City of Hamilton
Public Works Department
77 James Street North, Suite 320
Hamilton, ON L8R 2K3

CONSTRUCTION AND MATERIALS SPECIFICATIONS MANUAL

REVISION # 9 – November 5, 2018

NOTICE OF REVISION

November 5, 2018

Email Contact Information:

The City will only send notification of Manual revisions by email. If you would like to receive notifications of future revisions, send your email address to claudio.leon@hamilton.ca

Access to Hamilton Standards:

Each manual holder is responsible for determining implementation dates and directions for use of these revisions. It is recommended that you retain superseded versions of specifications for future reference.

All specifications and drawings are available free of charge online at the City of Hamilton website at:

https://www.hamilton.ca/develop-property/policies-guidelines/construction-and-material-specifications

Here you will find the latest versions of the published standards, archives of the previously published standards and Revision Information Sheets for currently published standards.

Hard-copy paper versions of the standards are available for a fee at our office located at:

Public Works Department – Reception
77 James Street North, Suite 320
Hamilton, Ontario, L8K 6E9
Call 905 546-2424, Ext. 4170.

Method of payment: Cash or company cheque payable to the City of Hamilton. Personal cheques must be certified.

Revisions to the Construction and Materials Specifications Manual:

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	**Dated**	**Document**	**Dated**	
Construction and Material Specification Manual Index	March 2018	Construction and Material Specification Manual Index	November 2018	Specification Dates Updated
Form 200, General Conditions	January 2011	Form 200, General Conditions	November 2018	Specification Revised
Form 300, General Construction Requirements	June 2017	Form 300, General Construction Requirements	November 2018	Specification Revised
Form 400, Specification for the Installation of Watermains	March 2018	Form 400, Specification for the Installation of Watermains	November 2018	Specification Revised
Form 500, Specification for Sewer Pipe Materials and CCTV Inspection	June 2017	Form 500, Specification for Sewer Pipe Materials and CCTV Inspection	November 2018	Specification Revised
Form 600, Specification for Granular Fill Materials	June 2017	Form 600, Specification for Granular Fill Materials	November 2018	Specification Revised
Form 800, Specification for Hot Mix Asphalt	March 2018	Form 800, Specification for Hot Mix Asphalt	November 2018	Specification Revised
Approved Products List Section 1 - Watermains	March 2018	Approved Products List Section 1 - Watermains	November 2018	Updated
Approved Products List Section 2 - Sewers	March 2018	Approved Products List Section 2 - Sewers	November 2018	Updated
Approved Products List Section 3 – Street Lighting	June 2017	Approved Products List Section 5 – Parks Construction Products	November 2018	Updated
Approved Products List Section 4 – Traffic Signals	June 2017	Approved Products List Section 4 – Traffic Signals	November 2018	Updated
Standard Road Drawing Index	March 2018	Standard Road Drawing Index	November 2018	Updated
RD-101	November 2005	RD-101	November 2018	Drawing Revised
RD-103	January 2011	RD-103	November 2018	Drawing Revised
RD-124.01	October 2017	RD-124.01	November 2018	Drawing Revised
RD-124.02	October 2017	RD-124.02	November 2018	Drawing Revised
Standard Watermain Drawing Index	June 2017	Standard Road Drawing Index	November 2018	Updated
WM-204.13 (1 of 2)	November 2005	WM-204.13 (1 of 2)	November 2018	Drawing Revised

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	**Dated**	**Document**	**Dated**	
-	-	WM-204.14	November 2018	New Drawing
-	-	WM-215.03	November 2018	New Drawing
WM-230	January 2011	WM-230	November 2018	Drawing Revised
WM-231	January 2011	WM-231	November 2018	Drawing Revised
-	-	WM-236.01	November 2018	New Drawing
-	-	WM-236.02	November 2018	New Drawing
Standard Sewer Drawing Index	January 2011	Standard Road Drawing Index	November 2018	Updated
SEW-300	November 2005	SEW-300	November 2018	Drawing Revised
SEW-301	November 2005	SEW-301	November 2018	Drawing Revised

Revision Summaries:

These summaries are for information purposes and will highlight major or substantial changes only. Each revision and specification should be reviewed in its entirety.

Construction and Materials Specification Manual Index:

- References and specification dates updated.

Summary of Changes to Form 200 – General Conditions

General - All references mate to 'Construction Lien Act' replaced with 'Construction Act'
200.03.01 – Revised.
200.03.10 – Revised.
200.03.15 – Revised.
200.04.06 – Revised - 'shall be new' (added).
200.06.02 – Revised.

Summary of Changes to Form 300 – General Construction Requirements

General – All references made to 'Schedule of Quantities and Prices' replaced with 'Schedule of Prices'
300.02.02 - Addition – 'Materials shall be new, reuse of materials is not permitted'.

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Summary of Changes to Form 400 - Specification for the Installation of Watermains:

General – All reference made to the Ministry of the Environment and Climate Change (MOECC) have been replaced with the 'Ministry of the Environment, Conservation and Parks (MECP)'.
400.02.01 – First paragraph added - 'All WM materials shall be new. Reuse of materials is not permitted'
400.05 – Second paragraph added.
400.09.02 – Revised.
400.09.03 – Revised.
400.09.04 – Revised.
400.09.05 – Added new section 400.09.05 for Stainless Steel Pipe. Subsequent sections renumbered.
400.09.06 – Stainless Steel Fittings added.
400.14.04.01 – Added 'Type II' to Granular B backfill.
400.14.04.02 – Deleted 'Granular B' bedding for Concrete Pressure Pipe watermains*, and* added 'Type II' to Granular B backfill.
400.14.04.03 – Added 'Type II' to Granular B backfill.
400.14.04.04 – Added 'Type II' to Granular B backfill.
400.20 – Third paragraph revised the – 'Long-side hydrant leads shall receive an additional gate valve and valve box installed on the lead at the main, close coupled with an anchor tee;
Fifth and sixth paragraphs revised.
400.23.02 - Revised the third paragraph – 'Long-side services shall receive an additional gate valve and valve box installed on the service at the main, close coupled with an anchor tee.'

Form 400 Appendix A – Procedure for the Disinfection, Testing and Connection of Watermains - Record of Watermain Break Form - Revised

Summary of Changes to Form 500 - Specification for Sewer Pipe Materials and CCTV Inspection:

500.03.04 – Section deleted and replaced as section 500.04.
500.04 – Replaces former sub-section 500.03.04. No changes to the content.
500.05 – New section – Covers Sewer Bedding and Backfill Materials.
500.06 – Renumbered.

Summary of Changes to Form 600 - Specification for Granular Fill Materials

600.04.02 – Deleted crushed blast furnace slag for sewer backfill. Use of slag is not permitted for backfill on sewer, private drains, watermains or water services.
600.04.03 – Granular 'B' "Type I" replaced Granular B "Type II".
Table 600-3 – Revised - Blast furnace slag is 'NOT' approved as asphalt aggregate.

Summary of Changes to Form 800 - Specification for Hot Mix Asphalt

- Table 800-5 - Revised
- 800.02.03.11 – Both paragraphs after Table 800-6 - Revised

Approved Products List

Section 1 – Approved Watermain Products List – Updated
Section 2 – Approved Sewers Products List – Updated
Section 3 – Approved Street Lighting Products List – Updated
Section 4 – Approved Traffic Signals Products List – Updated

Standard Road Drawings:

- **RD-101** – Dimension for Granular base behind the concrete curb added.
- **RD-103** – Dimension for Granular base behind the concrete curb added.
- **RD-124.01** – Note 11 Revised (throughout).
- **RD-124.02** – Note 11 Revised (throughout).

Standard Watermain Drawings:

- **WM-204.13** – Dimension 'D' for Watermains – Revised
- **WM-204.14** – New Drawing – Vertical Bend Anchor Block 45 for 400mm Dia. D.I. Watermain
- **WM-215.03** – New Drawing – Concrete Pipe Support Details for 750mm to 1200mm Dia. Watermains
- **WM-230** – Added waterproofing membrane.
- **WM-231** – Blow-off Valves added on both side of the line valves;
- **WM-236.01** – New Drawing – 3400mm x 4700mm Precast Valve Chamber for 750mm and 900mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valve
- **WM-236.02** – New Drawing – 3400mm x 4700mm Precast Valve Chamber for 1050mm and 1200mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valve

Standard Sewer Drawings:

- **SEW-300** – Added Granular 'A' for pipe bedding.
- **SEW-301** – Added Granular 'A' for pipe bedding.

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CONSTRUCTION AND MATERIAL SPECIFICATIONS MANUAL INDEX

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.01 DEFINITIONS AND INTERPRETATION

The following definitions shall apply:

.01.01 **"Approved Product List"** means the list of acceptable products and/or material approved for use within the City of Hamilton. Lists are issued on a ongoing basis and all references to approved products and materials lists shall be deemed to be to the most recent version.

.01.02 **"Contract"** means the agreement covering the performance of Work, including the supply of all Work, labour, services, materials, implements and equipment reasonably necessary for the proper and satisfactory execution and completion of the Work, and includes the Form of Tender, Plans, drawings, Specifications, bonds and any written supplementary agreements or written change orders issued by the General Manager.

.01.03 **"Contract Documents"** means all Tenders, Specifications, performance security, insurance, instructions to bidders, construction requirements, Contract For Works, special provisions, drawings and any and all Addenda and amendments related thereto and connected with the Work or project to be performed under the Contract.

.01.04 **"Contractor"** means the person, firm or company undertaking the execution of the Work under the terms of the Contract. Contractor shall be synonymous with Successful Bidder.

.01.05 **"City"** means the City of Hamilton, and where an authority or discretion is conferred upon the City under the Request for Tenders, means the appropriate official of the City as designated or appointed under its governing by-laws, resolutions or policies from time to time.

.01.06 **"General Manager"** means the General Manager of Public Works for the City of Hamilton or approved designate.

.01.07 **"Inspector"** means any person, partnership or corporation that the City or Project Manager may appoint for the purpose of assisting in the supervision and inspection of the Work and the materials to be used in the Work.

.01.08 **"Major Item"** means any individually bid item that has an actual cost, calculated on the basis of its actual or estimated tender quantity, whichever is the larger, and the unit price bid, equal to or greater than 5% of the total tender cost, calculated on the basis of the total of all the estimated quantities and the unit prices bid.

.01.09 **"Plans"** means any drawings or reproduction of drawings pertaining the Work.

.01.10 **"Project Manager"** means the person designated by the City to administer and oversee the Work.

.01.11 **"Site"** means the area at which the Work is to be carried out.

.01.12 **"Specification"** means all written or printed descriptions or instructions pertaining to the method and manner of performing the Work or to the quantities and qualities of the materials to be furnished under the Contract, and includes the Special Provisions, Supplemental Specifications, Standard Specifications, Approved Products, Form of Tender and General Conditions together with all written agreements, made or to be made pertaining to the method or manner of performing the Work, or to the quantities or qualities of materials to be furnished under the Contract. Ontario Provincial Standard Specifications and Ontario Provincial Standard Drawings in effect on the date that the Request For Tenders is issued.

.01.13 **"Sub-Contractor"** means a person, partnership, firm, syndicate, joint venture, or corporation undertaking the execution of a part of the Work by virtue of an agreement between himself and the Contractor, and who has independent control over the Work to be done under such agreement.

.01.14 **"Successful Bidder"** "Successful Bidder" means the bidder to whom the City has awarded the Contract.

.01.15 **"Tender"** means the Request For Tenders (RFT) for which these general conditions relate.

.01.16 **"Work"** means (unless the context requires a different meaning), the whole of the Work, materials, matters and things, required to be done or supplied, mentioned or referred to in the Contract Documents and Plans, or including all extra or additional requirements which may be ordered by the Project Manager.

Any Work or materials not herein specified, but which may be fairly implied as included in this Contract, and of which the Project Manager shall be the sole judge, shall be done or furnished by the Contractor as if such Work or material has been specified.

.01.17 **Clarifications**

01.17.01 In the Contract Documents, a word importing the masculine, feminine or neuter gender only includes members of the other genders;

a) a word defined in or importing the singular number has the same meaning when used in the plural number, and vice versa;

b) the provisions shall be read with such changes of number or corporate status as the context may require;

c) a reference to any Act, by-law, rule or regulation or to a provision thereof shall be deemed to include a reference to any Act, by-law, rule or regulation or provision enacted in substitution therefore or amendment thereof;

d) the headings to each section are inserted for convenience of reference only and do not form part of the Contract;

e) any reference to time shall be deemed to be a reference to Hamilton time;

f) all technical terms having a recognized meaning as a term of art in a relevant industry or trade shall be deemed to have that meaning in this Contract; and

g) all accounting terms have the same meaning as are applied to those terms by the Canadian Institute of Chartered Accountants;

h) any reference to an officer of the City shall be construed to mean the person holding that office from time to time, and also the designate or deputy of that person, and shall be deemed to include a reference to any person holding a successor office or the designate or deputy of that person.

01.17.02 The words 'approval', 'directed', 'required', 'considered necessary', 'authorized', 'acceptable', or 'satisfactory' or words of like import, means approval or directed, required, considered necessary, or authorized by and acceptable or satisfactory to the City or its consultant.

01.17.03 Except where otherwise defined, all terms that are defined in the Construction Act shall have the same meaning in the Contract Documents as in that Act.

01.17.04 Except where to do so would lead to an absurdity or a manifestly unfair result, the Contract Documents shall be deemed to be intended to be complementary, so that

(a) effect shall be given to each of them (i.e. provisions shall be considered to be repugnant only to the extent that they are inconsistent with each other); and

(b) what is required by any one shall be as binding as if required by all,

but in the event of inconsistency or conflict between two or more Contract Documents, they shall each have the priority as specified in 200.04.10.

.02 SCOPE OF THE WORK

.02.01 Notice to Proceed

The City may issue a written notice to proceed to the Successful Bidder prior to the execution of the Contract for Works.

Work under the Contract shall commence on the commencement date specified in the notice to proceed, unless otherwise agreed.

.02.02 Successful Bidder Responsibilities

It shall be the Successful Bidder's responsibility to co-ordinate, control and check work of its own forces and of all its Subcontractors and to ascertain that all work is done in accordance with all Contract Documents, governing regulations and good construction practice, is of first class workmanship, and that only proper materials and methods are suitable for the function or performance intended have been used.

The Successful Bidder shall be responsible for faithful and proper performance of all aspects of the Contract.

Without limiting the generality of any other provision of these conditions, unless otherwise provided in the Specifications or the special provisions, the Contractor shall be required to provide and pay for:

(a) all material, labour and service costs, charges for use of tools and equipment whether owned or rented, and where any work is to be carried out or services are to be rendered on property owned or occupied by the City, all protective and safety provisions, site signs and site conveniences, together with all cranes, scaffolding and shoring, freight costs, and material-handling and storing, and all services and incidentals whether shown or specified or required by good practice;

(b) all bonds or other accepted forms of bid, performance, and labour and material payment security, insurance, permits and inspections; all applicable taxes, worker's compensation and all other applicable labour-compensation charges necessary to carry out the project, make the supply and complete all Work in accordance with the Contract Documents;

(c) all services and materials required to carry out the Project, do all of the work and make all necessary or incidental supplies of goods, services, fixtures, construction components, landscaping and other finishing items, in each case fully in accordance with all Contract Documents and all instructions given by the City thereunder, and also in accordance with governing regulations and codes and in compliance with good industrial and commercial practice for first class workmanship, which in all instances, unless otherwise stipulated, shall be deemed to require work that has a finished appearance, is ready for use or occupancy and use for the purpose intended and is fully functional.

.02.03 Conformity of Work with Plans and Specifications

The Contractor shall perform all Work and shall supply all materials save and except those specified in the Contract Documents to be otherwise supplied and shall complete the whole of the Work all in strict conformance with the Plans and Specifications. Dimensions shall not be scaled from the Plans.

02.04 Supply of Materials

The Contractor shall supply all materials for this Contract unless specifically noted otherwise in the Contract Documents. All materials shall meet the Specifications as laid out in the Contract Documents and the appropriate Approved Product List, latest edition.

.02.05 Contractor's Investigations

The Contractor declares and represents that in tendering for the Work, and in entering into this Contract, they have either investigated for themselves the character of the Work to be done and all local conditions, including the location of any Public Utility which can be determined from the records or other information available at the offices of any person, partnership, corporation, including a municipal corporation and any board or commission thereof having jurisdiction or control over such Utility, that might affect their Bid or acceptance of the Work, or that, not having so investigated, they are is willing to assume and does hereby assume, all risk of conditions now existing or arising in the course of the Work which might or could make the Work, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the Bid was made.

The Contractor also declares that in tendering for the Work and in entering into this Contract they did not and do not rely upon information furnished by the City or any of its servants or agents respecting the nature or conformation of the ground at the site of the Work, or the location, character, quality or quantity of the materials to be removed, or to be employed in the construction of the Work, or the character of the equipment or facilities needed to perform the Work, or the general and local performance of the Work, under the Contract.

.02.06 Estimated Quantities

The estimated quantities set forth in the Tender documents are approximate only, and the basis of payment under this Contract, will be the actual amount of the Work done and material furnished, provided, that if the quantities of the Work to be done or material to be furnished under any item vary from such estimated quantities, the Contractor shall proceed with the Work but if such variation for a Major Item exceeds plus or minus 20% of the estimated quantity and if such variation materially increases or decreases the cost of the Work or material than either party to the Contract, upon the written request of the other shall as soon as reasonably possible, negotiate upward or downwards the compensation for the portion of the Work to be done or material to be furnished which is in excess of or
less than such estimated quantity plus or minus the 20% variation as the case may be.
The Contractor’s written request that the City negotiate the compensation shall be

made as prescribed by Section 200.02.08, for a notice of claim.

.02.07 Changes and Alterations

The Project Manager shall have the right, at any time before or during the prosecution of the Work, or before or after the execution of the Contract, to make or order in writing, any alterations or changes deleting, extending, increasing, decreasing, varying or otherwise altering any lines, grades, forms, dimensions, methods, Plans, materials, or the omission of any portion or portions of the Work, variations in any other way the Works Contracted for, or to order any additional or extra Work to be done or extra material to be furnished and the Contractor shall proceed with and carry out the Work as directed and shall supply such materials as directed, and shall do so without being entitled to any additional payment on account of any changes in Work or materials except as otherwise provided. The Contractor shall proceed with Work without delay and if they are of the opinion that they are is entitled to additional compensation, they shall make a written claim for additional compensation as prescribed by Section 200.02.08 herein. If, in the sole opinion of the Project Manager, such order or change materially increases or decreases the cost of the Work or materials from that on which the Contractor based their bid, other than estimated quantities, the Project Manager in his/her sole discretion may increase or decrease the Contract price by an amount or amounts they consider appropriate, and his/her decision shall be final. Nothing herein contained shall preclude City or the Project Manager from having extra, additional, or other Work done by the City Workers or other parties in the event of satisfactory arrangement therefore not having been concluded between the Project Manager and the Contractor or for any other sufficient reason in the sole opinion of the Project Manager.

.02.08 Extra Work

No Work or materials shall be regarded as extra to the Contract Work or materials unless approved in writing as an extra to the Contractor by the Project Manager with the method of payment for it by means of a mutually agreed unit price or a specified in "Section 300.39 Method of Payment of Extra Works by Force Account", provided that the price for the said extra to the Contract is not specified in the Contract.

Where the Contractor considers Work to be extra Work, they shall so notify the Project Manager in writing before proceeding with the Work. However, they shall proceed with the Work without delay on the direction of the Project Manager.

The Project Manager shall be the sole judge of whether any Work or materials are extra Work or materials, and his/her decision shall be final.

Should circumstances arise at any time which, in the Contractor's opinion, would entitle it to additional compensation, and which are not fully provided for herein, the Contractor shall at once, on discovery of such circumstances, notify the Project Manager in writing and shall state clearly and fully what the circumstances are. The claim for the additional sum or compensation shall be submitted within 30 days of completing the Work related to the claim.

.02.09 Claims

In case of the Contractor's neglect or failure to observe fully the conditions set out in this paragraph, they shall forfeit all right to payment therefore which it otherwise would have been entitled to and shall not make any claim in respect thereof, and if made, the Project Manager may reject the same as invalid, and the Contractor shall not have any right to recovery in respect thereof, at law or otherwise and such decision of the Project Manager shall be final.

.02.10 Cleaning Up Before Acceptance

Before any Work will be finally accepted by the City, the Contractor shall do such trimming and disposal of rubbish and surplus materials as to leave the Work neat and presentable throughout, in the opinion of the Project Manager.

.02.11 Acceptance of the Work

The Contractor shall notify the Project Manager in writing when, in the opinion of the Contractor, the Work has been satisfactorily completed in accordance with the Contract, and the Project Manager will then cause the Work to be inspected. When it is found by the Project Manager to be completed to their satisfaction, they will give Notice of Completion in writing to the Contractor and until then no partial or entire use or occupancy of the Work by the City shall be construed as acceptance of any or all of the Work.

.02.12 Scheduled Items of Work

Quantities quoted for the items in the "Schedule of Prices" are estimates only, and are for the purpose of indicating to Bidder’s the magnitude of the Work. For Work done on a unit price basis, the Contractor will be paid for the actual measured quantities at the respective unit prices bid.

Description of the items of the Work to be performed under the Contract, as set out in the "Schedule of Prices", are general in nature for the sake of brevity. It shall be the Contractor's understanding that all required Work shall be undertaken and performed by the Contractor as fully detailed in the Contract Documents.

.03 CONTRACTOR'S RESPONSIBILITY TO THIRD PARTIES

.03.01 Performance and Other Security

The Successful Bidder shall furnish a performance security and labour and material payment security to the City in the prescribed forms set out in the Construction Act, prior to the execution of the Contract for Work and within 10 Business Days of being notified that its Bid has been accepted in accordance with the following:

(a) the performance of the contract (a performance bond), **in an amount equal to 50% of the Base Bid Price excluding any contingency amount and all Value Added Taxes;** and

(b) the payment of all necessary services and materials required to complete the Contract in a satisfactory manner (a labour and material payment bond), in **an amount equal to 50% of the Base Bid Price excluding any contingency amount and all Value Added Taxes.**

A failure to provide any security described in subsection .03.01 shall:

(c) constitute a breach of the requirements of the Tender; and

(d) entitle the City to claim under any bid security described in the Instructions to Bidders Section 5; and

(e) allow Procurement to present a report to the Administration and Audit Committee recommending Council not accept any further bids from the Bidder for a specified period of time.

.03.02 Security and Deposit

The performance bond, maintenance bond, payment bond, or other bonds or cash or securities, deposited with the City, shall be held by the City to secure the due performance of all provisions of the Contract, including, without limiting the generality of the foregoing, the payment of all Sub-Contractors and materials suppliers with respect to this Contract.

.03.03 Insurance Requirements

At the time of execution of a Contract for the work, the Successful Bidder will be required to deposit with the City certificates of insurance or certified copies of policies of Commercial General Liability Insurance, Automobile Insurance and Property Insurance, together with such other coverages as may be applicable to the contract for the work. Such insurance coverages shall be obtained, maintained throughout the term of the contract (including any renewal thereof) and paid for by the Successful Bidder, including all costs for any applicable deductible. Coverages shall be in the amounts specified and otherwise in accordance with all other requirements set out in these General Conditions of the Contract and be in a form approved by the City.

.03.04 Commercial General Liability Insurance

Commercial General Liability Insurance, written on IBC Form 2100 or its equivalent, including but not limited to bodily and personal injury liability, property damage, products liability, completed operations liability, owners & contractors protective liability, blanket contractual liability, premises liability, and contingent employer's liability coverage, having an inclusive limit of not less than $2,000,000 per occurrence and in the aggregate and subject to the following;

(i) Where the work provides for or contemplates the handling of asbestos, coverage shall not contain an asbestos exclusion and same shall be noted on the certificate of insurance.

(ii) Where the Description of the Project, Supply or Work provides for or contemplates:

(I) the use of explosives for blasting or;

(II) vibration from pile driving or caisson work or

(III) the removal or weakening of support of any property, building or land whether such support be natural or otherwise.

Explosion, Collapse and Underground (XCU) coverages shall be added by endorsement and same shall be noted on the certificate of insurance.

(iii) Coverage shall be included for pollution from "hostile fires".

.03.05 Standard Form Automobile Liability Insurance

Standard Form Automobile Liability Insurance that complies with all requirements of the current legislation of the Province of Ontario, having an inclusive limit of not less than:

(i) Subject to paragraph (ii), $2,000,000 per occurrence;

(ii) where the Contract relates to the transportation of an explosive substance, snow removal or road construction, or will involve the use of one or more automobiles or any combination of automobiles and towed vehicles having in any case a combined aggregate weight of 10 tonnes or more before loading, $5,000,000 per occurrence,

for Third Party Liability, in respect of the use or operation of vehicles owned, operated or leased by the Contractor for the provision of services;

.03.06 Non-Owned Automobile Liability Insurance

Non-Owned Automobile Liability Insurance in standard form having an inclusive limit of not less than $1,000,000 per occurrence , in respect of vehicles not owned by the Contractor, that are used or operated on its behalf for the provision of services under the Contract;

.03.07 Builders Risk

Where the Description of Project, Work or Supply provides for or contemplates the construction of a building or structure, Contractor will provide Builders Risk insurance to cover the subject property;

(i) coverage shall be for the full amount of the Total Contract Price plus the full value of any optional features or other options that the City elects to order (but the City may require insurance up to the amount of the replacement cost of any building in structure in, on, or upon which any Work is to be done under the Contract, where in the reasonable opinion of the City's Manager of Risk Management there is a sufficient risk of damage to the same),

(ii) coverage shall;

(I) apply to all risks of direct loss or damage (including theft and sinkhole) but subject to any exclusions and limitations in the Special Conditions and the actual policy form;

(II) apply to all products, labour, equipment and supplies of every nature, the property of the City or Contractor or for which the City or Contractor may have assumed responsibility (whether on site or in transit), that is to be used in or pertaining to site preparation, and the erection, fabrication, construction, reconstruction, re-modeling or repair of any building, structure, other fixture or thing;

(III) include the installation, testing and any subsequent use of machinery and equipment, including boilers, pressure vessels or vessels under vacuum;

(IV) include damage to the Work caused by an accident to or the explosion of any boiler or other pressure vessel or equipment forming part of the Work;

(V) include off-site storage, transit and installation risks as indicated in the Installation Floater and Motor Truck Cargo insurance described hereafter, if such coverages are not separately provided

(VI) include flood and earthquake insurance if such risks exist.

include coverage for loss of income, extra expense and/or expediting expense is such exposures exist

(VII) be subject to a waiver of coinsurance

(VIII) be endorsed to grant permission to occupy.

(IX) be endorsed to cover the interests of all parties, including the City and all contractors and subcontractors

.03.08 Property Installation Floater All Risks Insurance.

Where the Description of Project, Work or Supply provides for or contemplates the supply and installation of fixtures, equipment, machinery, apparatus, etc., or other work such as minor renovations amounting to an improvement within the meaning of the *Construction Act* only, the Contractor shall provide a Property Installation Floater All Risks Insurance. The amount of coverage should be adequate to provide full replacement value of the property, repairs, additions or equipment being installed, otherwise being handled or stored on or off premises.

.03.09 Motor Truck Cargo or Transportation Insurance

If the Installation Floater insurance does not provide transportation coverage, separate Motor Truck Cargo or Transportation insurance All Risks is to be provided for materials or equipment transported in the Contractor's vehicles from place of receipt to building sites or other storage sites.

.03.10 Pollution Liability Insurance

Where requested by the City, Contractor to provide Contractors Pollution Liability Insurance covering the contractor's liability for bodily injury, property damage and environmental damage resulting from pollution and related cleanup costs incurred, all arising out of the work or services to be performed under this contract by or on behalf of the Contractor in an amount of not less than $2,000,000 per claim or per occurrence, which coverage shall be maintained in force for 12 months following the termination of this contract. Coverage shall be provided for both work performed on site, as well as during the transport of any hazardous materials if applicable. City of Hamilton shall be named as an additional insured.

.03.11 Property Insurance

The Contractor shall maintain Property Insurance, as may be applicable, with respect to loss or damage (including fire, theft, burglary, etc.) of its own property and property in its care, custody and control, including its equipment, tools, stock, used in connection with the Contract.

All polices of insurance policies shall:

(a) be recorded as being a primary policy and shall be in a form and issued by an insurance company satisfactory to the City, that is licensed to carry on business in Ontario;

(b) be maintained continuously during the course of carrying out the Project, Work or Supply; or for such period of time as may be required after

completion of the Project, Work or Supply, as deemed necessary by the City,

(c) provide for a deductible amount of no greater than $10,000; or such other amount as the City, at its sole discretion, may deem appropriate.

(d) (except in the case of automobile liability insurance, non-owned automobile liability insurance, professional errors & omissions liability insurance, and medical malpractice liability insurance) include the City named as an additional insured, to the extent of the Contractor's obligations to the City under the Contract Documents;

(e) contain cross liability and severability of interest provisions, as may be applicable;

(f) preclude subrogation claims against the City and any other person insured under the policy; and

(g) provide that at least 30 days prior written notice (15 days, in the case of automobile liability insurance, and 10 days in the event of non-payment of premiums) shall be given to the City by the Insurer before the Insurer or Contractor takes any steps to cancel, terminate, fail to renew, amend or otherwise change or modify the insurance or any part thereof.

The City reserves the right to require the Contractor to purchase such additional insurance coverage as the City's Risk Management Services Office may reasonably require. The City reserves the right to request such higher limits of insurance or otherwise alter the types of coverage requirements (taking into consideration such matters as the nature of the work, contract value, industry standards, and availability of insurance) as the City may reasonably require from time to time.

Any insurance coverage acquired under the Contract shall in no manner discharge, restrict or limit the liabilities assumed by the Contractor under the Contract. The dollar limit of insurance coverage shall not be limited by the dollar amount of the Contract.

The Contractor shall pay all premiums on the policies as they become due provided that the City may pay premiums as they become due and deduct the amount thereof from moneys due from the City to the Contractor should the Contractor fail to do so.

.03.12 Proof of Insurance and Claims Protocol

The Contractor shall deposit with the City such evidence of its insurance as provided in or required under the provisions of these Instructions, an Addendum or the Special Provisions,

a) at the time of execution of the Contract for Work (if any), or

b) in any event prior to commencing the Project, Work or Supply; and

and thereafter during the term of the Contract, no later than 20 Business Days prior to the renewal date of each applicable policy, the Contractor shall deposit with the City's Procurement Manager an original Certificate of Insurance originally signed by an authorized insurance representative, confirming thereon relevant coverage information including but not limited to name/description of City contract, name of Insurer, name of Broker, name of Insured, name of Additional Insureds as may be applicable, commencement and expiry dates of coverage, dollar limits of coverage, deductible levels as may be applicable, cancellation/termination provisions; or (at the City's election) a certified copy of the insurance policy or policies required under section 22. Certificate Holder will be addressed as the City Of Hamilton, City Hall, 71 Main Street West, Hamilton, Ontario L8P 4Y5. All certificates, cancellation, nonrenewal or adverse change notices should be mailed to this address.

The Contractor shall not do or omit to do anything that would impair or invalidate the insurance policies. Delivery to and examination or approval by the City of any certificates of insurance or policies of insurance or other evidence of insurance shall not relieve the Contractor of any of its indemnification or insurance obligations under the Contract. The City shall be under no duty either to ascertain the existence of or to examine such certificates of insurance or policies of insurance or to advise the Contractor in the event such insurance coverage is not in compliance with the requirements set out in the Contract.

Claims reported to the Contractor by a third party or by the City shall be promptly investigated by the Contractor. The Contractor shall make contact with the Claimant within 48 hours of receipt of notice of a claim. The Contractor shall initiate an investigation of the claim immediately upon notice, and advise the Claimant by letter of its position regarding resolution of the claim within 20 Business Days of the notice. The Contractor shall include in its letter of resolution the reasons for its position. Failing acceptance of the resolution by the Claimant of the proposed resolution, the Contractor agrees to report the claim to its Insurer for further review and response to the Claimant. Failure to follow this procedure shall permit the City to investigate and resolve any claims and offset the resultant costs against any monies due, from time to time, under the Contract.

Upon the receipt of a third party claim notice from the City's Risk Management Services Section, the Contractor shall:

a) Acknowledge receipt of the notice by way of a facsimile or e-mail back to Risk Management Services within 5 business days. The acknowledgment will indicate that the Contractor has received the claim and will include all pertinent contact information for the company individual responsible for the claim.

b) Provide Risk Management Services with an initial status update within the first 30 days of receipt of the claim notice.

c) Provide Risk Management Services with a status update upon request at any time as Risk Management Services deems necessary. This update should be provided within 10 business days of receipt of the request.

d) Provide a closing report to Risk Management Services promptly at the conclusion of a claim

Template's for initial/interim/closing reports will be provided by the City prior to the start of any work.

.03.13 Indemnification

The Contractor shall indemnify and shall defend and save the City, its elected officials, officers, and employees harmless from and against any claims, proceedings, fines, penalties, expenses and costs (including legal costs on a solicitor and client basis) that are incurred by, or made or instituted against, any of them or to which any of them may be liable by reason of,

(a) The Contractor carrying out or failing to carry out any obligation to which it is subject, or exercising any right to which it is entitled, under the Contract except to the extent that the same are caused by the negligence or deliberate wrong-doing of the City or other person entitled to indemnification under this section, or

(b) Any patent, trademark, copyright infringement or other breach of any intellectual property right of any person, for which the Contractor or any subcontractor to the Contractor is responsible.

The right of indemnification granted to the City or other person entitled to indemnification under subsection (1) shall extend to any amount paid by that person in the settlement of any claim against it, and in entering into any such settlement, that person may exercise its reasonable discretion as to the amount to be paid, but that person shall serve prior notice of any intended settlement on the Contractor, at least 5 Business Days prior to agreeing to any such settlement.

The City may enforce the rights of indemnity conferred on the elected officials, officers, and employees of the City under subsection (1) on their behalf and to the same extent as if they were parties to the Contract.

The rights to indemnity provided for in this section shall be deemed to be in addition to any rights with respect to insurance in favour of the City, its elected officials, officers and employees provided under the Contract Documents.

The rights to indemnity provided for in this section shall survive the expiration or any termination of the Contract.

.03.14 Notices by the Contractor and Observance of Laws, Statutes and Regulations

The Contractor shall give notice of the date of commencement of the Work to any department or Agency of the Provincial or Federal government and to any person, partnership or corporation, including a municipal corporation and any board or commission thereof who may be affected by the Work at least two (2) weeks in advance of such date. The Contractor shall obtain their own expense, all licenses or permits required by all by-laws or Statutes, and Regulations made thereunder.

The Contractor shall give reasonable notice to any department or agency of the

Provincial or Federal government and to any person, partnership or corporation, including a municipal corporation and any board or commission thereof, who may be affected by the Work, before any blasting operations are carried out.

In the event of accidental damage to, or interference with any utilities, pole lines, pipe lines, farm tile or other public or other privately owned Works, the Contractor shall immediately notify the owner of the location and details of such damage or interference.

The Contractor shall post prominently and maintain on the site of the Work and wherever else the Project Manager may require, legible copies of any notice

schedule or other information that it is required to post under this Contract or any Statute, Regulation, by-law or agreement.

.03.15 Assignment and Sub-Letting

The Contractor shall not assign, transfer or sub-let the whole or any portion of this Contract, or the whole or any portion of the Work to be performed under this Contract, without the consent in writing of the Project Manager and the Contractor shall not transfer or assign any monies which may be due or which may become payable under this Contract without the consent in writing of the Project Manager, provided that any consent so given, shall not under any circumstances, relieve the Contractor of any of the liabilities or obligations assumed by them under this Contract.

.03.16 Patents and Copyrights

The Contractor shall indemnify and save harmless the City from all and every claim for damages, royalties, or fees for the infringement of any patented invention or copyright occasioned by the Contractor in connection with Work done or material furnished by the Contractor under this Contract.

.03.17 Contractor's Responsibility for Losses and Damages

The Contractor, it's agents and all Workers and persons employed by it, or under it's control, or employed by or under the control of Sub-Contractors, shall use due care that no person or property is injured, and the Contractor shall be solely responsible for all damages by whomsoever claimed in respect of any such injury. The Contractor shall at it's own expense make such temporary arrangements as may be necessary to ensure the avoidance of any such damages or injury and to prevent the interruption of or danger to vehicular or pedestrian traffic on any railway or any public or private road allowance.

The Contractor will indemnify and save harmless the City from and against all actions, suits, claims and demands whatsoever of all persons whomsoever, which may be brought against or made upon the City, and for all loss, expense, costs, charges, damages, indemnities and/or liability which may be sustained, paid or incurred by the City by reason of or in consequence of this Contract, however caused.

All loss or damage occasioned to the Work or arising out of the nature of the Work

to be done, or from the normal action of the elements or from any reasonably foreseeable circumstance in the prosecution of the same, or from any normal obstruction or difficulties which may be encountered in the prosecution of the Work, having regard to the nature thereof, shall be sustained and borne by the Contractor at their own expense, and all material required to replace any defective or rejected Work, or to restore any failure shall be at the expense of the Contractor.

Notwithstanding the indemnity provision contained in this section, where in the opinion of the Project Manager, the Contractor has failed to rectify any damage, or injury or infringement or has failed to adequately compensate any person for any damage, injury or infringement for which the Contractor is responsible to the Contractor of its intention so to do, may withhold payment of monies due to the Contractor under this or any other Contract with the Contractor until the Contractor has rectified such damage, injury or infringement or has paid satisfactory compensation for such damage, injury or infringement.

.03.18 Obstructions and Utilities

Except as otherwise provided in this section, the Contractor assumes all the risks and responsibilities arising out of any obstruction on or under the road allowance and any traffic conditions caused by such obstruction including traffic conditions on any highway or road giving access to the Contract area and they shall not make any claim against the City for any loss, damage or expense occasioned thereby.

Before commencing Work the Contractor shall notify all owners of utilities, pipes, structures or other obstructions, sewers and watermains excepted, either under, on or above the surface within or adjacent to the Work area and request their accurate field location.

It is the Contractor's responsibility to co-ordinate it's proposed Works with any Work required by utilities. The Contractor shall make all reasonable efforts to schedule and co-ordinate it's Work to avoid delays.

.03.19 Labour Disputes

The Contractor shall bear the risk and responsibility of any loss, damage or expense to the Work or to themselves of any nature and kind whatsoever, arising from strikes or labour disputes.

.03.20 Plans and Working Drawings

The Contractor shall submit to the Project Manager for approval any shop Plans and working drawings which are not furnished by the City and which may be required for any part of the finished Work and the Contractor may be required to submit for the Project Manager's approval, working drawings for any falsework, forms or other incidental details of construction required in the construction, but not required as part of the finished Work.

It is expressly agreed that neither the provisions of Plans, shop drawings and/or working drawings by the Project Manager or the City nor the approval by the Project Manager of any Plans, shop drawings and/or working drawings submitted by the

Contractor, shall relieve the Contractor from any responsibility for the adequacy or soundness of such Plans, shop or working drawings or such Work, or for any deviation from such Plans, shop drawings, working drawings or Specifications.

.03.21 Explosives and Blasting

The Contractor shall comply with all laws respecting the handling, storage and use of explosives.

In addition to any other precaution that may be necessary, the Contractor shall, immediately prior to a blast, clear the blasting area of all residents, vehicular and pedestrian traffic, and shall post flagmen on each road entering the blasting area, who shall stop all traffic and shall prevent such traffic from entering the area until the blasting has finished. The Contractor shall provide and use a siren or whistle to warn the public and the workers that a blast is to be set off and to indicate the "all clear" after the blast has taken place. Four short soundings of the siren or whistle, two minutes before detonation of a blast shall be used for warning and for protection, and one long ten to fifteen second sounding of the siren or whistle shall be used to give the "all clear".

Notwithstanding any direction of the Project Manager in regard to explosives, drilling or methods of blasting used, the Contractor shall take all precautions necessary to ensure that persons are not injured and that property and the structures, including public utilities are not damaged. Without limiting the generality of Section 200.03.17, the Contractor shall be responsible for all claims whatsoever arising from the hauling, handling, use of or storing of explosives and all effects direct or indirect of the blasting operation.

No payment shall be made by the City for protective measures or for damages to persons or for damages or repairs to property, structures, or public utilities, or for any claim whatsoever arising from blasting operations.

The Contractor shall employ, at it's own expense, the services of a specialist experienced in seismic investigations to determine and control the permissible intensity of vibrations which will result from blasting operations. Investigations shall be carried out by the Contractor and the specialist before any rock excavation is started in order to determine the maximum explosive charges that can be used at different locations throughout the area of rock excavation. The Contractor shall submit a report to the Project Manager outlining the results of the investigations and tests made and detailing the control required during blasting throughout the area of rock excavation.

Further seismic reading shall be taken by the specialist during blasting operations. Such readings shall be continuous and shall be taken where buildings and structures are located within 60 metres of the blasting area.

Within the area of the above buildings and structures the monitoring equipment shall be placed to obtain representative readings. As construction proceeds, the monitoring equipment shall be repositioned on an on-going basis.

In addition to the above, vibrations generated shall not exceed a vibrational peak

particle velocity of 50 mm per second when monitored at the nearest building or structure.

If the monitoring station is not at the nearest structure, then the allowable particle velocity shall be reduced in accordance with the increased distance from the blast and shall be determined by the blasting specialist.

Additional monitoring and readings shall be obtained in other sensitive areas where the pre-blast survey indicates the need.

The Contractor and specialist shall visit the Owners of properties and buildings where tests and/or investigations are required and shall describe blasting and seismic investigations to them and obtain their permission to carry out the necessary investigations and notify them of the blasting schedule.

The Specialist will be an advisor to the Contractor and the acceptance of their reports and recommendations by the Project Manager will in no way relieve the Contractor of any responsibility for damage or injury by blasting.

All costs incurred by the Contractor in the employment of the specialist in seismic investigations shall be deemed to be included in the items in the Contract under which any rock excavation is required.

.03.22 Claims - Follow Up Procedure

The Contractor shall retain an independent adjuster who will determine the Contractor's liability for all third party claims and advise the claimants in writing of the determination of liability within thirty (30) days of service of the claim on the Contractor.

If the Contractor's independent adjuster fails to determine the liability for any of the third-party claims as noted above, the City reserves the right to have an independent adjuster review the claim and determine liability therefore. Any monies paid by the City in satisfaction of any third-party claim determined to be the Contractor's liability plus all associated costs will be deducted from monies owing to the Contractor by the City.

.03.23 Construction Liaison Committee

Upon the request of the Project Manager, the Contractor shall participate in a Community Construction Liaison Committee.

This committee may consist of local residents, the Contractor and City representative(s) and shall meet on a regular basis to discuss issues related to the Work being performed by the Contractor. In these cases, the City, and the Contractor will aid the local residents in establishing a Community Construction Liaison Committee.

.04 CONTROL OF WORK

.04.01 Project Manager's Authority

The Project Manager may supervise all Work included herein and shall determine the quantities, quality, acceptability and fitness of the several kinds of Work and materials which are to be paid for under this Contract, and determine all questions relating to the said Work and materials and the construction thereof. The Project Manager shall in all cases be the sole judge of all questions of fact which may arise in respect to the Contract, including, but not so as to limit the generality of the foregoing, all claims by the Contractor and all questions relating to the execution and progress of the Work, the supplying of materials and the interpretation of the documents comprising the Contract. The Project Manager's decision shall in all cases be final.

The Project Manager has authority to stop the progress of the Work or any part or parts thereof in an emergency or whenever in it's opinion such stoppage may be necessary to ensure the safety of life, or the structure, or neighbouring property, or whenever in his/her opinion the Work or any parts thereof is being carried out in an unsatisfactory manner, and the City shall not be responsible for any loss, expense, costs, charges, damages, indemnities and/or liability which may be sustained, paid or incurred by the Contractor, any other Contractor or Contractors, any Sub-Contractor or Sub-Contractors or any other person or persons by reason of such order to stop by the Project Manager.

If the Contractor should neglect to prosecute the Work properly or fail to perform any provision of this Contract, the City after five (5) days written notice by the Project Manager to the Contractor, may without prejudice to any other right or remedy the City may have, make good such deficiencies and may deduct the cost thereof from any monies then or thereafter due the Contractor.

Notwithstanding any other provisions in the Contract, in case of immediate danger to public safety, the City may take such emergency measures or may cause such immediate corrective repair Work to be done as the Project Manager deems necessary under the circumstances and shall notify the Contractor of the City's action, in writing, as soon as possible.

The cost of such emergency Work shall be borne by the Contractor, and the cost shall be deducted, collected or recovered by the City as provided in the Contract and in the Performance of Contract Security.

.04.02 Inspector's Authority

Inspectors of the City shall see that the provisions of the specifications are faithfully adhered to, especially with regard to the quality of workmanship and materials. Work done in the absence of an Inspector may be ordered to be opened-up for thorough examination, and if unacceptable, must be rebuilt or replaced as directed, at the Contractor's sole expense. Approval by an Inspector shall not be taken as, or construed into, an acceptance of defective or improper Work or materials, which must be removed and properly replaced whenever discovered at any stage of the Work. Directions given by Inspectors relating to the quality of material and workmanship, shall be obeyed at once by the Contractor. Inspectors do not have the power to set out Work or give any stakes, lines gauges, levels, or grades. Any orders or directions given by the Inspector, other than as herein provided for, shall

not be binding upon the City.

The Inspector is responsible for public relations on the project site. The Contractor must restrain it's employees from giving unauthorized information and shall refer all inquiries from whatever source, relating to the Works to be undertaken within the scope of the Contract, to the Inspector.

.04.03 Inspection

The Contractor shall at all times and at it's own expense furnish all reasonable aid and assistance required by the Project Manager or Inspector for the proper inspection and examination of the Work or any part thereof. The Contractor shall, at it's own expense, furnish samples for testing when required and shall furnish all reasonable facilities for the inspection of material and workmanship. The Contractor shall obey the directions and/or instructions of the Project Manager or his/her authorized representatives such directions and/or instructions and they shall be made in writing at the request of the Contractor.

Notwithstanding any inspection that the City might carry out, the failure of the Project Manager or the Inspector to condemn or object to any defective Work or material shall not constitute a waiver of any Specification or approval or acceptance of such defective Work or material and except as otherwise expressly provided herein the Contractor shall be and remain liable within the terms of the Contract for such defective Work or materials, any losses, damages, costs, charges or expenses in connection therewith.

.04.04 Superintendence

The Contractor shall at all times have on the Work as it's agent a competent superintendent or foreman capable of reading and thoroughly understanding the Plans and Specifications and of adequately communicating with the Project Manager and their representatives, and thoroughly experienced in the type of Work being performed who shall receive instructions from the Project Manager or his/her authorized representatives. The superintendent or foreman shall have full authority to execute the orders or directions of the Project Manager without delay,
and to promptly supply such materials, equipment, tools, labour and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of Work sub-let.

The Project Manager shall be provided, to his/her satisfaction, with the address and telephone number of the Contractor's representative who may be contacted and available within reasonable notice 24 hours a day, 7 days a week, on matters relating to this Contract.

.04.05 Methods and Sequence of Work

Before starting the Work the Contractor shall submit in writing to the Project Manager, their proposed methods and sequence of Work and shall obtain approval thereof and such approval shall not relieve the Contractor of any of their duties and obligations under this Contract.

The Contractor must notify the City at least one full week prior to the scheduled start of the Contract in order that the necessary inspection forces and traffic control procedures can be established.

