



Growing stronger together

**COUNTY OF OXFORD
DESIGN GUIDELINES
AND
SUPPLEMENTAL SPECIFICATIONS FOR
MUNICIPAL SERVICES**

OCTOBER 2016

Revisions

July 2016

In all sections of the Design Guidelines and Supplemental Specifications previous references to Ministry of the Environment (MOE) have been changed to Ministry of the Environment and Climate Change (MOECC)

SECTION – 1 GENERAL

1.3 Consulting Engineer

- Added requirement that Consulting Engineer to provide full time inspection to projects

1.4 Subdivider and Consultant Responsibilities

- Item (j) Added Transfer of Review for sewers, and new Source Water Protection requirements
- Item (q) Added requirement that all fire hydrants be flow tested in each phase of development
- Item (r) Added requirement for final inspection and acceptance that secondary video review of sewers is required along with secondary locate of watermain and services

1.5 Drawing and Design Requirements

- Added additional scale for Plan and profile scale of 1:250 horizontal
- Added maximum drawing sizes to be 610 x 915 mm (24"x36") unless otherwise specified
- Revised referencing system to the Canadian Spatial Reference System CSRS UTM83 Zone 17N

1.6 Cross-section Layout

- Added "Refer to local municipalities for any updates or revisions."

1.7 Applications and Approvals

- Revised (a) to read "All designs for sewers and watermain shall be submitted to the County for approval by its Engineer. Once approved, the Consultant will submit four copies of the plans with the appropriate application to the Ministry of the Environment and Climate Change, ensuring that all additional design and operational requirements are met as per section 1.4 (j)"

FIGURES

- Added 1.1.2 Service Locations (Semi-Detached Residential)

SECTION – 2 ENGINEERING AND DRAFTING STANDARDS

11.1 – As-built Submissions

- Item (f) Added complete Sanitary and Water Service Record Sheets for each lot
- Item (f) Added required asset information for pipe, valves, air releases, hydrants

SECTION – 3 WATERMAIN

- City of Woodstock and Town of Tillsonburg are service providers for the County of Oxford. The Service providers shall inspect all watermain and service installation on both public and private property in their respective locations. Inspection fees as set owner's responsibility to ensure adequate grounding after reconstruction is out by the local municipality will apply.

Revisions

PART 1 - LOCATION AND DESIGN

1.1 Mains

- In areas of reconstruction where existing metallic watermain is being replaced with PVC or HDPE, the property owner should be advised that the grounding of electrical systems to the water service may not be adequate. It will be the property complete.
- Item (b) Watermain constructed in existing road surface areas requires saw-cuts for clean edges to avoid over-break
- Item (f) Watermains to be arranged in a looped pattern for mutual support. Maximum length of watermain on a dead-end street without looping is 150m
- Item (g) All non-metallic direct bury watermain and services shall require tracer wire. All non-metallic directional drilled services shall require a single tracer wire.
- At the ends of capped watermain, 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 watermain.
- Tracer wire is not allowed between saddle and watermain
- For services 25 mm to 50 mm, tracer wire shall be connected at the main stop using the electrical thaw nut and to the curb stop electrical thaw nut. Each connection will be wrapped in petrolatum tape and compressed tightly by hand around the connection and fitting. For services that are 100 mm diameter or larger a connection will be permitted to the main line tracer wire using only approved connectors.
- 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 of the tracer wire. This test shall be conducted using the industry standard low frequency (512 Hz) line tracing equipment. 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.
- Item (h) Mechanical thrust restraint. This entire item has been revised with additional restraint requirements for pipes up to and including 300 mm diameter. Pipe larger than 300 mm shall be restrained as per the pipe manufacturer's recommendations.

1.2 Easement

1.2.2 *Minimum Easement Widths*

- Where watermains are located within easements between residences, the watermain shall be offset a minimum of 1.0 m from the property line to avoid fence posts.

1.3 Valves

- Item (a) If necessary, adjustments in the field can be made to avoid curbs or other obstructions that may interfere with valve placement.

1.4 Blow-Offs/ Swab Launches

- Blow offs or Swab launches where possible shall be installed in "soft surface" grassy areas with 19 mm clear stone bedding.
- Blow offs or Swab launches installed in "hard surface" asphalt or concrete areas will require 300 mm thick granular "A" bedding compacted mechanically in two (2) lifts of 150 mm thick.

Revisions

SECTION – 3 WATERMAIN

PART 1 - LOCATION AND DESIGN – cont'd

1.5 Casings and Spacers

- Casing materials other than steel must be approved by the County Engineer prior to installation. Steel casing sizes shall follow the new chart provided for inside diameters and wall thicknesses
- Valves should be located a minimum of 3.0 m from each end of the end of the casing. Where casings containing watermain 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.

1.6 Water Services

- The use of copper water service material in the municipal road allowance is not permitted except where existing watermain material is Cast Iron or Ductile Iron. **Copper services are not permitted in new construction.**

Electrical Grounding

- Effective June 30, 1993 electrical systems of all new developments shall not be grounded to the water system. Refer to the Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.
- Where an existing metallic watermain or service is replaced or upgraded with PVC or HDPE material, the grounding of electrical systems to the water service may not be adequate. It will be the property owner's responsibility to ensure grounding is adequate after the watermain or service upgrade is complete.
- Item (c) Added detail drawing Valves for the domestic and fire service should be located as per Detail D1857-1-2016.
- Item (e) Added For all non-metallic water services tracer wire will be installed and attached to the electrical thawing nut on the main stop and to the electrical thawing nut on the curb stop at property line. Splices into the main line tracer wire are not permitted unless the service size is 100 mm or larger.
- Item (g) added County is not responsible for exact match of coloured and/or impressed concrete
- Added item (h) alternative resolution of driveway restoration

1.7 Meters

- Accompanying all water meters will be an Electronic Radio Transmitter (ERT) device used for collecting water usage data.
- Item (a) revised contact information for Erie Thames Power Lines (Ingersoll) 519-485-1820
- In areas of the County that have not begun the universal metering program, meters shall be installed as per Detail D1805-1-2004, D1806-1-2004, D1807-1-2004.

1.8 Backflow Prevention

- In the City of Woodstock all residential services shall require the installation of a dual-check backflow preventor. Installation shall be as per Detail D1807-1-2004.

1.9 Service Valves

- Item (a) curb stop and service box will be placed on a 200x200x100 mm concrete support block. Wooden support blocks are not acceptable.

Revisions

SECTION – 3 WATERMAIN

PART 1 - LOCATION AND DESIGN – cont'd

1.10 Hydrants and Hydrant Testing

- Hydrants located near entrances shall be located a minimum of 1.5 m away from residential driveways and utilities, and 2.5 m away from driveways in industrial, commercial, or institutional areas.
- Tracer wire is not required to be installed to the hydrant.
- Public hydrants shall have the hydrant body painted YELLOW. The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291 colour coding based on flow testing.
- Upon completion of each phase of development, the County of Oxford requires that all fire hydrants be flow tested.
- It is the responsibility of the consultant or developer to confirm hydrant flow rates of all hydrants in the development prior to final acceptance.
- Hydrants located on private property shall have the hydrant body painted RED. The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291 colour coding based on flow testing.

1.11 Temporary Watermain and Services

- Added material KuriTec Series K6136

PART 2 - MATERIAL

2.1 Pipe, Fittings, Tracer Wire and Spacers

- Item (a) All fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system.
- Item (b) All PVC fittings used in PVC systems shall be colour coded blue. All metallic fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system. Ductile fittings in a PVC system require cathodic protection.
- Item (e) Tracer wire specification for CCS wire revised to;
Direct Bury - minimum break load 452 lbs, 30 volt rating, blue in colour.
Directional Boring - minimum break load 1150 lbs, 30 volt rating, blue in colour.
- Added new material - copper split-bolt connector with DRYCONN Direct Bury Waterproof Split-Bolt Housing (Aqua), DRYCONN 3-Way Direct Bury Waterproof connector (DB Lug Aqua) or approved equal. All connections shall be wrapped with petrolatum tape and compressed tightly by hand around wire and connector. Tracer wire connections to be installed as per Detail D1858-1-2016.

2.4 Gate Valves & Rods

- Added - The number of turns to operate the valve shall be 3 times the valve diameter in inches plus 2 to 3 turns.

2.5 Combination Air / Vacuum Valves

- Automatic air release valves should not be used in situations where flooding of the access hole or chamber may occur. Air release/vacuum valves shall conform to AWWA C512.
- Air / Vacuum valves for direct bury to be installed as per D1852-1-2011 and D1852-2-2011.

Revisions

SECTION – 3 WATERMAIN

PART 2 - MATERIAL

2.7 Service Material

- Copper service material is no longer accepted unless it is to be connected to an existing Cast Iron or Ductile Iron watermain. Copper is not permitted in new construction.
- All existing copper service material connected to PVC watermain that has been exposed and not replaced during construction shall require cathodic protection as per Section D Corrosion Protection and Insulation.
- Item (b) HDPE pressure class rating is now PC 200

2.8 Main Stops, 2.9 Curb Stops, 2.11 Fittings

- All fittings shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.
- Main Stops and Curb Stops shall be manufactured with electrical thaw nuts. Curb stops shall be installed with electrical thaw nuts on the private side facing away from the watermain.

2.12 Mechanical Restraint

- Revised list of restraint manufacturers. Please refer to those listed in this section.
- All restraint devices shall be approved by the County or the County of Oxford's service provider prior to installation.
- All mechanical restraints shall have corrosion protection as per Section – D Corrosion Protection and Insulation.

2.13 Hydrants

- Refer also to section 1.10 Hydrants and Hydrant Testing. All hydrants shall be equipped with a 100 mm STORZ pumper connection (cap painted black) and two (2) 63.5 mm hose connections 180° apart. City of Woodstock hydrants to be plugged.

PART 3 - INSTALLATION OF WATERMAINS

3.6 Bedding

- Bedding around the watermain and services may be granular material or clean screened sand.
- Item (a) Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.

3.14 Connections to Existing Mains & Jointing Watermain & Fittings

- Item (d) All connections to existing watermain shall be 6 m in length or less. Connection requirements longer than 6 m shall be flushed, pressure tested, and disinfected as per Part 5 – Testing of this specification.

3.16 Valves, Hydrants & Fittings

- Item (d) Hydrant valves to be located on the street side of the hydrant 1.0 m from hydrant barrel unless otherwise approved by the County Engineer.

Revisions

PART 3 - INSTALLATION OF WATERMAINS – cont'd

3.17 Petrolatum Coating System

- Material requirements shall be as per AWWA C217, CSA Z245.30-14, and be ISO 9001 and ISO 14001 compliant.
- Item (a) 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.

3.18 Cathodic Protection for PVC Watermain

- Refer to this section for the revised application and minimum sizing requirements for Zinc and Magnesium Anodes

3.19 Thermal Insulation

Rigid Board Insulation – Slab Type

- Insulation is required on all new or existing water services if minimum cover cannot be achieved. For watermains crossing underground structures or conduits where minimum cover cannot be achieved, a “Frost Box” is required. Watermains and services located 500 mm or less horizontally from a manhole or catchbasin shall require a minimum of 50 mm thick insulation. Water services crossing over or under storm sewer requires a minimum 500 mm of clearance. In instances where clearance is 500 mm or less from storm sewers the water service shall require insulation. Insulation shall be installed to a minimum of 1.0 m from the outside wall on both sides of the storm sewer.
- Pre-Insulated Pipe has been added to this section. Refer to Design Guidelines and Supplemental Specifications

PART 4 - SERVICE INSTALLATION

4.1 Connecting Services to Mains

- All new water services 100 mm diameter and larger on private property must be tested and disinfected as per Part 5 – Testing and Part 6 – Disinfection of this specification.
- Item (b) The type of connection will be determined by the County or the County of Oxford’s service provider.

4.2 Services

- Item (d) Material used for tail pieces shall be PEX, PE 3408/3608 Series 200 CTS, or approved equal

PART 5 – TESTING

5.1 Testing General

- Submission of Form F035 Watermain Inspection Report is required as final acceptance of the testing procedure.
- Item (c) Testing not to exceed 600 m unless approved by the County Engineer.

Revisions

PART 5 – TESTING – cont'd

5.2 Initial Flushing and Swabbing

- On projects supervised by the City of Woodstock or the Town of Tillsonburg swabs may be inserted as construction progresses. On County supervised projects swabs shall be inserted after initial flushing is complete. The placement of swabs during construction on County projects is not permitted unless authorized by the County Engineer. All new and rehabilitated watermains shall be cleaned and swabbed after the water services have been tapped.
- Swabbing - Swab diameter is 1.25 times the outside diameters up to and including 300 mm and 1.50 times the outside pipe diameters greater than 300 mm.

5.3 Test Pressure

- In areas where watermain has been rehabilitated with structural or cement mortar lining, pressure testing to 1035 kPa (150 psi) is not required. Rehabilitated watermain shall be tested at system pressure. A visual inspection is required for all fittings, valves, and connection points where entry into the piping has occurred, prior to backfilling, to verify there is no leakage.

PART 6 - DISINFECTION

6.1 General

- Rehabilitated watermain has been added to specification

PART 6 - DISINFECTION

6.3 Point of Application

- Backflow prevention device shall be an appropriate testable reduced pressure zone (RPZ) check valve assembly used ONLY above ground. The backflow prevention device shall be isolated from the new main during the hydrostatic pressure test by placing the isolation valves in the “closed” position.

6.4 Disinfection

- This section has been amended according to new MOECC Watermain Disinfection Procedure. Refer to this section for changes

6.5 Final Flushing

- Discharge of heavily chlorinated water into sanitary sewers is not permitted. Refer to this section for amendments

SECTION – 4 SANITARY

PART 1 - LOCATION AND DESIGN

1.2 Location and Alignment

- In some areas of new construction and reconstruction, design constraints may limit the ability for gravity flow basement drainage. In these instances a low pressure sewer with a grinder pump may be necessary. The County of Oxford does not guarantee basement drainage.

Revisions

SECTION – 4 SANITARY

PART 1 - LOCATION AND DESIGN – cont'd

1.10.3 Minimum Size and Grade of Sanitary Services

- Services shall be placed 1.0 m past property line. Cleanouts will be placed on private property as per the OBC. Where service lengths on municipal property are 45 m in length or greater a cleanout must be installed.

1.11.3 Casings and Spacers

- Casing materials other than steel must be approved by the County Engineer prior to installation. Steel casing sizes shall follow the new chart provided for inside diameters and wall thicknesses
- Valves should be located a minimum of 3.0 m from each end of the end of the casing. Forcemain inside casings located within easements between residences shall be offset a minimum of 1.0 m from the property line to avoid fence posts.
- Sewage forcemain inside a casing using bell and spigot PVC material shall be restrained using approved restraints.

1.11.3 Casings and Spacers– cont'd

- Casings shall be installed at the same design grade as the sewer. Joint restraint for gravity sewers will be at the discretion of the County Engineer.

1.11.4 Vertical Separation

- Watermain, a minimum clearance of 0.50 m shall be maintained between the two pipes. Crossing under a watermain, a minimum of 0.15 m clearance shall be maintained between the two pipes. This practice must also be followed when sanitary laterals are in conflict with any watermain. Water services require a minimum of 0.50 m separation vertically from sewers and laterals.

1.14 Low Pressure Sanitary Sewer, 1.15 Sewage Forcemain, 1.16 Valves – new sections added

PART 2 - MATERIAL

2.1 Pipe Material

- Revised - Field cut tees will only be permitted with approved materials and methods as set out by the County Engineer
- Added - 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.
- Added Forcemain material for open cut and trenchless installations

PART 3 - INSTALLATION

3.6 Bedding

- Bedding around the watermain and services may be granular material or clean screened sand.
- Item (a) Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.

Revisions

SECTION – 4 SANITARY

PART 3 - INSTALLATION-cont'd

Added new sections - 3.13.7 Tracer Wire, 3.16 Petrolatum Coating System – Forcemain, 3.17 Cathodic Protection – Forcemain, 3.18 Thermal Insulation, 4.3 Grinder Pumps – new sections added

PART 4 – Sanitary Service Installation

4.1 Location

- added County is not responsible for exact match of coloured and/or impressed concrete and alternative resolution of driveway restoration

PART 5 – FIELD TESTING

5.1 Leakage Testing

- Added Infiltration and exfiltration testing
- Added pressure testing of Forcemain, Low Pressure Sewers and Gravity Sewers in Source Water Protected areas

5.2 Closed-Circuit Television (CCTV) Inspection

- Added additional secondary video review
- Added additional video requirements for sewers within Wellhead Protection Areas

FORWARD

The purpose of this manual is to provide consistency in design guidelines and specifications for infrastructure owned by the County of Oxford located in the surrounding municipalities. This document has been written for municipal staff, Consulting Engineers, Developers and others to assist those involved in submitting land development and engineering design processes within the County of Oxford

The information contained in this document is intended to provide guidance beyond legislative and standard design practices. There will be specific situations where the design will not conform to these guidelines and supplemental specifications and it is not the intention of the County of Oxford to anticipate every situation.

Any deviation from the design guidelines and specifications contained herein must be submitted in writing to the County Engineer for approval. Approval must be granted before proceeding with design changes contrary to this document.

On an annual basis this document will be reviewed by municipal staff for the purpose of updating existing criteria when necessary and introducing new products or procedures if applicable to the design and construction practices. It will be the responsibility of those who perform the planning, design, and construction of Oxford County owned municipal infrastructure to verify that the design and installation is in strict accordance with the latest revision of this document.

This document can be found on the Oxford County website at www.oxfordcounty.ca located under Services for You / Water & Wastewater / Design Guidelines and Supplemental Specifications.

Should you have any questions regarding the information contained in this document, please contact the County of Oxford at 519-539-9800 Monday to Friday, 8:30am to 4:30pm.

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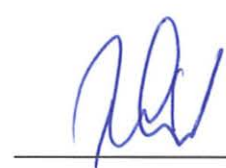


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It should be noted that Oxford County considers all documentation and drawings generated during and upon completion of the design project a property of Oxford County. As such, the County requires that all reports, design drawings, specification packages, and tender documents, etc. be made available to the County in both hard copy and electronic (non-PDF) format (i.e. original AutoCAD, Word files, etc.). Submission of a Letter of Interest (LOI) indicates acceptance by the consultant and any sub-consultants of the above condition.



SECTION 1 - GENERAL

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Figure 1.3	Sanitary and Water Service Records
Figure 1.3.1	Example - Sanitary and Water Service Records

1.1 Introduction

The following information contained herein comprises the “Design and Installation Guidelines and Supplemental Specifications for Municipal Services” which are to be utilized for the design of works within the County of Oxford on municipally owned road allowances, municipally owned property and for municipally owned infrastructure on easements.

The design information contained in this manual is intended to provide guidance beyond legislative and standard design practices for use in the County of Oxford. There will be specific situations where the design will depart from these practices as it is not possible nor is it the intention of the County of Oxford to anticipate every situation.

This document along with the Ontario Provincial Standard Specifications (OPSS), the Ontario Provincial Standard Drawings (OPSD), American Water Works Association (AWWA) Standards and Ministry of the Environment and Climate Change (MOECC) Guidelines provide the basis for the design of municipal construction projects and works intended for assumption in the County of Oxford.

These specifications and drawings may be revised from time to time as required by the County of Oxford. It will be the responsibility of the professional engineer who is designing and/or performing the contract administration for the work to verify that the installation of these systems will be in accordance with the latest revision of these Specifications.

The County of Oxford maintains its right to accept or refuse any design submissions. The County of Oxford requires an acceptable design for any given circumstance. Notwithstanding any item that may be contained or not included herein, the decision of the County Engineer concerning any matter shall be final.

ANY DEVIATION FROM THE FOLLOWING SPECIFICATION MUST BE SUBMITTED IN WRITING TO THE COUNTY ENGINEER FOR APPROVAL. APPROVAL MUST BE GRANTED BEFORE CONSTRUCTION CAN COMMENCE.

1.2 Definitions

Wherever used in the Contract Documents, or other document forming part of the Contract:

- a) “approved equal” means written permission from the County Engineer
- b) "Consulting Engineer" means a firm of Consulting Engineers registered with the Professional Engineers Ontario (PEO) who has been retained by Oxford County or Developer to act as their agent for the construction of municipal infrastructure herein.

SECTION 1 - GENERAL

- c) "Contract" means: the Contract to do the Work, the Bonds or Securities, the Addenda, (if any), the Specifications, the General and Supplementary General Conditions, the Tendering Information, the List of Contract Documents, Drawings, and other documents referred to or connected with the Agreement.
- d) "Contractor" means the person or Corporation to whom the Contract for the Work has been awarded.
- e) "County" means the County of Oxford.
- f) "County Engineer" means the Director of Public Works of the County of Oxford or his/her appointed representative.
- g) "Drawings" means all Plans, Profiles, Drawings, Sketches or copies thereof exhibited, used or prepared for or in connection with the Work embraced under the Contract.
- h) "Inspector" means an inspector for the County Engineer.
- i) "OBC" means Ontario Building Code.
- j) "Owner" means the County of Oxford.
- k) "Plant" means every temporary or accessory piece of equipment required to carry on or complete the work and extra work, in the time and manner herein provided.
- l) "Private Sewage Systems" means a sewage system (or systems), with a total design capacity of 10,000 litres per day or less, and shall be designed, constructed, operated and maintained in accordance with Part 8 of the Ontario Building Code. A system (or systems) with a total design capacity greater than 10,000 litres per day, falls under the jurisdiction of the MOECC.
- m) "Public Sewage Systems" means a piped collection system that transports wastes of domestic origins which is human body waste, toilet or bathroom waste, waste from other showers and tubs, liquid or water borne culinary and sink water or laundry waste, and such other waste as is suitable for treatment at a sewage treatment facility in accordance with County of Oxford Sewer Discharge By-law 2719-87.
- n) "Subcontractor" means the person or Corporation having a contract with the Contractor (or with another subcontractor) for the execution of a part or parts of the Work included in the Contract, or for the supplying of material for the Contract and worked to a special design according to the Drawings and Specifications.
- o) "Subdivider" or "Developer" to mean the same as Contractor.

- p) "Work" means labour, materials and other things required to be done that are shown, described or implied in the Contract Documents.
- q) The words "authorized", "directed", "required", "requested", "approved", "ordered", "sanctioned", and "satisfactory", unless some other meaning is obvious from the context, mean respectively authorized, directed, required, requested, approved, ordered or sanctioned by or satisfactory to the Engineer.
- r) The words "shall", "may", "herein", "person", "writing", "written", "surety", and "security" and words used in the singular number or the masculine gender shall, have the same meaning and effect as given in The Interpretation Act of the Revised Statutes of Ontario.

1.3 Consulting Engineer

The Developer will hire the services of a Consulting Engineer acceptable to the owner to prepare the detailed design of the project and, to direct the Developer's field staff and construction forces through the construction process.

The Consulting Engineer shall provide full time inspection and maintain record keeping of all infrastructure over which the County of Oxford will assume ownership. It is expected that the County or the County of Oxford's service provider will from time to time be present onsite to inspect and enforce the County of Oxford Design Guidelines and Supplemental Specifications. Any errors in construction or, deviation from the County of Oxford Design Guidelines and Supplemental Specifications will be rectified at the Contractors expense.

All drawings shall be stamped by a Professional Engineer.

1.4 Subdivider and Consultant Responsibilities

The Subdivider and their consultant shall:

- a) Prepare and submit to the Engineer a field inspection report setting out the salient engineering features of the Work, and the Engineer's proposed design methods in consideration of these features.
- b) Provide a Geotechnical Report which shall examine and confirm subsurface conditions and the impact on construction of public works and building construction within the plan of subdivision. The submitted report shall be signed and sealed by a licensed professional engineer.

The report shall specifically examine subsurface conditions such as:

- i) soil type(s)
- ii) groundwater levels
- iii) depth of refusal, bedrock, etc.
- iv) soil bearing capacity
- v) soil corrosivity
- vi) environmental conditions

The report shall address the suitability of native soils, excavated and / or imported materials for roadway construction, trench backfill, building foundation construction, and size and type of cathodic protection.

In addition to the forgoing, the report shall identify proposed construction methods, including those related to backfilling and the placement of fill materials, trenchless technologies, choice of structures, and routes. The submitted report shall also be accompanied by a scaled plan of the subdivision showing test pit or borehole locations, together with a log of test pit or borehole findings tied to geometric datum.

- c) Prepare and recommend alternate concepts and designs, geometrics, property cost, and environment features.
- d) Prepare a preliminary plan showing the principal features and geometrics of any proposed structure or structures, which shall be submitted in duplicate to the County. The plan shall provide standard design scaled at 1:500 meters for the County to mark locations of available connection points and feeder mains required.
- e) Provide field survey work required after the design criteria and function alignment have been established, which shall include all survey work for the detailed setting of alignment and grade to fit controlling natural and artificial topographic and underground features, mains, lateral and service connections and stabilization requirements of these structures.
- f) Investigate and confirm the present location of all above and below ground facilities, update plans and profiles to show the present location and proposed location, and prepare additional drawings required for alternative utility relocation as required.
- g) Participate in a reasonable number of meetings for informative, negotiate or presentative purposes with the County. Prepare and distribute minutes of project design meetings with clearly defined action items if required.
- h) Design the complete water, sanitary, and storm systems according to criteria and specifications provided by the Owner, and supply design drawings in a scale specified by the Owner.

SECTION 1 - GENERAL

The plans will show the location of the mains on the street with all valves, hydrants and other appurtenances showing the size and type of pipe, all fittings

and their location on the street with respect to the street plan as well as showing all other utilities. Plan and profile details will be given where crossings with other utilities are required and where complex arrangements of fittings are required.

- i) Co-ordinate the design with other utility services and resolve any conflicts. Hydro-excavation may be necessary to verify location of infrastructure.
- j) Arrange any approvals or applications required by any Board or other body having jurisdiction over utility systems.
- k) Provide all field layout of the system; changes from the approved drawings or specification must have prior approval in writing from the Owner. The Subdivider and or Consultant shall make all efforts to mark and preserve all existing survey monumentation. If these markers are disturbed or destroyed during construction it will be responsibility of the Subdivider and or Consultant to have these markers re-established.
- l) Notify the Owner in advance when factory or field inspections may be made.
- m) Be responsible for the ordering of all material and the letting and administration of the contract.
- n) The Owner on completion of construction shall be provided with plan and profile “as constructed” CAD files that have been geo-referenced along with individual water, sanitary, and storm service records as per Figure 1.3
- o) Upon completion of each phase of development, the County of Oxford requires that all fire hydrants be flow tested. Records of field test data must be submitted prior to commencement of the maintenance period. Testing will be completed in the presence of a licensed operator from the County or the County of Oxford’s service provider. It is understood that as phasing of developments progress, hydrant flow rates may change (i.e. dead-ends to looped connections). These locations will be re-evaluated by the County or the County of Oxford’s service provider.

It is the responsibility of the consultant or developer to confirm hydrant flow rates of all hydrants in the development with hydrants appropriately colour coded as per the National Fire Protection Association (NFPA) – 291 prior to final acceptance. All costs associated with testing and colour coding will be the responsibility of the developer.

- p) Final inspection for acceptance of the installed municipal services will not be performed prior to the end of the 2 year maintenance period until the following have been completed to ensure there are no defects in material or installation:

- All “as constructed” information has been submitted to the owner at no cost
- The Contractor 30 days prior to the completion of the maintenance period has conducted a secondary video review of the sewers
- A secondary locate of the watermain and services

1.5 Drawing and Design Requirements

All drawings shall be prepared in an AutoCAD drawing format.

The following scales are required for each drawing type:

Drawing Type	Scale
Overall Engineering Plan	1:1,000
Drainage Area Plans	1:1,000
Plan and Profile	1:250 or 1:500 horizontal, 1:50 vertical
Site Servicing Plan	1:500

Any changes to the scales as mentioned above shall be approved by the County of Oxford prior to submission.

A Key Plan should be provided on all drawings. Overall plans shall have a Key Plan drawn at a scale that provides sufficient detail to identify the location of the development within the community. Maximum drawing sheet sizes shall be 610 x 915 mm (24” x 36”) unless otherwise approved prior to submission.

Existing contours shall be shown on appropriate drawings at intervals to accurately illustrate the topography of the site. Existing contours at 1 m intervals are acceptable, but at the discretion of the County, lesser contour intervals down to 0.25 m may be required based on topography or engineering requirements.

All drawings are to be submitted referencing the Canadian Spatial Reference System CSRS UTM83 Zone 17N Coordinates. Additionally, a minimum of two Geodetic Benchmarks shall be shown providing horizontal and vertical location.

All plan view drawings shall have a North Arrow. All drawings shall have a Title Block, which shall include the scale of the drawing.

A legend shall be provided that clearly references any symbols or abbreviations used on the drawing.

All drawings shall bear the seal of a Professional Engineer, signed and dated, or where appropriate a Landscape Architect.

Drawings shall be submitted using County Title, plan, and plan/profile drawing layout as per Section 2. (Exceptions are drawings submitted to the City of Woodstock, Town of Tillsonburg, and Town of Ingersoll)

Submissions of all drawings shall include County drawing number, provided upon request (Exceptions are development within the City of Woodstock, Town of Tillsonburg, and Town of Ingersoll).

The following is a list of the County's requirement for drawings submission and does not include the requirement of the member municipalities.

- a) Title Sheet
 - Name and location of development
 - Name of Developer
 - Date of Submission
 - Name, address, phone number, fax number, email and contact name for the Developer's Professional Engineer
 - 32T number for developments
 - County Contract Number

- b) Sanitary Drainage Area Plan
 - Road allowances, lots, blocks and easements
 - Phasing (if applicable)
 - Proposed sewers including sizes, lengths, flow direction arrows, and grades
 - Entire sanitary drainage area (including external drainage areas)
 - Existing services
 - Sanitary manholes including numbering
 - Design criteria
 - Maximum Daily Flow

- c) Storm Drainage Area Plan
 - Road allowances, lots, blocks and easements
 - Phasing (if applicable)
 - Proposed sewers including sizes, lengths, flow direction arrows, and grades
 - Entire storm drainage area (including external drainage areas)
 - Existing services
 - Storm manholes including numbering
 - Design criteria

- d) Water Distribution Plan
 - Road allowances, lots, blocks and easements
 - General notes summarizing material and installation specifications
 - Proposed watermain including size, material
 - Water service connections
 - Water valves, hydrants, reducers
 - Blow-offs, swab launches
 - Phasing (if applicable)

- e) Plans and Profiles
- Road allowances, lots, blocks and easements
 - Dimensions of lot and block frontages
 - Bore hole locations (if applicable)
 - Benchmark locations
 - Sewer lengths, sizes, material, and grades
 - Proposed watermain including size, material, and typical depth of 1.8 m
 - Water, sanitary, and storm service connections
 - General notes summarizing material and installation specifications
 - Phasing (if applicable)
 - Existing services
 - Water valves and hydrants
 - Maintenance holes including numbering, stations, inverts, and top of lid elevations
 - Sewer and watermain profile
 - Road centerline stations and grades at 20 m spacing
 - Vertical curve data

1.6 Cross-section Layout

Figure 1.1, Service Locations

Figure 1.2, Typical Section layout.

Any deviation from the above standards must be submitted in writing to the County Engineer or local Municipality for approval. Refer to local municipalities for any updates or revisions.

1.7 Applications and Approvals

- a) Under the Transfer of Review program, all plans relating to the design and installation of sanitary sewers, storm sewers, appurtenances and services must be submitted to the County for review and approval. Once deemed acceptable, the County will forward a draft Environmental Compliance Approval (ECA) to the MOECC for final review and issuance of the ECA.

Where sewage works, including sanitary sewers and related pipes, are deemed to be significant drinking water threats (located in Wellhead Protection Areas with vulnerability scores of 10), the MOECC will require additional design and operational measures to be applied to the ECAs. At a minimum, all materials and joints shall be designed equivalently to watermain construction standards.

To ascertain whether the works are/will be a significant threat, the proponent can contact the County's Coordinator of Source Water Protection. Sewage works, including sanitary sewer and related pipes, that are significant threats to drinking water are not eligible for processing under the Transfer of Review Program and following review by the County packages will be forwarded to the MOECC for approval. The proponent should be prepared for longer than normal processing times for these applications.

- b) All plans relating to the design and installation of watermains must be submitted to the County for approval by its Engineer along with a completed MOECC Form – 1 Record of Watermains Authorized as a Future Alteration. Consultants and Municipal Service Providers shall be responsible for completing Parts 2 and 3 of Form – 1.

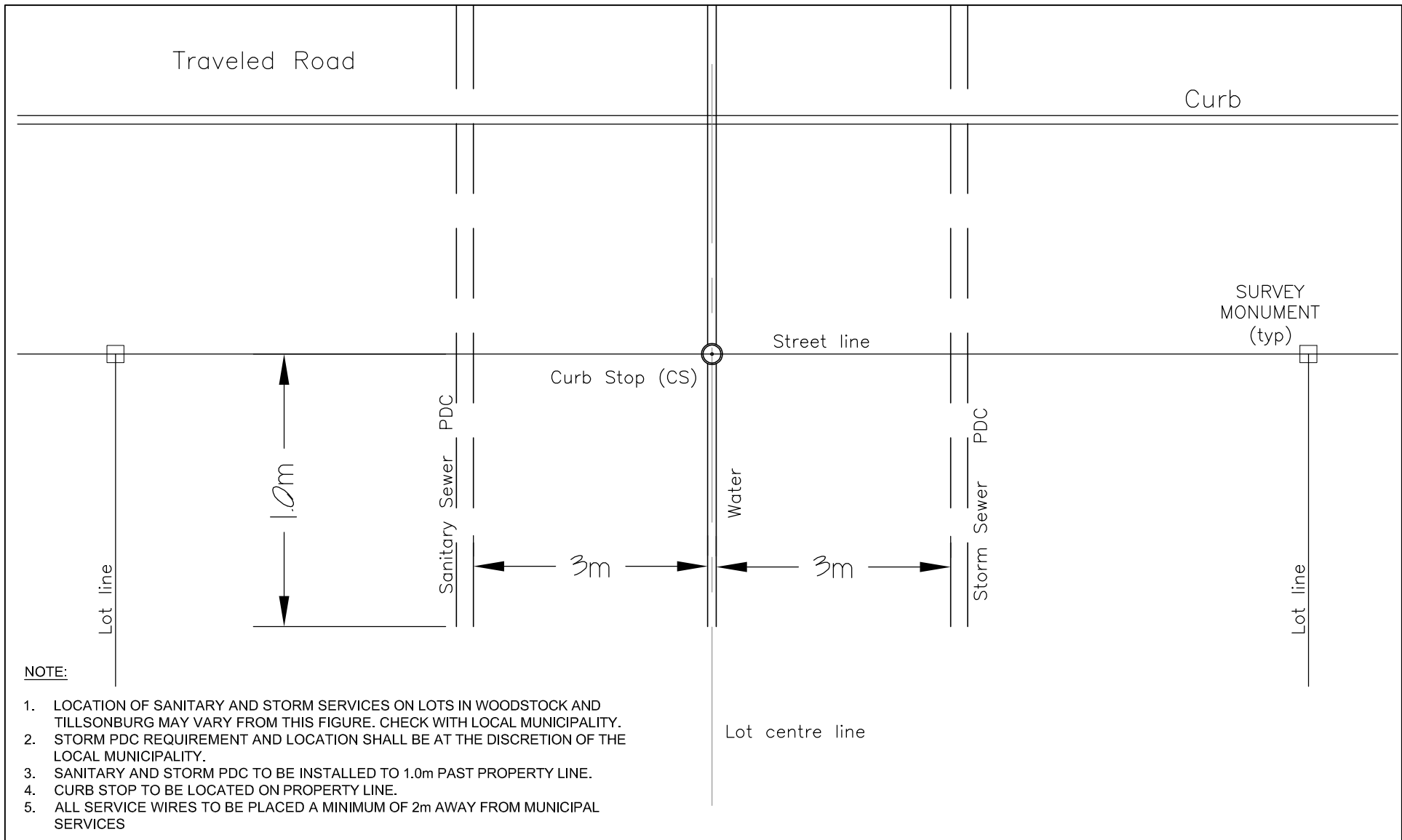
As outlined in Part 2 of Form – 1, an attached site plan shall be submitted identifying the location(s) of the undertaking, street names, easements, and nominal diameter of the watermain(s). Part 3 of Form – 1 must be completed and signed by a Professional Engineer who is licensed to practice in the Province of Ontario.

- c) One copy of the application including one set of plans will be retained by the County. These applications will contain the signature of the County Engineer. In addition, the Consultant will submit to the County a copy of the plans in dwg. file (Auto Cad) format. Before beginning any of the work, evidence must be filed with the County that approval from the MOECC has been obtained. All agreements must be signed and the required monies paid over to the County prior to the commencement of any work.



SECTION 1 – GENERAL

FIGURES



OXFORD COUNTY

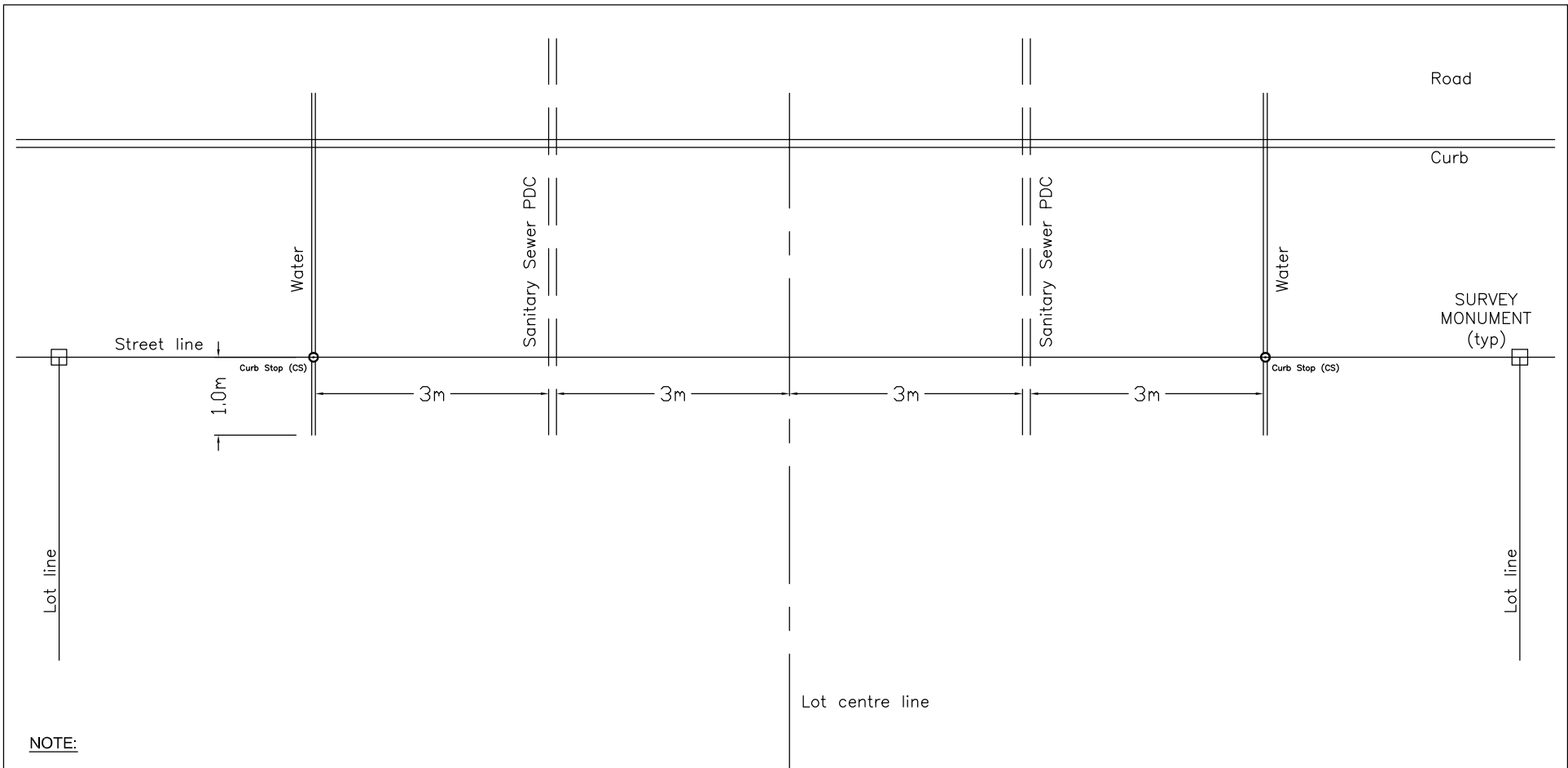
SERVICE LOCATIONS SINGLE FAMILY RESIDENTIAL

DWG FIG 1.1.1

DATE NOV 2008

REV

1



NOTE:

1. LOCATION OF SANITARY AND STORM SERVICES ON LOTS IN WOODSTOCK AND TILLSONBURG MAY VARY FROM THIS FIGURE. CHECK WITH LOCAL MUNICIPALITY.
2. STORM PDC REQUIREMENT AND LOCATION SHALL BE AT THE DISCRETION OF THE LOCAL MUNICIPALITY.
3. SANITARY AND STORM PDC TO BE INSTALLED TO 1.0m PAST PROPERTY LINE.
4. CURB STOP TO BE LOCATED ON PROPERTY LINE.
5. ALL SERVICE WIRES TO BE PLACED A MINIMUM OF 2m AWAY FROM MUNICIPAL SERVICES

OXFORD COUNTY

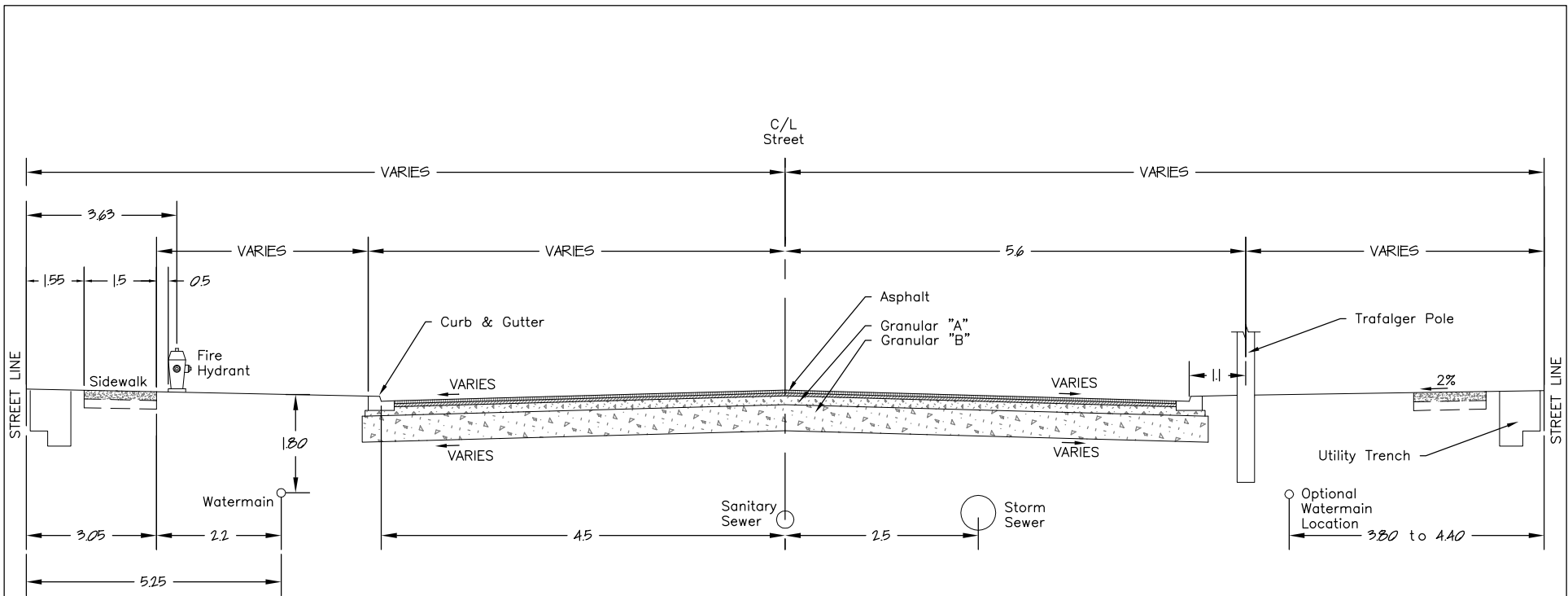
SERVICE LOCATIONS-SEMI DETACHED RESIDENTIAL

DWG FIG 1.1.2

DATE APRIL 2016

REV

0



TYPICAL SECTION - ARTERIAL STREET
N.T.S.

NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
 Curb and Gutter to Meet O.P.S.D.
 Street Light Standards on Alternate Sides of the Road.
 Trafalgar Poles to be located not less than 2.0m either side of hydrant laterals.

