6. Rehabilitation of existing Combined Sewer overflow structures is permitted including instrumentation and controls that are installed for the purpose of monitoring and reporting only.

4.1.7. Rehabilitation of existing CSO control structures is permitted including modifications that are intended only to improve the performance or optimize utilization of the existing control structures.

4.1.8. A Storm Sewer connection to a Combined Sewer is not permitted except for Combined Sewer separation project where the municipality plans a temporary storm connection to a combined system. This approach requires a detailed plan to disconnect and separate the Storm Sewer to a separated storm outlet according to an established schedule. Specifically, if it is demonstrated that such works will not result in an increase in CSO volume, frequency, duration, or by-pass of treatment during the schedule period.

4.2. CSO Detention Facilities

4.2.1. Construction of new CSO detention facility for an existing CSO control structure for the purpose of reducing volume, frequency, or duration of a CSO discharge and to improve quality of combined CSO discharges is permitted provided that;

1. Is not designed to replace an existing outfall to a watercourse;
2. Does not have a direct environmental discharge such as to watercourse, groundwater, or the ground from the detention structure;
3. Is controlled by an existing CSO control structure; and
4. It is demonstrated in a design brief by a Licensed Engineering Practitioner that such works has structural integrity to function as intended/designed.

5.0. STORM SEWERS

5.1. Design of Storm Sewers

5.1.1. Only Stormwater, drainage from foundations and roads, or LIDs shall be accepted or collected by Storm Sewers.

5.1.2. Sanitary Sewage or combined Sewage shall not be accepted or collected by Storm Sewers or transmitted or directed to a Stormwater works.

5.1.3. Storm sewers shall be designed, using the most recent rainfall intensity, duration, and frequency (IDF) curves available from the respective municipality for which the sewers are to be constructed. If the municipality does not have access to current IDF curves, adjacent jurisdictions shall be consulted for IDF curves, and the most stringent values shall be used in design.

5.1.4. In the design of conveyance drainage system, local climate data is to be used to establish design storm frequency criteria, at a 2-year return design storm or greater storm event can be used for minor system design.

5.1.5. Inlet times shall be calculated based upon the overland flow route modeled under fully developed system conditions as per the Official Plan.

5.1.6. Storm Sewer which are installed below seasonally high groundwater table shall be designed to minimize infiltration.

5.1.7. Storm Sewers design shall be verified (major system and minor system capacity analysis) accounting for the captured flows that enter the Storm Sewers (minor system) through inlets and the flow remaining at the surface (major system) at minimum under the following conditions;

1. No inlet capacity restriction; and
2. 50% inlet capacity restriction at depressions and roadway sags.

Maximum depths of flows at the surface and maximum hydraulic grade lines in the Storm Sewers shall be verified for up to the 100-year design storm.

5.2. Runoff Calculations

5.2.1. The peak rate of runoff from an area may be calculated using the following formula:

$$Q = 2.78\ C \cdot I \cdot A$$

Where Q is the Peak flow in liters per second, A is the area in hectares, C is run-off coefficient (dimensionless), and I is average rainfall in mm per hour for a duration equal to the time of concentration for a particular storm frequency.

5.2.2. Hydrologic and hydraulic simulation models can be used for systems to verify the capacity of the systems serving small or large areas or involving treatment and/or storage systems.

5.2.3. A Licensed Engineering Practitioner shall select the appropriate “C” values based on site conditions. The range of runoff coefficients shown in Table 3 may be used for design purposes.

Table 3 - Runoff Coefficients

Source	Runoff Coefficient (C)
Asphalt, concrete, roof areas	0.90-1.00
Grassed areas, parkland	0.15-0.35
Brick Roads	0.7-0.85
Sandy Soil	0.05-0.25
Playgrounds	0.2-0.35
Gravel	0.6-0.7
forest and dense wooded areas	0.10–0.25
Permeable pavements	0.15 to 0.25

5.2.4. For calculating runoff for less frequent, high intensity storms (e.g., 50 or 100-year storm) for particular type of area in Table 3, upper values of the range shall be used. The lower value of the range may be used for shorter (e.g., 2- or 5-year storm) recurrence interval storms under conditions of moderate to flat slopes. For urban areas the runoff coefficient may be increased to suit urban conditions.

5.3. Friction Factors

5.3.1. Storm Sewers shall be designed to transmit the required capacity when pipe is flowing full. Storm Sewer capacities can be calculated using the Manning's equation or Darcy–Weisbach equation. If Manning's equation is used for the roughness coefficient (n) as specified by the manufacturer or as listed in Table 4 or equivalent may be used for all new pipes.

Table 4 - Manning's Roughness Coefficient (n) for New Pipes

Pipe Material	Roughness Coefficient (n)
Smooth-walled pipe materials (HDPE, PVC, Concrete)	0.013
Corrugated metal pipe	
Plain Pipe	0.024
Paved Invert	0.020

5.4. Pipe Diameter

5.4.1. The minimum size of the Storm Sewer shall be 250 mm in diameter. For Storm Sewer laterals, the minimum service connections shall be 150 mm diameter color coded white. Color coding method includes pipe color, wrapping, demarcation tape, or stenciling.

5.5. Flow Velocity

5.5.1. The minimum flow velocity in the Storm Sewer shall be 0.75 m/s. Velocities in Storm Sewers shall not exceed 6 m/s.

5.5.2. Additional protection against erosion, scouring, and pipe displacement must be provided by a Licensed Engineering Practitioner where flow velocities exceed 4.5 m/s.

5.5.3. In certain circumstances, such as rehabilitation/replacement of an existing Sewer where deepening of individual Sewer section will not be possible, design flow velocities of less than 0.75 m/s may be considered provided that appropriate measures are taken to facilitate

frequent flushing and maintenance needs and the Municipality accepts the increased maintenance requirements.

5.6. Anchors/Restraints

5.6.1. Storm Sewers on 20 percent slope or greater shall be anchored securely with concrete anchors or equal.

5.6.2. Anchors and anchorage spacing shall be designed by a Licensed Engineering Practitioner based on Sewer material, anchor type, and site conditions.

5.6.3. Where velocity in the Storm Sewers approaching or exceeding 3 m/s due to steep grades and providing a drop maintenance hole is not possible, Sewers shall be designed for protection against maximum scouring velocity and erosion control measures, acceptable to the Owner shall be taken.

5.7. Pipe Material

5.7.1. All material used in the addition, modification, replacement, or extension of Storm Sewers including pipes, fittings, valves, and devices and materials used for the rehabilitation shall meet all applicable quality adopted by the Ontario Provincial Standards for Roads and Public Works and/or local municipal standards. Where applicable standards conflict, the more stringent standard shall apply.

5.7.2. Prior to specifying pipe material, soils shall be assessed for contamination and for the presence of compounds that may negatively impact the suitability of the proposed materials. Nitrile gaskets or equivalent shall be specified for soils contaminated with hydrocarbons.

5.7.3. If the material is used based on specific site conditions, the reasons for material selection shall be stated and location shall be identified in the record/ as-built drawings.

5.8. Pipe Strength

5.8.1. The Storm Sewer pipe material selected for a particular application shall be able to withstand all of the combinations of loading conditions to which the pipe is likely to be exposed along with an appropriate safety factor.

5.9. Pipe Cover and Frost Protection

5.9.1. Storm Sewers shall be installed at sufficient depth (greater than frost penetration) to prevent freezing, if this is not achievable, Sewers shall be insulated. Insulation must be designed/verified by a Licensed Engineering Practitioner.