Within seven (7) days of the award of this Contract, the Successful Bidder shall submit Three (3) copies of a construction schedule bar chart for approval by the Project Manager. This chart shall show clearly the proposed dates of commencement and completion of each major phase of the Work.

The Contractor will be required to employ a sufficient number of working crews to complete the Work within the working time specified in the Contract Documents.

.04.06 Quality of Materials

All materials supplied by the Contractor shall be new, shall conform to the requirements of the Specifications and be approved by the Project Manager prior to use in the Work.

Where required by the Project Manager, the Contractor shall furnish a complete written statement of the origin, composition and manufacture of all materials to be supplied by it and shall furnish samples thereof for testing purposes. The Contractor shall not change the source of supply of materials without the prior written authorization of the Project Manager.

Approval of any materials by the Project Manager shall not be considered as waiver of objection to the Work or materials at any subsequent time, due to their failure to conform with the Specifications.

.04.07 Modifications of Methods and Equipment

The Contractor shall furnish for the Project Manager's approval, such materials tests, mix designs and tests of items manufactured or fabricated off the job site as the Project Manager may require.

The Contractor shall make such alterations in it's method, equipment and working forces as the Project Manager in writing directs if at any time the method or equipment or working forces are found by the Project Manager to be unsafe or inadequate to ensure the protection, safety, or quality of the Work or to ensure a rate of progress sufficient in the opinion of the Project Manager to complete the Work within the time limit specified under the Contract, but notwithstanding the foregoing, the onus is on the Contractor to ensure that such required safety protection, progress and quality of the Work is maintained.

.04.08 Defective Work and Materials

The Contractor shall correct or replace any defective Work or material supplied by them, at it's own expense, upon the direction of the Project Manager.

If the Contractor should refuse or neglect to remove any defective Work or material supplied by it in accordance with a written notice from the Project Manager, such Work or material may be removed by order of the Project Manager, at the

Contractor's expense, and in addition to any other remedies available to the City, to recover the cost and expense of such removal, the City may deduct the cost and expense of such removal from any monies due to or to become due to the Contractor on any account.

.04.09 Deviation from Plans

The Contractor shall not deviate from the approved Plans, Specifications, or working drawings without the prior written consent of the Project Manager.

.04.10 Conflicts and Omissions

The documents comprising the Contract are complementary and what is required by any one of them shall be as binding as if required by all of them. The Contractor shall do all Work and furnish all materials in accordance with the best Construction and Engineering practices. In the event of a conflict between them, each shall enjoy priority against the others (subject to any express term or condition to the contrary) in accordance with the following successive order:

(1) Contract For Work
(2) Addenda
(3) Special Provisions
(4) Plans
(5) Specifications
(6) standard drawings and standard specifications
(7) Form of Tender
(8) General Conditions – Form 200
(9) General Construction Requirements – Form 300
(10) Supplementary Instructions to Bidders
(11) Instructions to Bidders

Neither party to the Contract shall take advantage of any apparent error or omission in the Plans or Specifications, but the Project Manager shall be permitted to make such corrections and interpretations as may be necessary for fulfilment of the intent of the Plans and Specifications. Any Work material not herein specified but which may be fairly implied as included in this Contract, of which the Project Manager shall be the sole judge, shall be done or furnished by the Contractor as if such Work or material had been specified and the Project Manager's decision shall be final.

.04.11 Lines, Levels and Grades

The City will provide the locations of published vertical bench marks and horizontal control points to the Contractor. The Contractor shall employ at it's own expense a qualified person who shall establish all other necessary lines, elevations and grades, and shall erect required batter boards and sight lines necessary to construct all proposed Works under the Contract. All monuments and reference stakes shall be placed so as to be undisturbed during excavation operations, and subsequent construction. The name of the person who is going to do this Work, their

qualifications and experience must be submitted to the Project Manager for approval.

From time to time, the above mentioned person shall verify by an instrument, base lines, bench marks and all other reference marks and the Contractor shall be responsible for the accuracy of all lines and levels and of the Work as built in accordance therewith.

The Project Manager may, at any time, check the lines, elevations, grades, batter boards and any other reference marks, set by the person employed by the Contractor, and the Contractor shall correct any errors disclosed by such check.

Such check shall not be construed to be approval of the Contractor's Work and shall not relieve the Contractor of the responsibility for the accurate construction of the entire Work.

In the event that the Contractor elects to use laser equipment to establish reference marks for any portion of the work, the Contractor shall provide the Inspector with the means of checking grades and/or reference marks including but not limited to batter boards or other means as may be approved by the Project Manager.

.04.12 Right of Entry

At any time during the currency of this Contract, the City, it's Contractors, employees or agents, may enter the property or location for the purpose of constructing or installing such collateral Works as the City may desire, and the Contractor shall not interfere with or prevent the construction of such collateral Works.

.04.13 Notice to Contractor

Any notice in writing to be given to the Contractor in relation to any matter arising under the Contract or in respect of the Work to be done hereunder may be given by delivering same to the Contractor, or the Contractor's representative, for the time being, or by mailing the same addressed to the Contractor at such address as it may have specified in their Bid and in default of any such address being so specified, such notice shall be deemed to have been given at the time of mailing of such notice to the last address which the City may have for the Contractor.

.04.14 Notice to City

Any notice to be given to the City may be served personally or by prepaid registered mail upon the Project Manager.

.04.15 Hindrances and Delays

The Contractor shall upon written notice from the Project Manager, discontinue or delay any or all of the Work when in the opinion of the Project Manager it is unwise to proceed for any reason whatsoever, and the Work shall not be resumed until the Project Manager shall in writing so direct.

When the Work under this Contract is for any reason discontinued, and will not be resumed until the following working season, or for any extended period, the Contractor shall, when directed by the Project Manager, open and place the roadway in a passable, safe and satisfactory condition for public travel, and the roadway shall not again be closed to pedestrian or vehicular traffic thereon or be obstructed without written authority of the Project Manager.

.04.16 Character and Conduct of Employees

The Contractor shall employ only orderly, experienced and competent persons to do the Work and should the Project Manager inform them in writing that any person or persons on the Work, are in the opinion of the Project Manager, inexperienced, incompetent or disorderly such person or persons shall be discharged from the Work and shall not again be employed on the Work without the consent in writing of the Project Manager.

The Contractor shall neither permit, nor allow the introduction or use of alcoholic liquors or beverages upon or about the Works in this Contract, or upon any of the grounds occupied under this Contract by them.

.04.17 City Office Closures

The Contractor shall not carry on it's operations under any Contract on Sundays, holidays or any days on which the City's administrative offices are closed, without the prior written permission of the Project Manager.

.05 PROSECUTION AND PROGRESS

.05.01 Time - The Essence of the Contract

Time shall be of the essence of this Contract.

.05.02 Commencement and Completion

The Work shall be commenced on the commencement date specified in the Notice to Proceed, and shall be continuously and with utmost diligence and dispatch carried on to completion unless otherwise provided in the Contract, and shall be completed and full possession given to the City within the time allowed in the Special Provisions, said time to commence on the commencement date specified in the Notice to Proceed, unless a longer time shall be allowed in writing by the Project Manager, in which case the Contract shall be carried on to completion and possession given to the City within the additional time as allowed.

.05.03 Non-Fulfilment of the Contract

If the Contractor fails or neglects to commence the Work or to prosecute the Work diligently and at a rate of progress that in the opinion of the Project Manager, will ensure the entire completion of the Work within the time limited therefore under this Contract; or should the Contractor become bankrupt or insolvent, or commit any act of insolvency, or bankruptcy, or abandon the Work or fail to observe and perform

any of the provisions of this Contract, of which the Project Manager shall be the sole judge, or should the Contractor default in the completion of the Work within the time or extended time limit therefore under this Contract or if the Work or any part thereof, is not progressing continuously and in such a manner as to ensure its entire completion, in the opinion of the Project Manager, within the time stipulated for completion, or if the Contractor fails or refuses to remedy any

defective or unsatisfactory Work or remove any defective material or cease any unsatisfactory Work when so ordered by the Project Manager or to comply with any reasonable order of the Project Manager, or if the Contractor shall persist in any course of action in violation of any of the provisions of this Contract, then in any or all of such cases, the Project Manager may notify the Contractor to discontinue all Work under the Contract, and the City may then employ such means as it may deem necessary to complete the Work, including exercising any right of the City under the Performance of Contract Security, and in such case the Contractor shall remain liable for all losses, damages, expenses, or costs which may be suffered by the City by reason of such delay and/or default by the Contractor. If the said losses, damages, expenses, or costs exceeds the sum which would have been payable under this Contract, if the same has been completed by the said Contractor, the Contractor or their surety, or both, shall pay the amount of such excess to the City or such amount or any portion thereof may be deducted from any monies due or to become due to the Contractor under this Contract.

All property, materials, articles and things whatsoever, including all machinery, tools, plant and equipment, and all rights, proprietary or otherwise, licenses, powers and privileges, whether relating to or affecting real or personal property, acquired, possessed or provided by the Contractor or by the City for the purpose of the Work shall be the property of the City and may be used, exercised and employed by the City as fully as they might have been used, exercised and employed by the Contractor, and the City may sell or otherwise dispose of at public auction, or private sale or otherwise, the whole or any portion or number of such property, materials, articles and things, at such price or prices, as it may deem fit and retain the proceeds of any sale of disposition and all other amounts then or thereafter due by the City to the Contractor on account of or in part satisfaction of any losses, damages, expenses or costs which the City may sustain or have sustained by reason of any delay or default or defect aforesaid.

.05.04 Extension of Time

An extension of time for completion of the Work or part thereof under this Contract may be granted in writing, by the Project Manager in the event of delay caused by strikes on the part of the workers employed, or by any act of the City, or any combination thereof or from such other cause as is beyond the Contractor's control, or in the event of extra or additional Work being ordered by the Project Manager. Such extension shall be for such time as the Project Manager may prescribe as being fair and reasonable, and the Project Manager shall fix the terms on which the said extension may be granted. An application for an extension of time as herein provided shall be made in writing by the Contractor to the Project Manager at least fifteen (15) days prior to the date of completion fixed by the Contract. Any additional

time granted for the completion of the Contract will be conditional upon the Contractor providing the City with evidence that all bonds or other securities, furnished to the City by the Contractor have been increased and extended at least to the limit of the time extension. Any extension of time that may

be granted to the Contractor shall be so granted and accepted without prejudice to any rights of the City whatsoever under this Contract, and all of such rights shall continue in full force and effect after the time limited in this Contract for the completion of the Work and whenever in this Contract, power and authority is given to the City or the Project Manager or any person to take any action consequent upon the act, default, breach, neglect, delay, non-observance or non-performance by the Contractor in respect of the Work or Contract, or any portion thereof, such powers and/or authorities may be exercised from time to time and not only in the event of the happening of such contingencies, before the time limited in this Contract for the completion of the Work, but also in the event of the same happening after the time so limited in the case of the Contractor being permitted to proceed with the execution of the Work under an extension of time granted by the Project Manager. In the event of the Project Manager granting an extension of time, time shall continue to be of the essence of this Contract.

.06 PAYMENT

.06.01 Price for Work

Unless otherwise provided in the Contract, the Contractor shall accept the compensation as herein provided in full payment for furnishing all necessary labour, materials, services, taxes, tools, equipment, supplies, light, power, water and other incidentals, and for performing all Work under the Contract.

.06.02 Prices and Payments

A Progress Payment Certificate will be given by the General Manager of Public Works Department using the Contractor's invoice as a guide only, once a month, as to the estimated amount of Work done and material furnished to the satisfaction of the General Manager of Public Works Department and of the value thereof in the opinion of the General Manager of Public Works Department according to the terms of the Contract. The City will pay to the Contractor 90 percent of the

amount shown on such certificates, less previous payments and the amount of any liens (plus 25% for security for costs) of which the City has notice and any amounts that the City deems necessary to retain for its protection against claims or liabilities or for any claim or claims the City may have, or have notice of, against the Contractor under this Contract, other Contracts, or otherwise and such payments shall not in any way be construed as an acceptance of all or any part of the Work or material under this Contract.

The parties agree that the City has the contractual right to set-off against any amounts owing by the City to the Contractor under this Contract, any amount owed to the City by the Contractor, whether such amount arises from this Contract or under any other contract between the City and the Contractor, irrespective of

whether or not those contracts are related or arise at equity or law. This right of set-off shall be subject to the Construction Act, as applicable.

Along with the Contractor's notification of completion of the Work as per Section 200.02.11, the Contractor shall submit, in quadruplicate, a Completion Invoice addressed to the General Manager of Public Works Department.

If the Work has been completed to the satisfaction of the Project Manager, subject to and upon such approval, and subject to a current Workplace Safety and Insurance Board Certificate, a Completion Payment Certificate will be issued to the Contractor. Payment shall then be made in an amount equal to the amount of the said certificate less 10 per cent holdback and less all amounts previously paid to the Contractor, provided that the City may retain any proportion or all of such payment that it deems necessary for its protection against claims, liabilities, damages, or costs or for any claims that the City may have or have notice of against the Contractor under this Contract or other Contracts or otherwise. Within one calendar month after the issuance of the Completion Payment Certificate, the Contractor shall notify the Project Manager of any errors or omissions herein.

Hold Back Monies Will Be Released On The Following Basis:

Substantial Performance

Holdback monies will be released no earlier than sixty (60) days after the date the Contractor publishes the Certificate of Substantial Performance in accordance with the Construction Act, as amended from time to time, and satisfactory evidence thereof has been submitted to the City.

Substantial Performance and Certificate of Substantial Performance shall have the same meaning as set out in the Construction Act, as amended from time to time.

Contract Completion

A Final Payment Certificate for any balance of holdback monies due, less any liens (plus 25% of any such liens for costs) which the City has notice and less any amounts that the City deems necessary to retain for its protection against claims, liabilities, damages or costs for any other claims the City may have against the Contractor otherwise, and such payment shall not in any way be construed as an acceptance of all or any part of the Work or material required under this Contract.

The final Payment Certificate will become due and payable sixty (60) days after date of acceptance of the entire Work.

The Contract shall be deemed to be completed and services or materials shall be deemed to be last supplied to the improvement when the price of completion, correction of a known defect or last supply is not more than the lessor of,

a) 1% of the Contract Price; or

b) $5,000.00

The Final Payment Certificate will be released only after satisfactory evidence has been given to the City that Section 32 of the Construction Act, as amended has been complied with.

Contingency Allowance

Where a contingency allowance is provided for in any of the Contract Documents, the Successful Bidder shall not be entitled to payment of the whole or any part of that amount, except to the extent that it can be shown that extra or additional work has been carried out by the Successful Bidder beyond that contemplated within the Contract Documents, and that a Change Order has been issued by the Project Manager entitling the Successful Bidder to receive such payment.

.06.03 Contractor's Discharge of Liabilities

The Contractor shall discharge all liabilities incurred by it for labour, materials or services, used or reasonably required for use in the performance of this Contract on the date upon which each become due.

The Contractor shall cause each Sub-Contractor engaged in the performance of this Contract to discharge all liabilities incurred by such Sub-Contractor for labour, materials, or services used or required for use in the performance of this Contract. Workers employed by a Sub-Contractor shall be paid in full at intervals not less frequently than semi-monthly and other liabilities of the Sub-Contractor, as aforesaid, shall be discharged on the date upon which each becomes due. At the request of the City, the Contractor shall furnish the City with evidence satisfactory to the City that the Contractor's liabilities and those of its Sub-Contractors as aforesaid have been discharged and this shall include a Certificate of Clearance or statement of status from the Workplace Safety and Insurance Board (WSIB) that the Contractor has complied with the requirements of the Workplace Safety and Insurance Board and is in good standing before the Board. Further, the Contractor shall immediately advise the City if there is any change in the Contractor's status with the WSIB and provide the City with the necessary certificate or statement associated therewith.

No payment to which the Contractor is otherwise entitled under this Contract shall, in the discretion of the Project Manager, be due and payable to it so long as it or any of such Sub-Contractors are in default under this Section. Upon such default occurring, the Project Manager may notify the Contractor to discontinue all Work under the Contract and the City shall have the same rights and privileges as are provided in Section 200.05.03 of these General Conditions. The City, after notice in writing to the Contractor and/or it's Surety, may pay any such liability of the Contractor and of the Sub-Contractors, as aforesaid, and deduct the amount so paid from any monies due or that may become due to the Contractor on any account, and, if there are insufficient monies due or to become due to the Contractor to permit of such deduction, the Contractor shall pay to the City upon demand, an amount sufficient to make up the deficiency. In making payments under this Section the City may act upon any evidence that it deems sufficient and may compromise any disputed liability and such payment should not be open to dispute or question by the Contractor or the surety, if any, but are final and binding upon them.

.06.04 Construction Claims Holdback Provision

The City reserves the right to withhold funds from payment to the Contractor in the event the Contractor fails to satisfy the claims handling requirements as specified in 200.03.12 and/or if it is evident that the Contractor is not responding to the claim in a legitimate manner.

The amount of the holdback will based on an assessment by Risk Management Services of damages claimed in addition to potential investigation and administration costs.

.06.05 Workplace Safety and Insurance Board Certificate of Clearance (WSIB)

The Contractor shall supply the following to the City prior to the execution of the Contract for Works or before commencing the Project, Work or Supply of any materials:

(a) shall submit to the City an original Clearance Certificate from the Ontario Workplace Safety and Insurance Board and shall provide additional certificates with respect to such coverage as often as the City deems necessary during the term of the Contract to ensure continued good standing with the Workplace Safety and Insurance Board; or

(b) furnish proof in a form satisfactory to the City from the Workplace Safety and Insurance Board that the Contractor does not require Workplace Safety and Insurance Board insurance, but in such a case if the Contractor changes its status during the term of the Contract so that such coverage is required, the Contractor shall immediately provide the City with the certificate required under clause (a).

(c) during the term of the Contract, when submitting each payment invoice, a copy of the Contractor's current certificate of clearance from the WSIB for itself as well as all major Sub-Contractors as determined by the City's Project Manager must be provided. Where a substantial portion of the work to be done under the Contract is to be carried out by a subcontractor, the City may require the Contractor to furnish the same evidence as provided under subsection (1).

The Contractor will not be paid any amount until or unless all required certificates of clearance have been provided by the Contractor to the City or alternately the City will withhold funds in an amount satisfactory to the Project Manager to protect the City’s potential liability of WSIB arrears.

If the City suspects that a certificate presented is not authentic or accurate, payment will be withheld until an original copy of the certificate has been received.

The City reserves the right to contact the Workplace Safety Insurance Board directly to confirm that the Contractor or Sub-Contractor is in good standing with the Board. In such cases that the City is advised that there are outstanding Workplace Safety Insurance Board payments, the provisions specified in 200.06.03 shall apply. The

City will advise the Contractor when monies are withheld or deducted due to non compliance with the requirements of the Workplace Safety and Insurance Board by the Contractor or Sub-Contractor.

.06.06 Certificate of Status

All successful Bidders which are corporations shall submit to the City a Certificate of Status from the Ministry of Consumer and Commercial Relations indicating that the successful Bidder is in good standing and has not been dissolved. The Certificate of Status shall be submitted to the City once per calendar year together with the executed Contract for the first Contract awarded by the City to the successful Bidder in each calendar year.

.06.07 Inspection of Books, Payrolls, Accounts and Records

The Contractor shall maintain and keep sufficient complete and accurate books, payroll, accounts and records relating to the Work or any extension or additions thereto or claims arising therefrom to permit the verification and audit thereof and shall have no claim for payment of any nature and kind whatsoever, therefore, unless such books, payrolls, accounts and records have been so maintained and kept.

The City may inspect and audit the books, payrolls, accounts and records of the Contract at any time during the period of the Contract and at any time thereafter as

deemed necessary by the City and the Contractor shall supply certified copies of payrolls and any other records required, whenever requested, by the City.

The Contractor shall preserve all original records pertaining in any way to the Work of the Contract, or any extensions or additions thereto or claims arising therefrom, for a period of twelve (12) calendar months after the expiration of the maintenance period and the Contractor shall require that all Sub-Contractors employed by it preserve all original records pertaining in any way to the Work of the Contract, or any extensions or additions thereto or claims arising therefrom for a similar period of time.

The Contractor shall file with the City forthwith upon the appointment of each Sub-Contractor a consent and covenant of each Sub-Contractor under seal by which the Sub-Contractor agrees to the provisions in the same Section in the same way as if the Section read, "Sub-Contractor" for "Contractor".

.07 MAINTENANCE

The Contractor shall maintain the Works and every part thereof, in perfect order and in complete repair during the period of twenty-four (24) calendar months from the date of the established completion thereof, as herein provided, and make good in a permanent manner, satisfactory to the Project Manager, any and all damage or injury to the Works, both during their construction and during the period of maintenance, as aforesaid, and should the Contractor from any cause fail to do so, then the City through the Project Manager, may do so, and the whole costs, charges and expenses so incurred, may be deducted, or collected by the City as provided for

herein. The decision of the Project Manager is to be final as to the necessity of repairs or of any Work done or required to be done under the provisions of this or any clause in the Contract Documents and for any amount of monies expended thereunder.

.07.01 Maintenance Review

The City will notify the Contractor prior to the expiry of the twenty-four (24) calendar month maintenance period to permit the Contractor to coordinate a final deficiency review. The Contractor will walk and review the entire physical limits of the Contract with the Project Manager or designate to review Work completed. The review will consist of all above and below ground components covered by the scope of Work of the Contract.

The Contractor will be responsible for providing all equipment required to conduct any necessary testing for the review. All deficiencies identified by the review will be corrected at the cost of the Contractor to the satisfaction of the Project Manager prior to the expiry of the maintenance period.

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.01 DEFINITIONS

The following definitions shall apply:

(i) **"Existing Road Grade"** - means the centre-line elevation of the existing road and/or allowance.

(ii) **"Proposed Road Grade"** - means the centre-line elevation of the road Work proposed under this Contract.

(iii) **"Future Road Grade**" - means the centre-line elevation of a future road beyond the scope of this Contract.

(iv) **"Private Drain"** - means that part of the drainage system that connects the yard sewer to the main sewer and is situated within the limits (road allowance) of the highway.

(v) **"Yard Sewer"** - means that part of the drainage system from a point 1 metre from the face of a facility on a parcel of land to the private drain or any other place of disposal. Also includes that part of a drainage system between a catch basin and storm water private drain.

(vi) **"Lateral", "drain"** - shall mean any part of drainage system situated within the limits (road allowance) of the highway, other than the main sewer. (e.g. catch basin drain)

.02 MATERIALS AND APPLIANCES

Unless otherwise specified, the Contractor shall at their expense, provide all materials, labour, water, tools, equipment, light, and power necessary for the execution of the Work.

.02.01 Ordering Responsibility

It shall be the sole responsibility of the Contractor to ascertain (and follow up until delivered), that all material or equipment, whether directly under their or under their Sub-Contractor's jurisdiction, which is not available from stock" (check same), but which requires longer manufacturing or delivery time, is ordered immediately after award of the Contract, and that all Shop Drawings which must be prepared before fabrication and all samples requested to be submitted for the City's selection, be so prepared or submitted by the responsible Sub-Contractors right away.

It is stressed that no deviations from Specifications or acceptance of substitutes, which may be proposed by the Contractor in order to compensate for tardiness in ordering or failure to expedite deliveries, or acceptance of Work for which Shop Drawings had not been submitted and reviewed by the City, shall be permitted.

Immediately upon the receipt of shipment(s), all Contractors and Sub-Contractors shall thoroughly check all shipments for correctness and completeness in order to avoid discovering the incorrectness or incompleteness of shipment(s) when installation of the same is due.

.02.02 Approved Products and Materials Lists

All products and materials that are supplied by the Contractor shall be new and shall be listed on the appropriate Approved Products Lists, issued by the City.
Reuse of existing materials is not permitted.

Where a product or material needed to complete the Works is not specified in the Contact Documents and is not on the current Approved Product List, the Contractor shall verify its use with the City prior to the start of any Works.

The City shall reserve the right to not allow a product that is listed on the Approved Products and Materials List, if for any reason, its use in a given application is deemed to be inappropriate.

.03 SHOP DRAWINGS – Submittals and Review

After the award of the Contract, prior to ordering the delivery of equipment to be supplied and in sufficient time to permit the satisfactory progress of the Work, the Contractor shall submit to the Project Manager for review, additional drawings or prints in triplicate of such equipment, together with other information in such detail as may be necessary to permit the Project Manager to become informed of the design of the equipment which the Contractor proposes to use.

Shop drawings and schedules shall be furnished by the Contractor for review and comments showing all piping components, fittings and appurtenances.

The Contractor shall make changes to the shop drawings as may be found necessary upon review by the Project Manager to make the same conform to the Specifications. Tabulated lists shall be provided by the Contractor of minor items of equipment for which drawings are not required. These lists shall show the name of the manufacturer, the catalogue type number, leading dimensions and other pertinent data.

Upon review and no further comments, shop drawings, lists and specifications shall become a part of the Contract and the materials and equipment furnished and installed shall conform with the final revision of shop drawings. Final shop drawings, lists and specifications shall not in any way release the Contractor from its responsibility for the proper fulfilment, by any equipment or material, of the requirements of the Contract, and of the purpose for which the said equipment and materials are installed, nor from its liability to replace the equipment and/or materials should they prove defective or fail to meet specified requirements.

.04 INFORMATION TO BE SUBMITTED AT PRE-CONSTRUCTION MEETING

The Contractor shall make available to the City the following information at the Pre-Construction Meeting.

a) Proposed Work schedule and cash flow schedule

b) Where blasting is anticipated, the name of the independent inspection company, together with the pre-construction survey report.

c) The addresses of all dump sites to be used to deposit materials together with letters of permission from the property owners involved.

d) Executed agreements and/or letters of permission for dumping will also be required from any municipalities involved, and where applicable, conservation and/or other authorities having jurisdiction.

e) The names and addresses of manufacturers and/or suppliers of all materials required in the Contract, including but not limited to the following: pipe, concrete, precast manholes, chambers, catch basins, asphalt, granular materials together with its sources and castings (when applicable).

f) Copy of the Contractor's company health and safety policy and program.

g) Notice of Project from Ministry of Labour.

h) Contractor's 24-hour hotline phone number

i) Impact on parking, access, garbage pickup and the anticipated disruption of services – water, sewer, postal delivery, schools.

j) Methods of bulkheading and/or weir construction in downstream sewer manhole(s) to prevent siltation to existing downstream sewer system.

k) The hourly rates of Contractor's staff ie. foreman, labourers, operators, pipe layers and the percent of corresponding burdens.

l) All types of equipment and their hourly and daily rates.

When, in the opinion of the Project Manager, the Contractor does not provide the required information in time for the pre-construction meeting, the Project Manager reserves the right to delay the start of construction and to immediately commence to charge Working days against the Contractor.

.05 PRE-CONSTRUCTION PHOTOGRAPHY

The Contractor shall provide the City with one set of pre-construction photographs (colour prints or digital files) prior to commencement of construction of the project.

The photographs shall be 3 1/2 x 5 inch (min.) colour prints, legibly marked on the back, showing location, house no. etc.

Digital photograph shall be in colour. File names shall indicate the building's municipal address.

Photograph prints shall be labelled showing location, house no. etc. in a manner not to obstruct the images.

A minimum of 2 photographs per typical residential property or the number required to show both sides of driveways, all vegetation, utilities, ditches, culverts, hydrants

etc. A series of photographs may be required to show long frontage properties (max. spacing of 20m), extra photographs of particular items such as culvert crossings, damaged buildings, etc. All photographs shall be overlapping and continuous. Photographs shall show general condition of pavement, curbs, walks, shoulders, ditches (as applicable). A series of all intersecting streets shall be supplied as well.

All photographs shall be of 35mm quality and clarity. The Contractor must have negatives available up to the end of the projects maintenance period. There will be no specific payment item for providing these photographs. Where a digital camera is used, the City will accept a CD with all the required photos.

All photographs shall be taken and provided to the City no later than 1 (one) week prior to the start of construction.

.06 WORK SITE LIMITS

All aspects of this entire item shall be at the Contractor's expense.

The site which may be occupied by the Contractor during the prosecution of this Contract will be limited to the areas shown on the drawings as the public road allowances. No plant, equipment, materials or temporary buildings shall be stored or erected and no roads shall be constructed by the Contractor outside the designated areas except as required by the Contract with the prior written permission of the Project Manager.

The Contractor shall be entirely responsible for providing and properly maintaining adequate temporary access roads to, and detour roads around, the designated areas.

If private lands are to be traversed or otherwise occupied by the Contractor, they shall complete all necessary legal arrangements with the owners for rights over access to and from, or occupancy of the private lands, or any combination thereof, and submit to the Project Manager acceptable proof that these legal arrangements have been completed prior to entering upon such lands. Upon completion of the Contract, the Contractor shall file with the City a release and indemnification absolving the City from all obligations with respect to damages claimed and incurred as a consequence of using said private lands.

On all lands to be used by the Contractor for any reason, the Contractor shall strip all topsoil and vegetation from areas to be disturbed and stock-pile this on the site for future restoration of the site. The Contractor shall be responsible for its own access. That portion of the site that will be used by the Contractor for the purposes of vehicular traffic, material storage purposes and temporary shelter, shall be properly drained and provided with a granular working pad that shall be kept free from mud and debris at all times.

The Contractor shall clearly define all limits of easements in order to confine operations to such areas.

Prior to entering the easements with any materials and/or equipment, the Contractor shall verify all survey markers along the limits of the easements. Upon such verification it shall be the Contractor's responsibility to install and maintain for the duration of the Contract, steel posts spaced at maximum intervals of 15.24m (50') continuously strung with brightly coloured plastic tape or such other method of marking as may be approved by the Project Manager.

The Contractor should note that the above requirement will be strictly enforced and that indiscriminate damaging of adjacent properties will not be tolerated.

Should the Contractor be found not confining its operations strictly to easement lands or designated areas, the Project Manager reserves the right to stop Work on the project until such time as the Contractor has supplied and temporarily installed snow fences along the limits of the easements and completely restored all damaged areas to the satisfaction of the Project Manager, all at the Contractor's own expense.

.06.01 Postal Services

Along the route of the Work, where mail boxes must be removed to facilitate construction, the Contractor shall temporarily relocate such mail boxes and posts to a safe location and shall make other arrangements suitable to the residents and Canada Post to facilitate uninterrupted postal delivery. All costs entailed shall be the responsibility of the Contractor.

.06.02 Temporary Access

The Contractor shall provide temporary roads, street approaches, walks, ramps, stairs and other means of access to the Site as required or ordered by the Project Manager or other authorized City representatives.

.06.03 Sanitary Convenience and Shelter

The Contractor shall provide, and properly maintain, in a clean condition, suitable and convenient privy or water closet accommodation for all workers employed on the Work such that it shall not be a source of inconveniences, complaint, or nuisance to the public or the residents in the vicinity of the Works.

The Contractor shall provide, at its own expense, an adequate, comfortable shelter, accessible during the noon hour and inclement weather, to all Workers employed on the Work, and its location shall be approved by the Project Manager.

Such sanitary conveniences shall meet all current applicable regulations and shall be otherwise satisfactory to the Project Manager.

.06.04 Contractor's Identification Signs

Signs, bearing the Contractor's name and 24 hour emergency phone number shall be supplied and installed by the Contractor on barricades, flashers or steady light stands at each end of all barricaded sections of the Work. Signs shall be constructed of weather-resistant materials with lettering a minimum of 75mm in

height, of contrasting colour with its background, clearly legible and neat in appearance.

All Contractor identification signs shall be positioned to be clearly visible to traffic at all times, repositioned as required and maintained by the Contractor for the duration of the Contract.

The Contractor is to supply a 24 hour phone number (hotline) available to the public and City at any time. This number is to be shown on the Contractor's identification signs as indicated above.

.06.05 Field Office

The Contractor shall provide and maintain in good condition for the exclusive use of the Project Manager, Inspector and assistants, one (1) insulated, weather- proof construction field office, having a floor space of not less than 12 sq. metres. The office's location on, or in the immediate vicinity of the project shall be determined by the Project Manager, and shall be constructed so that it can be moved to another site (if required) and shall be in operation within one week of commencement of the Contract.

The site office shall be of a standard equal to that usual in the trade for such construction and shall comply with the following requirements:

The site office shall be constructed and equipped as per current Occupational Health and Safety requirements and shall not be limited to the following:

a) All entrances are to be equipped with steel security doors and exterior type locks

b) All windows are to be equipped with heavy gauge steel bars or cages to prohibit entrance from outside

c) All windows are to be capable of being opened to the outside to allow natural ventilation of the office

d) A supply of fresh cold and hot drinking water

e) A fire extinguisher mounted next to all entrances

f) First Aid kit, including a portable eye wash kit

g) A designated location for the storage of photocopies of all locates obtained by the Contractor for the project.

h) A printer / scanner complete with a supply of paper and toner.

i) An internet connection shall be provided for the use for the Project Manager and Inspector.

j) The site office shall be cleaned weekly to the satisfaction of the Project Manager and Inspector.

k) The Contractor shall service, maintain and carry insurance on the site office and contents and provide evidence of insurance to the Project Manager before Work commences.

The office shall be provided with sufficient natural and electrical light, shall be adequately heated to maintain a minimum temperature of 20°C, and shall be adequately air-conditioned to maintain a maximum temperature of 24°C depending upon outside temperature conditions.

The office shall be equipped with a sloped plan table, two (2) chairs and a bench. The office shall be equipped with a minimum of one (1) electrical outlet.

Silent portable generators will be permitted when absolutely necessary with the approval of the Project Manager.

The Contractor shall make available to the Public Works Staff such ablution and sanitary facilities as provided for its own forces.

There will be no specific payment item for providing this office, including the cost of erecting it, relocating it if necessary, furnishing it, supplying it with heat/air-conditioning (as required), light and printer/scanner, and eventually removing it at the termination of the Contract. Upon removal of field office, the site shall be cleaned up and restored to original condition.

The Contractor shall note the above requirements will be strictly enforced and that a field office is required on all construction projects unless deemed not required by the Project Manager.

.07 ACCIDENT AND FIRST AID

The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to furnish first aid to anyone who may be injured in connection with the Work.

The Contractor must promptly report, in writing, to the Project Manager, all accidents arising out of, or in connection with the performance of the Work, whether on, or adjacent to the site, which caused death, personal injury, or property damage, giving full details and statements of witnesses. In addition, in case of death, serious injuries or damages, the accident shall be reported immediately by telephone, to the Project Manager. If any claim is made by anyone against the Contractor or any Sub-Contractor, on account of any accident, the Contractor shall promptly report the facts in writing to the Project Manager, giving full details of the claim.

.08 SAFETY MEASURES

The Contractor shall, at all times, comply with all safety by-laws, Municipal by-laws and Safety Acts of the Province of Ontario, Government of Canada and any staff instructions issued by the Project Manager, or through any Inspector appointed or

so recognized by the City.

All aspects of the Work under any Contract must meet all requirements of the Occupational Health Safety Act including Regulations for Construction Projects, as amended.

The Contractor shall file a "Notice of Project with the Ministry of Labour as required under the Occupational Health Safety Act.

.08.01 Special Protection

The Contractor shall take reasonable and required measures, including those required by authorities having jurisdiction, to protect the public and those employed on the Works from bodily harm and to protect adjacent public and private property and City property from damage. Without limiting the generality of any other provision in this Contract, the Contractor shall:

a) Provide and keep available in the Construction Office, safety helmets for authorized visitors to the site.

b) Protect excavation, trenches and building from damage by rainwater, ground water, backing up of drains or sewers and other water, frost and other weather conditions. Provide sheeting, piling, shoring, pumps, equipment, temporary drainage and enclosures if any as required. Provide necessary pumps, including spare pumps, for keeping the project free of water throughout the duration of the project.

c) Provide fences, hoarding, guard rails, barriers, night lights and pavement protection as required for protection of the public and of public and private property and constructed in accordance with and as required by law and authorities having jurisdiction. Erect sturdy railings around shafts, stairwells and the like to protect Workmen, supervisory personnel and the public from injury.

d) Provide and maintain guard lights at barricades, railings, obstructions in roads or sidewalks.

e) Properly secure the Job Site at night, on Saturdays and Sundays, on statutory holidays and other times when the Work is not in progress.

The Contractor shall make full restitution of such harm and damage resulting from failure to take adequate protective measures, and shall make good any damage to the Work from whatever cause.

.09 MATERIAL SAFETY DATA SHEETS

M.S.D.S. data sheets must be supplied and be readily available on the job site at all times and be issued to City staff if so requested.

.10 TRANSPORTING MATERIALS ON STREETS

The Contractor shall, if so directed by the Project Manager, provide tight trucks, approved by the Project Manager, to haul soft or wet material over the streets, in order to prevent litter on the street. In all cases where any materials are dropped from the trucks of the Contractor, the Contractor shall clean up the same as often as directed and also keep all roads and sidewalks clean and free from dirt and mud.

If the Contractor refuses or neglects to clean up said litter when ordered to do so by the Project Manager, the City shall do the necessary cleaning up, and the costs of same shall be deducted from monies due to the Contractor.

.11 TEMPORARY SUPPLY OF WATER, POWER, AND OPERATION OF CITY HYDRANTS

.11.01 Use of Hydrants

The City of Hamilton will allow Contractors to use existing fire hydrants as a source of water for construction Works. Where a Contractor requires the use of a hydrant, they shall obtain and complete a "Water Hydrant Use Agreement" from the Water Distribution Division and shall be bound by the rules and be responsible for all costs associated by the permit and the use of the hydrant.

The Contractor shall call 905 546-4426 to obtain the permit.

All persons operating a hydrant shall have sufficient knowledge on hydrant operation and water distribution systems. Guidelines for Obtaining Water from City Hydrants have been provided in Appendix A. All persons operating a hydrant must follow these guidelines and must complete the Hydrant Use Log Sheet provided each time a hydrant is used.

For those Contracts where the use of a hydrant is permitted, flushing of watermains shall be conducted during regular Working hours whenever possible. Prior to any flushing operation, the Contractor shall notify the Water Maintenance Section at 905 546-4426 to ensure that the after hours desk is aware of flushing operations. Hydrants shall have a hose connected directing water to the gutter and catch basins. An approved backflow preventer shall be used to prevent back siphon. No free flowing hydrants will be permitted.

All materials and arrangements of valves and piping required to provide temporary use by the Contractor shall be in accordance with the Project Manager's requirements to prevent freezing and contamination of service and watermain. All arrangements and costs for the above shall be paid by the Contractor.

The Contractor shall see that no waste of water is permitted and that water shall not be left running when not in use.

The Contractor shall take all necessary measures and precautions to prevent any icy conditions of the roadways developing as a result of use of water from the above service.

Any repairs to service or watermains made necessary as a consequence of damage due to the Contractor's operations, shall be made by the City's forces at the Contractor's expense.

.11.02 Power and Water Supply

The Contractor shall make all necessary arrangements and be responsible for all costs to provide themselves with an adequate supply of power to operate its equipment and to provide for lighting, etc. They shall bear all costs entailed.

The Contractor may arrange with the City, Public Works Department for a water service or services, to be installed at the Contractor's expense, from an existing watermain near the site or sites of its Work operations.

When the Contractor's need of temporary services (power and water) terminates, they shall make proper arrangements for their discontinuance.

.12 DRAINAGE AND DEWATERING

Ditches, culverts and gutters shall be kept open at all times. Any flow of water shall not be directed across or over pavements except through pipes or properly constructed troughs. The Contractor shall keep all portions of their Work properly and efficiently drained during construction and until completion. They will be held responsible for all damages until completion. They will be held responsible for all damage which may be caused by, or result from water backing up or flowing over, through, from or along any part of the Work, or which any of its operations may cause to flow elsewhere.

All trenches and other excavations shall be kept free of water at all times. The Contractor shall employ adequate means to remove the water in a manner that will prevent loss of soil and maintain the stability of the excavation.

The Contractor shall provide for the disposal of such water in a manner that will not be a danger to the public health, private property or to any portion of the Work completed or under construction either by them or any other Contractor, nor cause an impediment to the use of the streets by the public, and provide sediment control as required.

Drainage of the trench or other excavations through newly laid storm sewer pipe will be allowed only with the express permission of the Project Manager.

When drainage is directed to existing catch basins, the catch basins must be regularly inspected, and, cleaned of debris and sediment by the Contractor.

The Contractor shall not hold the City or other Contractors liable for leakage encountered by them in its Work from existing sewers, watermains, or drains, or from other sewers or drains under construction.

.13 NOISE

.13.01 Acceptable Noise Levels

The noise levels of construction equipment operating in built-up areas shall not exceed the values stated in the City of Hamilton's Noise By-Law to control noise.

The use of chainsaws and other types of power-saw on the site shall be limited to hours of the day when noise from this source will produce no complaints from the residents living in the vicinity.

.14 OVERTIME WORK

In general, Night, Sunday and Holiday Work requiring the presence of a Project Manager or Inspector, will not be permitted, except in case of an emergency, and then only to such an extent as deemed advisable and with the written permission of the Project Manager. It may be necessary or expedient in the judgment of the Project Manager to do Work at these times or after regular Working hours. When requested in writing by the Project Manager to perform such Work, the Contractor shall be entitled to additional payment as per Form 200.06. This additional payment shall be limited to include the overtime (plus 15%) of hourly paid labourers and the use of extra necessary equipment. The Contractor shall submit vouchers showing the hours worked and the type of additional equipment used.

.15 PRESERVATION OF SURVEY MONUMENTS

The location of existing survey monuments (eg. concrete monuments, stone monuments, iron bars, etc.) which have been established to indicate right-of-way, subdivisions and other surveyed limits of the ground surface, shall be ascertained by the Contractor prior to its entry onto the site, or sites, of the Work. The Contractor shall mark all concrete monuments, iron bars, etc., with a 50mm by 50mm by 1.2m marker which has been dipped in red paint for the upper 100mm.

During the course of the Work, when it is absolutely necessary to remove existing survey monuments, the Contractor shall arrange and pay for the establishment of proper reference points of the original markers by an Ontario Land Surveyor (OLS) before their removal. The Contractor shall provide the name and contact information of the Ontario Land Surveyor to the City for approval.

Reference points shall be clear of the Work and shall be marked in the manner specified in the foregoing paragraph. The Contractor shall arrange to replace any removed survey monuments in their original locations after completion of the Work, by the same Ontario Land Surveyor used to establish the reference points. Where the City is not satisfied with the survey services provided, it reserves the right to complete the works using an Ontario Land Surveyor and deduct any costs incurred from monies owing to the Contractor.

.16 SHORING EXISTING STRUCTURES

The Contractor shall at its own cost and expense, shore up or otherwise support or protect, any buildings, bridges, walls, fences, pavements, or other structures which may show defects or which, in the opinion of the Project Manager or the Contractor, may be liable to injury or to be endangered during the Work, and in the case of injury, damage or disturbance to any such structure during construction, herein contracted for, whether directly or indirectly by and because of the construction of said sewer and watermain, or of any extra Work entering into this Contract, the Contractor shall, at its own expense and costs, proceed to restore, repair, rebuild or otherwise make good, the damage, injury, or the disturbance noted, and put the said buildings, fences, walls or other structures, in a condition the same as or equal to that existing previous to its beginning the Work.

.17 ENVIRONMENTAL CONSIDERATION

.17.01 Equipment Fuelling and Maintenance

Equipment fuelling and maintenance shall be done in such a manner that no fuel or oil can gain access to surface water or ground water. This Work shall therefore not be done in or near any drainage ditch or watercourse.

.17.02 Cleaning Equipment and Construction Debris Disposal

The cleaning of equipment machinery in ditches or watercourses shall not be permitted. All construction and equipment debris must be contained and disposed of in locations approved by the Project Manager. Construction equipment shall be cleaned prior to entering public roadways, but not in areas where the debris can gain access to storm sewers, watercourses or ditches. Should such cleaning be impractical, the Contractor shall see to it that all trucks either its own or those rented, shall drive on the roadway shoulders only, until all mud and debris has been removed from the wheels. Contaminated shoulders and pavements shall be cleaned and protected from generating air-borne dust.

.17.03 Exhaust Emissions

Exhaust emissions shall be minimized through efficient machine maintenance. The Project Manager may require evidence that regular maintenance is carried out. Should any equipment show visible signs of exhaust emission problems, the Project Manager may require same-day service, or removal of the equipment from the Work site.

.17.04 Soil Erosion Control

This item shall be read in conjunction with the Hamilton Conservation Authority - Erosion & Sediment Control guideline for Hamilton Harbour Watershed.

Erosion of soil shall be prevented. Stabilization of disturbed areas shall be completed as soon as practical after completion of each section of Work. In areas not prone to surface erosion, stabilization may be delayed until more practical units of Work has accumulated. No areas or Work should remain uncompleted, however,

at the approach of the unsuitable weather season. Where soil erosion is expected to occur, vegetation strips shall be maintained between the disturbed areas and adjacent sensitive areas and watercourses. Provision shall be made to intercept site drainage at short distance intervals into settling ponds or permeable ground cover, to minimize sediment discharge. Snow fencing shall be placed between any Working areas and adjacent to sensitive areas and watercourses where endangered by construction machinery operations.

.18 PRESERVATION OF EXISTING STRUCTURES AND PLANTINGS

The Contractor will be required to remove, without extra remuneration, all boulders, stones, rocks, stumps, roots, trees, walls or other obstructions found upon the line of Work, and to fill up all unauthorized openings. All such filling shall be made using approved materials. The Contractor shall provide proper protection to prevent the fill from spreading on private property. Privately owned fences, hedges, trees, shrubs, walls, etc., encroaching on the line of the Work will normally be removed by the owner. In the event that such removal has not been carried out, the Contractor will be required to carefully remove the encroaching object and place safely on the owner's property (or remove from site if so authorized). No extra payment will be made for Work of this nature.

The Contractor will not be required to re-erect or replace any items removed under this paragraph.

Inconvenience to all owners whose properties abut on the proposed Works, shall be kept to a minimum by the Contractor, wherever and whenever it is in its power to do so. Doing this will tend to foster harmonious relations with the affected parties during the period of construction.

Lawns, or other landscaped areas, damaged or otherwise disturbed in the course of the Work, shall have a minimum of 100mm of approved topsoil. Topsoil shall be that of previously removed from the site and stockpiled, or approved imported material at the Contractor's expense.

When lawns have been cut or otherwise damaged, the Contractor shall, in addition to topsoiling, replace all sod. The sod shall be No. 1 Nursery Sod of a quality equal to or better than that which existed before commencing Work. The Contractor shall be responsible for maintaining and watering sod until such time as it is thoroughly established to the satisfaction of the Project Manager.

The Contractor will be required to remove all rubbish and material from boulevards and lawns adjoining the Work and restore same to as good and clean a condition as existed before commencement of the Work.

.19 TREES ENCOUNTERED DURING CONSTRUCTION

.19.01 Tree Removal

Under no circumstances shall the Contractor remove trees or tree limbs without prior permission to do so by the Project Manager. Trees subject to damage shall be fully protected by the Contractor to the satisfaction of the Project Manager.

