GENERAL CONDITIONS OF THE CONTRACT

SUBJECT INDEX

PROCTOR & REDFERN LIMITED
CONSULTING ENGINEERS
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GENERAL CONDITIONS OF THE CONTRACT

1. DEFINITIONS

1. Wherever used in the Contract Documents, or other documents forming part of the Contract:
   (a) the word "Contract" means: the Contract to do the Work, the Bonds or Securities, the Addenda (if any), the Specifications, the General and Supplementary General Conditions, the Tendering Information, the List of Contract Documents, the Drawings, and other documents referred to or connected with the Agreement.
   (b) the word "Owner" means the person or corporation accepting the Tender.
   (c) the word "Contractor" means the person or corporation to whom the Contract for the Work has been awarded.
   (d) the word "Subcontractor" means the person or corporation having a contract with the Contractor (or with another subcontractor) for the execution of a part or parts of the Work included in the Contract, or for the supplying of material for the Contract and worked to a special design according to the Drawings and Specifications.
   (e) the word "Engineer" means Proctor & Redfern Limited, Consulting Engineers, and their duly authorized agents.
   (f) the word "Work" means labour, materials and other things required to be done, that are shown, described or implied in the Contract Documents, and includes extra and additional Work that may be ordered by the Engineer.

2. DOCUMENTS

2. (a) The Contract Documents shall be signed and sealed, in triplicate, by the Owner and the Contractor.
   (b) The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. The intention of the Documents is to include plant, labour and materials (except as specifically excepted) necessary for the complete and proper execution of the Work.
   (c) Drawings and Specifications shall be read and interpreted together. Work not specifically described, but obviously necessary for the satisfactory completion of the Work for the purpose intended shall be supplied and performed by the Contractor as though it had been described and shown in the Drawings and Specifications.
   (d) Reference to published standard specifications shall be to the edition current at the time of the signing of the Contract Documents.

3. SUB-CONTRACTORS

3. (a) Without the written approval of the Engineer, the Contractor shall not change the Subcontractors named in the Contract.
   (b) The Contractor shall be held as fully responsible to the Owner for the acts and omissions of his Subcontractors (and of persons directly and indirectly employed by them) as for the acts and omissions of persons directly employed by the Contractor.
   (c) The Contractor shall bind every Subcontractor to the terms of the Contract Documents, as far as applicable to the Subcontractor's Work.
   (d) Nothing in the Contract Documents shall create any contractual relation between Subcontractors and the Owner.
   (e) Divison of the Specifications into sections or subsections shall be only for clarity of reading and reference, and shall not be taken to be a division into trades, subtrades or sections of Work of any kind.

4. NOTICES

4. (a) Any notice or communication to the Contractor shall be deemed to be legally well and sufficiently given and served, if:
   (i) handed to the Contractor or his authorized representatives, or
   (ii) posted or sent to the address given in the Tender, or,
   (iii) posted or sent to the Contractor's domicile or usual place of business, or
   (iv) posted or sent to the place where the Work is, or is to be, carried on, or
   (v) posted to or left at his last known address.

SECTION 01010 - GENERAL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The supply of all necessary labour, equipment and material for the installation of approximately:

1. Sanitary Sewers

(A) 2371 m of 200 mm diameter sanitary sewer.

(B) 2221 m of 250 mm diameter sanitary sewer.

2. Watermains

(A) 430 m of 150 mm diameter watermain.

(B) 65 m of 100 mm diameter watermain.

(C) 274 m of 65 mm diameter watermain.

(D) 160 m of 50 mm diameter watermain.

3. Surface restoration and all appurtenances related to the above work within the Fenwick Sewerage Area in the Town of Pelham.

1.02 LIMITS OF SITE

A. The limits of the site are -

1. The road or street allowances on which Work is to be performed.

1.03 SITE OFFICE

A. Provide an insulated field office for the use of the Engineer, and incorporating the following -

1. A minimum floor area of 18 sq. metre(200 sq. ft.)

2. Vinyl-asbestos floor tile.

3. Four opening windows (with screens).

4. A lockable door and screen door.

5. A plan table of 1.4 sq. metre(15 sq. ft.) min. area.

6. A desk and chair.

7. A lockable 4 drawer insulated filing cabinet.

8. A private sanitary facility.

9. A first-aid box as required by the Workmens Compensation Board for 6 to 15 Workmen.

B. Light the site office with fluorescent fixtures to a 650 lux(60 ft. candle) level and maintain a temperature above 21 degrees C. and below 30 degrees C.

PART 1 GENERAL (Cont'd)

1.03 SITE OFFICE (Cont'd)

C. Service, maintain and carry insurance on the site office and contents. Provide evidence of insurance to the Engineer before Work commences.

1.04 PROJECT SIGNBOARD

A. Supply a project signboard having dimensions of 1.8 m x 1.2 m (6 ft. x 4 ft.) with portable and sufficient framework to support the sign. Prominently display the sign in an approved location.

B. Before construction of the sign, obtain approval of the wording.

C. Provide the sign complete and in place within 2 weeks of the start of the Work.

1.05 SETTING OUT OF THE WORK

A. The Engineer will set such stakes as are necessary to mark the location, alignment, elevation and grade of the Work. Give adequate notice of the need for such setting out.

Carefully protect and preserve stakes, lot pins, marks and reference points and replace if destroyed or removed.

Provide grade stakes, masts, scaffolds, batter boards, straight edges, templates and other equipment necessary for laying out, and inspecting the Work.

Wherever necessary suspend Work temporarily to permit the Engineer to inspect and check the line and grade of any portion of the Work.

1.06 MEASUREMENT FOR PAYMENT

A. Unless otherwise specified, measurements will be taken in the horizontal plane.

1.07 CONSTRUCTION SCHEDULE

A. Within 2 weeks after being awarded the Contract, submit proposed construction schedule to the Engineer for approval. In the schedule show proposed progress in weekly stages for the main sections and subsections of the Work.

PART 2 PRODUCTS

2.01 TESTS

A. Where required by the Engineer, supply for testing, samples of materials to be used in the construction of the Work. Do not use materials until they have been so approved.

2.02 CANADIAN MATERIALS

A. Unless otherwise specifically approved, use materials and equipment of Canadian manufacture in constructing the Work.

PART 3 EXECUTION

3.01 TRAFFIC

A. Do not perform Work on public right-of-ways without approval of the road authorities.

B. Perform traffic control on streets in accordance with the rules of the appropriate road authority. Ensure that flagmen wear fluorescent red or orange safety vests, arm bands and hats.

C. Streets may be closed to through traffic only with the written permission of the Road Authority. Adequately mark detours on adjacent streets. Erect and maintain barricades on the closed streets and light at night. Inform the Road Authority when a road is re-opened to traffic.

D. On streets that are not officially closed, always maintain one lane of traffic in each direction. Should temporary detours be constructed, comply with the requirements of the road authority as to location, dimensions, strength, road markings, signing and other relevant details. Remove detours when no longer needed, and restore surfaces to the original condition.

E. Whether streets are officially closed or not, maintain reasonable access to adjacent properties for pedestrians and vehicles.

F. Maintain traffic signs in their original positions. Be sure that the signs are not obscured.

3.02 NOTIFICATIONS

A. When streets are to be closed, or traffic restricted, notify the appropriate fire and police departments, giving at least 7 days notice of the closing or restriction.

B. If bus routes are affected, notify the bus company, giving at least 7 days notice.

C. When streets are to be re-opened, or restrictions removed, notify the fire, police and bus authorities.

3.03 MUNICIPAL INSPECTORS

A. Municipal inspectors may be present during the construction of the Work. They have the power to order the Contractor to stop Work if the Work, in their opinion, is not being done in accordance with the set lines and grades or to the Drawings and Specifications.

Unless otherwise specified, the cost of municipal inspectors will not be charged to the Contractor.

PART 3 EXECUTION (Cont'd)

3.04 USE OF HYDRANTS

A. Keep fire hydrants accessible and free of obstructions.

B. Fire hydrants may be used as a source of water only with the approval of the water authority, and subject to its rules and conditions.

3.05 INCLEMENT WEATHER

A. Make adequate protection and take precautions at times of inclement weather.

B. Inclement weather or extra Work caused by such weather will not be accepted as reason for additional payment.

3.06 MUD AND DUST

A. Keep streets and other construction areas clean. If it is necessary to haul wet material, use suitable watertight trucks.

B. Control dust by the use of water or calcium chloride, or both.

3.07 OTHER CONSTRUCTION

A. Other construction may be proceeding at the same time near the Work of this Contract. Extend cooperation and free access to other companies and employees who may be Working in the area.

3.08 RAILWAYS

A. Carry out Work on or near railway property to the satisfaction and requirements of the railway authority and conform to the regulations of the Canadian Transport Commission. Pay railway costs and charges except that inspection and flagmen provided by the Railway Authority will be paid for by the Owner.

3.09 EXISTING UTILITIES

A. Contact the various utility companies prior to commencing Work and become informed of the exact location of utilities and protect them during construction and assume liability for damage to utilities.

B. Utilities that require relocation will be the responsibility of the Utility Company concerned at no expense to the Contractor. Cooperate with the utility companies concerned and always provide them free access to their plant.

C. Support existing pipes, ducts, or other underground services that intersect the pipe trench, or support the pipe trench in a manner acceptable to the Engineer and the Utility Company.

D. Where existing overhead pole lines are adjacent to the excavation, temporarily support them to the approval of the Engineer and the Utility Company concerned.

3.10 TEMPORARY ACCESS

A. Where necessary for access, provide and maintain suitable safe, temporary roads, walkways and bridges. Remove temporary access facilities and restore

PART 3 EXECUTION (Cont'd)

3.10 TEMPORARY ACCESS (Cont'd)

A. (Cont'd)

disturbed areas, after the Work of the Contract has been completed.

3.11 CLEAN-UP AND TIDY CONDITION

A. On a daily basis as the Work progresses and on completion of the Work, clean-up and remove the rubbish and debris from the site. Remove excess material that is not required to be left on the site by the conditions of the Contract.

B. Keep the site and the Work as tidy as practicable at all times.

SECTION 02550 - SITE CLEARING, EXCAVATING, BACKFILLING AND RESTORATION OF TRENCHES

PART 1 GENERAL

1.01 INTENT

A. This Section covers the Work for excavating, backfilling and restoration for sewers, watermains, from 600 mm beyond the exterior wall of structures. It also covers the site clearing, excavating, backfilling and restoration for manholes.

B. Work included is as follows -

1. Excavating
2. Sheathing and shoring
3. Backfilling
4. Restoration
5. Railway crossings

C. Related Work specified elsewhere is as follows -

1. Section 02560 - Sewers
2. Section 02570 - Watermains

1.02 EXISTING UTILITIES

A. Contact the various utility companies prior to commencing Work and become informed of the exact location of utilities and protect them during construction and assume liability for damage to utilities.

B. Utilities that require relocation will be the responsibility of the Utility Company concerned at no expense to the Contractor. Cooperate with the utility companies and always provide them free access to their plant.

C. Where existing pipes, ducts, or other underground services intersect the pipe trench support the pipe trench to the approval of the Engineer and the Utility Company.

D. Where existing overhead pole lines are adjacent to the excavation, temporarily support them to the approval of the Engineer and the Utility Company concerned.

1.03 EXISTING DRAINAGE

A. Maintain temporary and permanent flow in sewers, drains, gutters, ditches, watercourses, house and inlet connections.

1.04 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure in place timber sheathing left in the trench on the written order of the Engineer prior to backfilling of the trench. The Engineer will not measure sheathing specified on the Drawings to be left in place.

PART 1 GENERAL (Cont'd)

1.04 MEASUREMENT FOR PAYMENT (Cont'd)

A. (Cont'd)

2. Measure excavation for additional bedding on a cubic metre basis.

1.05 BASIS FOR PAYMENT

A. Conditions

1. Unless otherwise specified, include temporary access, site clearing, earth excavating, shoring, sheathing, support of existing utilities, dewatering, testing of material, backfilling, removal of surplus excavation, restoration and other labour, equipment and materials necessary for the complete installation of the Work, in unit prices for sewers, watermains, and manholes.

2. Where additional depth of bedding is ordered by the Engineer, additional payment will be made based on the unit prices in the Form of Tender for additional excavation and for the additional bedding material requested. Payments will be based on the actual additional depth requested and the maximum width of trench as specified in PART 3.03 of this Section.

B. Items

1. Sheathing left in the trench upon the written order of the Engineer will be paid for at the unit price contained in the Form of Tender. No additional payment will be made for sheathing shown on the Contract Drawings to be left in place or for cut off portion of the sheathing.

2. Where the excavated material is not suitable for backfill and there is no surplus suitable excavated material from other sections of the Work, the Engineer may order that the trench be wholly or partially backfilled with imported material for which payment will be made by theoretical vertical trench wall calculation.

PART 2 PRODUCTS

2.01 MATERIALS -

- Conform to latest edition of reference standards.

- Where MTC specifications are referred to comply also with supplements to those specifications.

A. Granular Materials

1. Granular 'A', 'B' and 'D' in accordance with MTC Form 1010.

2. Granular Bedding Material - Meet with the following gradation requirements.

(A)

Sieve Designation (Conforming to CGSB 8-GP-1d)	Percent Passing by Weight
150 mm	-
100 mm	-
26.5 mm	-
22.4 mm	100
16 mm	-
13.2 mm	-
9.5 mm	-
4.75 mm	25-100
1.18 mm	10-85
300 um	5-40

PART 2 PRODUCTS (Cont'd)
2.01 MATERIALS - (Cont'd)
A. 2. (A) (Cont'd)

150 um	-
75 um	0-8
53 um	-

um= 1 micron= 1/1000 millimetre (mm)

B. Hot Mix Asphalt

1. Hot mix asphaltic concrete - MTC Form 310.

C. Topsoil

1. Use existing topsoil wherever suitable and as approved by the Engineer. Before re-using the topsoil clean out foreign matter and stones over 50 mm in size.

2. Imported Topsoil - Medium loam from a meadow or farm area known to be free from weeds.

3. Notify the Engineer at least 3 days before starting topsoil stripping operations. Sources of supply will require the Engineer's approval before being brought on the job.

D. Fertilizer

1. Use complete commercial fertilizers, in compliance with the Canadian Fertilizer Act, not less than 60 percent urea-formaldehyde and the following percentages by weight -

Nitrogen	Phosphoric Acid	Potash
10	10	10 or
0	20	10

2. Superphosphate

Commercial superphosphate finely ground with a minimum analysis of 20 percent P_2O_5.

E. Sod

1. Use No.1 nursery grown, 50 percent Kentucky blue, 50 percent Merion blue sod, fully root permeated in a close mat, uniform in texture.

2. Cut sod by approved methods in accordance with the Nursery Sod Growers Association of Ontario. Cut pieces 1 sq. metre in area with a minimum of 20 mm soil portion.

F. Seed

1. Use certified seed meeting the requirements of the Seeds Act for Canada, No. 1 seed.

(A) A mixture of -

55 percent creeping red fescue

25 percent Canada blue

12 percent perennial ryegrass

5 percent red top

3 percent white Dutch clover.

PART 3 EXECUTION

3.01 SITE CLEARING

A. Remove trees, shrubs, roots, vegetation, loose surface rock, fences, and other obstructions on the line of the Work.

B. Carefully protect trees, fences, shrubs and other vegetation designated by the Engineer and save from injury during the construction operation.

3.02 TOPSOIL

A. If suitable for sodding and seeding, strip the topsoil from within the limits of excavation and from fill areas in advance of construction and stockpile in areas completely separated from subsoil and as designated by the Engineer.

B. Strip topsoil in such a manner as to prevent damage to the roots of trees designated to be saved.

3.03 EXCAVATING

A. Dig the trench to the alignment and depth required and only so far in advance of pipe laying as the Engineer will permit.

B. Minimum and maximum trench widths up to a point 300 mm above top of pipe, for single pipe -

1. Minimum

(A) 300 mm greater than the external diameter of pipe or 750 mm for earth excavation or 1 m for rock excavation whichever is greater, excluding an allowance for shoring.

2. Maximum

(A) Not more than 400 mm greater than the external diameter of pipe or 750 mm whichever is greater for pipe up to and including 850 mm dia., excluding an allowance for shoring.

(B) Not more than 600 mm greater than the external diameter of pipe for 900 mm dia. pipe and larger, excluding an allowance for shoring required to a point 300 mm above top of pipe.

C. Minimum and maximum trench widths up to a point 300 mm above top of the highest pipe, for more than one pipe side by side -

1. Minimum

(A) 300 mm greater than the horizontal dimension across the outer edges of the pipes or 750 mm, or 1 m for rock excavation whichever is greater, excluding an allowance for shoring.