OXFORD COUNTY

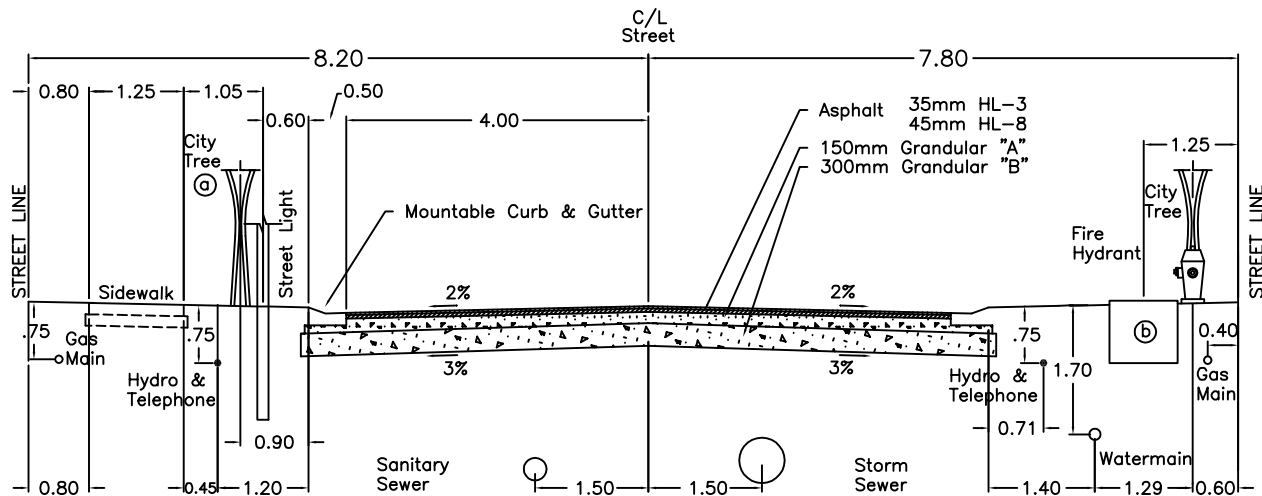
TYPICAL RESIDENTIAL ROAD SECTION

DWG FIG 1.2.1

DATE NOV 2008

REV

1



TYPICAL SECTION FOR 16.00m ROAD ALLOWANCE
1:100(Metric)

- Ⓐ City Tree to be placed Between mid-points of street light locations.
- Ⓑ 0.9 SQ. Mini transformer pad to be 0.10 above grade 0.75 deep

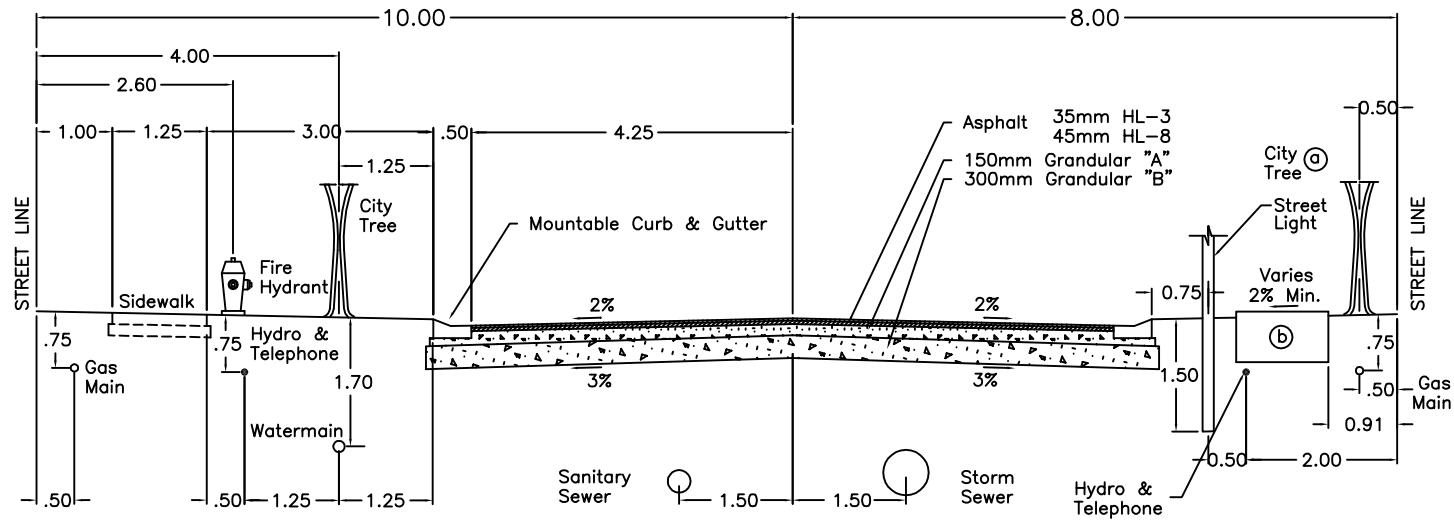
NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
Curb and Gutter to Meet O.P.S.D.
Sidewalks to be built on opposite side of street from Watermain, and extend to, and around Cul-de-sac to Pedestrian Access if one is provided.

**CITY OF WOODSTOCK
ENGINEERING DEPARTMENT**

Date: February 6, 2003

FIG 1.2.2



TYPICAL SECTION FOR 18.00m ROAD ALLOWANCE

LOCAL STREET

1:100(METRIC)

- Ⓐ City Tree to be placed between mid-points of street light locations
- Ⓑ 1.20 ∅ Transformer Pad to be .10 Above Ground .75 Deep

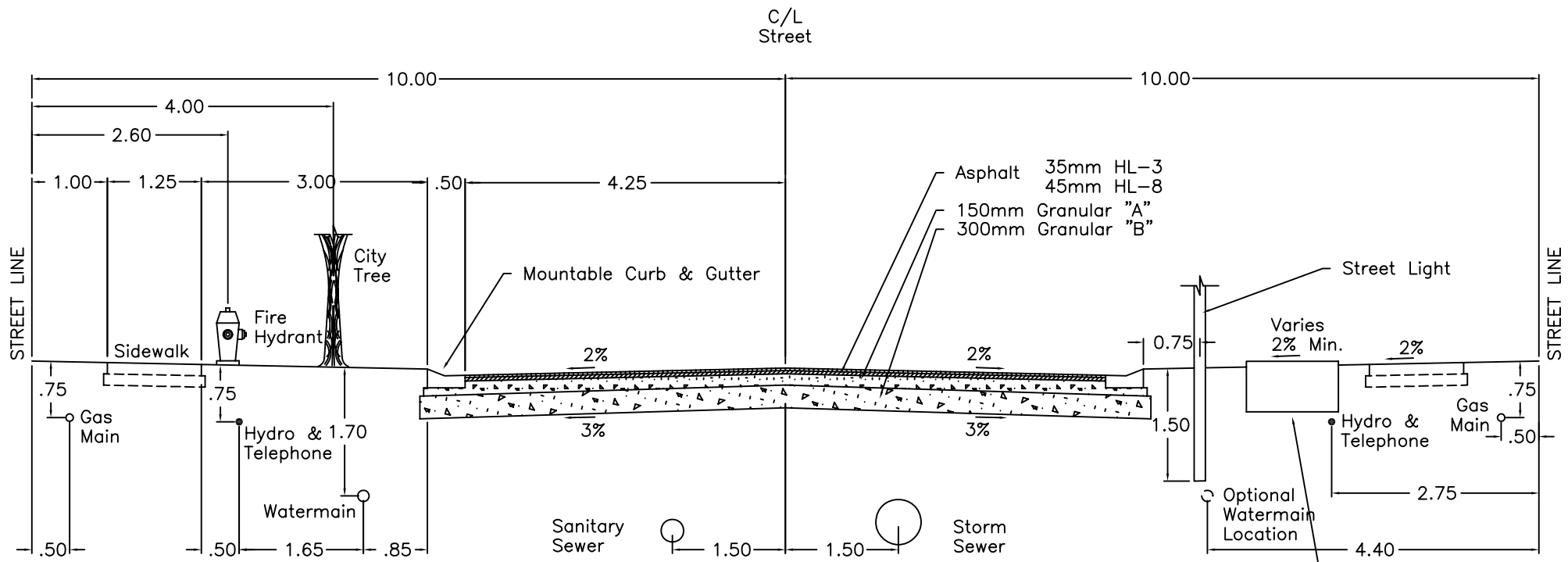
NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
Curb and Gutter to Meet O.P.S.D.
Street Lights Standards on Alternate Sides of the Road.

CITY OF WOODSTOCK
ENGINEERING DEPARTMENT

Date: February 6, 2003

FIG 1.2.3



TYPICAL SECTION – LOCAL STREET

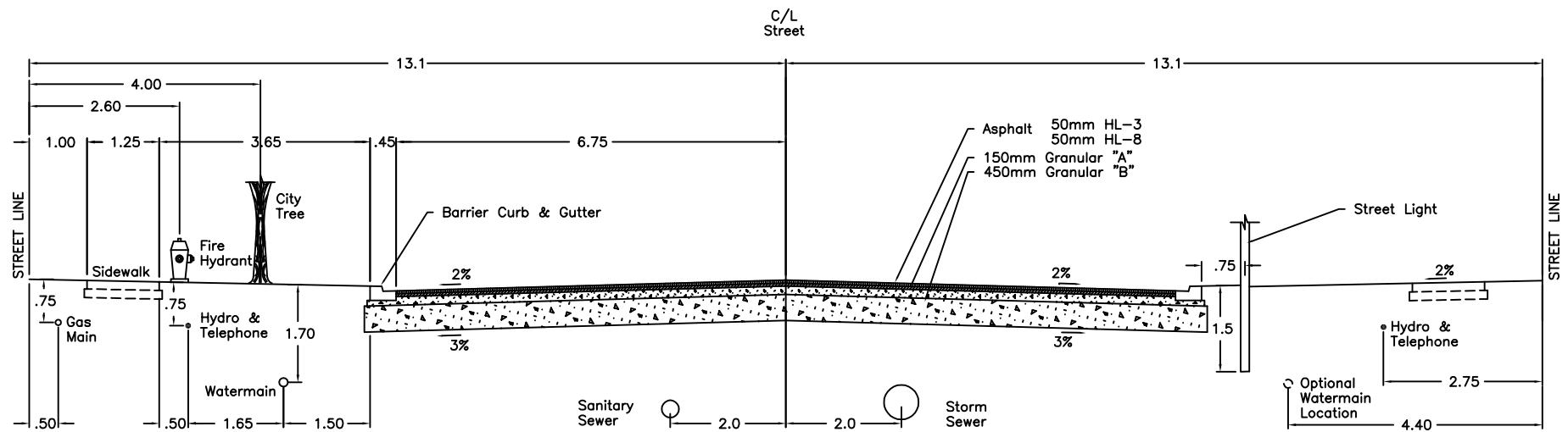
N.T.S.

NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
 Curb and Gutter to Meet O.P.S.D.
 Street Lights Standards on Alternate Sides of the Road.

FIG 1.2.4

			CITY OF WOODSTOCK	
			ENGINEERING DEPARTMENT	
			TYPICAL SECTION	
			LOCAL STREET	
3	February 6, 03	BMc	CITY ENGINEER	ST-404
2	JULY 91'	D.A.		
1	MARCH 91'	D.A.		
REVISIONS			DATE : Aug. 1978	



TYPICAL SECTION – ARTERIAL STREET

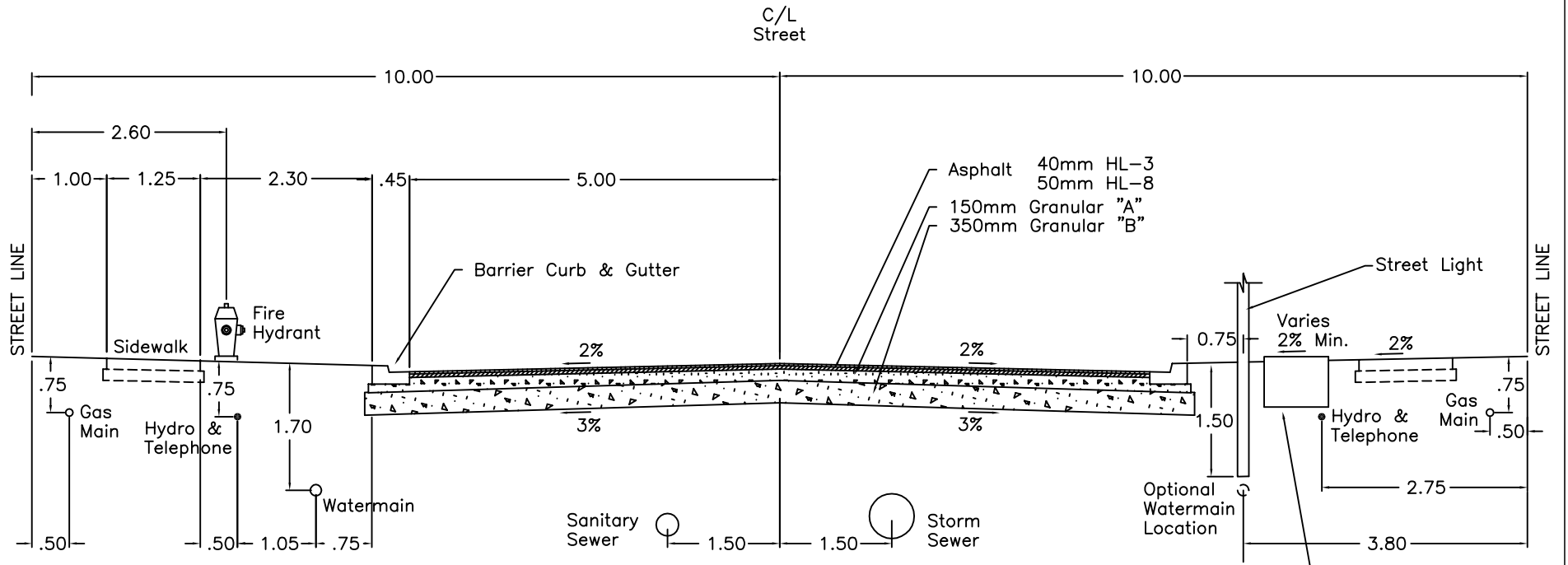
N.T.S.

NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
 Curb and Gutter to Meet O.P.S.D.
 Street Lights Standards on Alternate Sides of the Road.

FIG 1.2.5

			CITY OF WOODSTOCK ENGINEERING DEPARTMENT	
			TYPICAL CROSS SECTION OF 26m ROAD ALLOWANCE WITH 14m PAVEMENT FOR 4 LANE ARTERIAL	
2	JULY 90'	D.A.	CITY ENGINEER	ST-403
1	MARCH 90'	D.A.		
REVISIONS			DATE :SEPT. 82'	



TYPICAL SECTION — COLLECTOR STREET

N.T.S.

NOTE:

All Dimensions are in Metres Unless Otherwise Shown.
 Curb and Gutter to Meet O.P.S.D.
 Street Lights Standards on Alternate Sides of the Road.

FIG 1.2.6

			CITY OF WOODSTOCK ENGINEERING DEPARTMENT	
			TYPICAL SECTION COLLECTOR STREET	
			CITY ENGINEER	ST-405
			DATE : SEPT.1978	
REVISIONS				
2	JULY 90'	D.A.		
1	MARCH 90'	D.A.		

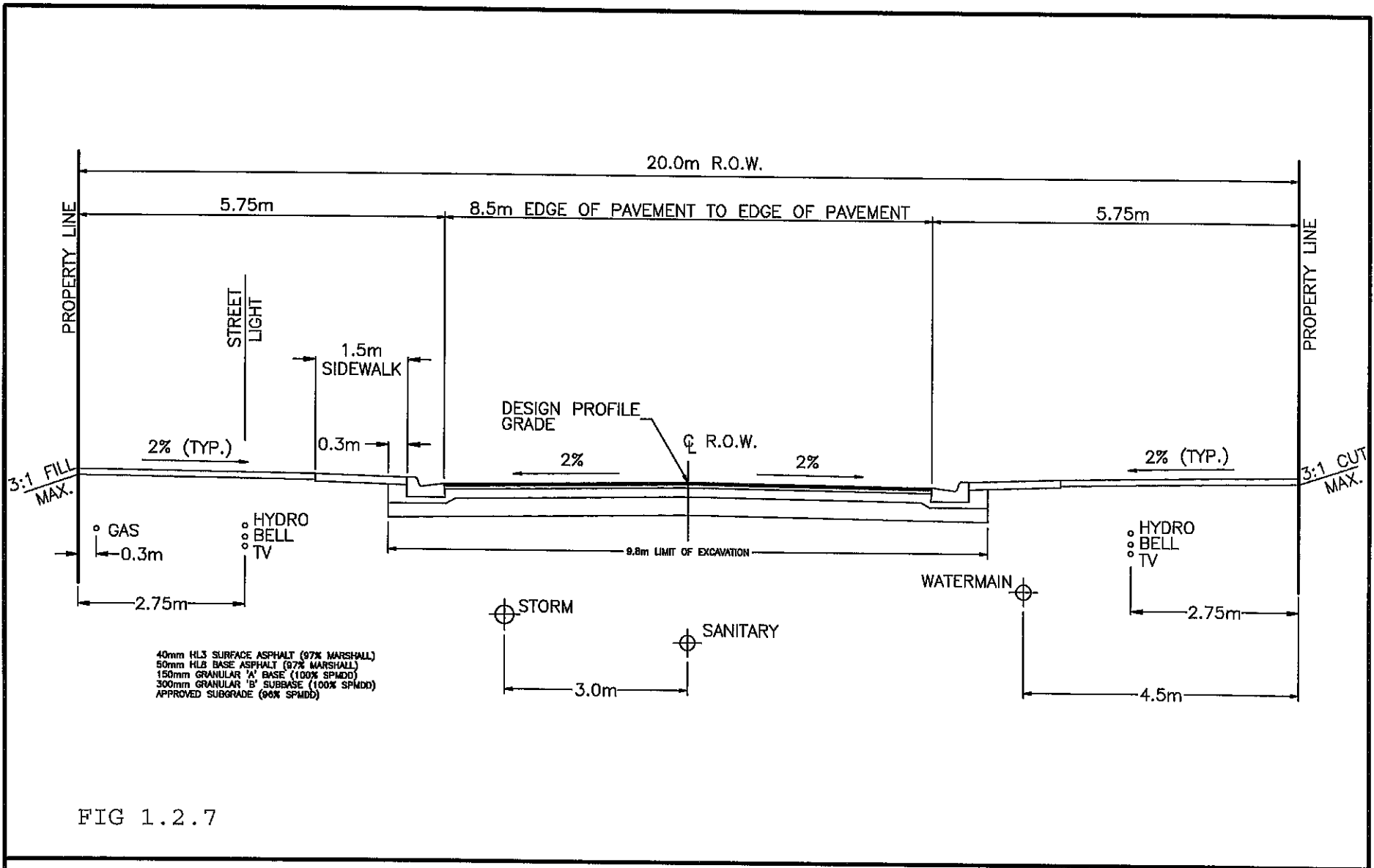


FIG 1.2.7

TYPICAL X-SECTION - LOCAL

TOWN OF TILLSONBURG
 CUSTOMER SERVICE CENTRE
 10 LISGAR AVENUE, TILLSONBURG, ONTARIO, N4G 5A5

DRAWING: K:\DESIGN CRITERIA\... \TYPICAL X-SECTION.DWG

DATE:

APPROVED BY:

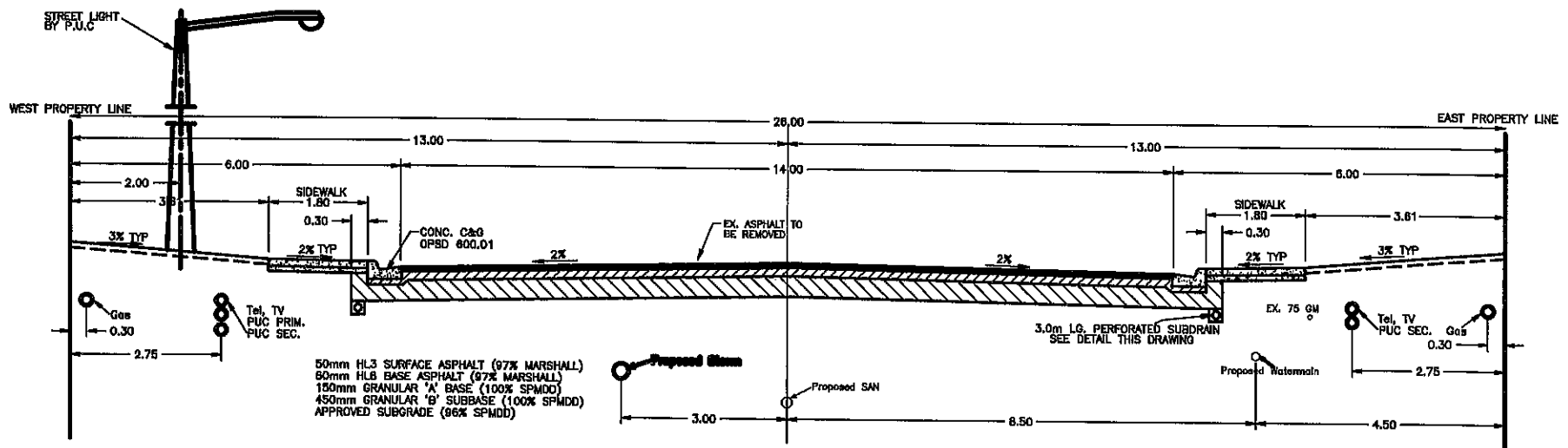


FIG 1.2.8

TYPICAL X-SECTION - ARTERIAL

DRAWING: K:\DESIGN CRITERIA\...\TYPICAL X-SECTION.DWG

DATE: May 7, 2007

APPROVED BY:

TOWN OF TILLSONBURG
 COMMUNITY SERVICES
 CUSTOMER SERVICE CENTRE
 10 LISGAR AVENUE, TILLSONBURG, ONTARIO, N4G 5A5

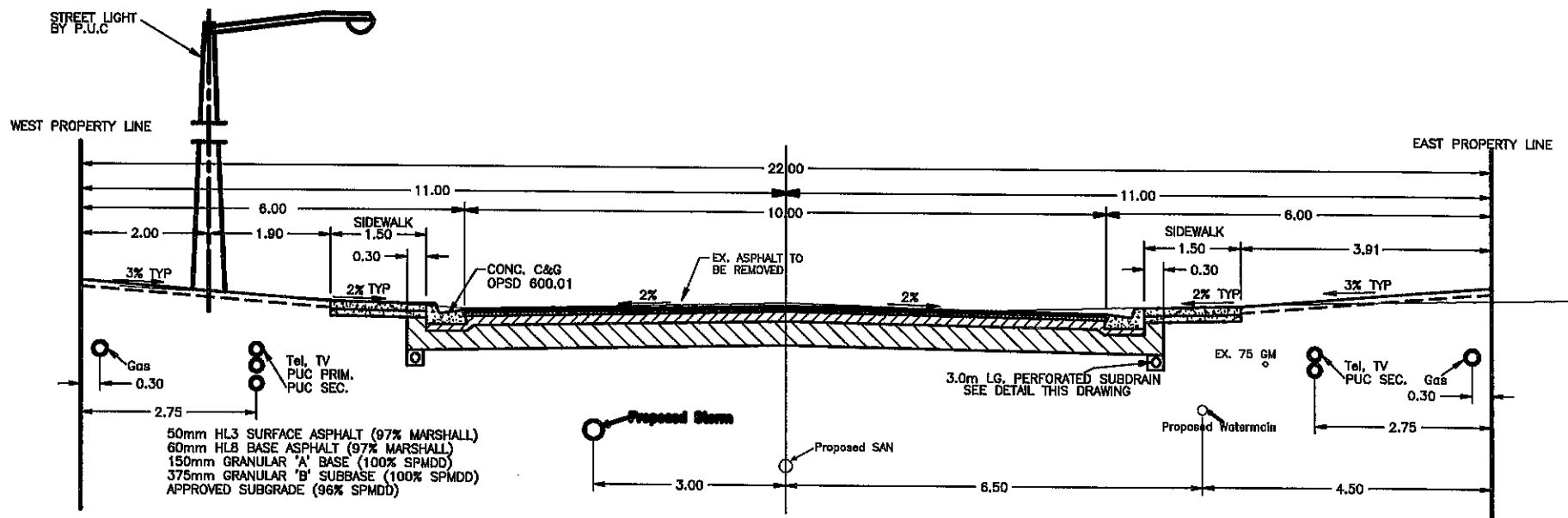


FIG 1.2.9

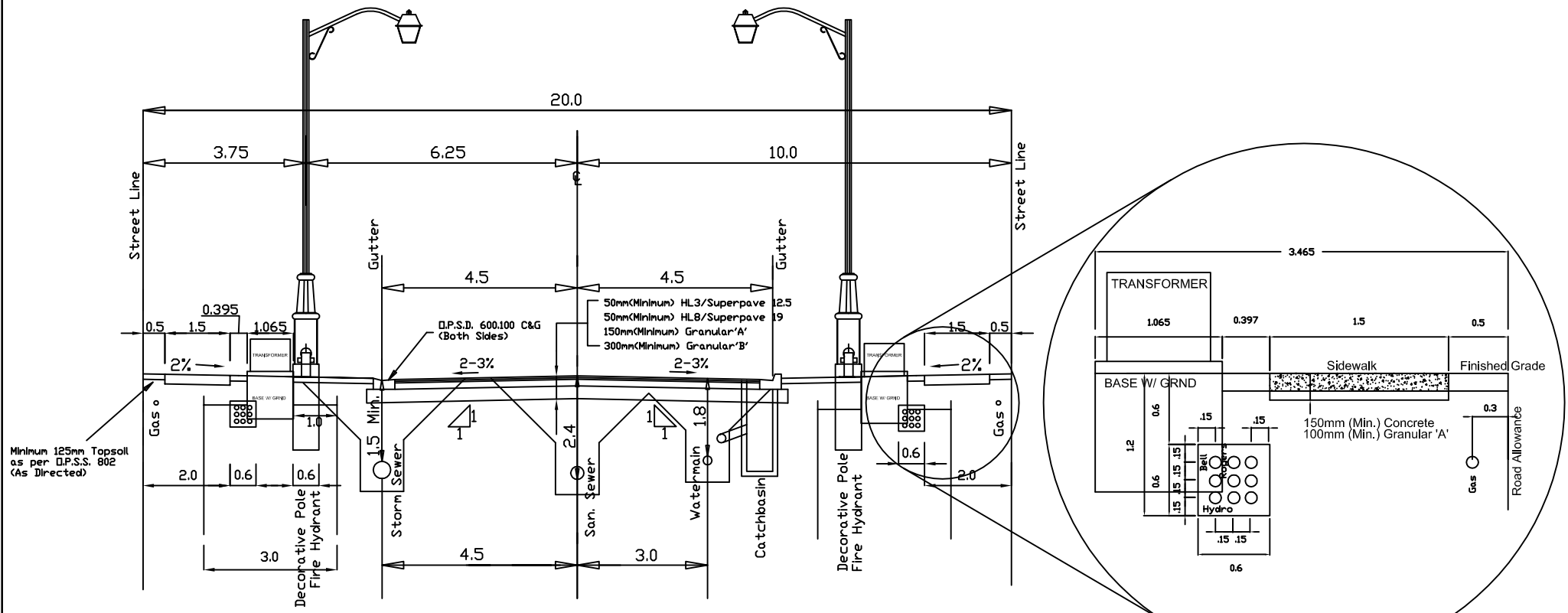
TYPICAL X-SECTION - COLLECTOR

DRAWING: K:\DESIGN CRITERIA\...TYPICAL X-SECTION.DWG

DATE: May 4, 2007

APPROVED BY:

TOWN OF TILLSONBURG
CUSTOMER SERVICE CENTRE
 10 LISGAR AVENUE, TILLSONBURG, ONTARIO, N4G 5A5



Typical 20m Cross-Section

N. T. S.
 Approved March, 2012
 Revised September, 2014

No.	BY	DATE	DESCRIPTION
6.		2012	Approved by Council (May14th)
5.	WK	2012	Utility Change
4.	TWE	2009	Crossfall Change
3.	JLA	01/04	Hydrant, S/W & Utilities Relocated
2.	ERM	01/98	Sidewalk Width- Preferred & Min'm
1.	EAB	01/93	Walks & Hydrants Relocated

REVISIONS

METRIC: ALL DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.

The Corporation of The Town of Ingersoll

Typical 20m - Residential Standard Local Cross Section

DRAWN BY: J.L.A.	APPROVED BY: E.R.M.	DATE: JAN.2004	STANDARD No. S-14
---------------------	------------------------	-------------------	----------------------

Figure 1.3 Sanitary, Water & Storm Service Record

- In-Service
- Spare
- Abandoned
- Blow-Off
- Future

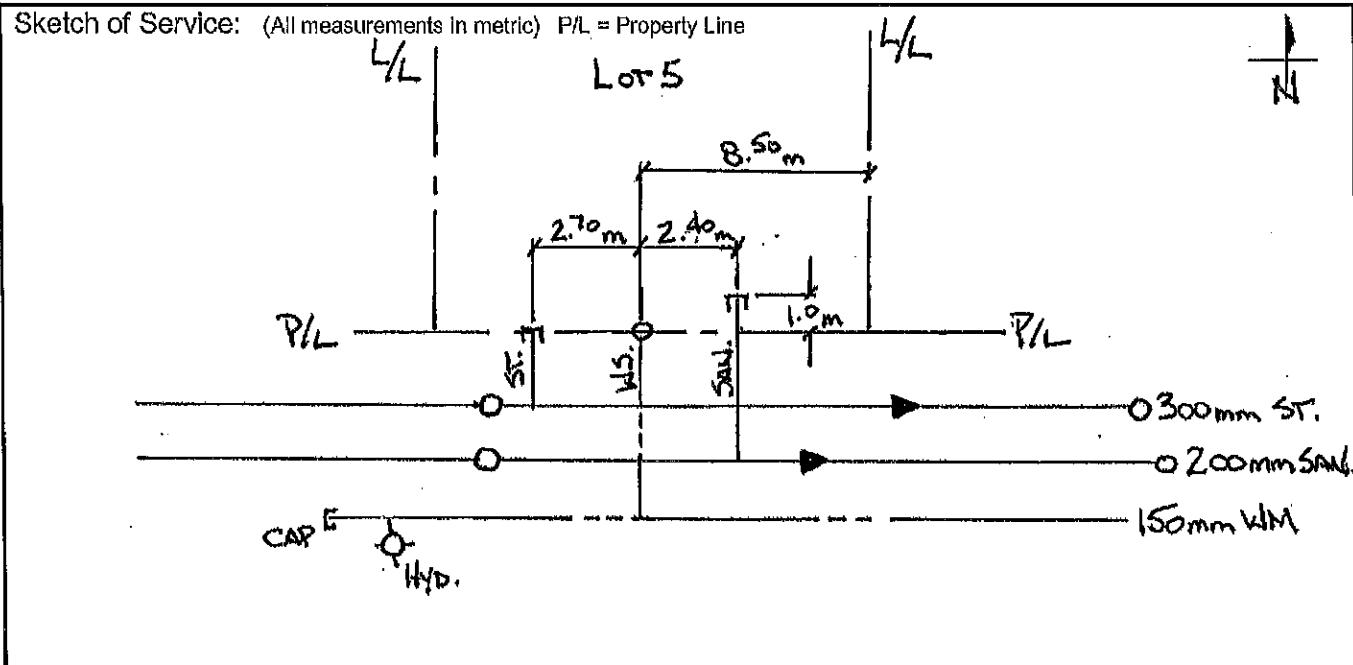
Municipality:		
Municipal Street & Number:	Lot Number:	
Sewer Lateral Material & Size (Main to P/L)	Collection Pipe Size & Material:	
Date Installed:	Inspected By:	
Sewer Service Later Material & Size (P/L to Bldg)		Distance from upstrm / dwnstrm MH _____ Main Sewer Tee installed Yes <input type="checkbox"/> No <input type="checkbox"/> Sewer Clean-out Installed Yes <input type="checkbox"/> No <input type="checkbox"/> Lateral into MH Yes <input type="checkbox"/> No <input type="checkbox"/> Proper connection at Property Line Yes <input type="checkbox"/> No <input type="checkbox"/> Septic tank abandoned properly Yes <input type="checkbox"/> N/A <input type="checkbox"/>
Date Installed:	Inspected By:	
Water Service Material & Size (Main to Curbstop Box)	Watermain Size & Material:	
Date Installed :	Inspected By:	
Water Service Material & Size (Curbstop to Bldg)	Contractor:	
Date Installed:	Inspected By:	
Date Water Turned ON:		Tapping saddle installed Yes <input type="checkbox"/> No <input type="checkbox"/> Trace wire (main to curbstop) Yes <input type="checkbox"/> N/A <input type="checkbox"/> Sand Bedding & Cover Material Yes <input type="checkbox"/> No <input type="checkbox"/> Old well properly abandoned Yes <input type="checkbox"/> N/A <input type="checkbox"/>

Sketch of Service: (All measurements in metric) P/L = Property Line <div style="text-align: right; margin-top: 20px;">+</div>	
Revision Date:	Revised By:

Sanitary, Water & Storm Service Record

- In-Service
- Spare
- Abandoned
- Blow-Off
- Future

Municipality: TAVISTOCK		
Municipal Street & Number: 555 MAIN ST	Lot Number: 5	
Sewer Lateral Material & Size (Main to P/L) 100mm SDR-35 PVC	Collection Pipe Size & Material: 200mm SDR-35	Distance from upstrm / dnstrm MH Main Sewer Tee installed Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Sewer Clean-out Installed Yes <input type="checkbox"/> No <input type="checkbox"/> Lateral into MH Yes <input type="checkbox"/> No <input type="checkbox"/> Proper connection at Property Line Yes <input type="checkbox"/> No <input type="checkbox"/> Septic tank abandoned properly Yes <input type="checkbox"/> N/A <input type="checkbox"/>
Date Installed: September 16, 2013	Inspected By: ABC Consultants / Contractor	
Sewer Service Lateral Material & Size (P/L to Bldg)		
Date Installed:	Inspected By:	
Water Service Material & Size (Main to Curbstop Box) Municipex 19mm dia.	Watermain Size & Material: 150mm DR-18 PVC	Tapping saddle installed Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Trace wire (main to curbstop) Yes <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Sand Bedding & Cover Material Yes <input type="checkbox"/> No <input type="checkbox"/> Old well properly abandoned Yes <input type="checkbox"/> N/A <input type="checkbox"/>
Date Installed: September 16, 2013	Inspected By: ABC Consultants / Contractor	
Water Service Material & Size (Curbstop to Bldg)	Contractor:	Date Water Turned ON:
Date Installed:	Inspected By:	



Revision Date:	Revised By:
----------------	-------------



Growing stronger together

**SECTION 2 – ENGINEERING DRAFTING
STANDARDS**

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FIGURES

Figure 2.1	Title Sheet
Figure 2.2	Plan / Profile Sheet
Figure 2.3	Street Light and Traffic Control Sheet

SECTION 2 – ENGINEERING DRAFTING STANDARDS

1.1 General Requirements

- a) A complete set of drawings shall consist of separate drawings of some or all of the following:
 - Site plan
 - Plan and profile for roads, drainage and storm sewers
 - Plan and profile for sanitary sewers and watermains
 - Plan and profile for sanitary and storm sewers for common trench designs
 - Plan of proposed street lighting, hydro, telephone, cablevision and gas
 - Plan of proposed signage and pavement markings
 - Additional plans showing any special detail and cross-sections (i.e. removals, grading, temporary watermain plan, etc.)
- b) Maximum drawing size shall be 610 mm x915 mm (24” x 36”).
- c) The County of Oxford contract drawings and AutoCAD standards are based on the current versions of the industry standard software by Autodesk: AutoCAD and Civil 3D Design. All drawings submitted to the County of Oxford must be in DWG format using AutoDesk AutoCAD support versions.
- d) Drawings scales and dimensions shall be shown on all drawings.
- e) The drawings shall be neat and legible with adequate clearance margins between the drawing information and the title block border. Notes and text shall locate and describe the proposed work in sufficient detail to facilitate construction. Limits of construction and match lines shall be clearly marked on the drawing.
- f) Plan and profile drawings shall be drawn with the profile on the bottom of the drawing sheet lined up under the plan if possible. Center line stations, utilities, invert, material and grade information shall be located across the bottom of the profile.
- g) North arrow shall be oriented in the two northerly quadrants, if possible.
- h) Lettering shall be to Leroy metric heights and widths. Vertical upper case lettering is preferred. Lettering shall be unobstructed by linework and other drawing information. Conflicts between linework, symbols, dimensioning or text shall be removed.
- i) Construction notes shall be boxed and located around the perimeter of the drawing, tagged to the drawing feature.
- j) All elevations shown on the drawings shall be metric geodetic datum. The source and location of the datum shall be clearly noted on each drawing (see Section 1 – General 1.5 Drawing and Design Requirements)

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- k) The drawing title block shall be the County of Oxford Standard Title Block and shall include the project name, project location, type of drawing (i.e. site Plan) and Engineer's name and/or company name and logo, Engineering File No. and the County of Oxford drawing number and key plan
- l) Plan profile drawings shall conform to scales as in Section 1- General 1.5 Drawing and Design Requirements.
- m) Standard details such as manholes, catch basins, hydrants, etc., that are shown and described in the County of Oxford Design Guidelines and Supplemental Specifications for Municipal Services need not be shown in detail on the drawings; the standard Drawing No. shall be quoted on the plan for reference. Standard symbols, abbreviations, materials, and hatch patterns shall be used. Any additional symbols, abbreviations, materials, and hatch patterns shall be included in the County of Oxford standard legend.
- n) All drawings shall bear the dated stamp/seal and signature of the professional engineer responsible for the design.
- o) Provisions shall be made on all drawings for the insertion of the County of Oxford drawing number in the space provided labeled "Drawing No." The County of Oxford will provide the number for insertion on the drawing. Consultant drawing number will be placed immediately above in the space labeled for that purpose.
- p) Numerical values on the construction drawings shall be shown to two (2) decimal places unless accuracy warrants otherwise.

2.1 – Site Plan and Key Plans

- a) The site plan of the construction works shall be scaled as in Section 1 – General 1.5 Drawing and Design Requirements
- b) The following existing and proposed information shall be shown on the Site Plan:
 - Existing watercourse
 - Pavement, curbs
 - Ditches, culverts, storm sewers, manholes cleanouts, inlet/outlet structures and catch basins
 - Sanitary sewers, manhole, cleanouts.
 - Watermains, valves, hydrants, chambers, blowoffs
 - All pertinent property, right-of-way and easements
 - Road allowance and easement dimensions
 - Lot numbers and existing legal plan numbers
 - One meter contour lines for slopes greater than 10% existing and proposed

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- Power and telephone and street light poles
 - Plan and profile drawing reference numbers
 - Gas mains, underground hydro, telephone, street lights and cable and their related appurtenances
 - Survey control monuments
 - Routing of all major storm flows including the 100-year storm.
- c) A Key Plan to a small scale, (e.g., 1:10000), showing the location of the works in relation to major streets, shall be provided in the upper right-hand section of the drawing sheet.
- d) A drawing index shall be provided and include the drawing titles, sheet numbers, and the County drawing number.
- e) Refer to Figure 2.1 for a sample Cover Sheet including the Site Plan and Key Plan.

3.1 – Plan and Profile Drawings - General

Each base plan and profile shall show but not be limited to the following information:

- a) All cadastral information including property lines, right-of-ways, easement lines and dimensions in sufficient detail to relate design to surrounding and adjacent properties shall be included on all drawing submissions.
- b) Legal description and civic addresses of existing properties.
- c) Road allowance dimensions.
- d) Existing pavement curbs, sidewalks, ditches, driveways, lanes, retaining walls, buildings, trees and shrubs within the right-of-way. Note significant trees on and within 5 metres of the right of way.
- e) All existing underground and surface utilities and services (with offsets, elevations, size, age and material type and as-built references) including but not limited to the following:
- Sanitary sewers, storm sewers, watermains and appurtenances
 - Street light poles, conduit and appurtenances
 - Hydro poles and underground wiring ducts and appurtenances
 - Telephone poles, underground wiring ducts and appurtenances and fibre optic cables
 - Gas mains and appurtenances
 - Cable television ducts and appurtenances
 - Traffic control devices, poles, conduits, signs and painting
 - Irrigation systems

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- f) All relevant topographic information. For slopes greater than 10 percent, one (1) meter contour lines are required.
- g) Autodesk Project name, drawing and layout name in the bottom left hand corner of the title block.
- h) Benchmark elevation, identification number and location shall be shown in the appropriate section of each title block.
- i) Right-of-way and/or road centreline stationing shall be to metric standards (0+000) at 20 metre intervals and shall be related geometrically to legal property lines or survey monuments. Stationing shall run left to right where possible and upstream on gravity pipes.
- j) Where possible, plan views shall be horizontal across the drawing sheet, and shall be aligned vertically by centre line stationing with the profile view below.
- k) Profile elevations shall be placed at both sides of the profile. Split profiles must show elevations on both sides of the break.

4.1 - Roads

The following shall be shown in addition to the information required in 3.1 Plan and Profile Drawings - General

- a) All proposed roadworks, complete with offsets from road centerline, including: pavement, curbs, sidewalks and poles.
- b) Stations of the BC & EC of road centreline and curb return horizontal curves together with the curve information including delta angle, radius, tangent length and arc length.
- c) Details of intersections with spot elevations at all critical points including grades and elevations of curb returns.
- d) Catchbasin rim elevations and stations related to road centerline chainage. To include lead locations to main, lead diameters and material in a table.
- e) Existing ground profile and finished pavement profile along the pavement centerline with elevations at 20 metre intervals.
- f) Crossfall or crown information with gutter elevations at change points.
- g) Proposed road centreline grade.

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- h) Stations and elevations of BVC, EVC, and VPI.
- i) Vertical curve information including the length of curve and sag or crest K value, where K equals the length of the vertical curve in metres divided by the algebraic difference in grades, percent.
- j) Elevations along the vertical curve at ten (10) metre intervals.
- k) Elevation and station of low and high spots of vertical curves.
- l) Where the slope of existing ground is greater than 10% across the right-of-way, cross-sections shall be shown at intervals not exceeding twenty (20) metres.
- m) Where there is an elevation difference of more than 1.2 m from the design road centre line to a suitable building site on the adjacent parcel, driveway grades and profiles shall be shown on the drawings.
- n) Where only a half road is being constructed, full width design cross-sections shall be provided as required to ensure the design suits the future development of adjacent properties.
- o) Typical road cross-section showing right-of-way width, proposed road design structure, pavement width, sidewalks, curbs, underground utilities, hydro, power and street light poles, hydrants and their related offsets.
- p) Proposed and existing monument with label (note: no monuments shall be destroyed during construction).
- q) Additional design details as required.
- r) Refer to Figure 2.2 for a plan and profile sample drawing.

5.1 – Storm and Sanitary Sewers

The following shall be shown in addition to the information required in 3.1 Plan and Profile Drawings - General

- a) Include common trench designs on the same construction drawing.
- b) All proposed storm and sanitary works including manholes, drop pipes, cleanouts, catchbasins, inlet/outlet structures, pipe work, ditches, culverts, inspection chambers, services and wyes, complete with offsets, rim elevations, stations related to the road centreline, and pipe inverts at manholes and pipe grade breaks.
- c) Existing ground profile and finished ground or pavement profile along the centerline of the proposed sewer.

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- d) Distance between manholes with proposed grade of pipe.
- e) Stations and elevations of the BC, and EC of all horizontal curves with the curve information including delta angle, radius, tangent length and arc length.
- f) Stations and elevations of BVC, EVC and VPI.
- g) Vertical curve information including the length of vertical and maximum pipe deflection.
- h) Elevations along vertical curves at ten (10) metre intervals.
- i) Size, type and class of pipe.
- j) Existing or proposed pipe crossings to be shown in profile and to include pipe inverts.
- k) Proposed inverts and offset locations to property line of service connections at property lines.
- l) Location of existing buildings on properties served by storm and sanitary sewers.
- m) Additional design details as required.
- n) Refer to Figure 2.2 for plan and profile sample drawing.
- o) Materials, types, size, inverts and flow direction to be shown for all proposed and existing culverts.

6.1 - Water

The following shall be shown in addition to the information required in 3.1 Plan and Profile Drawings - General

- a) All proposed waterworks including size, type and class of pipe, hydrants, valves, joint restraints, fittings and all related appurtenances with offsets and stationing related to road centreline.
- b) Locations of proposed service connections including an offset distance from a survey marker or lot corner.
- c) Existing ground profile and finished ground or pavement profile, and invert profile along the centerline of the proposed watermain.
- d) All other service crossings to be shown in profile (e.g., sewer mains, gas mains, etc.).

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- e) Extent of work required in making the connection to existing watermains.
- f) If the proposed watermain alignment or profile varies from the road centreline, the following shall be provided:
 - Stations of the BC and EC of horizontal curves together with curve information including delta angle, radius, tangent length and arc length.
 - Stations and elevations of the BVC, EVC and VPI of vertical curves together with curve information including curve length and maximum pipe deflection required.
 - Elevations along vertical curve at ten (10) metre intervals.
 - Proposed grades.
- g) Pipes requiring joint restraints shall be shaded, labeled and dimensioned from adjacent fitting showing the length of pipe requiring restraint.
- h) Additional design details as required.
- i) Refer to Figure 2.2 plan and profile sample drawing.

7.1 – Street Lighting and Traffic Control Signals

The following shall be shown in addition to the information required for plan view in 3.1 Plan and Profile Drawings - General

- a) Pole, conduit and appurtenances locations with offsets and stationing related to road centreline.
- b) Size, type, class of conduits.
- c) Schematics of wiring details for street lights and traffic signals.
- d) Details of detector loops and all other wiring circuit on traffic signals.
- e) Street lights shall be numbered and pertinent information, (i.e. wattage, lamp type, pole height and location, arranged in table format as per Figure 2.3)

8.1 – Signage and Pavement Markings

- a) A separate plan shall be prepared in all cases for road surface works. This plan shall detail eradications, alterations, additions and new regulatory and advisory signage and lines painting.

SECTION 2 – ENGINEERING DRAFTING STANDARDS

The design shall conform to Ministry of Transportation Installation Guidelines.
The following information shall be shown:

- Dimensions, lengths and colour of proposed lane or curb markings, medians, and crosswalks.
 - Lane widths, median radii and taper ratios.
 - Dimensioned location and type of new or relocated signs. Type of new, removed or relocated signs, including a sign inventory table.
 - A signs materials list indicating pavement markings shall be arranged in table format and shown on Figure 2.3
- b) For drawing clarity show curb locations only. Do not show utilities, legal information or addresses.

9.1 – Detail Sheet and Cross-sections

- a) Where there is not sufficient room on the plan and profile drawings, design details for the particular drawing may be provided on a separate sheet.
- b) Scale shall be determined by the designer to suit the design detail, and shall be included on the detail drawing.
- c) Where road cross-sections are required they may be provided on a separate sheet.
- d) Cross-sections shall be to a scale of 1:250 (H) to 1:100 (V) unless otherwise approved.
- e) Starting at the lower left hand corner of the drawing sheet, cross-sections shall be placed up the sheet in order of increasing stationing. Grid elevations shall be shown at the left hand side of each cross-section and stationing shall be shown above each cross-section. Adequate space shall be left between cross-sections so as to ensure clarity.
- f) Cross-sections shall include:
- Design road cross-section within the right-of-way.
 - Existing ground cross-section extending into the adjacent properties as required.

10.1 – Land Acquisition

- a) Where the proposed construction of capital works is over private lands and requires a right-of-way, a separate land acquisition drawing will be prepared for every lot affected.

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- b) The drawing will be on an 11x17 or 8-1/2 x 11 sheet of paper at a scale no less than 1:500.
- c) The drawing shall include the legal lot information, adjoining properties and street names, and a north arrow.
- d) The civic address and registered owners will be listed in the bottom right hand corner above the title block.
- e) The plan will show the area of the proposed new right of way and of the total lot area through which the right of way will go.
- f) A dimension perpendicular to the adjacent lot line and any other dimensions required to clarify the extent of the proposed right of way will be shown.

