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**EXCAVATION, BEDDING & BACKFILL**

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**PART 1 GENERAL**

- 1.01 OTHER CONTRACT DOCUMENTS      The General Conditions of the Contract, General Requirements and Supplemental Conditions attached hereto shall apply to and be a part of this Section.
- 1.02 DESCRIPTION OF WORK      The Work described herein is for the excavation of trenches or tunnels, the preparation of pipe foundation, the supply and placing of bedding, haunching and backfill materials, shoring and other protective works, drainage and de-watering of excavations, the disposal of surplus and unsuitable materials, and rough grading of the Site.
- 1.03 RELATED WORK      Section 02660 - Watermains  
Section 02665 - Building Connections  
Section 02700 - Sewers
- 1.04 CLASSIFICATION OF THE WORK      Excavation shall be classified as either Common or Rock. Unless otherwise specified in Section 01001 Supplemental Conditions or shown on the Drawings, Excavation shall be Common.
- Bedding shall be classified as either Sand, Gravel, Foundation Stone, or Excavated Bedding Material and unless otherwise specified in Section 01001 Supplemental Conditions or shown on the Drawings, Bedding shall be Sand Bedding.
- Backfill shall be classified as either Class 1, Class 2, or Class 3 as shown on the Standard Drawing STD 1111F attached to this Section. Unless otherwise specified in Section 01001 Supplemental Conditions or shown on the Drawings, Backfill shall be Class 2.
- Insulation shall be classified as either Flat or Box as specified in Section 01001 Supplemental Conditions or shown on the Drawings.
- 1.05 APPROVALS      The Contractor shall inform the Engineer, a minimum of two (2) weeks prior to commencing the Work, of the source of all bedding and backfill materials he intends to use in the Work and provide access to the material sources for sampling.

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**EXCAVATION, BEDDING & BACKFILL**

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**PART 2 PRODUCTS**

- 2.01 COMMON EXCAVATION Common Excavation shall include all excavation through frozen or unfrozen clay, silt, sand, gravel, hard-pan, dense tills, earth, roots, brush, rubbish, quick-sand, rubble, water, ice, snow, shale, cobbles, boulders (less than one cubic metre in volume), loose rock, surface or buried asphalt and concrete pavements, concrete or masonry rubble, existing underground and surface utilities and any other obstacles which may be encountered, excepting Rock Excavation as defined herein.
- 2.02 ROCK EXCAVATION Rock Excavation shall include individual boulders, rock fragments, pieces of concrete, or masonry exceeding one (1.0) cubic metre in volume, or solid ledge rock, bedrock, concrete or masonry which can not be removed by excavation equipment without the use of explosives, rock rippers, rock hammers or jack hammers. Soft or disintegrated rock, concrete or masonry removed with a hand pick, shovel or excavation equipment, or loose, shaken or previously blasted rock will not be considered as Rock Excavation.
- 2.03 EXCAVATED BEDDING MATERIAL Excavated bedding material shall be unfrozen sand, sand with gravel, or sand with gravel and silt excavated from the trench and free of organics, highly compressible soils, and hard lumps of material or stones larger than 10 millimetres in diameter.
- 2.04 CONCRETE BEDDING Concrete for pipe bedding shall be Type C manufactured using Type 50 sulphate resistant Portland cement as described in Section 02512 Ready Mixed Concrete.
- 2.05 BEDDING SAND Bedding Sand shall be natural, manufactured, or processed clean, dry, free running, unfrozen, sound, well graded dense granular material conforming to the requirements of CSA Standard CAN/CSA-A23.1 'Concrete Materials and Methods of Concrete Construction' with the following gradation;
- |               |                 |
|---------------|-----------------|
| 9.5 mm sieve  | 100% passing    |
| 4.75 mm sieve | 80-100% passing |
| 2.00 mm sieve | 40-80% passing  |
| 425 um sieve  | 10-40% passing  |
| 74 um sieve   | 0-3% passing    |

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**EXCAVATION, BEDDING & BACKFILL**

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2.06 BEDDING GRAVEL Bedding Gravel shall be natural, manufactured, or processed clean, dry, unfrozen, sound, angular, non cohesive, well graded dense granular material conforming to the requirements of CSA Standard CAN/CSA-A23.1 'Concrete Materials and Methods of Concrete Construction' with the following gradation;

25 mm sieve	100% passing
19 mm sieve	90-100% passing
12.5 mm sieve	30-60% passing
4.75 mm sieve	0-15% passing
2 mm sieve	0-5% passing

