CITY OF ORILLIA

Engineering Design Criteria

Prepared by C.C. Tatham & Associates Ltd.

July 2012

Please indicate revisions, date of revision and who made the revision in the table below. The entry of each revision will show at a glance, whether the contents of the Engineering Design Criteria is up to date or not.

Table 1 - Revisions

Revision No.	Date	Revision	Name
1	February, 2015	Section 6.3.6 added	Glen Harriss, Manager of Development
2	February, 2015	O.B.C. 1990 3.2.5.7 – Fire Access Route Design (Drawing)	Glen Harriss, Manager of Development
3	February, 2015	Water Sampling Station (Drawing)	Glen Harriss, Manager of Development
4	February, 2024	Section 4.5.3 Update	Steven Murphy, Project Engineer
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1 General Requirements

1.1 Introduction

The City of Orillia Engineering Design Criteria and Standard Drawings presented herein are intended as guidelines for land development to ensure uniform design throughout the Municipality. Innovative technological changes that improve or maintain the quality of the design on a life cycle cost basis may be considered at the discretion of the City.

These standards are to be read in conjunction with the latest editions of the Ontario Provincial Standard Specifications (OPSS), the Ontario Provincial Standard Drawings (OPSD), the City of Orillia Standard Drawings and the City of Orillia Standard Subdivision Agreement. In the case of a discrepancy the City Standards shall prevail.

It is the applicant's responsibility to obtain and check with the City of Orillia for new revisions. Copies are available from the City of Orillia or can be downloaded from the web site at **www.orillia.ca**. Standard drawings are available on CD in pdf format.

1.2 Definitions

In this document the following definitions shall apply:

"City" shall mean the City of Orillia.

"Clerk" means the Municipal Clerk of the City.

"Contractor" shall mean the firm of Contractors, the company or individual acting as the Contractor and having entered into a contract with the Developer/Owner to install the services.

"Developer(s)/Owner(s)" shall mean the person(s) entering into the subdivision agreement with the Corporation of the City of Orillia.

"City Representative" shall mean any person assigned to a project by the City to carry out work on their behalf. The name of the Representative shall be specified prior to the start of construction on any project.

"Standard Drawings" shall mean the person(s) entering into the subdivision agreement with the City.

"Consultant" shall mean a competent professional engineer or firm of engineers employed by the Developer which is skilled and experienced in municipal work and land development projects and registered with Professional Engineers Ontario, possessing a current Certificate of Authorization to practice professional engineering as required by the Professional Engineers Act.

"Landscape Architect and Arborist" shall both be in good standing with their respective professional organizations.

Abbreviations

"AWWA" shall mean the American Water Works Association.

"CHBDC" shall mean the Canadian Highway Bridge Design Code.

"CSA" shall mean the Canadian Standards Association.

"DFO" shall mean the Department of Fisheries and Oceans, Canada.

"LSRCA" shall mean the Lake Simcoe Region Conservation Authority.

"MNR" shall mean the Ontario Ministry of Natural Resources.

"MOE" shall mean the Ontario Ministry of the Environment.

"MTO" shall mean the Ontario Ministry of Transportation.

"NFPA 24" shall mean the National Fire Protection Association Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

"OPSD" shall mean the Ontario Provincial Standard Drawings.

"OPSS" shall mean the Ontario Provincial Standard Specification.

1.3 Submissions to Government and Other Agencies

The Consultant shall be required to make all submissions and representations necessary to obtain approval from all other affected authorities (such as DFO, MNR, MOE, MTO, Canada Post Corporation, Transport Canada, etc.) and any other agencies for works which fall within their jurisdiction. It is the responsibility of the Consultant to ensure all correspondence, comments and approvals are provided to the City.

1.4 Pre-Servicing Policy for Subdivision Development

Subsequent to Draft Plan Approval and prior to execution of a Subdivision Agreement, the City may consider agreeing to pre-servicing of a subdivision at the Owner's risk when the following conditions have been met and in accordance with City of Orillia By-Law Number 1989-38, as amended:

a) Written acceptance from the City for specific works for which pre-servicing can proceed.

b) Engineering drawings have been accepted for construction for the works under consideration.

c) Written approval of various agencies, e.g., MOE, MNR, MTO, Ministry of Citizenship, Culture and Recreation, where they relate to installation of services permitted by pre-servicing.

d) Written confirmation from utility companies including, but not limited to, OPC, Bell Canada, Rogers Cable and Union Gas, that satisfactory agreement has been reached for provision of respective services.

e) Upon approval of the pre-servicing application, the Owner satisfies all conditions of City of Orillia By-Law Number 1989-38, as amended.

f) No permission will be given to construct external services prior to full registration unless a Letter of Credit has been deposited with the City, for the total cost of the services and all restoration. Connections to existing services may not be permitted until the plan of subdivision is registered.

g) All other documents considered necessary to the works under the Pre-Servicing By-Law including 0.3 m reserves, easements, etc., must be approved as to form and description.

h) Cash deposits for engineering and legal fees for the City, in an amount determined by the City, must be paid to the City prior to the commencement of any works.

i) The required Insurance Certificate is to be submitted as per Pre-Servicing By-Law, with minimum coverage to be determined by the City.

j) A cash or Letter of Credit deposit as security to facilitate silt/erosion controls and potential emergency maintenance work by the City is to be submitted in an amount determined by the City.

k) Any required zoning by-laws must be in effect.

l) If the underground pre-servicing has been completed to the satisfaction of the City prior to the registration of the plan of subdivision, the City will not require the full value of the Letter of Credit provided an appropriate reduction request has been submitted and approved by the City.

m) The City reserves the right to require the Owner to enter into a formal Pre-Servicing Agreement based on the scope of development.

1.5 Model Homes and/or Sales Office

1.5.1 Model Homes

Subsequent to Draft Plan Approval and prior to execution of a Subdivision Agreement, the City may consider allowing the construction of model homes, which may or may not be used as a sales office, at the Owner's risk when the following conditions have been met:

a) A Pre-Servicing Agreement has been executed and all requirements met.

b) Zoning for the proposed development is in place.

c) An agreement for the construction of model homes has been executed with the City dealing with:

- Provision of a builder's road
- Provision of fire protection
- Provision of services (sewer, water, hydro) if available. If not Fire Department approval will be required.

- The overall grading plan has been approved and there has been preliminary acceptance of the drainage system for the model home lots.
- For each model home building permit application, security is provided to the City in the amount of $10,000.00 to ensure the obligations of the Developer are carried out as required by the terms of the Agreement or provide for the demolition and removal of the structure if the subdivision plan does not proceed to registration within one year.
- Confirmation the model homes shall not be occupied until after the registration of the Subdivision Agreement and Plan and all requirements within the Subdivision Agreement are met.
- Confirmation issuance of building permits for model homes is entirely at the risk of the Developer and without liability or responsibility to the Municipality. The Developer shall indemnify the Municipality from all damages arising in connection with the issuance of building permits for model homes.
- Confirmation the Developer agrees the use of model home lots shall be restricted to the following: parking; a sales office; model homes display.
- The number of model homes permitted. One model unit will be allowed for every ten (10) units however the total shall not exceed five (5).

1.5.2 Sales Office

In the event the owner intends to utilize a trailer or temporary structure or combination of both as a sales office subsequent to Draft Plan Approval or registration of a Site Plan Agreement and prior to execution of a subdivision agreement the City may consider allowing the construction under the following conditions:

a) The sales office is to be located on a proposed lot fronting on an existing opened road allowance.

b) Zoning for the proposed development is in place.

c) An agreement for the sales office has been executed with the City dealing with:

- An acceptable site plan
- Provision of fire protection
- Provision of services (sewer, water, hydro) if available. If not Fire Department approval will be required.
- The overall grading plan has been approved and there has been preliminary acceptance of the drainage system for the sales office lot.
- Security is provided by the City in the amount of $10,000.00 to ensure the obligations of the Developer are carried out as required by the terms of the Agreement or provide for the demolition and removal of the structure if the subdivision plan does not proceed to registration within one year.
- Confirmation issuance of a building permit for the sales office is entirely at the risk of the Developer and without liability or responsibility to the Municipality. The Developer shall indemnify the Municipality from all damages arising in connection with the issuance of building permits for the sales office.

- Confirmation the Developer agrees the use of the sales office lot shall be restricted to parking and the sales office.
- One sales office will be allowed for marketing homes within the development.

1.6 Subdivision Agreement Schedule

1.6.1 Preparation of Subdivision Agreement

The draft of the Subdivision Agreement will be prepared by the City Solicitor and forwarded to the Director of Planning and Development. The final Subdivision Agreement will be prepared under the direction of the Director of Planning and Development in consultation with various City departments, who will obtain Council's approval for the execution of the Agreement.

The Director of Planning and Development must be in a position to clear ALL conditions of Draft Plan Approval prior to the preparation of the Final Subdivision Agreement.

Note: In conjunction with preparation of the Subdivision Agreement the Developer's Consulting Engineer shall provide the City with the appropriate number of copies of the following:

a) Ministry of Environment Applications for approval for Municipal services to be constructed for the proposed subdivision.

b) The name of the person and title and/or company and Mortgagees with whom the Subdivision Agreement will be executed. The Developer's address and telephone number shall be provided.

c) The name, address and telephone number of the Developer's lawyer.

d) A breakdown of the number of units proposed within the subdivision:

i.e. - Single-family units

- Semi-detached units

- Townhouse units

- Apartment units - one bedroom and bachelor

- two or more bedrooms

e) The Reference Plan for the subdivision.

f) The legal description of the subdivision, based on the Reference Plan.

g) The proposed final plan for registration (M-Plan) complete with the street names, lot numbers, surveyor's certificate, Owner's certificate and all other pertinent information required by the registry office.

h) The final draft reference plans for any easements to be granted to the City.

i) The engineering drawings, acceptable to the City.

j) The "M" and "R" Plans reduced to legal size.

k) An O.L.S. certificate in tabular form identifying and certifying all lots and corresponding frontages, depths and areas are in compliance with the appropriate Zoning By-Law.

l) A detailed cost estimate of Municipal services to be constructed for the subdivision. The cost estimate shall be signed and sealed by a Professional Engineer.

The estimated cost of Services shall be detailed to show individual items of construction. The total estimated cost of Services shall include the following:

i. Detailed cost of services, per Schedule of Construction Costs, see Page 9;

ii. The actual estimated cost of street lighting and associated underground distribution system;

iii. Any other miscellaneous expenditures required by the Subdivision Agreement as the Developer's obligation, such as park equipment, park landscaping, development of open space, etc.;

iv. Allowances for contingencies and engineering in the amount of 15% of the estimated cost of services.

v. H.S.T.

This estimate will be used as a basis for calculation of the security to be posted for the development.

m) The Developer shall provide the City with written confirmation from the following utility authorities that satisfactory arrangements have been made for the installation of services in the proposed subdivision, at no cost to the City:

- Bell Canada
- Cable TV Company
- Canada Post
- Hydro One/Orillia Power Corporation
- Union Gas
- Any other Authority where required.

In addition to the above, Location Approvals shall also be submitted by the appropriate utility authorities. Where requested, easements shall be provided for utilities, at no cost to the utility company or municipality.

n) Proposed timetable for construction of services.

o) Proposed landscaping plan where necessary or required.

p) Proposed phasing plans.

1.6.2 Requirements Prior to Commencement of Construction

Prior to commencement of construction, the Developer's Consulting Engineer shall submit the following information to the City for approval (Allow at least 2 weeks for review).

a) 3 sets of all construction specifications.

b) The proposed contractor and subcontractors.

c) The contractor's list of suppliers.

d) One copy of the signed contract documents complete with unit prices.

e) All other information specified in the Subdivision Agreement as a requirement prior to commencement of construction or other information required by the City.

f) Ministry of Natural Resources, LSRCA and/or DFO work permits for works within water bodies.

g) Completed City of Orillia "Notice To Commence Work".

1.6.3 Certificate of Substantial Completion and Final Acceptance

The term "Certificate of Substantial Completion" shall be used to describe the date when the services are complete and acceptable to the City subject to the maintenance requirements pursuant to the Subdivision Agreement. "Final Acceptance" shall be the terminology used when the Developer's maintenance requirements have been fulfilled and the Services are acceptable to the City. "Final Acceptance" of the subdivision shall be the date on which the City agrees all the conditions of the Subdivision Agreement have been fulfilled, and all maintenance requirements have been completed.

The "Certificate of Substantial Completion" and "Final Acceptance" must be requested in writing by the Developer. The dates for "Certificate of Substantial Completion" and "Final Acceptance" of the Services in the development shall be established by the City.

When the Services are complete to the satisfaction of the Consulting Engineer, he shall advise the City in writing the work is completed and shall request an inspection by the City. The City shall carry out their inspections and shall advise the Consulting Engineer of any items of work requiring further rectifications. When all deficiencies have been corrected to the satisfaction of the City, a report shall be forwarded to the City ("Certificate of Substantial Completion") recommending a date for the commencement of the maintenance period.

Near the end of the maintenance period the services shall be re-inspected by the Consulting Engineer and City and all deficiencies found shall be corrected. When the Consulting Engineer is satisfied the work is complete and acceptable, he shall so advise the City and shall request a final inspection by the City. When all work is completed to the satisfaction of the City, a report shall be forwarded to the City recommending "Final Acceptance" of the works.

1.7 Security Reduction

Reductions in financial securities held by the City will be considered in accordance with the provisions of the Subdivision Agreement. Request for reductions should be made in accordance with the sample letter on page 10.

1.8 Administration Fees, Securities, Development Charges

The administration fees, securities and development charges applicable to subdivision development are stipulated in the subdivision agreement. Reductions in securities will be considered in accordance with the provisions of the subdivision agreement. A sample letter is enclosed on Page 10.

SCHEDULE OF CONSTRUCTION COSTS

SUBDIVISION: DEVELOPER: CONSULTING ENGINEER or LANDSCAPE ARCHITECT (where applicable):

SUMMARY

A. Municipal Works

Internal Work

Rough Grading	$_____
Sanitary Sewers	$_____
Water main	$_____
Storm Drainage Works	$_____
Storm Water Management Facilities	$_____
Curb and Sidewalk	$_____
Roads to Base Asphalt	$_____
Top Asphalt	$_____
Street Lights	$_____
Street Signs and Barricades	$_____
Streetscape, Landscaping and Boulevard Sodding	$_____
Fencing	$_____
Culverts	$_____
Driveway Entrances	$_____
Sub-Total	$_____

External Work

Water main	$_____
Sanitary Sewer	$_____
Storm Sewer	$_____
Roads to Top Asphalt	$_____
Sub-Total	$_____
Internal & External Sub-Total	$_____
Engineering and Contingencies allowance 15%	$_____
Sub-Total	$_____
HST (13%)	
Total	**$**_____

B. City of Orillia Administration Fees

To be calculated by the City in accordance with City of Orillia Bylaw Number 2002-166, as amended.

C. Notes:

1. Lot grading deposits and related fees are posted with the City at the time of building permit application, in order to secure adequate lot grading and drainage is maintained to the satisfaction of the City of Orillia.

Sample Letter - Request for Reduction in Letter of Credit

Date:

City of Orillia
50 Andrew Street, Suite 300
Orillia, ON L3V 7T5

Attention: Director of Planning and Development

Re: (Name of Subdivision)

Plan.

On behalf of the owners of the above development, we are requesting your consideration and approval of a reduction in the amount of the letter of credit held by the City as performance and maintenance security.

We have attached hereto a summary listing the value of the work completed to date, based upon the Schedule of Construction Costs included in the Subdivision Agreement, revised as noted to reflect all required alterations to the works. The current value of securities is calculated as follows:

1) Value of outstanding work $_____

(including contingency, engineering fees and HST)

2) Maintenance Holdback $_____

(10% of original securities)

Total $_____

We are also attaching a Statutory Declaration by the owner that all outstanding accounts relative to work in this subdivision have been paid.

Yours very truly,

(Signature of Engineer)

Name of Engineering Firm

2 Submission Requirements

2.1 Introduction

This section outlines the required submissions to be made to the City. All submissions are to be coordinated by the Consulting Engineer.

Second and Final submissions are not to be made until the City's comments regarding the first and second submission, respectively, have been received and incorporated.

Prints of drawings for all submissions shall be in accordance with City standards and each print shall be stamped with the submission number (1, 2, or 3) and date of submission.

Engineering drawings shall be submitted to the City. The Consulting Engineer is advised to review the Ministry of Transportation design criteria for adjacent roads to determine the requirements for submission of engineering drawings to MTO, if applicable.

2.1.1 Engineering Requirements for Draft Plan Approval

A Preliminary Engineering Report must be submitted by the Developer's Consultant. This report must be presented in a readable, comprehensive and professional manner. The Report must be signed and sealed by a Professional Engineer.

This Preliminary Report shall contain the following and be submitted in duplicate:

a) The Draft Plan

The Draft Plan must be in compliance with the Planning Act, as amended, and in a form acceptable to the Planning Department of the City. Reductions of the Draft Plan (11" x 17"), to scale, must be submitted.

b) Contour Plan

This plan must be at a scale of no larger than 1:1000 giving contour lines at sufficient intervals to permit assessment of existing surface drainage patterns. Contour intervals shall not be greater than 1.5 metres. This plan is to extend to the limits of the drainage area to be served by proposed sanitary and storm sewer systems, including lands beyond the boundaries of the subdivision. For large external drainage areas, separate Contour Plans at a larger scale may be provided. All elevations are to refer to Geodetic Datum.

c) General Plan of Services

This will be a plan based on the Draft Plan and must schematically show the proposed storm and sanitary sewer systems and water mains and their connection to existing systems. Direction of flow must be indicated on all sewers. This plan is to be accompanied by preliminary engineering calculations indicating the quantity of flows at the connection to existing systems and/or at proposed outfalls. Consideration must be given to the whole catchment area to ultimately be developed. Blocks and easements for storm and sanitary sewers, stormwater management facilities and water main systems shall also be shown.

Preliminary road profiles and area grading requirements must also be identified in the Preliminary Report. Blocks of land for community mail centres must be identified on the Draft Plan and the General Plan of Services.

Proposed noise attenuation barriers are to be shown.

d) Drainage Plan

When a natural drainage channel passes through and is affected by the construction of the subdivision, drawings must be submitted to indicate the location and typical cross-sections of the existing channel and of any proposed changes. In general, creek diversions will not be permitted. An erosion-sediment control plan will be required. A preliminary stormwater management plan and report will be required by the City in accordance with the requirements outlined in this document. The Consultant must submit an outline of the erosion-sediment control plan in accordance with the requirements of these standards.

All drainage designs shall be carried out in general compliance with the MOE, Stormwater Management Planning and Design Manual (March 2003) as amended.

Any proposed modifications to an existing channel and/or floodplain will (if applicable) require MNR and/or DFO review and approval. The Consulting Engineer must consult with staff from the appropriate agency(s) and confirm their requirements, prior to proceeding with the preliminary engineering report.

e) Soils Report

A preliminary soils investigation and report from a qualified geotechnical consultant will be required, with particular attention to sub-surface soil and groundwater conditions and the ability of the soils to structurally support underground services, roadways and foundations for residential, commercial, or industrial type structures.

f) Hydrogeological Report

Will be required upon request by the City, where impact to groundwater, wells, etc. may be considered.

g) Water Mains and Sanitary Sewers

Where water mains and sanitary sewers are proposed, comprehensive servicing reports shall be prepared and submitted to the City. Available capacity in existing water treatment and sewage treatment plants must be taken into consideration.

