# **DIVISION 4**

# CONSTRUCTION SPECIFICATIONS FOR WATERMAINS AND SEWERS

# 2020 STANDARD SPECIFICATIONS REVISIONS

**Division 4.1 City of Sarnia Watermain Standards** 

# 1. WATER SERVICES AND METERS (pg 5-6)

## i) Residential

- Added AquaPure PE-RT (Blue) to the approved material list

# **Division 4.2 City of Sarnia Sewer Standards**

# 1. STORM AND SANITARY SEWER PIPE (pg 3)

### i) Main Line

- Added Sanitite HP to the approved material list for Storm Sewer.

# **Division 5.0 City of Sarnia Standard Drawings**

Added Drawing 2700 (Sanitary Service cleanout)

Added Drawing 2800 (Temporary Steel Plate)

Added Drawing 3000 (1.5m Chainlink Fence)

Revised Drawing 109-F (Lot Servicing)

# DIVISION 4.1 CITY OF SARNIA WATERMAIN STANDARDS 2020

# WATERMAIN MATERIALS, CONSTRUCTION METHODS AND TESTING PROCEDURES

DIV	ISION 4.1 1
CIT	Y of sarnia watermain standards1
Α.	MATERIALS 4
1.	WATERMAIN PIPE
2.	WATER SERVICES AND METERS
3.	GATE VALVES
4.	VALVE BOXES7
5.	FIRE HYDRANTS
6.	HYDRANT EXTENSIONS8
7.	BRASS VALVES & FITTINGS TO SERVICE LINES
8.	RESTRAINT CLAMPS, TIE-BACKS, ANCHOR RODS9
9.	REPAIR CLAMPS AND COUPLINGS9
10	. SERVICE SADDLES 10
11	. TRACER WIRE 10
12	. TAPPING VALVES AND SLEEVES 11
13	. INSULATION FOR WATERMAINS 11
14	. PETROLATUM AND PETROLEUM COATING SYSTEMS
15	. PIPE BEDDING AND COVER MATERIAL 12
16	. GRANULAR BACKFILL MATERIAL 12
17	. ACCEPTABLE NATIVE MATERIAL 12
18	. BACKFLOW PREVENTORS 13
В.	CONSTRUCTION METHODS14
1.	TRENCH EXCAVATION 14
2.	TRENCH BACKFILLING 15
3.	SHEATHING AND SHORING 15
4.	DEWATERING16
5.	PIPE BEDDING - Watermain and Appurtenances
6.	PIPE LAYING 18
7.	CONCRETE THRUST BLOCKS 19
8.	VALVES AND APPURTENANCES 19
9.	HYDRANTS 20
10	CUTTING IN SLEEVES 21
11	. INSULATION OVER WATERMAINS

12.	METER PITS	21
13.	WATER SERVICE CONNECTIONS	22
C.	GENERAL PROVISIONS	23
1.	PETROLATUM AND PETROLEUM COATING SYSTEMS	25
2.	INSULATION FOR WATERMAINS	25
3.	BACKFILLING MATERIALS	26
4.	SHUTTING DOWN OR CHARGING WATERMAIN	26
D.	WATERMAIN TESTING PROCEDURES	28
1.	VISUAL INSPECTION	28
2.	PRESSURE AND LEAKAGE TEST	28
3.	DISINFECTION AND FLUSHING	32
4.	DISINFECTION	
5.	FINAL FLUSHING	36
6.	BACTERIOLOGICAL TESTS	37
7.	REPETITION OF PROCEDURE	37
8.	DISINFECTION OF TIE-IN SECTIONS	38
9.	FIRE HYDRANT FLOW TESTING	38
Ε.	SERVICING REQUIREMENTS	39
1.	SERVICES FOR NEW DEVELOPMENT	39
2.	EXISTING SHARED SEWER CONNECTIONS	39
3.	ABANDONING SERVICES	39

# A. MATERIALS

Spec. OPSS.MUNI. Form 441, 514, 517, and 518; C.S.W.S., Standard Detail Drawing 112-SF

### **1. WATERMAIN PIPE**

Supply and Place Watermain pipe and appurtenances meeting the specifications outlined below, (unless the pipe material is stated on the contract drawings or otherwise specified):

• For sizes of 100mm to 300mm, pipe must conform to, A.W.W.A. C-900, Pressure Class 150 psi, (DR 18) OPSS.MUNI.441 and certified Third Party in accordance to OPSS and Standards Council of Canada; CSA B137.3 PVC watermain pipe and appurtenances.

Or

- "Molecularly oriented PVC pipe in sizes 100mm (4") through 300mm (12") shall be Biaxially Oriented (molecular orientation in two directions), CSA certified to CSA Standard B137.3.1-09, third party certified to AWWA C909 and NSF 61 for potable water use. The pipe shall have Cast Iron Outside Diameters (CIOD), be color coded blue and have a Pressure Class of 235 psi." Where required, Bionax PVCO Approved Restraints Pipe-to-Pipe and Pipe-to-Fittings Restrainers shall be used as per manufacturer's recommendations". Pipe to be IPEX Bionax PVCO, CIOD watermain pressure pipe 100mm (4") through 300mm (12").
- For sizes of 350mm to 600mm (C.I.O.D.) pipe must conform to AWWA C905, Pressure Rating 165 psi, (DR 25) and be certified by CSA; CSA B137.3 "Rigid Poly (Vinyl Chloride)(PVC) Pipe for Pressure Applications." For pressure applications, each length of pipe must be hydro-tested at twice the rating and a short-term pressure test must be conducted once per production run.
- All joints to be bell and spigot with NSF approved rubber gaskets conforming to ASTM D3139; CSA logo must be clearly and permanently marked on all product; All watermain to be blue in colour

- All Pipes and fittings shall be manufactured by IPEX Inc; Northern Pipes; Rehau Industries Inc; Royal Pipe Co; Harrington Corporation; Diamond Plastic Corporation or National Pipe and Plastic Inc; or approved equal.
- Injection molded fittings (AWWA C907) shall be used up to 12" (300mm) diameter size. Fabricated fittings shall not be used.
- Ductile Iron Fittings (Self-Restrained) shall have distinctly cast • the rating, nominal them pressure diameter, on manufacturers name and AWWA Standard. All fittings shall be fusion bonded epoxy coated inside & out to NSF-61 standard and come capped from the factory to prevent contaminants inside the fitting. Joints and Fittings shall be in accordance with AWWA C111 & C153 latest revisions. Petroleum tape is not required on epoxy coated fittings. Self-Restrained fittings will be rated for 350PSI and can be used on PVC/PVCO and HDPE DIPS sizes. RCT Flex-Tite for sizes 4" (100mm) to 12" (300mm) size.
- Appurtenance and fittings for pipe sizes 350mm (14") diameter and greater, shall be, Ductile Iron, confirming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Appurtenance and fittings shall be furnished with MJ (Mechanical type Joints) in accordance with ANSI/AWWA C111/A21.11, of latest revision. The fittings must meet the requirements of pressure rating of the pipe system. All Ductile Iron fitting are required to be treated with full petrolatum coating as detailed in Watermain Materials.
- Tracer wire shall be installed on all non-metallic watermains, hydrants lateral and water services except where such water service pipe is of copper material

## 2. WATER SERVICES AND METERS

### i) Residential

Each property, including vacant lots, shall require to have a minimum diameter of 20 mm (3/4") copper service or 25mm (1") PEX tubing. The water services shall be a Type K soft copper material and or PEX Tubing extending from the watermain to the curb stop box.

Copper pipe for services shall conform to A.W.W.A. C800-89 Appendix A and OPSS.MUNI 401 and ASTM B88 and shall be Type "K"soft copper. All PEX pipe shall be manufactured to AWWA C904 and to SDR9 Copper tube size. All Pex shall be Blue in colour for potable water and certified to CSA B137.5 - cross linked polyethylene tubing for pressure application. All tubing will be certified to ASTM F876 and F877 and certified to NSF 14 and NSF 61. Approved PEX tubing may be Rehau Municipex and Ipex C-904. Polyethylene tubing is to be used with standard copper O.D. brass fittings. Mueller foot piece or approved equal to be placed at curb stop as per Manufacture's requirements.

All PEX tubing to be installed with tracer wire as per standard specification.

Any connection from the mainstop to the curbstop shall be a continuous piece; couplings are not permitted within the City right of way.

Any connection from the curbstop to the inside face of the building shall be a continuous piece; couplings are not permitted as per OBC 7.3.5.7(4).

Where the water meter is not installed inside a new or existing dwelling, at the discretion of the City Engineer, the meter may be installed in a meter pit at the property line as per City of Sarnia Standard Drawing #100-SF. The additional costs for an outside meter and the meter pit will be at the owner's expense.

### ii) Commercial, Industrial

All new water services 100mm (4") diameter and larger must be installed into the building as per City of Sarnia Standard 137-F before the watermain will be tested. Backflow preventors must be installed as per the current City of Sarnia backflow prevention program requirements.

### 3. GATE VALVES

Gate valves for watermain use shall conform to A.W.W.A. C509-87 Standard for Resilient Seated Gate Valves for Water and Sewage Systems and shall conform to OPSS.MUNI 441 and shall:

- For pipe sizes 100 mm (4") diameter to 200 mm (8") diameter, Joint ends must be Push on, complete with valve box, cover, riser and fittings.
- For pipe sizes 250 mm (10") and greater diameter, Joint ends must be mechanical joint with restrained gland packs, complete with valve box, cover, riser and fittings.

- Have resilient seated fully encapsulated gates
- Have a working design water pressure of 14.1 kg/cm (200 PSI) for all pipe sizes from 75 mm to 300 mm nominal pipe sizes
- All watermain gate valves turn to the right hand (clockwise) to open and shall have red painted operating nuts
- All sanitary forcemain gate valves turn to the left hand (counter clockwise) to open and shall have a black painted operating nut
- Have all exposed nuts and bolts made of type 304 stainless steel
- Have push-on joints (see AWWA 509 Sec 4.5.3 as per ANSI/A.W.W.A. C110/A21.11)
- Have epoxy coating to all interior and exterior ferrous surfaces as per A.W.W.A. C550-81
- Have a valve stem made of manganese bronze which has a yield strength greater than 207 MPa (30,000 PSI) or made of stainless steel BS420S37
- Be manufactured by Mueller (Model #A-2360-40) or American AVK Co series #25, #65 or Clow (model F6112)
- For pipe sizes 100mm (4") diameter to 200mm (8") diameter Push on joints, injection molded complete with valve box, cover, riser and fittings
- For pipe sizes 250mm (10") diameter and greater shall be mechanical joint with restrained gland packs, complete with valve box, cover, riser and fittings.
- All valves supplied shall be new, the City of Sarnia will not accept refurbished valves. The City Engineer has the authority to reject any valves.
- All valves to be backfilled with 19mm Clearstone
- Pea stone backfill is not an allowable option

## 4. VALVE BOXES

Valve boxes shall be the 130 mm screw type as supplied by Bibby Waterworks Inc. or Domestic Foundry Limited. Valve boxes to come with a hole to accommodate the tracer wire. They shall not transmit shock or stress to the valve and shall be centered and plumbed over the wrench nut of the valve with the box cover flush with the ground surface. Extensions to be installed on the operating nuts of valves and be sized to extend up to within 150 mm and 450 mm below the valve box cover.

### 5. FIRE HYDRANTS

Fire hydrants shall be Mueller Canada Valve "Century Hydrant", conformina to A.W.W.A Standard C502 with an easv maintenance hydrant operating system. Hydrants shall be a minimum of 1.98 meters long from the springline of the hydrant lead to the fracture head flange (6'-6" buried) unless otherwise required, opening counter clockwise, plugged wet barrel (nondraining). Base connections are to be push-on style, ground and barrel flanges, base and barrel flanges to have stainless steel nuts and bolts. In commercial, institutional, rural, industrial and high density residential locations they will be required to have two C.S.A. 65 mm hose nozzles and a standard 100 mm storz pumper connection (painted black).

Fire Hydrant Detail - City of Sarnia Standard 95-SF

### 6. HYDRANT EXTENSIONS

Hydrant extensions shall be complete with one piece rod and all necessary appurtenances to a maximum height of 300mm (12"). Multiple hydrant extensions are not permitted.

### 7. BRASS VALVES & FITTINGS TO SERVICE LINES

Brass valves and fittings to service lines shall conform to ANSI/A.W.W.A. C800 latest revisions. All connections shall be compression connections unless individual approval is given by the City Engineer for an alternate connection. All connections must provide a leak-proof seal and retaining service tubing or copper without slippage at a working pressure of 1050 KPa (150 PSI).

#### i) Corporation Stops

Corporation stops shall be no-lead brass, have inlet of AWWA taper thread (CC) and outlet shall be compression type (Mueller 110 style). All brass cast parts shall be certified to NSF-61 standard. Corporation stops shall be Mueller 300, Ford FB100NL or Cambridge Brass Series 301NL.

#### ii) Curb Stops and Boxes

Curbstops shall be ball style for all sizes and be no-lead brass certified to NSF-61 standard. Valves will have a minimum working pressure of 150 PSI and have a full bore ball. Approved manufacturers are Mueller 300, Cambridge 202NL & Ford B44NL. Curb stop boxes shall be Mueller type H-10306 – H-10334 or

Clow Model No. VSP1 and VSP2. Service boxes shall have type 304 stainless steel rods and stainless steel cotter pins.

### iii) Couplings and Adapters

Couplings and adapters shall be three piece couplings with compression joints at each end to fit the applicable connecting pipe sizes. Couplings shall be Mueller H15403 or Cambridge Brass 119NL or Ford C44 series with "Grip" or "Pack" or "Quick" joints.

# 8. **RESTRAINT CLAMPS, TIE-BACKS, ANCHOR RODS**

- For permanent installations, all clamps shall be smoothed over by using mastic and then the surface wrapped with Denso Tape.
- All restraining clamps shall be torqued to the Manufactures Specifications.
- Tie-backs and anchor rods used for restraining, anchoring or for thrusting of the watermain will be of 19 mm diameter solid threaded bar and bolts and treated with Petrolatum and Petroleum coating system
- Concrete thrust blocks should be used wherever possible as per O.P.S.D. 1103.01
- Restraint clamps shall be manufactured by Uniflange, model 1300 series, Sigma or Clow or equivalent as approved by the Manufacturer.
- Restraint clamps for mechanical joint fittings shall be Mega-Lug, One-Lok or approved equal for all sizes 300mm (12") in diameter or larger.
- Refer to City of Sarnia Standard Drawing 2500 for PVC thrust restraint.
- Restraint design calculations may be required by Manufacturer for Pipe over 300mm diameter.

# 9. REPAIR CLAMPS AND COUPLINGS

Stainless Steel repair clamps will be a minimum thickness of 20 gauge for sizes up to 200mm (8") 18 gauge for sizes over 300mm (12") Stainless steel will be fully passivated and gasket material shall be certified to NSF-61. All clamps will be a minimum of 300mm (12") long, nuts and or bolts shall be Teflon coated to prevent galling. Clamps will be Cambridge Brass model 425 or Smith Blair model 261.

All repair clamps and couplings shall be installed to

manufacturer's recommendations for pipe prep and torque. All couplings shall be fusion bonded epoxy coated and supplied with 304 stainless steel bolts. Gaskets and Epoxy in contact with potable water will be certified to NSF-61. Approved bolted couplings shall be Smith-Blair Model 441, Robar Model 1506. Two bolt wide range couplings shall be Epoxy Coated with 304 Stainless Steel Bolts NSF-61 certified. Approved manufacturers Smith-Blair model 421 and Hymax model 2000.

# **10. SERVICE SADDLES**

# i) Ductile Iron, Cast Iron and Asbestos Cement

Saddles for Ductile Iron, Cast Iron, and Asbestos Cement pipe shall have Ductile Iron epoxy body, galvanized steel straps and bolts. Saddles shall be manufactured by Smith Blair model 313, Robar 2506/2508, Mueller 521-529 or approved equal.

### ii) PVC

Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts and outlet. Band shall be type 304 Stainless Steel of minimum 18 gauge thickness. Saddles shall be manufactured by Smith Blair No. 375; Robar 2600 series; Cambridge Brass 8403 (double bolt)

# **11. TRACER WIRE**

Tracer wire shall be installed on all non-metallic watermains, hydrant laterals and water services except where such water service pipe is of copper material. The wire shall be installed in such a manner as to be able to properly trace all watermains, hydrant laterals and water services without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire. Tracer wire is to be brought up the outside of the hydrant valves only and inserted in the upper section of the valve box.

Tracer wire shall be RWU90, 12 gauge copper clad steel wire single stand colour coded blue for water, insulated jacket will be 30 ml HDPE suitable for direct bury application and break load of 452 lbs.

All spliced or repaired wire connections to be made using SnakeBite Locking Connectors Part #LSC1230B, DRYCONN Waterproof Connectors or approved equivalent specifically designed for direct burial applications complete with water proof closure. The Inspector may test the tracing wire for conductivity. If it is not continuous the Contractor shall at his expense, replace or repair the wire.

### **12. TAPPING VALVES AND SLEEVES**

Tapping valves to be Mechanical Joint by Flange. Tapping valves shall conform to A.W.W.A. C509-87 and must open right (clockwise). All tapping sleeves shall be stainless steel complete with 20mm diameter NPT test plug. The Pressure test to never exceed the static pressure of the watermain.

Approved resilient seat tapping valves shall be McAvity No. 20675R, Mueller T20360, Clow R/W F-6114, AVK Series 65. Approved Tapping Sleeves to be Romac SST Series, Robar 6606 Series, Ford Fast-xxx-MM Style and Smith Blair 663, or alternative approved by the Engineer.

An OPSS designed thrust block as per OPSD 1103.010 to be installed behind all tapping sleeves and valves.

