CONSTRUCTION SPECIFICATION FOR MANURE PIPELINE INSTALLATION IN OPEN CUT

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413.01 SCOPE

This specification covers the requirements for installing permanent manure pipelines in open cut.

413.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be as specified in the Contract Documents.

413.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

413.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 206	Grading
OPSS 401	Trenching, Backfilling, and Compacting
OPSS 404	Support Systems
OPSS 490	Site Preparation for Pipeline, Utilities, and Associated Structures
OPSS 491	Preservation, Protection, and Reconstruction of Existing Facilities
OPSS 492	Site Restoration Following Installation of Pipelines, Utilities, and Associated Structures
OPSS 517	Dewatering of Pipeline, Utility, and Associated Structure Excavation
OPSS 539	Temporary Protection Systems

Ontario Provincial Standard Specifications, Material

OPSS 1350	Concrete - Materials and Production
OPSS 1842	Pressure Polyethylene Pipe Products

CSA Standards

B137.2-13	PVC Injection-Moulded Gasketed Fittings for Pressure Applications [Part of CAN/CSA-B137-02, Thermoplastic Pressure Piping Compendium - B137 Series]
B137.3-13	Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications [Part of CAN/CSA-B137-02, Thermoplastic Pressure Piping Compendium - B137 Series]

ASTM International

A 153/A 153M-09	Zinc Coating (Hot Dip) on Iron and Steel Hardware
A 276-13a	Stainless Steel Bars and Shapes
A 307-12	Carbon Steel Bolts, Studs, and Threaded Rods 60,000 PSI Tensile Strength
B 633-13	Electrodeposited Coatings of Zinc on Iron and Steel
B 766-86 (2008)	Electrodeposited Coatings of Cadmium
D 3139-98 (2011)	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

American Water Works Association (AWWA)

C104/A21.4-13	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
C110/A21.10-12	Ductile-Iron and Gray-Iron Fittings
C111/A21.11-12	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
C153/A21.53-11	Ductile-Iron Compact Fittings
C509-09	Resilient-Seated Gate Valves for Water-Supply Service

American Society of Mechanical Engineers (ASME)

B18.2.1-2012	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series), Includes Errata (2013)

413.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Backfilling means as defined in OPSS 401.

Excavation, Earth and Rock means the excavation classified as earth and rock according to OPSS 206.

Fitting means connections, appliances, and adjuncts designed to be used in connection with pipes. Examples are: elbows and bends to alter the direction of a pipe; tees and crosses to connect a branch with a sewer main; plugs and caps to close a pipe end; and bushings, diminishers, or reducers to couple two pipes of different diameters.

Manure Pipeline means an installation designed for the conveyance of liquid manure under pressure using circular pipe.

413.05 MATERIALS

413.05.01 General

Pipe size shall be according to the requirements specified in the Contract Documents. Pipe material and class shall be as specified in the Contract Documents.
Pipe smaller than 100 mm in diameter shall not be used.

Fittings shall be suitable for and compatible with the pipe material and class with which they will be used.

413.05.02 Polyvinyl Chloride Pipe Products

Polyvinyl chloride pipe and fittings shall be according to CSA B137.3 and supplied from a plant approved by an organization accredited by the Standards Council of Canada.

Flexible elastomeric seals for bell and spigot joints shall be according to ASTM D 3139.

Fittings shall be either:

a) gray iron according to AWWA C110/A21.10;

b) ductile iron according to AWWA C110/A21.10 or AWWA C153/A21.53, and shall be cement lined according to AWWA C104/A21.4;

c) injection moulded polyvinyl chloride according to CSA B137.2; or

d) prefabricated polyvinyl chloride pipe diameters 200 mm and larger according to CSA B137.3.

413.05.03 Polyethylene Pipe Products

Polyethylene pressure pipe shall be according to OPSS 1842.

Fitting shall be either:

a) flanged gray iron according to AWWA C110/A21.10;

b) flanged ductile iron according to AWWA C110/A21.10 or AWWA C153/A21.53 and shall be cement lined according to AWWA C104/A21.4; or

c) polyethylene according to OPSS 1842.

Ductile iron pipe and fittings shall be cement lined according to AWWA C104/A21.4.

413.05.04 Valves

413.05.04.01 General

All valves shall open by operating in a counter-clockwise direction.

Valves shall be designed for a minimum cold water working pressure of 1,035 kPa.

Valves shall be cast or ductile iron gate valves.

Fasteners shall be made from material meeting the strength requirements of ASTM A 307 with dimensions according to ANSI ASME B18.2.1. Bolts, studs, and nuts shall be cadmium plated according to ASTM B 766 or zinc coated according to ASTM A 153M or ASTM B 633. Fasteners for mechanical joints shall be ductile iron according to AWWA C111/A21.11.

413.05.04.02 Gate Valves

Gate valves shall be according to AWWA C509.

Stem sealing on non-rising stem valves shall utilize O-ring type seals that do not require adjustment.

