Oxford County Design Guidelines | 7 | Sanitary

TABLE OF CONTENTS

LIST OF FIGURES

7 SANITARY

7.1 General

The current Ontario Provincial Standards, American Water Works Association Standards, Canadian Standards Association, and Ministry of the Environment, Conservation, and Parks (MECP) Guidelines for Drinking Water Systems provide the minimum requirements that must be met. In addition, the following criteria must be included in the Design presented for approval to the **County of Oxford Public Works**. If there is a discrepancy between the County Specifications and the MECP Guidelines, then the **County of Oxford Public Works** shall be contacted to resolve the issue. Any deviation from these specifications must be submitted in writing to the **County of Oxford Public Works** for approval.

7.1.1 Study Requirements

As part of all submission packages, prior to construction, the Developer shall submit a hydrological study along with a description of how hydrological conditions have been considered and addressed in the wastewater design.

The hydrological study should be conducted by a Professional Geoscientist or Professional Engineer licensed to practice in Ontario to determine critical information related to:

- Groundwater Levels
- Hydrostatic Pressures
- Seasonal High Groundwater Table

The methodology of the hydrological study should consider whether the work is a single service retrofit or an installation of a new sanitary sewer collection system. Common methodology suited for conducting a hydrological study are:

- Borehole and/or test pits (best suited for retrofits)
- Piezometers (best suited for retrofits and new installations)

In instances where a hydrological study is not feasible, historical data completed within the last 10 years, which has been reviewed by a Professional Geoscientist or Professional Engineer licensed to practice in Ontario, could be used in lieu of the hydrological study at the sole discretion of the **County of Oxford Public Works**.

Where a hydrological study is not feasible and/or historical data is not available, the sanitary sewer should be designed with the assumption that the hydrostatic pressure is at the surface grade.

As part of all submission packages, prior to construction, the Developer shall complete a geotechnical investigation along with a description of how geotechnical conditions have been considered and addressed in the wastewater design. The cost of required geotechnical testing

and placement of suitable material will be the responsibility of the Developer. A soils investigation report shall be submitted to determine the corrosiveness of the native soils including recommendations on cathodic protection methods.

As part of all submission packages a pre-construction report should be prepared by the Developer's Geotechnical Engineer that includes soil classification, recommendations of structural requirements for pipe and bedding, measures for corrosion protection, and construction methods to be used. The soils investigation report shall be submitted to **Oxford County Public Works** for review and comment and following this review a finalized version addressing all comments shall be submitted.

The cost of these studies, including investigations and reporting, shall be the responsibility of the Developer. The City of Woodstock and Town of Tillsonburg are Service Providers for The County. Oxford County Design Guidelines are to be followed for all wastewater systems within the County. No alternate guidelines shall be permissible, and all deviations are up to the sole discretion of **Oxford County Public Works**. Full-time inspection within the public right-of-ways shall be required by the Developer's Engineer in consultation with the County and its Service Providers. Inspection fees as set out by the County and its Service Providers will apply.

7.1.2 Non-Permitted Flows

Connections from foundation, weeping tile drainage or roof drainage are not permitted to enter the sanitary sewer system, or any hazardous waste as defined under the Environmental Protection Act (EPA) Regulation 347. All wastewater discharged to the collections system must conform with Oxford County By-Law 6270-2020 Modernized Sewer Use By-Law.

7.2 Sanitary Collection System Design

7.2.1 Drainage/Sub-Drainage Area Plans

Drainage/sub-drainage area limits for which sewers are to be designed for are to contain and follow the lot/block lines to the proposed maintenance holes located on the right-of-way.

All areas and populations are to be shown for each drainage/sub-drainage areas.

7.2.1.1 External Sewer Shed Limits and Drainage Areas

When a design abuts an undeveloped or un-serviced area, the Developer shall identify the external sewer shed limit to be designed for.

All areas and populations are to be shown for all drainage areas within external sewer shed limits.

For new subdivisions, refer to **Section 2 – Procedures for Development** for additional requirements.

7.2.2 Design Flow

Sanitary sewer design calculations for approved drainage area plans are to be completed on the template shown in **Figure 7.01 Sanitary Sewer Design Sheet.**

The Developer is responsible to ensure that based on existing flow data and through the performance of hydraulic modeling, the design will not cause exceedance of capacity or level of service within the existing sanitary system. The **County of Oxford** reserve the right to validate impacts on the existing system using their hydraulic model.

7.2.2.1 Equivalent Population

.1 Residential

Unless site specific information is available, population equivalent densities are to be calculated based upon the criteria outlined in the table below.

Table 7-1 Population Equivalent Densities

Density Level	Density (Unit/Hectare)	People/Unit
Low	30	3
Medium	75	2.4
High	150-300	1.6

When the number of units and type of housing are available, calculation of the equivalent population should be based on the criteria in the table below.

Table 7-2 Housing Equivalent Population Densities

Housing Type	Density (Persons/Unit)
Single Detached	4.2
Semi-Detached	4.2
Townhouse	3.4
Large Apartment (Greater than 1 bedroom)	3.1
Small Apartment (less than or equal to 1 bedroom)	1.7

.2 Commercial/Institutional

The Developer shall consider 100 people/hectare for commercial and institutional areas, in the absence of known information. Deviation from this standard where there is known information will require approval of the **County of Oxford Public Works.**

.3 Schools

The equivalent population for schools is calculated as follows:

- Elementary Schools: 1/3 x number of students (600 students minimum)

- Secondary Schools: 1/3 x number of students (1500 students minimum)

.4 Hospitals

Apply a population equivalent of 3 persons per bed.

.5 Industrial

Use a flow allowance of 25,000 L / Ha / day, in the absence of known information. Deviation from this standard where there is known information will require approval of the **County of Oxford Public Works.**

Industrial users with sewage discharge design criteria greater than this will be considered heavy users. Heavy users should consult with the **County of Oxford Public Works** with respect to their specific requirements for water use and sewage discharge in terms of confirming capacity is available within the municipal infrastructure to meet their needs. Heavy users should also consult with the **County of Oxford Public Works** prior to any upgrades which will increase their discharge rates to the municipal sewer system.

7.2.2.2 Average Dry Weather Flow

The daily per capita sanitary flow shall be 230 L / person / day. The Average Dry Weather Flow (ADWF) shall be calculated as follows:

$$\text{ADWF} = \text{Daily per Capita Flow} \times \text{Equivalent Population}$$

7.2.2.3 Peaking Factor

The Peaking Factor (M) is the ratio of peak dry weather flow to average dry weather flow. Peaking factor calculations are to be determined based on the Harmon formula:

$$M = 1 + \frac{14}{4 + P^{1/2}}$$

where:

M = ratio of peak flow to average flow

P = tributary population in thousands

The peaking factor shall be limited to a minimum of 2.0 and a maximum of 4.0.

7.2.2.4 Extraneous Flow

An allowance for extraneous flow (E) from sources such as inflow and infiltration shall be made at a rate of 8,640 L / Ha / day.

7.2.2.5 Peak Flow Calculation

Peak flow (Q_p) calculations are to be determined based on the following formula:

$$Q_p = \left(\frac{ADWF \times M}{24 \times 60 \times 60}\right) + E$$

where:

Peak Flow (Q_p) = Peak flow within sewer

ADWF = Average Dry Weather Flow

Peaking Factor (M) = Harmon Peaking Factor

Extraneous Flow (E) = Allowance for inflow and infiltration

7.2.3 Pipe Size and Sewer Hydraulics

7.2.3.1 Minimum Pipe Size

The peak flow (Q_p) shall not exceed 70% of the full flow capacity of the pipe. Pipe capacity is determined Manning's formula:

$$Q_{full} = \frac{1}{n} \times A \times R^{2/3} \times 2 \geq \frac{Q_p}{0.7}$$

where:

Q_{Full} = Full flow capacity of pipe (m³/s)

Q_P = Peak Flow, calculated in accordance with **Section 7.2.2.5** (m³/s)

n = Mannings roughness coefficient (0.013)

A = Cross sectional area of pipe (m²)

R = Hydraulic radius (area/wetted perimeter)

S = Slope of pipe (m/m)

Notwithstanding the above, the minimum allowable size of a sanitary sewer shall be 200mm.

On private property, the minimum size for sanitary building sewer shall be determined in accordance with Part 8 of the OBC.

7.2.3.2 Flow Velocity

Velocities in sanitary sewers shall be calculated using the following formula:

$$V = \frac{Q}{A}$$

where:

V = flow velocity (m/s)

Q = Design flow (m^3 /s)

A = cross sectional area of flow (m^2)

The minimum velocity permitted in sanitary sewers is 0.6 m/s.

The maximum velocity permitted in sanitary sewers is 4.5 m/s.

To determine velocities based on actual flow, refer to **Figure 7.02 "Hydraulic Elements Graph for Circular Pipe."**

7.2.3.3 Minimum Grades

All sanitary sewers shall be designed and sloped to achieve self scour / cleansing and the minimum velocity as outlined in **Section 7.2.2.8**.

The minimum grade on a 200 mm diameter sanitary sewer is 0.33%. Where there are only a few dwelling units connected to the upper section of a 200 mm sanitary sewer, the minimum grades shall be adjusted as follows:

1 to 5 units	0.61%
6 to 8 units	0.52%
9 to 12 unit	0.43%
13 or more units	0.33%

On the first upstream section of sewer (e.g. cul-de-sac) a minimum grade of 1.00% is required.

7.2.4 Layout of Sewer

7.2.4.1 General

Gravity sewers shall be designed as straight lines from maintenance hole to maintenance hole. Deflection in either the horizontal and vertical directions will not be permitted.

7.2.4.2 Sanitary Sewers within Road Allowance

Sanitary sewers are to be located in the standard location indicated on the appropriate typical road cross-section in **the County's Standard Drawings,** unless otherwise approved.

7.2.4.3 Sanitary Sewers on Private Property

Sanitary sewers on private property are regulated by the OBC. Where there are no specific regulations in the NBCC, details from this manual will apply.

7.2.4.4 Sanitary Sewer Pipe Depth

The minimum depth of a sanitary sewer shall be 2.4 m from the finished ground elevation to the obvert of the pipe unless otherwise approved by the **County of Oxford Public Works**. Where frost protection is warranted, insulation is required, as per the **County of Oxford Standard Drawings**.

The maximum allowable pipe depth shall be in accordance with the relevant "Height of Fill" table in the **Ontario Provincial Standard Drawings** (latest edition), assuming an embankment condition and subject to confirmation by the Developer's Professional Engineer. Greater depths may be accepted at the sole discretion of **County of Oxford Public Works**, upon submission of the relevant engineering calculations.

7.2.4.5 Minimum Distance Between Sewers

The minimum distance between sewers shall be 2.0 m, measured horizontally from the outside of each pipe. Special cases may be reviewed by **County of Oxford Public Works** for site specific design choices and depths.

7.2.4.6 Sanitary Sewers and Other Utilities Separation

Designers should refer to Ontario Ministry of the Environment, Conservation, and Parks (MECP) F-6-1 Procedures to Govern Separation of Sewers and Watermains and the OBC (latest revision) regarding the location of sanitary sewers and services relative to watermains and water services and to the Public Utilities Act of Ontario regarding the location of watermains relative to other utilities. In all cases, clearances shall be measured from the outside of each pipe or utility.

A Subsurface Utility Engineering (SUE) investigation shall be completed and paid for by the Developer for the complete project area including test pits at critical crossing locations or as requested by the **County of Oxford Public Works**. SUE investigations shall be provided based on ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.

Encroachment of utilities, structures, sewers and/or any utility appurtenances, which may impact the sewer, the integrity of its bedding, and/or structural capabilities, shall have design considerations applied to adequately protect the sewer and the utilities.

It is preferable that utility crossings be at a 90-degree angle to reduce the supporting lengths required during construction.

7.2.4.7 Casings and Spacers

Where casings are required for sanitary sewers crossing bridges, roadways, railways, rivers, streams, or creeks, casing specifications shall be as set out by the governing authority.

Casings shall be steel plate ASTM A 139 Grade B welded joint. Casing materials other than steel must be approved by **County of Oxford Public Works** prior to installation.

Steel casings shall use the following inside diameters and wall thicknesses as listed below. The designer shall ensure that the minimum requirements noted will suit the project-specific parameters.

Table 7-3 Steel Casing I.D. and Wall Thickness

Nominal Pipe Size (mm)	Minimum Casing ID (mm) (I.D.)	Minimum Casing Wall Thickness (mm)
100	315	6.35
150	356	7.94
200	454	7.94
250	546	7.94
300	584	9.53
350	686	9.53
400	762	12.70
450	787	12.70
500	838	12.70
600	991	12.70

Casings shall be filled with clean sand. The use of Cellular Grout is not permitted.

Where casings containing forcemains are used in the above locations, valving shall be required at each end of the casing for isolation purposes. When a forcemain is placed inside a casing, it shall be supported by spacers using the centered configuration. Where a forcemain is located between proposed residential dwellings, it shall require a casing with fusible pipe placed inside the casing. The casing shall extend the entire length of the property. Valves should be located a minimum of 3.0 m from each end of the end of the casing. Where casings containing forcemain are located within easements between residences, the casing shall be offset a minimum of 1.0 m from the property line to avoid fence posts.

If a sewage forcemain is placed inside a casing using bell and spigot PVC material, all pipe bell joints inside the casing shall be restrained using approved restraints. All restraints shall be wrapped with a Petrolatum Coating System. Mechanical joints inside the casing are not permitted.

When a gravity sanitary sewer is placed inside a casing, the sewer shall be supported by spacers using the centered configuration. The casing shall be installed at the same design grade as the sewer to facilitate the use of the centered configuration method for spacer placement. The size, location, and number of spacers will be as per the manufacturer's recommendation. Joint restraint for gravity sewers will be at the discretion of **County of Oxford Public Works**.

Both ends of the casing will be covered using an approved rubber end seal to prevent backfill from entering the casing.

7.2.5 Pipe Material

Both rigid and flexible pipe are permitted in the construction of sanitary sewer systems including sanitary laterals. These materials include concrete, and polyvinyl chloride (PVC). The design engineer shall ensure that the use of watertight, non-corrosive materials, such as PVC is utilized for sewer pipes.

Where reinforced concrete pipes are utilized the design engineer shall denote the selection and testing process used to support resistance to sulphate and chemical degradation. Reinforced concrete pipes with sulphate-resistant cement can be considered. Refer to **Section 7.3** for additional information on pipe material requirements.

In selecting the most appropriate material for the sanitary sewers, the Designer shall specify product(s) that will not leak under the hydrostatic pressures and seasonal high groundwater table documented in the geotechnical/hydrological pre-construction report. The selected pipe and pipe gasket materials should be compatible and resistant to environmental factors such as local soil contamination, and other special considerations.

New and replacement sanitary sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are to be constructed of materials and with joints that are equivalent to watermain standards of construction. **County of Oxford Public Works** may upon review of these sewers specify pipe material and colour. Associated costs are the sole responsibility of the Developer.

On private property, materials for sanitary building sewers and private sewers shall comply with Part 7 of the NBCC.

7.2.6 Pipe Bedding and Backfill

The Designer shall specify requirements for pipe bedding and backfill based on soil and groundwater conditions, and the proposed pipe material. Bedding around the sewer and services may be Granular 'A' material, 19 mm Crusher Run Limestone, or clean screened sand.

Where pipe will be installed below the groundwater table the Designer shall provide bedding requirements that will prevent erosion of the bedding following installation.

Native material may be used as backfill for pipe outside of the roadway, where it is deemed suitable in the Geotechnical Report. Backfill within roadways shall be Granular 'B' Type II or 0.4 MPa unshrinkable fill as selected by the Designer, native material will not be a permissible backfill below any roadways.

7.2.7 Maintenance Holes

7.2.7.1 Spacing of Maintenance Holes

The maximum allowable horizontal spacing (centre to centre) between maintenance holes shall be as follows:

Table 7-4 Spacing Between Maintenance Holes

Pipe Size	Maximum Spacing (m)
Less than 600mm	120
600mm and greater	190

Maintenance holes are additionally required where there is a change in the direction of the flow, slopes, or a change in the diameter of sewers.

When spacing of a maintenance hole dictates that the maintenance hole should be placed within the vicinity of a roundabout, sanitary maintenance holes are not permitted to be located within the grassed area of the roundabout. Sanitary maintenance holes must be located within the apron of the island, for maintenance purposes.

7.2.7.2 Precast Maintenance Hole Sizing Criteria

All sizing of sanitary precast maintenance holes are based on incoming and outgoing pipe sizes and should be sized and conform to **Figure 7.03**.

Precast maintenance holes should be designed in accordance with the relevant **Ontario Provincial Standard Drawings.** Where cast-in-place maintenance holes are required, their design shall be stamped by the Developer's Professional Engineer.

7.2.7.3 Head Losses

When velocities in the downstream pipe from a maintenance hole exceed a velocity of 1.2 m/s, head losses must be accounted for in the design of the sewer and larger sanitary laterals. These losses shall be accounted for by lowering the obvert of the outgoing sewer below the obvert of the incoming sewer by the amount equal to the head loss.

Drops in maintenance holes to compensate for Head Loss (HL) shall be calculated using the following formula:

$$H_L = K_L \frac{V^2}{2g}$$

where:

K_L = Head loss coefficient

V = downstream velocity (m/s) g = 9.8m/s^2

Head loss coefficients (KL) are to be applied as noted in the table below. Notwithstanding the calculation above, the minimum drop at a maintenance hole shall be the greater of the calculated head loss or the minimum drop shown in the table.