11.1 – As-built Submissions

- a) Drawings shall include all information as specified elsewhere for the construction drawings, but shall be corrected upon completion of construction to note all works removed during construction. Note abandoned services and reflect As-Built conditions for permanent records.
- b) All dimensions shown shall reflect the As-Built conditions of the construction and all references to “Proposed” ,”Install”, etc. shall be removed. As-Built drawings shall be to scale in accordance with the As-Built dimensions shown. The revision table shall be completed indicating the drawings are As-Built.
- c) All As-Built features shall be surveyed and survey points imported into the digital drawing. The As-Built drawing shall reflect the true elevation and location of all constructed features, in both the plan and profile views. Tolerance for moving features in drawings will be >1.0m (e.g. manholes installed less than 1.0m from design location do not need to be shifted on the digital as-builts/drawings).
- d) The As-Built drawings shall be submitted in the following digital formats:
 - Supported Acrobat PDF
 - “AutoCAD Etransmit” Autodesk: AutoCAD Supported format or equivalent method to ensure transfer of all reference files, pen and Font styles.
- e) Line work for all constructed works shown on the drawings shall retain the thicker line density (as for proposed works) for ease of determining the extent of works covered by the drawings.
Proposed construction for future phases of the project shall not be shown on the As-Built drawings.

SECTION 2 – ENGINEERING DRAFTING STANDARDS

- f) All As-Built drawings shall include the following information as well as the required asset information as listed below:
- The location and elevation of all existing utilities and services encountered in the construction operation,
 - The location and invert elevation at property line of all individual service connections, and the wye Chainage, at the main for all constructed and existing works,
 - A note on each drawing describing the type of trench material (sand, gravel, clay, hard pan, etc.) encountered during construction and the location and profile of all rock.
 - Complete Sanitary and Water Service Record Sheets for each lot

Pipe

- Diameter
- Material
- Manufacturer
- DR Rating
- Pressure Class / Series Pipe Number
- Size Class – CTS, DIPS, IPS
- Install Date

Valves

- Diameter
- Location
- Manufacturer
- Open Direction (Left / Right)
- Number of turns
- Type (i.e. gate, butterfly, etc.)
- Install Date
- Depth to nut if available (m)

Air Release

- Location
- Size
- Manufacturer
- Model
- Serial No.
- In Chamber (Y/N)
- Secondary Valves (Y/N) – No.of valves
- Drain Valve (Y/N)
- Distance – Valve to Watermain (m)

Hydrants

- Location
- Manufacturer
- Open Direction (Left / Right)
- Depth of Bury (m)
- Distance – Hydrant to Valve (m)
- Distance – Valve to Watermain (m)
- Flow at 140 kPa (L/s)



SECTION 2 – ENGINEERING DRAFTING STANDARDS

FIGURES

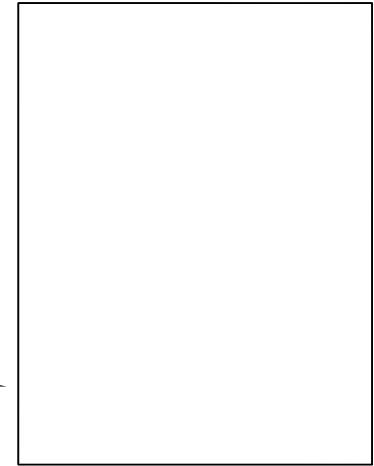


TYPE OF CONSTRUCTION
TITLE

PROJECT TITLE
MUNICIPALITY

CONTRACT No.

LIST OF DRAWINGS



KEY PLAN

FIG 2.1

IT IS THE RESPONSIBILITY OF THE PLAN USER TO INFORM THEMSELVES OF THE EXACT LOCATION OF ALL POLES, LINES, CONDUITS, WATER MAINS, SEWERS, AND OTHER UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES BEFORE COMMENCING THE WORK. SUCH UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN THE ACCURACY OF THE POSITION IS NOT GUARANTEED. THE CONTRACTOR SHALL ASSUME ALL LIABILITY FOR DAMAGES TO THE UTILITIES DURING CONSTRUCTION.

MINISTRY OF TRANSPORTATION, ONTARIO

REVISIONS	DATE	ANALYST	DESCRIPTION OF REVISIONS	RECOMMENDED BY

LEGEND

<p>HIGHWAY SIGNAL HEAD (30mm Red) WITH BACKBOARD AND MAST ARM</p> <p>HIGHWAY SIGNAL HEAD (30mm Red) WITH BACKBOARD AND OVERHEAD CABLE</p> <p>ORANGE HIGHWAY SIGNAL HEAD WITH BACKBOARD AND MAST ARM (ALL 30mm LENSES)</p> <p>SIGNAL HEAD WITH ARROW INDICATION AND BACKBOARD (Example shown Type 2 Head)</p> <p>SIGNAL HEAD WITH BACKBOARD AND ONE OR MORE PROGRAMMABLE LENSES (Example shown Type 2 Head)</p> <p>STANDARD SIGNAL HEAD WITH BACKBOARD AND MAST ARM (ALL 30mm LENSES)</p> <p>STANDARD SIGNAL HEAD WITH MAST ARM, WITHOUT BACKBOARD</p> <p>PEDESTRIAN SIGNAL HEAD</p> <p>PEDESTRIAN PUSH BUTTON</p>	<p>VEHICLE PASSAGE LOOP DETECTOR</p> <p>VEHICLE LOOP DETECTOR</p> <p>DUPLEX LOOP DETECTOR</p> <p>DIAMOND LOOP DETECTOR</p> <p>MICRO-LOOP DETECTOR</p> <p>EMERGENCY VEHICLE PRE-DETECTION DETECTOR</p> <p>MICRO-WAVE DETECTOR</p> <p>TRAFFIC CONTROLLER</p> <p>TRAFFIC SIGN</p> <p>TRAFFIC SIGN WITH FLASHING BEACON</p> <p>ILLUMINATED TRAFFIC SIGN</p>
---	---

MODIFIED:

TRAFFIC CONTROL SIGNAL HEADS
ALL 30mm LENSES, EXCEPT AS NOTED

Standard Highway Disabled

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿

① ② AMBER ARROW MUST BE USED IN A PROTECTED/PERMISSIVE SIMULTANEOUS LEFT TURN OPERATION.
NOTE: FOR SPECIAL ARROW HEADS ①, ②, ③ AND ④, 30mm AMBER BALL AND 30mm GREEN BALL LENSES SHOULD BE USED

CLASSIFICATION OF ROADWAY	TRAFFIC SIGNAL HEADS			LOCATION	
	TYPE	SIZE	BACKBOARD	MOUNTING HT.	OFFSET FROM POLE
ROADWAY _____	PRIMARY				
	SECONDARY				
	AUXILIARY				
MULTILANE <input type="checkbox"/>	PRIMARY				
TWO-LANE <input type="checkbox"/>	SECONDARY				
ROADWAY _____	PRIMARY				
	SECONDARY				
	AUXILIARY				
MULTILANE <input type="checkbox"/>	PRIMARY				
TWO-LANE <input type="checkbox"/>	SECONDARY				

MUNICIPALITY _____	MINISTRY OF TRANSPORTATION, ONTARIO
INTERSECTION _____	SIGNALS WARRANTED:
DATE _____ SCALE _____	SIGNAL DESIGN RECOMMENDED FOR APPROVAL:
RECOMMENDED BY _____	SIGNAL INSTALLATION APPROVED AS FOR SECTION 144 (31) H.T.A.:
REGIONAL TRAFFIC REPRESENTATIVE (SIGNAL INSTALLATION)	APPROVAL DATE: _____

FIG 2.3

DRAWING NAME: CREDIT:



Growing stronger together

SECTION 3 - WATERMAIN

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DETAILS

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- D1805-1-2004: Water Meter and Remote Register
- D1806-1-2004: Water Meter Gap and Remote Wire Installation
- D1807-1-2004: 16 mm to 25 mm Water Meter with Valves on both sides
- D1811-1-2004: 25 mm to 50 mm Water Meter with By-pass
- D1812-1-2007: Rigid Board Insulation – Slab Type
- D1818-1-2005: Typical Water Meter in Chamber
- D1822-1-2005: 100 to 200 mm Swab Launcher Detail
- D1828-1-1993: Fire Hydrant and Valve Installation
- D1832-1-1993: Mechanical Joint Offset Installation - Under
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- D1834-1-1993: Valve Rod Extension – 100 mm & Larger
- D1835-1-2006: 50 mm Watermain Detail for Cul-De-Sac
- D1836-1-2006: Back Flow Preventer – Existing to New Watermain
- D1838-1-2007: Water Service Connection – 25 mm Diameter
- D1839-1-2007: Water Service Connection – 32 mm, 38 mm, and 50 mm Diameter
- D1846-1-2009: Valve Box Tracer Wire Installation
- D1852-1-2011: ARI D090 Air Relief Valve with Catchbasin
- D1852-2-2011: ARI D090 Air Relief Valve with Casing
- D1856-1-2016: Water Meter and Remote Radio Transmitter
- D1857-1-2016: Domestic and Fire Service Detail
- D1858-1-2016: Tracer Wire Connection Details

F035 – Watermain Inspection Report

PART 1 - LOCATION AND DESIGN

The current Ontario Provincial Standards, American Water Works Association Standards, Canadian Standards Association, and Ministry of Environment and Climate Change (MOECC) Guidelines for the Design of Water Distribution 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.

In areas of suspected soil contamination a geotechnical investigation will be required. The cost of required geotechnical testing and placement of suitable material will be the responsibility of the Consultant or Developer.

The City of Woodstock and Town of Tillsonburg are service providers for the County of Oxford. The Service providers shall inspect all watermain and service installation on both public and private property in their respective locations. Inspection fees as set out by the local municipality will apply.

1.1 Mains

The following specifications are for Ductile Iron (DI), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) and Concrete Pressure Pipe (CPP).

Molecular Oriented PVC pipe (PVCO) is an accepted material however this material may only be used in new subdivisions and new development areas. This material is not permitted for use in the reconstruction of existing areas. The use of this material will be reviewed on a case by case basis.

In areas of reconstruction where existing metallic watermain is being replaced with PVC or HDPE, the property owner should be advised that the grounding of electrical systems to the water service may not be adequate. It will be the property owner's responsibility to ensure adequate grounding after reconstruction is complete.

HDPE pipe over 50 mm in diameter is to be used for directional drilling only unless approved in writing by the County Engineer.

All pipes up to and including 600 mm diameter shall be delivered to the Work Area with end covers. End covers shall be factory installed on both ends with a tamper evident seal. Components shall adhere sufficiently to withstand the stresses caused during shipment.

- a) Mains shall be located as per Section-1 General, Figure 1.2. These drawings indicate the location of the main on municipal streets. Any deviation from these standards must be submitted in writing to the County Engineer or local Municipality for approval.

SECTION 3 - WATERMAIN

- b) In areas of construction where watermain or services will be located in existing road surfaces or through driveways and entrances, the existing pavement, curbs, sidewalks and driveways shall be saw-cut in clean straight lines to minimize over-break prior to construction. All concrete and asphalt driveways, curbs, and sidewalks shall be restored to existing or better conditions within construction limits. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions.
- c) It is recognized that the above standards apply where straight runs are being installed. On curves, the main location may deviate slightly from the standard by using the maximum allowable deflection in the pipe joints. Refer to manufacture's specifications regarding pipe deflection. A minimum number of special bends should be used.
- d) The minimum cover of the watermain and services shall typically be 1.80 m. Watermain and services may be required to be deeper to avoid conflicts with other infrastructure.
- e) No mains less than 150 mm in diameter or dead-end mains shall be installed unless approved by the County Engineer.
- f) Watermains shall be arranged in a looped pattern for mutual support and reliability. Dead ends shall be avoided wherever practical. Watermains on dead end streets where the watermain length would exceed 150 m shall be looped, where possible. In new residential subdivision developments no more than 40 units with individual water services on a proposed or future phased street may be serviced without looped connections to existing or proposed streets. On new streets where lots are serviced without looping, the watermain design shall provide a minimum fire flow based on the type of buildings (i.e residential, industrial, commercial, or institutional).
- g) All non-metallic direct bury watermain and services shall require tracer wire. All non-metallic directional drilled watermain shall require two (2) tracer wires. All non-metallic directional drilled services shall require a single tracer wire. Tracer wire material shall be as per Part 2 – Material, Section 2.1 Pipe, Fittings, Tracer Wire and Spacers. At any location where joints in the wire must occur only approved connectors will be used.

The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted.

Tracer wire will be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the watermain. At the ends of capped watermain, 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 watermain.

At service saddles, tracer wire is not allowed to be placed between the saddle and the watermain. Joints in the wire shall only occur at ends of rolls or services that are 100 mm diameter or larger.

At each main valve a continuous loop of 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 loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500mm and coiled to not interfere with valve operation.

For services 25 mm to 50 mm, tracer wire shall be connected at the main stop using the electrical thaw nut and to the curb stop electrical thaw nut. Each connection will be wrapped in petrolatum tape and compressed tightly by hand around the connection and fitting. For services that are 100 mm diameter or larger a connection will be permitted to the main line tracer wire using only approved 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 or 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 of 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 contractors expense. Continuity testing in lieu of actual line tracing shall not be accepted.

- h) Mechanical thrust restraint is required on **all** fittings, bends, tees, hydrant tees, valves, hydrants, crosses, reducers and plugged or capped dead-ends. In addition all watermain repairs shall require mechanical restraints as listed below.

In calculating restrained distances a **safety factor = 2 to 1**, with a **test pressure = 150 psi** is to be used with reference to pipe manufacturers specifications.

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 Engineer 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;

All fittings, bends, tees, hydrant tees, valves, crosses, reducers up to 200 mm shall be restrained to the pipe along with a minimum of 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 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 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 6 full pipe length joints (30 m) measured from the end of pipe.

All plugged or capped ends shall be tapped to relieve pressure prior to removal if necessary.

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 above restrained lengths mentioned above from fittings, bends, tees, hydrant tees, valves, hydrants, crosses, reducers and plugged or capped ends shall be restrained.

Pipe larger than 300 mm shall be restrained as per the pipe manufacturer's recommendations. PVC 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. The County of Oxford reserves the right to specify the use of mechanical and/or concrete thrust blocks.

1.2 Easement

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

An easement is required to ensure that the municipal services and utilities crossing the site can be properly installed and maintained by the County or the County of Oxford's service provider. An easement provides the right to use private land for a specific purpose which is in the public's interest.

1.2.1 Type of Easement

a) Municipal (Servicing) Easement

Is required for watermains and access roads that cross a site and which are maintained by the County or the County of Oxford's service provider.

b) Utility Easement

Is required for telephone, hydro, gas and cable television services. Each utility company should be consulted for their specific requirements.

c) Temporary Easements and Working Easements

Are required for watermains and access roads that cross a site temporarily. The services in the easement are to be maintained by the owner of the services.

1.2.2 Minimum Easement Widths

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of the watermain or a minimum width of 5.0 m assuming no other services are located within the easement. Where watermains are located within easements between residences, the watermain shall be offset a minimum of 1.0 m from the property line to avoid fence posts.

1.3 Valves

a) Valves shall be located at all intersections. At cross intersections a minimum of 3 valves shall be installed and a minimum of 2 valves shall be installed at tee intersections. The valve locations shall be on the extension of the street line. If necessary, adjustments in the field can be made to avoid curbs or other obstructions that may interfere with valve placement.

b) At each valve a loop of 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 loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500 mm and coiled to not interfere with valve operation. Tracer wire to be installed as per Detail D1846-1-2009.

- c) In residential areas valve spacing shall not exceed 250 m (820 ft) apart. In high density residential, commercial, or industrial areas valve spacing shall not exceed 150 m (500 ft) apart. Valves will be located in such a manner that no more than 60 services will be isolated by operating no more than 4 valves.

Valves on transmission mains shall be located at all road crossings or at the discretion of the County Engineer. Test stations for locating purposes shall be installed a maximum 500 m after each valve. Test stations to be located a maximum 500 m apart.

- d) Watermains crossing rivers, bridges, railways, controlled access highways, and between residential dwellings shall be valved on each side of the crossing.
- e) Hydrants shall be valved with the valve located 1.0 m from the street side of the hydrant barrel. Valving as per Detail D1828-1-1993.

1.4 Blow-Offs/ Swab Launches

When dead end mains are encountered, a fire hydrant or blow-off is required near this dead end. The blow-off must be designed in such a manner as to convey the water to a suitable drain and must be operable without the need for excavating. Stop and Drain type valves are permitted. Blow offs or Swab launches where possible shall be installed in “soft surface” grassy areas with 19 mm clear stone bedding.

Blow offs or Swab launches installed in “hard surface” asphalt or concrete areas will require 300 mm thick granular “A” bedding compacted mechanically in two (2) lifts of 150 mm thick.

Blow-offs will be 50 mm diameter for mains up to and including 200 mm diameter. Blow-offs will be 100 mm diameter and use the swab launch detail for 250 mm and 300 mm mains.

In areas that do not have fire hydrants, permanent swab launches will be installed for swabbing and flushing. Blow-offs and swab launches to be installed as per Detail D1803-1-2013 and Detail D1822-1-2005.

1.5 Casings and Spacers

Where casings are required for watermain 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 the County Engineer prior to installation.

Steel casings shall use the following inside diameters and wall thicknesses as listed below;

Nominal Pipe Size	Minimum Casing Size (I.D.)	Minimum Casing Wall Thickness
100 mm (4")	315 mm (12.4")	6.35 mm (0.25")
150 mm (6")	356 mm (14")	7.94 mm (0.3125")
200 mm (8")	454 mm (17.875")	7.94 mm (0.3125")
250 mm (10")	546 mm (21.5")	7.94 mm (0.3125")
300 mm (12")	584 mm (23")	9.53 mm (0.375")
350 mm (14")	686 mm (27")	9.53 mm (0.375")
400 mm (16")	762 mm (30")	12.70 mm (0.500")
450 mm (18")	787 mm (31")	12.70 mm (0.500")
500 mm (20")	838 mm (33")	12.70 mm (0.500")
600 mm (24")	991 mm (39")	12.70 mm (0.500")

Where watermain is located between proposed residential dwellings, it shall require a casing with fusible watermain pipe placed inside the casing. The casing shall extend the entire length of the property with valves placed on the watermain at each end of the casing for isolation purposes. Valves should be located a minimum of 3.0 m from each end of the casing. Where casings containing watermain 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 the watermain material used inside the casing is PVC or Ductile Iron bell and spigot, 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. Both ends of the casing will be covered using an approved rubber end seal to prevent backfill from entering the casing.

When watermain is placed inside a casing, the watermain shall be supported by spacers using the centered configuration. The size, location, and number of spacers will be as per the manufacturer's recommendation.

1.6 Water Services

The use of copper water service material in the municipal road allowance is not permitted except where existing watermain material is Cast Iron or Ductile Iron. **Copper services are not permitted in new construction.** The minimum size permitted for water services is 25 mm diameter except in areas of low pressure as designated by the County of Oxford, setbacks from the main greater than 30 m (100 ft) and ends of cul-de-sacs. In areas of low pressure, setbacks greater than 30 m (100 ft), and ends of cul-de-sacs, the minimum size of water service allowed may be larger than 25 mm diameter.

Water services larger than 25 mm diameter must be hydraulically modelled for sizing based on required demand as supplied by the property owner, developer, or contractor.

All non-metallic water services shall require tracer wire.

Electrical Grounding

- i. *Effective June 30, 1993 electrical systems of all new developments shall not be grounded to the water system. Refer to the Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.*
- ii. *Where an existing metallic watermain or service is replaced or upgraded with PVC or HDPE material, the grounding of electrical systems to the water service may not be adequate. It will be the property owner's responsibility to ensure grounding is adequate after the watermain or service upgrade is complete.*

All existing or new copper water services located and exposed or, replaced in the municipal road allowance that will remain in service after reconstruction shall require cathodic protection as per SECTION- D Corrosion Protection and Insulation.

Water services shall be installed as per Detail D1838-1-2007 and D1839-1-2007 with a minimum 1.80 m of cover from the watermain to the property line. If a minimum cover of 1.80 m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. Water services crossing sewers or utility obstructions require a minimum 500 mm of clearance under and a minimum of 150 mm over the obstruction. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

- a) No services shall be installed until stakes have been provided to indicate the proper line and grade of the lot or lot boundaries or the exact location of the service laying line.

The contractor shall satisfy himself as to the accuracy of all lines and grades. Errors in service locations shall be corrected to the satisfaction of the Engineer at the expense of the Developer. The service pipe is to be laid at right angles to the main and will extend in a straight line to the property line. Services shall be placed on property line and marked with a 50 mm X 100 mm blue stake extending from the curb stop to 600 mm above finished grade. Maintain separation between services as per Figure 1.1 Section 1.

- b) Under no circumstance will a single service be permitted to supply more than one dwelling unit.
- c) Where a fire service is required for a building, its installation must conform to the National Building Code. One (1) service is to be taken to the property line. Domestic service must be tapped off the fire service outside the building with separate shut off valves. Valves for the domestic and fire service should be located as per Detail D1857-1-2016. Fire services are not metered.
- d) Water services shall be installed along with watermain and tested under 1034 kPa (150 psi) standard test pressure. Service material used must be rated to minimum 1034 kPa (150 psi).

- e) For all non-metallic water services tracer wire will be installed and attached to the electrical thawing nut on the main stop and to the electrical thawing nut on the curb stop at property line. Splices into the main line tracer wire are not permitted unless the service size is 100 mm or larger. The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted. The tracer wire to be used for services shall be of the same size and type used for watermain placement. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.
- f) All services located at the end of a cul-de-sac shall be minimum 25 mm diameter regardless of material used and installed as per Detail D1835-1-2006.
- g) 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 the construction limits only. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressed concrete is extremely difficult to match when replacing parts of driveways, curbs, or sidewalks. The County or its service provider is not responsible for an exact match of these areas.

The County or the County of Oxford's service provider require a minimum of 48 hours notice prior to placement of finished grade materials surrounding the curb stop. Curb stops shall be inspected and raised to the level of finished grade. All service boxes located in concrete, asphalt, or interlocking brick surfaces shall have a 100 mm inside diameter PVC pipe 300 mm in length placed around the cap and flush with the surface. After placement of final grade material the curb stop shall be flush with the surface and in a fully accessible and operable state.

- h) 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 or its service provider 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 provider acknowledging acceptance. Included in the agreement will be a holdback to ensure that the curb stop is placed to proper grade and is fully functional after the property owners restoration has been completed.

1.7 Meters

As stated in Bylaw No. 5514-2013, One (1) County meter will be placed in each single family residential, multi-family residential, commercial, industrial and institutional building. Generally this means one meter per individual property except for apartment condominiums which will only have one meter. Accompanying all water meters will be an Electronic Radio Transmitter (ERT) device used for collecting water usage data.

SECTION 3 - WATERMAIN

All water used in the above mentioned buildings will pass through such meter and the owner of the premises shall be held liable for water charges.

As of January 1, 2016 all customers connected to municipal water systems in the County of Oxford will require a water meter and ERT device. Water meters shall be installed by a licensed plumber.

The ERT device shall be installed by the County or the County of Oxford's service provider prior to turning water on. Water meters and ERT device will be installed as per Detail D1807-1-2004 and D1856-1-2016. Secondary meters may be purchased from the County for the convenience of the owner, as in apartment houses or multiplex units, at the owner's request and expense.

All secondary meters shall be installed in a manner so that all water supplied passes through the County meter prior to passing through the secondary meter. Secondary meters shall not be read or billed separately or maintained by the County.

- a) Meters will generally be sized one size smaller than the size of the service. The size of the meter must be negotiated with the Engineer in accordance with the flow requirements.

Contact your local municipality to purchase the water meter and ERT device.

Township of Blandford –Blenheim	519-463-5347
Township of East Zorra-Tavistock	519-462-2697
Township of Norwich	519-879-6568 or 519-863-2709
Township of South West Oxford	519-877-2702 or 519-485-0477
Township of Zorra	519-485-2490
Erie Thames Power Lines (Ingersoll)	519-485-1820
Town of Tillsonburg	519-842-9200
City of Woodstock	519-539-1291
County of Oxford	519-539-9800

The meter shall be installed immediately inside the wall of the building. Sufficient space for installation and maintenance must be provided.

The meter must be protected against freezing and be accessible for meter reading. In areas of the County that have not begun the universal metering program, meters shall be installed as per Detail D1805-1-2004, D1806-1-2004, D1807-1-2004.

- b) For Industrial, Commercial, and Institutional properties where the meter is 75 mm or larger, a lockable by-pass for this meter must be installed. For Industrial, Commercial, and Institutional properties with meters smaller than 75 mm, a lockable by-pass will be installed where the customer cannot tolerate a shut-down of the water service during business hours.

Such locations would include coin operated equipment such as laundromats, services in which there is water-cooled equipment, production line(s) where a shut-down of approximately one hour would create problems. Residential by-passes are not permitted.

- c) Meter by-passes shall be installed according to Detail D1811-1-2004 or D1818-1-2005.

1.8 Backflow Prevention

A backflow prevention device shall be required for all industrial, commercial, and institutional developments. Such a device will be installed by the Developer, Contractor, or property owner at their expense. These devices shall be as per AWWA standards and approved by the County Engineer. A current test/calibration certificate shall be provided to the County upon installation. On an annual basis the backflow prevention device shall be retested/calibrated and certificates shall be submitted to the County. Installation and calibration will be done in the presence of a licensed water operator from the County or the County of Oxford's service provider.

In the City of Woodstock all residential services shall require the installation of a dual-check backflow preventor. Installation shall be as per Detail D1807-1-2004.

1.9 Service Valves

- a) Where the service is 50 mm in diameter or less, a corporation stop shall be installed at the main and a curb stop at the property line. The curb stop and service box will be placed on a 200x200x100 mm concrete support block. Wooden support blocks are not acceptable.
- b) For services larger than 50 mm in diameter, a single valve will be installed at the property line if the main can be closed down during its installation.

If the main cannot be closed down, then a tapping sleeve and valve will be installed at the main.

- c) In building complexes such as town housing developments or shopping plazas, where individual services are connected to a larger common service, a valve shall be placed on each individual service where it joins the common service. Valves must be easily accessible for operation and must be in accordance with drawings approved by the County Engineer. Sectionalizing valves on the common service may also be required.

1.10 Hydrants and Hydrant Testing

Hydrant laterals shall be a minimum of 150 mm diameter. Hydrant spacing will not be approved in excess of 90 m from the face of a building as per the latest revision of the Ontario Building Code, Part 3, Section 3.2. Hydrants placed adjacent to buildings with siamese connections shall be located a maximum of 45 m away from the connection.

Hydrant spacing on streets may range between 90 m and 180 m. Hydrants located in residential areas shall be located on a common lot line.

Hydrants located near entrances shall be located a minimum of 1.5 m away from residential driveways and utilities, and 2.5 m away from driveways in industrial, commercial, or institutional areas. Where possible, hydrants should be located at the high point of the watermain. The County reserves the right to request additional hydrants if necessary.

Hydrant valves to be located 1.0 m from the street side of the hydrant barrel. Tracer wire shall be brought up on the outside of the valve box, then looped inside the box through a drilled hole with rubber grommet at the top of the valve box, then return to the outside of the valve box and return to the watermain. Tracer wire is not required to be installed to the hydrant. Hydrants shall be installed according to Detail D1828-1-1993

Public hydrants shall have the hydrant body painted YELLOW. The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291 colour coding based on flow testing. Colour coding is for the purpose of indicating available flows at 140 kPa (20 psi) residual pressure.

Upon completion of each phase of development, the County of Oxford requires that all fire hydrants be flow tested. Records of field test data must be submitted prior to commencement of the maintenance period. Testing will be completed in the presence of a licensed operator from the County or the County of Oxford's service provider. It is understood that as phasing of developments progress, hydrant flow rates may change (i.e. dead-ends to looped connections). These locations will be re-evaluated by the County or the County of Oxford's service provider.

It is the responsibility of the consultant or developer to confirm hydrant flow rates of all hydrants in the development prior to final acceptance. All costs associated with testing will be the responsibility of the consultant or developer.

When necessary and required by the Fire Department or as arranged by property owners, hydrants will be located on private property. Hydrants located on private property shall have the hydrant body painted RED.

The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291 colour coding based on flow testing. Private hydrant testing and colour coding will be the responsibility of the property owner.

When hydrants are located on private property, a maintenance agreement shall be entered into with the County.

(Exceptions for maintenance agreements are the City of Woodstock and the Town of Tillsonburg)

Note: Hydrants shall not be placed in non-fire rated distribution systems.

1.11 Temporary Watermain and Services

This section is to be read in conjunction with OPSS 493.

When service interruption is likely to be greater than 24 hours for 2 or more residential units and or buildings, temporary watermain must be installed. Each home or business shall have its own temporary water service connection. Shared services shall not be permitted. An approved back-flow preventer device shall be installed at the point of connection. The backflow preventer shall be placed above ground level with the excavation backfilled.

Prior to construction the Contractor shall submit a written detailed procedure outlining methods, materials, connection points to existing mains, connections to supply customers, and disinfection process for approval by the County Engineer. A drawing showing the proposed layout of the temporary water supply system indicating connection points to the existing watermain must also accompany the submission. Contractors 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 existing watermain. It will be the responsibility of the Contractor to maintain the temporary watermain and services in a safe operating condition at all times.

When a hydrant is removed from service, a temporary hydrant may be required. Temporary hydrants will be installed with the necessary valves and fittings and shall be installed where existing hydrants have been removed or where spacing requirements dictate. Hydrants out of service will be bagged and clearly marked with a "HYDRANT OUT OF SERVICE" tag.

Closed loop temporary systems (i.e. hydrant to hydrant) will not be permitted. Each dead-end branch will have fittings in place to facilitate flushing and sampling of the temporary watermain.

Temporary watermain shall be a minimum of 50 mm diameter Aquamine high impact, ASTM PVC 1120, D 2241, DR 17, 1720 kPa, or approved equal. The diameter of the temporary watermain shall be based on the number of services in the affected area. This main shall be certified for potable water use as per ANSI/NSF Standard 14 and Standard 61.

Service piping shall be a minimum of 19 mm inside diameter KuriTec Series K6136 reinforced PVC flexible connection or approved equal. Service piping shall be certified for potable water use as per ANSI/NSF Standard 61. Customer connections to external hose bibs shall require a brass wye fitting with dual shut-offs.

Prior to customer connection, all temporary watermain and temporary service piping shall be tested and disinfected. Testing of the temporary watermain and services will be at system pressure. Once testing of the temporary watermain is complete with no leakage, service piping shall be connected to the temporary watermain. There shall be no leakage in service piping.

Services shall be plugged, capped, or valved off at the end of the service pipe once flushing has been completed. Temporary watermain and services shall then be disinfected by removing plugs, caps, or opening valves to flow super-chlorinated water for the disinfection process. Plugs and caps shall be replaced and valves closed once the disinfection process has begun. Taping ends of service piping is not permitted. All piping, hoses, valves, plugs, caps, and fittings for all connections shall be the responsibility of the Contractor. Flushing, swabbing, disinfecting and commissioning of the temporary system shall meet the requirements of Part 5 and Part 6 of this specification.

When a replaced section of watermain is restored to service, the Contractor shall remove any corresponding temporary pipe and house service connection and shall leave the street, sidewalk and adjacent property in a neat and orderly condition.

PART 2 - MATERIAL

NOTE: All chemicals and materials used in the operation of the drinking water system that come into contact with water within the system shall meet all current applicable standards set by the American Water Works Association (“AWWA”), Canadian Standards Association (“CSA”), the American National Standards Institute (“ANSI”) safety criteria standards, American Society for Testing and Materials (ASTM), NSF/14, NSF/60 and NSF/61.

In areas of suspected soil contamination a geotechnical investigation will be required. The cost of required geotechnical testing and placement of suitable material will be the responsibility of the Consultant or Developer.

Materials shall remain consistent throughout projects. Mixing of materials is not permitted. The County or the County of Oxford’s service provider reserves the right to select any material or product it deems appropriate for the application.

All pipes up to and including 600 mm diameter shall be delivered to the work area with end covers.

End covers shall be factory installed on both ends and a tamper evident seal on the bell end only. Components shall adhere sufficiently to withstand the stresses caused during shipment.

The Contractor will get approval for all materials selection from the County Engineer prior to delivery to the site.

2.1 Pipe, Fittings, Tracer Wire and Spacers

Joint lubricants shall be as supplied by the pipe manufacturer and approved by the County Engineer. Acceptable watermain pipe material:

a) **Ductile Iron (DI)**

Ductile Iron Cement Mortar Lined CL 52 as per AWWA C104, C150 and C151.

Fittings shall be mechanical joint only as per AWWA Specifications C110, C150 and C153. **Fittings are required to be cement mortar lined.**

All fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

Installation of Tyton joint watermain pipe and mechanical joint fittings shall conform strictly to the manufacturer's instructions.

b) **Polyvinyl Chloride (PVC)**

PVC AWWA C900, CSA B137.3 - Class 235 DR 18 (complete with tracer wire) 100 mm through 300 mm diameter colour coded blue.

PVC AWWA C905, CSA B137.3 - Class 235 DR 18 (complete with tracer wire) 350 mm through 1200 mm diameter colour coded blue.

*PVC0 AWWA C909, CSA B137.3 – Class 235 C.I.O.D. (complete with tracer wire) 100mm through 300mm diameter colour coded blue.

*This material may only be used in new subdivisions and new development areas. This material is not permitted for use in reconstruction of existing areas.

PVC pipe used for the directional drilling process must meet or exceed the pressure rating of HDPE DR 11. For directional drilling of PVC pipe only the “Terra Brute”, “Cobra Lock”, “Diamond Lok-21”, or fusible PVC jointing process shall be permitted.

PVC Push-on fittings are permitted with the exception of service tees and main valves. All PVC fittings shall be injection molded as per AWWA C907, CSA B137.2 colour coded blue. **All** push-on fittings shall require mechanical restraint. All restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

The use of fabricated fittings will not be permitted unless approved in writing by the County Engineer.

Ductile Iron fittings used in PVC watermain systems shall be cement mortar lined mechanical joint only as per AWWA Specifications C110 and C153. All fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

All Ductile Iron fittings in PVC watermain systems shall require cathodic protection as listed in Section – D, 3.18 Cathodic Protection for PVC Watermain.

c) **High Density Polyethylene (HDPE)**

HDPE pipe is to be used for directional drilling only unless approved in writing by the County Engineer.

Unless specified otherwise all HDPE pipe will be Ductile Iron Pipe Size (DIPS).

HDPE AWWA C901 and C906, DR 11, PE 3408/3608 DIPS “Blue Stripe” (complete with tracer wire).

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

Note: Watermain less than 100 mm dia. shall be copper tubing size (C.T.S.)

d) **Concrete Pressure Pipe (CPP)**

Concrete Pressure Pipe and fittings as per AWWA C301 (L) Class 14 or C303 Class 150.

The Contractor shall submit certified shop drawings for all pipe and specials giving details, design, and method of construction, type of joint, etc., of the pipe, before fabrication commences. Cathodic protection measures shall be submitted in accordance with shop drawing requirements.

e) **Tracer Wire and Connectors**

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-D-1248, minimum break load 452 lbs, 30 volt rating, blue in colour.

For directional boring two (2) 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-D-1248, minimum break load 1150 lbs, 30 volt rating, blue in colour.

Tracer wire shall be manufactured to CAN/CSA B137.3. The use of thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted.

Tracer wire connected to existing cast iron or ductile iron pipe shall be properly connected with a thermite weld or approved equivalent. Welds will be completely sealed with a mastic type sealer. The mastic shall be TC mastic or approved equal.

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) or approved equal. Tracer wires at ends of rolls, repairs, or water services 100 mm diameter or larger 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. Tracer wire connections to be installed as per Detail D1858-1-2016.

f) **Casing Spacers**

When watermain is placed inside a casing, the watermain shall be supported by spacers using the centered configuration. The size, location, and number of spacers will be as per the manufacturer's recommendation.

Approved Casing Spacers are as follows:

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

2.2 Pre-Cast Valve Chambers

- a) All chambers are to be precast, complying in all respects with the design requirements of OPSS 441 and OPSD 1101 chambers, including concrete materials and joint waterproofing. Manufacturer's design drawings, calculations and certification shall be submitted at least 10 working days prior to commencing work. Certification shall be marked on units.

Shop drawings for precast chambers will include all details, and be reviewed and stamped by a registered Ontario Professional Engineer retained by the contractor.

- b) All chambers are to be designed to counteract full buoyancy forces as if the groundwater level is at the ground surface. All buried external surfaces of the chambers are to be waterproofed as specified herein.
- c) All chambers are to be fitted with frost straps. Each strap shall run continuously from the bottom slab to the top section.
- d) Pipe supports are to be adequately sized to support the valves, pipes and appurtenances that will be supplied by the contractor. The supports will be reinforced concrete and tied to the base with properly sized dowels.
- e) Units shall be constructed in accordance with details indicated, plumb and true to alignment and grade. Complete units as pipe laying progresses.

Precast concrete base shall be set on a minimum of 75 mm granular bedding compacted to 95 % Standard Proctor Maximum Dry Density (SPMDD) or as indicated on Contract Drawings.

- f) Each joint shall be watertight with approved rubber ring gaskets. Clean surplus mortar and joint compounds from interior surfaces of unit.

All lifting holes shall be filled with non-shrink grout. Floor of chamber will be sloped to sump pit at 1 in 20.

The Contractor will get approval for chamber selection from the County Engineer prior to supplying the material to the site.

2.3 Chamber Piping and Fittings

The piping, valves and fittings to be incorporated into the chambers will comply in general with all requirements of the buried watermain, with the additional requirements below.

- a) The Contractor shall submit shop drawings for review of all chamber piping, fittings, and valves, clearly showing all proposed materials, dimensions, details of thrust restraint (thrust blocks not permitted). Piping and fittings of all diameters shall meet the applicable AWWA standards.
- b) Chamber piping and fittings 400 mm or larger shall be concrete pressure pipe of the same rating as the main. Chamber piping and fittings less than 400 mm will be ductile iron, Class 52.
- c) All exposed metal surfaces not otherwise coated with approved AWWA epoxy coatings will receive corrosion protection as described in Section D, 3.17 of this specification or as per manufacturers recommendations.
- d) Vent piping and fittings shall be stainless steel, manufactured from type 304 L stainless steel produced from parent metal conforming to ASTM-A240 and AWWA Manual M11 (pressure limit 1035 kPa). All vents shall have a minimum of two bands of 50 mm wide high reflective yellow tape.
- e) Tracer wire within the chambers shall be secured to the inside wall and shall be accessible from the surface.
- f) All other materials which are not specifically described herein or noted on the Contract Drawings, but required for the completion of the work (such as couplings, gaskets, jointing materials, fasteners, other accessories) shall be as selected by the contractor, subject to approval of the County Engineer.

2.4 Gate Valves & Rods

- a) Valves shall be gate valves manufactured to AWWA C509 Specifications. Tapping valves and sleeves must be approved by the County Engineer.

The number of turns to operate the valve shall be 3 times the valve diameter in inches plus 2 to 3 turns. Valves with number of turns in excess of this will not be permitted.

NOTE: All gate valves and tapping valves must be resilient seat, epoxy coated gate valves.

- b) Valve boxes as supplied by Canada Valve, Mueller Ltd. or approved equal will be acceptable. All boxes shall be screw type.
- c) Valve rods shall be manufactured as per Detail D1834-1-1993.

Valves must be mechanical joint and must open Counter-Clockwise.

All valves connected to the City of Woodstock water system shall open Clockwise.

2.5 Combination Air / Vacuum Valves

Air release/vacuum relief valves should be installed at high points on distribution and transmission watermains where air can accumulate. Automatic air release valves should not be used in situations where flooding of the access hole or chamber may occur. Air release/vacuum valves shall conform to AWWA C512.

Air valves shall be combination air valve with cast iron or plastic boot and cover, stainless steel internal parts, class 125 flange inlet boot rated to 1378 kPa W06, 0 to 1034 kPa working pressure. Seat to be bronze with Buna-N seat. Under Ground Air Valve Systems must be approved by the County Engineer. Air / Vacuum valves for direct bury to be installed as per D1852-1-2011 and D1852-2-2011. The Contractor shall submit shop drawings for review of all piping, fittings, and valves, clearly showing all proposed materials, dimensions and locations. The final number and location of these valves will be reviewed by the County Engineer prior to construction. Piping and fittings of all diameters shall meet the applicable AWWA standards.

- a) Exterior surface of valve body shall be epoxy coated
- b) Adequate support shall be provided for the valve

Valves shall be Valmatic, Apco, ARI, or approved equal.

2.6 Waterproofing of Chambers and Manholes

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

The membrane shall be applied over a prime or tack coat and hand rolled to assure positive adhesion. 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. This product is supplied by Form and Build Supply Ltd (London / Kitchener) and Wiegand Sales Ltd. (Cambridge).

2.7 Service Material

The County of Oxford will accept cross-linked polyethylene (PEX) or high density polyethylene (HDPE) service material manufactured to Copper Tube Size (CTS). Copper service material is no longer accepted unless it is to be connected to an existing Cast Iron or Ductile Iron watermain. **Copper is not permitted in new construction.**

All existing copper service material connected to PVC watermain that has been exposed and not replaced during construction shall require cathodic protection as per Section D Corrosion Protection and Insulation. All non-metallic services shall be a minimum of 25 mm diameter and require a tracer wire. All service material shall conform to NSF 61.

- a) Cross-linked polyethylene (PEX) service material may be used from minimum 25 mm diameter up to and including 50 mm diameter nominal size. Material shall be pressure rated to a minimum of 1103 kPa (160 psi). Pipe shall be manufactured using the high pressure peroxide (Engel) method of cross linking in accordance with AWWA C 904, ASTM D3350 and a minimum degree of cross-linking of 80% in accordance with ASTM D 2765, Method B.

Pipe to have a co-extruded UV Shield made from UV resistant high-density polyethylene, colour blue.

Pipe to be certified to standards ASTM F 876, F 877, F 2023, CSA B137.5, NSF 14, and 61.

Pipe connecting to AWWA C 800 compression joint valves and fittings shall be installed using stainless steel support liners inside pipe at each joint according to manufacturer's specifications.

- b) High Density Polyethylene (HDPE) service material may be used from minimum 25 mm diameter up to and including 50mm diameter.

Material shall be pressure rated to a minimum of 1379 kPa (200 psi). Pipe shall be PE 3408/3608 Pressure Class 200 Copper Tube Size (CTS), colour black with copper stripe, manufactured in accordance with AWWA C901, CSA B137.1, NSF 14, and 61.

Pipe connecting to AWWA C 800 compression joint valves and fittings shall be installed using stainless steel support liners inside pipe at each joint according to manufacturer's specifications.

2.8 Main Stops

Fittings for 25 mm to 50 mm Services

All main stops shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Acceptable fittings shall be Ball Valve style and as listed below:

Size	Main Stops Inlet	Outlet
25 mm	AWWA Thread	Copper Compression
32 mm x 38 mm	AWWA Thread	Copper Compression
38 mm x 50 mm	AWWA Thread	Copper Compression

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire. Acceptable fittings for tracer wire are Mueller 110 compression for electrical thaw connection or approved equal.

Service Saddles

Note: Service Saddle Bands shall be double bolt type 304 Stainless Steel of minimum 20-gauge thickness.

Approved service saddles for PVC watermain are Concord D-71, Rockwell 371, or approved equal.

2.9 Curb Stops

All curb stops shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Size	Curb Stops General Description	Copper Connections
25 mm	Ball Valve	Compression
38 mm	Ball Valve	Compression
38 mm	Ball Valve	Compression
50 mm	Ball Valve	Compression
50 mm	Ball Valve	Compression

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire. Acceptable fittings for tracer wire are Mueller 110 compression for electrical thaw connection or approved equal.

Curb stops shall be installed with electrical thaw nuts on the private side facing away from the watermain. Inverted Key type curb stops and “Stop and Drain” types are **not** permitted.

2.10 Curb Boxes

All curb boxes shall be manufactured with metallic composition. All curb boxes must be able to be located using a magnetic locating device. Curb box length to be manufactured to accommodate minimum 1.80 m depth of bury.

Curb Boxes	
25 mm to 50 mm services	20 mm hexagon head plugs

Note: Operating rod to have modified top to enable use of same key as used on the A726 box with stainless steel operation rods and connecting pins.

2.11 Fittings

All fittings shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Size	General Description
38 mm	St. Elbow - Rough Brass
50 mm	St. Elbow - Rough Brass
38 mm	90 degree Elbow – Rough Brass
50 mm	90 degree Elbow – Rough Brass
38 mm	Copper to Iron
50 mm	Copper to Iron
25 mm	Copper to Copper
38 mm	Copper to Copper
50 mm	Copper to Copper

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire where required.

2.12 Mechanical Restraint

(For thrust restraint design see Part 1.1 f)

All restraint devices shall be approved by the County or the County of Oxford’s service provider prior to installation.

Restraint devices for PVC, Ductile Iron, and HDPE pressure pipe of all sizes shall be manufactured of high strength ductile iron, ASTM A536, grade 65-45-12, and shall incorporate a series of machined serrations on the inside diameter to provide contact to the pipe and support the pipe wall.

Connecting bolts shall be of high strength, low alloy material, ANSI/AWWA C111/A21.11. All mechanical restraints shall have corrosion protection as per Section – D Corrosion Protection and Insulation.

Restraint devices shall meet or exceed the requirements of ASTM 1674 and Uni-B-13-92 recommended performance specification for joint restraint devices for use on PVC pipe and shall be FM approved. Notarized original certification shall be included with submittal documents.

Restraint devices for PVC

Joint restraints for PVC pipe and fittings shall be either serrated ring or wedge action type as manufactured by Uniflange, EBAA, Star, Sigma, Romac or approved equal.

Restraints for Molecular Oriented PVC pipe (PVCO) shall be as per the pipe manufacturer's recommendation. It should be noted that Romac "grip ring" restraints are not permitted for use with PVCO pipe.

Restraint devices for Ductile Iron

Joint restraints for Ductile Iron pipe and fittings shall be either serrated ring or wedge action type as manufactured by Uniflange, EBAA, Star, Sigma, Romac or approved equal.

Restraint devices for HDPE

Restraint devices shall be designed to resist pull out forces based on the maximum working pressure rating of the pipe. Forces experienced due to expansion and contraction of the pipe require special consideration.

Internal pipe wall stiffeners must be used when restraining HDPE. The stiffeners must be sized to encompass the entire bearing length of the restraint device. Pipe systems must be engineered to prevent movement causing the fitting to slide or rotate on the pipe.

Joint restraints for HDPE pipe and fittings shall be either serrated ring or wedge action type as manufactured by EBAA, Star, Sigma, or approved equal.