2.07 FOUNDATION STONE Foundation Stone shall be natural or manufactured, clean, angular, open graded, granular material conforming to the requirements of CSA Standard CAN/CSA-A23.1 'Concrete Materials and Methods of Concrete Construction' with the following gradation;

19 mm sieve	100% passing
12.5 mm sieve	0 -5% passing

2.08 GRANULAR BACKFILL Granular Backfill shall be natural, manufactured, or processed clean, dry, unfrozen, sound, hard, angular, non cohesive, well graded, dense gravel conforming to the requirements of CSA Standard CAN/CSA-A23.1 'Concrete Materials and Methods of Concrete Construction' with the following gradation;

100 mm sieve	100% passing
4.75 mm sieve	30-75% passing
74 um sieve	0-15% passing

2.09 COMMON BACKFILL Common Backfill shall be dry unfrozen material excavated from the trench, free of organic or soft materials which would disintegrate through decay or weathering, free of lumps or stones exceeding 150 millimetres in diameter and of such gradation and moisture content that the soil will compact to the specified density and remain stable.

2.10 UNSHRINKABLE BACKFILL Unshrinkable Backfill shall be a mixture of dry, unfrozen concrete aggregates, cement and water conforming to the requirements of Section 02512 Ready Mixed Concrete.

2.11 INSULATION

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**EXCAVATION, BEDDING & BACKFILL**

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**PART 3 EXECUTION**

Insulation shall be Type 4 high density extruded polystyrene rigid foam board.

Insulation shall be DOW Hi-40 or approved equal.

**3.01 CLEARING THE  
RIGHT OF WAY**

Roadways, lanes and easement right-of-ways shall be cleared as directed by the Engineer. Trees marked for removal shall be cut down, and all stumps and roots larger than 200 millimetre diameter excavated and removed from the Site. Branches from trees on private property which extend into the municipal right of way shall be cleanly cut and treated. Movable items (mail boxes, signs, benches) shall be temporarily relocated or removed from the Site as directed by the Engineer. Any structures (sheds, fences, garages, etc) which are partly or wholly within the municipal right of way or on private property but obstructing the Work, shall not be removed without the written authorization of the Engineer.

**3.02 PAVEMENT**

The Contractor shall neatly saw cut existing oiled surfaces, asphalt or concrete pavements (including roads, driveways and sidewalks), at the limit of excavation marked by the Engineer. The excavated pavement shall break along straight lines and the face of the remaining pavement shall be vertical. Any pavement damaged or removed beyond the marked limit of shall be restored to original condition by the Contractor at his sole expense.

Where it is required to excavate existing gravelled roads or driveways, the Contractor shall first remove and stockpile the gravel prior to excavation and replace and compact the same following backfilling.

**3.03 CULVERTS**

If an existing culvert must be removed in the course of the Work, the Contractor shall salvage, store and upon completion of backfill, install the culvert as directed by the Engineer.

If, in the opinion of the Engineer, the existing culvert can not be salvaged, the Contractor shall remove and dispose of the culvert as directed by the Engineer and shall install a new culvert in place of the original. Unless stated otherwise in Section 01001 Supplemental Conditions, shown on the Drawings, or listed in the Unit Price Schedule, the supply of the a new culvert will be by the City unless the Engineer

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**EXCAVATION, BEDDING & BACKFILL**

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requests the new culvert be supplied by the Contractor, then payment will be as Additional Work in accordance with the General Conditions of the Contract attached hereto.

**3.04 TOPSOIL REMOVAL**

If directed by the Engineer, the Contractor shall remove and stockpile topsoil for reuse. The topsoil shall be removed when dry enough to prevent any contamination with the subsoil material. The Contractor shall not intermix grass, weeds, roots root mat brush and stones larger than 75 millimetres with the stockpiled topsoil.

**3.05 EXCAVATION OF TRENCHES**

Excavation shall be to the line and grade shown on the Drawings and as set out on the Site by the Engineer. Vertical variance from grade shall not exceed 25 millimetres and horizontal variance from grade shall not exceed 100 millimetres. The excavation shall not extend beyond the marked limit of excavation and shall not be open more than 30 metres ahead of or behind the pipe-laying operations, unless otherwise directed by the Engineer. The Contractor shall not leave open more than 6 metres of trench at the end of each calendar day.