The gate valve end configuration shall be as specified in the Contract Documents.

413.05.04.03 Air Release and Air/Vacuum Valves

Air release and air/vacuum valves shall be sewage type.

413.05.05 Risers

Riser type shall be as specified in the Contract Documents.

413.05.06 Concrete

Concrete for thrust blocks and fitting and appurtenance supports shall be according to OPSS 1350 with a nominal minimum 28-Day compressive strength of 20 MPa.

413.05.07 Straps, Tie-Rods, Angles, Nuts, and Bolts

Stainless steel straps, tie-rods, angles, nuts, and bolts used with concrete thrust blocks shall be according to ASTM A 276, Type 316 stainless steel.

413.07 CONSTRUCTION

413.07.01 Site Preparation

Site preparation shall be according to OPSS 490.

413.07.02 Preservation and Protection of Existing Facilities

Preservation and protection of existing facilities shall be according to OPSS 491.

413.07.03 Protection Against Floatation

Damage to the pipeline due to floatation shall be prevented during construction and until completion of the work.

413.07.04 Cold Weather Work

All work shall be protected from freezing. Pipe and bedding material shall not be installed on frozen ground.

413.07.05 Transporting, Unloading, Storing, and Handling Materials

All pipes, fittings, and gaskets that are unsound or damaged shall be rejected.

Manufacturer's recommendations for transporting, unloading, storing, and handling of materials shall be followed.

413.07.06 Excavation

Excavation for the placement of forcemains shall be according to OPSS 401.

413.07.07 Support Systems

Support systems shall be according to OPSS 404.

413.07.08 Dewatering

Dewatering shall be according to OPSS 517.

413.07.09 Temporary Protection Systems

The construction of all temporary protection systems shall be according to OPSS 539. Where the stability, safety, or function of an existing roadway, railway, other works, or proposed works may be impaired due to the method of construction, such protection as may be required shall be provided. Protection may include sheathing, shoring, and the driving of piles where necessary to prevent damage to such works or proposed works.

413.07.10 Installation of Pipe

Pipe shall be laid in a dry trench.

Ends of pipe shall be kept clean.

Pipe shall be laid within the alignment and grade tolerances specified in the Contract Documents. The barrel of each pipe shall be in contact with the shaped bed throughout its full length.

Pipe shall be kept clean and dry as work progresses. A removable watertight bulkhead shall be installed at the open end of the last pipe laid whenever work is suspended.

Pipe shall not be laid until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

413.07.11 Jointing

413.07.11.01 General

Joint surfaces shall be clean. Pipe ends shall be lubricated with material recommended by the pipe manufacturer.

Manufacturer’s instructions for jointing of pipe shall be followed.

Joints and all connections shall be made watertight.

All bolts, nuts, coupling, rubber rings, and connecting pieces shall be cleaned thoroughly prior to installation.

Pipe shall be aligned on centreline to previously laid pipe.

Pipe shall be pulled or pushed only by a hand-operated winch. A backhoe shall not be used for pushing pipe.

Joints shall be prevented from opening after the pipe has been laid.

413.07.11.02 Polyvinyl Chloride Pressure Pipe

Joints shall be bell and spigot with rubber gaskets. If gaskets are supplied separately, they shall be inserted in the groove of the bell end of the pipe.

The spigot shall be lubricated. The spigot end shall be inserted and pushed into the bell until the second reference mark is flush with the face of the bell.

413.07.11.03 Polyethylene Pressure Pipe

Polyethylene pipe 100 mm diameter and larger shall be joined by the thermal butt fusion process. Procedures recommended by the pipe manufacturer shall be followed.

Connections to non-polyethylene fittings and appurtenances shall be made with flanged joints according to the manufacturer's recommendations. Bolts shall be tightened to the torque specified by the manufacturer for the particular size and type of stub end.

413.07.12 Cutting of Pipe

Whenever cutting of pipe is required, the pipe shall be cut according to the recommendations of the pipe manufacturer.

413.07.13 Change in Line and Grade

413.07.13.01 Polyvinyl Chloride Pipe

Polyvinyl chloride pressure pipe joints may be deflected, but shall not exceed manufacturer's recommendations. Otherwise, fabricated bends shall be used.

413.07.13.02 Polyethylene Pipe

Use of pipe flexibility may be allowed, but shall not exceed manufacturer's recommendations.

413.07.14 Installation of Valves

413.07.14.01 General

The work of installing valves shall include the valves and couplings, and when specified in the Contract Documents, valve boxes. Valves shall be installed at locations and be of the type specified in the Contract Documents. Valves and connecting pipes shall be aligned accurately and supported as specified in the Contract Documents.

413.07.14.02 Air Release and Air/Vacuum Valves

Air release and air/vacuum valves shall be installed at locations specified in the Contract Documents.

Each air release and air/vacuum valve shall be provided with an isolating valve.

