

1.1 GENERAL

RELATED REQUIREMENTS

.1

MEASUREMENT PROCEDURES

- .1 Measure trenching and backfilling, other than granular bedding and surround in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Measure water main including trenching and backfilling, in metres of each size of pipe installed.
 - .1 Horizontal measurement will be made over surface, through valves and fittings, after work has been completed.
- .3 Measure valves in units installed including excavation and backfilling, valves and valve boxes and thrust blocks.

REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-[10], Standard for Hypochlorites.
 - .2 ANSI/AWWA B301-[10], Standard for Liquid Chlorine.
 - .3 ANSI/AWWA B303-[10], Standard for Sodium Chlorite.
 - .4 ANSI/AWWA C104/A21.4-[08], Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - .5 ANSI/AWWA C105/A21.5-[10], Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .6 ANSI/AWWA C111/A21.11-[07], American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
 - .7 ANSI/AWWA C110/A21.10-[08], American National Standard for Ductile-Iron and Gray Iron Fittings for Water.
 - .8 ANSI/AWWA C150/A21.50-[08], Standard for Thickness Design of Ductile-Iron Pipe.
 - .9 ANSI/AWWA C151/A21.51-[09], Standard

- for Ductile-Iron Pipe, Centrifugally Cast.
- .10 ANSI/AWWA C153/A21.53-[11], Standard for Ductile-Iron Compact Fittings.
 - .11 ANSI/AWWA C200-[05], Standard for Steel Water Pipe - 6 Inch (150 mm) and Larger.
 - .12 ANSI/AWWA C203-[08], Standard for Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - .13 ANSI/AWWA C205-[07], Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.
 - .14 ANSI/AWWA C206-[11], Standard for Field Welding of Steel Water Pipe.
 - .15 ANSI/AWWA C207-[07], Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
 - .16 ANSI/AWWA C208-[07], Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
 - .17 ANSI/AWWA C300-[11], Standard for Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
 - .18 ANSI/AWWA C301-[07], Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
 - .19 ANSI/AWWA C303-[08], Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
 - .20 ANSI/AWWA C500-[09], Standard for Metal-Seated Gate Valves for Water Supply Service.
 - .21 ANSI/AWWA C504-[10], Standard for Rubber-Seated Butterfly Valves.
 - .22 ANSI/AWWA C600-[10], Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
 - .23 ANSI/AWWA C602-[11], Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
 - .24 ANSI/AWWA C651-[05], Standard for Disinfecting Water Mains.

 - .25 ANSI/AWWA C800-[05], Standard for Underground Service Line Valves and

- Fittings.
- .26 ANSI/AWWA C900-[07], Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
- .1 ASTM A53/A53M-[10], Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A307-[10], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .4 ASTM B88M-[05(2011)], Standard Specification for Seamless Copper Water Tube [Metric].
 - .5 ASTM C117-[04], Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .6 ASTM C136-[06], Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .7 ASTM C478M-[11], Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
 - .8 ASTM D698-[07e1], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .9 ASTM D2310-[06], Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .10 ASTM D2657-[07], Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 - .11 ASTM D2992-[06], Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass"