Excavated material shall be piled in manner that does not endanger the Work or obstruct roads, surface drainage, sidewalks, driveways, hydrants and control devices. Street gutters, ditches and culverts shall be kept clear unless other provisions have been made for drainage. If it is impracticable to place the excavated material adjacent to the trench, it shall be removed and stockpiled as directed by the Engineer.

The Engineer may stop the excavation operation or any other portion of the Work and require the Contractor to complete the pipe installation and backfilling up to such point as he may direct and the Contractor shall not thereby become entitled to any additional allowance or compensation other than an extension to the Contract Time as determined by the Engineer.

If the Work is stopped on the whole or at any part of the trench, and the trench is left open for an unreasonable length of time in advance of the installation of the pipe, the Contractor shall, when directed by the Engineer, refill such trench or part thereof until he is ready to proceed with the installation of the pipe. If the Contractor should refuse, neglect, or otherwise fail to refill

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**EXCAVATION, BEDDING & BACKFILL**

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completely such trench within 48 hours of receipt of notice to do so, the Engineer shall have the trench refilled and the cost thereof shall be charged to the Contractor.

3.06 DEPTH OF  
EXCAVATION

Trench excavation shall be sufficiently deep to permit the pipe and bedding materials to be installed to the specified grade. The bottom of the trench shall be firm, stable, undisturbed soil, level, and free of loose, soft or organic matter and stones. Where the bottom of the excavation is disturbed, damaged or puddles as a result of the Contractor's excavation methods, he shall, at his own expense, carry out any further excavation as the Engineer directs. Any excavation beyond the specified depth not requested by the Engineer shall be filled with approved compacted bedding material at the Contractor's sole expense.

3.07 UNSUITABLE  
SUBGRADE

The Contractor shall notify the Engineer of any unsuitable sub grade conditions (organics, silt pockets, rubbish) and discontinue the Work in the area until the Engineer has determined the extent of the problem. If, in the opinion of the Engineer, the trench bottom at subgrade is unstable or contains unsuitable material, the Contractor shall excavate, remove and replace the unsuitable material with approved compacted bedding material to the specified grade.

3.08 ROCK EXCAVATION

Where rock excavation is specified the Contractor shall remove the rock to provide a clear distance between any projecting rock and the pipe/structure of not less than 150 millimetres for pipe having an outside diameter of 600 millimetres or less and not less than 225 millimetres for pipe having an outside diameter greater than 600 millimetres. The trench bottom shall be brought to the specified grade with approved compacted bedding material.

3.09 WIDTH OF  
EXCAVATION

The width of excavation from a point 300 millimetres above the pipe crown to the bottom of the trench shall be sufficient to allow the pipe/structure to be installed as specified. Where the width of excavation below the pipe crown extends beyond the limits shown on the Standard Drawing STD 1111F attached to this Section, the Drawings, or as described in Section 01001 Supplemental Conditions as a result of encountering

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**EXCAVATION, BEDDING & BACKFILL**

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unsuitable sub grade or over-excavation, the anticipated external loading condition of the pipe shall be reviewed for compliance with the original design. If necessary, the Class of bedding and/or strength of the pipe shall be upgraded to meet the new loading condition.

**3.10 TRENCH WALLS**

Where the extended trench width results from an unsuitable soil condition beyond the Contractor's control, the sole cost of such upgrading shall be the City's. Where the extended trench width results from excavation beyond the specified limits the sole cost of such upgrading shall be the Contractor's.

The Contractor shall maintain vertical side walls on all trenches, without contravening safety regulations or requirements. If, in the opinion of the Engineer, it is impossible to maintain vertical side walls, a 'Y' type of excavation may be permitted to a point 300 millimetres above the pipe crown, however the trench side walls below this point shall remain vertical. If the trench width must be maintained at the minimum as specified herein, in Section 01001 Supplemental Conditions, shown on the Drawings, or due to limitations of available right-of-way, encroachments with existing utilities, structures, or other works the Contractor shall supply and use, at his sole expense, a trench cage or shoring in accordance with the requirements of the latest revision of the Manitoba Workplace Safety and Health Act.

Unless otherwise directed by the Engineer, shoring shall be left in place and neatly cut off 1 metre below the proposed finish grade. The use of shoring a trench cage shall not diminish the required width of the excavation, obstruct placing and tamping of bedding and backfilling material under and around the pipe, injure or delay the Work or endanger adjacent pavements or structures. The removal of shoring or moving of a trench cage shall not cause lateral or longitudinal movement of the pipe or disturb the existing bedding material. All voids shall be promptly filled and compacted as the Work proceeds.

