



Section E – Force mains and Appurtenances

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E1.00 General

Force mains are a part of the wastewater collection system designed to meet the wastewater flow requirements for each area or subdivision. The design of force mains needs to consider current collection requirements as well as future, where collection network extensions are made to accommodate adjacent or external areas.

All force mains and appurtenances shall be installed at the minimum covers specified in this section. In areas where the minimum cover cannot be achieved, special provisions shall be considered to protect the pipe from live loading and freezing.

The force main shall be sized to accommodate the peak design flow produced by the pumping station pumps and be designed in accordance with MECP guidelines.

Where applicable, force mains shall be designed in accordance with the latest edition of the Design Criteria for Sanitary Sewers, Storm Sewers, and Force mains for Alterations Authorized under an Environmental Compliance Approval, MECP.

Final approval to construct the Works will not be given until the Township and the Township's consulting engineers have accepted the Works.

Record Drawings of the force main shall be provided to the Township within 90 days of the force main being in service.

E1.01 Confirmation of Available Capacity

As part of the pre-consultation process and prior to the commencement of any design, the Developer and / or Designer must contact the Township and confirm if there is adequate capacity in an existing pumping station and the associated force main or receiving wastewater treatment plant to accommodate the proposed project.

E1.02 Service Area

Systems shall be designed to service all areas within the catchment area to the maximum future development in accordance with the Official Plan.

E1.03 Force main Pressures

The maximum sustained operating pressure shall not exceed 700 kPa (100 psi).

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E2.00 Force main Design**E2.01 General**

The standard drawings depict, in part, the Township's requirements for locations and methods of construction. These standards will form part of the engineering drawings. The Township must approve any variation from these standards.

E2.02 Location in Right-of-way

Depending on the location of the pumping station and the discharge location of the force main, the force main may be located within ROWs similar to the water mains shown on the Township's standard roadway cross-section drawings. The force mains may also run within blocks depending on station and discharge locations.

Force mains shall be installed as per OPSS 412.

E2.03 Material Specifications

Force main pipes up to and including 600 mm diameter shall be C900 Class 235 rated PVC pipe with rubber gasket joint fittings, manufactured in accordance with the latest edition of AWWA C900. Pipe fittings shall be cast or ductile iron, cement lined manufactured to AWWA C110. All fittings shall be supplied with mechanical joint ends.

In environmentally sensitive locations including well head protection areas, preference for a fused pipe material shall be considered.

During installation, the force main pipe shall be appropriately identified as the materials used can sometimes be confused with water mains. This is especially critical at locations where force mains and water mains cross to avoid cross-connections. Green pipe or green stripes on the force main pipe are required.

E2.04 Bedding

Force main bedding and cover shall be installed as per OPSD 802.010 using Granular "A" embedment material or high-performance bedding for flexible pipes.

Alternative embedment material shall be sand meeting gradation requirements of OPSS 1004.05.05 compacted to 98% Standard Proctor Density. Geotechnical

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certification of alternative material must be provided every 150 m and approved by the Township prior to installation. The compaction testing must include the entire envelope (haunches, bedding, and top of pipe).

E2.05 Depth of Cover

Curb and Gutter Roads	1.80 m minimum cover.
Open Ditch Roads	2.2 m minimum cover.
Unbuilt Future Roads	1.80 m minimum cover measured from ultimate design grade.
Road Crossings	2.2 m minimum cover.
Watercourse, Creeks	2.0 m minimum cover.

In areas where the Township allows a forcemain to be installed with less than a minimum cover, the contractor is to supply and install insulation as directed by the Township to protect force mains and appurtenances.

E2.06 Horizontal Separation Between Sewers and Water mains

Force mains shall be designed to have a minimum clear distance of 2.50 m from water mains.

Where clearances cannot be achieved, the design shall be completed in accordance with MECP Procedure F-6-1.

E2.07 Forcemain Crossing Water mains and Other Utilities

Water mains shall normally cross above sewers and force mains with sufficient vertical separation to allow for proper bedding of the water main (minimum 0.5 m).

When it is not possible for a water main to pass over a sewer / forcemain, the water main can pass under the sewer / forcemain provided a vertical separation of 0.5 m is maintained between the sewer / forcemain and the top of the water main. The sewer / forcemain must be adequately supported to prevent settling and displacement of joints.

Force mains crossing over or under other utilities must be designed with a vertical separation of 0.50 m between the outside edges of the forcemain and the utility.

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E2.08 Minimum Sizes and Velocity

The minimum diameter for a forcemain conveying raw sewage shall not be less than 100 mm, unless otherwise approved by the Township.