- (Glass-Fiber-Reinforced
Thermosetting Resin) Pipe and
Fitting.
- .12 ASTM D2996-[01(2007)e1], Standard
Specification for Filament-Wound
"Fiberglass" (Glass-Fiber-Reinforced
Thermosetting Resin) Pipe.
 - .13 ASTM F714-[10], Standard
Specification for Polyethylene (PE)
Plastic Pipe (SDR-PR) Based on Outside
Diameter.
 - .14 ASTM C618-[08a], Standard
Specification for Coal Fly Ash and Raw
or Calcined Natural Pozzolan for Use
in Concrete.
- .3 American Water Works Association
(AWWA)/Manual of Practice
- .1 AWWA M9-[2008], Concrete Pressure
Pipe.
 - .2 AWWA M11-[2004], Steel Pipe - A Guide
for Design and Installation.
 - .3 AWWA M17-[2006], Installation, Field
Testing, and Maintenance of Fire
Hydrants.
- .4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-8.1-[88], Sieves, Testing,
Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-[M88], Sieves, Testing,
Woven Wire, Metric.
 - .3 CAN/CGSB-34.1-[94], Pipe, Asbestos
Cement, Pressure.
 - .4 CGSB 41-GP-25M-[77], Pipe,
Polyethylene, for the Transport of
Liquids.
- .5 CSA International
- .1 CAN/CSA-A257 Series-[09], Standards
for Concrete Pipe (Consists of A257.0,
A257.1, A257.2, A257.3 and A257.4).
 - .2 CAN/CSA-A3000-[08], Cementitious
Materials Compendium (Consists of
A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-B137 Series-[09],
Thermoplastic Pressure Piping
Compendium. (Consists of B137.0,
B137.1, B137.2, B137.3, B137.4,

- B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
- .1 CAN/CSA-B137.1-[09], Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CAN/CSA-B137.3-[09], Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .4 CSA G30.18-[09], Carbon and Steel Bars for Concrete Reinforcement.
 - .6 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520-[07], Standard for Fire Hydrants.
 - .2 CAN/ULC-S543-[09], Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Pipe certification to be on pipe.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
 - .2 Submit complete drawings and construction schedule for water mains 600 mm diameter and larger. Include method for installation of water main.

- .4 Samples:
 - .1 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
 - .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum prior to beginning work. Include manufacturer's drawings, information, and shop drawings where pertinent.

CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
- .3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, and valve boxes for incorporation into manual.

DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements:
deliver materials to site in original
factory packaging, labelled with
manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in
dry location and in accordance with
manufacturer's recommendations in
clean, dry, well-ventilated area.
 - .2 Store and protect water distribution
piping from nicks, scratches, and
blemishes.
 - .3 Replace defective or damaged
materials with new.
- .4 Develop Construction Waste Management
Plan related to Work of this.

SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions
to existing services.
- .2 Submit schedule of expected interruptions
for approval and adhere to interruption
schedule as approved by Departmental
Representative.
- .3 Notify Departmental Representative a
minimum of 24 hours in advance of
interruption in service.
- .4 Do not interrupt water service for more
than 3 hours and confine this period
between 10:00 and 16:00 hours local time
unless otherwise authorized.
- .5 Notify fire department of planned or
accidental interruption of water supply
to hydrants.
- .6 Provide and post "Out of Service" sign on
hydrant not in use.
- .7 Advise local police department of
anticipated interference with movement of
traffic.

MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Polyethylene pressure pipe:
 - .1 NPS 1/2 to NPS 6: to CAN/CSA-B137.1 type PE 3406 160 ASTM F714, type DR 11.
 - .2 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 flanged with ductile iron backing flanges.
 - .3 Cast iron fittings with flanged ends: to ANSI/AWWA C110/A21.10 for pipe size above NPS 4, Cement mortar lined to ANSI/AWWA C104/A21.4.
 - .4 Polyethylene fittings: to CAN/CSA-B137.1, for pipe sizes NPS 4 and less.

VALVES AND VALVE BOXES

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C500, standard iron body, brass mounted double disc valves with non-rising stems, suitable for 1 Pa with mechanical grooved type coupling joints.
- .3 Underground type indicator valve where indicated. Indicator post to accurately indicate valve open or closed.
- .4 Cast iron valve boxes: bituminous coated screw type adjustable over minimum of 450 mm complete with valve operating extension rod, 30 25 x 25 150 mm below cover.
 - .1 Base to be large round type with minimum diameter of 300 mm.
 - .2 Top of box to be marked "WATER"/"EAU".
- .5 PIPE BEDDING AND SURROUND MATERIAL
 - .1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel, or sand.
 - .2 Gradations to be within limits

specified when tested to [ASTM C136] [ASTM C117]. Sieve sizes to [CAN/CGSB-8.1] [CAN/CGSB-8.2].