2.2 First Engineering Submission

The following submissions shall be compiled and submitted to the City simultaneously:

Engineering Submission

1) A Letter of Retainer from the Consulting Engineer stating they have been engaged for the design and general construction inspection of all works, and coordination of sub-consultants.
2) Five complete sets (unless noted otherwise) of the following drawings are required:
    a. Approved Draft Plan
    b. Proposed Plan for Registration (M Plan) showing all lot and block numbering and dimensioning
    c. General servicing plan
    d. Composite utility plan
    e. Storm drainage plans
    f. Erosion and sediment control plan
    g. Plan and profile drawings
    h. Miscellaneous and special detail drawings
    i. Grading plan
    j. Landscape and streetscape plan
    k. Grading plans for park blocks
    l. Grading plan for school blocks
    m. Copies of detail drawings for outlets and watercourse improvements
    n. Preliminary R Plan(s) showing proposed easements (if required)
    o. Sanitary drainage plan
3) Three copies of the Stormwater Management Report and storm sewer calculations on standard design sheets.
4) Three copies of water supply and distribution report providing calculations to support the design of the distribution works including main sizes, fire flows and anticipated flows and pressures for domestic and other users.
5) Three copies of sanitary design calculations on standard design sheets.
6) Three copies of the Traffic Report (if required).
7) Three copies of the Acoustical Report (if required).

8) Three copies of the Arborist Report (if required).

9) Three copies of the Geotechnical Report.

10) Archaeological Assessment (if required).

11) Illumination calculations (if required).

12) A letter from the Consultant, summarizing the contents of the submission and certifying the design conforms to the City Engineering Design Criteria.

Municipal Structures Submission

When a new roadway structure (i.e. bridges, culverts, water crossings) is proposed, a specific submission related to the structure is required, which includes the following information.

1) Two copies of the General Arrangement drawing(s), prepared in general accordance with the MTO Structural Manual. It includes the roadway structure plan, profile, elevation and cross sections.

2) Two copies of the Design Report which includes but is not limited to the description of the works, how the detail was arrived at, different options and cost analysis/least expensive alternate.

3) Two copies of the Design Criteria Sheet which includes but is not limited to the type/class of roadway, volume of traffic, geometric information and cost estimate.

4) Two copies of the Geotechnical Report.

5) Two copies of the Hydrology Report.

6) A letter from the Engineer responsible for the design which certifies:

   - The bridge type, length and width are appropriate;
   - CHBDC requirements are met;
   - Ministry standards have been followed;
   - The most economical life cycle cost solution has been selected for the site.

7) The structural design drawings and details included as part of the Subdivision Agreement shall be stamped and signed by the Professional Engineer who designed the roadway structure and by the Professional Engineer who checked the structural design drawings.

Parks and Landscaping Submission

1) A Letter of Retainer from the Consulting Landscape Architect stating they have been engaged for the design and complete general construction inspection of all landscape works, plus an outline of the items contained within the submission.

2) A covering letter from the Consulting Engineer and/or Landscape Architect stating the landscape work is in conformity with the proposed grading and municipal services for the development, plus an outline of the items contained within the submission.

3) Two copies of the following drawings (where applicable):

   - Existing Natural Features Assessment

- Tree Survey/Vegetation Analysis and Tree Preservation Plan
- Streetscape and Buffer Planting Plans
- Detailed Park Development Plans
- Stormwater Management Pond Planting Plan

2.3 Subsequent Submissions

Subsequent submissions shall be made, as required, until the drawings and designs are acceptable to the City. The design of the underground electrical distribution system shall be completed by an Electrical Engineer retained by the proponent, to the requirements of the Orillia Power Corporation (OPC). This design shall be submitted to the City and shall be approved prior to the final approval of the engineering drawings. The design of the Bell telephone system, Cable TV system and gas mains shall follow the same format as the OPC requirements, for a joint trench scenario.

All utility information is to be shown on a Utility Coordination Plan, prepared by the Consultant.

The following submissions shall be compiled and submitted to the City simultaneously, comprised of the number of copies shown.

2.3.1 Second Engineering Submission

The following submissions shall be compiled and submitted to the City simultaneously.

Engineering Submission

1) First submission drawings “red lined” by the City from the First Submission review.
2) Detailed chart or report with all of the First Submission comments and how they have been met.
3) Copies of all other applicable approval agencies comments.
4) Three complete sets of all revised drawings, proposed M- and R- Plans.
5) Original plus one copy of Ministry of Environment application forms, signed by the Developer and the Consulting Engineer.
6) Three copies of the Subdivision Agreement Schedules Pertaining to Engineering Submission and all applicable cost estimates.
7) Three copies of Composite Utility Plan.
8) Three copies of streetlight design plans.

2.3.2 Final Engineering Submission

The following plans and documents shall be compiled and submitted in their entirety by the Consultant in one complete package. Any incomplete submissions, delivered to the City, shall be returned immediately.

1) One copy of the Proposed M-Plan and R-Plan.
2) Two complete sets of all drawings listed in the Subdivision Agreement.
3) Drawing originals stamped and signed by the Consulting Engineer and/or Landscape Architect (where applicable).
4) A digital copy of the complete set of engineering drawings in accordance with the City CAD requirements.
5) Two copies of the final storm drainage plan and the storm sewer design sheet labelled final design.
6) Copies of all required approvals – i.e. MOE, MTO, etc.
7) Detailed cost estimate of all proposed works.
8) Two copies of the Owner's insurance certificate as per the Subdivision Agreement.
9) The Developer shall submit evidence in writing that agreements are in place with Orillia Power, Bell Telephone Company and Cable TV for the installation of these utilities in a common trench in the prescribed locations on road allowances within the plan of subdivision.
10) The Developer shall submit evidence in writing that agreements are in place with Orillia Power Corporation or any other approved Contractor for the installation of street lighting.
11) The Developer shall submit evidence in writing that satisfactory arrangements are in place with Canada Post for the location of mailboxes.

    The drawing originals will be signed and stamped "Reviewed" for construction and will be returned to the Consultant. Five copies of the complete set shall be returned to the City. Only drawings accepted for construction shall be utilized during construction of the works. Any changes in drawing originals by the Consulting Engineer are subject to approval by the City.

    Upon completion of the construction of the services, the Consultant shall obtain the 'as-constructed' field information and revise the original drawings accordingly.
12) A summary of lot area and frontage for each Lot/Block to be developed to confirm By-law compliance prior to registration and Building Department Administration.

3 Drawing Requirements

3.1 Specifications for Engineering Drawings

Size:

1) Drawings to be Metric Standard A1 (594mm X 841mm) or Imp. equivalent

Format:

2) Same as City standard sheets unless otherwise approved.

Materials for Final Submission and “as-constructed” drawings:

3) Bond for Final Submission
4) Translucent Mylar for "as-constructed"
5) Black Ink (permanent)
6) Digital copies on CD

Materials for Preliminary Submissions:

- Bond
- Black Ink (permanent)

3.2 General Drawing Requirements

All engineering drawings shall be prepared in metric and in a neat and legible fashion. The design information presented on these drawings shall be completed in ink.

The standard City of Orillia title block as shown in the detail drawings shall be used on all engineering drawings. A title sheet is required for the engineering drawings.

All General Plans, Lot Grading Plans, Area Rough Grading Plans, Plan and Profile drawings and Detail Drawings shall be prepared on standard A1 sheets. Storm and Sanitary Drainage Area Plans may be completed on larger sized drawings so the entire drainage system being designed may be presented on one sheet.

The lot numbering and block identification on all engineering drawings shall be the same as shown on the Registered Plan for the area.

All elevations shown on the engineering drawings are to be of geodetic origin (stating NAD 1927 or NAD 1929). Aerial photo interpretation methods for securing existing contours and elevations will

not be accepted by the City for base plan information on engineering drawings. A local benchmark (stating NAD 1927 or NAD 1929) note must appear in each drawing.

All plan and profile drawings are to be prepared so each street can be filed separately. The street names shall be identified on the plan portion of the drawings.

When streets are of a length that requires more than one drawing, match lines are to be used with no overlapping of information.

The reference drawing numbers and centreline stations for all intersecting streets and match lines shall be shown on all plan and profile drawings.

A north arrow and key plan shall be included on the top right hand side on all drawings.

All engineering drawings shall be stamped by a Professional Engineer. The Engineer's stamp must be signed and dated, and the drawings are to be signed by the City Engineer prior to the issuance of drawings for tendering.

All landscape drawings shall be stamped by a certified Landscape Architect.

Work on the drawings to be done neatly and legibly.

Existing information shall be shown light or background line weight. Proposed information shall be shown bold or foreground line weight.

In general east-west streets shall have zero chainage at their westerly limit and north-south streets shall have their zero chainage at their southerly limits. Chainage on a plan-profile shall increase from left to right.

3.3 Computer Aided Drawings (CAD)

Digital software compatible with AutoCAD .DWG file format Version 2007 or higher shall be used to prepare all drawings, in accordance with industry accepted standards and protocols.

3.4 General Servicing Plans

A "General Plan of Services" drawing showing aboveground services and appurtenances shall be prepared for all developments at a maximum scale of 1:1,000.

When more than one "General Plan of Services" drawing is required for any development then the division of drawings shall reflect the limits of the Registered Plans as closely as possible. Where more than one plan is prepared, a supplementary "General Plan of Services" at a smaller scale shall be prepared to show the entire plan of subdivision on one drawing.

The reference Geodetic Benchmark and the Site Benchmarks to be used for construction shall be identified on the General Plan of Services.

A Key Plan at a scale of 1:10,000 shall be shown on all “General Plan of Services” drawings and the area covered by the drawing shall be clearly identified.

A drawing index shall be shown on all “General Plans of Services” to identify the Plan and Profile Drawing number for each street or easement shown.

All road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as shown on the Registered Plan.

All existing services, utilities and abutting properties are to be shown in light or background weight lines.

All services to be constructed are to be shown on the “General Plan of Services” in solid lines.

Dimensioning of utilities and roadways is not required on the “General Plan of Services”.

All sites for parks, schools, churches, commercial and industrial development must be shown.

If a subdivision encroaches on an existing floodplain (Lake Simcoe or Mill Creek), the approved fill line restrictions must be shown, as specified by City of Orillia Flood Plain Mapping.

General Plans shall indicate, but not be limited to the following:

- roadways with curb lines and street names;
- water mains and appurtenances, with notes showing sizes;
- maintenance hole numbers;
- sewers with notes showing sizes, and direction of flow;
- signage
    - school
    - traffic control
    - future land use;
- barricades;
- fencing indicating height and type;
- retaining walls;
- catch basins;
- community mail boxes with number of units serviced;
- hydro vaults, street lights, sidewalks;
- boulevard trees.

3.5 Storm Drainage Plans

Watershed Area

The watershed area shall be determined from contour plans and shall include all areas that naturally drain into the system and any fringe areas not accommodated in adjacent storm drainage systems, as well as other areas which may become tributary by reason of regrading. This information shall be confirmed with the City Engineer prior to the start of the design of the internal servicing of the site.

External Areas

A plan shall be prepared to a scale of 1:1,000 to 1:2,000 dependent upon the size of the watershed area, to show the nature of the drainage of the lands surrounding the development site and to show all external drainage areas contributory to the drainage system for the development. The external drainage areas shall be divided into smaller tributary areas and the area and the location to which the tributary area is considered to drain in the design shall be clearly shown. The plan shall clearly show all existing contours used to justify the limits of the external drainage areas.

In lieu of precise information on development as a whole or any part of a watershed area, the latest Zoning By-law and Official Plan issued by the City shall be used to determine the correct values of the run-off parameters to be used for all external areas in the design and to determine the specific areas to which these values apply.

This external drainage area plan shall be prepared and shall be submitted to the City Engineer at the functional report stage and prior to the commencement of the detailed storm sewer design.

Internal Areas

An internal storm drainage plan shall be prepared to a scale of 1:1,000 and shall include all streets, lots, blocks and other lands within the development. The proposed storm sewer system shall be shown on this plan with all maintenance holes numbered consecutively from the outlet. These maintenance holes shall be the tributary points in the design and the area contributing to each maintenance hole shall be clearly outlined on this plan. The area, in hectares, of each contributing area (to the nearest hundredth) and the run-off parameter used shall be shown in a circle located within the contributing area. In cases where areas of different run-off parameters may be tributary to the same maintenance hole, the areas and the parameters shall be separately indicated on the plan.

In determining the tributary area to each maintenance hole, the proposed grading of the lots must be considered to maintain consistency in the design.

In the case of large areas under single ownership or blocks requiring future site plan agreements, the design shall be prepared on the basis of the whole area being contributory to one maintenance

hole in the abutting storm sewer unless more than one private storm connection is necessary to serve the property, in which case the appropriate area tributary to each connection shall be clearly shown and taken into account in the storm sewer design.

The storm drainage plan shall indicate but not be limited to the following:

- existing contours;
- drainage patterns of adjacent lands;
- runoff coefficients and areas (ha) of tributary areas outside the development and for each section of the storm sewers within the development;
- direction of runoff;
- street names;
- maintenance hole numbers;
- sewer sizes, slope and directions of flow;
- any catch basins or swales, on the lots or blocks, required to collect the runoff;
- temporary or permanent quantity and quality storm water management facilities;
- major and minor overland flow routes;
- culverts and other drainage appurtenances.

3.6 Sanitary Drainage Plans

All tributary areas used for the determination of the design flows shall be shown on a plan at the scale of 1:1,000. The plan shall indicate the land use, area and population density or number of units.

Standard sanitary sewer design sheets shall be used to compute the design flow for each leg of sewer. Each sanitary drainage area on the plan shall show an identification number along with population and area.

3.7 Grading Plans

Drawing size (594 x 841 mm) A1.

Scale: 1:500 for single-family or semi-detached urban areas, 1:200 for multi-family areas and 1:1,000 for rural estate areas.

The specified lot grade shall be shown at a location 8 m from the street line. For “split” or “walkout” type drainage patterns, the specified rear of house grade shall be shown. The specified minimum basement floor elevation for each lot shall also be shown.

The grading plans shall indicate, but not be limited to the following:

- elevations to be referenced to geodetic datum;

- all lots and blocks within the subdivision, numbered in accordance with the plan proposed for registration;
- existing contours at maximum 0.5 m intervals within the subdivision and extended outside the subject lands far enough to determine the existing drainage pattern;
- driveway, water service box locations and building envelopes;
- elevations at existing trees, structures, watercourses, etc.;
- centreline elevations of proposed and existing roads at 20 m intervals;
- proposed elevations at front and rear building envelope;
- proposed elevations at the corners of each lot and block and intermediate point of grade change;
- proposed elevations at sideyard highpoints if applicable;
- proposed 0.5m contours for grading within large blocks and parks;
- proposed grades for major and minor overland flow routes;
- lot fabric of subject lands including lot, block and easement description;
- physical structures such as fencing, retaining walls, etc.;
- an arrow indicating the direction of the surface water run-off from all lots;
- all swales, other than the normal side yard swales, along with percent grade and the invert elevation of the swale at regular intervals;
- all swales to be topsoiled (minimum 100 mm) and sodded;
- all rear yard catch basins including the rim elevation of the catch basin and the invert elevation of the outlet pipe;
- all terracing required with the intermediate grades specified;
- all rear lot surfaces shall be constructed to a maximum lot grade of 12 % for 6 m behind the house, remaining are to have slopes of 3:1 maximum;
- the lot grading plan shall make note of the City Standard Drawings applicable to the grading of the development. The City reserves the right to refuse any house type, which is incompatible with the lot grading design, specified for a lot;
- a 0.6 m strip shall be left undisturbed along the boundary of the subdivision next to adjacent properties unless grading is required to eliminate drainage problems on adjacent properties. Such grading must be stipulated on the approved Lot Grading Plan. Silt Control fencing shall be shown within the undisturbed strip along the boundary of the subdivision;
- lot drainage is to be self-contained within the subdivision limits, where possible;
- proposed locations for building envelopes and envelopes for private sewage disposal where required;
- all proposed easements for registration;
- heights of proposed retaining walls, fences, etc.;
- all retaining walls in excess of 1.2m to be engineered by P.Eng.

3.8 Plan-Profile Drawings

Plan – profile drawings are required for all Municipal roadways, blocks and easements where services are proposed within the development, for all outfalls beyond the development to the permanent outlet, for all boundary roadways abutting the development and for other areas where utilities are being installed below grade. Plan – profile drawings are to be drawn to a maximum horizontal scale of 1:500 and a maximum vertical scale of 1:50 and are to include the following:

- complete legend;
- all existing or proposed services, utilities and abutting properties are to be shown in light or background weight lines;
- all services to be constructed are to be shown in solid lines;
- the profile portion of the drawing shall be a vertical projection of the plan portion whenever possible;
- all road allowances, lots, blocks, easements and reserves are to be shown and are to be identified in the same manner as on the Registered Plan;
- all curb and gutter and sidewalks shall be shown and dimensioned on the plan portion of the drawing;
- where multiple drawings are required for one street, match lines must be used with no overlap or duplication of information;
- where intersecting streets or easements are shown on a plan-profile, only the diameter of the pipe and direction of flow of the intersecting sewers shall be shown;
- on profile portion of drawings the type of sewer, diameter, length and grade shall be shown;
- on profile portion of drawings the water main diameter and length, shall be shown;
- only the type, direction of flow and diameter of pipe shall be shown in the plan portion;
- all maintenance holes shall be shown on the plan and on the profile portions of the drawing and be identified by chainage and I.D. number and shall also be referred to the applicable Standard Drawing or to a special detail on the profile portion of the drawing. All invert elevations shall be shown on the profile with each having reference to the north arrow;
- all sewer maintenance holes which have safety platforms are to be noted;
- all drop connections are to be noted and referred to the Standard Drawing;
- all catch basins and catch basin connections shall be shown. Catch basins are to be numbered for easy reference. All rim and invert elevations for rear lot catch basins are to be shown;
- all water mains, hydrants, valves, bends and fittings, etc. shall be shown, described and dimensioned on the plan portion of the drawing. In addition, the water main shall be plotted to true scale size on the profile portion of the drawing and shall be described;
- the location of all storm, water and sanitary service connections shall be shown on the plan portion of the drawing using different symbols for each service. These services need only be dimensioned when the location differs from the standard location as shown on the City Standard Drawings. The connections to all blocks in the development shall be fully described and dimensioned (size, length, grade, invert elevations, materials, class of pipe, bedding, etc.);

- the centreline of construction with the 20 m stations noted by a small cross shall be shown on the plan portion of the drawing;
- the original ground at centreline and the proposed centreline road profile shall be plotted on the profile. The proposed centreline road profile shall be fully described (length, grade, P.I. elevations, vertical curve data, high point chainages, low point chainages, etc.);
- details of the gutter grades around all 90 degree crescents, intersections and culs-de-sac shall be provided on the plan portion of the drawing as a separate detail at a scale of 1:100;
- special notes necessary to detail construction procedures or requirements are to be shown;
- chainage for the centreline of construction are to be shown on the profile portion of the drawing. The P.I., B.H.C., E.H.C., B.V.C. and E.V.V. chainages are to be noted;
- the basement elevation of all existing dwellings on streets where sewers are to be constructed shall be noted on the profile;
- all existing services, utilities and features are to be shown on the plan portion. Those services and utilities below grade critical to the new construction shall also be shown in the profile. Test holes may be required to determine actual elevation of these services and utilities;
- profiles of roadways shall be produced sufficiently beyond the limits of the proposed roads, to confirm the feasibility of possible future extensions;
- the location of all luminaire poles shall be clearly shown on the plan portion;
- the proposed location and type of all street name and traffic control signs shall be shown on the plan portion;
- proposed locations and types of all trees to be shown on the plan portion;
- where possibility of conflict with other services exist, connections are to be plotted on the profile or a crossings chart included;
- the detail information from all borehole logs is be plotted on the profile drawings and located on the plan.