5.9.2. For Storm Sewers that are subject to traffic loading, a loading factor in accordance with the regulations, codes and by-laws of authorities having jurisdiction shall be considered for selecting depth of pipe cover. This includes but not limited to: Highway Bridge Design Code (for vehicular traffic), Railway Safety Act, and Transport Canada Act. Appropriate structural support must be provided to the pipes as required.

5.9.3. Maximum pipe cover should be per the manufacturer recommendations.

5.10. Storm Maintenance Holes

5.10.1. Maintenance holes shall be provided at each change in alignment, pipe size, grade, material, and at all pipe junctions. For blind connections, an upstream maintenance hole at a distance of 30 m (max) is required to facilitate maintenance. Pre-manufactured bends may be acceptable if maintenance access is provided and is acceptable to the Owner.

5.10.2. Maintenance hole spacing depends on pipe size; spacing shall be in conformance to local municipal design guidelines. Where municipal design guidelines do not exist, the maximum spacing as listed in Table 5 should be used.

Table 5 - Maintenance Hole Spacing

Sewer Diameter (mm)	Maximum Spacing (m)
250 to 975	110
1050 to 1350	130
1500 to 1650	160
1800 and above	305

5.11. Catch Basins

5.11.1. Catch basins shall be provided at adequate intervals to ensure that the drainage is intercepted up to the capacity of the Storm Sewer.

5.11.2. Street catch basin spacing will vary with the street width, grade and cross fall, the location of pedestrian crossing points, intersections, low points, location of sanitary maintenance holes and driveway depressions. Maximum Catch basin spacing shall be per Table 6.

Table 6 - Catch Basin Spacing

Road Gradient (%)	Maximum Spacing (m)
0 to 3	110
3.1 to 4.5	90
Over 4.5	75

5.11.3. The minimum diameter of the catch basin lead is 100 mm and the minimum of 1% slope shall be provided for a catch basin lead.

5.12. Inverted Siphons

5.12.1. Inverted siphons shall be designed with consideration of potential siltation and air locking.

5.12.2. Inverted siphons shall be designed with water-tight joints, and to withstand hydrostatic pressure.

5.12.3. Gravity drains or any other means of draining or dewatering the inverted siphon shall be incorporated to facilitate inspection and maintenance.

5.12.4. The minimum pipe size for inverted siphons shall be nominally 250 mm in diameter.

5.12.5. Appropriate cover shall be provided above the inverted siphon based the type of crossing structure.

5.12.6. Pipes shall be sized such that a self-cleansing velocity between 1.1 m/s to 1.3 m/s is achieved in 25 mm storm event (First Flush). Where the required velocities cannot be achieved alternate means of flushing shall be incorporated in the design.

5.12.7. Inverted siphon shall be designed with at least two parallel barrels of same size, each capable of transmitting the design flowrate. Single barrel inverted siphons are acceptable provided that additional arrangements are incorporated in the design to facilitate inspection, and maintenance.

5.12.8. Inverted siphons shall be equipped with inlet and outlet chambers sized to facilitate inspection and maintenance.

5.12.9. Control valves/sluice gates shall be installed in inlet and outlet chambers especially on multi-barrel siphons to isolate or divert flows to each pipe.

5.12.10. Inverted siphons shall not be design with sharp vertical or horizontal bends, the slope for the upward vertical leg shall be limited to 2:1 (H: V).

5.13. Service Connections (Service Laterals)

5.13.1. The minimum diameter for a service connection shall be 150 mm in diameter.

5.13.2. Storm Sewer pipes shall be colour coded white to avoid cross connections. Color coding method includes pipe color, wrapping, demarcation tape, or stenciling.

5.13.3. Tracer wire is recommended for service connections where feasible as determined by the design engineer.

6.0. Third Pipe Collection System

6.1.1. Third Pipe Collection System shall be designed to collect water only from the foundation drains.

6.1.2. Foundation drain discharge collection system shall not receive water from any sites that are contaminated or suspected to be contaminated unless;

1. Environmental site assessment is completed to confirm that site is free from contamination;
2. Remediation work is undertaken prior to acceptance by the system; or
3. Pretreatment is in place to achieve acceptable results.

6.1.3. Foundation drain collection pipes shall be installed at sufficient depth (greater than frost penetration) to prevent freezing. If this is not achievable due to site specific condition, the pipes shall be insulated to provide the required protection.

6.1.4. The minimum size of the pipe in the foundation drain collection system shall be 150 mm in diameter (nominal pipe size).

6.1.5. The minimum slope for the gravity pipes within the foundation drain collection system shall be 1% where feasible.

6.1.6. Maintenance holes shall be provided for foundation drain collection system as required, maintenance hole spacing shall not be more than 150 m.

6.1.7. All material used in the foundation drain Sewers including pipes, fittings, valves, devices, shall meet all applicable quality standards adopted by the Ontario Provincial Standards for Roads and Public Works and/or local municipal standards. Where applicable standards conflict, the more stringent standard shall apply.

7.0. Documentation

7.1.1. The required documentation specified here in this document and in the ECA shall be completed.

7.1.2. A Design Brief shall be prepared by a Licensed Engineering Practitioner to demonstrate the proposed design is in conformance with all the applicable requirements of the Design Criteria and complies with all applicable Ministry policies, guidelines, and regulations. At minimum, the Design Brief shall include; hydraulic calculations; approval requirements, and completed pipe data form PIBS 6238e; additionally, the design brief shall include but not limited to the following for:

1. Sanitary Sewers/forcemain/conveyance ditches/swales;
    a. Hydraulic design sheets (applicable only to Sewers);
    b. A design report or equivalent detailing the engineer's design decisions and rationale, especially where high groundwater and/or other inflow and infiltration risk factors exist.
    c. "Forcemain or siphon: contingency plans for possible overflows (applicable to forcemain or siphon only)".
2. Municipal Stormwater Management System;
    a. Stormwater management report (including lot level and conveyance controls);
    b. A description of the water quality and quantity criteria;
    c. Hydraulic performance of the system verifying Storm Sewer capture rates and major and minor system capacities;
    d. "Oil / grit separators: design brief, calculations and manufacturers specifications (applicable to oil / grit separators only)".
3. Sewage pumping stations;
    a. Buoyancy calculations; forcemain hydraulic calculations; assessment of transient pressures; wet well and emergency storage tank sizing; design flows and firm capacity; headworks;
    b. Electrical systems including standby power; controls and instrumentation description including alarms;
    c. HVAC systems; and hazard ratings throughout station - risk assessment; and
    d. Contingency plans for Emergency Situations.

7.1.3. The forms referenced in the Environmental Compliance Approvals (ECAs) for Sewage and Stormwater are available in the Central Forms Repository at www.forms.ssb.gov.on.ca.

8.0. Inspection and Testing for Sanitary Sewers, Storm Sewers and Forcemains

8.1. General Requirements

8.1.1. All new and replaced Sanitary Sewers, forcemains, maintenance holes, connections and chambers shall be inspected and tested to ensure integrity of the installed material for water tightness prior to placing into service.

8.1.2. All inspections and testing shall be performed as specified here in this document.

8.1.3. Inspection and testing plans including; procedure, equipment, schedule, safety requirements, and emergency response plan shall be submitted to the Owner/Operating Authority at least two (2) weeks or as required by the Owner/Operating Authority prior to the inspection or testing. Plans must be accepted by the Owner prior to proceeding with the inspection or testing.

8.1.4. The Owner and the Operating Authority shall be notified and a confirmation of receipt shall be acquired at least five (5) business days or otherwise required by the Owner/Operating Authority prior to inspection or testing.

8.1.5. All inspection reports and test results shall be provided to the Owner in a format (e.g., printed copies, PDF copies and digital files) specified by the Owner or the Operating Authority.