.3 Table

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	[100]	-
19 mm	-	-
12.5 mm	[65-90]	[100]
9.5 mm	-	-
4.75 mm	[35-55]	[80-100]
2.00 mm	-	[50- 90]
0.425 mm	[10-25]	[10- 50]
0.180 mm	-	-
0.075 mm	[0- 8]	[0- 10]

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

BACKFILL MATERIAL

.1 As indicated in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling .

PIPE DISINFECTION

.1 Liquid chlorine to ANSI/AWWA B300 ANSI/AWWA B301 ANSI/AWWA B303 to disinfect water mains.
.2 Disinfect water mains in accordance with ANSI/AWWA C651.

1.2 EXECUTION

EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in

- presence Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Departmental Representative.
 - .2 Remove defective materials from site as directed Departmental Representative.

TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 1800mm minimum from finished grade or as indicated.
- .3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding

as required to suit joints.

- .5 Compact each layer full width of bed to 95 % minimum of corrected maximum dry density 95 % maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted bedding material.

PIPE INSTALLATION

- .1 Terminate building water service 1m outside building wall opposite point of connection to main.
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Lay pipes to ANSI/AWWA C600 ANSI/AWWA manufacturer's standard instructions and specifications.
 - .1 Do not use blocks except as specified.
- .3 Join pipes in accordance with ANSI/AWWA C600 ANSI/AWWA C602 ANSI/AWWA C206 AWWA M-9 M-11 manufacturer's recommendations.
- .4 Bevel or taper ends of PVC pipe to match fittings.
- .5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .6 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which

shows differential settlement after installation greater than 10 mm.

- .7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Position and join pipes with equipment and methods approved by Departmental Representative.
- .11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Align pipes before jointing.
- .13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .14 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .15 Complete each joint before laying next length of pipe.
- .16 Minimize deflection after joint has been made.
- .17 Apply sufficient pressure in making joints

to ensure that joint is completed to manufacturer's recommendations.

- .18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
- .19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .21 Do not lay pipe on frozen bedding.
- .22 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
- .23 Backfill remainder of trench.

VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of Bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1m. Valves not to be supported by pipe.
- .3 Install underground post-type indicator valves as indicated.

TRACING WIRE INSTALLATIONS

- .1 Tracing wire shall be installed on all water mains. The tracing wire will be laid flat and secured every 3m at the top or at the spring line of the water main. Tracing wire is to be continuous, except for splice connections for services.

HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least [5] days after placing concrete or 2 days if high early strength concrete is used.
- .5 Test pipeline in sections not exceeding 365m in length, unless otherwise authorized by Departmental Representative.
- .6 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated, or as directed by Departmental Representative.
- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and

valves, to prevent movement when test pressure is applied.

- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow water absorption by pipe material.
- .13 Thoroughly examine exposed parts and correct for leakage as necessary.
- .14 Apply hydrostatic test pressure of 1034 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 2 hours.
- .15 Examine exposed pipe, joints, fittings, and appurtenances while system is under pressure.
- .16 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .17 Repeat hydrostatic test until defects have been corrected.
- .18 Apply leakage test pressure of 1034 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .19 Static pressure will not be allowed to drop more than 70 kPa for test pressure for 2 hours.
- .20 Locate and repair defects if leakage is greater than amount specified.
- .21 Repeat test until leakage is within specified allowance for full length of

water main.

PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 3 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % of corrected maximum dry density.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % of corrected maximum dry density.

BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95 % corrected maximum dry density.
 - .1 In other areas, compact to at least 90% corrected maximum dry density.

FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: under direct control of Departmental Representative carried out by specialist contractor.
 - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.

- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants, and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains to the requirements of local authority.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point

of filling water main and to occur at same time.