3.9 Utility Coordination Plan

The Utility Coordination Plan shall be prepared in the same format as “General Plan of Services” and show all the same aboveground information as well as the proposed location of driveways, Bell, Hydro, Gas and Cable TV. All locations must be established and resolved by the Consulting Engineer in conjunction with the Utility companies and in accordance with the locations shown on the typical cross-section.

3.10 Detail Drawings

The City of Orillia Standard Drawings shall be utilized whenever applicable. The use of the latest revision of the Ontario Provincial Standard Drawings may be utilized as specified in this document or when approved by the City. These drawings shall be reproduced as part of the engineering drawings for the development and must be referred to by number on the affected plan and profile drawings. The Consulting Engineer shall be responsible to check the suitability of the details provided on these standard drawings for the application proposed. Individual details shall be

provided by the Consulting Engineer for all special features not covered by the City of Orillia Standard Drawings. These special details shall be drawn on standard sized sheets and shall be included as part of the engineering drawings. The minimum scale to be used for any special maintenance hole or sewer detail shall be 1:25.

3.11 Parkland Development Drawings

General Requirements

The Developer shall be responsible to prepare a detailed Grading Master Plan for approval by the City, for all lands to be dedicated for park purposes. This plan shall show all existing trees and features in conformity with the end use of the park and that are to remain. All other trees shall be removed by the Developer subject to City approval. Prior to preparing park development plans, the Developer shall meet with City staff to review City recreational needs, i.e. soccer pitches, ball diamonds, etc.

This Master Plan shall be prepared at a scale of 1:500 and form part of the approved Engineering Drawings, indicating the following, at a minimum:

- existing contours;
- drainage structures and direction of overland drainage;
- species and size of existing plant material to remain and be protected;
- species and size of plant material to be removed;
- proposed underground services, as required;
- layout of all proposed recreation facilities;
- layout of parking lot and spaces (including handicapped parking);
- layout of all trails;
- proposed site amenities including benches, bike racks, trash receptacles, signs, washrooms;
- perimeter fencing;
- park lighting;
- all surface treatments;
- all proposed plant materials.

A Park Development Cost Estimate based on estimated quantities with corresponding unit prices is required along with the drawing submission.

3.12 Trails and Walkways

Drawing requirements for trails and walkways will be determined in conjunction with the City at the time the need is identified.

3.13 Landscaping

3.13.1 General Requirements

All landscape plans shall be drawn and stamped by a Full Member of the Ontario Association of Landscape Architects. All landscape plans shall be drawn at a minimum scale of 1:500.

The landscape documents may include but not be limited to the following drawings:

- Existing Natural Features Assessment;
- Tree Survey/Vegetation Analysis;
- Tree Preservation Plan and Details;
- Streetscape and Buffer Planting Plans and Details;
- Detailed Park Development Plans and Details;
- Trails Master Plans and Details;
- Landscape Restoration Plans and Details;
- Stormwater Management Facility Planting Plan;
- Lighting Plans;
- Planting Plans.

Detailed Cost Estimates will be required for all approved landscape plans. This estimate will be used for security purposes. All streetscape plans shall be consistent with the City of Orillia Engineering Design Criteria and will require City approval before implementation of the plans. For reference the City has accepted the "Urban Design Guidelines, Stone Ridge Community, Charter Construction" prepared by MHBC (April 22, 2005). This document is to be considered as a guideline only.

The Streetscape Plan shall show the following:

- existing trees and natural features to remain;
- building envelopes, driveways and sidewalks;
- walkways, trails and easements;
- required fencing including privacy, acoustic and chain link;
- proposed plantings;
- entry features;
- location of street lighting;
- location of public utility boxes and easements and hydrants;
- heights of existing and proposed retaining walls, fences etc.

Construction details will be required for all landscape elements to be implemented as part of the development.

Any required landscape Restoration Plans and Stormwater Management Facility Planting Plans will require City approval prior to implementation of the plans.

Developers are required to display approved landscape plans at the sales pavilions for the homebuilders in any new subdivision.

3.13.2 Notes for Streetscape Submission Drawings

The following notes pertaining to layout requirements are to be included on all streetscape submission drawings:

NOTE 1

Depicted on this plan are the species and the approximate location of street trees. Once driveways, utilities and light standards have been installed, the exact location of street trees will be staked on site by the Landscape Architect and approved by the City prior to planting.

NOTE 2

Minimum clearances for Street Trees (when trees are planted 2.1 m from the curb):

- *2.0 m from water hydrants;*
- *2.0 m from driveways;*
- *2.0 m from neighbourhood mailboxes;*
- *3.0 m from hydro transformers;*
- *5.0 m from streetlight poles;*
- *15.0 m minimum from street line (street intersection as measured from back of curb) and behind the daylight triangle as per the Geometric Design Standards for Ontario Highways;*
- *18.0 m from face of all warning signs.*

When the minimum distances noted above are not achievable, street trees may be planted in an alternate location, 0.5 m from the property line (0.8 m behind the sidewalk) and adjacent to any fences. In cul-de-sac locations the street tree may be planted just inside the private property line. If a tree is planted in an alternate location, the distances marked with an asterisk must still be maintained.

NOTE 3

The tree pits and planting beds for all trees and shrubs located within 1.0 m of underground utilities are to be hand dug.

NOTE 4

Minimum clearance for fences from fire hydrants is 1.0 m.

NOTE 5

All plant material must conform to the Canadian Standards for Nursery Stock and must be guaranteed for a minimum period of 24 months following acceptance of the work by the City.

3.13.3 Notes for Naturalization Submission Drawings

The following layout note is to be included on the submission drawings for all areas to be naturalized:

NOTE 1

All plantings and hard landscape features are to be staked out on site and approved by the Landscape Architect and City prior to installation. Any deviations from the approved landscape plans require prior City approval.

3.14 As-Constructed Drawings

3.14.1 General

The "As-Constructed" drawings constitute the original engineering drawings amended to incorporate the construction changes and variances in order to provide accurate information on the works as installed in the development.

3.14.2 "As-Constructed" Field Survey

The "As-Constructed" revisions shall be based upon a final survey of all the subdivision services and the consulting Engineer's construction records. The final survey of the subdivision services shall include a field check of the following items:

a) Location and invert elevations of all sewer maintenance holes.

b) Distances between all sewer maintenance holes.

c) Location of all roadway catch basins.

d) Location, rim and invert elevations for all rear yard and lot catch basins.

e) Location of all sidewalks and curbs.

f) Location and ties to all valve boxes and valve chambers.

g) Location of all hydrants.

h) Location and ties to all special water main appurtenances.

i) Road centreline elevations.

j) Site benchmarks.

k) Location of all service connections to all lots and blocks and location of connection from nearest downstream maintenance hole (i.e. 0 +023).

l) Sewer pipe sizes.

m) Location of all fencing constructed as part of the subdivision services.

n) Streetscape landscaping/boulevard plantings.

3.14.3 Drawing Revisions

The original drawings shall be revised to incorporate all changes and variances found during the field survey and to provide the ties and additional information to readily locate all underground services.

All sewer and road grades are to be recalculated to two decimal places.

All Street line invert elevations of storm and sanitary house connections to each block shall be noted on the drawing.

All street names, lot numbering and block identification shall be checked against the Registered Plan and corrected if required.

The "As-Constructed" revision note shall be placed on all drawings in the revision block. The title sheet of the Engineering Drawings shall be clearly marked with "As-constructed".

The Contract Number, and/or City Job File Number, if applicable, shall be added to the drawings.

Tolerances

A maximum vertical plotting tolerance of 0.2 m on the 1:50 vertical profile portion of the drawings and a maximum horizontal plotting tolerance of 1 metre on the 1:500 scale drawing shall be considered acceptable without replotting.

All sewer lengths are to be shown to the nearest 0.5 m.

The information shown on the "As-Constructed" drawings may be checked by the City at any time up to two years after final acceptance of the subdivision and if discrepancies are found between the information shown on the drawings and the field conditions, then the drawings will be returned to the Consultant for rechecking and further revision.

The consultant shall be required to explain in writing any major difference between the design and the "As-Constructed" data and to provide verification that alteration does not adversely affect the design of the subdivision services.

Submissions

Upon completion of all construction work and the "As-Constructed" revisions, the original drawings shall be submitted to the City for their permanent records.

The submission of the “As-constructed” mylar drawings and digital format to the City must be completed before “Final Acceptance” of the subdivision will be given.

The Consulting Engineer shall provide a written declaration to the City stating all subdivision works have been constructed in accordance with the terms of the Subdivision Agreement, approved Engineering Drawings and the City’s Design Criteria, prior to “Final Acceptance”.

Drawings supplied in a digital format in addition to the standard mylar shall conform to the most recent requirements and AutoCAD standards of the City.

3.14.4 Storm Sewers

All actual storm system invert elevations shall be indicated on the "as-constructed" drawings. If the difference is greater than 150 mm from the design vertical alignment, affected portions of the sewer or overland drainage route shall be redrawn in profile. Any maintenance hole which differs from the proposed horizontal location by more than 1.50 m shall be redrawn in both plan and profile.

In addition the following shall be indicated on the "as-constructed" drawings:

- pipe/culvert size, grade, type, class;
- chainage from MH along main to service tees.

NOTE: If as-constructed grade of sewer differs by more than 1% of the design grade, the Consultant shall submit revised hydraulic calculations.

3.14.5 Sanitary Sewers

All actual sanitary sewer invert elevations shall be indicated on the "as-constructed" drawings. If difference is greater than 150 mm from the design vertical alignment, affected portions of the sewer shall be redrawn in profile. Any maintenance hole which differs from proposed horizontal location by more than 1.50 m shall be redrawn in both plan and profile.

In addition the following shall be indicated on the “as-constructed” drawings:

- pipe size, grade, type, class;
- chainage from MH along main to service tees;
- dimensions from lot corners and elevations for service laterals.

NOTE: If as-constructed grade of sewer differs by more than 1% of the design grade, the Consultant shall submit revised hydraulic calculations.

3.14.6 Water Mains

All actual water main obvert elevations at 50 m intervals shall be indicated on the "as-constructed" drawings. If the difference is greater than 150 mm from design vertical alignment, affected portions of the water main shall be redrawn in profile. If horizontal alignment changes exceed 1.0 m the affected portions of the water main shall be redrawn in plan.

In addition the following shall be indicated on the “as-constructed” drawings:

- pipe size, type, class;
- swing-ties to all main appurtenances (valves, bends, tees, etc.);
- chainage from appurtenance along main to main stops;
- dimensions from lot corners and elevations for service laterals.

3.14.7 Roadways

All actual roadway centre line elevations, at a maximum 20 m interval, shall be indicated on the "as-constructed" drawings. Gutter elevations shall be indicated for cul-de-sacs and intersections to show drainage into storm system. If horizontal road alignment changes more than 1.0 m or vertical geometry changes greater than 150 mm the plan and/or profile shall be redrawn as appropriate.

In addition the following shall be indicated on the “as-constructed” drawings:

- driveways, lay-bys, curb depressions;
- road signage;
- lane marking and stop bar locations.

4 Servicing Design Requirements

4.1 Introduction

The purpose of this section is to outline the minimum design requirements for the construction of municipal services in the City. These requirements are intended to provide guidance to the designer and do not relieve the Owner and its Consultant of the responsibility for submitting a completed product demonstrating competent engineering design in full compliance with all applicable legislation.

Any deviation from the minimum City standards shall be specifically referred to by the applicant and/or his agent with a copy of written approval of the City attached.

4.2 Storm Drainage System

4.2.1 General Requirements

To assist in the attainment of proper drainage, the City has set the following objectives for drainage management within its boundaries:

- Prevent loss of life and minimize impact to adjacent properties;
- Prevent inconvenience from surface ponding and flooding;
- Prevent adverse impacts on the local groundwater systems and base flows in receiving watercourses;
- Prevent downstream flooding and erosion;
- Prevent pollution discharges to watercourses;
- Prevent soil losses and sediments to sewer systems and water bodies from construction activity;
- Prevent impairment of aquatic life and habitat; and
- Promote orderly development in a cost-effective manner.

4.2.2 Storm Water Management

The storm water management requirements generally must reflect distinct solutions and vary depending upon the watershed, and in some cases the storm sewer shed, where the site is located. Site-specific requirements can be obtained from the City. A storm water management report will be required for all development applications.

Site specific storm water management reports shall be consistent with existing Watershed Planning Studies and Master Drainage Plans prepared in support of the Official Plan and / or Secondary Plan areas including the Storm Water Management Master Plan (MMM 2005).

Storm water management designs must also be in accordance with City requirements and receive its approval, accordingly.

In general, storm water management reports shall address the following:

a) storm water quantity;
b) storm water quality;
c) sediment and erosion control;
d) baseflow maintenance.

Quantity Control

The City implements a Major and Minor system approach to storm water conveyance and control, comprised as follows:

Minor (convenience) System - 5 year return period for private works, 2 year return period for municipal infrastructure - surface swales, roadside ditches, curb and gutters, catch basins and storm sewers.

Major (overland) System -100 year return period - streams, valleys, man-made channels, roadways, roadside ditches and ponds.

In general, quantity control measures are to be designed in accordance with the MOE Stormwater Management Planning and Design Manual – March 2003 or latest version and LSRCA criteria where applicable for phosphorus level controls.

In addition to introducing pond storage into a storm water management system, increased flows resulting from increased impervious areas may be mitigated by utilizing measures such as: discharging rainwater leaders onto grassed areas, providing temporary rooftop and parking lot storage, or using grassed swales rather than piped flow.

Other factors, such as snowmelt run-off with large volume and longer duration and potential adverse downstream effects due to uncoordinated timing of peak flows must be considered when designing storm water management facilities.

Underground storage tanks and 'superpipe' systems of storm water storage are discouraged as part of the municipal system due to inherent long term, high replacement and maintenance costs and will only be considered in exceptional cases.

Joint use facilities i.e. detention ponds over recreational playing fields and passive parks, will be considered on an individual basis subject to suitably designed control measures and the intended park use.

The degree of control on the quantity of run-off from a proposed development shall be as follows:

The post-development peak flow shall not be greater than the corresponding pre-development peak flow for the 1:5 year, 1:10 year, 1:25 year and 1:100 year storms. Other regulatory agencies may require other storm flows to be analyzed (i.e. 2 year and/or Regional flows).

Runoff Quantity

Rural Catchments – shall be modelled with OTTHYMO using the SCS 24 hour design storm to generate peak flow value.

Urban Catchments – shall be modelled with OTTHYMO using the Chicago 4 hour design storm.

In general, the SCS design storms should be used for determining the hydrographs for undeveloped watersheds and for checking detention storages required for quantity control. The Chicago design storms should be used for determining hydrographs in urban areas and also for checking detention storage. In many cases, the consultant will be required to run both sets of design storms to make sure the more stringent is used for each individual element of the drainage system (pipe flow, street flow, channel flow, detention storage).

The time step for discretization of the design storm can vary according to the size of the sub-watershed, but must not exceed the estimated time of concentration. The maximum rainfall intensity should be compatible with that of real storms on record.

All parameter assumptions used in the OTTHYMO input shall be clearly identified in the storm water management report.

Quality Control

In general, water quality controls are to be designed in accordance with the MOE Stormwater Management Planning and Design Manual – March 2003, or latest version and LSRCA criteria where applicable for phosphorus level controls.

Prior to initiating design, the Consultant shall contact the City for acceptability of specific measures in consideration of long term maintenance and effectiveness.

Specific pond design requirements which are particular to the City are as follows:

Pond Requirements

The design of stormwater management ponds shall be completed with consideration of the following aesthetic and landscape design criteria:

- Stormwater management dry ponds shall be designed to limit the maximum depth of water to 1.8 m above the lowest point of the stormwater basin. An additional 0.3 m freeboard is

required above the maximum flood level. The maximum depth of the extended detention zone shall not exceed 1.0 m above the lowest point of the pond.

- Maximum side slope will be 5:1 from the bottom of the dry pond to the limit of maximum extended detention, with a minimum horizontal length of 3.0 m. The minimum allowable gradient on the bottom of the basin shall be 1.0% and the maximum gradient shall be 5%.
- Stormwater management wetlands shall be designed to limit the maximum depth of water to 2.1 m above the lowest point of the stormwater basin excluding micropools. An additional 0.3 m freeboard is required above the maximum flood level. The maximum depth of the extended detention zone shall not exceed 1.0 m above the permanent pool elevation. Maximum peak flow attenuation zone shall not exceed 1.8 m above the permanent pool elevation. The permanent pool depth shall range between a minimum depth of 0.15 m to a maximum depth of 0.45 m.
- A maximum 5:1 slope below the permanent pool level shall be permitted around the entire stormwater management wetland. A maximum 5:1 slope above the permanent pool level shall be permitted around the entire stormwater management wetland. The slope shall extend from the permanent pool level, to the limit of maximum extended detention. The horizontal distance of this slope must be a minimum of 3.0 m.
- Stormwater management wet ponds shall be designed to limit the maximum depth of water to 3.3 m above the lowest point of the stormwater basin. An additional 0.3 m freeboard is required above the maximum flood level. The maximum depth of the extended detention zone shall not exceed 1.0 m above the permanent pool elevation. The permanent pool depth shall range between a minimum depth of 1.0 m to a maximum depth of 1.5 m.
- A maximum 5:1 slope below the permanent pool level shall be permitted around the entire stormwater management wet pond. The horizontal distance of this slope must be a minimum of 3.0 m. A slope commencing from this point to the lowest point of the stormwater basin shall be a maximum of 3:1. A maximum 5:1 slope above the permanent pool level shall be permitted around the entire stormwater management wet pond. The slope shall extend from the permanent pool level to the limit of maximum extended detention. The horizontal discharge of this slope shall be a minimum of 3.0 m.
- Fencing of stormwater management facilities shall be minimized. Where stormwater management facilities to be owned by the City abut private property, fencing may be required at the discretion of the City. At a minimum, demarcation of property boundaries is required. Fencing and/or property demarcation shall be to City standards.
- In situations where existing natural areas are proposed to be used for stormwater management, exemptions to the depth and slope criteria may be provided to minimize disturbance to the natural feature, at the discretion of the City.
- Designed pedestrian access areas shall not exceed a maximum slope of 12:1.
- Notwithstanding the above slope and depth criteria, in the case of headwall design, the depth of water related to adjoining sideslopes may vary and fencing is required for safety purposes.
- Areas subject to the collection of contaminants or spills shall be fitted with adequate oil/grit separators.
- Maintenance access requirements are to be determined on a site-by-site basis, however, the following general criteria are recommended: Controlled maintenance access routes shall be provided to both inlet and outlet structures and forebays. A minimum 3.0 m wide surface to accommodate maintenance vehicles within a minimum 10 m turning radius

(inside radius) and a flat 10 m loading areas is required. Maintenance access routes shall not exceed a maximum slope of 10:1. The design of maintenance routes and loading areas shall be to the approval of the Public Works Department.

- Sediment drying area may be required adjacent to the forebay area to facilitate dewatering of sediment prior to removal to an approved disposal location.
- Maintenance by-pass shall be provided via a maintenance hole upstream of the entry to the pond to divert all flow from the pond during maintenance and sediment removal procedures.