The purpose of these specifications is to preserve and prevent damage to existing trees during construction projects.

a) Excavating within two metres of the vicinity of the base of any tree must be done by hand digging. Construction shall be done in such a way as to ensure the roots will not be damaged.

b) During construction any item which may cause soil compaction or damage to the tree will not be permitted within the dripline of any tree. Excavation soil, equipment, supplies or debris must not be piled even temporarily over the roots.

c) Any roots contacted or exposed during excavation will be root pruned. Make a clean square cut (flush) three inches back from the damage with a saw.

d) Any limbs damaged/broken during construction will be trimmed with a square cut (flush) three inches back from the damage with a saw.

e) No change of grade will be permitted within the dripline of any tree. If a major grade change is required a retaining wall or tree well will be built in order to maintain the original grade around a city tree. No foundations or retaining walls will be constructed where severing of major roots will occur.

f) Backfilling will consist of good topsoil free from debris, bricks, lumber, nails, steel stake, etc.

g) When installing underground connections within the dripline of a municipal or City of Hamilton tree, proper auguring techniques as specified by the Arborist shall be used.

.20 UTILITIES

.20.01 Co-ordination With Other Contractors and Utilities

The Contractor shall co-operate and co-ordinate with all other Contractors and/or utility companies that may have Work to complete adjacent to or within the limits of the Contract. The Contractor shall permit access to the Work site by these other Contractors/Utilities when required.

The Project Manager reserves the right to alter the methods of operations in the Contract to avoid interference with other Work.

.20.02 Verify Locations and Elevations of Utilities

The Contractor shall verify the elevations and locations of all utilities in the vicinity of its proposed trenches. Excavation of all such utilities shall be carried out far enough ahead of its pipe laying crews to permit deflection of the proposed installation if required without requiring additional fittings.

Where utilities are found to conflict with the proposed installations as shown on the Contract Drawings, the Contractor shall immediately notify the Project Manager.

.20.03 "Ontario One Call"

Contractors shall use "Ontario One Call", telephone number 1-800-400-2255 utility locating service. Some utilities have not subscribed to "Ontario One Call" and it is the responsibility of the Contractor to ensure all field locates have been ordered from the pertinent authorities and are available prior to any construction.

.20.04 Protection of Existing Plant, and Utilities, Overhead and Underground

It shall be the Contractor's responsibility to contact all pertinent owners of plant and utilities and to verify the location of all underground plants in the vicinity of its trenches and Work. All such plant and utilities endangered by the Contractor's Work shall be adequately supported and protected from damage by the Contractor, at its own expense, to the satisfaction of the Project Manager and the plant or utility owner involved. See Ontario One Call Form 300.20.03.

The Contractor shall restore all plant and utility, underground and above ground, disturbed or damaged by construction to the satisfaction of the Project Manager and the local authorities having jurisdiction over the same. All restoration is to be done at the Contractor's expense.

.20.05 Procedures for Excavating Near Utilities

(Applies to all Utilities except Bell Canada)

It is a requirement for all Contractors to ascertain the location of any utilities that they may come in contact with during the course of its construction activities.

.20.05.01 Notification

The first requirement is that the Contractor must contact the Utility (note Call Ontario One Call service) and request a locate of plant in the area of the Construction. When a field locate has been given and that locate indicates that a potential conflict with the proposed construction exists, the following procedures will be used:

.20.05.02 Initial Exposure

After a locate has been provided, the Contractor will not use *mechanical equipment within one metre of any such locate without first digging a test hole to determine the plant's depth.

* The term "mechanical equipment" refers to backhoes, graders, heavy earth moving equipment, augers and other earth piercing equipment. Jackhammers and concrete saws are not considered to be "mechanical equipment".

The normal procedure for digging this hole, or test holes, would be to stop the mechanical equipment 1.0m away from the locate mark and have a labourer dig laterally in towards the Utility at various depths until the plant is found. If this is not possible due to the location and direction of construction activity in relationship to the located plant, then a test hole should be dug off to the side of the roadway,

entirely by hand, to determine the depth of the plant at that location. After this initial test hole is dug by hand, then mechanical equipment may be used to dig further test holes as close as 0.3m to the plant. Regardless of the location of the preliminary test holes, it is necessary that one test hole be located in the centre of the proposed trench or excavation directly over the Utility.

In any case, the last 0.3m must be excavated by hand. Whenever mechanical equipment is used closer than 1.0m to the Utility, a labourer must be used in conjunction with the mechanical equipment to probe and hand dig for the plant in the excavation. Whenever physically possible, the mechanical equipment shall be operated parallel to rather than perpendicular to the direction of the plant when excavation is within 1.0m of the Utility.

If it is not possible to dig the test hole off to the side of the roadway, then the test hole will be dug over the utility in the roadway with mechanical equipment, subject to the following conditions:

A concrete saw or jackhammers are only permitted to break the concrete. A backhoe may be used to remove these cut pieces of concrete. Excavation below the concrete is to be done by hand.

If another layer of concrete is encountered, the Utility and Project Manager should be consulted with, as the layer could be a concrete encased duct.

If there are other layers of concrete, or similar hard materials (not to include frozen ground), a backhoe may be used to excavate and remove this concrete providing that it does not excavate in more than 150mm swaths, and that a labourer is used to probe for the plant, by hand, between each swath. Once the initial test hole is completed, further test holes must be dug at sufficient short horizontal intervals as determined by the Contractor to ensure that possible variances, such as altered plant depths, are recognized. Mechanical equipment may be used with the labourer to dig these further test holes, provide that mechanical equipment is not used closer than 0.3m to the plant.

.20.05.03 Continuous Exposure

Once the plant has been located by the various test holes, then the Contractor must expose the plant along its length which is in conflict with the proposed construction. Mechanical equipment must not be used closer than 0.3m and the last 0.3m must be dug by hand. What is meant by exposing here is to uncover the top of the plant along its length of conflict.

It is of importance here that exposing the plant is not necessary when the test holes have determined that the proposed construction will maintain a 0.3m buffer of undisturbed soil between the mechanical equipment and the plant.

Once the plant is physically exposed, digging with mechanical equipment is allowed up to 150mm of plant, the last 150mm must be hand dug.

.20.05.04 Damages

If during the exposure procedure any damage is caused to sheath integrity for telecommunication, power cables or external damage to pipeline coatings, the appropriate utility shall be notified in order for repairs to be made.

.20.05.05 Breakout Existing Road At Existing Bell Structures

To facilitate road excavation required around any existing Bell structure which is clay pipe or conduit without concrete encasement, the Contractor must conform to the following minimum requirements:

1. Structure must be uncovered using the Bell approved procedures with the exception that mechanical excavation may be used within 0.3m alongside the structure once it has been exposed.

2. Manual excavation is required to expose the top of the structure. Saw cutters and jackhammers should not be used over the structure.

3. There can be NO heavy equipment or trucks working on top of the structure or crossing the structure once it has been exposed - i.e. the road surface has been removed from the top of the support of the existing soil beside the structure has been removed.

4. The structure cannot be undermined at any location without complete bridging in place. The bridging must be installed with a support at either end on original soil. The support area at each end must equal 30% of the intended open span under the structure.

5. The structure must not rest directly on any hard material after construction - i.e. watermains, sewer pipes, concrete, unshrinkable fill, etc. There must be a minimum of 150mm of properly compacted sand cushion between the bottom of the structure and any installation under the structure.

6. Compaction equipment must not run over the structure at any time, nor can such equipment be used within 0.5m alongside the structure.

7. Where the structure has been exposed and is adjacent to an excavated area, shoring may be required, at Bell Canada's discretion, to prevent collapse.

8. All costs associated with protective measures noted above or identified later (including during construction) will be borne by the Contractor.

9. Adherence to these requirements or any to be determined later does not absolve any party from normal responsibility for loss due to damages.

10. Bell Canada's on site Inspector must be informed of the location of any excavation activities taking place within 1.0 m of the structure 24 hours in advance.

11. Any damage, incidental or otherwise, must be reported to the Bell Inspector, or in its absence, to Bell Canada repair at 611.

To facilitate both road excavation and traffic requirements the haulage trucks must be loaded on the hardtop behind the backhoe, i.e. no "third lane" loading.

.20.06 Notification of Existing Utilities

Should any utility or structure, within the limits of this Contract and interfering with the laying of the sewer or watermain, be unexpectedly encountered, the Contractor shall immediately notify the Project Manager in writing, giving the location and conditions. The point may be passed over until satisfactory arrangements are made without any claim for damage, or extra compensation arising from the delay, the Contractor being allowed an extension of time as provided.

.20.07 Sub-Surface and Other Site Conditions

The information shown on the Contract Drawings regarding sub-surface and other site conditions is, at best, a guide to assist in the determination of conditions that will probably be encountered when excavating. The City assumes no responsibility for the accuracy of this information, and the Contractor shall have no claim against the City due to it encountering conditions other than those indicated on the Contract Drawings.

It is expected that Contractors shall make, at their own expense, such tests, inspections, and other on-site investigations as they consider necessary to satisfy themselves as to the nature of the conditions to be met with and the quantities of the various kinds of Work to be done.

However, should the Contractor encounter, in the course of construction, conditions more difficult than those anticipated on the basis of its investigations, they shall have no claim against the City on this account.

.21 CONNECTING TO EXISTING PLANT

As part of its construction procedure the Contractor shall, prior to construction, verify the positions and elevations, by excavating if necessary, of all existing watermains, sewers and manholes that are required to connect to. All such verifications shall be carried out far enough ahead of its pipe installation operations to permit approved adjustments to alignment and/or grade of the proposed Works. All costs entailed shall be included by the Contractor in the prices bid for the items involved.

All costs involved to remove, re-install or correct its Work in any way, due to the Contractor's negligence in carrying out the above investigations shall be borne by the Contractor.

.21.01 Maintain Flow

The Contractor shall supply all labour and materials to maintain flow in all existing sewers, private drains, watermains, and water services involved in this Contract.
Any existing services cut shall be permanently repaired by the Contractor at no cost

to the City and all materials will be supplied by the Contractor to the satisfaction of the Project Manager.

.21.02 Connection to Existing Watermain

A reduced pressure zone backflow preventer is required on all temporary supply lines used for filling and flushing of all water lines. Only approved backflow preventer valves are permitted.

The Contractor shall test, swab, and chlorinate the new systems, to the satisfaction of the Project Manager, in accordance with Form 400, Appendix 'A' – Procedure for the Disinfection, Testing and Connection of Watermains, prior to connection to existing watermains.

The Contractor shall supply and install all temporary caps or plugs, pipe closure, oversized, and adapter pieces as required in order to connect to existing watermains.

All costs arising from these requirements shall be included in the respective unit prices.

.22 COLD WEATHER WORK

The Project Manager may permit Work to be done when the air temperature is below freezing, in which case the Contractor shall, at its own cost and expense, furnish sufficient temporary protection and take all necessary precautions to protect the Work so as to prevent damage.

The Contractor shall protect all water pipe from freezing, but the City Project Manager reserves the right to do this Work and charge cost of same to the Contractor.

In the event of stoppage of the flow through any watermain or water service due to frost, or in the event of any watermain or water service is damaged due to the Contractor's operations, while they are on the Worksite or after leaving, due to trench settlement or other cause, the Contractor shall thaw the frozen watermain or water service, or repair the damaged watermain or water service at their own expense. If the Contractor does not properly and promptly thaw or repair the frozen or damaged watermain or water service, the Project Manager may arrange to thaw, repair or replace the same and the associated cost to do so will be deducted from any sum or sums due, or to become due to the Contractor.

.23 EXCAVATED MATERIALS

Where applicable, this section will be superseded, in its entirety, by the Special Provisions contained within the Contract Documents.

The Contractor shall strip all topsoil from those areas which will suffer disturbance in the course of performing the required Work. This topsoil shall be neatly stockpiled near the site, as directed by the Project Manager, and shall be disposed of later as directed. The cost of this Work shall be borne by the Contractor.

All surface or excavated materials which in the opinion of the Project Manager, are suitable for reuse in future surfacing, repaving, backfilling, or otherwise, shall be properly stored in such suitable places as directed by the Project Manager.

.23.01 Disposal of Surplus or Unsuitable Materials From All Operations For Which Excavation is Required

Material excavated in carrying out the Work of the various tender items included in this Contract which is unsuitable for, or which is surplus to the requirements for backfill or embankment construction, shall be disposed off site at locations arranged for by the Contractor at its own expense. The disposal/site location shall be submitted to the Project Manager and the Governing Conservation Authority for review and approval, before any material is permitted to leave the site. Conservation Authority approval shall be solely based on the area in which it has jurisdiction and does not relieve the Contractor from compliance with any other applicable law.

See also Form 300.04 - "Information to be submitted at Preconstruction Meeting".

.24 WORK ON AND UNDER RAILWAY COMPANY RIGHTS-OF-WAY

It shall be the sole responsibility of the Contractor to contact and arrange with the appropriate officials for such access routes as they may require across Railway property.

The Contractor shall immediately advise the Chief Engineer or Representative of the Railway Company, in writing, at least forty-eight (48) hours in advance of any Work being performed on or near Railway property in order that a Railway Inspector can be made available.

Flagmen, Inspectors or other staff as required and provided by the Railway Company will be at the expense of the Contractor and all other mandatory requirements of the Railway Company with respect to Work performed or under the Railway right-of-way, shall be complied with by the Contractor at its expense.

The Contractor shall be responsible for all damage and injury to the facilities of the Railway Company resulting from its construction operations and other Work attendant thereon. In the event of settlement, or injury to, these facilities as a consequence of inadequate, insufficient or otherwise unsuccessful method or means of support employed in its construction operations, then the Railway Company may proceed to regrade and realign such tracks, and restore facilities to the condition similar to that existing to commencement of Work on the Contract, at the Contractor's expense.

.25 TIDINESS

The Contractor shall at all times, keep its Work sites free from accumulation of waste materials and rubbish due to their employees or the Work.

Cleaning up, to the satisfaction of the Project Manager, shall be a mandatory

condition to the final acceptance of the Work.

.25.01 Dust Control

The Contractor will supply and apply calcium chloride to areas along the route of the Contract at intervals as required to effectively control dust created by the Contractor's construction operations. This is a provisional item and will only be required when, in the opinion of the Project Manager, such control is necessary.

Quantities shown in the Schedule of Prices are an approximate estimate only and payment will be made on the unit price stated for the actual amount.

Concrete cutting shall be done using wet saws or by methods that minimize concrete dust emissions.

.25.02 Progress Clean-up Restoration and Public Relations

To maintain good public relations the Contractor shall, during construction, attend to the following:

a) All trenches to be backfilled on progressive basis each day (no more than 12m (40 feet) open at any time).

b) All disturbed areas to be graded after backfill to maintain drainage on a progressive basis.

c) All excess material to be removed as the job progresses.

d) Restoration shall be completed as soon as possible.

The Contractor shall respond to the direction of the Project Manager regarding the above or any other complaints in a positive manner and within 48 hours. If the Contractor does not co-operate, the Project Manager reserves the right to have the Work done by others, and to charge the costs to the Contractor.

In addition to the above, if the Contractor continues to ignore proper clean-up, restoration and/or attending to Public Relations the Project Manager reserves the right and may deduct 15% of any monies due to the Contractor on progress payments.

.26 MATERIALS TO BE SALVAGED

Where the City has indicated that materials are to be salvaged, the Contractor will arrange for the delivery of such items to the appropriate City Yard as directed by the Contract Documents and/or the Project Manager.

All cost associated with the collection, delivery and unloading of the materials to be salvaged shall be deemed to be included in the prices provided.

.27 CONSTRUCTION EQUIPMENT

All equipment, including plant and machinery, to be used for the required construction shall be furnished by the Contractor at its own expense. Equipment to be used shall be subject to the Project Manager's approval, but approval, or failure to approve, of the equipment, on the part of the Project Manager, shall not relieve the Contractor of responsibility for proper performance of the Contract, or from its liability thereunder.

.28 STOPPAGE OF WORK

If the Work, or any part thereof is suspended or left uncompleted by the Contractor, for what is in the opinion of the Project Manager, an unreasonable length of time, the Contractor shall in the instance of a trench or other excavation, and when so directed by the Project Manager, refill such trench or excavation or part thereof, and temporarily repave over the same at its own expense. If the Contractor refuses, neglects or fails to completely refill such trench and temporarily repave over the same within 48 hours, after the receipt of a notice in writing to do so, the City may refill and temporarily repair the pavement over the trench, at the Contractor's expense.

.29 SHEATHING AND SHORING

The Contractor shall furnish at its own expense, place and maintain such sheathing, shoring and bracing, and at such locations and elevations as are necessary, or as may be directed to support and protect the excavation and to prevent any movement which could in any way disturb or weaken the supporting materials, adjacent pavements, property, buildings or other Works.

"Close Sheathing" is defined as vertically placed sheathing in which the edge of the adjacent individual members comprising it are in full contact with each other throughout the entire length of the sheathing place, so as to prevent adjacent soil from entering the trench either below or through such sheathing.

.30 TUNNELLING, BORING AND JACKING OF PIPES

.30.01 General

Pipe tunnel details may be shown on the Plans, or alternatively tunnels may be constructed at the Contractor's option in place of trench excavation. In the latter case for a continuous tunnel greater than 6 metres in length, the Contractor shall submit its proposed plan of tunnel operation to the Project Manager for approval. This request for approval shall include drawings showing the following details.

(a) The tunnel shaft bracing and dimensions
(b) Tunnel supports
(c) Method of back packing tunnel supports
(d) Bracing to prevent pipe shifting and floating

.30.02 Jacking Operations

Where shown on the drawings or where the Contractor elects to jack pipe in place of tunnelling, or deep trench excavations, the Contractor shall submit details of the

jacking pit bracing, jacking head and method, for approval by the Project Manager.

The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the chamber operation. Excavation shall be performed entirely within the jacking head and no excavation in advance thereof shall be permitted. Every effort shall be made to avoid any loss of earth outside the jacking head.

Excavated material shall be removed from the conduit as excavation progresses and no accumulation of such material within the conduit will be permitted. The Contractor shall excavate, maintain and restore all required jacking and receiving pits that may be necessary to complete the Work. Once the jacking operation has commenced, it shall be continued uninterrupted, until the conduit has been jacked between its specified termination points.

Upon completion of the jacking operation, all voids around the outside of the conduit shall be filled by grouting. Grouting equipment and approved material shall be on the site before jacking operations are started in order that grouting around the jacked conduit may be started immediately after the jacking operation is finished.

.31 RESTORATION

The Contractor shall repave and/or restore all surfaces, cut or otherwise damaged in the course of the Work, to a condition at least equivalent to that existing prior to the commencement of the Work.

The schedules provide for payment of the major items required to restore areas cut or damaged by construction. It is however a Contract requirement that all areas and items disturbed by construction be completely restored to original conditions by the Contractor. Items include but are not necessarily limited to the following:

The reconstruction of ditches to original conditions;

The reconstruction of fences, signs, guiderails, barricades, etc., removed to facilitate construction;

The restoration of all areas of roadways, roadway shoulders, driveways, private walks, grassed areas, etc. cut or damaged by construction;

The replacement of all culverts cut or damaged by construction with new 2.0mm wall thickness, galvanized corrugated, steel culverts as per OPSS.MUNI 421 and OPSS 1801, of the same diam. and length as existing. The culverts shall be installed to the same elevations and grades as existing in a minimum of 150mm granular "A" encasement.

The seed supplied shall contain not less than 35% Marion or Kentucky Blue Grass by weight and shall be uniformly spread at a rate of not less than 1.81 kg. per 93 sq. metres (4 lbs. per 1,000 sq. ft.) and thoroughly raked into the top soil.

All fences, signs, posts, etc. removed to facilitate construction shall be reinstated by the Contractor in the same locations as existing prior to construction.

For purposes of this Contract, the Contractor shall include all costs of restoration as specified, in its prices bid for the various items in the Schedule of Prices to which restoration pertains.

.31.01 Repaving Roads

When the Contractor closes an excavation in a paved street they shall, repave the area of the Work in accordance with the City's Standard Specifications and Standard Drawings, RD-100.01 and RD-100.02, for the type of roadway pavement required to be restored.

.31.02 Repairs to Curbs, Sidewalks and Roads

The Contractor shall replace all curbs, sidewalks and roads as soon as possible but consistent with its operations, in the area and according to the requirements concerning concrete Work during the appropriate season. All restoration of curbs, sidewalks and roads shall conform to City of Hamilton Public Works Department Standard Specifications.

If so directed by the Project Manager, the Contractor shall make temporary repairs to curbs, sidewalks and roads immediately, as specified and shall maintain the Work until permanent repairs can be made.

.31.03 Temporary Closing of Excavation

If the Contractor elects to stop its operations at an excavation with the intention of returning to it at a later date, more than four (4) weeks removed, they shall close the excavation in a manner safe for traffic to be restored to normal.

Notice, 10 days in advance, shall be given if the Contractor intends to temporarily close an excavation. With this notice, he shall submit details of its proposed temporary surface, making the site safe for traffic.

The Contractor shall not temporarily close an excavation before receiving the approval of the Project Manager.

.31.04 Grading and Excavation Behind the Sidewalks and Curbs (All Sections)

a) All grading, excavation and/or filled areas to be sodded shall be included in the prices for sodding per square metre.

b) All grading and excavation for driveway repairs shall be included in the unit prices stated for driveway repairs.

c) All grading and excavation for private concrete repairs shall be included in the prices per square metre for private Work repairs.

.31.05 Saw Cutting of Pavement

Prior to excavation in areas not subject to reconstruction, the Contractor shall saw cut existing pavements back to a minimum of 300mm beyond trench edges. Cuts

shall be to depths sufficient to allow removal of pavements, and base without damaging adjacent surfaces.

.31.06 Cutting, Fitting and Patching

The Contractor shall co-ordinate the Work of all cutting, fitting and patching necessary to make the various parts of the Work come together properly. The Contractor shall also co-ordinate the cutting, fitting and patching as required to connect the Work on this Contract with that of any separate Contractor.

.32 TRAFFIC CONTROL DURING CONSTRUCTION

.32.01 Provision for Traffic, Construction and Maintenance of Detours and Roadways

The Contractor shall at all times carry on the Work in a manner that will create the least interference with traffic consistent with the faithful performance of the Work. The Contractor shall not close the road or provide any detour except with the approval of the Project Manager, in writing. The Contractor, at its own expense, shall at all times provide for the safe passage and control of traffic by supplying, placing, maintaining, changing, and removing such barricades, signs, lights, and traffic controllers as are required for the proper notification and protection of the public approaching or passing through any part of the Contract area and all devices so used shall be in accordance with the Ministry of Transportation of Ontario, Traffic Control Manual and the Ontario Traffic Manual Book 7 - Temporary Conditions and all aspects of the Work shall conform to Occupational Health and Safety Act as amended.

Where, with the approval of the Project Manager, the road is closed and the traffic is diverted to any other public roads, the Contractor shall, at its own expense supply and erect barricades, lights and such other protection as may reasonably be required by the Project Manager at all points where traffic might enter on that portion of the road so closed to traffic. The Contractor, when required by the Project Manager, shall supply traffic control personnel, to protect the barricades and direct traffic at each end of the portion or portions of the highway closed to traffic.

The City will erect signs and lights and maintain such approved detours over other public roads which may be used during the said closure of the road.

The Contractor will not be required to maintain any existing public road within the limits of the Work of the Contract until such time as they have commenced operations on the said road. Once the Contractor has commenced operations, they shall maintain at all times, the existing road or any roadside detour unless otherwise specifically provided.

The Contractor shall at its own expense and prior to the acceptance of the Work, rectify to the satisfaction of the Project Manager, any defacement of the road allowance due to the construction and maintenance of detours.

If, at any time, the Contractor fails to provide for the safe passage and control of traffic on any existing road or detour for which, under these General Conditions he is responsible, and if the Contractor fails to correct forthwith such an unsatisfactory

condition upon being so directed in writing, the Project Manager may immediately correct the unsatisfactory condition and take such other action as they deem necessary for the safe passage and control of traffic. The City may deduct from any monies due or to become due to the Contractor, on any account, any cost or expense incurred by the City under this paragraph.

Failure to act on the part of the Project Manager under this subsection shall not relieve the Contractor from its responsibilities under this Contract.

The Contractor shall co-ordinate the removal and reinstallation of any existing parking meters, Traffic Control Signals or Street Signing with the City of Hamilton Traffic Department.

The Contractor shall restore all parking meters or traffic control signs, or signals damaged by construction to the satisfaction of the Project Manager and the City of Hamilton Traffic Department. All restoration is to be done at the Contractor's expense.

A Traffic Co-ordination Meeting shall be arranged, where required, at least 2 weeks in advance of the start of construction.

Wherever roadway plates are required they must be saw cut in, flush with the road surface, and be skid resistant.

The Contractor shall provide Traffic Protection Plans, as required, to meet all requirements of the Ministry of Labour and the Occupational Health and Safety Act.

The Contractor will be required to strictly adhere to all requirements for barricading, lighting, and traffic control as specified by the City of Hamilton, and the Ministry of Transportation, Ontario Traffic Manual, Book 7 - Temporary Conditions.

Wherever possible, the Contractor shall avoid working on arterial roadways with high traffic volumes during peak traffic periods. In general the peak traffic periods shall be considered to be 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. on weekdays. Any exceptions to this requirement shall be at the discretion of the Project Manager. The Contractor shall have no basis for increased working time due to this requirement.

Where there is no item in the Schedule of Prices for traffic control, all costs for the above shall be deemed to be included and no separate payment will be made.

.32.02 Hamilton Street Railway (HSR) and School Bus Services

Wherever possible, HSR and school bus traffic shall be maintained at all times, including the provision for suitable, clean areas for bus stops. At temporary bus stops, a flat platform shall be constructed of granular "A" material for pedestrian use. In addition, a safe walkway must be maintained between the temporary bus stop and any adjacent sidewalk.

Prior to closing any roadway, the Contactor shall ensure that all school bus operators using that route are notified well in advance.

The Contractor shall contact and notify the City and the HSR at 528-4200, Ext. 1810, at least one week prior to:

a) Closing or restricting lanes on any local streets or arterial roads with HSR routes. The Contractor will notify the HSR two weeks prior to closing any arterial roads in this Contract so bus traffic can be maintained and to give sufficient time for the HSR to notify its customers. All bus movements must be approved by the HSR and/or authorities having jurisdiction over school bus traffic.

b) Working in areas of existing bus shelters to co-ordinate their removal and/or identify and maintain any underground electrical conduit

c) The removal and/or relocations of any bus stops during construction

d) The pouring of concrete or laying asphalt for any landing pad or shelter pad, in order to ensure they are properly located and any inserts for the bus stops are supplied

.32.03 Traffic Control – Police Services

The Contractor shall be responsible for arranging for and full payment of all costs for the use of Hamilton Police Services or other Police forces having jurisdiction where:

a) The use of Police Officers is required for the safe passage of traffic through construction detours and/or traffic signals

(b) In the opinion of the Project Manager, construction operations require the use of Police Officers as a safety precaution

.33 UTILITY FRAME AND COVER RAMPING/BARRICADING

The Contractor shall note if a street is opened to traffic prior to completion of construction the Contractor shall:

a) Temporarily ramp all utility frames and covers with hot mix asphalt.

b) Temporarily barricade all utility frames and covers where necessary.

.34 DAMAGE BY VEHICLES AND OTHER EQUIPMENT

If at any time, in the opinion of the Project Manager, damage is being done or is likely to be done to any highway or any improvement thereon, other than such portions as are part of the Work, by the Contractor's vehicles or other equipment whether licensed or unlicensed, the Contractor shall, on the direction of the Project Manager and at the Contractor's own expense make changes in or substitutions for such vehicles or other equipment or shall alter loading or shall in some other

manner remove the cause of such damage to the satisfaction of the Project Manager, except that where such a change, substitution, alteration or removal is made in circumstances that could not have been foreseen by the Contractor at the time of tendering and in respect of a vehicle hauling a load within its licensed capacity, it shall be at the expense of the City.

.35 EXCESS LOADING OF MOTOR VEHICLES

Where a vehicle is hauling material for use in the Work under this Contract, in whole or in part upon a public highway and where motor vehicles registration is required for such vehicles, the Contractor shall not cause or permit such vehicles to be loaded beyond the capacity for which it is licensed whether such vehicle is registered in the name of the Contractor or otherwise, except upon those areas within the limits of the Contract as designated in the special provisions.

The Contractor shall bear the onus of weighing disputed loads. Notwithstanding any other provision of this Contract, where a vehicle is hauling material which is being measured for payment by weight, over any portion of highway on which overloading is not permitted by this Contract, no payment shall be made by the City to the Contractor for any part of the load carried in said vehicle that exceeds the licensed capacity of the vehicle.

.36 BLASTING AND USE OF EXPLOSIVES

.36.01 Blasting Provisions

Should the Contractor, in its excavating, find it expedient to use explosives, they shall observe and be governed by the applicable provisions of the regulations in accordance with Form 300.08.

In reference to statutory and other regulations, it is to be understood that each reference is to the latest version, and that all amendments made before or during the performance of the Work are equally binding.

In addition to Form 200.03.21, the following shall apply:

Where blasting is anticipated the Contractor must hire an independent Inspection Company, at its own expense, to conduct a pre-construction inspection of the properties within 100 metres of the construction area which must be completed prior to carrying out any blasting operations.

This will include all structures considered to be of potential risk, including, but not limited to buildings, driveways, sidewalks, swimming pools, patios, etc.

The pre-construction survey report shall include as a minimum the following information and shall be made available to the City at the pre-construction meeting:

1) Type of structure, including type of construction, and the date if possible, when built.

2) Any differential settlements: visible cracks in walls, floors and ceilings shall

be identified and described, including a diagram, if applicable, room by room.

3) Any other apparent structural or cosmetic damage or defect must also be noted.

4) The report shall use positive dimensions whenever practical to do so, instead of general terms, e.g. "sagging 1 to 2 inches" as opposed to "sagging badly".

5) Clear quality photographs, as deemed necessary for proper recording of significant concerns.

The standard inspection procedure will include the provision of an explanatory letter to the building owner with a formal request for permission to carry out an inspection.

In the event that free access cannot be gained to any property, or after three (3) attempts being made, or through refusal by the owner or tenant, it shall be considered a complete inspection. If after three calls, the occupant cannot be contacted, the exterior of the building will be inspected if accessible.

The Contractor shall provide, at the pre-construction meeting, at no expense, a copy of the pre-construction survey report to the Project Manager. The survey report shall indicate the address of each of the properties inspected, the refusals received, and an evaluation of any evident or potential hazards that exist.

The Contractor shall employ, at its own expense, the services of a Specialist experienced in seismic investigations to determine and control the permissible intensity of vibrations which will result from blasting operations. Investigations shall be carried out by the Contractor and the Specialist before any rock excavation is started in order to determine the maximum explosive charges that can be used at different locations throughout the area of rock excavation. The Contractor shall submit a report to the Project Manager outlining the results of the investigations and tests made, and detailing the control required during blasting, throughout the area of rock excavation.

Further seismic readings shall be taken by the Specialist during blasting operations. Such readings shall be on a continuous basis and shall be taken where buildings and structures are located within 60 metres (200 ft.) of the blast area.

Within the area of the above, building and structures, the monitoring equipment shall be placed to obtain representative readings. As construction proceeds, the monitoring equipment shall be repositioned on an on-going basis.

In addition to the above, vibrations generated shall not exceed a vibrational peak particle velocity of 50mm (2 inches) per second when monitored at the nearest building or structure.

If the monitoring station is not at the nearest structure, then the allowable particle velocity shall be reduced in accordance with the increased distance from the blast and shall be determined by the blasting specialist.

Additional monitoring and readings shall be obtained in other sensitive areas where the pre-blast survey indicates the need.

The Contractor and Specialist shall visit the Owners of properties and buildings where test and/or investigations are required and shall describe blasting and seismic investigations to them and obtain their permission to carry out the necessary investigations and notify them of the blasting schedule. In addition, all property owners with 300m of the blast area shall be provided with the blasting schedule. In addition all property owners having had their property surveyed shall be provided with a card, stating that a copy of the pre-blast survey, of their property will be provided upon written request.

The Specialist will be an advisor to the Contractor and the acceptance of his/her reports and recommendations by the Project Manager will, in no way relieve the Contractor of any responsibility for damage or injury by blasting.

.36.02 Tunneling

Where blasting methods are employed in tunneling operations all conditions and requirements as stated herein shall be met and adhered to by the Contractor.

The blasting specialist shall be present and monitor the first ten (10) blasts detonated at the tunnel heading as a trial section. If it is found that the maximum allowable particle velocity has not been exceeded at any time during the test section, the City will allow the Contractor to continue its operation employing seismic recorders only.

The recorders shall be supplied and installed by the blasting Specialist, repositioned on an on-going basis as Work progresses and shall be checked for accurate operation at intervals not to exceed three (3) Working days.

Should the Contractor elect to alter its blasting methods they shall immediately notify the Specialist and the City and have another trial section of ten (10) blasts recorded in the presence of the Specialist at the Contractor's own expense.

If at any time during construction, the recordings indicate that the maximum allowable particle velocity has been exceeded, the Project Manager will require the blasting Specialist to be present at each and every further detonation or until such time as the Project Manager is satisfied that all requirements are being adhered to, all at the Contractor's own expense.

All costs incurred by the Contractor in the employment of the Specialist in seismic investigations shall be deemed to be included in the items in the Contract under which any rock excavation is required.

.36.03 Blasting Mats

Where blasting methods are employed by the Contractor in the vicinity of buildings, structures or other properties subject to damage by flying material, the Contractor shall supply and place blasting mats or use such other methods as may be

approved by the Project Manager to prevent damage by air borne materials.

.37 SHORT TERM PAVEMENT MARKINGS

All short term and temporary pavement markings shall be installed in accordance with the Contract Documents, OPSS 710 and the Ontario Traffic Manual unless otherwise noted.

In general, short term pavement markings refer to any marking that is required to provide delineation and positive guidance to road users until permanent pavement markings can be installed. Short term pavement markings are typically used where the road surface has been altered in such a manner as to obscure existing pavement markings however the road and general lane arrangement is unaffected (i.e. road resurfacing where a milled surface will be left for an extended period of time before final paving or where there is a time lag between final paving and the application of permanent pavement markings).

In general, temporary pavement markings refer to any marking that is required to provide delineation and positive guidance to road users through work zones where the general lane arrangement of the road is altered to facilitate construction (i.e. lane shifts, lane reductions, lane narrowing etc.)

Under no circumstances shall short term or temporary pavement markings conflict with any permanent pavement marking. Furthermore, only Temporary Preformed Plastic Pavement Marking Tape shall be used on road surfaces that are not being reconstructed or resurfaced unless otherwise specified in the contract documents or agreed to by the parties.

For short term pavement markings involving directional dividing line and lane lines, Table 1 of OPSS 710 is amended as follows.

TABLE 1: SHORT TERM PAVEMENT MARKINGS

Type of Roadway	Min. Line Length	Max. Gap Length	Max. Duration*
All roads, Speed Limit < 90 km/h	0.3 m	6.0 m	15
All roads, Speed Limit ≥ 90 km/h	0.3 m	9.0 m	15
* Maximum number of Working Days before permanent markings must be placed.			

.38 PROPOSED ROAD, CURB AND SIDEWALK GRADES AND ELEVATIONS

The Contractor shall calculate all proposed road, curb and sidewalk grades and elevations and shall submit them to the Project Manager for review, prior to construction.

The proposed grades for road, curb and sidewalk construction shall be determined using the following design criteria:

1. All gutter grades shall be 0.75% minimum slope to catch basins.

2. Radii to be improved where possible, up to 9 metres maximum where there is sufficient property. Contractor to verify property lines for improvements, with the City prior to construction.

3. All driveway repairs to have a minimum slope of 2% toward the road.

4. All apron approaches shall not exceed a maximum slope of 8% toward the road.

5. At all arterial cross streets, road cross fall shall be 1%.

6. At all local cross streets, road cross fall shall be 2%.

7. Sidewalk cross fall shall be 2%.

8. Boulevard cross fall shall be 4%.

9. All variations from specified criteria shall be approved by the Project Manager.

.39 METHOD OF PAYMENT FOR EXTRA WORKS BY FORCE ACCOUNT

For the purpose of this section,

"Work" means the Extra Work approved by the Project Manager pursuant to Form 200.02.08, which is to be paid for on a time and material basis.

"cost of labour" means the amount of wages and payroll burden paid or incurred directly by the Contractor for or in respect of the labour forces and for or in respect of supervision by foreman actively and necessarily engaged on the Work. Costs will be based on the recorded time and hourly rates of pay for such labour and supervision, but shall not include any payment or costs incurred for general supervision, administration or management or any wages, or payroll burden for which the Contractor is compensated by any payment made by the City for equipment.

"payroll burden" means the payment in respect of Worker's compensation, vacation pay, employment insurance, public liability and property damage insurance, sickness and accident insurance, pension fund, and shall include any costs or expense of food, lodging and incidental expenses such as the Project Manager may approve when such costs are assumed by the Contractor as a condition of employment of those directly and actively engaged in the extra Work.

"cost of material" means the cost of materials by the Contractor for the extra Work as shown by itemized invoices and the cost of material from the Contractor's stock used on the Work valued at current prices.

Subject to such exceptions as the Project Manager may permit in writing, the Work performed by the Contractor under this section shall be subject to all the terms, conditions, specifications and provisions of this Contract.

Daily Work records prepared by the Project Manager or Inspector reporting the labour and equipment employed and the material used on the Work shall be reconciled with and signed each day by the Contractor's representative.

The City shall pay the Contractor for labour on the Work, at the rate of 135% on the first $3,000.00 of the cost of labour, and at the rate of 120% on the cost of labour in excess of $3,000.00.

The City shall pay the Contractor for material used in the Work, 120% at the rate of the cost of material, up to $3,000.00 and at the rate of 115% over $3,000.00 excluding the costs of materials for which compensation is included in the rental rates for construction equipment. Material originally supplied and used by the Contractor in the Work, and subsequently salvaged by the Contractor in reusable condition shall be accepted by the Contractor and 50% of the costs of such material shall be deducted from the amount payable to the Contractor.

Where the Contractor arranges for Work on a Time and Material Basis, or a part of it, to be performed by Sub-Contractors on a Time and Material Basis and has received approval prior to the commencement of the Work, in accordance with the requirements of OPSS.MUNI 100 subsection GC3.09, Sub-Contracting by the Contractor, the Owner will pay the cost of Work on a Time and Material Basis by the Sub-Contractor calculated as if the Contractor had done the Work on a Time and Material Basis, plus a mark-up calculated on the following basis:

(a) 20% on the first $3,000; plus

(b) 15% on the amount from $3,000 to $10,000; plus

(c) 5% on the amount in excess of $10,000.

No further mark-up will be applied regardless of the extent to which the Work is assigned or sublet to others. If Work is assigned or sublet to an associate, as defined by the Securities Act, no mark-up whatsoever will be applied.

Equipment owned by the Contractor used in the Work shall be paid for in accordance with the Ministry of Transportation, Ontario "Schedule of Rental Rates for Construction Equipment, Including Model and Specification Reference", as set out in the OPSS 127, hereinafter called the "127 Rate". Each period of time during which the equipment is actively and of necessity engaged in performing the Work, and the first two hours of each immediately following period during which the equipment is not so engaged but the Work is otherwise proceeding, shall be considered Working time for which the City shall pay the Contractor the "127 Rate". Equipment owned by the Contractor that is not covered by the "127 Rate", shall be paid at a negotiated price.

The City will pay the Contractor for the Working Time of all equipment other than

Rented Equipment and Operated Rented Equipment used on the Work on a Time and Material basis at the "127 Rates" with cost adjustments as follows:

(a) Cost $10,000 or less - no adjustments

(b) Cost greater than $10,000 but not exceeding $20,000 - payment $10,000 plus 90% of the portion in excess of $10,000; and

(c) Cost greater than $20,000 - $19,000 plus 80% of the portion in excess of $20,000.

The City will pay the Contractor for the Working Time of Rented Equipment used on the Work on a Time and Material Basis at 110% of the invoice price approved by the Project Manager up to a maximum of 110% of the "127 Rate". This constraint will be waived when the Project Manager approves the invoice price prior to the use of the Rented Equipment.

The City will pay the Contractor for the Working Time of Operated Rented Equipment use on the Work on a Time and Material Basis at 110% of the Operated Rented Equipment invoice price approved by the Project Manager prior to the use of the equipment on the Work on a Time and Material Basis.

Any period of time, or part thereof, which is not herein considered Working time, and during which the equipment owned by the Contractor is required to remain on the site of Work, shall be considered standby time. The wages, salary and payroll burden of the operator or operating crew who cannot be otherwise employed during standby time shall be included in the cost of labour. In addition the City shall pay one-third of the "127 Rate" for that portion of standby time which together with the Working Time does not exceed 10 hours in any one day.

When equipment owned by the Contractor is being transported by float within the limits of the Contract to or from the site of the Work, payment shall be made by the City only in respect of the float. When equipment owned by the Contractor is being moved under its own power, it shall be deemed to be working. The Project Manager shall negotiate payment for transporting such equipment from sources outside the limits of the Contract.

"Rental Equipment" means equipment that is rented or leased for the special purpose of Work on a Time and Material Basis from a person, firm or corporation that is not as associate or affiliate of the lessee as defined by the Securities Act, and is approved by the Project Manager.

Notwithstanding any other provision of this Section, no payment shall be made to the Contractor for or in respect of hand tools or equipment that are tools of the trade.

Except where there is agreement in writing to the contrary, the compensation as herein provided shall be accepted by the Contractor as compensation in full for all costs and expenses arising out of the Work including all costs of general supervision, administration and management time spent on the Work and no other payment or allowance shall be made in respect of such Work.

The Contractor shall submit to the City a separate invoice in triplicate for the Work within thirty days of the completion of the Work. Each invoice shall include the number and covering dates of the Work, and shall itemize separately labour, materials and equipment, and submitted with the invoice shall be receipted invoices for materials, rented equipment, and other charges incurred by the Contractor on the Work.

APPENDIX A - GUIDELINES FOR OBTAINING WATER FROM CITY HYDRANTS FOR AUTHORIZED CONTRACTORS AND CITY STAFF.

1. General

a. This document provides procedural guidelines to Contractors and City Staff authorized to operate City Hydrants for the purpose of obtaining water.

b. Water obtained from City hydrants shall be solely used for the operations related to City of Hamilton business. The City may require that water usage is metered.

c. Any person operating a hydrant shall have sufficient knowledge on hydrant operation and water distribution systems.

d. Only hydrants included in the approved hydrant list should be used. The List is updated yearly and can be obtained from Engineering Services, Asset management Section, Subsurface Group.

e. All persons operating a hydrant must maintain a Hydrant Use Log Form by entering the required information each time a hydrant is used. Completed forms are to be submitted to the City Inspector weekly.

f. A hydrant pump must be used to pump out water each time a hydrant is used if the water in the hydrant body does not drain properly, especially during the months of November, December, January, February and March. Hydrant pump shall be disinfected with 1% Sodium Hypochlorite spray before use. This will occur regardless of the outside temperature. The City inspector will perform periodic spot checks utilizing a camera to ensure that pumping has been successful and no ice has built up that could possibly limit hydrant operation. In the event an issue is discovered, the inspector shall be notified immediately. The Inspector shall call CSR's to schedule a WDO to inspect the hydrant.

g. In the case where prolonged use of a fire hydrant is required, Inspector is to call "hydrant out of service" with the CSR's for the communication with Fire Department and update in Hansen system. Inspector is to call "hydrant back in service" with CSR's when operations are completed.

2. Hydrant Operation - Normal Operation

a. Verify direction of operation by visual observation of arrow on top of hydrant and/or the presence of black painted "L" on body.

b. Only City of Hamilton approved hydrant wrenches are to be used in the operation of a fire hydrant.

c. Remove cap of port to be used while ensuring that remaining port caps are tightly secured. If front port is to be used, install appropriate adaptor as required.

d. All hydrants are to be operated in the fully open position with a hydrant adaptor / backflow preventer installed for control. The hydrant adaptor shall be disinfected with 1% Sodium Hypochlorite spray before each use.

e. Open all hydrants slowly. Initially flow the hydrant just enough to remove branch water and then open a minimum of three to four turns to ensure the main valve drains are fully open. Proceed to open hydrant to full open position. If flow must be regulated, a 2 ½" gate valve must be used.

f. Close hydrant slowly. Once the flow has stopped, turn the operating nut ½ a turn in the open direction to take the strain off the operating parts of the hydrant while ensuring that the hydrant is fully off.

g. Verify that the hydrant is draining following closure by looking in the open port to see if the water level is dropping. If the hydrant does not drain or does not shut off completely, notify the City inspector immediately.

h. In the event that the hydrant body does not drain, pumping out the water with a hydrant pump shall be used. Hydrant pump shall be disinfected with 1% Sodium Hypochlorite spray before each use.

i. Replace cap of port used slightly to ensure air has been released and tighten.

j. Replace hydrant marker flag if one was present.

3. Connection / Disconnection of Hydrant Adaptor

a. Before installing the hydrant adaptor, the hydrant adaptor shall be disinfected with 1% Sodium Hypochlorite spray.

After disconnection of hydrant adaptor, the hydrant should be inspected for proper operation and sufficient drainage of hydrant body.

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.01 SCOPE

.01.01 General

This Specification covers the requirements for the installation of ductile iron, polyvinyl chloride, concrete and steel watermains. All watermains and water services shall be supplied and installed in accordance with OPSS.MUNI 441 – Construction Specification for Watermain Installation in Open Cut, as amended by this specification.

.01.02 Work Included

The Contractor shall, unless specified otherwise, furnish all equipment, tools and labour necessary to do the Work required under this Contract and unload, haul and distribute all pipe, fittings, valves, hydrants and accessories. The Contractor shall also remove the pavement as stipulated; excavate the trenches and pits to the required dimensions; excavate the bell holes; construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground structure where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, fittings, valves, hydrants and accessories; backfill and consolidate trenches and pits; restore roadway surface, unless otherwise stipulated; remove and dispose of surplus excavated materials as directed; clean the site of the Work; and maintain the street or other surface over trenches as specified.

.02 RESPONSIBILITY FOR MATERIAL

.02.01 Material Furnished by the Contractor

All watermain materials furbished by the Contractor shall be new. Reuse of watermain pipe, components and appurtenances is not permitted.

Unless otherwise noted in the Contract Documents, the Contractor shall supply all materials required to complete the Works. This will include but not be limited to:

a) The proposed watermain pipe(s) complete with all valves, connections, fittings, special appurtenances, thrust blocks, anchor blocks, tee's, bends, sleeves, and all lowerings in accordance with the elevations and grades shown on the Contract Drawings.

b) Water for testing and disinfection shall be supplied by the Contractor from a location corresponding to the appropriate Drinking Water System. Hydrant usage will require the necessary permit and meterage charges. The Contractor shall be responsible for the transportation of this water from source of supply to point of use.

c) The Contractor shall be responsible for all material furnished by them and shall replace all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labour required for the replacement of installed material discovered defective prior to the final acceptance of the Work.

d) In addition to Form 200.04.06, all materials supplied by the Contractor shall be in accordance with the applicable current Approved Products List or Contract specification. Any material used that is not approved or not appropriate shall be removed and replaced by the Contractor at no cost to the City.

.02.02 Material Furnished by the City

Where the Contract Documents or Drawings indicate that the City will supply materials, the Contractor shall pick-up the required materials at the designated location and haul such materials to the site as required.

The Contractor's responsibility for material furnished by the City shall begin F.O.B. at the point of delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the execution of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery to and shall reject all defective material.

.02.03 Safe Storage

The Contractor shall be responsible for the safe storage of material supplied by or to them and accepted by them and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

.02.04 Replacement of Damaged Material

Any material furnished by the City that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor.

.02.05 Disposition of Defective Material

Prior to acceptance of responsibility for safe storage by the Contractor under Form 400.02.03, any material furnished by the City found to be defective shall be set aside and removed from the site or the Work by the City. All defective materials furnished by the Contractor shall be promptly removed by from the site.