- .10 Operate valves, hydrants, and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of 2 days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
 - .3 Specialist contractor to submit certified copy of test results.
- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

1.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1.1 GENERAL

RELATED REQUIREMENTS

- .1 Not Used

MEASUREMENT AND PAYMENT

- .1 Measure excavation and backfill under Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Measure supply and installation of sanitary sewer including testing and including excavation and backfilling and granular bedding and surround.

REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C111/A21.11-[07], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 ASTM International
 - .1 ASTM C12-[09], Standard Practice for Installing Vitrified Clay Pipe Lines.
 - .2 ASTM C14M-[07], Standard Specification for Non-reinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .3 ASTM C76M-[10a], Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .4 ASTM C117-[04], Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .5 ASTM C136-[06], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .6 ASTM C425-[09], Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 - .7 ASTM C428-[05(2006)], Standard

- .8 Specification for Asbestos-Cement Nonpressure Sewer Pipe.
- .8 ASTM C443M-[07], Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
- .9 ASTM C663-[98(2008)], Standard Specification for Asbestos Cement Storm Drain Pipe.
- .10 ASTM C700-[09], Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
- .11 ASTM C828-[06], Standard Test Method for Low-pressure Air Test of Vitrified Clay Pipe Lines.
- .12 ASTM D698-[07e1], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lb/ft³ (600 kN-m/m³)).
- .13 ASTM D1869-[95(2005)e1], Standard Specification for Rubber Rings for Asbestos Cement Pipe.
- .14 ASTM D2680-[01(2009)], Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- .15 ASTM D3034-[08], Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .16 ASTM D3350-[10], Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-[88], Sieves, Testing,

- Woven Wire, Inch Series.
- .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3 CAN/CGSB-34.9-[M94], Pipe, Asbestos Cement, Sewer.

- .5 CSA International
 - .1 CSA A3000-[08], Cementitious Materials Compendium.
 - .2 CSA A257 Series-[09], Standards for Concrete Pipe and Manhole Sections.
 - .3 CAN/CSA-B70-[06], Cast Iron Soil Pipe, Fittings, and Means of Joining.
 - .4 CSA B1800-[11], Thermoplastic Non-pressure Pipe Compendium.
 - .1 CSA B182.1-[11], Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA B182.2-[11], PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.
 - .3 CSA B182.6-[11], Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
 - .4 CSA B182.11-[11], Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

- .6 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
 - .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
 - .3 Notify Departmental Representative

and building manager 24 hours
minimum in advance of any
interruption in service.

ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00
- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions,
printed product literature and data
sheets for [pipes, and backfill] and
include product characteristics,
performance criteria, physical
size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed
by professional engineer registered
or licensed in Province of New
Brunswick, Canada.
 - .2 Indicate on drawings proposed method
for installing carrier pipe for
under crossings.
- .4 Samples:
 - .1 Inform Departmental Representative
at least 4 weeks prior to beginning
Work, of proposed source of bedding
materials and provide access for
sampling.
- .5 Certificates:
 - .1 Certification to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and
certification 2 weeks minimum before
beginning Work.

- .7 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control:
submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

DELIVERY, STORAGE AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.
- .2 Develop Construction Waste Management Plan related to Work of this Section.

1.2 MATERIALS

PLASTIC PIPE

- .1 Gravity Pipe: Type PSM Polyvinyl Chloride (PVC): to ASTM D3034 CSA B182.2.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked-in Separate gasket and integral bell system.
 - .3 Nominal lengths: 4m.
- .2 Pressure Pipe: Polyvinyl chloride (PVC) pipe: to ASTM D2241, ANSI/AWWA C900, CSA B137.
 - .1 DR: 18.
 - .2 Gasket bell end.
 - .3 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications.
 - .4 Rubber gaskets: to ANSI/AWWA C111/A21.11. Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC.

SERVICE CONNECTIONS

- .1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.
- .2 Plastic pipe: to CSA B182.1, with push-on joints.

CEMENT MORTAR

- .1 Portland cement: to CSA A3000, normal type 10.
- .2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.
 - .1 Add only sufficient water after mixing to give optimum consistency for placement.
 - .2 Do not use additives.