**3.11 WATER CONTROL**

The Contractor shall supply and maintain, at his own expense, all necessary portable drainage equipment (including power, pumps, sand points and discharge hose) to keep all excavations, trenches, tunnels, and installed pipe free of water

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**EXCAVATION, BEDDING & BACKFILL**

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and provide a stable trench bottom at all times. De-watering shall be carried out by methods approved by the Engineer, and shall not interfere with the Work, damage property or harm the environment. The installed pipe shall not be used as a drain and at no time shall water be disposed of in a municipal sewer or drain unless authorized by the Engineer.

The ground adjacent to all excavations shall be graded to prevent surface water from entering the trench and the Contractor shall construct and maintain all temporary ditches or drains as necessary for the conveying water removed from excavations. When temporary ditches or drains are no longer required, the Contractor shall reinstate the ground to its original conditions. The Contractor will be liable for any and all damage which results from the blockage or damage to drains, surface drainage ditches or other facilities by the discharge of water from the Work.

### 3.12 PIPE BEDDING

The pipe bedding material shall be placed in the bottom of the trench prior to the installation of the pipe as shown in the Standard Drawing STD 1111F attached to this Section, on the Drawings or as directed by the Engineer.

The Bedding material shall be placed in the bottom of the trench and compacted, to 90% Modified Proctor Density, to provide a continuous uniform longitudinal support under and around the entire pipe barrel to a point 300 millimetres above the top of the pipe. NOTE For the installation of concrete pipe, the Bedding material beneath the invert of the pipe shall not be compacted by mechanical means and shall remain firm but yielding. Cavities in the bedding material shall be provided for flanges, couplings, collars, sleeves or bells of sufficient dimension to ensure the proper jointing of the pipe. The use of wooden blocks, bricks or other hard materials to bring the pipe to grade will not be permitted.

Excavated Bedding Material shall be used only if the Engineer determines the excavated material is suitable for bedding. Foundation Stone shall have a minimum depth of 150 millimetres and shall be installed to the spring line of the pipe.



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**EXCAVATION, BEDDING & BACKFILL**

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**3.13 BACKFILLING**

Trenches shall be backfilled as soon as possible after the pipe has been installed and the bedding has been approved by the Engineer. Backfill shall extend to the depth as stated in the Section 01001 Supplemental Conditions or as shown on the Drawings. At the end of each days operation the end of the pipe shall be sealed and the trench backfilled.

No bolder, loose rock, or concrete rubble exceeding 150 mm in its largest dimension shall be incorporated in the backfill. Where there is not sufficient suitable site material available for the required backfill, imported backfill shall be used. The Engineer shall approve imported backfill before use. Payment for supplying imported backfill will be as a Change in Work as described in the General Conditions of the Contract attached hereto.

**Class 1 Backfill:** The trench shall be filled with Granular Backfill in even layers not exceeding 600 millimetres in thickness and thoroughly compacted by mechanical means or flooded to a density of 95% of the maximum dry density as determined by the Modified Proctor Test. The Engineer shall approve each compacted layer prior to installation of the next layer. Granular Backfill shall extend from the pipe bedding to within 1.0 metres of the proposed grade. The remainder of the trench shall be backfilled with Unshrinkable Backfill to the elevation of the proposed finished grade or proposed roadway sub grade as directed by the Engineer.

**Class 2 Backfill:** The trench shall be filled with Granular Backfill in even layers not exceeding 600 millimetres in thickness and thoroughly compacted by mechanical means or flooded to a density of 95% of the maximum dry density as determined by the Modified Proctor Test. The Engineer shall approve each compacted layer prior to installation of the next layer. Granular Backfill shall extend from the pipe bedding to the elevation of the proposed finished grade or proposed roadway sub grade as directed by the Engineer.

**Class 3 Backfill:** The trench shall be filled with the excavated material in even layers not exceeding 600 millimetres in thickness and thoroughly compacted by mechanical means to a density equivalent to 95% of the density of the surrounding

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**EXCAVATION, BEDDING & BACKFILL**

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unexcavated material. The Engineer shall approve each layer of backfill prior to installation of the next layer. Surplus material shall be mounded over the trench to such height as permitted by the Engineer.