Table 7-5 Head Loss Coefficients

Alignment Change Type	Head Loss Coefficient, KL	Minimum Drop (m)
15-45 deg bend	0.70	0.030
45-90 deg bend	1.00	0.060
Tees, Crosses	1.00	0.060

7.2.7.1 Maintenance Hole Drop Structures

Sanitary drop structures are required when the difference in invert elevations between the upstream and outlet sewers in the maintenance hole is equal to or greater than 0.6 metres.

For external drop structures on 1200 mm maintenance holes only OPSD 1003.010 or 1003.020 will be accepted.

Internal drop structures shall only be used in maintenance holes 1500 mm diameter and larger where a minimum height of 600 mm from the inlet pipe invert to the bottom of the channel exists. Drop pipes shall be one size smaller than the incoming sewer with a minimum of 150 mm diameter and a maximum of 375 mm diameter. Anchor straps shall not be placed within 150 mm of any maintenance hole section joint. Internal drop structure systems shall conform with OPSD 1003.031 and must be approved by the **County of Oxford Public Works**.

7.2.7.2 Maintenance Hole Tees

Maintenance Hole tees are not allowed for any sanitary sewer less than 1200 mm diameter. Maintenance hole tees can be constructed in lieu of regular maintenance holes on 1200 mm or greater trunk sewers. Refer to OPSD 707.010 for additional requirements. Ensure sewers which slope away from the maintenance hole but are not intended to take flows from the maintenance hole, have the inverts high enough to not accept sewage.

7.2.7.3 Maintenance Hole Frame and Covers

Maintenance hole frames and covers are required for all maintenance holes and shall conform with OPSD 401.010.

Maintenance hole frames and covers are to be clear of curb and gutters on bends in the road for new construction. Maintenance hole frames and covers may be located in the curb and gutter on reconstruction projects, only as approved by **Oxford County Public Works**.

Maintenance hole frames and covers and by association steps must be aligned to avoid being located in the wheel path of the street, and to be located above a benching platform to avoid conflict with an inletting or outletting sewer pipe. The proposed location of maintenance hole frames and covers and by association steps must be shown in plain view on the engineering drawings, represented by a solid circle reflecting the above requirements.

7.2.7.4 Watertight Maintenance Hole Lids/Covers

Watertight maintenance hole lids are required when sanitary maintenance holes are located within overland storm flow routes. These locations are within 100-year flood plain areas, within gutter locations and within an easement and/or open space area where overland flow is directly over and or adjacent to the maintenance hole lids. Watertight maintenance hole lids are also required under sanitary surcharge conditions. Watertight lids shall conform with OPSD 401.030.

Watertight maintenance hole lids are not required under the following circumstances:

- Where design dictates that the maintenance hole lids end up in the curb and gutter and where it is possible to rotate the cone so that the maintenance hole lid is clear of the gutter, the cone should be rotated such that a watertight lid would not be required;

- Where, in the profile design of the street, the maintenance hole is located in the low point of an overland flow route, the maintenance hole may be in standard location but would be submerged under a greater than two-year storm event. Maintenance holes located in a standard location on streets that carry an overland flow route with a continuous grade, or cascading grade (even though some of these may be briefly submerged) do not require watertight lids.

7.2.7.5 Lockable Maintenance Hole Covers

Lockable maintenance hole covers are required to reduce access by the public, when directed by **County of Oxford Public Works** in areas such as parks and open spaces, pumping stations or pollution control plants. Lockable maintenance hole covers shall conform with OPSD 401.060.

7.2.7.6 Maintenance Hole Inserts

The use of inserts in sanitary maintenance holes will be required in areas of new construction until such time as the roadway is paved with the top asphalt layer.

7.2.7.7 Maintenance Hole Steps

Maintenance hole steps are required for access and are to conform with OPSD 405.010 or 405.020.

The following notes shall apply:

- All steps are to be galvanized steel or aluminum;
- A detail or restoration plan is required for the relocation of maintenance hole steps within existing maintenance holes, where applicable; and
- Maintenance hole steps shall be located to avoid conflict with an inletting or outletting sewer pipe. Access to maintenance holes must be above the benching platform.

7.2.7.8 Maintenance Hole Safety Landings

Maintenance hole safety landings are required at the mid-point depth of the maintenance hole, when the depth of the maintenance hole is between 5.0 and 10.0 metres. Additional safety landings are required at third-point depths, when the maintenance hole is equal to or greater than 10.0 m to 15.0 m deep. Maintenance hole safety landings shall conform with OPSD 404.020. Fibre Reinforced Polymer (FRP) safety landings equivalent to the aluminum landings may be

acceptable at the sole discretion of **County of Oxford Public Works**. FRP safety landings shall be designed and stamped by the landing supplier.

Incoming pipes are to be below safety landings. Where this is not possible, approval is required from the **County of Oxford Public Works**.

7.2.7.9 Waterproofing of Chambers and Maintenance holes

Waterproofing of chambers and maintenance holes is required. Waterproofing membrane shall be supplied and installed on all exterior concrete surfaces of the chambers and maintenance holes, including the edges of the base slab, up to within 300 mm of the cover elevation.

7.2.7.10 Benching

All maintenance holes require benching at the bottom of the maintenance hole. Benching shall conform with OPSD 701.021. Benching height shall be to the obvert of the highest existing pipe.

Where benching is different from OPSD 701.021, a benching detail is required.

7.2.7.11 Steps in Benching

Steps in maintenance hole benching are required when the pipe diameter is greater than 450mm.

7.2.7.12 Adjustment Units

Maintenance hole adjustment units are required on all maintenance holes to ensure that proper grade is provided between the top of the maintenance hole and the maintenance hole lid. A maximum of 150 mm of adjustment rings will be permitted. Ensure that the difference in grade between the maintenance hole lid and the first ladder rung does not exceed 450 mm. Adjustment units shall conform with OPSD 704.010. Clay brick will not be allowed for use as maintenance hole adjustment units.

7.2.7.13 Maintenance Hole Access

Access to maintenance holes for the purpose of maintenance is to be provided in all circumstances, including where maintenance holes for municipal sewers are located within easements or are otherwise located outside of the paved road surface. When designing maintenance access roads for sewers, generally the maintenance access road/path will have a 3.0 metre wide hard asphalt surface with a 4.0 metre wide granular base.

Adequate curves and turn-around facilities are required for maintenance vehicles to manoeuvre. Slopes (4% maximum), cross falls (2% minimum to 4.5% maximum) and drainage of access roads are also to be addressed in the design.

Where sanitary sewer maintenance holes are installed below the 100-year flood line, **County of Oxford Public Works** shall be consulted, and access road alternatives may be considered in this situation. Watertight maintenance hole lids shall be required (Refer to **Section 7.2.6.4**).

A 0.3 m separation is required between the maintenance access and the top/bottom of any slopes, fences, and property line(s).

Wherever possible, sewer access roads in parks and open spaces shall be integrated into the public open space pathway networks and respect natural heritage features.

See **Section 7.2.8** for easement requirements.

7.2.8 Sanitary Laterals

7.2.8.1 Location

Sanitary laterals to single family and semi-detached lots are to be located in accordance with **Oxford County Standard Drawings**.

Sanitary laterals to multi-family (town housing, row housing and apartments), commercial and industrial blocks are to be connected to a maintenance hole on the Right-of-Way.

Sanitary laterals shall be installed at 90° to the sewer main where possible. In general, sanitary laterals will not be permitted to enter the main against the flow in the main. Where design constraints arise (i.e.: top end of cul-de-sac or crescent), sanitary laterals may have to be located in reverse location and identified as such on the servicing drawings for approval by **Oxford County Public Works**.

Where horizontal or vertical bends are required, long radius sweeps shall be used. Short bends are not acceptable. Single family and semi-detached lot sanitary laterals shall NOT be connected to a maintenance hole.

Direct connection of sanitary laterals to sanitary sewers greater than 6 metres in depth will not be permitted to minimize potential Inflow and Infiltration. Where a sanitary sewer is greater than 8 metres in depth, and local servicing is required, it will be required to provide a shallower local sewer to which sanitary lateral connections may be made. Deviations from this will require the approval of **Oxford County Public Works**.

7.2.8.2 Minimum Size and Grade

Services shall have the minimum sizes and grades detailed in the table below. The actual size of the sanitary lateral required for multi-family, non-residential, commercial, and institutional blocks is dependent on the flows.

Table 7-6 Service Minimum Size and Grade

Building Type	Minimum Diameter (mm)	Minimum Grade (%)
Residential, single family and semi-detached lots	100	2.0
Residential multi-family block	150	1.0
Non-residential block	150	1.0
Commercial block	150	1.0
Institutional block	200[a]	1.0

Industrial block	200[a]	1.0

a. Design of proper service diameter for Institutional and Industrial blocks shall utilize the Functional Servicing Report submitted for those developments.

All sanitary laterals must have a maximum slope of 2.0% at a constant gradient.

7.2.8.3 Sanitary Lateral Connections to Sewers/Maintenance Holes

.1 Typical Connection Requirements

Sanitary laterals 100mm and 150mm in diameter must be connected to the main sewer and shall not be constructed to any sanitary maintenance hole.

Sanitary laterals 200mm in diameter and larger are to be connected to the main sewer at maintenance holes.

.2 Connections to Existing Sewers for Lot Infill Situations

In a situation where a lot severance or lot infill condition exists, and a new sanitary service will be connected to an existing sanitary mainline, the Property Owner must determine if the existing sanitary or combined sewer is at risk of surcharging or has a history of surcharging. This information can be obtained from **County of Oxford Public Works**. If it is determined that there is a surcharge risk, the Owner must provide surcharge protection to their development.

When connecting sanitary laterals to existing sewers in a lot infill situation, connections must be made utilizing an approved saddle or premanufactured tee, in accordance with OPSS.MUNI 410, as amended by these specifications and **Section 7.3.**

7.2.8.4 Sampling/Inspection Maintenance Holes

Sampling/Inspection maintenance holes are required where Institutional, Commercial, and Industrial developments outlet to sanitary sewers owned and maintained by the County and the County of Oxford's Service Provider, where flows are in excess of 200 m^3/day.

Sampling/Inspection maintenance holes shall be located at the property line unless otherwise approved by the **County of Oxford Public Works**. They shall be a minimum of 1200 mm diameter, or more as required by **Figure 7.03**. Sampling/Inspection Maintenance Holes are required to meet all requirements outlined for other maintenance holes in **Section 7.2.6**.

7.2.8.5 Vertical Clearance

For vertical clearances from the sanitary lateral to the watermain see **Section 6.2.4.8** of the Oxford County Design Guidelines.

7.2.8.6 Sanitary Lateral Cleanouts

Where removal is requested and approval is granted by **Oxford County Public Works**, the cleanout and tee must be removed entirely. The Property Owner may be required to install a new sanitary lateral. Approval will be given on a case-by-case basis and will apply to the entire phase of development.

7.2.8.7 Pipe Material

Refer to **Section 7.2.4** and **Section 7.3**.

7.2.8.8 Sanitary Lateral Depth

The minimum depth of a sanitary lateral shall be 2.4 metres from the finished property line elevation to the obvert of the sanitary lateral. The maximum cover on a sanitary lateral shall be as per **Section 7.2.3.4**.

7.2.9 Easements

Easements are required for all sewers to be assumed by the municipality located outside a road allowance on privately owned property.

An easement is required to ensure the municipal services and utilities crossing the site can be properly installed and maintained by the appropriate authority (municipality or private). An easement provides the right to use private land for a specific purpose which is in the public's interest.

All maintenance holes located within easements require hard surface access. Refer to **Section 7.2.6.13** for hard surface details.

7.2.9.1 Types of Easements

.1 Multi-purpose Easement for Municipal Services

Required for sanitary sewers and access roads that cross a site and which are maintained by the County.

.2 Private Easements

Private easements are required for private sanitary sewers and access roads that cross a parcel of land to service other private lands. A joint access and maintenance agreement between the interested parties shall be entered into.

.3 Temporary Easements and Working Easements

Temporary easements are required for sanitary sewers and access roads that cross a site temporarily. The services in the easement are to be maintained by the owner of the services.

Working easements are required, as necessary during construction, to allow for the safe construction and finishing of the surface restoration. Once construction is completed, the working easement is released.

7.2.9.2 Minimum Easement Widths

Easement widths are determined by the diameter of the pipe being installed and the depth of cover from the centreline of the road/ground over the pipe to the invert of the sewer. The minimum width of a sewer easement at a depth of up 2.4 metres, shall be 5.0 metres (2.5 metres each side of sewer). Easement widths for sewers at depths greater than 2.4 metres shall be approved by **Oxford County Public Works**.

7.2.10 Odour Control

Sewer gases can develop which cause odours and corrosion of concrete sewer infrastructure due to:

- hydraulic design which induces turbulence in flow and encourages the release of sewer gases (i.e. sewer forcemains which jet into maintenance holes or chambers, poor benching or transitions where sewers outlet into an existing sewer, high sewer slopes which induce hydraulic jumps, elevation changes with poor transitions)
- long residence time of sewage in sewer systems (i.e.: sewer systems, pumping stations and forcemains which service new developments and have low flows initially, pumping stations and forcemains with long forcemains)
- Effluent quality which exceeds Waste Discharge By-laws

Every effort should be made to minimize the conditions or designs which may lead to the creation of sewer gases (odours and corrosion). Where it is not possible to avoid these types of situations, it will be a requirement to mitigate the impacts through the use of means acceptable to **Oxford County Public Works**. Examples of this may be:

- The use of chemical dosing of County approved or accepted oxidizing agents to address pumping stations and forcemains with long retention times, either on a short term or long-term basis.
- The use of corrosion resistant materials (such as plastic pipe or liners) in situations where it is not possible to improve hydraulic conditions which will introduce turbulence and sewer gas creation.

The MOE Design Guidelines for Sewage Works also provides information and guidelines with respect to odours and corrosion in sewers.

7.3 Sanitary Collection System Construction

Supply and installation of sanitary collection systems shall be in accordance with the current Ontario Provincial Standard Specifications (Municipal) an Ontario Provincial Standard Drawings as amended herein.

7.3.1 Approved Products and Product Approval Process

All products proposed for use on wastewater system construction projects in Oxford County shall be submitted to **County of Oxford Public Works** in writing and approved prior to use.

The County reserves the right to select any product or material they deem suitable for the application and may provide an AWWA standard and/or other specifications and conditions for the use of such products or materials. Products or materials installed without the approval shall be removed and replaced with an approved replacement at no expense to the County.

Manufacturers, distributers, contractors, designers, and other parties may request that products be considered as an approved equivalent to the products listed herein. A typical product approval submission shall include but not be limited to the following:

- Detailed product data sheet including materials and material properties, performance specifications, and any relevant standards (AWWA, ASTM, ISO, CSA, etc.)
- A list of sizes, classes, etc. with detailed dimension information
- Detailed installation guide
- Safety Data Sheet
- Material warranty information
- References for use on past projects
- Other information as may be requested by **County of Oxford Public Works** or to demonstrate equivalency to the products specified herein

Review and acceptance of an equivalent product is at the sole discretion of **County of Oxford Public Works**.

The Designer reserves the right to exclude the use of one or more of the acceptable products noted herein within their design where the use of these the approved materials listed herein is not acceptable due to project-specific constraints. Modifications may be listed in the Contract Drawings and/or Specifications.

7.3.2 Sanitary Sewer Materials

Both rigid and flexible pipes are permitted in the construction of sanitary sewer systems including sanitary laterals. These materials include PVC, concrete, and HDPE pipe. HDPE pipe shall only be used for directional drilling unless otherwise approved by **County of Oxford Public Works**. All materials shall be CSA and ASTM certified.

The Contractor must get approval for its pipe selection from the County of Oxford Public Works prior to supplying the material to the site.

7.3.2.1 Gravity Sewers

.1 Polyvinyl Chloride (PVC)

PVC shall only be used for sewers with nominal diameters 100mm – 600mm inclusive. PVC sewers shall be Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2), green in colour.

Gravity sanitary PVC main shall be SDR 35 as per OPSS.MUNI.MUNI 1841, unless a higher SDR is necessitated by the design. Sanitary services shall be PVC SDR 28, green in colour, and have a factory placed tee at the main. All PVC and fabricated moldings shall be CSA certified.

.2 Concrete

Non-Reinforced concrete sewers shall only be used for sewers with nominal diameters up to and including 450mm. Non-reinforced concrete sewers shall be CAN/CSA 257.1 Class 3 concrete, unless a higher class is necessitated by the design.

Reinforced concrete sewers may be used for pipes with nominal diameters greater than 450mm. Reinforced concrete sewers shall be CAN/CSA 257.2 Class 65-D, unless a higher class is necessitated by the design.

Trench conditions shall be determined by the Developer's Engineer. Trench conditions shall be as per OPSD 807.010, 807.030, and 807.040.

.3 Joints

Where indicated on Contract Drawings or as directed by **County of Oxford Public Works**, wrap joints with a waterproof membrane or the use of clay collars in high ground water areas.

7.3.2.2 Forcemains

Unless approved by **County of Oxford Public Works**, all PVC forcemain pipe shall be "Green" in colour. HDPE pipe 100mm and larger shall be manufactured with "Green Stripe". All forcemain pipe regardless of material and installation methodology shall be installed with "Green" tracer wire.

.1 Open Cut Installation

The following pipe is permitted for use in open cut forcemain installations on County projects:

- PVC AWWA C900, CSA B137.3 – Class 235 DR 18 (complete with tracer wire) 100mm through 1500mm diameter colour coded green.