PIPE BEDDING AND SURROUND MATERIALS

- .1 Granular material to following requirements:
 - .1 Crushed or screened stone, gravel, or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 ASTM C117.
 - .1 Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .2 Table:

Sieve Designation	% Passing Stone/Gravel	% Passing Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	[100]	-
19 mm	-	-
12.5 mm	[65-90]	[100]
9.5 mm	-	-
4.75 mm	[35-55]	[50-100]
2.00 mm	-	[30-90]
0.425 mm	[10-25]	[10-50]
0.180 mm	-	-
0.075 mm	[0-8]	[0-10]

- .3 Concrete mixes and materials for cradles, encasement, supports: to Section 03 30 00

- Cast-in-Place Concrete.

BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Unshrinkable fill: to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.3 EXECUTION

EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed Departmental Representative.

PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.
- .3 Clean and dry pipes and fittings before installation.
- .4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer or sewer connection.
- .3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

CONCRETE BEDDING AND ENCASEMENT

- .1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .1 Place concrete to details as indicated by Departmental Representative.
- .2 Position pipe on concrete blocks to facilitate placing of concrete.
 - .1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.

- .2 Place granular bedding materials in uniform layers not exceeding 150mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .1 Do not use blocks when bedding pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% corrected maximum dry density.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

INSTALLATION

- .1 Lay and join pipes to: ASTM C12.
- .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Handle pipe using methods approved by Departmental Representative.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Tolerances: 10mm.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Joint deflection permitted within limits recommended by pipe manufacturer.

- .7 Water to flow through pipe during construction, only as permitted Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's written recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

- .12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
- .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .14 Make watertight connections to manholes.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
 - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 3m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.
- .6 Compact each layer from mid height of pipe

to underside of backfill to at least 90% corrected maximum dry density.

- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.
 - .1 In other areas, compact to at least 90% corrected maximum dry density.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- .5 Do infiltration and exfiltration test to ASTM C828.
- .6 Do infiltration and exfiltration testing

as specified herein and as directed by
Departmental Representative.

- .1 Perform tests in presence of
Departmental Representative.
- .2 Notify Departmental Representative
24 hours minimum in advance of
proposed tests.

- .7 Carry out tests on each section of sewer
between successive manholes including
service connections.

- .8 Install watertight bulkheads in suitable
manner to isolate test section from rest
of pipeline.

- .9 Exfiltration test:
 - .1 Fill test section with water to
displace air in line. Maintain under
nominal head for 24 hours to ensure
absorption in pipe wall is complete
before test measurements are begun.
 - .2 Immediately prior to test period add
water to pipeline until there is head
of 1m over interior crown of pipe
measured at highest point of test
section above static ground water
level.
 - .3 Duration of exfiltration test: 2
hours.
 - .4 Water loss at end of test period:
not to exceed maximum allowable
exfiltration over any section of
pipe between manholes.

- .10 Infiltration test:
 - .1 Conduct infiltration test in lieu
of exfiltration test where static
ground water level is 750 mm or more
above top of pipe measured at highest
point in line to be used.
 - .2 Do not interpolate a head greater
than 750 mm to obtain an increase
in allowable infiltration rate.
 - .3 Install watertight plug at upstream
end of pipeline test section.

 - .4 Discontinue pumping operations for
at least 3 days before test
measurements are to begin and during

- this time, keep thoroughly wet at least one third of pipe invert perimeter.
- .5 Prevent damage to pipe and bedding material due to flotation and erosion.
 - .6 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
- .11 Infiltration and exfiltration: not to exceed following limits in L per hour per 100m of pipe, including service connections.