2.13 Hydrants

Fire hydrants shall be Canada Valve (Darling), Century, MacIvity M67, East Jordan Iron Works Watermaster 5CD250 or approved equal.

Public hydrants shall have the body painted YELLOW with bonnet and caps painted in accordance with the National Fire Protection Association (NFPA) 291 colour coding based on flow testing.

Private hydrants shall have the body painted RED with bonnet and caps painted in accordance with the National Fire Protection Association (NFPA) 291 colour coding based on flow testing.

All hydrants shall have a brass to brass seat and open Counter-clockwise. All hydrants shall be equipped with a 100 mm STORZ pumper connection (cap painted black) and two (2) 63.5 mm hose connections 180° apart.

Hydrants shall be plugged when installed in areas of high groundwater. Plugs to be installed by manufacturer. Hydrants with plugged drains must be clearly marked and pumped dry after each use.

All hydrants attached to the City of Woodstock Water System shall be plugged and open Clockwise.

2.14 Granular Material

As per OPSS 1010.

2.15 Testing

Supply test certificates in accordance with the appropriate specification, for following materials:

- a) Pipe
- b) Valves
- c) Fittings
- d) Hydrants

2.16 Delivery

Materials found to be defective in manufacture or damaged in handling after delivery, shall be replaced. Materials found to be damaged upon installation shall be replaced, which will include the costs of furnishing of material and labour required for the replacement.

2.17 Handling

Load and unload materials so as to avoid shock or damage. The lining and coating of pipes shall not be damaged.

Extra precautions and care must be taken at temperatures below freezing to eliminate the possibility of impact damage to the pipe.

2.18 Storage

Place materials in a safe storage area. Keep interiors of pipes and fittings clean.

2.19 Non Shrinkable Fill Concrete

25 kg/cu m Portland cement
 Aggregates Per Can 3-A23.1 specifications
Slump 150 mm to 200 mm
 28 day strength must not exceed 0.4 MPa
 24 hour strength - at least 0.07 MPa

PART 3 - INSTALLATION OF WATERMAINS

The Contractor shall, unless specified otherwise furnish all material, equipment, tools, and labour necessary to complete the installations. The installation of watermain shall be as per AWWA Standards and Specifications and OPSS 401, 404, 441, 517, 1010, and Ontario Health and Safety Association OHS A Reg. 213/91 with the following exceptions/amendments.

Contractors shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to commencing construction. A licensed operator or Inspector from the County or the County of Oxford's service provider shall be present for all watermain construction.

SECTION - A OPEN CUT**3.1 Line and Grade**

- a) Contractors shall provide stakes to indicate the line and grade of the watermain as well as the location of fittings, bends, tees, valves, hydrants, crosses, reducers and plugged or capped dead-ends in accordance with the approved drawings before beginning any work. Line and grade stakes shall be marked and placed a minimum of 20 meters to a maximum of 50 meters apart. Minimum cover to top of pipe shall be 1.80 m. In areas where joint deflections or offsets require pipe to be laid with less than 1.50 m of cover, insulation shall be placed over the pipe to prevent freezing as per Detail D1812-1-2007.

Mains shall be laid and maintained to the required grades and locations with all valves, fittings, hydrants, etc. to be plumb and in accordance with the drawing locations. No deviation in excess of 150 mm will be permitted.

- b) Contractors shall carry out exploratory excavations where necessary to establish or discover the location and elevation of existing pipes, conduits or other buried objects.

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 Density.

3.3 Excavation and Trench Preparation

- a) 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.

- b) Where trench excavations are not kept within the design limits of the pipe, the County Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.
- c) Where the sub grade in its natural state is inadequate to support the pipe, the County Engineer will give instructions as to proper procedures.
- d) The sub grade shall be removed where it has been adversely changed by construction operations or cannot adequately support the pipe. Where poor soil conditions exist, the excavated material will be replaced with crushed stone or other approved material as directed by the County Engineer.

3.4 Dewatering

- a) Always maintain the excavation free of water.
- b) The discharge of water from excavations into sanitary sewers is strictly prohibited. The cost for cleanup of the sewer or other affected areas will be the responsibility of the Contractor or Developer.

3.5 Lowering & Laying

- a) Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by the County Engineer shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.
- b) 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.
- c) 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 the noon hour as well as overnight. The trench shall be kept dry and free from water.

No pipe shall be laid in water except by permission of the Engineer. No water shall be allowed to run through installations during construction.

Note: If trench flooding occurs that enters the main, contact the Inspector and/or the Engineer to determine the course of action for disinfection.

- d) Cutting of the pipe for inserting valves, fittings or closure pieces 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.
- e) Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted by the County Engineer.
- f) At grades above 10 percent, laying shall start at the bottom with the bell ends facing upward. Where deflection in the line laying is required, either in the vertical or horizontal plane, the deflection may be made at the joints with the maximum allowable deflections not being exceeded. Pipe deflection will be done in accordance with the manufacturer's specifications. If in the opinion of the Inspector, the deflection is excessive he or she will order the job stopped. The County Engineer or their representative, if deemed necessary, will order the installation of special fittings in order to provide the necessary deflection.

Thrust restraints shall be installed on all offsets according to manufacturer's specifications. Offset locations and details shall be shown on Construction and As-Constructed Plans. Such installations shall be made as per Detail D1832-1-1993 and D1833-1-1993.

- g) When the new main shall cross existing utilities, or where an existing watermain is undermined during laying operations, the County Engineer may order the installation of support beams.

Support beams shall be approved by the County Engineer prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. The County Engineer shall decide the method to be used.

In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to a minimum of 95 percent Standard Proctor density. Pipe must not be laid on blocks.

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

- j) Installations shall be kept thoroughly clean during the progress of the work and until the completion and final acceptance thereof.
- k) The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the Drawings

Where vertical or horizontal curves are shown, the pipe line shall not deviate more than 300 mm from line, or more than 75 mm from grade.

3.6 Bedding

For the purpose of this specification all materials placed between the trench bottom and 300 mm over the top of the pipe shall be considered as bedding. Bedding around the watermain and services may be granular material or clean screened sand.

- a) Granular materials greater than 19 mm in size shall not be used for pipe bedding. Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.
- b) Bedding material shall be placed full width of trench. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.
- c) The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

3.7 Backfilling

- a) Backfill shall be considered as starting from 300 mm over top of the pipe. All materials below this point shall be considered as bedding.
- b) If the County Engineer 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 the County Engineer.
- c) 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 250 mm.

Backfill material shall be placed in lifts not exceeding 300 mm and compacted to a minimum 95 percent Standard Proctor Density.

- d) 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 the County Engineer or other road authority.

Backfill on all County road allowances in the travelled portion of the roadway shall be granular material as set out in the Ontario Provincial Standards.

Installation of material will be as directed by the County Engineer or other road authority.

- e) The Inspector may order the trench to be bedded by hand from the bottom of the trench to the centre line of the pipe with sand, placed in layers of 75 mm and compacted by vibratory equipment. Bedding material shall be deposited on each side of the pipe simultaneously.
- f) From the centre line of the pipe, fittings, and appurtenances to a depth of 300 mm above the top of the pipe, trenches shall be backfilled by machine or by methods approved by the Inspector. The type of backfill material used shall be sand, gravel or approved excavated material.

The Contractor shall use special care in placing and compacting this portion of the backfill so as to avoid damaging or moving the pipe.

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

3.8 Compaction Test

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

- a) When tests show that the compaction does not meet the specified requirement, the Contractor will carry out further compaction in a manner directed by the County Engineer, and pay for further testing to establish proof of the specified compaction.
- b) For backfill compaction, tests will be performed in accordance with the testing company's recommendations.
- c) Co-operate with the County Engineer and testing company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

SECTION - B DIRECTIONAL DRILLING**3.9 Scope**

This specification covers the requirements for the installation of pipes by horizontal directional drilling.

3.10 Definitions

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.

3.11 Submission and Design Requirements*3.11.1 Submissions*

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

- a) Direction boring equipment and specifications;
- b) Sequence of operation;
- c) Location of entry and exit points;
- d) Location and positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- e) Disposal site for cuttings;
- f) Dewatering plan; and
- g) Slurry management plan.

3.11.2 Design Requirements

Procedures, materials and water management plan to be acceptable to the Ministry of Environment and Climate Change (MOECC), 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.

3.11.3 Record Drawing Requirements

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

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

3.12 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 the County Engineer.

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.

3.13 Construction

3.13.1 General

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

3.13.2 Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall not be modified without written consent from the County Engineer.

All water extracted during any dewatering process shall be diverted through a filter system or settling ponds/basins to ensure minimum sediment transport (as per OPSS 518). 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.

3.13.3 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 ± 100 mm over the total distance between the ground entry and exit points.

3.13.4 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.

3.13.5 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:

- a) Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- b) 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.
- c) Location of other surface features (eg. adjacent structures, walkways, fences, poles, trees, etc.)
- d) Location of other underground features (eg. utilities, foundations, etc.)
- e) Protection of water courses against the transport of excavated or other materials into receiving waters.

3.13.6 Pipe Installation

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. PVC pipe shall be joined using the "Terra Brute", "Cobra Lock", "Diamond Lok-21", fusible PVC, or approved jointing process. 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 HDPE pipe shall be prepared for butt fused flanged connections. All joints shall be restrained. Use of concrete thrust blocks for restraint shall not be permitted.

3.13.7 Tracer Wire

Refer to Part 2 – Material, 2.1 (e) Tracer Wire and Connectors.

When Directional Drilling is used for watermain installation, two (2) tracer wires will be installed simultaneously. The second wire will be used as a backup if the other tracer wire is broken during installation. Tracer wire shall be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the watermain.

Joints in the wire between valves will not be allowed. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.

Tracer wires shall have sufficient slack to be knotted together prior to placement of connector. Petrolatum tape shall then be wrapped around connection and compressed by hand around connector. Tracer wire connections to be installed as per Detail D1858-1-2016.

At each valve, a loop of 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 D1846-1-2009. 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.

3.13.8 Testing

As per PART 5 of this specification.

3.13.9 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 MOE guidelines, policies and regulations.

SECTION - C CONNECTIONS**3.14 Connections to Existing Mains & Jointing Watermain & Fittings**

NOTE: All chemicals and materials used in the operation of the drinking water system that come into contact with water within the system shall meet all applicable standards set by both the American Water Works Association (“AWWA”) and the National Standards Institute (“ANSI”) safety criteria standards NSF/60 and NSF/61.

- a) Contractors 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 existing watermain. Contractors shall locate and make connections to existing watermain as shown on the Drawings in the presence of a licensed operator from the County or the County of Oxford’s service provider.
The method of connecting shall be determined by the County Engineer. Where connections are to be made to concrete or steel mains, the installation will be such as to bare all coatings and materials in a proper manner. The Contractor shall submit a program for this work which shall be approved by the County Engineer before work commences.
- b) Contractors shall not operate existing valves. Contractors shall notify any existing customers of shut downs. Notices and customer lists of the affected area will be supplied by the County or the County of Oxford’s service provider.
- c) The jointing of pipe shall be made in accordance with the manufacturer's instructions or as per AWWA Standards C600.

NOTE: No substitution of accessories will be permitted and only lubricants as supplied by the manufacturer will be permitted. The deflection of mechanical joint pipe, in order to form long radius curves, shall not exceed the manufacturer’s recommendations.

- d) Extreme care shall be taken to prevent contamination of the existing watermain and new closure fittings. All new piping and appurtenances placed in the connection of the new main and existing waterworks system must be disinfected with a 1-% solution of sodium hypochlorite or equivalent method. All connections to existing watermain shall be 6 m in length or less. Connection requirements longer than 6 m shall be flushed, pressure tested, and disinfected as per Part 5 – Testing of this specification.

3.15 Jointing of Push on Joint Pipes

- a) The jointing of Push On pipes will be in accordance with the pipe manufacturer's specifications or as per AWWA Standard C600.
- b) The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer’s recommendations.

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

3.16 Valves, Hydrants & Fittings

- a) Valves, valve boxes and hydrants shall be installed plumb at all locations. The valve box will be installed on every valve in such a manner that no shock or stress shall be transmitted to the valve. The box shall be centered and plumb over the operating nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed.

Valve extension rods shall be installed on every valve when deeper than 1.8 m according to Detail D1834-1-1993.

- b) Bends, crosses, tees and other fittings shall be installed where shown. Mechanical thrust restraint is required. Mechanical restraints to be installed as per 1.1 f) and manufacturers specifications. Any joints less than 6 m or one full length of pipe from fittings, etc. shall be restrained.
- c) Prior to installation hydrants should be cycled to full open and full closed positions to ensure no internal damage or breakage has occurred during shipping and handling.
- d) Hydrants shall be installed according to D1828-1-1993. Hydrant valves to be located on the street side of the hydrant 1.0 m from hydrant barrel unless otherwise approved by the County Engineer. Hydrants shall be set with the barrel vertical, outlets parallel to the roadway and at a depth suitable for the finished grade at the hydrant location. Temporary extension pieces may be necessary. Hydrants shall be installed using mechanical restraints.
- e) Hydrants shall be set on concrete blocking, as shown on OPSD 1105.010. The excavation around the hydrant shall be filled to a minimum of 150 mm above the hydrant drain, with at least 0.50 cubic metres of 19 mm clean crushed stone, free from fine material, which shall be covered with filter cloth before backfilling. Hydrants shall not be backfilled before being inspected by the County Engineer.
- f) Cast iron plugs or caps shall be installed on all dead-ends with the dead-end being equipped with a suitable blow-off.
- g) Hydrants installed in areas of high water table may require drain outlets to be plugged to prevent contamination. Hydrants with plugged drains must be clearly marked and pumped dry after each use.

SECTION - D CORROSION PROTECTION AND INSULATION**3.17 Petrolatum Coating System**

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.

- a) All surfaces of fittings, flanged connections, nuts, bolts, tie rods, clamps, valves, sleeves, Victaulic 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.
- b) All surfaces of pipes, valves, fittings, and appurtenances in valve chambers shall be coated using petrolatum materials. Valves or appurtenances that are epoxy coated do not require this procedure.
- c) 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 contractors expense.

3.18 Cathodic Protection for PVC Watermain

As per the General Section of the Design Guidelines and Supplemental Specifications 1.4 Subdivider and Consultant responsibilities item b), the size and type of anodes shall be determined through the Geotechnical report. The list below indicates the minimum anode requirements. 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 ductile iron, cast iron pipe fittings, joint restraints, copper water service lines, and attached to tracer wire at the ends of watermain. At the ends of watermain 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 watermain.

In areas of reconstruction where new non-metallic services are connected to existing copper services at property line, anodes shall be connected to the existing copper service pipe behind the curb stop on private property. Where existing metallic water service materials other than copper are encountered on private property, the home owner should be advised of replacement.

In subdivisions that have undeveloped lots with existing copper service lines on municipal property, an anode shall be installed on the copper service line during the connection inspection.

Valves or appurtenances that are epoxy coated do not require this procedure. Anodes shall be installed as per OPSS 442 and OPSD 1109.011. Attaching anodes to restraint nuts or gland pack nuts is not permitted.

Connections to fittings, and joint restraints will be done using the “cad weld” method and coated with mastic. Anodes attached to copper services will be done using a silicon bronze ground clamp attached to the service pipe. The clamped connection shall be wrapped with DENSO tape or approved equal and compressed by hand around the connection. Installation shall be as per the manufacturer’s specifications and recommendations.

Minimum Anode Sizing

Zinc – ASTM B-418 Type II

For new installations of fittings, joint restraints, and services.

Fittings and joint restraints	11 kg (24 lb) Z-24-48
Water Services 38 mm and over	11 kg (24 lb) Z-24-48
Water Services under 38 mm	5.5 kg (12 lb) Z-12-24

Magnesium – ASTM B-843 Type M-1C

For existing metallic watermain, services, or connection between cast iron / ductile iron watermains and PVC pipe.

Fittings and joint restraints	14 kg (32 lb) M-32-22
Water Services 38 mm and over	14 kg (32 lb) M-32-22
Water Services under 38 mm	7.7 kg (17 lb) M-17-20

3.19 Thermal Insulation

Rigid Board Insulation – Slab Type

If minimum cover of 1.80 m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. No watermain or water service shall have a ground cover less than 1.0 m deep from ground surface to the top of pipe. Insulation is required on all new or existing water services if minimum cover cannot be achieved.

For watermains crossing underground structures or conduits where minimum cover cannot be achieved, a “Frost Box” is required.

Watermains and services located 500 mm or less horizontally from a manhole or catchbasin shall require a minimum of 50 mm thick insulation.

Water services crossing over or under storm sewer requires a minimum 500 mm of clearance. In instances where clearance is 500 mm or less from storm sewers the water service shall require insulation.

Insulation shall be installed to a minimum of 1.0 m from the outside wall on both sides of the storm sewer. 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. Manufactures specification of material shall be provided prior to installation.

Refer to Detail D1812-1-2007 for Rigid Board Insulation – Slab Type.

Pre-Insulated Pipe

Pre-insulated watermain pipe may be used as an alternative. This option should be presented in the initial design phase prior to construction. The watermain pipe shall consist of a factory applied rigid polyurethane foam minimum 50 mm thick and an outer protective jacket. The outer protective jacket shall consist of a tape wrap – Scapa #366 polyethylene with UV inhibitor, or, a factory applied extruded black HDPE copolymer with UV inhibitor. Pre-insulated pipe shall be Urecon or approved equal, and shall be installed in strict conformity with the manufacturer’s recommendations. Pre-insulated watermain pipe shall be approved by the County prior to installation.

PART 4 - SERVICE INSTALLATION

4.1 Connecting Services to Mains

Contractors shall give the County or the County of Oxford’s service provider a minimum of 48 hours notice prior to connecting services. A licensed operator from the County or the County of Oxford’s service provider shall be present for all connections.

All new water services 100 mm diameter and larger on private property must be tested and disinfected as per Part 5 – Testing and Part 6 – Disinfection of this specification. Private services will not be connected unless testing and sampling has been completed. A licensed operator from the County or the County of Oxford’s service provider shall be present for the testing and sampling procedure. The installation of services shall be as per OPSS, OPSD and AWWA standards with the following exceptions/amendments.

- a) **Direct tapping of services to PVC watermain is not permitted.** Water service connection main stops shall be tapped into the main at a 45 degree angle. All service connections shall be tapped in with the main under working pressure.

One continuous piece of service pipe shall run from the watermain to the curb stop and service box at the street line.

Curb stops shall be installed with electrical thaw nuts on the private side facing away from the watermain.

Services of 25 mm shall be installed as per D1838-1-2007. Services of 32 mm, 38 mm and 50 mm in diameter shall be installed as per D1839-1-2007. Couplings shall not be permitted unless the service length exceeds 30 m (for copper) between the main and the curb stop. The minimum cover shall be 1.8 m below final grade from the watermain to the building.

- b) Services of 100 mm diameter and larger shall be connected by either cutting out a section of the main and installing a tee with a cut-in sleeve or by using a tapping sleeve and valve. The type of connection will be determined by the County or the County of Oxford’s service provider.
- c) Non-metallic services shall have inside diameters matching typical C.T.S. service size requirements.

Tracer wire is required on all non-metallic service material and shall be bound to the electrical thaw nut on the main stop and to the electrical thaw nut on the curb stop. The tracer wire to be used for services shall be of the same size and type used for watermain placement.

- d) The County or the County of Oxford’s service provider will make all connections unless otherwise agreed in writing. The Contractor will install service connections in subdivisions or new developments.
- e) All tapping machines and other required equipment to be used onsite shall be satisfactory to the County or the County of Oxford’s service provider.
- f) For repairs or replacement of copper services to Ductile Iron pipe, tapping to the following maximum sizes will be allowed:

on 100 mm mains	19 mm only
on 150 mm mains	up to 30 mm maximum
on 200 mm or larger mains	up to 38 mm maximum

NOTE: Saddles should be used on all taps > 25 mm (on ductile pipe).

Stainless Steel Double bolt saddles shall be used on all services for PVC watermain from 25 mm to 50 mm dia. Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts, and outlet.

- g) When connections are to be made to mains other than cast iron or ductile iron, they shall be done under special instructions from the County Engineer.

4.2 Services

Cathodic protection if required shall be as per SECTION – D Corrosion Protection and Insulation.

- a) Curb boxes shall be installed vertically, flush with finished grade, and located on the property lines. If extensions are required only threaded couplers shall be used. **Set-screw type extensions are not permitted.**
- b) All service boxes located in concrete, asphalt, or interlocking brick surfaces shall be clean and operable upon assumption. All service boxes located in concrete, asphalt, or interlocking brick surfaces shall have a 100 mm inside diameter PVC pipe 300 mm in length placed around the cap and flush with the surface.
- c) Blue painted stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the water service. These stakes shall extend from service invert to a minimum of 600 mm above finished grade.

A record of service location must be produced for the As-Constructed drawings and provided digitally to the County.

Water services are to be located on these drawings by showing proper plan view locations which includes any bends and sweeps between the connection at the watermain and the right-of-way, tie-in or curb stop. **Depth below existing ground and invert elevation shall be indicated on the service locate sheet drawing.**

- d) All services shall require extensions from the curb stop to a minimum of 600 mm above finished grade. These tail pieces will be used for testing and air relief purposes only. Material used for tail pieces shall be PEX, PE 3408/3608 Series 200 CTS, or approved equal and shall conform to AWWA C901.

Upon completion of testing, service tails will be capped and fastened to marker posts.

4.3 Alignment and Grade

- a) Water services shall be installed perpendicular to the property line.
- b) New water services shall be located to connect to existing services and/or as detailed on Figure 1.1 Section 1.
- c) All services shall have a minimum depth of 1.80 m from the watermain to the property line. When replacing existing services located at lot corners, curb stops should be placed a minimum of 1.50 m away from lot corners in a manner as not to disturb survey markers.

4.4 Service Terminations

Terminations shall be as per OPSD 1104.010 and 1104.020. For 100 mm and larger the service shall terminate with a restrained cap threaded with a 50mm plug for air release.

PART 5 – TESTING

5.1 Testing General

The Contractor shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to testing. A licensed operator from the County or the County of Oxford's service provider shall be present for the testing procedure, and is required to fill out and submit the Watermain Inspection Report. Submission of Form F035 Watermain Inspection Report is required as final acceptance of the testing procedure. Testing shall be conducted as per OPSS and AWWA requirements with the following exceptions/amendments.

- a) The Contractor shall test all watermain, in such lengths or sections as directed by the County Engineer. The Contractor shall provide all labour, water, pumps, gauges, caps, stoppers, air release cocks, pipe work and other apparatus required to complete the tests.
- b) The Contractor shall supply the County Engineer with the pressure gauges intended to be used prior to the first test in order that they may be checked for accuracy.

All equipment used by the Contractor in carrying out the testing shall be approved by the County Engineer.

- c) Under no circumstances will the test lengths be permitted to exceed 600 m unless approved by the County Engineer.
- d) Pipe crossings on bridges, under rivers, creeks, railway tracks, Provincial roads, and other right-of-ways shall be tested separately.

5.2 Initial Flushing and Swabbing

Prior to testing and disinfection, and under the supervision of the County or the County of Oxford's service provider, all dirt and foreign matter in the system shall be removed. Pipelines shall be cleaned by flushing and swabbing.

On projects supervised by the City of Woodstock or the Town of Tillsonburg swabs may be inserted as construction progresses. On County supervised projects swabs shall be inserted after initial flushing is complete. The placement of swabs during construction on County projects is not permitted unless authorized by the County Engineer. All new and rehabilitated watermains shall be cleaned and swabbed after the water services have been tapped.

Swabbing

- Swab diameter is 1.25 times the outside diameters up to and including 300 mm and 1.50 times the outside pipe diameters greater than 300 mm.
- each branch of the new mains will be swabbed using three sequentially numbered swabs.

- velocity of the swabs shall not be less than 0.76 m/sec.

5.3 Test Pressure

Test pressure shall be 1035 kpa (150 psi). This will be measured at the highest elevation in the test section. The test section shall be filled slowly with water and all air shall be removed from the pipeline. A period of 24-hours for absorption should be allowed before starting the test. The test section shall be subjected to the specified continuous test pressure for 2 hours.

In areas where watermain has been rehabilitated with structural or cement mortar lining, pressure testing to 1035 kPa (150 psi) is not required. Rehabilitated watermain shall be tested at system pressure.

A visual inspection is required for all fittings, valves, and connection points where entry into the piping has occurred, prior to backfilling, to verify there is no leakage.

Testing and inspection will be completed to the satisfaction of the County or the County of Oxford's service provider.

5.4 Blocking & Blanking

Once the Contractor has been notified by the Engineer to test a section of the pipeline the Contractor shall check that all relevant open ends are capped off and that all bends, tees, crosses, etc. are adequately restrained to safely withstand the test pressure.

5.5 Air Release Taps

The Contractor may be directed by the County Engineer to excavate certain portions of the pipeline in order to provide taps for the release of air without additional payment.

Air release taps shall be installed at all high points to accomplish this before the test pressure is applied.

5.6 Filling Pipe

The section of the pipeline to be tested shall be slowly filled with water obtained by the Contractor at his own expense from a source approved by the Engineer. The Contractor shall ensure that all air has been removed from the section of the pipeline to be tested.

5.7 Leakage Test

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

- b) The Contractor shall provide the County Engineer with the necessary equipment for measuring the exact quantity of water added in order to maintain the test pressure throughout the duration of the test.
- c) The County or the County of Oxford's Service Provider shall calculate the allowable leakage for testing purposes. Allowable leakage for Polyethylene shall be as per OPSS 441.07.24.

If any section under test discloses a leakage greater than that allowed, the Contractor shall locate and repair the defective area or areas at his own expense.

PART 6 - DISINFECTION

6.1 General

- a) After the conclusion of flushing, swabbing, pressure and leakage tests to the complete satisfaction of the County Engineer, the Contractor shall disinfect the newly constructed or rehabilitated water system including all sumps and chambers that are intended to hold potable water as per MOECC Watermain Disinfection Procedure, AWWA Standard for Disinfecting Watermain, C651, OPSS 441.07.25. and the National Standards Institute ("ANSI") safety criteria standards NSF/60 and NSF/61.

The two acceptable methods are:

- 1) *A known quantity of water and a known quantity of Chlorine* mixed in an approved tanker truck to achieve the required concentration of chlorine. This mixture will then be used to fill the new water main.
- 2) *A modified continuous feed method.* This will be a known flow of water in the new water main injected with a known flow of chlorine to achieve the required concentration of chlorine.

Note: The method, materials, quantities, and equipment to be used will be submitted to the County Engineer for approval before the construction starts. Equipment used should be specific to testing and disinfecting and not used for any other purposes.

- b) The Contractor shall complete the disinfection within ten days of being directed to do so.
- c) The Contractor shall give the County or the County of Oxford's service provider a minimum of 48 hours written notice prior to disinfecting. A licensed operator from the County or the County of Oxford's service provider shall be present for the disinfecting procedure.

6.2 Contractor to Supply

The Contractor shall supply all labour, water, materials, chemicals, flushing taps, disinfecting agents, etc. necessary to complete the disinfection and final flushing of the system to the satisfaction of the County Engineer.

6.3 Point of Application

The new watermain shall be kept isolated from the existing waterworks system using a physical separation until satisfactory bacteriological testing has been completed and accepted by the County or the County of Oxford's service provider. Water required to fill the new main for hydrostatic pressure testing, disinfection and flushing may be supplied through a temporary connection between the existing water system and the new main. Temporary connections shall be as per Detail D1836-1-2006.

The temporary connection shall include an appropriate testable reduced pressure zone (RPZ) check valve assembly used **ONLY** above ground along with isolation valves located on each side of the device.

The County or the County of Oxford's service provider staff will require the Contractor to provide written certification of the backflow prevention device's operation in accordance with CAN/Canadian Standards Association-B64 Series Manual each time the device is installed. See also Part-1 Section 1.6 Backflow prevention. The backflow prevention device shall be isolated from the new main during the hydrostatic pressure test by placing the isolation valves in the "closed" position.

It will be necessary to re-establish the connection after completion of the hydrostatic pressure test to disinfect and flush out the chlorinated water prior to the final connection of the new main to the waterworks system.

6.4 Disinfection

Chlorination methods for disinfecting newly constructed watermains shall be as per AWWA C651. Minimum contact times, initial chlorine concentrations, and maximum allowable decreases in chlorine concentration shall be as per MOECC Watermain Disinfection Procedure.

For the slug method the initial chlorine concentration shall be equal to or greater than 100 mg/L. The maximum allowable decrease in chlorine concentration shall be not less than 25 mg/L.

For the continuous feed method the initial chlorine concentration shall be equal to or greater than 25 mg/L. The maximum allowable decrease in chlorine concentration shall be not less than 40% of the initial chlorine concentration to a maximum of 50 mg/L.

Water entering the system shall be controlled to flow slowly during the application of the chlorine solution. The use of Dole valves may be required.

The County or the County of Oxford's service provider shall record the duration of disinfection, as well as the initial dose and remaining residual at the end of the contact time.

6.5 Final Flushing

After the 24 hour retention period, heavily chlorinated water should not remain in prolonged contact with pipe.

In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main, fittings, valves, hydrants, blow-offs, branches and all service tails.

It is unacceptable to allow heavily chlorinated water to remain in a main over a weekend or a 48 hour period.

Disposing of the heavily chlorinated water:

Dechlorination of water shall be as per AWWA C655.

The environment to which the chlorinated water is to be discharged shall be inspected prior to final flushing. All chlorinated water used for testing, flushing, and disinfecting watermains shall be disposed of safely. Any discharge of chlorinated water that will cause damage to the environment, including aquatic and terrestrial species shall require a neutralizing chemical to be applied to thoroughly neutralize the residual chlorine.

When necessary, Federal, Provincial, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. Chlorinated water may not be discharged to any water body.

Discharge of heavily chlorinated water into sanitary sewers is not permitted.

Acceptable means of disposal is by discharge into a storm sewer or open environment (drainage ditch) with a free chlorine residual of 0.0 mg/L (i.e. no detectable level of chlorine). The concentration of chlorine in the water leaving the main will be approved by a certified operator from the County or the County of Oxford's service provider on site. When discharging into the open environment or storm sewer, it will be the responsibility of the contractor to ensure the effectiveness of the dechlorinating process.

The contractor shall provide a written plan for the dechlorinating process which will be submitted to the County or the County of Oxford's service provider for approval prior to discharge.

6.6 Connection Samples

The free chlorine residual must be between 0.50 mg/l to 1.50 mg/l. After final flushing and before the new watermain is approved for connection to the existing water system, two sets¹ of water samples shall be taken at least 24 hours apart.

¹ The minimum for a section of water main under 350 m. long is two results each for EC and TC taken 24 to 48 hours apart.

Samples shall be collected every 350 meters, from the end of the line, and from each branch.

Only a certified municipal operator or person designated by the Municipality (OWRA Reg. 128/04) shall collect bacteriological samples.

Initial samples as described above will be paid for by the County. Contractors shall contact the County of Oxford for information regarding current approved laboratory services.

All water samples are to be analyzed at a laboratory that is accredited and licensed to perform microbiology tests on regulated municipal drinking water. If additional samples are required they will be done at the Contractor's expense.

The results should be emailed to water_analytical@oxfordcounty.ca directly from the laboratory or may also be faxed directly to the County of Oxford at 519-421-4711.

For sampling performed in the City of Woodstock or the Town of Tillsonburg results should be forwarded to the Water Operations Manager at these locations.

Samples will be taken by an operator employed by the County or the County of Oxford's service provider who will also provide the sample container, complete the appropriate paperwork (chain of custody) for samples going to the laboratory and seal the container or sample bottles.

The requested tests, free chlorine residual, time the sample was taken, location and the operator's name must be on the chain of custody. Samples submitted without appropriate paperwork (i.e. chain of custody) will be rejected by the testing laboratory and not analyzed.

Contractors will arrange for delivery of samples to the lab if a pick up cannot be conveniently arranged.

Samples should be transported in a container with ice or cold packs to maintain a temperature between 4° and 10° Celsius, until delivered to the laboratory. Samples must be received at the laboratory within the holding time required for the type of sample. Samples taken from water mains isolated from the municipal consumers are identified as NR (not regulated under Reg. 170/03).

The minimum acceptable requirements for bacteriological tests are:

<i>E. coli</i>	0 colonies per 100 ml
Total coliform	0 colonies per 100 ml

If background bacteria are reported, the result shall not be accepted above 200 colonies per 100 ml. If an HPC (heterotrophic plate count) is analyzed, the result shall not be accepted above 500 colonies per 1 ml.

6.7 Commissioning of New Main

Contractors must provide in writing, a method of dewatering in order to protect the final connection from contamination of the new or existing watermain with foreign material or groundwater. Should contamination occur, the entire cost of disinfecting the mains will be at the Contractor's expense.

One method of dewatering is to provide a crushed stone sump in the trench and sufficient pumps to control the water being drained from the main, assuring no backflow into the pipes from the trench.

All new piping and appurtenances placed in the connection of the new main and existing waterworks system must be disinfected with a 1-% solution of sodium hypochlorite or equivalent method.

When all of the initial tests including the bacteriological samples are satisfactory, approval from the County or the County of Oxford's service provider must be obtained prior to connecting the main to the existing water system.

Contractors shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to connecting.

A licensed operator from the County or the County of Oxford's service provider must be present on site during the removal of the temporary connection and until the connection to the existing waterworks has been completed.

6.8 Contractor's Liability

The Contractor shall be liable for all damage to equipment, property, persons, etc. caused by or as a result of the pressure and leakage tests performed and the flushing, disinfection and cleansing of the system, pipeline and accessories.

6.9 Removal of Equipment

Upon completion of the testing and disinfection of each section, the Contractor shall remove all ancillary equipment and plug all holes left by the air release taps in a manner satisfactory to the County Engineer.

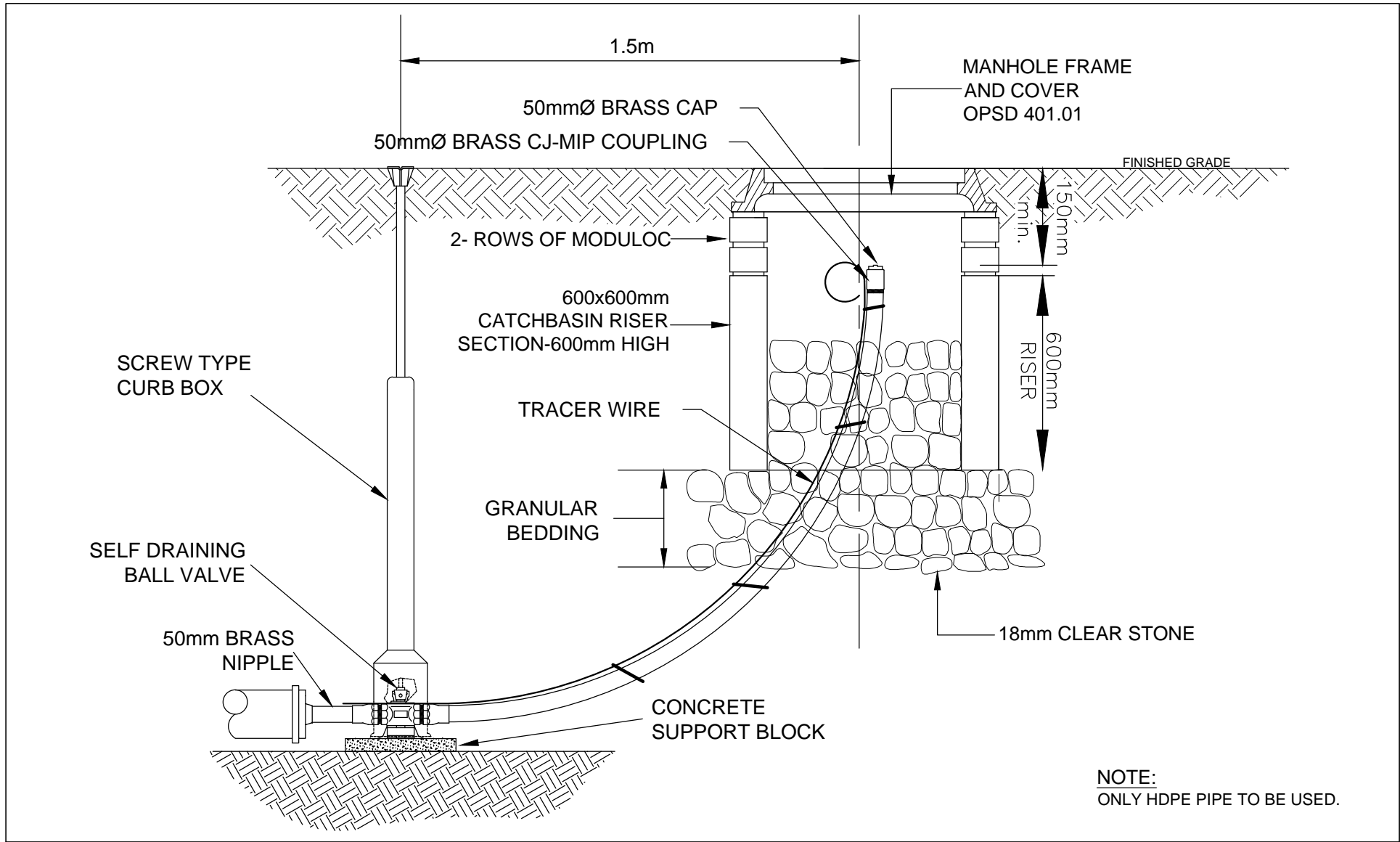
6.10 Defects in Pipework

The Contractor shall, at his own expense, carry out all remedial work necessary to rectify any defects revealed in watermain, pipelines and pipe work.



SECTION 3 – WATERMAIN

DETAILS




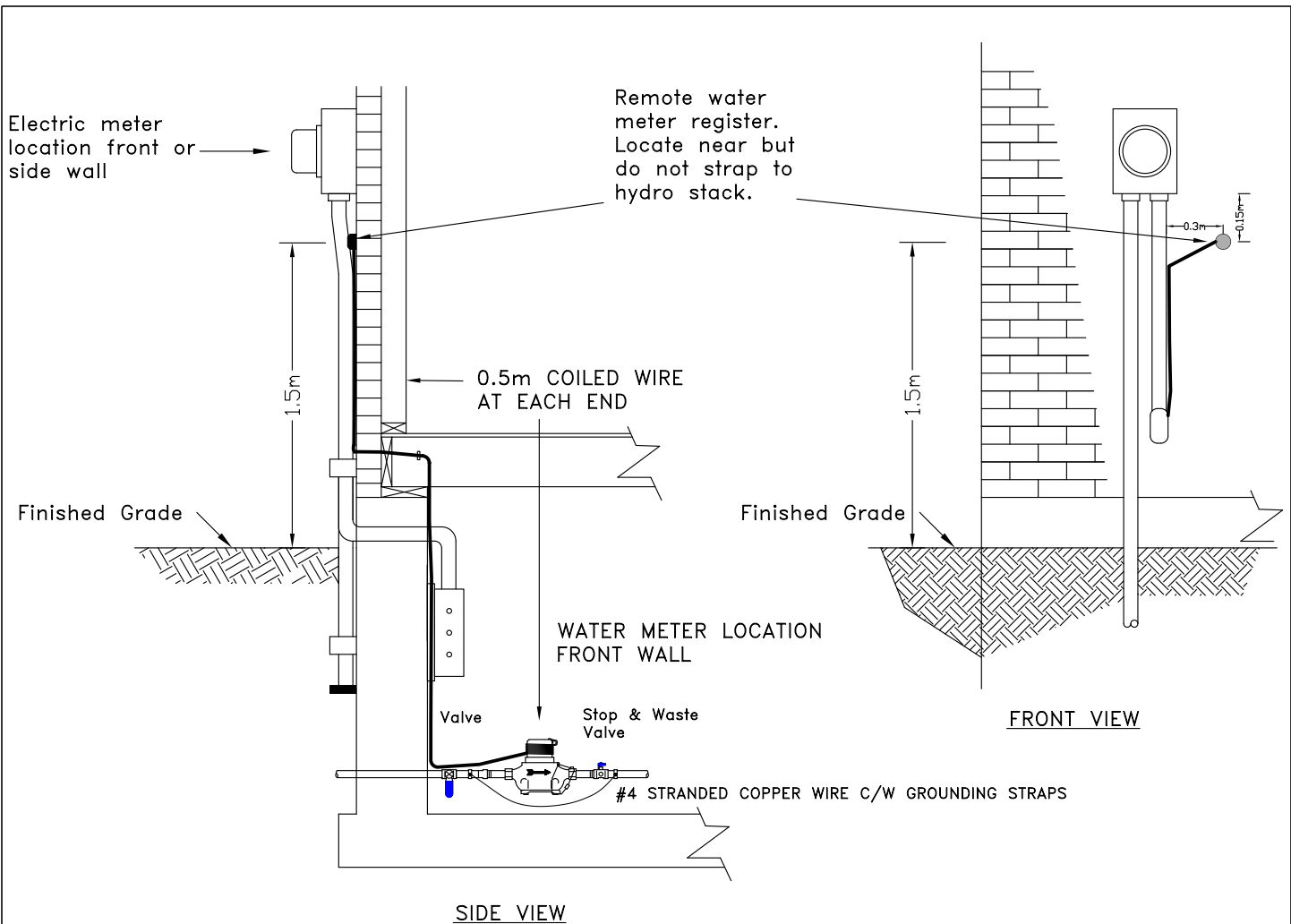
OXFORD COUNTY

50mm BLOW OFF-MANHOLE COVER

DWG D 1803-1-2013

DATE SEPT. 2013

REV  2



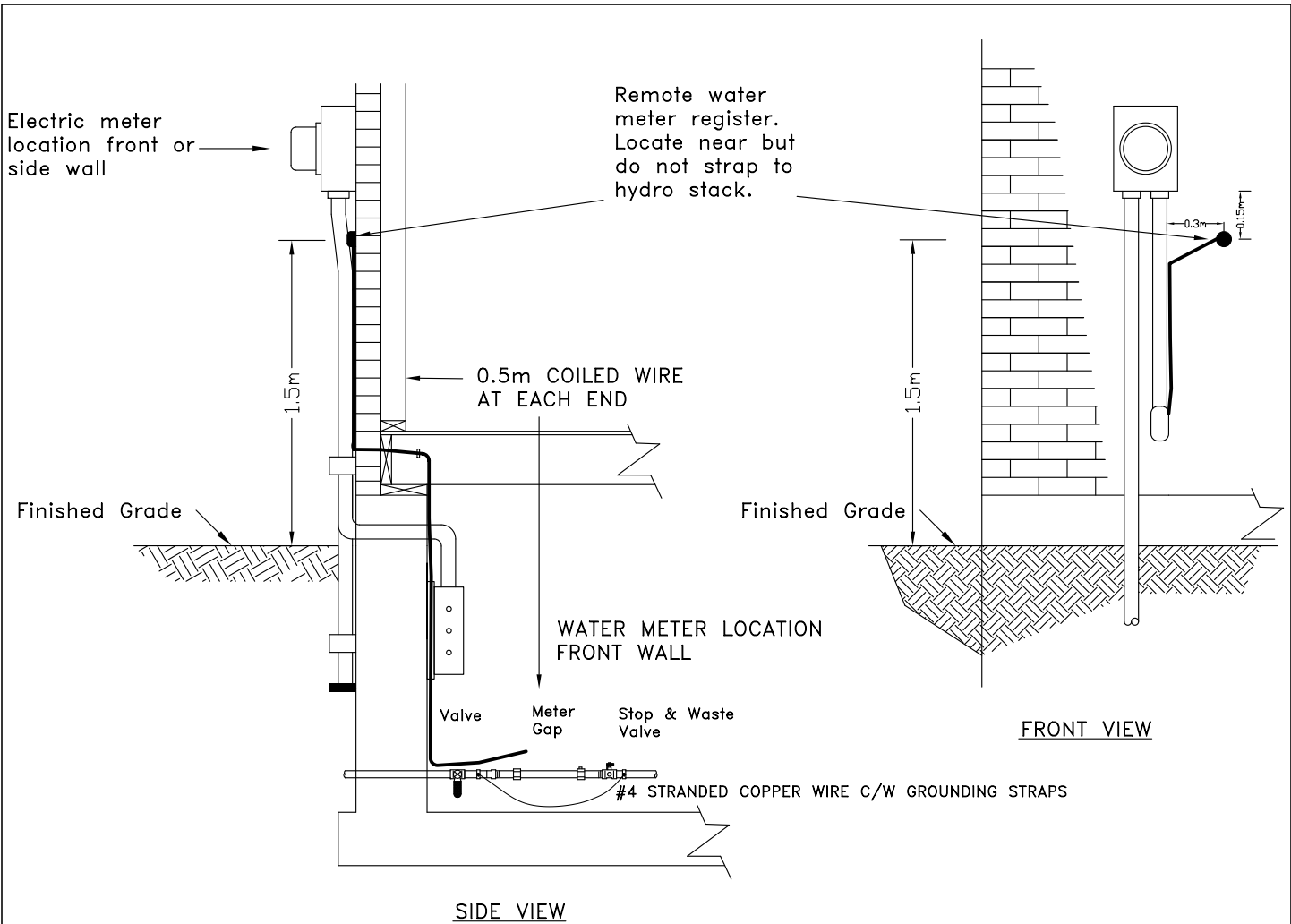
NOTES:

- 1) ONE SERVICE PER RESIDENTIAL UNIT (1.7m MINIMUM COVER FROM FINISHED GRADE).
- 2) WATER METER TO BE INSTALLED BY CONTRACTOR/OWNER (SUPPLIED BY LOCAL MUNICIPALITY AT OWNERS EXPENSE) COMPLETE WITH BALL VALVES ON BOTH SIDES OF METER (VALVE ON DOWNSTREAM SIDE SHOULD BE DRAINING TYPE). WATER METERS MUST BE INSTALLED IN **HORIZONTAL POSITION**. METER GAPS (SPACERS) TO BE INSTALLED IN COMMUNITIES WITHOUT WATER METERS. CONTRACTOR/OWNER MUST ENSURE METER/SPACER IS ACCESSIBLE IN FUTURE FOR METER CHANGES/READS ETC.
- 3) REMOTE WATER METER REGISTER TO BE LOCATED IMMEDIATELY BELOW ELECTRIC METER BUT NOT SECURED TO STACK. REGISTER SUPPLIED WITH METER BY COUNTY OF OXFORD/TOWNSHIP OFFICE. WE REQUEST THE CONTRACTOR/ELECTRICIAN INSTALL THE WIRE FROM THE ELECTRIC METER LOCATION TO THE WATER METER LOCATION. THE 22 GAUGE - 3 COND. SOLID COPPER WIRE IS TO BE OBTAINED AT THE COUNTY OF OXFORD/TOWNSHIP OFFICE. NO SPLICES, NO DIRECT BURY OF REMOTE WIRE.
- 4) WATER METER, REMOTE, REMOTE WIRE AND CONNECTION AT PROPERTY LINE TO BE INSPECTED BY THE COUNTY OF OXFORD WHEN COMPLETED. CALL 539-9800, 48 HOURS IN ADVANCE TO SCHEDULE AN APPOINTMENT.
- 5) COMMERCIAL/INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