.03 HANDLING OF MATERIAL

.03.01 Loading and Unloading

All pipe fittings, pipe, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

.03.02 Transporting, Unloading, Storing and Handling Pipe

All pipe up to and including 600mm shall be delivered to the site with end covers and tamper evident seals in accordance with OPSS.MUNI 441.07.07.

.04 APPROVED WATERMAIN MATERIALS

All watermain pipe, fittings and other materials shall be as listed on the Approved Products List, as amended. Materials shall meet the current version of the applicable standards, including but not limited to CSA, ASTM, ANSI/AWWA, NSF Standard 61 and OPSS.

Acceptable pipe materials are ductile iron, polyvinyl chloride and concrete pressure pipe. Steel Pipe is acceptable in project specific applications only.

OPSS.MUNI 441.05.02	Ductile Iron Pipe – acceptable. Refer to Form 400.05.
OPSS.MUNI 441.05.03	Concrete Pressure Pipe – acceptable. Refer to Form 400.06.
OPSS.MUNI 441.05.04	Polyvinyl Chloride Pipe – acceptable. Refer to Form 400.07.
OPSS.MUNI 441.05.04.03	Molecularly Oriented Polyvinyl Chloride Pipe (PVCO) – acceptable. Refer to Form 400.07.01.
OPSS.MUNI 441.05.05	Polyethylene Pipe - not acceptable.
OPSS.MUNI 441.05.06	Steel Pipe – acceptable for special projects only per the Contract Documents.
OPSS.MUNI 441.05.07	Copper Pipe – acceptable. Refer to Form 400.23.
OPSS.MUNI 441.05.08	Composite Pipe - not acceptable.

.05 DUCTILE IRON PIPE WATERMAIN

All watermain materials shall be in accordance with AWWA C104, C105, C110, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version.

Watermain gaskets shall be EPDM (Ethylene Propylene Diene Monomer), Nitrile NBR (Acrylonitrile Butadiene), or Fluorocarbon (Viton, Fluorel or approved equivalent. Selection of gasket material shall be suitable for the existing soil geo-environmental conditions.

.05.01 Ductile Iron Pipe Watermain – 100mm, 150mm, 200mm and 300mm

Ductile iron pipe shall be Pressure Class 350, cement lined, Tyton joint and/or restrained Joints, for 300mm and smaller pipe as per OPSS.MUNI 441.05.02 with cement lined fittings.

All pipe and mechanical joints of pipe shall be protected by Polyethylene Encasement in accordance with this specification and the manufacturer's

recommendation. Field cut pipe shall be kept to a minimum.

Anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings. Joint restraint shall be selected from the Approved Products List and installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material**.**

.05.01.01 Polyethylene Encasement of Ductile Iron Watermain

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and the following:

(i) Material to be Low Density, polyethylene film having a nominal thickness of 8 mil (.008 inch) in accordance with ANSI/AWWA C105/A21.5, Section 4.1.2.3
(ii) Installation Method "A" only to be used. (Poly-Tube with overlap - No sheets)
(iii) Direct service connection tapping through triple polyethylene adhesive tape & the polyethylene film is to be used for all service taps.
(iv) Junctions between wrapped & existing unwrapped pipe - polyethylene wrap is to cover the adjacent pipe for a distance of at least 0.9m. Secure the end with sufficient circumferential turns of tape.
(v) Attached service lines of dissimilar metals shall be wrapped with polyethylene or suitable dielectric tape for a minimum clear distance of 0.9m away from the ductile iron pipe.

.05.02 Ductile Iron Pipe Watermain – 400mm and Larger

All ductile iron watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Pipe shall be Class 52, ductile iron cement lined, with Tyton and/or restrained Joints as per OPSS.MUNI 441.05.02, with cement lined fittings. All pipe and mechanical

joints of pipe shall be protected with Polyethylene Encasement in accordance with this specification and the manufacturer's recommendation. Field cut pipe shall be kept to a minimum.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

Restrained Mechanical Joint for ductile iron pipe will be required at all fittings and for suitable length as recommended by the Supplier. Restraint shall be selected from the Approved Products List and shall be installed in strict accordance with the manufacturer's specifications and recommendations. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

All watermain joints and fittings within areas of engineered fill shall be restrained.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and as described in subsection .05.01.01.

Closure pipe shall consist of Restrained Mechanical Joint Fittings and Solid Sleeve.

All dead ends on watermain shall be closed with cast iron plugs/caps or bulkheads that are adequately restrained for pressure testing and provided with a 50mm corporation main stop.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.05.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.

b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;

c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.

d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve

chamber drawing submission by the Contractor.

e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.06 CONCRETE PRESSURE PIPE WATERMAIN (500mm and Larger)

All concrete watermain shall be in accordance with AWWA C301 and/or C303, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version. Non-cylinder pipe is not permitted.

400mm concrete pressure pipe will only be permitted for short repair sections or where specifically approved for use by the City.

All concrete watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Restrained Joint Concrete Pressure Pipe will be required at all fittings and for suitable length as recommended by the manufacturer. Joints alone shall be capable of withstanding thrust up to 150psi test pressure. Joint restraint shall be in accordance with the manufacturer's recommendations. Welded joints will not be permitted.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

Tracer wire shall be installed on concrete pressure pipe shall be light coloured, plastic coated and strapped to the pipe at 6m intervals and in accordance with Form 400.11.

Closure pipe shall consist of two lengths of pipe with a dresser coupling. The lengths of pipe shall be made to lengths measured in the pipe trench by the Contractor.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

.06.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.

b) Pipe layout drawings and schedules showing the location and type of all

pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;

c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.

d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve chamber drawing submission by the Contractor.

e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07 POLYVINYL CHRLORIDE (PVC) PIPE WATERMAIN

All PVC watermain shall be in accordance with OPSS.MUNI 441, AWWA C605, C900, C907, C909, this specification and be selected from the Approved Products List, latest version.

.07.01 Polyvinyl Chloride (PVC) Pipe – 100mm, 150mm, 200mm and 300mm

Pipe shall be in accordance with OPSS.MUNI 441.05.04, and the following:

OPSS.MUNI 441.05.04 Polyvinyl Chloride Plastic Pipe Products

PVC pipe in sizes 100mm, 150mm, 200mm and 300mm shall have cast iron outside diameters (CIOD) in all sizes. Pipe shall be joined by means of integral elastomeric–gasket joints conforming to ASTM D3139. Acceptable PVC materials are as follows:

a) Polyvinyl chloride pipe (PVC) Class 235, DR18 conforming to AWWA C900 and CSA B137.3;

b) Molecularly oriented polyvinyl chloride (PVCO), Pressure Class 235 (PC235) conforming to AWWA C909.

Fittings for 100mm, 150mm and 200mm PVC pipe shall be injection molded PVC conforming to AWWA C907. Fittings for 300mm shall be manufactured from segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, protective coatings (primer, mastic and tape) and cathodic protection must be installed to the satisfaction of the Project Manager.

Anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings (WM series). Joint restraint shall be selected from the Approved Products List and installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.01.01 Service Connection Fittings and Appurtenances – PVC Pipe

OPSS.MUNI 441.05.12 Service Connection Fittings and Appurtenances

Add the following:

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2, or using service saddles selected from the Approved Products List.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material.

.07.02 Polyvinyl Chloride (PVC) Pipe – 400mm to 750mm

All PVC watermain 400mm to 750mm shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

OPSS.MUNI 441.05.04 Polyvinyl Chloride Pipe

Revised as follows:

PVC pipe in sizes 400mm to 750mm shall conform to AWWA C900 and shall be designed according to AWWA Manual M23: PVC Pipe-Design and Installation, 2nd Edition. All 400mm pipe shall be DR18. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

Fittings for 400mm through 750mm PVC pipe shall be manufactured from segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, protective coatings (primer, mastic

and tape) and cathodic protection must be installed to the satisfaction of the Project Manager.

Joint restraint will be required at all fittings and for suitable lengths as recommended by the manufacturer. Joint restraint shall be selected from the Approved Products List and installed in strict accordance with the manufacturer's recommendations. Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

All watermain joints and fittings within areas of engineered fill shall be restrained.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.

b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;

c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.

d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve chamber drawing submission by the Contractor.

e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07.03 Installation of Pipes

OPSS.MUNI 441.07.14 Installation of Pipe

Add the following:

Excavation and Preparation of Trench shall be completed in accordance with the manufacturers recommendations and AWWA C605.

.07.04 Jointing Polyvinyl Chloride (PVC) Pressure Pipe

OPSS.MUNI 441.07.15.04 Polyvinyl Chloride Pressure Pipe – PVC and PVCO

Add the following:

PVC pipe shall be laid in accordance with AWWA C605. Pipe deflection shall be in accordance with subsection .07.05 Changes in Line and Grade.

Bell and Spigot Joints

The pipe shall be jointed in accordance with AWWA C605 and the manufacturer's specifications. If elastomeric gaskets are supplied separately, they shall be inserted into the groove of the bell end of the pipe.

Lubricant for gaskets shall conform to pipe manufacturers recommendations and shall be NSF-61 approved. Clean the gasket, the bell, the groove area and the spigot area with a clean rag to remove any dirt or foreign material before assembling. Insert the gasket into the groove and seal it firmly. Apply lubricant, as provided by the manufacturer, to the beveled spigot end. Push the lubricated end past the gasket into the bell until the reference mark is even with the bell.

.07.05 Changes in Line and Grade

OPSS.MUNI 441.07.17 Change in Line and Grade

Add the following:

All pipe joint deflections shall be less than or equal to 50% of the values recommended by the manufacturer. No deflection of the pipe barrel for changes in line or grade are permitted.

.07.06 Polyvinyl Chloride (PVC) Pipe - Cathodic Protection

The following are minimum requirements. Specific soil conditions may require changes to the cathodic protection system. The installation and placement of anodes and tracer wires shall be in accordance with OPSD 1109.011 and the following:

Cathodic protection shall be provided for all tracer wires on PVC watermain pipes. One (1) 5.4kg zinc anode will be provided for every 1000m tracer wire.

One (1) 5.4kg zinc anode is to be installed on all copper service connections, by means of a service ground clamp, coated with T.C. Mastic or wrapped with “Scotchfill” electrical putty or approved equal. The anode is to be placed at least 1.0m away from the water service and as deep as the service and within 1.0m of the curb stop.

One (1) 10.8kg zinc anode is to be installed on each hydrant. If PVC pipe is used between the hydrant tee and the hydrant boot, two (2) 10.8 kg zinc anodes shall be used.

One (1) 5.4kg zinc anode is to be installed on every line valve, and every metallic fitting connected to a PVC watermain. Fittings include bends, tees, crosses, sleeves, reducers, plugs, caps and couplings.

One (1)14.5kg magnesium anode is to be connected to the first length of an existing metallic watermain pipe when connected to a new PVC watermain.

All sacrificial zinc anodes shall conform to ASTM B-418 Type II and shall be made of high grade electrolytic zinc, 99.99 % pure. Magnesium anodes shall conform to ASTM B-107-Type M1.

For all anodes connected to new pipe, fittings or to existing metallic watermains, a Cadwelder and CA-15 or equivalent cartridge shall be used. All thermite weld connections to be coated with T.C. Mastic (Tapecoat of Canada), Roybond 747 Primer and Royston “Handy Cap” or approved equal.

Contractors are advised that there is no specific pay item for Cathodic Protection; all costs shall be included in all other appropriate items.

.08 TRUNK WATERMAIN DESIGN AND OPERATING PARAMETERS – 400mm AND LARGER

All trunk watermains shall be in accordance with the following requirements:

The pipe manufacturer shall calculate the joint restraint required based on the trench width, cover over the pipe, bedding and pressures indicated in this specification and on the Contract Drawings.

Watermains, fittings and restraint shall be designed and constructed for operation under the following parameters:

Design / Field Test Pressure	Working Pressure	Surge Pressure (Additional)	Additional External Loads
150psi	100psi	100psi	Hwy. H-20 S16

a) The factor of safety for pipe and fitting restraint shall be 2 times the design / field test pressure (300psi).

b) Pipe joints alone shall be capable of withstanding 150psi test pressure.

c) Trench Type 5 shall be used.

d) Proposed joint restraint shall be able to accommodate all operating, test and surge pressures independent of anchor blocks.

e) Anchor blocks will be required in addition to joint restraint.

f) All restrained joints shall be installed in strict accordance with the manufacturer's specifications and recommendations and shall include appropriate corrosion protection.

g) Depth of bury shall be a maximum of 1.6m to top of pipe or less. Where drawings or documents indicate depth of bury less than 1.6m to top of pipe, that value will be used.

.09 VALVE CHAMBERS

.09.01 Chambers

Valve chambers shall be in accordance with OPSS.MUNI 402, OPSS 1351, City standards and Contract Drawings. Chambers shall be capable of withstanding the required thrust forces and be selected from the Approved Products List.

Pre-cast chambers shall be supplied from a plant listed as Prequalified under the Plant Prequalification Program by the Ontario Concrete Pipe Association.

.09.02 Valve Chamber Piping

Chamber piping materials shall be ductile iron pipe, concrete pressure pipe or stainless steel pipe in accordance with the following:

.09.03 Ductile Iron

Ductile Iron Pipe shall be a minimum of Class 54, conform to AWWA C151 and be cement lined as per AWWA C104.

.09.04 Concrete Pressure Pipe

Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.

.09.05 Stainless Steel Pipe (750mm and larger)

The Contractor may consider a stainless steel valve chamber piping option with similar configuration to the City's standard drawings for concrete pressure pipe valve chamber piping. The Contractor shall submit detailed chamber stainless steel piping layout drawings for the City's review prior to the submission of shop drawings.

Stainless Steel pipe shall be Schedule 40, Grade 316L or higher, ASTM A778, shall be straight seam with full penetration butt-weld as per AWWA C220, NSF61 approved. Stainless steel pipe shall be pickled and passivated.

Fabricated fittings shall be according to AWWA C208.

Angle collars with slip-on backing flange ASTM A774 are acceptable.

Connections between dissimilar pipe/flange metals shall be done with flange insulating gaskets kits.

Blow-off valve piping, air valve piping and pitometer piping shall be stainless steel.

All bolts shall be SS type 304 bolts, nuts and washers

.09.06 Chamber Fittings

Ductile Iron Fittings shall conform to AWWA C110.
Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.
Stainless Steel Fabricated fittings shall conform to AWWA C208.

.09.07 Bolts

All nuts, bolts and washers shall be stainless steel. Bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length shall be sufficient to accommodate flanges, gaskets and insulators. Protective coatings (primer, mastic and tape) shall be applied to all nuts and bolts inside chambers.

.09.08 Design

All pipe and fittings shall be designed to the values given in the Trunk Watermain Design and Operating Parameters – 400mm and Larger, subsection 400.08.

.09.09 Submissions

The following shall be in addition to the trunk watermain requirements outlined in Form 400, Sections .05.02.01, .06.01 or .07.02.01. The following information shall be submitted prior to ordering or installing any chamber components:

a) Shop drawings, specifications and data sheets for all pipe specials**;**

b) Valve type, catalogue data, actuator type (with input and output torque ratings), principal dimensions, schedule of parts and materials and expected time of delivery;

c) Layout drawings showing all chamber pipe and internal components. Itemized listing of chamber components including model names, numbers and all dimensions.

.10 VALVES

OPSS.MUNI 441.05.09 Valves

All valves shall be selected from the Approved Products List or as specified in the Contract Documents.

OPSS.MUNI 441.05.09.01 General

Revised as follows:

Valve types shall be in accordance with the following:

a) All gate and butterfly valves installed within the boundaries of the former City of Hamilton are to be open right (clockwise), with the City's 25mm standard operating nut WM-203.04.

b) All gate and butterfly valves in the remainder of the new City are to open left (counter clock-wise), with the City's 50mm operating nut.

The remainder of the new City of Hamilton shall be defined as the former municipalities of Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek.

c) Track and roller option required for horizontal position valves.

d) Bell end valves not acceptable.

e) Fasteners including nuts, bolts and bolt studs shall be stainless steel.

.10.01 Gate Valves

OPSS.MUNI 441.05.09.03 Gate Valves

Add the following:

Valves 75mm to 400mm shall be ductile iron gate valves.

.10.02 Butterfly Valves

OPSS.MUNI 441.05.09.04 Butterfly Valves

Add the following:

a) Valves greater than 400mm shall be butterfly valves selected from the Approved Products List.

b) Torque ratings shall be as specified by the City. Contractor shall supply detailed actuator information upon request.

c) Butterfly valves shall be installed so that the valve seat adjustment faces the spool piece side.

.10.03 Air Release and Vacuum Valves

OPSS.MUNI 441.05.09.05 Air Release and Air/Vacuum Valve

Revised as follows:

Air release and air/vacuum valves shall be double acting type selected from the Approved Products List.

.11 TRACER WIRE AND CONDUCTIVITY TESTING

.11.01 Tracer Wire

Tracer wire shall be installed on all new installations of polyvinyl chloride and concrete pressure pipe including mains, branches and services. The wire shall be positioned along the top of the pipe and fastened at 6 metre intervals. Tracer wire

shall be as listed on the Approved Products List.

The wire is to be installed between each valve and/or the end of the new watermain. Joints in the wire between valves shall be avoided. At each valve and hydrant secondary valve, the tracer wire loop shall be brought up the outside of the valve box and inserted into the tracer wire opening in the upper section. Insertion point shall be clear of the lid and use a protective grommet. Tracer wire shall be secured to the outside of the valve box near the top prior to backfilling. The tracer wire shall also be connected to the cathodic protection system as required.

Splices in tracer wire shall be done using a splice kit approved for use in direct bury underground use.

.11.02 Conductivity testing

The Contractor will be required to conduct all tracer wire conductivity testing to ensure that the tracer wire is installed correctly and intact. Testing shall be conducted by authorized personnel using approved testing equipment and shall be supervised by the Contract Inspector or Project Manager. No payments for watermain works shall be processed until tracer wire testing is completed and accepted by the City. All costs for conductivity tests shall be included in the watermain item. If the tracer wire is not electrically continuous from valve to valve, the Contractor shall, at their expense, replace or repair the wire as required.

.12 TEMPORARY WATER SERVICE BY-PASS FOR CONSUMERS

Where called for or where needed, the Contractor shall provide, maintain and remove by-pass piping in accordance with OPSS 493, Appendix A attached to this specification and the following requirements.

12.01 Submissions

In order to evaluate the impact on the water network as a whole and the ability of the by-pass pipe to provide the volumes and flows required, the Contractor shall provide the proposed by-pass system layout proposal to the Project Manager for review and written approval. The Contractor shall not commence the installation of any by-pass materials in the absence of such written approval.

The Contractor will be required to revise the by-pass system and construction staging per the conditions provided in the written approval and shall provide revised drawings.

The Contractor shall have no basis for increased working time due to these requirements, revisions and/or conditions and all associated costs will be deemed to be included in the unit prices bid.

The Contractor shall supply 3 prints of the by-pass proposal a minimum of 3 weeks in advance of installation. Drawings of the system(s) being proposed shall be 1:500 metric scale (hard copy and PDF format) will be submitted to the Project Manager for approval. The Contractor shall provide By-pass Piping Submissions, for all phases of the bypass installation, in accordance with Form 400 and the following requirements.

a) construction staging

b) pipe sizes, manufacturer and material

c) by-pass connection points/details

d) back flow preventer size, location and manufacturer

e) temporary hydrants connection points

f) water services connection points

g) horizontal location of the by-pass pipe in the road allowance

h) locations and the materials used to ramp over the by-pass pipe

i) locations where by-pass pipe is to be buried and the associated temporary restoration.

.12.02 General Description

Temporary by-pass pipe, where required, shall be laid above ground to supply water to consumers connected to a pipeline while that pipeline is out of service. An approved back-flow preventer shall be used by the Contractor whenever connecting to a hydrant.

Temporary by-pass shall include hoses and the necessary outlet/fittings to each house service connection. The Contractor shall maintain the temporary water lines in safe operating condition at all times. The Contractor shall be required to mound over the by-pass wherever it crosses a street, driveway, or sidewalk, in order to prevent injury to vehicular and pedestrian traffic. Lights and barricades shall be furnished and maintained by the Contractor when required by the Project Manager. When a replaced section of watermain is restored to service, the Contractor shall remove any corresponding temporary pipe and house service connection and shall leave the street, sidewalk and adjacent property in a neat and orderly condition.

.12.03 By-Pass Pipe and Materials

The size, pipe, hose and other materials furnished by the Contractor for the temporary service pipe and connections to house services/branches, shall be approved by the Project Manager and be fully adequate to withstand the indicated pressures and all other conditions of use. The pipe and fittings shall provide adequate water tightness and be disinfected prior to being put into service.

.12.04 Service of Water to Feed By-Pass

The Contractor shall furnish all above and below ground connections required to provide the necessary pressurized water to feed the temporary by-pass line. All connections shall be at reasonably close and convenient locations and hydrants

will be used whenever available.

.12.05 Temporary Connection to Customer

The Contractor shall make all shut-offs of consumers services and the final connections from the by-pass pipe to the consumer using flexible hose. Special connections requiring excavation, cutting or tapping shall be made by the Contractor. The Contractor shall notify the customer concerning this operation in advance. When the pipeline has been replaced, the Contractor shall clean the service by back-flushing with air or water. Once the pipeline is returned to service, the Contractor shall restore the consumer to service and disconnect the hose from the consumer connection. Where admittance to the customer's premises is denied or impossible, by virtue of absence, the connection cannot be cleared, it may be necessary to excavate and clear the service at the main. This shall be paid for on a unit price basis stated in the Form of Tender - Schedule of Quantities and Prices.

Where 100mm diameter Temporary Connections to the Consumers are called for, the length of the 100mm diameter piping required will be paid at the unit price for 100mm diameter Temporary By-Pass Piping. Cutting-in or tapping shall be provided by the Contractor and is included in the price bid.

All temporary service connection materials shall conform to the NSF 61 Standard. All hose used for individual property connections shall be minimum 20mm I.D., designed for a working pressure of 860kPa and be free from defects in materials and workmanship.

The pipe, hose and all other materials supplied by the Contractor for temporary servicing shall be approved by the Project Manager. Materials shall be fully adequate to withstand the pressures and other conditions of use and shall be of material which does not impart any taste or odour to the water in accordance with NSF 61 Standard. The pipe and fittings shall provide adequate water tightness and care shall be exercised throughout the installation of any temporary pipe and service fittings to avoid the possible pollution of any City main/property services or the contamination of the temporary service pipe. Flushing of the private service connections and chlorination of the by-pass line prior to their use will be required. The temporary service connection shall be valved near the point of connection to the by-pass and also to the private plumbing system so that, except for the final connection, the by-pass line and private services may be chlorinated.

During freezing, stormy or inclement weather, no Work shall be done except that which is directed by the Project Manager. No by-pass service pipe or property service connections shall be installed during freezing or inclement weather and pipes already in use shall be removed or drained and services restored when directed by the Project Manager. Removal and re-installation of such pipes or services shall be done at the Contractor's expense.

Each home shall have its own temporary water service connection to the by-pass pipe and a connection to the private plumbing via a wye at an outside tap. The branching of wyes from a single spigot shall not be permitted; nor will connecting homes in series. An approved hose connection vacuum breaker (HCVB) shall be

supplied on the open end of all wyes.

It shall be the responsibility of the Contractor to ensure an adequate water supply at all times. During the construction process, the Contractor is responsible for restoring a customer's water supply within two hours of notification from the Project Manager.

.12.06 Disinfection of Temporary Service Connections

Temporary service connections shall be chlorinated at the commencement of the Contract Works. Disconnection and relocation of service connections from one site to another within the Contract Works will not be subject to re-chlorination, unless otherwise directed by the Project Manager.

Where temporary service connections are disinfected in conjunction with the temporary by-pass watermain no physical connections to hose bibs will be permitted until after successful disinfection.

Where temporary by-pass service connections are disinfected offsite in a controlled environment, one set of samples shall be collected from every 350m of service hose connected in a series. One set of samples shall also be taken from the source and at each end of any hose group connected in series, regardless of the total length. Where temporary by-pass service connections are disinfected in conjunction with the temporary by-pass water main additional samples must be taken at the end of any two (2) temporary by-pass service connections for every 350m of temporary by-pass watermain disinfection.

.13 EXCAVATION AND PREPARATION OF TRENCH

.13.01 General

The trench shall be excavated only so far in advance of pipe laying as permitted. Removals shall be in accordance with Form 300 – General Construction Requirements.

.13.02 Alignment and Grade

Refer to OPSS.MUNI 441.07.14, 441.07.17, Form 200.02.05, 200.02.06 and 200.03.18.

.13.03 Excavation to Grade

Refer to OPSS.MUNI 441.07.08 and 441.07.14.

.13.04 Excavation in Poor Soil

Where the bottom of the trench at the required pipe grade is found to be unstable or to include material which, in the opinion of the Project Manager, should be removed, the Contractor shall excavate and remove such unsuitable material. Poor soil may consist of ashes, cinders, all types of refuse, organic or inorganic material.

Material shall be removed to the width and depth required to provide adequate

support to the pipe and allow proper installation. The Contractor shall be allowed extra compensation for this work provided for in Form 200.

Where the bottom of the trench at subgrade is found to consist of material which, in the opinion of the Project Manager, cannot be removed and replaced with an approved material and thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe. Pipe foundation shall consist of piling, timbers, concrete or other materials. All plans for pipe foundation shall be approved by the Project Manager. Extra compensation will be allowed for such additional work as per Form 200.

.13.05 Excavation in Rock

Where excavation is made in rock or boulders, the trench shall be excavated to the width and depths that are required to provide for the granular bedding shown on plans.

In areas where the proposed watermain trench bottom varies from rock to earth, the Contractor shall taper the bottom of the earth trench over a two (2) metre length and supply, place and compact Granular "A" in this section to minimize any differential settlement between the two (2) bedding conditions.

.13.06 Preparation of Trench Bottom

The bottom of the trench at pipe grade shall be finished to within 9mm of a straight line between pipe joints or batter boards and all tolerances shall be above the specified grade. It will only be permissible to disturb the finished surface over a distance of 450mm near the middle of each pipe for the withdrawal of slings or other lifting tackle.

.13.07 Preparation of Trench Bottom Below Grade

Where the trench has been excavated below pipe grade the Contractor shall place Granular "A" in 150mm layers to the required grade. Each layer shall be compacted by approved vibratory tampers to obtain 95% of the Standard Proctor Maximum Dry Density. The surface of the compacted granular material shall be finished to provide a continuous uniform support for the pipe at grade to the accuracy specified in subsection .13.06.

Unless otherwise specified, when the trench bottom has been excavated below the required pipe grade, the preparation of the trench bottom to pipe grade will be at the Contractor's expense. When the trench bottom is excavated below the pipe grade at the direction of the Project Manager, the preparation of the bottom of the trench to pipe grade will be allowed as extra compensation as provided for in Form 200.

.13.08 Care of Surface and Excavated Material for Reuse

Refer to Form 300.22.

.13.09 Piling Excavated Material

All excavated material shall be piled in a manner that will not endanger the Work

and that will avoid obstructing sidewalks and driveways. Hydrants, valves, utilities and drainage courses shall be left unobstructed and accessible until the Work is completed.

.13.10 Interruption of Service, Shutting Down or Charging of Mains

OPSS.MUNI 441.07.21 Shutting Down or Charging Mains

Revised by the following:

No valves or other controls on the existing system shall be operated for any purpose by the Contractor. Only City employees will operate such valves, hydrants, blow-offs and curb stops. Refer to Form 300.21 Connecting to Existing Plant and Appendix A.

.14 BEDDING AND BACKFILL OF WATERMAINS

.14.01 General

OPSS.MUNI 401.07.10, 441.07.13 and 441.07.14 are revised by the following:

Bedding and backfill shall be conducted in accordance with the depths and widths specified on the standard drawings and/or on the Contract Drawings. No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding or backfilling of watermains or water service trenches. All granular bedding and cover materials shall meet the requirements of Form 600.

.14.02 Bedding

Bedding shall be Granular material conforming to Form 600, placed in accordance with WM-200.01 and 200.02. Granular material shall extend to a minimum of 300mm above the top of pipe. Bedding materials shall conform to Form 600 and shall be compacted in accordance with Form 900. Bedding shall be shaped and compacted adequately to support pipe barrel and bells as required.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding of watermains.

.14.03 Backfill

Unless otherwise specified on the Contract Drawings or documents, trenches may be backfilled with select, approved native excavated earth materials from trenches. Where these materials are unavailable or deemed to be unsuitable, granular backfill will be used. Where granular backfill materials are used, they shall conform to Form 600 and shall be compacted in accordance with Form 900.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for backfilling of watermain trenches.

The use of unshrinkable fill shall be employed where normal means cannot produce the required compaction of the material.

.14.04 Summary of Bedding and Backfill Materials

Bedding and backfill of watermains shall be in accordance with the following:

.14.04.01 Ductile Iron and Polyvinyl Chloride (PVC) Pipe Watermain

Bedding and cover - Granular "A"
Backfill - Select approved excavated native materials or Granular “A” or “B” Type II

.14.04.02 Concrete Pressure Pipe Watermain

Bedding and cover - Granular "A"
Backfill - Select approved excavated native materials or Granular “A” or “B” Type II

.14.04.03 Water Services

Bedding and cover – Granular “D” (crushed stone)
Backfill: approved excavated native materials or Granular “A” or “B” Type II

.14.04.04 Hydrants

Bedding and cover - 19mm washed crushed stone
Backfill approved excavated native materials or Granular “A” or “B” Type II

.15 LAYING

.15.01 Laying Pipe

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a suitable watertight plug. Before filling main with water in freezing weather, exposed pipe and fittings shall be covered with straw, or other approved means shall be taken in order to prevent freezing.

Refer to also OPSS.MUNI 441.07.14 and 441.07.15.

.15.02 Cutting Iron Pipe

Refer to OPSS.MUNI 441.07.16 Cutting of Pipe and the following:

The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe and in accordance with the manufacturer's recommendations.

The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed nor shall the cutting of pipe with hammer and chisel be allowed.

.16 JOINTING MECHANICAL-JOINT PIPE

.16.01 Assembling Joints

Refer to OPSS.MUNI 441.07.15.

.16.02 Bolting of Joint

Refer to OPSS.MUNI 441.07.15 and all nuts shall be tightened with a suitable torque-limiting wrench. The torque for various sizes of bolts shall be as follows:

SIZE mm	RANGE OF TORQUE N·m
16	55-80
19	80-120
25	95-135
32	120-160

Nuts spaced 180° apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

.16.03 Permissible Deflection in Mechanical-Joint Pipe

Refer to Table 4.1 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage and Tunnels.

.17 JOINTING STEEL CYLINDER REINFORCED CONCRETE PIPE

Refer to OPSS.MUNI 441.07.15 Jointing

.18 JOINTING TYTON-JOINT PIPE

.18.01 Cleaning and Assembling Joint

Refer to OPSS.MUNI 441.07.15 Jointing

.18.02 Preparation of Spigot on Site

Where spigots require preparation on site, the outside of the spigot shall be filed to produce an angle of approximately 30°.

.18.03 Electrical Conductors

"Lockwedges" or strap-type electrical connections supplied by the pipe manufacturer shall be provided at each joint to ensure electrical conductivity. A minimum of two wedges per joint shall be installed in accordance with the manufacturer's directions.

Strap-type electrical connections shall be connected at each joint in accordance with manufacturer's directions.

The wedges shall be installed only after the pipe has been laid to proper line and grade and shall be preferably located at 180° apart.

.18.04 Permissible Deflection in Tyton-Joint Pipe

Refer to Table 4.2 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage, Watermains and Utilitity

.18.05 Jointing Flange Pipe

Unless otherwise specified, the Contractor shall furnish all bolts, studs, nuts and gaskets required to completely connect up all flanged pipe, fittings, flanges and other appurtenances attached to the pipe.

All bolts and nuts shall have American Standard threads of the Coarse Thread Series, and shall conform to ASA B18.2. For sizes 28mm diameter and below, they shall be of the conventional type and the material shall conform to ASTM A-307 (Grade B). Materials for bolts and studs 31mm diameter and above shall conform to ASTM A-193 (Grade B-7) or to ASTM A-325 (S.A.E. Grade 5). Nuts shall conform to ASTM A-194 Grade 2H. Bolts shall have hexagonal heads and shall be held with hexagonal semi-finished nuts. The length of any bolt shall be such that it will not project beyond the nut more than 13mm or less than 6mm, and no bolt shall be less than the diameter of the hole in which it fits by more than 3mm.

Gaskets shall be red rubber full faced 3mm thick in accordance with dimensions given in the latest edition of ASME B16.21 for Non Metallic Gaskets for Pipe Flanges**.**

.19 SETTING VALVES AND FITTINGS

.19.01 Valve Boxes

Valve boxes shall be used for secondary valves at hydrants and where indicated on the watermain plans and profiles. Valve boxes shall be centred and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed. Refer to Standard Drawing WM-202. Installed valve boxes over gate valves shall be staked and the marking on the stake shall read "Gate Valve".

.19.02 Drainage of Mains

Drainage branches, blowoffs, air vents and appurtenances shall be provided with gate valves. Drainage branches or blowoffs shall not be connected to any sewer, submerged in any stream or be installed in any other manner that will permit back siphon into the distribution system.

.19.03 Dead Ends

All dead ends on new mains shall be closed with cast iron plugs or caps and provided with a 19mm corporation main stop.

.20 HYDRANTS

Hydrants supplied shall be in accordance with OPSS.MUNI 441.05.10, as amended by City standards and must be selected from the Approved Products List. Hydrants shall be installed in accordance with OPSS.MUNI 441.07.19, as amended and the following:

The Contractor shall supply and install the standard 3-way hydrants complete with secondary valves. Hydrant extensions and connections to the proposed watermains shall be in accordance with drawing WM-203.01 and WM-203.02, in the locations shown on the Contract Drawings. All hydrant extensions shall be done from the bottom, at the boot. No extension from the top will be permitted.

Long-side hydrant leads shall receive an additional gate valve and valve box installed on the lead at the main, close coupled with an anchor tee.

All proposed or replacement hydrant lead pipe material (DI or PVC) shall match the proposed watermain pipe material. Fittings at the watermain can be either DI or PVC.

All parts of the hydrant above ground shall be primed and painted “Red”, including caps and bonnets. Paint shall be phenolic alkyd primer conforming to CGSB-1.40 and exterior gloss alkyd type CGSB 1-GP-59 paint. Storz nozzles shall be painted gloss black. Quick drying alkyd primers in accordance with CGSB-1.210 are not permitted for use.

If hydrant paint coatings are scratched or damaged during the course of the Work, the Contractor shall prime and paint the damaged areas. The Contractor shall use a Phenolic Alkyd primer conforming to CGSB-1.40 and Exterior Gloss Alkyd type CGSB 1-GP-59 paint and shall apply a minimum 2mm thickness in addition to the factory supplied primer and finish coat as required by Annual Supplies Specifications. The surface to be painted shall be clean, dry and free of grease.

For bedding and backfill requirements refer to Form 400.14.

The Contractor shall salvage all existing fire hydrants as directed by the Project Manager and deliver them to the Arvin Yard, where the Contract limits are east of (Upper) Wentworth Street.

Where the Contract limits are west of and including (Upper) Wentworth Street, hydrants shall be delivered to the Dundas Yard.

The City does not accept deliver of gate valves and secondary valves. The Contractor will be responsible for removal and disposal off site of any of these materials.

Arvin Yard - 911 Arvin Avenue, Stoney Creek

Dundas Yard - 135 King Street East, Dundas

.21 BACKFLOW PREVENTERS

OPSS.MUNI 441.05.11 Double Check Valve Backflow Preventers

All backflow preventers used on hydrants shall be supplied by the City in accordance with Appendix A, Section 2.1.

Where Contract Documents require the Contractor to supply a backflow preventer, the type shall be in accordance with City of Hamilton By-Law 10-103 and CSA B64-11.

.22 ANCHORAGE

.22.01 Anchorage for Fittings

All fittings shall be anchored according to the method shown on the standard drawings, the Contract Documents, or as otherwise directed. The concrete shall be placed such that the joints will be accessible for repairs.

.22.02 Metal Harness

Metal harness of tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing, or if directed. Steel rods or clamps shall be galvanized or otherwise rustproof treated, or shall be painted as shown or directed.

.23 WATER SERVICES

Water services shall be installed in accordance with AWWA C800, OPSS.MUNI 441 and be selected from the Approved Products List.

.23.01 Services – 19mm to 50mm Diameter

Refer to OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Water service pipe shall be Type "K" soft copper and include the connection at the main and a curb stop with rod.

19mm and 25mm water services shall be installed in accordance with WM-207.01.

50mm water services shall be installed in accordance with OPSD 1104.02.

Connections to ductile iron watermain pipe shall be in accordance with Form 400.05.

Connections to PVC watermain pipe shall use a service saddle and be in accordance with Form 400.07.

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2.

Where a water service is connected to a 50mm copper watermain loop, the connection shall be in accordance with WM-205.01 or WM-205.02.

Insulation of water services, where required, shall be in accordance with WM-207.03.

.23.02 Services - 100mm Diameter and Larger

Service connections shall be in accordance with OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Services shall be installed in accordance with WM-207.04 and WM-207.05, include the connection at the main, a reducer where required, a gate valve and valve box at property line.

Long-side services shall receive an additional gate valve and valve box installed on the service at the main, close coupled with an anchor tee.

Service pipe shall be either ductile iron or polyvinyl chloride in accordance with Form 400.05 or 400.07 and shall be constructed using the same pipe material as the proposed watermain.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured “Tee”.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

.23.03 Curb Boxes

Curb boxes are to be located in accordance with standard watermain drawing WM-207.01 and WM-207.02 or as otherwise directed.

The Contractor shall indicate the positions of all water services installed in the following manner:

At each curb box location, a 1.83m, 50mm x 100mm wooden stake shall be planted and shall have a 1 metre bury. Stakes shall be painted white, and each shall bear, on its broad side, above ground, the words "WATER SERVICE", painted in black.

The Contractor shall be responsible for the preservation of all marker stakes. Where stakes are damaged or displaced in any way, the Contractor shall arrange to have the stakes replaced and accurately positioned, at their own expense.

.23.04 Trench for Water Service

The Contractor shall excavate and backfill the service trench from the watermain to the street line to a minimum depth of 1.6m below the proposed road grade whichever is the lower elevation unless otherwise directed.

.23.05 Laying Water Service Pipe

The Contractor shall lay the service pipe and install fittings to the street line. Soldered joints will not be permitted.

The service shall be bedded in accordance with Standard Drawing No. WM-200.01 and WM-200.02.

If laid over a sewer service or in a rock trench, the pipe shall be laid on a minimum of 150mm of tamped earth or sand. Service corporation fittings shall be installed into the watermain under pressure.

Valves in service pipe lines shall be properly braced before any pressure test is conducted.

Backfill for water service trenches shall be as specified for the watermain trench.

Service pipe at street line shall be temporarily plugged to prevent entrance of foreign material.

.23.06 Leaks in Services

All leaks that may develop in service lines laid by the Contractor within two years after date of completion of Contract shall be immediately repaired by the Contractor when notified by the Project Manager. Emergency repairs will be made by the City at the Contractor's expense.

.24 CONCRETE AND MORTAR

.24.01 Materials

Refer to OPSS.MUNI 441.05.13, 441.07.23 and OPSS Division 9. Concrete shall be Type HS High Sulfate Resistant in accordance with OPSS 1301 and Form 700.

.24.02 Proportioning and Mixing Mortars

Refer to OPSS.MUNI 441.05.14 and OPSS Division 9.

.24.03 Jointing Old and New Work

All joints between different sections of concrete masonry shall be made in an approved manner after the adjoining surfaces are cleaned, washed, roughened and coated with a neat cement grout, at locations approved of by the Project Manager, suitable provisions being made for the bonding of said joints.

.24.04 Placing in Water

No concrete shall be laid in water, except by permission of the Project Manager, nor shall water be allowed to rise and flow over newly placed concrete for a period of 24 hours.

.24.05 Forms

Forms shall be of such strength and rigidity and so supported that they will not deflect objectionably under the weight of pressure of the wet concrete.

They shall be properly braced and tied together so as to maintain position and shape, and prevent leakage of mortar.

Forms shall be so constructed that the finished concrete will conform to the shapes, lines, grades and dimensions indicated on the plans.

The face adjacent to the exposed concrete face shall consist of dressed lumber, smooth and clean.

.24.06 Form Removal

Shoring and forms shall not be removed before the time determined by the Project Manager.

.24.07 Curing of Concrete

After concrete has sufficiently set, its exposed surfaces shall be kept continuously moist for a period of at least seven (7) days.

Effective means shall be provided for maintaining the temperature of the concrete at not less than 10° C for at least 72 hours after placing. The temperature shall then be reduced at a maximum rate of 5.6° C per day until that of the surrounding atmosphere has been reached.

No concrete shall be deposited on ground that is frozen or which contains frozen materials.

Hydrostatic testing shall not be carried out until concrete anchor or thrust blocks have a minimum of 5 days curing time.

.24.08 Finish

Special care shall be used to secure smooth, uniform finish to the exposed surface of concrete. After form removal, concrete surfaces shall be immediately rubbed smooth to a uniform, satisfactory finish, and all surfaces subject to wear shall be faced with facing mixture where shown on the plans.

.24.09 Defects

Should any voids or other defects be discovered in any part of the Work when the forms are taken down, or at any other time, the defective Work shall be removed and the space refilled with a suitable concrete mortar in a proper manner at the expense of the Contractor.

.24.10 Reinforcing Steel

The ties for reinforcing shall not show on the exposed face of the concrete. All steel for reinforced concrete shall be supplied by the Contractor.

.25 DISINFECTION, TESTING AND CONNECTION OF WATERMAINS

OPSS MUNI. 441.07.25 - Flushing and Disinfecting Watermains

Revised as follows:

All connections, flushing, hydrostatic testing, swabbing, and bacteriological testing procedures shall be in accordance with Form 400 - Appendix A and the Ministry of the Environment, Conservation and Parks (MECP) Watermain Disinfection Procedure.

APPENDIX A PROCEDURE FOR THE DISINFECTION, TESTING AND CONNECTION OF WATERMAINS

1.0 INTRODUCTION

1.1 Scope: Watermain Installation and Testing Procedures

This procedure covers the cleaning, disinfection, hydrostatic testing and sampling of watermains. Unless specified otherwise this procedure applies to all new watermains, above ground by-pass watermains and relined watermains.

1.2 Definitions

Appurtenance means an appurtenance within the meaning of O. Reg. 170/03.

Category 1 Classification are watermain breaks with no evident or suspected contamination.

Category 2 Classification are watermain breaks with evident or suspected contamination.

Contaminant means foreign matter that is not intended to enter a watermain.

Contamination means the introduction of a Contaminant into a watermain.

Contractor means the person, partnership or Corporation undertaking the Work as identified in the agreement.

CHEL means the City of Hamilton Environmental Laboratory.

CSR means City of Hamilton Customer Service Representative.

CS&CO means City of Hamilton Customer Service and Community Outreach section.

Disinfectants means calcium or sodium hypochlorite that meets or exceeds ANSI/AWWA B300 or liquid chlorine that meets or exceeds ANSI/AWWA B301.

Flushing means post repair valve operation to restore secondary disinfection and discharge suspended materials by flowing water through the repaired section of watermain and out of the system. This definition does not include recharging the watermain or a requirement to achieve scouring velocity within the watermain.

Inspector means the City of Hamilton, Public Works, Engineering Services Contract Inspector or the City of Hamilton, Planning and Economic Development, Growth Management Inspections/Development Construction Coordinator who hold a minimum MECP, O.Reg. 128/04 Water Operator Distribution Licence.

LIMS means the City of Hamilton Environmental Laboratory work order database.

LWO Number means the City of Hamilton Environmental Lab Work Order Number.

MECP means the Ministry of the Environment, Conservation and Parks.

Neutralizing Agent means Sodium Thiosulfate that meets or exceeds Appendix C of ANSI/AWWA Standard C651.

Project Manager means the City of Hamilton, Public Works, Engineering Services Project Manager or the City of Hamilton, Planning and Economic Development, Growth Management Project Manager.

SDWA means the Safe Drinking Water Act of Ontario.

Service Pipe means a service pipe within the meaning of O. Reg. 170/03.

Specialist means a company specializing in regulated water systems or a company approved by the Project Manager, whose personnel hold a minimum MECP, O.Reg. 128/04 Water Operator Distribution Licence.

NSF 61 means the National Sanitation Foundation, Standard 61.

1.3 References

These procedures are based on and shall be used in conjunction with, the following:

- Ontario Provincial Specifications (OPS),
- American Waterworks Association Standards (ANSI/AWWA C651 – Disinfecting Water Mains and Appendices A and B),
- Safe Drinking Water Act of Ontario
- Ministry of the Environment, Conservation and Parks (MECP) – Watermain Disinfection Procedure
- The City of Hamilton Design Criteria
- The Canadian Standard Association - CAN/CSA-B64.10
- Hamilton Water procedure PW-WW-P-013-007 entitled DWQMS Water Quality Testing for New Watermain Connections.

1.4 General Requirements for Watermain Installation

The Contractor shall keep pipes clean and dry and take precautions to protect the interiors of pipes, fittings and valves against contamination. End caps shall be installed when Work is not in progress and removed only when connecting the next pipe or appurtenance or continuing Work. Pipes shall not be laid directly in water. Existing watermains, which are dead ended during construction, shall have a minimum 25mm bleeder installed at the dead end. New watermains which are temporarily dead ended shall have a minimum 50mm blow off installed with a temporary cap if there is no hydrant downstream of the last water service on the watermain.

1.5 Connection and Testing Procedures Plan and Meeting

The Contractor shall provide a plan to the Project Manager and Inspector detailing the connection locations, swabbing locations, hydrostatic testing, chlorination and dechlorination methods, disposal of water and final connection methods prior to the commencement of such works. If the project is being constructed in phases, this plan shall detail each of these items for each phase.

A pre-watermain connection and testing meeting shall be held by the Project Manager prior to

any commissioning procedures.

1.6 Forms

The following forms are attached to this document:

a) Watermain Commissioning Form – Swabbing and Hydrostatic Testing Record
b) Watermain Commissioning Form – Disinfection and Chlorine Residual Sample Record
c) Record of Watermain Break Form

1.7 Supervision, Testing and Records

The Inspector shall witness all cleaning, swabbing, hydrostatic testing, disinfection and conduct sample collection. The Specialist carrying out the cleaning and disinfection shall take and record measurements in conjunction with the Inspector on the appropriate Watermain Commissioning Form.

1.8 Valve Operation

City of Hamilton Water Distribution staff must perform the operation of all existing valves inclusive of hydrant secondary valves. In the event of an emergency, the Inspector may operate or direct the Contractor to operate valves.

The Contractor shall be responsible for dewatering any chambers that are fully or partially submerged for the City operation of the valves related to construction activities.

The opening and closing of any valve should be coordinated with the Inspector. All known affected residences or businesses shall be notified 48 hours prior to a planned disruption of water service.

2. WATERMAIN TESTING PROCEDURE

This document is to be read in conjunction with the forms attached to the end of this document. These procedures are to be used in conjunction with the Ontario Provincial Standard Specifications (OPSS), the American Waterworks Association Standards (AWWA) and the Safe Drinking Water Act of Ontario (SDWA), including the MECP - Watermain Disinfection Procedure.