The Contractor may use compaction equipment in the trench to consolidate the backfill as it is placed when there is sufficient cover to prevent damage to the pipe or structure.

The Contractor shall thoroughly compact all trenches and shall correct any settlement or subsidence during the one (1) year warranty period.

3.14 JETTING AND  
FLOODING OF  
BACKFILL

If approved by the Engineer, the backfill material shall be jetted and flooded utilizing a minimum 25 mm diameter pipe complete with perforated jetting nozzle. Each nozzle insertion shall be within 1000 mm of the crown of the pipe. For each 1500 mm of trench width one longitudinal row of jetting insertions shall be provided with the maximum spacing between nozzle insertions along a row being 1500 mm. Water shall be injected until the water rises above the top surface of the backfill and ponds on the surface. Additional backfill material as specified shall be placed to maintain the surface of the trench at the specified elevation.

Surface flooding of the backfill will not be considered an acceptable alternate to the method described above.

3.15 INSULATION

Insulation requirements shall be as follows and as detailed on STD 1111T attached to this Section;

-Less than or equal to 2.1 metres of cover:

Box style insulation 1200 mm x 100 mm.

-Greater than 2.1 m but less than 2.4 m cover:

Flat style insulation 1200 mm x 100 mm.

-More than 2.4 m but less than 3.0 m cover:

Flat style insulation 1200 mm x 50 mm.

3.16 TRENCHLESS  
INSTALLATION

If specified in Section 00001 Supplemental Conditions or shown on the Drawings, the Contractor shall install the pipe by means of auguring, coring, pushing, directional boring or tunnelling. The trenchless method proposed shall be subject to the prior approval of the Engineer and all Work shall be in accordance with the requirements of the latest revision of the Manitoba Workplace Safety and Health Act.

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**EXCAVATION, BEDDING & BACKFILL**

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The trenchless installation shall be straight and large enough to enable the pipes to be pushed through without interference or obstruction. At entry and exit locations, the Contractor shall excavate pits for the installation equipment. Each pit shall be of adequate length to allow each pipe length to be lowered parallel to the tunnel and joined to the length of pipe installed. The excavated pits shall be backfilled in the same manner as the connecting pipe.

The bell, coupling or grooved end of the previously installed pipe shall extend clear of the tunnel opening and be completely exposed to facilitate joining. The pipe lengths shall be securely joined. The trenchless installation shall be straight and large enough to enable the pipes to be pushed through without interference or obstruction. At entry and exit locations, the Contractor shall excavate pits for the installation equipment. Each pit shall be of adequate length to allow each

**3.17 CROSSING UNDER  
HIGHWAYS AND  
RAILWAY TRACKS**

The Contractor shall arrange with the Railway Company or Manitoba Department of Highways well in advance to arrange a suitable schedule for the installation of the railway/roadway crossing. All Work is done in strict accordance the owners requirements.

The railway/roadway crossing shall be constructed in accordance with the requirements of the authority having jurisdiction over the right-of-way being crossed. The Contractor shall comply with all the requirements and regulations of the authority having jurisdiction. The Contractor shall provide the nearest engineering office of the said authority having jurisdiction with a minimum of 72 hours notice in writing of his intention to commence construction within the railway said right-of-way.

The installation of the railway/roadway crossing shall be as shown on the Drawings and unless otherwise noted shall be by boring, tunnelling or jacking. The methods and equipment employed to install the casing shall be as determined by the Contractor and approved by the Engineer. The Contractor may excavate tenches for a crossing within the right of way of the roadway or railway but only to within the limits shown on the Drawings.

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**EXCAVATION, BEDDING & BACKFILL**