2. Maximum

(A) 600 mm greater than the horizontal dimension across the outer edges of the pipes.

D. The width of the trench at ground level is not to be less than the width at any depth in the trench. Fill overbreak and slides that have occurred during excavation with approved materials.

E. Where trench excavations are not kept within the design limits of the pipe, the Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.

PART 3 EXECUTION (Cont'd)

3.03 EXCAVATING (Cont'd)

F. Grade and shape the pipe trench and the specified bedding to give uniform and even bearing for the length of the pipe. Dig bell holes at each joint. Make corrections in the grade with compacted granular material acceptable to the Engineer, or with fill concrete.

G. Where pipes are to be laid in filled ground, construct the fill first, to at least 600 mm above the elevation of the top of the pipes before trenching for the pipes. Place fill in 300 mm lifts and compacted to 95 percent Standard Proctor Density.

H. Where the subgrade in its natural state is inadequate to support the pipe, the Engineer will give instructions as to the proper procedure, and such additional Work as ordered will be paid for as described in the Form of Tender.

I. Remove the subgrade where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with granular 'A' or other approved material as directed by the Engineer.

J. Trench in existing roadways in a manner to prevent overbreak. Saw cut pavement in clean straight lines prior to the start of excavation.

K. Excavation on Canboro Road shall be vertical trench wall with positive trench support, as shown on the drawings.

L. Intersecting Services

1. Where two pipes cross and there is more than 3 ft. (clear) between them, continue the bedding material for the lower pipe upward to form a support for the upper pipe. Extend the bedding material the full width of the trench, 2 ft. wider than the outside diameter of the upper pipe at the top and sloped at 1:1 down to the top of the bedding of the lower pipe. In addition, support the upper pipe by timber as directed by the Engineer.

2. Where two pipes cross and there is less than 3 ft. (clear) between them, encase the lower one in 2000 p.s.i. (15 MPa in metric) concrete, and extend the concrete up to the centreline of the upper pipe and with a length along the lower pipe equal to its outside diameter plus 2 ft. Have the concrete support the upper pipe across the full width of the trench.

3. Include the costs of these supports in the unit prices for the various pipe lines.

3.04 SHEATHING AND SHORING

A. Supply, install and remove temporary sheathing and shoring where directed by the Engineer and in accordance with applicable safety regulations.

B. Drive sheathing to a sufficient penetration to effectively cut off any seepage of water into the base of the excavation which could create an upward flow of water or a 'quick' condition at the base of the excavation. Leave sheathing in place until the trench has been backfilled to a minimum depth of 600 mm above the pipe. If there is danger of cave-in completely backfill the trench before removing sheathing.

C. Take special care to ensure that voids left by the sheathing and shoring are refilled with approved material.

D. Withdraw sheathing and shoring as the trenches are being backfilled, except where the Contractor, at his own request and expense, is permitted to leave the same in place. Sheathing left in place on written order of the Engineer will be an addition to the Contract.

E. Cut off sheathing left in place at least 1 m below the surface of the ground.

PART 3 EXECUTION (Cont'd)

3.06 COMPACTION TESTS

A. Where compaction of backfill is called for, the Engineer may order compaction tests by an independent testing company. Tests will be arranged for by the Engineer and paid for by the Owner.

1. Where tests show that the compaction does not meet the specified requirement, carry out further compaction in a manner directed by the Engineer, and pay for further testing to establish proof of the specified compaction.

2. For backfill compaction, tests will be made at every 0.5 m max. depth, after each three 150 mm lifts have been placed.

3. Co-operate with the Engineer and Testing Company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

3.07 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

A. Surplus excavated material will be the property of the Owner. Haul, dump and uniformly spread the surplus material at the Centennial Park site, as directed by the Engineer.

3.08 RESTORATION

A. Roadways, Driveways and Parking Lots

1. Restore roadways, driveways and parking lots as follows unless shown otherwise on the Drawings -

2. Roadways can be restored with asphalt or surface treatment.

(A) Paved roadways, driveways and parking lots

	Roadways (thickness)	Parking Lots and Driveways (thickness)
(1) H.L. 2A	40 mm	50 mm
(2) H.L. 8	50 mm	
(3) Granular 'A'	450 mm	150 mm
(4) Granular 'B'		

(B) Surface Treated Roadways, Driveways and Parking Lots

(1) Primer M.C.-0 Grade	1 litre/sq. m. - 1 coat
(2) Seal R.C.-0Grade	1 litre/sq. m.- 2 coats
(3) 9.5 mm stone	12 kg/sq. m. - 2 coats
(4) Granular 'A'	150 mm
(5) Granular 'B'	300 mm

(C) Gravel Roadways, Driveways and Parking Lots

(1) Granular 'A'	300 mm
(2) Granular 'B'	

3. If weather conditions delay the placing of the permanent asphalt restoration on paved areas, and the Engineer considers that it is not practical to satisfactorily maintain the gravel surface, then carry out temporary restoration using 50 mm cold mix cold laid asphalt.

No additional payment will be made for this temporary road restoration, maintenance, or for its removal prior to the placing of the final restoration.

4. Carry out asphalt work in accordance with MTC specification Form 310.

5. Carry out placing of Granular A & B in accordance with MTC specification Form 314.

6. Where filling is required, construct fills in accordance with MTC specification Form 200.

B. Sidewalks, Curbs and Gutter.

1. Restore existing sidewalks, curbs and gutters as directed by the Engineer.

2. Remove concrete sidewalks, curbs and gutters back to an existing expansion or contraction joint where practical or saw cut prior to restoration as directed by the Engineer. Provide 20 MPa concrete air-entrained and cured as directed by the Engineer.

3. Restore asphalt sidewalks using 40 mm hot-mix asphalt surface course on top of 150 mm Granular 'A' compacted to 95 percent Standard Proctor Density.

4. Restore gravel sidewalks using 150 mm Granular 'A' compacted to 95 percent Standard Proctor Density.

C. Preparation of Subgrade for Seeding and Sodding

1. Verify the subgrade and if required make adjustments to allow for topsoil and seeding or sodding to finish level with adjacent surfaces.

2. Scarify the backfill and disturbed areas to a minimum depth of 75 mm to produce an even, loose textured surface, free of stones, roots, branches larger than 75 mm in dia., and live weeds.

3. Have the finished subgrade approved by the Engineer prior to placing the topsoil.

D. Preparation of Finish Grade

1. Spread the topsoil evenly over the approved subgrade to a minimum of 100 mm. Compact to 80-85 percent Standard Proctor Density.

2. Work the fertilizer into the top 25 mm of the topsoil by discing, raking or harrowing to provide a smooth, fine textured finish surface, and firm against footprints.

3. Base quantities of fertilizer on the following minimum rates -

(A) 10 - 10 - 10 at 11 kg/100 sq. m. or

0 - 20 - 10 at 6.5 kg/100 sq. m. with

(B) Superphosphate at 13.5 kg/100 sq. m.

4. Lay sod or spread seed within 48 hours of working the fertilizer into the topsoil.

E. Laying sod (sod all boulevard areas)

1. Lay sod as soon as possible after delivery.

2. Lay sods together so that there are no open joints or pieces overlapping. Lay sod smooth and flush with existing grade.

PART 3 EXECUTION (Cont'd)

3.09 RESTORATION (Cont'd)

E. (Cont'd)

3. Immediately after laying sod spread sufficient water to saturate the sod and the upper 100 mm of topsoil.

4. After sod and soil has dried sufficiently to prevent damage, roll the area with a roller providing 72 kPa pressure to ensure a good bond between sod and soil and to remove minor depressions and irregularities.

5. Water with sufficient amounts to ensure continued healthy and vigorous growth.

F. Seeding (seed all grassed areas other than boulevards)

1. Spread seed by means of a mechanical dry seeder, at a rate of 11.4 kg/ha.

2. Work seed into the top 50 mm of the topsoil by raking or harrowing and compact so that the surface is smooth and firm.

3. After working the seed into the topsoil and compacting, water with sufficient amounts to ensure germination and continued healthy growth.

3.10 RAILWAY CROSSINGS

A. Perform Work at railway crossings to conform to the general order and regulation of the Canadian Transport Commission and the local railway authority.

B. The cost of inspection and flagmen provided by the railway authority will be paid for by the Owner.

C. Install the steel liner crossing the railway tracks by boring and jacking or tunnelling as detailed on the Drawings. Submit to the railway authority details of boring head arrangement. Do not proceed until the submission has been approved. Proceed with the Work at a time acceptable to the Railway Authority and provide the advance notice required.

D. Install the main in the steel liner in accordance with the Drawings.

SECTION 02560 - SEWERS

PART 1 GENERAL

1.01 INTENT

A. This Section covers sewer Work, and manholes from 600 mm beyond the exterior walls of structures.

B. This Section covers sewer Work including -

1. Pipe
2. Manholes
3. Sanitary sewer house service connections
4. Line and grade
5. Bedding
6. Testing

C. Related Work specified elsewhere is as follows -

1. Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches

1.02 TESTING

A. Supply test certificates in accordance with the appropriate specification, for the following materials -

1. Pipe

1.03 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Replace materials found to be defective in manufacture or damaged in handling after delivery including the furnishing of material and labour required for the replacement of installed material found to be defective.
2. Pick-up materials furnished by the Owner at ... and haul to and distribute at the site.

B. Handling

1. Load and unload materials so as to avoid shock or damage.

C. Storage

1. Place materials in safe storage. Keep interiors of pipes, and fittings clean.

1.04 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure sewers along the centreline of constructions from centre to centre of manhole.

PART 1 GENERAL (Cont'd)

1.04 MEASUREMENT FOR PAYMENT (Cont'd)

A. (Cont'd)

2. Measure house service connections along the centreline of construction from the centreline of the main sewer or manhole to the street line.

3. Count each type of manhole.

1.05 BASIS OF PAYMENT

A. Conditions

1. Unless otherwise specified include testing of materials, bedding and testing of pipes after installation and the requirements of Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches.

2. The Engineer will measure the Work when completed and the Contract Price will be increased or decreased in accordance with the final measurement.

B. Items

1. Include in the unit price per lineal metre of sewer, the pipe and the complete installation of the pipe, including the connections to manholes, existing sewers or other facilities. Dewatering and vertical trench support as required.

2. Include in the unit price for each sanitary sewer house service connection as outlined in the Form of Tender, the pipe and the complete installation of the service pipe, necessary fittings, connection to the main sewer, riser pipe, capping and marking the connection at the street line.

3. Upon completion of the Work, the structures will be measured from the top of cover to the lower of either the lowest invert or the floor of the structure. If the constructed depth of the structure differs by more than 300 mm, from the depth indicated in the Contract Documents, the amount to be paid will be adjusted. The adjustment will take into account only the difference in depth in excess of 300 mm and will be based on the unit prices tendered in the Form of Tender.

4. If the average constructed depth of a sewer differs by more than 300 mm from the average depth shown in the Contract Documents, an adjustment will be made to the Contract price, based on the unit price tendered for earth excavation in trenches, listed in the Form of Tender. The adjustment will take into account only the difference in average depth in excess of 300 mm.

5. Include in the unit price for each manhole, the complete installation of the manhole including concrete, benching, brickwork, reinforcing steel, ladder rungs, drop and safety grating if required, frame and cover as shown on the Drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. Tender on the basis of the type of material specified in the Specifications.

PART 2 PRODUCTS (Cont'd)

2.02 MATERIALS

Conform to latest edition of reference standards.

A. Conversion Table

Diameters shown are internal sizes.

Nominal Imperial Diameter	Actual Conversion to Metric	Nominal Metric Diameter	Permissible Variation of Concrete Pipe Min.	Max.
Inches	mm	mm	mm	mm
4	102	100		
5	127	125		
6	152	150	150	160
8	203	200	200	210
9	229	225		
10	254	250	250	260
12	305	300	300	310
14	357	350		
15	381	375	375	390
16	406	400		
18	457	450	450	465
20	508	500		
21	533	525	525	545
24	610	600	600	620
27	686	675	675	695
30	762	750	750	775
33	838	825	825	850
36	914	900	900	925
39	991	975	975	1005
42	1067	1050	1050	1030
48	1219	1200	1200	1230
54	1372	1350	1350	1385
60	1524	1500	1500	1540
66	1676	1650	1650	1695
72	1829	1800	1800	1850
78	1981	1950	1950	2000
84	2134	2100	2100	2155
90	2286	2250	2250	2310
96	2438	2400	2400	2465
102	2591	2550	2550	2620
108	2743	2700	2700	2770
114	2896	2850	2850	2925
120	3048	3000	3000	3080
132	3353	3300	3300	3390
144	3660	3600	3600	3695

B. Concrete sewer pipe

1. Concrete pipe -

   (A) Non-reinforced Circular Concrete Pipe (up to and including 375 mm dia.) - CSA A257.1

2. Pipe Diameter and Class - 200 mm, 250 mm, E.S.

3. Fittings and Specials - In accordance with the specification for the type of pipe being used.

4. Fittings, cast iron single or bootjack, of straight or reducer type, of the size required, with clean-out and stopper, as manufactured by A.W. Crowle Limited, or approved equal.

PART 2 PRODUCTS (Cont'd)
2.02 MATERIALS (Cont'd)
B. (Cont'd)

5. Portland Cement - type - 10

6. Rubber Gaskets - CSA A257.3

(A) Sanitary Sewers -

(1) Recessed tongue concrete pipe - snap rubber gasket into a recess or groove cast in pipe tongue.

C. Asbestos Cement Sewer Pipe

1. Asbestos Cement Pipe and Fittings - ASTM C428.

2. Pipe Diameter and Class - 200 mm, 250 mm, Class 2400.

3. Joints - 'Ring-Tite', 'Fluid-Tite' or approved equal.

4. Rubber Rings Used to Seal the Joints of the Pipe - ASTM D1869.

5. Supply pipe in standard lengths. Supply short lengths, machined as required, to install fittings in the correct locations and to provide a joint 300 mm each side of structures.

D. Vitrified Clay Sewer Pipe

1. Vitrified Clay Pipe and Fittings - CSA A60.1M

2. Joints - Flexible Type - CSA A60.3M Type 1

3. Pipe diameter and class - 200 mm, 250 mm, E.S.

E. Polyvinyl Chloride Sewer Pipe

1. PVC gravity-flow sewer pipe - ASTM D3034.

2. Pipe Diameter and Class - 200 mm, 250 mm, SDR-35

3. Joints - 'Ring-Tite', 'Fluid-Tite' or approved equal.

4. Rubber rings used to seal the joints of the pipe - ASTM D1869.

F. Manholes

1. Precast Concrete Manholes - ASTM C478 and as shown on the Drawings. Rubber type gaskets - ASTM C443.

(A) Comply with Ontario Ministry of the Environment "Standard Specification No.12 Covering Precast Concrete Manholes".

2. Cast Iron Covers for Sanitary Sewer Manholes - as manufactured by Canada Iron Foundaries Limited or approved equal as shown on the drawings.

3. Ladder rungs - as shown on the Drawings

4. Bricks - clay or shale ASTM C32 grade MS

- concrete ASTM C55, N11

5. Reinforcing Steel - CSA G30.12, Grade 60.

6. Drop Pipe Assemblies - As shown on the Drawings

G. Sanitary Sewer House Service Connections.

1. Asbestos Cement Pipe - ASTM C644, Class 2400

2. Vitrified Clay Pipe - CSA A60.1M

PART 2 PRODUCTS (Cont'd)

2.02 MATERIALS (Cont'd)

G. (Cont'd)

3. P.V.C. - service pipes, fittings and adaptors - ASTM D3034, SDR-28

4. Service Connections to the Main Sewer - by manufactured tee or by Crowle cast (bolt-on) iron saddles (fastened with Everdur bronze bands) or by grouting bell end into main sewer.

H. Plugs - expanding rubber type or approved alternative for unconnected sewers, sewer laterals and stubs.

PART 3 EXECUTION

3.01 LINE AND GRADE

A. Supply, erect and maintain batter boards and site rails to ensure accurate line and grade of pipes. Always have at least three batter boards in use, placed not more than 15 m apart. Obtain Engineer's approval for alternative methods.

B. Provide and utilize laser-type instrument to control line and grade for sewers with a grade of 0.50 percent or less.

3.02 FROZEN GROUND

A. Do not place Work on frozen ground. Should the bottom of the trench become frozen, remove and replace the frozen material with bedding material compacted to 95 percent Standard Proctor Density.

3.03 BEDDING

A. Sewer bedding - as specified on the Drawings

B. Granular material - "A" Conform to Section 02550.

C. Compact Granular Bedding Material to 95 percent Standard Proctor Density.

D. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.

3.04 PIPE LAYING

A. Lay, joint and test pipes and fittings in accordance with the manufacturer's instructions and in the manner hereinafter specified.