All required low-end chlorine residual tests shall be performed by the Specialist and confirmed by the Inspector utilizing an electronic tester such as a Hach Pocket Colourimeter or equivalent.

All Works associated with swabbing, pressure and leakage testing, chlorination, dechlorination and sterilization of the watermain are to be performed by a company specializing in this type of work or a company approved by the Project Manager and witnessed by the Inspector. The Inspector in charge of monitoring shall take and record measurements as per the Commissioning Forms attached herein.

Temporary by-pass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic pressure testing. A visual check shall be performed at line pressure on a temporary by-pass to ensure that it is leak free.

2.1 Temporary Connection and Backflow Preventer

The temporary connection is to be used for all water supplies to maintain continuous supply of water unless otherwise noted. The size of the temporary connection shall be 50mm diameter for watermains up to and including 200mm diameter and 100mm diameter for watermains 250mm diameter to 400mm diameter, inclusive. All materials for the temporary connections are to conform to the City of Hamilton Approved Products List. Watermains larger than 400mm in diameter shall be as per design standards.

For Public Works projects, the hydrant adapter (backflow preventer and meter) shall be a reduced pressure principle type and shall be supplied by the City of Hamilton upon receipt of request from the Project Manager.

For Planning and Economic Development projects, the hydrant adapter (backflow preventer and meter) shall be supplied by the City of Hamilton upon request from the Inspector on behalf of the Contractor.

The adapter shall be installed on a prescribed hydrant and charged by a City of Hamilton Water Distribution Operator. Hydrant(s) utilized as the source water for temporary by pass will be determined by the Project Manager in consultation with City of Hamilton Water Distribution staff.

The existing distribution system and backflow preventer shall be physically disconnected from the test section during all hydrostatic testing.

2.2 Charging of Watermains

The watermain is to be recharged via a temporary connection equipped with an approved backflow preventer.

2.3 Swabbing

The isolated section of watermain shall be charged or pressurized prior to the commencement of swabbing. The swabs shall be numbered and carefully controlled by the Specialist to ensure that all swabs that are introduced into the watermain are retrieved and accounted for. The Inspector shall record the number of swabs inserted and retrieved. All swabs must be inspected prior to insertion and immediately after they exit the watermain to ensure that they have remained intact and that pieces of the foam do not remain inside the watermain. New swabs shall be used for this procedure and under no circumstances will used swabs be allowed.

All watermain pipes must be swabbed with a minimum of THREE swabs plus a minimum of one swab shall be passed through each hydrant lead, large diameter water service, stub or blow-off. Additional swabs shall be used as directed by the Project Manager or Inspector should discharge water not run clear within ten seconds of the swab exiting the discharge point. No additional payment shall be made for subsequent swabbing.

Swabs shall be forced through the watermain using potable water at a minimum velocity of 0.6m to 1m per second. The Project Manager must approve all methods of disposal of the discharged water. The Contractor shall take all necessary precautions to minimize soil erosion and shall reinstate any affected areas upon completion.

The swabs must be new open cell polyurethane foam, having a density of 1.5 pounds per cubic

foot (24 kilograms per cubic metre) and are to be a minimum of 50mm larger than the nominal pipe diameter with a length at least one and a half times its diameter. Watermains 300mm or smaller may be swabbed through hydrants with the approval of the Project Manager. Procedures for swabbing watermains larger than 300mm must also be approved by the Project Manager.

2.4 Hydrostatic Testing

Leakage tests shall be carried out on the test section of watermain after swabbing operations have been successfully completed. The Contractor shall ensure that no air pockets are present in the test section of watermain. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during all hydrostatic testing. The test section shall be capped and the main filled with potable water under a pressure of 1035 kPa. After any visible leaks are stopped, leakage shall then be measured by a calibrated meter with readings taken at fifteen minute intervals for a period of two hours and recorded on the Watermain Commissioning form. The allowable leakage shall not exceed 0.128 litres per mm of pipe diameter per km of pipe for the 2 hour period. If the leakage exceeds this figure, the Contractor shall locate and repair all leaks and the test section shall be retested until a satisfactory result is obtained.

The watermain is to be tested in sections, where a section is a length of watermain between two valves or a valve and a dead end. Should the Contractor wish to test more than one section at a time, the Project Manager/ Inspector will calculate the allowable leakage for all sections within the tested portion and the smallest calculated leakage will become the allowable for the entire tested portion.

2.5 Disinfection of Watermains

Disinfection of watermains shall be done in accordance with ANSI/AWWA C651 – Disinfecting Water Mains, as amended by the MECP Watermain Disinfection Procedure and this Form.

Water distribution watermains shall be disinfected using the continuous-feed method of chlorination.

Trunk/transmission watermains shall be disinfected using the continuous-feed method or the slug method of chlorination.

2.5.1 Continuous-Feed Method of Chlorination

Watermains shall be completely filled to remove air pockets and flushed to remove any particulates. After flushing is completed, the main shall be filled with potable water.

The chlorine solution shall be thoroughly mixed prior to pumping it into the system. Chlorine solution shall be injected into the system through the access point at the temporary connection. The chlorine solution shall be applied so that the initial chlorine concentration is a minimum of 50mg/L throughout the system and does not exceed 120mg/L.

The chlorine solution shall flow through each hydrant and blow-off. The high chlorine residual is to be measured and recorded by the Specialist at each sample location in conjunction with the Inspector.

The high chlorine concentration shall be left in the isolated system for a minimum of 24

hours. After the required contact time, the chlorine residual shall be measured and recorded at each sample location by the Specialist in conjunction with the Inspector. Flow required to take the chlorine residuals shall be provided through the temporary connection.

The maximum allowable decrease in chlorine concentration after 24 hours is 40% of the initial chlorine concentration, to a maximum decrease of 50 mg/L.

Table 1: Chlorine Concentration and Contact Time for Continuous-Feed Method of Chlorination

Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration
24 hours	Minimum 50mg/L not to exceed 120mg/L	40% of the Initial Chlorine Concentration (to a Maximum of 50mg/L)

The following examples are provided to demonstrate the proper use of Table 1:

Example 1
When using the continuous-feed method of chlorination with an initial chlorine concentration of 50mg/L, the maximum allowable decrease in chlorine concentration is 40% of 50mg/L, or 20mg/L. Therefore, at least 30mg/L of chlorine must be present after 24 hours.

Example 2
When using the continuous-feed method of chlorination with an initial chlorine concentration of 150mg/L, the maximum allowable decrease in chlorine concentration is 50mg/L, because 40% of 150mg/L is greater than the maximum allowable decrease of 50mg/L. Therefore, at least 100mg/L of chlorine must be present after 24 hours. However, the initial chlorine concentration should not exceed 120mg/L.

If the chlorine residual meets the above Table 1 criteria after 24 hours, the chlorine is ready to be discharged. In the event that the chlorine residual is less than the allowable levels after 24 hours, the chlorine in the system is to be discharged and the system is to be re-chlorinated.
The Inspector has the authority to require further swabbing if the residual is less than the allowable levels after 24 hours. Once this has been achieved, the watermain shall be flushed and sampled for chlorine residual levels.

Minimum acceptable levels are 40% of the initial chlorine concentration to a maximum decrease of 50mg/L.

Note:
Where copper pipe is used for smaller diameter watermains (less than 100mm), Table 1 does not apply. Copper watermains shall be disinfected using the continuous-feed method, with an initial chlorine concentration of ≥ 50 mg/L. Due to the chlorine demand exerted by the copper, no minimum chlorine concentration is required following the 24 hour contact time, and the effectiveness of the disinfection process shall be demonstrated by the bacteriological testing.

2.5.2 Slug Method of Chlorination

Watermains shall be completely filled to remove air pockets and flushed to remove any particulates. After flushing is completed, the main shall be filled with potable water.

The chlorine solution shall be thoroughly mixed prior to pumping it into the system.
Through the access point at the temporary connection, the system shall receive a dose of chlorine, fed at a constant rate such that the water will have not less than 100mg/L chlorine concentration, not to exceed 200mg/L.

The chlorine shall be applied continuously and for a sufficient period of time to develop a solid column, or slug, of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration no less than 25mg/L of the initial chlorine concentration for at least 3 hours.

The chlorine residual shall be measured in the slug as it moves through the main.
The duration of disinfection as well as the initial and residual chlorine concentration, at the end of the contact time, shall be measured and recorded by the Specialist at each sample location in conjunction with the Inspector.

If at any time the chlorine residual drops more than 25 mg/L, the flow shall be stopped; chlorination equipment shall be relocated at the head of the slug; and, as flow resumes, chlorine shall be applied to restore the chlorine in the slug to not less than 100 mg/L.

As chlorinated water flows past fittings and valves, related valves and hydrants in the isolated system shall be operated so as to disinfect appurtenances and pipe branches.

Table 2: Chlorine Concentration and Contact Time Slug Method of Chlorination

Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration
3 hours	Minimum 100mg/L not to exceed 200mg/L	25mg/L

The following example is provided to demonstrate the proper use of Table 2:

Example:
When using the slug method of chlorination, with a minimum contact time of 3 hours, the chlorine concentration shall be measured in the slug at the beginning of the disinfection process, as the slug moves through the watermain, and at the point of discharge. If at any point the chlorine concentration has decreased by more than 25 mg/L, the flow shall be stopped and additional chlorine shall be added to restore the chlorine concentration in the slug to not less than 100 mg/L, not to exceed 200mg/L. For example, if the initial chlorine concentration in the slug is 150 mg/L, then the chlorine concentration must not decrease below 125 mg/L.

2.6 Removal/Disposal of Super Chlorinated Water

The Contractor shall dechlorinate the discharge water to protect receiving streams and other bodies of water, via catch basins or other points of entry, as per the MECP regulations and ANSI/AWWA C651 as amended. If in near proximity to the sewer treatment plant, the plant is to be notified and must approve receiving the water. The Contractor shall be required to supply all labour, equipment and materials to dechlorinate the water including, but not limited to, de-chlorination mats, diffusers and dechlorination chemicals. There shall be no separate payment for dechlorination.

2.7 Bacteriological Sampling

Bacteriological sampling shall be done in accordance with ANSI/AWWA C651, the MECP - Watermain Disinfection Procedure – Section 1.1.2, and the following:

Before the watermain, or temporary above ground by-pass system can be approved for connection to the existing water distribution system, twenty four hours after the discharge of super chlorinated water, two (2) consecutive rounds of water samples, taken at least 16 hours apart, shall pass the appropriate chlorine residual (within the respective drinking water system – Woodward, Fifty Road and communal wells) and bacteriological testing requirements as per the City of Hamilton Laboratory testing procedures. Prior to chlorine residual and bacteriological testing, all other testing and disinfection shall be completed and any super chlorinated water removed from all portions of the watermain system under consideration including hydrant leads, stubs, branches, services, etc.

Twenty four hours after the discharge of super-chlorinated water, the Inspector shall field test for residual chlorine at each testing point of the new watermain to be no less than 0.25mg/L and to be no greater than 3.0mg/L. The Inspector will then take the bacteriological sample at each sample location and deliver it to the City of Hamilton Environmental Laboratory. The watermain test section shall be immediately shut down and must not be disturbed or flushed for the period between this sample round and the next bacteriological sample round at least 16 hours later. The watermain must remain continually pressurized through the approved backflow preventer from the start of the bacteriological testing until the connection to the existing system is undertaken.

Samples shall be taken from the end of every dead end and from every 360 metres or less of new watermain pipe. No hose or hydrant shall be used in the collection of bacteriological samples.

2.8 Sample Results

Once the new watermain is installed and pressure tested, the proper numbers of water samples are to be collected by the Inspector. The Inspector shall drop off sample bottles at CHEL along with the completed chain of custody form(s).

Lab staff will process and log in the bottle(s). Each chain of custody form will be assigned an LWO Number. In addition to the LWO, each sample bottle will be assigned a unique record number. Samples delivered after 3:30pm on working days will be set up the same day but may not be logged in until the next day. Samples delivered after 4:00pm on working days may not be set up for analysis or logged in until the next day.

Lab staff, using the LIMS database, will generate an email that will be sent to the Inspector. The email will contain the LWO and record numbers that can then be used by the Inspector when calling in to the lab.

Special arrangements can be made to bring sample bottles to the lab on a weekend. Inspectors are to call CHEL on the Friday and provide the sample location, account number and the project/permit number (if applicable). In this case, CHEL will pre-log the samples into LIMS.

Inspectors can call the CHEL after 24 hours and 48 hours to determine the status of water quality testing with the understanding that these results are provisional until they have gone through the data approval process. The new watermain cannot be put into service until the final

approved lab report from the CHEL has been obtained.

After the 48-hour testing period, data is entered into the LIMS database which will go through a data approval process. CHEL will create a PDF file of the final approved lab report for each LWO and save the file at the following locations:

a) For CS&CO staff, the PDF file is saved at N:\Environmental Laboratory Reports\CSCO_WmRech
b) For Planning and Economic Development, Growth Management, the PDF file is saved at N:\Environmental Laboratory Reports\Development Engineering
c) For Public Works, Engineering Services, the PDF file is saved at N:\Environmental Laboratory Reports\Construction.

The files will be named as follows:

PRIVATE-ROADS_XXXXXX_- ###### _YYYY-MM-DD HH-MM-SS Final Report.pdf

where:

XXXXXX represents the permit No. / Contract No., if supplied.

represents the LWO Number.

YYYY-MM-DD is the date that the PDF was created.

HH-MM-SS is the time that the PDF was created.

The pdf file of the final approved lab report is also emailed to the Inspector.

If changes are required to the staff permissions for the files above, the Lab Services Project Manager must be contacted at Ext. 1145.

Inspectors shall also contact a CSR 24 hours and/or 48 hours ahead of the proposed watermain shutdown, depending on the project, to facilitate the connection of the new watermain to the source watermain and inform the CSR of the following information: name of the Inspector, Contract No. or development site, where/when to meet WDO, duration of shutdown and LWO number.

The CSR will create a Service Request containing the information listed above. The CSR will also attach by OLE the corresponding LWO PDF file from the network drive N: \ environmental laboratory reports\CSCO_WmRech . The CSR will then create the Service Request for a WDO to connect the new watermain to the existing water distribution system.

If sample results are successful, the system will be put into service. A single failed bacteriological parameter will constitute a failure of the entire sampling round. If sample results do not meet requirements, the failed section must be flushed or re-disinfected as directed by the Project Manager/Inspector and re-sampled at the sample locations. Sampling will continue until two (2) consecutive sets of water samples, taken 24 hours apart, pass both the appropriate chlorine residual and bacteriological requirements as per the City of Hamilton Laboratory testing procedures.

3. CONNECTION TO EXISTING WATER DISTRIBUTION SYSTEM

Connections to the existing water distribution system shall be done in accordance with ANSI/AWWA C651 and the following:

Once the bacteriological tests have passed, the connection to the existing watermain shall be performed.

A sump, minimum 300mm depth, shall be excavated in the trench bottom and be filled with clear stone to provide a location to collect and pump water.

Watermains shall be cut back to remove any temporary taps. The Contractor shall disinfect the connection watermain pipe as outlined in section 3.1 and shall dewater the watermain and trench in a controlled manner as to not allow backflow of water into the watermain.

If trench water, dirt, or debris has entered the watermain during the final connection, the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Inspector. If contamination is evident or suspected, the procedures defined under Section 3 of the MECP - Watermain Disinfection Procedure for Category 2 watermain breaks shall apply.

3.1 Connections and Tapping of Watermains

The new pipe, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% to maximum 12% solution of sodium hypochlorite immediately prior to being installed. The existing watermain being connected to shall also be cleaned in the immediate area of the connection and spray-disinfected with the same solution.

Where existing watermains are tapped, the drill/cutting/tapping bits and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected.

The Contractor shall make every possible effort to ensure that the final connection is no more than one pipe length.

4. WATER SERVICES

Service connections shall be tapped and connected under pressure. All connections shall be inspected to ensure they are drip tight prior to backfilling. The pipe shall be left exposed until directed by the Inspector, after which backfilling shall be completed.

Services 100mm in diameter and larger shall be considered mainline and shall meet all mainline procedures and testing requirements of Section 2.5 Disinfection of Watermains,and MECP - Watermain Disinfection Procedure - 1.1 New Watermains.

For new services 38mm in diameter up to but not including 100mm diameter, sanitary conditions must be maintained during installation and shall be thoroughly flushed prior to connecting to the existing service. Required drill / cutting / tapping bits, and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with the drinking water shall be cleaned and spray-disinfected with a minimum 1% to maximum 12% solution of sodium hypochlorite immediately prior to the connection.

If any of the disinfected surfaces come into contact with the soil and/or water in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

All by-pass services hoses to be used shall be of potable water grade and shall meet the requirements of NSF 61 Standard. Service hoses shall be capped on both ends with brass caps until installed. Service hoses shall not be installed on by-pass piping until the day of the change over from the distribution watermain to the above ground by-pass watermain, and shall be thoroughly flushed prior to connection.

5. WATERMAIN BREAKS

Watermain breaks shall be treated in accordance with the MECP – Watermain Disinfection Procedure, Section 3. Watermain Disinfection Procedures for Emergency Repairs.

The watermain break repair process is to be documented by completing a Record of Watermain Break Form attached to this document. A copy of the completed Form shall be sent to Hamilton Water Distribution.

6. RELINING OF WATERMAINS

Relining of existing watermains shall be treated in accordance with the MECP – Watermain Disinfection Procedure, Section 1.2 Relining of Watermains, and Section 2.5 of this document.

WATERMAIN COMMISSIONING FORM

Swabbing and Hydrostatic Testing Record

CONTRACT/SITE NAME:

DATE:	LOCATION:
TIME:	
PERFORMED BY:	WITNESSED BY:
No. SWABS INSERTED:	No. OF SWABS RETRIEVED:

DATE	WATERMAIN SECTION, LENGTHS AND DIAMETERS	TIME	LEAKAGE (litres)

0.128 L/mm of pipe diameter per kilometre of pipe for the 2 hour test period

PRESSURE TEST PASSED: YES ☐ NO ☐

WATERMAIN COMMISSIONING FORM

Disinfection and Chlorine Residual Sample Record

CONTRACT/SITE NAME:

DATE	TIME	SAMPLE LOCATION	HIGH CHLORINE RESIDUAL (mg/L)	24 HOUR CHLORINE RESIDUAL (mg/L)

DATE	TIME	SAMPLE LOCATION	CHLORINE RESIDUAL		
			TOTAL (mg/L)	FREE (mg/L)	COMBINED (mg/L)

RECORD OF WATERMAIN BREAK FORM

Watermain Breaks

Category 1: Where there is **no** evidence or suspected Contamination of the watermain before and/or during the repair process.

Category 2: Adverse Water Quality Incident where there **is** evidence or suspected Contamination of the watermain before and/or during the repair process, or where the watermain pipe repair is greater than 6.0m.

Note: In Special Cases of Sewage or Chemical Contamination contact the Water Distribution O.R.O. or the Manager of Water Distribution.

For Watermain Breaks Categories 1 & 2:

Name of Operator-In-Charge (OIC):	Type of watermain repair:
Date: Time:	Flow maintained until Air-gap created: [ ] Yes [ ] No
Location:	Air-gap maintained through repair process: [ ] Yes [ ] No
Size of watermain:	Pipe & repair parts disinfected: [ ] Yes [ ] No
Watermain pipe material:	Post-repair Flushing undertaken: [ ] Yes [ ] No
Type of watermain break:	Microbiological samples taken: [ ] N/A [ ] Yes [ ] No
Observations:	

For Watermain Breaks Category 2 (Records in addition to the above):

Method of Disinfection: [ ] Spray [ ] Continuous [ ] Slug	Microbiological samples taken: [ ] Yes [ ] No
Initial Chlorine Concentration (ICC) (ppm):	Chain of custody prepared: [ ] Yes [ ] No
Final Chlorine Concentration (FCC) (ppm): FCC % (% of ICC):	Watermain returned to normal service: [ ] Yes [ ] No *Date:* *Time:*
Contact time (hrs,min):	Water Advisory declared: [ ] Yes [ ] No [ ] N/A *Date:* *Time:*
Post-repair Flushing (hrs,min):	Ministry Office - notification: [ ] Yes [ ] No [ ] N/A *Date:* *Time:*
Upstream residual reading (mg/L):	Spills Actions - notification: [ ] Yes [ ] No [ ] N/A *Date:* *Time:*
Downstream residual reading (mg/L):	Medical Officer of Health notification: [ ] Yes [ ] No [ ] N/A *Date:* *Time:*
Describe site specific plan and/or additional steps required by the MECP Watermain Disinfection Procedure, Sections 3.4.1 and 3.4.2:	

*If final downstream disinfectant residual is less than 0.2mg/L free chlorine in a chlorinated system or 1.0 mg/L combined chlorine in a chloraminated system, then provide the location and results of upstream disinfectant residuals(s) or by using documented benchmarks for the area, as per Section 3.2.6 of the Ontario Watermain Disinfection Procedure.

TABLE OF CONTENTS

.01 CONCRETE PIPE

.01.01 General

This specification covers the material requirements for circular concrete pipe to be used for the conveyance of storm water and sewage. All pipe materials shall meet the requirements of OPSS 1301, OPSS.MUNI 1820, this specification and be selected from the Approved Sewer Products List.

All pipe supplied shall be from a plant listed as Prequalified under the Plant Prequalification Program by the Ontario Concrete Pipe Association.

.01.02 Classes and Uses of Concrete Pipe

The classes of concrete pipe specified for various construction applications are outlined as follows:

a) Reinforced Concrete Pipe:
ASTM Designation C-76, Class III, or CSA A257.2, 65-D

b) Reinforced Concrete Pipe:
ASTM Designation C-76, Class IV, or CSA A257.2, 100-D

c) Reinforced Concrete Pipe:
ASTM Designation C-76, Class V, or CSA A257.2, 140-D

Reinforced concrete pipe shall be used for the construction of storm sewers, manhole channels, and inlet chamber drains which require pipe with an internal diameter of 300mm and larger.

.01.03 Sulphate Resistant Portland Cement

Portland cement used in the manufacture of concrete pipe shall be Type HS High Sulphate Resistant and meet the requirements of OPSS 1301. The type of cementing materials used shall be marked on each pipe in accordance with OPSS 1301.07.02.

.01.04 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City representative to verify that the pipe conforms to the City's specification.

The pipe manufacturer shall provide the required test specimens, labour and testing equipment required to satisfy the City that the proposed pipe materials meets the specification.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.02 CLAY PIPE

.02.01 General

This specification covers the material requirements for circular clay pipe to be used for the conveyance of storm water, sewage, and industrial waste.

.02.02 Classes and Uses of Clay Pipe

Extra strength clay pipe shall be used for the construction of the following installations:

a) Storm sewers, sanitary sewers and manhole channels up to and including pipe with an internal diameter of 600mm.

b) Inlet chamber drains up to and including pipe with an internal diameter of 600mm, and inlet chamber drain risers up to and including pipe with an internal diameter of 250mm.

c) Private sanitary drains and private sanitary drain risers for pipe with an internal diameter up to and including 250mm.

d) Catch basin drains, catch basin drain risers, and manhole drop pipes for pipe up to and including an internal diameter of 250mm.

.02.03 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City's representative to verify that the pipe conforms to the City's specification. The pipe manufacturer shall provide the required test specimens, labour, and testing equipment and machines to meet the quality assurance conditions of the City.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.03 PVC PIPE

.03.01 General

This specification covers the material requirements for circular PVC pipe to be used for the conveyance of storm water and sewage. All pipe materials shall meet the requirements of OPSS 1841, this specification and be selected from the Approved Sewer Products List, latest edition.

.03.02 Classes and Uses of PVC Pipe

The Standard Dimension Ratio (SDR) is the ratio of the average pipe diameter to the minimum wall thickness. The specified SDR values for main sewers and private drain laterals are as follows:

a) SDR 35 for main sewer installations with a pipe diameter of 200mm up to and including 600mm.

b) SDR 28 for private drains and laterals.

c) Profile or Ribbed pipe is not accepted.

.03.03 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City's representative to verify that the pipe conforms to the City's specification.
The pipe manufacturer shall provide the required test specimens, labour, and testing equipment and machines to meet the quality assurance conditions of the City.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.03.03.01 Pipe Stiffness

The pipe stiffness shall be determined at 5 % deflection according to ASTM D2412. The minimum pipe stiffness requirements for SDR values of 35 and 28 shall be 50 and 100 respectively.

.03.03.02 Internal Hydrostatic Pressure

A typical joint assembly shall be subjected to an internal pressure of 74 kPa for 10 minutes without leakage.

.03.03.03 Internal Vacuum

A typical joint assembly shall be subjected to an internal vacuum of 74 kPa for 10 minutes without leakage.

.04 APPROVED SEWER PIPE MATERIALS

The following chart is a summary of the acceptable sewer pipe materials. This chart is for information purposes only and the use of any pipe material is subject to the approval by the City prior to installation.

TABLE 500-1
Approved Sewer Pipe Material

Type / Application	Sewer Pipe Size												
	150 mm	200 mm	250 mm	300 mm	375 mm	450 mm	525 mm	600 mm	675 mm	750 mm	825 mm	900 mm	>900 mm
PVC SDR 28													
SANITARY	X												
STORM	X												
PVC SDR 35													
SANITARY		X	X	X	X	X	X	X					
STORM		X	X	X	X	X	X	X					
VITRIFIED CLAY E.S.													
SANITARY	X	X	X	X	X	X	X	X					
STORM	X	X	X	X	X	X	X	X					
CONCRETE													
SANITARY				X	X	X	X	X	X	X	X	X	X
STORM				X	X	X	X	X	X	X	X	X	X

.05 BEDDING AND BACKFILL OF SEWERS

.05.01 General

Bedding and backfill shall be conducted in accordance with the depths and widths specified on the standard drawings and/or on the Contract Drawings.

OPSS.MUNI 401.07.10 is revised by the following:

.05.02 Bedding

Bedding shall be Granular 'A' material conforming to Form 600, placed in accordance with SEW-300, SEW-301 and SEW-302. Granular 'A' bedding material shall extend to a minimum of 300mm above the top of pipe.
Granular 'A' bedding material shall be compacted in accordance with Form 900. Bedding shall be shaped and compacted adequately to support pipe barrel and bells as required.

.05.03 Backfill

Unless otherwise specified on the Contract Drawings or documents, trenches may be backfilled with select, approved native excavated earth materials from trenches. Where these materials are unavailable or deemed to be unsuitable, granular backfill shall be used.
Where Granular backfill is used, it shall be Granular "A" or "B" Type II, shall conform to Form 600 and shall be compacted in accordance with Form 900.

The use of unshrinkable fill shall be employed where normal means cannot produce the required compaction of the material.

.06 CCTV SEWER INSPECTION

.06.01 CCTV Reports and Submittals

The Contractor shall submit the following once all inspections are complete:

a) A printed inspection report, including an index for each inspection, and detailed records for every inspection performed

b) A PDF version of the printed report

c) Electronic media generated during inspection arranged and identified in a manner that facilitates referencing to each inspection record

d) A database as specified in Form 500.06.04 Data Format

The Contractor is required to keep a record of all inspection material for the duration of the maintenance period, or a minimum of 3 years from the date of inspection.

.06.02 Inspection Related Instructions

The Contractor will be held responsible for damage to street surfaces, curbs, gutters, existing utilities, etc. that result from their negligence during any inspection.

The Contractor shall repair, at their cost, any damage resulting there from, which shall be subject to approval, by the City.

The Contractor will be required to inspect all sewers without disturbing the existing condition of the sewer. Should the Contractor decide to use a stringing method to inspect the sewer, the stringing lines shall not be left in the sewer for more than five days or without consent of the Project Manager.

All obstructions, cracks, irregularities must be fully inspected and documented. The Contractor must inform the City's representative immediately of any obstruction encountered, locations of hazardous atmosphere, or sewers that are in immediate danger of structural failure while the inspection is still in progress. Where possible, the survey shall be reversed so that the extent of the blockage can be assessed.

The Contractor, under the supervision of the Project Manager, or their representative, may install plugs in the sewers to prevent the flow of sewage during inspection for a period of no longer than 10 minutes. The plugs must then be removed for a minimum of 10 minutes after which time they may be installed again for the period stated above. Plugs shall only be installed when and for the time period directed by the Project Manager where the existing flow hinders a proper inspection.

.06.03 Occupational Health and Safety – Confined Space Entry

The Contractor shall ensure that all aspects of the required work are, at all times, in full and complete compliance with the Occupational Health and Safety Act, as amended.

The Contractor shall provide approved equipment and training to personnel who enter confined spaces as may be required on this project. The procedures the Contractor follows for Confined Space Entry must meet or exceed the requirements outlined by the Occupational Health and Safety Act.

.06.04 Data Format

Data structure shall be as specified in the latest NASSCO standard for mainline, manhole, or lateral inspection.

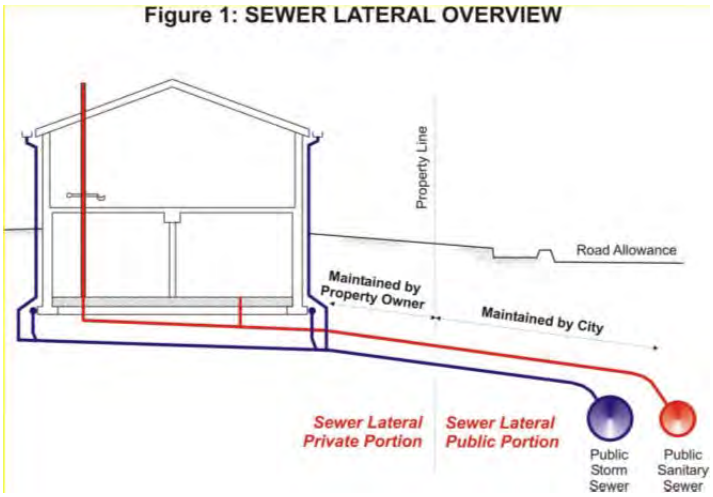
Database file shall be in Microsoft Access format.

Key fields issued by the City to identify inspection records and assets shall be used during inspection and be included in the database inspection records.

.06.05 Lateral Inspection and Asset Inventory

A Sewer Lateral-Private Portion refers to the drain pipe extending from a building on private property to the Sewer Lateral-Public Portion. The Sewer Lateral-Private Portion may be used to convey either storm water, sanitary sewage, or a combination of the two. Figure 1 outlines the location of the Sewer Lateral-Private Portion.

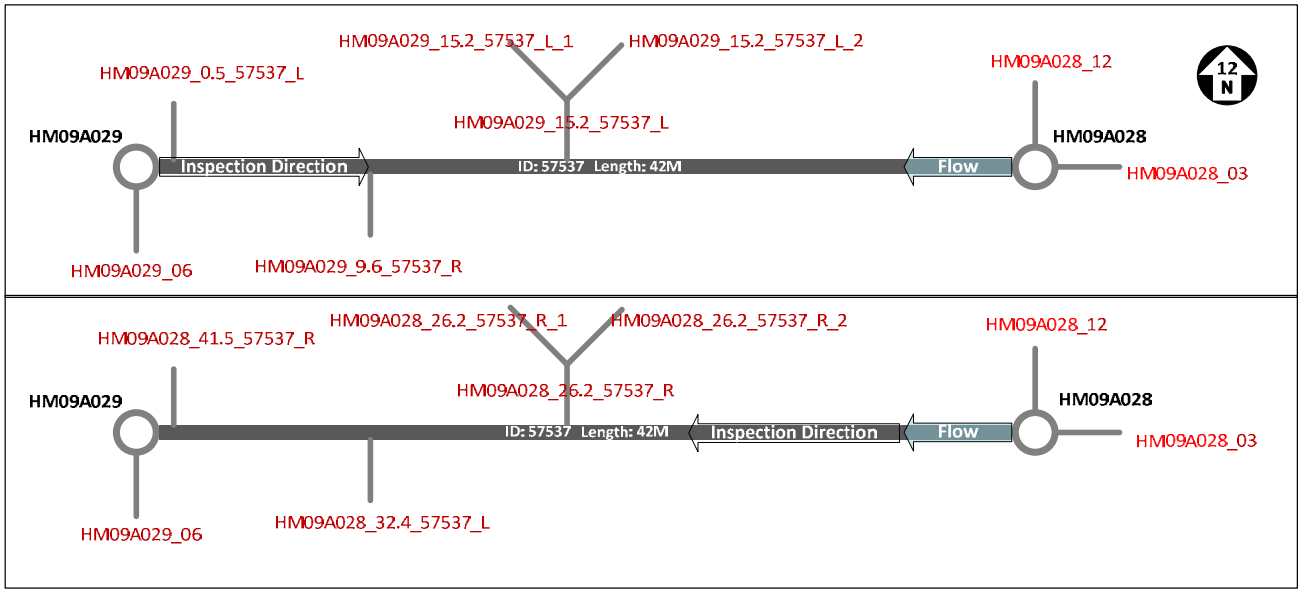
Figure 1: SEWER LATERAL OVERVIEW



Unless otherwise specified, Contractors shall inspect laterals from the mainline sewer only and up to property line (public portion).

Where sewer lateral inventory is not available, Contractors will be required to generate lateral inventory based on conditions observed during inspection in relation to the existing mainline sewer inventory. Figure 2 outlines the methodology for lateral ID creation.

Figure 2: Sewer Lateral Inspection – Lateral ID Creation



ID Components - Mainline Laterals (PACP Lateral_Segment_Reference field)
Starting Manhole ID_Chainage_Mainline ID_Direction of Lateral

Start Manhole ID:	The Hansen Manhole ID (MH_ID*)
Chainage:	Length in m to one decimal point from start manhole to lateral connection
Mainline ID:	The Hansen Mainline ID (COMPKEY*)
Direction of Lateral:	**L** – Left, **R** – Right

*City of Hamilton GIS layer field name reference

ID Components - Manhole Laterals
Manhole ID_Clock Position

Manhole ID:	The Hansen Manhole ID
Clock Position:	North is 12o'clock

.01 GENERAL

Unless amended herein, granular material physical properties, and testing procedures to evaluate granular material quality shall conform to the requirements of OPSS 1001.

.02 GRANULAR 'A' BASE COURSE AND GRANULAR 'B' SUBBASE

.02.01 Physical Properties

Granular 'A'

Physical properties shall conform to OPSS.MUNI 1010.05.02, and Table 1, with the additional requirement that the granular material shall be composed of 100% crushed particles.

100 % Reclaimed Concrete Material (RCM) and up to 30% by mass Reclaimed Asphalt Pavement (RAP) shall be accepted in Granular 'A' base course materials.

Granular 'B' – Type II

Physical properties shall conform to OPSS.MUNI 1010.05.03.03 and Table 1.

.02.02 Gradation Properties

Gradation properties for Granular 'A' and 'B' shall conform to OPSS.MUNI 1010, Table 2.

Granular 'B' for sub base shall meet the gradation requirement for Type II.

.03 GRANULAR PIPE BEDDING

.03.01 Physical Properties

Physical properties shall conform to Table 600-1.

Slag (blast furnace and steel slag) shall not be used for pipe bedding of watermains or water services.

.03.02 Gradation Properties

Gradation properties shall conform to the requirements of Granular material in OPSS.MUNI 1010, Table 2.

Granular D shall conform to the gradation requirements in Table 600-2.

.04 GRANULAR TRENCH BACKFILL

.04.01 Excavated Native Materials

Trenches may be backfilled with select, approved excavated native materials, or as specified in the Contract Documents. Where granular trench backfill material is required refer to Form 600.04.02 and 600.04.03.

.04.02 Physical Properties

Physical properties shall conform to Table 600-1.

Crushed bedrock, is acceptable for granular trench backfill.

Use of slag is not permitted for backfill of sewers, private drains, watermains or water services.

.04.03 Gradation Properties

Gradation properties shall conform to the requirements of Granular B, Type II material in OPSS.MUNI 1010, Table 2.

TABLE 600-1

PHYSICAL TESTS	GRANULAR TRENCH BACKFILL	GRANULAR PIPE BEDDING	MTO LAB TEST NUMBER
Los Angeles Abrasion, Loss in Maximum Allowable Percent	N/A	N/A	LS 603
Petrographic Number, Maximum Allowable	250	250	LS 609
Plasticity Index	0	0	LS 704
Percentage of Crushed Particles, by mass Minimum	N/A	N/A	LS 607
Maximum Allowable Percentage of Asphalt Coated Particles in Coarse Aggregate	30	30	LS 621

TABLE 600-2
GRADATION REQUIREMENTS FOR GRANULAR D

SIEVE SIZE	PERCENTAGE PASSING BY MASS
106 mm	-
53 mm	-
26.5 mm	-
22.4 mm	-
16 mm	-
13.2 mm	-
9.5 mm	100
4.75 mm	50-100
1.18 mm	20-55
300 µm	10-30
150 µm	-
75 µm	0-12
53 µm	-

.05 BLAST FURNACE SLAG

The use of blast furnace slag shall be in accordance with Table 600-3.

APPROVED USES OF BLAST FURNACE SLAG TABLE 600-3		APPLICATIONS			
		APPLIED TO LAND SURFACE	APPLIED BELOW LAND SURFACE	PLACED IN WATER	ENCAPSULATED USES
GRANULAR BASE (Granular A) Under Asphalt/Concrete Pavement	Urban Road Cross-Section		APPROVED		
	Rural Road Cross-Section with Ditches		NOT APPROVED		
GRANULAR SUBBASE (Granular B) Under Asphalt/Concrete Pavement	Urban Road Cross-Section		APPROVED		
	Rural Road Cross-Section with Ditches		NOT APPROVED		
SUBGRADE STABILIZATION			USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES		
GRANULAR SHOULDER MATERIAL Rural Road Section with Ditches		NOT APPROVED	NOT APPROVED		
LIGHT-WEIGHT EMBANKMENT/BERM FILL		USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES	USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES		
WATERMAIN TRENCH BACKFILL			NOT APPROVED		
SEWER TRENCH BACKFILL			NOT APPROVED		
PIPE BEDDING/COVER MATERIAL			NOT APPROVED		
CLEAR STONE BEDDING AROUND PERFORATED SUBDRAIN PIPE			NOT APPROVED		
HOT MIX ASPHALT AGGREGATE		NOT APPROVED			NOT APPROVED IN ASPHALT
GABION AGGREGATE FOR RETAINING WALLS		NOT APPROVED			
LIGHT WEIGHT CONCRETE AGGREGATE					APPROVED IN CONCRETE

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.01 GENERAL

This specification covers the requirements for hot mix asphalt designed using the Superpave method, including warm mixes.

Unless otherwise amended herein, the design, materials, production and placement of hot mix asphalt shall conform to the following:

- OPSS.MUNI 310 – Construction Specification for Hot Mix Asphalt, including Appendix C
- OPSS.MUNI 1003 – Material Specification for Aggregates – Hot Mix Asphalt
- OPSS.MUNI 1101 - Material Specification for Performance Graded Asphalt Cement
- OPSS.MUNI 1151- Material Specification for Superpave and Stone Mastic Asphalt Mixtures.

.02 SUPERPAVE MIXES

Superpave types shall be as specified in the contract documents, shall be in accordance with Tables 1 and 2 of OPSS.MUNI 1151, and shall be approved prior to use.

The Performance Graded Asphalt Cement (PGAC) shall be in accordance with OPSS.MUNI.1101, as amended by this specification.

.02.01 Design Requirements

.02.01.01 Submission and Design Requirements

The design of Superpave mixes shall be in accordance with the requirements of OPSS.MUNI 1151 Material Specification for Superpave and Stone Mastic Asphalt Mixtures, as amended by this specification.

.02.01.02 Mix Requirements for Design Purposes – Hot Mix and Warm Mix

1151.04.01 of OPSS.MUNI 1151 is amended by the addition of the following:

Asphalt cement shall be performance graded asphalt cement and shall be as described in section .02.02.02.

The Contractor shall design, produce and place asphalt in accordance with the following:

- All surface and binder course asphalt produced and placed on or after November 1 of any year shall be a Warm Mix;
- Where weather conditions at the time of paving prevent the placement of Hot Mix asphalt in accordance with OPSS temperature requirements, a Warm Mix shall be used.

Warm mix asphalt shall be in accordance with section 02.01.03.

.02.01.03 Additional Design Requirements for Warm Mix Asphalt

OPSS.MUNI 310.04.01 of OPSS.MUNI 310 - Appendix 310-C is hereby deleted and replaced with the following:

The Contractor shall be responsible for the following:

a) Using an approved WMA additive listed below:

i) Advera
ii) Evotherm
iii) Hyper Therm
iv) Sasobit
v) SonneWarmix

b) Preparation of the mix design and reporting of all testing results in accordance with test method LS-318 Practice for the Design of Superpave Warm Mix Asphalt (WMA).

c) Any WMA technology not listed in a) above shall be subject to review and approval by the City.

d) The WMA mix design and the job mix formula at the anticipated WMA production temperature, both of which shall be according to the requirements of this specification.

e) Ensuring that, during the development and verification of the WMA mix design, the WMA technology does not adversely affect the asphalt cement performance grade and the WMA mixture performance.

f) Moisture content of the aggregate coming from the dryers shall not exceed 0.5%.

.02.01.04 Submission Requirements – Warm Mix Asphalt

OPSS.MUNI 310.04.02 of OPSS.MUNI 310 - Appendix 310-C is deleted and replaced by following:

A minimum of 4 weeks prior to paving with WMA, the following information shall be submitted to the Project Manager, in writing:

a) The name of the supplier and the approved WMA technology selected.

b) All test results required under LS-318 and any other details on how the requirements of this specification shall be met.

c) If applicable, the type and dosage of WMA additives, how the additives are to be incorporated to produce the WMA, and the WMA technology supplier's established recommendations for usage.

d) Where a proposed technology is not currently approved, the Contractor shall submit the following information a minimum of 4 weeks prior to proposed paving dates for review and approval:

i) Name of process, manufacturer, type of process and the technology group;

ii) Manufacturer's recommendations including:

a) Process description and mix design recommendations;
b) Required plant modification and hauling recommendations;
c) Mixing and compaction temperatures;
d) Construction aspects, if any differences from conventional HMA paving besides temperatures.

iii) Projects where the process has been used including:

a) Client including contact information (telephone, email);
b) Mix designs;
c) Date and location of construction;
d) To date performance.

Where the proposed technology is not approved, the Contractor shall be required to supply and place an approved technology.

.02.01.05 Superpave Mix Verification

1151.04.02.02.02 of OPSS.MUNI 1151 is amended by the addition of the following:

After receiving the asphalt mix design from the Contractor's own laboratory or from a hired firm's laboratory, the Contractor shall provide asphalt mix verification test results in accordance with the following criteria:

a) The tests must be performed by a laboratory independent from the firm producing the asphalt mix design.

b) The laboratory performing verification testing must have a valid "Certificate of Conformance" issued by the Canadian Council of Independent Laboratories (CCIL) Asphalt Laboratory Certification Program and be qualified under the following categories:

i) Asphalt Mix Design – Marshall and Superpave Methods (Type A)

ii) Asphalt Mix Compliance – Marshall and Superpave Methods (Type B)

All verification testing must be reviewed and accepted by the City of Hamilton prior to the start of any paving operations.

The mix design shall be submitted for acceptance at least 4 weeks before construction. The mix design shall be reviewed and approved by the City. Prior to construction, a trial batch shall be submitted to the Project Manager for verification and approval.

The submitted mix design shall include the JMF and the documents listed in Section 1151.04.05 of OPS 1151 MUNI. The mix design that does not include the required documents will not be reviewed and accepted.

.02.01.06 Asphalt Cement Requirements

The asphalt cement content of the approved JMF shall be equivalent to or greater than those shown in Table 800-1.

TABLE 800-1
Superpave Minimum Asphalt Cement Content

Mix Type	Minimum Asphalt Cement Content for JMF
Superpave 9.5	5.5
Superpave 12.5	5.0
Superpave 19mm	4.8
Superpave 25mm or greater	4.6

.02.02 Materials

.02.02.01 Aggregate

Aggregates used shall be in accordance with OPSS.MUNI 1003 Material Specification for Aggregates – Hot Mix Asphalt.

.02.02.02 Performance Graded Asphalt Cement (PGAC)

Performance Graded Asphalt Cement shall be in accordance with OPSS.MUNI 1101 - Material Specification for Performance Graded Asphalt Cement, as amended by the following:

1101.05 of OPSS.MUNI 1101 is amended by the addition of the following:

The basic grade of asphalt cement shall be PG 58–28.

In accordance with ASTM M332 standard, the dynamic shear, T 315, G*sinδ carried out on the residue from pressurized aging vessel (PAV), shall be maximum 6,000 kPa for 58H,V, E -28.

1101.08.03 of OPSS.MUNI 1101 is amended by the addition of the following:

A sample of asphalt cement shall be taken at the beginning of the asphalt paving project. At the discretion of the Project Manager, more samples may be required, for instance to represent 1,000 tons of a particular asphalt mix.

Table 1 of OPSS.MUNI 1101 is deleted in its entirety and replaced with the following:

Table 800-2
Additional testing requirements and acceptance criteria for PGAC grades

Property and Attributes (Unit)	Test Method	Results Reported Rounded to the Nearest	Acceptance Criteria	Rejectable
Ash Content, % by mass of residue (%)	LS-227	0.1	≤ 0.6	>0.6
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58H-28 is specified	Multiple Stress Creep Recovery (MSCR) testing according to AASHTO T 350 testing conducted at a temperature of 58 °C	0.01	≤ 2.0	> 2.0
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58V-28 is specified		0.01	≤ 1.0	> 1.0
Non-recoverable creep compliance at 3.2 kPa (Jnr-3.2) (kPa-1) when PGAC 58E-28 is specified		0.01	≤ 0.5	> 0.5
Average percent recovery at 3.2 kPa (R3.2) (%)		0.1	> the lesser of [(29.371) (Jnr-3.2)$^{-0.2633}$] or 55	≤ the lesser of [(29.371) (Jnr-3.2)$^{-0.2633}$ -10] or 45
Percent difference in non-recoverable creep compliance between 0.1 kPa and 3.2 kPa, Jnrdiff (%)		0.1	N/A Testing carried out only for information purpose	

For residential street pavements, regular PG58-28 asphalt cement will be used with no polymer modification and no MSCR testing required.

Guidelines for the selection of PGAC graded using Multiple Stress Creep Recovery (MSCR) test is given in Table 800-3 below.

Table 800-3
Guidelines for Selection of PGAC Graded Using MSCR Test

Road Type	Recommended PGAC Grade Using MSCR Test	Optional Grade Increase (Note 1)
Urban Freeway	58V-28	N/A
Rural Freeway Urban Arterial	58H-28	58V-28
Rural Arterial Urban Collector	Consider specifying 58H-28 if truck traffic is greater than 20% of AADT	58V-28
Rural Collector Urban/Suburban Collector	58-28	58H-28 or 58V-28
Toll Plaza Port Facility Dedicated Transit ways Truck Marshalling Yards (standing traffic)	58E-28	N/A

Notes:

A. It is recommended that MSCR graded PGAC is used in both surface and top binder courses, i.e. top 80 mm to 100 mm of hot mix.

1. Consideration should be given to an increase in the high temperature traffic level for roadways which experience a high percentage of Trucks or bus traffic at slow operating speeds, frequent stops and starts, and historical concerns with instability rutting.

.02.03 Construction

The supply and placement of hot mix and warm mix asphalt shall be in accordance with the following:

a) OPSS.MUNI 310 Construction Specification for Hot Mix Asphalt, as amended;

b) OPSS.MUNI 310 - Appendix C for the placement of warm mix asphalt, as amended.