### **13. INSULATION FOR WATERMAINS**

Insulation for placing over watermains shall be 50mm STYROFOAM SM(HI)-40 as per City of Sarnia Standard for Insulation of Shallow Mains and Offsets.

### **14. PETROLATUM AND PETROLEUM COATING SYSTEMS**

Reference to petrolatum coating systems means an approved petrolatum and petroleum coating system that conforms to A.W.W.A. C217-90 standard and is approved for use by the City Engineer.

While each product must be applied according to the manufacturer's instructions, the application will generally be done in the following fashion:

The item to be coated shall be cleaned of all dirt, oil, grease, flakes of paint and metal and any other item that might prevent adhesion of the petrolatum system. If the item requires blast cleaning or heavy wire brushing to prepare it, it will be rejected. After cleaning, a uniform and continuous coat having a film thickness of at least 3 mil (76  $\mu$ m). Any rough or uneven surfaces shall be filled in or smoothed over by using the mastic supplied by the manufacturer.

The whole surface shall then be wrapped with the top coating at 55% overlap and a minimum thickness of 40 mil (1016  $\mu$ m).

Petrolatum and petroleum coating systems approved by the City Engineer are Denso Petrolatum Products as supplied through Denso of Canada Limited and Petro Petrolatum Coating Systems as supplied by Petrolatum Coating Systems Pty. Ltd.

All watermain appurtenances including caps, valves (bolts and bonnet only), hydrants, restrainer clamps, nuts, bolts, tees, elbows, fittings, clamps, couplings, blow offs, and transition joints are required to be treated with full petrolatum Coating System complying with manufacturer instructions.

## **15. PIPE BEDDING AND COVER MATERIAL**

All watermain pipe bedding and cover shall be Granular "A", using 100% S.B.C.M. as per drawing 112-SF.

When trench conditions are wet so that the Granular "A" bedding becomes saturated and soft, but the bottom and side of the trench remain solid, then the bedding material is to be 20 mm uniformly graded clear crushed stone.

Pea stone bedding or backfill is not an acceptable material.

### **16. GRANULAR BACKFILL MATERIAL**

All granular backfill material shall be Granular "B" Type 1 in OPSS MUNI 1010 or be approved excavated native granular material complying to the requirements of select subgrade material in OPSS MUNI 1010, and be approved for use by the City Engineer.

### **17. ACCEPTABLE NATIVE MATERIAL**

Acceptable native material shall be friable and free from rubbish, wires, cans or debris of any sort; boulders or rock or concrete fragments with a dimension greater than 150 mm; roots, stumps, trees or timbers; and frozen materials. Material shall be compatible with native material.

### **18. BACKFLOW PREVENTORS**

A Temporary Water Connection Agreement must be approved prior to any connections to new or existing hydrants. The backflow and hydrants are only to be operated by The City of Sarnia Public Works Department.

A minimum charge for installation, testing and removal of the backflow preventor is accepted at the Engineering Department.

A refundable damage deposit is also required to be submitted to the Engineering Department. The deposit will not be refunded if damages have occurred including lost or stolen parts, misuse or from freezing.

Consumption charges will be deducted from the refundable deposit.

# **B. CONSTRUCTION METHODS**

### **1. TRENCH EXCAVATION**

### i) General

For the purpose of shoring or bracing, a trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.

Excavation shall include the removal of all water and materials of any nature which interfere with the construction work. Removal of ground water to a level below the structure subgrade will be necessary only when required by the plans or elsewhere in these specifications. Excavation for conduits shall be by open trench unless otherwise specified or shown on the drawings. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first obtain approval from the Engineer.

#### ii) **Protection of Existing Utilities**

It shall be the Contractor's responsibility to protect and support existing underground utilities such as gas, watermains, telephone and electric cables, sewers, etc., which may be encountered during the progress of the work. The Contractor shall arrange for stakeout of such utilities by the appropriate owning authorities prior to commencement of excavation. This shall be done at no extra cost to the City, and shall be included in the tendered unit prices.

All existing gas pipes, water pipes, electric conduits, sewers, drains, fire cisterns, hydrants, oil pipe lines, gas pipe lines, Bell Telephone conduits, railway tracks, and other structures, which, in the opinion of the Engineer, do not require to be changed in location, shall be carefully supported and protected from injury by the Contractor, and in case of injury, they shall be restored by him, without additional compensation, to as good condition as that in which they are found. Supply to the utility company shop drawings describing the method of support for the approval of the utility company. Where pipes, conduits, or sewers are removed from the trench, leaving dead ends in the ground, such dead ends shall be carefully plugged or bulkheaded with brick, mortar or concrete by the Contractor, without additional compensation.

#### iii) Maximum Length of Open Trench

Except by permission of the Engineer, the maximum length of open trench shall be 30 meters or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. The distance is the collective length at any location including open excavation, pipe length and appurtenant construction, and backfill which has not been completed.

### iv) Maximum and Minimum Width of Trench

The Contractor shall comply with the Occupational Health and Safety Act, latest version, and regulations for construction projects.

For pipe (except corrugated metal pipe), the minimum and/or maximum width of trench permitted at the top of the pipe shall be as shown on the standard drawings (O.P.S.D. 802.010). Thesides to the trench shall be vertical.

For corrugated metal pipe, the trench shall be at least 300 mm wider for pipe 900mm dia or less; the trench shall be at least 500mm wider for pipe 900mm or greater than the diameter of the pipe to be installed as per OPDS 802.010

If the maximum trench width is exceeded, the Contractor may be required to provide additional bedding, another type of bedding, or a higher strength of pipe, as shown on the plans or approved by the Engineer.

### 2. TRENCH BACKFILLING

The trench backfill, from 300 mm over the pipe to the frost line, which is approximately 1.5 meters below grade, shall be approved imported fill material or acceptable native material placed in 300 mm layers and compacted to 95% of the maximum dry density, depending on the material. Where native material is acceptable for backfill, it must be used from the frost line to the subgrade, placed in 300 mm layers, and compacted to 95% of the maximum dry density.

### 3. SHEATHING AND SHORING

The Contractor shall furnish, put in place, and maintain such sheathing, shoring, and bracing and at such locations and elevations as are necessary or as may be required to support and protect the sides, bottom and roof (if any) of the excavation, and to prevent any movement which can in any way disturb or weaken the supporting material below or beside the works or diminish the width of the excavation or otherwise disturb, damage, or delay the work or damage or endanger adjacent pavements, property, buildings, or other works. The cost of such measures shall be allowed for by the tenderer in the prices tendered in the Schedule of Items and Prices for the relevant structures or pipe laying.

If, in the opinion of the Engineer and at any location, the Contractor has not taken adequate or satisfactory measures to fulfill his responsibilities as set out in the preceding paragraph hereof or elsewhere herein, the Engineer may direct the Contractor to take corrective action, and on being so directed, the Contractor shall forthwith furnish, put in place, and maintain satisfactory sheathing, shoring, and bracing at no additional cost to the Owner.

Neither the absence of a direction from the Engineer or the Inspector to the Contractor with respect to sheathing, shoring, or bracing hereunder, nor the approval or disapproval by the Engineer or the Ministry of Labor Inspector of the measures taken by the Contractor hereunder shall relieve the Contractor of his responsibilities as set out herein.

### 4. **DEWATERING**

Unless the Municipality has identified dewatering as an item in the schedule of quantities due to extenuating circumstances, the Contractor shall at all times keep all excavations, trenches, and tunnels free from water at his own expense. He shall employ pumps, deep wells, well points, or any other method necessary to remove the water in a manner that will prevent loss of soil and maintain the stability of the sides and bottom of the excavation.

He shall provide for the disposal of water removed from the excavation in such a manner as shall not be a danger to the public health, private property, or to any portion of the work completed or under construction either by him or any other contractor, or to the surface of the streets, and shall cause no impediment to the use of the streets by the public.

The Contractor shall not hold the Owner or other Contractors liable for leakage encountered by him in his work from existing sewers, watermains, or drains or from other sewers or drains under construction.

Gutters shall be kept open at all times for surface drainage and no damming or ponding of water in gutters or other waterways will be allowed except with the permission of the Engineer. The Contractor shall not direct any flow of water across or over pavements except through approved pipes or properly constructed troughs.

#### i) Depth of Trenches

Trenches shall be excavated to the depth required for the foundations of the sewers, watermains, and appurtenances shown on the drawings. If the trench is excavated below required grade, the Contractor shall fill it to grade with approved structural fill at his own expense and to the satisfaction of the Engineer.

#### ii) Disposal of Excavated Material

No excavated material shall be stockpiled within street lines of any roadway. Material excavated within the limits of street lines shall be removed at the Contractor's expense. In all other areas, the Contractor shall stockpile sufficient excavated material as may be required to fill completely any temporary diversions which he may construct for his own convenience, together with material required for normal backfilling around structures.

Excavated material in these areas in excess of that required for backfilling shall be disposed of at the Contractor's expense.

A release letter may be requested by The City of Sarnia from the owner of the disposal site detailing contact information, location, and site condition. This release letter in no way grants approval, accepts, responsibility or liability by the City of Sarnia.

### **5. PIPE BEDDING - Watermain and Appurtenances**

#### i) Sub-Base

The surface upon which the water pipe is to be laid shall be firm and true to grade. If soft, spongy, unstable, or unsuitable material is encountered upon which the bedding material is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with compacted approved bedding material.

#### ii) Granular Bedding

Granular bedding shall be laid to the dimensions shown on the drawing. Care shall be taken that there is even compaction of the bedding. The Contractor shall ensure that the material at the side of the pipe is compacted to the trench wall to the same degree as that underneath the pipe.

The pipe shall be supported for the full length of the barrel with bearing along the bottom four-tenths of its diameter. The coupling or bell shall not rest on the bedding or subgrade. The bedding shall then be compacted under the haunches of the pipe.

Granular bedding shall be granular "A" as per drawing 112-SF. Where pipe is bedded on rock, 19mm clear stone will be supplied by the Contractor to a height of the exterior diameter of the pipe. Pea stone bedding is not an acceptable material.

The granular material shall be placed in 150 mm layers and compacted to 100% maximum dry density.

### 6. PIPE LAYING

Pipe shall be carefully inspected in the field before and after lying. If any cause for objection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer.

Pipe shall be laid at a minimum depth of 1.8 meters with the bell end of the pipe upgrade.

Pipe shall be laid true to line and grade with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the bell or collar which shall not bear upon the subgrade or bedding. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken out and re-laid at the Contractor's expense. Any change in direction shall be approved by the Engineer using radius pipe and/or fittings. and deflections of the pipe as per manufacturer's requirements.

Trenches where pipe laying is in progress shall be kept dry and no pipe shall be laid in water or upon wet bedding, or on frozen ground. As the pipes are laid, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the preceding length has been thoroughly embedded and secured in place so as to prevent any movement or disturbance of the finished joint.

No walking on or working over the pipes after they have been laid shall be allowed until there is at least 300 mm of cover over them, except as may be necessary in refilling the trench and compacting the backfill.

A watertight plug shall be used whenever pipe laying is not in progress. Care should be taken to prevent pipe flotation should the trench fill with water.

There shall be a minimum of 500mm of vertical separation between the watermain and any sewer or other pipeline which must be crossed.

### 7. CONCRETE THRUST BLOCKS

When concrete thrust blocks are required, the concrete shall be 20 MPa and shall be constructed to the dimensions shown on the Standard Drawings. After the pipe has been jointed and the laying approved, the trench shall be cleared of all loose material and the trench wall neatly trimmed to provide the thrust block with support against an undisturbed solid surface.

The side of the thrust block shall be formed to the required dimensions before pouring concrete. When soft unstable soils such as clay, muck, or peat occur, the Engineer shall determine the safe bearing loads and order the removal and replacement of it with ballast before casting thrust blocks or recommend the use of corrosion resistant tie rods as per OPSD 1103.010.

### 8. VALVES AND APPURTENANCES

Valves shall be installed along the property line extension at intersections in an unpaved area as per drawing 134-F.

Otherwise, valves shall be installed as shown on the construction drawings. All valves are to be backfilled with 19mm clearstone. Pea stone is not an acceptable material. Align accurately and support both valve and connecting pipes as per drawing 2082-S.

A valve box shall be provided for every valve which has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a metal grease case. The valve box shall not transmit shock or stress to the valve. It shall be centered and plumb over the operating nut of the valve, with the box cover set to finished grade. A stem extension shall then be installed in accordance with the standard drawing.

### 9. HYDRANTS

All hydrants shall stand plumb and shall have their hose nozzles parallel with the street line and the pumper (steamer) nozzle perpendicular to the curb. The hydrant shall be set with the breakaway flange 75-150 mm above finished grade. The hydrant shall be located as indicated on the drawings. Mid-block installations shall be those shown on the drawings or as directed by the Engineer. The hydrant shall be supported by concrete blocking set on a solid foundation. Each hydrant shall be connected to the main with a 150 mm branch controlled by an independent 150 mm valve. Restrainers or thrust blocks are required at the tee and behind the hydrant as shown on the Standard Drawing 95-SF. Hydrant drain holes are to be plugged. All hydrants will be required to have a push on boot.

All Hydrants are to be painted yellow following installation and prior to release of holdbacks. The Contractor shall apply two coats of "Sico Safety Yellow Code #635-520" paint or approved equal over quick dry red oxide primer. Cost of supply and application of paint and primer shall be included in the price of hydrant installation. Temperature of air must be a minimum of  $10^{0}$  C during application and curing of paint."

### **10 CUTTING IN SLEEVES**

This assembly allows a new gate valve, tee, or other fitting to be inserted into an existing main. The following table gives the length of pipe to be cut out for the various valve and tee sizes.

MAIN SIZE (mm)	100	150	200	250	300
FOR VALVE	540	560	590	605	685
FOR TEE	710	795	835	920	1015

After the main has been shut down, the pipe shall be cut and the section removed. An approved coupling by the City Engineer, is placed over each of the exposed pipe ends. The valve or tee is supported, aligned, and securely coupled to the appropriate length spool pieces. With the valve or tee in its final position, the remaining couplings are coupled to the pipe ends.

### **11. INSULATION OVER WATERMAINS**

Installation depth of the watermain shall be 1.8 meters, where a minimum of 1.5 meters of cover cannot be achieved insulation shall be installed over watermain.

Insulation thickness and width as per drawing 138-F. The material shall be Styrofoam SM (HI)-40, with 150mm of compacted fine sand material below and above the insulation. All inside edges or ends shall be butted tightly together and all end joints shall be staggered, as required by the Engineer.

Thermal insulation shall be anchored with two 6mm (1/4 inch) diameter hardwood skewers per sheet of Styrofoam. The skewers shall be 150mm longer than the total board thickness and shall be inserted at opposing angles of 30 degrees from the vertical. Insulation to extend until watermain has a minimum of 1.5 m of natural cover.

### **12. METER PITS**

Meter pits shall be installed as per City of Sarnia standard drawing 100-SF. All meter pits shall be set to finish ground elevation.

### **13. WATER SERVICE CONNECTIONS**

All connections shall be laid perpendicular to the main and extended to the center of each lot as indicated on the Contract Drawings or as directed by the Engineer.

Tapping methods must be completed using a Mueller Drilling/Tapping Machine or approved equal. Dry tapping is not an approved procedure by the City Engineer.

Taps should be at least 300mm (12") apart and staggered around the top section of the pipe. The corporation stop, when installed, shall engage at least three full threads and be left fully open. Service saddles shall be installed a minimum distance of 1.0 meters from the mainline joint. A vertical gooseneck shall be provided on the service, as shown on the Standard Drawing 150-F for all 19mm (3/4") diameter copper services. Water Services 25mm (1") and above shall be tapped into the main at least 45 degrees above the horizontal as shown on Standard Drawing 150-G. It shall be terminated at the property line with a curb stop and box which should rest on a concrete brick for support. The box shall be plumb and the top set to finished grade.

Any services not immediately connected to an existing service will require a series 160 polyethylene tail at the property line rising from the curb stop to 1.0 meters above service grade. Poly to be folded over and zip tied to the marker stake and backfilled.

All services shall have a minimum of 1.8 meters of cover. Place and compact 150mm of Granular "A" bedding, and 300mm of Granular "A" cover material, to 100% S.P.D.

Services shall be bedded and installed in accordance with Standard Drawings 112-SF.

All fittings including corporation stop, curb stop, and connection materials are to be "no lead" or lead free.

No unions will be permitted on any portion of the service in the City right-of-way unless directed by the Engineer or for a repair situation.

Each family unit of a single family detached house, semidetached, duplex, or row housing shall have an individual 20 mm service.

# C. GENERAL PROVISIONS

All pipes up to and including 600 mm diameter shall be delivered to the Work Area with end covers by Manufacturers. A tamper evident seal shall be placed on the bell end. These components shall adhere sufficiently to withstand the stresses caused during shipment. (Refer OPSS.MUNI 441 for further details)

The Contractor shall supply and install a tracer wire and connections with the watermain. Tracer wire must be continuous (unspliced), 12 gauge, solid copper plastic coated wire, RWU90, 600V, or approved equal. Tracer wire is to be brought up the outside of the hydrant valves only and inserted in the upper section of the valve box.

Excavate, remove, and dispose of materials of all types and descriptions, including rock and concrete, from the installation of the watermain pipes.

Any sections of abandoned underground utilities and municipal services (i.e. gas main, bell conduit, watermain, sewer pipe and services, etc.) encountered as part of watermain installation and found to be in conflict shall be removed by the contractor at his cost.

Prior to removal of any abandoned sections of underground utilities, the contractor will contact the relevant utility company to confirm the nature of the piping/conduit and whether any special means of removal/abandonment are required.

Supply, place and compact Granular "A" bedding and cover, using 100% S.P.D.