OXFORD COUNTY

WATER METER AND REMOTE REGISTER

DWG	D 1805-1-2004	DATE	NOV. 2008	REV	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> 1 </div>
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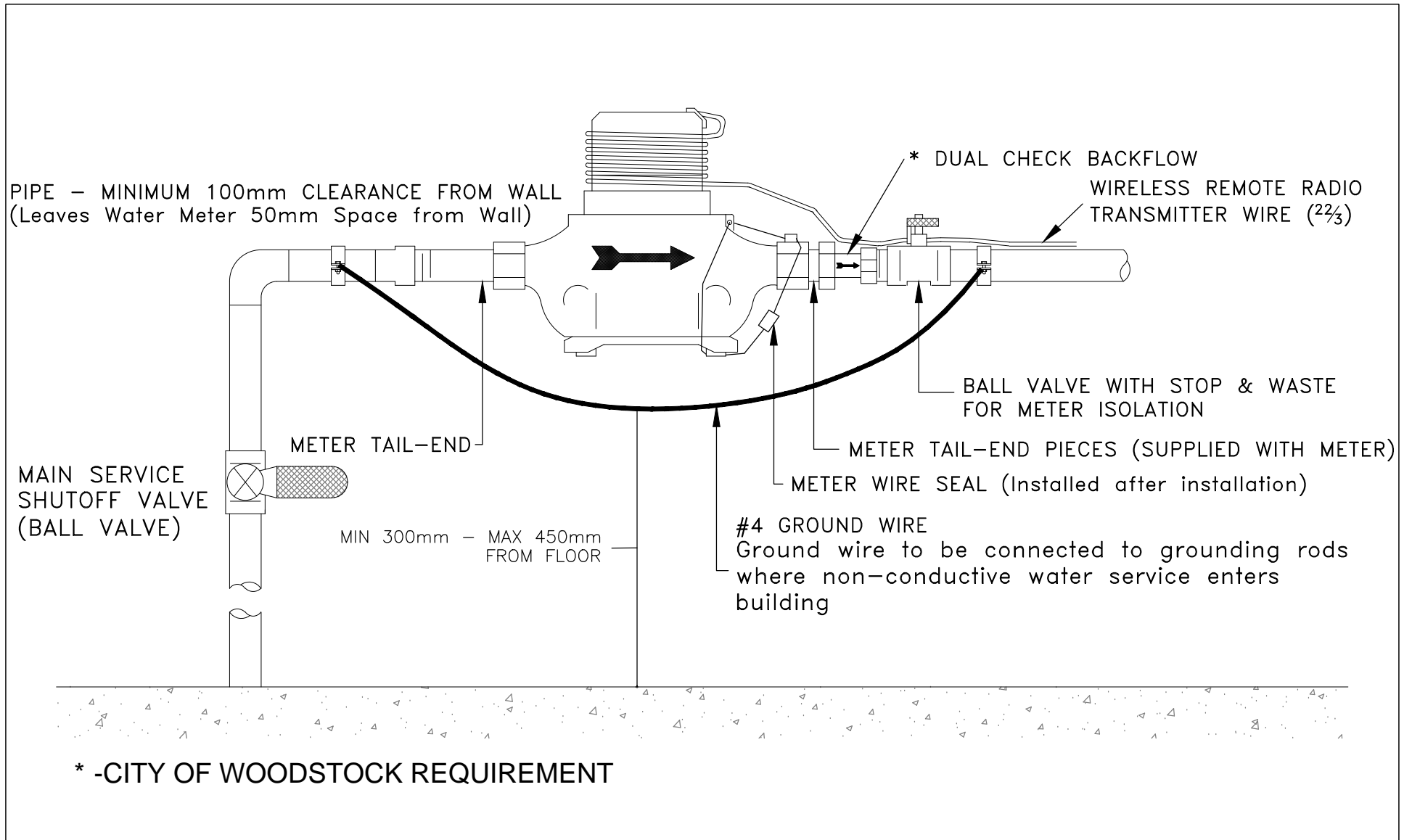
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- 4) WATER METER, REMOTE, REMOTE WIRE AND CONNECTION AT PROPERTY LINE TO BE INSPECTED BY THE COUNTY OF OXFORD WHEN COMPLETED. CALL 519-539-9800, 48 HOURS IN ADVANCE TO SCHEDULE AN APPOINTMENT.
- 5) COMMERCIAL/INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

OXFORD COUNTY

WATER METER GAP AND REMOTE WIRE INSTALLATION

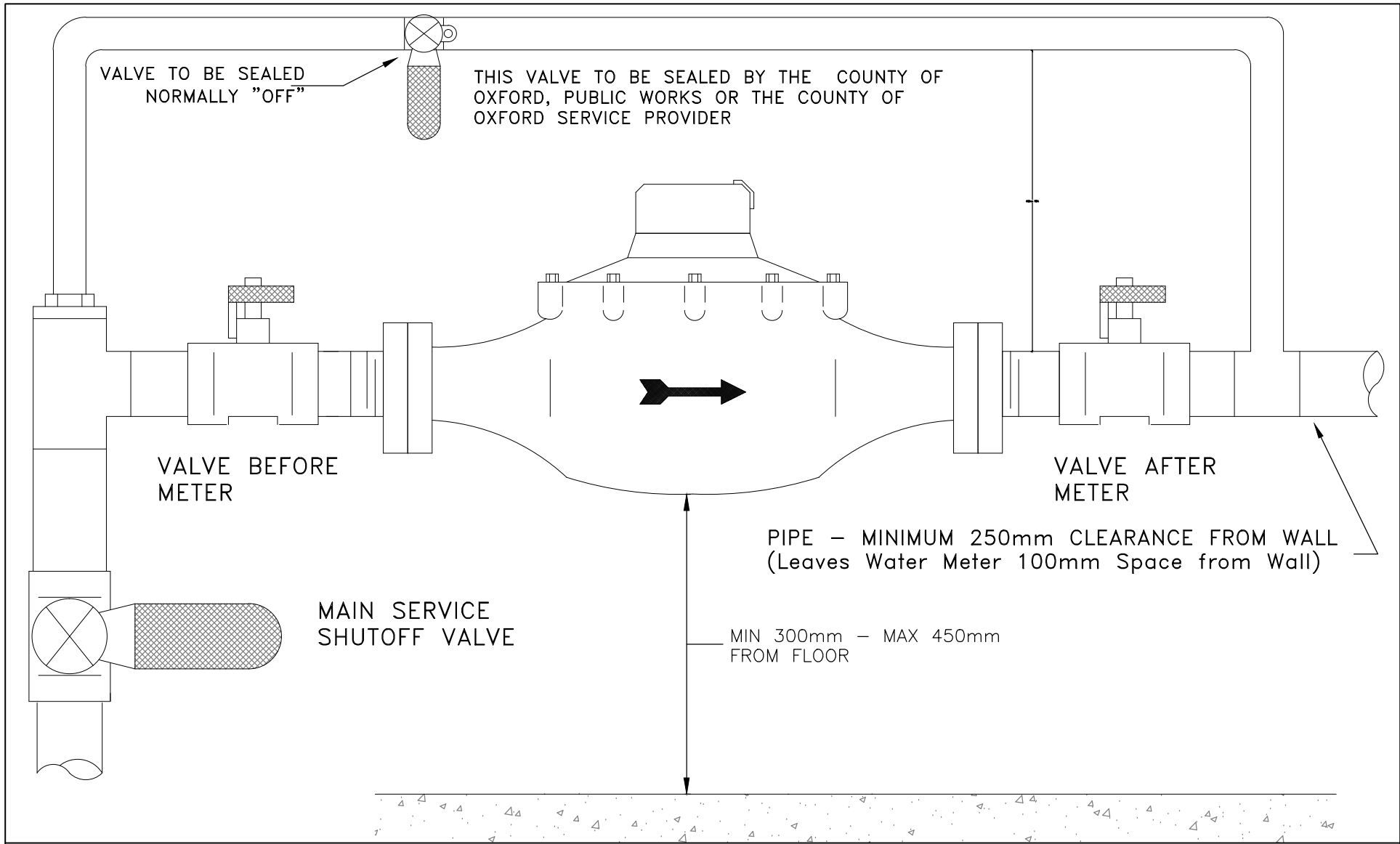
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OXFORD COUNTY

5/8" to 1" WATER METER WITH VALVES ON BOTH SIDES-RESIDENTIAL & COMMERCIAL

DWG	D 1807-1-2004	DATE	NOV 2008	REV
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OXFORD COUNTY

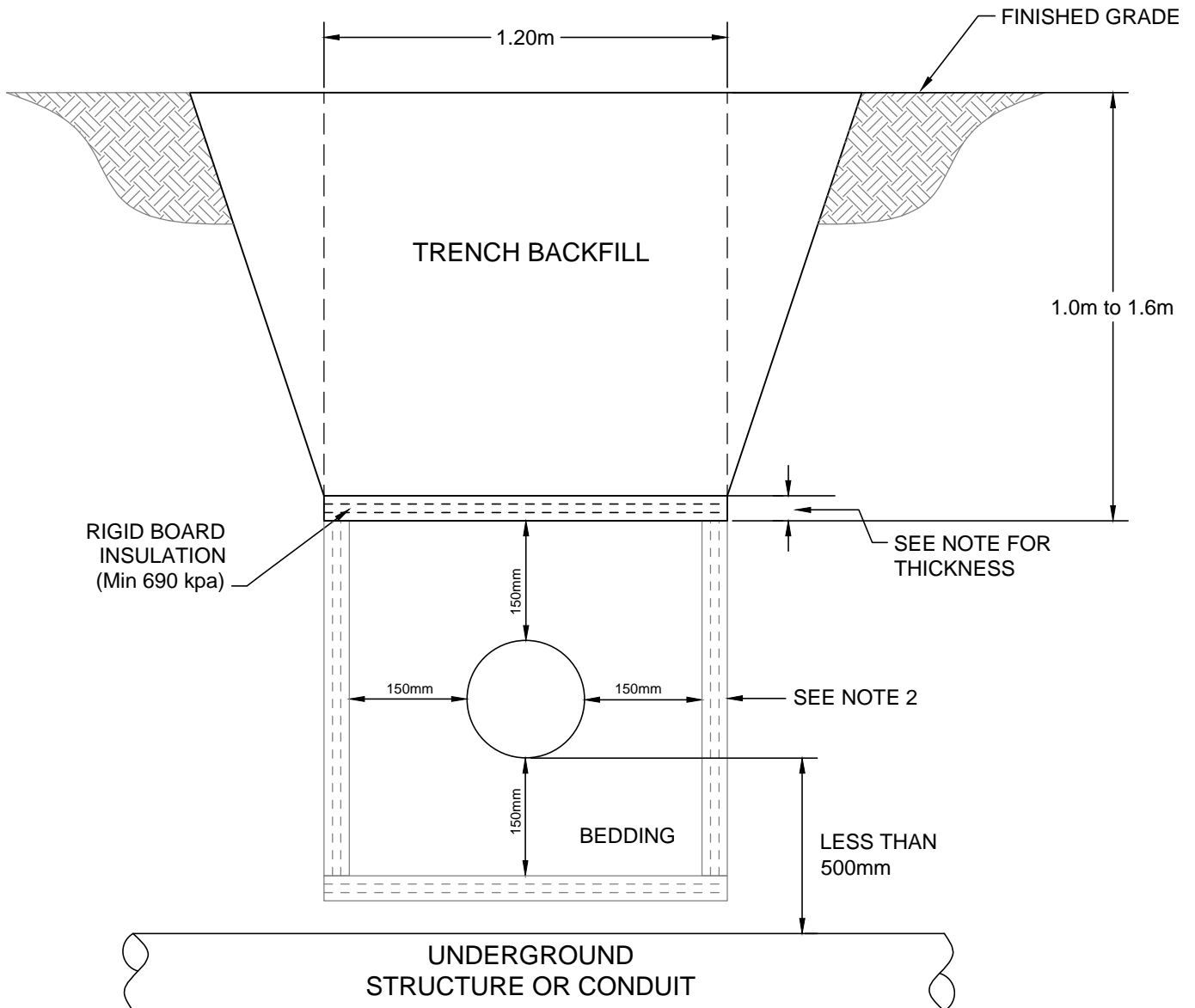
1" to 2" WATER METER WITH BY-PASS RESIDENTIAL & COMMERCIAL

DWG D 1811-1-2004

DATE NOV. 2008

REV  2

1.
 - IF GROUND COVER IS LESS THEN 1.0m LOWER WATER MAIN TO 1.8m.
 - IF GROUND COVER IS 1.0m-1.3m USE 75mm THICK INSULATION.
 - IF GROUND COVER IS 1.3m-1.6m USE 50mm THICK INSULATION.
2. FOR CROSSING OR UNDERGROUND STRUCTURES OR CONDUIT A "FROST BOX" IS REQUIRED.
3. FOR WATERMAIN AND SERVICES LOCATED 500mm OR LESS HORIZONTALLY ADJACENT TO MANHOLES OR CATCHBASIN REQUIRES A MINIMUM 50mm INSULATION IS REQUIRED.
4. INSULATION IS REQUIRED ON ALL NEW OR RECONSTRUCTED WATER SERVICES IF ADEQUATE COVER AS LISTED ABOVE CANNOT BE ACHIEVED.



OXFORD COUNTY

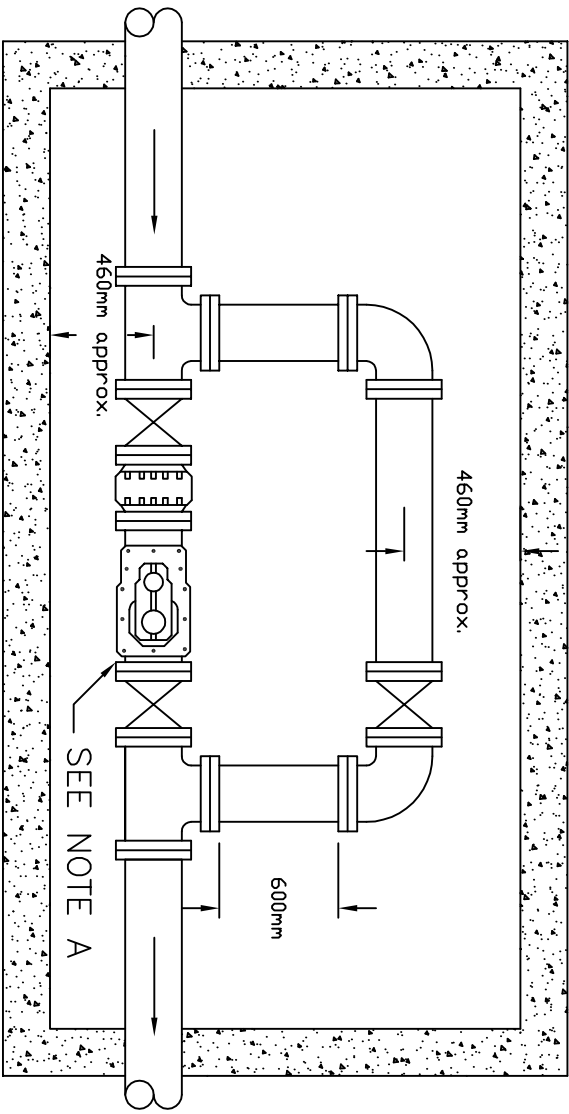
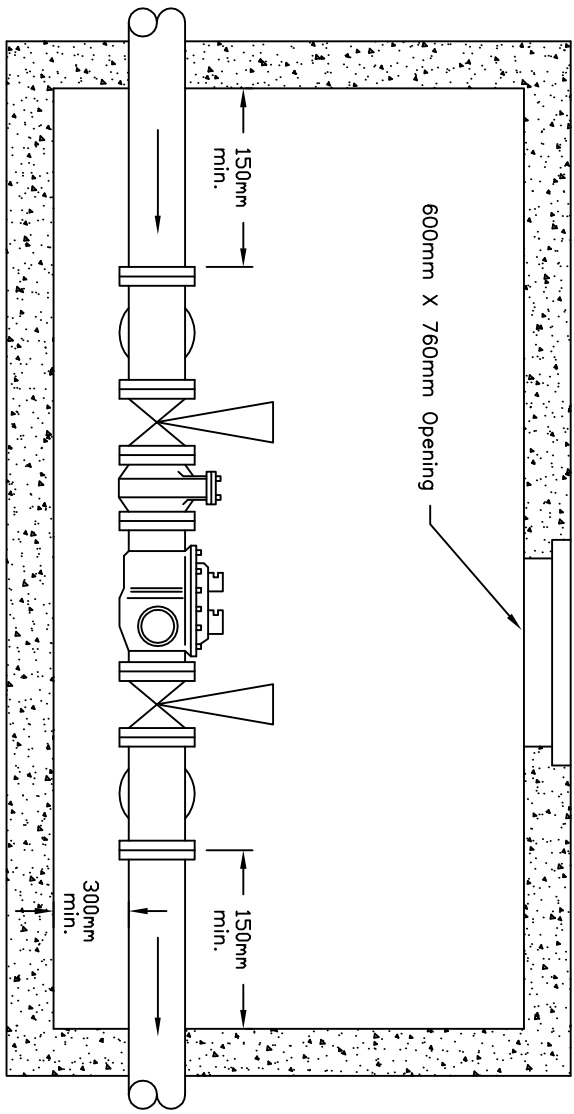
RIGID BOARD INSULATION-SLAB TYPE FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

DWG D 1812-1-2007

DATE NOV. 2007

REV





General Notes:

- Minimum size pit is: 1.83m High
3.05m Long
1.83m Wide
- Valving, bypass and manhole to be supplied by customer
- Inquiries may be directed to the water meter supervisor.
- The County of Oxford requires shut-off valves on both sides of all water meters.
- Meters should be installed in a location no more than 450mm from the floor and in an open position for ease of reading and maintenance.

Note A:

- 6" Turbine Meter required
- 6" Fire Flow Strainer
- 6" Uniflange connection on victaulic coupler spacer in line with meter/strainer required (minimum 200mm required)
- 8"to6" reducer may be made outside of chamber

OXFORD COUNTY STANDARD DRAWING

**TYPICAL WATER METER
IN CHAMBER**

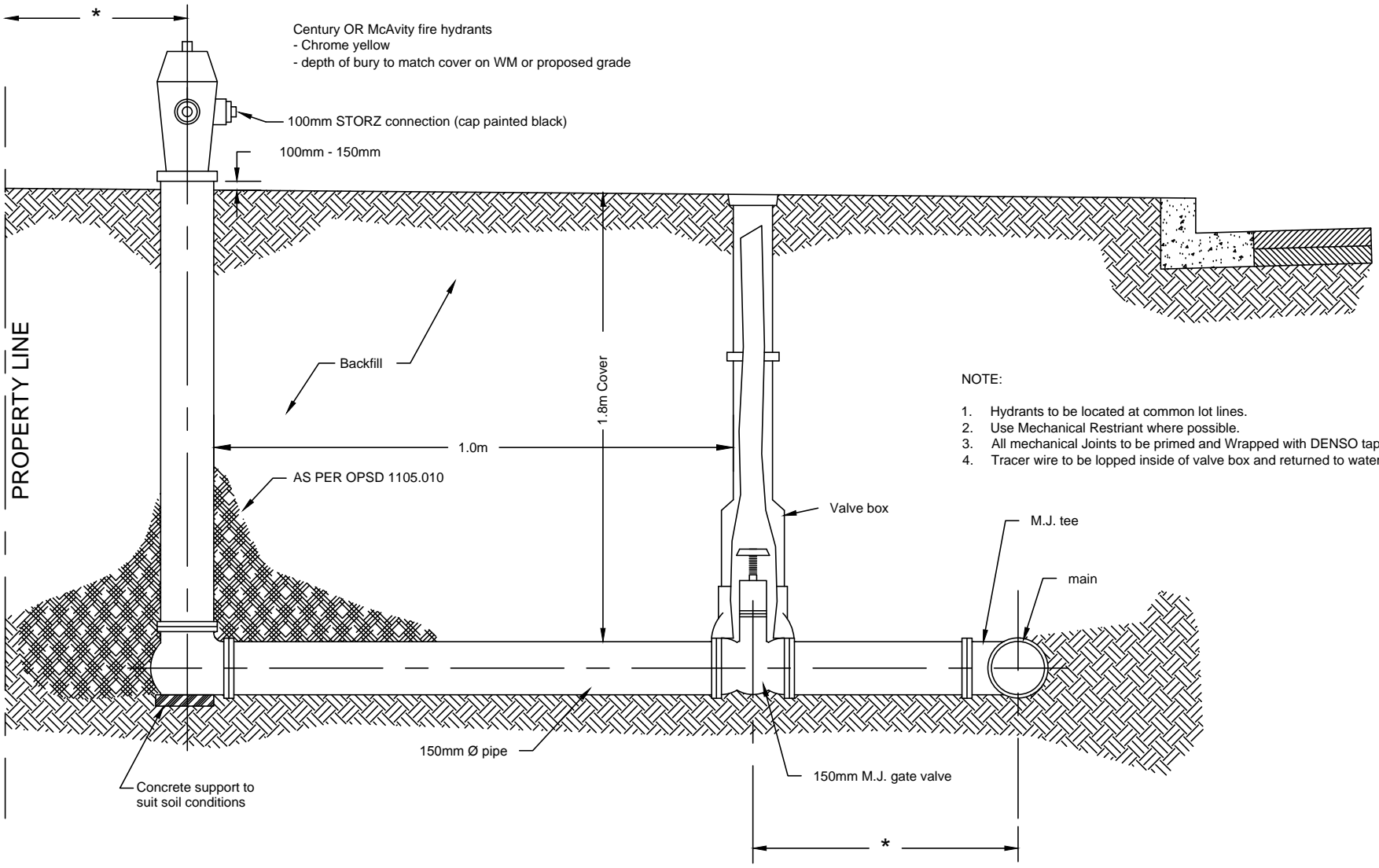
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12/2005



D1818-1-2005

* DIMENSIONS ARE AREA SPECIFIC



OXFORD COUNTY

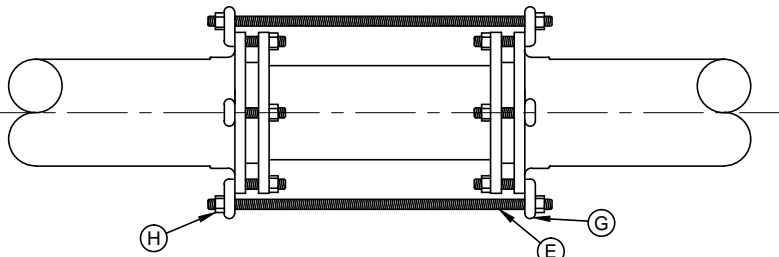
FIRE HYDRANT & VALVE INSTALLATION

DWG D 1828-1-1993

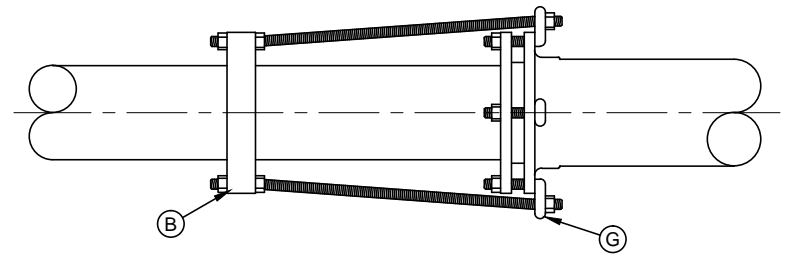
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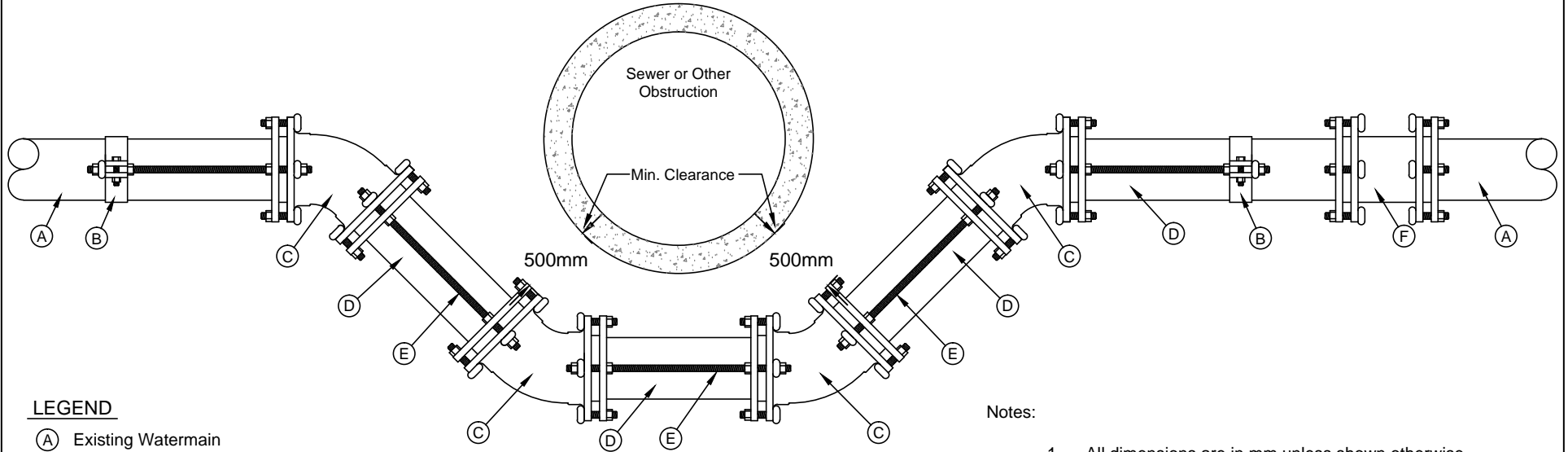
4



Tie Rod Assembly

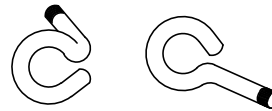


Tie Rod Assembly Using Clamp



LEGEND

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Tie Bolt Joint Restrainer
- (H) Tie Nut



Tie Bolt Joint Restrainer

Notes:

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Insulation may be required, Refer to D1812-1-2007

OXFORD COUNTY

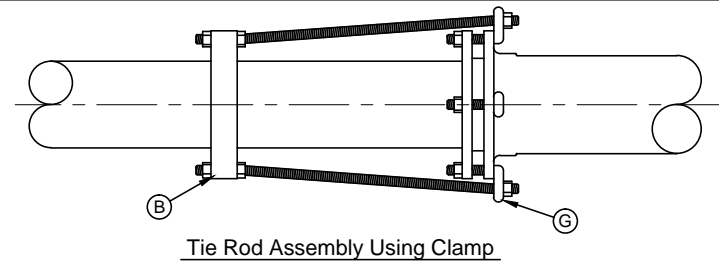
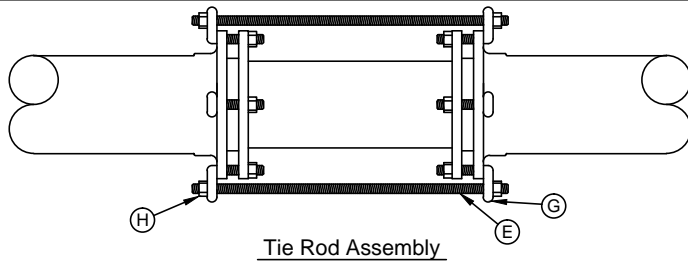
MECHANICAL JOINT OFFSET INSTALLATION-UNDER

DWG D 1832-1-1993

DATE NOV. 2008

REV



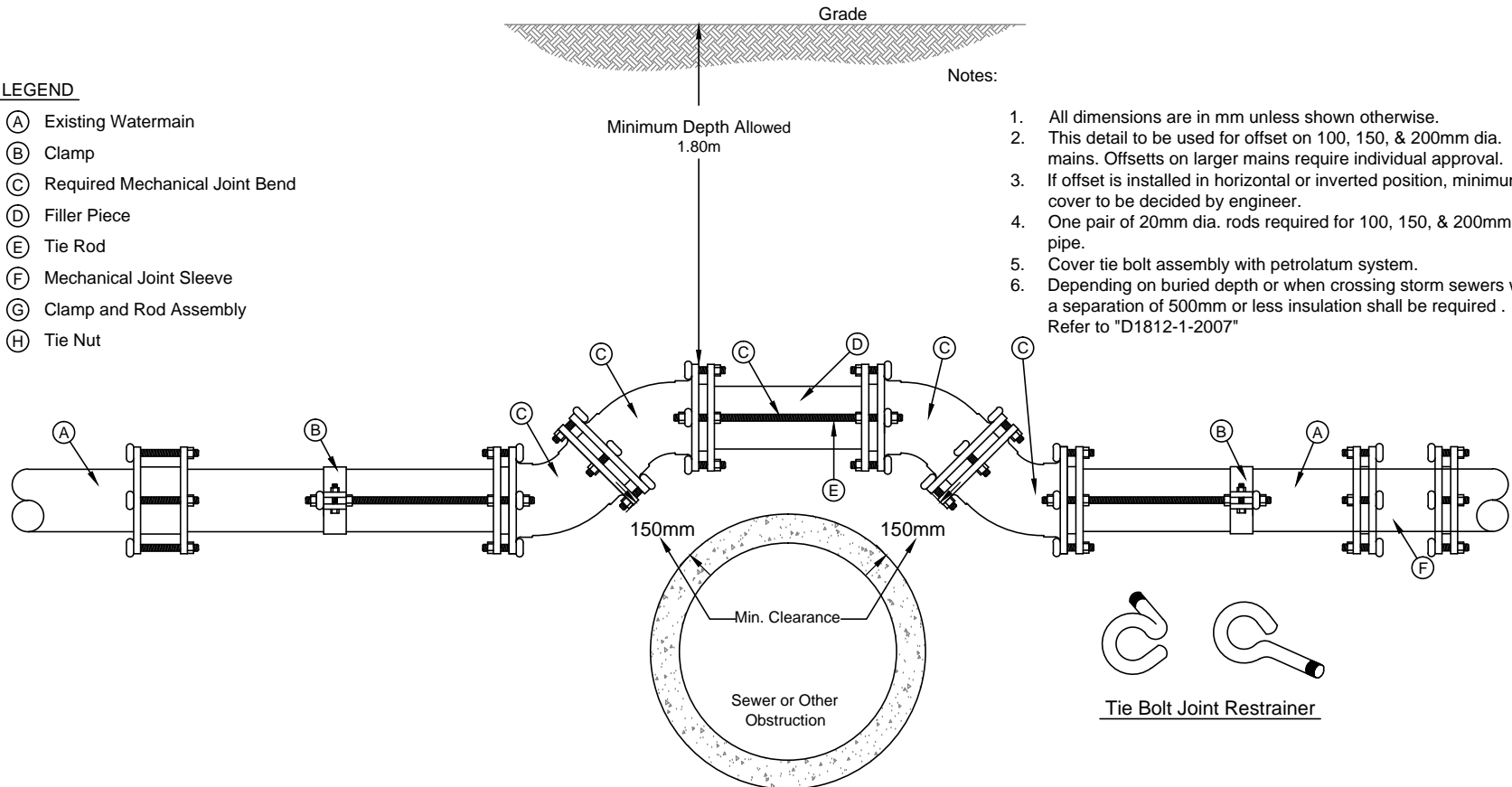


LEGEND

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Clamp and Rod Assembly
- (H) Tie Nut

Notes:

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Depending on buried depth or when crossing storm sewers with a separation of 500mm or less insulation shall be required. Refer to "D1812-1-2007"



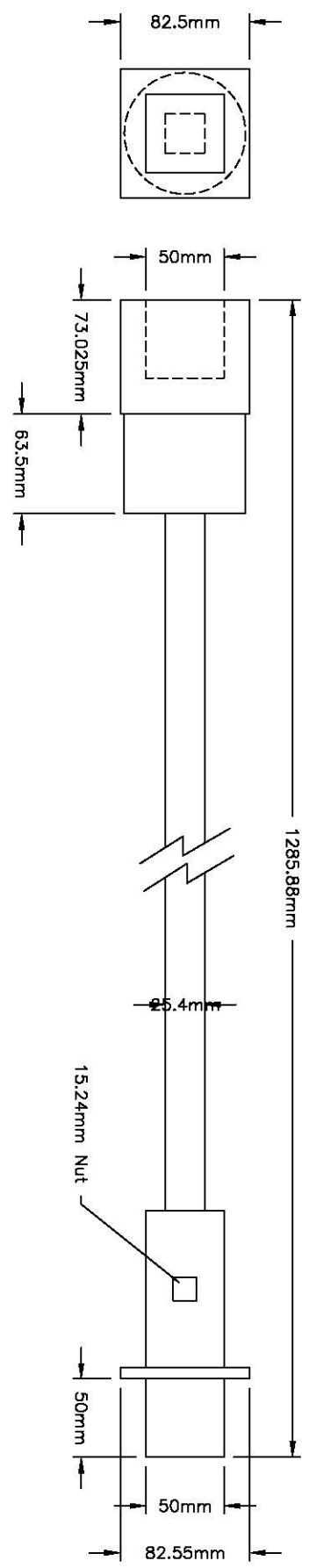
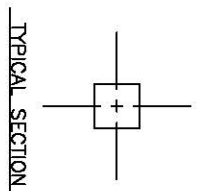
OXFORD COUNTY

MECHANICAL JOINT OFFSET INSTALLATION-OVER

DWG D 1833-1-1993

DATE NOV. 2008

REV 2

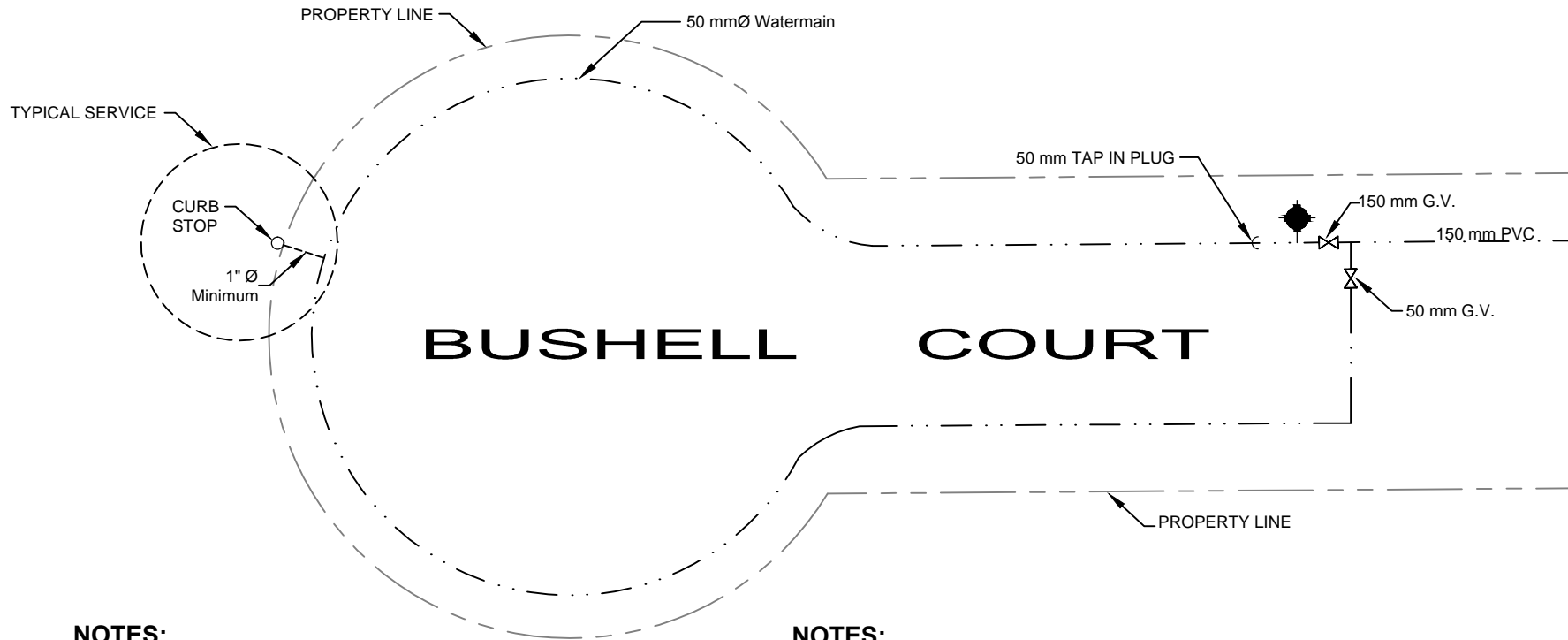


OXFORD COUNTY STANDARD DRAWING
**STANDARD VALVE ROD EXTENSION
 PIECE FOR 100mm & LARGER VALVES**

REV#:
 MM/YYYY



D1834-1-1993



NOTES:

1. Minimum service size is 25mm.
2. Maximum of 7 services off of 50mmØ.
3. All fittings shall be brass compression, copper tubing size.
4. Restrain joints where required.
5. Material shall be PEX or P.E. series 200.

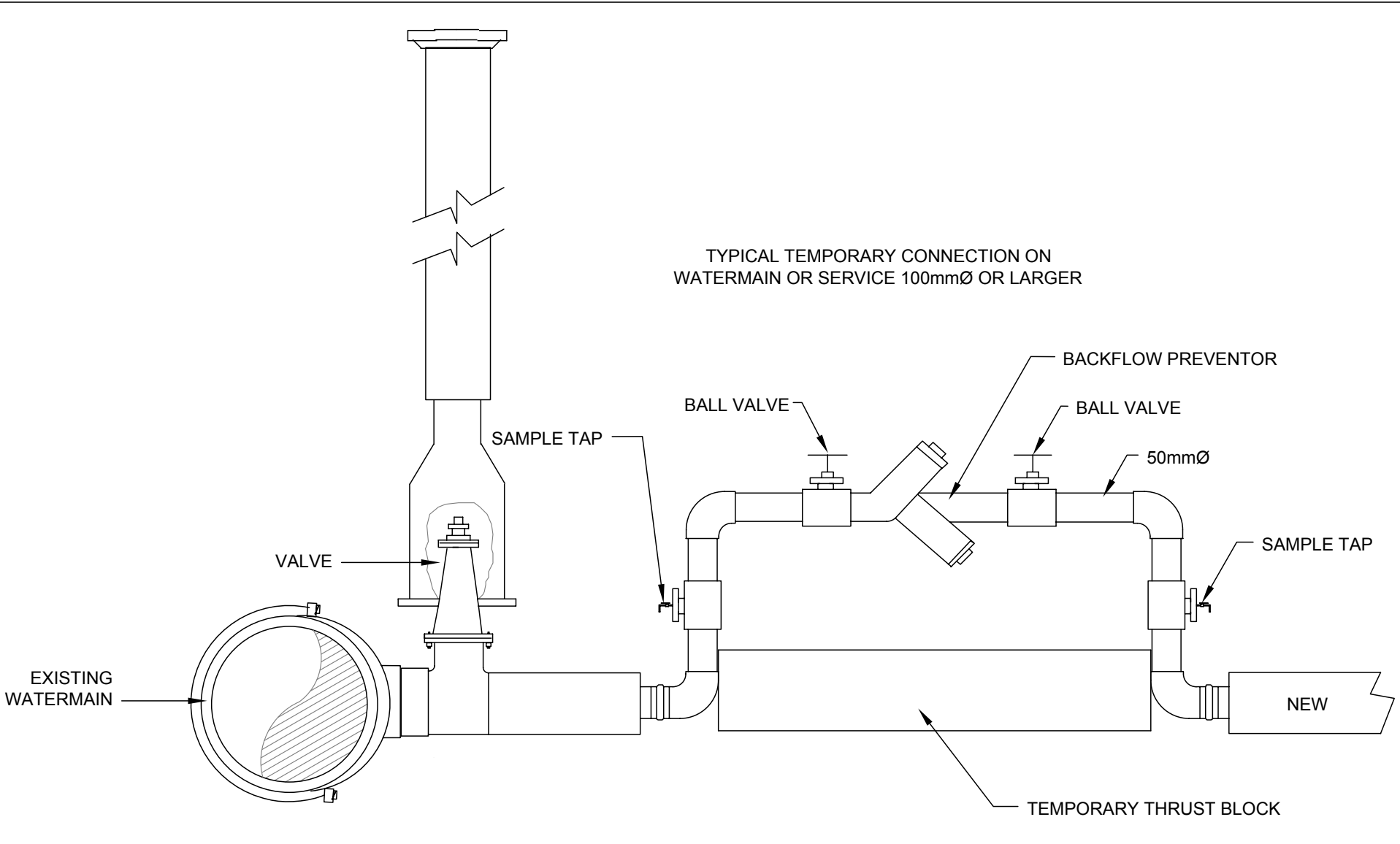
NOTES:

6. All Non-Metallic pipe shall require stainless steel inserts.
7. Tracer wire to be installed as per oxford County design guidelines and supplement specifications.

OXFORD COUNTY STANDARD DRAWING

50mm WATERMAIN DETAIL

FOR CUL-DE-SAC




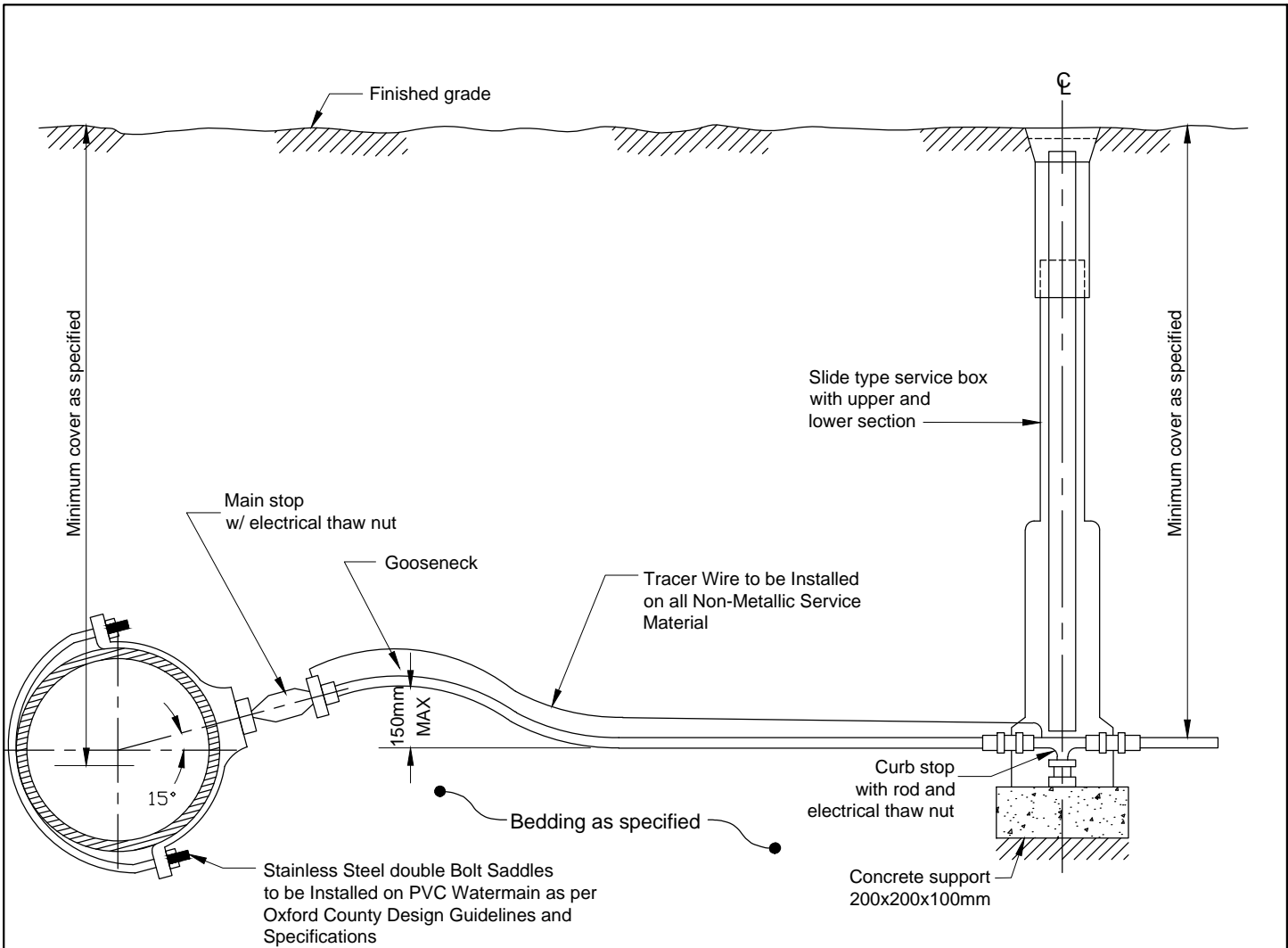
OXFORD COUNTY

BACK FLOW PREVENTOR-EXISTING TO NEW WATERMAIN

DWG D 1836-1-2006

DATE NOV. 2008

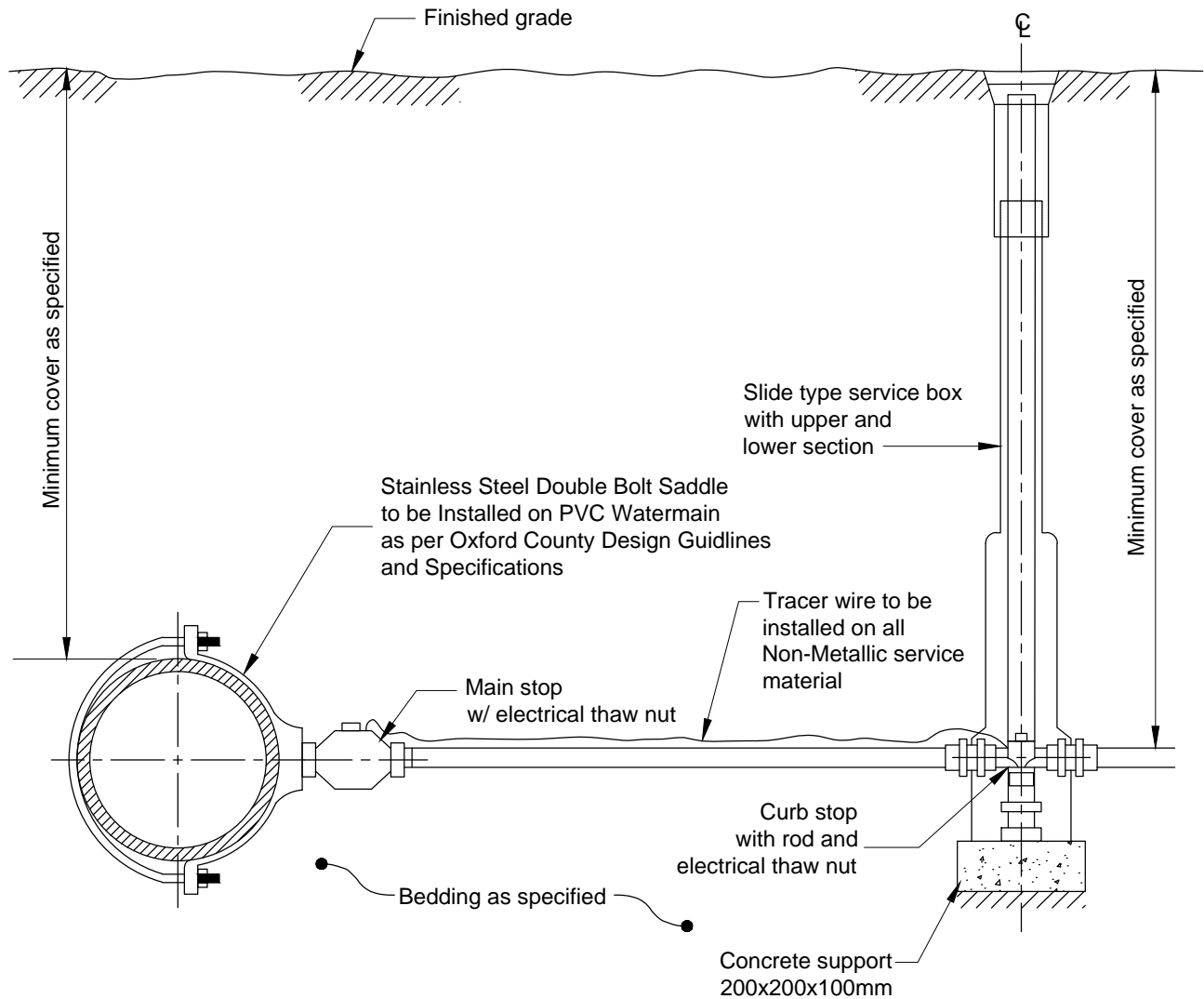
REV  1



NOTES:

1. Non-Metallic Service shall Be Minimum 25mmØ.
2. For Plastic service pipes, install main stop at 15° above horizontal with a minimum 1.2m long gooseneck.
3. Service connections to plastic watermains to be made using Stainless Steel Double Bolt service saddle.
4. Couplings shall not be permitted between the main stop and the curb stop.
5. Direct Tap Ductile Iron pipe with approved tool with standard AWWA inlet thread.
6. All water services to be Installed 90° to the longitudinal axis of the watermain.
7. All dimensions are in millimeters unless otherwise shown.
8. Non-Metallic services require tracer wire to be installed as shown above.
9. Service Material as per Oxford County Design Guidelines and specifications.