.2 Trenchless Installation

The following pipe is permitted for use in trenchless (HDD) forcemain installations on County projects:

- HDPE AWWA C901 and C906, DR 11 Pressure Class 160 psi (1103 kPa), PE 3408/3608 "Green Stripe."

All HDPE material shall be Ductile Iron Pipe Size (DIPS) or Copper Tubing Size depending on the diameter of the pipe being used.

Fittings shall be butt fusion or mechanical joint only as per AWWA Specifications C110, C153 and C906. Push-on fittings are not permitted.

Pipe fittings including tees, bends, service saddles, etc. shall be rated at the same pressure rating or higher than the pipe. Mechanical joint adaptors shall include stiffener or as specified by the pipe manufacturer.

Low pressure sewer and services less than 100mm dia. shall be copper tubing size (C.T.S.) Series 200.

.3 Tracer Wire

Tracer wire is required for all forcemain installations. The use of thermoplastic High Heat-resistant Nylon coated wire (THHN) in place of tracer wire is not permitted.

Tracer wire for direct bury shall be Solid #12 AWG (0.0808" diameter), 21% conductivity, high strength (HS), copper-clad hard drawn high carbon steel (CCS) tracer wire, 30 mil. HDPE insulation jacket complying with ASTM D1248, minimum break load 452 lbs, 30-volt rating, green in colour.

Tracer wire for directional boring shall be four Solid #12 AWG (0.0808" diameter), 21% conductivity, extra high strength (EHS), copper-clad hard drawn high carbon steel (CCS) tracer wire, 45 mil. HDPE insulation jacket complying with ASTM D1248, minimum break load 1150 lbs, 30-volt rating, green in colour.

At each inline valve a single tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole complete with rubber grommet. Tracer wire will attach to the mainline wire with approved connectors only. Splices of any other nature will not be permitted and will result in the total replacement of the mainline tracer wire. The length of tracer wire inside the valve box shall be +/-500mm and coiled to not interfere with valve operation. Tracer wire to be installed as per the **Oxford County Standard Drawings**.

Test stations shall be Copperhead Snakepit CD14*TP or approved equal. The maximum distance between stations shall be 500m.

All connections or repairs in the tracer wire system shall be made using a copper split-bolt connector with DRYCONN Direct Bury Waterproof Split-Bolt Housing (Aqua), DRYCONN 3-Way Direct Bury Waterproof connector (DB Lug Aqua), Pro-Line TracerLock (TL-LUG-SS) Connector, SnakeBite Locking Connector (LSC1230), or approved equal. Tracer wires at ends of rolls, or repairs shall have sufficient slack to be knotted together prior to placement of connector. All connections shall be wrapped with petrolatum tape and compressed tightly by hand around wire and connector.

At the end of forcemains a 5.5 kg zinc anode must be installed at the end of the tracer wire or the wire brought up to a test station.

No splices of the mainline tracer wire are permitted. Tracer wire connections to be installed as per **Oxford County Standard Drawings**.

Tracer wire continuity testing shall be conducted following installation and prior to final restoration demonstrating the conductivity/traceability to the satisfaction of the County or its Service Provider.

7.3.2.3 Casings and Casing Spacers

Casings shall be in accordance with the Contract Drawings. The Contractor shall submit certified shop drawings showing casings, spacers, pipe and any specials required giving details, design, and method of construction, type of joints, etc., of the casing, spacers and pipe before construction commences.

Approved Casing Spacers are as follows:

- CCI #304 Stainless Steel
- PSI Ranger II
- Cascade

Not withstanding the above, the Contractor shall comply with the casing spacer requirements of applicable Regulatory bodies.

7.3.3 Installation of Sanitary Sewer by Open Cut

The installation shall be in accordance with OPSS.MUNI 401, 404, 410, 517, and 1010 with the following exceptions/amendments.

7.3.3.1 Line and Grade

Contractors shall provide stakes to indicate the line and grade of the sanitary sewer as well as the location of fittings, bends, tees, reducers and plugged or capped dead-ends in accordance with the approved Contract Drawings before beginning any work.

Line and grade stakes shall be marked and spaced a minimum of 20m to a maximum of 50m apart. Mains shall be laid and maintained to the required grades and locations with all fittings, etc. to be plumb and in accordance with the Contract Drawing locations. No deviation in excess of 150mm will be permitted.

Contractors shall carry out explorations where necessary to establish or discover the location and elevation of existing pipes, conduits or other buried objects.

7.3.3.2 Frozen Ground

Do not place material on frozen ground. Should the bottom of the trench become frozen remove and replace the frozen material with bedding material compacted to 100 percent Standard Proctor Maximum Dry Density.

7.3.3.3 Excavation and Trench Preparation

All excavations and trenching operations shall comply with the associated provisions of the Construction Projects Regulation (O.Reg 213/91). Trenches shall be provided so that pipe can be laid with the proper alignment and depth so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at all points between the bell holes.

Where trench excavations are not kept within the design limits of the pipe, **County of Oxford Public Works** may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.

Where the subgrade in its natural state is inadequate to support the pipe, the Engineer shall give instructions as to the proper procedure subject to approval by **County of Oxford Public Works**.

The sub grade shall be removed where it has been adversely changed by construction operations or field conditions and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by **County of Oxford Public Works**.

7.3.3.4 Dewatering

Always maintain the excavation free of water. Should active dewatering be required, the water elevation shall be reduced to at least 1m below the excavation subgrade.

The discharge of water from the construction site into sanitary sewers is strictly prohibited, unless a discharge permit has been obtained. The costs for cleanup of the sewer or other affected areas will be the responsibility of the Contractor / Developer.

7.3.3.5 Lowering & Laying

Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by **County of Oxford Public Works** shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.

The interior of the pipe shall be inspected and completely cleaned of all sand or foreign materials before placing in the line. No foreign materials are to be placed in the pipe during its laying.

The inside of the bell and the outside of the spigot shall be brushed and free from all oil, grease or dirt before jointing. Precautions must be taken to prevent dirt from entering the joint space.

At all times when pipe laying is not in progress the open ends of the pipe shall be closed by water-tight plugs or other means approved by the Inspector. This must be adhered to during any non-working periods, including breaks, overnight, and on weekends. The trench shall be kept dry and free from water. No pipe shall be laid in water except by permission of **County of Oxford Public Works**. No water shall be allowed to run through installations during construction.

Cutting of the pipe shall be done in a neat manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.

Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted upon approval by **County of Oxford Public Works**. At grades above 10 percent, laying shall start at the bottom with the bell ends facing upward.

When deflection in the line laying is required, either in the vertical or horizontal plane, the deflection may be made at the joints. Pipe deflection will be done as per manufacture's specifications, and shall not exceed **50%** of the Manufacturer's recommended maximum deflection. If in the opinion of the Inspector, the deflection is excessive, they will order the job stopped. **County of Oxford Public Works** or their representative, if deemed necessary will order the installation of special fittings in order to provide the required deflection. Offset locations and details shall be shown on Construction and As-Constructed Plans.

When a new sewer crosses existing utilities, or where an existing watermain or sewer is undermined during laying operations, **County of Oxford Public Works** may order the installation of support beams. Support beams shall be approved by **County of Oxford Public Works** prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. **County of Oxford Public Works** shall approve the method to be used. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150mm layers to a minimum of 95 percent Standard Proctor Maximum Dry Density. Pipe must not be laid on blocks.

No pipe shall be laid until the preceding pipe joint has been compacted and the pipe carefully embedded and secured in place.

All pipe and fittings shall be installed strictly in accordance with the manufacturer's instructions. At least two copies of the manufacturer's manual of instructions shall be kept on the job site; one copy in the possession of the foreman, the other with the pipe layers.

Installations shall be kept thoroughly clean during the progress of the work and until the completion and final acceptance thereof.

The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the Contract Drawings. Where vertical or horizontal curves are shown, the pipeline shall not deviate more than 300mm from line, and not more than 75mm from grade.

Sanitary sewers installed at a depth of 3.5m or greater will require the use of settlement control joints on all service laterals. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The settlement control joint permits axial movement of the riser when laterals are placed in deep excavations. These fittings shall be installed as per the manufacturer's specifications.

7.3.3.6 Bedding

For the purpose of this specification all materials placed between the trench bottom and 300mm over the top of the pipe shall be considered as bedding.

Granular materials greater than 19mm in size shall not be used for pipe bedding. Granular material shall be compacted to a minimum of 95 percent Standard Proctor Maximum Dry Density.

Bedding material shall be placed full width of trench. Compact material around the pipe with hand operated vibratory equipment properly shaped to ensure full compaction below the haunches. Mechanical tampers larger than 9.9kW shall not be used over the top of pipe where cover is less than 300mm.

The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

7.3.3.7 Backfilling

Backfill shall be considered as starting from 300mm over top of the pipe. All materials below this point shall be considered as bedding.

If **County of Oxford Public Works** decides that the site selected excavation material either wholly or partially, is not suitable for backfill, then suitable imported material shall be provided of a type approved by **County of Oxford Public Works**.

Backfill trenches from the top of the pipe bedding to the underside of surface restoration with site selected excavated material. Provide backfill free of roots, organic material and stone larger than 250mm. Backfill material shall be placed in lifts not exceeding 300mm and compacted to a minimum 95 percent Standard Proctor Maximum Dry Density.

Where Trench Plugs are required the type of backfill must be considered to mitigate I/I.

Backfilling on a public road allowance, or in an area that is to be designated as a public road allowance, shall be done in accordance with the requirements of **County of Oxford Public Works** or other road authority. Backfill on all County Road allowances in the travelled portion of the roadway shall be granular material or unshrinkable fill as set out in the Ontario Provincial Standards.

Installation of material will be as directed by **County of Oxford Public Works** or other road authority.

No frozen material shall be used for backfilling nor shall backfilling be carried out where material in the trench is frozen.

The surface shall be restored so that all pavement, sidewalks, curbs, gutters, shrubbery, fences, poles, sod and other property and surface structures removed or disturbed during the work shall be restored to a condition at least equal to that before the work began.

7.3.3.8 Compaction Test

County of Oxford Public Works may order compaction tests by an independent testing company. Tests will be arranged by the County or the County of Oxford's service provider.

When tests show that the compaction does not meet the specified requirement, the Contractor shall carry out further compaction in a manner directed by **County of Oxford Public Works** and shall be responsible for paying for further testing to establish proof of the specified compaction.

For backfill compaction, tests will be performed in accordance with the testing company's recommendations.

The contractor shall co-operate with **County of Oxford Public Works** and the testing company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

7.3.4 Installation of Sanitary Sewer by Directional Drilling

7.3.4.1 Scope

This specification covers the requirements for the installation of sanitary forcemains by horizontal directional drilling (HDD).

7.3.4.2 Definitions

Horizontal directional drilling is defined as trenchless installation of pipes pulled through a drilled and reamed hole.

A pilot hole is drilled under and across the surface area that cannot be disturbed along a predetermined horizontal and vertical design profile. Direction and elevation is controlled by a steering mechanism in the drill string just behind the cutting head.

Reaming is enlargement of pilot hole to a suitable size to allow for the installation of the pipe.

7.3.4.3 Submission and Design Requirements

.1 Submissions

Submit shop drawings showing all equipment and plans required to complete the pipe installation by HDD. This information shall include:

- Directional boring equipment and specifications;
- Sequence of operation;
- Location of entry and exit points;
- Location and positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- Disposal site for cuttings;
- Dewatering plan;

- Contingency plan; and
- Slurry management plan.
- Frac-out Mitigation Plan

.2 Design Requirements

Procedures, materials, and water management plan are to be acceptable to the Ministry of Environment Conservation, and Parks (MECP), Ministry of Natural Resources (MNR), local Conservation Authority and the other public agencies having jurisdiction over the project.

All plant, personnel and construction activity must be contained within working areas or easement limits shown on the Contract Drawings.

.3 Record Drawing Requirements

Record drawings shall be provided following pipe installation. Record drawings shall include the following details:

- Horizontal (plan) location of installed pipe tied to known reference points.
- Profile of the installed pipe with elevations.
- Location of all joints and flanged connections tied to known reference.
- Subsurface ground conditions encountered (soil, clay, rock, etc.)

7.3.4.4 Equipment

The drilling equipment shall be suitable for installation of the pipe size and length required. The boring equipment shall consist of the drilling rig, cutting and steering head, drill stems, power and control equipment, mixing tanks for drilling fluids and a slurry recovery system.

The steering system shall include a probe situated behind the cutting head that can interface with an above ground portable computer control console.

The probe shall be able to indicate the orientation of the steering and cutting tool.

The cutting tool shall be steerable from the above ground computer control console so that any deviation from the design alignment can be corrected as boring progresses.

The drilling equipment shall be capable of being retractable and reset to a different horizontal alignment should obstacles such as boulders, tree roots, etc. be encountered. The Contractor shall not change the vertical alignment without the approval of **County of Oxford Public Works**.

A surface probe shall be provided that can detect the location and depth of the cutting tool/steering system. The surface probe shall be used to confirm that the pipe alignment is within the easement and at the location identified.

7.3.4.5 Construction

.1 General

The Contractor shall provide all necessary equipment, drilling fluids, and power to perform the work specified.

.2 Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall be in accordance with the accepted plan and shall not be modified without written consent from **County of Oxford Public Works**.

All water extracted during any dewatering process shall be diverted through a filter system or settling ponds/basins to ensure minimum sediment transport.

The filter system or ponds/basins shall be located so as not to interfere with normal construction activity and the public use of such areas.

.3 Line and Grade

Line and grade control will be maintained to the locations and elevations on the Contract Drawings. Variations in grade will not be acceptable.

The control system must be capable of maintaining line and grade to 100mm (50mm up or down) over the total distance between the ground entry and exit points.

.4 Soil Transportation System

The directional boring system shall have a slurry system designed to enable excavated soil removal. The slurry system shall have a system of screens and desilting/sedimentation tanks to separate the soil from the slurry. The drilling fluids may be transported to the drill rig for reuse. Disposal of the slurry on-site or into drainage systems will not be permitted.

.5 Entry and Exit Points

The Contractor shall review site conditions and make an assessment of entry and exit points. Assessment shall take the following items into consideration:

- Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- Setbacks or open cut excavation requirements at entry and exit points to provide the pipe profile and construction of appurtenances as indicated on the Contract Drawings.
- Location of other surface features (e.g. adjacent structures, walkways, fences, poles, trees, etc.)
- Location of other underground features (e.g. utilities, foundations, etc.)
- Protection of water courses against the transport of excavated or other materials into receiving waters.

7.3.4.6 Pipe Installation

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. The pipe shall not be laid to a radius greater than that recommended by the pipe manufacturer.

The successfully tested pipe shall then be installed in the reamed hole. The Contractor shall ensure by the use of shear couplings or other means that the amount of tension applied does not exceed the tensile capacity of the pipe during the pipe installation process.

The Contractor shall allow sufficient time for the longitudinal stresses in the HDPE to dissipate before the pipe is cut for connection.

The installed pipe shall be cut to the length and at elevations detailed in the Contract Drawings. The ends of the pipe shall be prepared for butt fused flanged connections. All joints shall be restrained.

7.3.4.7 Disposal of Materials

Surplus excavated material and slurry shall be disposed off-site. The Contractor shall make his own arrangements for off-site disposal and for carrying out soil tests to ensure that disposal is consistent with MECP guidelines, policies and regulations.

7.3.5 Connections

7.3.5.1 Connections to Existing Sewers

The Contractor shall notify the County or the County of Oxford's service provider in writing a minimum of 48 hours in advance of their intention to connect to the existing sanitary sewer. The method of connecting shall be confirmed with **County of Oxford Public Works**. The Contractor shall submit a program for this work which must be accepted by **County of Oxford Public Works** before the work commences.

.1 Jointing of Push on Joint Pipes

The jointing of the Push On pipes will be in accordance with the pipe manufacturer's specifications. Joints shall be bell and spigot with rubber gaskets.

The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer's recommendations.

On straight lengths, no lateral deviation in excess of 150mm will be tolerated and on straight grades no grade deviation in excess of 75mm will be tolerated.

7.3.6 Installation of Maintenance Holes

7.3.6.1 Construction Practices

Maintenance holes shall be supplied and installed in accordance with OPSS.MUNI 407 and the applicable Ontario Provincial Standard Drawings, as amended herein.

The void between the sewer pipe and the cored hole of the precast maintenance hole section shall be filled with cement bricks and approved non-shrinkable grout. Pre booted maintenance holes will be allowed but only with previous approval by **County of Oxford Public Works**. All joints between bricks are to be completely filled with concrete mortar. Bricks are to be parged on the outside. Parging shall contain an approved bonding agent. All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with the manufacturer's specifications.

All precast maintenance hole section joints shall contain an approved rubber gasket. In areas of high groundwater, exterior joint collars or external wrapping (eg. 'Cretex' waterproofing or equivalent, installed as per manufacturer's specifications) of the maintenance hole joints will be required.

A minimum 300mm vertical/horizontal clearance between openings on the inside of the maintenance hole is required for all sewer and lateral connections.

Where adjacent maintenance holes are located in close proximity to one another, the area between the adjacent maintenance holes shall be backfilled in accordance with the specifications in the following table:

Table 5-1 Material Between Adjacent Maintenance Holes

Distance Between Adjacent Maintenance Holes	Material
0.6 metres or less	concrete or crushed stone
0.6 metres to 2.4 metres	granular material
more than 2.4 metres	approved native material or granular material

The above noted backfill shall be compacted to the Standard Proctor Maximum Dry Density specified in the soils report, or as approved by **County of Oxford Public Works**.