Depending on the design pumping rates, a forcemain shall be designed to have a self-cleansing velocity of at least 0.6 m/s with the maximum velocity not to exceed 3.0 m/s.

The need for dual forcemains shall be reviewed with Township Public Works staff at the design phase.

E2.09 Tracer Wire

Tracer wire shall be installed on all forcemains to permit field tracing of the pipe, without loss or deterioration of signal using industry standard locating equipment. The wire is to be secured to the top of the forcemain with mastic tape, at every fitting and valve and at intervals not to exceed 30 m. All tracing wires shall be No. 12 gauge stranded copper wire complete with an outer plastic coating. The wire shall be protected from damage during the installation of Works.

Tracing wire shall be connected to valves in chambers and extended along the bottom of the chamber, up the chamber wall and securely fastened to the top rung of an access ladder with fiberglass tape. The tracer wire is to be continuous with no joints. Where joints are required (i.e., between rolls) they are to be soldered together and wrapped in dielectric tape and overwrapped with vinyl tape.

Where directed by the Township, utility location markers shall be placed for specific features. A certificate of continuity from the Developer's consulting engineer will be required at the time of commissioning.

E2.10 Corrosion Protection

For any installation of forcemains, an investigation of the soil conditions shall be undertaken to determine the corrodibility of the native soils and to provide recommendations with regard to corrosion protection.

All ferrous forcemains, fittings, and tracer wire connections shall have corrosion protection provided by sacrificial anodes. Cathodic protection shall be provided for all tracer wires on PVC forcemains. Sacrificial caps are to be provided on

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every bolt of all mechanical joints and restrainers. The bolt lengths shall be sufficient to accommodate the caps.

Zinc anodes or other corrosion protection measures may also be required as directed by the Township. The location of anodes shall be shown on the Record Drawings.

E2.11 Caution Tape

When the forcemain is installed in non-standard locations, green caution tape shall be installed along its length, between 0.3 m and 0.5 m above the forcemain.

E2.12 Joint Restraint

Mechanical joint restraints and concrete thrust blocks are to be installed on bell and spigot joints for all force mains constructed in fill material and at horizontal bends, vertical bends, tees, end of force mains, connections for all force mains, and valves and all areas of disturbed non-native backfill material and shall conform to the latest OPSS and pipe / restrainer manufacturer requirements.

The contractor shall provide a Restraint Plan prepared by a licensed engineering practitioner indicating all mechanical restrainers and fittings to the Township for review and acceptance prior to construction of the forcemain. All mechanical restrainers shall be identified on plan and profile drawings.

The minimum length of restrained pipe beyond the fitting is to be in accordance with the manufacturer's recommendations. All mechanical restraint systems shall be installed with cathodic protection.

E2.13 Termination

All force mains shall be discharged to MHs. The forcemain shall enter the MH with a smooth flow transition at a point no more than 0.3 m above the flow line.

For flows greater than 30 L/s, transition MHs shall be provided at forcemain discharge points to provide smooth flow into the receiving gravity sewer. The transition MH shall be designed based on the pipe size, alignment and inspection, and maintenance needs. The sewer connecting the transition MH to the downstream MH shall be sized to flow at half depth to ensure a smooth flow.

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Depending on the nature of the wastewater being collecting in the area and time it spends in the forcemain, consideration shall be given to corrosion protection within the receiving MH to prevent degradation from the release of hydrogen sulfide or other corrosive chemicals.

E3.00 Valving Requirements

E3.01 Type

Unless specified or approved by the Township, resilient seat gate valves shall be used on force mains 600 mm in diameter and smaller. The valves are to have mechanical joint ends and be installed with cathodic protection. The valves shall have a non-rising stem and a 50 mm square operating nut, opening counterclockwise. For valves on deep force mains, a valve extension stem may be required.

For force mains larger than 600 mm in diameter, the valves shall be housed within a chamber. The frame and cover of the chamber shall be flush with finished grade, with the top of the chamber roof slab at least 0.6 m below the profile of the finished pavement. The chamber is to be fully waterproofed.

Where forcemain valves are located under traveled road surfaces, the top of the operating box shall be set 50 mm below road grade for gravel surfaces and flush with road grade for paved surfaces.

E3.02 Size

In all cases, the size of the valves shall be the same size as the forcemain diameter.