OXFORD COUNTY STANDARD DRAWING WATER SERVICE CONNECTION 25mm DIAMETER	REV#:	
	Dec 2013	



NOTES:

1. Service Material as per Oxford County Design Guidelines and Specifications.
2. Any Junction made in service pipe between main stop and curb stop to be made with approved couplings.
3. All water services to be installed 90° to the longitudinal axis of the watermain.
4. All dimensions in millimeters unless otherwise shown.
5. Non-Metallic services require tracer wire to be installed as shown above.

OXFORD COUNTY STANDARD DRAWING

WATER SERVICE CONNECTION

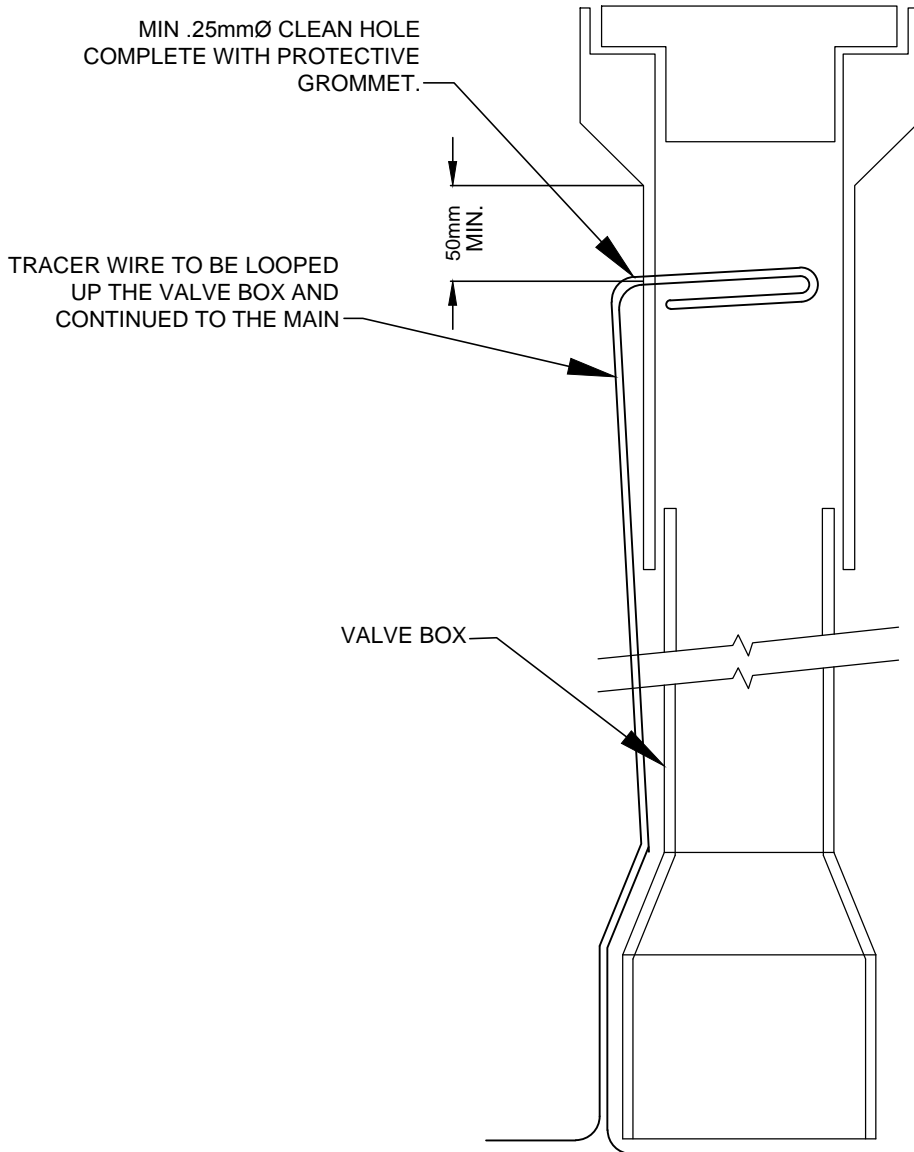
32mm, 38mm & 50mm DIAMETER SIZES

REV#:

Dec 2013



D1839-1-2007



NOTES:

1. TRACER WIRE- #12 AWG SOLID CCS TRACING WIRE AS PER OXFORD COUNTY DESIGN GUIDELINES AND SUPPLEMENT SPECIFICATIONS.
2. TRACER WIRE SHOULD BE LOOPED UP THE OUTSIDE OF ALL VALVE BOXES AND EXTENDED INTO THE VALVE BOX BY AT LEAST 500mm THROUGH HOLE 50mm BELOW THE BOTTOM OF THE COVER BELL.

OXFORD COUNTY

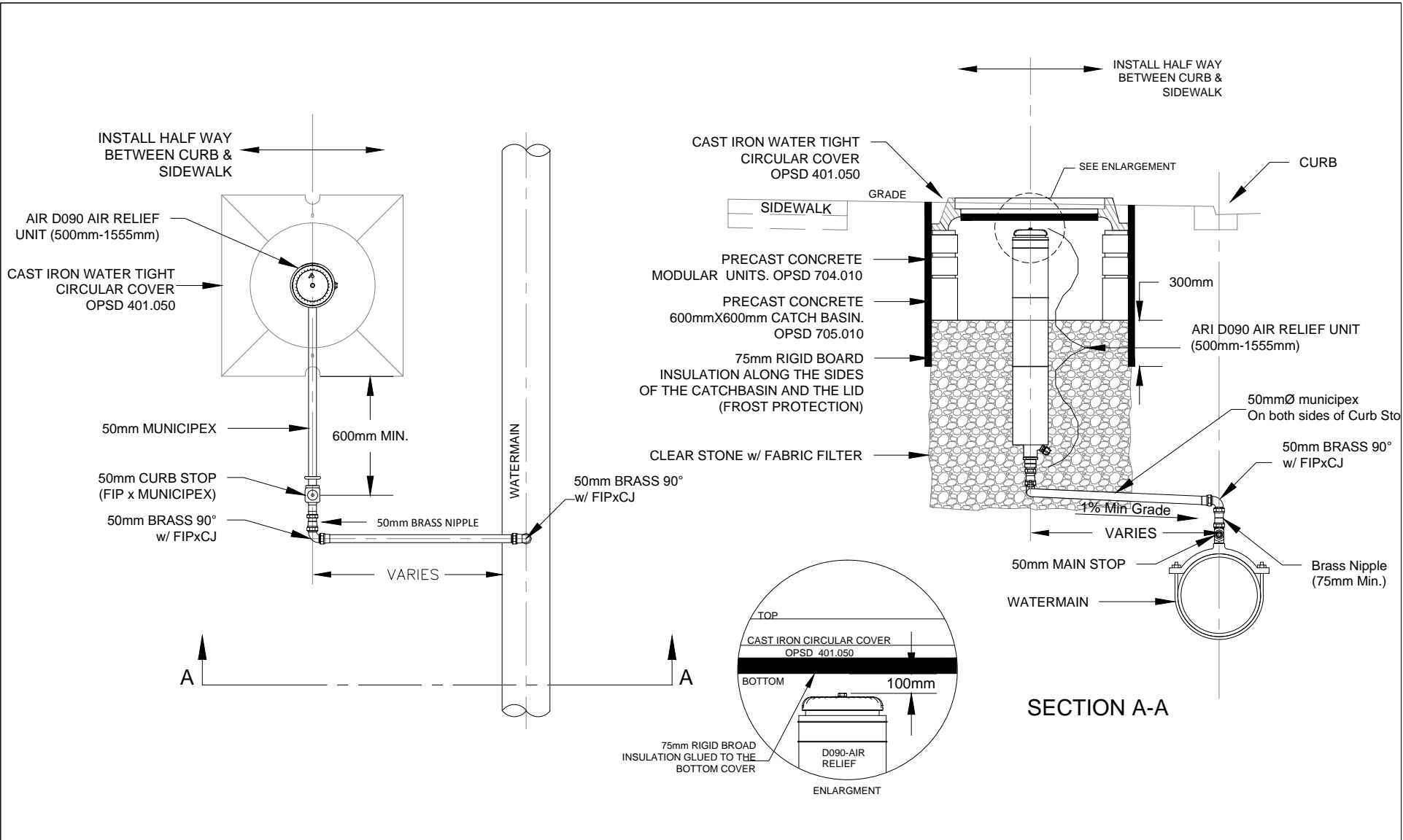
TRACER WIRE VALVE BOX INSTALLATION

DWG D 1846-1-2009

DATE MARCH 2009

REV





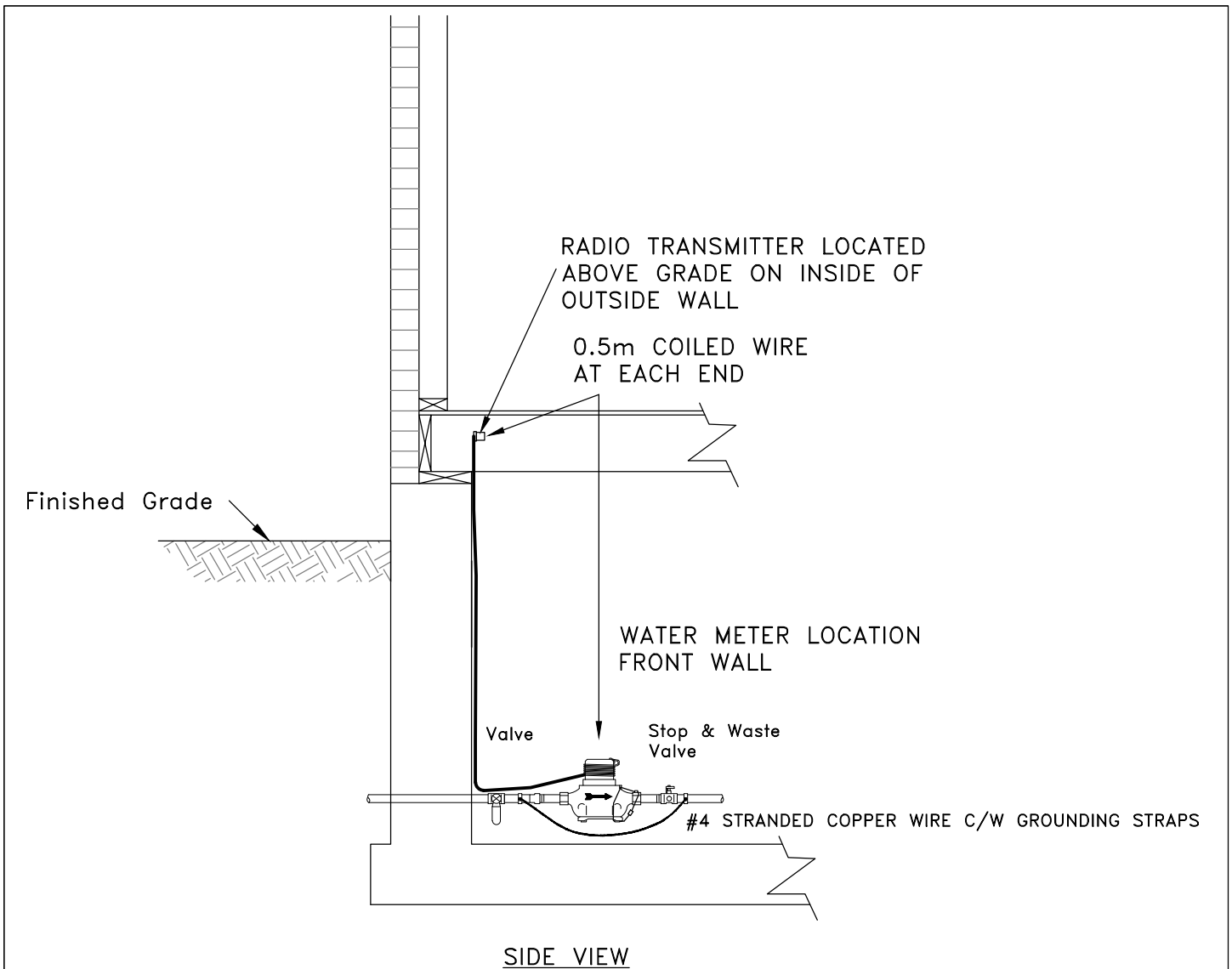
OXFORD COUNTY

ARI D090 AIR RELIEF w/ OPSD 704.010 CATCHBASIN

DWG D 1852-1-2011

DATE OCTOBER 2011

REV  1



NOTES:

1. ONE SERVICE PER RESIDENTIAL UNIT (1.8m MINIMUM COVER FROM FINISHED GRADE).
2. WATER METERS MUST BE INSTALLED IN **HORIZONTAL POSITION**. CONTRACTOR / OWNER MUST ENSURE METER IS ACCESSIBLE FOR FUTURE MAINTENANCE.
3. RADIO TRANSMITTER MUST BE LOCATED ABOVE GRADE AND SECURELY FASTENED INSIDE ON AN OUTSIDE WALL. 22 GAUGE - 3 COND. SOLID COPPER WIRE MUST BE USED TO CONNECT THE WATER METER TO THE ROAD.
4. RADIO TRANSMITTER MUST BE INSTALLED AS PER MANUFACTURER SPECIFICATIONS.
5. COMMERCIAL / INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

OXFORD COUNTY

WATER METER AND REMOTE RADIO TRANSMITTER

DWG

D 1856-1-2016

DATE

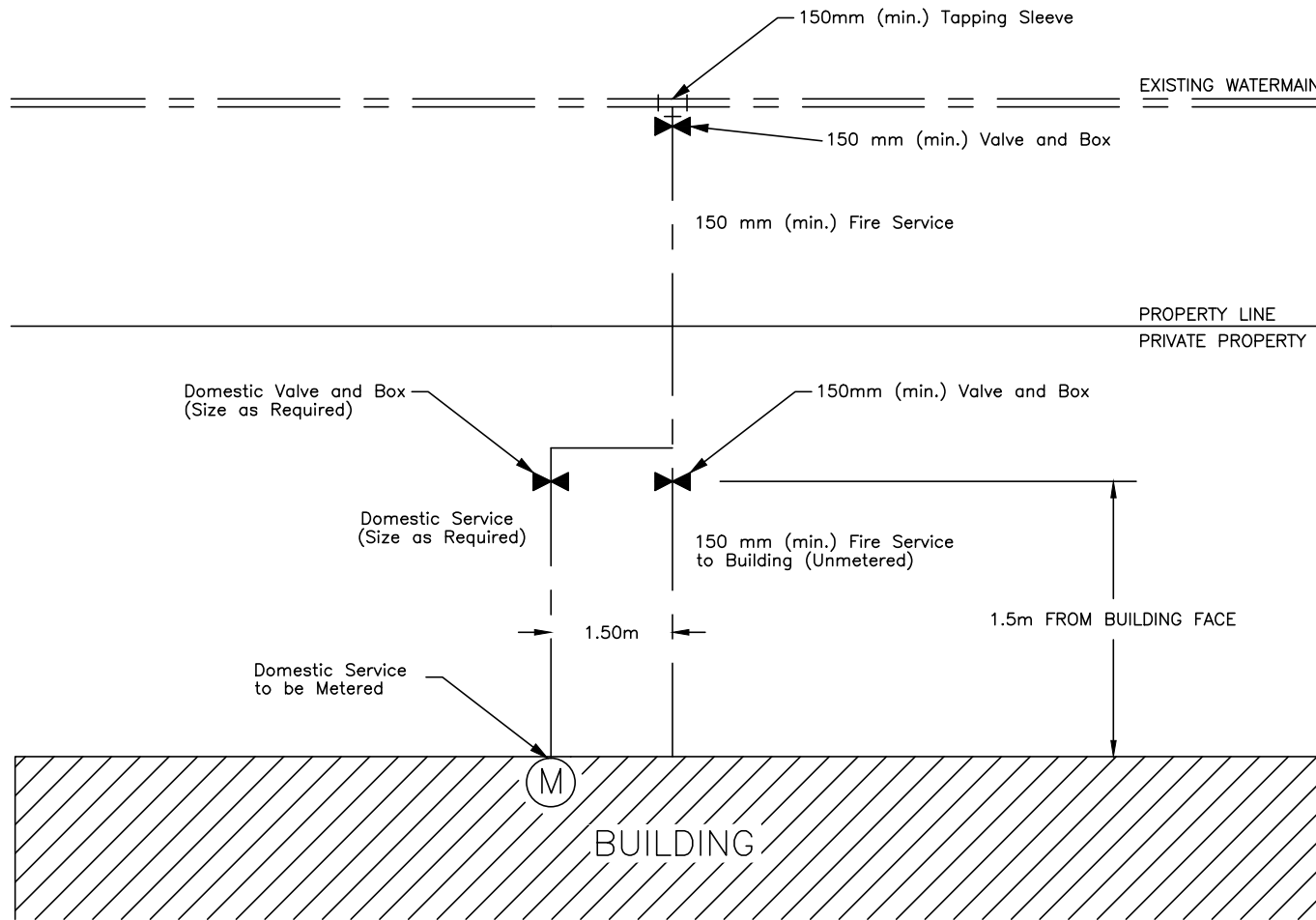
APRIL, 2016

REV



NOTES:

- 1. TRACER WIRE TO BE INSTALLED AS PER OXFORD COUNTY DESIGN GUIDELINES AND SUPPLEMENT SPECIFICATIONS
- 2. WHERE WATERMAINS CAN BE SHUT DOWN AND A TEE INSTALLED DOMESTIC AND FIRE SERVICE VALVES TO BE PLACES ON PROPERTY LINE.
- 3. VALVE LOCATION AT WATERMAIN OR PROPERTY LINE WILL BE REVIEWED ON A CASE BY CASE BASIS WHERE NECESSARY.



OXFORD COUNTY

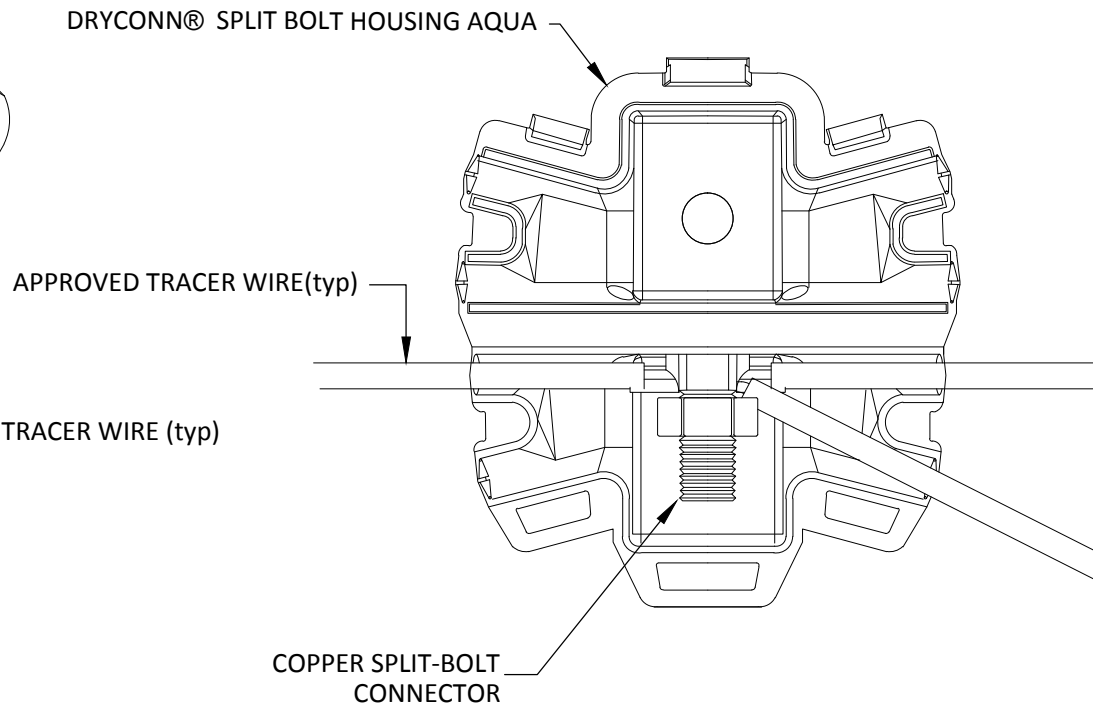
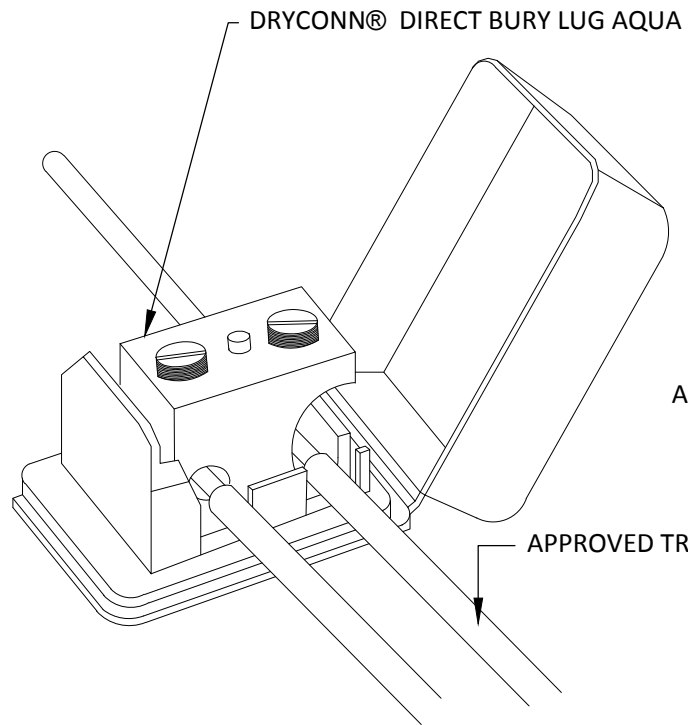
DOMESTIC AND FIRE SERVICE DETAIL

DWG D 1857-1-2016

DATE APRIL 2016

REV

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NOTES: ALL CONNECTORS TO BE WRAPPED WITH DENSO TAPE OR APPROVED EQUAL AND COMPRESSED TIGHTLY BY HAND AROUND CONNECTOR.

OXFORD COUNTY

TRACER WIRE CONNECTOR DETAILS

DWG D 1858-1-2016

DATE APRIL 2016

REV

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Growing stronger together

SECTION 4 - SANITARY

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FIGURES

Figure 4.1 - Sanitary Sewer Design Sheet

Figure 4.2 – Hydraulic Elements of Circular Pipe

Figure 4.3 – Maximum Pipe Sizes for Precast Maintenance Holes

DETAILS

D 1812-1-2007: Rigid Board Insulation – Slab Type

D 1847-1-2011: Low Pressure Sanitary Sewer Cleanout

D 1849-1-2011: Low Pressure Sanitary Service

D 1850-1-2011: Grinder Pump and Sewer Lateral Connection Detail

D 1850-2-2011: Grinder Pump and Sewer Lateral Connection with Cleanout

D 1854-1-2011: Gravity Sanitary Sewer Cleanout

PART 1 - LOCATION AND DESIGN

The current Ontario Provincial Standards and Ministry of the Environment and Climate Change Guidelines for the Design of Sewage Works 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.

1.1 Non-Permitted Flows

Connection from foundations, weeping tile drainage or roof drainage is not permitted to enter the sanitary sewer system, as per the County of Oxford Sewer Use By-law 2719-87, or any hazardous waste as defined under the EPA Regulation 347.

1.2 Location and Alignment

In some areas of new construction and reconstruction, design constraints may limit the ability for gravity flow basement drainage. In these instances a low pressure sewer with a grinder pump may be necessary. The County of Oxford does not guarantee basement drainage.

Sanitary sewers are to be located in front of, or are accessible to each lot and block facing a City street. Sanitary sewers are also to be located as per Section-1 General, Figure 1.2. Any deviation from these standards must be submitted in writing to the County Engineer or local Municipality for approval.

When a maintenance hole is designed to be located 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 in the asphalt area of the street, for maintenance purposes.

In areas where sanitary sewer or services will be located in existing road surfaces or through driveways and entrances, the existing pavement, curbs, sidewalks and driveways 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. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressed 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.

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

1.3 Drainage/Sub-drainage Area Plans

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

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

1.4 External Sewershed Limits and Drainage Areas

When designs abut undeveloped or unserved areas, the external sewershed limit shall be identified and designed for.

Note: All areas and coefficients are to be shown for all drainage areas within external sewershed limits.

1.5 Design Chart

Sanitary sewer design calculations for approved drainage area plans are to be completed on the standard design chart, as per Figure 4.1 for details and additional design information.

1.6 Peaking Factor Calculation

Peaking factor calculations are to be determined based on the Harmon formula:

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

Where M= ratio of peak flow to average flow

P= tributary population in thousands

1.7 Design Criteria

For Sanitary Sewer Design Guidelines refer to Chapter 5, Section 5.5 of the Ministry of the Environment Design Guidelines for Sewage Works.

1.8 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete and polyvinyl chloride (PVC) pipe for pipe sizes 200 mm to 1650 mm. A coefficient of 0.011 is to be used for all pipe sizes 1800 mm or greater.

1.9 Pipe Size

Pipe size is determined using the formula where the pipe design flow is equal to or greater than the calculated peak design flow:

$$Q = (1/n) \times A \times R^{2/3} \times S^{1/2}$$

Where:

- Q = Design flow (m³/sec)
- n = Manning's roughness coefficient
- A = cross sectional area of flow (m²)
- R = hydraulic radius (area/wetted perimeter)
- S = slope of pipe (m/m) - %

The minimum allowable size of a sanitary sewer shall be 200 mm.

On private property, the minimum size for sanitary services shall be 100 mm, in accordance with Part 7 of the OBC.

1.10 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 (L/s)
 A = cross sectional area of flow (m²)

1.10.1 Minimum and Maximum Velocities

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, as per Figure 4.2 “Hydraulic Elements of Circular Pipe”.

1.10.2 Minimum Grade of Sanitary Sewer

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

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

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

- b) The minimum grade on all other sewer sizes shall be established by determining the minimum grade required to achieve a velocity of at least 0.6 m/s.

1.10.3 Minimum Size and Grade of Sanitary Services

All residential, commercial, industrial, and institutional private drain connections shall be sized according to the design criteria or as required by Part 7 of the OBC. Services shall be placed 1.0 m past property line.

Cleanouts will be placed on private property as per the OBC. Where service lengths on municipal property are 45 m in length or greater a cleanout must be installed.

Details must be shown on all design sheets and drawings for approval by the County Engineer. The following are the minimum standards:

- a) For residential, single family and semi-detached homes, the diameter of pipe shall be 100 mm with a minimum allowable grade of 1.0%.
- b) For multi-family block, the minimum diameter of pipe is 150 mm with a minimum grade of 1.0%
- c) For commercial, the minimum diameter of pipe is 150 mm with a minimum allowable grade of 2.0%.
- d) For institutional and industrial, the minimum diameter of pipe is 200 mm with a minimum allowable grade of 2.0%.

1.11 Pipe Depth

1.11.1 Minimums

The minimum depth of a sanitary sewer on new development shall be determined based on a service depth of 2.4 m below finished grade at property line to the obvert of the pipe.

1.11.2 Maximum Depth of Cover

- a) Concrete Pipe

The maximum allowable cover permitted on concrete pipe shall be as per OPSD 807.01, 807.03, 807.04 and 807.05.

- b) Flexible Pipe

The maximum allowable cover permitted on flexible pipe shall be as per OPSD 806.021, 806.040 and 806.06.

- c) Where sanitary sewers are installed at depths of 3.5 m or greater, sanitary service laterals shall require a controlled settlement joint fitting. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The controlled settlement joint permits axial movement of the riser when laterals are placed in deep excavations.

1.11.3 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 the County Engineer prior to installation.

Steel casings shall use the following inside diameters and wall thicknesses as listed below;

Nominal Pipe Size	Minimum Casing Size (I.D.)	Minimum Casing Wall Thickness
100 mm (4")	315 mm (12.4")	6.35 mm (0.25")
150 mm (6")	356 mm (14")	7.94 mm (0.3125")
200 mm (8")	454 mm (17.875")	7.94 mm (0.3125")
250 mm (10")	546 mm (21.5")	7.94 mm (0.3125")
300 mm (12")	584 mm (23")	9.53 mm (0.375")
350 mm (14")	686 mm (27")	9.53 mm (0.375")
400 mm (16")	762 mm (30")	12.70 mm (0.500")
450 mm (18")	787 mm (31")	12.70 mm (0.500")
500 mm (20")	838 mm (33")	12.70 mm (0.500")
600 mm (24")	991 mm (39")	12.70 mm (0.500")

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 the County Engineer.

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

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.

1.11.4 Vertical Separation

In all cases this is measured from outside wall diameter to outside wall diameter. When crossing over or under a storm sewer, a 0.30 m clearance shall be maintained between the two pipes. Where it is necessary to cross over a watermain, a minimum clearance of 0.50 m shall be maintained between the two pipes. When crossing under a watermain, a minimum of 0.15 m clearance shall be maintained between the two pipes. This practice must also be followed when sanitary laterals are in conflict with any watermain. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

Water services require a minimum of 0.50 m separation vertically from sewers and laterals.

1.11.5 Horizontal Separation

The minimum distance allowed by the County for sewers and watermain separation is 3.0 m, and should be constructed in separate trenches as per OPSS specifications.

If it is not possible to maintain this separation, approval by the Ministry of Environment is required.

1.12 Maintenance Holes

Maintenance holes shall be constructed as per OPSS 407. Where required, frost straps shall be installed as per OPSD 701.100. A maximum spacing between sanitary maintenance holes shall be no more than 120 m measured horizontally from center of chamber to center of chamber.

Sanitary maintenance holes must be placed in the asphalt area of the street for maintenance purposes. Should there be a need for a maintenance hole through an easement, it shall be located on a hard surface where available.

When placing a maintenance hole in the vicinity of a roundabout, maintenance holes are not permitted to be located within the grassed area of the roundabout. Maintenance holes must be located in the asphalt area of the street for maintenance purposes.

1.12.1 Sampling / Inspection Maintenance Holes

Sampling / Inspection maintenance holes are typically required where Industrial, Commercial, and Institutional developments outlet to sanitary sewers owned and maintained by the County and the County of Oxford's service providers.

Flow in excess of 200 m³/day will require an inspection manhole for process flow. The Chief Building Official for the municipality must be notified during the preliminary design stages.

Flows less than 200 m³/day should refer to Sewer Use By-Law 2719-87 – Section 4

If required, the Sampling / Inspection maintenance holes shall be located at property line, or a location approved by the County Engineer.

The minimum size of the Sampling / Inspection maintenance hole shall be 1200 mm diameter.

1.12.2 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 4.2. Only pre-benched maintenance holes complete with gasket and strap at openings will be accepted.

1.12.3 Maintenance Hole Diameter

Precast maintenance hole diameter requirements shall be as per OPSD Section 700.

1.12.4 Maintenance Hole Frame and Cover

Maintenance hole frames and covers are required for all maintenance holes shall be as per OPSD 401.010, unless otherwise approved by County Engineer. This should be outlined on the contract drawings, in the general notes.

Watertight maintenance hole lids are required when the maintenance holes are located in areas where overland water might cause infiltration as per OPSD 401.030. These areas are defined as: flood plain, within gutter locations, an easement and/or open space where overland flow is directly over or adjacent to the maintenance holes. Watertight maintenance hole lids are required where there is the possibility of sanitary surcharge conditions.

Watertight lids are not required when the proposed profile of a street with continuous grade has a maintenance hole located in the low point of an overland flow route, but may be submerged under a greater than two year storm event.

If the County Engineer feels that a public safety issue is possible in a designed area, they may require that a lockable maintenance lid be placed. These conditions may arise in proposed park areas where there is a sanitary sewer present or if a pumping station may be required as per OPSD 401.060.

1.12.5 Maintenance Hole Steps

Maintenance hole steps are required for access as per OPSD 405.010 or 405.020. Only steps supplied by the maintenance hole supplier will be accepted. They must be made of galvanized steel or aluminum. The reuse of existing steps is not acceptable.

The County requires steps be installed as per OPSD 704.010

1.12.6 Maintenance Hole Drop Structures

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

Internal drop structures shall 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 system shall be as per OPSD 1003.031 and must be approved by the County Engineer.

1.12.7 Maintenance Hole Safety Landing

Maintenance hole safety landings shall be as per OPSD 404.020. Maintenance hole safety landings are required in maintenance holes with a depth of between 5.0 m and 10.0 m and should be shown on all proposed drawings or outlined in the general notes. All incoming pipes should be below any safety platform. 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.

1.12.8 Waterproofing of Chambers and Manholes

In areas of high groundwater waterproofing of chambers and manholes is required.

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

The membrane shall be applied over a prime or tack coat and hand rolled to assure 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.

1.12.9 Benching

As detailed in the Precast Maintenance Hole Sizing Criteria section, only pre-benched maintenance holes will be accepted. Should a new sewer intersect an existing sewer at a maintenance hole, then benching shall be required as per OPSD 701.021.

Should an existing maintenance hole require additional benching to improve the hydraulics, then the existing benching should be removed and new benching placed to the obvert of the existing pipes.

1.12.10 Adjustment Units

Maintenance hole adjustment units shall be as per OPSD 704.010. 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 top of the maintenance hole lid. The difference in grade between the top of the maintenance hole lid and the first ladder rung shall not exceed 450 mm.

A maximum of 150 mm of adjustment rings will be permitted. 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.

When using precast concrete adjustment units, only approved PVC shims will be allowed. Concrete, clay brick and wood spacers will not be allowed.

1.13 Easement

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

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

1.13.1 Type of Easement

a) Municipal (Servicing) Easement

Is required for sanitary sewers and access roads that cross a site and which are maintained by the County or the County of Oxford's service provider.

b) Utility Easement

Is required for telephone, hydro, gas and cable television services. Each utility company should be consulted for their specific requirements.

c) Private Servicing Easement

Is 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.

d) Temporary Easements and Working 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.

1.13.2 Minimum Easement Widths

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of a sewer or a minimum width of 5.0 m (2.5 m each side of pipe), assuming no other services are located within the easement.

1.14 Low Pressure Sanitary Sewer

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 on-site pumping unit for each individual property which outlets to a common force main or gravity sewer.

The County of Oxford does not guarantee basement drainage.

1.14.1 System Layout

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

a) Preliminary Design

The following information is required for preliminary design submission:

- Plan 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
- Topographic plan
- Report on soil conditions
- 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. Lay out 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

1.14.2 Pipe

All low pressure sanitary sewers and services shall require tracer wire. All low pressure sanitary sewers directional drilled shall require two (2) tracer wires. All low pressure sanitary services directional drilled shall require a single tracer wire. Tracer wire material shall be as per Part 2 – Material, Section 2.1 Pipe, Fittings, Tracer Wire and Spacers. At any location where joints in the wire must occur only approved connectors will be used.

The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted.

Tracer wire will be installed along the top of the pipe, and bound at 6-meter 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 or repairs.

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 or 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 of 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 contractors expense. Continuity testing in lieu of actual line tracing shall not be accepted.

Minimum pipe sizes are as follows:

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. Minimum size of low pressure sewer is 50 mm diameter.

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 copper tubing size. Service valves will be placed on the property line. The minimum depth of cover shall be 1.80 m of cover to the top of pipe.

For industrial, commercial, or institutional servicing from the grinder pump on private property to the low pressure sewer, the service size shall be a minimum 32 mm copper 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 1.80 m to the top of pipe. Depths less than 1.80 m of cover shall require insulation as per Detail D 1812-1-2007 for Rigid Board Insulation – Slab Type.

Services shall be installed as per D1849-1-2011. Where the low pressure sanitary service connects to a gravity lateral at property line the connection will be as per D1850-1-2011 and D1850-2-2011

1.14.3 Grinder Pumps

Pumps shall be a 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 building in a location convenient for maintenance.

Grinder Pump RequirementsResidential

For residential applications the grinder pump holding tank shall have a minimum capacity of 265 L and accommodate flows of a minimum 2650 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, 1 phase. The inlet shall be sized to accommodate a 100 mm diameter pipe. The discharge shall be sized to accommodate 32 mm diameter pipe.

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

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, 1 phase. The inlet shall be sized to accommodate a 100 mm diameter pipe. The discharge shall be sized to accommodate 32 mm diameter pipe.

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

1.14.4 Valves

- a) Valves shall be located at all intersections. At cross intersections a minimum of 3 valves shall be installed and a minimum of 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 D1846-1-2009.

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.

- b) In residential areas valve spacing shall not exceed 250 m (820 ft) apart. In high density residential, commercial, or industrial areas valve spacing shall not exceed 150 m (500 ft) apart. Valves will be located in such a manner that no more than 60 services will be isolated by operating no more than 4 valves.

1.15 Sewage Forcemain

The following specifications are for Ductile Iron (DI), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE).

- a) The forcemain shall be sized to have a flow velocity between 0.60 to 4.0 m/s with the lower limit preferred for the initial phase. Minimum size of forcemain is 100 mm diameter.
- b) The design profile and size of the forcemain shall minimize the excessive negative head to the system.
- c) On curves, the main location may deviate slightly from the standard by using the maximum allowable deflection in the pipe joints. Refer to manufacture's specifications regarding pipe deflection. A minimum number of special bends should be used.
- d) The minimum cover of the forcemain shall typically be 1.80 m. The forcemain in some cases may be required to be deeper to avoid conflicts with other infrastructure.
- e) Air-relief valves shall be located at all high points in the system.
- f) For non-metallic direct bury forcemain, the size of tracer wire to be installed will be Solid #12 TWU copper tracer wire or Solid #12 AWG 21% conductivity, high strength, copper-clad hard drawn high carbon steel (CCS) tracer wire, 30 mil. HDPE insulation jacket complying to ASTM-D-1248, minimum break load 452 lbs, 30 volt rating, green in colour.

For directional boring two (2) solid #8 TWU copper tracer wires or (2) Solid #12 AWG 21% conductivity, high strength, copper-clad hard drawn high carbon steel (CCS) tracer wire, 45mil. HDPE insulation jacket complying to ASTM-D-1248, minimum break load 1150 lbs, 30 volt rating, green in colour.

The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted. Tracer wire will be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the forcemain. Joints in the wire between valves will not be allowed. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.

At each main valve a continuous loop of 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 loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500mm and coiled to not interfere with valve operation.

Prior to 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 or 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 of 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 contractors expense. Continuity testing in lieu of actual line tracing shall not be accepted.

- g) Mechanical thrust restraint is required on **all** fittings, bends, tees, valves, crosses, reducers and plugged or capped dead-ends. In addition all forcemain repairs shall require mechanical restraints.

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

In calculating restrained distances a **safety factor = 2 to 1**, with a **test pressure = 150 psi** is to be used with reference to pipe manufacturers specifications.

Prior to construction all thrust restraint design shall be submitted to the County Engineer 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;

All fittings, bends, tees, valves, crosses, reducers up to 200 mm shall be restrained to the pipe along with a minimum of 3 full pipe length joints (18 m) measured from each side of appurtenance.

All 250 to 300 mm fittings, bends, tees, valves, crosses, reducers shall be restrained to the pipe along with a minimum of 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 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 6 full pipe length joints (30 m) measured from the end of pipe.

All plugged or capped ends shall be tapped to relieve pressure prior to removal if necessary.

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 above restrained lengths mentioned above from fittings, bends, tees, valves, crosses, reducers and plugged or capped ends shall be restrained.

Pipe larger than 300 mm shall be restrained as per the pipe manufacturer's recommendations. PVC 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 forcemain is re-pressurized. The County of Oxford reserves the right to specify the use of mechanical and/or concrete thrust blocks.

1.16 Valves

- a) Valves shall be located at all intersections. At cross intersections a minimum of 3 valves shall be installed and a minimum of 2 valves shall be installed at tee intersections. If necessary, adjustments in the field can be made to avoid curbs or other obstructions that may interfere with valve placement.

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 complete with rubber grommet. Tracer wire will loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500 mm and coiled to not interfere with valve operation. Tracer wire to be installed as per Detail D1846-1-2009.

- b) Valves on forcemains in rural areas shall be located at all road crossings or at the discretion of the County Engineer. Test stations for locating purposes shall be installed a maximum 500 m after each valve. Test stations to be located a maximum 500 m apart.

PART 2 - MATERIAL**2.1 Pipe Material**

Both rigid and flexible pipe are permitted in the construction of sanitary sewer systems including private drain connections. These materials include PVC, concrete, and HDPE pipe. HDPE pipe shall be used for directional drilling only unless otherwise approved by the County Engineer. All materials shall be CSA and ASTM certified.

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

Field cut tees will only be permitted with approved materials and methods as set out by the County Engineer.

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. The County may upon review of these sewers specify pipe material and colour. Associated costs are the sole responsibility of the proponent.

The Contractor will get approval for pipe selection from the County Engineer prior to supplying the material to the site.

Gravity Sewers**PVC**

Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2)
100 mm – 600 mm inclusive.

Gravity sanitary PVC main shall be SDR 35 as per OPSS 1841. 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.

Concrete

Trench conditions to be determined by the Consulting Engineer. Trench conditions shall be as per OPSD 807.010, 807.030, and 807.040. Concrete pipe material must comply with the following CSA requirements.

- a) Non-Reinforced – CAN/CSA 257.1 Class 3 concrete for pipes 450 mm or less in diameter.
- b) Reinforced – CAN/CSA 257.2 65-D concrete for pipes more than 450 mm in diameter.

Forcemain

Where possible or as directed by the County Engineer 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 shall be installed with “Green” tracer wire.

Open Cut Installation

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18 (complete with green tracer wire) 100 mm through 300 mm diameter colour coded “Green”.

PVC AWWA C900 (CIOD), CSA B137.3 - PC 165 DR 25 (complete with green tracer wire) 100 mm through 300 mm diameter colour coded “Green”.

PVC Series (IPS) 160 SDR26, CSA B137.3 - (complete with green tracer wire)

50 mm through 300 mm diameter gasketed ends

Trenchless Installation

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18, with mechanically restrained joints (complete with green tracer wire) 100 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18, fusible pipe (complete with green tracer wire) 100 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 200 SDR21, fusible pipe CSA B137.3 - (complete with green tracer wire) 150 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 165 DR 25, fusible pipe (complete with green tracer wire) 150 mm through 300 mm diameter

High Density Polyethylene (HDPE)

HDPE material for forcemain is to be used for directional drilling only unless approved in writing by the County Engineer.

Unless specified otherwise all HDPE pipe will be Ductile Iron Pipe Size (DIPS).

HDPE AWWA C901 and C906, DR 11 Pressure Class 160 psi (1103 kPa), PE 3408/3608 DIPS “Green Stripe” (complete with “Green” tracer wire).

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

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

2.2 Directional Drilling Material

Unless otherwise specified all HDPE material shall be Ductile Iron Pipe Size (DIPS) or Copper Tubing Size depending on the diameter of the pipe being used. Pipe material used for directional drilling shall be HDPE DR11 Pressure Class 160 psi (1103 kPa) DIPS (Green Stripe) or PVC. PVC pipe used for the directional drilling process must meet or exceed the pressure rating of HDPE DR 11. For directional drilling of PVC pipe only the “Terra Brute”, “Cobra Lock” or fusible PVC jointing process shall be permitted. Inside diameters shall meet or exceed typical sizing requirements associated with PVC pipe.

HDPE 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.

2.3 Casing Spacers

When sanitary sewer is placed inside a casing, the sewer pipe shall be supported by spacers using the centered configuration. The size, location, and number of spacers will be as per the manufacturer’s recommendation.