B. Lower pipe carefully into the trench. Before lowering and while suspended, inspect the pipes for defects. Remove foreign material from inside of the pipe.

C. Use temporary watertight bulkheads to prevent the flow of trench water, storm water, silt and sand within the pipe.

D. Do not deviate from line and grade except where changes in direction or the laying of pipes along a curve are limited by the pipe manufacturers tolerance for joints.

E. Install concrete pipe only after a minimum number of days after the day of manufacture have elapsed, according to the following table -

PART 3 EXECUTION (Cont'd)

3.04 PIPE LAYING (Cont'd)

E. (Cont'd)

Pipe Dia.	Days after Date of Manufacture Leave Plant	Install
up to 1500 mm	3	4
1500 mm and over	4	5

F. Where storm and/or sanitary sewers intersect, backfill the trench of the lower pipe with 20 MPa concrete up to the grade of the higher pipe. Fill the lower trench from wall to wall for a length along the trench not less than 600 mm greater than the nominal dia. of the higher pipe. Place the concrete by forming with boards across the trench at the time of laying the lower pipe.

3.05 MANHOLES

A. Proceed with the construction of manholes at the same time as the pipe laying operation.

B. Install precast manholes in accordance with the Drawings

C. Set covers at slope and height compatible with pavement or final grade levels.

D. Parge brickwork inside and outside with 13 mm thickness of sand cement mortar.

3.06 HOUSE SERVICE CONNECTIONS

A. Lay house service connections from the main sewer to the edge of the street allowance as shown on the Drawings

B. Where the main sewer is 450 mm or less in dia., connect the house drain by using approved "T" junctions.

C. Lay sewer connections with a minimum fall of 6 mm per 300 m or 2%. Grades at the streetline will be set by the Engineer.

D. If sanitary service pipes are excavated below the grade of the storm sewer, backfill the service trench beneath and for 300 mm either side of the storm pipe with 20 MPa concrete up to the grade of the storm sewer.

E. Where the storm sewer has more than 3 m of cover from the top of pipe to finished road grade, the sanitary drain may be laid over the top of storm sewer, with concrete encasement of the sanitary drain through the storm trench.

F. Before backfilling, have the invert elevation of every sewer service instrument checked and accepted by the Engineer.

G. Place a marker of 50 mm x 100 mm lumber 2.5 m long at each sewer service as soon is it is installed. Have markers project 1.3 m above ground, and identified by painting the top 300 mm with red paint.

H. If risers are required, support them in the walls of the main sewer trench, or encase them in concrete. Include the price for risers in the Tender Price per service. Provide risers when the sewer depth exceeds 4 m.

I. Backfill service pipes with selected fine material tamped in place by hand to a depth of 300 mm over the pipes before machine backfilling.

J. No additional payment will be made for extra excavation necessary, hand work, concrete on intersecting pipes, timber or stone support on intersecting pipes, for excessive depth, for risers, or for extra length to service lots

on corners. Include items mentioned above in the Tender Price per service, based on the depths and lengths indicated.

3.07 CLEANING AND TESTING OF SANITARY SEWERS

A. Flush and clean sewers and manholes prior to testing. Carry out testing in the presence of the Engineer.

Supply water for cleaning and testing.

B. Inspect manholes and pipe for defects and signs of leakage. Repair visible leaks or faults as approved by or as directed by the Engineer.

C. Carry out testing from manhole to manhole as the Work progresses.

D. Do not proceed with construction of new sewers when three sections of complete sewers have not been tested or have been tested and are unacceptable.

E. After backfilling test sewers for infiltration and/or exfiltration as directed by the Engineer and carry out repairs as necessary and re-test until the works pass the leakage tests. Permissible leakage is as outlined in the following table -

1. Test	Permissible Leakage
Infiltration Test -	0.15 litre/hr/mm dia. per 100 m of sewer
Exfiltration Test - in all cases except when infiltration testing is required.	0.18 litre/hr/mm dia. per 100 m of sewer

2. Permissible leakage may be increased by 25 percent provided that the leakage is offset by leakage measurement in adjacent sections such that the total leakages are within the amount allowable for the combined sections.

F. Method of Exfiltration Test for Sewers -

1. Isolate section of sewer to be tested at its outer limits by temporarily plugging the inlets of two manholes.

2. Fill pipe and manholes with water to provide a minimum net positive head, taking into account existing ground water table, of 1 m above the crown of the pipe in the upstream manhole. Optionally, the pipe may be filled not higher than the above level, up to 24 hr prior to time of testing, to permit the normal absorption into the pipe walls to take place. Do not exceed 3 m max. head in downstream manhole.

3. Test by letting the water stand in the manholes for 1 hr and observing the drop of level at the end of the period.

4. The drop in water level in the manholes at the end of the test will be a measure of leakage from the sewer.

G. Method of Infiltration Test for Sewers -

1. Isolate the section of sewer to be tested at its upper limits by temporarily plugging the outlet of the upstream manhole.

2. Construct a temporary dyke in the inlet pipe of the downstream manhole. The measurement of infiltration may be determined by timing the flow of water into a calibrated container, or over a weir, or by other method acceptable to the Engineer.

PART 3 EXECUTION (Cont'd)

3.07 CLEANING AND TESTING OF SANITARY SEWERS (Cont'd)

G. (Cont'd)

3. Do not start until steady state conditions have been established to the satisfaction of the Engineer.

H. No part of the Work will be accepted until the sewers are clean and free from sand, earth, mud, or other obstructions and have successfully passed the infiltration or exfiltration tests. When required by the Engineer pass a test ball of 50 mm less in diameter than the sewer from manhole to manhole.

I. Furnish labour, tools, and equipment necessary to clean and test the sewer.

J. The alignment of sewers between manholes may be tested at each section as laid. When required by the Engineer shine a strong light through the pipe from manhole to manhole. If less than one-half of the full diameter of the pipe at the light source is visible from the far end, re-align the pipes when ordered by the Engineer.

3.08 STEEL LINER PIPE

A. Install the steel liner crossing the railway tracks by boring and jacking as detailed on the Drawings. Submit to the railway authority details of boring head arrangement. Do not proceed until the submission has been approved. Proceed with the Work at a time acceptable to the Railway Authority and provide the advance notice required.

B. Install the main in the steel liner in accordance with the Drawings.

C. Perform Work at railway crossings to conform to the general order and regulation of the Canadian Transport Commission and the local railway authority.

D. The cost of inspection and flagmen provided by the railway authority will be paid for by the Owner.

E. Include all costs associates with the supply and installation of the steel liner and sewer inside the liner in the price tendered in the Form of Tender.

SECTION 02570 - WATERMAINS

PART 1 GENERAL

1.01 INTENT

A. This Section covers all watermain Work.

B. This Section covers watermain Work including -

1. Pipe
2. Fittings, specials and joints
3. Hydrants
4. Valves, valve boxes
5. Service connections
6. Line and grade
7. Bedding
8. Testing
9. Disinfecting

C. Related Work specified elsewhere is as follows -

1. Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches

1.02 CERTIFICATES OF TESTING

A. Provide test certificates in accordance with the appropriate specification for the following materials -

1. Pipe
2. Fittings, specials and gaskets
3. Valves
4. Hydrants

1.03 AFFIDAVIT OF COMPLIANCE

A. Provide the Owner with an affidavit stating that the following material is in accordance with the appropriate specification. Provide this affidavit prior to the delivery of the material to the site.

1. Pipe
2. Fittings, specials and gaskets
3. Valves
4. Hydrants

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Replace materials found to be defective in manufacture or damaged in handling after delivery including the furnishing of material and labour required for the replacement of installed material found to be defective.

B. Handling

1. Load and unload materials so as to avoid shock or damage.

PART 1 GENERAL (Cont'd)

1.04 DELIVERY, STORAGE AND HANDLING (Cont'd)

B. (Cont'd)

2. Handle pipe and fittings so that the coating and lining will not be damaged. If, however, the coating or lining is damaged, then repair in a satisfactory manner.

C. Storage

1. Place materials in safe storage. Keep interiors of pipes, fittings, and other accessories clean. Store valves and hydrants so as to protect them from damage by freezing.

1.05 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure watermains along the centreline of construction, straight-through bends, fittings, specials and valves.

2. Measure service connections in the horizontal plane along the centreline of the pipe from the centre of watermains to the street line.

3. Count complete hydrant sets

4. Count complete valves and valve boxes

5. Count complete connections to existing mains

6. Count complete blow-off assemblies.

1.06 BASIS FOR PAYMENT

A. Conditions

1. Unless otherwise specified, include testing of materials, thrust blocks, anchor blocks, bedding, insulation, testing and disinfecting the pipes after installation and the requirements of Section 02550 Site Clearing, Excavating, Backfilling and Restoration of Trenches.

2. The Engineer will measure the Work when completed and the Contract price will be increased or decreased in accordance with the final measurement.

B. Items

1. Include in the unit price per lineal metre for watermains the complete supply and installation of the pipe and necessary fittings.

2. Include in the unit price for each hydrant the complete supply and installation of the pipe from the main, connection to the main, secondary valve and valve box, hydrant, crushed stone backfill and blocking of the hydrant as shown on the Drawings.

3. Include in the unit price for each valve and valve box the complete supply and installation of the valve and valve box as shown on the Drawings.

4. Include in the unit price for each blow-off assembly the complete supply and installation of the necessary piping and gate valve as shown on the Drawings.

5. Include in the unit price for water service connection to main the work necessary to supply and install the main stop, curb stop and box and connection to existing service pipe as necessary.

PART 1 GENERAL (Cont'd)

1.06 BASIS FOR PAYMENT (Cont'd)

B. 5. (Cont'd)

Include in the unit price for copper water service pipe, complete supply and installation of the service pipes as specified.

6. Include in the unit price for connection to existing watermains the locating of and connection to the existing watermain.

7. Include in the unit price for the salvage and re-installation of existing blow-off all the work necessary to complete the blow-off relocation.

PART 2 PRODUCTS

2.01 GENERAL

A. Tender on the basis of the type of pipe specified in the specifications.

2.02 MATERIALS

- Conform to latest edition of reference standards.

A. Conversion Table

Refer to referenced specification for inside dia. and outside dia. actual sizes.

Nominal Imperial Diameter	Actual Conversion to Metric	Nominal Metric Diameter
Inches	mm	mm
4	102	100
6	152	150
8	203	200
10	254	250
12	305	300
14	357	350
15	381	375
16	406	400
18	457	450
20	508	500
21	533	525
24	610	600
27	686	675
30	762	750
33	838	825
36	914	900
39	991	975
42	1067	1050
48	1219	1200
54	1372	1350
60	1524	1500
66	1676	1650
72	1829	1800

78	1981	1950
84	2134	2100
90	2286	2250
96	2438	2400
102	2591	2550
108	2743	2700
114	2896	2850
120	3048	3000
132	3353	3300
144	3660	3600

B. Ductile Iron Pipe

1. Pipe - AWWA C151 (ANSI A21.51).

2. Pipe Diameter and Class - as shown in the Form of Tender.

3. Supply pipe in standard lengths with push-on joints - AWWA C111 (ANSI A21.11). Provide copper straps across push-on joints to provide electrical continuity.

4. Pipe - cement-lined - AWWA C104 (ANSI A21.4).

C. Asbestos Cement Pipe

1. Pipe - AWWA C400

2. Pipe diameter and class - as shown in the Form of Tender.

3. Supply pipe in standard lengths. Supply short lengths machined as required to install fittings and valves in the correct locations.

4. Joints - 'RING-TITE', 'FLUID-TITE', or approved equal.

5. Rubber rings used to seal the joints of the pipe - ASTM D1869

D. Polyvinyl Chloride Pipe

1. Pipe diameter and class as shown in the Form of Tender.

2. Joints - 'RING-TITE' or approved equal.

E. Polyethylene Pipe

1. Conform to the following standards -

(A) Use polyethylene resin compound designated as p-34, ASTM D1248.

(B) Have the pipe manufactured to CSA B137-1 for 150 mm dia. and smaller

(C) Provide certification of compliance with the above requirements, in writing by the pipe supplier.

(D) Base the pressure class of pipe selected on a pipe design stress of 4.34 MPa for 150 mm dia. and smaller and 4.9 MPa for 200 mm dia. and larger.

2. Design

(A) Ensure that in both cases the relationship between design strength and dimensions is according to I.S.O. formula.

$$\frac{2S}{P} = \frac{Do}{t} - 1$$

where S - design stress

t - min. wall thickness

P - pressure

Do - outside diameter

3. Pipe Diameter and Class as shown on the Drawings.

4. Jointing Methods

(A) Thermal Butt Fusion

(1) Assemble shipped lengths of pipe into suitable installation lengths by butt fusion process unless specifically stated otherwise.

(2) Make pipe so joined from same class and type of raw material made by a single raw material manufacturer.

(3) Obtain further information from the pipe manufacturer's literature.

(B) Mechanical Connections

(1) Where required to connect flanged valves or fittings use a flange adapter.

(2) Provide the adapter with a polyethylene stub end and a metal back-up ring in accordance with the manufacturers recommendations.

(3) Make gaskets from 3 mm thick red rubber sheet or compressed asbestos with rubber compound bonding.

(4) Use - bolts with regular heavy hex head

- nuts with semi-finished hex

- length as specified by pipe manufacturer

- material compatible with metal back-up ring material

F. Cast Iron Fittings and Specials

1. Cast Iron Fittings - AWWA C110 (ANSI A21.10).

2. Pressure Rating of Fittings - 1.724 MPA (ANSI B.16.1).

3. Fittings - mechanical joint ends

4. Rubber gaskets for fittings - AWWA C111 (ANSI A21.11)

5. Rubber Gaskets for Mechanical Joints - lead tipped

G. Gate Valves

1. Gate Valves - AWWA C500.

2. Gate Valves - non-rising spindle, double disc parallel seat with mechanical joint ends. Valves - open counter clockwise unless specified otherwise and be equipped with 'O' rings.

PART 2 PRODUCTS (Cont'd)

2.02 MATERIALS (Cont'd)

H. Valve Boxes

1. Valve Boxes - cast iron, slide type and adjustable, Emco or approved equal.

2. Depth of trench from top of pipe to finish grade 1.7 m

I. Hydrants

1. Hydrants - AWWA C502.

2. Hydrants - Crane "McAvity M-67" or Darling Century.

3. Bury Depth - 1.8 m.

4. Hydrants - slide gate shut off, two piece barrel with flange at ground line, 6 in. main valve, two 2 1/2 in. dia. hose nozzles - CSA B89.2 (Ontario thread), 6 in. inlet connection with mechanical joints, 1 in. square operating and cap nut. Paint red and open counter clockwise.

J. Corporation Service Fittings

1. Corporation Main Stops, Curb Stops, and Curb Boxes - AWWA C800.

2. Service Connections - made by means of an approved saddle.

3. Corporation Main Stops -

(A) 18 mm water service -

(1) Canadian Brass cc 102

(2) Emco series 15960

4. Curb stops -

(A) 18 mm -

(1) Canadian Brass cc 128

(2) Emco 15710

5. Curb Boxes - minimum and maximum extension of the curb box is 1.5 m to 1.8 m

6. Copper Pipe - seamless soft coppper water tube - ASTM B-88, type 'K'.

7. Service Boxes - to suit valve or curb stop, with No.304 stainless steel rod and 6 mm x 63 mm cotter pins.

PART 3 EXECUTION

3.01 LINE AND GRADE

A. Supply, erect and maintain batter boards and site rails to ensure accurate line and grade of pipes. Always have at least 3 batter boards in use, placed not more than 15 m apart. Obtain Engineer's approval for alternative methods.

B. On straight lines, lateral deviation in excess of 150 mm will not be tolerated. On straight grades, grade deviation in excess of 80 mm will not be tolerated.

C. For vertical or horizontal bends do not deviate the pipe lines more than 300 mm from line or more than 150 mm from grade as the case may be.

PART 3 EXECUTION (Cont'd)

3.02 FROZEN GROUND

A. Do not place work on frozen ground. Should the bottom of the trench become frozen, remove and replace the frozen material with bedding material compacted to 95 percent Standard Proctor Density.

3.03 BEDDING

A. Watermain Bedding - as specified on the Drawings.

B. Granular Material - "A". Conform to Section 02550.

C. Compact granular bedding material to 95 percent Standard Proctor Density.

D. Compact the material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of the pipe where cover is less than 300 mm.

E. Do not use crushed slag produced from iron blast furnace slag for cast iron pipe fittings or valves.

3.04 CONNECTION TO EXISTING WATERMAINS

A. Connect new mains to existing mains as shown on the Drawings.

B. Obtain permission from the Engineer and the authority responsible for the existing mains prior to making connections to an existing main. Valves on the existing system will be operated only by the watermain authority. Notify affected water users in advance of interruption of service.