Supply, place, and compact approved backfill material using Standard Backfill and Compaction Method. (SBCM)

When backfilling any excavation, trench, and void of any nature or description, the backfill from 300 mm over the pipe to the frost line, which is approximately 1.5 meters below grade, shall be acceptable native material or approved imported fill material placed in 300 mm layers and compacted to 95% S.P.D. Where native material is acceptable for backfill, it must be used from the frost line to the subgrade, placed in 300 mm layers and compacted to 95% S.P.D. The Contractor is responsible for dewatering the trench of water from all sources. Under no circumstances is ground or surface water to enter the watermain pipe.

Provide a temporary bulkhead and sufficient thrust block required to perform the necessary tests prior to connecting to the existing watermain, so that shutdown time of existing watermain is limited. This shall also apply to sections of watermains constructed in which the Contractor wishes the Municipality to fully accept part of the constructed system and the temporary bulkhead is the only means to isolate part of the system to be tested.

Install blow-offs as required on the proposed main in order to perform the necessary tests.

Provide a watertight plug, as outlined in the watermain specifications. Provide and use a temporary watertight plug to protect against unsuitable material during working hours.

All existing and new watermain services shall be reconnected or connected to the new watermain with 20mm diameter pipe (or as directed by the Engineer), soft copper, Type "K", including main stop, complete in every respect and as required by the Engineer.

Supply and place concrete thrust blocks in accordance to OPSD 1103.010 for horizontal bends and OPSD 1103.020 for vertical bends and OPSS.MUNI 441 when thrust blocks are not possible or asrequested by the City Engineer, restraint systems may beinstalled as per City of Sarnia Standard Drawing 2500.

Provide the necessary equipment and materials to perform pressure test, leakage test, and to chlorinate and flush the watermain constructed in this Contract. All lengths of watermain are to be hydraulically foam swabbed to remove any possible debris.

Cap or plug with concrete any abandoned watermains or pipes, as required by the Engineer.

Provide potable water at all times to the residential and commercial units affected by the shutdown of the water supply during construction, to the satisfaction of the Engineer.

Connect the proposed watermain to the existing watermains, complete in every respect.

### **1. PETROLATUM AND PETROLEUM COATING SYSTEMS**

Reference to petrolatum coating systems means an approved petrolatum and petroleum coating system that conforms to A.W.W.A. C217-90 standard and is approved for use by the City Engineer.

While each product must be applied according to the manufacturer's instructions, the application will generally be done in the following fashion. The item to be coated shall be cleaned of all dirt, oil, grease, flakes of paint and metal and any other thing that might prevent adhesion of the petrolatum system. If the item requires blast cleaning or heavy wire brushing to prepare it, it will be rejected.

After cleaning, a uniform and continuous coat having a film thickness of at least 3 mil (76  $\mu$ m). Any rough or uneven surfaces shall be filled in or smoothed over by using the mastic supplied by the manufacturer. The whole surface shall then be wrapped with the top coating at 55% overlap and a minimum thickness of 40 mil (1016  $\mu$ m).

Petrolatum and petroleum coating systems approved by the City Engineer are Denso Petrolatum Products as supplied through Denso of Canada Limited and Petro Petrolatum Coating Systems as supplied by Petrolatum Coating Systems Pty. Ltd.

All watermain appurtenances including caps, valves (bolts and bonnet only), hydrants, restrainer clamps, nuts, bolts, tees, elbows, fittings, clamps, couplings, blow offs, and transition joints are required to be treated with full Petrolatum Coating System complying with manufacturer's instructions.

### 2. INSULATION FOR WATERMAINS

Insulation shall be installed over watermain where a minimum of 1.5m of cover cannot be achieved. Insulation thickness and width as per drawing 138-F. The material shall be Styrofoam SM (HI)-40, with 150mm of compacted fine sand material below and above insulation. All inside edges or ends shall be butted tightly together and all end joints shall be staggered, as required by the Engineer.

Thermal insulation shall be anchored with two 6mm (1/4 inch) diameter hardwood skewers per sheet of Styrofoam. The skewers shall be 150mm longer than the total board thickness and shall be inserted at opposing angles of 30 degrees from the vertical. Insulation to extend until watermain has a minimum of 1.5m of natural cover.

### **3. BACKFILLING MATERIALS**

i) Pipe Bedding and Cover Material

The material used for pipe bedding and pipe cover, to 300 mm above the top of the pipe, shall be Granular "A" is to be from a quarried bedrock source.

When trench conditions are wet so that the Granular "A" bedding becomes saturated and soft but the bottom and side of the trench remain solid, then the bedding material is to be 20 mm uniformly graded clear crushed stone.

ii) Granular Backfill Material

All granular backfill material shall be Granular "B" Type 1 in OPSS MUNI 1010 or be approved excavated native granular material complying to the requirements of select subgrade material in OPSS MUNI 1010, and be approved for use by the City Engineer.

iii) Acceptable Native Material

Acceptable native material shall be friable and free from rubbish, wires, cans or debris of any sort; boulders or rock or concrete fragments with a dimension greater than 150 mm; roots, stumps, trees or timbers; and frozen materials. Material shall be compatible with native material.

### 4. SHUTTING DOWN OR CHARGING WATERMAIN

The Contractor shall not shut down or charge any watermain or operate any gate valve or hydrant for any reason outside the construction limits. The operation of valves and hydrants shall be performed by City forces only. Twenty-four (24) hours advance notice shall be given to the City Waterworks Department when a valve or hydrant operation is required. The Contractor may operate new water valves on uncomissioned watermains to the satisfaction of the Engineer. All water users supplied by a main scheduled to be shut down, for any length of time, shall be notified by the Contractor at least forty-eight (48) hours prior to shut down. The Contractor shall advise in writing the water users when the service will be restored.

# **D. WATERMAIN TESTING PROCEDURES**

### **1. VISUAL INSPECTION**

The watermain and all related appurtenances shall be cleaned of all foreign material before installation to the satisfaction of the Engineer.

The valves must be thoroughly inspected for defects, damages, and proper operation before installation.

The watermain shall be inspected by the Engineer for alignment and obstructions during the installation of the pipe.

## 2. PRESSURE AND LEAKAGE TEST

The work of laying the pipe and all appurtenances shall be of such a character as to leave all pipe and connections watertight and able to withstand a static pressure of 1 MPa (150 psi).

Hydrostatic pressure test and leakage test must be performed on all watermains and appurtenances constructed. All valves shall be tested.

The Contractor must follow these procedures when testing the constructed watermain:

At no time will the Contractor be permitted to operate any valves on the distribution system. The Municipal Works & Services Department must be called to operate valves.

Contractor's Foreman or Superintendent must notify the Engineering Department and Waterworks Superintendent twenty-four (24) hours before the watermain is to be charged and later tested. Before the above is done, the Contractor must be certain that he has all the required test material, labor, and equipment. The Contractor must also make the required arrangement to obtain an approved water supply.

The City of Sarnia Public Work Department shall supply and install an independent cross connection control apparatus for the filling of watermains for pressure testing, flushing and disinfection. As recommended practice of AWWA C651. Watermains must be filled using a temporary connection from a hydrant or may require supply of water and a tanker. Only potable water must be used, with chlorine residual consistent with the Ontario Drinking Water Standards.

When temperature is 0°C or lower, the Contractor must construct a temporarily heated enclosure with a minimum dimension of 2.4 m square by 2.0 m high located at the point where pressure is to be introduced, and a 1.2 m square by 2.0 m high heated enclosure around hydrants and blow-offs to be used to remove air from the watermains and also to be used to flush the watermains.

This requirement must be fulfilled if temperature is at 0°C or is anticipated to decrease below 0°C during the test period.

In temperature 0°C or lower, the Contractor, at his cost, must take all precautions required to prevent watermains and appurtenances from freezing and will be totally responsible to undertake all necessary measures to repair or replace frozen watermains and appurtenances that are damaged.

Before filling the new watermains, the Contractor must verify that all required blow-offs have been installed at locations required to remove air from the watermain, and as required to achieve adequate flushing.

The Contractor must introduce water gradually into the main and fill at a rate that will not cause water hammer or damage to the main in any way.

When filling the watermain, the Contractor must make certain that blow-offs and hydrants located at high points of the system to be tested are opened. These must remain opened until all air has been expelled from the sections of watermains to be tested and until the flushing of the main has been completed.

The watermains constructed must be flushed through hydrants and main-cocks (blow-offs) to produce a flushing velocity of not less than 0.76 m/second.

Watermains to be cleaned with foam swabs in each branch. Two new swabs shall be placed inside the watermain being a minimum of 50mm larger than the diameter of the main. Once the Contractor has flushed the watermains to be tested for the required period and is certain that all the air has been removed from the system, the blow-offs and hydrants can be completely closed.

After the above procedure is followed, the valve feeding the system to be tested can also be completely closed and the hydrostatic and leakage test can begin.

The hydrostatic and leakage test to be carried out is a one test operation and the Contractor must complete all the previous procedures and proceed as follows:

a) install the required main-cock to perform the test;

b) install the complete hook-up to perform the test (i.e. the fittings from the main-cock to the pressure pump, from the pressure pump to the pressure gauge, and from the pressure pump to the supply barrel);

c) install the approved test gauge;

d) apply the pressure to the watermains to be tested until the pressure reads 1 MPa (150 psi). This pressure is to be maintained for a period of two (2) hours (120 minutes).

When the Contractor is ready to perform the Official Watermain Hydrostatic and Pressure test, he must contact the Project Supervisor and inform him that he wishes the test to begin. At this time, if the Project Supervisor agrees that all procedures and requirements to perform the test have been fulfilled, he will then give the Contractor authorization to continue with the test. When authorization is given to continue with the official test, the City's Inspector or Project Supervisor will record:

a) the initial time of the test;

b) the time and pressure reading before the pressure is reapplied, the procedure required to raise the pressure from the dropped value to the required pressure value of 1 MPa. This procedure must be carried out as often as required during the test period to maintain the pressure as specified above. The dropped value must not be lower than 150 psi; the water volume used in Section 2 to raise the pressure from the dropped value to 1 Mpa (150 psi).

c) all test data shall be recorded on the City of Sarnia Official Test Sheet. When the test is completed, the Project Supervisor shall determine the amount of leakage and compare it to the allowable leakage of 2.22 liters per day per mm of diameter per km of pipe.

 $A = T \times F \times D \times L$ 

Where:

- A = allowable leakage in liters
- F = a constant flow rate of 0.0925 liters per hour
- T = time period of test; i.e. 2 hours
- D = diameter of pipe in millimeters
- L = length of pipe being tested in kilometers

If the watermain has failed the leakage test, it is necessary to find the point or points where the excessive leakage is taking place. There are a few steps that can be taken to ensure that it is a pipe leak, and not a leak at a fitting. First, leave the line under normal pressure. The next day, repeat the test. If the leakage measured the next day is greater than before, the leak probably is in a pipe joint or a damaged pipe. If the leakage is the same, it is more probably in a valve or a service connection.

To determine which it is, take the following steps. Insert the key for the curb stops in each shutoff and listen at the top of the key. It may be possible to hear a leak since the key acts somewhat like a stethoscope.

If a leak is heard, open the shutoff and close it again. If there is now no audible leak, test the section again.

If no leaking curb stops are found, crack the main valves at the ends of the test section several times and close them again. This is to flush out any sand grains in the valve seats that may prevent the valves from closing completely causing slight leakages.

If it is found that the leakage does not occur at either of the above points, it is then necessary to try and find a leak through trial and error. Some sort of leak detector, such as a sensitive microphone with amplifier and earphones is necessary. Any leaks in the line should be repaired and the line retested until the measured leakage is less than the allowable leakage.

The Contractor shall bear the expense of all labor, material, and equipment incurred in eliminating the leak or leaks, and the retesting until successful results are obtained.

On the successful completion of the hydrostatic and leakage test, the Contractor must immediately disinfect the watermains tested.

The City of Sarnia will only accept the watermain section tested after the results of the hydrostatic and leakage test are acceptable; the chlorination test has been performed; the flushing of the watermain is completed; the Waterworks Section has checked all valves on the system; the hydrants have all been inspected; and bacteriological testing has been successfully completed.

When all the above have been met, the Engineering Department will confirm the acceptance in writing.

The cost for providing all necessary labor, material, and equipment required to carry out all the procedures set in this section to perform the required tests is to be included in the Unit Prices of the Tender Items. No extra payment will be made.

### 3. DISINFECTION AND FLUSHING

In a public water distribution system, all newly laid watermains, temporary water systems, or existing watermains which have been repaired, must be disinfected before being placed into service, in accordance with **ANSI/AWWA C651** or latest revision. It is necessary to follow this practice in order to protect consumers against the possibility of infection which could result from ingestion of water contaminated by disease producing organisms. In all likelihood, the newly constructed system will have sustained contamination during transit, storage of the components, and laying of the piping. Often the pipe must be laid in soggy trenches and possibly on occasions be in contact with wastewater or even sewage admitted into the trench through service cuts.

In general, the disinfection procedure consists of twenty-two operations:

- 1. Inspecting all materials to be used to ensure the integrity of the materials.
- 2. Preventing contaminating materials from entering the watermain during storage, construction, or repair and noting potential contamination at the construction site.
- 3. Removing, by flushing or other means, those materials that may have entered the watermain.
- 4. Physical isolation is required for all new watermains.
- 5. Testing against valves will not be permitted.
- 6. Mechanical tie-ins are to be kept to a distance of not more than 6 meters.
- 7. Watermain is to be installed completely with the addition of swab launchers.
- 8. Contractor is to confirm the line and grade of existing mains by means of excavation prior to commencing line laying. Physical ties are to be free from bends elbows.
- 9. Watermain is to be pressurized to line pressure using an adequate backflow preventer prior to tapping any services. All services to be tapped under pressure.
- 10. All services are to be installed as per the City of Sarnia Standards
- 11. Services are to be installed complete with a series 160 polyethylene tail at the property line rising from the curb stop to 1.0 meter above grade.
- 12. All lengths of watermain are to be hydraulically foam swabbed to remove any possible debris.
- 13. All watermain and services are to undergo pressure testing, leakage testing, and bacteriological testing as per Sarnia' Standards.
- 14. All watermain and services shall be disinfected with heavily chlorinated water for a period of 24 hours as per City of Sarnia Watermain Disinfection Procedures.
- 15. All watermain and services shall be de-chlorinated as per the requirements of the M.O.E.
- 16. All services to be flushed following de-chlorination.
- 17. Upon successful completion of all testing, tie-ins and connections all services are to be flushed resulting in an adequate chlorine residual.
- 18. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
- 19. Protecting the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures.
- 20. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.
- 21. Determining the bacteriological quality by laboratory test after disinfection.
- 22. Final connection of the approved new watermain to the active distribution system.

The cost of providing all necessary labor, material, and equipment required to carry out all the requirements of this section is to be included in the Unit Prices of the Tender items. No extra payment will be made.

#### 4. **DISINFECTION**

The acceptable method of disinfecting newly constructed watermains is the continuous-feed method.

The continuous-feed method is suitable for general application, and because no tablets are required to be left in the pipe during construction and preliminary flushing can be done to remove light particulates from the main. This is the procedure recommended for typical installations and is described below.

The continuous-feed method consists of completely filling the main to remove all air pockets, flushing with potable water to remove particulates, and chlorinating the water in the main. Chlorination is done by introducing a solution to create an initial chlorine concentration of  $\geq 25$  mg/L (25ppm). After a minimum contact time of 24 hours in the main, there must be a free chlorine residual of not less than 40% of the Initial Chlorine Concentration to a maximum of 50 mg/L (50ppm).

Disinfection Method	Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration		
Continuous Feed	24 hours	≥25 mg/L	40 % of the Initial Chlorine Concentration to a Maximum of 50 mg/L		

For preliminary flushing, the velocity in the main shall not be less than 0.75 m/s. The following table indicates the flow rates required for commonly used pipe:

Diameter	Diameter (mm)Flow ProduceSize of 250.75m/s		of Ta	ps	No of	
(mm)			38	50	64mm	
	(l/s)	No. of Taps in Pipe			Outlets	
100	6.3	1	-	-	1	
150	12.6	-	1	-	1	
200	25.2	-	2	1	1	
250	37.9	-	3	2	1	
300	56.8	-	-	2	2	
400	100.9	-	-	4	2	

(Source: AWWA C651-14 Table 3)

Typically, chlorine solutions are available as calcium hypochlorite, a granular product having 65% available chlorine, or sodium hypochlorite, a liquid product having 10% to 15% available chlorine. They are prepared for feeding into the main as a one-percent solution (10,000 ppm). For calcium hypochlorite, a 1% solution requires 1 lb. (454 g.) in 30.0 liters of water. Appendix "A" provides a reference for comparison of measures of concentration. The quantity of one-percent solution required to produce 25 mg/L concentration in 30m of pipe is as follows:

Pipe Diameter (mm)	1% Chlorine Solution (I)
100	0.6
150	1.4
200	2.5
150	3.9
300	5.4
400	9.8

(Source: AWWA C651-14 Table 4)

Chlorine solution shall be introduced into the main not more than 3 m. downstream from the beginning of the pipe. It may be

applied to the watermain with a gasoline or electrically powered chemical-feed pump designed for feeding chlorine solutions. Feed lines shall be made of material capable of withstanding the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Chlorine application shall not cease until the entire main is filled with a solution having a concentration of at least 25 mg/L. To ensure that this concentration is provided, chlorine concentrations can be measured using high-range test kits that are easy to use and satisfactory for the precision required. The chlorinated water shall be retained in the main for at least twenty-four (24) hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances.

If application of chlorine is carried out from one source, the Contractor must flush hydrants and blow-offs at various locations to the satisfaction of the Engineer to ensure that the chlorine has transferred into all parts of the constructed watermain.

Extreme care is to be exercised by the Contractor to ensure that the section of main being chlorinated is isolated from the existing water system. No valves shall be operated thereby preventing escape of chlorine solution into the distribution system.