4.2.3 Storm Sewer Design

General

Storm sewers, designed and constructed in accordance with the most recent requirements and specifications of the City, shall be of adequate size and depth to provide service for the development of lands within the upstream watershed and/or for the drainage of any areas designated by the City. Storm drainage shall be directed to an outlet considered adequate in the opinion of the City and applicable agencies.

Channel works, bridges, culverts and all other drainage structures or works shall be designed, approved and constructed in accordance with the most recent drawings and specifications of all applicable agencies having jurisdiction, such as the City, LSRCA, MOE, MTO, MNR, DFO, etc.

4.2.3.1 Hydrology and Design Flows

Storm sewers shall be designed to drain all lands based on the Rational Method. The Rational Method calculations must be checked using a model approved by the City where the drainage area is greater than 10 hectares. The larger of the flows is to be used in the design of the sewer system unless approved otherwise.

Q = 0.0028 C I A where: Q = Flow in cubic metres per second
A = Area in Hectares
C = Run-off coefficient
I = Intensity in mm/hr

Storm sewers shall generally be designed to accommodate 1:5 year storm flows for private works and 1:2 year storm flows for municipal infrastructure.

Intensity of Rainfall

The intensity of rainfall is to be determined from the Intensity-Duration-Frequency values from the Atmospheric Environment Services Orillia Station.

Where $\mathbf{I = A \times t^B}$ and I is in mm/hr, t is time of concentration in hours; A and B are as follows:

Storm Return Period	A	B
2 year	22.5	-0.728
5 year	29.9	-0.725
10 year	34.8	-0.724
25 year	40.9	-0.723
50 year	45.5	-0.722
100 year	50.0	-0.722

Time of Concentration

The minimum initial time of concentration is to be 10 minutes.

Pre-Development Areas:

To calculate the initial time of concentration (tc) for upstream, undeveloped lands, the following formulas may be used: Bransby-Williams or Airport Method. The most appropriate method will be determined at the discretion of the City.

Run-off Coefficient

Run-off coefficients to be used in storm sewer design with the Rational Method shall be as follows:

Parks over 4 hectares	0.20*
Parks 4 hectares and under	0.25*
Single-family Residential (Urban)	0.45
Single-family Residential (Suburban)	0.40
Semi-detached Residential	0.60
Townhouses, Maisonettes, Row Houses, etc.	0.70
Apartments	0.75
Schools and Churches	0.75
Industrial (rural)	0.75
Industrial (urban)	0.90
Commercial	0.90
Heavily Developed Areas	0.90
Paved Areas	0.95

*Parks with increased impermeable area will require a higher run-off coefficient.

A minimum run-off coefficient of 0.55 is to be used for undeveloped upstream area where future residential development is expected and 0.75 where future industrial, high-density residential or commercial development is expected.

Drainage Area

Drainage systems must be designed to accommodate all upstream drainage areas considering interim and ultimate conditions.

4.2.3.2 Pipe Sizing and Specifications

Pipe Capacities

Manning's formula shall be used in determining the capacity of all storm sewers. The capacity of the sewer shall be determined on the basis of the pipe flowing full.

The value of the roughness coefficient 'n' used in the Manning's formula shall be as follows:

- concrete pipe 0.013
- concrete box culverts 0.013
- corrugated metal 68 x 13mm corrugations 0.024
- corrugated metal 25% paved invert 0.021
- PVC pipe 0.013
- HDPE smooth wall ribbed pipe 0.013

Flow Velocities (Flowing full)

For circular pipes the minimum acceptable velocity is 0.75 m/s and the maximum acceptable velocity is 4.5 m/s.

Minimum Sizes

The minimum size for an on-street storm sewer shall be 300mm diameter.

Minimum Grades

Regardless of flow velocities obtained, the minimum design grades for pipe storm sewers shall be as follows:

Sewer Size (diameter)	Concrete Pipe
up to 375 mm.	0.40%
450 mm. to 525 mm.	0.30%
600 mm. to 1,200 mm.	0.20%
1,200 mm. and over	0.15%

Depth of Storm Sewers

The depth of a deep storm sewer shall be sufficient to provide a suitable outlet for the building foundation weeping tiles. The minimum cover to the top outside pipe barrel of a deep storm sewer shall generally be 2.5 to 3.0 metres depending on the storm service connection requirements. The

minimum cover to the top outside pipe barrel of a shallow storm sewer system shall not be less than 1.5 metres from the centreline of the roadway unless alternate measures are implemented as approved by the City.

Location

The storm sewers shall be located as shown on the standard City road cross-section drawings. This standard location shall be generally 1.5 metres north or east of the centreline of the road allowance. In the case of crescents, looped and curvilinear streets, this standard location may be varied to the extent that the storm sewer remains on the same side of the centreline of the street (i.e., left or right) to avoid crossing the sanitary sewer trenches at the changes in direction of the street.

Pipe Crossings

A minimum clearance of 0.20 metres shall be provided between the outside of all pipe barrels at all points of crossing. In cases where the storm sewer crosses a recent utility trench at an elevation higher than the elevation of the utility, a support system shall be designed to prevent settlements of the storm sewer, or alternatively the original trench will be re-excavated to the top of the utility and shall be backfilled with non-shrinkable fill (low strength concrete) to adequately support the storm sewer. When the storm sewer passes under an existing utility, adequate support shall be provided for the utility during and after construction to prevent damage to that utility.

Radius Pipes

Radius pipe shall be allowed for storm sewers 975mm in diameter and larger provided a maintenance hole is located at the beginning or at the end of the radial section. The minimum centre line radius allowable shall be in accordance with the minimum radii table as provided by the pipe manufacturer.

Limits of Construction

Sewers shall be terminated with a maintenance hole at the upstream subdivision limits when external drainage areas are considered in the design. The design of the terminal maintenance holes must allow for the future extension of the sewer.

When external areas are not included in the sewer design, the sewer shall extend at least half way across the frontage and/or flankage of any lot or block in the subdivision.

Sewer Alignment

Storm sewers shall be laid in a straight line between maintenance holes unless radius pipe has been designed. Joint burial (common trenching) with sanitary sewers will be considered when supported by the recommendations of a soils report prepared by a qualified geotechnical engineering consultant.

Changes in Pipe Size

No decrease of pipe size from a larger size upstream to a smaller size downstream will be allowed regardless of the increase in grade.

Pipe Material Classification and Bedding

All storm sewer mains shall generally be constructed of reinforced concrete with suitable strength class recommended by the Consultant. Smooth wall ribbed PVC may be used for mains up to 900 mm diameter. Storm sewer leads from catch basins shall be constructed with non-reinforced concrete pipe or PVC pipe.

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. For rigid pipe, Class B bedding (compacted Granular A bedding and cover over the sewer) in accordance with OPSD shall be used.

Embedment for flexible pipe shall be homogeneous Granular A in accordance with OPSD.

Alternate granular materials for pipe bedding may be specified, subject to the approval of the City, however clear stone bedding is generally not permitted. In areas where it is difficult to control the infiltration of ground water into the sewer trenches clear stone bedding may be considered provided it is completely wrapped in a suitable geotextile, selected and installed in accordance with the manufacturer's requirement.

The width of trench at the top of the pipe must be carefully controlled to ensure the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used. Where poor soil conditions and high ground water levels are present, the Consulting Engineer shall prepare special designs for the City's approval.

- Reinforced concrete pipe shall conform to the requirements of OPSS 1820.
- Polyvinyl chloride (PVC) pipe products shall conform to the requirements of OPSS 1841.The pipe must be manufactured with factory assembled spigot gasket and integral bell joints.
- Polyethylene pipe products shall conform to the requirements of OPSS 1840.

Testing and Acceptance

All newly constructed storm sewers shall be visually inspected upon satisfactory completion of all other testing, prior to the City's recommendation for issuance of "Substantial Completion". All storm works shall be thoroughly flushed and/or cleaned of debris. If deemed necessary by the City, a CCTV inspection as per OPSS 409 shall be required prior to "Final Acceptance".

4.2.3.3 Maintenance Hole Requirements

Maintenance holes must be precast concrete and shall be designed and constructed in accordance with the most recent OPSS and OPSD. Where the standard drawings are not applicable, the maintenance holes shall be individually designed and detailed.

Location and Spacing

Maintenance hole shall be located at each change in alignment, grade or pipe material, at all pipe junctions, at the beginning or end of all radius pipe sections and at intervals along the pipe to permit entry for maintenance to the sewer.

Maximum Spacing

The maximum spacing between maintenance holes shall be as follows:

Pipe Size (diameter)	Maximum Maintenance Hole Spacing
600mm or less	120 metres
675mm and over	150 metres

Maintenance Hole Design

a) All maintenance hole chamber openings shall be located on the side of the maintenance hole parallel to the flow for a straight run maintenance hole, or on the upstream side of the maintenance hole at all junctions.

a) The change in direction of flow in any maintenance hole shall not be permitted at acute interior angles.

b) Safety gratings shall be provided in all maintenance holes when the depth of the maintenance hole exceeds 5 m. The maximum spacing between safety gratings shall not exceed 5 m.

c) The obvert(s) on the upstream side of a maintenance hole shall not be lower than the obvert of the outlet pipe.

d) The maximum change in direction of flow in a maintenance hole, for sewer sizes 900 mm diameter and over, shall be 45°.

e) Where the difference in elevation between the obvert of the inlet and outlet pipes exceeds 0.9 m, a drop structure shall be placed on the inlet pipe.

f) All storm sewer maintenance holes shall be benched to the obvert of the outlet pipe on a vertical projection from the spring line of the sewer, all in accordance with the standard detail drawing.

g) The minimum width of benching in all maintenance holes shall be 230 mm.

h) Maintenance holes in boulevards shall be located, wherever possible, a minimum of 1.5 m from the face of curb or other service.

i) Minimum size of any maintenance hole stack shall be 685 mm square.

Elevations for Maintenance Hole Frames and Covers

All maintenance holes, located within the travelled portion of a roadway, shall have the rim elevation set flush with the surface of the base course asphalt. The concreting and setting of the frame and cover shall be completed in accordance with the details provided in the standard drawing. A maximum of 300mm of modular rings shall be permitted on maintenance holes in new subdivisions. No concrete shall extend over the edge of the maintenance hole.

Prior to the placement of the final lift of asphalt, maintenance hole frames shall be reset to final elevations.

Head Losses and Drops

Suitable drops shall be provided across all maintenance holes to compensate for the loss in energy due to the change in flow velocity and for the difference in the depth of flow in the sewers.

In order to reduce the amount of drop required, the designer shall, wherever possible, restrict the change in velocity between the inlet and outlet pipes to 0.6 metres/sec.

Hydraulic calculations shall be submitted for all junction and transition maintenance holes on sewers where the outlet is 1,050 mm. or greater. In addition, hydraulic calculations may be required for maintenance holes where the outlet pipe is less than 1,050 mm dia. if, in the opinion of the City, there is insufficient invert drop provided across the maintenance hole.

Regardless of the invert drop across a maintenance hole as required by calculations, the obvert of the outlet pipe shall not be higher than the obvert of the inlet pipe in any maintenance hole.

The minimum drops across maintenance holes shall be as follows:

Change of Direction	Minimum Drop (mm)
0	30
1° to 45°	50
46° to 90°	80

Frame and Grate

All maintenance hole frames shall be “The Adjustable” by Mueller Model AJ633-R with OPSD 401.010 Type A closed cover labeled “Storm”.

4.2.3.4 Catch basin Requirements

Location and Spacing

Catch basins shall be selected, located and spaced in accordance with the conditions of design. The design of the catch basin location and type shall take into consideration the lot areas, the lot grades, pavement widths, road grades and intersection locations.

All catch basins and their leads shall be of the single, double or backyard type. To ensure the capture or inlet capacity matches that of the storm sewer, the spacing of catch basins on streets may be varied.

If detailed analysis of the major-minor system and SWM analysis of the pipe system indicate the need for inlet controls, additional constrictions should be implemented. Since reduction in the size of the standard catch basin covers is not desirable, an orifice plate can be located in the catch basin. This is applicable only to private development. Orifice plates are not permitted within the municipal right-of-way.

Catch basins shall be generally located upstream of sidewalk crossings at intersections and upstream of all pedestrian crossings. Catch basins shall not be located in driveway curb depressions. Double catch basins shall be required when the catch basin intercepts flow from more than one direction.

Rear lot catch basins and connections shall be located as outlined in the lot grading criteria. In general, the catch basin and the catch basin connections shall be located entirely on one lot.

Maximum spacing for catch basins including cul-de-sac gutters shall be as follows:

- Road grade 0.5% to 3.0% 110m
- Road grade 3.1% to 4.5% 90m
- Road grade greater than 4.6% 75m

Catch basin Types

Catch basins must be pre-cast concrete and shall be designed and constructed in accordance with the most recent OPSS and OPSD.

Special catch basins and inlet structures shall be fully designed and detailed by the Consultant.

Double catch basins are to be installed at the low point of any road.

Catch basin Leads

For single catch basins, the minimum size of connection shall be 300 mm diameter and the minimum grade shall be 1.0%.

For double catch basins, the minimum size of connection shall be 375 mm diameter and the minimum grade shall be 1.0%.

For rear lot catch basins, the minimum size of the connection shall be 300 mm diameter and the minimum grade shall be 1.0%.

In general, catch basins located in close proximity to a maintenance hole shall have their leads connected to the maintenance hole. Long catch basin connections (in excess of 20 m.) shall be connected to a maintenance hole or, alternatively, the lead can be connected to the sewer and a 1,200 mm diameter maintenance hole catch basin used in lieu of the normal 600 mm. square catch basin.

Frame and Grate

In general, the "bike—proof" catch basin grate shall be required for all catch basins located in roadway or walkway areas, and the pyramidal type shall be used for rear lot and ditch located catch basins.

The frame and cover for catch basins in roadway or walkway areas shall be as detailed in OPSD 400.100. Catch basins located in grassed areas shall have a Birdcage Grate per OPSD 400.120.

Catch basins at Intersections

All catch basins at street intersections shall be located on the tangent section of the curb at a minimum of 0.6 metres distant from the beginning or the end of the radial portion of the curb.

Elevations for Catch basin Frames and Grates

All catch basins located within the travelled portion of a roadway, shall have the frame elevation set flush with the surface of the base course asphalt. The adjusting and setting of the frames and grates shall be completed in accordance with the details provided in OPSD 704.010 upon placement of surface course asphalt.

Temporary asphalt curbing shall be placed behind all catch basins within the travelled portion of the roadway at the stage of base course asphalt. Asphalt curbing shall be placed in accordance with OPSD 601.010 - Type "D", between the two adjacent expansion joints as shown on the Standard Drawing.

Prior to placing surface course asphalt, temporary asphalt curbs shall be removed and replaced by concrete curb.

4.2.3.5 Rainwater Leaders, Foundation Drains and Storm Connections

Rainwater Leaders

Rainwater leaders on all single family and semi-detached residential units shall be discharged onto

grassed or garden areas and away from wells or tile bed areas. Rainwater leaders shall not encroach over other adjacent private lands.

The rainwater leaders of all townhouses shall be discharged onto grassed or garden areas.

Pre-cast concrete splash pads shall be placed at each rainwater leader downspout.

The rainwater leaders from all commercial, industrial, institutional and high density residential buildings should be discharged onto grassed or garden areas, if possible and if acceptable to the City.

Foundation Drains

The City requires a sump pump system be installed in every building.

In any case, the underside of footing shall be set above the seasonal high ground water level.

Where sump pumps are installed in residential developments with open ditches, discharge pipelines shall not be placed within the City's ditch lines of the road allowances. Sump pump discharge pipelines shall be directed to rear or side yard drainage swales.

4.2.4 Channel, Culvert and Overland Flow

For channel, culvert, bridge and/or erosion control projects the proponent is responsible for obtaining all necessary approvals from the governing agencies, such as the LSRCA, MNR, DFO and/or MOE.

4.2.4.1 Culverts and Bridges

Culvert and Bridge Hydraulic Capacity

Only arterials and collectors should, if feasible, be permitted to cross the major system watercourses. It is also recommended designers consider the need to design culverts and bridges on such arterials and collectors for at least the 1:100 year storm flow, if not for the Regional Storm flow. If smaller culverts or bridges are provided, the backwater effects for the 1:100 year and Regional Storm flows must be determined. Concrete box culverts shall be designed and placed for all watercourse crossings subject to the approval of the City. Ministry of Natural Resources, DFO and/or LSRCA approval under their regulations may be required for watercourse/valley crossings.

Road Classification	Design Flood Frequency
Arterial	1:100 Year to Regional
Collector	1:50 Year
Urban Local	1:25 Year
Rural Local	1:25 Year

Temporary Detour	1:10 Year
Driveway	1:5 Year

All culverts must be of sufficient length to provide for a preferred 5:1 (minimum 3:1) slope off the driving surface to the ditch invert. All driveway culverts require entrance approval.

Bridges and other major drainage structures shall require special designs as determined by the City. Hydraulic calculations will be required.

The frequency and magnitude of flooding or erosion shall not be increased on upstream or downstream properties.

4.2.4.2 Open Channels

The proposed criteria for an open channel design shall be submitted to the City for approval prior to the actual design being undertaken. Open channels shall be defined as major system overland flow channels, minor system outfall channels or natural channels. Major system overland flow channel designs may be required to accommodate the Regional Storm or the 100-year storm for new development.

The Consultant shall also be responsible for obtaining the approval of the design from the Ministry of Natural Resources, DFO, LSRCA and the Ministry of the Environment, if the open channel concept is favourably considered.

"Natural" channel design criteria will be determined on a site by site basis. The following guidelines must be considered:

Open Channels	Minimum Velocity	Maximum Velocity
Grass lined - Natural	0.7 m/s	1.5 m/s
Grass lined - Maintained	0.7 m/s	1.5 m/s
Gabion lined	0.7 m/s	2.5 m/s
Concrete lined	0.7 m/s	4.0 m/s

4.2.5 Watercourse Erosion and Bank Instability

Where erosion or bank instability is already evident in an area to be developed or re-developed, the City requires the situation be stabilized by appropriate remedial measures. Where development will potentially cause significantly increased downstream erosion, the City also requires the Developer to mitigate further damage by appropriate remedial and preventative measures.

When designing remedial erosion or bank stabilization works, preservation of the watercourse dynamics and natural valley aesthetics must be secondary only to achieving a sound technical

solution. The proposed design shall reference the MNR Natural Channel Design Manual. A normal bank flow channel has a capacity of about the 1:2 year flood. Protection to this level will be adequate provided care is taken to prevent any damage by higher floods and provided the channel bank is not coincident with a higher valley bank. In this latter case, it may be necessary to protect the bank to a level as high as the 1:100 year flood or even the flood resulting from the Regional Storm.

The proposed criteria for an erosion or bank stability design shall be submitted to the City for approval prior to the actual design being undertaken.

4.2.6 Overland Flow Routes

An overland flow route continuous to the nearest major channel must be established through all areas and shall be contained within either the road right-of-way or by easements.

The depths of flooding permitted on streets and at intersections during the 1:100 year storm are as follows:

- no building shall be inundated at the ground line, unless the building has been flood proofed;
- for all classes of roads, the depth of water at the gutter shall not exceed 0.3m.

Flow across road intersections shall not be permitted for minor storms (generally 1:10 year). To meet the criteria for major storm run-off, low points in roads must have adequate provision for safe overland flow.

4.2.7 Inlet/Outlet and Special Structures

Inlet and outlet structures shall be fully designed on the engineering drawings. The details provided shall include the existing topography, proposed grading and the work necessary to protect against erosion.