C. Provide temporary water service for interruptions longer than 3 hr.

3.05 PIPE LAYING

A. Lay, joint and test pipes and accessories in accordance with the manufacturers instructions and in the manner hereinafter specified, in the presence of and subject to the Engineer's approval.

B. Use temporary water tight bulkheads to prevent the flow of trench water, storm water, silt and sand within the pipe.

C. Carefully lower pipe into the trench. Before lowering and while suspended, inspect the pipe for defects. Remove foreign material from the inside of the pipe.

D. Support bends, tees and dead ends by 20 MPa concrete thrust blocks to undisturbed ground as detailed on the Drawings. Arrange thrust blocks to transfer the full thrust of the deflection at test pressure without exceeding the bearing capacity of the ground.

E. Construct anchor blocks of 20 MPa concrete as shown on the Drawings.

F. Connect copper straps across push-on joints to provide electrical continuity.

G. For details of pipe laying requirements for polyethylene pipe refer to the manufacturer's 'recommended standards for the handling and underground installation of polyethylene pressure pipe'. Comply fully with these requirements.

PART 3 EXECUTION (Cont'd)

3.06 VALVE AND VALVE BOXES

A. Install valves and valve boxes plumb, centered over the operating nut and supported in place during backfilling with the cover flush with the finished grade.

B. Do not backfill until valves or valve boxes have been inspected by the Engineer, or the inspector of the authority having jurisdiction.

3.07 HYDRANTS

A. Install hydrants plumb with the nozzles parallel with the watermains, and with the pumper nozzles (if any) facing the curb. Ensure that no portion of the hydrant or nozzle cap is within 150 mm of the back of the curb or the edge of the sidewalk.

B. Set hydrants to the established grade with nozzles at least 150 mm above the ground.

C. Do not backfill until hydrants have been inspected by the Engineer.

3.08 WATER SERVICE CONNECTION

A. Use standard waterworks equipment for installing corporation main stops. Do not cross threads of corporation main stops during insertion and apply a maximum torsion of 360 N. Leave corporation main stops in the open position. On thinner wall pipe use full circle saddle. Use a cutting and tapping tool of a type recommended by the pipe manufacturers and insert the stop. Take care that no undue stress is applied to the pipe when tapping the main and inserting the main stop, that may later result in a fracture. Tap for service connection while the main is under pressure.

B. Install service boxes and curb stops at the street line (or in sidewalk) with the box in the centre of the sliding adjustment and the top set to the finished grade. Set curb stop on blocking.

C. Install service connections in a trench separate from the sewer connection and clear of other utilities.

D. Lay service connections from the watermain to the curb stop in an evenly graded trench with class 'B' bedding as detailed on the Drawings. Do not splice service connections.

E. Install a 50 mm x 100 mm timber marker beside each service box. Drive marker 1.0 m into the ground and let it project 1.0 m above the ground with the top 300 mm painted orange.

3.09 TESTING

A. Clean out valved Section of pipe or part thereof by flushing at scouring velocities prior to testing. Operate valves and hydrants during flushing under the supervision of the operating authority.

B. Subject the section of pipe under test to a pressure of 1 MPa. By means of pumping out of a suitable container of known volume maintain the pressure at 1 MPa for one hr. and record the amount of water used in this period.

C. Determine the allowable leakage from the C 600 A.W.W.A. formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

where

PART 3 EXECUTION (Cont'd)
3.09 TESTING (Cont'd)
C. (Cont'd)

L = allowable leakage in U.S. gal/hr (for metric convert to litres/hr.)

N = number of joints under test

D = nominal dia. of pipe in inches

P = test pressure in psi

1. For metric convert to litres/hr.

3.10 STERILIZING WATERMAINS

A. Flush the main prior to chlorination with sufficient volumes to produce scouring velocities in the mains. Operate all valves and hydrants during this flushing under the supervision of the operating authority.

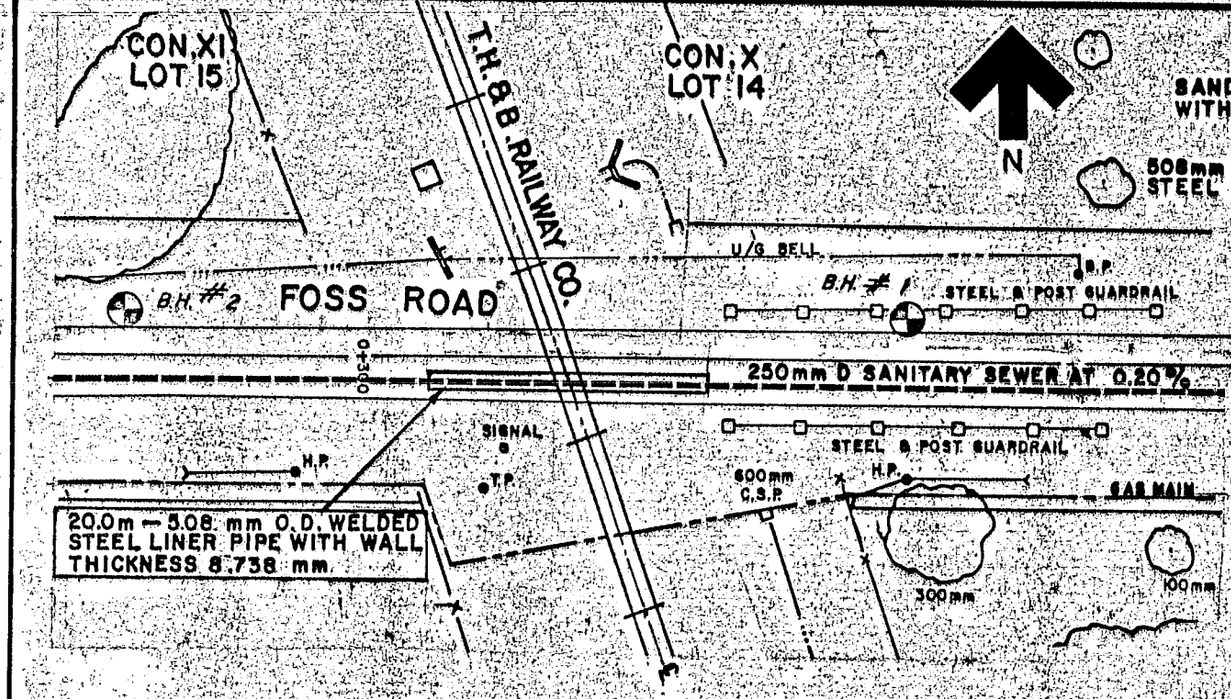
B. Dissolve chlorinous compounds such as 'pittchlor' or 'hth' in water to produce a solution.

C. Introduce the solution at one end of the system being sterilized until water taken off at the remote end(s) tests at a level of 50 mg/litre.

D. Allow the chlorinous solution to remain in the mains for 24 hr. at which point flush the system clean of the chemical.

Give the Engineer at least 2 days notice of the date when disinfection of the system is to start so that the arrangements can be made for others to take samples and test the chlorine residual.

a weekend, then one of the following two alternative procedures shall be followed:



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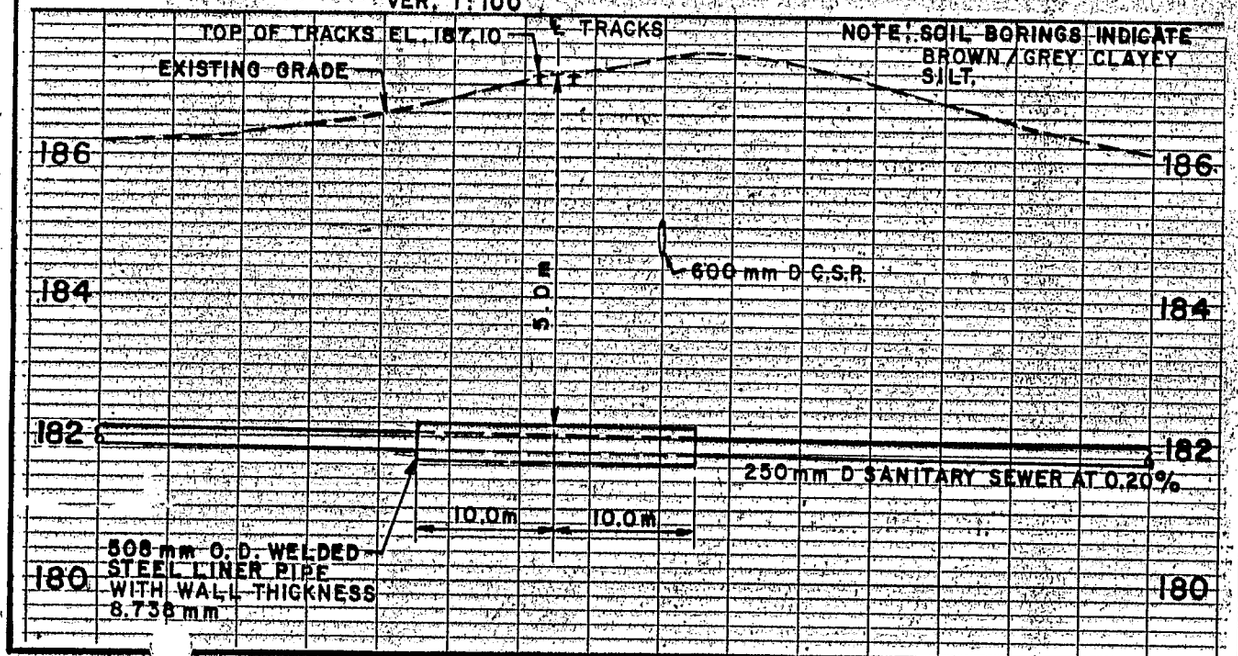
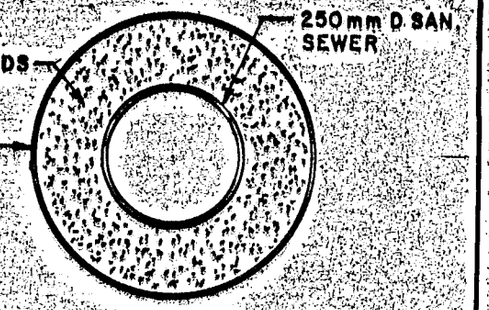




SECTION THROUGH WELDED STEEL LINER PIPE BORED & JACKED INTO PLACE

REGISTERED PROFESSIONAL ENGINEER
G. K. STRACHAN
PROVINCE OF ONTARIO

PROVINCE OF ONTARIO
REGIONAL MUNICIPALITY OF NIAGARA
TOWN OF PELHAM

Toronto Hamilton & Buffalo Railway Co.

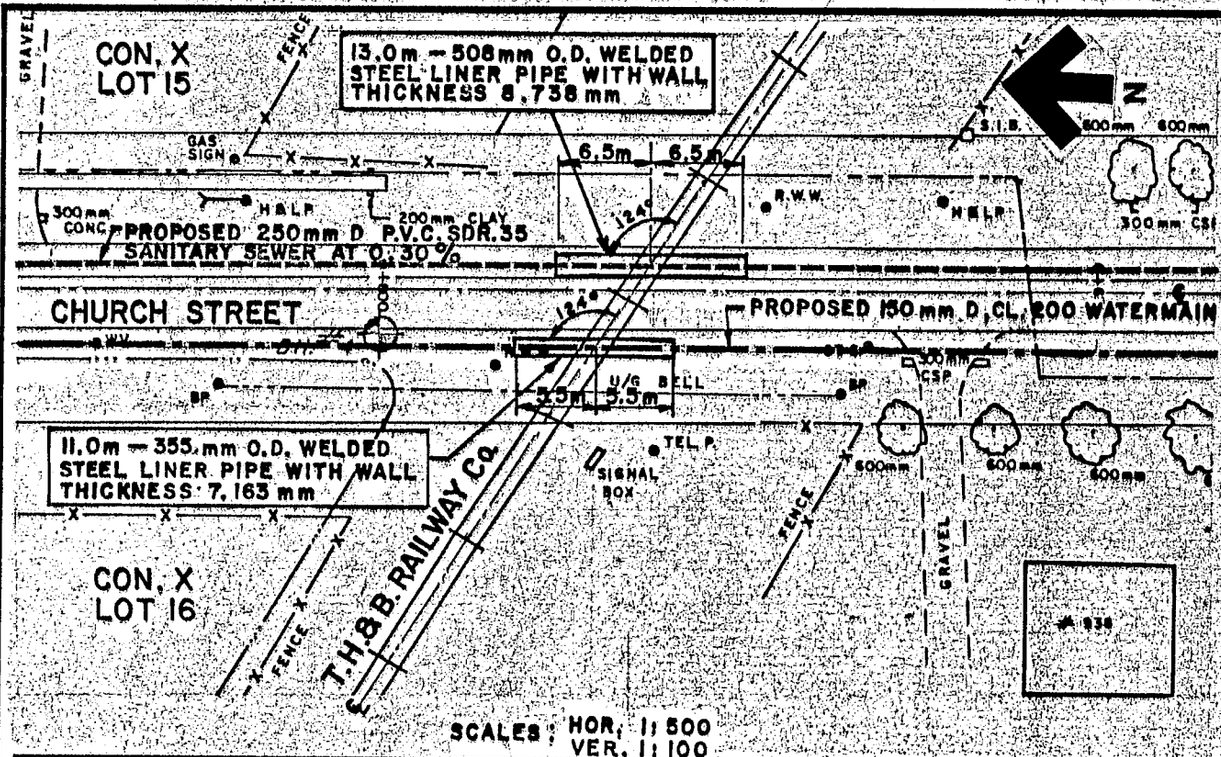
508 mm O.D. LINER & 250 mm D SANITARY SEWER

Proctor & Redfern Limited
Consulting Engineers and Planners
St. Catherines

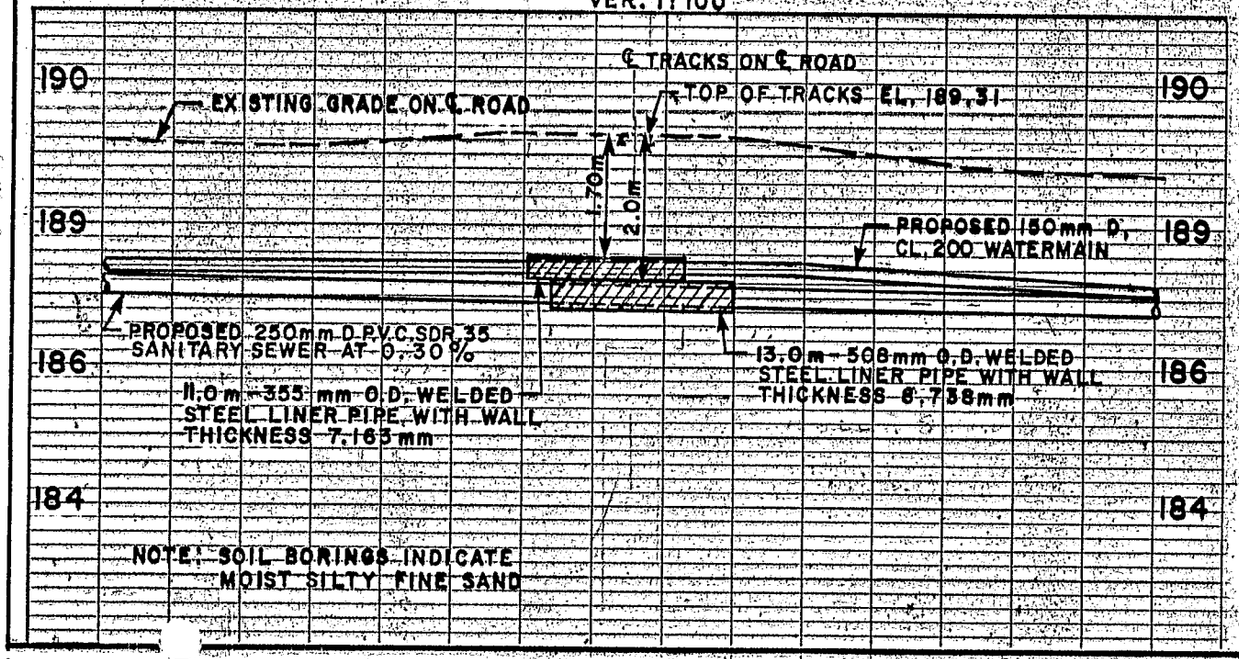
M.P.C.II WELLAND SUBDIVISON

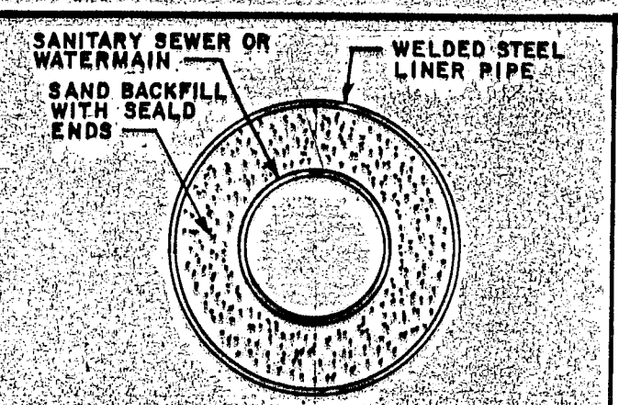
APPROVED
TORONTO HAMILTON & BUFFALO RAILWAY CO.
AREA ENGINEER

Drawn By: E.H.	Date: AUG. 1981	DWG. N 490-L2	REV. 1



SCALES: HOR. 1:500
VER. 1:100





SECTION THROUGH
WELDED STEEL LINER PIPE
BORED & JACKED INTO PLACE

REGISTERED PROFESSIONAL ENGINEER
G. K. STRACHAN
PROVINCE OF ONTARIO

PROVINCE OF ONTARIO
REGIONAL MUNICIPALITY OF NIAGARA
TOWN OF PELHAM

Toronto Hamilton & Buffalo Railway Co.