8.1.6. A single testing plan can be used for similar tests on the same project; however, each test shall be recorded separately.

8.1.7. Seasonal variation (e.g., spring freshet) on groundwater conditions shall be considered on selecting appropriate testing method.

8.1.8. In special circumstances, specific inspection and testing requirements may apply, refer to MECP's Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit for additional inspection and testing requirements for Sanitary Sewers, forcemains, and associated Appurtenances when;

1. Installed within areas the works would pose a Significant Drinking Water Threat; and
2. If the required separation distance from watermains and associated Appurtenances cannot be achieved.

8.2. Inspections

8.2.1. All new Sanitary Sewers including connections, Storm Sewers, and associated Appurtenances shall be inspected to confirm alignment and to ensure that the Sewer pipe is free from obstructions, debris, and defects.

8.2.2. All maintenance holes/access structures shall be inspected for any defects, leaks, debris, and to ensure proper benching.

8.2.3. Acceptable inspection methods for Sanitary Sewers, Storm Sewers, and maintenance holes include;

1. Closed-Circuit Television (CCTV) Inspection as per OPSS.MUNI 409;
2. Zoom Camera Inspections as per OPSS.MUNI 432;
3. Sonar Inspections as per OPSS.MUNI 435; and
4. Laser Inspections as per OPSS.MUNI 434.

8.2.4. All new, replaced, and rehabilitated Sanitary Sewers, Storm Sewers, and maintenance holes shall be video inspected to evaluate the physical condition and to identify any obstructions or defects. Any issues identified in the inspections shall be corrected and the respective pipe segments and maintenance holes shall be re-inspected.

8.2.5. In addition to methods outlined in section 8.2.3, maintenance holes can be inspected through visual observation. The visual observation inspections shall be completed using digital cameras and recorders and cover both surface and internal inspections. The procedure shall comply with all applicable health and safety requirements, including, but not limited to *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*

8.2.6. Sonar inspections can be used for Sanitary Sewers, and Storm Sewers under submerged and partially submerged conditions.

8.2.7. Laser inspections are recommended for more accurate measurement of defects and deflection in the Sanitary Sewers and Storm Sewers.

8.3. Leakage Testing

8.3.1. Leakage Test shall be performed on all new Sanitary Sewers and maintenance holes to ensure integrity of the conveyance system.

8.3.2. Prior to performing a leakage test, both active and inactive service connections and stubs shall be identified using dye testing or other equivalent methods.

8.3.3. All new and inactive service laterals shall be plugged using plugs designed to withstand test pressures, plugs shall be suitably braced for additional safety. All inactive service connections shall be sealed.

8.3.4. For replacements of existing sanitary sewers with active service connections that cannot be plugged to complete leakage testing:

1. The service lateral connection to the sanitary sewer shall be completed with a manufactured gasketed tee connection or a cored connection with a manufactured insert. The work shall be inspected to ensure a water-tight connection is established between the service lateral and the sanitary sewer.
2. A waterproof membrane may be wrapped around the connection point of the service lateral to the main sanitary sewer, encasing the fitting and extending around the service lateral for added protection.
3. The sanitary maintenance holes shall be externally wrapped with Waterproof membrane placed externally around all precast joints, including joints below the maintenance hole frame and cover, with a minimum 300mm wide strip.

8.3.5. Pipe sections and associated components that are subject to pressure testing shall be fully restrained against movements in the event of failure. Component that are not intended to be pressurized shall be isolated.

8.3.6. Prior to leakage testing potential risks and hazards shall be identified and appropriate safety measure shall be taken. The procedure shall l conform to all applicable health and safety requirements, including, but not limited to: *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*, and *Fire Protection and Prevention Act, 1997, S.O. 1997, C.4*.

8.3.7. The following are acceptable leakage tests for Sanitary Sewers and maintenance holes:

1. Low Pressure Air Testing;
2. Water (Hydrostatic) Testing;
3. Vacuum Testing.

8.3.8. Groundwater elevations shall be considered for selection of the appropriate testing method.

8.3.9. Low pressure air test is not recommended when groundwater elevation is 600 mm or greater above the crown of the pipe being tested at the time of testing. Where groundwater elevation is less than or equal to 600 mm test pressure shall be adjusted to compensate for ground water pressure.

8.3.10. Low pressure air testing equipment shall include a pressure relief valve set to 9 psi (max) to avoid over pressurizing.

8.3.11. Low pressure air testing procedure shall conform to:

1. OPSS.MUNI 410;
2. ASTM F1417; or
3. ASTM C924M.

8.3.12. Water test procedure shall conform to:

1. OPSS.MUNI 410; or
2. ASTM C 969.

8.3.13. Vacuum testing procedure shall conform to:

1. ASTM C1244/C1244M

8.3.14. Clean water shall be used for hydrostatic testing. Water used in the hydrostatic testing shall be disposed as per all the applicable requirements.

8.3.15. If a segment of the system fails during leak testing, source of leakage shall be identified, and all defective material shall be repaired or replaced to the satisfaction of the Owner. The repaired or replaced sections shall be retested until results acceptable to the Owner are obtained. During retesting, maintenance holes shall be tested separately to pipe Sewers.

8.4. Deflection Testing

8.4.1. A deflection test shall be completed for all new flexible Sanitary Sewers and Storm Sewers at least 30 calendar days after backfilling but prior to paving.

8.4.2. Pipe segments failing the deflection test shall be removed and replaced.

8.4.3. Mandrel testing and laser profiling are acceptable tests for pipe deflection testing.

8.4.4. Mandrel test shall be performed in accordance with OPSS.MUNI 438.

8.4.5. Laser profiling shall conform to OPSS. MUNI 434.

8.4.6. Equipment used to perform Mandrel tests shall be specifically designed for the pipe material being tested.

8.5. Hydrostatic Testing

8.5.1. Hydrostatic testing shall be performed to all new and rehabilitated/repaired forcemains in accordance with OPSS.MUNI 412 (Ontario Provincial Standards Specification, published by Ontario Ministry of Transportation) at a minimum pressure of 1.5 times the maximum operating pressure.

8.5.2. Water used in the hydrostatic testing shall be disposed to Sanitary Sewers as per all the applicable requirements for disposal.

8.5.3. The maximum pressure shall be measured and recorded at the lowest point along the length of the pipe subject to testing.

APPENDIX I

Identification of Risks to Sources of Drinking Water

Identification of Risks to Sources of Drinking Water

Components of sewage systems may present a risk to municipal drinking water sources, and therefore be subject to source protection plans made under the *Clean Water Act, 2006* (CWA). This document is intended to assist owners and operators of sewage systems to identify which components of their systems can present a risk as well as comply with relevant conditions in their Environmental Compliance Approval to protect sources of drinking water.

Introduction

The purpose of the *Clean Water Act* is to protect Ontario's sources of drinking water as part of an overall commitment to safeguard human health and the environment. Under the CWA, communities across the province are protecting their existing and future drinking water supplies through prevention – by developing collaborative, watershed-based source protection plans that are locally driven and based on science. The plans apply within 38 source protection areas across Ontario, covering the areas where 95% of the population live.

These plans identify the **vulnerable areas** around municipal drinking water sources (i.e. wells or surface water intakes) where certain activities such as operating sewage works, fuel storage or manure spreading pose a risk of contaminating the source.

You can learn more about source protection in Ontario and the locally developed source protection plans at: www.ontario.ca/page/source-protection.