Inlets

Inlet structures shall be fully designed by the Consultant when OPSD structures are not deemed suitable. Inlet grates shall generally consist of inclined parallel bars or rods set in a plane at approximately 180 degrees with the top away from the direction of flow. Gabions, riprap or concrete shall be provided at all inlets to protect against erosion and to channel the flow to the inlet structure.

Hydraulic design calculations for inlet structures must be performed in accordance with guidelines established by the Ministry of Transportation Drainage Manual.

The design of any culvert on a new or reconstructed watercourse where an inlet grating is required must provide a measure of safety and minimize the risk of entanglement or entrapment of a person.

Outlets

The OPSD headwall standards shall be used for all storm sewers up to 2,400 mm diameter. For sewers over 2,400 mm. the headwalls shall be individually designed. All headwalls shall be equipped with a grating over the outlet end of the pipe and a railing across the top of the headwall for the protection of the public.

All outlets shall blend in the direction of flow of the watercourse with the directional change being taken up in the sewer rather than the channel.

Storm sewer outfalls shall not be connected to existing or proposed road crossing culverts. Storm sewer outfalls must be terminated at separate headwall structures, adjacent to the outlet side of road crossing culverts.

Gabions, Terra-fix blocks, riprap, concrete or other erosion protection shall be provided at all outlets to prevent erosion of the watercourse and the area adjacent to the headwall. The extent of the erosion protection shall be indicated on the engineering drawings and shall be dependent upon the velocity of the flow in the storm sewer outlet, the soil conditions, the flow in the existing watercourse and site conditions.

4.3 Sanitary Sewer System

4.3.1 General Requirements

Within the City, the responsibility for the local collection and treatment of sanitary waste in the municipally operated sewage treatment plant rests with the City.

Prior to the commencement of any design for any sanitary sewage works, the applicant shall obtain confirmation from the City adequate treatment plant capacity is available for the development proposed.

Sanitary sewers designed and constructed in accordance with the most recent requirements and specifications of the City are required to carry domestic, commercial and industrial sewage from each area of the development under consideration. Flow is to be by gravity, in general. Pumped systems will be considered only where other alternatives are not possible and only with the approval of the City.

4.3.2 Sanitary Drainage System

4.3.2.1 Design Flows (As per City of Orillia Report #PD-02-038/ April 2003)

The design flow in each length of sewer shall be computed on the standard sanitary sewer design sheets. For each area entered on the design sheet, the maintenance hole numbers, the size and

grade of the sewers, and the number of the detailed plan and profile for each section of the sanitary sewer shall also be shown.

Calculations shall be based be the following:

Residential Sewage Flows

The following formula shall be used to calculate the sewage flow for residential areas:

$$Q_{(d)} = \frac{PqM}{86.4} + IA$$

Where;

$Q_{(d)}$ = Peak domestic flow plus extraneous flows, in L/s
P = Design population, in thousands
q = Average daily per capita flow, in L/cap/d
M = peaking factor
I = unit of peak extraneous flow, in L/s/ha
A = Gross tributary area, in hectares

An average daily per capita flow of 300 L/c/d shall be used for new development.

An average daily per capita flow of 350 L/c/d shall be used for areas older than 10 years old.

The value of peak extraneous flow shall be 3.46 cu.m./ha.d.

The peaking factor shall be calculated based on the Harmon formula,

$$M = 1 + \frac{14}{4+P^{0.5}}$$

Where;

P = population, in thousands

Maximum	M – 4.0
Minimum	M – 1.5

The design population shall be derived from the drainage area and expected maximum population over a design period of 20 years.

For areas where the lands are zoned for specific residential use, but detailed planning information is not available, the following population densities shall apply for calculation of sewage flows only:

Type of Housing	Units/Hectare

Single Family Residential,	12
Multiple Residential	42

When the number and type of housing units within a proposed development are known, the calculation of population for the proposed development shall be based on the following:

Type of Housing	Person/Unit
Single Family Dwelling, Semi-detached & Duplex, Townhouse	2.95
Apartment	2.95

Future land use and population shall be based on the approved Official Plan and Secondary Plans of the area.

Commercial Sewage Flows

An average design flow of 28 m^3/ha/day shall be used for the design of all local sewers, with a peak factor of 1.60.

A peak design flow of 0.10 L/s/ha shall be used for infiltration.

The area shall be based on the gross lot area.

Industrial Sewage Flows

An average day design flow of 36 m^3/ha/day for industry shall be used (excludes infiltration and peaking effects).

The area shall be calculated using the gross area included in the industrial block or development.

Peak flow and infiltration factors shall be applied as per the MOE Design Guidelines.

The City through its Planning Policies encourages the establishment of only those industries which have low sewage requirements (dry industries).

Institutional Sewage Flows

A design flow of 28 m^3/ha/day shall be used for the design of all local sewers, with a peak factor of 1.60.

A peak design flow of 0.10 L/s/ha shall be used for infiltration.

The area shall be calculated using the gross area included in the school or institutional site.

1.1.1.1 Pipe Sizing and Specifications

Pipe Capacities

Manning's formula shall be used in determining the capacity of all sanitary sewers. The capacity of the sewer shall be determined on the basis of the pipe flowing full.

For all types of pipe a roughness coefficient of n = 0.013 shall be used.

Flow Velocities

Minimum acceptable velocity = 0.6 m/s
Maximum acceptable velocity = 3.0 m/s

The velocity change in a maintenance hole from one pipe to another shall not exceed 0.6 m/s.

Pipe Grades

The maximum and minimum grades for pipes shall be the grade necessary to meet the maximum and minimum velocity requirements except the required grade for the minimum velocity requirement shall not exceed 2% or the road grade where the road grade exceeds 2%.

Minimum Sizes

The minimum size for an on street sanitary sewer shall be 200 mm diameter.

Depth of Sanitary Sewers

The minimum desirable design grades shall be 0.5% for all local sewers and 1% for the first upstream leg.

The depth of the sewer shall be measured from the final centreline finished road elevation to the top of the sanitary sewer.

In all instances, the proposed sanitary sewer shall be installed at a depth sufficient to also service lands external to the site as determined by the City.

For residential, commercial and institutional areas the minimum depth shall be 2.75 m.

For industrial areas, the minimum depth shall be 2.15 m.

Sanitary sewers shall be located a minimum of 1.0 m below basement floor elevations to allow for the installation of sewer laterals.

Location

All sanitary sewers shall be located as shown on the typical City roadway cross sections.

In general, this location is 1.5 m south or west of the centreline of the roadway. A minimum horizontal clearance of 3.0 m is required between the sanitary sewer and water main.

Storm Sewer and Water Main Crossings

Generally, a minimum clearance of 0.20 m shall be provided at the point of crossing between the outside of the pipe barrels of storm and sanitary sewers. A minimum vertical clearance of 0.50 m shall be provided at the point of crossing between the outside of the pipe barrels of the sanitary sewers and water mains.

The sanitary sewer connections are required to go under the storm sewer.

Limits of Construction

Sewers shall be terminated with a maintenance hole at the upstream subdivision limits when external drainage areas are considered in the design. The design of the terminal maintenance holes must allow for the future extension of the sewer.

Sewer Alignment

Sanitary sewers shall be laid in a straight line between maintenance holes unless radius pipe has been designed. Joint burial (common trenching) with storm sewers will be considered when supported by the recommendations of a soils report prepared by a qualified geotechnical engineering consultant.

Changes in Pipe Size

No decrease of pipe size from a larger size upstream to a smaller size downstream will be allowed regardless of the increase in grade.

Pipe Bedding

The class of pipe and the type of bedding shall be designed to suit loading and proposed construction conditions. Details are illustrated in the OPSD standard Bedding and Backfill details. In general, Type B bedding and cover (compacted Granular A bedding and cover over the sewer) shall be used for rigid pipe sewers.

Embedment for flexible pipe shall be homogeneous Granular A material in accordance with OPSD requirements.

The width of trench at the top of the pipe must be carefully controlled to ensure the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used.

Alternate granular materials for pipe bedding may be specified, subject to the approval of the City, however clear stone bedding is generally not permitted. In areas where it is difficult to control the infiltration of ground water into the sewer trenches clear stone bedding may be considered provided it is completely wrapped in a suitable geotextile, selected and installed in accordance with the manufacturer's requirement.

Where poor soil conditions and high ground water levels are present, the Consultant shall prepare special designs for the City's approval.

Materials

For single family and semi-detached units, multiple family, and other residential blocks, the service connections shall be PVC.

All bends on sanitary service connections shall be long radius, sweep bends.

Sanitary sewers shall be constructed of reinforced concrete pipe, Polyvinyl Chloride (PVC) pipe or polyethylene.

The type and classification of all sanitary sewer pipes shall be clearly indicated on all profile drawings for each sewer length.

Reinforced concrete pipe shall be used for sewers 600 mm diameter or larger. PVC pipe may only be used for sanitary sewers up to and including 600 mm in diameter.

- Reinforced Concrete Pipe shall be steel reinforced and conform to OPSS 1820.
- Polyvinyl Chloride Pipe (PVC) shall conform to OPSS 1841.
- Dimension ratio (DR) of PVC sewer pipe shall not exceed 35.
- Polyethylene pipe shall conform to OPSS 1840.

For sewer applications requiring pressure pipe, pipe design should reference MOE guidelines.

Testing and Acceptance

All testing shall be carried out from maintenance hole to maintenance hole including house service connections as work progresses.

An infiltration or exfiltration test as per OPSS 410 shall be completed on all sewers 1200 mm in diameter and smaller. The City shall determine which test is to be undertaken. Low pressure air testing may be considered.

Infiltration Test

An infiltration test shall be carried out where the ground water at time of testing is 600 mm or more

above the crown of pipe throughout the section of sewer under test.

The infiltration shall not exceed the following calculated allowable infiltration for the section tested:

0.75 L/mm of diameter/100 metres of sewer/hour.

Exfiltration Test

An exfiltration test shall be carried out where the ground water table is lower than 600 mm above the crown of pipe of highest point of highest service connection included in the test section. The static head for testing exfiltration shall be at least 600 mm above the ground water table.

The allowable leakage for the test section shall not exceed the following:

0.75 L/mm of pipe diameter/100 metres of sewer/hour.

Deflection Test

A deflection test shall be performed on all sewers constructed using PVC pipe material.

Deformation gauge (Pig) test as per OPSS is required on all pipe works prior to substantial performance, but a minimum 30 days after installation.

Video Record

All pipe works shall have a CCTV inspection as per OPSS 409 complete as part of the substantial performance and final acceptance inspections.

A permanent record in video tape or DVD form shall be supplied, illustrating a continuous record of the sewer installations, service connections, maintenance hole, etc. A report identifying any unusual or sub-standard conditions shall also be submitted.

At the discretion of the City, flushing, cleaning, additional video inspections and records may be required prior to “Final Acceptance”.

4.3.2.2 Maintenance Hole Requirements

Maintenance holes to be either precast concrete and shall be designed and constructed in accordance with the most recent OPSS and OPSD. Where the standard drawings are not applicable, the maintenance holes shall be individually designed and detailed.

Location and Spacing

Maintenance hole shall be located at each change in alignment, grade or pipe material, at all pipe junctions and at intervals along the pipe to permit entry for maintenance to the sewer.

Maximum spacing of maintenance holes shall be 120 m for sewers 600 mm or less in diameter and 150 m for sewers 675 mm or greater in diameter.

Maintenance Hole Details

a) All maintenance hole chamber openings shall be located on the side of the maintenance hole parallel to the flow for straight run maintenance hole, or on the upstream side of the maintenance hole at all junctions.

b) The maintenance hole shall be centred on the sanitary sewer main.

c) The maximum change in the direction of flow in any sanitary sewer maintenance hole shall be 90 degrees. A change of flow direction at acute interior angles shall not be permitted.

d) A maximum invert drop of 0.25 m within the maintenance hole will only be allowed if the design of the sewer cannot be modified to reduce the drop or modified to accommodate a drop structure.

e) If the design of the sewer system is such that the difference in elevation between the maintenance hole inlet and outlet exceeds 0.9 m, then a drop structure will be required.

f) Whenever feasible, sewer systems should be designed to avoid the use of drop structures.

g) When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5 m/s, the following minimum invert drops across the maintenance hole shall be made to compensate for hydraulic losses:

ALIGNMENT CHANGE	DROP REQUIRED
straight run	grade of sewer
15 - 45 degrees	0.03m
45 - 90 degrees	0.06 m

h) When the upstream flow velocity exceeds 1.5 m/s, the drop required through a maintenance hole shall be calculated using the standard calculation sheet, “Hydraulic Calculations for Manholes” found in the MOE Design Guidelines.

i) For all junction and transition maintenance holes, the drop required shall be calculated using the standard calculation sheet “Hydraulic Calculations for Manholes” found in the MOE Design Guidelines.

j) The obvert(s) on the upstream side of a maintenance hole shall in no case be lower than the obvert(s) on the downstream side of the maintenance hole.

k) All maintenance holes shall be benched as detailed on the Standard Drawings.

l) When any dimension of a maintenance hole exceeds those on the Standard Drawings, the maintenance hole must be individually designed and detailed.

    a. Safety gratings shall be required in all maintenance holes greater than 5.0 m in depth. Safety gratings shall not be more than 5.0 m apart and shall be constructed in accordance with the Standard Drawings.

Whenever practical, a safety grating shall be located 0.5 m above the drop structure inlet pipe.

Frame and Grate

All maintenance holes located within the travelled portion of a roadway shall have the rim elevation initially set flush with the surface of the base course asphalt. The concreting and setting of the frame and cover shall be completed in accordance with the details provided in the standard drawing. A minimum of two modular rings and a maximum of 300mm of modular rings shall be permitted on maintenance holes in new subdivisions. No concrete shall extend over the edge of the maintenance hole.

Prior to the placement of the final lift of asphalt, maintenance hole frames shall be reset to final elevation.

Where maintenance holes are located in areas to be flooded by the major design storm, maintenance hole covers shall be water tight and the maintenance hole is to be suitably vented.

All other maintenance hole frames shall be "The Adjustable" by Mueller Model AJ633-R with OPSD 401.010 Type A closed cover labelled "Sanitary".

4.3.2.3 Service Connections

All sanitary sewer service connections for single and semi-detached dwellings and townhouse units shall be individual services.

Location

The proposed locations for the sanitary sewer service connections shall be shown on the plan and profile drawings and shall be in accordance with the locations specified on the Standard Drawings.

Sanitary connections shall be in accordance with the following Standards:

- OPSD 1006.010 Sewer Service Connection for Rigid Pipe;
- OPSD 1006.020 Sewer Service Connection for Flexible Pipe.

Residential connections shall terminate at the center of the property line with a test fitting, 125 mm x 100 mm reducer, plug suitably braced to withstand test pressures and 89 mm x 38 mm marker placed from the invert of the connection to 600 mm above grade painted green.

Connection to Main

The connection to the main sewer shall be made with an approved manufactured tee. Approved saddles shall only be used for connecting to existing sewer mains.

No service connection of a size greater than half the diameter of the main sewer shall be cut into the main sewer. A maintenance hole shall be installed on the main sewer at the intersection of a service

connection, which has a size greater than half the diameter of the main sewer except as provided below:

A 150 mm service connection will be permitted to connect to a 200 mm or 250 mm main sewer providing an approved manufactured tee is installed and providing the invert of the service connection is above the springline of the main sewer.

Size

Sanitary connections are to be sized as follows:

Single family residential:

- single 125 mm diameter (min.) PVC SDR 28
- Joints; Bell and Spigot with rubber gasket.
- PVC pipe to be green in colour.

Service Connection to all block developments:

An inspection maintenance hole shall be required on private property 1.50 m from property line to centre of rim.

Multiple family residential block, institutional, commercial and industrial blocks:

- designed in accordance with Section 3.3.3.2;
- Min. size 200 mm diameter.

Depth

The depth of the service connections for single-family units and semi-detached units at the property line, measured from the final centreline road elevation shall be:

Minimum - 2.50 m

Risers shall be used when the depth to obvert of the sewer main exceeds 4.50 m. The riser connection shall not exceed 3.0 m in depth.

Grade

The minimum and maximum grades for sanitary sewer service connections shall be as follows:

Size of Connection (mm)	Minimum Grade (%)	Maximum Grade (%)
125	2.0	8.0
150	1.0	6.0

200	0.5	6.0

Joints and Bedding

Joints and bedding for connections are to be equivalent to joints and bedding as specified for sanitary sewer pipe.

4.4 Water Supply System

4.4.1 General Requirements

Jurisdiction

Within the boundaries of the City, the responsibility for the supply, treatment and storage of water for the municipal water system rests with the City.

The City is responsible for the distribution of the treated water to the individual users.

Water mains designed and constructed in accordance with the most recent requirements and specifications of the City are required on every street within all proposed plans of subdivision. Water mains shall be of adequate size to provide service for the development of adjacent lands designated by the City.

Prior to the commencement of any design for new water mains within the City, the applicant shall obtain confirmation from the City adequate water supply exists for the development proposed.

4.4.2 Water Main Design Criteria

All water mains shall be sized to meet the greater of the maximum day plus fire flow or the maximum hour demand.

System Designs

The maximum sustained operating pressure shall not exceed 700 kPa (101.5 psi). If pressure in a localized area is above this level, a pressure-reducing valve shall be installed on each service connection within that area.

Under normal conditions of maximum day demand, the pressure shall not drop below 275 kPa (40 psi) at any point in the water system.

Under conditions of simultaneous maximum day and fire flow demands, the pressure shall not drop below 140 kPa (20 psi) at any point in the water system.

Friction Factors

The following "C' values shall be used in the Hazen-Williams equation, for the design of water distribution systems regardless of pipe materials.

Pipe Diameter (mm)	C-Factor
150	100
200 to 300	110
400 to 600	120
Over 600	130

The above C-factors represent long-term values. A C-factor of 140 shall be used to calculate maximum velocities for transient pressure estimations, or for checking pump motor sizes for runout conditions.

In evaluating existing systems for expansion, the C-factors shall be determined by actual field tests, wherever possible.

The Hazen-Williams equation shall be used to calculate the flow in water mains as follows:

$$Q = 0.84918\ (C)\ (A)\ (R)^{0.63}(S)^{0.54}$$

where Q = Discharge (m^3/sec.)

C = Coefficient of Roughness

A = Cross-Sectional Flow Area (m^2)

R = Hydraulic Radius (m)

S = Slope of Energy Grade Line (m/m)

Domestic Demand

Domestic water demand shall be calculated on the basis of an average day consumption rate of 300 litres per capita per day for development, and 350 L/cap/day for existing areas more than 10 years old.

The maximum day and peak hour factors shall be determined from the current MOE design guidelines although the following are considered minimums:

Maximum daily demand factor: 1.60
Peak hourly demand factor: 4.5

Peak flows other than domestic flows shall be determined on an individual basis.

Commercial and Institutional Water Demands

An average day flow of 28 cu.m. /hectare/day shall be used for design purposes to estimate the water consumption for large commercial areas unless more specific data is available.

When specific planning information is available, water consumption for individual commercial and institutional sites may be calculated from the following table:

Use	Water Usage	
Shopping Centers	2500—5000	L/1000m^2/day
Hospitals	900—1800	L/bed/day
Schools	70— 140	L/student/day
Campgrounds	225— 570	L/campsite/day

When using the above unit demands, maximum day and peak rate factors shall be developed. For establishments in operation for only a portion of the day, such as schools, shopping plazas, etc., the water usage shall also be factored accordingly. For instance, with schools operating for 8 hours per day, the water usage rate will be at an average rate of say 70 L/student/day times 24 divided by 8 or 210 L/student over the 8 hour period of operation.

The water usage will drop to residential usage rates during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of peak demand rates, a fixture-unit approach shall be used.