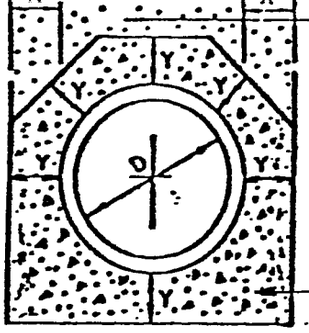
508mm O.D. LINER & 250mm SEWER & 355mm O.D. LINER & 200mm WATERMAIN

Proctor & Redfern Limited
Consulting Engineers and Planners
St. Catharines

M.P. 6.43 WELLAND SUBDIVISON

APPROVED _____
TORONTO HAMILTON & BUFFALO RAILWAY CO.
AREA ENGINEER

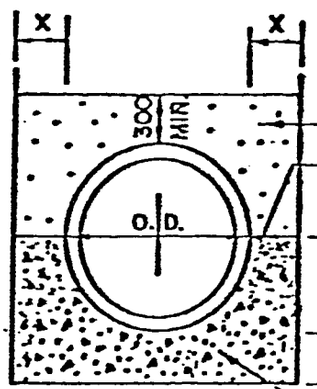
Drawn By: E.H. Date: AUG. 1981 Dwg E-81490-L1



REMAINDER OF BACKFILL PLACED IN LAYERS AND THOROUGHLY CONSOLIDATED.

CONCRETE 20 MPa

CONCRETE ENCASEMENT



DENSELY COMPACTED GRANULAR MATERIAL

O.D./8 (150 mm MIN.)

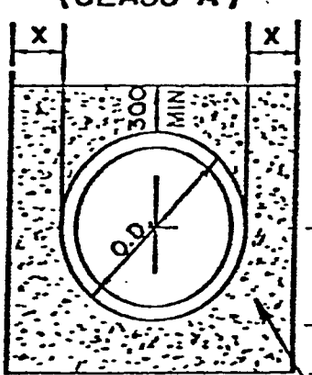
O.D./2

O.D./4 (150 mm MIN., 300 mm MAX.)

CONCRETE 15 MPa

D	X		Y
	MIN.	MAX.	
UP TO 900 mm	150 mm	300 mm	150 mm
1000 mm TO 3000 mm	200 mm	300 mm	200 mm

CONCRETE CRADLE (CLASS 'A')



O.D./2

O.D./4 (150 mm MIN., 300 mm MAX.)

COMPACTED GRANULAR 'A' MATERIAL

GRANULAR BEDDING (CLASS 'B')

NOTES: 1 BACKFILL HANDPLACED TO 600 mm ABOVE TOP OF PIPE & CAREFULLY TAMPED IN 150 mm LAYERS, REMAINING TO BE PLACED IN LAYERS & THOROUGHLY CONSOLIDATED ACCORDING TO SPECIFICATION.

2. COMPACTION – 95% PROCTOR DENSITY MINIMUM
   BOND BREAKER IF SPECIFIED

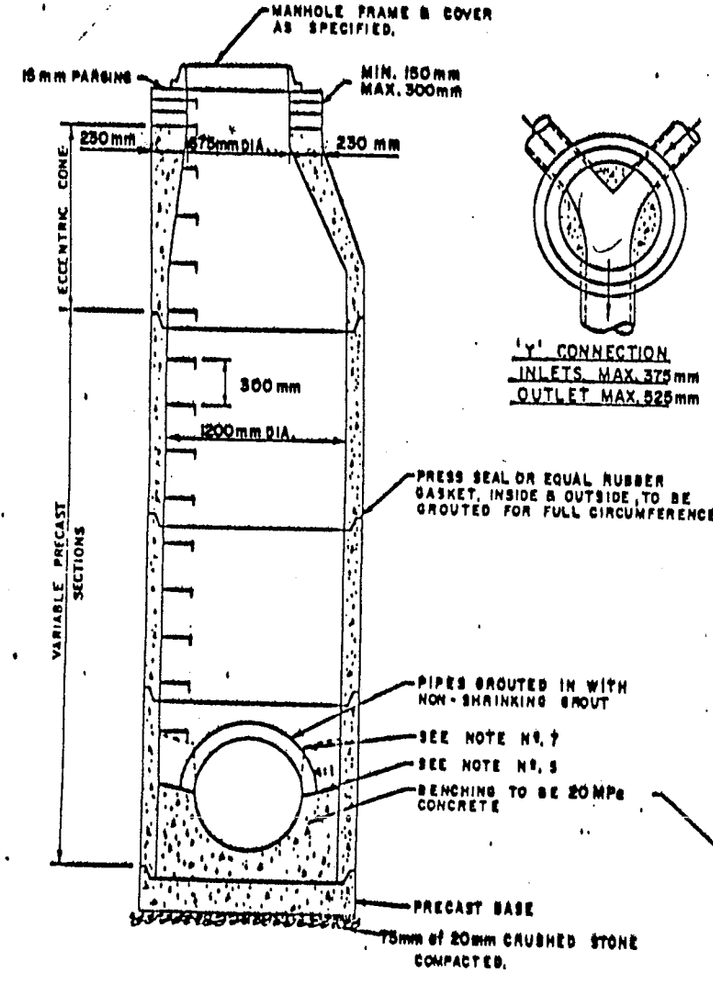
3. WHERE SHEATHING IS USED A BOND BREAKING MATERIAL IS REQUIRED BETWEEN CONCRETE BEDDING AND SHEATHING.

DIMENSIONS IN mm EXCEPT AS NOTED

REVISIONS	
APPROVED BY	BEDDING FOR SANITARY AND STORM SEWER PIPES

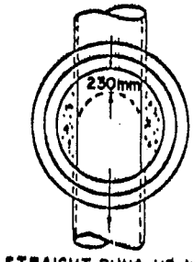
Proctor & Redfern Limited
Consulting Engineers and Planners
Toronto St. Catharines

DRAWING NO. E-81490 - LIM REV. 3

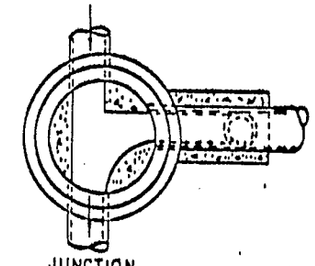


'Y' CONNECTION
INLETS. MAX. 375mm
OUTLET MAX. 525mm

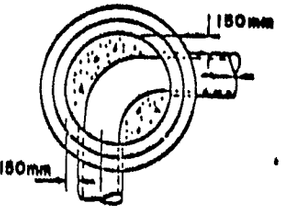
NOTE: Channel in dead end manhole to finish 230mm from upstream well.



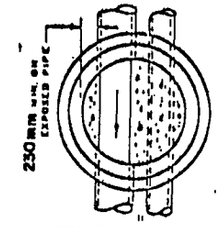
STRAIGHT RUNS UP to 750mm



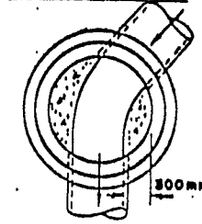
JUNCTION
NO PIPE OVER 375mm



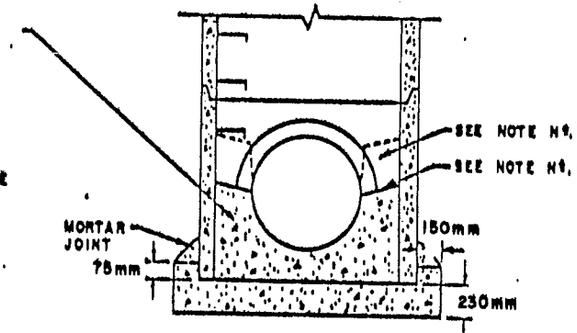
90° BEND
INLET MAX 375mm
OUTLET MAX. 525mm



ON DUAL SYSTEM
MAX. 250 & 375mm



45° BEND
MAX. 600mm



OPTIONAL CAST IN PLACE BASE

NOTES

1. For cast in place base, concrete to be 20 MPa at 28 days.
2. Precast manhole sections shall be equal to A.S.T.M. specifications C-478.
3. Steps. Top step to be 300 mm minimum, 400 mm maximum below top of frame. Bottom step to be 300 mm maximum above crown of pipe.
4. Parging mix on all brickwork to be 1:3 mortar mix and applied 15 mm thick.
5. Top of benching to be sloped no greater than 8:1 (horizontal to vertical).
6. All joints and lifting holes in manhole sections to be completely filled with a 1:3 mortar mix and pointed before backfilling.
7. Where used or applicable to storm sewer, benching shall be to crown.
8. Pipes entering precast sections on manhole must not enter at joints.
9. For drop manholes use in conjunction with E-79423-L15M.

1200mm DIAMETER SANITARY AND STORM PRECAST MANHOLE

APPROVED

DRAWING NO. E-81490 – L2M

APPROVED BY

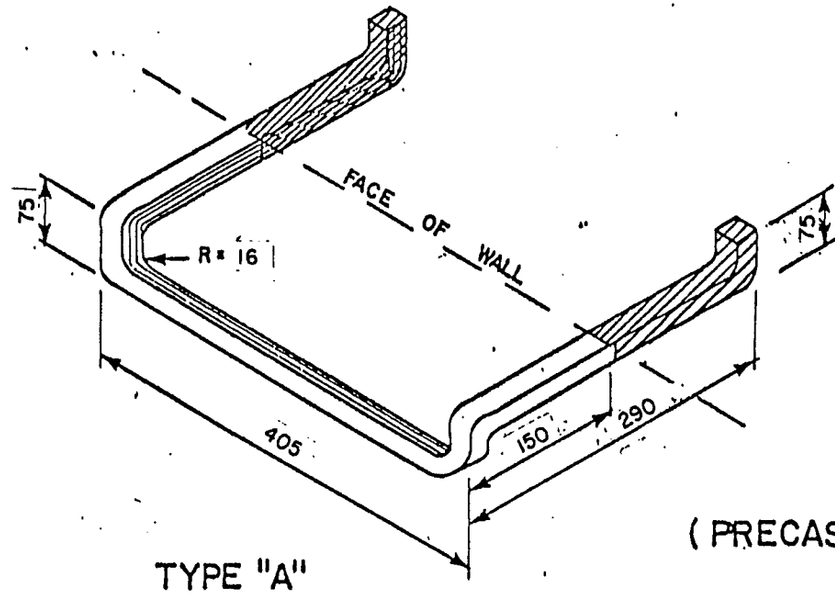
REVISIONS

ALUMINUM SAFETY LADDER RUNGS

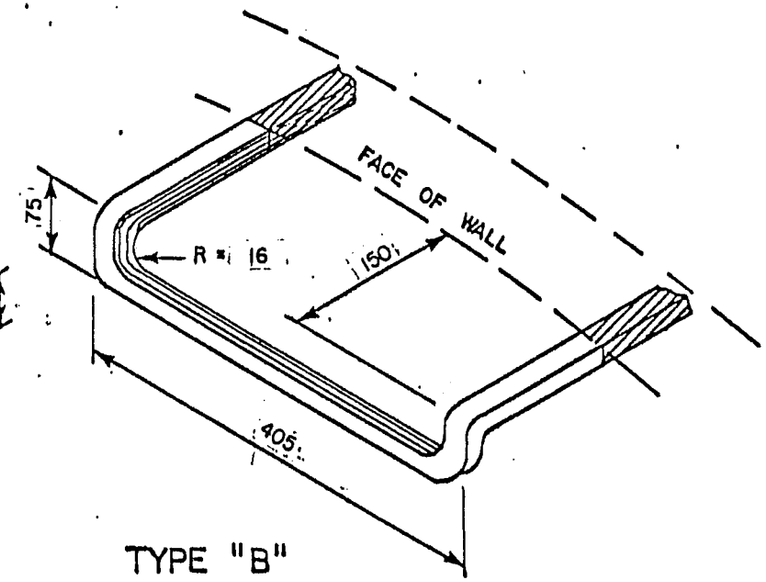
Proctor & Redfern Limited
Consulting Engineers
Toronto

DRAWING NO. E-81490-L3M

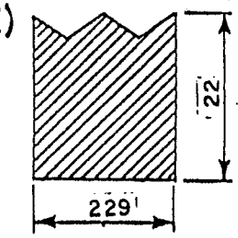
REV.0



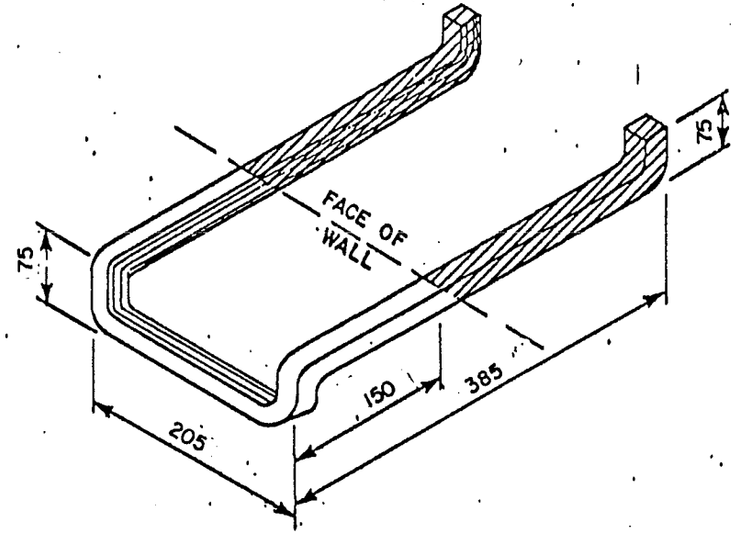
TYPE "A"
(CAST IN PLACE CONCRETE)



TYPE "B"
(PRECAST CONCRETE)



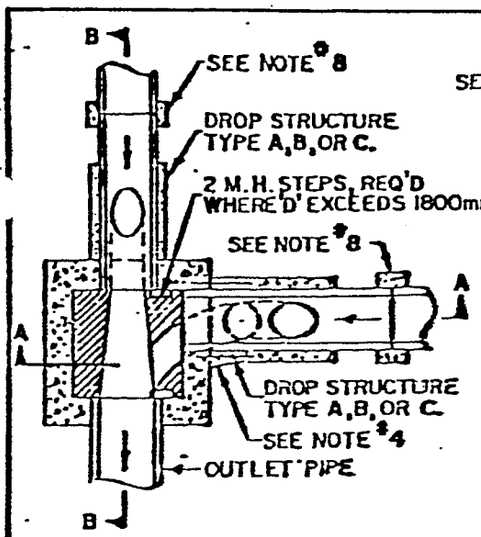
SECTION THROUGH
ALUMINUM STEPS



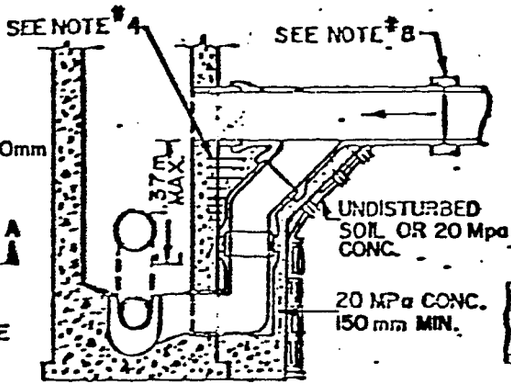
TYPE "C"
(MASONRY)

NOTES:

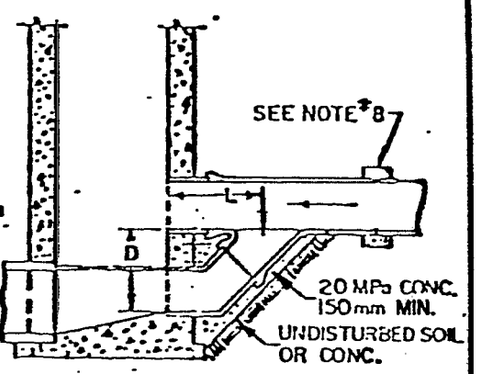
1. MATERIAL FOR STEPS TO BE ALUMINUM ALLOY 65 ST 4 (ALUMINUM CO. OF CANADA SPECIFICATION)
2. ALL ALUMINUM IN CONTACT WITH CONCRETE OR BRICKWORK TO HAVE 2 COATS FLINTKOTE C-12 STATIC ASPHALT PAINT OR APPROVED EQUAL
3. CONTRACTOR TO SUPPLY SHOP DRAWING SHOWING PIPE MANUFACTURERS METHOD OF SECURING STEPS IN PRECAST UNITS
4. LADDER RUNGS TO BE SPACED 300 CENTER TO CENTER ON FACE OF WALL



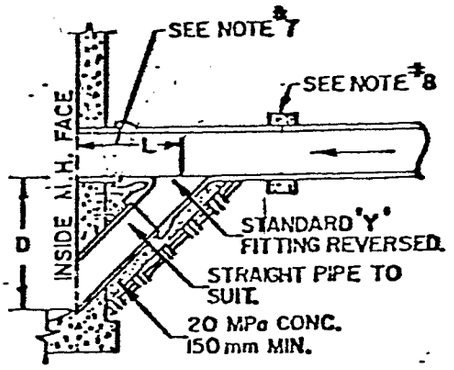
PLAN



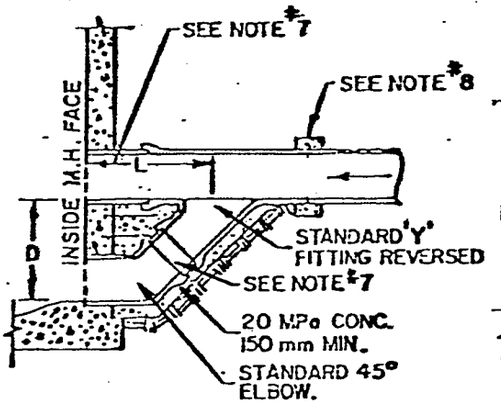
SECTION A-A



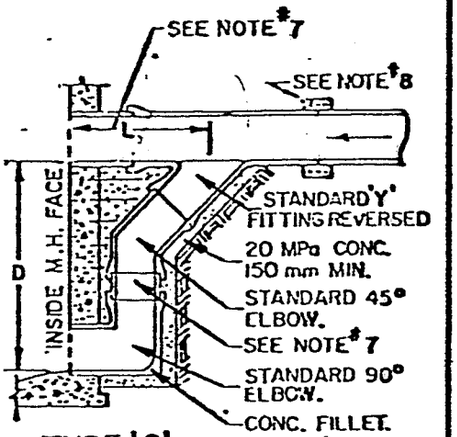
SECTION B-B



TYPE 'A'



TYPE 'B'



TYPE 'C'
PREFERRED

TABLE OF MINIMUM DIMENSIONS

Drop Pipe (mm)	Type 'A'		Type 'B'		Type 'C'	
	'D' (m)	'L' (mm)	'D' (m)	'L' (mm)	'D' (m)	'L' (mm)
200	0.9	810	0.6	760	1.2	1070
250	1.0	840	0.65	810	1.3	1070
300	1.1	868	0.7	910	1.5	1140
375	1.2	918	0.9	1140	1.9	1220
450	1.3	990	1.0	1220	2.0	1300
525	1.4	1040	1.05	1300	2.2	1450
600	1.5	1090	1.2	1370	2.4	1520
675	1.6	1140	1.2	1450	2.5	1600
750	1.7	1220	1.3	1520	2.7	1580

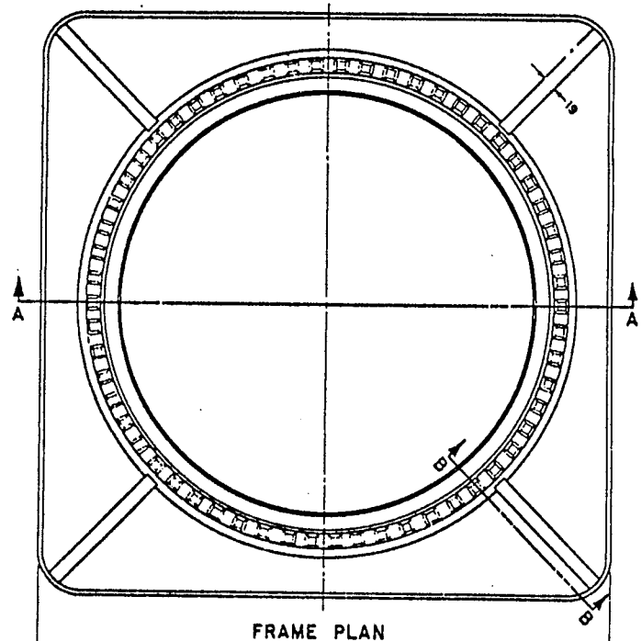
NOTES

1. Drop pipe to be one pipe size smaller than inlet pipe.
2. Drop pipe to be crowns level with outlet pipe and benched to crown.
3. Drop pipe to blend with flow.
4. Drop structure to be encased in a minimum of 150 mm of 20 MPa concrete and dowelled to manhole with 15 mm ϕ dowels, 450 mm long, either side of drop pipe and at 300 mm C to C.
5. This standard where applicable to be used in conjunction with standard precast manhole details.
7. Adjustment in 'D' and 'L' to be made with plain end straight pipe.
8. Where 'Y' fitting joins first pipe, a 300 mm wide by 150 mm thick 20 MPa collar is to be constructed.
9. All concrete in drop-structure to be 20 MPa at 28 days.
10. Minimum dimensions based on use of standard concrete fittings as per latest information by suppliers.
11. All dimensions are subject to manufacturers permissible variations.

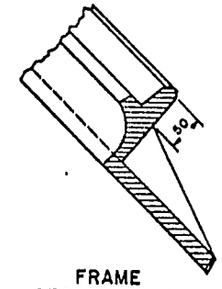
DROP STRUCTURES FOR MANHOLES

APPROVED

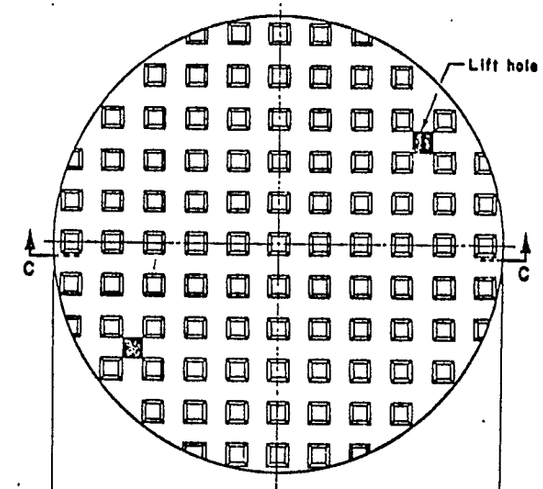
DRAWING NO. E – 81490 – L4M REV. 1



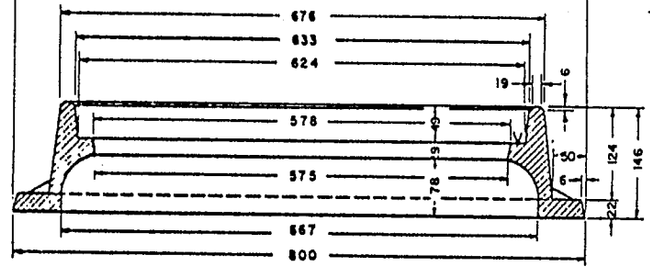
FRAME PLAN



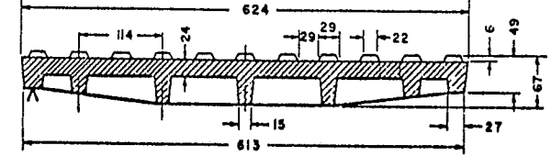
FRAME
SECTION B-B



COVER PLAN



FRAME SECTION A-A



COVER SECTION C-C

NOTES:

A Allowable tolerances:
Dimensions 305 mm or less – ± 3 mm
Dimensions over 305 mm up to and including 1 m – ± 6 mm

B Marking:
The initials or mark of the manufacturer are to be distinctly cast in raised letters on both frame and grate.

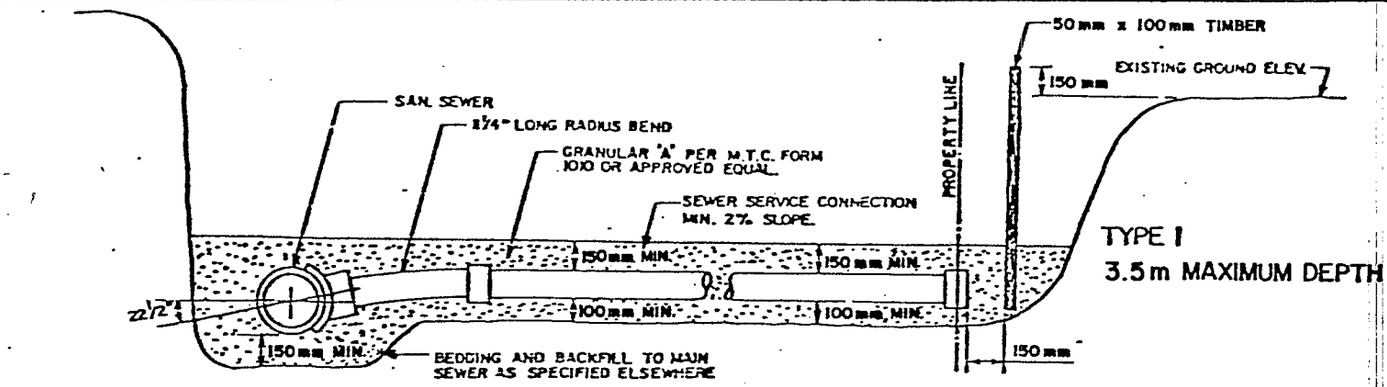
C All dimensions are in millimetres unless otherwise specified.

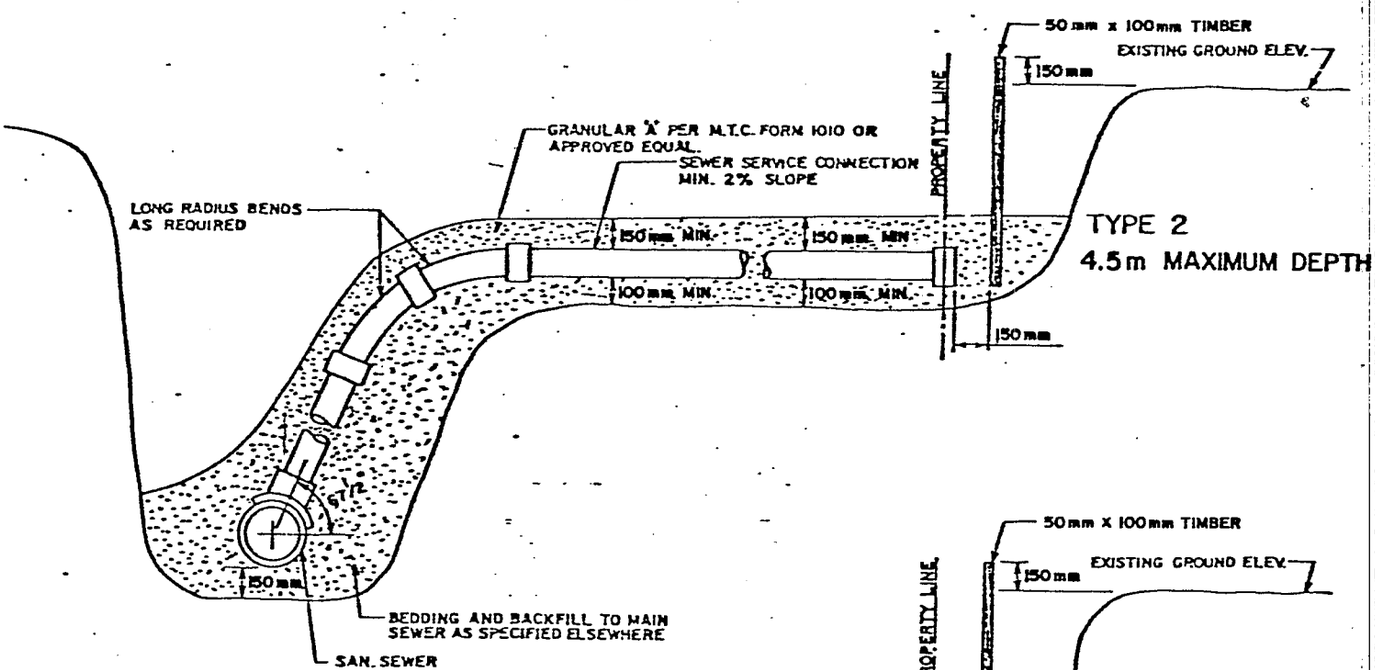
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO | No DD-704-B

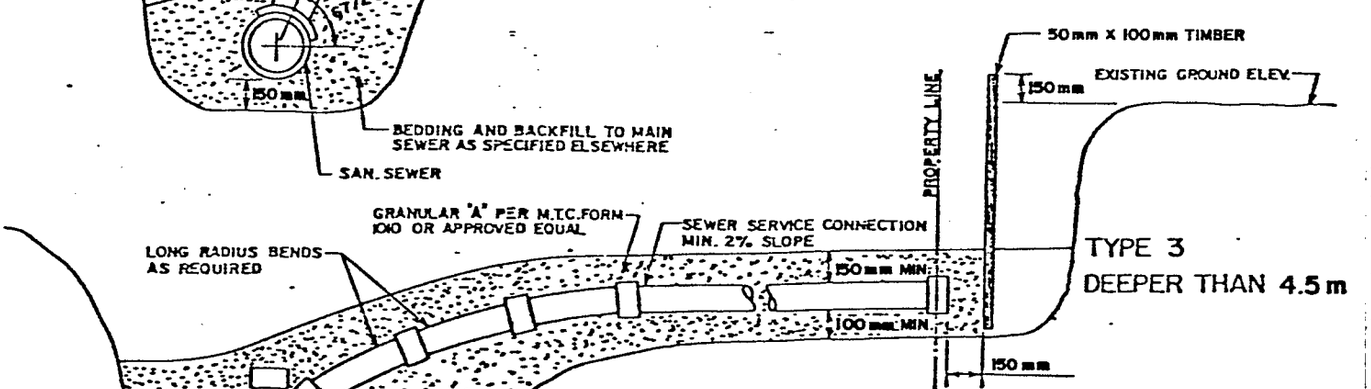
MANHOLE FRAME AND CLOSED COVER

Date 1979 01 01 | Rev

J. E. Callaghan
Director Design and Construction Branch







NOTES:

1. FOR 200mm AND 250mm DIA. SEWERS ONLY FACTORY MADE TEES TO BE USED
2. FOR SEWERS 300mm DIA. AND LARGER, EITHER FACTORY MADE TEES OR APPROVED STRAP-ON SADDLES MAY BE USED.
3. STRAP-ON SADDLES MUST BE INSTALLED ON THE MAIN SEWER PIPE BEFORE THAT PIPE IS LAID.
4. MINIMUM SERVICE CONNECTION SIZE FOR SINGLE SERVICES TO BE 125 mm DIA.
5. MINIMUM SERVICE CONNECTION SIZE FOR DOUBLE SERVICES TO BE 150 mm DIA.
6. SEWER SERVICE CONNECTION MUST BE SECURELY PLUGGED AT PROPERTY LINE WITH AN EXPANDING TYPE PLUG OR APPROVED EQUAL.
7. PLUG AT PROPERTY LINE SHALL BE ADEQUATELY BRACED TO WITHSTAND TESTING PRESSURES.
8. PAYMENT WILL BE MADE AT THE UNIT PRICE PER METRE, MEASURED ALONG THE GROUND SURFACE, FROM THE CENTERLINE OF THE MAIN SEWER TO THE END OF THE PIPE AT THE PROPERTY LINE.
   THE VERTICAL RISER SECTION WILL BE PAID FOR AS A LUMP SUM REGARDLESS OF DEPTH.
9. IF TWO CONNECTIONS ARE MADE TO THE SAME VERTICAL RISER (SHOWN IN DOTTED OUTLINE) THE VERTICAL RISER SHALL BE 150mm DIA. MIN.