#### 5. FINAL FLUSHING

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is not higher than that generally prevailing in the system, and shall be disposed of safely. Acceptable means of disposal are by discharge to storm sewer or a drainage ditch with a free chlorine residual of 0.0mg/l. A discharge plan for the dechlorination process may be required including monitoring, erosion control measures, and chemicals used to dechlorinate.

Acceptable chemicals may be Hydrogen Peroxide, Sodium Thiosulphate or Sodium Pyrosulphite or approved equal.

#### 6. BACTERIOLOGICAL TESTS

After final flushing and before the watermain or temporary potable water system is placed in service, two consecutive sets of acceptable samples shall be taken at least twenty-four (24) hours apart. At least one set of samples shall be collected from every 350 m. of the new watermain, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*. The Engineer or his representative must be present when the samples are collected.

The Contractor shall collect water samples in the presence of a City of Sarnia representative and send to an environmental laboratory accredited by the Standards Council of Canada for microbiology testing of water. Samples for bacteriologic analysis shall be collected in sterile bottles provided by the accredited laboratory, and shall follow the sampling procedure directed by the laboratory. The sample bottles may contain sodium thiosulphate or other preservative to neutralize chlorine. This material must not be rinsed out of the bottles.

No hose or fire hydrant shall be used in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly must be removed and retained for future use.

Water shall be tested for bacteriological contamination. The bacteriological analysis must prove results of zero total coliforms, zero fecal coliforms, and zero background colonies or organisms per 100 ml. The laboratory shall provide a written report confirming the analysis. The new watermain is not to be placed into operation until the results of these tests are known to be satisfactory, and the Contractor has submitted the laboratory results to the Engineer.

#### 7. **REPETITION OF PROCEDURE**

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. When the samples are satisfactory, the new main may be connected to the distribution system.

#### 8. **DISINFECTION OF TIE-IN SECTIONS**

Connections to the distribution shall be disinfected in accordance with AWWA C651-14, or latest revision. For short connections (less than one pipe length  $\leq$  5.5m), this requires spraying or swabbing of 1-5% solution of chlorine just prior to being installed.

#### 9. FIRE HYDRANT FLOW TESTING

Flow testing shall be required on all new fire hydrants installed on private Site Plans and Subdivisions before issuance of occupancy or building permit. Flow tests will be completed by the Developer and results submitted to the Engineering Department. All costs associated with flow test to be borne by the Developer. Colour Code the bonnets of hydrant(s) to designated level of service being provided by that hydrant. The flow test is to be performed by a qualified person who holds a MOE drinking water license and according to NFPA 291 standards. NFPA 291 color coding is to be based on the theoretical flow at 20psi residual pressure. The City is to be notified 48 hours in advance and to be on site during the flow test. The Developer is responsible to pump out all hydrants that have been flow tested.

Blue	1500 us gpm or greater
Green	1000 to 1499 us gpm
Orange	500 to 999 us gpm
Red	Less than 500 us gpm

### **E. SERVICING REQUIREMENTS**

#### **1. SERVICES FOR NEW DEVELOPMENT**

Private

Where development occurs on property that has an existing water services, these existing services must be abandoned and new services installed unless it can be proven that the services are a minimum 20 mm (3/4") water service.

Use of these existing water connections shall be at the sole discretion of the City Engineer and wholly the responsibility of the owner/developer.

#### 2. EXISTING SHARED SEWER CONNECTIONS

Capital Projects

There may be some cases where existing water services are shared by adjoining properties. If the City Engineer finds any property owners on the street wanting a new separate connection, the Contractor shall install 20mm (3/4") copper or Pex water service from the main to the property line. All cost associated with this work shall be included in the prices bid for supply and installation of private service. Before commencing any of this work, the City Engineer's approval must be obtained. This work may be deleted from the contract if found unnecessary, without any payment to the contractor.

#### 3. ABANDONING SERVICES

Abandoning services shall be coordinated and witnessed by the Development Engineering Department staff. The work shall be completed before the Engineering Department's signing off on the demolition application form.

Commencement of the demolition project before the services can be disconnected and capped, the owner shall provide a deposit to the City.

#### i) For Redevelopment

When an existing building is demolished and the services are to be reused for re-development within 5 years.

The water service shall be disconnected at the curb stop or property line and a 20mm (3/4'') poly pipe installed for flushing

purposes. The poly is to be brought 300mm (12") above the ground surface and marked with a 2"x4" as per the City of Sarnia Standards Drawing 2064-S. This must be completed before the building demolition permit will be issued.

#### ii) **Permanently**

When an existing building is demolished with no intention of redevelopment within 5 years

The water service mainstop shall be shut off, the service cut and both ends crimped within 150mm (6") of the watermain. The curb stop box and rod shall be removed at property line.

# DIVISION 4.2 CITY OF SARNIA SEWER STANDARDS

2020

STOR	AND SANITARY SEWER MATERIAL, CONSTRUCTION
A. N	METHODS AND TESTING PROCEDURES
1.	STORM AND SANITARY SEWER PIPE
i)	Main Line3
ii)	Service Laterals4
iii)	Concrete Pipe Service Connections4
iv)	PVC (Ribbed or Profiled)4
vi)	Culverts
2.	FILTER CLOTH
3.	SUBDRAINS
i)	HDPE Pipe – Road Side5
ii)	HDPE Pipe – Storm Manholes6
4.	BACKFILLING MATERIALS7
i)	Pipe Bedding and Cover Material7
ii)	Backfill Material7
5.	MANHOLES – STORM AND SANITARY7
6.	PRECAST CATCHBASINS8
7.	BACKWATER VALVE DEVICES
в. с	ONSTRUCTION METHODS10
1.	TRENCH EXCAVATION
i)	General10
ii)	Protection of Existing Utilities10
iii)	Maximum Length of Open Trench11
iv)	Maximum and Minimum Width of Trench11
2.	TRENCH BACKFILLING
3.	SHEATHING AND SHORING
4.	DEWATERING12
5.	DEPTH OF TRENCHES
6.	DISPOSAL OF EXCAVATED MATERIAL
7.	PIPE BEDDING14
i)	Sub-Base14

i	i)	Concrete Bedding1	4
i	ii)	Concrete Encasement1	4
i	v)	Concrete Cradle1	4
١	/)	Granular Bedding1	5
١	vi)	Pipe Lying1	5
8.	I	MANHOLE AND CATCHBASINS1	6
i	)	Manhole Shafts1	6
i	i)	Manhole and Catchbasin Frames1	6
i	ii)	Safety Gratings1	6
i	v)	Openings in Manhole and Catchbasins1	7
١	/)	Pre-Cast Riser Sections1	7
١	vi)	Adjustment Covers1	7
١	vii)	Pavement Reconstruction During Adjustments1	8
١	viii)	Debris Removal1	8
i	x)	Removal of Existing Manholes and Catchbasins1	8
9.	I	BUILDING SEWER LATERALS1	.8
i	)	Tees on Sewer Main1	8
i	i)	Depth and Location of Sewer Laterals1	8
i	ii)	Minimum Slope for Sewer Laterals1	9
i	v)	Weeping Tiles and Eaves Troughs1	9
10	. IN	STALLATION OF CULVERTS1	9
C.	TE	STING PROCEDURES2	1
1.	-	TV INSPECTION OF SEWERS AND SANITARY SERVICES2	1
D.	SE	RVICING REQUIREMENTS2	2
1.		SERVICES FOR NEW DEVELOPMENT2	2
2.	I	EXISTING SHARED SEWER CONNECTIONS2	2
3.		ABANDONING SERVICES2	3

## A. MATERIALS

#### **1. STORM AND SANITARY SEWER PIPE**

Place Sewer pipe and appurtenances meeting the specification outlined below, (unless the pipe material is stated on the contract drawings or otherwise specified):

#### i) Main Line

SDR (smooth walled) polyvinyl chloride (PVC) pipe must be used for sewers for sizes up to 450mm (18") diameter. The sewer pipe shall be SDR 35 PVC and shall be certified by CSA; CSA B182.2 and ASTM approved, conform to OPSS.MUNI 1841 and manufactured by Rehau Industries Inc., ADS Inc., Royal Pipe Co., Ipex Inc., Diamond Plastics Corporation, Northern Pipe Products or National Pipe and Plastics Inc.

Concrete pipe with gasketed bell and spigot jointing can be used for sewer sizes 525mm (21") diameter and above. Concrete Reinforced Pipe must comply with CSA A257.2.

Pipe material above 525mm (21") diameter shall be at the discretion of the contractor.

Sanitite HP, as certified under CSA 182.13 made from polypropylene, can be used for sewer sizes 300mm (12") diameter to 1500mm (60") diameter. Sewer sizes between 300mm and 600mm diameter must be dual wall and meet or exceed 320KPa. Sewer sizes between 750mm and 1500mm must be triple wall and meet or exceed 320KPa. All factory joints shall be double factory installed gaskets. When using Sanitite HP, all lateral connections must be made with Inserta Tees specific to the mainline diameter and obtain joint performance of 15PSI. Must use hole saws manufactured by the supplier. Sanitite HP can be used in Storm Sewer systems, not Sanitary Sewer systems.

All service connections shall be made using manufactured tees. Inserted tees are not acceptable.

#### ii) Service Laterals

SDR (smooth walled) polyvinyl chloride (PVC) pipe must be used for laterals and shall be SDR 28 PVC and certified by CSA; CSA B182.2 and ASTM approved, conform to OPSS.MUNI 1841 and manufactured by Rehau Industries Inc., Royal Pipe Co., Ipex Inc., Diamond Plastics Corporation, Northern Pipe Products or National Pipe and Plastics Inc.

Sanitary Sewer laterals shall be 150mm diameter and white in colour. Storm Sewer laterals shall be 150mm diameter and green in colour.

Where laterals are required to connect to existing services, 150mm (6") x 100mm (4") diameter PVC glued Wye, 100mm (4") PVC SDR 28 diameter riser pipe is required. Riser pipe to be single pipe length only, joints within risers are not permitted. Clean out caps to be cast iron cap and/or must be locatable and installed to finished grade. Caps to be Emco# DF 44 c/w solvent weld bushing or approved equal.

#### iii) Concrete Pipe Service Connections

Service connections to concrete pipe shall be made using manufactured PVC tees. Service connections may be made by using manufactured concrete tees or by core drilling the concrete pipe.

Core Bell Adaptor Coupling or an approved equivalent may be used for sewer lateral 100mm(4") diameters to 250mm (10") diameter installed on concrete pipe 300mm (12") diameter or larger. Kor-N-Tee Adapter is not an approved alternate. The applicable class of concrete pipe will be as specified in the tender item or in the Special Specifications.

#### iv) PVC (Ribbed or Profiled)

PVC (ribbed or profiled) service pipe may be used on private site plans for sanitary mainline sewers and SDR 28 or SDR 35 PVC service pipe. All service connections shall be made using manufactured tees. Pipe shall be CSA and ASTM approved and manufactured by Rehau Industries Inc., Royal Pipe Co., Ipex Inc., Diamond Plastics Corporation, Northern Pipe Products, Hanson Pipe and Products. A transition from ribbed or profile pipe to SDR smooth walled or concrete pipe must be made through a manhole before sewer line outlets onto the City's right of way.

#### vi) Culverts

Culverts shall be new Aluminized Type 2 corrugated steel pipe (CSP) with a 2.8 mm wall thickness in all cases. All corrugation profiles shall be of helical lockseam manufacture using 68mm x 13mm corrugations for culverts 1600mm dia. and smaller and 125mm x 25mm corrugations for greater than 1600mm dia. Pipe with 125mm x 25mm shall be used if 68mm x 13mm corrugations.

Multiple culverts shall be connected using a standard corrugated coupler fitted with bolts and angle attachments.

End protection shall be rip rap ends with 1.5:1 side slopes. The rip rap shall be placed on a layer of filter fabric and consisting of 100mm x 250mm quarry stone or approved equal.

#### 2. FILTER CLOTH

Filter cloth shall be a non-woven geotextile with U. V. resistance sufficient to retain 70% of the original strength or better after 22,500 hours of exposure as per ASTM D 4355, and shall have a minimum mass of 146 grams per square meter as per ASTM D 5261 and shall be 140N Mirafi geotextile as manufactured by Nicolon/Mirafi Group or 4546 grade geotextile as manufactured by Amoco Fabrics and Fibres Company or 270R grade geotextile as manufactured by Terafix.

Filter cloth shall have a 25% overlap when used for subdrains.

#### 3. SUBDRAINS

#### i) HDPE Pipe – Road Side

"Boss 1000" or "Challenger 1000" Perforated high density polyethylene (HDPE) pipe manufactured by Armtec Infrastructures Incorporated or approved equal. Pipe shall be 150mm (6") diameter and have split coupling connectors, wrapped with an approved filter cloth. Subdrain excavation shall be at 300mm below subgrade and installed 300mm behind back of curb. Granular bedding shall be 20mm clear stone and have a minimum cover of 100mm all around the Subdrain. Pea stone bedding is not an acceptable material. See typical City of Sarnia drawing detail 160-JM.

#### ii) HDPE Pipe – Storm Manholes

"Boss 2000" or "Challenger 2000" Perforated high density polyethylene (HDPE) pipe manufactured by Armtec Infrastructures Incorporated or approved equal. Pipe shall be 150mm (6") diameter and have split coupling connectors, wrapped with an approved filter cloth as per City of Sarnia 2071-S1 being a length of 6.0 meters each side of the manhole. . Granular bedding shall be 20mm clear stone and have a minimum cover of 100mm all around the subdrain Pea stone bedding is not an acceptable material.

#### 4. BACKFILLING MATERIALS

#### i) Pipe Bedding and Cover Material

Bedding shall be as per City of Sarnia Standard Drawing 108-SF, detailing 20mm Granular Clear Crushed Stone to the spring line. Granular A pipe cover to 300mm above top of pipe. All pipe bedding to comply with OPSD 802.030 and OPSD 802.031

#### ii) Backfill Material

All backfill material shall be Granular B Type I in OPSS.MUNI 1010 or be approved excavated native material complying to the requirements of select subgrade material in OPSS.MUNI 1010, and be approved for use by the City Engineer. On all service laterals, backfill to be placed up to 600mm below finished grade to property line, unless otherwise directed by the Geotechnical Engineer.

#### 5. MANHOLES – STORM AND SANITARY

Manholes and their adjustment units shall be made of precast concrete and conform to OPSD 701 and OPDS 1001 series unless indicated. Manhole tops to be precast taper tops. Flat top manholes shall be used only where depth of cover or other extenuating circumstances precludes the use of taper tops. Where grade adjustments are required, a minimum of one to a maximum of three adjustment rings as per OPSD 704.010.

All Sanitary Manholes shall be pre-benched and have a completely finished surface. The sizing and benching of manholes shall be determined by OPSD 701.021 and as per manufacturer's recommendations.

All Storm Manholes to be manufactured with a 300 mm deep sump, benching is not required. 150mm diameter subdrains into storm manholes to be cored.

Pipe connections to Storm or Sanitary Manholes shall be rubber booted with "Kor-n-Seal" boots for pipe sizes up to 450mm (18") diameter PVC Pipe. Concrete cradle as per OPSD 708.020 for all concrete pipe sizes, boots are not required for concrete storm connections.

Manhole frames and covers shall conform to OPSD 401.01 and be Type "A" closed cover without lugs. The manholes must be orientated so that the cover is centered over the pipe and in line with the ladder rungs. Manhole steps shall be in compliance with OPSD 405.020. Safety platforms shall be aluminum and be supplied and installed as per OPSD 404.020.

#### 6. PRECAST CATCHBASINS

Catchbasin and their adjustment units shall be made of precast concrete and conform to OPSD 705.010. Where grade adjustments are required, a minimum of one to a maximum of three adjustment rings as per OPSD 704.010.

150mm (6") diameter subdrains into catchbasins to be cored and to be a minimum 1.0 meters below finished grade and 100mm (4") above the outlet pipe.

Pipe connections to Catchbasins shall be rubber booted with "Korn-Seal" boots or approved equal.

Catchbasin frames and covers shall conform to OPSD 401.081 and to be "Fish Style" as provided by Bibby-Ste-Croix, Star Pipe Products or East Jordan

#### 7. BACKWATER VALVE DEVICES

In construction of a Single Family Dwelling/Single Detached/ Semi Detached/ Row housing/ or existing service alterations that are served by a public sanitary sewer and where plumbing fixtures are located below the level of the adjoining street (basement), a backwater valve shall be installed in the sanitary building drain. The backwater valve shall be installed upstream, or in lieu of, the sanitary building drain cleanout. A backwater valve that is installed in a building drain may not serve more than one dwelling unit.

Work shall include opening the floor; making the connection to the internal plumbing pipe, being the final outlet connection to the dwelling, upstream of the building drain cleanout; all necessary

fittings to make the connection; including a riser, acceptable backfill material to support the work and floor, access cover, and satisfactory restoration of the concrete floor.

Backwater valve device design and installation shall be installed and maintained by the owner at their expense and shall be readily accessible for inspection by County of Lambton Building Services. Backwater Valve Devices shall consist of a "normally open" design, conforming to CAN/CSA-B70, CAN/CSA-B181.1, CAN/CSA-B181.2, CAN/CSA-B182.1 and manufactured by Mainline backflow products – Adapt-a-valve or approved equal.

All work to be done in conformance with the Ontario Building Code 2012.

This item shall include any plumbing permits required by the County of Lambton Building Services.

## **B. CONSTRUCTION METHODS**

#### **1. TRENCH EXCAVATION**

#### i) General

For the purpose of shoring or bracing, a trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.

Excavation shall include the removal of all water and materials of any nature which interfere with the construction work. Removal of ground water to a level below the structure subgrade will be necessary only when required by the plans or elsewhere in these specifications. Excavation for conduits shall be by open trench unless otherwise specified or shown on the drawings. However, should the Contractor elect to tunnel or jack any portion not so specified, he shall first obtain approval from the Engineer.