Drinking Water Threats

Ontario Regulation 287/07 under the CWA lists 22 **drinking water threats**; activities that can contaminate or deplete a drinking water source. One of these activities is "**the establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage**." Depending on the circumstances, sewage works may be a **significant drinking water threat**. Every significant threat is addressed by policies in the local source protection plan.

The new Consolidated Linear Infrastructure Environmental Compliance Approvals (ECAs) for both municipal sanitary sewage collection systems as well as municipal stormwater management systems contain special requirements that apply to elements of the works that are significant drinking water threats. Whether you are designing a new sewage collection or stormwater collection system, expanding an existing system, or conducting normal operations and maintenance, it is important to be able to identify where components of your system (e.g. sanitary sewers, pumping stations, holding tanks, stormwater outfalls, etc.) may be significant drinking water threats, in order to comply with the ECA.

Below are some resources that can help you do this.

Source Protection Tools

STEP 1: Use the Source Protection Information Atlas (SPIA) to find out if the Works are located in a source protection area or vulnerable area.

- SPIA is an online mapping tool that will provide source protection details for any point or property in Ontario including the specific **source protection area, vulnerable area and vulnerability score**.
- Vulnerable areas include:
    - Wellhead Protection Areas (WHPA) around groundwater wells
    - Intake Protection Zones (IPZ) around surface water intakes
    - Issues Contributing Areas (ICA)
    - Event Based Areas (EBA)
    - Significant Groundwater Recharge Areas (SGRA) and Highly Vulnerable Aquifers (HVA)
    - Learn more about these vulnerable areas in the **Help and Resources** tab in SPIA – A Document of Definitions.

Select the link to explore SPIA: Source Protection Information Atlas

Learn more about source protection **vulnerable areas** in the Help and Resources tab in SPIA

- Vulnerability score:
    - An assigned number (2 to 10) which indicates how vulnerable (i.e. sensitive) the drinking water source is to contamination.
    - The vulnerability of a drinking water source is affected by the natural characteristics of the system, such as the type of soil and rock in the area, how quickly water can travel through it, the type of source (e.g. lake or river), water flow and wind conditions, rainfall, the slope of the land, land cover, soil type and the source vulnerability (e.g. depth of intake or well, distance from shoreline).
    - Generally, the higher the vulnerability score, the more sensitive the drinking water source.

- You can use SPIA to determine the vulnerable areas and vulnerability score for a single point (e.g. a pumping station) or an **entire** property (e.g. a wastewater treatment plant). There may be more than one vulnerable area or vulnerability score within a single property.
- SPIA will provide a link to the local source protection plan for any result within a source protection area.
- If you have questions or require assistance using SPIA, use the **Help and Resources** tab at the bottom of the SPIA page.

STEP 2: Use the Threats Tool to find out if the Works pose a risk to sources of drinking water.

- The 22 prescribed drinking water threats are categorized into threat subcategories in the Tables of Drinking Water Threats, which are amended from time to time. These tables set out the circumstances including **vulnerability scores**, where activities pose a risk to drinking water.
- The Threats Tool is an interactive online tool that allows users to quickly search the Tables of Drinking Water Threats.
- The Threats Tool was created to allow users to easily identify significant, moderate or low threats to municipal drinking water sources.
- This Tool allows users to search the Tables of Drinking Water Threats by:
    - Vulnerable zone (WHPA, IPZ) and vulnerability score
    - Threat category (i.e. sewage) and subcategory (e.g. sanitary sewers)
    - Parameters of concern (chemical and pathogens).

Access the Threats Tool here: http://swpip.ca/

Alternatively, you can use the Help and Resources link in the Source Protection Information Atlas

- Search the Threats Tool for the current or proposed sewage works using the *Search* function. For Works eligible for pre-authorization, the currently applicable subcategories under the sewage threat are below:
    - Wastewater Collection Facilities and Associated Parts: Sanitary Sewers (includes sanitary forcemain, rising main, gravity sanitary sewer, or partially separated sanitary sewer that forms part of a wastewater collection facility, not including its appurtenances);
    - Sewage Pumping Station or Lift Station Wet Well, a Holding Tank or a Tunnel that store sewage;
    - Combined Sewer Overflow (CSO) outfall, a Sanitary Sewer Overflow (SSO) from a manhole or a sewage pumping station overflow (PSO) from a wet well;
    - Stormwater drainage system or stormwater management facilities including Low Impact Developments (LID) and outfalls.

- Search for **significant, moderate and low threats** in both the chemical and pathogen table.
- The results will show which **vulnerable area** and **vulnerability score** the chemical and / or pathogen is a significant drinking water threat. For example:
    - Sanitary sewers and associated parts are a significant drinking water threat when located in wellhead protection areas (WHPAs) scoring 10, as well as in certain kinds of Issue Contributing Areas (nitrogen, phosphorus, *E. coli*) and Event Based Areas (sanitary trunk sewer breaks).
    - Stormwater Management Facilities and Drainage Systems outfalls may be a significant

threat when located in surface water intake protection zones (IPZs / WHPA-Es) scoring 8 or greater, or when located in WHPAs scoring 10 depending on the Storm Water Management Facility associated land uses and proportion of impervious areas, as well as certain Issue Contributing Areas.

- Alternatively, you can search by vulnerable area to see which activities would be significant drinking water threats.
- Please note that the above guidance reflects the 2021 Technical Rules which are amended from time to time.

Consider the **vulnerable areas** and **vulnerability scores** at your site and any overflow or discharge locations against the circumstances specified for drinking water threats to assess if the Works are a significant, moderate or low drinking water threat at that location.

Issues Contributing Areas (ICA) are vulnerable areas associated with groundwater or surface water systems, WHPA-ICA or IPZ-ICA, respectively, where activities and conditions may contribute to a parameter of concern identified in the raw water. Certain types of sewage works can contribute to the parameter of concern (chemical or pathogen) and can be either a low, moderate, or significant threat within the protection zone where the ECA activities are located. If the parameter causing the issue is associated with the sewage works proposed at the site – namely chloride, sodium, nitrogen, phosphorus and *E. coli* for Stormwater Management Facilities and Drainage Systems, and nitrogen, phosphorus and *E. coli* for sanitary sewers, sewage pumping stations and CSOs – then the activity typically poses a significant threat **regardless** of the vulnerability score. Check the Assessment Report and Source Protection Plan to confirm any local refinements to the list of activities that may contribute to an issue.

If you have any questions, or need assistance during the threat assessment, please contact the source protection authority listed in the plan for assistance. Additionally, **Conservation Ontario** has resources available at https://conservationontario.ca/conservation-authorities/source-water-protection.

The location within a vulnerable area (e.g. WHPA-A score 10) and type of work (e.g. sanitary sewers and associated parts) and the risk associated with the Works (i.e. significant, moderate or low drinking water threat) can be used for the source protection reporting requirements within your ECA as included in **Section 7** (7.2) of the Sanitary Sewers ECA or **Section 8** (8.2) of the Stormwater ECA.

STEP 3: Check the Source Protection Plan

Access Conservation Ontario's Source Protection Plans and Resources

- If you have determined that one or more of your sewage system components are a significant drinking water threat within your municipality after using SPIA and the Threats Tool there may be source protection policies which apply.
- Use the **source protection area** identified on SPIA to look up the corresponding **Source Protection Plan** to see what policies may apply.
- Source protection plans contain policies for the activities that pose a significant risk to drinking water. The Plan may also contain policies for activities that pose a moderate or low risk.
- Determine if there are any source protection plan policies which relate to your proposed Works (there may be more than one).
- If you have questions regarding the source protection plan policies, please contact the Source Protection Authority listed in the plan for assistance.