7.3.6.2 Waterproofing of Chambers and Maintenance Holes

Where indicated in the Contract Drawings, construct maintenance holes with water-tight designs and appropriate venting to mitigate infiltration. Maintenance holes must be constructed using watertight materials and techniques, including sealed joints and rubber gasketed covers, to prevent surface water from entering the system. The membrane shall be applied over a prime or tack coat and hand rolled to ensure positive adhesion. A compatible elastomeric mastic shall be applied to seal horizontal and vertical terminations, as a flashing and to form corner fillets. Openings in walls or roof slabs for piping, valve boxes or access chimneys shall be sealed with two layers of membrane material and mastic to provide a tight seal. Waterproofing membrane shall be Sealtight Mel-Rol waterproofing system as manufactured by W.R. Meadows or approved equal. Only 150mm of surface elevation adjusters and modular gaskets will be permitted, any further adjustment shall be completed using precast riser sections.

7.3.6.3 Adjustment Units

All maintenance hole frame and covers shall be adjusted to the finished road grade by means of metal shims at each corner or by means of an approved precast adjustment ring. Metal or PVC will be permitted and are to be at least 75mm x 200mm (3" x 8") and their thickness is to be determined by the adjustment required. Concrete, clay brick and wood spacers will not be allowed. The space between the bottom of the maintenance hole frame and cover and the top of the precast maintenance hole is to be at minimum the thickness of one adjustment unit and at maximum 150mm. The number and type of adjustment rings will be affected by either the use of precast concrete adjustment units or “Lifesaver” Adjusting Units as manufactured by IPEX (or approved equal).

7.3.7 Corrosion Protection and Insulation

7.3.7.1 Petrolatum Coating System – Forcemain

Material requirements shall be as per AWWA C217, CSA Z245.30-14, and be ISO 9001 and ISO 14001 compliant. The installation of the petrolatum coating system shall be in strict conformity with the manufacturer's specifications with the following exceptions/amendments.

- All flanged surfaces, nuts, bolts, tie rods, clamps, valves, sleeves, couplings, joint restraints, etc., shall be protected using petrolatum materials. Prior to application all surfaces shall be free of dirt, grease, oil, paint, or foreign material. The minimum acceptable application of a petrolatum coating system is a two-step process consisting of a primer and petrolatum tape. Where voids or other surface irregularities are encountered, filler material is required where the tape will not come into full contact with surfaces. Placement of petrolatum tape only is not acceptable.
- All surfaces of pipes, valves and appurtenances in valve chambers shall be coated using petrolatum materials. Valves or appurtenances that are epoxy coated do not require this procedure.
- Petrolatum coatings shall be DENSO or approved equivalent. After final inspection of the applied coating system any defects in the application process shall be repaired at the Developer's expense.

7.3.7.2 Cathodic Protection – Forcemain

Anodes shall be installed at the locations shown on the Contract Drawings in accordance with OPSS.MUNI 442 and OPSD 1109.011. Attaching anodes to restraint nuts or gland pack nuts is not permitted.

Connections to valves, fittings, and joint restraints will be done using the "cad weld" method and coated with mastic. Installation shall be as per the manufacturer's specifications and recommendations.

.1 Minimum Anode Sizing

The Minimum anode sizes used shall be in accordance with the table below.

Table 5-2 Minimum Anode Size

Scenario	Anode Size and Type
New Installations of Fittings, Joint Restraints, and Services	11kg Z-24-48 Zinc – ASTM B418 Type II
Existing metallic watermain, services, or connection between cast iron / ductile iron watermains and PVC Pipe	14kg M-32-22 Magnesium – ASTM B843 Type M-1C

7.3.7.3 Thermal Insulation

If minimum cover of 1.80m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. Insulation shall be Rigid Board Insulation – Slab

Type (See **Oxford County Standard Drawings** for additional information). No forcemain, gravity sewer, low pressure sewer, or services shall have a ground cover less than 1.0m deep from ground surface to the top of pipe. Where crossings of underground obstructions and utilities occur insulation shall be installed to a minimum of 1.0m from the outside wall of the obstruction on both sides. Material used to thermally insulate mains and services shall have a minimum compressive strength of 690 kPa. All thermal insulation joints shall be tightly butted together and secured by tape or other means to prevent movement during backfill. Manufacturer's specification of material shall be provided prior to installation.

7.3.8 Service Installation

7.3.8.1 Location

Sanitary lateral to single family, semi-detached and row housing lots are to be located in accordance with **Oxford County Standard Drawings**.

All sanitary laterals shall be installed a minimum of 1.0m past property line on all new construction.

Sanitary lateral connections to sanitary sewers shall be as per OPSD 1006.010 or 1006.020 (as applicable).

Where there is a conflict with the proposed sanitary lateral location due to maintenance holes etc., then sweeps must be used to establish a perpendicular connection at the main and perpendicular to properly locate at the R.O.W.

Services located in existing driveways, sidewalks, or curbs shall be saw-cut in clean straight lines to minimize over-break prior to repair or construction. All concrete and asphalt driveways, curbs, and sidewalks shall be restored to existing or better conditions within construction limits only. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressioned concrete is extremely difficult to match when replacing parts of driveways, curbs, or sidewalks. The County or the County of Oxford's service providers are not responsible for an exact match of these areas.

If the property owner cannot agree to the methods and materials required to reinstate all concrete and asphalt driveways, curbs, and sidewalks to existing or better conditions the County will undertake a quotation for reinstatement to the construction limits according to existing materials. Based on the quotation the property owner may receive monetary compensation to pursue other alternatives. Prior to receiving compensation, the property owner will sign an agreement with the County or the County of Oxford's service providers acknowledging acceptance. Included in the agreement will be a holdback to ensure that where sanitary service cleanouts exist, they are placed to proper grade and are fully functional after the property owner's restoration has been completed.

7.3.8.2 Connections to Maintenance Holes, Sewers, and Services

When connecting sanitary laterals to existing sewers in a lot infill situation, connections must be made with an approved saddle or pre-manufactured tees, as per OPSS.MUNI 410 and OPSD 1006.020. Drop structures for maintenance holes shall be as per OPSS.MUNI 1003.010, 1003.020, 1003.030, and 1003.031 and shall be of the type detailed on the Contract Drawings.

Connection can only occur in the presence of the County or the County of Oxford's service provider. When connecting to existing maintenance holes only cored holes with proper rubber connectors are acceptable. Written notice is required 48 hours in advance to schedule an inspection.

.1 Connection to Existing Services

When connecting to existing sanitary laterals and size on size connection cannot be achieved, only eccentric couplings shall be used.

When connecting PVC to PVC pipe, only gasketed PVC repair sleeves shall be used. When connecting other dissimilar sizes and materials it may be necessary to use a "Fernco" or equivalent rubber coupling for connection. All materials used to connect existing services to new services shall be approved by the County or the County of Oxford's service provider.

All connections shall be inspected by the County or the County of Oxford's service provider.

7.3.8.3 Cleanouts

Where private maintenance cleanouts are required, they shall be located off the R.O.W. For private sanitary lateral cleanouts, Part 7 of the National Building Code of Canada (NBCC) takes precedence.

Where sanitary lateral cleanouts are required to be within the R.O.W., prior approval must be granted by **County of Oxford Public Works**.

For properties that require sewage grinder pumps connecting to a gravity sewer lateral, a cleanout shall be installed off the R.O.W. at 1.0m past the property line.

Cleanout and lateral connection to be installed as per **Oxford County Standard Drawings**.

7.3.8.4 Marking and Recording of Sanitary Lateral Connections

Green painted surface stakes 50mm x 100mm shall be placed during trench restoration to mark the termination of the sanitary lateral. These stakes shall extend from sanitary lateral invert to minimum 500mm above finished grade at property line.

Once the sanitary lateral has been placed, a record of its location must be produced for the As-Constructed drawings and provided digitally to the County.

Pipes are to be located on these drawings by showing proper plan view locations which include any bends and sweeps between the tee and the R.O.W. tie-in or stub. Also required on the drawing is the pipe invert elevation at property line.

7.3.9 Field Testing

7.3.9.1 General

Field testing described in this section shall be conducted as per OPSS.MUNI 409, and OPSS.MUNI 410 for gravity sanitary sewers. All testing shall be performed in the presence of the County or the County of Oxford's service provider.

For sanitary sewers in new developments leakage and deflection testing is required. In areas of reconstruction only deflection testing is required.

7.3.9.2 Cleaning and Flushing Services

Contractors are not permitted to flush the new sewer lengths into existing sewers. Contractors shall provide and place temporary plugs where necessary to prevent silt and debris from entering existing sewers. Where silt and debris has entered the existing sewers as a result of construction activities, the existing sewer lengths and maintenance hole structures shall be inspected by **County of Oxford Public Works**. Once the affected areas have been identified, the Contractor shall clean, flush and video those sections as directed by **County of Oxford Public Works** at their own expense.

7.3.9.3 Leakage Testing

Leakage tests shall be performed as infiltration or exfiltration tests and as outlined in OPSS.MUNI 410.

Infiltration tests shall be conducted when the groundwater at the time of testing is 600mm or more above the crown of the pipe for the entire length of the test section.

Exfiltration tests shall be conducted when the groundwater level is lower than 600mm above the crown of the pipe or the highest point of the highest service connection included in the test section.

Testing shall be carried out on completed pipe sewers 1200mm in diameter and smaller. There shall be no visible leakage for pipe sewers larger than 1200mm in diameter.

Testing shall be carried out from maintenance hole to maintenance hole. Tests may be carried out prior to service connections being installed in the section being tested.

The construction of new mainline pipe sewers shall not proceed when three previously placed sections of the pipe sewer have not been tested or have been tested and are unsatisfactory.

All costs associated with any corrective action to repair deficiencies and additional testing to ensure compliance shall be the responsibility of the Contractor / Developer. Prior to final acceptance and assumption of infrastructure all performance reports and testing results shall be reviewed by **County of Oxford Public Works**.

7.3.9.4 Pressure Testing of Forcemain, Low Pressure Sewers, and Gravity Sewers

Pressure testing of forcemain and low-pressure sewer shall be done at two times the design system pressure to a maximum of 827 kPa (120 psi) or as directed by **County of Oxford Public Works**.

The test section shall be subjected to the specified continuous test pressure for two (2) hours.

All sanitary sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are to be pressure tested in accordance with Division 441 (formally 701) of the Ontario Provincial Standards Specifications (OPSS). The entire section of pipe from maintenance hole to maintenance hole shall be sealed and pressure

tested at once, in accordance with OPSS.MUNI 441. Costs associated with the testing are the sole responsibility of the proponent.

7.3.9.5 Mandrel Deflection Testing of Sewer Pipe

Mandrel deflection testing shall be performed on all pipe sewers constructed using plastic pipe. The allowable deflection for pipes 100 to 750mm in diameter is 7.5% of the base inside diameter of the pipe. For pipes greater than 750mm in diameter, 5.0% of the base inside diameter is allowable. Base inside diameter is defined by the CSA or ASTM standard to which the pipe is manufactured.

A suitably designed device as defined by OPSS.MUNI 410 shall be pulled through the pipe sewer to demonstrate that the pipe deflection does not exceed the allowable deflected diameter. The device shall be pulled manually through the pipe not sooner than 30 days after the completion of backfilling and installation of service connections.

Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test. All sections of pipe that fail the deflection test shall be repaired and retested.

7.3.9.6 Closed-Circuit Television (CCTV) Inspection

The Contractor shall undertake a video inspection after cleaning and flushing as per OPSS.MUNI 409 for all sewers upon completion of installation, as amended herein.

When performing a single service retrofit connection or sanitary sewer installation in a new development, the County requires the Contractor to conduct wastewater sewer lateral and/or sewer main CCTV Video Inspections. This must be carried out prior to assumption of the infrastructure and/or acceptance of the service connections. The work must be carried out by an Operator who holds a valid Certificate from the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP). Provide a copy of the Operator's certificate with all submissions.

Physical/Visual inspection must be completed on all work after construction to ensure any defects are rectified prior to the County's assumption. The Consultant's Inspector is responsible for the following:

- To bring the general site servicing drawing and/or the as recorded drawings to the inspection;
- To provide all labour and equipment to assist staff during the inspection;
- To ensure all structures have been pre-inspected and all imperfect work has been rectified by the Contractor, and;
- Failure to comply with any of the above will result in cancellation of the inspection and a charge back to the Developer

30 days prior to the completion of the 2-year maintenance period, the Contractor shall conduct a secondary video review of the sewers to ensure there are no defects in material or installation.

If any issues or deficiencies (such as cracks, breaks, blockages, sags etc.), are encountered with the sanitary sewer or lateral service connections within the public road allowance after final acceptance has been granted and within two years of the occupancy date, the County shall require that the Developer/Contractor rectify the matter immediately at the Developer/Contractor's cost.

One copy of the video inspection with a condition survey report from each survey shall be supplied to the County or the County of Oxford's service provider in USB format. Videos and reports are to be submitted directly to the County of Oxford Customer Service Department or the County of Oxford's service provider.

The following information shall be displayed on the title screen of all CCTV Videos:

- Contract Number
- Inspection Date & Time
- Asset ID
- Street Name (or address for service laterals)
- Sewer Use Type
- Start and Finish MH IDs
- Survey Direction (Upstream or Downstream)
- Pipe Material
- Pipe Diameter (Or dimensions for non-cylindrical pipe)
- Segment Length in metres
- CCTV Contractor & Operator Name

The following information shall be continuously displayed on screen for the duration of the video:

- Start and Finish MH IDs
- Distance from Start of inspection
- Defect coding at defects

Defect Coding shall be in accordance with NASSCO's PACP.

Each CCTV inspection shall be accompanied by an electronic PDF format inspection report generated from the sewer or watermain file. The inspection report shall identify all defects, including photographs. For reports on sewers installed by the Contractor the report shall also identify the Contractor's proposal for rectifying the defects, which will be completed at the Contractor's cost. The header of the report shall include the same information as requested for the title screen of the accompanying video, detailed above.

New and replacement sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are required to establish operational procedures which include CCTV inspections every 5 years with records made available for inspection by the MECP. Costs associated with the testing are the sole responsibility of the Developer.

7.4 Septic Tank Effluent Pump (STEP) / Septic Tank Effluent Gravity (STEG) Systems

STEP/STEG systems shall be considered in areas in which conventional gravity sewers are not feasible or cost effective (permitted in Mount Elgin only). STEP systems must be designed in

accordance with the more stringent of the most recent version of applicable codes and regulations, industry standards, and Oxford's standards. At minimum, the following design standards shall be referenced in the design:

- MECP Design Guidelines for Sewage Works, Chapter 22: Large Subsurface Sewage Disposal Systems
- The latest version of the Ontario Building Code.
- CSA B66:21 Design, material, and manufacturing requirements for prefabricated septic tanks and sewage holding tanks.

7.4.1 Tanks and Inlet Piping

Septic tanks shall be designed and manufactured in compliance with CSA B66:21 Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks. Septic tanks shall be watertight, resistant to corrosion and decay, and designed for all anticipated structural loads, including a minimum of 600 mm of earth cover. Where vehicle access is allowed, the tank shall be protected with appropriate structural slabs.

Tanks shall be equipped with an effluent screen to ensure the retention of collected solids and grease. Tank lids must be installed in a manner to prevent ponding of surface water and prevent I/I from entering the system. The tanks may require risers for this purpose. No more than 1.2 meters of cover above the tank is permitted to ensure that the tank remains accessible for access and maintenance.

Design of the STEP system shall account for areas of high groundwater. Design considerations shall be implemented to prevent tank flotation.

7.4.2 Pumps and Outlet Piping

Effluent pumps for the STEP system shall be submersible turbine pumps, appropriately sized for the head and flow requirements of the system. Conventional centrifugal pumps can be considered for low-head applications. All proposed pumps to be approved and supplied by Oxford County as per our Grinder Pump and Greywater Systems Policy.

Pressurized service lines from a STEP tank to the common collector sewer shall be minimum 25 mm diameter. A shutoff valve shall be installed in a tamperproof valve vault at the property line. In addition, a swing check valve shall be installed at the tank outlet.

7.5 Low Pressure Grinder Pump Station and Service Installation Requirements

Low pressure sanitary sewers will be considered where traditional gravity sewers are unable to service certain developments or lots. Areas that are not large enough to provide economic justification for gravity sewers, contain poor soil conditions, or topography that is not suitable for a gravity sewer, a low-pressure sewer system may be considered. This system will comprise of an outdoor on-site pumping unit for each individual property which outlets to a common forcemain or gravity sewer.

Oxford County does not guarantee basement drainage. All proposed pumps to be approved and supplied by Oxford County as per our Grinder Pump and Greywater Systems Policy.

7.5.1 System Layout

The preliminary layout of a proposed low pressure system should be approved by the **County of Oxford Public Works** before detailed design proceeds.

a) Preliminary Design

The following information is required for preliminary design submission:

- Site plans of the entire area to be served by the proposed system, including adjacent areas currently and potentially served by gravity sewers and community sewage pump stations.
- System flow rates and hydraulic profiles.
- Effluent requirements if discharged or infiltrated in the soil.
- Topographic plan.
- Report on soil conditions, including but limited to parameters such as soil permeability, absorption capacity, depth to water table, soil texture, percolation tests.
- Preliminary layout.
- Area development sequence and timetable.
- Pump unit power requirements.

b) Design Development

Basic data and design criteria for detailed system layout shall include the following:

- Location, elevation, and design flow for each pump unit
- Location and direction of flow of each lateral, branch, and main, plus details of the system discharge point. Layout of system to minimize length of runs, avoid abrupt changes in direction and avoid loops.
- Location and elevation of high points. Adjust pipe profiles where possible to avoid high points

7.5.2 Pipe Sizing

Minimum pipe sizes are as follows:

7.5.2.1 Main

The low pressure sewer shall be sized to have a flow velocity between 0.80 to 2.50 m/s with the lower limit preferred for the initial phase. Size of the low pressure sewer will be based on design flow requirements as well as number, and type of lots to be serviced. The minimum size of low pressure sewer is 50 mm diameter.