.02.03.01 Pre-pave Meeting

At least one (1) week prior to any scheduled milling or paving operation to occur, a mandatory Pre-pave meeting shall be held. The Contractor shall ensure that all required documentation relating to the milling and paving operations has been submitted for review and approved prior to the meeting. The items shall include, but are not limited to, the following:

a) Approved mix designs and Job Mix Formulas;

b) Proposed milling and paving dates and paving equipment to be used;

c) Asphalt placement and compaction rolling patterns;

d) Roadway, lane closures and vehicle access restrictions;

e) Tack coat scheduling and application patterns.

.02.03.02 Asphalt Plant Inspection

The Contractor shall permit access to the City's inspector in order to monitor the asphalt mix production, particularly the amount of Reclaimed Asphalt Pavement (RAP) added. The stockpiles of aggregates and RAP shall be clearly labelled / identified.

The asphalt plant's health and safety procedures that may be required shall be provided by the Contractor in advance.

Upon request from the Project Manager, the Contractor shall supply copies of plant records during asphalt production that will allow a demonstration of the proportion of RAP added to the mix.

.02.03.03 Tack Coat

Prior to the application of any of surface or binder coarse asphalt, tack coat shall be applied. Hot-mix and warm-mix asphalt can be placed only after the tack coat is cured (changes the colour from brown to black and becomes sticky).

.02.03.04 Placement of Binder and Surface Course Asphalt

Any type of asphalt having a thickness of 80mm or more shall be placed in a minimum of 2 lifts unless otherwise directed by the Project Manager.

The finished elevation of the surface course asphalt shall be placed so as to be flush with the lower edge of curb at the depressed portion of all wheelchair ramps. The surface course asphalt shall slope down and away from the curb to form a gutter line in front of the wheelchair ramp.

.02.03.05 Binder Course Asphalt – Temporary Ramping

When the surface course asphalt is to be delayed or placed the following year, temporary asphalt ramps shall be placed at all wheelchair ramps and driveway approaches. The top of the temporary asphalt ramps shall be placed so as to be flush with the lower edge of curb at the depressed portion of all wheelchair ramps and driveway approaches. The temporary asphalt ramps shall be removed at the time of placement of the surface course asphalt at no additional cost.

.02.03.06 Use of Paving Equipment – Paving in Echelon

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

Paving in Echelon is mandatory for the placement of binder and surface course asphalt. The pavers shall be operated at the same time and maintain a distance of not more than 50m from each other so that a hot joint is obtained between the lanes of mixtures being placed. The Contractor shall supply sufficient personnel to adequately control both spreading operations simultaneously.

Where the entire width of the proposed pavement platform cannot be paved in echelon with 2 pavers, one longitudinal construction joint is permitted. Each half of the road shall be paved in echelon resulting in only one longitudinal joint in the binder and surface courses located at the centreline of the road. The joint shall be located to ensure that it does not align with the wheel path of traffic.

.02.03.07 Asphalt Material Transfer Vehicle

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

A Shuttle Buggy® Asphalt Material Transfer Vehicle (AMTV) is required for all paving operations, including paving using only one paver. The use of an AMTV will be paid for by the tonne.

.02.03.08 Re-Heating and Compaction of Longitudinal Joints

OPSS.MUNI 310.07.07 is amended with the addition of the following paragraph:

For surface course, the Contractor shall use an approved method of re-heating, re-working and compacting all centreline longitudinal cold joints. Pricing shall be based on an infra-red heating system capable of maintaining a minimum temperature of 93° C to produce a welded joint, without scorching or burning the mix.

All re-heating methods shall be approved prior to the start of any asphalt placement.

The density of the mix at any longitudinal joint shall be within 1.5 percent of the mainline mat density. Compaction of longitudinal joint shall be measured within 0.3 m from the joint.

.02.03.09 Review of Longitudinal Joint Quality

Prior to the expiry of the 24 month maintenance period, all joints in surface course asphalt shall be reviewed. The review will consider weld quality, proper compaction and separation. All joints showing signs of separation or poor welding shall be re-heated and compacted to achieve a welded joint. All repairs to longitudinal joints shall be at the cost of the Contractor.

.02.03.10 Aggregate Gradation and Asphalt Cement Content Acceptance

OPSS.MUNI 310.08.04 is deleted and replaced by the following:

If the HMA is borderline for aggregate gradation or asphalt cement content specified in Table 800-4, the Contractor shall take immediate corrective action through process control at the HMA plant. A total of three consecutive borderline test results for any attribute representing up to 1,000 tonnes of HMA production shall result in the work being deemed rejectable.

TABLE 800-4
Production Tolerances on the Job-Mix Formula
Aggregate Gradation and Asphalt Cement Content

Mix	Attribute	Tolerances on the Job-Mix Formula % (Note 1)		
		Acceptable	**Borderline**	**Rejectable**
Surface Course	DLS, 4.75mm sieve size	< 5.0	5.0 to 7.5	>7.5
	600 µm sieve size	< 3.5	3.5 to 5.0	>5.0
	75 µm sieve size	< 2.0	2.0 to 3.0	>3.0
Binder and Levelling Courses	DLS, 4.75mm sieve size	< 7.0	7.0 to 10.0	>10.0
	600 µm sieve size	< 4.5	4.5 to 6.0	>6.0
	75 µm sieve size	< 2.0	2.0 to 3.0	>3.0
All Mixes	Asphalt Cement Content	< 0.20	0.2 to 0.30	>0.30
Note 1: Tolerances on the job-mix formula apply as both plus and minus from the job-mix formula percent.				

Rejected HMA due to aggregate gradation, such as non-compliance on the DLS 4.75mm, 600 µm, or 75 µm sieve sizes, or non-compliance due to the asphalt cement content specified in Table 800-4, shall be subject to review and corrective actions, including but not limited to payment reduction, or material removal and replacement with acceptable HMA at the Contractor's expense.

The asphalt cement content and aggregate gradation shall be determined for each day's mix production for a given plant location on the basis of the sampling frequency criteria in Table 800-5.

Table 6 found in OPSS.MUNI 310 is hereby deleted and replaced by Table 800-5 below.

TABLE 800-5
Criteria for HMA Sampling and Testing

MIX TYPE	ASPHALT PLANT DAILY PRODUCTION FOR PROJECT	MINIMUM SET OF TEST SAMPLES
Surface Course	≤ 1000 tonnes > 1000 tonnes	3 One additional sample per 250 tonnes or part thereof
Binder Course	≤ 1000 tonnes > 1000 tonnes	3 One additional sample per 500 tonnes or part thereof

Note:

1. The Project manager may reduce the sampling/testing frequency for HMA that is consistently being produced to the specification requirements, or for very low volume
2. A set of test samples are to include a QC sample(for the contractor), a QA sample (for The City) and a Hold (for The City)

Field samples for quality assurance and/or quality control testing shall be Quarter Master Samples obtained during asphalt placement and compaction procedures that meet the minimum sample size of 20 kg as given in OPSS.MUNI 310, Table 6. Samples obtained from the spreader hopper or truck box shall not be used for QA/QC testing.

Samples shall be taken and collected by the contractor at locations determined by the Project Manager or the City's representative. These samples shall be representative of the paving operations. At each location, three samples shall be taken and packed in separate cardboard boxes supplied by the paving contractor. The box samples shall be numbered in sequence for a given contract, and shall be marked to identify each individually. In addition, each sample shall be labelled to include the following minimum identification:

1. Contract Number;
2. Location of Sampling;
3. Date and Time of sampling;
4. Asphalt type;
5. Load number;
6. Load tonnage.

Two of the samples from each sample location shall be the property of The City.

.02.03.11 Air Voids Acceptance for HMA Production

The production of air voids for all HMA mixes shall be evaluated according to Table 800-6.

Table 9 found in OPSS.MUNI 310 is hereby deleted and replaced by Table 800-6 below.

TABLE 800-6
Laboratory Air Void Criteria for Hot Mix Asphalt Production (LS-265)

Mix	Air Voids (%)		
	Acceptable	Borderline	Rejectable
All Mixes	3.0 to 5.0	2.0 to 2.9 and 5.1 to 6.0	< 2.0 and > 6.0

If the HMA is borderline for air voids as specified in Table 800-6, the Contractor shall be notified in writing and shall take immediate corrective action through process control at the HMA plant. A total of three consecutive borderline test results representing up to 1,000 tonnes of HMA production shall result in the work being deemed rejectable.

Rejected HMA due to air voids shall be subject to review and corrective actions, including but not limited to payment reduction, or material removal and replacement with acceptable HMA at the Contractor's expense.

.02.03.12 Asphalt Layer Segregation

All hot mix asphalt shall be inspected for segregation in accordance with the following:

.02.03.12.01 Types of Segregation

Segregation consists of areas with comparatively coarser texture than that of the surrounding pavement. All segregation is deemed to be deficient materials and/or workmanship, regardless of the type, location, cause or severity. The Contractor shall provide traffic control, as required, to conduct all segregation assessments.

Two main types of segregation are recognized:

Mid-lane Segregation:consists of any continuous or semi-continuous longitudinal mark or "streak", typically no greater than 300mm in width. Such segregation is often found in the middle of the lane, in the vicinity of a paver's gearbox, but may be located anywhere across the width of the lane.

Other Segregation: consists of discrete areas or patches of regular, irregular or chevron shape.

.02.03.12.02 Severity of Segregation

The severity of segregation is categorized as follows:

Slight Segregation: The pavement matrix is in place between the coarse aggregate particles; however there are slightly more coarse aggregate particles in comparison with the surrounding acceptable mix.

Medium Segregation: The pavement has significantly more coarse aggregate particles than the surrounding acceptable mat and usually exhibits some lack of surface matrix.

Severe Segregation: The pavement appears very coarse, with coarse aggregate particle against coarse aggregate particle and the pavement has little or no matrix.

.02.03.12.03 Paving Segregation

If the Contractor fails to prevent slight segregation in paving, the Project Manager will issue a written warning and request the Contractor to address the problem. The Contractor may be allowed to continue paving at the discretion of the Project Manager. If medium segregation is observed, the paving operation will be stopped. The Contractor shall prove to the satisfaction of the Project Manager that the paving can be continued without any medium segregation.

.02.03.12.04 Correction of Segregation

If the Contractor's actions fail to prevent continued slight to medium segregation from any source, the Project Manager may instruct the Contractor to cease paving until the problem has been corrected and the City shall not be held responsible for any additional costs that the Contractor may incur as a result.

From the time that the Contractor receives notification of mid-lane segregation, the Contractor will be allowed a maximum of 100 tonnes of mix to be placed on the Contract, in order to demonstrate the effectiveness of any repairs and/or adjustments that have been made to a defective paver.

The Contractor shall demonstrate the repairs and/or adjustments to the paver, which is acceptable to the Project Manager. If the Contractor is unable to eliminate segregation to the satisfaction of the Project Manager, by making repairs or adjustments to the paver within the allowable 100 tonnes of hot mix, then the Contractor shall discontinue the use of that machine and/or material.

.02.03.12.05 Mid-Lane Segregation

Medium to severe mid-lane segregation shall be repaired by removal and replacement at no cost to the City. Slight mid-lane segregation will be accepted into the work with no payment reduction.

.02.03.12.06 Other Segregation

The disposition of Other Segregation shall be as follows:

Slight Segregation: Slightly segregated mix will be accepted into the work with no payment reduction.

Medium Segregation: Medium segregation in all HMA lifts shall be repaired at the direction of the Project Manager at no cost to the City.

Severe Segregation: All severely segregated mix shall be repaired by removal and replacement at no cost to the City.

Levelling or padding courses with a total thickness which is less than that is normally placed in a lift of hot mix (i.e., usually 40mm), that is not machine-laid and any areas of "handwork" shall not be assessed on the basis of segregation but on the basis of other workmanship-related problems. However, if they deteriorate prior to being overlaid by another pavement course, the Project Manager will assess the causes of the deterioration before determining responsibility for the cost of repairs.

.02.03.12.07 Repairs

All repairs shall be subjected to the approval by the Project Manager.

Repairs shall consist of removal and replacement with new hot mix or a hot mix overlay, where permitted.

Repairs for segregated hot mix shall be full lane or shoulder width. However, localized repairs may be permissible for mid-lane segregation in binder courses provided hot joints are used or the mat is still hot.

A paver shall be used for all repairs except those where localized repairs are allowed.

Where localized repairs are allowed for mid-lane segregation in binder courses, these repairs shall be:

- Less than or equal to 300mm in width;
- To the full depth of the subject lift; and
- Entirely tack-coated.

Hot mix used in all repairs shall meet the requirements specified for the tender item in the Contract. All repairs shall be done in a workmanlike manner complying with all requirements for placing hot mix stated in the Contract. All repaired areas must be entirely tack-coated and all transverse joints in surface course repairs must butt up to a vertical face.

For surface and binder courses, all repairs for remedial work due to visually defective mix, including pavement removal and replacement, overlays where permitted, additional shouldering, traffic control and any other work which has to be redone such as line painting shall be made entirely at the Contractor's expense.

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Backflow Preventers	**FOR WATERMAIN COMMISSIONING PURPOSES ONLY**	Watts	009 (16mm to 50mm)
			LF909 (75mm to 200mm)
Backwater Valve		Bibby-Ste-Croix	69060
Corrosion Protection	Zinc Anodes: 5.4 Kg and 10.5 Kg ASTM B-418, Type 2 Magnesium Anodes: 14.5 Kg - B-107, ASTM 843, Type M1 OPSS.MUNI 442		
	Protective coatings for metal fittings	Advanced Corrosion Solutions Inc.	ACS PetroGuard (primer, mastic and tape)
		Bren Technologies	Petro Coating Systems (PCS) (primer, mastic and tape)
		Denso North America	Denso Wrap (primer, mastic and tape)
		PetroWrap	PetroWrap (primer, mastic and tape)
		Trenton	No. 1 Wax Tape (primer, mastic and tape)
	Polyethylene encasement for ductile iron watermain pipe and fittings ANSI/AWWA C105 A21.5 - 8 mil low density Poly-Tube with overlap		
Couplings	Water Service Couplings 19mm to 50mm AWWA C800, NSF 61(Annex G) compression fit copper to copper connections	Cambridge Brass	118NL
		Ford Meter Box Co.	C44-Q-NL
		Mueller	H-15403N
	Water Service Couplings 19mm to 50mm AWWA C800, NSF 61(Annex G) copper to lead or alloy connection	Ford Meter Box Co.	Q14-NL,Q24-NL, Q34-NL with internal stop

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Couplings Cont'd…	**Direct Buried** Watermain Pipe Couplings AWWA C219 epoxy coated with stainless steel straps, nuts and bolts	Ford Meter Box Co.	FC1 and FC2A 100mm to 300mm DI and PVC
			FC2W-xx-SH 100mm to 400mm DI and PVC
		Robar Industries	1506 (4 or 5 bolt model) 100mm to 400mm DI and PVC
		Krausz Industries	Hymax Model No. 2000 100mm to 600mm DI and PVC
		Viking Johnson	MaxiFit (100mm to 1200mm)
	In-Chamber Watermain Pipe Couplings epoxy coated with stainless steel nuts and bolts	**Victaulic**	Style 31 300mm & 400mm (DI pipe)
			Style 44 500mm and Larger Steel Pipe and CPP
			Style AGS W77 **(used when specified in the contract documents)** 500mm and Larger Steel Pipe and CPP
Curb Stops	19mm to 50mm AWWA C800 NSF 61(Annex G) compression ends ball type, non-draining.	Cambridge Brass	202NL
		Ford Meter Box Co.	B44-Q-NL
		Mueller	300 B-25209N
Fittings	Ductile Iron Up to 300mm Pressure Class 350, cement lined, AWWA C104, C110 / A21.10, C153/A2.53, OPSS.MUNI 441, NSF 61	Bibby-Ste-Croix	
		Sigma	
		Star Pipe Products	
		Tyler/Union	DM, DFF and XM
	Ductile Iron 400mm and larger Class 52, cement lined restrained mechanical joint AWWA C104, C110 / A21.10, OPSS.MUNI 441.05.02	Bibby-Ste-Croix	
		Sigma	
		Star Pipe Products	
		Tyler/Union	DM, DFF and XM

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Fittings Cont'd…	PVC 100mm, 150mm, 200mm, injection molded AWWA C907, B137.3 OPSS.MUNI 441	Ipex	Blue Brute
		Royal	Royal
	PVC 300mm to 750mm CSA B137.3 shall use AWWA C900 pipe, bonded and over-wrapped with fiberglass-reinforced polyester	Ipex	Blue Brute, Big Brute
		Royal	Royal
Hydrants	3 way hydrants AWWA C502 CAN / ULC S-520 2-63.5 mm side ports, CSA standard thread, stainless steel nuts, bolts and studs 100mm “STORZ” pumper connection 25mm hydrant operating nut open left (counter clockwise) Extensions permitted at boot only	American AVK	Style 2780
		Clow Canada	Brigadier Series M -67
		Mueller	Darling B-50-B
Insulation	Extruded Polystyrene	Dow	Styrofoam Highload 100
		Owens Corning	Foamular 1000 (Pink)
Joint Restraint	Ductile Iron Pipe	Ebaa Iron	Mega-Lug Series 1100 Black epoxy coated wedges and nuts (100mm to 1200mm)
			Tru-Dual Series 1500TD (100mm to 300mm)
		Ford Meter Box Co.	Uni-Flange Series 1390 (100mm to 300mm)
		Smith-Blair	Cam-Lock Series 111 - epoxy coated wedges and nuts (100mm to 600 mm)
			Bell-Lock 115 and 165 (100mm to 300mm)

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Joint Restraint Con'd…	Ductile Iron Pipe Con'd…	Sigma	One-Lok - SLDE (100mm to 600mm)
		Star Pipe Products	Stargrip Series 3000 and 3100 (100mm to1200mm)
		Tyler/Union	TUFGrip TLD (black)
			TUFGrip Dual Wedge (TDW) Series 1500 (100mm to 600mm)
	Polyvinyl Chloride Pipe (PVC) AWWA C900 ASTM F1674	Ebaa Iron	Tru-Dual Series 1500TD (100mm to 300mm)
		Ford Meter Box Co.	Uni-Flange Series 1390 (100mm to 300mm)
		Sigma	PV-Lok - SLC (100mm to 600mm)
		Star Pipe Products	Stargrip Series 4000 Top breakaway nut same size as the T-bolt (100mm to 750mm)
			Stargrip Series 4000G2 (100mm to 300mm)
			1000C - pipe to MJ or Push-On Fittings (100mm to 600mm); 1100C – Bell Joints (100mm to 600mm); 1200C – pipe to PVC Pressure Fittings with DI pipe OD (100mm to 300mm)
			1000G2C – pipe to MJ push-on fittings (100mm to 300mm); 1100G2C – Bell Joints (100mm to 300mm); 1200G2C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).
		Smith-Blair	Bell-Lock 115 (100mm to 300mm)
			Cam-Lock Series 120 (100mm to 600 mm)
		Tyler/Union	TUFGrip TLP (red).
			TUFGrip Dual Wedge (TDW) Series 1500 (100mm to 600mm)

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Joint Restraint Con'd…	Molecularly Oriented Polyvinyl Chloride (PVCO) AWWA C909	Sigma	PV-LOK: PWM - PVCO to MJ fitting PVPF - PVCO to PVC fitting PWP - PVCO bell and spigot.
		Star Pipe Products	Stargrip Series 4000 (100mm to 300mm)
			Stargrip Series 4000G2 (100mm to 300mm)
			1000G2C – pipe to MJ push-on fittings (100mm to 300mm); 1100G2C – Bell Joints (100mm to 300mm); 1200G2C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).
		Tyler/Union	TUFGrip TLP (red) - pipe to MJ fittings (100mm to 300mm)
			TUFGrip Dual Wedge (TDW) Series 1500 (100mm to 300mm)
Main Stops (Corporations)	19mm to 50mm AWWA C800 NSF 61(Annex G) compression end, ball Type non-draining	Cambridge Brass	301NL - A3H3, A4H4, A6H6, A7H7
		Ford Meter Box Co.	FB1000 Series, Q Type
		Mueller	300 B-25008N
Pipe	Concrete Pressure Pipe 500mm and larger AWWA C301 and C303, OPSS.MUNI 441 Plant pre-qualified by ACPPA	Forterra	
		Decast Ltd.	
	Ductile Iron Pipe 100mm to 200mm & 300mm Pressure Class 350, AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company *(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)*	Tyton Joint Pipe
			TR Flex Joint Pipe

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Pipe Cont'd…	Ductile Iron Pipe, Thickness Class 52 AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company *(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)*	Tyton Joint Pipe 400mm to 1050mm
			TR Flex Joint Pipe 400mm to 900mm
	Ductile Iron Pipe 1200mm Pressure Class 350 AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company *(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)*	Tyton Joint Pipe
	Polyvinyl Chloride (PVC) AWWA C900 - DR18 OPSS.MUNI 441	Diamond Plastics Corp. (DPC)	AWWA C900 (100mm to 200mm & 300mm)
		Ipex	Blue Brute (100mm to 200mm & 300mm & 400mm)
			Centurion (400mm)
		National Pipe and Plastics	AWWA C900 (100mm to 200mm & 300mm)
		Next Polymers	Aqualoc (100mm to 200mm & 300mm & 400mm)
		Royal	Royal (100mm to 200mm & 300mm & 400mm)
	Molecularly Oriented Polyvinyl Chloride (PVCO) 100mm to 200mm & 300mm AWWA C909-PC235, OPSS.MUNI 441	Ipex	Bionax
	Polyvinyl Chloride (PVC) 500mm to 750mm AWWA C900, OPSS.MUNI 441	Ipex	Big Brute, Centurion
		Royal	Royal
	Water Service Pipe 19mm to 50mm AWWA C800, OPSS.MUNI 441, ASTM B88, Type K Soft Copper	Great Lakes Copper Canada Ltd.	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Repair Clamps	**Direct Buried** (clamps to be supplied with conductivity strip)	Robar Industries	5616, 5626, 5636
		Ford Meter Box Co.	Style FS1, FS2 and FS3
	In-Chamber	Straub Tadco	Straub-Flex, non-restrained up to 1200mm (modified for Hamilton)
Service Boxes	Slide adjustment type Stainless steel rods brass cotter pin	Mueller	H-10300 Series
		Clow Canada	"D" Series
Service Saddles	DI, PVC Pipe Outlet size: 19mm to 50mm	Cambridge Brass	403 and 812 Series
		Ford Meter Box Co.	FS202
		Robar Industries	2506 DS, 2616
		Smith-Blair	317
	Concrete Pressure Pipe Outlet size:19mm to 50mm	Ayotte Enterprises	A-900 with A-571 thermoplastic coating (400 mm only)
Tapping Sleeves	Outlet size: 100mm to 400mm Protective coating shall be applied to all steel sleeves.	Ayotte Enterprises	A-600 with A-571 thermoplastic coating, stainless steel nuts and bolts - concrete pipe only
		JCM Industries	JCM 415 epoxy coated with stainless steel nuts and bolts, concrete pipe only
		Smith-Blair (Steel)	#622 epoxy coated (up to 750mm) Ductile Iron and PVC pipe
		Robar Industries (Steel)	6808 and 6906 epoxy coated (100mm to 500mm) Ductile Iron, C900 PVC only
		Romac (Steel)	FTS420 epoxy coated Ductile Iron pipe
Tracer Wire	Solid 12 gauge copper		TWU75 or RWU90XLPE

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valves	**Butterfly Valve 450mm and Larger** AWWA C504, Class 150B manual actuator - traveling nut type with external position indicator nuts, bolts, and bolt studs to be stainless steel Former City of Hamilton: 25mm operating nut, open right (clockwise) Former Municipalities: 50mm operating nut, open left (counter clockwise)	Clow Canada	M & H 504 (450mm to 500mm) M & H AWWA Large Diameter (600mm and larger) Valve seat adjustment to face spool piece side
		Mueller	Lineseal
		Henry Pratt Company	2FII (450mm and 500mm)
			Triton XR-70 (Flanged ends) 600mm and larger
	Gate Valve* Resilient Wedge 100mm to 300mm AWWA C509, C515 nuts, bolts, and bolt studs to be stainless steel, bronze pin top adjustment not permitted Former City of Hamilton: 25mm operating nut, open right (clockwise) Former Municipalities: 50mm operating nut, open left (counter clockwise) *includes hydrant secondary valves	Clow Canada	F-6100, F-6102, F-6106
		Mueller	A2360-6, A2360-19, A2360-23
		American AVK Co.	Series 65

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valves Cont'd…	**Gate Valve** **Resilient Wedge** **400mm** AWWA C509, C515 nuts, bolts, and bolt studs to be stainless steel Former City of Hamilton: 25mm operating nut, open right (clockwise) Former Municipalities: 50mm operating nut, open left (counter clockwise)	Clow Canada	F-6102
		Mueller	A2361-6
	Combination Air Release and Vacuum Breaker Valves AWWA C512 with surge protection	A.R.I Flow Control Accessories	D-060 C HF NS
		Vent-O-Mat	Water RBX Series
	Tapping Valves 100mm to 300 mm AWWA C509	Clow	F-6106
		Mueller	A2360-19
	Tapping Valves 400mm to 600mm AWWA C509	Clow Canada	F-6106BG
		Mueller	A-2361-19
Valve Boxes	Sliding Type with 6mm pre-drilled tracer wire hole and grommet in upper section	Bibby-Ste-Croix	VB1000 Series
		Star Pipe Products	VB-5000 Series (VBDF414-48, VBDF414-60)
Valve Chambers	OPSS 407, 1351 Plant must be pre-qualified by the Ontario Concrete Pipe Association	Anchor	
		Co-Pipe	
		Con Cast	
		Decast Ltd.	
		Forterra	
		M-Con	
		Wilkinson	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valve Chamber Frame and Cover	OPSS 1850 OPSD 402.011 WM 212.03	Bibby-Ste-Croix	
		EJ (McCoy)	
		Mueller	
		R.B. Agarwalla	
	750mm cover OPSS 1850 10 - 25mm vent holes “WATER” cast into cover 4 lifting keyways	EJ (McCoy)	Frame 1220Z1, Product No. 00122016 Cover 1220B, Product No. 00122028
Water Meter Reader Enclosure		Hoffman Nema 4x, fiberglass	Includes internal mounting plate

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Catch Basins	CSA A257.4 Form 700 OPSS 407, 1351 Supplied from a plant prequalified by the OCPA	Co-Pipe	
		Con Cast	
		Forterra	
		M-Con	
		Decast Ltd.	
		Wilkinson	
Catch Basin Frames & Covers	OPSD 400.100 ASTM A48 OPSS 1850	Bibby-Ste-Croix	
		Domcast	
		EJ (McCoy)	“All in one” cover
		Govind Steel	GS
		Labco	
		Mueller	
		Prosperity Exim P.	MF
		R.B. Agarwalla	
Couplings	**CSA B182.2** **CSA B182.4** **OPSS 1841**	Fernco Connectors	
		Kwik Connectors	
		Mission Rubber Co.	
		Pipe Conx	
		Preper-PLS Tech	
Culvert Pipe	Corrugated Steel (CSP) Riveted or Spiral CSA G401 galvanized or aluminized (Type 2) OPSS 1801 and 1841 up to 1000mm - 1.6 Gauge over 1000mm - 2.0 Gauge	Armtec	Hel-Cor, Ultra Flo
		Atlantic Industries	
		Canada Culvert	Steelcor
	HDPE and PVC OPSS 1840, ASTM F 894	Armtec	Big "O", Boss 2000
		ADS	ADS N12
Goss Traps	**SEW-304**	EJ (McCoy)	
		CB Trap	
Maintenance Holes	CSA A257.4-M92 Form 700 OPSS 1351 1200mm to 3000mm Supplied from a plant prequalified by the OCPA	Coldstream	
		Co-Pipe	
		Con Cast	
		Forterra	
		M-Con	
		Decast Ltd.	
		Wilkinson	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Maintenance Hole Frames & Covers	OPSD 401.010 Type A and B ASTM A48	Bibby-Ste-Croix	
		Domcast	
		EJ (McCoy)	
		Govind Steel	GS
		Mueller	
		Prosperity Exim P.	LM
		R.B. Agarwalla	
Sewer Pipe	Vitrified Clay Pipe 150mm to 600mm CSA A60.1M-1976 Form 500	Logan	T-Tap (without flanges)
	Concrete Pipe - Reinforced 300mm or greater CSA A257.2 65-D, 100-D, 140-D Form 500 and 700 OPSS 1820 Supplied from a plant prequalified by the OCPA	Co-Pipe	
		Con Cast Pipe	Reinforced Concrete Pipe
			PERFECT Pipe (600mm, 900mm & 1200mm)
		Forterra	Concrete Bell (mortared in)
		M-Con	
		Decast Ltd.	
	Polyvinyl Chloride Pipe (PVC) Smooth Wall 150mm – SDR 28 200mm to 600mm – SDR 35 CSA B182.2 Form 500 OPSS 1841	Ipex	Ring-Tite Enviro-Tite
		Diamond Plastics	SANI-21
		National Pipe & Plastics	PVC Sewer Pipe
		Next Polymers	NEXT Duraloc
		Royal	Royal
Saddles / Connections	CSA B182.2 CSA B182.4 100mm to 300mm	ADS Canada	Inserta – Tee Saddle Tee (2 straps) Saddle Wye (2 straps) Wing Adapter Universal Sewer Saddle 22 ½° to 45° bends
		Fernco 100mm and 150mm	EZ Tap
		Specialty Products 2000 Inc. (150mm)	Core Bell Adaptor
Valves	Combination Air / Vacuum Breaker AWWA C512	A.R.I	D-020 (stainless steel)

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
High Pressure Sodium Lamps – all wattages, medium and mogul base	Non-cycling, TCLP compliant including lead-free brass base. 30,000+ hours life, universal operating position. Meet ANSI specification corresponding to wattage.	General Electric	Ecolux NC
		Osram Sylvania	Lumalux Plus/Eco
		Philips	Ceramalux ALTO Non-Cycling
Metal Halide Lamps – all wattages, medium and mogul base	Inclusive of probe start, pulse start and ceramic metal halide. Operating position designation as per luminaire requirements. Meet ANSI specification corresponding to wattage.	General Electric	Multi-Vapor
		Osram Sylvania	Metalarc
		Philips	Metal Halide (standard)
Metal Halide Lamps – 200W	200W pulse start lamps	Venture	Uni-Form
Photocell – Standard life, twist-lock type	Standard Life Photoelectric controller with NEMA rated locking type blades. OPSS 2485 Note: Use only permitted for maintenance/replacement. Prohibited for use with LED luminaires.	Fisher-Pierce	FP-N7700 Series Instant Response
		DTL Series (Acuity)	DSS 124
		Precision	
Photocell – Long life, twist-lock type	Long Life Photoelectric controller with NEMA rated locking type blades. OPSS 2485	DTL Series (Acuity)	DLL 127
		Fisher-Pierce	TRS Series
Photocell – Standard life, button type	Photoelectric controller – button/micro CSA C239	Fisher-Pierce	B Series
		DTL Series (Acuity)	DBE Series

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Cobra-head Luminaires – drop glass, all wattages	Prismatic drop glass high pressure sodium and metal halide 'cobra-head' luminaires Integral twist-lock photocell socket CSA C22.2 No. 9.0-96 CSA C653-08, OPSS 2432 Note: Use only permitted for maintenance/replacement.	Cooper Lighting	OVZ Series
		American Electric Lighting	115 Series
		General Electric	M-250R2 Series
LED Cobra-head Luminaires – all wattages	Light Emitting Diode (LED) 'cobra-head' luminaires, conforming to specifications established in RFPQ C11-59-12	General Electric	EVOLVE
Cobra-head Luminaire – sag/flat glass, all wattages	Sag glass/flat glass (cut-off) high pressure sodium and metal halide 'cobra-head' luminaire. Integral twist-lock photocell socket CSA C22.2 No. 9.0-96 CSA C653-08 OPSS 2432 Note: Use only permitted for maintenance/replacement.	Cooper Lighting	OVF Series
		American Electric Lighting	115 Series
		General Electric	M-250R2 Series
Decorative Luminaire – Carriage Style, all wattages	Decorative carriage (4-sided lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K601 Empress Series
		Cooper Lighting	Springdale Series
		Cyclone	Elencia Series
		American Electric Lighting	Georgian Style Series

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Decorative Luminaire – Tear Drop Style, all wattages	Decorative tear-drop (lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K211 Manchester Series
		Holophane	Memphis Series
		Philips Lumec	Renaissance Series
Decorative Luminaire – Acorn Style, all wattages	Decorative post-top (lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K118 Washington Series
		Cooper Lighting	ARN Acorn Series
Power Supply Pedestal Feeder Wiring	Single conductor, stranded copper wire 90 degree Celsius, 600V rated Type RWU90-XLPE #2 AWG (minimum) CSA C22.2 No.38	Anixter Canada	6CN Series (or equal)
		General Cable	
		Southwire	
Pole-to-pole and Branch Feeder Wiring	Single conductor, stranded copper wire 90 degree Celsius, 600V rated Type RWU90-XLPE #6 AWG (minimum) CSA C22.2 No.38	Anixter Canada	6CN Series (or equal)
		General Cable	
		Southwire	
In-pole/In-arm (internal) Wiring	Single conductor, solid copper wire 90 degree Celsius, 600V rated Type TWU #12 AWG (minimum) CSA C22.2 No.75	Anixter Canada	6CA Series (or equal)
		General Cable	
		Southwire	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Electrical Conduit and Fittings	Type II rigid polyvinyl chloride (PVC) 50mm (minimum) CSA C22.2 No.211.2-06	Ipex	Scepter
		Royal	Rigicon
Concrete Pole – Standard Duty, all lengths	Direct buried, spun concrete pole– street lighting use. Class B (minimum) CSA A14-M1979 CSA C22.2 No. 206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Heavy Duty, all lengths	Direct buried, spun concrete pole – combined use (street lighting & traffic signals). Class D (minimum) CSA A14-M1979 CSA C22.2 No. 206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Decorative Octagonal, all lengths	Direct buried, spun concrete pole – street lighting use. Class B (minimum) Octagonal decorative tapered profile, midnight black etched finish CSA A14-M1979 CSA C22.2 No.206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Decorative Post/Top Mount, all lengths	Direct buried, spun concrete pole – street lighting use. Decorative, including profiled decorative base, midnight black etched finish – post top luminaire mounting. CSA A14-M1979 CSA22.2 No.206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	Sheridan Collection Series

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Street Light Luminaire Bracket Arm - Standard, all projection lengths	Aluminum tapered sidemount elliptical bracket arms. OPSS 2428 OPSD 2250.01 OPSD 2420.01	Aluminous Lighting Products	
		Stresscrete Group	
		Dynapole	
Street Light Luminaire Bracket Arm – Decorative, all projection lengths	Decorative metal 'Victorian' scroll arm – side mount configuration – midnight black painted finish	Stresscrete Group	17x Series
Pole Identification Tag	Aluminum Engraved modular number/letter insert type pole ID tags. 25mm letter/numbers, black text on white or natural aluminum background. Vertical orientation, affixed with aluminum banding	Almetek	E-Z Tag V400-TH-A
		Electromark	
Power Supply Pedestal	Complete pedestal assembly consisting of the following: - 100A rated meter socket c/w blank/shorting meter socket insert - 120/240V, 100A panelboard c/w 60A-2P main breaker, 6x40A-1P branch breakers and provision for up to 12 breakers - All equipment contained within a weather proof, tamper proof, dark green in colour metal ground/pad mounted enclosure - Enclosure door and internal panelboard door shall have provision for pad-locking CSA or ESA Approved	Pedestal Solutions Inc.	HSLM271-6-40
		Keltour Controls Inc.	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Ground Rod Inspection Well	Polymer 254mm dia. Light duty inspection well/handwell ASTM C857 – A0.3 SCTE – Light Duty	Carson - Oldcastle Precast	L Series 910

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Electrical Conduit and Fittings	Polyvinyl Chloride (PVC) 25mm, 50mm and 75mm Bell end conduit NEMA TC-2 Schedule 80 CSA C22.2 No. 211.2-06 DT:0111-01 and DT:0111-02	Ipex	Scepter (type II), includes IPEX 100 conduit cement
	High Density Polyethylene (HDPE) - CSA B137.1-05, ASTM F2160 DT:0111-01 and DT:0111-02	Ipex	
		Carlon	
Electrical Handholes	Polyvinyl Chloride (PVC) OPSD 2113.010 - Type III, rectangular	Ipex	
	Precast concrete with cast iron frame & cover OPSD 2112.02 (460mm dia.) ANSI/ASTM A48	HY-GRADE	
Detector Loop Lead-in Cable	# 14 AWG Overall shielded, twisted pair Polyethylene insulation PVC Jacket, 600 V	Belden	8720
Detector Loop Sealant	Non-shrinking Won't fracture at - 40 º C	3M	Detector loop sealant 5000
		Chemque Canada	Q-Seal: 290S, 290W 295S, 295M
Detector Loop Splice Tape	Vinyl electrical tape OPSS 623 compliant CSA 22.2 No. 197 600 volts (- 18º C to 105º C)	3M	Scotch Super 88
Detector Loop Wire	Stranded copper wire #14 AWG, Black Type RWU-90 X-link 1000 V - 40º C OPSS 623 - CSA 22.2 No. 38	General Cable	Spec. # 5600
Grid Interconnecting Conductors	Solid, soft drawn, un-insulated Bare #2 AWG copper wire	Erico	Eritech
		Southwire	

PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Ground Electrode Conductor	Stranded copper wire RWU90-XLPE - insulated Green #3 AWG	Noramco	
		General Cable	
Ground Electrode Connectors	Compression connectors	ABB (Thomas & Betts)	Blackburn E-Z-Ground
Ground Enhancement Material	< 20 ohm-cm resistivity MSDS sheet required DT:011-01 and DT:011-02	SAE Inc.	Conducrete DM100
		Erico	GEM25A
		Harger Lighting and Grounding	Ultrafill
Ground Rod Inspection Well	Polymer Concrete	Oldcastle Precast	Carson H-Series
Grounding Plates	254mm x 400mm x 6mm (10" x 16" x 1/4") galvanized steel CSA C22.2 No. 41-M or UL467 Min 0.2 sq. metre surface area DT:011-01 and DT:011-02	ABB (Thomas & Betts)	Blackburn 1016TB
		Erico	Eritech EGGPC
		Hydel Enterprises	1016GPGC
Grounding Rods	3.0m x 19mm (10' x 3/4 ") copper clad steel, pointed minimum 10 mils of copper CSA C22.2 No. 41-M or UL467 DT:011-01 and DT:011-02	ABB (Thomas & Betts)	Blackburn 7510
		Erico	Eritech 613400
		Hydel Enterprises	3410CC
Junction Boxes for Detector Loop Splices	Fibre reinforced PVC OPSD 2300.010, Type No. P1-5 200mm x 200mm x 175mm Flanged with cover H-10 highway loading	Ipex	Scepter - H887

DRAWING No.	DATE	DESCRIPTION
RD-100.01	November 2005	Road Restoration Over Utility Cuts –Sheet 1of 2
RD-100.02	November 2005	Road Restoration Over Utility Cuts - Sheet 2 of 2
RD-101	November 2018	100 mm Dia. Perforated Drain Pipe Detail
RD-102.01	June 2017	Wheelchair Ramp Locations Without Inegrated Accessibility Treatment
RD-102.02	June 2017	Control Joints at Side Inlet Catch Basin Frame and Cover and Utility Pole Isolation Boxout
RD-103	November 2018	Combined Concrete Walk and Curb and Independent Concrete Walk
RD-104	January 2011	Asphalt Sidewalk
RD-105	November 2005	Interlocking Paving Stone Sidewalk
RD-106	June 2017	Standard Approach
RD-107	June 2017	California Style Approach
RD-108	June 2017	Asphalt Driveway Approach
RD-109	June 2017	Concrete Apron Approach
RD-110.01	June 2017	Offset Curb & Gutter Detail at Single Catchbasin
RD-110.02	June 2017	Offset Curb & Gutter Detail at Double Catchbasin
RD-111	June 2017	Shoulder Paving for Manholes and Chambers in Shoulders
RD-112	November 2005	Concrete Alleyway
RD-113.01	November 2005	Typical Road Cross Section - Local Urban Residential (20.0 m Right–of-Way)
RD-113.02	November 2005	Typical Road Cross Section - Local Urban Residential (18.0 m Right–of-Way)
RD-113.03	November 2005	Typical Road Cross Section Local Urban Residential - Without Sidewalk For Cul De Sacs (18.0 m Right–of-Way)
RD-113.04	November 2005	Standard Road Section For Private Townhouses
RD-113.05	June 2017	Rural Cross Section
RD-114	June 2017	Unsignalized Industrial & Commercial Entrance - Urban Section
RD-115	June 2017	Hammerhead Turning Movement Diagram
RD-116.01	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Symmetrical (18.0 m Right–of-Way)

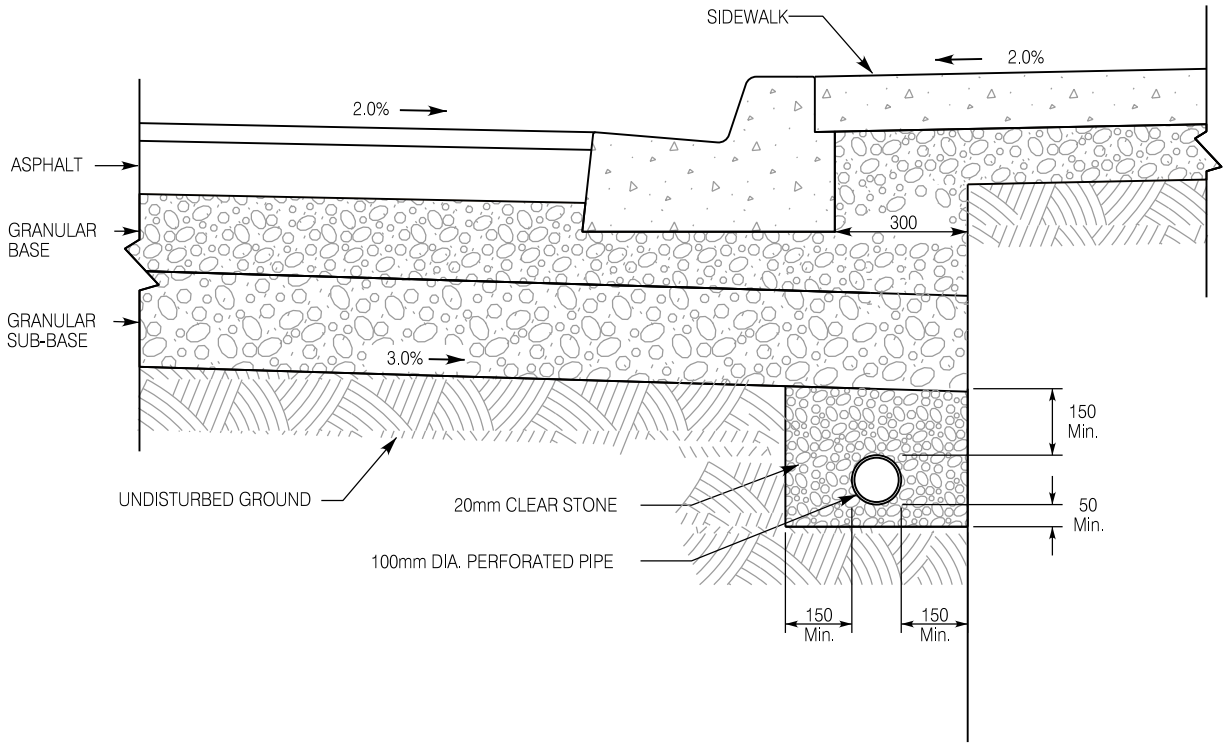
Note: 24” x 36” and 18” x 24” size drawings are not bound in this document

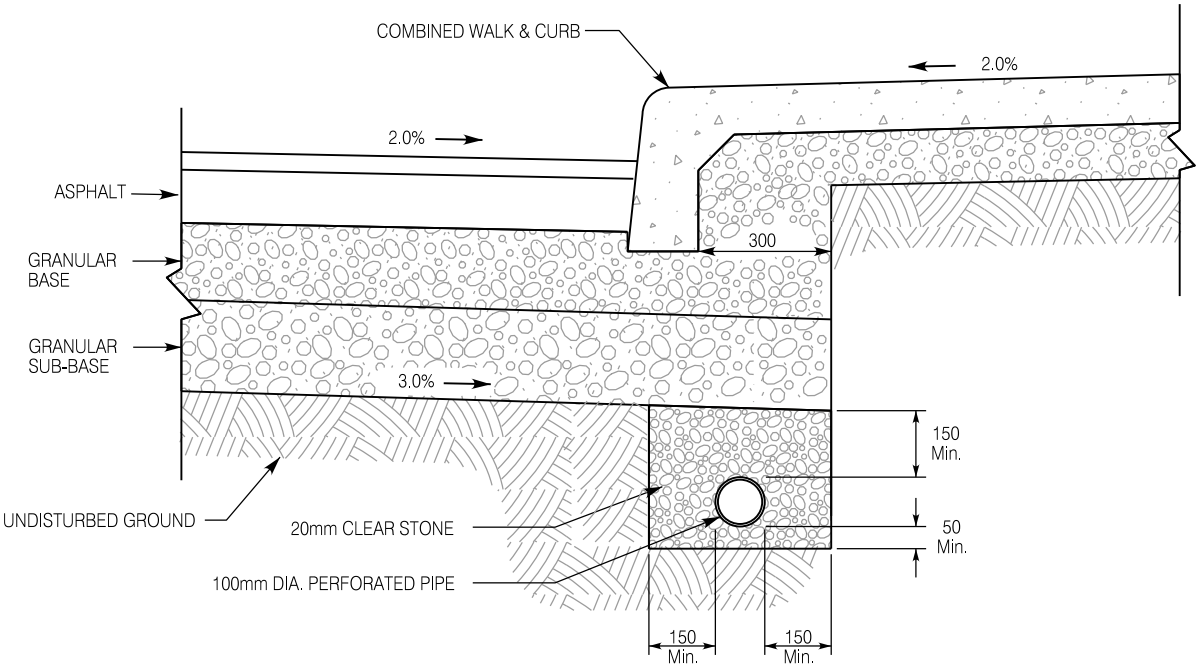
DRAWING No.	DATE	DESCRIPTION
RD-116.02	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Offset Left (18.0 m Right–of-Way)
RD-116.03	November 2005	Cul-De-Sac For Industrial & Commercial Streets
RD-116.04	June 2017	Temporary Turning Circle (20.0 m R.O.W.)
RD-117	June 2017	Rural Residential Entrances
RD-118	June 2017	Rural Industrial & Commercial Entrances
RD-119.01	November 2005	Measurement for Payment Diagram – Road Reconstruction Only
RD-119.02	November 2005	Measurement for Payment Diagram – Road Reconstruction and Combined Walk and Curb Reconstruction
RD-119.03	January 2011	Measurement for Payment Diagram – Widening / Realignment /Narrowing
RD-119.04	November 2005	Measurement for Payment Diagram – Road and Independent Curb and Gutter Reconstruction
RD-120	June 2017	Typical Transit Shelter Pad for 1.2 m by 3.0 m Shelter
RD-121	November 2005	Rear Yard Swale Detail
RD-122	November 2005	Typical Toe of Excarpment Swale & Berm Detail
RD-123.01	June 2017	Privacy Fence
RD-123.02	June 2017	Privacy Fence Details
RD-124.01	November 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24” x 36”)
RD-124.02	November 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24” x 36”)
RD-124.03	March 2018	Integrated Accessibility – Sidewalk/Urban Braille Guidelines (Size 24” x 36”)
RD-125.01	November 2005	Heritage Poles and Details (Size 24” x 36”)
RD-125.02	June 2017	Heritage Poles and Details (Size 24” x 36”)
RD-126	November 2005	Irrigation – Typical Details (Size 24” x 36”)
RD-127	June 2017	Typical Construction of Flagstone Wall on Slope
DT:0111-01	September 2015	Typical Installation of Underground Traffic Control Devices (Size 24” x 36”)
DT:0111-02	September 2015	Typical Installation of Grounding and Bonding for Traffic Control Devices (Size 24” x 36”)

Note: 24” x 36” and 18” x 24” size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
DT:0119-01	January 2017	Standard Design for Speed Humps (Size 18” x 24”)

Note: 24” x 36” and 18” x 24” size drawings are not bound in this document

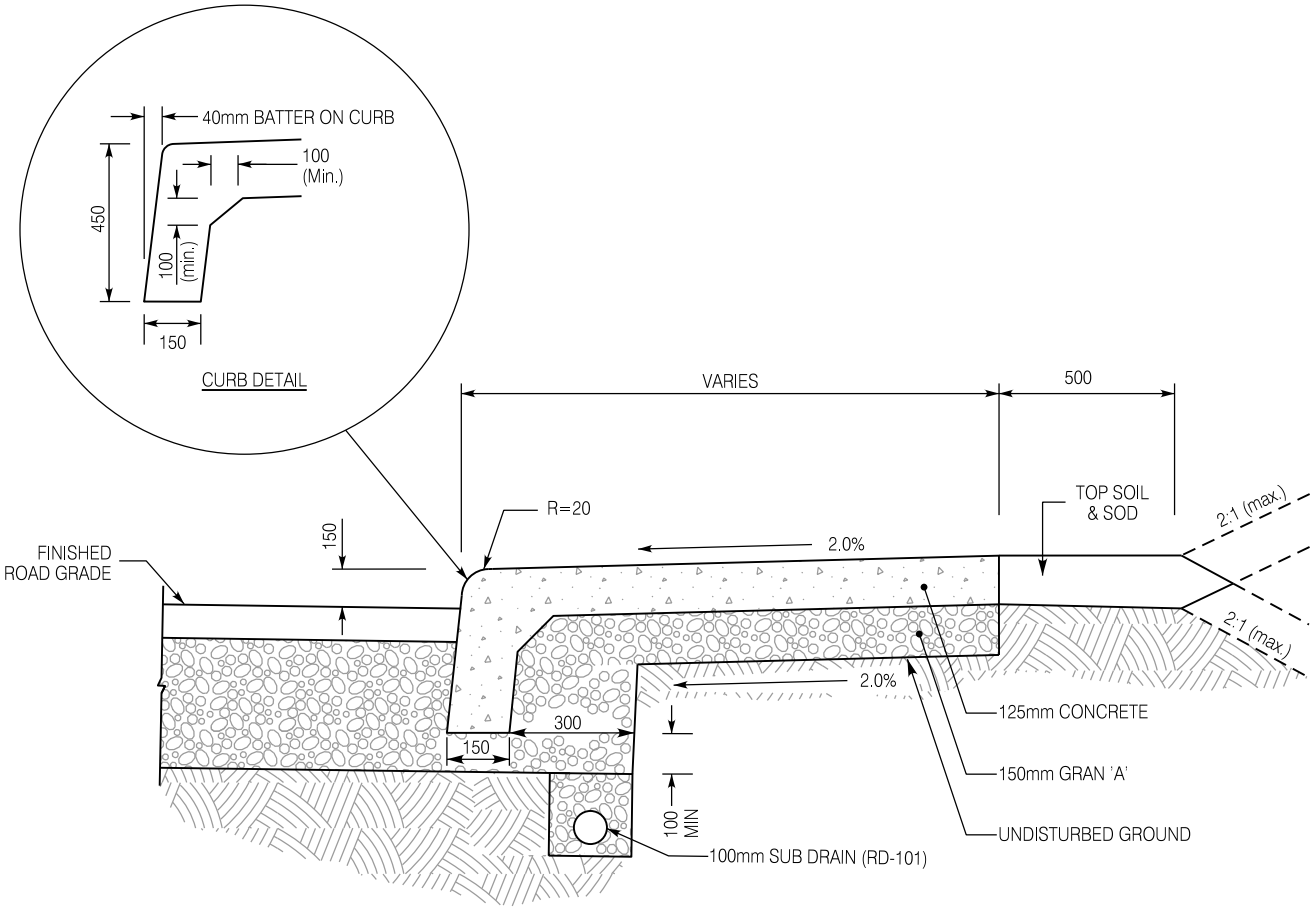




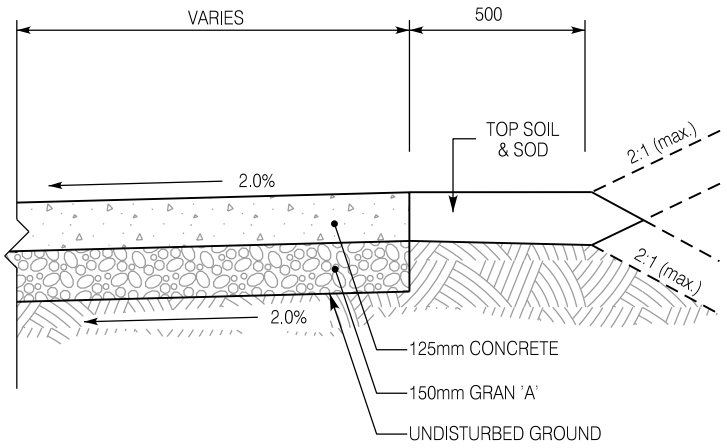
City of Hamilton
Public Works Department

PERFORATED DRAIN PIPE

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE November 2018	REV No 1	FORMERLY:	HAMILTON STD No RD-101



COMBINED CONCRETE WALK AND CURB



INDEPENDENT CONCRETE WALK

DENOTES UNDISTURBED GROUND.