The peak water usage rates in campgrounds varies with the type of facilities provided (showers, flush toilets, clothes washers, etc.) and the ratio of these facilities to the number of campsites. A peak rate factor of 4 shall be used. This factor shall be applied to the average expected water usage at full occupancy of the campsite.

Industrial Water Demands

The City, through its Planning Policies encourages the establishment of only those industries, which have low water consumption requirements. An average design flow of 36 cu.m. /hectare/day shall be utilized for design purposes to estimate the average consumption rate for industrial areas unless more specific data is available.

Fire Flows

The requirements for fire flows shall be discussed and agreed upon with the City prior to proceeding with detailed design.

In general, the minimum fire flow requirement for a particular structure or area of the municipality shall be as outlined by the MOE, Fire Underwriters Survey and NFPA 24.

4.4.3 Pipe Sizing and Specifications

4.4.3.1 Selection of Main Sizes, Pressures and Depth

For all water mains designed to carry fire flows, the following minimum sizing for water mains shall apply:

For Residential areas	150 mm diameter
For Commercial areas	200 mm diameter
For Industrial areas	300 mm diameter
	to be sized according to the anticipated water demand.

In general, the following standardized water main sizes shall be used in the City:

150 mm
200 mm
300 mm
400 mm
500 mm
600 mm

Depth of Water Mains

Curb and Gutter Roads - 1.70 m minimum to obvert, measured below finished centre line road grade.

Open Ditch Roads - The cover over the water main and the service connections shall not be less than 1.70 metres.

Unimproved Roads - 1.70 m minimum to obvert, measured below a future design centre line road grade.

Watercourses, Creek - Adequate frost protection shall be provided below stream bed. Generally 1.70 m minimum to obvert, measured below the watercourse invert shall be considered acceptable.

4.4.3.2 Location of Water Mains

Water mains shall be located as shown on the standard City road cross-section. This location shall generally be on the north or east sides of the street.

Horizontal Separation Between Water Mains and Sewers

Under normal conditions water mains shall be designed with a minimum clear horizontal separation of at least 3.00 m from any sewer or sewer maintenance hole. The distance shall be measured from the nearest edges of the pipes or structures.

Separations of Water mains and Sewers – Special Conditions

Under unusual conditions (where a significant portion of the construction will be in rock, or where congestion with other utilities will prevent a clear horizontal separation of 3.00 m) a water main may be laid closer to a sewer, provided the elevation of the crown of the sewer is a least 0.50 m below the invert of the water main. Such separation shall consist of in-situ material or compacted native earth backfill.

In rock trenches, facilities shall be provided to permit drainage of the trench to minimize the effect of the impounding of surface water and/or leakage from sewers in the trench.

Water Main Crossing Sewers

Under normal condition water mains shall cross above sewers with sufficient vertical separation to allow for proper bedding and structural support of the water main and the sewer main.

When it is not possible for the water main to cross above the sewer main, the water main passing under a sewer shall be protected as follows:

a) A vertical separation of at least 0.50 m shall be provided between the outside face of the sewer and the top of the water main.
b) The sewer shall be adequately supported to prevent excessive deflection of joints and settling.
c) The length of water main pipe under the sewer shall be centred at the point of crossing so the joints will be equidistant and as far as possible from the sewer. Water main pipe joints shall be located 1.5 metres (minimum) from the centreline of the sewer (both sides).

4.4.3.3 Utility Crossings

Water mains crossing over or under other utilities shall be designed with a 300 mm minimum clear separation between the outside edges of the water main and the utility.

4.4.3.4 Dead-Ends

Water distribution systems shall be designed in grid patterns or looped to avoid dead-end sections.

Temporary dead-ends on water mains to be extended in the future shall be equipped with a fire hydrant at the end of the temporary dead-end main. The fire hydrant shall be immediately preceded by a valve to facilitate the future extension of the water main without disruption to the existing users.

4.4.3.5 Extra Mains and Extra Fittings

No roadway leading out of a subdivision shall be completed and accepted by the City until connecting water mains are installed complete to the subdivision limits.

Extra fittings shall be installed at any point on the water mains requested by the City to provide for future connections.

4.4.3.6 Pipe Classification and Bedding

Acceptable materials for water main pipe up to and including 300 mm diameter are as follows:

- Polyvinyl Chloride Pipe (PVC) manufactured in accordance with the latest edition of CSA B137.3. A minimum Class 150, DR 18 pipe shall be used.
- Fittings shall be of cast iron or ductile iron; cement lined and shall be manufactured to AWWA C110. All fittings shall be supplied with mechanical joint ends.
- Polyethylene pressure pipe shall be to OPSS 1842.
- Copper pipe service connections shall comply with ASTM B 88 (Type "K" soft copper).

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Pipe bedding and cover shall be homogeneous granular material in accordance with OPSD requirements for flexible pipe.

The width of trench at the top of the pipe must be carefully controlled to ensure the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used.

Where poor soil conditions and high ground water levels are present, the Consultant shall prepare special designs for the City's approval.

4.4.3.7 Thrust Restraint

Adequate restraint must be provided at all fittings and deflections in the water distribution system to prevent pipe movement and subsequent joint failure. The Engineer shall provide thrust restraint calculations on the drawings.

Mechanically restrained joints or concrete thrust blocks in accordance with OPSD shall be used for all PVC water mains. The recommended type of restraint in the design will depend on anticipated soil conditions.

4.4.3.8 Corrosion Resistance

All ferrous fittings, tracer wires and copper water service connections shall have corrosion protection provided by means of sacrificial anodes.

Sacrificial anodes shall be in the form of packaged zinc anode or zinc anode caps and meet ASTM B-418-73-type II.

Anode caps are to be installed on every valve, hydrant and fitting connected to a non-ferrous water main. Anode caps (Protect-o caps) are to be installed on all bolts.

Fittings shall include bends, tees, crosses, sleeves, reducers, plugs, caps, joint restrainers and couplings etc.

4.4.3.9 Tracer Wires

A tracer wire shall be provided along the top of all Polyvinyl Chloride (PVC) water mains to permit future field tracing. These tracer wires shall be attached to the top of the water main and shall be looped inside each valve box, including hydrant valves and shall also be connected to the bottom flange of all hydrants. Tracer wires shall be No. 12 gauge stranded copper (TWH) complete with plastic coating.

4.4.3.10 Fire Hydrants

All fire protection design requirements shall be reviewed with the City at the preliminary design stage.

Branch Valves and Boxes

All hydrants installed on water mains up to and including 300 mm in diameter shall be installed with a 150 mm diameter branch valve attached to the water main with an anchor tee.

All hydrants installed on water mains greater than 300mm in diameter shall be controlled by a 150 mm diameter, branch valve directly secured to the supply main with flanged fittings or restraining tie-rods.

Fire hydrants shall be Canada Valve, Century No. 1 open left with 2 CSA hose ports, one 33 B pumper port and a breakaway type 6" MJ base. The hydrant lead shall be minimum 150 mm with resilient seated gate valve shut off "Open Left" by Clow or Mueller. The hydrants shall have all drain holes plugged and be installed as per OPSD 1105.010.

Hydrant Spacing

Hydrants shall be installed on all water mains 150 mm in diameter and larger with the following maximum allowable spacing:

- 150 m in residential areas, or to provide for a maximum hose length or 75 m.
- 90 m in industrial and commercial areas.

Location of Hydrants

Hydrants shall be located on the projection of a lot line and offset from the street line in accordance with the standard cross-section.

Hydrants shall be located 1.20 m minimum distance from the edge of any driveway or house service connection.

A hydrant shall be placed at the end of every cul-de-sac and dead end street as well as at the high points in roads.

Hydrant Ports

In all areas hydrants shall be equipped with 114 mm dia. Pumper ports and 2 - 64 mm dia. side ports.

Pumper port to face 90^{o} to fire access route.

Direction of Opening

All hydrants shall be equipped with a non-rising stem and shall open in a counter clockwise direction.

Colour of Hydrants

All hydrants shall be factory painted as specified on the standard detail drawings. The hydrant body shall be painted reflectorized yellow. For City Hydrants barrels are red, bonnet and caps primer. Private hydrants are yellow.

Hydrant Markers

Each hydrant is to be provided with a standard marker for easy identification in the winter.

4.4.3.11 Valves

Type

Gate valves shall be used on all water mains.

All valves shall be of the approved type with non-rising stem and a 50 mm square operating nut opening counter-clockwise.

All valves on water mains 200 mm in diameter and smaller shall have mechanical joint ends.

All valves larger than 300 mm in diameter shall be installed inside chambers and shall have flanged ends. A flange to plain end spacer and a Victaulic coupling shall be installed inside the chamber to permit removal of the valve if necessary.

Size

All line valves shall be the same size as the water main.

Number, Location and Spacing

Generally, three valves are required at a tee intersection and four valves are required at a cross intersection with the valves being located at a point where the street line projected intersects the water main. All valve boxes and valve chambers shall be located in boulevards and out of pavement areas wherever possible.

Line valves on distribution water mains shall be located so a maximum of 20 houses can be shut-off from another block and isolated from the system at any time. In no case, however, shall the valve spacing along a water main exceed 300 metres.

Valve Boxes and Chambers

All valves on water mains 300 mm in diameter and smaller shall have valve boxes and specified direct bury operators must be used.

All valve boxes shall be three-piece, sliding-type, size 'D'.

All valves on water mains 400 mm or larger in diameter shall be installed within concrete chambers set flush with finished grade. The top of the roof slab of valve chambers shall be at least 0.60 m below the profile of the finished pavement.

Air Relief Valves

Air relief valves shall be installed at all significant high points of the water distribution system.

Air relief valves shall be double-acting type, combination air release/vacuum valve.

Air relief valves shall be housed within a chamber as illustrated in the Standard Detail Drawings, and drained to storm sewers where possible. The chambers are to be equipped with "P" traps to prevent movement of gasses.

Drain Valves

Drain valves shall be located at the low points of all water mains 400 mm in diameter and greater. These valves shall be constructed in a separate chamber as illustrated in the standard detail drawings.

4.4.3.12 Service Connections

Individual service connections shall be installed to each unit within the development. Semi -detached lots shall be provided with two separate water service connections.

Minimum Sizing

The minimum size of service connection to be provided for a single-family residence located less than 30 metres from the supply main shall be 19mm in diameter.

For single family residences located between 30 metres and 60 metres from the supply main, the minimum size of service connection permitted shall be 25 mm in diameter.

For other situations requiring a specific evaluation, the following factors shall be used to determine the minimum size of service connections:

- peak water consumption of the building to be serviced.
- total length of service required to reach the building.
- elevation of the building with respect to the elevation of the water main.
- available head in the water main.
- loss of head in the service connection.
- required head at the point of water usage.

Location

Water service connections shall be installed to the mid-point of the frontage of all single family lots as shown on the Standard Drawings.

The location of water service connections for semi-detached lots and freehold townhouses shall be as shown on the Standard Drawings to avoid locating the service under the driveways.

After construction, the end of the connection shall be marked by a suitable length of 50 mm x 100 mm lumber extending from the end of the connection to a point 0.9 m above grade. The top of this marker shall be painted blue.

Location of Curb Stop or Control Valve

The curb stop on all water service connections 50 mm in diameter and less shall be located at the street limit as shown on the Standard Drawing.

The control valve on water service connections 100 mm in diameter and larger shall be located at the supply main with the valve secured to the supply main by means of anchor tees, flanged fittings or approved restraining tie rods, as illustrated on the standard detail drawings.

Water service valve boxes shall not be located in driveways. In the event the designed driveway and water service box locations conflict as a result of the final house siting, the water service box shall be moved to a location to the satisfaction of the City.

Connection to Supply Main

Water service connections 50 mm in diameter and smaller may be tapped into the supply main with the following restrictions:

a) For PVC water mains, a stainless steel saddle shall be used for all connections.

b) The maximum size of connection that can be direct tapped into a 150 mm water main is 32 mm in diameter. Larger sized service connections shall be connected by a cast iron fitting factory-tapped for the required service connection size.

Water service connections 100 mm in diameter and larger shall be made by installing a tee on the supply main.

Service connections for industrial, commercial, institutional or multiple dwelling uses will be considered on an individual basis. Fire connections may be required for industrial, commercial, institutional or multiple dwelling lots.

Materials and Fittings

As specified by the City of Orillia. See "Material Specifications for Water main and Appurtenances", Section 8 Item #6.

4.4.5 Testing and Acceptance

Connections to existing water mains or water service connections shall not be made until the new water main has been tested, swabbed, chlorinated and flushed to the satisfaction of the City and written permission is received from the City.

Hydrostatic testing and disinfection of the entire water main system, including service connections to the property line and hydrants, shall be performed in accordance with ANSI/AWWA C651-99 (or latest requirements) and MOE Regulations, or NFPA 24 for designated private fire lines, prior to acceptance of the system as substantially performed.

A neutralizing chemical shall be applied be in accordance with American Water Works Association Standards (ANSI / AWWA C651-99".

The Contractor will be required to have three consecutive successful tests (zero E-Coli, zero total coliform and background colony counts of less than 200) on 3 consecutive days of the water main before the water main shall be considered passed.

The Contractor shall do all sampling in accordance with the Drinking Water Systems O.Reg 170/03 under the supervision of the City of Orillia representative.

4.5 Roadways

4.5.1 Street Classification

All roadways in new developments shall be classified according to the traffic volume expected and to the intended use of the roadway. For predominantly residential areas 2 classifications shall be noted as follows: Local, or Collector. For industrial areas the streets shall be classified Local or Collector dependent upon length of street, traffic volume expected and expected amount of truck traffic. Arterial roadways shall be classified as divided or undivided. The proposed classification of all streets in the development shall be confirmed with the City prior to the commencement of the design.

The following table is presented as a guide to the determination of the street classification.

CRITERIA	LOCAL	COLLECTOR	ARTERIAL
Source Provided	Land Access	Land Access	Traffic
Movement	Traffic Movement	Transit Routes	Transit Routes
Length of Trip	Short	Medium	Long
Flow	Interrupted	Interrupted	Through
Interconnections	Local	Local Collector	Collector
Arterial	Collector	Arterial	Freeway
Estimated A.A.D.T.	0—1,000	1,000—3,000	over 3,000

4.5.2 Geometric Design Requirements

- Table 1 -

	Road Classification									
	Residential				Industrial				Arterial	
	Local		Collector		Local		Collector		4 Lane	5 Lane
Design Element										
ROW Width (m)	20.0		23.20		23.2		26.0		30.0	30.0
Road Width (m) (face of curb)	8.5		10.66		10.66		8.0		14.0	18.60
Design Speed (km/h)	50		60		50		60		80	100
Posted Speed (km/h)	50								60	60
Stopping Sight Distance (SSD)	65		85		65		85		135	185
horizontal curve radius (m)	90		130		90		160		340	440
Maximum grade (%)	8		8		8		8		8	8
minimum grade	0.5		0.5		0.5		0.5		0.5	0.5
vertical curve - minimum 'K'										
crest curve	8		15		8		15		35	70
sag curve - unlit	12		18		12		18		30	45
sag curve - illuminated	5		12		8		12		15	25
cross fall from centreline	2 %									
Standards at Intersections										
	Intersecting Roads									
Design Element	local - local	local - collector	collector - collector	collector - arterial	arterial - arterial					
intersection angle (degrees)	70-110	70-110	70-110	80-100	80-100					
curb radius - minimum (m)	5	7.5	10	15	18					
daylight rounding - min. (m) ***Note 1***	5	5	*	*	*					
Max grade for through road (%)	3.5	3	3	2	2					
tangent on approach (from limit of daylighting) - min (m)	30	50	60	75	75					
NOTES:										
1. daylighting requirements for all other intersection types shall be designed by the Consultant according to each particular situation										

4.5.1.1 Horizontal Curves

Horizontal alignment is to conform to the requirements as outlined in Table 1. In general, “right angle bends” will not be permitted on local streets except in the case of “Courts” or “Crescents” serving no more than 50 residential lots. Where permitted, these bends must not have a deflection angle greater than 110 degrees.

4.5.1.2 Vertical Curves

All points of grade change in excess of 1% shall be designed with vertical curves as outlined in the current Ministry of Transportation of Ontario publications. The minimum visibility curves to be used are outlined in the geometric details for each roadway classification in Table 1. The minimum tangent length of any road grade shall be 9 metres.

4.5.1.3 Backfall at Intersecting Streets

At all street intersections the normal crossfall of the major street shall not be interrupted by the crown line of the minor street. A 1 to 2 per cent backfall shall be provided on the minor street at all street intersections. This backfall shall continue to the end of the curb return radii to facilitate proper drainage of the intersection. Overland flow routing of storm drainage through the intersection must be maintained.

4.5.1.4 Curb Return Radii at Intersections

The curb return radii at street intersections shall conform to the dimensions presented in Table 1.

4.5.1.5 Daylighting Requirements at Intersections

Daylighting at all intersection quadrants shall be included in the road allowances to provide for uniform boulevard widths. Such daylighting shall be included on the proposed plan for Registration (M-Plan) and on all engineering drawings.

For local roads intersecting local roads, the minimum daylighting requirement shall be a radius of 5 metres. For all other intersections, the size of the daylighting or visibility triangle is a function of the number and width of lanes, the various design speeds on the intersecting roads and the R.O.W. widths on both roads. The Consulting Engineer shall submit detailed calculations for sizing of daylighting triangles at these intersections in accordance with the design criteria prepared by the Ministry of Transportation Ontario, Chapter E (at Grade Intersections).

4.5.2 Cul-de-Sacs

Permanent cul-de-sacs shall be constructed in accordance with the details provided in the standard drawings and shall be designed with a minimum grade of 1% from the centre of the bulb to the curb.

Minimum gutter grades of 1% shall be maintained along the flow line of all gutters around the cul-de-sac. The design road grade on the cul-de-sac shall be such that the drainage is directed away from the end of the cul-de-sac and towards the beginning of the bulb area where catch basins are to be located. All cul-de-sacs, bulbs and intersections shall be detailed at a scale larger than the road plan. The details shall show gutter, crown and other grades sufficient to determine that the road will properly drain and shall be used as a basis for layout.

Temporary Turning Circles

Temporary turning areas will be considered whenever a road is to be continued in the future in a phased Plan of Subdivision. Details for the requirements of temporary turning areas are provided in the Standard Drawings.

4.5.3 Driveway Entrances

Location of Driveway Entrances

New driveway entrances may be permitted for existing lots where no driveway entrance has previously been provided, subject to the restrictions of this guideline and the City of Orillia Engineering Design Criteria.

New driveway entrances may be permitted to replace existing driveway entrances, provided they establish superior standards over existing conditions.

Multiple Driveway Entrances

Corner-lot properties may have two driveway entrances, limited to one driveway entrance per frontage.

For lots with a frontage exceeding 33 metres, a circular driveway entrance may be permitted. The minimum separation distance between two driveway entrances on the same lot crossing the same lot line, measured at the property line, shall be:

- 9.0 metres for access to an arterial road.
- 15.0 metres for access to a local road or collector road.

Restrictions on Driveway Entrance Locations

The following locations are not permissible for new driveway entrances or widening of existing driveway entrances onto a City of Orillia Right of Way:

- Within a Plan of Subdivision, such as Westridge, Stoneridge.
- Within 20 metres of a signalized intersection from curbline of intersecting street.