#### ii) Protection of Existing Utilities

It shall be the Contractor's responsibility to protect and support existing underground utilities such as gas and watermains, telephone and electric cables, sewers, etc., which may be encountered during the progress of the work. The Contractor shall arrange for stakeout of such utilities by the appropriate owning authorities prior to commencement of excavation. This shall be done at no extra cost to the City, and shall be included in the tendered unit prices.

All existing gas pipes, water pipes, electric conduits, sewers, drains, fire cisterns, hydrants, oil pipe lines, gas pipe lines, Bell Telephone conduits, railway tracks, and other structures, which, in the opinion of the Engineer, do not require to be changed in location, shall be carefully supported and protected from injury by the Contractor, and in case of injury, they shall be restored by him, without additional compensation, to as good condition as that in which they are found. Supply to the utility company shop drawings describing the method of support for the approval of the utility company.

Where pipes, conduits, or sewers are removed from the trench, leaving dead ends in the ground, such dead ends shall be carefully plugged or bulk headed with brick, mortar or concrete by the Contractor, without additional compensation.

#### iii) Maximum Length of Open Trench

Except by permission of the Engineer, the maximum length of open trench shall be 30 meters or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is the greater. The distance is the collective length at any location including open excavation, pipe length and appurtenant construction, and backfill which has not been completed.

#### iv) Maximum and Minimum Width of Trench

The Contractor shall comply with the Occupational Health and Safety Act, latest version, and regulations for construction projects.

For pipe (except corrugated metal pipe), the minimum and/or maximum width of trench permitted at the top of the pipe shall be as shown on the standard drawings (OPSD 802.010). The sides to the trench shall be vertical.

For corrugated metal pipe, the trench shall be at least 300 mm wider for pipe 900mm dia or less; the trench shall be at least 500mm wider for pipe 900mm or greater than the diameter of the pipe to be installed as per OPDS 802.010

If the maximum trench width is exceeded, the Contractor may be required to provide additional bedding, another type of bedding, or a higher strength of pipe, as shown on the plans or approved by the Engineer.

#### 2. TRENCH BACKFILLING

The trench backfill, from 300 mm over the pipe to the frost line, which is approximately 1.5 meters below grade, shall be approved imported fill material or acceptable native material placed in 300 mm layers and compacted to 95% of the maximum dry density, depending on the material. Where native material is acceptable for backfill, it must be used from the frost line to the subgrade, placed in 300 mm layers, and compacted to 95% of the maximum dry density.

#### 3. SHEATHING AND SHORING

The Contractor shall furnish, put in place, and maintain such sheathing, shoring, and bracing and at such locations and elevations as are necessary or as may be required to support and protect the sides, bottom and roof (if any) of the excavation, and to prevent any movement which can in any way disturb or weaken the supporting material below or beside the works or diminish the width of the excavation or otherwise disturb, damage, or delay the work or damage or endanger adjacent pavements, property, buildings, or other works. The cost of such measures shall be allowed for by the tenderer in the prices tendered in the Schedule of Items and Prices for the relevant structures or pipe laying.

If, in the opinion of the Engineer and at any location, the Contractor has not taken adequate or satisfactory measures to fulfill his responsibilities as set out in the preceding paragraph hereof or elsewhere herein, the Engineer may direct the Contractor to take corrective action, and on being so directed, the Contractor shall forthwith furnish, put in place, and maintain satisfactory sheathing, shoring, and bracing at no additional cost to the Owner.

Neither the absence of a direction from the Engineer or the Inspector to the Contractor with respect to sheathing, shoring, or bracing hereunder, nor the approval or disapproval by the Engineer or the Ministry of Labor Inspector of the measures taken by the Contractor hereunder shall relieve the Contractor of his responsibilities as set out herein.

#### 4. **DEWATERING**

Unless the Municipality has identified dewatering as an item in the schedule of quantities due to extenuating circumstances, the Contractor shall at all times keep all excavations, trenches, and tunnels free from water at his own expense. He shall employ pumps, deep wells, well points, or any other method necessary to remove the water in a manner that will prevent loss of soil and maintain the stability of the sides and bottom of the excavation. The contractor shall provide for the disposal of water removed from the excavation in such a manner as shall not be a danger to the public health, private property, or to any portion of the work completed or under construction either by him or any other contractor, or to the surface of the streets, and shall cause no impediment to the use of the streets by the public.

The Contractor shall not hold the Owner or other Contractors liable for leakage encountered by him in his work from existing sewers, watermains, or drains or from other sewers or drains under construction.

Gutters shall be kept open at all times for surface drainage and no damming or ponding of water in gutters or other waterways will be allowed except with the permission of the Engineer. The Contractor shall not direct any flow of water across or over pavements except through approved pipes or properly constructed troughs.

#### 5. DEPTH OF TRENCHES

Trenches shall be excavated to the depth required for the foundations of the sewers, watermains, and appurtenances shown on the drawings. If the trench is excavated below required grade, the Contractor shall fill it to grade with approved structural fill at his own expense and to the satisfaction of the Engineer.

#### 6. DISPOSAL OF EXCAVATED MATERIAL

No excavated material shall be stockpiled within street lines of any roadway. Material excavated within the limits of street lines shall be removed at the Contractor's expense. In all other areas, the Contractor shall stockpile sufficient excavated material as may be required to fill completely any temporary diversions which he may construct for his own convenience, together with material required for normal backfilling around structures.

Excavated material in these areas in excess of that required for backfilling shall be disposed of at the Contractor's expense.

#### 7. PIPE BEDDING

#### i) Sub-Base

The surface upon which the sewer pipe is to be laid shall be firm and true to grade. If soft, spongy, unstable, or unsuitable material is encountered upon which the bedding material is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with compacted bedding material.

#### ii) Concrete Bedding

Where concrete bedding is called for or specified, the concrete used shall be 20 MPA and shall be construed to the dimensions shown on the drawings. After the trench has been prepared, the pipe shall be carefully laid to line and grade and shall be supported on precast concrete blocks. After the concrete shall be placed to the lines and grades shown on the drawings, particular care shall be exercised to work the concrete under the pipe, care being taken that the alignment and grade are maintained.

Where it is deemed by the Engineer, the concrete bedding may be placed in two pours. When the bedding is placed in two pours, no concrete shall be placed until the initial slab poured has cured for a minimum of 24 hours. The above work shall be performed by the Contractor without extra cost to the owner.

#### iii) Concrete Encasement

Where the sewer pipe is to be encased in concrete, the external surface of the pipe shall be thoroughly cleaned before placing concrete.

#### iv) Concrete Cradle

Where the concrete cradle is poured to the sheathing of a trench, at least on thickness of building paper shall be placed between the sheathing and the concrete. Sheathing shall be withdrawn without displacing or damaging the cradle. All cradles shall be placed with a minimum 20 MPa concrete and in compliance with OPSD 708.020.

#### v) Granular Bedding

Granular bedding shall be laid to the dimensions shown on the drawing. Care shall be taken that there is even compaction of the bedding. The Contractor shall ensure that the material at the side of the pipe is compacted to the trench wall to the same degree as that underneath the pipe.

The pipe shall be supported for the full length of the barrel with bearing along the bottom four-tenths of its diameter. The coupling or bell shall not rest on the bedding or subgrade. The bedding shall then be compacted under the haunches of the pipe. Where pipe is bedded on rock, 19mm clear stone will be supplied by the Contractor to a height of the exterior diameter of the pipe. Pea stone bedding is not an acceptable material.

#### vi) Pipe Lying

Pipe shall be carefully inspected in the field before and after lying. If any cause for objection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer.

Pipe shall be laid with the bell end of the pipe upgrade.

Pipe shall be laid true to line and grade with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the bell or collar which shall not bear upon the subgrade or bedding. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken out and re-laid at the Contractor's expense. Any change in direction shall be approved by the Engineer using radius pipe and/or fittings.

Trenches where pipe laying is in progress shall be kept dry and no pipe shall be laid in water or upon wet bedding, or on frozen ground. As the pipes are laid, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the preceding length has been thoroughly embedded and secured in place so as to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they have been laid shall be allowed until there is at least 300 mm of cover over them, except as may be necessary in refilling the trench and compacting the backfill.

A watertight plug shall be used whenever pipe laying is not in progress. Care should be taken to prevent pipe flotation should the trench fill with water.

There shall be a minimum of 500mm of vertical separation between the watermain and any sewer or other pipeline which must be crossed.

#### 8. MANHOLE AND CATCHBASINS

#### i) Manhole Shafts

Manhole shafts shall be constructed with the minimum number of prefabricated manhole units possible, until the total height of each manhole is approximately 400mm below the rimmed elevation shown on the contract drawings. The remaining distance to the frame shall be built up with approved precast concrete adjustment units. The manhole or catchbasin shall be installed so the shaft is plumb.

#### ii) Manhole and Catchbasin Frames

Manhole and catchbasin frames shall be secured against sliding. All ladders, safety gratings, and other fittings shall be specified. Prior to adjustment or rebuilding, the existing frame and grate or cover shall be carefully removed and salvaged. Once a manhole, catchbasin, or ditch inlet has been adjusted or rebuilt, the salvaged or new frame and grate or cover shall be set to the correct elevation.

#### iii) Safety Gratings

Safety Gratings are required in all manhole depth between 5.0m and 10.0m, grates shall be placed at midpoint. Manhole depth between 10.0m and 15.0m, grates shall be placed at third points as per OPSD 404.020.

#### iv) Openings in Manhole and Catchbasins

The Contractor shall make whatever size openings as necessary in the walls of manholes, catchbasins, ditch inlets, concrete culverts, and sewers by using an abrasive wheel, saw or boring machine, without damaging the remaining structure and securely and neatly grout in the required pipe(s).

Pipes placed in the wall of precast or cast-in-place structures as inlet and/or outlet shall have a joint within 300mm of the wall to allow for the extension of the sewer. The pipe shall be securely sealed into place using grout or pipe seals. Seals shall be installed according to the manufacturer's directions and the approval of the Engineer.

#### v) Pre-Cast Riser Sections

Where the top is to be lowered or raised, the cone section shall be removed and riser sections of suitable height shall be removed, substituted for, or added to the existing riser sections. The cone section shall then be replaced. Any height alteration on to the Pre-cast riser is not acceptable.

#### vi) Adjustment Covers

When manhole covers are to be raised to accommodate resurfacing of the adjacent pavement, the Contractor must use manhole concrete adjuster rings to raise the manhole cover a sufficient height to accommodate the thickness of resurfacing material.

All existing mortar and brickwork shall be removed from the top of the existing structures prior to adjustment or rebuilding with precast concrete adjustment units.

Where grade adjustments are required, a minimum of one to a maximum of three adjustment rings as per OPSD 704.010. Additional manhole steps shall be required when the distance from the adjusted elevation of the structure to the first step would be in excess of 0.45 meters. Manhole steps shall in compliance with OPSD 405.020.

#### vii) Pavement Reconstruction During Adjustments

Were bituminous or concrete pavement must be removed to adjust or rebuild a structure, the edges of such pavement shall be neatly cut.

All construction debris resulting from adjustment or rebuilding of manholes, catchbasins, or ditch inlets shall be removed from the Contract site at the Contractor's expense.

#### viii) Debris Removal

During the progress of work and until the completion and final acceptance, manholes, catchbasins and ditch inlets shall be kept clean and free of all foreign material

#### ix) Removal of Existing Manholes and Catchbasins

Manholes. Catchbasins, valve chambers shall be removed where shown or required. The excavation shall be backfilled with Granular "B" Type 1 and compacted to 100% maximum dry density or backfilled with unshrinkable fill. Cast iron frames and covers shall be taken to Public Works. Remaining materials shall be disposed of by the contractor at a site provided by him. After the removal of catchbasins the Contractor shall plug the existing connections by using a manufactured plug with a water-tight gasket.

#### 9. BUILDING SEWER LATERALS

#### i) Tees on Sewer Main

The Contractor shall supply and build into the sewer the number of tees required for sewer service connections and catchbasin laterals as shown on the drawings or as directed by the engineer, unless specified otherwise. Open ends of branches shall be sealed with approved, watertight stoppers. Saddles may only be used with the written permission of the Engineer.

#### ii) Depth and Location of Sewer Laterals

The depth of invert of the sanitary sewer service at the street line shall in general be 1800mm below finished road grade or in particular to a depth specified by the Engineer. Services shall be located at the existing service of the lot to be served and extended to the street line. No service shall enter the main sewer below the spring line. Location of the junction of the connection with the main sewer shall be set and recorded by the Engineer. If risers are required, they shall be supported on a 150mm Granular 'A" bedding similar to normal lateral.

Sewer lateral shall be terminated at the property line with a coupling or bell fitted with a watertight plug, when pre-servicing a subdivision. Lot servicing locations for pre-servicing shall be as per City of Sarnia 109-F

Replacement laterals in existing developments must be connected to existing lateral at the street line with a manufactured Fernco rubber boot to fit existing pipe size and type, as approved by the Engineer.

A separate and independent sanitary sewer lateral shall be provided for each single-family unit, each unit of a semi-detached house, each unit of a row housing building or tenement, each apartment building, each office building etc.

#### iii) Minimum Slope for Sewer Laterals

The minimum slope for a sanitary lateral shall be 1.00%. The minimum slope for a storm lateral shall be 0.5%. The maximum slope for either is 8.0%. Risers will be required to maintain this tolerance. No pipe shall be laid on blocking or shims.

#### iv) Weeping Tiles and Eaves Troughs

Weeping tile shall be connected to a storm service or pumped to the surface away from the foundation to drain overland to the road or rear yard catchbasin. Eaves troughs shall be discharged onto the ground and directed away from the foundation. All lots shall be graded to ensure no impact on adjacent properties.

#### **10. INSTALLATION OF CULVERTS**

The Contractor shall supply, install, and backfill aluminized corrugated steel pipe with a minimum wall thickness of 2.8mm in all cases. All corrugation profiles shall be of helical lockseam manufacture using  $68 \times 13$ mm corrugations. If  $68 \times 13$ mm

corrugations are not available, then 125 x 25mm corrugations shall be used.

Culverts shall be installed with the invert 10% (minimum 150mm) below the proposed channel bottom elevation. If more than one length of pipe is required, pipes shall be joined with an approved manufactured standard corrugated coupler that is fitted with bolt and angle attachments and sits snugly onto the pipe end corrugations. After the couplers are connected they shall be wrapped with filter fabric around the coupler and pipe with a minimum 300mm overlap.

The culvert may also be moved upstream or downstream as necessary to avoid existing tile outlets and to avoid cutting into the new pipe. If the pipes cannot be avoided they shall be extended upstream or downstream of the proposed culvert and shall be done with non-perforated HDPE agricultural tubing with a manufactured coupling, elbow and rodent grate.

The bottom of the excavation shall be excavated to the required depth with any over excavation backfilled with clear stone or drainage stone. When the pipe has been installed to the proper grade and depth, the excavation shall be backfilled with clear stone or drainage stone from the bottom of the excavation to the springline of the pipe. Care shall be taken to ensure that the backfill on either side of the culvert does not differ by more than 300mm so that the pipe is not displaced. Culverts shall be backfilled from the springline to within 150mm of finished grade with granular "B". The top 150mm shall be backfilled with compacted 100% crushed granular "A" material to finished grade.

All backfill shall be free from deleterious material. All backfill material above the springline shall be mechanically compacted to 100% standard proctor density using appropriate compaction equipment.

Rip rap ends are to be used with 1.5:1 side slopes. The rip rap shall consist of 100mm x 250mm quarry stone or approved equal. The area to receive the rip rap shall be graded to a depth of 400mm below finished grade. Filter fabric (Terrafix 270R or approved equal) shall then be placed with any joints overlapped a minimum 600mm. The quarry stone shall then be placed with

the smaller pieces placed in the gaps and voids to give it a uniform appearance.

The Contractor shall maintain a dry working area during construction. The Contractor shall install a silt fence downstream of the work area (at bottom end of channel improvement if all work is completed at the same time). The silt fence shall consist of filter fabric or manufactured silt fence supported with posts (OPSD 219.190).

After completion of the construction the silt fence and any collected sediment shall be removed.

## **C. TESTING PROCEDURES**

#### **1. TV INSPECTION OF SEWERS AND SANITARY SERVICES**

All sewers and services installed in new subdivisions and under City Contracts must be inspected by TV camera (CCTV) according to OPSS 409 requirements and proven to meet the engineering design prior to the sewers being accepted off maintenance. All costs for the TV inspection will be included in the unit price bid for the installation of sewers in the tender form.

Where sewers or sanitary service connections are found to be not true to line or grade or not meeting the engineering design, they will be removed and re-installed to meet specifications and to the satisfaction of the City Engineer. All cost to repair the sewer and any damage resulting from the repair will be at the Contractor's expense.

The City shall be provided with a digital video file (DVD, FTP, USB) of the sewer and a report with detailed log of each sewer length. The sewers must be cleaned using high velocity jet (hydrocleaning) equipment and the TV inspection must be completed no later than 48 hours after sewer cleaning.

## **D. SERVICING REQUIREMENTS**

#### **1. SERVICES FOR NEW DEVELOPMENT**

Private

Where development occurs on property that has existing sewers these services must be abandoned and new services installed unless it can be proven that the services are 150mm (6") diameter SDR 28 PVC.

Should the owner/developer choose to use TV inspection to prove the quality of the services, then the TV inspection must be carried out by a TV inspection company that is approved by the City Engineer. The digital video file (DVD, FTP, USB) of the service must be a colour video and includes the linear measurement, date and address of property on the on-screen format. The City Engineer will be provided with one copy of such video for his records.