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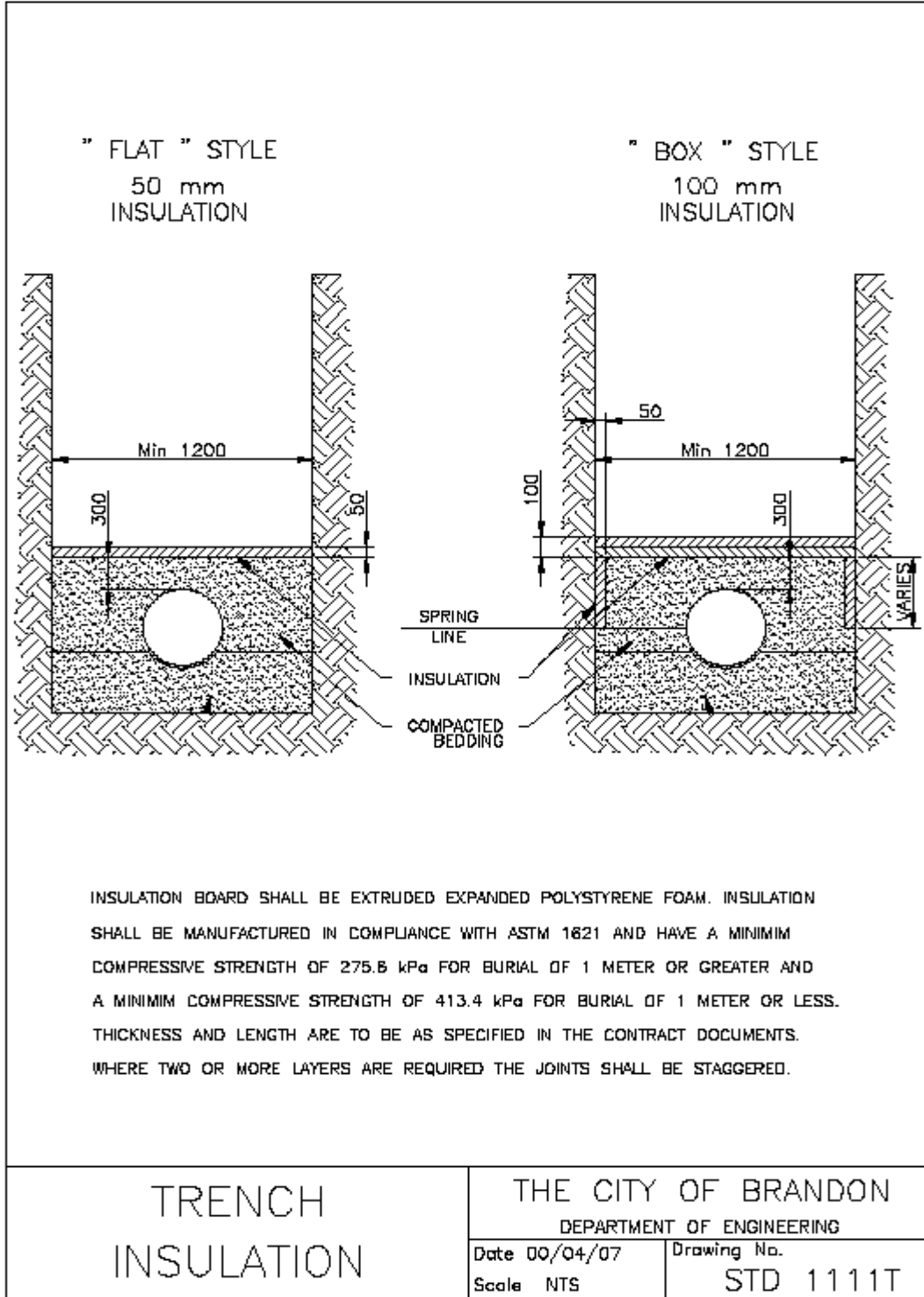
Each casing shall be installed true to line and grades and the Contractor shall modify his operations to correct any deviation. Unless shown otherwise on the Drawings, the Contractor shall be permitted a tolerance from grade or alignment of 25 millimetres per 25 metres. The driving ends of the casing shall be properly protected against damage. Casing joints shall be welded with a continuous circumferential weld. The Contractor shall provide stress transfer across the joints which is capable of resisting the installation forces. Any section of casing showing signs of failure shall be removed and replaced with a new section of casing.

Excavation shall not be made in excess of the outer dimensions of the casing being installed unless approved by the Engineer. Should appreciable loss of ground occur during the casing installation, the voids shall be backpacked promptly to the extent practicable with a material approved by the Engineer. Excavated material shall be removed from the casing as installation progresses, and no accumulation of such material within the casing will be permitted. Once the jacking operations have commenced, they shall be continued uninterrupted until the casing has been installed between the specified limits shown on the Drawings. This requirement may be modified if the Contractor submits to the Engineer, for prior approval, methods and details that shall prevent the freezing of the casing and ensure that the heading is stable at all times.