City of Hamilton
Public Works Department

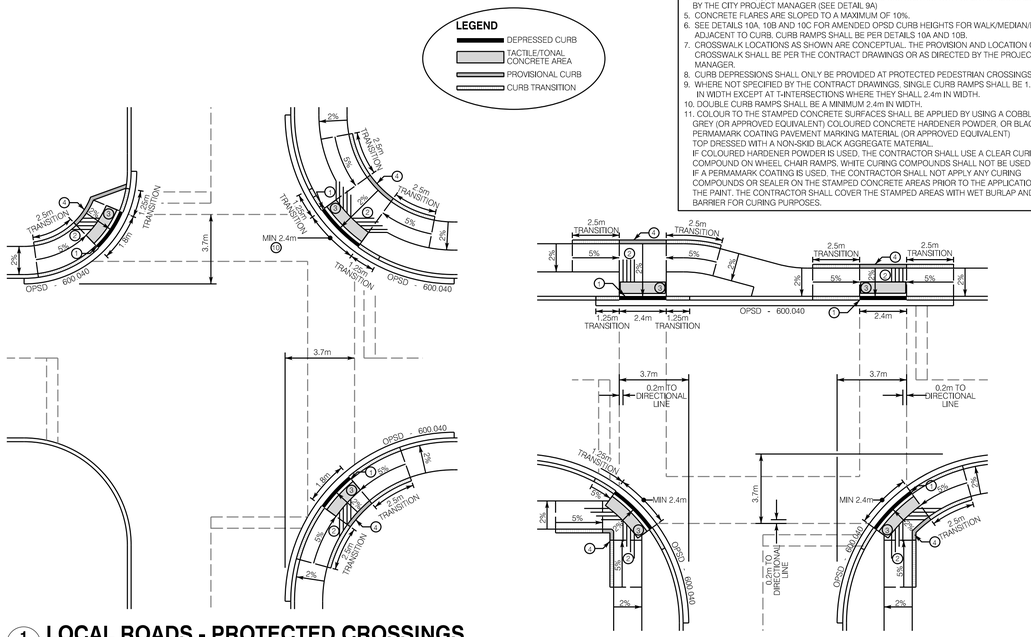
COMBINED CONCRETE WALK AND CURB & INDEPENDENT CONCRETE WALK

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE November 2018	REV No 2	FORMERLY: RHS-303	HAMILTON STD No RD-103

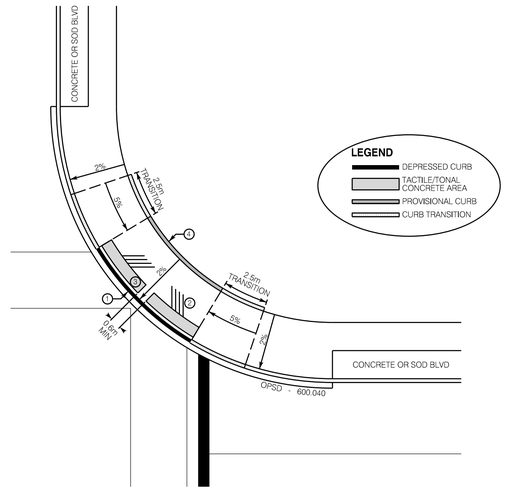
CITY OF HAMILTON - INTEGRATED ACCESSIBILITY - SIDEWALK/URBAN BRAILLE GUIDELINES

RD-124.01

NOTES:
1. ALL CURBING AT CURB RAMPS SHALL BE PER RD-124.03 DETAIL 10B) iii).
2. DIRECTIONAL LINES TO BE PER DETAIL 18A AND SHALL BE ALIGNED WITH DIRECTIONAL LINES IN OPPOSING CORNERS OR IN THE MEDIAN ISLAND.
3. TACTILE/TONAL CONCRETE STAMP SHALL BE OFFSET 150mm FROM BACK OF CURB, IS 610mm DEEP AND BE PER DETAIL 18B.
4. 125mm HEIGHT (Typ.) PROVISIONAL CURB POURED MONOLITHIC WITH WALK AS REQUIRED BY THE CITY PROJECT MANAGER (SEE DETAIL 9A)
5. CONCRETE FLARES ARE SLOPED TO A MAXIMUM OF 10%.
6. SEE DETAILS 10A, 10B AND 10C FOR AMENDED OPSD CURB HEIGHTS FOR WALK/MEDIAN/BLVD ADJACENT TO CURB. CURB RAMPS SHALL BE PER DETAILS 10A AND 10B.
7. CROSSWALK LOCATIONS AS SHOWN ARE CONCEPTUAL. THE PROVISION AND LOCATION OF CROSSWALK SHALL BE PER THE CONTRACT DRAWINGS OR AS DIRECTED BY THE PROJECT MANAGER.
8. CURB DEPRESSIONS SHALL ONLY BE PROVIDED AT PROTECTED PEDESTRIAN CROSSINGS.
9. WHERE NOT SPECIFIED BY THE CONTRACT DRAWINGS, SINGLE CURB RAMPS SHALL BE 1.8m IN WIDTH EXCEPT AT T-INTERSECTIONS WHERE THEY SHALL 2.4m IN WIDTH.
10. DOUBLE CURB RAMPS SHALL BE A MINIMUM 2.4m IN WIDTH.
11. COLOUR TO THE STAMPED CONCRETE SURFACES SHALL BE APPLIED BY USING A COBBLESTONE GREY (OR APPROVED EQUIVALENT) COLOURED CONCRETE HARDENER POWDER, OR BLACK PERMAMARK COATING PAVEMENT MARKING MATERIAL (OR APPROVED EQUIVALENT)
TOP DRESSED WITH A NON-SKID BLACK AGGREGATE MATERIAL.
IF COLOURED HARDENER POWDER IS USED, THE CONTRACTOR SHALL USE A CLEAR CURING COMPOUND ON WHEEL CHAIR RAMPS. WHITE CURING COMPOUNDS SHALL NOT BE USED.
IF A PERMAMARK COATING IS USED, THE CONTRACTOR SHALL NOT APPLY ANY CURING COMPOUNDS OR SEALER ON THE STAMPED CONCRETE AREAS PRIOR TO THE APPLICATION OF THE PAINT. THE CONTRACTOR SHALL COVER THE STAMPED AREAS WITH WET BURLAP AND VAPOUR BARRIER FOR CURING PURPOSES.

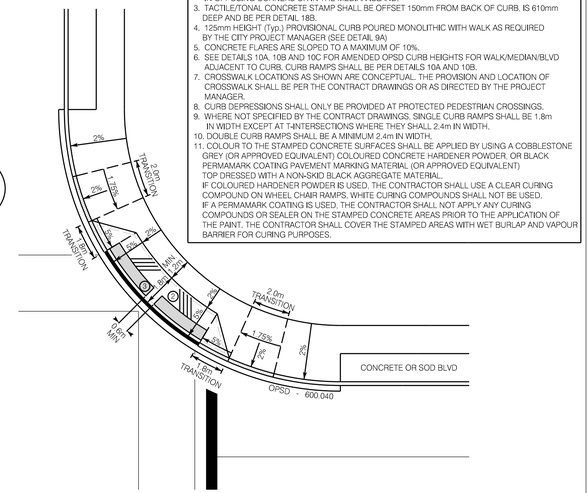


1 LOCAL ROADS - PROTECTED CROSSINGS



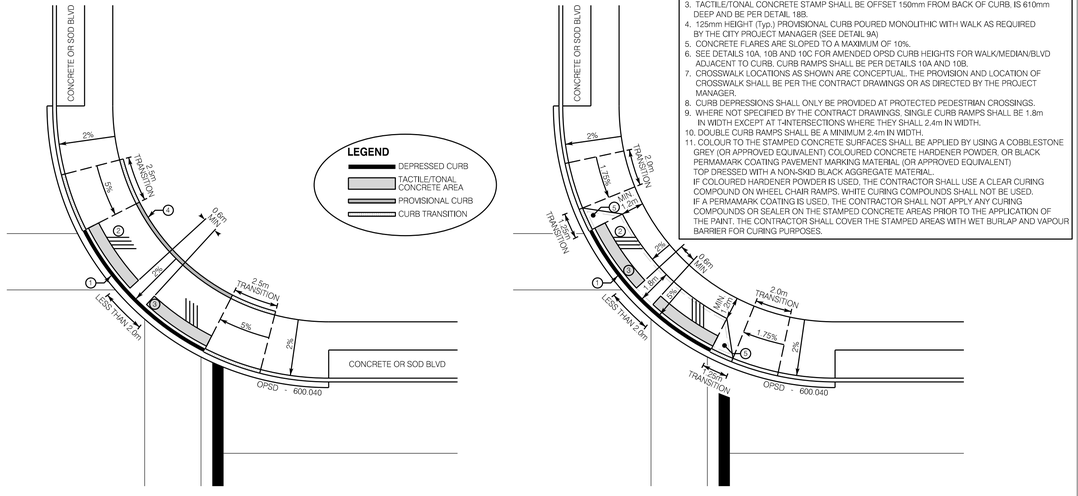
PREFERRED TREATMENT

2A WALK ADJACENT TO CURB (VARIABLE WIDTH)



2B WALK ADJACENT TO CURB (3.0m WIDTH OR LARGER) BACK OF WALK ELEVATION MAINTAINED SEPARATE CURB RAMP POUR

2 INTERSECTING CROSSWALKS

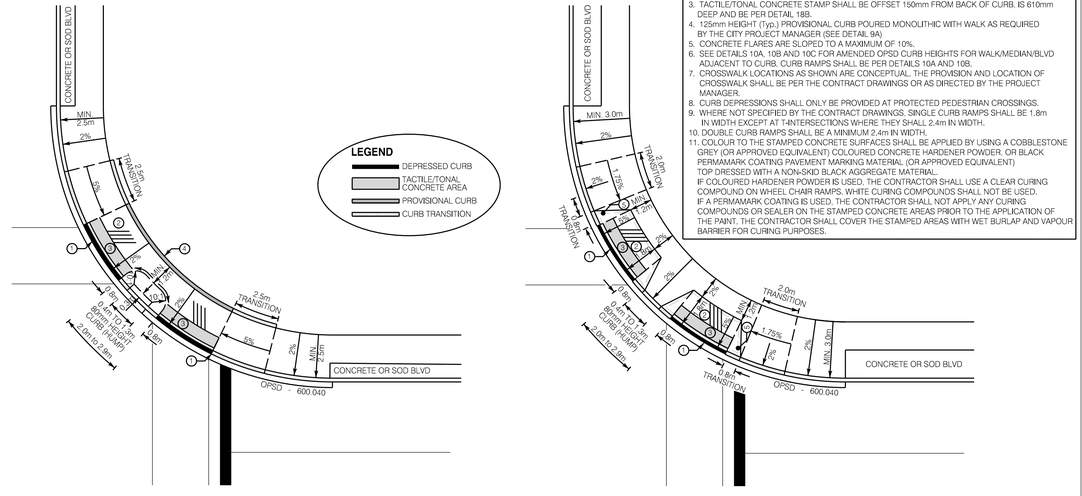


PREFERRED TREATMENT

3A WALK ADJACENT TO CURB (VARIABLE WIDTH)

3B WALK ADJACENT TO CURB (3.0m WIDTH OR GREATER) BACK OF WALK ELEVATION MAINTAINED SEPARATE CURB RAMP POUR

3 SEPARATED CROSSWALKS DISTANCE LESS THAN 2.0m



PREFERRED TREATMENT

4A WALK ADJACENT TO CURB (2.5m WIDTH OR GREATER)

4B WALK ADJACENT TO CURB (3.0m WIDTH OR GREATER) BACK OF WALK ELEVATION MAINTAINED SEPARATE CURB RAMP POUR

4 SEPARATED CROSSWALKS DISTANCE 2.0m to 2.9m

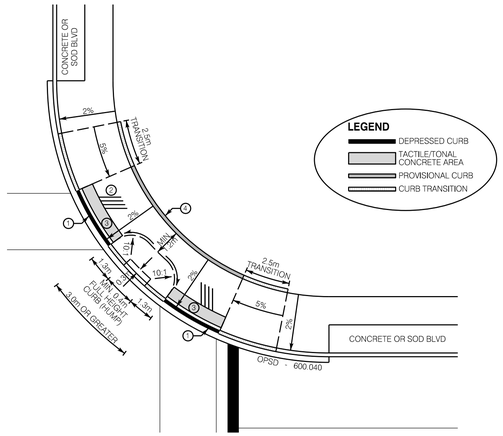
City of Hamilton
Public Works Department

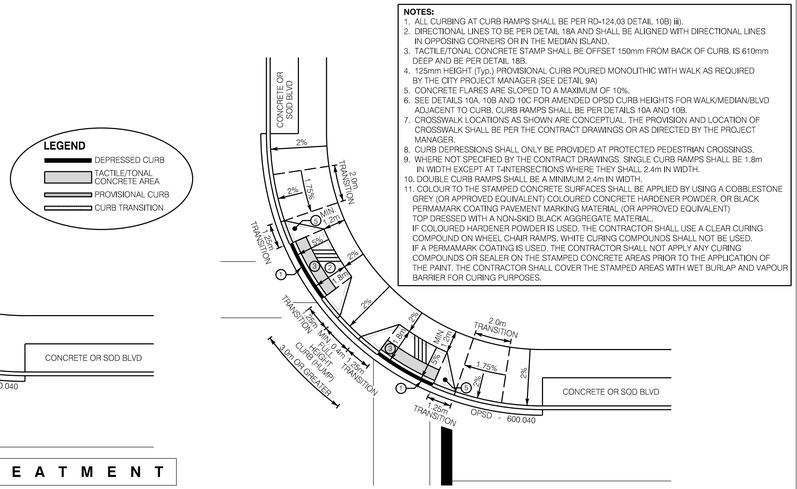
CITY OF HAMILTON - INTEGRATED ACCESSIBILITY - SIDEWALK/URBAN BRAILLE GUIDELINES

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE November 2018	REV No. 1	FORMERLY	HAMILTON STD. No. RD-124.01

CITY OF HAMILTON - INTEGRATED ACCESSIBILITY - SIDEWALK/URBAN BRAILLE GUIDELINES

RD-124.02





NOTES:
1. ALL CURBING AT CURB RAMPS SHALL BE PER RD-124.03 DETAIL 10B) iii).
2. DIRECTIONAL LINES TO BE PER DETAIL 18A AND SHALL BE ALIGNED WITH DIRECTIONAL LINES IN OPPOSING CORNERS OR IN THE MEDIAN ISLAND.
3. TACTILE/TONAL CONCRETE STAMP SHALL BE OFFSET 150mm FROM BACK OF CURB, IS 610mm DEEP AND BE PER DETAIL 18B.
4. 125mm HEIGHT (Typ.) PROVISIONAL CURB POURED MONOLITHIC WITH WALK AS REQUIRED BY THE CITY PROJECT MANAGER (SEE DETAIL 9A)
5. CONCRETE FLARES ARE SLOPED TO A MAXIMUM OF 10%.
6. SEE DETAILS 10A, 10B AND 10C FOR AMENDED OPSD CURB HEIGHTS FOR WALK/MEDIAN/BLVD ADJACENT TO CURB. CURB RAMPS SHALL BE PER DETAILS 10A AND 10B.
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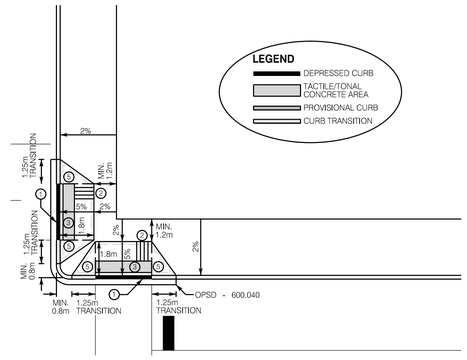
P R E F E R R E D T R E A T M E N T

5A WALK ADJACENT TO CURB (VARIABLE WIDTH)

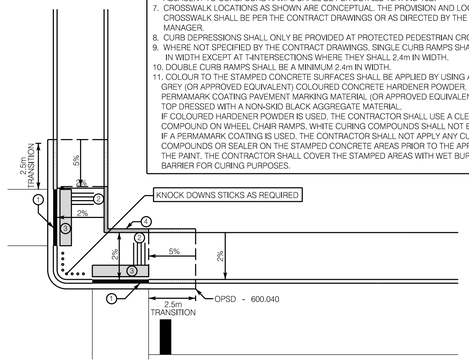
5B WALK ADJACENT TO CURB (3.0m WIDTH OR GREATER)
BACK OF WALK ELEVATION MAINTAINED
SEPARATE CURB RAMP POUR

5 SEPARATED CROSSWALKS DISTANCE GREATER OR EQUAL TO 3.0m



P R E F E R R E D T R E A T M E N T

6A WALK ADJACENT TO CURB (3.0m WIDTH OR GREATER)



NOTES:
1. ALL CURBING AT CURB RAMPS SHALL BE PER RD-124.03 DETAIL 10B) iii).
2. DIRECTIONAL LINES TO BE PER DETAIL 18A AND SHALL BE ALIGNED WITH DIRECTIONAL LINES IN OPPOSING CORNERS OR IN THE MEDIAN ISLAND.
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4. 125mm HEIGHT (Typ.) PROVISIONAL CURB POURED MONOLITHIC WITH WALK AS REQUIRED BY THE CITY PROJECT MANAGER (SEE DETAIL 9A)
5. CONCRETE FLARES ARE SLOPED TO A MAXIMUM OF 10%.
6. SEE DETAILS 10A, 10B AND 10C FOR AMENDED OPSD CURB HEIGHTS FOR WALK/MEDIAN/BLVD ADJACENT TO CURB. CURB RAMPS SHALL BE PER DETAILS 10A AND 10B.
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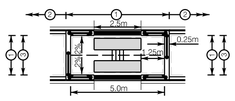
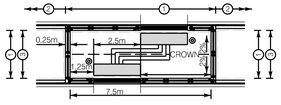
IF A PERMAMARK COATING IS USED, THE CONTRACTOR SHALL NOT APPLY ANY CURING COMPOUNDS OR SEALER ON THE STAMPED CONCRETE AREAS PRIOR TO THE APPLICATION OF THE PAINT. THE CONTRACTOR SHALL COVER THE STAMPED AREAS WITH WET BURLAP AND VAPOUR BARRIER FOR CURING PURPOSES.

6B WALK ADJACENT TO CURB (VARIABLE WIDTH)

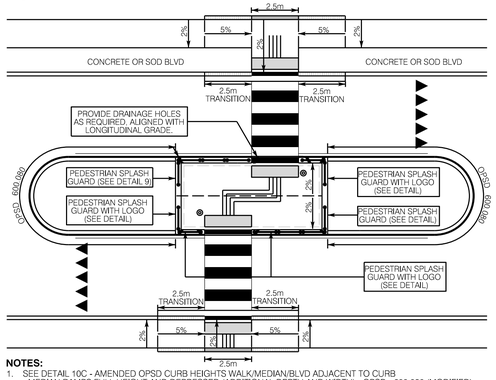
6 1m RADIUS AT BANNED TURNS



7A PEDESTRIAN CORRAL - MEDIAN LANE WIDTHS - 3.0m TO 3.4m



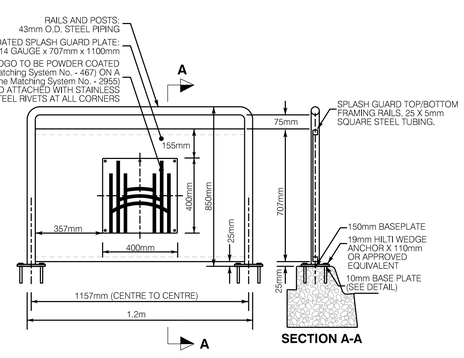
7B PEDESTRIAN CORRAL - MEDIAN LANE WIDTHS - 3.45m OR GREATER



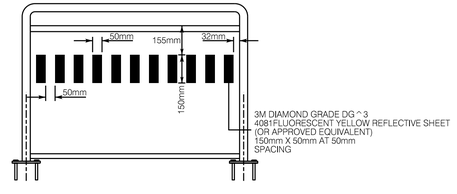
NOTES:
1. SEE DETAIL 10C - AMENDED OPSD CURB HEIGHTS WALK/MEDIAN/BLVD ADJACENT TO CURB - MEDIAN RAMPS FULL HEIGHT AND DEPRESSED (ADDITIONAL DEPTH AND WIDTH) - OPSD - 600.080 (MODIFIED)
2. CURB SHALL BE OPSD - 600.080 (UNMODIFIED).
3. SEE DETAIL 10C - AMENDED OPSD CURB HEIGHTS WALK/MEDIAN/BLVD ADJACENT TO CURB*** WITHOUT GUTTER.

7C GENERAL

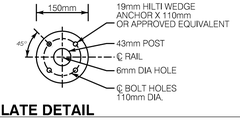
7 MEDIAN ISLANDS - PROTECTED CROSSING



8A PLAN AND SECTION (OUTER FACE)

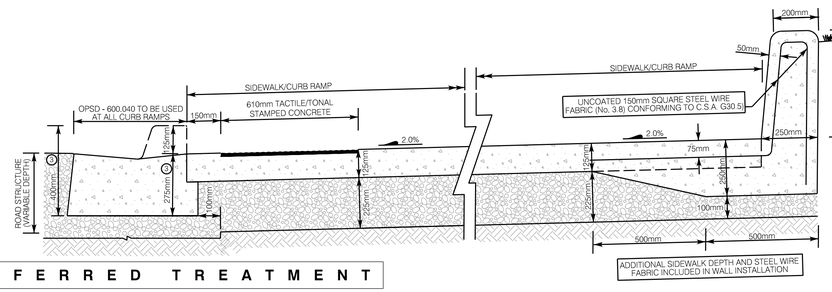


8B PLAN AND SECTION (INNER FACE)



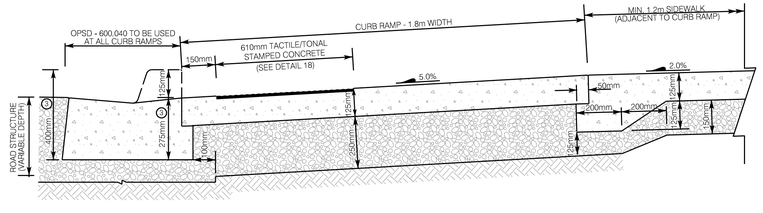
8C BASE PLATE DETAIL

8 SPLASH GUARD

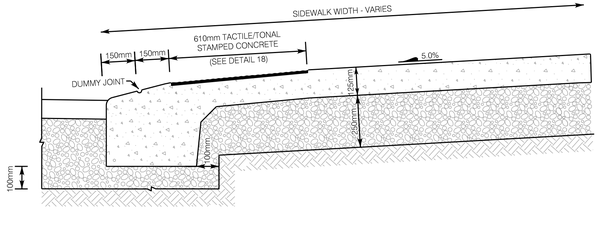


P R E F E R R E D T R E A T M E N T

9A COMBINED SIDEWALK AND CURB RAMP



9B INDEPENDENT SIDEWALK AND CURB RAMP



9C COMBINED SIDEWALK AND CURB

9 CURB RAMPS

City of Hamilton
Public Works Department

CITY OF HAMILTON - INTEGRATED ACCESSIBILITY - SIDEWALK/URBAN BRAILLE GUIDELINES

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE November 2018	REV No. 1	FORMERLY	HAMILTON STD. No. RD-124.02

DRAWING No.	DATE	DESCRIPTION
WM-200.01	May 2013	Bedding & Backfill for Concrete & PVC Watermains and Water Services
WM-200.02	November 2005	Bedding & Backfill for Ductile Iron Watermains and Water Services
WM-201.01	June 2017	1200mm Dia. Precast Valve Chamber for 300mm Dia. Watermains & Smaller
WM-201.02	June 2017	Tapping Valve Installation for D.I. Watermain 300mm Dia. and Smaller
WM-201.03	June 2017	Level Valve Chamber – 150mm Dia. to 300mm Dia. Watermains
WM-202	June 2017	Valve Box Installation For 100mm to 400mm Dia. Watermains
WM-203.01	November 2005	Hydrant Installation
WM-203.02	November 2005	Hydrant Installation using Anchor Tee
WM-203.03	November 2005	Relocation of Ditches at Hydrants
WM-203.04	January 2011	Operating Nut Adaptor for Use on Open Right (Clockwise) Valves
WM-204.01	January 2011	Concrete Anchor Blocks For 300mm Dia. Watermains And Smaller
WM-204.02	January 2011	11-1/4^{o} & 22-1/2^{o} Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.03	January 2011	45^{o} Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.04	January 2011	45^{o} Angle Anchor Block with Leg for 400mm to 600mm Dia. D.I. Watermains
WM-204.05	January 2011	90^{o} Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.06	January 2011	90^{o} Angle Anchor Block with Leg for 400mm to 600mm Dia. DI Watermains
WM-204.07	January 2011	Tee Anchor Block Details for 400mm to 600mm Dia. D.I. Watermain Branches
WM-204.08	January 2011	Tee Anchor Block with Leg for 400mm to 600mm Dia. D.I. Branch Watermains

*24’ x 36’ size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-204.09	January 2011	Concrete Thrust Block for 400mm to 600mm Dia. D.I. Watermains
WM-204.10	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 11 $^{1}/_{4}^{o}$ & 22 $^{1}/_{2}^{o}$ Vertical Bends
WM-204.11	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 45 ^{o} Vertical Bend
WM-204.12	January 2011	Vertical Bend Anchor Block 7 $^{1}/_{2}^{o}$ to 22 $^{1}/_{2}^{o}$ for 400mm Dia.D.I. Watermain
WM-204.13 (1 of 2)	November 2018	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-204.13 (2 of 2)	January 2011	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-204.14	November 2018	Vertical Bend Anchor Block 45^{o} for 400mm Dia D.I. Watermain
WM-205.01	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (20.0 m R.O.W.)
WM-205.02	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (18.0 m R.O.W.)
WM-206	November 2005	50mm Dia. Dead End Blow-Off
WM-207.01	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connection and Yard Service
WM-207.02	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connections in a Common Trench
WM-207.03	November 2005	Insulation Details for Water Services at Gooseneck
WM-207.04	November 2005	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter with Cut in Tee & Sleeve
WM-207.05	November 2005	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter using Tapping Sleeve & Valve
WM-208	November 2005	Remote Receptacle Installation for Meter Chambers
WM-209	June 2017	Piping & Chamber for 16-50mm Dia. Meter Installation
WM-210	November 2005	Piping for 16-250mm Dia. Meter for Internal Installation
WM-211.01	November 2005	Standard Remote Installation for 16-25mm Dia. Meters

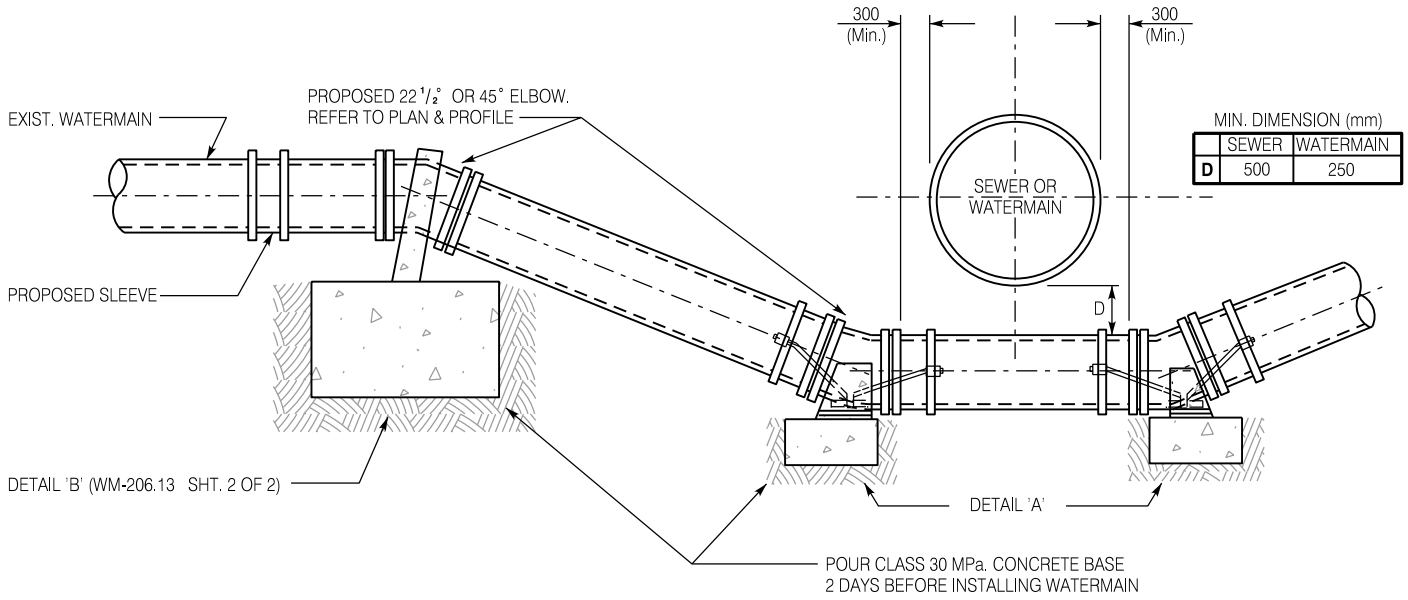
*24’ x 36’ size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-211.02	November 2005	Alterations of Existing 16-25mm Dia. Piping Prior to Meter Installation
WM-211.03	November 2005	Single Family Residential Water Meter Installation for 16-25mm Dia. Services
WM-211.04	November 2005	Meter Pipe Spacer Installation
WM-212.03	November 2005	Valve Key Frame & Cover
WM-213	November 2005	Chamber End Plates for 100mm Dia. to 300mm Dia. Watermains
WM-214	November 2005	Removable Slab Lifting Hole Details & Lifting Hook Detail for Chambers
WM-215.01	November 2005	Valve Support
WM-215.02	November 2005	Pipe & Valve Support
WM-215.03	November 2018	Concrete Pipe Support Details for 750mm to 1200mm Dia. Watermains
WM-216	November 2005	Blow-Off Connection at Access Chamber
WM-217	November 2005	Pitometer Connection for Steel & Concrete Pipe
WM-230	November 2018	2400mm Precast Valve chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off (Size 24" x 36")
WM-231	November 2018	Precast Valve Chamber for 450mm Dia., 500mm Dia. and 600mm Concrete or Ductile Iron Pipe *(Size 24" x 36")
WM-232	January 2011	1800mm Precast Valve Chamber for 400mm to 500mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off *(Size 24" x 36")
WM-233	January 2011	1800mm x 3000mm Precast Valve Chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 100mm Dia. to 300mm Dia. Branch *(Size 24" x 36")
WM-234	November 2005	1800mm x 2400mm and 1800mm x 3000mm Precast Meter Chambers for 100mm Dia. To 250 mm Dia. Water Services *(Size 24" x 36")
WM-235	November 2005	1800mm x 2400mm Precast Tapping Valve Chamber for 100mm to 300mm Dia. D.I. Pipe Tapping off 400mm to 600mm Dia. Watermain *(Size 24" x 36")

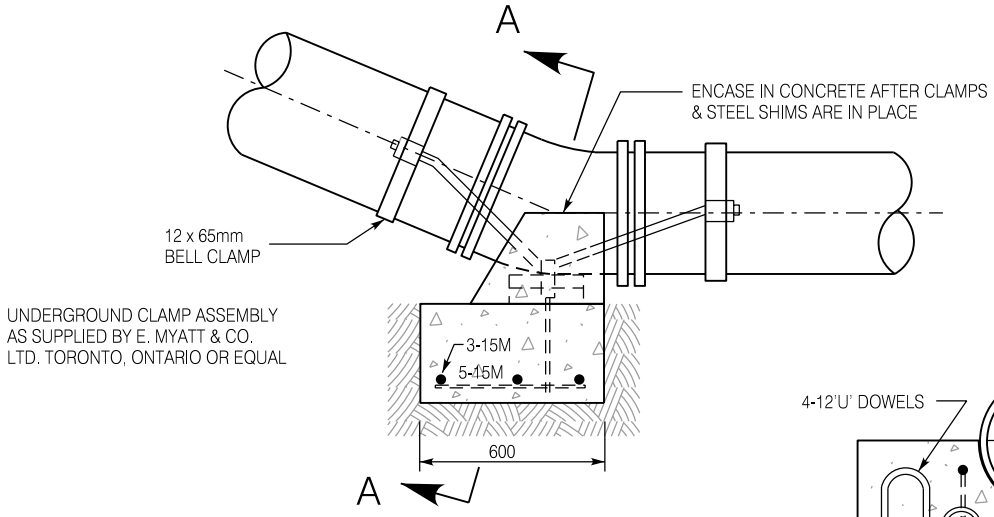
*24' x 36' size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-236 (1 of 2)	November 2018	3400mm x 4700mm Precast Valve Chamber for 750mm and 900mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valves *(Size 24" x 36")
WM-236 (2 of 2)	November 2018	3400mm x 4700mm Precast Valve Chamber for 1050mm and 1200mm Dia. Concrete Pressure Pipe with Butterfly Valve, 100mm Dia. Air Release Valve and 150mm Dia. Blow Off Valves *(Size 24" x 36")

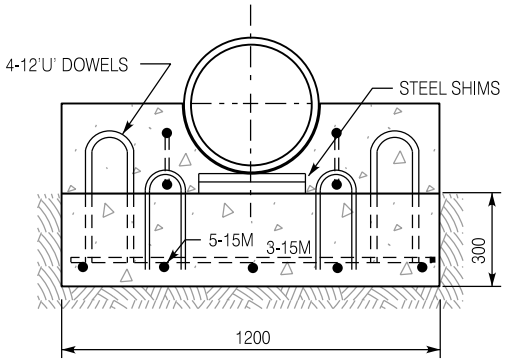
*24' x 36' size drawings are not bound in this document



SIDE VIEW



DETAIL A



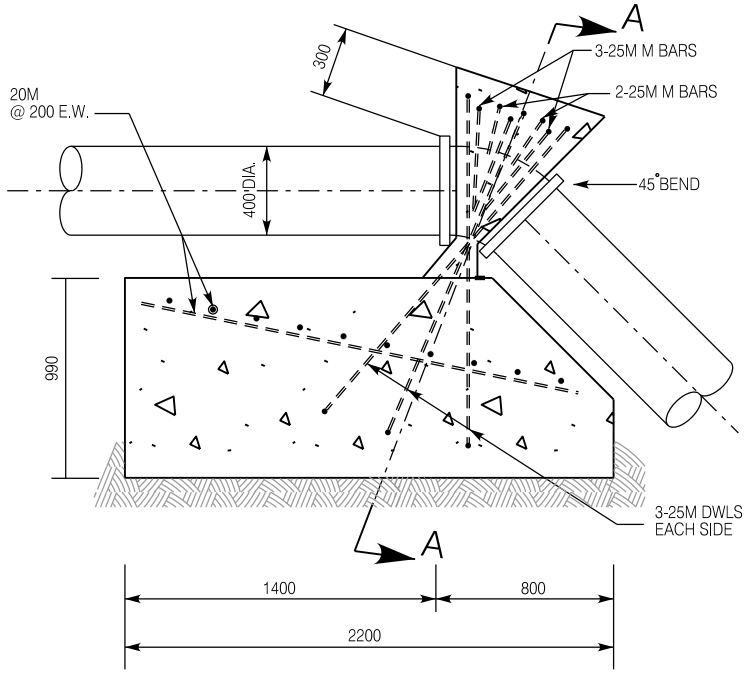
SECTION A-A

DENOTES UNDISTURBED GROUND.

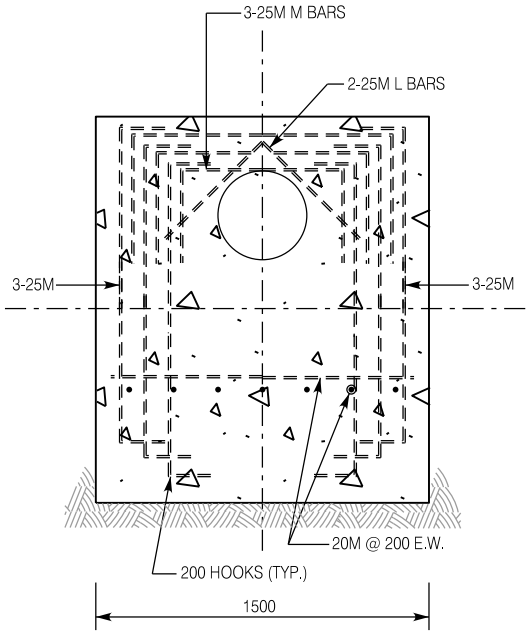
City of Hamilton
Public Works Department

CONCRETE ANCHOR BLOCK FOR 100mm TO 300mm DIA. WATERMAIN LOWERING

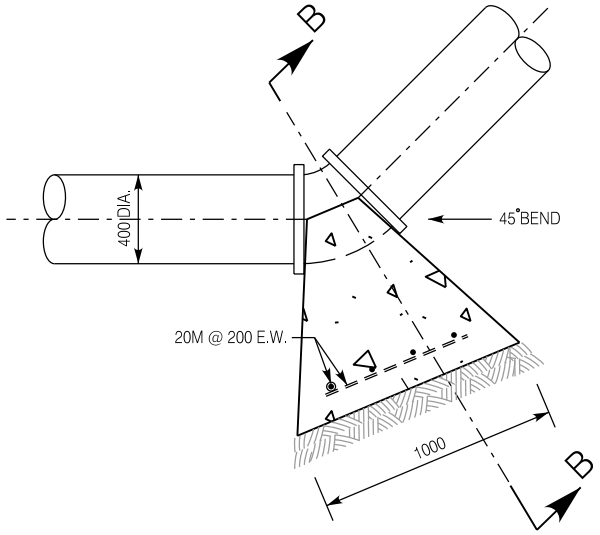
DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE November 2018	REV No 1	FORMERLY: RWS-413(1)	HAMILTON STD No 1 0F 2	WM-204.13



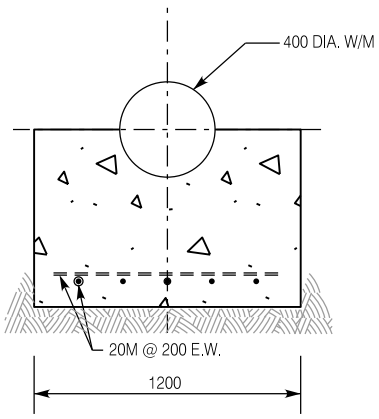
FOR UPWARD THURST



SECTION A-A



FOR DOWNWARD THRUST



SECTION B-B

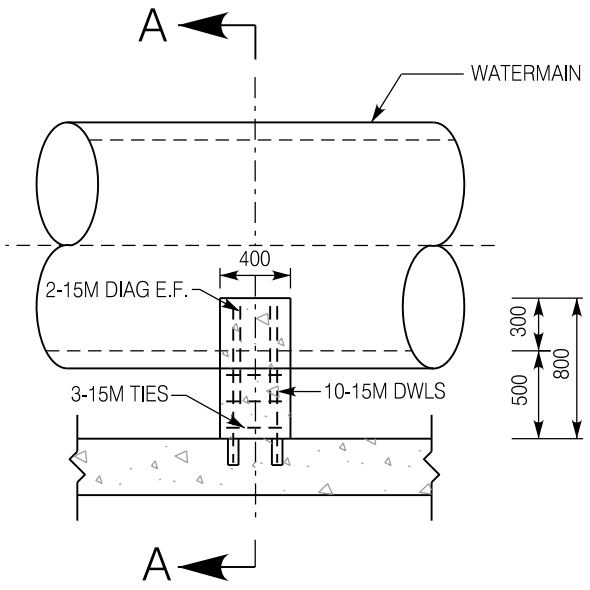
NOTES:

1. DENOTES UNDISTURBED GROUND.
2. ALL CONCRETE TO BE 40 MPa.
3. MINIMUM COVER OF CONCRETE OVER REINFORCING TO BE 75mm.
4. ALL REINFORCING STEEL TO BE GRADE 400.