Use of this existing sewer connection shall be at the sole discretion of the City Engineer and wholly the responsibility of the owner/developer.

#### 2. EXISTING SHARED SEWER CONNECTIONS

Capital Projects

There may be some cases where existing sewer laterals are shared by adjoining properties. If the City Engineer finds any property owners on the street wanting a new separate connection, the Contractor shall install a 150mm (6") diameter pipe from the sewer to the property line. All cost associated with this work shall be included in the prices bid for supply and installation of private service or laterals. Before commencing any of this work, the City Engineer's approval must be obtained. This work may be deleted from the contract if found unnecessary, without any payment to the contractor.

#### 3. ABANDONING SERVICES

Abandoning services shall be coordinated and witnessed by the Development Engineering Department staff. The work shall be completed before the Engineering Department's signing off on the demolition application form.

Commencement of the demolition project before the services can be disconnected and capped, the owner shall provide a deposit to the City.

#### i) Permanently

Sanitary and storm laterals shall be excavated at the property line and capped with a water tight fitting. For any material that is not PVC, a Fernco fitting to a PVC stub and a water tight cap must be installed. Services must be marked with a stake buried 1.20 meters deep with approximately 30 cm extended above ground as a location marker as per City of Sarnia Standard drawing 2064-S.

## DIVISION 4.3 CITY OF SARNIA CONCRETE SIDEWALKS, CURBS AND DRIVEWAYS STANDARDS 2020

## CONCRETE MATERIALS, CONSTRUCTION METHODS AND TESTING PROCEDURES

Α.	MA	ATERIALS	3
1.	. C	CONCRETE FOR SIDEWALK AND CURBS AND GUTTERS	3
	i)	Ready Mix Concrete	3
	ii)	Granular "A" Subase	3
	iii)	Tactile Warning Plates	4
В.	со	ONSTRUCTION METHODS	5
1.	. F	FORMS FOR CONCRETE SIDEWALK AND CURBS	5
2.	. F	REMOVAL OF EXISTING CONCRETE AND PAVED SURFACES	5
3.	. J	IOINTS IN CURBS AND GUTTERS	5
4.	. E	EXISTING SIDEWALK REMOVAL	6
5.	. C	CONCRETE SIDEWALKS AND DRIVEWAYS	6
6.	. Т	FACTILE WARNING PLATES	7
7.	. C	CONSTRUCTION OF CURB AND GUTTER	7
8	. C	CURB CUTS TO EXISTING CURBS	8
9.	. C	CURB FILLS ON EXISTING CURB CUTS	8
1(	О.	SUPPLY AND PLACING OF GRANULAR "A"	8
	i)	Bedding Under Sidewalks, Driveways, Curbs and Gutters	8
1	1.	SAWCUTTING OF CONCRETE	8
1:	2.	EXCAVATION	9
1:	3.	CONCRETE PROTECTION DURING CURING	9
14	4.	ACCEPTANCE OF WORK	9
C.	TE	STING PROCEDURES	10
	i)	Concrete	10
	ii)	Granular "A"	10

## A. MATERIALS

#### 1. CONCRETE FOR SIDEWALK AND CURBS AND GUTTERS

#### i) Ready Mix Concrete

Concrete shall comply with the requirements of OPSS. MUNI 1350 and the following specific requirements:

Description	Specification
Class of Concrete	Exposure Class C-2
Min. Compressive Strength	32 MPa at 28 days
Max. W/C Ratio	0.45
Coarse Aggregate	19mm nominal size
Air Content	5 to 8%
Maximum Slump	75mm +/- 20 mm

Only ready-mix concrete will be used. Hand-mixed or volume batch concrete will not be allowed.

Contractors must possess a current, valid Certificate of Ready Mixed Concrete production Facilities. A copy of this Certificate must be provided with your submission.

Note: The City reserves the right to hire the services of a third party for concrete testing. If the test confirms compliance with the specifications the City will pay for the test. If the test indicates non-compliance, the Contractor shall be responsible for the cost of the test and for replacing the material including associated costs such as removal, disposal and labour to re-set the concrete.

#### ii) Granular "A" Subase

Granular "A" shall be 100% crushed limestone and shall meet OPSS Specification 1010 with 100% passing the 26.5 mm sieve and be approved by the City Engineer before use. Compaction of Granular "A" under sidewalks, curb, gutters and driveways shall be minimum of 100% of the maximum dry density using Method "A" as per OPSS 501.08.02.

#### iii) Tactile Warning Plates

Tactile Warning Plates shall be incorporated at every location with a pedestrian crossing or as specified in the contract documents. Tactile Warning Plates are to be installed on sidewalk ramps to warn visually impaired pedestrians that they are entering the roadway. According to CSA B651-201, follow O.Reg. 191/11 and meet the following requirements:

- Plates are to be uncoated cast iron material with natural rust finish.
- Plates are to be set back approximately 150mm from back of curb and it must extent the full width of the curb cut/sidewalk ramp.
- Plates are to be parallel with curb radius (ie. Not necessarily perpendicular to direction of pedestrian travel).
- This may require the use of radial plates versus square plates on larger radii.
- The ramp must have a minimum clear width of 1.5m, exclusive of any flared sides.
- Plates to come complete with L Shape anchor brackets.
- Contractor to provide shop drawings for review 2 weeks prior to installation.

The following manufactures are approved suppliers of the cast iron warning plates:

East Jordan Iron Work, East Jordan Michigan Ontario Branch: (519) 448-3395 159 Sugar Maple Road St. George, Ontario NOE 1NO

Neenah Foundry, Neenah, Wisconsin Ontario Representative: 1-866-624-9722 Crozier/Ashleigh Suffron 1 Young Street, Suite 1801 Toronto, Ontario M5E 1W7

## **B. CONSTRUCTION METHODS**

#### 1. FORMS FOR CONCRETE SIDEWALK AND CURBS

The Contractor shall provide a template cut to the true section of the curb, gutter or sidewalk for the purpose of testing the forms and sub-grade. Height of side forms for sidewalk shall not be less than the required depth of the concrete.

## 2. REMOVAL OF EXISTING CONCRETE AND PAVED SURFACES

Existing concrete curbs and gutters, concrete sidewalks, asphalt pavement and base, concrete pavement and base and asphalt and concrete driveways shall be broken out and removed as required. In executing the work, every effort must be made to minimize damage to adjacent properties and services. Weights dropped from considerable height to cause fractures of pavements will not be permitted. Concrete and asphalt surfaces shall be saw-cut to straight lines as required before removal.

The City Engineer will determine and mark the limits of all removals.

The Contractor will be required to replace or repair, at his own expense, any damage caused by his operations to adjacent pavement, properties, services, etc. beyond the limits of removal.

Material removed shall be disposed of off the site at the expense of the Contractor.

#### 3. JOINTS IN CURBS AND GUTTERS

Control joints shall be saw-cut in concrete curbs and gutters at maximum 3.0 metre intervals, at each side of curb cuts for
driveway or sidewalk ramps, and on each side of catchbasins a maximum distance of one metre from the catchbasin.

Where curb and gutter abuts sidewalks, saw-cuts in the curb and gutter shall align with saw-cuts in the abutting sidewalk at 3.0 metre intervals.

## 4. EXISTING SIDEWALK REMOVAL

Sidewalks that are to be replaced will be removed no more than one (1) day before they are to be replaced. Replacement is to follow immediately after removal without delay. Short sections of sidewalk six metres (20 feet) long or less, which are removed for reasons such as a service installation, will be restored immediately with a 25 mm cold mix surface and maintained as a smooth walkable surface until replaced. Temporary gravel sidewalk will not be acceptable.

#### 5. CONCRETE SIDEWALKS AND DRIVEWAYS

All sidewalks will be constructed as detailed in Drawings 108-F, 112-F, 119-F, 122-F, 2485, 2486 and OPSS 350, 353, 904, and 1350. Generally, sidewalks will be constructed with a thickness of 125mm (5"). For sidewalks that cross commercial driveways, the thickness will be 200mm, as directed by the City Engineer.

Generally the tender item for payment of concrete sidewalks shall include preparation of subgrade, excavation, supply and placing of 100mm (4") of Granular "A" 100% crushed Limestone and all costs for equipment, labour and materials to construct a concrete sidewalk 125mm (5") or 200mm (8") thick.

Wheelchair ramps shall be constructed similar to drawings 2485 and 2486, as and where directed by the City Engineer. Payment for construction of these ramps shall be included in the price bid for sidewalks and curbs and gutters.

Plain concrete driveways shall be constructed as specified on drawings 108F, 109F, 112F and 122F at 125mm (5") or 200mm

(8") thickness including supply and placement of 100mm (4") of Granular "A" 100% crushed limestone.

At no time will water be added to the concrete on site. Concrete which is unworkable or that is too stiff to produce a satisfactory product is to be discarded at the Contractors expense.

## 6. TACTILE WARNING PLATES

Tactile Warning Plates shall be incorporated at every location with a pedestrian crossing or as specified in the contract documents. Tactile Warning Plates are to be installed on sidewalk ramps to warn visually impaired pedestrians that they are entering the roadway. According to CSA B651-2012 and follow O.Reg. 191/11, City of Sarnia Standard Drawings 153-F, 154-F, 155-F and meet the following requirements:

- Plates are to be uncoated cast iron material with natural rust finish.
- Plates are to be set back approximately 150mm from back of curb and it must extent the full width of the curb cut/sidewalk ramp.
- Plates are to be parallel with curb radius (ie. Not necessarily perpendicular to direction of pedestrian travel). This may require the use of radial plates versus square plates on larger radii.
- The ramp must have a minimum clear width of 1.5m, exclusive of any flared sides.
- Contractor to provide shop drawings for review 2 weeks prior to installation.
- Plates to come complete with L Shape anchor brackets.

# 7. CONSTRUCTION OF CURB AND GUTTER

All costs for labour, materials and equipment required to construct concrete curb as per OPSD 600.010, 108F, 119F, and 122F or to match the existing, shall be included in the unit price on the tender for construction of curb and gutter.

Payment of the tender item shall include for preparation of subgrade, excavation, supply, placing and compaction of Granular "A", and all costs for equipment, labour and material needed for the construction of the curbs and gutters.

At no time will water be added to the concrete on site. Concrete which is unworkable or that is too stiff to produce a satisfactory product is to be discarded at the Contractors expense.

# 8. CURB CUTS TO EXISTING CURBS

Curb cuts shall only be cut by the Approved City of Sarnia's contractor on acceptance by The City Of Sarnia Engineering and Planning Departments. Curb cuts shall conform to drawing 108-F. All costs shall be paid by the owner or developer.

# 9. CURB FILLS ON EXISTING CURB CUTS

All curb fills to be done by the City of Sarnia Public Works Department when approved by the Engineering Department. All costs shall be paid by the owner or developer.

# 10. SUPPLY AND PLACING OF GRANULAR "A"

#### i) Bedding Under Sidewalks, Driveways, Curbs and Gutters

All sidewalks, driveways, curbs and gutters will be placed on a 100mm (4") thick bedding of Granular "A" 100% crushed Limestone. This bedding shall be compacted to 100% maximum dry density using Method "A" as per OPSS 501.08.02.

#### **11. SAWCUTTING OF CONCRETE**

It may be necessary to saw cut concrete roads, curb and gutters, driveways or sidewalks in order to limit demolition at a straight edge. All costs required including labour, materials and equipment to saw cut concrete will be included in the tender item for concrete.

Saw cutting of control joints of new sidewalks to deepen the trowelled joint to 40mm is not acceptable.

Water or other methods shall be used to minimize dust according to the Occupational Health and Safety Act and Regulation for Construction Projects.

# 12. EXCAVATION

Any excavation required to complete the work will be done to the required elevation and in a level smooth and neat fashion and shall include any compaction and preparation of the subgrade. Excavation shall include all costs for any machine work, use or rental and any hand excavation, utility locations, tree root removal, fees or any other expense incurred or necessary in the excavation process.

# **13. CONCRETE PROTECTION DURING CURING**

All sidewalks, driveways, curb and gutters, curb cut and curb fillins are to be protected by the contractor according to OPSS 904. The Contractor is responsible for keeping vehicle and pedestrian traffic off the concrete during the curing process. The Contractor will be responsible to replace any concrete due to neglect or vandalism at the Contractor's expense.

# **14. ACCEPTANCE OF WORK**

The Contractor will be responsible to protect all work from damage, indentations and abrasions caused by the public, tree branches, weather, etc. Any work that is deemed unacceptable by the City Engineer because of damage, indentation, abrasions, poor finish, poor workmanship or unacceptable material, etc. must be removed and replaced with new at no cost to the City.

# C. TESTING PROCEDURES

#### i) Concrete

Field sampling and testing of plastic concrete for slump and air content shall be undertaken by the owner. Cylinders shall be cast as per OPSS specifications. All concrete shall meet OPSS 904 and 1350 and all reinforcing steel shall conform to OPSS 904 and 905.

When concrete cylinders are tested for compression, the compressive strengths will be calculated in accordance with CAN/CSA-A23.1-M90 Section 17.5.7.1., CAN/CSA-A23.1-M90 Section 17.5.7 Compression strength requirements, CAN/CSA-A23.1-M90 section 17.5.7.1 Standard Cured Cylinders.

The strength level of each class of concrete shall be considered satisfactory if the averages of all sets of three consecutive strength tests for that class at one age equal or exceed the specified strength, and no individual strength test is more than 3.5 MPa below the specified strength. These requirements shall not apply to field-cured specimens.

#### ii) Granular "A"

Testing to prove conformity to OPSS 1010 will be at the cost of the Contractor. Specific truckloads of material when delivered and observed on site to be substandard, based on the opinion of the City Engineer, will be rejected and removed from the site immediately at no cost to the City for the material, delivery or removal. When on site quality controlled testing finds that a large portion of the delivered material is substandard then the City Engineer will determine what remedial action, the quality control testing and any additional testing will be paid for by the contractor.

The granular "A" shall be compacted to 100% maximum dry density using Method "A" as per OPSS 501.08.02. and confirmed by the Geotechnical Engineer.

# DIVISION 4.4 CITY OF SARNIA DRIVEWAY AND ROADS STANDARDS

2020

# DRIVEWAY AND ROADS STANDARDS

Α.	MATERIALS	. 3	
1.	HOT MIX ASPHALT (HMA)		
2.	2. BITUMINOUS TACK COAT		
3.	GRANULAR "A" AND "BII"		
4.	CONCRETE		
5.	PAVEMENT MARKINGS		
В.	CONSTRUCTION METHODS	. 5	
1.	EXCAVATION5		
i)	) Preparation of Sub-grade5		
ii	i) Removal of Existing Concrete and Asphalt5		
ii	ii) Protection of Roadbed During Construction6		
2.	TEMPORARY ASPHALT RAMP AT CONCRETE GUTTER6		
3.	PREPARATION OF THE SUB-GRADE AND SUB-BASE6		
4.	PLACING7		
5.	SPREADING7		
6.	ROLLING AND COMPACTING7		
7.	MAINTENANCE		
8.	ADJUSTING MANHOLE AND VALVE BOX COVERS		
9.	BITUMINOUS TACK COAT		
10.	FINISHED ASPHALT AT GUTTERS9		
11.	ASPHALT DRIVEWAYS9		
12.	DUST SUPPRESSION		
i)	) Water		
ii	i) Calcium Chloride Flakes		
C.	TESTING PROCEDURES	11	
1.	HOT MIX ASPHALT (HMA)		
2.	GRANULAR "A" & B"II"12		
3.	CONCRETE		
4.	SUBGRADE13		
5.	GRANULAR SUBASE		

# A. MATERIALS

# 1. HOT MIX ASPHALT (HMA)

At the preconstruction meeting, the Contractor shall submit to the City Engineer a mix design prepared by a laboratory, having the Canadian Council of Independent Laboratories Type "A" Certification, for each hot mix asphalt type to be used on a project. Each mix design shall comply with OPSS.MUNI. 1150.04.01.02 be carried out during the calendar year in which the paving is done and be corroborated by a five point Marshall Mix test from the same laboratory. Hot mix asphalt supplied to the project must comply with the requirements of the mix design, OPSS.MUNI 1003, 1101, 1150 and be placed according to OPSS.MUNI 310. The asphalt type and its thickness will be detailed in the special specifications or on the drawings or in the soils report.

Asphalt cement shall be performance graded asphalt cement according to OPSS.MUNI 1101.

Aggregates for hot mix asphalt shall be according to OPSS.MUNI 1003.

Reclaimed asphalt pavement (RAP) when permitted in HMA shall be according to the aggregate requirements of OPSS.MUNI 1003.

# 2. BITUMINOUS TACK COAT

The bituminous tack coat shall be SS-1 emulsified asphalt consisting of the suitable paving asphalt diluted with an equal <u>amo</u>unt of water, as per OPSS.MUNI 1103. A solution of asphalt, cut and mixed with diesel fuel, or other petroleum products, shall **not** be used. The addition of polymers or other additives after the manufacturers of emulsified asphalt shall not be permitted.

#### 3. GRANULAR "A" AND "BII"

Granular materials will conform to OPSS.MUNI 1010 and must be approved prior to use by the City Engineer and shall be supplied and installed to his satisfaction. Granular "A" and Granular "BII" shall be 100% crushed limestone.

Each pile designated for City use will be tested to ensure conformity to OPSS.MUNI 1010. At the pre-construction meeting the Contractor will submit the source of the granular material to be used on site.

#### 4. CONCRETE

Concrete shall comply with the requirements of OPSS.MUNI 1350 and the following specific requirements:

Description	Specification
Class of Concrete	Exposure Class C-2
Min. Compressive Strength	32 MPa at 28 days
Max. W/C Ratio	0.45
Coarse Aggregate	19mm nominal size
Air Content	5 to 8%
Maximum Slump	75mm +/- 20 mm

Only ready-mix concrete will be used. Hand-mixed or volume batch concrete will not be allowed.