Approved Casing Spacers are as follows:

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

2.4 Bedding Material

As per OPSS 1010

PART 3 - INSTALLATION

The installation of sanitary sewers shall be as per OPSS 401, 404, 410, 517, and 1010 with the following exceptions/amendments.

SECTION A - OPEN CUT

3.1 Line and Grade

- a) 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 drawings before beginning any work.

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

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

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 Density.

3.3 Excavation and Trench Preparation

- a) 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.
- b) Where trench excavations are not kept within the design limits of the pipe, the County Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.
- c) Where the sub grade in its natural state is inadequate to support the pipe, the County Engineer will give instructions as to the proper procedure.
- d) The sub grade shall be removed where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by the County Engineer.

3.4 Dewatering

- a) Always maintain the excavation free of water.
- b) The discharge of water from the construction site into sanitary sewers is strictly prohibited. The costs for cleanup of the sewer or other affected areas will be the responsibility of the Contractor / Developer.

3.5 Lowering & Laying

- a) Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by the County Engineer shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.

- b) 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.
- c) 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 the noon hour as well as overnight. The trench shall be kept dry and free from water. No pipe shall be laid in water except by permission of the County Engineer. No water shall be allowed to run through installations during construction.

- d) 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.
- e) Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted by the County Engineer.
- f) 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 with the maximum allowable deflections not being exceeded. Pipe deflection will be done as per manufacture's specifications. If in the opinion of the Inspector, the deflection is excessive they will order the job stopped. The County Engineer 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.
- g) When a new sewer crosses existing utilities, or where an existing watermain is undermined during laying operations, the County Engineer may order the installation of support beams. Support beams shall be approved by the County Engineer prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. The County Engineer shall decide the method to be used. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to a minimum of 95 percent Standard Proctor density. Pipe must not be laid on blocks.
- h) No pipe shall be laid until the preceding pipe joint has been compacted and the pipe carefully embedded and secured in place.
- i) 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.

- j) Installations shall be kept thoroughly clean during the progress of the work and until the completion and final acceptance thereof.
- k) The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the drawings. Where vertical or horizontal curves are shown, the pipe line shall not deviate more than 300 mm from line, and not more than 75 mm from grade.
- l) 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.

3.6 Bedding

For the purpose of this specification all materials placed between the trench bottom and 300 mm over the top of the pipe shall be considered as bedding. Bedding around the sewer and services may be granular material or clean screened sand.

- a) Granular materials greater than 19 mm in size shall not be used for pipe bedding. Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.
- b) Bedding material shall be placed full width of trench. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.
- c) The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

3.7 Backfilling

- a) Backfill shall be considered as starting from 300 mm over top of the pipe. All materials below this point shall be considered as bedding.
- b) If the County Engineer 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 the County Engineer.
- c) 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 250 mm. Backfill material shall be placed in lifts not exceeding 300 mm and compacted to a minimum 95 percent Standard Proctor Density.

- d) 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 the County Engineer or other road authority. Backfill on all County road allowances in the travelled portion of the roadway shall be granular material as set out in the Ontario Provincial Standards.

Installation of material will be as directed by the County Engineer or other road authority.

- e) The Inspector may order the trench to be bedded by hand from the bottom of the trench to the center line of the pipe with sand, placed in layers of 75 mm and compacted by vibratory equipment. Bedding material shall be deposited on each side of the pipe simultaneously.
- f) From the center line of the pipe, fittings and appurtenances to a depth of 300 mm above the top of the pipe shall be backfilled by machine or by methods approved by the Inspector. The type of backfill material used shall be sand, gravel or approved excavated material. The Contractor shall use special care in placing and compacting this portion of the backfill so as to avoid damaging or moving the pipe.
- g) No frozen material shall be used for backfilling nor shall backfilling be carried out where material in the trench is frozen.
- h) 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.

3.8 Compaction Test

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

- a) When tests show that the compaction does not meet the specified requirement, the Contractor will carry out further compaction in a manner directed by the County Engineer, and pay for further testing to establish proof of the specified compaction.
- b) For backfill compaction, tests will be performed in accordance with the testing company's recommendations.
- c) Co-operate with the County Engineer and testing company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

SECTION B - DIRECTIONAL DRILLING**3.9 Scope**

This specification covers the requirements for the installation of pipes by horizontal directional drilling.

3.10 Definitions

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.

3.11 Submission and Design Requirements**3.11.1 Submissions**

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

- a) Direction boring equipment and specifications;
- b) Sequence of operation;
- c) Location of entry and exit points;
- d) Location of positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- e) Disposal site for cuttings;
- f) Dewatering plan; and
- g) Slurry management plan.

3.11.2 Design Requirements

Procedures, materials, and water management plan are to be acceptable to the Ministry of Environment and Climate Change (MOECC), 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.

3.11.3 Record Drawing Requirements

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

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

3.12 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 the County Engineer.

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.

3.13 Construction

3.13.1 General

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

3.13.2 Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall not be modified without written consent from the County Engineer.

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.

3.13.3 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 ± 100 mm over the total distance between the ground entry and exit points.

3.13.4 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.

3.13.5 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:

- a) Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- b) 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.
- c) Location of other surface features (eg. adjacent structures, walkways, fences, poles, trees, etc.)
- d) Location of other underground features (eg. utilities, foundations, etc.)
- e) Protection of water courses against the transport of excavated or other materials into receiving waters.

3.13.6 Pipe Installation

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. PVC pipe shall be joined using the jointing process. 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.

3.13.7 *Tracer Wire*

Refer to Part 1 – Location and Design, 1.15 (f) Sewage Forcemains.

When Directional Drilling is used for forcemains and low pressure sewer installation, two (2) tracer wires will be installed simultaneously. The second wire will be used as a backup if the other tracer wire is broken during installation. Tracer wire shall be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the watermain.

Joints in the wire between valves will not be allowed. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.

Tracer wires shall have sufficient slack to be knotted together prior to placement of connector. Petrolatum tape shall then be wrapped around connection and compressed by hand around connector. Tracer wire connections to be installed as per Detail D1858-1-2016.

At each valve, a loop of 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 D1846-1-2009. 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.

3.13.7 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 MOECC guidelines, policies and regulations.

SECTION C - CONNECTIONS

3.14 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 determined by the County Engineer. The Contractor shall submit a program for this work which shall be approved by the County Engineer before the work commences.

3.15 Jointing of Push on Joint Pipes

- a) 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.
- b) The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer's recommendations.
- c) On straight lengths, no lateral deviation in excess of 150 mm will be tolerated and on straight grades no grade deviation in excess of 75 mm will be tolerated.

SECTION D – CORROSION PROTECTION AND INSULATION**3.16 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.

- a) All flanged surfaces, nuts, bolts, tie rods, clamps, valves, sleeves, Victaulic 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.
- b) 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.
- c) 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 contractors expense.

3.17 Cathodic Protection - Forcemain

As per the General Section of the Design Guidelines and Supplemental Specifications 1.4 Subdivider and Consultant responsibilities item b), 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. Anodes shall be installed as per OPSS 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.

Minimum Anode Sizing

Zinc – ASTM B-418 Type II

For new installations of valves, fittings, and restraints - 11 kg (24 lb) Z-24-48.

Magnesium – ASTM B-843 Type M-1C

For existing valves, fittings, and restraints, or connection between cast iron / ductile iron forcemains and PVC pipe - 14 kg (32 lb) M-32-22.

3.18 Thermal Insulation

Rigid Board Insulation – Slab Type

If minimum cover of 1.80 m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. No forcemain, gravity sewer, low pressure sewer, or services shall have a ground cover less than 1.0 m 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 1.0 m 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. Manufactures specification of material shall be provided prior to installation.

Refer to Detail D1812-1-2007 for Rigid Board Insulation – Slab Type.

PART 4 – SERVICE INSTALLATION

4.1 Location

Private Drain Connections (PDC’s) to single family, semi-detached and row housing lots are to be located in accordance with Figure 1.1, Section- 1 General.

Location of sanitary services on lots in the City of Woodstock and the Town of Tillsonburg may vary from Figure 1.1. Location must be confirmed with the City of Woodstock and Town of Tillsonburg.

All PDC's shall be installed a minimum of 1.0 m past property line on all new construction.

No PDC's are to be connected directly into a maintenance hole unless design constraints arise (i.e. cul-de-sac).

PDC's on private property of town house complexes, row housing and apartments are to be connected to a maintenance hole located on the R.O.W.

PDC's for industry and commercial property are also to be connected to a maintenance hole located on the R.O.W.

All PDC's shall be installed perpendicular to the sewer main using factory supplied tees, where possible. Under no circumstances will flow from the PDC enter the main against the flow in the main. Connections shall be as per OPSD 1006.020.

Where there is a conflict with the proposed PDC location due to a 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 impressed 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 owners restoration has been completed.

4.2 Connections to Maintenance Holes, Sewers, and Services

When connecting PDC's to existing sewers in a lot infill situation, connections must be made with an approved saddle or pre-manufactured tees, as per OPSS 410

and OPSD 1006.020. Drop structures for maintenance holes shall be as per OPSS 1003.010, 1003.020, 1003.030, and 1003.031.

a) Residential

PDC's of 100 mm and 150 mm in diameter must be connected to the main sewer.

b) Multi-family, Commercial, Institutional and Industrial

PDC's of 200 mm in diameter or larger are to be connected to the main sewer at maintenance holes.

c) Connections to Existing Sewers

In situations of a lot severance or lot infill where a new sanitary service will be connected to an existing main, the advocate of the severance/infill, or their agent, must determine if the existing sewer is at risk for surcharging or has a history of surcharging. This information, if available, may be obtained from the County or the County of Oxford's service provider.

If it is determined that there is a surcharge risk, then the development advocate must provide surcharge protection to their development. Connection can only occur if a County Waste Water Collection Operator or the County of Oxford's service provider is present. When connecting to existing manholes only cored holes with proper rubber connectors are acceptable. Written notice is required 48 hours in advance to schedule an inspection.

d) 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.

4.3 Grinder Pumps

Refer to Part 1 – Location and Design, 1.14.3 Grinder Pumps

4.4 Vertical Clearance

As outlined in 1.12 of this Section, the County has established a minimum clearance, when sanitary sewers cross other services. In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a storm sewer, a 0.30 m clearance is required between the two pipes.

When crossing over a watermain, a minimum of 0.50 m clearance is required between the two pipes. Where the sewer crosses under a watermain a minimum of 0.15 m separation is required.

Where there is conflict in crossing existing utilities, and the utility is unable to relocate, a minimum separation of 0.15 m is required between the two.

4.5 Risers

Risers may be required in situations where there is a conflict of sewers or a greater than expected grade change. These risers must be manufactured, approved, supplied and placed as per OPSD 704.010.

4.6 Cleanouts

Where PDC's cleanouts are required within the R.O.W., approval must be granted by the County Engineer.

Where private maintenance cleanouts are required, they shall be located off of the R.O.W. For private PDC cleanouts, Part 7 of the OBC takes precedence.

For properties that require sewage grinder pumps connecting to a gravity sewer lateral, a cleanout shall be installed at 1.0 m past the property line. Cleanout and lateral connection to be installed as per Detail D1850-1-2011 and D1850-2-2011.

4.7 Depth

The minimum depth of a sanitary PDC in new construction and development shall be 2.4 m from the finished proposed grade at property line to obvert of the pipe. In existing areas where new sewers are being constructed, the depth of service at property line may vary based on main line sewer designs and existing topography. The County of Oxford does not guarantee basement drainage.

4.8 Marking and Recording of PDC Service Connections

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

Once the PDC has been placed, a record of its location must be produced for the As-Constructed drawings and provided digitally to the County as per Figure 1.3, Section-1 General.

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.

PART 5 – FIELD TESTING

5.1 General

Field testing described in this section shall be conducted as per OPSS 409, and OPSS 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.

5.2 Cleaning and Flushing Sewers

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 manhole structures shall be inspected by the County Engineer. Once the affected areas have been identified, the Contractor shall clean, flush and video those sections as directed by the County Engineer at their own expense.

5.3 Leakage Testing

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

Infiltration tests shall be conducted when the groundwater at the time of testing is 600 mm 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 600 mm 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 1200 mm in diameter and smaller. There shall be no visible leakage for pipe sewers larger than 1200 mm 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.

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

Pressure testing of forcemain and low pressure sewer shall be done at 2 times the design system pressure to a maximum of 827 kPa (120 psi) or as directed by the County Engineer.

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). If a portion of sewer is located between manholes, the entire section from manhole to manhole shall be sealed and pressure tested according to OPSS 441. Costs associated with the testing are the sole responsibility of the proponent.

5.4 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 750 mm in diameter is 7.5% of the base inside diameter of the pipe. For pipes greater than 750 mm 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 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.

5.5 Closed-Circuit Television (CCTV) Inspection

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

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

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. Videos and reports are to be submitted directly to the County of Oxford Customer Service Department or the County of Oxford's service provider.

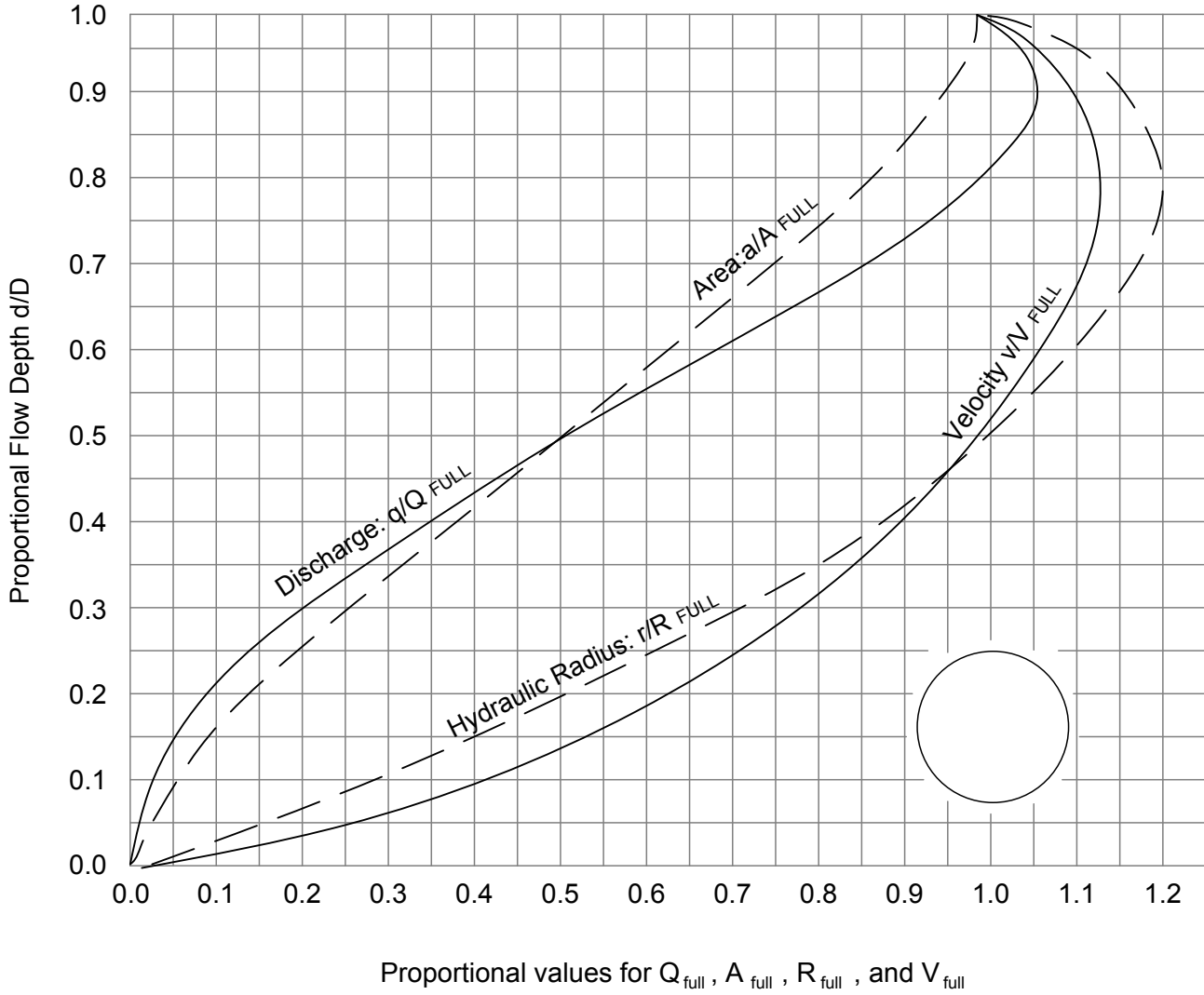
New and replacement sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are required to establish operational procedures which include CCTV inspections every 5 years with records made available for inspection by the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



Growing stronger together

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FIGURES



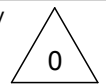
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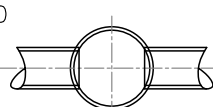
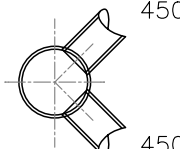
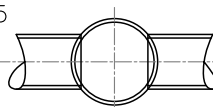
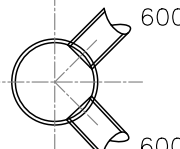
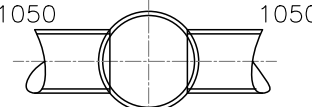
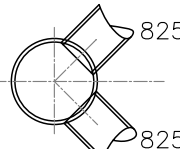
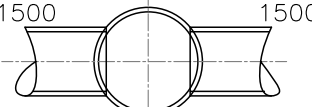
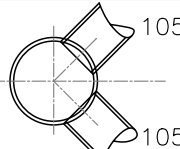
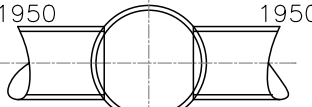
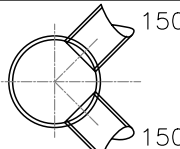
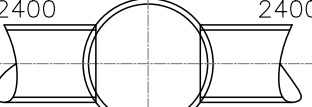
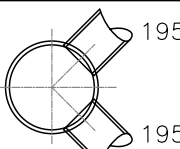
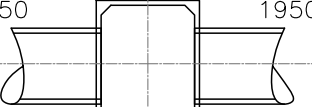
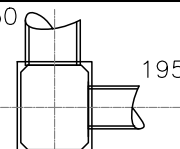
HYDRAULIC ELEMENTS OF CIRCULAR PIPE

DWG FIG 4.2

DATE DEC. 2008

REV



MAINTENANCE HOLE INSIDE DIAMETER (mm)	MAX. PIPE SIZE FOR STRAIGHT THROUGH INSTALLATION (mm)	MAX. PIPE SIZE FOR RIGHT ANGLE INSTALLATION (mm)
1200	600 	450 
1500	825 	600 
1800	1050 	825 
2400	1500 	1050 
3000	1950 	1500 
3600	2400 	1950 
3000 x 2400	1950 	1950 

1. ALL DIMENSIONS ARE FOR CONCRETE PIPE.
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. KNOCKOUTS FOR SMALL DIAMETER CATCH BASINS 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

MAXIMUM PIPE SIZES FOR PRECAST MAINTENANCE HOLES

DWG FIG. 4.3

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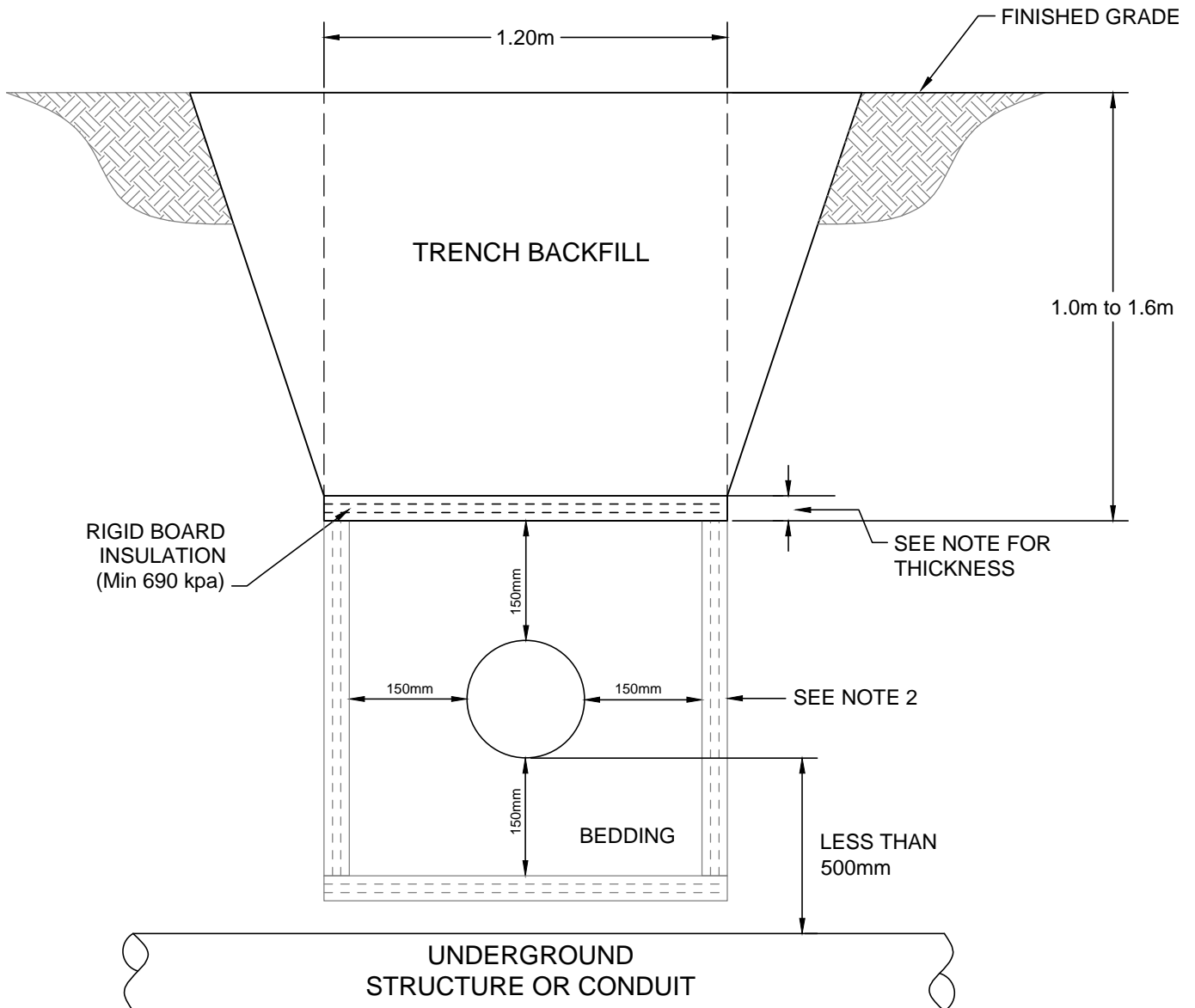


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SECTION 4 – SANITARY

DETAILS

1.
 - IF GROUND COVER IS LESS THEN 1.0m LOWER WATER MAIN TO 1.8m.
 - IF GROUND COVER IS 1.0m-1.3m USE 75mm THICK INSULATION.
 - IF GROUND COVER IS 1.3m-1.6m USE 50mm THICK INSULATION.
2. FOR CROSSING OR UNDERGROUND STRUCTURES OR CONDUIT A "FROST BOX" IS REQUIRED.
3. FOR WATERMAIN AND SERVICES LOCATED 500mm OR LESS HORIZONTALLY ADJACENT TO MANHOLES OR CATCHBASIN REQUIRES A MINIMUM 50mm INSULATION IS REQUIRED.
4. INSULATION IS REQUIRED ON ALL NEW OR RECONSTRUCTED WATER SERVICES IF ADEQUATE COVER AS LISTED ABOVE CANNOT BE ACHIEVED.



OXFORD COUNTY

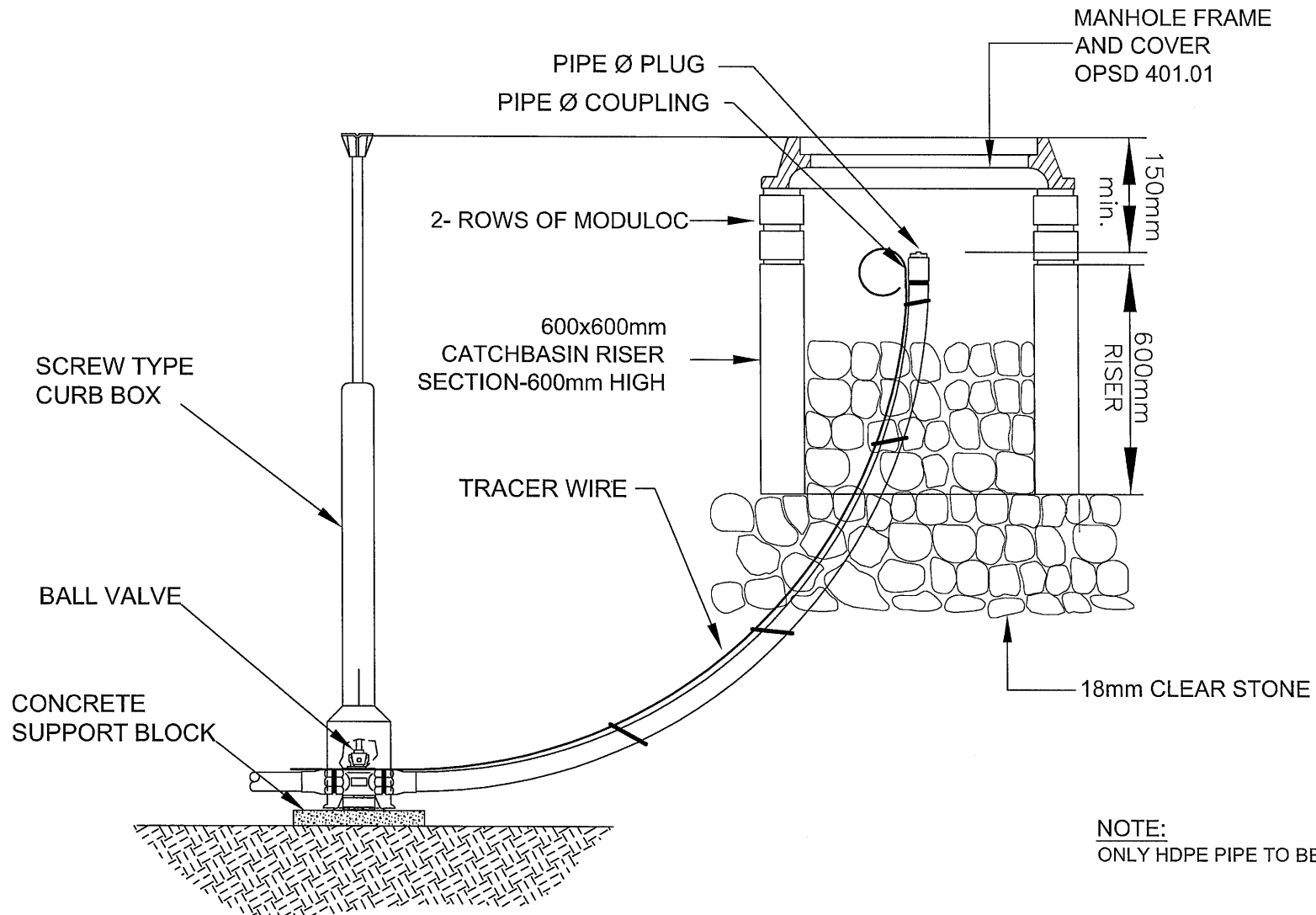
RIGID BOARD INSULATION-SLAB TYPE FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

DWG D 1812-1-2007

DATE NOV. 2007

REV





NOTE:
ONLY HDPE PIPE TO BE USED.

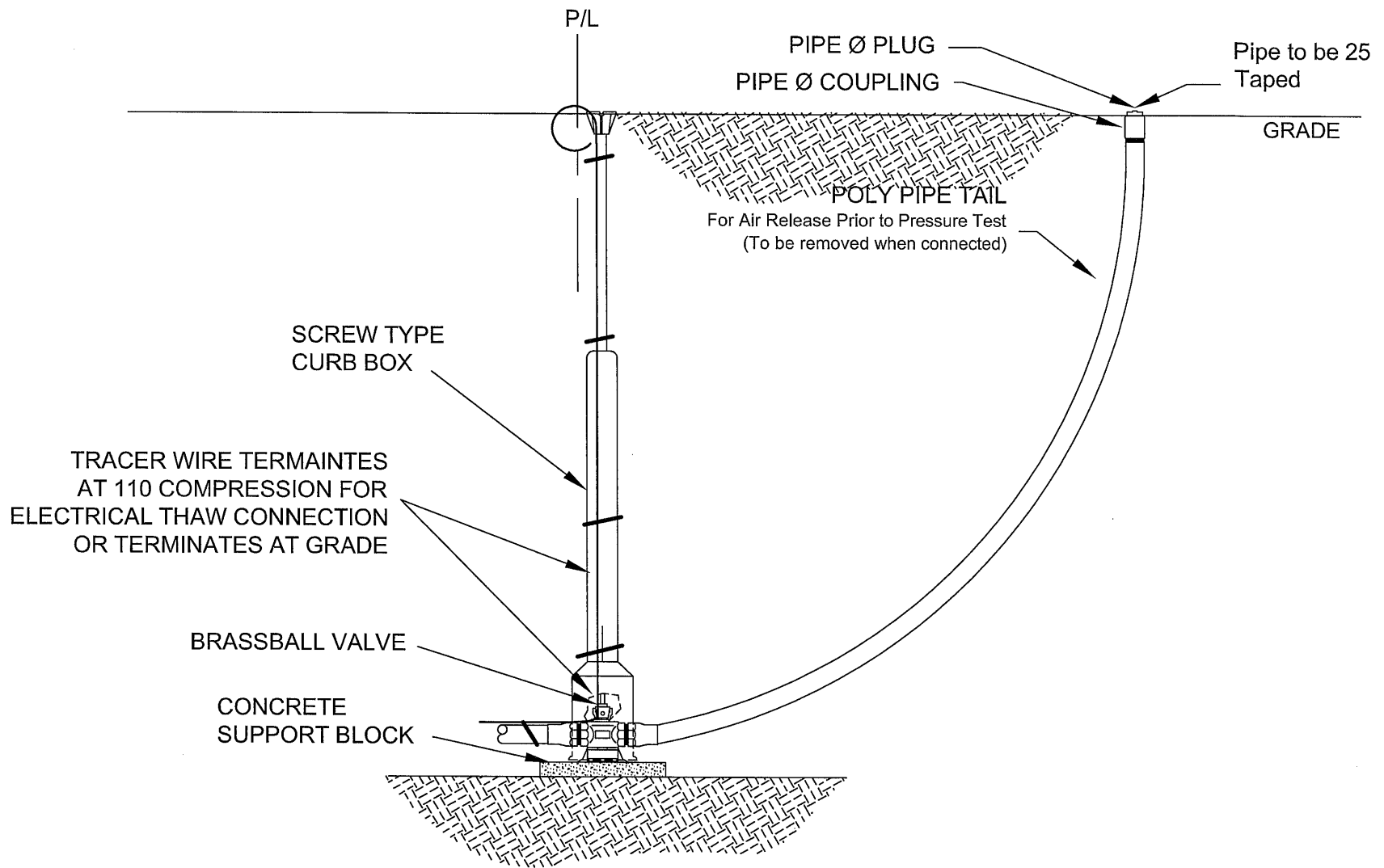
OXFORD COUNTY

LOW PRESSURE SANITARY SEWER CLEANOUT

DWG D 1847-1-2011

DATE APRIL 2011

REV
1



OXFORD COUNTY

LOW PRESSURE SANITARY SERVICE

DWG D 1849-1-2011

DATE AUGUST 2011

REV

3



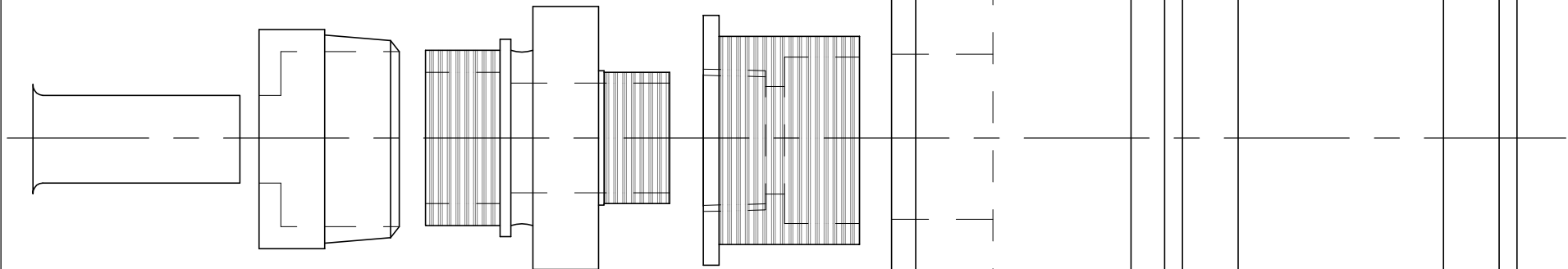
Complete Assembly



Fernco Coupling & PVC Bushing



Brass Coupling w/ insert



Cambridge 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 1/4" FIP
Sch80 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

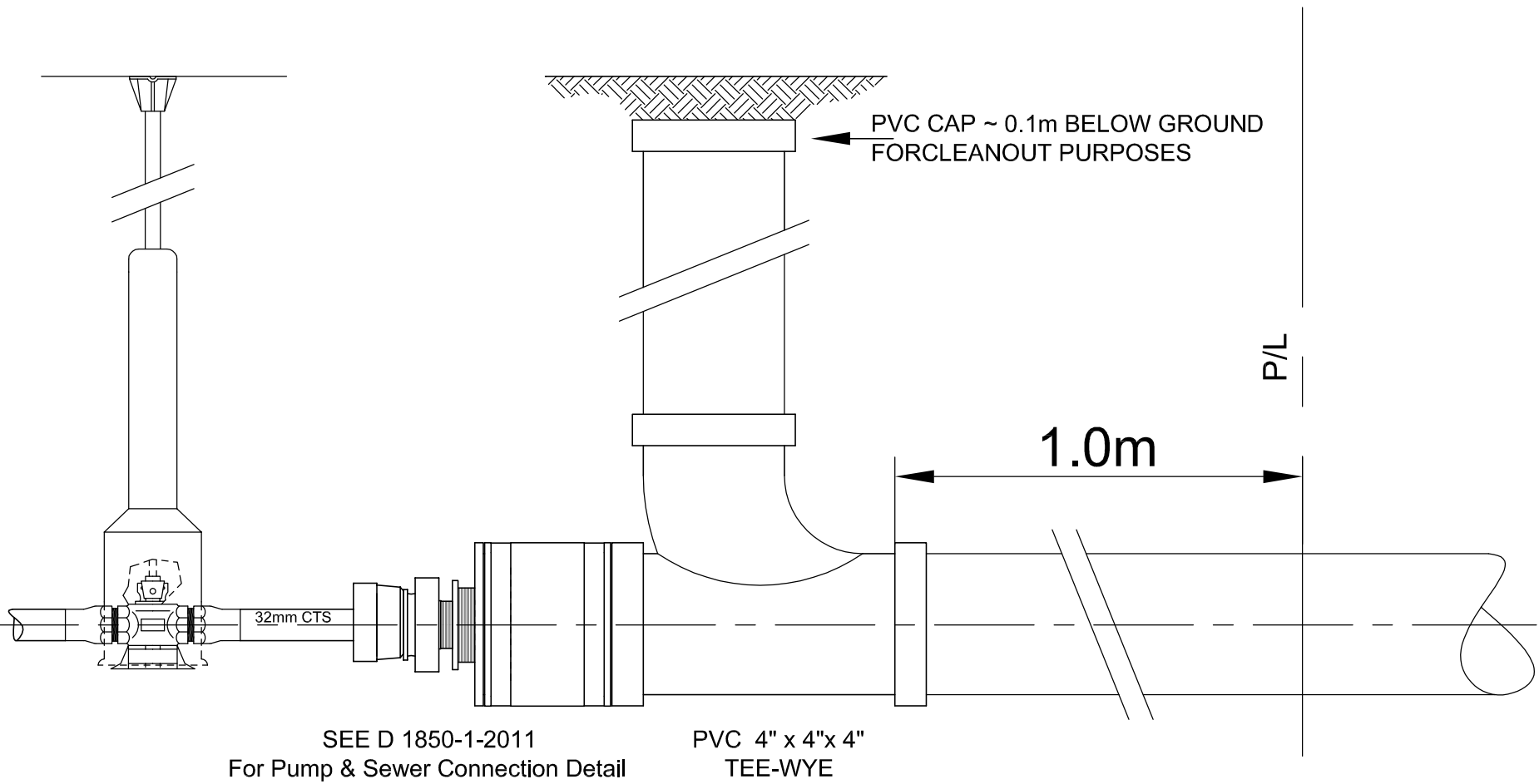
Grinder Pump & Sewer Lateral Connection Detail

DWG D 1850-1-2011

DATE August 2011

REV

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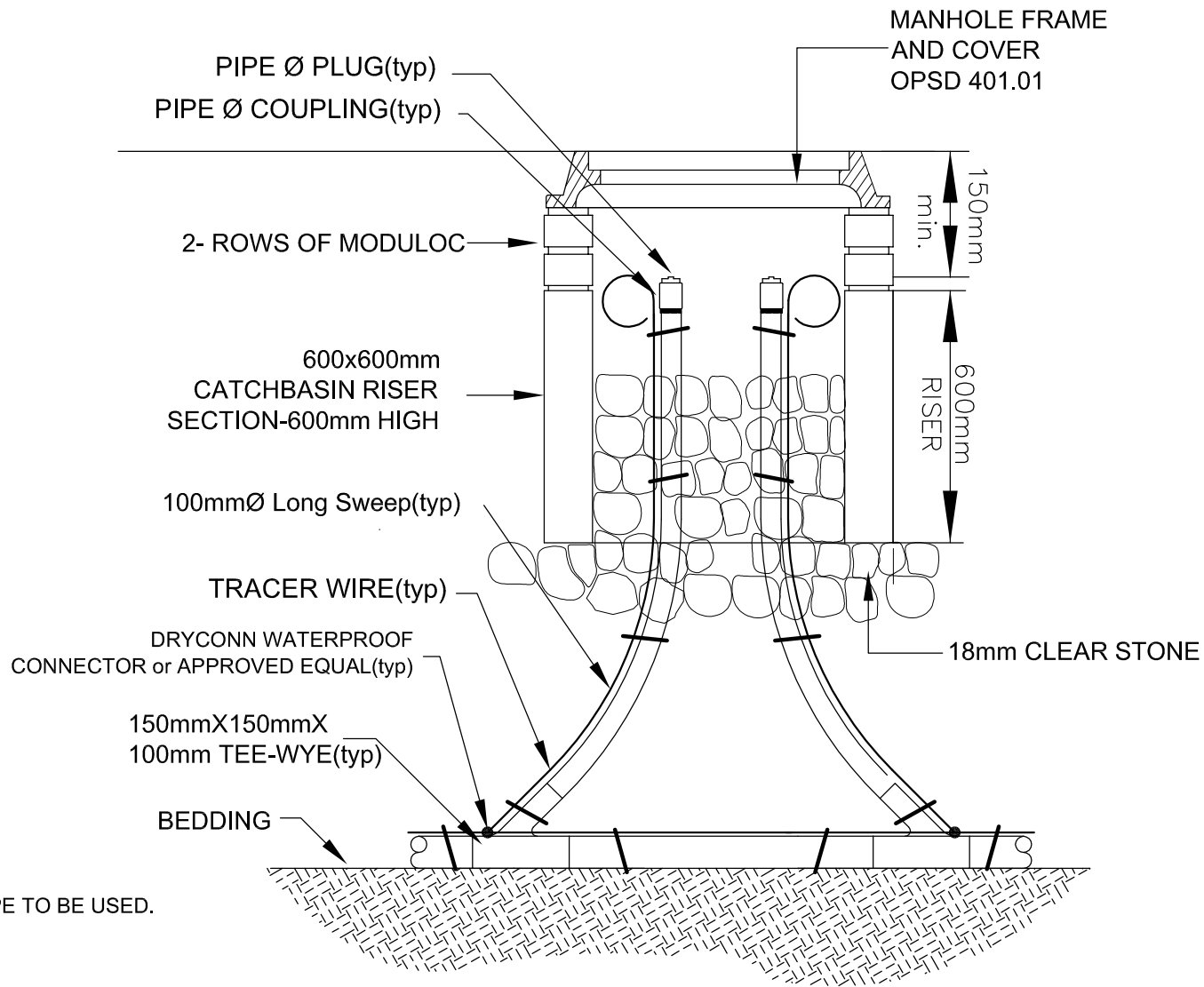
OXFORD COUNTY

Grinder Pump Sewer Lateral Connection w/ Cleanout

DWG D 1850-2-2011

DATE August 2011

REV
0



NOTE:
ONLY PVC PIPE TO BE USED.

OXFORD COUNTY

GRAVITY SANITARY SEWER CLEANOUT

DWG D 1854-1-2011

DATE JULY 2012

REV

0



Growing stronger together

SECTION 5 - STORM

Applicable on all County Roads

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- Figure 5.1 – Storm Sewer Design Chart
- Figure 5.2 – Hydraulic Elements of Circular Pipe
- Figure 5.3 – Maximum Pipe Sizes for Precast Maintenance Holes

DETAILS

- D1812-1-2007: Rigid Board Insulation – Slab Type
- D1832-1-1993: Mechanical Joint Offset Installation - Under
- D1833-1-1993: Mechanical Joint Offset Installation - Over

PART 1 - LOCATION AND DESIGN

The current Ontario Provincial Standards and Ministry of the Environment and Climate Change (MOECC) Guidelines for the Design of Sewage Works 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.

1.1 Permitted Flows

Storm drainage shall be designed to collect storm water discharge from pervious and impervious areas, both on private lands via catchbasins and private drain connections. Indirect connections of foundation drains (footing tile) via sump pumps to storm Private Drain Connections (PDC's) are permitted.

1.2 Location and Alignment

Generally, storm drainage is to be located in front of, or in locations accessible to each lot or blocks facing the County Road. Storm sewers are to be located as per Section-1 General, Figure 1.2. Any deviation from these standards must be submitted in writing to the County Engineer or local Municipality for approval.

When a maintenance hole is designed to be located within the vicinity of a roundabout, storm maintenance holes are permitted to be located within the grassed area of the roundabout.

Storm sewers on private property are regulated by the Ontario Building Code (OBC). Where there are no specific regulations in the OBC, details from this manual will apply.

1.3 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 R.O.W.

Note: All areas and coefficients shall be shown for each drainage/sub-drainage areas.

1.4 External Sewershed Limits and Drainage Areas

When designs abut undeveloped or unserved areas, the external sewershed limit shall be identified and designed for.

Note: All areas and coefficients are to be shown for all drainage areas within external watershed limits.

1.5 Design Chart

Storm sewer design calculations for approved drainage area plans are to be completed on the standard design chart as per Figure 5.1 for details and additional design information.

1.6 Peaking Factor Calculation

Flows shall be calculated using the formula: $Q = 2.78 \times A \times C \times I$

Where Q= peak flow (L/s)
 A= area (hectares)
 C= runoff coefficient
 I= average rainfall intensity (mm/hr)

1.7 Design Criteria

For Storm Sewer Design Guidelines refer to Chapter 5, Section 5.4 of the Ministry of the Environment and Climate Change (MOECC) Design Guidelines for Sewage Works.

1.7.1 Storm Design Curve

Intensity duration frequency (IDF) curves from Canada Atmospheric Environment Service (AES) for weather stations within a 50 kilometres radius of Oxford County are acceptable.

1.7.2 Time of Concentration

- a) The time of concentration for residential areas at the upstream end of a system shall be 15.0 minutes.
- b) The time of concentration is to be adjusted when lateral flows account for 50% or more in the design flows.
 - i) Adjusted time of concentration shall be calculated using the formula:

$$T_{c-adj} = \frac{(T_{ct})(Q_t) + (T_{cl})(Q_l)}{(Q_t - Q_l)}$$

Where T_{c-adj} = adjusted time of concentration (min)
 T_{ct} = time of concentration in the trunk sewer (min)
 Q_t = design flow in the trunk sewer (L/s)
 T_{cl} = time of concentration in the lateral sewer (min)
 Q_l = design flow in the lateral sewer (L/s)

- ii) The adjusted time of concentration is used downstream of the junction manhole.

1.7.3 Intensity

Rainfall intensity shall be taken from IDF curves.

1.8 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete, HDPE (Boss 2000), and polyvinyl chloride (PVC) pipe for pipe sizes 300 mm to 1650 mm. A coefficient of 0.011 is to be used for all pipe sizes 1800 mm or greater.

1.9 Pipe Size

Pipe size is determined using the formula where the pipe design flow is equal to or greater than the calculated peak design flow:

$$Q = (1/n) \times A \times R^{2/3} \times S^{1/2}$$

Where:

- Q = Design flow (m³/sec)
- n = Manning's roughness coefficient
- A = cross sectional area of flow (m²)
- R = hydraulic radius (area/wetted perimeter)
- S = slope of pipe (m/m) - %

The minimum allowable size of a storm sewer shall be 300 mm.

The minimum allowable size of a single catchbasin lead shall be 250 mm.
The minimum allowable size of a double catchbasin lead shall be 300 mm.

On private property, the minimum size for storm building sewer shall be 100 mm, in accordance with Part 7 of the OBC.

1.10 Flow Velocity

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

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

Where:

- V = flow velocity (m/s)
- Q = Design flow (L/s)
- A = cross sectional area of flow (m²)

1.10.1 Minimum and Maximum Velocities

The minimum velocity permitted in storm sewers is 1.0 m/s

The maximum velocity permitted in storm sewers are:

- a) 4.5 m/s for 300 mm to 825 mm diameter sewer, and
- b) 6.0 m/s for 900 mm diameter and larger storm sewers

To determine velocities based on actual flow, as per Figure 5.2 “Hydraulic Elements of Circular Pipe”.

1.10.2 Minimum Grades

- a) The minimum grade on a 300 mm diameter storm sewer is 0.54%.
- b) The minimum grade on all other sewer sizes shall be established by determining the minimum grade required to achieve a velocity of at least 1.0 m/s.

1.11 Pipe Depth

1.11.1 Minimums

The minimum depth of a storm sewer shall be 1.5 m from the finished ground elevation to the obvert of the pipe.

1.11.2 Maximum Depth of Cover

- a) Concrete Pipe

The maximum allowable cover permitted on concrete pipe shall be as per OPSD 807.01, 807.03, 807.04 and 807.05.

- b) Flexible Pipe

The maximum allowable cover permitted on flexible pipe shall be as per OPSD 806.021, 806.040 and 806.06.