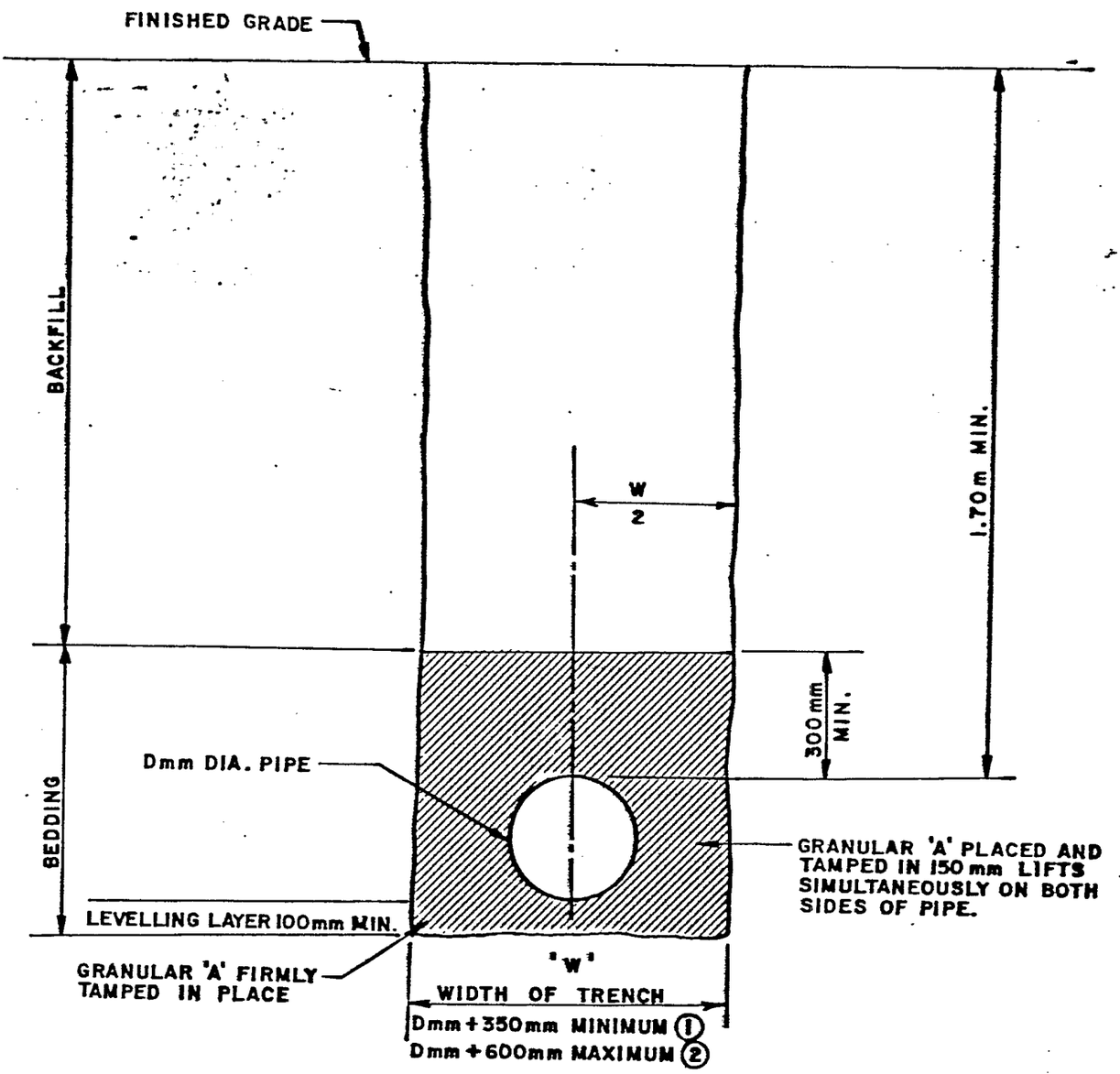
SANITARY SERVICES TO NEW SANITARY SEWERS

MINISTRY OF THE ENVIRONMENT

PROJECT CONSTRUCTION BRANCH

Service Connections

Scale, N.T.S. | Date Nov 1974 | No. E-81490-L5M



NOTES:

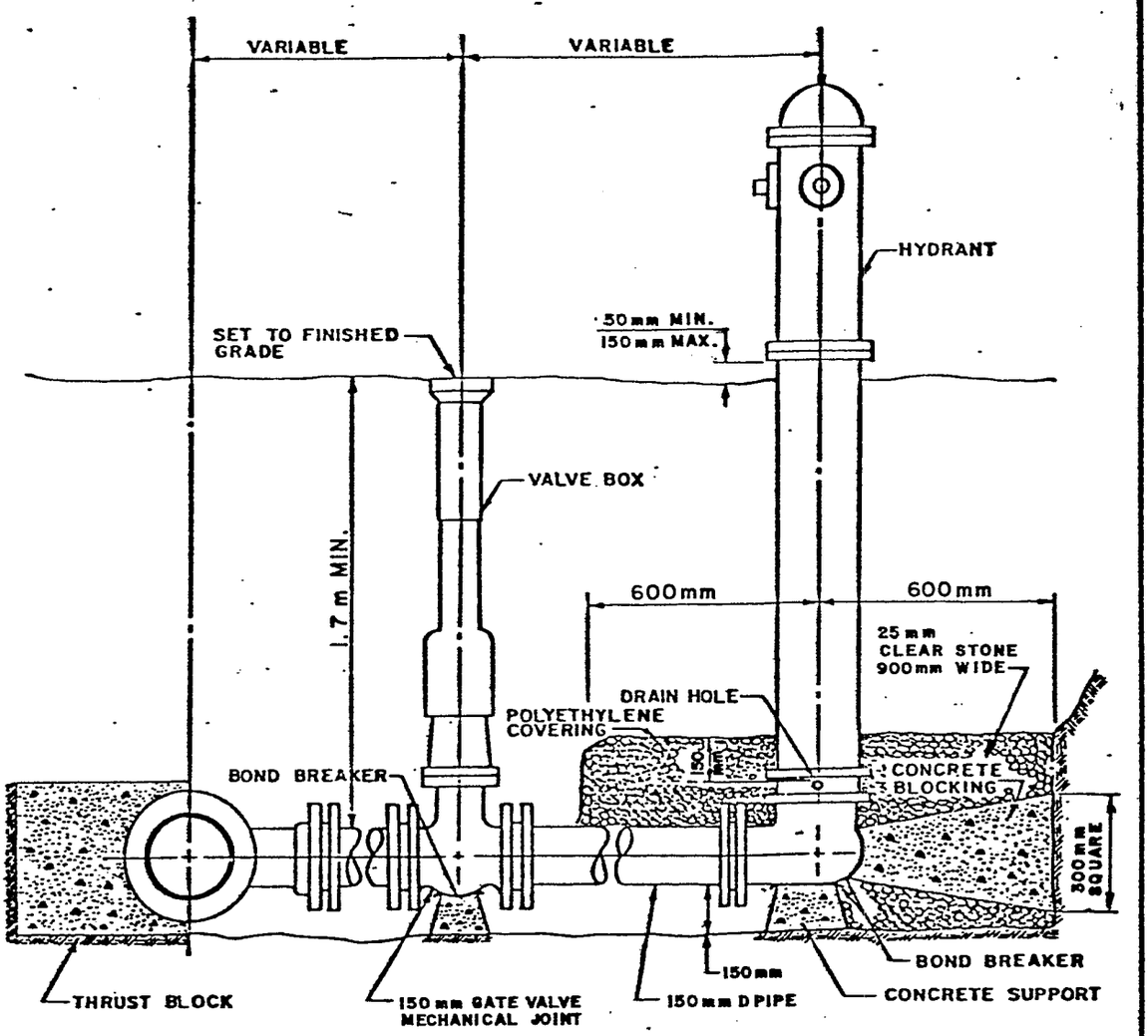
(1) Granular material shall meet contract granular 'A' specifications (fine traffic bound or screenings) throughout except where water is encountered 19 mm clear crushed stone shall be substituted.

(2) Where the bottom of the trench is found to be unstable or otherwise unacceptable it shall be excavated to the width and depth ordered by the inspector and refilled and compacted to the bottom of the pipe with 50 mm Crusher run Crushed.

(3) In no case shall frozen material be used for bedding or backfilling.

Revisions		
	BEDDING AND BACKFILL DETAILS FOR WATERMAIN	Proctor & Redfern Limited Consulting Engineers and Planners Toronto St. Catharines Drawing No. E-81490-L6M Rev. 0

SOURCE: M.E.A. MODEL No. 441



NOTES:

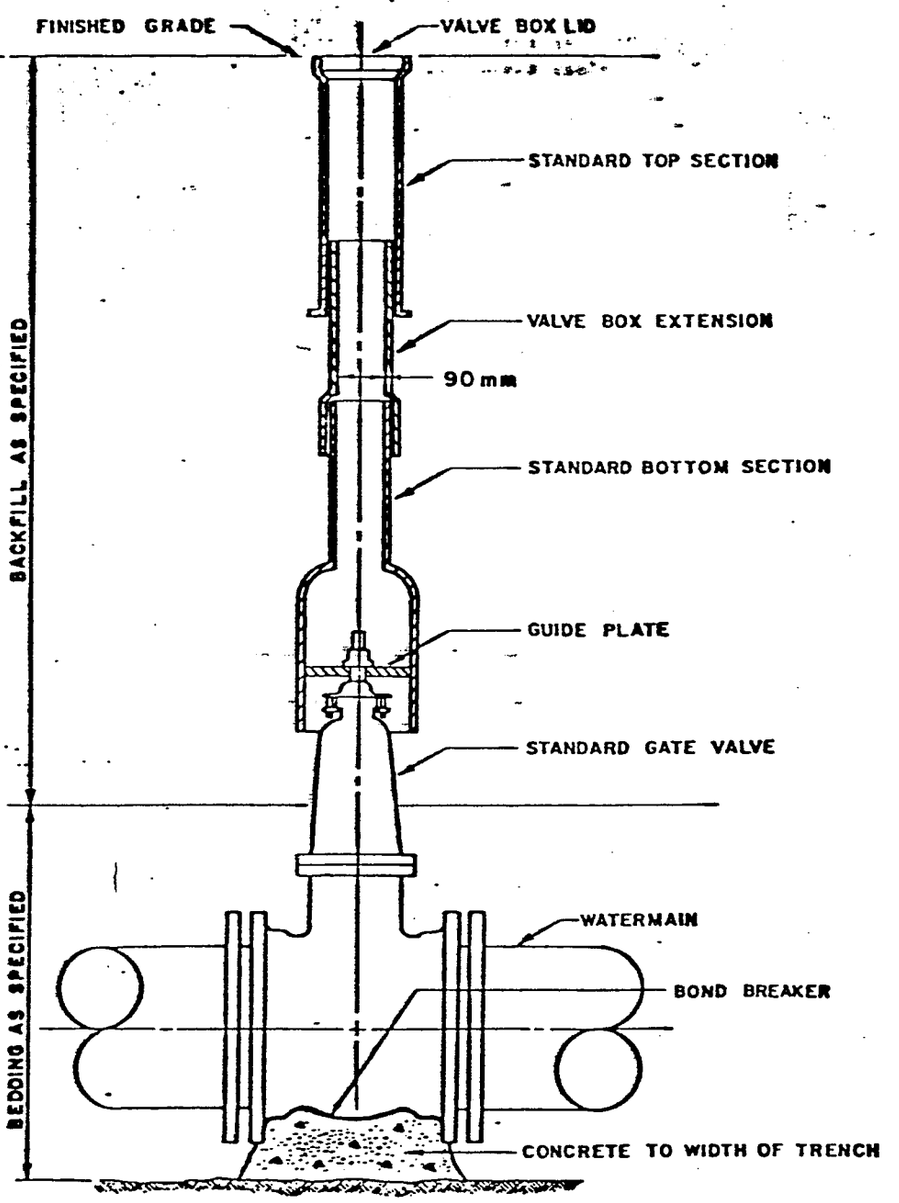
(1) ALL CONCRETE TO BE 20 MPa AT 28 DAYS.
(2) ALL CONCRETE TO BE AGAINST UNDISTURBED TRENCH WALL.
(3) BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.

HYDRANT INSTALLATION

Proctor & Redfern Limited
Consulting Engineers and Planners
Toronto St. Catherines

Drawn By
Chkd. By
Drawing No. E-81490-L7M
Rev. 0

SOURCE: M.E.A. MODEL No. 405



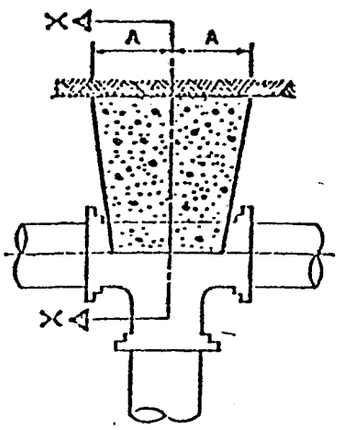
NOTES:

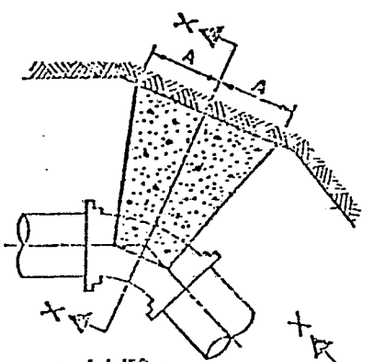
(1) VALVE BOX TO BE ADEQUATELY BRACED WHILE BACKFILLING AND MUST REMAIN PLUMB.
(2) VALVE BOX EXTENSION TO BE USED ONLY IF REQUIRED.
(3) BOND BREAKER TO BE USED BETWEEN CONCRETE AND VALVE.
(4) ALL CONCRETE TO BE 20 MPa AT 28 DAYS.

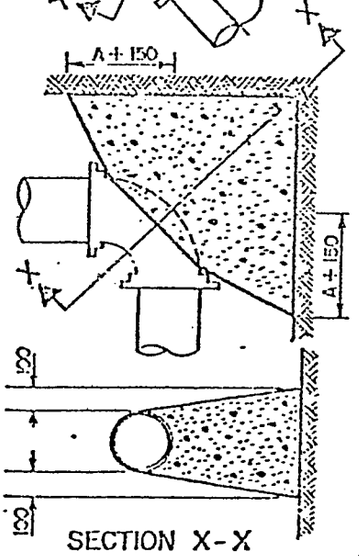
VALVE BOX INSTALLATION
100mm D TO 300mm D WATERMAINS

Proctor & Redfern Limited
Consulting Engineers and Planners
Toronto

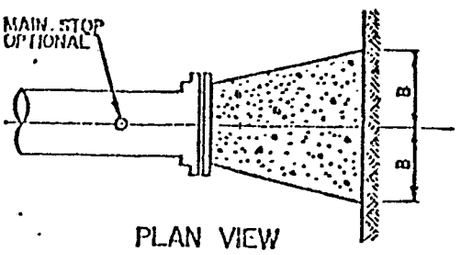
Drawn By		Drawing No.	Rev.
Chd. By		E-81490-L8M	Q



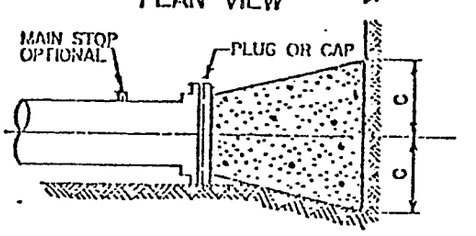




SECTION X-X



PLAN VIEW



ELEVATION VIEW

MINIMUM DIMENSIONS			
SIZE OF PIPE	A	B	C
100	150	150	150
150	230	230	200
200	230	300	200
250	300	380	250
300	380	450	300
350	450	550	380
400	500	600	450

NOTES

1. ALL CONCRETE TO BE 20 MPa.
2. ALL CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED GROUND.
3. CLEARANCE OF 80 mm TO BE MAINTAINED FROM FACE OF BELL TO CONCRETE.
4. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.
5. THIS BLOCKING DESIGN APPLIES ONLY WHERE 1030 kPa PRESSURE IS NOT EXCEEDED.