7.5.2.2 Services

For residential servicing from the grinder pump on private property to the low pressure sewer the service size shall be a minimum 32 mm diameter HDPE (DR 11) tubing size. Service valves with check valves will be placed on the property line. The minimum depth of cover shall be 1.80m.

For industrial, commercial, or institutional (ICI) servicing from the grinder pump on private property to the low pressure sewer, the service size shall be a minimum 32 mm HDPE (DR 11) tubing size, or as determined by ICI design flow rates. Service valves will be placed on the property line.

The minimum depth of cover shall be as per Detail 6.04 for Rigid Board Insulation – Slab Type from the County's Standard Drawings.

Services shall be installed as per **Figure 7.05**. Where the low pressure sanitary service connects to a gravity lateral at property line the connection will be as per **Figure 7.06** and **Figure 7.07**.

7.5.3 Tracer Wire

All low pressure sanitary sewers and services shall require tracer wire. Tracer wire material shall follow relevant standards for watermain and sanitary sewers provided elsewhere in these standards.

Tracer wire will be installed along the top of the pipe and bound at 6-metre intervals. The wire must be installed between each valve and/or the end of the sewer. At the ends of capped low pressure sewers, a minimum of 2 m of tracer wire shall be extended beyond the end of the pipe, coiled and secured for future connection. The end of the tracer wire shall be spliced to the wire of a 5.5 kg zinc anode and is to be buried at the same elevation as the sewer.

At service saddles, tracer wire is not allowed to be placed between the saddle and the sewer. Joints in the wire shall only occur at ends of rolls, services or repairs with approved splicing connectors.

Verification of conductivity of the tracer wire shall be performed upon completion of rough grading and prior to placement of base coat asphalt on all streets before substantial completion of the project. An additional locate shall be performed prior to expiration of the warranty period before final acceptance.

A locate or conductivity test with the new tracer wire shall be performed by the contractor and completed in the presence of a licensed water operator from the County of Oxford's service provider. The tracer wire shall be installed in such a manner as to be able to trace all components without loss or deterioration of signal or without the signal migrating off the tracer wire. This test shall be conducted using the industry standard low frequency (512 Hz) line tracing equipment. If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire. If a dispute arises as to the ability to trace all components, an independent 3rd party may be required to resolve the dispute and will be done at the contractor's expense. Continuity testing in lieu of actual line tracing shall not be accepted.

7.5.4 Grinder Pumps

Pumps shall be Simplex (single pump) for single family residential applications. Pumps for multi-family units, industrial, commercial, or institutional applications may require Duplex (two pumps) depending on estimated design flow requirements.

Pumps shall be located on private property outside the main building in a location convenient for maintenance.

Grinder pump requirements are as follows:

7.5.4.1 Residential

For residential applications, the grinder pump holding tank shall have a minimum capacity of 265L and accommodate minimum flows of 2,650 L/d.

The pump shall have a minimum 0.75 kilowatt, 1,725 rpm, high torque, capacitor start, thermally protected, 240- or 120-volt, 60 hertz, 1 phase. The inlet shall be sized to accommodate a 100mm diameter pipe. The discharge shall be sized to accommodate a 32mm diameter pipe.

Acceptable pumps are DH071 as manufactured by E/One or approved equivalent.

7.5.4.2 Industrial, Commercial, or Institutional

For Industrial, Commercial, or Institutional applications the size of the grinder pump and grinder pump holding tank will be based on estimated design flow requirements.

For light ICI applications the grinder pump holding tank shall have a minimum capacity of 570 L and accommodate flows of a minimum 11,360 L/d. The pump shall have a minimum 0.75 kilowatt, 1725 rpm, high torque, capacitor start, thermally protected, 240- or 120-volt, 60 hertz, single phase. The inlet shall be sized to accommodate a 100mm diameter pipe. The discharge shall be sized to accommodate 32mm diameter pipe.

Acceptable pumps are DH152 as manufactured by E/One or approved equal.

7.5.5 Valves

Valves shall be located at all intersections. At cross intersections, a minimum of three (3) valves shall be installed and a minimum of two (2) valves shall be installed at tee intersections. Depending on location of other utilities, and where possible, the valve locations shall be on the extension of the street line.

At each valve, the tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole. Tracer wire to be installed as per **Detail 6.17**.

Prior to acceptance of the completed work the contractor shall perform a locate or conductivity test with the new tracer wire. The inspector shall be present when the tracing wire is tested.

If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire.

In residential areas valve spacing shall not exceed 250 m apart. In high density residential, commercial, or industrial areas valve spacing shall not exceed 150 m apart. Valves shall be placed in such a manner that no more than sixty (60) services will be isolated by operating no more than four (4) valves.

7.6 Sanitary Sewage Pumping Stations

A design brief shall be provided for the design of all sanitary sewage pumping stations to document design decisions including any deviation from this standard. The following standards shall be used in the design of sanitary sewage pumping stations.

Refer to **Section 8** for further facilities design guidelines.

7.6.1 External Standards and Guidelines

Sewage pumping stations shall be designed in accordance with the most recent version of applicable codes and regulations, industry standards, and Oxford's standards, or as approved by Oxford County. At minimum, the following design standards shall be referenced in the design:

- MECP Design Guidelines for Sewage Works
- MECP Environmental Noise Guideline - Stationery and Transportation Sources -Approval and Planning (NPC-300 shall apply to all sewage pumping stations)
- Oxford County's CLI ECA
- Ministry's Standard Operating Policy for Sewage Works
- National Fire Protection Association (NFPA 820)
- Hydraulic Institute Standards (Various)
- Canadian Standards Association (CSA) B139 - Installation Code for Oil Burning Equipment: as adopted by the Technical Standards and Safety Authority (TSSA)
- Ontario Provincial Standards Specifications (OPSS) and Drawings (OPSD)
- CSA Z462 – Workplace Electrical Safety (Arc Flash Assessment requirements)
- Occupational Health and Safety Act
- Ontario Electrical Safety Code
- O. Reg. 833, 1990 Control or Exposure to Biological or Chemical Agents

7.6.2 Sewage Pumping Station Design Summary

The station capacity shall be at minimum equal to the anticipated peak flow to the station under a five-year storm event, not including the use of standby pumps.

Sewage pumping stations within Oxford County have different requirements depending on their capacity. These requirements are summarized in the table below.

Table 7-7: Sewage Pumping Station Requirements

Type	Rated Capacity	Pumps	Wet Well Cells	Valve Chamber	No. of Forcemains
I	Up to 25 L/s	Two submersible wet well pumps (one standby plus one shelf spare)	Single wet well and upstream bypass maintenance hole	Separate below-grade structure (confined space with ladder access)	One, sized for rated capacity
II	25 L/s to 100 L/s	Three submersible wet well pumps (one or two standby)	Single wet well and upstream bypass maintenance hole	Separate below-grade structure (confined space with ladder access)	One, sized for rated capacity
III	100 L/s to 250 L/s	Three to four submersible wet well pumps (at least one standby)	Dual wet well	Separate below-grade structure with access house (stairway access, non-confined space)	Two, each sized for rated capacity
IV	Greater than 250 L/s	Four or greater dry well submersible pumps (at least one standby)	Dual wet well plus dry well	Valve room in building (stairway access, non-confined space)	Two, each sized for rated capacity

7.6.3 Site Layout

Perimeter fencing shall be 1.8 m high chainlink security fencing as per OPSD 972.130 and OPSD 972.132. Secure and lockable gates shall be provided at all access points.

Exposed surfaces such as access hatches, doors, etc. shall be designed to be vandal resistant and prevent unauthorized entry. Ensure that all ventilation louvers to the pumping station are properly secured to prevent entry of foreign material including outside debris and rodents. All hatches to be lockable with padlocks provided by Oxford County.

An asphalt driveway large enough for a large Vacuum Truck (approx. 12,000 L to 18,000 L) shall be provided. Provide a minimum of two (2) parking spaces for Type I and II stations and a minimum of four (4) parking spaces for Type III and IV stations.

The exterior of the facility shall be provided with LED lighting system and lamps suitable for horizontal, base up or base down operation. Lights shall be automatically turned on or off by motion sensors or light sensors and shall be capable of being manually turned on or off from a designated central location.

The site layout shall accommodate space and location of a standby generator, as well as the required asphalt driveway for delivery of the generator fuel.

Locate the pumping station entrance floor level and all access hatches at least 300mm above the Conservation Authority flood line and 100-year flood elevation, whichever is higher. The design of grading and stormwater management shall allow the sewage pumping station site to be fully accessible by vehicular traffic during a 25-year flood event.

Water service shall be provided to all sewage pumping stations.

Refer to **Section 8.6** of the facilities design guidelines for further site security requirements.

7.6.4 Yard Piping

Yard piping includes all watermain, sewer, forcemain and storm sewer outside the station to the property line. Yard piping shall comply with the relevant standards for watermain and sanitary sewers provided elsewhere in these standards.

For buried pressure pipe size 100 mm and larger, tandem flexible restrained pipe joints shall be provided outside of structures to allow for potential differential settlement.

Ensure yard piping has sufficient cover to protect against frost damage. Where this is not possible, insulation shall be provided.

Tracer wire should be provided on all non-metallic buried piping.

Where ferrous materials are used for the yard piping, including fittings, valves, and couplings, corrosion protection shall be provided.

7.6.5 Building Design

7.6.5.1 Building Classification

All buildings shall be designed in compliance with OBC (latest revision) and Canadian Standards Association (CSA) design standards for concrete, masonry blocks and steel. All buildings shall be designed as Post Disaster.

Dry wells and Type III Pumping Station Valve chambers shall be designed for continuous human occupancy. Provide at least two (2) means of access/egress to these spaces. Main access shall be by stairs and secondary access/egress can be via ladder.

7.6.5.2 General Requirements

A control building with a pitched steel roof should be provided for Type II, III, and IV pumping stations. If no control building is provided, install a double door enclosure with rain guard, interior

SS door panel and min 200 mm base support brackets (or approved equivalent panel). Heater and UPS are required for the inside panel. Panel sizing to accommodate all SPS controls, SCADA, and ancillary devices

The following guidelines along with those listed in **Section 8** shall be followed in designing the facility:

- The exterior materials and finishes shall be designed maintenance free.
- The building shall be insulated and complete with vapour barriers.
- For above grade structures, utilize steel reinforced concrete masonry block wall systems or combined with face brick systems or pre-cast insulated concrete wall panels. Refer to **Section 8.3.3** for thermal resistance requirements.
- Do not use exposed wood or gypsum boards on any interior walls or ceiling finishes.
- Interior walls shall have waterproof antimicrobial painted finish.
- All exterior wall surfaces including entrance doors and louvers shall be coated with an anti-graffiti clear coat.
- All floors shall be finished with a slip-resistant surface.
- Provide a sloped metal shingle roof equipped with snow guards. Roofs shall be designed to drain rainwater away from entrances.
- Water from eavestroughs and downspouts shall be discharged to a vegetated area. Discharges shall be designed to prevent ice formation on commonly utilized walking or driving areas
- Exterior doors shall be insulated hollow metal and equipped with a touch-bar panic exit device, three sets of heavy-duty hinges, heavy-duty closer mechanism, head and jamb seals, door sweep, threshold, and a kick plate. All door hardware shall be stainless steel.
- Main door electronic locking mechanism compatible with Oxford County security system.
- Interior doors shall be hollow metal and equipped with a window panel, a touch-bar panic exit device, three sets of heavy-duty hinges, heavy-duty closer mechanism, head and jamb seals, and a kick plate. Interior doors leading to the generator room shall be insulated for noise attenuation. All door hardware shall be stainless steel. Ensure that doors are sized to allow for the removal of the largest piece of equipment in each room unless other means of removal are provided (i.e., removable panels, slabs, or access hatches).
- Provide heavy-duty roll-up doors or double doors where practical to allow room for equipment delivery and removal. All roll-up doors shall be electrically powered unless they are located in classified (explosion proof) areas where manual operation is acceptable. A personnel entry door shall be provided near each roll-up door.
- Washrooms are mandatory at all Type III and IV pumping stations, as well as at pumping stations in remote areas. A hot water heater and wash sink shall be provided at all pumping stations.
- All facilities shall be equipped with a permanent eye-wash station supplied with tempered water in accordance with the latest editions of ANSI Z358.1.
- A security/alarm system specified by Oxford County shall be provided for all Type I and II pumping stations.
- A security/alarm system complete with access control specified by Oxford County shall be provided for all Type III and IV pumping stations.

7.6.6 Below-Grade Structures

All buried structures shall be designed as water retaining structures with zero leakage. Watertight lids should be provided for any structures vulnerable to flooding or within an overland flow route.

A leakage test shall be completed prior to backfilling and waterproofing installation. Leaking cracks and joints shall be repaired to achieve a fully watertight structure. Visual leakage tests are acceptable for all non-water retaining structures.

All buried structures shall be designed to withstand hydrostatic and buoyancy uplift forces assuming groundwater elevations are to the surface or maximum flood elevation, whichever is greater.

A protective concrete coating or concrete additive shall be applied to all interior concrete surfaces to enhance the concrete durability and provide additional corrosion protection as approved by Oxford County.

Interior hatches shall be flush with the floor surface. Exterior hatches shall be raised above finished grade. Exterior hatch covers shall be insulated.

Access hatches shall be equipped with EME Davit Crane Posts (Flygt or approved equivalent). Access hatches shall be equipped with interior gratings.

Maintenance holes shall be epoxy coated or complete with concrete additive to reduce H2S impacts.

7.6.7 Grinders

All Type II, III, and IV pumping stations require accommodation for an electrically driven influent grinder capable of handling the peak inlet flow to the pumping station without sewer surcharge. The need for grinders for all stations shall be evaluated on a case-by-case basis with input from Operation Staff.

Electric motors shall be explosion proof and suitably classified for the installation environment in accordance with the NFPA 820 and the Electrical Code. Motors shall be rated for 575V /3-phase / 60 hz power with a 1.15 service factor. Motors shall be designed for full time in-air operation with periodic submergence up to 12 m of head for a maximum period of 40 days. Motors shall be rated NEMA 6P (IP68) CSA certified.

The grinder shall be equipped with a lifting bail made of Type 316L stainless steel, to allow for removal or installation of the grinder without entry from operations staff. The stainless-steel lifting bail shall be able to accommodate a stainless steel lift out chain of sufficient length to clear the grinder access hatch elevation by a minimum of 1.5 m. An access hatch shall be provided above the channel frame and guide rail system suitable for installation and removal of the grinder.

The grinder's local control panel shall be CSA approved. The grinder local control panel shall be located inside the building in a non-classified area. The panel enclosure shall be wall-mount with the proper NEMA rating to suit the operating environment. The control panel shall consist of a relay-logic type without a programmable logic controller (PLC) control. Include a main circuit breaker with disconnect handle, full voltage reversing type starters, current sensor, timer

counters, a transformer rated for 600/120 VAC, 250VA, pilot lights, pushbuttons, selector switches, and an E-Stop for status indication and local control.

7.6.8 Wet Well

Wet wells shall be sized for a minimum cycle time of 10 minutes for each pump. The system shall be designed for a maximum of ten (10) pump starts per hour. Refer to Section 7.2.7 of the MECP Design Guidelines for Sewage Works for additional information.

Wet wells shall be designed to avoid excessive turbulence, and excessive pre-swirl into the pump. Flow distribution at the pump intake shall be even and balanced. Avoid conditions that favour development of flow vortices. The design should reduce the potential for entrained air into the pump suction. Avoid sedimentation of solids that may impact pump performance and increase wet well maintenance requirements.

Provide benching to limit solids build-up in the wet-well and to achieve a self-cleaning system on manual pump down. Where possible, provide benching at 60 degrees or greater around the pump suctions.

For submersible wet well pump installations, the flow path between the sump entrance and the pump inlets must be long enough for entrained air to rise to the surface and escape before reaching the pumps.

Sufficiently dissipate the energy of falling water to keep high and irregular velocities from occurring within the sump. Minimize the release of odorous and corrosive compounds within the wet well through design features such as wet well geometry and hydraulics, and ventilation. Sewage free fall within the wet well shall not exceed 1.05 m from inlet sewer invert elevation to the Duty 1 Pump start elevation.

Where required, utilize inlet sump baffle wall system and slots in the floor of the baffle to direct the flow evenly toward the pump inlets.

Provide a permanent standpipe cleanout to facilitate vacuum cleaning for all wet wells deeper than 5.0 m.

Provide safe access to the floor of the wet well by ladder. The ladder shall be located to offer access directly to the base of the wet well. Provide steps in the benching as required.

A knife gate valve and swingflex check valve shall be provided on the pump riser for each pump in Type I wet well stations. A catwalk should be provided within the wet well to work on these valves.

At minimum, natural ventilation of wet wells shall be provided. Permanent supply air mechanical ventilation shall be provided for all Type III and IV wet wells. For Type I and II stations, make provisions for a portable ventilator fan and portable flexible ductwork that can adequately ventilate the wet well for confined space entry. Ensure the temporary installation of the portable duct work does not interfere with personnel access or equipment removals. The electrical supply outlet for the fan should be located nearby in a non-classified area. Fans, ductwork, and associated equipment shall be fabricated from non-sparking corrosion resistant material such as Type 316L SS or FRP.