STEP 4: Incorporate features into the Works to mitigate risks to sources of drinking water

- If any of the works are a significant drinking water threat and source protection plan policies apply, features should be incorporated in the design, operation, and maintenance that mitigate the risk to drinking water sources as indicated in your ECA, such as:
    - Adopting design, construction, operation and maintenance considerations included in the ministry's Standard Operating Policy for Sewage Works (section 1.2.8) and implementing any actions summarized in the Standard Operating Policy for Source Protection Prescribed Instruments published on the Environmental Registry (posting #012-2968), as amended from time to time. The Sewage SOP was developed in 2014, reflecting the Technical Rules and drinking water threat circumstances in effect at that time and is available using the archive search tool.
    - Features and considerations included in the MECP Design Criteria document section 1.3 – Protection of Water Supplies
    - Any source protection plan policy requirements pertaining to the Works
- MECP includes **guidelines and conditions** for significant drinking water threats as part of its provincial obligations under source protection plan policies:
    - For **new, altered or modified works**: refer to the design criteria guidelines for significant drinking water threats. This may include requirements for operations, maintenance, record keeping, and reporting.
- Fulfil reporting and other requirements included in your ECA including those in **Section 7** (Sanitary Sewers ECA) or **Section 8** (Stormwater ECA) for the protection of drinking water sources.

APPENDIX II

Source Protection
Standard Operating Policies

Ministry of the Environment and Climate Change's Source Protection Standard Operating Policies

The EBR Registry Number 012-2968 provides information on the Standard Operating Policies ("**SOPs**") developed by the Ministry of the Environment and Climate Change ("**ministry**") to support the ministry's implementation of source protection prescribed instrument policies. The content of the SOPs for ensuring approvals for waste, sewage works, hauled sewage, water taking and land application of pesticides **conform with policies in source protection plans** are summarized below**, noting that where a prohibition policy applies, the ministry will refuse the application as is legally required**. The ministry will apply the SOPs on a province-wide basis, to ensure a consistent approach to implementing source water protection policies.

This document has two sections: the first section provides a summary of the ministry actions to be taken to conform with source protection prescribed instrument policies for significant threat activities (otherwise known in the **Clean Water Act, 2006** ("**CWA**") as significant threat policies), and the second section provides a summary of the ministry's actions to be taken to have regard to policies that govern moderate and low threat activities (otherwise known as moderate and low threat policies).

The threat activities listed below are defined in the ministry's Table of Drinking Water Threats ("**Table**"). This Table was prepared and released as part of the Director's Technical Rules issued under section 107 of the CWA.

The Risk Management Measures Catalogue ("**RMMC**") provides means to determine which management measure(s) and management targets is/are suitable to effectively manage a specific threat to the quality or quantity of source water, allowing the user to take local conditions into consideration.

Section 1: Summary of Ministry Actions to be taken to Conform with Source Protection Prescribed Instrument Policies for Future Significant Threat Activities

Waste Disposal Site Prescribed Threat Activities

Threat activities:

- Landfarming Petroleum Refining Waste, threat #1a
- Landfilling (Hazardous Waste and Liquid Industrial Waste), threat #1b
- Landfilling waste from municipal sources, threat #1c
- Landfilling Industrial and Commercial waste, threat #1d
- Liquid Industrial Waste Injection into a Deep Well Disposal Site, threat #1e
- Storage of Hazardous/Liquid Industrial Waste at Waste Disposal Sites, threat #1g

- Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste or clause (d) of the definition of liquid industrial waste (under Regulation 347), threat #1h

Prescribed Instrument:

An Environmental Compliance Approval ("**ECA**") under Part II.1 of the *Environmental Protection Act* ("**EPA**") for activities under s.27 of the EPA.

Standard Operating Policy:

The ministry screens ECA applications for waste disposal sites to identify if the site is located in a vulnerable drinking water area and if the activity meets the circumstances to be considered a significant threat to drinking water.

A stringent site-specific technical review is conducted to ensure that waste disposal facilities are designed and operated in a manner that meet regulatory, guidelines and best management practices. The ministry's assessment of the proposal is clearly documented which includes how the activity meets the ministry's requirements and how the Statement of Environmental Values were considered. The technical review in conjunction with imposing conditions in an ECA related to design, environmental monitoring, reporting and trigger mechanisms and contingency plans, provide comprehensive controls that ensure regulated waste management activities do not become significant drinking water threats. Where proposals do not meet these requirements, the ECA application will be refused.

When a source protection policy requires risk management of a waste prescribed significant threat activity, the ministry will apply current program and regulatory standards when making a decision on the ECA.

Details and Rationale:

For significant drinking water threat activities, the *Environmental Assessment Act* ("**EAA**") process (where it applies), the requirements for an ECA under the EPA and requirements under existing regulations and guidelines are comprehensive and adequately address the objectives of the source protection policies.

The EAA sets out a planning and decision-making process to evaluate the potential environmental effects of a proposed project before any decisions are made to proceed with the project. Since March 2007, certain private and public sector waste management projects are subject to the EAA through the Waste Management Projects Regulation (O. Reg. 101/07). The level of assessment required depends on the project's expected environmental effects. Projects subject to an environmental assessment (EA) cannot obtain an ECA to engage in the waste management activities until the requirements of the EAA have been met. As part of the EA process, proponents are required to:

- anticipate environmental, social, economic and cultural consequences of a proposed project or activity (i.e. siting considerations, effects on surface and/ groundwater quality, quantities and flow, commitments to monitoring of discharges and emissions);
- assess plans to manage any potential environmental effects resulting from the proposed project or activity (i.e. development of mitigation measures); and,
- allow for the involvement of the public and government agencies in the review of the proposed project or activity.

The EPA, specifically section 27 (under Part V), requires proponents to obtain an ECA from the ministry prior to using, operating, establishing, altering, enlarging or extending a waste disposal site. The ECA includes stringent conditions that:

- identify the maximum volume and design requirements for the waste disposal site;
- approve a closure plan for the site or require a detailed closure be submitted based on the conceptual closure plan included in the site's Design and Operations Plan;
- approve plans such as Environmental Monitoring Plans, trigger mechanism plans, and contingency plans to ensure the long-term protection of the environment;
- require record keeping, inspections (daily, monthly and annual) and the submission of an annual report;
- state the ministry's requirements for buffer lands, and includes appropriate setbacks from wellheads or intake zones, as appropriate;
- require financial assurance (for privately owned sites) to ensure that if a proponent is unable or unwilling to meet their responsibilities for the site or whether the site is abandoned, the site is properly closed and maintained to ensure it does not pose a risk to the environment, including drinking water sources.

Existing program and regulatory requirements for the approval of waste disposal sites are consistent with the significant threat prescribed instrument policies. Therefore existing program requirements conform with source protection risk management policies.

The Risk Management Measures Catalogue ("**RMMC**") provides a means for a user to determine which management measure(s) and management targets is/are suitable to effectively manage a specific threat to the quality or quantity of source water, allowing the user to take local conditions into consideration. The RMMs were reviewed to determine if they are consistent with waste disposal site designs typically approved by the ministry. Site specific design criteria are submitted to the ministry with an application for a prescribed instrument (i.e. an ECA), as prepared by a Qualified Person (e.g. Professional Engineer).