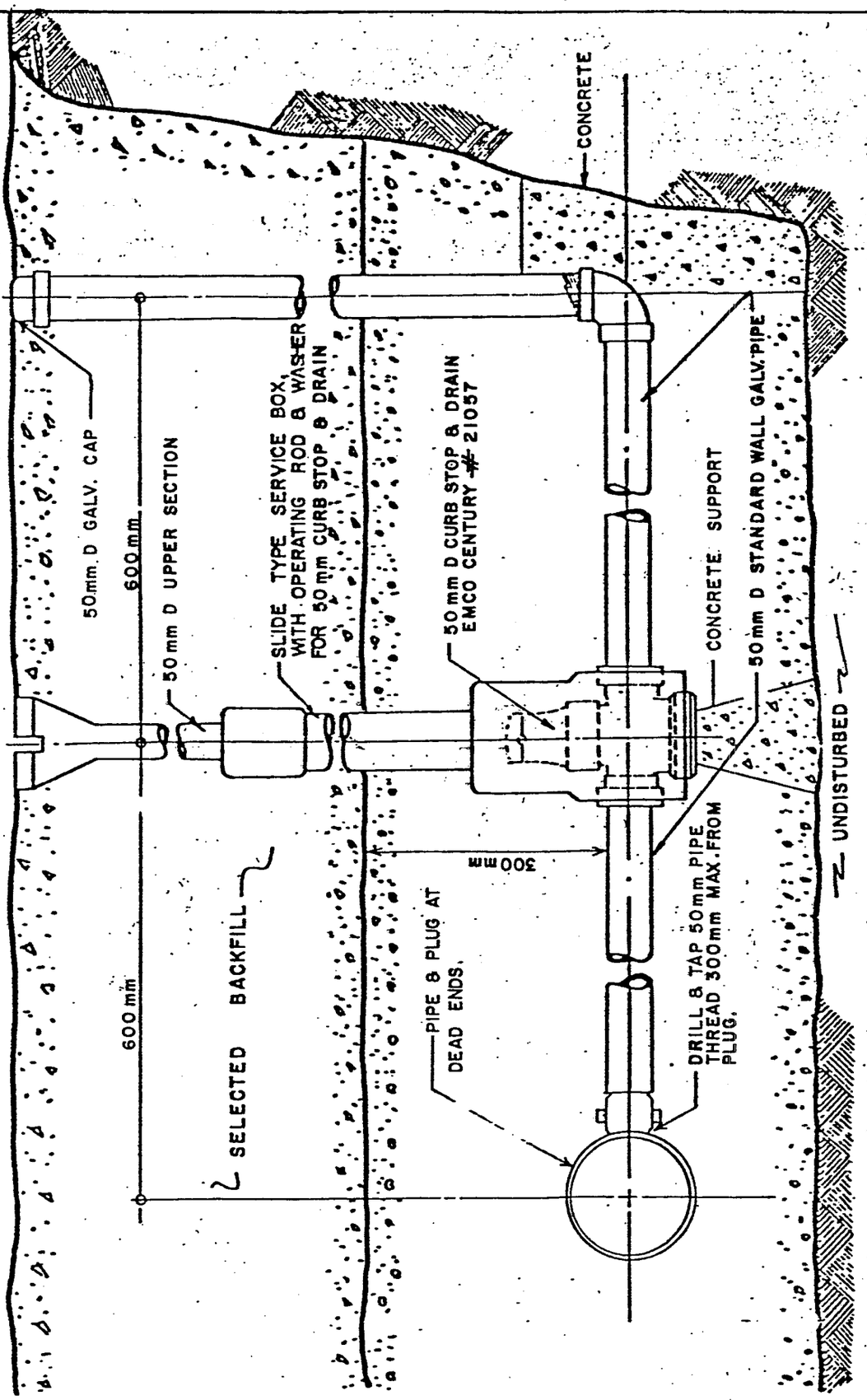
ALL DIMENSIONS ARE EXPRESSED IN mm UNLESS OTHERWISE NOTED.

	APPROVED	SCALE: N.T.S.
		DIVISION
CONCRETE THRUST BLOCKS TEES, PLUGS & HORIZONTAL BENDS 400 mm DIAMETER WATERMAINS & SMALLER		DATE:
		DRAWING NO. E-81490-L9M

WATER SERVICE

Consulting Engineers and Planners
Toronto

DRAWING No. E-81490-L10M



BLOW - OFF DETAIL

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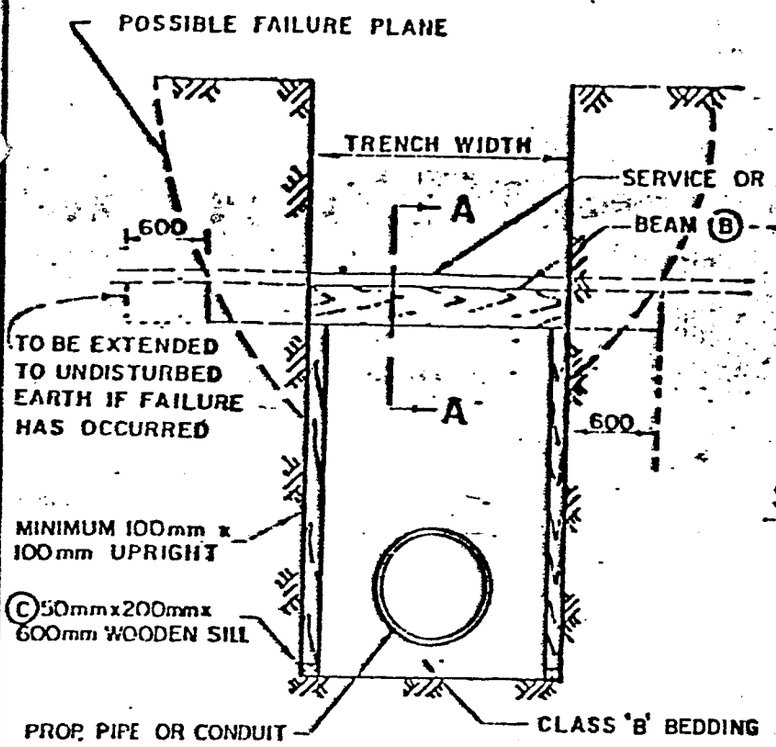
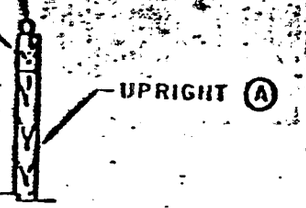
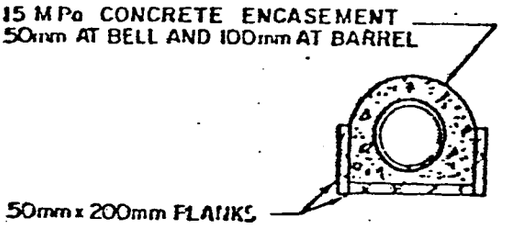
Drawing No. E-81490-LII M REV. 1



CROSS SECTION

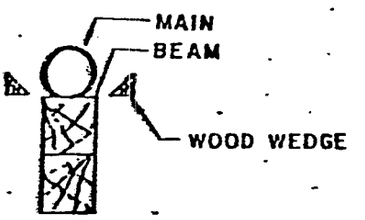


SECTION A-A



DRAIN

CONC. ENCASED WHERE REQUIRED



SERVICES & MAINS

SIZE OF PIPE SUPPORTED	(A) UPRIGHT	(B) BEAM	(C) SILL
38,50 & 75	100x100	1/150x150	50x200x600
100 & 125	150x150	2/150x150	50x200x600
150 & 200	200x200	2/200x200	50x200x600
250 & 300	300x300	2/300x300	50x200x600

NOTES:

1. WHERE THE WIDTH OF TRENCH EXCEEDS 2 m METHOD OF CONSTRUCTION IS TO BE SPECIFIED BY THE SUPERVISING ENGINEER.
2. THE CONTRACTOR IS REQUIRED TO MAINTAIN ALL SERVICES & MAINS ENCOUNTERED DURING CONSTRUCTION AND SUPPORT THEM AFTER CONSTRUCTION OF THE PIPE.

DIMENSIONS IN mm EXCEPT AS NOTED

REVISIONS	
APPROVED BY	TYPICAL DETAILS FOR SUPPORTING UTILITIES

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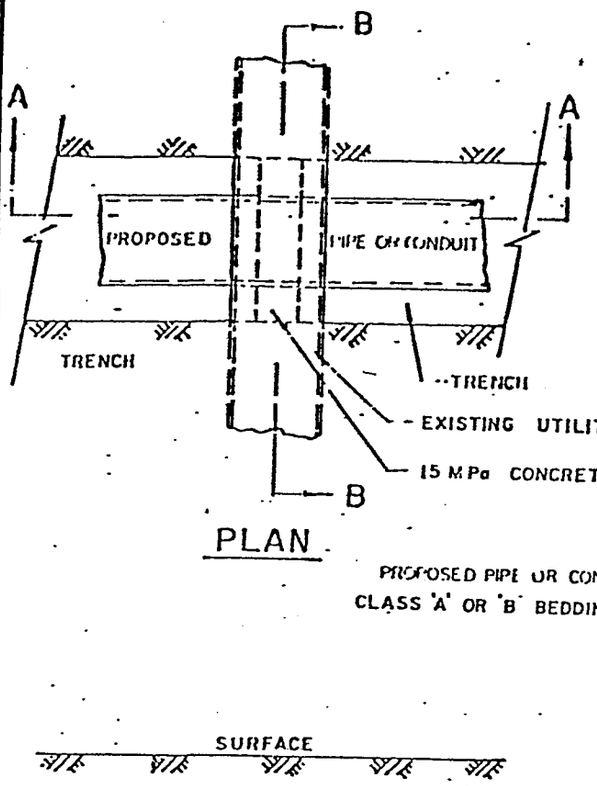
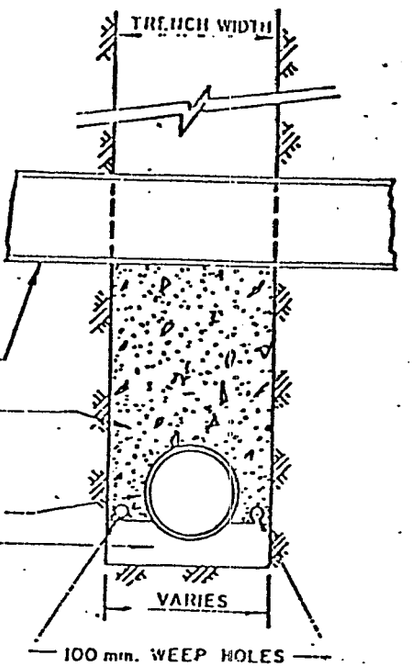
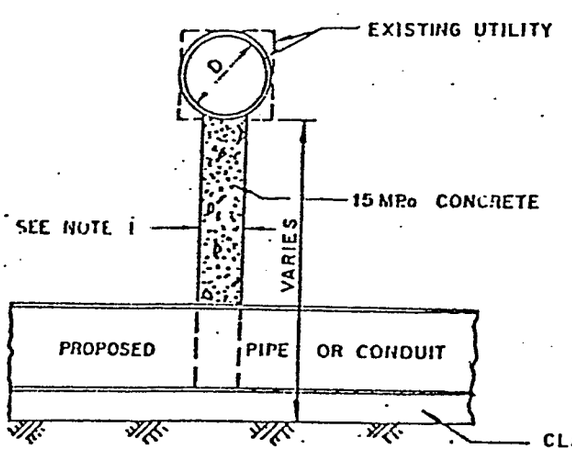
DRAWING NO. E-81490-L12M REV. 0





SECTION B-B



SECTION A-A

NOTES

1. WIDTH OF CONCRETE TO BE MIN. 300 mm WHERE A WATERMAIN IS BEING SUPPORTED WIDTH OF CONCRETE SHALL BE D + 150 mm.
2. CONCRETE ENCASED STEEL MAINS SHALL BE SUPPORTED WITH CONCRETE TO UNDERSIDE OF MAIN. TAR PAPER IS TO BE USED BETWEEN THE TWO CONC. SURFACES.
3. WATERMAINS AND GASMAINS SHALL HAVE A BEARING BLOCK OR PLATE OF MIN. DIMENSION 75 mm x 200 mm WITH WEDGES BETWEEN THE PIPE OR CONDUIT AND THE CONCRETE SUPPORT.

DIMENSIONS IN mm EXCEPT AS NOTED

REVISIONS	
APPROVED BY	TYPICAL DETAIL FOR SUPPORTING UTILITIES LARGER THAN 300 mm

Proctor & Redfern Limited
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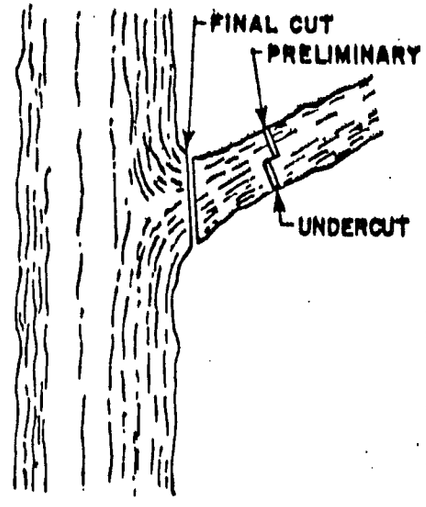
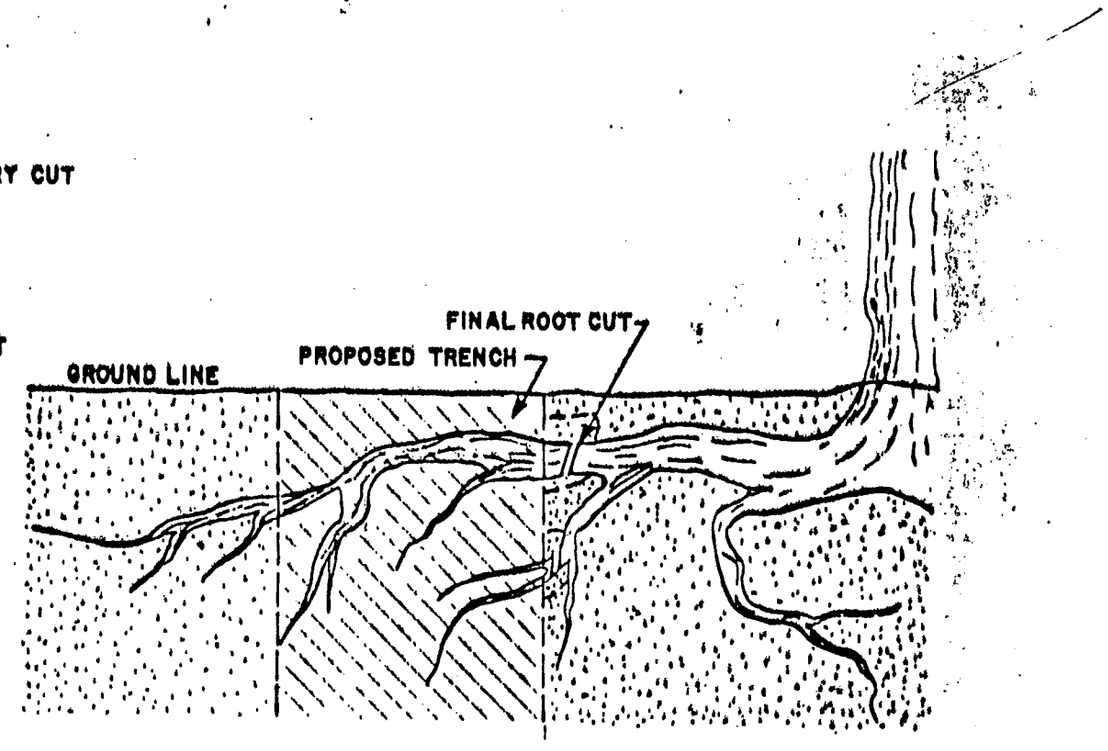
Toronto St. Catharines

DRAWING NO. E-81490-L13M REV 0





1. ALL FINAL CUTS SHALL BE MADE FLUSH WITH THE REMAINING LIMB OR TRUNK.
2. ALL CUTS SHALL BE PAINTED WITH A SUITABLE WOUND DRESSING.
3. FINAL CUTS ON LIMBS WHICH ARE TOO LARGE TO HOLD WITH THE HAND SHALL BE PRECEDED BY PRELIMINARY CUT FROM 300 mm TO 600 mm BEYOND THE FINAL CUT SUCH PRELIMINARY CUTS SHALL INCLUDE AN UNDERCUT TO PREVENT STRIPPING OF THE BARK.
4. ALL ROOTS 40 mm AND OVER SHOULD HAVE ANY SHATTERED ENDS CUT BACK TO SOUND WOOD AND TREE WOUND DRESSING APPLIED TO THE WOUND.

ALL DIMENSIONS ARE IN MILLIMETRES.

REMOVAL AND TREATMENT OF TREE BRANCHES AND ROOTS.