1.11.3 Vertical Separation

In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance shall be maintained between the two pipes.

Watermain and services crossing sewers or utility obstructions require a minimum 500 mm of clearance under and a minimum of 150 mm over the obstruction. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

This practice must also be followed when storm laterals are in conflict with any watermain or water service.

1.11.4 Horizontal Separation

The minimum distance allowed by the County for sewers and watermain separation is 3.0 m, and should be constructed in separate trenches as per OPSS specifications.

If it is not possible to maintain this separation, approval by the Ministry of Environment and Climate Change (MOECC) is required.

1.12 Maintenance Holes

Maintenance holes shall be constructed as per OPSS 407. Where required, frost straps shall be installed as per OPSD 701.100.

The void between the sewer pipe and the cored hole of the precast maintenance hole shall be filled with cement bricks and approved non-shrinkable grout. All joints between bricks are to be completely filled with concrete mortar. Bricks shall be parged on the outside and inside of the maintenance hole. Parging shall contain an approved bonding agent. All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with manufacturers specifications.

A maximum spacing between storm maintenance holes of no more than 110 m measured horizontally from centre of chamber to centre of chamber is required when pipe diameter is 300 mm to 975 mm diameter. The maximum allowable horizontal spacing for the corresponding pipe sizes larger than 975 mm are as follows:

Length	Sewer Diameter
130 m	1050-1350 mm
160 m	1500-1650 mm
305 m	1800 mm and larger

When placing a maintenance hole in the vicinity of a roundabout, storm maintenance holes should be placed within the area of a roundabout. Storm maintenance holes are permitted to be located within the grassed area of the roundabout provided any proposed landscaping does not hinder the access to the maintenance hole.

1.12.1 Precast Maintenance Hole Sizing Criteria

All sizing of storm precast maintenance holes are based on incoming and outgoing pipe sizes and should be sized and conform to Figure 5.3.

1.12.2 Maintenance Hole Diameter

Precast maintenance hole diameter requirements shall be as per OPSD 701.

1.12.3 Maintenance Hole Frame and Cover

Maintenance hole frames and covers are required for all maintenance holes. Maintenance hole frames and covers shall be as per OPSD 401.010. This should be outlined on the contract drawings, in the general notes.

If the County Engineer feels that a public safety issue is possible in a designed area, they may require that a lockable maintenance lid be placed. These conditions may arise in proposed park areas.

For all of the above mentioned covers, a maximum of 150 mm of adjustment rings will be allowed, as per OPSD 704.01 and be effected by either the use of precast concrete adjustment units or “Lifesaver” Adjusting Units as manufactured by IPEX.

1.12.4 Maintenance Hole Steps

Maintenance hole steps are required for access as per OPSD 405.010 or 405.020. Only steps supplied by the maintenance hole supplier will be accepted. They must be made of galvanized steel or aluminum. The reuse of existing steps is not acceptable.

The County requires steps be installed as per OPSD 704.010

1.12.5 Maintenance Hole Drop Structures

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

Internal drop structures shall 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 outlet pipe invert. 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 system shall be as per OPSD 1003.031 and must be approved by the County Engineer.

1.12.6 Maintenance Hole Safety Landing

Maintenance hole safety landings shall be as per OPSD 404.020. Maintenance hole safety landings are required in maintenance holes with a depth of between 5.0 m and 10.0 m and should be shown on all proposed drawings or outlined in the general notes. All incoming pipes should be below any safety platform. 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.

1.12.7 Waterproofing of Chambers and Manholes

In areas of high groundwater waterproofing of chambers and manholes is required.

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

The membrane shall be applied over a prime or tack coat and hand rolled to assure 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.

1.12.8 Benching

All maintenance holes require benching at the bottom of the maintenance hole. Benching shall be as per OPSD 701.021. Where benching is different from OPSD 701.021, a benching detail is required.

Should an existing maintenance hole require additional benching to improve the hydraulics then the existing benching should be removed and new benching placed to the obvert of the existing pipes.

1.12.9 Adjustment Units

Maintenance hole adjustment units shall be as per OPSD 704.010. 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 top of the maintenance hole lid. The difference in grade between the top of the maintenance hole lid and the first ladder rung shall not exceed 450 mm.

A maximum of 150 mm of adjustment rings will be allowed. This will be affected by either the use of precast concrete adjustment units or "Lifesaver" Adjusting Units as manufactured by IPEX.

When using precast concrete adjustment units, only approved PVC shims will be allowed. Concrete, clay brick and wood spacers will not be allowed.

1.13 Easement

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

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

1.13.1 Type of Easement

a) Municipal (Servicing) Easement

Is required for storm sewers and access roads that cross a site and which are maintained by the County or the County of Oxford's service provider.

b) Utility Easement

Is required for telephone, hydro, gas and cable television services. Each utility company should be consulted for their specific requirements.

c) Private Servicing Easement

Is required for private storm 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.

d) Temporary Easements and Working Easements

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

1.13.2 Minimum Easement Widths

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of a sewer or a minimum width of 5.0 m (2.5 m each side of pipe), assuming no other services are located within the easement.

1.14 Catchbasins

Catchbasins shall be constructed as per OPSS 407 with standard 600 mm sump unless otherwise specified. Catchbasins are to be provided to collect drainage from both pervious and impervious areas. The following are the general guidelines to be used in the provision of catchbasins and catchbasin leads.

1.14.1 Location

Street – On street corners and intersections, the catchbasin is to be located 0.6 m from the beginning of curve (BC) or end of curve (EC) of the curvature.

Lot/Rear Yard – The catchbasin and lead are to be located 0.6 m from the property line, entirely on one lot or block.

Parks – Catchbasins are to be located to minimize flow across pathways and provide positive drainage from park facility.

1.14.2 Minimum Lead Diameter and Grade

Street – The minimum diameter and grade of a catchbasin lead on a street is 250 mm @ 0.69% (velocity of 1.0 m/s)

Lot/Rear Yard – The minimum diameter and grade of a catchbasin lead in a rear yard is 300 mm @ 0.54% (velocity of 1.0 m/s)

Parks – The minimum diameter and grade of a catchbasin lead in a rear yard is 250 mm @ 0.69% (velocity of 1.0 m/s)

1.14.3 Spacing

The desired maximum distance between catchbasins or from a crest in a road to a catchbasin is 90 m, measured along the curb line on each side of the road.

1.14.4 Depth of Cover

The minimum depth of cover over a catchbasin lead is to be 1.5 m within the road allowance and 1.2 m off the road allowance. Where minimum depths cannot be achieved and therefore frost protection is warranted, insulation shall be required as per Detail D-1812-1-2007.

1.14.5 Allowable Ponding

No surface ponding is allowed to develop under a 2 year design storm event. Ponding on major overland flow routes allows for 300 mm on street catchbasins and 450 mm on rear yard catchbasins.

1.14.6 Requirement for Length of Leads

Standard catchbasins (600 mm x 600 mm), maintenance hole catchbasins and maintenance holes are to be constructed/connected in accordance with the following:

- a) Catchbasins within 9.0 m of a maintenance hole are to have their leads connected into the maintenance hole.
- b) Catchbasin leads 9.0 to 15.0 m may have their leads connected into the main sewer.

- c) Catchbasin leads 15.0 to 30.0 m in length may be constructed by:
 - i) Having a catchbasin at one end and the other connected into a maintenance hole or a sewer 900 mm in diameter and larger, or by
 - ii) Having the lead connected into a sewer 825 mm in diameter or smaller at one end with a maintenance hole catchbasin at the other end.
- d) Catchbasin leads over 30.0 m in length, are to be connected into a maintenance hole or a sewer 900 mm in diameter or larger at one end and have a maintenance hole catchbasin at the other end.

1.14.7 Catchbasin Frame and Grates

- a) Catchbasin Cast Iron Frame and Flat Square Grate
To be constructed in conjunction with a catchbasin 600 mm x 600 mm as per OPSD 400.02.
- b) Catchbasin Cast Iron Curb Inlet Overflow Plate
To be constructed in conjunction with curb inlet catchbasin as per OPSD 400.09.
- c) Ditch Inlet, Galvanized Steel, Honey Comb – Grating
To be constructed in conjunction with ditch inlet catchbasin as per OPSD 403.01.

1.14.8 Catchbasin Steps

- a) Maintenance Hole Steps – Hollow
To be constructed as per OPSD 405.010.
- b) Maintenance Hole Steps – Solid
To be constructed as per OPSD 405.020.

1.14.9 Catchbasin Subdrains

Pipe subdrains shall be provided on both sides of all catchbasins installed in hard surface areas. Subdrains are not required in rear lot catchbasins or in a catchbasin located in grassed areas.

All subdrains shall be 150 mm diameter, minimum 3.0 m long, of perforated PVC pipe with geotextile filter sock MIRAFI 150N or Terrafix 200R. Pipe ends to be capped.

1.15 Storm Sewer Inlet and Outlet Structures - Headwalls

Headwalls are required at the end of all storm sewer systems which provide for a transition from the storm sewer to an open channel, river, creek, SWM pond or other received body of storm water. In some cases, headwalls are required at the inlet of a storm sewer and/or large storm drain.

1.15.1 Type of Headwall

The following headwall designs are based on the velocity and in certain cases the diameter of the storm sewer, as per Municipal Works Design Manual (Municipal Engineers Association – MEA) and OPSD.

There are five types of headwall designs:

- a) Under 1.3 m/s with pipe diameters under 600 mm – as per OPSD 804.03
- b) Under 2.1 m/s – MEA Type 1, as per OPSD 804.04 where applicable or detail design modifying of OPSD 804.04.
- c) Between 2.1 – 2.7 m/s – MEA Type 2, as per OPSD 804.04 where applicable or detailed design modifying OPSD 804.04 and 1 baffle post.
- d) Between 2.7 – 4.6 m/s – MEA Type 3, as per OPSD 804.04 where applicable, or detailed design modifying OPSD 804.04 and 3 baffle post
- e) Between 4.6 – 10.0 m/s – MEA Type 4 (stilling basin) or detail design

1.15.2 Concrete Strength

The concrete for all headwalls is to have a minimum strength of 30 MPa with a 5% to 7% air entrainment and 70 to 90 mm slump.

1.15.3 Chamfers

All exposed corners of all headwalls should be chamfered 25 mm or more depending on the size of the headwall.

1.15.4 Weeping Tiles

Weeping tiles are to be provided on each side at the base of the sewer outlet and extended through the headwall. On larger headwalls they shall be placed on the side or wing walls.

1.15.5 Baffle Posts

Baffle posts are to be provided for sewer flows between 2.1 m/s and 4.6 m/s. The locations of posts are per the type of headwall. The height of the baffle posts should be equal to the full depth of flow. Sizing of the posts are 1/6 the size of the pipe diameter together with reinforcing bars.

1.15.6 Grill/Grates

Hot dipped galvanized grills/gates are to be placed over the storm outlets horizontally or vertically as required and should be fixed to the headwall with anchor bolts. Grills and gates as per OPSD 804.05.

1.15.7 Railing

A railing is required on all headwalls which exceed 1.0 m in height from the top of the headwall to the proposed top of slope, as per OPSD 980.101.

1.15.8 Rip Rap/Rock Protection

Rip rap is to be constructed as per OPSD 810.01 at the end of headwalls, on the bottom and sides up to design water level, downstream until the projected side wall meets the channel slope at half the design water depth of flow, and at creeks and rivers.

PART 2 - MATERIAL**2.1 Pipe Material**

Both rigid and flexible pipe are permitted in the construction of storm sewer systems including private drain connections. These materials include PVC, concrete and HDPE pipe. All materials shall be CSA certified. **Field cut tees will not be permitted.** On private property, materials for storm sewers and private sewers shall comply with Part 7 of the OBC.

The Contractor will get approval for pipe selection from the County Engineer prior to supplying the material to the site.

PVC

- a) Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2) – 100 mm – 600mm inclusive. Storm PVC main shall be SDR 35 as per OPSS 1841.
- b) Polyvinyl chloride (PVC) pipe – ribbed (CSA B182.4) – 200 mm – 600 mm pipe inclusive.

Storm services must be PVC SDR-28 (white) and have a factory placed tee at the main. All PVC and fabricated moldings shall be CSA certified.

Concrete

Trench conditions shall be determined by the Consulting Engineer. Trench conditions shall be as per OPSD 807.010, 807.030, and 807.040. Concrete pipe material must comply with the following CSA requirements.

- a) Non-Reinforced – CAN/CSA257.1 Class 3 concrete for pipes 450 mm or less in diameter.
- b) Reinforced – CAN/CSA257.2 65-D concrete for pipes more than 450 mm in diameter.

HDPE

High-density polyethylene (HDPE) double wall smooth interior annular profile pipe (CSA B182.6) with integral bell and spigot (Boss Poly-Tite) for use on storm sewer only (200 mm to 600 mm inclusive).

2.2 Directional Drilling Material

Pipe material used for directional drilling shall be HDPE DR11 DIPS (Brown Stripe) or PVC. PVC pipe used for the directional drilling process must meet or exceed the pressure rating of HDPE DR 11.

For directional drilling of PVC pipe only the “Terra Brute”, “Cobra Lock” or fusible PVC jointing process shall be permitted. Inside diameters shall meet or exceed typical sizing requirements associated with PVC pipe.

HDPE 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.

2.3 Bedding Material

As per OPSS 1010

PART 3 - INSTALLATION

The installation of storm sewers shall be as per OPSS 401, 404, 410, 517, and 1010 with the following exceptions/amendments.

SECTION A - OPEN CUT**3.1 Line and Grade**

- a) Contractors shall provide stakes to indicate the line and grade of the storm sewer as well as the location of fittings, bends, tees, reducers and plugged or capped dead-ends in accordance with the approved drawings before beginning any work. Line and grades shall be marked a minimum of 20 m to a maximum of 50 m. Mains shall be laid and maintained to the required grades and locations with all fittings, etc. to be plumb and in accordance with the drawing locations. No deviation in excess of 150 mm will be permitted.
- b) Contractors shall carry out explorations where necessary to establish or discover the location and elevation of existing pipes, conduits or other buried objects.

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 Density.

3.3 Excavation and Trench Preparation

- a) 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.
- b) Where trench excavations are not kept within the design limits of the pipe, the County Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.
- c) Where the sub grade in its natural state is inadequate to support the pipe, the County Engineer will give instructions as to the proper procedure.
- d) The sub grade shall be removed where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by the County Engineer.

3.4 Dewatering

- a) Always maintain the excavation free of water.
- b) Do not use storm sewers for the discharge of water from the trench.

3.5 Lowering & Laying

- a) Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by the County Engineer shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.
- b) 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.
- c) 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 the noon hour as well as overnight. The trench shall be kept dry and free from water, no pipe shall be laid in water except by permission of the County Engineer. No water shall be allowed to run through installations during construction.
- d) 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.
- e) Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted by the County Engineer.
- f) 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 with the maximum allowable deflections not being exceeded. Pipe deflection will be done as per manufacture's specifications. If in the opinion of the Inspector, the deflection is excessive they will order the job stopped. The County Engineer or their representative, if they deems it required, will order the installation of specials in order to provide the required deflection. Offset locations and details shall be shown on Construction and As-Constructed Plans.
- g) When a new sewer crosses existing utilities, or where an existing watermain is undermined during laying operations, the County Engineer may order the installation of support beams. Support beams shall be approved by the County Engineer prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. The County Engineer shall decide the method to be used. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to a minimum of 95 percent Standard Proctor density. Pipe must not be laid on blocks.
- h) No pipe shall be laid until the preceding pipe joint has been compacted and the pipe carefully embedded and secured in place.

- i) 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.
- j) Installations shall be kept thoroughly clean throughout, during the progress of the work and until the completion and final acceptance thereof. They shall be left clean on the completion of the work.
- k) The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the drawings. Where vertical or horizontal curves are shown, the pipe line shall not deviate more than 300 mm from line, no more than 75 mm from grade.

3.6 Bedding

For the purpose of this specification all materials placed between the trench bottom and 300 mm over the top of the pipe shall be considered as bedding. Bedding around the sewer and services may be granular material or clean screened sand.

- a) Granular materials greater than 19 mm in size shall not be used for pipe bedding. Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.
- b) Bedding material shall be placed full width of trench. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.
- c) The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

3.7 Backfilling

- a) Backfill shall be considered as starting from 300 mm over top of the pipe. All materials below this point shall be considered as bedding.
- b) If the County Engineer 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 the County Engineer.
- c) 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 250 mm.

Backfill material shall be placed in lifts not exceeding 300 mm and compacted to a minimum 95 Percent Standard Proctor Density.

- d) 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 the County Engineer or other road authority. Backfill on all County road allowances in the travelled portion of the roadway shall be granular material as set out in the Ontario Provincial Standards.

Installation of material will be as directed by the County Engineer or other road authority.

- e) The Inspector may order the trench to be bedded by hand from the bottom of the trench to the centre line of the pipe with sand, placed in layers of 75 mm and compacted by vibratory equipment. Bedding material shall be deposited on each side of the pipe simultaneously.
- f) From the centre line of the pipe, fittings and appurtenances to a depth of 300 mm above the top of the pipe shall be backfilled by machine or by methods approved by the Inspector. The type of backfill material used shall be sand, gravel or approved excavated material. The Contractor shall use special care in placing and compacting this portion of the backfill so as to avoid damaging or moving the pipe.
- g) No frozen material shall be used for backfilling nor shall backfilling be carried out where material in the trench is frozen.
- h) 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.

3.8 Compaction Test

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

- a) When tests show that the compaction does not meet the specified requirement, the Contractor will carry out further compaction in a manner directed by the County Engineer, and pay for further testing to establish proof of the specified compaction.
- b) For backfill compaction, tests will be performed in accordance with the testing company's recommendations.
- c) Co-operate with the County Engineer and testing company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

SECTION B - DIRECTIONAL DRILLING

3.9 Scope

This specification covers the requirements for the installation of pipes by horizontal directional drilling.

3.10 Definitions

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.

3.11 Submission and Design Requirements

3.11.1 Submissions

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

- a) Direction boring equipment and specifications;
- b) Sequence of operation;
- c) Location of entry and exit points;
- d) Location of positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- e) Disposal site for cuttings;
- f) Dewatering plan; and
- g) Slurry management plan.

3.11.2 Design Requirements

Procedures, materials, and water management plan are to be acceptable to the Ministry of Environment and Climate Change (MOECC), 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.

3.11.3 Record Drawing Requirements

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

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

3.12 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 the County Engineer.

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.

3.13 Construction

3.13.1 General

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

3.13.2 Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall not be modified without written consent from the County Engineer.

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.

3.13.3 *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 ± 100 mm over the total distance between the ground entry and exit points.

3.13.4 *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.

3.13.5 *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:

- a) Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- b) 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
- c) Location of other surface features (eg. adjacent structures, walkways, fences, poles, trees, etc.)
- d) Location of other underground features (eg. utilities, foundations, etc.)
- e) Protection of water courses against the transport of excavated or other materials into receiving waters.

3.13.6 *Pipe Installation*

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. PVC pipe shall be joined using the jointing process. 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.

3.13.7 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 MOECC guidelines, policies and regulations.

SECTION C - CONNECTIONS

3.14 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 storm sewer. The method of connecting shall be determined by the County Engineer. The Contractor shall submit a program for this work which shall be approved by the County Engineer before the work commences.

3.15 Jointing of Push on Joint Pipes

- a) 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.
- b) The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer's recommendations.
- c) On straight lengths, no lateral deviation in excess of 150 mm will be tolerated and on straight grades no grade deviation in excess of 75 mm will be tolerated.

PART 4 – SERVICE INSTALLATION

Storm sewer private drain connections (PDC's) are not permitted on County Roads or in the City of Woodstock. If a storm PDC is required it will be as approved by the County Engineer or local municipality. Storm sewer PDC's when required shall be installed as described in this section.

4.1 Location

Private Drain Connections (PDC's) to single family, semi-detached and row housing lots are to be located in accordance with Figure 1.1, Section-1 General. Location of storm and sanitary services on lots in the Town of Tillsonburg may vary from Figure 1.1. Location must be confirmed with the Town of Tillsonburg.

All PDC's shall be installed a minimum of 1.0 m past property line on all new construction.

No PDC's are to be connected directly into a maintenance hole unless design constraints arise (i.e. cul-de-sac). This design must be approved by the County Engineer.

PDC's on private property of town house complexes, row housing and apartments are to be connected to a maintenance hole located on the R.O.W.

PDC's for industry and commercial property are also to be connected to a maintenance hole located on the R.O.W.

All PDC's shall be installed perpendicular to the sewer main using factory supplied tees, where possible. Under no circumstances will flow from the PDC enter the main against the flow in the main. Connections shall be as per OPSD 1006.020.

Where there is a conflict with the proposed PDC location due to a 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.

4.2 Minimum Size and Grade

All commercial, industrial, and institutional private drain connections shall be sized according to the design criteria and must be shown on all design sheets and drawings for approval by the County Engineer. The following are the minimum standards:

- a) For residential, single family and semi-detached homes, the minimum diameter of pipe is 100 mm with a minimum allowable grade of 2.0%.
- b) For multi-family block, the minimum diameter of pipe is 300 mm with a minimum grade of 1.0%
- c) For commercial, the minimum diameter of pipe is 300 mm with a minimum allowable grade of 1.0%.
- d) For institutional and industrial, the minimum diameter of pipe is 375 mm with a minimum allowable grade of 1.0%.

4.3 Connections to Maintenance Holes/Sewers

When connecting PDC's to existing sewers in a lot infill situation, connections must be made with an approved saddle or premanufactured tees, as per OPSS 410 and OPSD 1006.020. Drop structures for maintenance holes shall be as per OPSS 1003.010, 1003.020, 1003.030, and 1003.031.

a) Residential

PDC's of 100 mm, 150 mm, 200 mm, and 250 mm in diameter must be connected to the main sewer. No storm PDC's of this size are to be connected into any maintenance hole.

b) Multi-family, Commercial, Institutional and Industrial

PDC's of 300 mm in diameter or larger are to be connected to the main sewer at maintenance holes, except in the cases where the main sewer is 900 mm in diameter or larger, in which the PDC may be connected directly into the sewer.

c) Connections to Existing Sewers

In situations of a lot severance or lot infill where a new storm service will be connected to an existing main, the advocate of the severance/infill, or their agent, must determine if the existing sewer is at risk for surcharging or has a history of surcharging. This information, if available, may be obtained from the County or the County of Oxford's service provider.

If it is determined that there is a surcharge risk, then the development advocate must provide surcharge protection to their development. Connection can only occur if a County Waste Water Collection Operator is present. When connecting to existing manholes only cored holes with proper rubber connectors are acceptable. Written notice is required 48 hours in advance to schedule an inspection.

4.4 Vertical Clearance

As outlined in 1.12 of this Section, the County has established a minimum clearance, when storm sewers cross other services. In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance is required between the two pipes.

Watermain or services crossing sewers or utility obstructions require a minimum 500 mm of clearance under and a minimum of 150 mm over the obstruction. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

Where there is conflict in crossing existing utilities, and the utility is unable to relocate, a separation of 0.15 m is required between the two.

4.5 Risers

Risers may be required in situations where there is a conflict of sewers or a greater than expected grade change. These risers must be manufactured, approved, supplied and placed as per OPSD 704.010.

4.6 Cleanouts

Where PDC's cleanouts are required within the R.O.W., approval must be granted by the County Engineer.

Where private maintenance hole cleanouts are required, they shall be located off of the R.O.W. For private PDC cleanouts, Part 7 of the OBC takes precedence.

4.7 Depth

The minimum depth of a storm PDC shall be 1.2 m from the finished property line elevation to the obvert of the pipe. In existing areas where new sewers are being constructed, the depth of service at property line may vary based on main line sewer designs and existing topography. The County of Oxford does not guarantee basement drainage.

Where storm PDC's are installed at depths of 3.5m or greater, laterals shall require a controlled settlement joint fitting. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The controlled settlement joint permits axial movement of the riser when laterals are placed in deep excavations.

4.8 Marking and Recording of PDC Service Connections

Brown painted surface stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the storm PDC. These stakes shall extend from PDC invert to minimum 500 mm about finished boulevard grade.

Once the PDC has been placed, a record of its location must be produced for the As-Constructed drawings and provided digitally to the County as per Figure 1.3, Section-1 General.

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

4.9 Thermal Insulation

Rigid Board Insulation – Slab Type

No watermain or water service shall have a ground cover less than 1.0 m deep from ground surface to the top of pipe. Insulation is required on all new or existing water services if minimum cover cannot be achieved.

For watermains crossing underground structures or conduits where minimum cover cannot be achieved, a "Frost Box" is required.

Watermains and services located 500 mm or less horizontally from a manhole or catchbasin shall require a minimum of 50 mm thick insulation. Insulation shall be installed to a minimum of 1.0 m each side of the structure.

Water services crossing over or under storm sewer requires a minimum 500 mm of clearance. In instances where clearance is 500 mm or less from storm sewers the water service shall require insulation.

Insulation shall be installed to a minimum of 1.0 m from the outside wall on both sides of the storm sewer. 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. Manufactures specification of material shall be provided prior to installation.

Refer to Detail D1812-1-2007 for Rigid Board Insulation – Slab Type.

PART 5 – FIELD TESTING

5.1 General

The Contractor shall undertake a video inspection after cleaning and flushing as per OPSS 409 for all sewers upon completion of installation. After completion of the 2 year maintenance period, the sewers shall be videoed again to ensure there are no defects in material or installation. 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.

5.2 Cleaning and Flushing Sewers

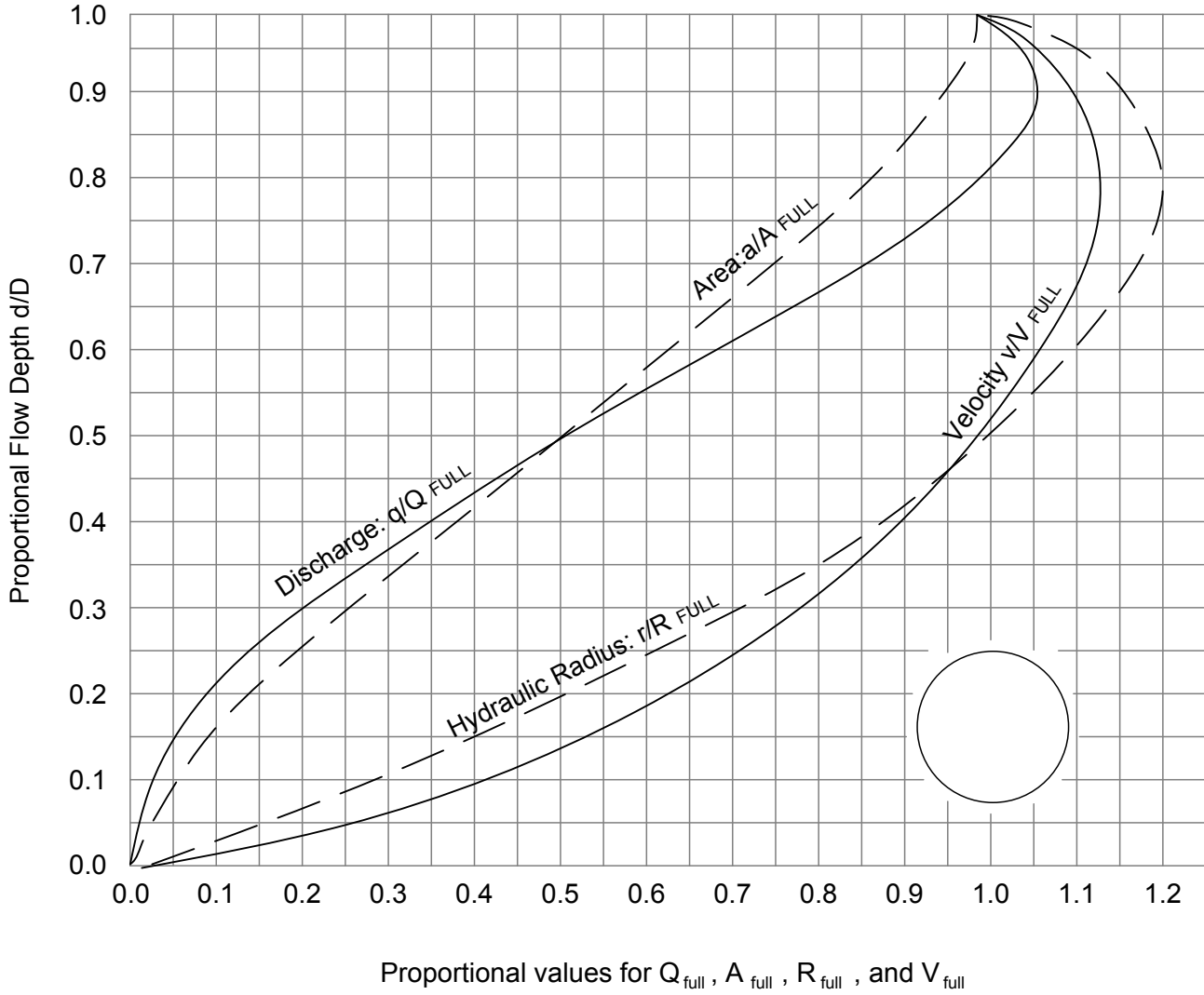
Contractors are not permitted to flush the new sewer lengths into existing sewers. Contractors shall provide and place temporary plugs where necessary to prevent silt and debris from entering existing sewers.

Where silt and debris has entered the existing sewers as a result of construction activities, the existing sewer lengths and manhole structures shall be inspected by the County Engineer. Once the affected areas have been identified, the Contractor shall clean, flush and video those sections as directed by the County Engineer at their own expense.



SECTION 5 – STORM

FIGURES



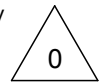
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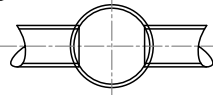
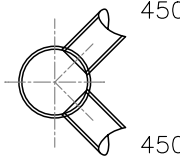
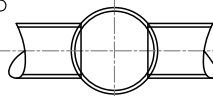
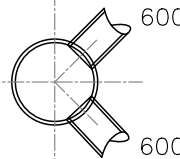
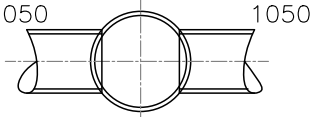
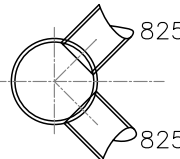
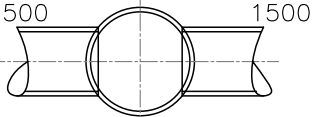
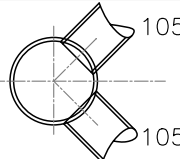
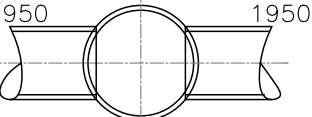
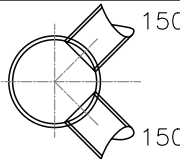
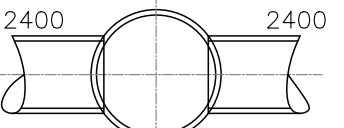
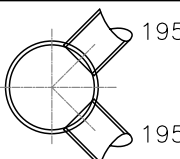
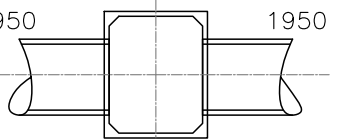
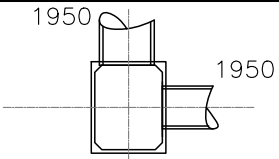
HYDRAULIC ELEMENTS OF CIRCULAR PIPE

DWG FIG 5.2

DATE DEC. 2008

REV



MAINTENANCE HOLE INSIDE DIAMETER (mm)	MAX. PIPE SIZE FOR STRAIGHT THROUGH INSTALLATION (mm)	MAX. PIPE SIZE FOR RIGHT ANGLE INSTALLATION (mm)
1200	600 	450 
1500	825 	600 
1800	1050 	825 
2400	1500 	1050 
3000	1950 	1500 
3600	2400 	1950 
3000 x 2400	1950 	1950 

1. ALL DIMENSIONS ARE FOR CONCRETE PIPE.
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. KNOCKOUTS FOR SMALL DIAMETER CATCH BASINS 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

MAXIMUM PIPE SIZES FOR PRECAST MAINTENANCE HOLES

DWG FIG. 5.3

DATE NOV 2008

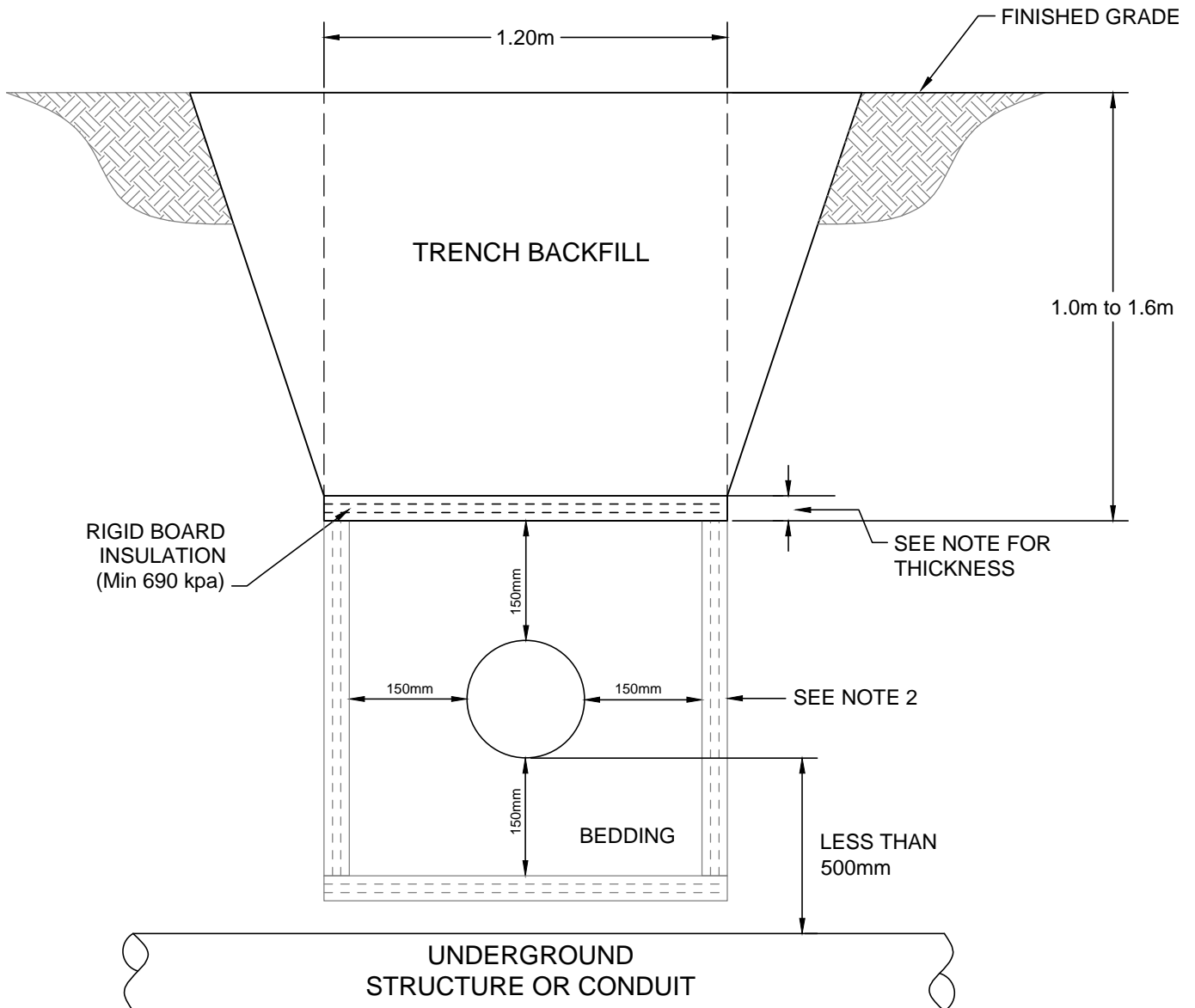
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**SECTION 5 – STORM
DETAILS**

1.
 - IF GROUND COVER IS LESS THEN 1.0m LOWER WATER MAIN TO 1.8m.
 - IF GROUND COVER IS 1.0m-1.3m USE 75mm THICK INSULATION.
 - IF GROUND COVER IS 1.3m-1.6m USE 50mm THICK INSULATION.
2. FOR CROSSING OR UNDERGROUND STRUCTURES OR CONDUIT A "FROST BOX" IS REQUIRED.
3. FOR WATERMAIN AND SERVICES LOCATED 500mm OR LESS HORIZONTALLY ADJACENT TO MANHOLES OR CATCHBASIN REQUIRES A MINIMUM 50mm INSULATION IS REQUIRED.
4. INSULATION IS REQUIRED ON ALL NEW OR RECONSTRUCTED WATER SERVICES IF ADEQUATE COVER AS LISTED ABOVE CANNOT BE ACHIEVED.



OXFORD COUNTY

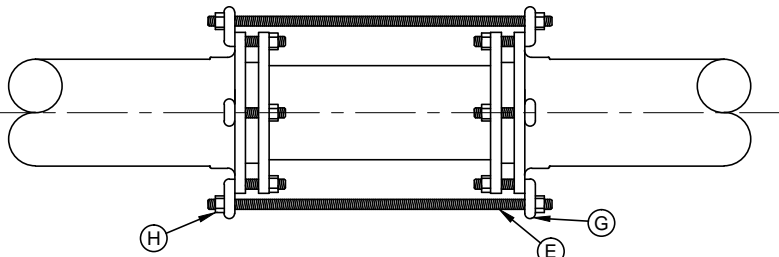
RIGID BOARD INSULATION-SLAB TYPE FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

DWG D 1812-1-2007

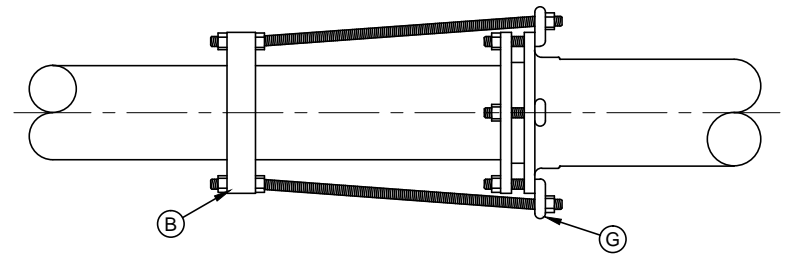
DATE NOV. 2007

REV

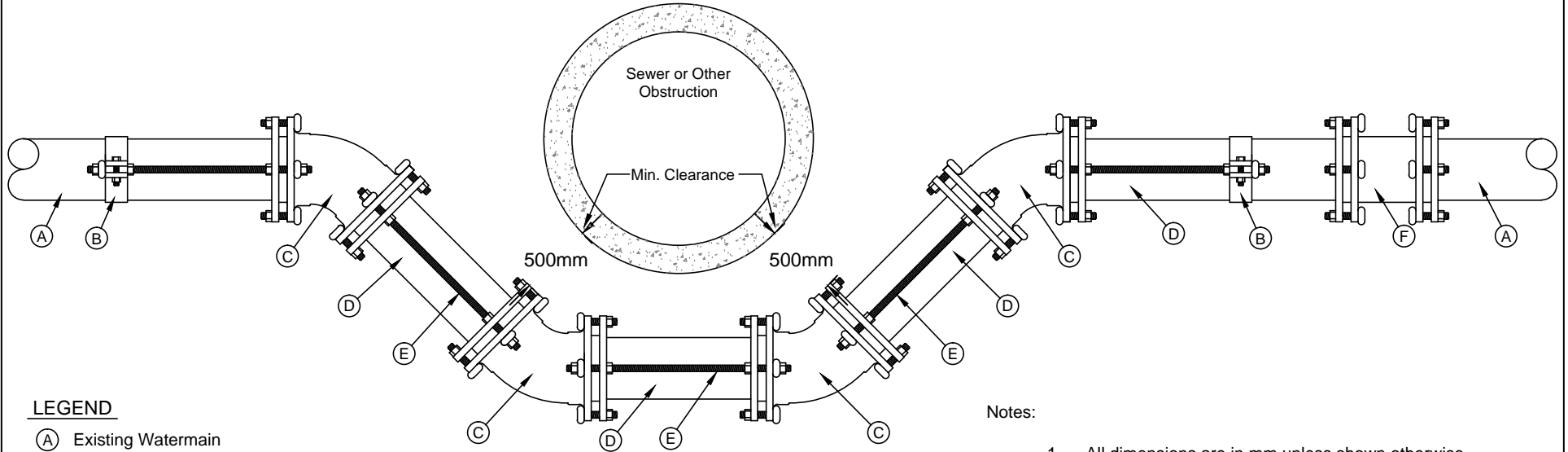




Tie Rod Assembly

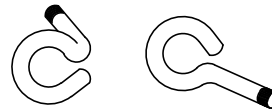


Tie Rod Assembly Using Clamp



LEGEND

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Tie Bolt Joint Restrainer
- (H) Tie Nut



Tie Bolt Joint Restrainer

Notes:

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Insulation may be required, Refer to D1812-1-2007

OXFORD COUNTY

MECHANICAL JOINT OFFSET INSTALLATION-UNDER

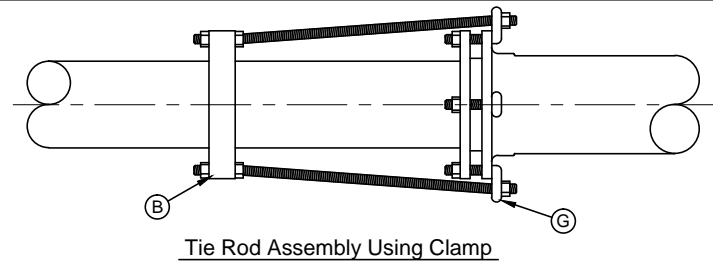
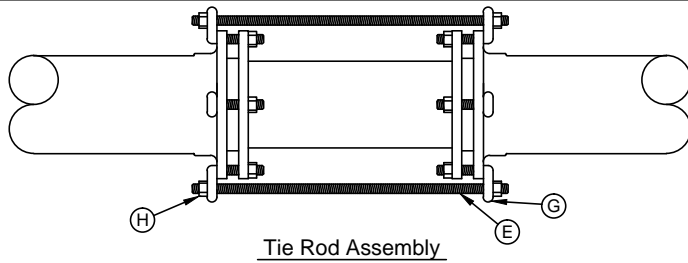
DWG D 1832-1-1993

DATE NOV. 2008

REV



2

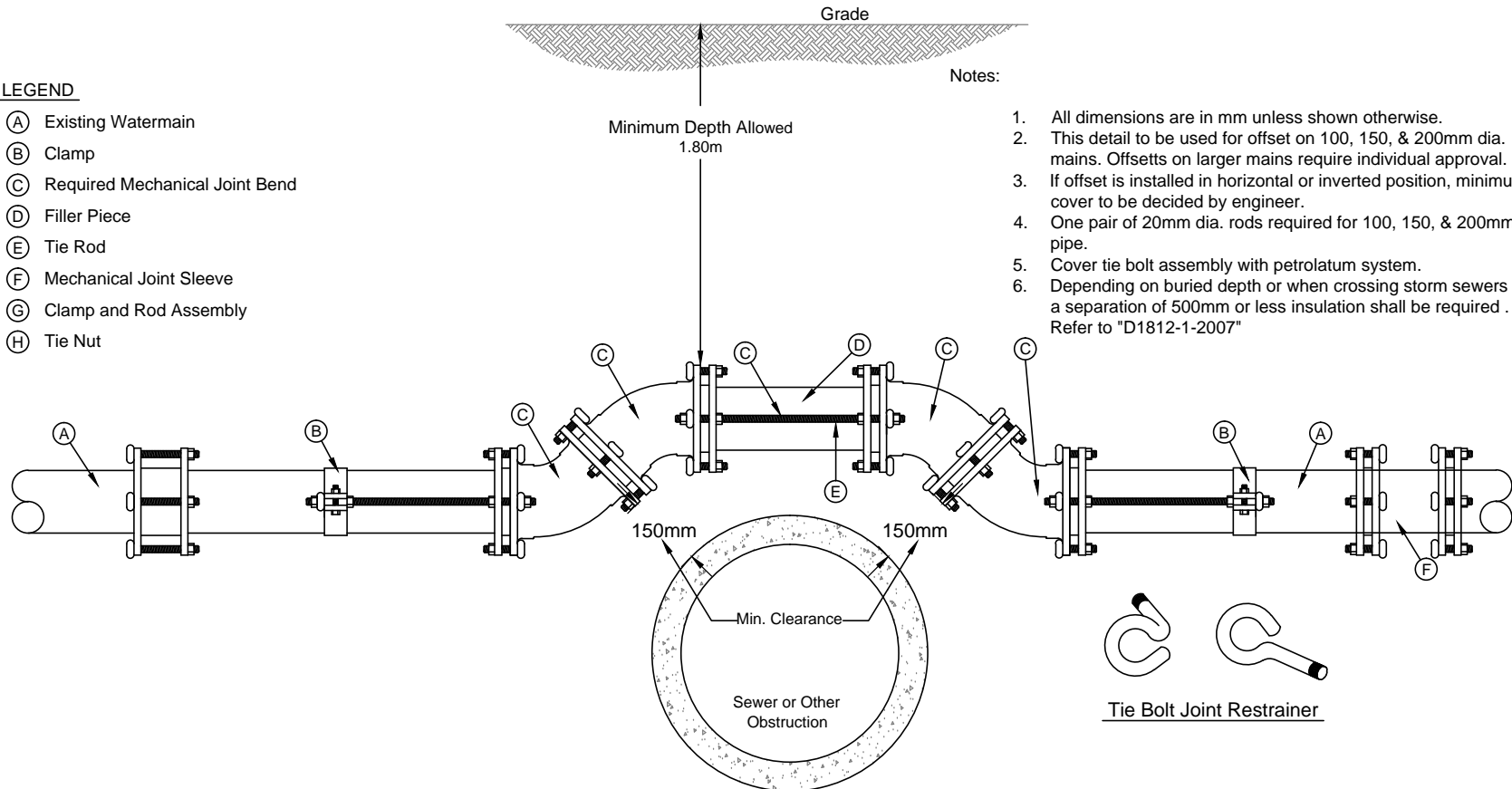


LEGEND

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Clamp and Rod Assembly
- (H) Tie Nut

Notes:

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Depending on buried depth or when crossing storm sewers with a separation of 500mm or less insulation shall be required. Refer to "D1812-1-2007"



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MECHANICAL JOINT OFFSET INSTALLATION-OVER

DWG D 1833-1-1993

DATE NOV. 2008

REV 2