Ministry Policy and Guideline Framework for each Waste Sub-threat Activity:

Waste Sub-threat Activity	Ministry's Policies and Guidelines
Landfarming Petroleum Refining Waste, threat #1a	• Section 27 of the EPA requires that an ECA be obtained from the ministry prior to using, operating, establishing, altering, enlarging or extending a waste disposal site. • To obtain an ECA for a new Landfarming Petroleum Refining Waste site, detailed technical assessments of the site must be carried out to identify any potential effects on the environment including groundwater, surface water, air and soil to show how these potential effects can be satisfactorily addressed (review completed by the ministry's regional technical support section and/or Environmental Approvals Branch review engineer(s)). • Regulation 347 (General Waste Management) made under the EPA, was amended in 2005 to establish a land disposal restrictions ("**LDR**") program in Ontario. Under these rules, hazardous wastes that are to be land disposed must be treated to meet prescribed treatment requirements prior to land disposal. • The ministry's LDR program prohibits the direct disposal of hazardous waste to land without meeting the treatment standards within Regulation 347. • The ministry receives very few ECA applications related to landfarms. • Hydrogeology and surface water studies would be a component of the application. During the technical review, site specific conditions may be included in the ECA to ensure that each specific site has adequate measures to protect drinking water sources including monitoring plans, inspection procedures, reporting requirements and contingency measures.
Landfilling Hazardous Waste and Liquid Industrial Waste, threat	• The EAA provides for the analysis of impact assessment, conservation and wise management of Ontario's environment by establishing a responsible

#1b	and accountable process for decision-making before a project is undertaken. Key components of an environmental assessment ("**EA**") include the mitigation and management of potential environmental impacts. The EA process for a proposal such as a Hazardous and Liquid Industrial Waste Disposal Site includes consideration and evaluation of alternatives. • Waste Management Projects are subject to O. Reg.101/07 made under the EAA. This regulation describes the waste management projects that are designated by the regulation and subject to the EAA and EA requirements. Under the regulation, waste management projects may be required to undertake an Individual EA or an Environmental Screening Processes ("**ESP**") to ensure that the intent of the EAA is met. • New landfills or expanding landfills that are proposed to have waste disposal volumes of less than 40,000 m^3 are not designated under the EAA. These landfills are required to meet the requirements of the EPA Regulation 347 (General Waste Management). • For landfills subject to the EAA requirements, numerous technical studies and impact assessments are required to be completed. This includes a hydrogeological assessment, surface water assessments and geotechnical assessments. Section 6 of the Landfill Standards and A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites (PIBS 3651E), outline the type of technical studies required. • **Hazardous and Liquid Industrial Waste Disposal (Landfill) Sites** are subject to Part V of the EPA and applicable regulation made under the Act (i.e. Regulation 347 and O. Reg. 232/98). Section 27 of the EPA requires that an ECA be obtained from the ministry prior to using, operating, establishing, altering, enlarging or extending a waste disposal site. The EPA is the overarching legislation that provides the basic legislative framework for waste management in Ontario. These landfills may also have requirements under the *Ontario Water Resources Act* ("**OWRA**").

	An application to obtain an ECA for a new or expanding landfill site must include reports that address the detailed technical assessments of the site carried out to identify any potential effects on the environment including groundwater, surface water, air and soil to show how these potential effects can be satisfactorily addressed. **Applicability of Regulation 232/98, under the EPA** • O. Reg. 232/98, Landfilling Sites contains comprehensive landfill standards that include requirements for site design, operation, closure, post-closure care and financial assurance. **Applicability of Regulation 347, under the EPA** • Regulation 347 is the general waste management regulation that provides an overview of waste management in the Province. **Guidelines** • Guideline B-7: Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities establishes the basis for determining the "reasonable use" of groundwater on property adjacent to sources of contaminants and for determining the levels of contaminant discharges considered acceptable by the ministry. The Guideline applies to matters which fall under the authority of the EPA and OWRA.
Landfilling waste from municipal sources, threat #1c and Landfilling Industrial and Commercial waste, threat #1d	• Source protection policies were reviewed and it was determined that the ministry's current regulatory framework for municipal/industrial/commercial landfills meets the policy requirements. The current framework for waste threats #1c and #1d is the same as waste threat #1b described above.
Liquid Industrial Waste Injection into a Deep Well Disposal Site, threat #1e	• A waste disposal site ECA for activities under section 27 of Part V of the EPA is required for deep well injection of waste, except for oil field brine disposal which is regulated by the Ministry of Natural Resources

	and Forestry (MNRF) through the *Oil, Gas and Salt Resources Act*. • The ministry regulates deep well injection of waste through the Deep Well Disposal Regulation (Regulation 341) and Regulation 347 under the EPA. • Under Regulation 341 of the EPA, operators of a waste well disposal must provide the ministry's local district office Director with monthly reports showing the source, volume and chemical composition of the wastes received at the site, and the volume of wastes discharged into the well. • Regulation 347 was amended in 2005 to establish a Land Disposal Restriction (LDR) program in Ontario. Under these rules, hazardous wastes that are to be land disposed must be treated to meet prescribed treatment requirements prior to land disposal. • The ministry's LDR program prohibits the direct disposal of hazardous waste into deep wells without meeting the treatment standards within Regulation 347. This will not affect the disposal of non-hazardous fluids such as brine. ***Oil, Gas and Salt Resources Act*** • MNRF regulates disposal of brine through the *Oil, Gas and Salt Resources Act* (the disposal of brine is exempt from the EPA, and only regulated by MNRF if re-injected in wells). • Currently, there are no ministry approved deep well disposal sites operating in Ontario. The last two (2) ministry-approved deep well disposal sites were plugged in 2013.
Storage of Hazardous/Liquid Industrial Waste at Waste Disposal Sites, threat #1g	• Waste management projects are subject to O. Reg. 101/07 made under the EAA. This regulation describes the waste management projects that are designated by the regulation and subject to the EAA and EA requirements. Under the regulation, waste management projects for the storage of waste at transfer/processing sites may be required to undertake

	the Environmental Screening Process to ensure that the purpose of the EAA is met. • The EPA is the overarching legislation that provides the basic legislative framework for waste management in Ontario. Hazardous Waste and/or Liquid Industrial Waste Transfer and Processing Sites, Municipal Hazardous and Special Waste Depots (MHSW Depots) and hazardous waste thermal treatment facilities (all sites where storage of hazardous and liquid industrial occurs) are subject to Part V of the EPA and the regulations made under the EPA. • Section 27 of the EPA requires that an ECA be obtained from the ministry prior to using, operating, establishing, altering, enlarging or extending a waste disposal site. • Storage of hazardous waste and liquid industrial waste by a generator for more than 24 months requires an ECA (per section 17.2 of Regulation 347). • To obtain approval for a new Hazardous Waste Transfer and Processing site, MHSW Depot and /or Hazardous Waste thermal treatment facility, a technical assessment of the site must be carried out to identify any potential effects on the environment including groundwater, surface water, air and soil to show how these potential effects can be satisfactorily addressed. **Regulations and Guidelines** Regulations and guidelines for storage of hazardous waste and/or liquid industrial waste at transfer/processing sites include: • Regulation 347 limits the mixing, blending, bulking, etc. of hazardous waste. • Household Hazardous Waste Collection and Facility Guidelines, 1993. • Ministry's Guidelines of "Environmental Protection Measures at Chemical and Waste Storage Facilities", 2007.

	Technical Review Approval Process • The ministry's review engineers/evaluators with knowledge of hazardous waste and liquid industrial waste storage activities are assigned to review ECA applications for these proposed activities. Applicants of proposed hazardous waste and liquid industrial waste storage sites are required to submit supporting documentation, including storm water management plans, secondary storage containment plans, emergency spill procedures and contingency measures. • Review engineers will impose site specific terms and conditions in the ECA to ensure that each specific site has adequate measures to protect drinking water sources.
Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste or clause (d) of the definition of liquid industrial waste (under Regulation 347)*, threat #1h	The source protection policies were reviewed and it was determined that the ministry's current regulatory framework for storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste or clause (d) of the definition of liquid industrial waste (under Regulation 347)* meets the policy requirements. The current framework for waste storage threats #1h is same as it is for hazardous waste storage threat #1g.