Contractors must possess a current, valid Certificate of Ready Mixed Concrete production Facilities. A copy of this Certificate must be provided with your submission.

Note: The City reserves the right to hire the services of a third party for concrete testing. If the test confirms compliance with the specifications the City will pay for the test. If the test indicates non-compliance, the contractor shall be responsible for the cost of the test and for replacing the material including associated costs such as removal, disposal and labour to re-set the concrete.

#### 5. PAVEMENT MARKINGS

Pavement markings shall conform to OPSS 710 and be designed in accordance with the Ontario Traffic Manual Book 11. All markings must adhere to any provisions provided for under the Accessibility for Ontarians with Disabilities Act (AODA). All stop bars, cross walks and parking stalls shall be of the "Durable Pavement Marking" type.

# **B. CONSTRUCTION METHODS**

## 1. EXCAVATION

Excavation shall be carried to the lines and grades as shown on the drawings and described in the Specifications or as directed by the City Engineer. The excavation operations shall proceed in such a manner that proper drainage of the road foundation exists at all times.

#### i) Preparation of Sub-grade

Prior to placing granular sub-base materials, the sub-grade shall be shaped and thoroughly compacted to conform accurately to the line, grade and cross section shown on the drawings or as specified. No fill, base course materials or concrete shall be placed on the sub-grade until approval is given by the City Engineer. If the subgrade is left exposed to the weather resulting in unacceptable subgrade, all costs to repair will be that of the Contractor.

All soft areas that show up during construction shall be excavated and filled with compacted Granular B"II". All holes, ruts and other defects in the sub-grade shall be similarly excavated, filled and compacted.

Where such soft areas are due to neglect or faulty construction practices on the part of the Contractor, this work shall be carried out at his expense.

#### ii) Removal of Existing Concrete and Asphalt

Existing concrete curbs and gutters, concrete sidewalks, asphalt pavement and concrete pavement and base to be removed shall be broken out and removed as required. In executing the work, every effort must be made to minimize damage to adjacent properties and services. Weights dropped from considerable height to cause fracture of pavements will not be permitted.

The Contractor will be required to replace or repair, at his own expense, any damage caused by his operations to adjacent pavement, properties and services. All match lines between new and existing asphalt shall be constructed with a 450 mm wide X 50 mm deep milled lap joint on the existing pavement.

Material removed shall be disposed of by the Contractor unless otherwise directed by the City Engineer.

#### iii) Protection of Roadbed During Construction

During the construction of the roadway, the roadbed shall be well-drained at all times. Side ditches, gutters, embankments or otherwise shall be so constructed as to avoid damage by erosion. The contractor shall prevent machinery from driving over the prepared roadbed.

# 2. TEMPORARY ASPHALT RAMP AT CONCRETE GUTTER

Supply and place a temporary asphalt ramp along the face of the concrete gutter on base asphalt for protection from winter plow damage and building activities. The temporary asphalt ramp must be removed prior to the placement of the final lift.

# 3. PREPARATION OF THE SUB-GRADE AND SUB-BASE

Before placing the granular base and sub-base courses, the Contractor must ensure that the alignment, grade, cross- section compaction and drainage of the preceding sub-base or sub-grade course conforms to the requirements of the drawings and specifications and has been approved by the City Engineer.

Before placing the sub-base course, the Contractor must ensure that all services and excavations to the road base have been completed.

In no instant will base course asphalt be accepted in the event of the subbase being frozen, muddy or unstable roadbed.

## 4. PLACING

Tolerance for Granular "A" and "BII" are to be  $\pm \frac{1}{4}$ " or  $\pm 7$  mm. The base shall be placed on the prepared sub-grade and subbase and compacted in layers not exceeding 100 mm after compaction. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed. The granular thickness shall be specified on the drawings or contract documents.

The placing of material shall begin at the point designated by the Engineer. Placing shall be from vehicles especially equipped to distribute the material in a uniform layer or windrow. The layer shall have the required thickness. Material shall be placed in a manner that the sub-base material will not be distributed or contaminated.

When hauling is done over previously placed material, hauling equipment shall be routed as uniformly as possible over the entire area of previously constructed layers. Any damage to the subgrade resulting from the hauling vehicles shall be repaired at the contractor's expense.

The Granular "BII" grades must be verified by the Engineer and compaction results approved by a Geotechnical Engineer before any Granular "A" shall be placed.

#### 5. SPREADING

As each layer of sub-base and base course material is placed, it shall not be allowed to segregate but be maintained in a uniformly mixed condition. During the spreading and mixing, water may need to be added in the amount necessary to provide the optimum moisture content for compacting as specified. Uniformly mixed material shall be spread smoothly to a uniform thickness or in case of the top layer to the cross section shown on the drawings or specified.

# 6. ROLLING AND COMPACTING

Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of pneumatic tired roller or steel wheeled power rollers as specified by the **Geotechnical** Engineer. Rolling shall progress gradually from the sides to the centre, parallel with the centre line of the road, and shall continue until the entire surface has been rolled. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform.

Along curb, manholes, headers and walls and at all places not accessible to the roller, the base material shall be tamped thoroughly with mechanical tampers. The materials shall be both bladed and rolled until a smooth even surface has been obtained. If the above does not achieve the required compaction density, it shall be the Contractor's responsibility to provide the necessary equipment, material and water to achieve the compaction required.

## 7. MAINTENANCE

The Contractor shall be responsible for the protection and maintenance of both sub-grade, sub-base and base courses until final acceptance of the work or placing of asphaltic paving materials. Repair, filling of pot holes, regrading, etc. as is required to make good any damage, will be at the Contractor's expense.

Some granular materials tend to retain moisture and the material may become too wet for proper acceptance as a base material. If this occurs, the Contractor shall be fully responsible for all costs of removing and replacing all Granular "BII" and Granular "A" material that, in the opinion of the City Engineer, is too wet for use as road base material.

If the Contractor elects to withdraw the wet Granular "BII" or Granular "A" material to allow it to dry, all costs involved in this operation will be the Contractor's responsibility. No extension of working days will be granted for delays in the Contractor's operations caused by waiting for wet Granular materials to dry out. Costs of any delays to other parts of the contract due to wet Granular materials shall be the full responsibility of the Contractor.

Testing and costs for testing and re-testing, if applicable, will be the responsibility of the Contactor.

## 8. ADJUSTING MANHOLE AND VALVE BOX COVERS

There will be some existing manhole and valve box covers to be raised or lowered by either removing brickwork, or adding pre cast concrete adjustment rings. The cost of such work shall be paid for at the unit price bid on the tender sheet for the supply and installation of manholes and gate valves

## 9. BITUMINOUS TACK COAT

The contractor shall furnish and evenly apply a solid black bituminous tack coat to the entire surface of the asphalt including, total face of concrete gutters, manhole frames, catch basin frames and all other surfaces against which new asphalt pacing is to be placed. The cost of supplying the material and applying the tack coat shall be included in the unit price bid for asphalt paving. See OPSS.MUNI Specification 310.07.02.02.

Bituminous Tack Coat may not be required on surfaces that have been prepared using cold milling or other scarified surface as approved by the City Engineer.

# **10. FINISHED ASPHALT AT GUTTERS**

The second lift of asphalt shall be placed to an elevation of 6.5 mm ( $\frac{1}{4}$ ")  $\pm$  3.0 mm ( $\frac{1}{8}$ ") higher than the edge of gutter where the asphalt meets the gutter.

# 11. ASPHALT DRIVEWAYS

For new driveways, an H.L.3 asphalt mixture shall be placed in accordance with OPSS.MUNI 311 "Construction Specifications for Asphalt Sidewalk, Driveway, Boulevard and Sidewalk Resurfacing", and shall be laid to a minimum thickness of 50mm.

Where existing driveways are to be repaired, the driveway shall be neatly saw cut in straight lines where directed by the City Engineer. The face of the existing asphalt cut and the adjoining curb or sidewalk, shall be painted a full cover layer of Tack Coat. The asphalt shall then be placed, levelled, raked and rolled in a manner acceptable to the City Engineer. Unless otherwise indicated, 150 mm thickness of Granular "A" base and 50 mm of H.L.3 asphalt will be used.

# 12. DUST SUPPRESSION

The Contractor, depending on dust problems, may be required to supply and spread water or calcium chloride flakes as directed by the City Engineer.

#### i) Water

If water is to be used it shall be supplied by the City of Sarnia Public Works Department who will install a backflow preventer and meter on a fire hydrant. The Contractor must sign and agree to the terms of the temporary hydrant agreement. The Contractor shall use application equipment which is capable of distribution of the water in a uniform manner as approved by the City Engineer.

#### ii) Calcium Chloride Flakes

If Calcium Chloride Flakes are to be used, the contractor will supply and spread the calcium as per OPSS 2501 and when directed by the City Engineer at the rate of 0.5 kg per sq. m. The Calcium Chloride shall be loose dry flakes and according to CAN/CGSB 15.1. The Calcium Chloride should be delivered in moisture proof 20kg or 40 kg bags. The Calcium Chloride flakes shall be as manufactured by Dow Chemical of Canada (Dowflake Xtra) or equal. All costs for the above will be included in the appropriate tender item.

# C. TESTING PROCEDURES

Testing and costs for testing will be the responsibility of the contractor.

# 1. HOT MIX ASPHALT (HMA)

Hot mix asphalt supplied to the project must comply with the specifications set out in Standard Specification Driveways and Roads, Materials section Hot mix asphalt. It will be the Contractor's responsibility and expense to do the quality control necessary to ensure and confirm that the hot mix asphalt complies with this specification. The Contractor's quality control will include but not be limited to the following.

Two weeks before placing hot mix asphalt, the Contractor must submit test results showing aggregate gradation and asphalt cement content from samples of each type of asphalt to be used that were taken from the asphalt plant within the most recent month of operation. These tests are to prove that the plant is producing hot mix asphalt that meets the design mix. These tests must be submitted and each asphalt approved by the City Engineer before it can be laid on the project.

During the process of placing the hot mix asphalt, random tests showing the aggregate gradation, percent air voids, asphaltic cement content and compaction will be taken from every 400 tonne lot or part lots of asphalt placed. The minimum number of the above tests will be three (3) or at least one test from each lane of the road way. Each test will include enough asphalt material to allow a full Marshall test to be done at a later date should it be required.

The above testing by the Contractor does not prevent the City from taking its own tests to ensure integrity and confirm tests arranged by the Contractor. They City will pay for only those tests which it takes on its own. All other testing and quality control will be included in the Contractor's price quoted on the tender form for the supply and placing of hot mix asphalt. All the above testing will be done by a laboratory that has the Canadian Council of Independent Laboratories Type "A" Certification, that is qualified in asphalt testing and that is approved for this purpose by the City Engineer.

If the hot mix asphalt does not comply with City of Sarnia specifications and OPSS for materials or placing and is not free from all deficiencies and defects, then, at the Contractor's expense, the asphalt shall be removed and replaced with asphalt that does comply and is without deficiencies and defects.

None of the top course of asphalt may be laid until testing has proved that the base course has met the material and placing specifications above, is free from all defects and deficiencies and has been approved by the City Engineer.

# 2. GRANULAR "A" & B"II"

Testing to prove conformity to OPSS 1010 will be at the cost of the Contractor. Specific truckloads of material when delivered and observed on site to be substandard, based on the opinion of the City Engineer, will be rejected and removed from the site immediately at no cost to the City for the material, delivery or removal. When on site quality controlled testing finds that a large portion of the delivered material is substandard then the City Engineer will determine what remedial action, the quality control testing and any additional testing will be paid for by the Contractor. See Standard Specification No. 1 Section 51.

# 3. CONCRETE

When concrete cylinders are tested for compression, the compressive strengths will be calculated in accordance with:

CAN/CSA-A23.1-M90 Section 17.5.7.1. CAN/CSA-A23.1-M90 Section 17.5.7 Compression strength requirements, CAN/CSA-A23.1-M90 section 17.5.7.1 Standard Cured Cylinders The strength level of each class of concrete shall be considered satisfactory if the averages of all sets of three consecutive strength tests for that class at one age equal or exceed the specified strength, and no individual strength test is more than 3.5 MPa below the specified strength. These requirements shall not apply to field-cured specimens.

Compressive strength testing shall conform to CAN/CSA-A23.2-M -3C and -9C and with the following requirements:

- Only cardboard moulds shall be used to cast the test cylinders. A disc of wax paper matching the inside diameter of the cylinder mould shall be placed at the base of the cylinder mould prior to casting. The interior side walls of the cardboard mould shall be treated with a light coating of release agent to assist in the demoulding operation.
- The cylinders shall only be demoulded on the same day of testing for compressive strength.
- The load indicating mechanism of the compression testing machine shall be capable of showing load changes of 100 newtons or less.
- The minimum test requirement shall be one set of test cylinders, per supplier, per day.

#### 4. SUBGRADE

Approval of subgrade will only be given when the degree of compaction is a minimum of 95 percent of the maximum dry density as determined by method "A" of OPSS.MUNI 501.08 and the Geotechnical Engineer.

Before placing the granular on sub-base the Contractor shall proof-roll the base and be approved by the GeotechnicalEngineer before placing of sub-base granulars.

#### 5. GRANULAR SUBASE

Each layer shall be compacted to a minimum of 100% of the maximum dry density. The maximum dry density and the field density determination will be in accordance with OPSS.MUNI 501.

Approval will only be given when the degree of compaction of the Granular "A" and "BII" is a minimum of 100 percent of the maximum dry density as determined by method "A" of OPSS.MUNI 501.08 and the Geotechnical Engineer.

# DIVISION 4.5 CITY OF SARNIA RESTORATION STANDARDS

2020

RES	TORATION STANDARDS	1
Α.	MATERIALS	4
1.	CONCRETE	4
2.	HOT MIX ASPHALT	4
3.	GRANULAR MATERIALS	4
4.	TOPSOIL	4
5.	SOD	4
6.	SEED	4
6.	FERTILIZER	5
В.	CONSTRUCTION METHODS	6
1.	TEMPORARY DRIVEWAY RESTORATION	6
2.	REPAIRS TO DRIVEWAYS AND WALKWAYS	6
i)	General	6
ii	) Asphalt Driveways	6
ii	i) Concrete Driveways	6
iv	v) Temporary Road Repairs	7
v	) Unpaved Driveways	7
v	i) Walkways	7
4.	DRIVEWAY ENTRANCE RAMPS, COMBINED SIDEWALK CURB AND GUTTER	7
5.	ACCESSIBLE RAMPS	7
6.	EXCAVATION FOR PROPOSED GRASS BOULEVARDS	8
7.	TOPSOIL, FERTILIZER AND SOD	8
8.	SEED	9
8.	TREE REMOVAL	9
9.	SAFETY AND CLEANUP	9
10.	DAMAGE TO PUBLIC OR PRIVATE PROPERTY	
11.	FINAL CLEAN-UP	
C.	TESTING PROCEDURES	12
i)	Concrete	
ii	) Asphalt	

iii)	Granular Material	12
iv)	Topsoil	12
v)	Sod	12
vi)	Fertilizer	12

# A. MATERIALS

# **1. CONCRETE**

Concrete, formwork, and associated materials for sidewalks, driveways and curbs and gutters shall be as per Standard Specification ""Concrete Sidewalks, Curbs, Gutters and Driveways."

# 2. HOT MIX ASPHALT

Asphalt for driveways, walkways, etc. shall be as per Standard Specifications "Roads and Driveways."

# 3. GRANULAR MATERIALS

Granular materials shall be as per Standard Specification "Roads and Driveways."

# 4. TOPSOIL

Topsoil shall be screened, nursery grade and as per OPSS 802.05.01

## 5. SOD

Sod shall be as per OPSS 803.05.01

#### 6. SEED

The seed mix to be used for this item shall be as follows: 55% Creeping Red Fescue

27% Canada Blue Grass

15% Perennial Rye Grass

3% White Dutch Clover

# 6. FERTILIZER

Fertilizer shall be uniformly applied to all services which are to be sodded at a rate of 5 kg of fertilizer per 100 square meters of surface area and shall be incorporated into surfaces by raking, disking or harrowing. Fertilizer shall be applied not more than 48 hours before the sod is placed and shall be standard commercial fertilizer (16-8-8) and a minimum of 30% nitrogen being slow release. Chemical fertilizers shall be as per OPSS 803.05.03.

# **B. CONSTRUCTION METHODS**

# **1. TEMPORARY DRIVEWAY RESTORATION**

All driveways shall be excavated and temporarily restored with Granular "A" material to give access to private properties as soon as possible to the satisfaction of the City Engineer.

# 2. REPAIRS TO DRIVEWAYS AND WALKWAYS

#### i) General

This clause shall apply to all driveways and walkways, both on the road allowance and on private property. In general, driveways and walkways shall be restored with the same surface material as existed before construction, that is, asphalt, concrete or crushed stone, but the decision as to the material used for restoration shall be made by the City Engineer.

Damage to existing driveways shall be kept to a minimum. The area of any existing driveway to be removed shall be agreed upon with the City Engineer before the work proceeds. Damage to driveways outside the agreed areas shall be repaired at the Contractor's expense.

#### ii) Asphalt Driveways

Asphalt driveways shall be repaired as specified for asphalt driveway construction as specified in Standard Specification "Roads and Driveways."

#### iii) Concrete Driveways

Concrete driveways shall be repaired as per Standard Specification "Concrete Sidewalks, Curbs and Driveways" and shall be saw-cut in a neat straight line parallel to the sidewalk before removal as determined by the City Engineer.

#### iv) Temporary Road Repairs

Where a Contractor installs servicing to a site, it shall be his responsibility to permanently restore the road immediately on completion of the underground work. If this is not possible as approved by the City Engineer, the Contractor must temporarily restore the cut with a 25 mm HL3 asphalt surface (cold mix if hot mix not available) until the permanent restoration can be completed. Permanent restoration must be completed as soon as possible. All costs for the above, including the removal of the temporary asphalt will be borne by the contractor.