Nominal Pipe diameter in mm	Asbestos -Cement or Plastic pipe	Concrete or Vitrified Clay pipe
Values shown in columns 2 and 3 are in litres per hour per 100 metres of pipe.		
100	3.88	25.5
125	4.62	30.0
150	5.51	34.0
200	7.45	41.5
250	9.39	49.5
300	11.33	56.5
350	13.27	63.5
400	14.91	70.0
450	16.84	76.0
500	18.78	81.5
550	20.72	87.0
600	22.80	92.5
700	26.53	102.0
800	30.11	110.5
900	33.69	118.0
1000	37.56	124.5
1100	41.29	130.0
1200	45.01	135.0

- .12 Leakage: not to exceed following limits in liters per hour per mm of diameter per 100m of sewer including service connections:

- .1 Exfiltration, based on 600mm head:
0.175 L.
- .2 Infiltration: 0.150 L.
- .13 Repair and retest sewer line as required,
until test results are within limits
specified.
- .14 Repair visible leaks regardless of test
results.
- .15 Television and photographic inspections:
 - .1 Carry out inspection of installed
sewers by video camera, digital
camera or by other related means.
 - .2 Provide means of access to
Departmental Representative to do
inspections.
- .16 Payment for inspection services and
retesting of failed test are not
considered additional to the contract.
No additional payment will be made for CCTV
inspection, testing or retesting of the
line(s).

1.4 CLEANING

CLEANING

- .1 Progress Cleaning: clean in accordance
with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each
day.
- .2 Final Cleaning: upon completion remove
surplus materials, rubbish, tools and
equipment in accordance with Section
01 74 11 - Cleaning.
- .3 Waste Management: separate waste
materials for recycling in accordance with
Section 01 74 21 -
Construction/Demolition Waste Management
and Disposal.
 - .1 Remove recycling containers and bins
from site and dispose of materials
at appropriate facility.

END OF SECTION

1.1 GENERAL

RELATED REQUIREMENTS

- .1 Section 31 23 33.01 Excavation, Trenching and Backfilling
- .2 Section 33 31 13 Public Sanitary Sewerage Piping
- .3 Section 33 36 33 Utility Drainage Field

REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A23.4-09, Precast Concrete-Materials, and Construction.
 - .3 CSA B66-10, Design, Material and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks.

ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for utility septic tanks and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in New Brunswick, Canada.
 - .2 Shop Drawings: to CSA A23.4.
 - .1 Indicate on drawings:
 - .1 Design calculations for items designed by manufacturer.
 - .2 Tables and bending diagrams of reinforcing steel.
 - .3 Camber.
 - .4 Formwork.
 - .5 Finishing schedules.
 - .6 Methods of handling and erection.
 - .7 Storage facilities.
 - .8 Openings, sleeves, inserts and related reinforcement.

QUALITY ASSURANCE

- .1 Manufacturers and erectors of precast concrete elements are to be certified by CSA as meeting requirements of CSA A23.4.

DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect utility septic tanks from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.2 MATERIALS

DESIGN REQUIREMENTS

- .1 Design precast concrete septic tank in accordance with CSA B66, and to carry handling stresses, indicated service loads and required depth of bury.
- .2 Tank to be dual compartment and to have minimum total working capacity of 6000 Litres.
- .3 Tank to be complete with effluent filter on outlet piping.

MANUFACTURE

- .1 Manufacture units in accordance to CSA A23.4.

FINISHES

- .1 Finish tanks to CSA A23.4, commercial grade.

ACCESS

- .1 Include access holes to surface to facilitate cleaning and inspection.

TANK BEDDING AND SURROUND MATERIAL

- .1 Granular material in accordance with the following requirements:
 - .1 Crushed gravel or sand, gradation in accordance with Section 33 31 13, Public Sanitary Utility Sewer Piping
 - .2 Obtain Departmental Representative's approval prior to use.

BACKFILL MATERIAL

- .1 Selected excavated material, free from rocks larger than 25 mm and organic matter.
- .2 Obtain Departmental Representative's approval prior to use.