The wet well light switch shall activate the wet well fan and be accessible without entering the wet well.

Type IV sewage pumping station wet well designs shall be supported with computational fluid dynamics (CFD) analysis to confirm uniform flow and velocity toward the pump intakes in accordance with the ANSI/HI 9.8 design criteria.

Wet wells shall be epoxy coated or complete with concrete additive to reduce H2S impacts.

7.6.9 Dry Well

Dry wells shall be completely separated from wet wells with gas tight common walls, and independent ventilation systems. The dry well shall be separated from electrical rooms and generator rooms and meet the fire separation requirements outlined in the OBC.

Pumping functionality must be maintained under flooded dry well conditions. Emergency stops, local disconnects, junction boxes, start/stop push buttons, and other instruments or equipment that is not submergence rated shall be located above the maximum wet well surcharge elevation.

A duplex sump pump shall be provided, complete with piping that discharges to a wet well inlet chamber.

Provide stair access to the dry well and a second ladder exit as a minimum.

Dry wells shall be designed for continuous human occupancy.

7.6.10 Pumps

Pump selection and station design shall be based on the system-head calculations and friction curves specified within the MECP Design Guidelines for Sewage Works. Pump selection should ensure the station can deliver the peak influent flow rate under normal wet well operating levels, using a forcemain friction factor of C=100 and without using standby pumps.

Pumps shall be optimized to achieve the highest efficiencies at average flow rates. Selection of pumps should take into consideration the full range of anticipated flows (high and low flow rates) within the planning horizon. Pumps shall be capable of operation under both maximum (low wet well level) and minimum (overflow wet well surcharge level) system-head curve conditions without overloading the motor and must remain within the Allowable Operating Region (AOR) of the pump.

All pumps shall be fully submersible, non-clog sewage design, with suction and discharge openings a minimum of 100mm and, pump body shall be protected by a factory applied sewage resistant coating.

Suction lift, and screw pumps are not permitted. Grinder pumps shall be permitted in Type I stations only (if required).

Pump and motor assemblies shall have CSA approval as one unit, per CSA standard C22.2-108.

Ensure the pump cycle working volume is sufficient to accommodate a maximum of six pump starts per hour unless the motor size requires a fewer number of starts per hour.

All pumps to be provide with timeclocks and pump sensors monitor (Flygt MiniCas or equivalent)

Submersible pumps shall be Flygt, Gorman Rupp, or an approved equal. The Gorman Rupp pump piping package is not typically permitted.

7.6.11 Valves

Stainless-steel slide gate valves per AWWA C561 shall be used for influent maintenance hole and wet well isolation applications. Slide gates must be capable of withstanding hydrostatic forces at the maximum water level that may potentially be encountered (i.e. during overflow conditions) with 40% of the allowable leakage specified in AWWA C561. The slide gate gear must also be located above the normal water level as to not submerge the gear under normal conditions. Factory test all four-sided slide gate valves as per AWWA C651. Provide access above slide gates for removal and installation.

Air release, air vacuum, or combination air valves shall be AWWA C512 fusion bonded epoxy inside and out. For Type III and IV stations, all air valve selections shall be confirmed with a detailed transient analysis.

All check valves shall be AWWA C508 fusion bonded epoxy coated inside and out, swing flex type, non-slam with rubber flapper complete with stainless steel hardware and backflow actuator. Avoid check valve cavitation by making sure the check valve is placed at an elevation not greater than 8.0 m above the pump discharge.

For valves under 450 mm in size, plug valves are preferred over knife gate valves. Plug valves shall be AWWA C517 fusion bonded epoxy coated inside and out. Knife gate valves shall be AWWA C520 fully stainless steel.

All forcemain valves should be installed within a chamber. Do not direct bury valves. Valves shall be located on the outside edge of the chamber to prevent backflow when working on the internal piping.

Gate valves are not acceptable on wastewater piping.

Provide a fully restrained flexible dismantling coupling and spool piece adjacent to all non-buried valves.

All valves within chambers shall be flanged construction. Wafer and lug style valves are not permitted.

For confined spaces, valve operators shall consist of a combination of hand wheel and extension stem such that they can be operated from the surface. The use of angled valve stems or valve stem with off-set swivel joints should be avoided as much as possible.

All valves in maintenance holes, wet wells and exterior valve chambers must be accessible for operation with a truck mounted motorized valve turner.

For non-confined spaces, ensure valves are accessible for operation staff for manual operation from floor level or platform access. Chain wheel operation is not permitted.

7.6.12 Process Piping

All non-buried process piping and hardware shall be Schedule 10 type 316L stainless steel. Process pipe size shall be a minimum of 100 mm (50 mm for Type I stations). Joints shall be Victaulic or approved equivalent.

In all interior locations, all process piping shall be equipped with a flange connection at a maximum distance of 300 mm prior to all wall or floor penetrations. All process piping wall penetrations shall be cast-in-place complete with embedded thrust flange.

Vertical pump discharge risers in wet wells and dry pits shall be designed for a velocity between 1.5 and 2.5 m/s. Adequate scouring velocities should be selected to effectively mobilize heavy solids and grit.

Process piping and fittings shall also be designed for maximum transient pressures or minimum 1,034 kPa (150 psi) as well as full vacuum, thrust restraint, and thermal expansion / contraction. Pressure test piping to a minimum of 1,034 kPa (150 psi) for two (2) hours with zero visible leakage.

Provide a bypass connection to allow for the following:

- Pumping from the wet well through the discharge header to a tanker truck (bypassing the forcemain).
- Portable pumping from the inlet bypass maintenance hole to the forcemain (bypassing the wet well and pumps).
- Bypass piping to have the ability to launch swabs.

7.6.13 Forecemains

At design pumping rates, a minimum cleansing velocity of at least 0.9 m/s shall be maintained. The maximum flow velocity shall be 3.0 m/s. The diameter for raw wastewater forcemain shall not be less than 100 mm.

Forcemains shall have a minimum cover of 1.8m. Forcemains should be designed to have positive grade, and negative discharge points to be minimized (where possible).

Air relief valves shall be installed at all high points in the forcemain to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on forcemains. The forcemain configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves.

Forcemain design shall include transient analysis and consider the provision of water hammer relief for Type II, III, and IV stations.

Forcemains should enter the gravity sewer system at a point not more than 200 mm and not less than 100 mm above the benching of the receiving maintenance hole. Each forcemain outlet shall be equipped with a removable fibergrate cover to facilitate forcemain cleaning through swabbing.

Pipe and joints shall be equal to water main strength materials suitable for design conditions. The forcemain, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater lift stations. The need for surge protection chambers shall be evaluated. Forcemain pipe materials shall be Polyvinyl Chloride (PVC) or High-Density Polyethylene (HDPE).

Friction losses through forcemains shall be based on the Hazen Williams formula or other acceptable methods, including the Darcy-Weisbach equation and the Manning forumula. When

the Hazen Williams formula is used, the following value for "C" shall be used regardless of pipe material:

Table 7-8 Hazen Williams Roughness Factor

Pipe Diameter (mm)	Hazen Williams Roughness Factor
Up to and including 150mm	100
Greater than 150mm, up to and including 250mm	110
Greater than 250mm, up to and including 600mm	120
Greater than 600mm	130

When initially installed, forcemains may have a significantly higher "C" factor. The forcemain shall be appropriately identified when they are constructed of material that may cause the forcemain to be confused with potable water mains.

Forcemains shall be tested to ensure there is no leakage. Specify method of testing and obtain prior approval from **County of Oxford Public Works**.

Tracer wire is required on all forcemains. Refer to **Section 7.3** for additional requirements.

7.6.13.1 Thrust Restraint

Mechanical thrust restraint is required in areas of Engineered fill. In areas of Engineered fill an additional restrained length of pipe shall apply to the requirements listed below.

Prior to construction all thrust restraint design shall be submitted to the **County of Oxford Public Works** for review. The results should be shown on the contract drawings along with the type of restraint to be used.

The following are minimum requirements with respect to thrust restraint:

- All fittings, bends, tees, hydrant tees, valves, crosses, reducers up to 200 mm shall be restrained to the pipe along with a minimum of three (3) full pipe length joints (18 m) measured from each side of appurtenance.
- All 250 to 300 mm fittings, bends, tees, hydrant tees, valves, crosses, reducers shall be restrained to the pipe along with a minimum of four (4) full pipe length joints (24 m) measured from each side of appurtenance.
- Plugged or capped dead ends up to 200 mm shall be restrained to the pipe along with a minimum of four (4) full pipe length joints (24 m) measured from the end of pipe.
- All 250 to 300 mm plugged or capped dead ends shall be restrained to the pipe along with a minimum of six (6) full pipe length joints (30 m) measured from the end of pipe.
- All piping larger than 300 to 400 mm plugged or capped dead ends shall be restrained to the pipe along with a minimum of six (6) full pipe length joints (30 m) measured from the end of pipe.

In addition to manufacturer's specifications and where possible full lengths of pipe shall be placed each way from all fittings to the lengths listed above. Any joints encountered in the restrained lengths listed above from fittings, bends, tees, hydrant tees, valves, hydrants, crosses, reducers and plugged or capped ends shall be restrained.

Where fittings, bends, tees, hydrant tees, valves, crosses, or reducers are connected or adjacent to existing infrastructure, joints on the existing system shall also be restrained to the lengths listed above.

Pipe larger than 400mm shall be restrained as per the restraint manufacturer's recommendations. Shop Drawings submitted by the pipe manufacturer shall include:

- Letter of Compliance
- Pipe design calculations
- Summary of fittings and method of restraint
- Installation Guide
- Tabulated Layout Drawings indicating restrained lengths for fittings and valves stamped and signed by a Professional Engineer licensed to practice Engineering in the Province of Ontario

On vertical offsets due to conflicting utilities such as sewers, the pipe shall be backfilled before the watermain is pressurized. **County of Oxford Public Works** reserves the right to specify the use of mechanical restraint and/or concrete thrust blocks.

7.6.13.2 Valves

Valves on forcemains in rural areas shall be located at all road crossings or at the discretion of **County of Oxford Public Works**.

7.6.13.3 Cathodic Protection

All flanged surfaces, nuts, bolts, tie rods, clamps, valves, sleeves, Victaulic couplings, joint restraints, etc., shall be protected using petrolatum materials. Refer to **Section 7.3** for additional requirements.

The size and type of anodes shall be determined through the Geotechnical report. Anode locations shall be clearly shown on the Construction and as-built drawings. In addition, a tabular listing of the stations at which the anodes are to be installed shall be provided.

Sacrificial anodes shall be installed at all valves, ductile iron, cast iron pipe and fittings, and joint restraints. At the ends of forcemain the tracer wire shall be spliced to the wire of a 5.5 kg zinc anode and is to be buried at the same elevation as the forcemain.

Valves or appurtenances that are epoxy coated do not require this procedure.

7.6.14 Emergency and Maintenance Storage

Emergency and maintenance storage shall be provided as detailed in the table below.

Table 7-9: Emergency and Maintenance Storage

Station Type	Storage Capacity at Rated Capacity
Type I	2 hours
Type II	2 hours
Type III	2 hours (minimum 1 hour on site)
Type IV	2 hours (minimum 1 hour on site)

Emergency storage can be provided by overflow pond, large diameter concrete pressure pipe, leak tested in-ground reinforced concrete chambers, upstream trunk sewers, and upstream emergency and maintenance storage.

7.6.15 Overflow

An overflow shall be provided at elevation before any finished basement floor backups. Overflows should have isolation valve and check valve complete with paddle flow switch alarm (bi-directional). The overflow elevation shall be confirmed by **Oxford County Public Works.**

7.6.16 Odour Control

Odour control studies shall be undertaken where new sewage pumping stations are being constructed within 50 m of sensitive receptors including but not limited to residential or commercial areas, parks, and schools.

Consideration shall be given to providing a permanent odour control system on a case-by-case basis, based on the results of the odour control study. Acceptable odour control systems include: biofilters, biotrickling filters, ozone systems and activated carbon systems, chemical injection systems, coagulant (ferric chloride) utilization, application of oxidizers (H202, nitrate) or a combination of these technologies, selected based on the expected or measured odorant loading and required ventilation rate. Activated carbon systems shall be equipped with a mist eliminator and grease filter. Biofilters and biotrickling filters shall be provided with a service water connection and a drain connection back to the sanitary sewer or wet well.

Wet well headspace shall be actively ventilated, treated continuously, and kept under marginal negative pressure to prevent fugitive emissions for Type III and IV stations.

All Type III and IV stations shall be designed to accommodate future odour control equipment.

7.6.17 Mechanical Requirements

7.6.17.1 General Requirements

Mechanical systems shall be robust, easily maintainable, and appropriately designed for operating conditions in which they are located. Mechanical equipment shall comply with the OBC,

CEC, and MECP Design Guidelines for Sewage Works, with provisions for safe maintenance and energy efficiency.

7.6.17.2 Heating and Cooling

Areas periodically occupied by operations staff, including Type IV dry wells, Type III valve chambers, generator rooms, and all electrical and control rooms should have heating designed for an ambient temperature of 20 °C.

Refer to **Section 8.4** of the facilities guidelines for further requirements.

7.6.17.3 Ventilation

As a minimum, all wet wells and emergency and maintenance wastewater storage structures shall be equipped with a passive ventilation system to permit rising and falling liquid levels.

Portable mechanical ventilation equipment (fan and hose) is required for Type I and II stations. Permanent mechanical ventilation equipment is required for wet wells, dry wells, and valve chambers on a case-by-case basis. The ventilation system for process areas shall be designed in accordance with NFPA 820.

Refer to **Section 8.4.6** of the facilities guidelines for further requirements.

7.6.18 Water Service

A potable water service line shall be provided to all facilities. The minimum water service size shall be 50mm. Backflow prevention is required in accordance with **Section 6.2.14** of the Design Guidelines.

Refer to **Section 8.13** for further requirements.

7.6.19 Electrical

600 V MCC and motor starter panels should be separated from low voltage control panels (120 VAC or less).

The preferred electrical service entrance power supply shall be 600 volt, three phases.

An Automatic Transfer Switch (ATS) shall be provided for all facilities with standby power generators.

MCCs and all components shall be designed, manufactured, and tested in accordance with NEMA standards.

Unless otherwise specifically noted, all electric motors shall be high efficiency, explosion-proof motors. All electric motors including and over 0.50 hp must be 575 V, three phases, 60 hz (Type II, III, and IV stations)

All electrical control equipment must be located outside of process, chemical, or other hazardous areas whenever possible. The electrical design should reduce the operator risk of arc flash

hazards by reducing or eliminating the need to be near high voltage electrical equipment during normal operations. Cabinets and panels can be sized to permit safe maintenance work.

Provide addressable heat and smoke detectors monitored by a vendor-specific fire alarm system when required by the NBCC.

Refer to **Section 8.11** for further requirements.

7.6.20 Standby Power

Permanent standby backup power systems shall be provided for all stations where flows are in excess of 10 L/s and must meet the full load capacity of the facility. Portable generators are not acceptable.

Backup power systems shall consist of a closed loop liquid-cooled generator within a self-contained, lockable, sound-attenuating outdoor enclosure.

Where outdoor generators are not acceptable due to neighbourhood aesthetic concerns, install standby power generator within a building. Only Type I facilities can have generators located within the electrical and control room. Otherwise, all other generators must be located in a dedicated room within a building.

Site-specific noise and emission attenuation measures shall be provided to minimize impact to neighbouring communities, comply with local noise By-Laws, and meet the requirements of NPC-300.

All generators shall be designed to use natural gas or diesel where natural gas is not available. Fuel tanks should be sized based on 36 hours of operation at the facility's firm capacity plus ancillary loads starting from a 95% full tank. Fuel tanks should include a fuel level-indicating transmitter, low fuel float switch, and an interstitial space alarm switch (where applicable). All instruments shall be installed and monitored by SCADA. An approved sight gauge shall also be provided. Either an electronic overfill or a mechanical overfill prevention device shall be installed and a vent whistle shall be provided on each common vent pipe.

The generator shall be provided with an onboard control system compatible with the automatic transfer switch (ATS) and designed to provide automatic starting, monitoring, protection and control functions.

Refer to **Section 8.11.7 Life, Safety, Emergency, and Security Systems** within the Facilities Design Guidelines for further requirements.

7.6.21 Instrumentation and Control

When selecting instruments and devices, review process operating conditions to determine the most suitable instrument technology. All instruments should be installed in locations that are safe for workers and easily accessible. Instruments shall be suitable for their intended service, easily serviceable, and calibrated.

At minimum, the instruments noted in the table below shall be included for sewage pumping stations.

Table 7-10: Instruments Included in Sewage Pump Stations

Instrument Type	Application
Level Transmitter	• Wet well level • Emergency and maintenance storage level monitoring • Diesel fuel tank level monitoring
Float	• Flood/high level monitoring • Pump backup control • Overflow monitoring (to emergency storage or environment)
Smoke, Carbon Monoxide, and Heat Detectors	• Building condition monitoring
Temperature Transmitter	• Building and PLC panel temperature monitoring
Flow	• Forcemain flow monitoring (where flows are in excess of 25 L/s) • Station inlet flow monitoring • Overflow monitoring
Pressure Transmitter	• Forcemain pressure monitoring • Pump discharge pressure for Type II and III stations • Pump discharge and suction pressure monitoring for Type IV stations • Incoming natural gas line pressure
Hazardous Gas Detection Sensors (H2S, CH4)	• Dry wells, Type III valve chambers, and building rooms that are connected atmospherically to a classified space. • Detectors will monitor for combustible gas detection with an alarm set for 10% of the lower explosive limit (LEL).