413.07.15 Installation of Riser Sets

The work of installing riser sets shall include the placing of risers, riser isolating valves, riser tees, restraining devices, riser caps, and safety and support devices.

Riser sets shall be installed at locations specified in the Contract Documents.

413.07.16 Thrust Restraints

All connections, caps, and bends shall be restrained by concrete blocking or restrained joints as specified in the Contract Documents. Concrete for thrust blocks shall be placed against undisturbed ground. Joints and couplings shall remain free from concrete.

413.07.17 Backfilling and Compacting

Backfilling and compacting shall be according to OPSS 401.

413.07.18 Hydrostatic Testing

413.07.18.01 General

Hydrostatic testing shall be conducted under the supervision of the Contract Administrator upon completion of the pipeline, including backfilling.

A test section shall be either a section between valves or the completed pipeline.

Test pressure shall be 1,035 kPa.

The test section shall be filled slowly with water and all air shall be removed from the pipeline. A 24-hour absorption period may be allowed before starting the test. The test section shall be subjected to the specified continuous test pressure for two hours.

413.07.18.02 Polyethylene Pipe

The test procedure shall consist of initial expansion and test phases.

During the initial expansion phase, the test section shall be pressurized to the test pressure and sufficient make-up water added each hour for 3 hours to return to test pressure. After the initial expansion phase, the test phase shall begin.

The test phase shall be 2 hours after which a measured amount of make-up water is added to return the test pressure. If the amount of make-up water added does not exceed the values shown in Table 1, leakage is not indicated.

If the amount of make-up water exceeds the values shown in Table 1, all leaks shall be located and repaired and the test section shall be retested until a satisfactory result is obtained.

The test duration should not exceed 8 hours. If the pressure test is not completed, the test section shall be de-pressurized and allowed to relax for 8 hours prior to bringing the test section up to pressure again.

413.07.18.03 Other Pipe

The test section shall be subject to the specified continuous test pressure for 2 hours.

The leakage is the amount of water added to the test section to maintain the specified test pressure for the test duration. The measured leakage shall be compared with the allowable leakage as calculated for the test section. The allowable leakage is 0.082 litres per millimetre of pipe diameter per kilometre of pipe for the 2-hour test period.

If the measured leakage exceeds the allowable leakage, all leaks shall be located and repaired and the test section shall be retested until a satisfactory result is obtained.

413.07.19 Cleaning and Flushing Pipe

All pipe shall be cleaned and flushed.

413.07.20 Site Restoration

Site restoration shall be according to OPSS 492.

413.07.21 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

413.09 MEASUREMENT FOR PAYMENT

413.09.01 Actual Measurement

413.09.01.01 Pipeline

Measurement of pipeline shall be by length in metres along the horizontal centreline of the pipe from the point of connection to portable equipment or existing pipeline to a point vertically above the end of the new pipeline.

413.09.01.02 Valves

For measurement purposes, a count shall be made of the number of valves installed regardless of the type and size.

413.09.01.03 Riser Sets

For measurement purposes, a count shall be made of the number of riser sets installed regardless of the type.

413.09.01.04 Connections to Existing Pipelines

For measurement purposes, a count shall be made of the number of connections to existing pipelines.

413.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

413.10 BASIS OF PAYMENT

413.10.01 Pipeline - Item
Valves - Item
Riser Sets - Item
Connections to Existing Pipelines - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

When the Owner raises or lowers the invert of a pipeline by up to 150 mm, it shall not constitute a Change in the Work and adjustment shall not be made to the payment. Where the invert of a pipeline is raised or lowered by more than 150 mm, this shall then constitute a Change in the Work for the full extent of the change from the original grade.

TABLE 1
Test Phase Make-Up Amount for Pressure Polyethylene Pipe

Pipe Diameter mm	Make-Up Water litre/km
100	31.0
150	74.5
200	124.2
250	161.4
300	285.6
350	335.2

Appendix 413-A, November 2019
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer may consider including soil boring data, a geotechnical report, a subsurface report, or a soils report in the Tender Documents.

The designer should include the following in the Contract Documents:

- Pipe size, material, and class. (413.05.01)
- Gate valve end configuration. (413.05.04.02)
- Type of risers. (413.05.05)
- Alignment and grade tolerances for the pipe installation. (413.07.10)
- Valve type, location, and support. (413.07.14.01)
- Air release and air/vacuum valve locations. (413.07.14.02)
- Locations of riser sets. (413.07.15)
- Type of thrust restraints. (413.07.16)

The pipe diameter should be adequate to develop a flow velocity of 0.8 to 2.5 m/s in the pumping system.

Corrosion protection system provisions should be specified, if appropriate.

Tracer wire or tracer tape should be specified, if appropriate

Under conditions of high ground water, external fluids may enter via air release and air/vacuum release valves; therefore, appropriate measures should be taken.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 1103.010	Concrete Thrust Blocks for Tees, Plugs, and Horizontal Bends
OPSD 1103.020	Concrete Thrust Blocks for Vertical Bends