1.3 EXECUTION

EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for utility septic tank installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

INSTALLATION

- .1 Place bedding and surround material in unfrozen condition.
- .2 Do excavation in accordance with Section 31 23 33.01 Excavation, Trenching and Backfilling.
- .3 Place tank bedding material in accordance with details as indicated.
 - .1 Compact to 95% maximum dry density to ASTM D698.
- .4 Make inlet and outlet joints of septic tank watertight.
- .5 Conduct leakage test on septic tank in presence of Departmental Representative before backfilling.
 - .1 Fill tank to level of effluent pipe, and allow to stand for 24 hours.
 - .2 Allowable leakage is zero.
 - .3 If leakage occurs, remove seal

materials, and reseal as directed by
Departmental Representative.

- .6 Do backfilling in accordance with Section 31 00 00.01 - Earthwork.
 - .1 Compact to 95 % maximum dry density to ASTM D698.

1.4 FINAL CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1.1 GENERAL

RELATED REQUIREMENTS

- .1 Section 31 23 33.01 Excavation, Trenching and Backfilling
- .2 Section 33 31 13 Public Sanitary Sewerage Piping
- .3 Section 33 36 00 Utility Septic Tanks

REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Method for Material Finer Than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D4318-10, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 CSA International
 - .1 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CAN/CSA-B137.1-0], Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CAN/CSA-B1800-11, Thermoplastic Non-Pressure Piping Compendium. (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .1 CAN/CSA-B182.2-11 PVC Sewer

Pipe and Fittings (PSM Type).

ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for drainage field materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit copy of certification or licence of approved installers.
- .4 Test Reports:
 - .1 Submit 2 certified copies of factory tests of pipe material.

QUALITY ASSURANCE

- .1 Use licensed installers who comply with local authority having jurisdiction.

DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect drainage field materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .1 Granular material in accordance with the requirements as follows:
 - .1 19-76 mm Crushed Gravel
 - .2 Submit samples at least two (2) weeks prior to beginning work, in accordance with Section 01 33 00 Submittal Procedures.

IMPORTED FILTER MATERIAL

- .1 Sand conforming to requirements of Table 3 in the New Brunswick Technical Guidelines for On-site Sewage Disposal Systems.
- .2 Test in accordance with Section 33 36 00 - Utility Septic Tanks.
- .3 Submit samples at least two (2) weeks prior to beginning work, in accordance with Section 01 33 00 Submittal Procedures.

GEOTEXTILE COVER

- .1 Geotextile cover: to Section 31 32 19.00-Geotextile.
 - .1 UV resistant polyolefin fabric.
 - .2 As indicated.

PIPE FOR DISPOSAL FIELDS

- .1 Straight PVC DR35 pipe and fittings to CAN/CSA-B182.2, perforated or unperforated as indicated.

1.3 EXECUTION

EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for drainage field installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

AREA TYPE DISPOSAL FIELD INSTALLATION

- .1 Rough grade to depths as indicated.
- .2 Scarify existing subgrade and leave topsoil.
- .3 Place sand material in unfrozen condition as indicated.
- .4 Operate construction equipment across disposal only after receipt of written approval from Departmental Representative.
- .5 Connect 100 mm perforated PVC pipe to header as indicated.
- .6 Install distribution valve and chamber between pump chamber and dispersal field.
- .7 Set header pipe level as indicated.
- .8 Connect each distribution pipe individually to header pipe.
- .9 Maintain pipe elevations within 5 mm of elevations indicated.
- .10 Backfill and align trenches until pipe grade only after receipt of written approved from Departmental Representative.
- .11 Cover disposal field as indicated.
 - .1 Use only material approved in writing by Departmental Representative.
 - .2 Do not compact.
 - .3 Overfill to allow for settlement.
- .12 Grade areas surrounding disposal field bed as indicated, to provide for diversion of surface run off waters.

1.4 FINAL CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each

- day.
- .2 Final Cleaning: upon completion
remove surplus materials, rubbish,
tools, and equipment in accordance
with Section 01 74 11 - Cleaning.