All hardware and equipment is to conform to the most recent version of the County's SCADA Standards and be approved by **Oxford County Public Works.**

See **Section 8.11** for further requirements.

RESIDENTIAL POPULATION DENSITIES

A. HECTARE BASIS
THE FOLLOWING POPULATION ALLOWANCE APPLY WHEN DESIGNING SANITARY SEWERS
LOW DENISTY (SINGLE FAMILY/SEMI-DETACHED) =30 UNITS/HECTARE @ 3 PEPOLE/UNIT
MEDIUM DENISTY (TOWNHOUSE/ROWHOUSE) =75 UNITS/HECTARE @ 2.4 PEOPLE/UNIT
HIGH DENSITY (APARTMENTS) =150-300 UNIT/HECTARE @ 1.6 PEOPLE/UNIT

B. LOT BASIS
SINGLE FAMILY =3 PEOPLE
DUPLEX/DEMI =6 PEOPLE

SANITARY SEWER DESIGN SHEET
OXFORD COUNTY

DESIGN CRITERA
SEWAGE=250 LITRES/CAPITA/DAY
INFILTRATION=8640 LITRES/HECTARE/DAY
PEAKING FACTOR: $M = 1 + \frac{14}{4+P*0.5}$

DATE: ____________

DESIGNED BY: ____________

PROJECT NAME: ____________

PROJECT FOLE No: ____________

LOCATION				AREA			POPULATION					SEWAGE FLOWS			SEWER DESIGN					PROFILE						
AREA No.	STREET	FROM MANHOLE	TO MANHOLE	NET OR GROSS	DELTA HECTARES	TOTAL HECTARES	PER HECTARE	PER LOT	No OF LOTS	DELTA POP.	TOTAL POP.	INFILT L/S	SEWAGE L/S	TOTAL L/S	n	PIPE SIZE (mm)	SLOPE %	CAP L/S	VELOCITY m/s	LENGTH M	FALL IN SEWER	HEADLOSS	DROP IN MANHOLE	INVERT ELEVATIONS U.S.	INVERT ELEVATIONS D.S.	PEAKING FACTOR

OXFORD COUNTY STANDARD DRAWING

SANITARY SEWER DESIGN SHEET

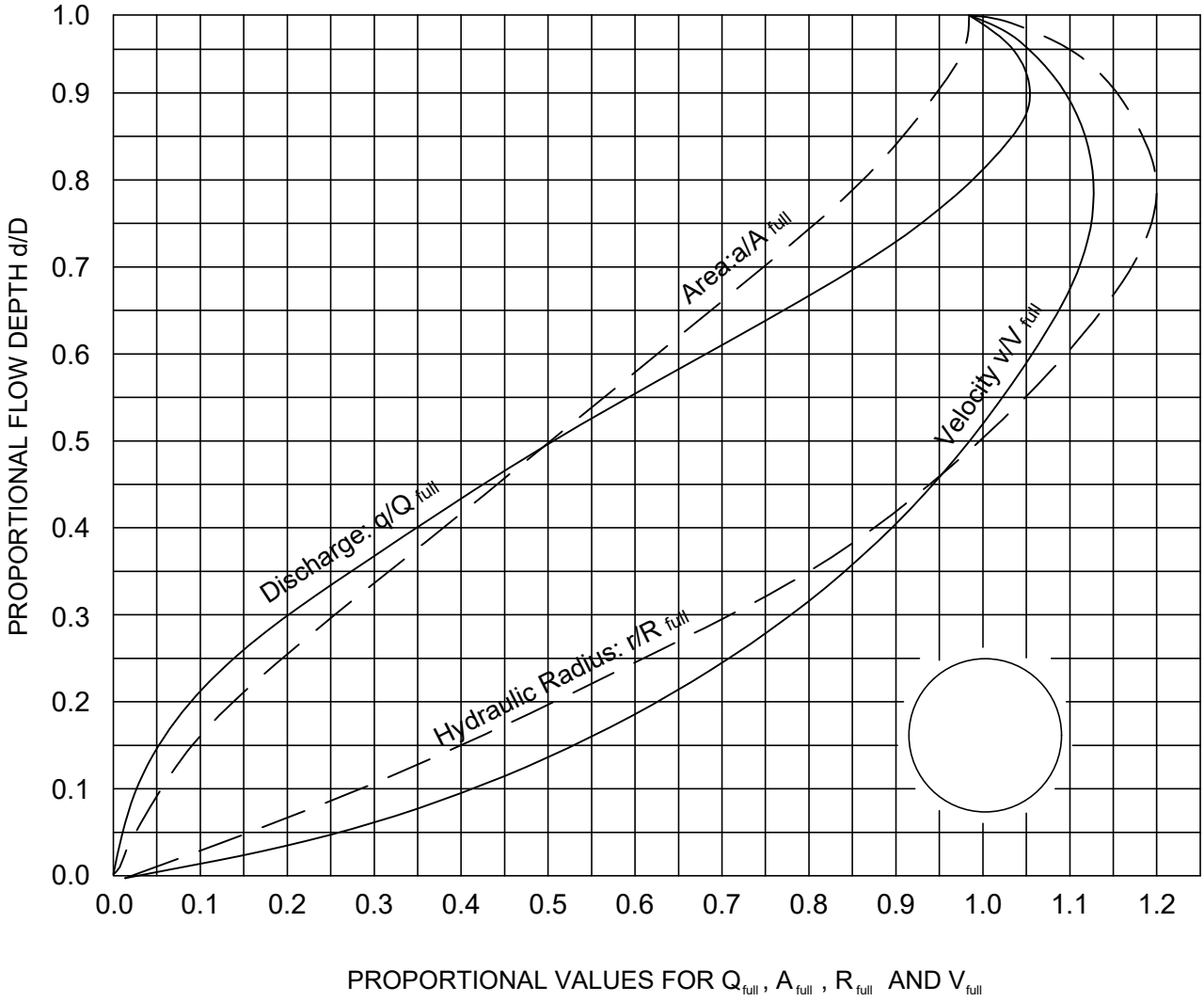
REV#: 1

09/2025

Oxford County
Growing stronger together

FIG. 7.01

PREVIOUSLY: FIG. 4.1



OXFORD COUNTY STANDARD DRAWING

HYDRAULIC ELEMENTS OF CIRCULAR PIPES

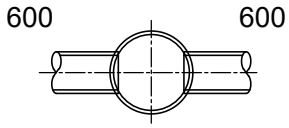
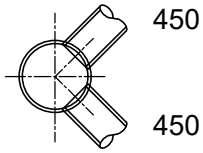
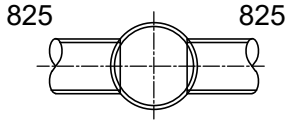
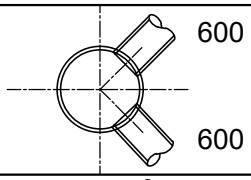
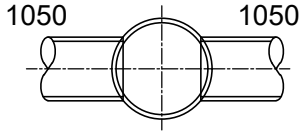
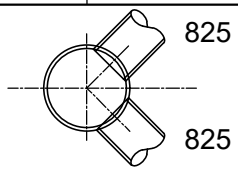
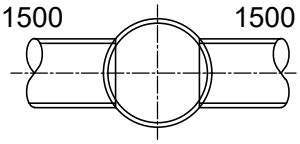
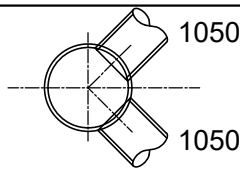
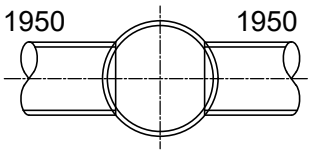
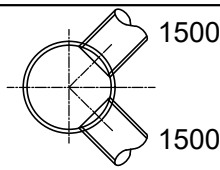
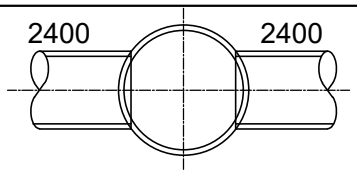
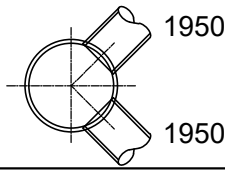
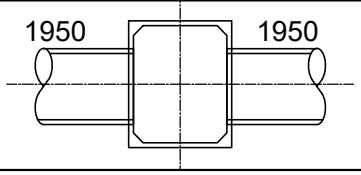
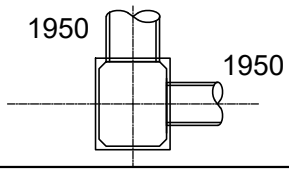
REV#: 1

09/2025

OxfordCounty
Growing stronger together

FIG. 7.02

PREVIOUSLY: FIG. 4.2

MAINTENANCE HOLE INSIDE DIAMETER (mm)	MAX. PIPE SIZE FOR STRAIGHT THROUGH INSTALLATION (mm)	MAX. PIPE SIZE FOR RIGHT ANGLES INSTALLATION (mm)
1200		
1500		
1800		
2400		
3000		
3600		
3000 x 2400		

NOTES:

1. ALL DIMENSIONS ARE FOR CONCRETE PIPE.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. KNOCKOUTS FOR SMALL DIAMETER CATCH BASIN LEAD SIZES 300mm OR LESS COULD BE PROVIDED IN ADDITION TO WHAT IS SHOWN.
4. INFORMATION TAKEN FROM ONTARIO CONCRETE PIPE ASSOCIATION (O.C.P.A.)

OXFORD COUNTY STANDARD DRAWING

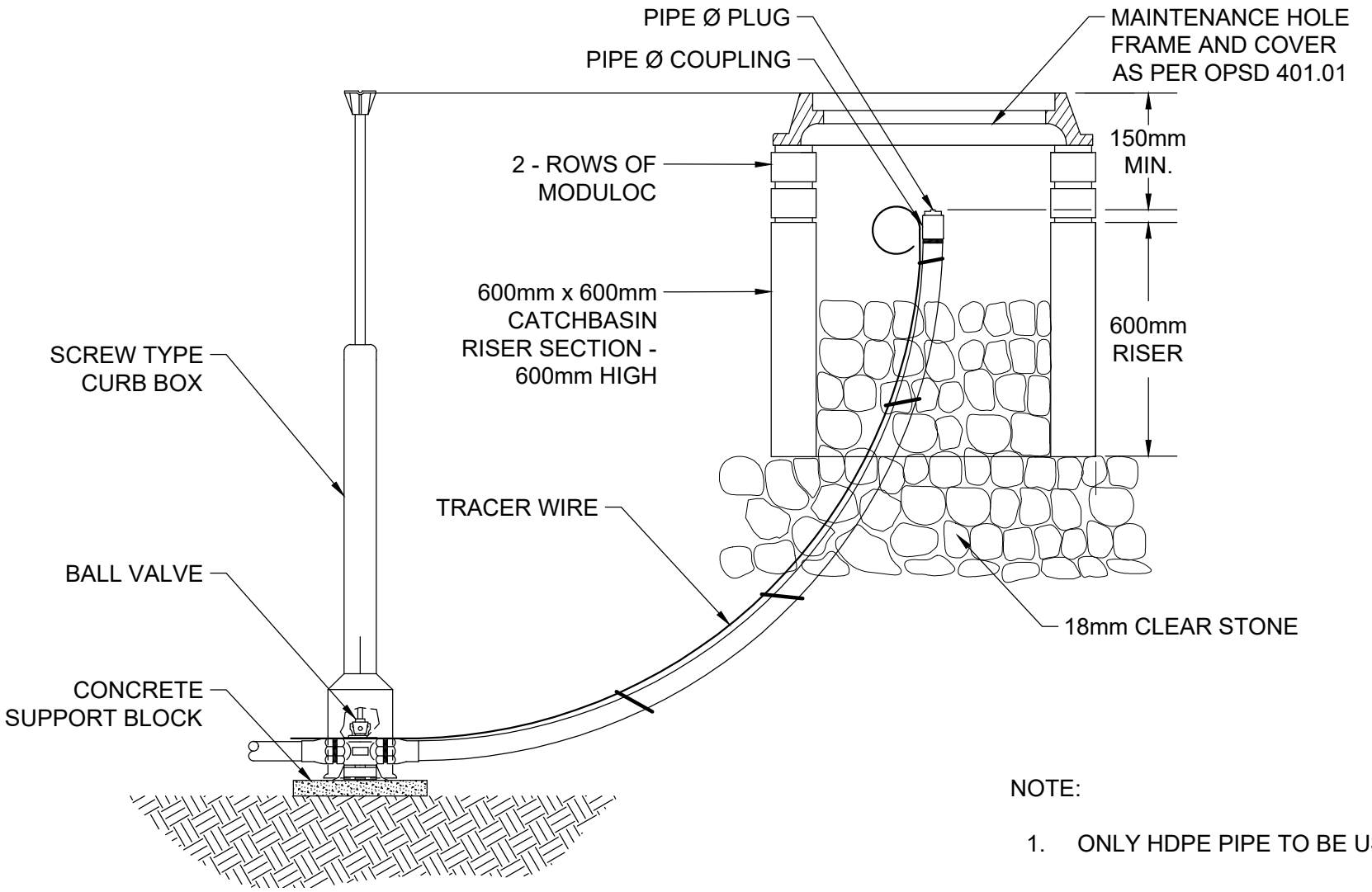
MAXIMUM PIPE SIZE FOR PRECAST MAINTENANCE HOLES

REV#: 1

09/2025

FIG. 7.03

PREVIOUSLY: FIG. 4.3



NOTE:

1. ONLY HDPE PIPE TO BE USED.

OXFORD COUNTY STANDARD DRAWING

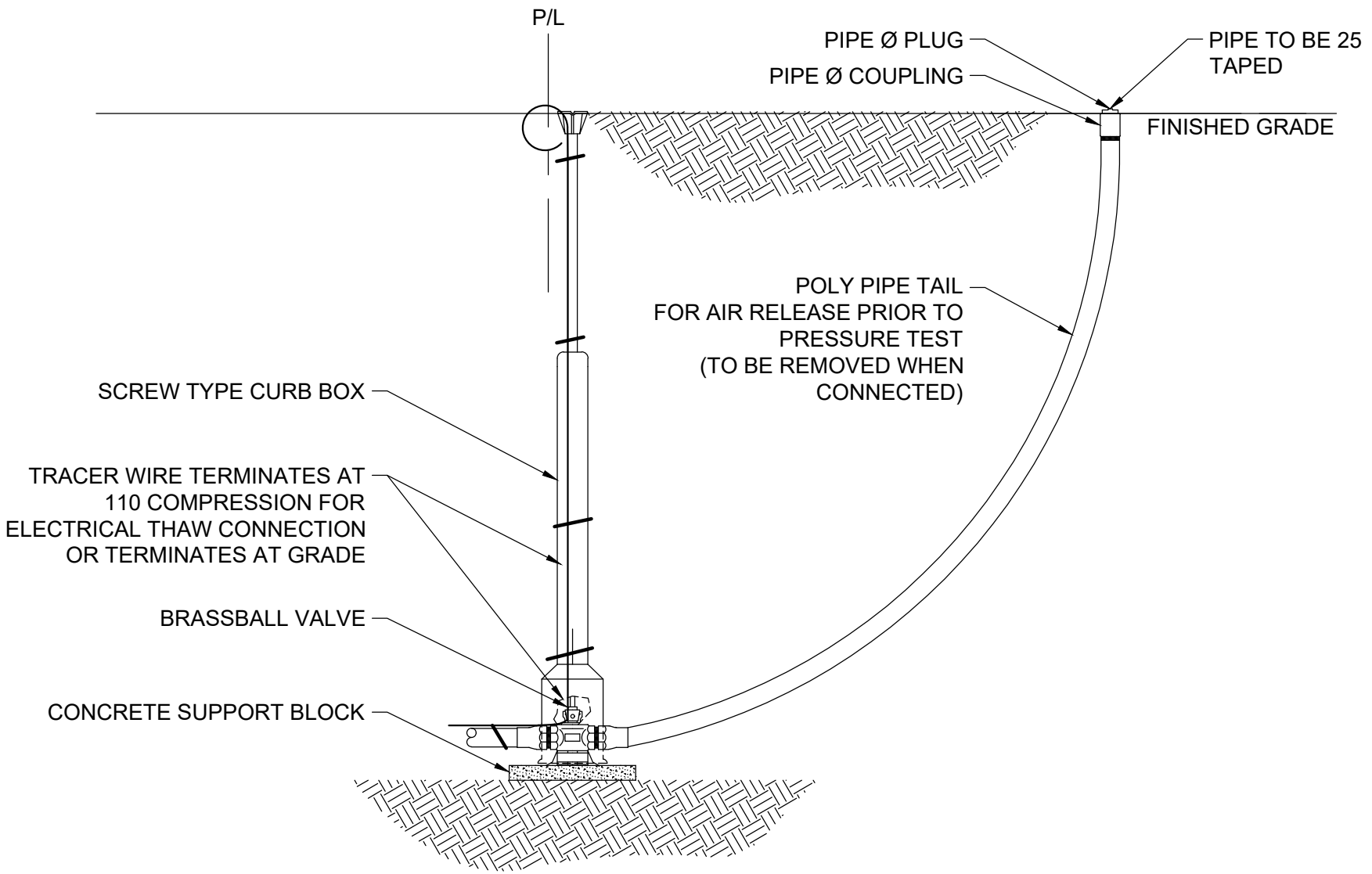
LOW PRESSURE SANITARY SEWER CLEANOUT

REV#: 2

09/2025

FIG. 7.04

PREVIOUSLY: D1847-1-2011



OXFORD COUNTY STANDARD DRAWING

LOW PRESSURE SANITARY SERVICE

REV#: 4

09/2025

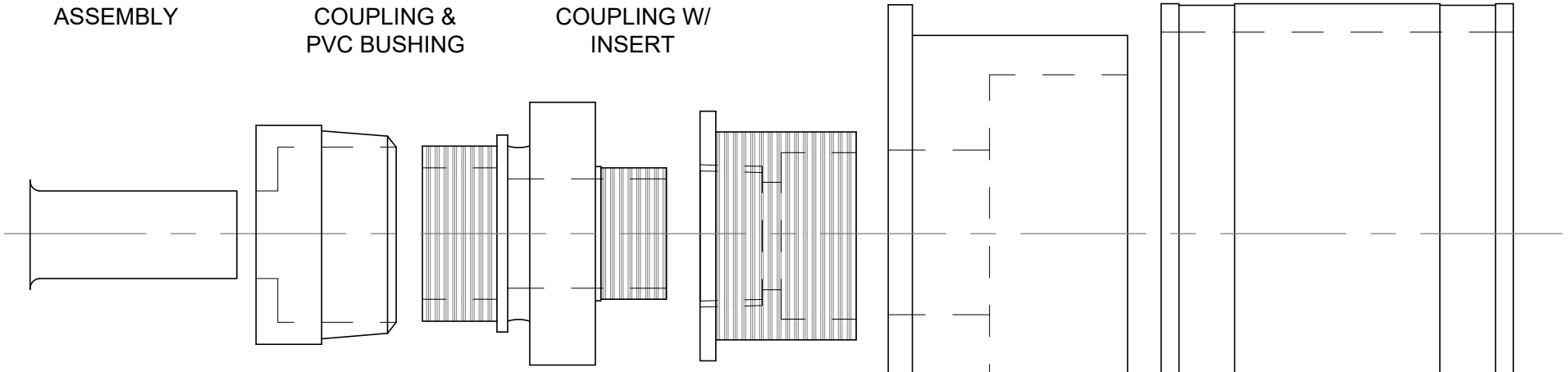
FIG. 7.05

PREVIOUSLY: D1849-1-2011

COMPLETE ASSEMBLY

FERNO COUPLING & PVC BUSHING

BRASS COUPLING W/ INSERT



CAMBRIDGE 1-1/4" CTS INSERT OR APPROVED EQUAL

1-1/4" MIP x 1-1/4" BRASS COMPRESSION BUSHING FOR PEP

*

CAMBRIDGE BRASS SERIES 117(117-PE5F5) OR APPROVED EQUAL

2" MIP x 1-1/4" FIP SCH90 PVC BUSHING

4" MALE SOCKET x 2" FIP SCH80 PVC BUSHING

FERNCO COUPLING 1056-44 4" CI/PLASTIC TO 4" CI/PLASTIC OR APPROVED EQUAL

OXFORD COUNTY STANDARD DRAWING

GRINDER PUMP & SEWER LATERAL CONNECTION

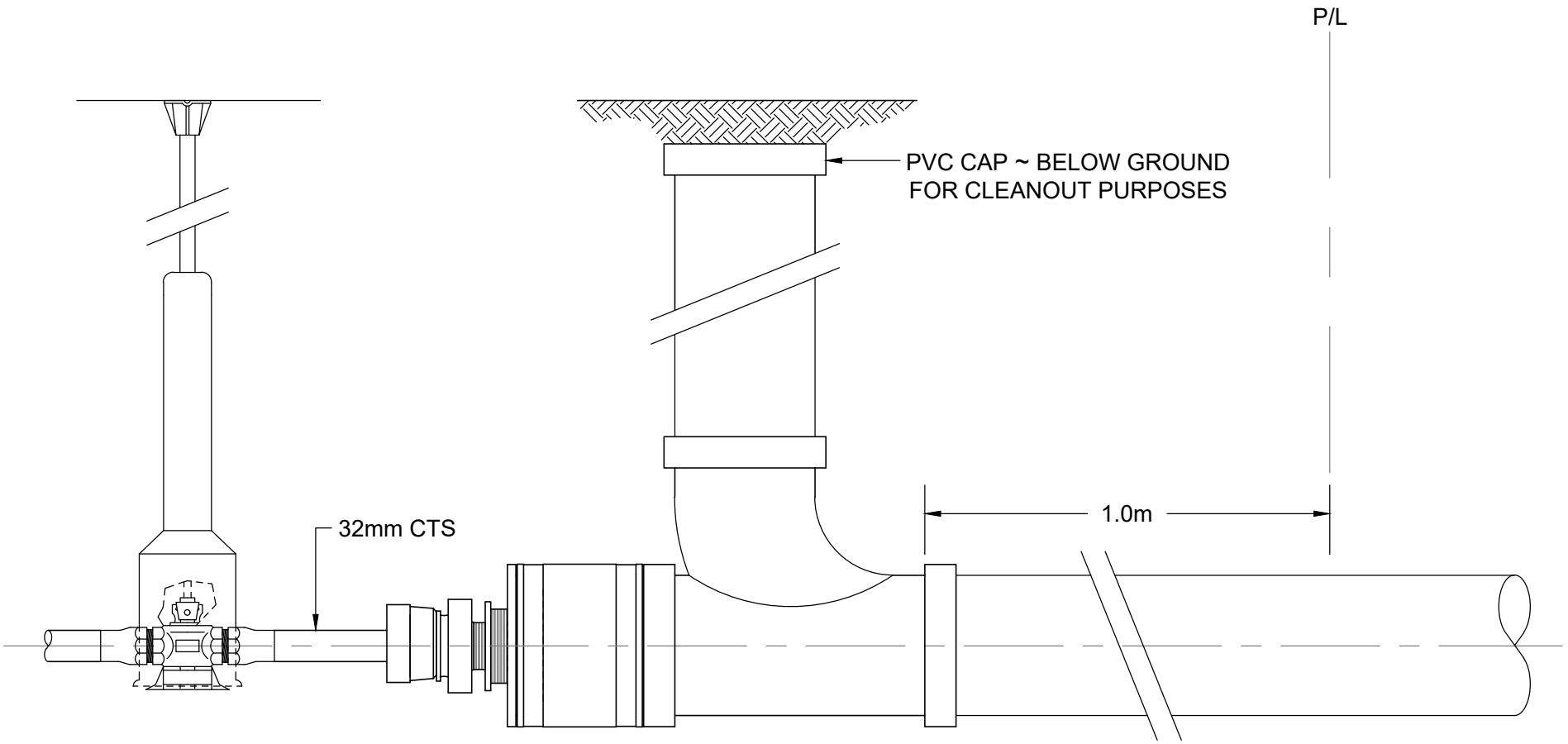
REV#: 1

09/2025

Oxford County — Growing stronger together

FIG. 7.06

PREVIOUSLY: D1850-1-2011



OXFORD COUNTY STANDARD DRAWING

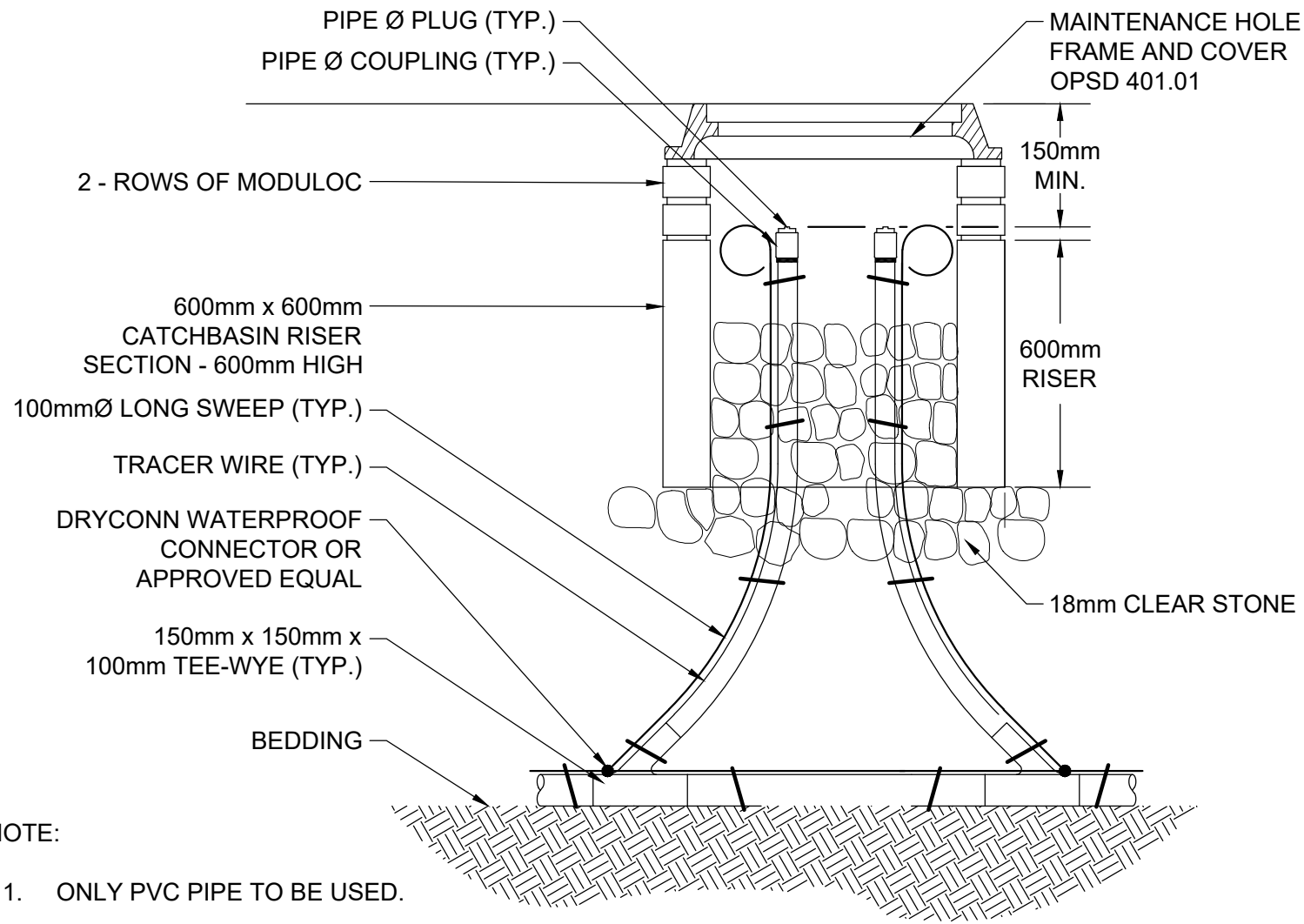
GRINDER PUMP SEWER LATERAL CONNECTION W/ CLEANOUT

REV#: 1

09/2025

FIG. 7.07

PREVIOUSLY: D1850-2-2011



NOTE:

1. ONLY PVC PIPE TO BE USED.

OXFORD COUNTY STANDARD DRAWING

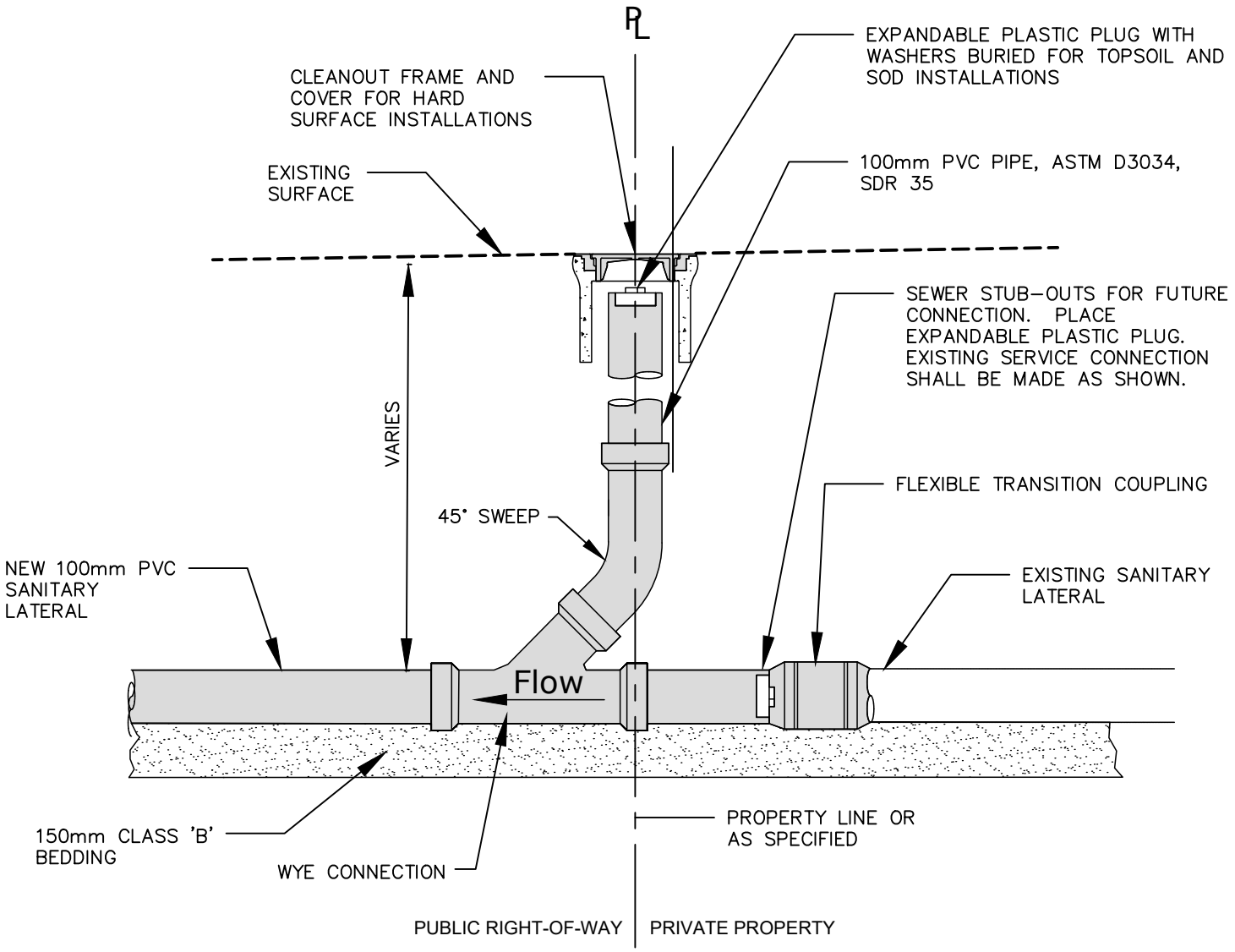
GRAVITY SANITARY SEWER CLEANOUT

REV#: 1

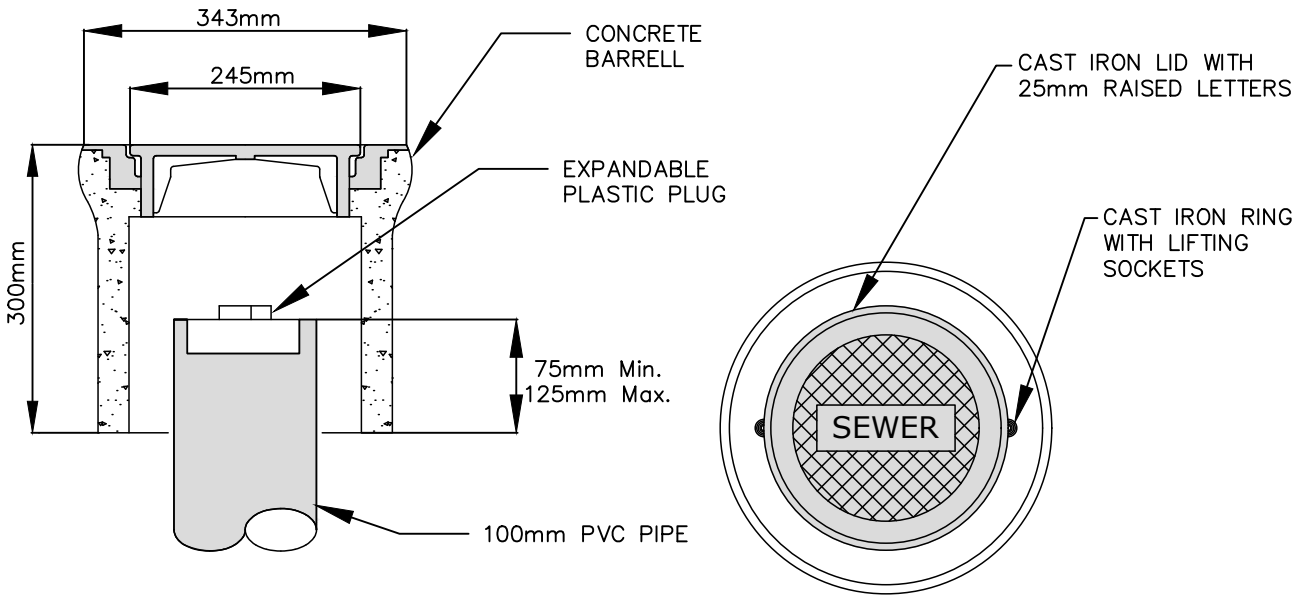
09/2025

FIG. 7.08

PREVIOUSLY: D1854-1-2012



SECTION VIEW



OXFORD COUNTY STANDARD DRAWING	REV#: 1	Oxford County Growing stronger together
TYPICAL SANITARY CLEANOUT	12/2025	
	FIG. 7.09	

PREVIOUSLY D 1860-1-2018