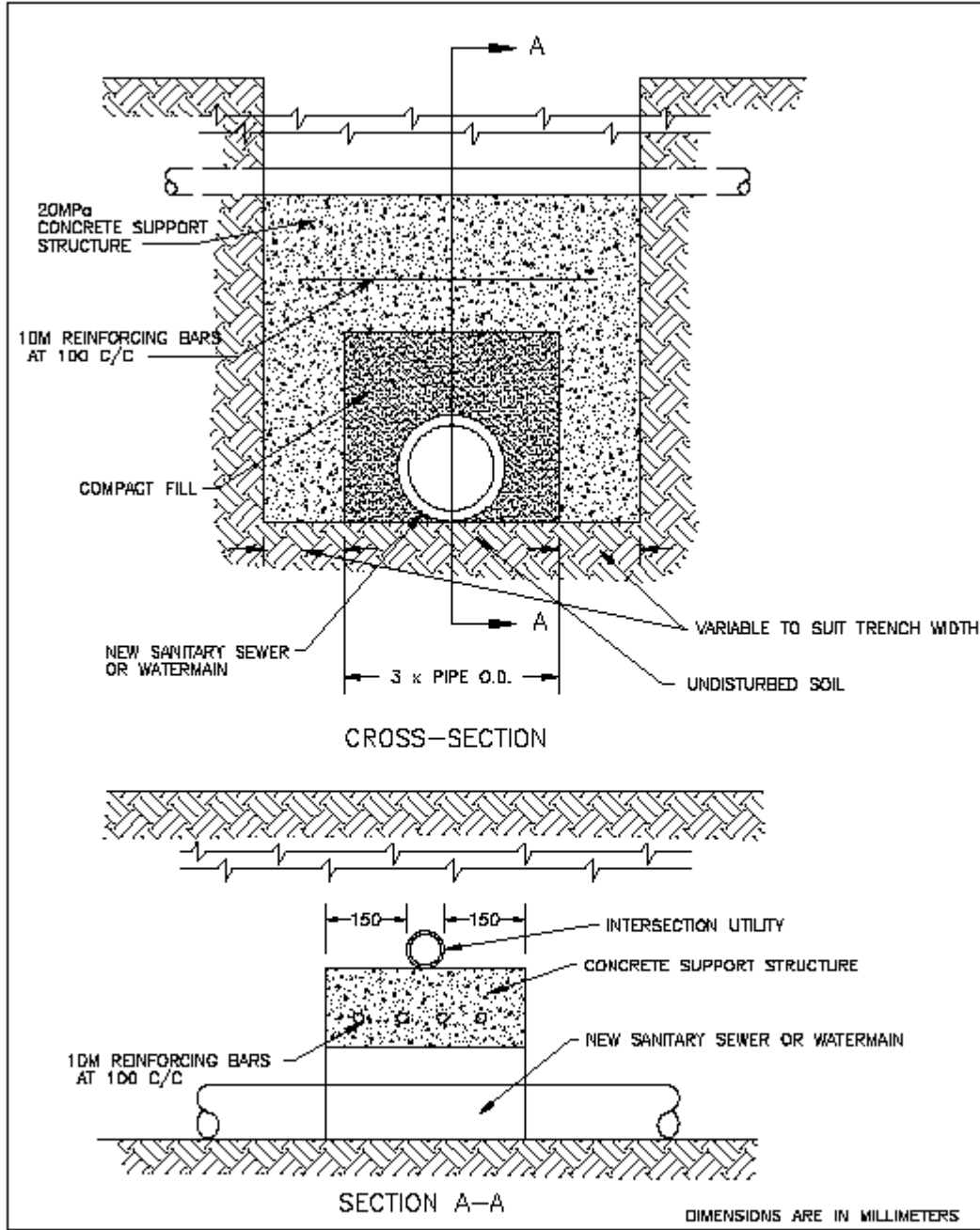
If it becomes necessary for the Contractor to install a crossing through a railway or roadway embankment by open trench excavation, the Contractor shall first obtain written permission from the authority having jurisdiction clearly stating they have no objection to having their physical plant excavated and crossed. The Contractor shall be fully responsible for all additional costs associated with any open excavation, including but not limited to the additional cost for bedding and backfill materials. No additional payment will be made by the City for the restoration to roadways or railways for open trench installation beyond the limits shown on the Drawings.

Prior to backfilling, all casings shall be permanently plugged to prevent the intrusion of water or solids into the casing void. For steel casings a steel plate shall be spot welded to the casing end, and for PVC casings a plug of the same type and class of pipe shall be installed at each end of the casing.