* For reader clarity, the sub-threat 1h, "Storage of wastes described in clauses (p), (q), (r), (s), (t) or (u) of the definition of hazardous waste or clause (d) of the definition of liquid industrial waste" is storage of non-hazardous waste at transfer/processing sites.

Clauses (p), (q), (r), (s), (t) or (u) of the definition of "hazardous waste" or clause (d) of the definition of "liquid industrial waste" ("Small Quantity Wastes") are time-accumulating and amount thresholds that determine how a waste is classified in Regulation 347. Generally, these clauses state that small amounts and/or accumulation of inherently hazardous waste can be managed as non-hazardous waste for the purposes of waste management. For the purposes of Source Protection, these materials can be a threat to drinking water.

Sewage Prescribed Threat Activities

Threat activities:

- Combined Sewer discharge from stormwater outlet to surface water, threat #2a
- Discharge of stormwater from a stormwater facility, threat #2b
- Industrial sewage effluent discharge, threat #2c
- Sanitary sewers and related pipes, threat #2d
- Septic system, threat #2e
- Sewage Holding tank, threat #2f
- Sewage Treatment Plant bypass, threat #2g
- Sewage Treatment Plant effluent discharge (includes lagoons), threat #2h
- Storage of Sewage, threat #2i
- Sewage – Mine tailings, storage, treatment and discharge, threat #1j

Prescribed Instrument:

ECA under Part II.1 of the EPA for activities under s.53 of the OWRA

Standard Operating Policy:

For sewage works governed by ECAs where the sewage works are located in areas where they are significant drinking water threats, the ministry will conform with source protection policies by applying design and operational measures (identified in the table below) to an ECA to manage the threat. The ministry has also introduced a new requirement for ECA applicants to submit a Source Protection Supplementary Report to outline how the activity for the sewage works is being managed and mitigated so that the activity will not become a significant drinking water threat. These requirements follow a precautionary and pollution prevention approach and will be applied on a consistent province-wide basis to protect drinking water sources. Some of the requirements identified below are currently implemented by the ministry on a site-specific basis. However, the ministry will now apply these requirements whenever the proposal would be considered a significant drinking water threat activity. The "General" section of the table is applicable to all sub-threat activities identified in the Table.

Sewage works that are significant threats to drinking water are not eligible for processing under the Transfer of Review Program. Only applications for approval of sewage works that have low technical complexity and low potential for significant environmental or public health impact and that are proposed to be located within certain designated municipalities are eligible to be processed under this program. An ECA application for sewage works that is excluded from the Transfer of Review Program must be submitted directly to the Environmental Approvals Access and Service Integration Branch of the ministry for review and processing. For additional information on the Transfer of Review Program, please refer the ministry's "Guide to Applying for an Environmental Compliance Approval, 2012".

Ministry staff are currently screening ECA proposals for sewage works to identify if the site is located in a vulnerable drinking water area and if the activity meets the circumstances as a significant threat to drinking water. Guidance documents will be developed and/or updated to outline the ministry's ECA requirements for source protection.

Sewage Sub-Threat Activity	Requirements for ECA Applications
General (applicable to all sewage works included within this table)	In order to prevent potential risks from becoming a significant drinking water threat, the ministry is implementing the following requirements for the establishment of sewage works where the works have been identified as a significant drinking water threat. **Design Requirements** • Design must include a Source Protection Supplementary Report that demonstrates that the proposed design recognized the significant drinking water threat and has implemented mitigation measures to protect drinking water sources. The report should identify drinking water sources, how the sewage works has met the requirements of the CWA and the ministry's design and operational requirements and how the works considered the Risk Management Measures Catalogue (e.g., monitoring, reporting requirements), as amended, to address the risks • Designs must be accompanied with a monitoring and reporting plan. • Designs must be accompanied with a Spill Prevention and Contingency Plan, covering information requirements as per O.Reg. 224/07 to prevent, eliminate or ameliorate any adverse drinking water effects that result or may result from spills of pollutants. This includes steps taken in the event drinking water sources are contaminated for example, notifying members of the public who may be directly affected by a spill. **Operational Requirements** • The Spill Prevention and Contingency Plans must be kept up-to-date. • Regular and annual reports to include maintenance, inspections, and monitoring details.

	• All reports are required to be kept onsite (where the reports can be kept on-site) and at the operating authority's office. • All reports are required to be made readily available upon request by ministry staff, Source Protection Authority or any other parties identified in Source Protection Plans.
Stormwater management works	**Design Requirements** • Design must be based on providing Enhanced Level water **quality** control as per the ministry's Stormwater Management and Planning Manual, 2003. • Design must include an additional 20% water **quantity** control in addition to the requirements of the ministry's Stormwater Management and Planning Manual. • Design must be accompanied with erosion and sediment control measures to cover all phases of construction. **Operational Requirements** • The erosion and sediment control measures plan must be kept up-to-date with records of inspections and maintenance made available for inspection by the ministry. • The monitoring and reporting plan must be kept up-to-date and on-site or at the operating authority's office.
Combined sewers	New combined sewers are currently prohibited per the ministry's Design Guidelines for Sewage Works, 2008 and Procedure F-5-5. Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems are outlined in Procedure F-5-5. Combined sewer outflows are to be reported to the Spills Action Centre as per the obligations under Part X of the EPA. **Design Requirements** • Same as "General" section. **Operational Requirements** • Operational procedures established to include closed-circuit television (CCTV) inspections every 5 years with records made available for inspection by the ministry.

Sanitary sewers and related pipes	**Design Requirements** • New and replacement sewers are to be constructed of materials and with joints that are equivalent to watermain standards of construction and are to be pressure tested in accordance with Division 441 (formerly 701) of the Ontario Provincial Standards Specification (OPSS). **Operational Requirements** • Operational procedures established to include CCTV inspections every 5 years with records made available for inspection by the ministry.
Sewage treatment plant discharge via bypass	**Design Requirements** • Appropriate sizing to reduce bypasses-in adherence to the ministry's Sewage Works Design Guideline (2008) and provisions of Procedure F-5-5 and F-5-1. **Operational Requirements** • Response plan for unplanned bypasses.
Sewage treatment plant – storage/holding tanks	**Design Requirements** • Same as "General" section.
Sewage treatment plant effluent (including lagoons)	**Design Requirements** • Appropriate sizing to reduce bypasses-in adherence to the ministry's Sewage Works Design Guideline, 2008 and provisions of Procedure F-5-5 and F-5-1. • Design must include an inspection/maintenance frequency and strategy to prevent unplanned bypasses. • Response plan for pre-mature effluent discharge (i.e. in the event of seasonal lagoons).
Industrial effluent discharge	**Design Requirements** • Designs must include an industrial sewage discharge flood protection and risk assessment report, considering the 1:200

	year storm event, or an additional 0.5 metres freeboard elevation on any lagoon or wastewater containment area. • Decommissioning plan for every component of the sewage system. • Design must include a contingency plan for responding to effluent quality not complying with effluent criteria.
Industrial effluent discharge – mine tailings	**Design Requirements** • Designs must include an industrial sewage discharge flood protection and risk assessment report, considering the 1:200 year storm event, or an additional 0.5 metres freeboard elevation on any lagoon or wastewater containment area. • Design must include a contingency plan for responding to effluent quality not complying with effluent criteria. • Response plan for pre-mature effluent discharge (i.e. in the event of seasonal discharge from tailing ponds).
Onsite sewage systems	In order to prevent potential groundwater and shallow groundwater contamination and risks from becoming a significant drinking water threat, the establishment of all new onsite sewage systems must adhere to the following criteria. **Design Requirements** • Design must comply with site specific effluent requirements (objectives, limits, triggers, monitoring, reporting, contingencies, etc.) as established at early stage during pre-application consultation with ministry District/Regional Offices. **Operational Requirements** • Maintenance inspections by a qualified person. • Operational plan, which at a minimum shall include, but not limited to: o Pump out and inspection of sewage underground tanks (including septic, balancing tanks, etc.) of each sewage system identified as moderate and high risk in the Sewage System Assessment Report.