City of Hamilton
Public Works Department

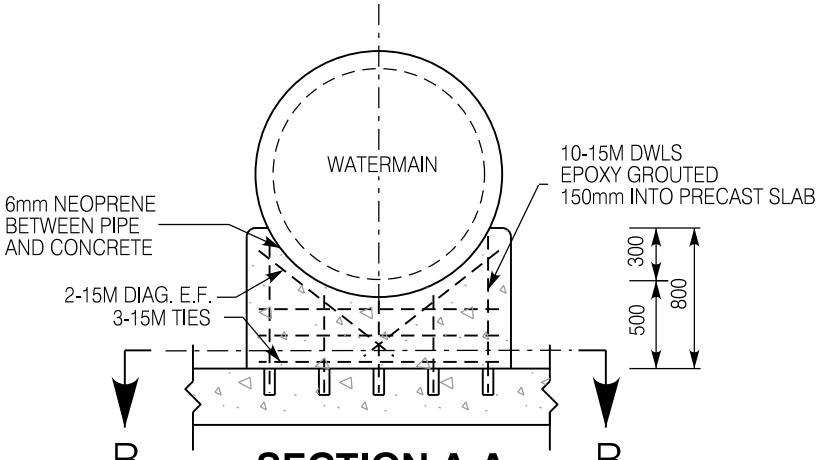
VERTICAL BEND ANCHOR BLOCK
45° FOR 400mm DIA WATERMAIN

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED	DATE: DRAFT NOVEMBER 2018	REV No		HAMILTON STD No WM-204.14



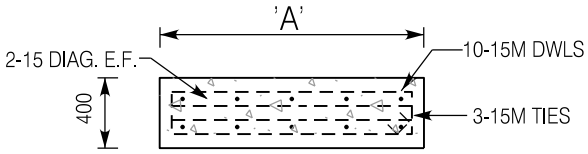
EVELVATION

SCALE: 1:40



SECTION A-A

SCALE: 1:40



SECTION B-B

SCALE: 1:40

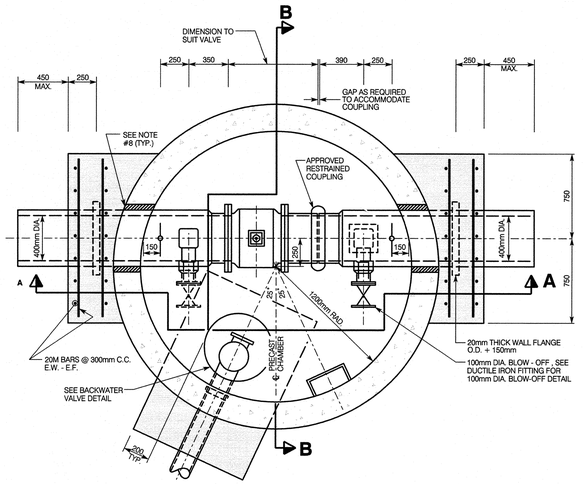
	WATERMAIN DIAMETER	
	750mm & 900mm	1050mm & 1200mm
DIM 'A'	1300mm	1600mm

City of Hamilton
Public Works Department

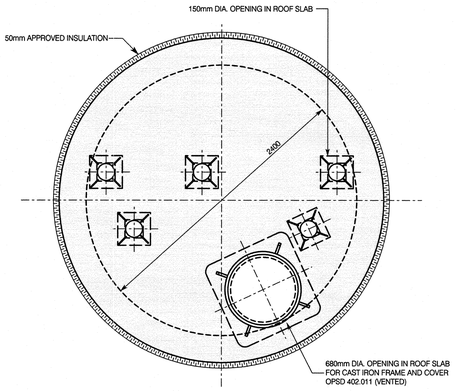
Concrete Pipe Support Details for 750mm to 1200mm Dia. Watermains

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED	DATE: DRAFT MARCH 2018	REV No		HAMILTON STD No NEW DRAFT	WM-215.03

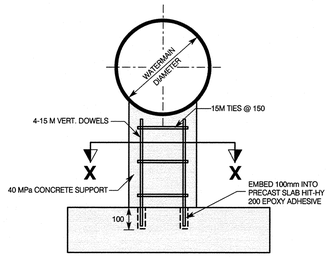
2400mm PRECAST VALVE CHAMBER FOR 400mm DIA. CONCRETE OR DUCTILE IRON PIPE WITH 50mm AIR VALVE & 100mm BLOW-OFF



CONCRETE PIPE - PIPING LAYOUT

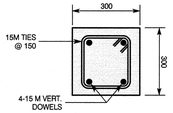


ROOF PLAN - TYPICAL



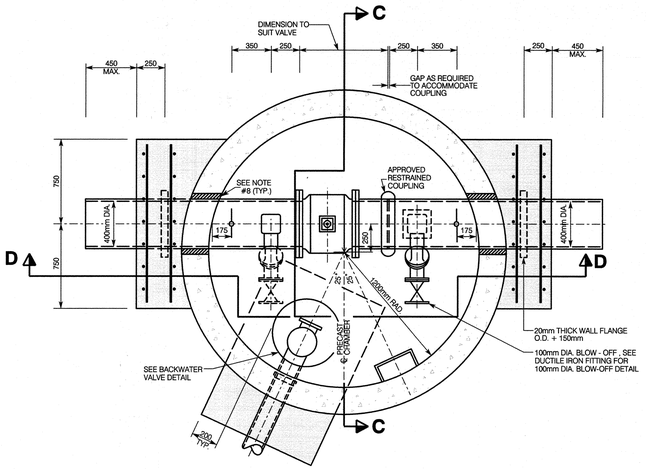
300 x 300 CONCRETE SUPPORT

1:50

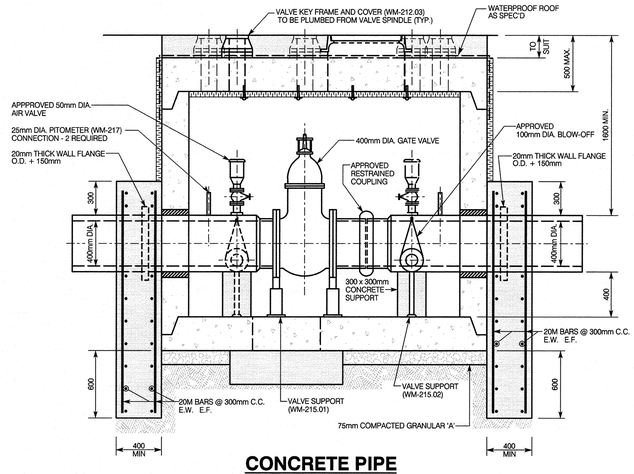


SECTION X-X

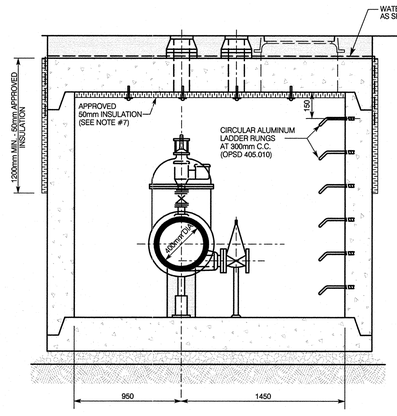
1:50



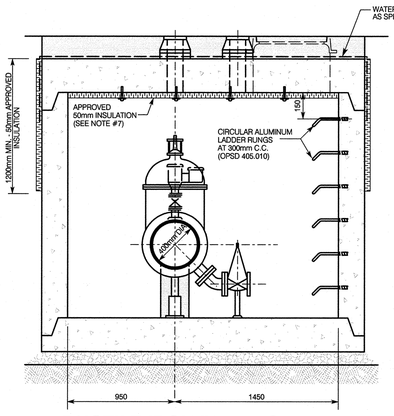
DUCTILE IRON PIPE (CL 54) - PIPING LAYOUT



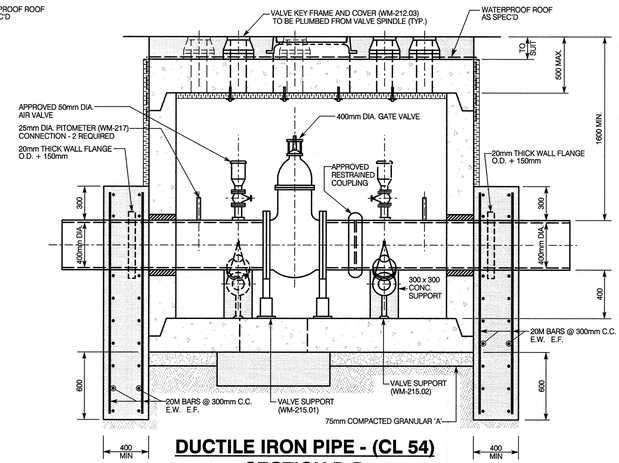
CONCRETE PIPE SECTION A-A



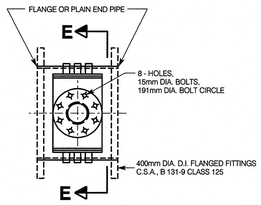
CONCRETE PIPE SECTION B-B



DUCTILE IRON PIPE - (CL 54) SECTION C-C

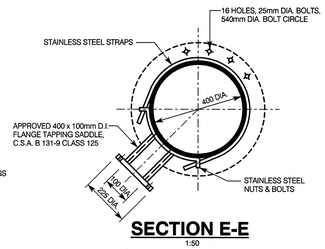


DUCTILE IRON PIPE - (CL 54) SECTION D-D



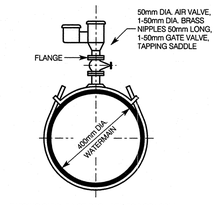
DUCTILE IRON FITTING FOR 100mm DIA. BLOW-OFF

1:50



SECTION E-E

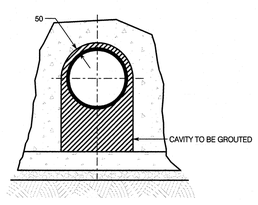
1:50



TAPPING SADDLE NOT REQUIRED FOR CONCRETE PRESSURE PIPE WHEN TAPPED OUTLET IS PROVIDED

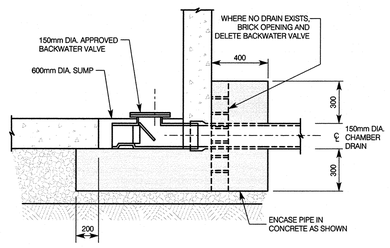
AIR VALVE INSTALLATION FOR DUCTILE IRON PIPE

1:50



DOGHOUSE DETAIL

1:20



BACKWATER VALVE DETAIL

1:20

NOTES:

1. PRECAST CHAMBERS AND SECTIONS SHALL BE MANUFACTURED TO ASTM C-478, CSA, MEET H-20 S16 LOADING REQUIREMENTS AND IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCTS LIST.
2. FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15mm THICK WITH 1:3 NON-SHRINK MORTAR MIX.
3. ALL ADJUSTMENTS TO CHAMBER AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.
4. ALL CONCRETE TO BE 40 MPa., TYPE 50 CEMENT.
5. ALL REINFORCING TO BE HIGH BOND STRUCTURAL GRADE.
6. WHEN AIR VALVE SPECIFIED, THE CHAMBER WALLS, ROOF, COVER (SEE DETAIL) AND CHIMNEY SHALL BE INSULATED WITH 50mm APPROVED INSULATION TO A MINIMUM DEPTH OF 1200mm BELOW TOP OF CHAMBER.
7. FASTEN INSULATION TO CEILING WITH 50mm DIA. WASHERS (GALVANIZED) & 6mm DIA. TAPCON CONCRETE ANCHORS @ 450mm CENTRES.
8. DOGHOUSE OPENING TO BE CUT OUT MIN. 50mm LARGER THAN O.D. OF PROPOSED WATERMAIN. PIPE TO BE WRAPPED WITH MIN. 30mm THICK OF DENSO PLAST MASTIC. REMAINING CAVITY TO BE GROUTED. (SEE DOGHOUSE DETAIL).
9. ALL FLANGES TO BE IN ACCORDANCE WITH ANSI / AWWA.
10. SUPPLY AND APPLY DENSO CORROSION PROTECTION AS SPECIFIED, TO ALL STEEL, CAST OR DUCTILE IRON SURFACES, SADDLES, (INCLUDING BALES) VALVES, FLANGES, NUTS AND BOLTS.
11. SEE CONTRACT DRAWINGS FOR LOCATION / ORIENTATION OF 50mm AIR VALVE OR 100mm BLOW-OFF IN CHAMBER.
12. CHAMBER PIPING SHALL BE CONCRETE OR DUCTILE IRON CLASS 54.
13. WATERPROOF MEMBRANE SHALL BE APPLIED TO ROOF AND ALL CHAMBER WALLS PRIOR TO BACKFILLING.
14. APPROVED RESTRAINED COUPLING SHALL BE IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCTS LIST.

PRECAST CONCRETE | POURED IN PLACE CONCRETE | GROUT

REGISTERED PROFESSIONAL ENGINEER — J. HUDOBA — NOV 5/18 — PROVINCE OF ONTARIO

J & M STRUCTURAL

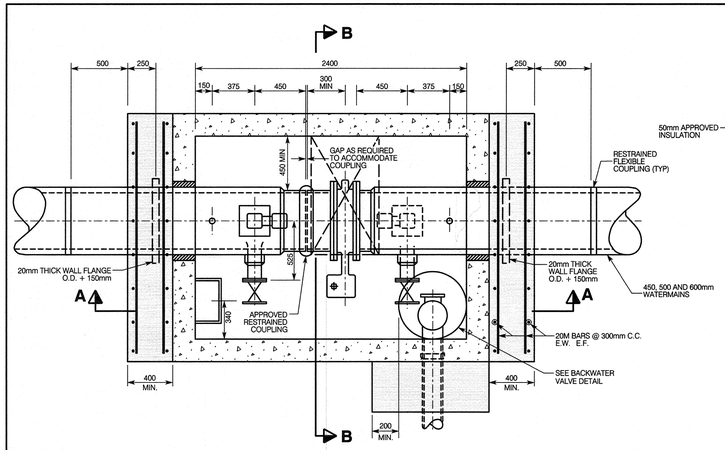
City of Hamilton
Public Works Department

2400mm PRECAST VALVE CHAMBER FOR 400mm DIA. CONCRETE OR DUCTILE IRON PIPE WITH 50mm AIR VALVE & 100mm BLOW-OFF

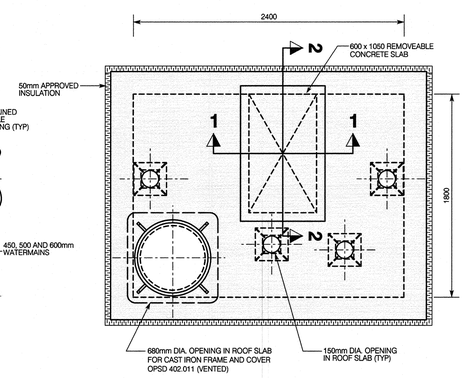
DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED 1:25	DATE	REV No	FORMERLY	HAMILTON STD No.
	NOVEMBER 2018	2	RWS-323	WM-230

WM-230

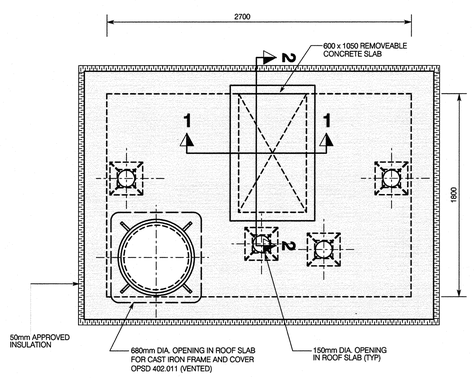
PRECAST VALVE CHAMBER FOR 450mm, 500mm AND 600mm DIA. CONCRETE PIPE OR DUCTILE IRON PIPE



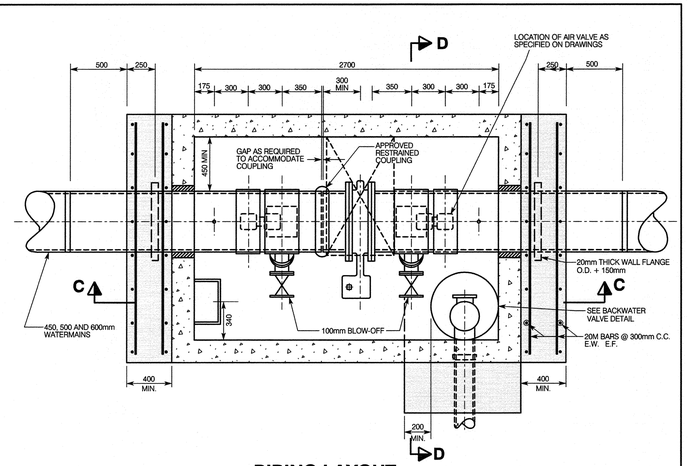
PIPING LAYOUT CONCRETE PIPE



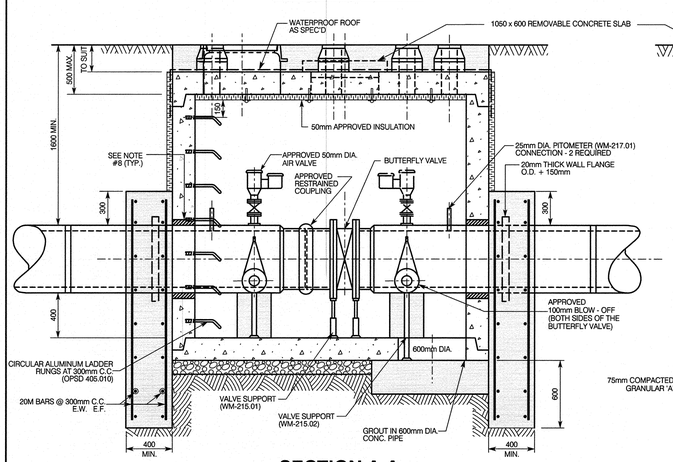
ROOF PLAN CONCRETE PIPE



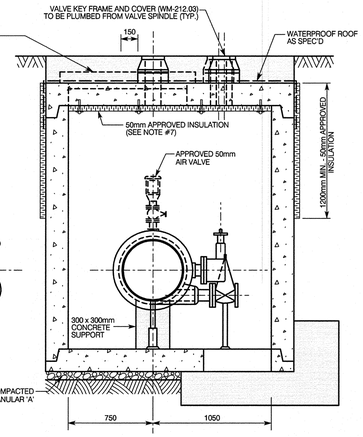
ROOF PLAN DUCTILE IRON PIPE



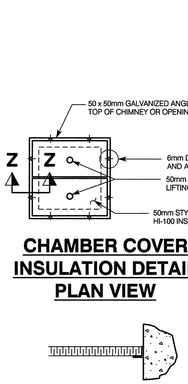
PIPING LAYOUT DUCTILE IRON PIPE - (CL54)



SECTION A-A CONCRETE PIPE

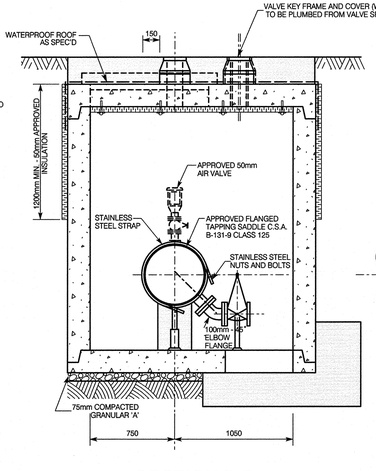


SECTION B-B CONCRETE PIPE

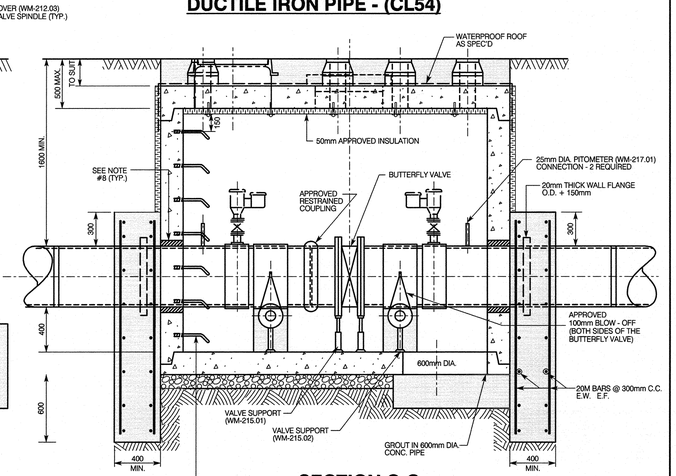


CHAMBER COVER INSULATION DETAIL PLAN VIEW

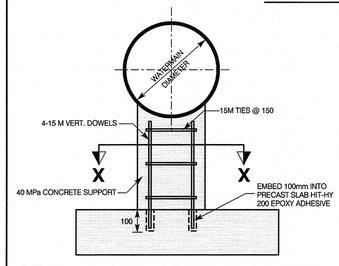
SECTION Z-Z



SECTION D-D DUCTILE IRON PIPE - (CL 54)

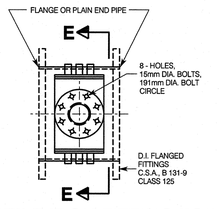


SECTION C-C DUCTILE IRON PIPE - (CL54)



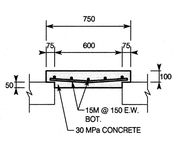
300 x 300 CONCRETE SUPPORT

1:50

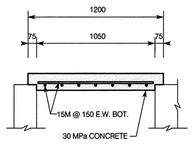


DUCTILE IRON FITTING FOR 100mm DIA. BLOW-OFF

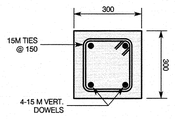
1:50



SECTION 1-1 REMOVEABLE CONCRETE SLAB

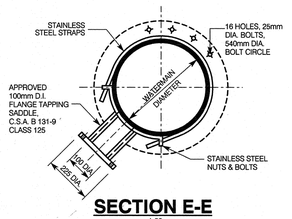


SECTION 2-2 REMOVEABLE CONCRETE SLAB



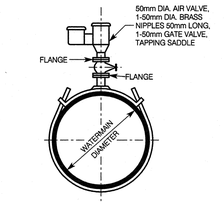
SECTION X-X

1:50



SECTION E-E

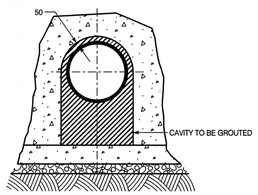
1:50



TAPPING SADDLE NOT REQUIRED FOR CONCRETE PRESSURE PIPE WHEN TAPPED OUTLET IS PROVIDED

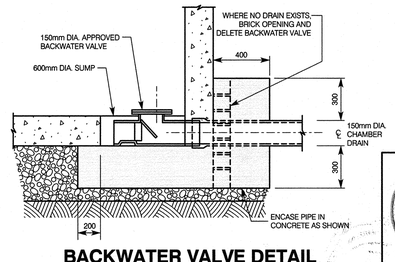
AIR VALVE INSTALLATION FOR DUCTILE IRON PIPE

1:50



DOGHOUSE DETAIL

1:20



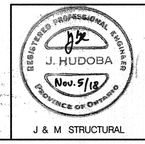
BACKWATER VALVE DETAIL

1:20

NOTES:

1. PRECAST CHAMBERS AND SECTIONS SHALL BE MANUFACTURED TO ASTM C-478, CSA, MEET H-20 S16 LOADING REQUIREMENTS AND IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCTS LIST.
2. FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15mm THICK WITH 1:3 NON-SHRINK MORTAR MIX.
3. ALL ADJUSTMENTS TO CHAMBER AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.
4. ALL CONCRETE TO BE 40 MPa., TYPE 50 CEMENT.
5. ALL REINFORCING TO BE HIGH BOND STRUCTURAL GRADE.
6. WHEN AIR VALVE SPECIFIED, THE CHAMBER WALLS, ROOF, COVER (SEE DETAIL) AND CHIMNEY SHALL BE INSULATED WITH 50mm APPROVED INSULATION TO A MINIMUM DEPTH OF 1200mm BELOW TOP OF CHAMBER.
7. FASTEN INSULATION TO CEILING WITH 50mm DIA. WASHERS (GALVANIZED) & 6mm DIA. TAPCON CONCRETE ANCHORS @ 450mm CENTRES.
8. DOGHOUSE OPENING TO BE CUT OUT MIN. 50mm LARGER THAN O.D. OF PROPOSED WATERMAIN. PIPE TO BE WRAPPED WITH MIN. 50mm THICK OF FLAST MASTIC MATERIAL. REMAINING CAVITY TO BE GROUTED. (SEE DOGHOUSE DETAIL).
9. ALL FLANGES TO BE IN ACCORDANCE WITH ANSI / AWWA
10. ALL METAL COMPONENTS INSIDE VALVE CHAMBER, INCLUDING STAINLESS STEEL NUTS AND BOLTS, SHALL HAVE A PROTECTIVE CORROSION TAPE COATING SYSTEM (PRIMER, MASTIC AND TAPE). PROTECTIVE CORROSION TAPE COATING (PRIMER, MASTIC AND TAPE) IS NOT REQUIRED ON VALVE BODIES.
11. SEE CONTRACT DRAWINGS FOR LOCATION / ORIENTATION OF 50mm AIR VALVE AND 100mm BLOW-OFF ON BOTH SIDES OF THE VALVE.
12. CHAMBER PIPING SHALL BE CONCRETE OR DUCTILE IRON CLASS 54.
13. WATERPROOF MEMBRANE SHALL BE APPLIED TO ROOF AND ALL CHAMBER WALLS PRIOR TO BACKFILLING.
14. APPROVED RESTRAINED COUPLING SHALL BE IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCTS LIST.
15. ALL FLANGE BOLTS TO BE STAINLESS STEEL.
16. ALL THREADED PIPE AND FITTINGS MUST BE STAINLESS STEEL 316L.
17. ALL VALVES TO BE RESILIENT SEAT TO AWWA C509 FUSION BOUNDED EPOXY (FBE ANSI/NST 61 APPROVED) SHOP COAT FINISH ON INTERIOR AND EXTERIOR OF VALVE TO AWWA C550.
18. EXTERIOR AND INTERIOR OF ALL STEEL (NOT STAINLESS STEEL) PIPE SHALL BE LIQUID EPOXY COATED TO AWWA C210.

PRECAST CONCRETE | POURED IN PLACE CONCRETE | GROUT



J. HUDOBA
J & M STRUCTURAL

City of Hamilton
Public Works Department

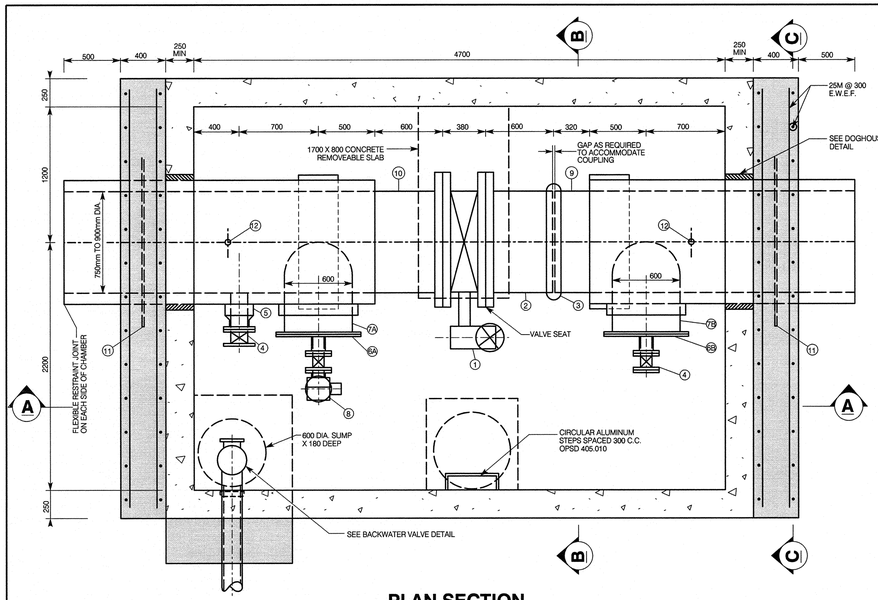
PRECAST VALVE CHAMBER FOR 450mm, 500mm AND 600mm DIA. CONCRETE PIPE OR DUCTILE IRON PIPE

DIMENSIONS SHOWN ARE IN MILLIMETERS UNLESS OTHERWISE NOTED 1:25	DATE NOVEMBER 2018	REV No 3	FORMERLY RWS-324	HAMILTON STD No. WM-231

WM-231

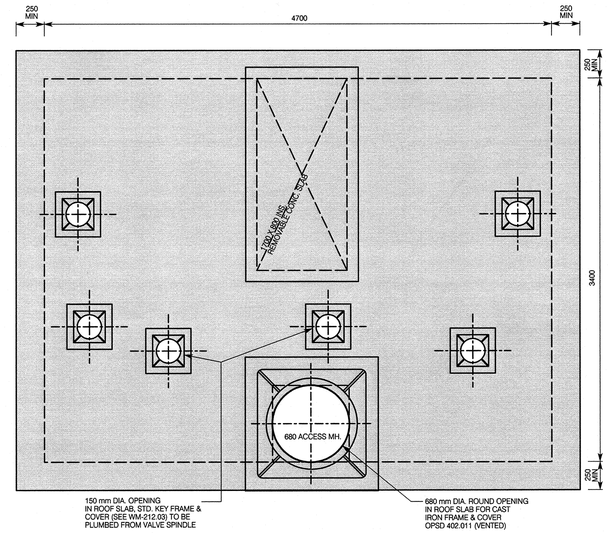
3400 X 4700mm PRECAST VALVE CHAMBER FOR 750mm AND 900mm DIA. CONCRETE PIPE WITH BUTTERFLY VALVE, 100mm DIA. AIR RELEASE VALVE AND 150mm DIA. BLOW OFF VALVE

WM-236.01



PLAN SECTION

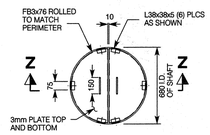
SCALE: 1:25



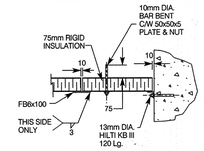
TOP SLAB VIEW

SCALE: 1:25

NOTES:
ALL ALUMINUM 6061-T6 MILL FINISH & PAINTING (2) COATS BITUMENOUS PAINT WHERE IN CONTACT WITH CONCRETE. ALL HARDWARE STAINLESS STEEL. COVERS ARE NON LOAD BEARING



PLAN VIEW

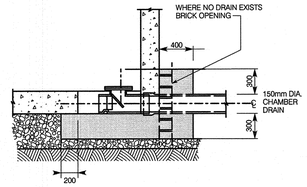


SECTION Z-Z

CHAMBER COVER INSULATION DETAIL

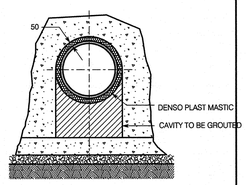
NOT TO SCALE

MARK	PIPE MATERIAL DESCRIPTION
1	FLANGED BUTTERFLY VALVE c/w GEAR BOX DESIGNED FOR SUBMERGED CONDITIONS
2	ADAPTER - 600 mm LONG GROOVED STEEL END - FLANGED TO VALVE
3	RESTRAINED COUPLING, VICTAULIC STYLE AGS W77 (OR APPROVED EQUAL)
4	BLOW-OFF - 150 mm GATE VALVE c/w BLIND FLANGE
5	150 mm TANGENT FLANGED BRANCH OUTLET BOTTOM
5A	600 mm REDUCING FLANGE TO 100 mm NPT (ECCENTRIC) TOP
6A	600 mm TANGENT FLANGED BRANCH OUTLET, TOP
6B	600 mm REDUCING FLANGE TO 150 mm NPT (ECCENTRIC) BOTTOM
7B	600 mm TANGENT FLANGED BRANCH OUTLET, BOTTOM
8	100 mm DIAMETER AIR VALVE FLANGED APPROVED, 1-100 mm GATE VALVE (FLANGED), 1-100 mm NIPPLE x 150 mm LONG (FLANGED ONE END, NPT ONE END) AND 1-100 mm ELBOW (FLANGED)
9	CPP WITH GROOVED STEEL END
10	CPP WITH FLANGED END
11	19 mm THICK WALL FLANGE (O.D. PLUS 150 mm)
12	50 mm PITOMETER CONNECTION AS PER WM-217 (MODIFIED)



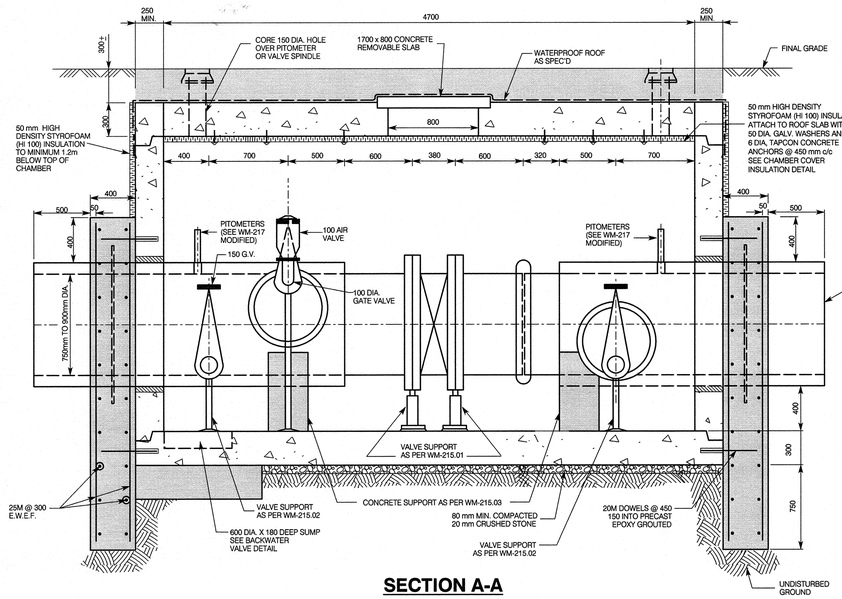
BACKWATER VALVE DETAIL

NOT TO SCALE



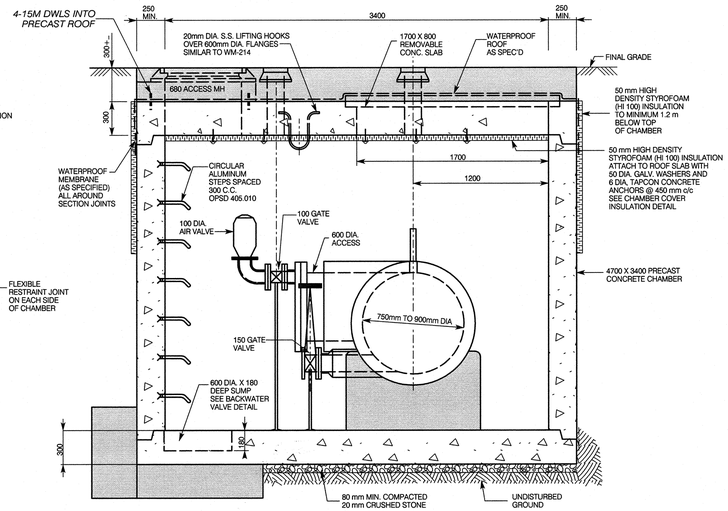
DOGHOUSE DETAIL

NOT TO SCALE



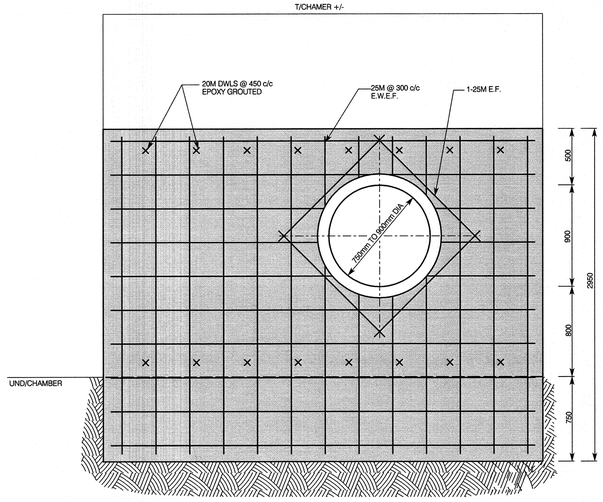
SECTION A-A

SCALE: 1:25



SECTION B-B

SCALE: 1:25



CHAMBER ANCHOR SECTION C-C

SCALE: 1:25

NOTES:

1. *PRECAST CHAMBER AND SECTIONS TO BE MANUFACTURED TO ASTM C-478 CSA. MEET H-20 S16 LOADING REQUIREMENTS AND IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCT LIST.*
2. *FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15 mm THICK WITH 1:3 NON-SHRINK GROUT.*
3. *ALL ADJUSTMENTS TO CHAMBER ACCESS AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.*
4. *UNLESS OTHERWISE INDICATED, OUTSIDE FORMWORK TO BE USED ON ALL CAST IN PLACE CONCRETE STRUCTURES*
5. *ALL FLANGES TO BE IN ACCORDANCE WITH ANSI / AWWA*
6. *ALL METAL COMPONENTS INSIDE VALVE CHAMBER, INCLUDING STAINLESS STEEL NUTS AND BOLTS, SHALL HAVE A PROTECTIVE CORROSION TAPE COATING SYSTEM (PRIMER, MASTIC AND TAPE). PROTECTIVE CORROSION TAPE COATING (PRIMER, MASTIC AND TAPE) IS NOT REQUIRED ON VALVE BODIES.*
7. *SEE CONTRACT DRAWINGS FOR LOCATION OF AIR RELIEF VALVE*
8. *ALL CHAMBERS WILL HAVE 150 DIA BLOW-OFF AND 600 ACCESS ON BOTH SIDES OF THE VALVE.*
9. *WATERPROOF MEMBRANE SHALL BE APPLIED TO ROOF AND ALL CHAMBER WALLS PRIOR TO BACKFILLING*
10. *APPROVED RESTRAINED COUPLING SHALL BE IN ACCORDANCE WITH THE APPROVED WATERMAIN PRODUCT LIST.*
11. *DOGHOUSE OPENING TO BE CUT OUT MIN. 50 mm LARGER THAN O.D. OF PROPOSED WATERMAIN, PIPE TO BE WRAPPED WITH MIN. 50 mm THICK OF DENSO PLAST MASTIC. REMAINING CAVITY TO BE GROUTED (SEE DOG HOUSE DETAIL).*
12. *ALL FLANGE BOLTS TO BE STAINLESS STEEL.*

STANDARD REINFORCED CONCRETE NOTES:
-MINIMUM STRENGTH OF CONCRETE TO BE 40 MPa IN 28 DAYS, TYPE 50 CEMENT.
-ALL REINFORCING TO BE HIGH BOND STRUCTURAL GRADE
-MINIMUM LAP FOR REINFORCING TO BE 24 BAR DIAMETERS

CONCRETE COVER OVER REINFORCING
-FOR CONCRETE POURED AGAINST SOLID GROUND -75 mm
-FOR CONCRETE IN FORMS AGAINST EARTH -50 mm
-OR AS SHOWN ON THE DRAWINGS

- DENOTES CAST IN PLACE CONCRETE

- DENOTES PRE-CAST CONCRETE

- DENOTES GROUT

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO
J. HUDOBA
Nov. 5/18
J & M STRUCTURAL

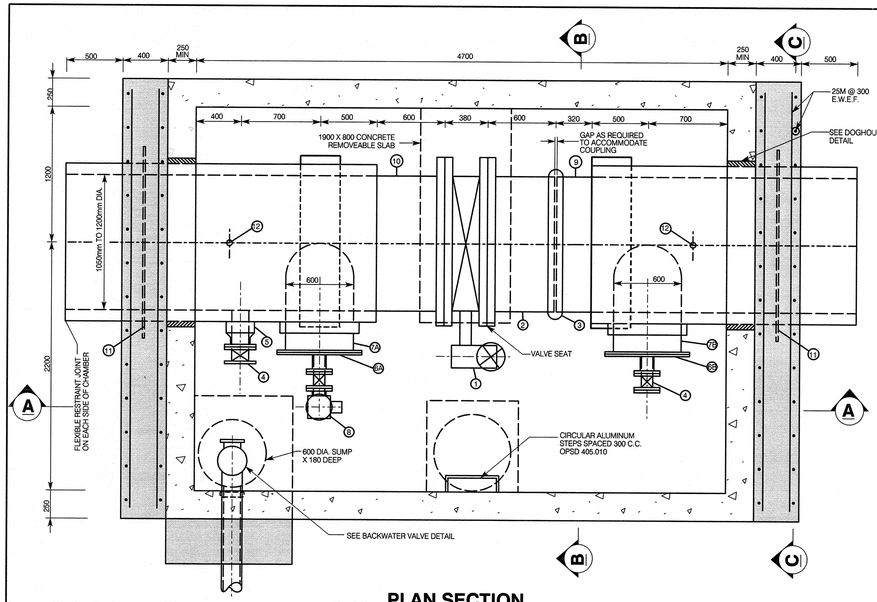
City of Hamilton
Public Works Department

3400 X 4700mm PRECAST VALVE CHAMBER FOR 750mm AND 900mm DIA. CONCRETE PIPE WITH BUTTERFLY VALVE, 100mm DIA. AIR RELEASE VALVE AND 150mm DIA. BLOW OFF VALVE

DIMENSIONS SHOWN ARE IN MILLIMETERS UNLESS OTHERWISE NOTED 1:25	DATE NOVEMBER 2018	REV No	FORMERLY	HAMILTON STD No. WM-236.01

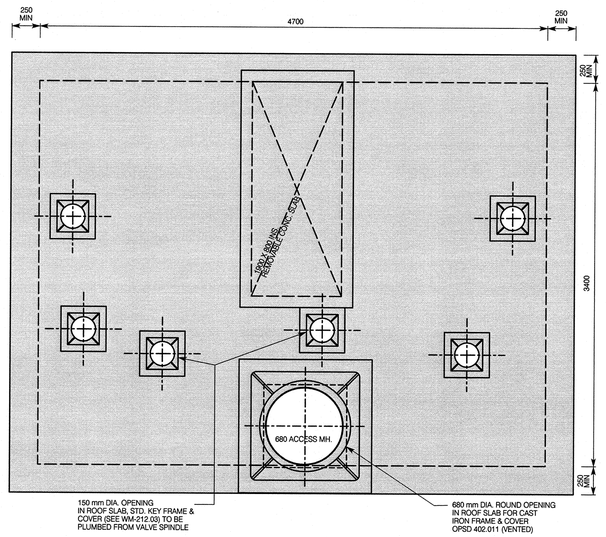
3400 X 4700mm PRECAST VALVE CHAMBER FOR 1050mm AND 1200mm DIA. CONCRETE PIPE WITH BUTTERFLY VALVE, 100mm DIA. AIR RELEASE VALVE AND 150mm DIA. BLOW OFF VALVE

WM-236.02



PLAN SECTION

SCALE: 1:25



TOP SLAB VIEW

SCALE: 1:25

NOTES:
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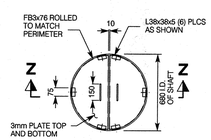
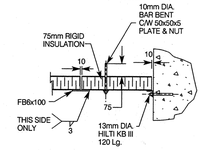


PLAN VIEW



SECTION Z-Z

CHAMBER COVER INSULATION DETAIL

NOT TO SCALE

MARK	PIPE MATERIAL DESCRIPTION
1	FLANGED BUTTERFLY VALVE c/w GEAR BOX DESIGNED FOR SUBMERGED CONDITIONS
2	ADAPTER - 600mm LONG GROOVED STEEL END - FLANGED TO VALVE
3	RESTRAINED COUPLING, VICTAULIC STYLE AGS W77 (OR APPROVED EQUAL)
4	BLOW-OFF - 150 mm GATE VALVE c/w BLIND FLANGE
5	150 mm TANGENT FLANGED BRANCH OUTLET BOTTOM
5A	600 mm REDUCING FLANGE TO 100 mm NPT (ECCENTRIC) TOP
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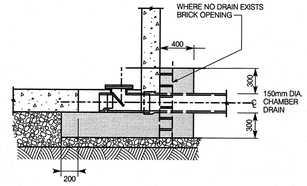
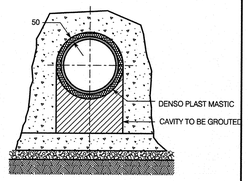


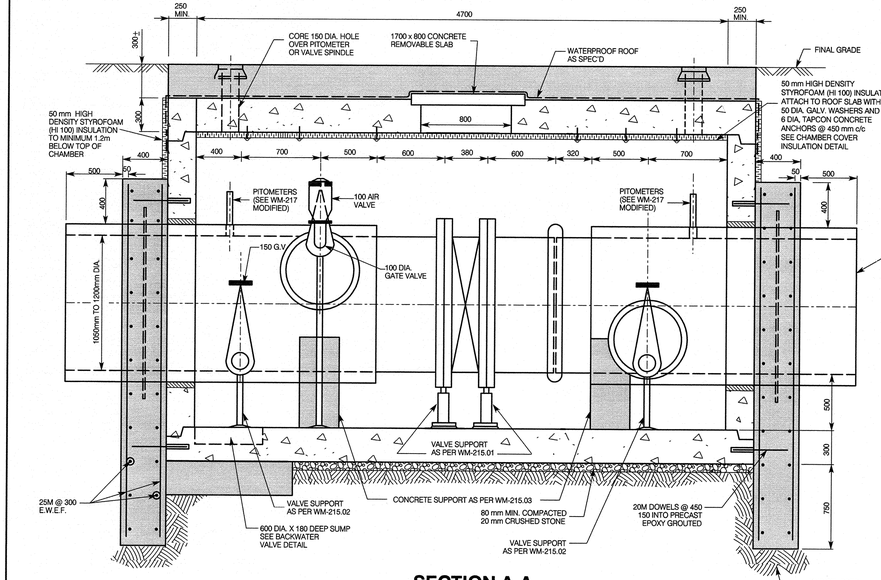
BACKWATER VALVE DETAIL

NOT TO SCALE



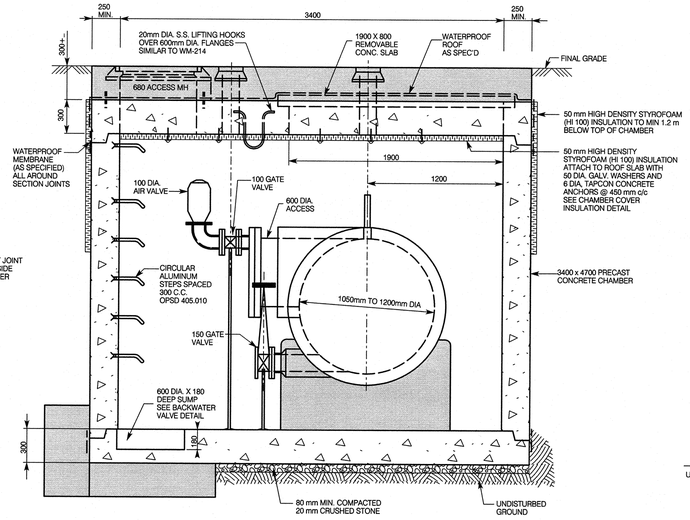
DOGHOUSE DETAIL

NOT TO SCALE



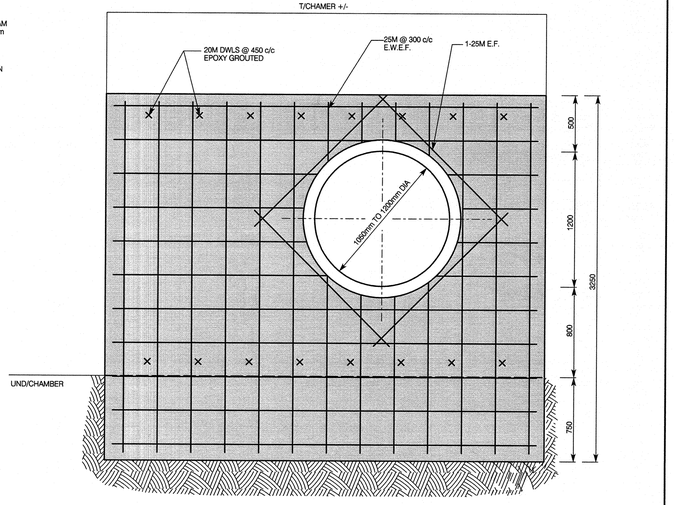
SECTION A-A

SCALE: 1:25



SECTION B-B

SCALE: 1:25



CHAMBER ANCHOR SECTION C-C

SCALE: 1:25

NOTES:

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CONCRETE COVER OVER REINFORCING

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REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO
J. HUDOBA
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3400 X 4700mm PRECAST VALVE CHAMBER FOR 1050mm AND 1200mm DIA. CONCRETE PIPE WITH BUTTERFLY VALVE, 100mm DIA. AIR RELEASE AND 150mm DIA. BLOW OFF VALVE

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