E3.03 Emergency Valve Connections

An emergency valve connection shall be installed on all force mains immediately downstream of the sewage pumping station to allow for the connection of discharge pipes from portable pumps to bypass the sewage pumping station for maintenance or emergency purposes. This allows for the station to be isolated and bypassed while still making use of the forcemain. The standard method of emergency connection to a vacuum truck shall include the required isolation valves and quick connection point at or near the pumping station wet well.

Other valving on force mains is generally discouraged as it can cause damage to pumping station pumps if the valves are left in the closed position.

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E3.04 Valve Boxes and Chambers

All valves on force mains 600 mm in diameter and less shall have three piece, sliding type, Type 'D' valve boxes. Valve boxes are required on force mains 600 mm diameter or less, except at high points where a chamber is required complete with an air release valve. The top of the valve box is to be set at the finished grade elevation. All valve stems must be within 1.6 m of finished grade. A valve stem extension shall be required where necessary to meet this criterion.

On force mains greater than 600 mm dia., valves in chambers are required as noted previously.

E3.05 Air Relief, Vacuum Relief, or Combination Valves

A combination of sewage air and vacuum relief valves shall be installed at all high points of the force main route as required to prevent air locking and negative pressure.

Air / vacuum relief valves shall conform to the latest version of AWWA Standard C512 Air Release, Air / Vacuum, and Combination Air Valves for Water and Wastewater Service.

All air / vacuum relief valves will be installed with a ball valve of the same size as the air / vacuum relief valve for isolation purposes.

Fully waterproof chambers are to be provided to house the valves.

E4.00 Force main Testing

The integrity of all force mains is to be evaluated and confirmed with both pressure and leakage testing. Flexible pipe material may also be tested with a deflection test.

Consideration of pipe swabbing facilities with mandrel launchers and catchers may be required in special instances.

E4.01 Construction Sequence

The force main shall be installed at a time stipulated by the Township and shall be completed prior to construction of finished roads and ditches.

Backfill of force mains across roadways shall be approved granular material thoroughly compacted. The force main shall not be backfilled until approval from the Township has been given.

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Any bypass pumping required shall be approved by the Township in advance of the start of construction, including a bypass pumping drawing to be submitted to the Township for review and approval.

E4.02 Commissioning Force main

The Developer's consultant shall provide a comprehensive written Force main Commissioning Plan and Final Connection Plan proposal of how the testing is to be conducted and by whom. Plans are to be submitted prior to the start of the force main construction for acceptance by the Township. The consultant shall witness all testing and provide the Township with certification of compliance.

E4.03 Hydrostatic Leakage Test

Prior to any testing, the Developer's consultant shall obtain and review the most current version of the Township's testing and commissioning checklist and submit the required documentation.

All force main piping shall be cleaned and flushed prior to commencing the leakage testing process. Testing shall be completed with potable water and shall be completed in sections not exceeding 1,000 m in length unless otherwise noted.

The section of force main being tested shall be sealed off and slowly filled with water. The pipe shall remain filled for not less than 24 hours prior to the pressure test. Air shall be removed from the section of pipe being tested. Air release taps shall be installed to remove air from the pipe section prior to pressure testing. When air has been removed from the pipe, necessary gauges can be connected. The line shall stay pressurized for two continuous hours. Leakage shall be defined as the quantity of water that must be supplied into the newly installed pipe, or the section being tested, to maintain a specified hydrostatic test pressure after the air has been removed. Pipe installation will not be accepted if leakage is greater than 0.082 L/mm of pipe diameter per kilometer for the two hours test.

If the pipe section does not pass the leakage test, repairs to the pipe shall be completed prior to restarting the test.

For PVC pipe, leakage testing shall be in accordance with OPSS No. 412 and tested to a pressure of 1,034 kPa (150 psi) or the maximum rated working pressure of the pipe, whichever is less.

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E4.04 Acceptance of Force main

Generally, the Township shall accept the force main for operating purposes as soon as the system has been constructed and tested to the satisfaction of the Township. Once accepted, the Township shall be the Operating Authority and shall operate and control the system.

Notwithstanding the above, the assumption of the wastewater system by the Township shall be subject to and in accordance with the Subdivision Agreement for the development.

E4.05 Decommission of Force main

Where an existing force main is to be abandoned, the pipe is to be removed, or capped and grouted, complete with mechanical restraints, and valve stems are to be removed. The method of decommissioning is to be confirmed with the Township during the design phase of the project.

E4.06 Continuity Test

The Township shall do a continuity test on the force main or tracer wire during the test procedures. Should the Township find a problem with continuity or installation of the tracer wire, the contractor will not be allowed a final connection to the system. The contractor / Developer shall be responsible for the repair, at no cost to the Township.