**EXCAVATION, BEDDING & BACKFILL**



**EXCAVATION, BEDDING & BACKFILL**



CITY OF BRANDON  
 ENGINEERING DEPARTMENT

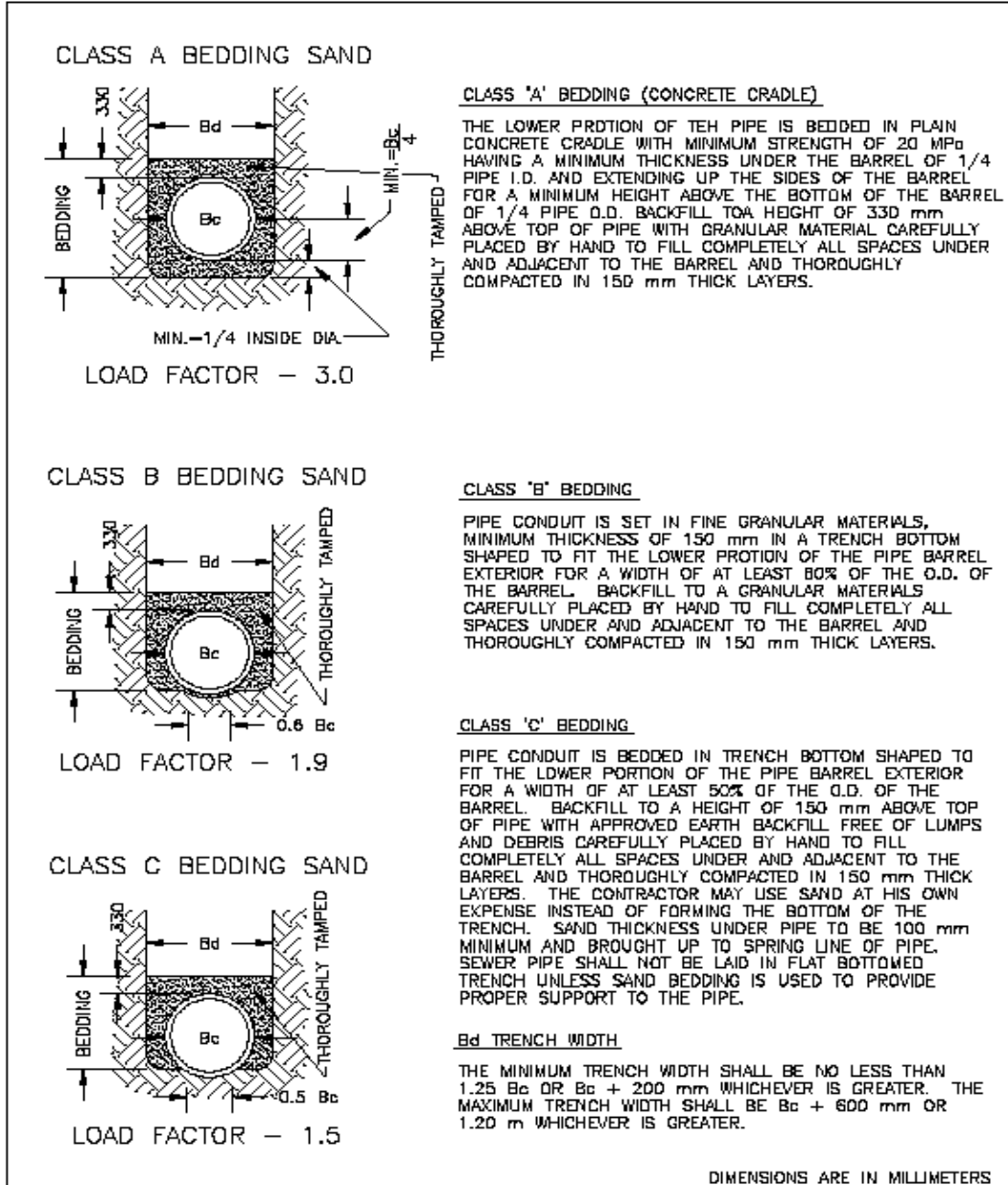
SUPPORT DETAILS FOR  
 EXISTING UTILITIES

DATE: JAN. , 1998.

DWG. NO. - STD11112

REVISED:

**EXCAVATION, BEDDING & BACKFILL**



CITY OF BRANDON ENGINEERING DEPARTMENT	BEDDING DETAILS	
	DATE: JAN. , 1988.	DWG. NO.- STD1111F

REVISED:

END OF SECTION