- Within 20 metres of an intersection of a Collector Road, Arterial Road, or Provincial Highway.
- Within 15 metres of an intersection from curbline of intersecting Local Road.
- Within 15 metres of a bridge termination.
- Within 15 metres of an at-grade railway crossing.
- Within 30 metres of a roadside guardrail treatment.
- Within 1.5 metres of an existing driveway entrance edge for residential.
- Within 3.0 metres of an existing driveway entrance edge for commercial and industrial uses.
- Driveway cuts shall be located at a minimum distance of 1.0 metre from any side lot line.
- Within exclusive lanes for channelization, acceleration, or deceleration.
- Where minimum stopping sight distances, as determined by the TAC Design Guide, are not met.
- Where the entrance obstructs or interferes with City-approved on-street parking spaces.
- When reviewing an application, the General Manager or designate shall consider,
    - Any potential adverse effect on public health and safety
    - Any potential inconvenience to the public.
    - Any concerns for the deposit of persons or property

Driveway Entrance Design

Driveway entrances and aprons must be finished with materials such as asphalt, paving stones, impressed concrete, or other durable hard surfaces to the satisfaction of the Director of Engineering or designate.

The municipal sidewalk and roadway curb must be continuous through all driveways.

Driveway entrances must be set flush with the top of sidewalk elevation within 300mm of either side of the sidewalk.

If there is a need to provide parallel parking between driveway entrances along the roadway, a spacing of 6.5 metres is required.

The minimum distance of a driveway to the face of a utility shall be as follows:

- Hydro Pole/Signal - 1.0 metre
- Pole/Light Standard Fire Hydrant - 1.5 metres
- Communications Pedestal - 1.0 metre (Telecommunication utilities)
- Hydro Transformer - 2.5 metres

Construction Requirements

The Developer/Contractor/Landowner is responsible for the grading, gravelling and the paving of all driveways from the curb to the streetline or to the sidewalk where sidewalks are proposed within the development.

The minimum consolidated depth requirements for the granular base and asphalt in driveways shall be as follows:

Driveways with Curbs

a) Single-Family Residential
- asphalt 50 mm of HL3 asphalt
- granular base - 300 mm of Granular "A"

b) Commercial, Light Industrial and Apartments
- asphalt - 50 mm HL8 base course
  - 40 mm HL3 surface course
- granular base - 300 mm Granular "B" plus 150 mm of Granular "A"

c) Heavy Industrial Driveways
- asphalt - 75 mm HL8 base course
- 40 mm HL3 surface course
- granular base - 300 mm Granular "B" plus 150 mm. of Granular "A"

Alternate types of driveways (i.e. paving stones, concrete pads, etc.) will be subject to approval by the City.

Driveway Approaches with Open Ditches

The Developer is responsible for the grading, gravelling and paving of all driveways from the edge of pavement of the roadway to the street line.

The minimum consolidated depth requirements for the granular base and asphalt in residential driveways shall be as follows:

- 300 mm Granular "A"
- 50 mm HL3 asphalt

The minimum consolidated depth requirements for the granular base in commercial, industrial and apartment driveways shall be as follows:

- 300 mm Granular "B"
- 160 mm Granular "A"
- 50 mm HL8 base asphalt
- 40 mm HL3 surface asphalt

Driveway Entrance Grades

Driveway entrance grading shall be in accordance with OPSD 350.010 for industrial, commercial and apartment entrances and OPSD 351.010 for residential entrances.

Maximum grades are not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grades.

The minimum driveway entrance grade shall be 0.5%.

The use of negative grade driveway entrances is actively discouraged. Negative sloping driveway entrances will only be considered in estate residential developments under special circumstances. Where negative sloping driveway entrances are used, a positive slope of at least 2.5 % must be maintained from the garage over a minimum distance of 10.0 metres.

Driveway Entrance Depressions

The width and location of the depressions in the curb and gutter for single-family residential driveway entrances shall be as detailed on OPSD 351.010 with particular attention being placed on the location of the garage and the direction of traffic flow.

Driveway cuts shall be located at a minimum distance of 1.0 metre from any side lot line.

Driveway entrances depressions are to be placed when concrete curb and gutter is initially poured. Double driveway entrances depressions are to be placed for all single-family residential lots.

The width and location of the driveway entrance depressions for apartment, commercial, and industrial driveway entrances shall be as detailed on OPSD 350.010. These driveway entrances shall be designed to accommodate the anticipated vehicular traffic without causing undue interference with the traffic flow on the street.

All apartment, commercial and industrial driveway entrances shall be provided with barrier curbs constructed to blend into the roadway curb and gutter.

Culverts

The minimum length of each residential C.S.P. driveway culvert shall be 7.0 metres and the minimum diameter shall be 400 mm. The maximum length of residential driveway entrance culverts shall be 9.0 metres. The maintenance and repair of such culverts shall remain the responsibility of the Developer/Land Owner until such time as the Works have been accepted by the City.

Culverts shall be backfilled with a minimum compacted base of 150 mm of 19 mm limestone and cover of 300 mm of 19 mm limestone.

The construction of driveway entrance headwalls at each end of the driveway culvert will not be permitted, unless otherwise approved by the City.

A 3.0 metre wide platform area shall be constructed in the ditches fronting each fire hydrant. The minimum culvert length shall be 6.5 metres and minimum diameter shall be 400 mm.

4.5.4 Special Road Works

Whenever it is necessary to cut through an existing City road, the Developer will be responsible for properly compacting the backfill material and restoring the surface pavement to its original conditions immediately upon completion of backfilling operations.

Before making detours, permission is required from the City of Orillia Public Works Department. Where the road is not part of the City road system, approval from the appropriate road authority will also be necessary. In all cases the Fire, Police Departments, School Bus Companies and Ambulance Service must be notified by the Developer or his Contractor.

All work shall be done in accordance with By-laws of the City.

4.5.5 Pavement Design (Roadways)

In general, pavement design shall be completed by the geotechnical consultant in accordance with the most recent City of Orillia Standards, OPSS and OPSD.

The minimum pavement design for all streets in new subdivisions shall be as detailed on the Standard Drawings. In all cases, a qualified Geotechnical Consultant shall be engaged by the Developer to sample, test and design a suitable pavement section for each particular site. Soil sampling shall be carried out in the presence of the Geotechnical Consultant at intervals not exceeding 40 metres along the centreline of the subdivision road. The composition and design thickness of the pavement section shall be determined from:

1) Mechanical sieve analysis of the subgrade soil;
2) Frost susceptibility;
3) Drainage; and
4) Traffic volumes.

Copies of all test results and proposed road designs shall be submitted with the Engineering Drawings. In no case will a pavement design less than the minimum City of Orillia Standard as shown on the standard drawing for the particular road classification be considered acceptable.

Prior to the placement of asphalt pavement, the Consulting Engineer must submit to the City for approval, the asphalt pavement mix designs. The pavement design must be sufficient to provide for ultimate wheel loads over the road, prior to placement of surface course asphalt.

In all cases:

- base course asphalt shall be O.P.S.S. HL4 or HL8 with a minimum insitu A.C. content of 4.5%;
- the wearing course of asphalt shall be:

- for Local Roads, Collector Roads and Industrial Roads - O.P.S.S. H.L3;
- for Arterial Roads O.P.S.S. HL1.

- O.P.S.S. Granular 'A' and Granular 'B' materials shall be used for road construction.
- For new subdivision roads, City of Orillia standards for crushed Granular B to be used. Refer to Typical General Notes for Roads (Section 4) for required gradation.

4.5.6 Top Course Asphalt Placement

Prior to placement of top course asphalt, the following works must be completed:

- all sidewalk, curb and boulevard work;
- raise maintenance hole and catch basin frames;
- install delineation for raised frames 40 mm above asphalt lift;
- flush and sweep surface and evenly apply tack coat;
- base course asphalt pad as required in accordance with OPSS;
- final sewer video inspection;
- place top course asphalt in accordance with OPSS.

The following conditions must also be met:

a) A minimum period of one year has expired from the completion date for the placement of the base course asphalt;
b) 85% of the dwellings have received unconditional Occupancy Certificates.
c) All undeveloped lots are rough graded in accordance with the approved lot grading plans;
d) All service connections for multiple-family, commercial, institutional or other blocks are installed; and
e) The approval of the City is obtained in writing.

4.5.7 Curbs and Gutters

Where constructed to an urban cross-section, new City streets shall be constructed with mountable curb and gutter to OPSD 600.060 on local roadways and barrier curb and gutter to OPSD 600.070 on collector or higher order roadways. Prior to final acceptance all curb blemishes will be rectified by removing a minimum 1 m section of curb and replacing.

A driveway entrance is required for each lot. Curb depressions are required at each intersection as per OPSD 310.030.

A minimum of 300 mm of Granular 'B' material compacted to 95% Standard Proctor Density will be required as a base for all curb installations.

Minimum grade on curb is 0.75% desirable, 0.5% absolute minimum.

4.6 Street Name and Traffic Signs

4.6.1 Plan

The proposed location and type of all street name and traffic control signs shall be shown on Plan and Profile Drawings.

Location

Street name signs shall be placed at each intersection and shall identify each street at the intersection. The location of the street name signs are shown in the City of Orillia Standard Drawing.

4.6.2 Street Name Signs

All street name signs will be supplied and installed by the City with all costs charged to the Developer.

4.6.3 Traffic Control and Advisory Signs

Location

Traffic control and advisory signs shall be located as shown on the City of Orillia Standard Drawings. In cases where the positioning of the signs is not covered by the standard drawings, the location must be in conformance with the Ontario Traffic Manuals or the Highway Traffic Act Regulations for Ontario.

All signs, with exception of "Parking" signs, shall be mounted approximately at right angles to the direction of and facing the traffic they are intended to serve. On curved alignments the angle of placement should be determined by the course of the approaching traffic rather than by the roadway edge at the point where the sign is located. Signs for different purposes should not be placed closer together than 30 m.

Parking signs shall be mounted facing 30 – 45 degrees to the flow of traffic.

Type

All traffic control and advisory signs shall conform to the current revised standards of the Ontario Traffic Manuals.

Erection

All traffic control signs shall be mounted on galvanized steel punch out type or uniflange type posts, 3.65 m. in length. Channel posts shall be a minimum 14 gauge thick and a minimum width of 45 mm. The posts shall be pre—punched with a minimum of 24 holes at 50 mm centres compatible with standard bolthole arrangements for traffic control signs. Signs shall be individually erected on

separate posts.

Traffic control signs must be erected by the Developer at the completion of the base course asphalt road construction and prior to the issuance of Building Permits. Signs must be maintained by the Developer until “Final Acceptance” by the City.

Upon completion of base course asphalt, the Developer shall place signage at each point of ingress/egress to the subdivision stating the following:

“THIS ROAD UNASSUMED BY THE CITY OF ORILLIA USE AT OWN RISK”

Each sign shall be 450 mm wide by 600 mm high with black letters on white reflectorized background, mounted on “U’ channel posts, 3.65 metres in height.

4.7 Roadway Markings

The Developer will design pavement markings for all roadways over two lanes in width or as required by the City. The design shall be in accordance with the Ontario Traffic Manual, Book 11 and approved by the City. These pavement markings will be installed on both the topcoat of asphalt and the base coat of asphalt. The Developer shall be responsible for stop bars on roadways up to two lanes in width. All roadway markings shall be installed in accordance with OPSS 532.

4.8 Traffic Signals

Traffic Signals are to be designed on individual site-specific bases and in accordance with the Ontario Traffic Manual, Book 12.

4.9 Streetlighting

Streetlights are required for all roadways and most walkways in the City as described in the Official Plan, and other locations as directed by the City. Systems are the responsibility of the Developer to design and construct. Streetlight system designs shall be prepared by an Electrical Consultant engaged by the Developer and submitted to the City for approval. The illuminance method as outlined in the American National Standard Practise for Roadway Lighting ANSI/IES RP-8-00 (R2005) or latest edition is to be used as a guideline.

The Developer shall arrange with Orillia Power Corporation (OPC) or Hydro One for the connection of all lighting systems. The estimated cost of the total installation must be approved by the City. The Developer shall provide easements wherever they are required.

4.9.1 Street Light Locations

Poles shall be located at a maximum spacing of 45 m.

Where possible, pole locations are to be placed on the projection of side lot lines. Where super mail boxes are proposed within a plan of subdivision, street lights must be located immediately adjacent to the super mail boxes.

Adequate illumination at all intersections must be provided.

No street lights should be placed within 3.0 m of a transformer.

Staggered arrangement of luminaire poles is not acceptable.

On curving roadways, lights are to be placed on outer radii where possible with spacing to be reduced by 30%.

Proposed lighting levels adjacent to Provincial and County roads are to be reviewed and approved by the appropriate road authority.

4.9.2 Light Source, Fixture and Pole

All luminaires shall comply with all applicable requirements of CSA Standard C22.2 No. 9, “General Requirements for Luminaires”.

For local roads, luminaires shall be a minimum 100 Watt High Pressure Sodium lamp, manufactured by Durastar (Series 20).

Landmark luminaires of appropriate wattage are to be used on collector and arterial roads.

Each light shall be controlled by a dusk to dawn photo electric cell.

For local roads poles for 7.60m mounting height are to be direct burial type round concrete Stresscrete #TEC-30-BPR-CSA “Concrete Poles” complete with 3.0m aluminum tapered elliptical arm, made by Sylvania or equivalent, 100mm by 175mm handhole and cover, ground lug at the handhole and two below grade wiring apertures as per City of Orillia Standard.

Stresscrete or approved equal poles of appropriate height and class, with tapered single elliptical aluminium arms of appropriate length, are to be used on collector and arterial roads.

4.9.3 Approval and Construction

Approval of plans for streetlighting must be obtained from the City. Electrical Safety Authority (ESA) approval for the installed street lighting system must be obtained by the developer. The Developer must guarantee and maintain the lighting until final acceptance of the development. The City, upon energization of the streetlighting, will pay energy charges.

4.9.4 LED Streetlighting

Under Review by Public Works.

4.10 Pedestrian Ways

4.10.1 Sidewalks

The location requirements for sidewalks in new subdivisions shall be confirmed with the City prior to commencing the detailed design. In general, sidewalks are required on both sides of all arterial and collector roadways and at least one side of all local streets. For local roadways, the locations of schools, parks, churches, commercial establishments etc., the length of street, traffic volume expected and the number of dwelling units serviced will be used as criteria in determining whether sidewalks are required on one or two sides of the street.

The sidewalk shall conform in details and dimensions to the current Standard Drawings and shall be installed at locations as shown on the typical road cross sections. The width of sidewalks for streets is 1.50 m.

The sidewalks shall be increased in thickness at all driveway locations as shown on the Standard Drawings. In cases where the sidewalk has been constructed prior to the establishment of an entrance to other than a single-family residence then the existing sidewalk shall be removed and shall be replaced with a thickened sidewalk section (min. 200 mm) in accordance with OPSD 310.010.

At street intersections the curb and the sidewalk shall be depressed to meet the roadway elevation as shown on OPSD 310.030.

When a sidewalk is constructed adjacent to a curb and gutter a keyway shall be provided along the back of the curb to support the sidewalk, all in accordance with the details shown on OPSD 310.020.

The City requires all concrete sidewalks be constructed as indicated on the approved Engineering Drawings, prior to the release of the first conditional or unconditional Occupancy Certificate in accordance with the City's Subdivision Agreement, and in any event no later than one (1) year after the completion of base course asphalt.

4.10.1.1 Location

Sidewalks shall be constructed locations as shown on the City's Road Cross-Section Standards. Where there are no other determining factors dictating location, sidewalks shall generally be placed on north and east sides of the street. Streetlight poles, when not staggered, should be located on the same side as the sidewalk. Local roads shall have, as a minimum, a sidewalk constructed on one side of the right-of-way and Arterial/Collector Roads shall have sidewalk on both sides.

4.10.1.2 Specification

Sidewalks shall be constructed according to OPSD 310.010, 310.020, 310.030, 350.010, 351.010 and OPSS 351. Concrete sidewalks shall be placed on a minimum 150 mm compacted granular A base.

4.10.2 Trailways

The Developer may be required to design and construct a trail system or pathways and linkages to existing trail systems. Pathways will be required adjacent to parkland, in general. Walkway easements adjoining parallel roads or acting as service access shall be fenced, gated, signed and planted according to City standards. The provision of new trails shall support a City wide trails network.

The City's trails network shall generally be comprised of the following:

- multi-use urban cycle trails, 3.0 m width (hard surface, multiple user);
- multi-use rural soft surface trails, 3.0 m width (crusher fines, multiple users);
- greenway trails, 2.0 m width (soft surface, 4-season multi-use trails);
- snowmobile trails;
- road-based cycle routes.

Proposed trails should link together local points of interest, all open space amenities, and civic institutions and connect to the regional trails network. To the extent possible the route should utilize public open spaces, unopened right-of-ways, blocks and easements away from roadways. In the event trails are located along roadways additional right-of-way width may be required by the City.

Trails connecting through urban areas located within the road right-of-way should be paved multi-purpose cycle ways.

Trails through sensitive natural features should be designed as soft surface paths and located to avoid fragile areas.

Entrance points to the trail system should be marked with signage coordinated with the City.

- The minimum standard for the multi-use urban trail shall be:
- 3.0 m width, of 150 mm concrete;
- 30 MPa with 6-8% entrained air;
- 200 mm granular A base compacted to 95% SPDD;
- broom finish with tooled edges and control joints.

4.11 Fencing

Fencing shall be in accordance with the most recent requirements and specifications of the City as shown on the standard drawing, 72-STD-14.

Fencing is required:

- along side yard flankage and/or rear yards backing onto roadways unless noise attenuation barriers are required;
- along public walkways In accordance with City Standards;
- as designated by the City Engineer;
- acoustic fencing per approved report.

The minimum requirements for residential chain link fence heights are in accordance with the following:

Adjacent Land Use	Fence Height (m)
Parklands/Woodlots	1.8
Public Walkways	1.2 in front of dwellings
	1.8 between dwellings and rear yards
Pools	as per OBC

All chain link fencing shall be galvanized.

4.12 Lot Grading

4.12.1 General Requirements

The grading of all lots and blocks in new developments must be carefully monitored by the Consulting Engineer in order to provide sites suitable for the erection of buildings and to provide satisfactory drainage from all lands within the development. In this regard, the design of the grading for all developments will be of primary concern to the municipality and the following criteria shall be used in the preparation of all lot grading plans for new development in the City.

All lot drainage shall be designed to conform to the Stormwater Management Report, overall Lot Grading Plan for the subdivision and City standards. The Developer shall be responsible for performing the grading of lots to the satisfaction of the City.

4.12.2 Drawing Requirements - Residential

Prior to application for a building permit, individual lot grading plans for each lot shall be approved by the Developer's Consultant prior to submission to the City. Three (3) copies of the lot grading plans shall be provided to the City and display the following information:

1. Lot description including Registered Plan Number.
2. Geodetic site benchmark as shown on approved Engineering Drawings.
3. Dimensioned property limits and house outline location with all setbacks shown.
4. House type; normal, side split, back split, etc.
5. Finished first floor elevation.
6. Finished garage floor elevation.
7. Finished and original grades over septic tile beds.
8. Finished basement floor elevation (all locations).
9. Elevation of underside of footings.
10. Top of foundation wall (all locations).
11. Existing and proposed lot grades for each of the corners of the lot and intermediate points of grade change.
12. Existing trees to be maintained.
13. Driveway locations, widths and proposed grades.
14. Finished road grades adjacent to lot.
15. Location of house entrances.
16. Location of rainwater downspouts.
17. Location of walkways.
18. Arrows indicating the direction of all surface drainage and swales.
19. Location and elevation of swales.
20. Patios, decks and/or porches.