	○ Hydraulic test to assess for any leakage at the time of the pump out. ○ Removal of any trees, where they or their roots, are growing in the leaching beds. ○ Preparing public information brochure for distribution (in cases of larger sites with more than one resident on site) regarding taking care of septic systems. ○ Prohibit the construction of any structures such as decks, patios, or sheds over the disposal fields, as well as there should be no parking or driving vehicles over the surface of disposal fields and over any other components of the onsite sewage system.
Holding tanks	The ministry will not issue approvals for new underground holding tanks as current design and operational measures are not sufficient to ensure the activity will never become a significant drinking water threat. The proponent may only consider installation of above-ground tanks in compliance with the current requirements for holding tanks (Ministry Guideline F-9 and Ontario Building Code -OBC), subject to a site-specific review. **Design Requirements** • Same as "General" section. **Operational Requirements** • Inspections of holding tanks every five (5) years for assessment of holding tanks structural integrity including a hydraulic septic test to assess for any possible leakage, and complete with a written assessment and recommendations.

Hauled Sewage Prescribed Threat Activities

Threat activity:

- Application of hauled sewage to land (waste subthreat #1i)

Prescribed Instrument:

An ECA under Part II.1 of the EPA for activities under s.27 of the EPA.

Standard Operating Policy:

The application of hauled sewage to land in locations where it would be a significant drinking water threat cannot be adequately managed with an ECA, such that the activity would never become a significant drinking water threat. To conform with significant threat prescribed instrument policies, the ministry will not approve the land application of untreated hauled sewage in areas where it has been identified as a significant drinking water threat.

Details and Rationale:

Ministry experts determined that ECA terms and conditions could not adequately manage the land application of hauled sewage activity to ensure the activity never becomes a significant drinking water threat. This approach will address all of the parameters of concern associated with untreated hauled sewage as identified under the CWA (pathogens, nitrates and phosphorus).

Pesticides Prescribed Threat Activities

Threat activity:

- Application of Pesticides to Land, threat #10

Prescribed Instrument:

Pesticide permits for land exterminations issued under section 7 of the Pesticides Act are identified as Prescribed Instruments under the CWA.

Standard Operating Policy:

For activities that are identified as significant drinking water threats, the ministry will:

- ensure the permit includes appropriate terms and conditions that address emergency response measures and spill contingency plans for any pesticide

mixing, loading, and handling related to the proposed pesticide treatment which are protective of drinking water sources.

- ensure the permit includes applicable terms and conditions related to site specific setbacks to watercourses, timing restrictions (including consideration of weather events) and spills/runoff management or other measures necessary to manage the significant threat activity in order to protect sources of drinking water.

The additional terms and conditions will be included on all permits where the land application of pesticides is considered a 'significant' drinking water threat.

Details and Rationale:

The ministry will manage significant drinking water threat activities by including appropriate terms and conditions in all permits where the land application of pesticides is a significant drinking water threat.

These conditions will address emergency response measures and spill contingency plans as well as consideration for other measures necessary to manage the significant threat activity. Including these additional terms and conditions will help ensure broader environmental protection from the handling and use of pesticides and ensure a consistent approach to protecting source water across the province.

Permit to Take Water

Threat activity:

- An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body, threat #19

Prescribed Instrument:

Section 34 of the Ontario Water Resources Act, with respect to the permits to take water" is defined as a prescribed instrument by s.1.0.1, O. Reg. 287/07 (General) under the CWA.

Standard Operating Policy:

No instrument changes are required at this time to address source protection prescribed instrument policy requirements. However, the ministry is engaged in a broader review of how information generated through the source water protection planning process can enhance a proponent's development of, and subsequent ministry review and evaluation of, water taking proposals that are subject to regulation by a permit. Pending the outcome of this review, best available science would be considered by proponents and

qualified person experts when preparing applications as well as by the ministry in the permit decision-making process, particularly those for higher risk groundwater takings.

Details and Rationale:

A Permit to Take Water (PTTW) Director, when considering an application for a PTTW, is required under section 4, O. Reg. 387/04 (Water Taking), under the OWRA, to consider issues, including those relating to water availability, such as may concern municipal residential drinking water systems and any planned municipal use of water that has been approved. A PTTW Director is provided statutory discretion to impose terms and conditions deemed proper to safeguard Ontario waters. The current administration of the PTTW program implements requirements prescribed by prevailing statute, regulation and program policy, and in doing so ensures future proposed and existing water takings which are subject to PTTW are not significant drinking water threats.

As specific examples of this, a signing Director considering an application for a PTTW is required by regulation to consider matters that include but are not limited to those relevant to source protection policies such as:

- the need to sustain ecological and hydrological integrity of key hydrologic features, functions and aquatic systems,

- the need for implementation of water conservation and efficient use measures, and
- the need to protect existing and approved future municipal water supply (i.e., ensure municipal water supply requirements are not interfered with by other permitted water takings.

Therefore, no changes to the terms and conditions already included in PTTWs instrument are recommended to further control water taking in geographic areas identified as significant drinking water quantity threats recognizing that the broader review of how source protection water quantity information can be factored into the PTTW application and decision-making processes is underway.

Section 2: Summary of Ministry Actions to be Taken to Have Regard To Source Protection Prescribed Instrument Policies for Moderate and Low Threat Activities

It has been determined that the ministry's review and approval processes for instruments that manage moderate and low drinking water threats for waste, sewage, water taking and application of pesticides drinking water threat activities, are adequate to meet the requirements of source protection prescribed instrument policies. For activities that are identified as moderate or low drinking water threats, no additional measures beyond the existing approval requirements are required.

However, for moderate and low drinking water threats for the application of hauled sewage to land threat activities, the ministry's SOP does identify review and approval process changes.

Hauled Sewage Moderate and Low Threat Activities SOP

If the ministry issues an ECA authorizing the land application of hauled sewage in locations where the activity would be a moderate or low threat, it will include terms and conditions that require the site to be designed, constructed and operated in a manner that meets acceptable standards that are protective of the environment and drinking water sources. The ministry is strengthening application and review requirements in these locations.

Updated requirements for surface application will include:

- a supplemental application checklist
- the ECA will:
    - be issued for less than 2 years duration
    - include terms and conditions that address spill prevention procedures
    - restrict land application activities to sites meeting specified standards relating to: maximum permitted slope, soil permeability requirements, minimum setbacks, storage requirements, prohibition on winter spreading and record keeping requirements.

Updated requirements for dewatering trenches will include:

- a supplemental application checklist
- the requirements of the ministry's "Draft Guide to Disposal of Septage in Dewatering Trenches, Ministry of the Environment, September 2008"
- the ECA will:
    - include terms and conditions that require the facility to be designed, constructed and operated in compliance with specific standards including maximum permitted slope, soil permeability requirements, minimum setbacks to surface water and to wells, storage and maximum application rate requirements,
    - include terms and conditions that require the facility to be closed as per the site specific closure plan.