END OF SECTION

1.1 GENERAL

RELATED REQUIREMENTS

- .1 Not used.

REFERENCES

- .1 ASTM International:
- .1 ASTM C14M-07, Standard Specification for Non reinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M-10a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C144-04, Standard Specification for Aggregate for Masonry Mortar.
 - .6 ASTM C443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .7 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft; (600 kN-m/m;)).
 - .8 ASTM D1248-05, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .9 ASTM F667-06, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

- .2 Canada Green Building Council (CaGBC):
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum 2007).
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .4 CSA International:
 - .1 CSA A3000-08, Cementitious Materials Compendium.
 - .2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.
 - .3 CAN/CSA G401-07, Corrugated Steel Pipe Products.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water:
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Samples:
 - .1 Inform the Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Certification: to be marked on pipe.
- .5 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.
- .6 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 authorities having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50 75% of construction wastes were recycled or salvaged.
 - .3 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

- .2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 MATERIALS

CORRUGATED STEEL PIPE

- .1 Corrugated steel pipe: to CAN/CSA-G401.
- .2 Water-tight cut-off collars: as indicated.
- .3 Prefabricated end sections wing walls: as indicated.
- .4 Corrugated fluming: to CAN/CSA-G401.

- .1 GRANULAR BEDDING AND BACKFILL
- .2 Granular bedding and backfill material to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed pit run or screened stone, gravel, or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .3 Table:

Sieve Designation	% Passing
200 mm	-
75 mm	100
50 mm	-
38.1 mm	-
25 mm	-
19 mm	-
12.5 mm	-
9.5 mm	-
4.75 mm	25-85
2.00 mm	-
0.425 mm	5-30
0.180 mm	-
0.075 mm	0-10
- .4 Concrete mixes and materials for bedding, cradles, encasement, supports: to Section 03 30 00- Cast-in-Place Concrete.

1.3 EXECUTION

EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions:
 - .1 Visually inspect substrate in presence of the Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied and after receipt of

written approval to proceed from the
Departmental Representative.

PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of corrected maximum dry density of maximum density to ASTM D698.

- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by the Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

LAYING CORRUGATED STEEL PIPE CULVERTS

- .1 Begin pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .5 Do not allow water to flow through pipes during construction except as permitted by the Departmental Representative.

JOINTS: CORRUGATED STEEL CULVERTS

- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.
 - .4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved in writing by the Departmental Representative or two coats of zinc rich epoxy paint.

- .5 Structural plate:
 - .1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.
 - .2 Drift pins may be used to facilitate matching of holes.
 - .3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.
 - .4 Draw bolts up tight, without overstress, before beginning backfill.
 - .5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint or two coats of zinc rich epoxy paint approved by the Departmental Representative.

BACKFILLING

- .1 Backfill around and over culverts as indicated or as directed by the Departmental Representative.
- .2 Place granular backfill material backfill material, approved in writing by the Departmental Representative, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% corrected maximum dry density maximum density to ASTM D698 taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross:
 - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.5 Place backfill in unfrozen condition.

1.4 FINAL CLEANING

CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

- 1.1 RELATED REQUIREMENTS
- .1 Section 26 05 00 - Common Work Results for Electrical.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 QUALITY ASSURANCE
- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
- .1 Certificates: signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .2 Manufacturer's Instructions: for installation and special handling criteria, installation sequence and cleaning procedures.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

handling, storage and installation
instructions, and datasheets.

3.2 INSTALLATION

- .1 Install duct in accordance with manufacturer's instructions and at elevations as indicated.
- .2 Clean inside of ducts before laying.
- .3 Install plastic duct spacers and ensure full, even support every 1.5 m and smooth transition throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
- .6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.
 - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Place continuous strip of warning tape 300 mm above duct before backfilling trenches.
- .9 Install markers as required.
- .10 Notify the Departmental Representative for field review upon completion of direct buried ducts and obtain acceptance prior to backfill.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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