#### v) Unpaved Driveways

Unpaved driveways shall be repaired using compacted Granular "A". Unless otherwise indicated, 150 mm thickness of Granular "A" 100% crushed limestone will be used.

#### vi) Walkways

The above requirements for driveways shall also apply to walkways.

# 4. DRIVEWAY ENTRANCE RAMPS, COMBINED SIDEWALK CURB AND GUTTER

Driveway entrance ramps in combined sidewalk and curb and gutter construction shall be constructed as shown on the standard drawings 119-F and 122-F at the locations of existing driveways or as directed by the City Engineer.

# 5. ACCESSIBLE RAMPS

Accessible ramps shall be constructed as shown on the standard drawings at the locations shown on the road drawings or where required by the City Engineer. Tactile warning Plates to be installed in the sidewalk ramps as required in Standard Specifications "Concrete Sidewalk, Curb, Gutter and Driveways".

# 6. EXCAVATION FOR PROPOSED GRASS BOULEVARDS

When the sidewalk and curb and gutter construction is complete, the Contractor, where directed by the City Engineer, shall excavate the remaining material from the area between the sidewalks and the curb and gutter. The excavation shall be to a depth of 125mm (5") below a straight line extending from the sidewalk to the top of the curb and shall be smooth and evenly graded over the whole area. Excavated material shall be disposed off site at the Contractor's expense.

# 7. TOPSOIL, FERTILIZER AND SOD

The Contractor shall be required to place 100mm (4") of topsoil, fertilizer and a layer of sod between driveways from the sidewalk to the curb and gutter; and disturbed areas behind the sidewalk, and other areas as directed by the City Engineer. Placing of sod shall be done to suit trees and tree roots. No work shall be done on private property without prior consent from the City Engineer.

Fertilizer shall be uniformly applied to all services which are to be sodded at a rate of 5 kg of fertilizer per 100 square meters of surface area and shall be incorporated into surfaces by raking, disking or harrowing. Fertilizer shall be applied not more than 48 hours before the sod is placed and shall be standard commercial fertilizer (8-32-16) and a minimum of 30% nitrogen being slow release. Chemical fertilizers shall be as per OPSS 571.05.03.

Sod shall be placed right against any boundaries or obstacles and full sized pieces shall be trimmed as necessary to ensure a tight fit. Grouping small pieces to cover a space will not be allowed. After the sod has been laid, it shall be rolled to compact and level it and the topsoil. The final result shall be a layer of sod that is a smooth evenly graded surface without gaps, humps or hollows.

# 8. SEED

The seed shall be applied at a rate of 100 kg/Ha. The fertilizer to be used shall be 8-32-16 and applied at a rate of 350 kg/Ha.

The seed shall be placed in early spring to June 10<sup>th</sup>, or August 1<sup>st</sup> to September 15<sup>th</sup>. The seed should be placed with a mechanical seeder, i.e. Brillion; hydro-seeding the slopes will be considered. The seeding operation must be immediately followed with a baled straw and asphalt emulsion type of mulch.

The Contractor will be responsible to water and maintain the sod for a period of 30 days after it was laid. At the end of that time, the sod will be inspected and shall be green and succulent and showing evidence of rooting into the underlying soil. Any sod which fails to meet these requirements will be replaced at the Contractor's expense and subject to another 30 day maintenance expense.

# 8. TREE REMOVAL

The only tress which can be removed are those designated for removal by the contract drawings or specifications and/or which both the City Engineer and the City Arborist have given approval for the removal of. No other trees will be removed or have limbs or roots cut or trimmed or damaged in any fashion. Minor damage to trees will be repaired by the City Arborist at the Contractor's expense. Major damages to branches, trucks, root, etc. of a tree as determined by the City Arborist will require removal of this tree and replacement with a 100 mm caliper tree of a kind to be chosen by the City, all at the contractor's expense.

# 9. SAFETY AND CLEANUP

Safety and cleanup of work sites are of great concern to the City because of the potential to cause public discontent and hazard when they are delayed or done poorly. The Contractor must clean up his work as a daily, on-going process so that all work sites are kept clean and safe at all times. At no time may cleanup be allowed to "collect" for a period of time.

The City requires that the Contractor clean up at all sites prior to weekends and holidays in order to minimize hazards and complaints.

The Contractor shall provide barricades and/or fencing such as to provide a physical barrier that will separate the work site from the general public, including the visually impaired. All sidewalk and road crossings inside and outside the fenced construction area designated for pedestrians must always be made accessible for persons with disabilities.

All costs for safety and cleanup are to be included in the unit rate that applies to the work involved.

# **10. DAMAGE TO PUBLIC OR PRIVATE PROPERTY**

The Contractor must take care to ensure that he does not damage City sidewalks, asphalt, curbs, gutters, grassed areas or any other City property not marked by the City Engineer for removal. Special care must be taken by the Contractor to not damage any private property of any sort, including buildings, vehicles, fences, driveways, walkways, landscaping and grassed areas. Included in this damage would be stabilizer marks and tire tread depressions in grassed areas.

When any such damage occurs to City or private property, the damage must be repaired to the satisfaction of the City Engineer and the cost for these repairs will be at the expense of the Contractor.

# **11. FINAL CLEAN-UP**

The work site within the limits of construction must be thoroughly cleaned before the work will be declared complete by the City Engineer. Cleaning will include, but not be limited to, sweeping all sidewalks, roads, driveways and gutters, cleaning out all catchbasins and manholes, cleaning all sewers of construction debris, removing excess asphalt from all manhole lids and valve box covers, removing concrete from around nuts on curb stops, replacing screws on sanitary cleanout caps that are concrete filled and removing any and all excess material and construction traffic control signs.

# C. TESTING PROCEDURES

#### i) Concrete

Concrete shall be as per Standard Specification "Concrete sidewalks, Curbs, Gutters and Driveways".

#### ii) Asphalt

Asphalt shall be as per Standard Specification "Driveways and Roads".

#### iii) Granular Material

Granular Materials shall be as per Standard Specification "Driveways and Roads" and Standard Specification "Concrete Sidewalks, Curbs, Gutters and Driveways".

#### iv) Topsoil

Topsoil shall be as per OPSS 802.05.01

#### v) Sod

Sod shall be as per OPSS 803.05.01

#### vi) Fertilizer

Chemical fertilizers shall be as per OPSS 803.05.03

# DIVISION 5.0 CITY OF SARNIA STANDARD DRAWINGS

2020

# **STANDARD DRAWINGS**

#	Drawing #	Revision Detail	Drawing Description
	87-SF		Sewer Lateral Drop Pipe
-	95-SF		Hydrant Installation
-	100-SF		Standard Residential Meter Pit
-			
	101-SF		Water Chamber For Water Meters
			Pressure Varying Mains
	102-S⊦		Pump Station No. 1 Modification for Muffin Monster
	106-SF		Typical 50mm Watermain Blowoff
	100-Si 107-SF		Water Distribution System
	107 Si		Standard Curb Cuts for Posidontial
	100-1		Driveways
	108-SF		Granular Foundations – Storm and
			Sanitary Main Line and Service Laterals
			Trenches
	109-F	Updated	Lot Servicing
	110-F		Rear Lot Catch Basin Detail
	112-F		Concrete Sidewalk
	112-G		Christina Street Concrete Sidewalk
	112-SF		Granular Foundations for Watermain
			and Water Service Trenches
	113-SF		Multi Use Trail Cross Section
	113-SF-1		Fence Detail for Multi Use Trail
-	114-F		Utility Location Local Road 20m Road
			Allowance
-	114-AF		Utility Location Local Road 20m Road
			Allowance
	115-SF		Standard Meter Pit
	119-F		Alternate Detail For Combined
			Sidewalk - Curb and Gutter
	120-F		Driveway Culvert Cross Section
	122-F		Urban Industrial Commercial and
			Apartment Entrance
	128-F		Backyard Dry Well Installation
	130-F		Sample Lot Grading Plan
	134-F		Standard Location For Water Valves at
			Intersections
	136-F		Project Signboard
	137-F		Typical Service Entrances
	138-F		Insulation of Shallow Mains and Offsets

150-F		Typical Temporary Water Service Blow Off Installation (Copper only)
150-G		Typical Temporary Water Service Blow Off Installation
151-F		Proposed Orifice Control Plate
152-F		Street Name Sign Template
153-F		Signalized Intersection Configurations of Pedestrian Crossing
154-F		Location of Dropped Curbs at Controlled Intersections
155-F		Tactile Walking Surface Indicator and Depressed Curb Detail
160		Typical Subdrain Detail
1882-S		Extension Shute for Catchbasins
2064-S		Standard Timber Markers for House Connections
2071-S1		Storm Subdrain Pipe
2485		Typical Wheelchair Ramps in Sidewalk Separate
2486		Typical Wheelchair Ramp in Sidewalk Adjacent to
2500		PVC Pipe Thrust Restraints
2600		Temporary Water Supply Detail
2700	New	Sanitary Service Cleanout w/ 4m Extension
2800	New	Temporary Steel Plate
3000	New	1.5m Chainlink Fence
















































		1830mm (6 FEET)				
	PROJECT NAME CONTRACT NO 20					T
		CONTACT #	EMERGEN	CY #	(4 FEET)	
	CONTRACTOR	<i>OFFICE</i> 111-111-1111	AFTER HOU 333–333–3	RS 3333	1220mm	
	CITY OF SARNIA	ENGINEERING . DEPT. 519-332-0330	NGINEERING SARNIA POLICI DEPT. 519-332-0330 519-344-886			
N	IOTES					
' ть	E CONTRACTOR SHALL SUPPLY A					
SIGNBOARD AT LOCATIONS DESIGNATED BY ENGINEER.		REV.1 REVISE	D	11/09		
THE SIGNBOARD SHALL BE 1220mm (4 FEET) HIGH AND 1830mm (6 FEET)WIDE. A SUITABLE FRAMEWORK SHALL BE SUPPLIED AND ERECTED BY THE CONTRACTOR TO SUPPORT THE SIGN. NO ADDITIONAL SIGNS OR NOTICES OTHER THAN REQUIRED FOR TRAFFIC AND PEDESTRIAN INSTRUCTIONS AND PUBLIC WARNING MAY BE EXHIBITED ON THE SITE WITHOUT THE APPROVAL OF THE ENGINEER. LETTERING SHALL BE GREEN ON A WHITE BACKGROUD THE SIGNBOARD SHALL BE ERECTED IN POSITION, AND MOVED WITH THE PROGRESS OF WORK, AS DIRECTED BY CITY ENGINEER.						AP.BY
			CITY OF SARNIA     PROJECT SIGNBOARE     APPROVED BY: T.W.     DRAWN BY: J.RAMSAY     SCALE: N.T.S.     DWG.No.			
			CHK' BY: J.ROBERTS	DATE: 02/03	150	, — Г





CHK' BY: J.ROBERTS DATE: 02/03







## 6.25" Ext. w/4" text **Highway Gothic Condensed font** EVAN ST 6.25" X 54 cm TEMPLE ST 6.25" X 69 cm MAXWELL ST 6.25" X 76 cm CANADORE CRT 6.25" X 91cm REV.1 DESCRIPTION DATE AP.BY REV.# OF SARNIA CITY STREET NAME

APPROVED BY:		BK.	
DRAWN BY: OD	SCALE: N.T.S.	DWG.No.	
СНК' ВҮ:	DATE: FEB 2014	152-1	

SIGN TEMPLATE





## CONTINUOUS DROPPED CURB AT INTERSECTION CORNER

## NOTES

- A. 2.5m MINIMUM FOR PEDESTRIAN CROSSING PAVEMENT MARKINGS.
- B. WHEN DISTANCE IS LESS THAN 3.0m USE CONTINUOUS DROPPED CURB AT INTERSECTION CORNER. WHEN DISTANCE IS GREATER THAN OR EQUAL TO 3.0m USE TWO SEPARATED DROPPED CURBS AT INTERSECTION CORNER.
- 1. DROPPED CURB TO BE PROVIDED FOR WIDTH OF ALL PEDESTRIAN CROSSINGS 1.5m MIN.
- 2. TACTILE WALKING SURFACE INDICATORS TO BE PROVIDED ONLY WITHIN WIDTH OF PEDESTRIAN CROSSINGS.
- 3. TACTILE WALKING SURFACE INDICATORS ARE TO BE INSTALLED AT ALL PEDESTRIAN CROSSINGS IN CONJUNCTION WITH ALL ROAD AND SIDEWALK CONSTRUCTION AND RECONSTRUCTION.
- 4. EACH LOCATION IS SITE SPECIFIC AND CONSULTATION WITH THE CITY OF SARNIA MAY BE REQUIRED FOR NON TYPICAL INTERSECTIONS AND PEDESTRIAN CROSSINGS.
- REFER TO 153-F FOR VARIOUS CONFIGURATIONS OF PEDESTRIAN CROSSINGS AT SIGNALIZED INTERSECTIONS.

REV.1	REV.1 REVISED FOR 2016 SPEC.					
REV.#	V.# DESCRIPTION			AP.BY		
	CITY OF SARNIA					
LOCATION OF DROPPED CURBS AT CONTROLLED INTERSECTIONS						
APPRO	APPROVED BY:					
DRAWN	BY: OD	SCALE: N.T.S.	DWG.No			
СНК' Е	BY:	DATE: FEB 2014	154	⊦—⊦		

TWO SEPARATED DROPPED CURBS

AT INTERSECTION CORNER



Proposed road cross slope 2.0*     Image: cross slope 3.0*     Image: cross slope 3.0* <th>ED R RUSHED TONE D 150mr BDRAIN XK</th> <th></th> <th></th> <th>DOmm</th> <th></th>	ED R RUSHED TONE D 150mr BDRAIN XK			DOmm	
	REV.#	DESCR	IPTION	DATE	AP.BY
NOTE					
ROAD WIDTHS ARE EDGE OF PAVEMENT TO EDGE OF PAVEMENT					
CONTRACTOR TO PROVIDE CURB AND SIDEWALK CONNECTIONS WITH A	TYPICAL				
SMOOTH TRANSITION					
LOT LINES ARE SHOWN APPROXIMATE ONLY, NOT TO BE USED AS LEGAL DOCUMENTATION		20RDKY	AIN DEI	AIL	
ALL EXISTING INFORMATION IN THIS DRAWING ARE PROVIDED ONLY FOR THE ASSISTANCE OF THE CONTRACTOR AND THEIR ACCURACY IS NOT	APPRO\	/ED BY:		BK.	
GUARANTEED.	DRAWN	BY: OD	SCALE: N.T.S.	DWG.No	). C
	снк' в	IY:	DATE: JAN 2016	16	50














REDUCER





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		PVC PIPE	THRUST REST	RAINT				
	N	MIN. LENGTH OF PVC	C WM. TO BE	RESTRAIN	NED (m)			
LEN PIPE	100 mm	150 mm	200 mi	n	250 mm	1 3	00 mm	
GTH DIA.	(4")	(6")	(8")		(10")		(12")	
A	7.0	7.0	7.0		14.0		14.0	
В	14.0	14.0	20.0		20.0		25.0	
C	7.0	7.0	7.0		14.0		14.0	
D	7.0	7.0	14.0		14.0		14.0	
E	7.0	7.0	7.0		7.0		7.0	
F	7.0	14.0	20.0		20.0		25.0	
G	7.0	7.0	7.0		14.0		14.0	
н	7.0	7.0	7.0		7.0		7.0	
" DENOTES RESTRA	INT DEVICE S BASED ON CLAY TYPE SC	IL CONDITIONS TYPICALLY FO		REV.#	DESCR	IPTION	DATE	AP.BY
1.5M. REFER TO AS EVALENT OR PIPE IS TERMINED BY THE F	STM D2487 FOR COMPLETE S SITUATED BELOW WATER ENGINEER.	TABLE, RESTRAINED LENGTH	IS WILL BE		CITY	OF SARN	IA	
EDUCER DIMENSION AN ONE PIPE SIZE, 1 ESTRAINT SYSTEMS VC WATERMAIN PIPI	<ul> <li>+ H' ASSUMES ONE REDUC</li> <li>RESTRAINED LENGTH WILL</li> <li>OVER 300MMØ TO BE DET</li> <li>E WITH STANDARD GRANUI</li> </ul>	TION IN PIPE SIZE. IF REDUCT . BE DETERMINED BY THE ENG 'ERMINED BY MANUFACTURER LAR 'A' EMBEDMENT MATERIAL	TION IS GREATER SINEER.		PVC P RES	IPE THRUS STRAINTS	ST	
ESIGN FOR RESTRA	INT SYSTEMS WHEN CONN	ECTING TO EXISTING INFRAST	RUCTURE WILL	APPROVED I	BY: RW		BK.	
AT THE DISCRETION	N OF THE CITY ENGINEER.						DWG.No.	
L RESTRAINERS TO	HAVE PETROLATUM AND	PETROLEUM COATED SYSTEM		DRAWN BY:	OD	SCALE: N.I.S.	250	0
				CHK' BY: BI	_	DATE: MAR'14		





























17	VBLE 1 -	Step-Bevel	for Circul	lar Structu	ıral Plate P	ipe	Ľ	ABLE	2 – Pai	rtial Bevel	and Step-	Bevel for	Pipe-A	rch Struc	tural Plate	Pipe	
2	H for t	bevels of	V for I	bevels of	X for t	bevels of	,	i		ħ	/ for bevels	of		7	for bevels of		
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2120	1830	3050	1220	1520	450	300	269(	205	30 /6	1980	2640	3050	1320	1	I	300	
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2430	2050	2020	0202	0701	200	455	340(	707		0 1800	2400	3050	1200	1	I	180	
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