21. Terraces, retaining walls and tree wells.
22. Location and dimensions of all easements.
23. All yard catch basins with rim and invert elevations.
24. Curb cut locations.
25. Hydrants, street lights, Bell and cable TV pedestals, hydro transformers.
26. Location and type of any private sewage disposal system and reserve areas and private wells.
27. Location of all road features along frontage and flankage of lots (curb lines, catch basins, sidewalks, etc.).
28. Lot grading certificate by Developer's Engineer in accordance with the Subdivision Agreement requirements.
29. Proposed driveway culverts with size, type, invert and slope information.
30. Number of front and rear entry step risers.
31. Engineered fill level is to be shown where applicable.

Prior to a building's superstructure proceeding, the Developer's Engineer or OLS must certify the final footing and foundation elevations conform to the site grading plans and the Building Code.

4.12.3 Certification

Prior to pouring building footings, an Ontario Land Surveyor must install survey pins in order to accurately locate the foundation.

Prior to the release of any lot from the conditions of the Subdivision Agreement, the Developer's Consulting Engineer shall provide certification to the City the grading and drainage of each lot is in accordance with the approved lot grading and drainage plans.

This certification is to include that:

- the lot grading plan conforms to the storm drainage plan. Plan and certificate are to be submitted with the building permit application;
- the final footing and top of foundation are in conformance with the certified grading plan (Tolerance 100 mm);
- the final grading for each lot conforms to the individual lot grading plan.

If the final grading differs from the approved lot grading plan, the Consulting Engineer shall provide details of the variance from the approved plans and shall include his recommendations for rectification of the area if required.

A site inspection shall be arranged by the Consultant, with the City Engineer, to review the grading of lots after completion of sodding.

4.12.4 Lot Grading Design - Residential

The specified lot grade shall be calculated in accordance with the Lot Grading Detail Sections included in the City of Orillia Standard Drawings.

The front yards of all lots shall be graded to drain towards the street.

Rear to front lot grading is preferred and a maximum of three rear lots shall outlet between any two lots.

All boulevard areas shall be graded with a constant slope from the curb to the street limit (minimum slope to be 2%, maximum slope to be 5%) and all water boxes, maintenance hole covers, valve boxes, etc. shall be set flush with the finished sod surface.

Driveways shall not be used as outlets for any swales.

All rear yard drainage shall be directed away from the houses in defined swales which outlet at the curb, sidewalk or a rear yard catch basin. Overland flow routes must be provided for all rear yard catch basins which will protect all structures in the event of catch basin blockage or a major storm event.

The drainage from all the lands within the subdivision limit is to be provided for internally with drainage over abutting lands being permitted only in exceptional cases at the discretion of the City Engineer.

The grading along the limit of the subdivision shall be carefully controlled to avoid disturbance to the adjoining areas. In general, lot drainage should be directed away from top of banks or valley slopes.

The lot grading design shall provide for drainage problems on adjacent property that can be best resolved by permitting drainage through the subdivision.

All lot surfaces shall be constructed to a preferred minimum grade of 2.0%, and absolute minimum of 1%.

All lot surfaces shall be constructed to a maximum average lot grade of 12% (calculated from the difference in lot elevations between the rear wall of the house and property line - embankments included). A minimum of 6 metres adjacent to the rear of the house shall be graded at 2% - 5% slope.

Maximum slope between all terraces and embankments shall be 3:1 when the vertical difference does not exceed 1 metre and 4:1 when the vertical differences exceed 1 metre. Between successive terraces, an intermediate level area of at least 1.50 metres in width must be provided.

The lot grading design shall provide for the temporary drainage of all blocks of land within the subdivision intended for future development under site plan agreements or park development plans.

The maximum flow allowable to any side yard swale shall be from the equivalent of three lots or 0.5 hectares, whichever is less.

The maximum area contributing to a rear yard swale discharging directly onto a road allowance shall be the equivalent of three rear yards or 0.50 hectares, whichever is less.

Swales providing internal drainage from each lot shall have a minimum slope of 1.0%.

Minimum depth of any swale to be 150 mm.

Maximum depth for a rear yard swale to be 750 mm.

Maximum depth for a side yard swale to be 450 mm.

Maximum side slope on any swale shall be 3:1.

All drainage swales shall be located on lot lines unless the adjacent property is not undergoing development. In such cases drainage swales shall be located entirely within the lot being developed.

Each lot shall have at least one side yard with a maximum slope of 2% for 1.5 m continuous width from front to rear yard;

The grade around houses shall be a minimum of 2% away from houses from a point 150 mm below top of foundation wall or as required by OBC.

Generally, rear yard catch basins shall be eliminated wherever possible. When required, rear yard catch basins and outlet pipes shall be located entirely on the same lot. In general, rear yard catch basins shall be located 2.0 metres from the lot line.

Driveway grades shall be designed and constructed at a minimum of 2% and maximum of 6% grade. Driveway locations shall not extend beyond lot line projections within the right-of-way.

4.12.5 Sodding

The subdivision shall be sodded according to the following:

- all swales, ditches, drainage easements, and slopes 10% or greater shall be sodded using 100 mm top soil and No. 1 nursery sod;
- all residential lots shall have a minimum of 100 mm top soil and sod, rear and front;
- where the combined side yard between buildings is less than 1.5 m the surface treatment shall be 75 mm of clear stone over a vegetation suppressing geotextile.

4.12.6 Retaining Walls

Retaining walls shall be constructed according to the following:

- where retaining walls are required they shall be constructed on the higher lot so the wall and tie-back do not cross property lines;
- retaining wall design and construction shall be certified by the Engineer, in accordance with OBC requirements;
- retaining walls shall be constructed entirely on private property, not on property to be assumed by the City;
- retaining walls shall comply with the City's Bylaw requirements.

4.12.7 Area Grading

4.12.7.1 General Requirements

Where earth cuts and fills in excess of 400mm are required within the lots and blocks of the new development, area rough grading must be performed prior to road construction.

In general, blocks intended for future development, such as institutional and commercial uses, shall be graded to preliminary grades and drain appropriately, compatible with adjacent roadways and abutting properties and complete with appropriate re-stabilization and erosion and sediment control measures as described in this document.

4.12.7.2 Drawing Requirements

Drawing size: (594 x 841 mm) AI

Scale: 1:1,000 for single-family (Rural)
1:500 for single-family (Urban)
1:200 for multi-family areas.

All lots and blocks within the subdivision are to be shown and are to be numbered in accordance with the plan proposed for registration.

Existing contours are to be shown at maximum 0.5 m intervals.

The area rough grading plan must identify all areas where the depth of fill sections and cut sections are in excess of 400 mm.

4.12.7.3 Construction Requirements

Prior to commencing rough grading, the Developer must implement the approved erosion and

sediment control plans as outlined in this document.

Where the proposed grading plan identifies fill over registered lots, 'Engineered Fill" shall be placed and supervised by the Consulting Engineer.

All block grading shall conform to the storm water management report. The Developer shall be responsible for the grading of blocks until assumption of the subdivision.

The Developer and his Consultant shall be responsible for approval and certification of the following:

- certification the block grading plan conforms to the storm drainage plan. The block grading plan and certification shall be submitted with the building permit application;
- certification of the final grading for each block conforms to the storm drainage plan and the block grading plan.

4.13 Easement and Block Requirements

4.13.1 General Requirements

The City shall require conveyance of easements or dedication of blocks, without consideration and free and clear of all liens and encumbrances, to the minimum width requirements, or greater as determined by the City Engineer, in the following circumstances:

Easement Dedications

Rear and side yard swales designed to convey external or municipal drainage.

Rear and side yard piped storm drainage systems, including catch basins, french drains, maintenance holes and other appurtenances.

Storm sewers, water mains, and sanitary sewers (other than private connections).

Where underground services are required beyond the limits of a subdivision or site plan.

Block Conveyances

All overland flow routes, open channels, and defined drainage systems accommodating a major storm.

Walkways and bicycle paths.

Valleys, streams, open channels, watercourses (whether flowing or intermittent), seepage areas, wetlands, natural bodies of water and floodplain lands identified by the City as being environmentally significant requiring protection or designated as hazard or open space lands.

Stormwater management facilities, including detention and retention ponds, water quality control facilities and infiltration facilities which are to be owned and operated by the City.

4.13.2 Easement Width Requirements

Easements must be located on one side of the common lot line between adjacent lots. Pipes shall be centred on the easement. The easements will not be permitted to straddle common lot lines. Buildings, including footings or building extensions, will not be permitted to encroach over the limits of the City's easements.

Where two pipes are to be located on one easement, the minimum width of easement shall be the width of easement required for the larger of the two pipes plus 1/2 the width of easement for the smaller pipe, rounded to the next 1.0m increment. Additional easement width may be required to ensure adequate separation between the two pipes and a minimum separation of 3.0 metres between the easement limit and the nearest pipe.

4.13.2.1 Storm and Sanitary Sewer Mains

The minimum width of easements for storm and sanitary sewers shall be in accordance with the following:

Size of Pipe	Depth of Invert	Minimum Width of Easement
250 to 375mm	3.0 m maximum	6.0 m
450 to 675mm	3.0 m maximum	6.0 m
750 to 1500mm	3.0 m maximum	6.0 m
1650mm and up	4.0 m maximum	4.0 m plus 3 times O.D. of pipe

For easements containing more than one pipe or underground service the minimum width will be based on the above chart for the maximum pipe size plus 3.0 m.

4.13.2.2 Storm Connections for Rear Yard Catch basins

The minimum width of permanent easements for leads to rear yard catch basins shall be 5.0 metres for pipe sizes ranging from 250 mm to 450 mm in diameter. For pipe sizes greater than 450 mm, the above criteria shall apply. The lead shall be centred on the easement.

4.13.2.3 Water Mains

The minimum width of easements for water mains shall be in accordance with the following:

Size of Pipe	Depth of Invert	Minimum Width of Easement

Up to 600 mm	3.7 m maximum	6.0 m
675 mm and up	3.7 m maximum	9.0 m

4.13.2.4 Drainage Swales

Easements are required for drainage swales which convey external or municipal storm water.

The minimum width of permanent easements for lot drainage swales shall be 4.0 metres. Additional easement widths may be required depending on the critical depth of swales proposed. Drainage swales to be centered over easements.

4.13.3 Block Width Requirements

Blocks of land shall be of sufficient dimension to accommodate the proposed facility, access from a public right-of-way and maintenance requirements.

The minimum width of blocks of land for open drainage channels shall be the width of top of open channel plus 7.5 metres along one side of the channel for maintenance requirements.

Valley lands (crest of slope to crest of slope) may be contained within blocks of land to be conveyed to the City, as a condition of development. Blocks of land in this case shall include 3.0 metre platform widths on both sides. Blocks of land will not be considered as part of parkland dedication requirements.

4.14 Erosion and Sediment Control

4.14.1 General Requirements

Prior to commencement of any work on site, the Owner is required to implement an Erosion and Sediment Control Plan (ESCP) consisting of a report and drawing(s) as required, to be approved by the City. This is in order to effectively reduce on-site erosion and prevent off-site transport of silt, both overland and via the municipal storm sewer system, or into treed and / or environmentally sensitive areas within or external to the development. The ESCP shall include provision to minimize windblown dust and to minimize and manage mud tracking on to adjacent roads.

All erosion and sediment controls are temporary measures constructed prior to any other site work which shall be maintained until assumption of the subdivision. Prior to assumption of the subdivision all temporary measures shall be removed and any disturbed areas stabilized.

Erosion and sediment control measures shall be designed in accordance with Provincial guidelines and the requirements herein.

4.14.2 ESCP Measures and Requirements

The ESCP must address specific requirements for each stage of construction as follows:

- Tree removal
- Clearing and grubbing
- Topsoil stripping and rough grading
- Construction of services
- Street and building construction

Additional requirements may be necessary where creek or stream crossings for underground services, bridge or culvert construction across active streams, channel diversions and outfalls to active streams are encountered. Plans shall outline measures to reduce impact on the streams including the timing of construction activities to minimize disruption as required by LSRCA, MNR and DFO, where applicable.

All disturbed ground left inactive shall be stabilized by seeding, sodding, mulching or covering or by other equivalent measure. The period of time shall not exceed 30 days unless otherwise authorized by the City.

The phasing of individual developments must be taken into account during the design of the control measures including locations for topsoil stockpiles. A primary consideration will be to expose the least possible area of land for the shortest possible timeframe.

All installed erosion and sediment control measures shall be inspected by the Consultant once per week and after each rainfall of 1cm or greater. Inspection reports shall be forwarded to the City within 5 days of inspection.

Typical accepted measures to mitigate erosion during construction are as follows:

Silt Fence

Silt fencing shall be installed wherever surface runoff drains onto adjacent properties, completely around the base of topsoil stockpiles and along the perimeter of all other areas sensitive to sediment accumulation (e.g. watercourses, valleys, woodlots, areas to remain undisturbed etc.).

Silt fence shall be in accordance with City of Orillia Standard Drawings. Installations shall be specified as “Light Duty” or “Heavy Duty” according to the application.

Topsoil Stockpile Protection

Stockpiles shall be located so the toe of the slope is a minimum of 10m away from a roadway, drainage channel or residential lot. The maximum sideslopes shall be 1.5 horizontal to 1.0 vertical.

Runoff shall be controlled by light duty sediment control fence or other approved measures. If remaining for more than 30 days, stockpiles shall be stabilized by vegetative cover or other means.

The maximum stockpile height shall be approved by the City in consideration of the surrounding land uses and duration the stockpile is to be in place

Sediment Basins, Interceptor Swales

Temporary sediment basins shall be constructed on sites having a disturbed drainage area of greater than 4 hectares. Basins may also be required for smaller areas of disturbance which are sensitive in nature as required by the City.

The basin shall be designed to settle out particles 0.04 mm in diameter or larger from surface water runoff and storm sewer flows and shall be sized to meet LSRCA criteria of minimum 125 m^3/ha, 24hr detention and 125 m^3/ha permanent pool storage volume or the ultimate pond criteria.

Ponds are to have filter fabric / clear stone wrapped perforated riser outfalls with anti-seepage collars and rip rap overflow weirs.

Rock Check Dams

To be installed in swales and ditches in accordance with OPSD 219.210 and 219.211 where runoff drains to adjacent properties.

Catch basin Controls

Sediment controls are to be provided according to City of Orillia Standard Drawings.

Catch basins shall be cleaned when the sump is full and before sediment accumulates to within 300mm of the outlet lead.

Stone Pad Construction Access (Mud Mat)

In order to reduce the tracking of mud onto paved streets, a pad of crushed stone shall be constructed at the site entrance and exit leading onto any existing road. The stone pad shall be a minimum of 450mm thick, 30m long and 5m wide. The first 15m from the entrance/exit shall be constructed with 50mm clear stone. The remaining 15m shall be constructed with 150mm riprap.

4.14.3 Drawing and Report Requirements

Drawings

ECSP Drawings shall be comprised of, and include the following:

- Scale at 1:500 or 1:1000

- Location of buildings, existing and proposed, within and adjacent to the property
- All natural features within and adjacent to the property (woodlots, watercourses, valley lands etc.)
- Trees to be preserved
- Existing contours at 0.5m intervals
- Proposed interim and final elevations
- Areas to be disturbed
- Direction of overland flow
- Staging of construction and implementation of control measures
- Proposed erosion and sediment control measures (silt fence, check dams, sediment basins, interceptor swales, stone mud mats, etc.)
- Topsoil stockpile locations with estimated quantities, maximum height and side slopes
- Detail drawings

Report

A brief report shall accompany the drawings which, at a minimum, outline staging of construction and implementation of the proposed erosion and sediment control measures, a description of measures to be undertaken, silt basin calculations, features to be protected and an inspection and maintenance program.

The report shall also recommend measures to control dust such as road cleaning, watering, work restrictions on windy days, minimizing disturbed areas and other measures.

4.15 Utilities

4.15.1 General Requirements

The appropriate utility company or their approved contractor shall install the services for Bell, Hydro, Gas, and Cable TV. The Developer must bear the cost of any surcharges for underground installation made and must grant any necessary easements for their services.

Utility crossings for new roads shall be placed prior to placement of granular road base material. Utility crossings for existing roads shall have the asphalt surface saw cut and removed for a width of the trench plus a minimum of 0.5 metres out from each side of the trench walls.

Compaction of backfill for utility trenches shall be 95% Standard Proctor Dry Density.

4.15.2 Electrical Design Requirements

Electrical distribution systems shall generally be designed as buried systems. All requirements for the design of the electrical distribution and street lighting system shall be agreed upon with Orillia Power Corporation (OPC).

4.15.3 Electrical Services Plan

It is the Developer's responsibility to make direct arrangements with OPC to design and construct the primary and secondary electrical distribution system, together with all necessary plans.

The Developer is responsible to engage a qualified electrical consultant to design the streetlight electrical distribution system and submit plans to the City for approval by the City. The Developer is responsible to arrange and perform the installation of the streetlight system in accordance with OPC requirements.

Where Site Plan proposals abut County or Provincial roads, lighting level plans with supporting computer printouts shall be submitted to the respective road authorities for their approval, if required.

4.16 Canada Post

The Engineer must communicate directly with Canada Post for locating of their proposed facilities. All proposed locations must be shown on the Composite Utility Plan. Any temporary placement of post boxes must be placed in accordance with the approved final location.

4.17 Landscaping

4.17.1 General Streetscape Standards

The Developer is responsible to plant trees along all road allowances in and abutting the development in accordance with the specifications established pursuant to the Subdivision Agreement. Tree locations on municipal roads must be confirmed with the City of Orillia.

The developer is required to prepare a landscape design prepared by a qualified Landscape Architect to be approved by the City on a site by site basis. In general, at least one tree shall be planted in front of each single family dwelling, semi-detached unit and townhouse block. A minimum of 2 trees shall be placed along the flankage side of each corner lot.

Trees shall be placed so their mature form will not conflict with other essential services and functions.

Timing of Construction

All trees are to be placed during either the spring or fall dormant season in unfrozen soil.

Quality and Source

All boulevard trees shall be #1 quality nursery grown stock, 2.25 m. to 4.0 m. in height with a minimum trunk diameter of 40 mm. measured at a minimum of 1.0 m. above ground level. All trees shall be free from physical damage, insects, pests and diseases and must have at least three quarters of the root system intact. All trees must meet with the standards of the City of Orillia Designated Boulevard

Tree Chart.

4.18 Parkland Development

Services

The Developer shall provide to the satisfaction of the City, a water service connection and sanitary sewer and storm sewer lateral connections to the street line for the park, if required by the City. Metering requirements for water service connections shall be confirmed with the City.

Where required by the City, underground primary or secondary electrical cables shall be placed from the road allowance to designated locations within parkland.

Grading

The park shall be fine graded in accordance with the approved grading plan with particular care being taken to avoid damage to those trees or features to remain. All graded areas shall be covered with a minimum of 150 mm of approved topsoil and shall be seeded and fertilized in accordance with the specifications of the City Engineer. All topsoil stripped from parklands shall remain on-site and not removed or sold. The seed mixture proposed shall be approved by the City prior to placement. All park blocks less than 0.4 ha. in size shall be sodded on 150 mm. of topsoil. All stones and debris shall be removed and disposed of by the Developer prior to the seeding or sodding of any park.

The Developer shall provide chain link fencing along park boundaries or walkways as required by the City. Building materials or equipment cannot be stored on parkland and parkland shall not be used as a dumpsite. Stripped topsoil shall not be stockpiled on parkland or other City blocks.

Timing of Construction

All park blocks must be graded and seeded or sodded within one year of the completion of the base course asphalt road construction in the area adjacent to the park. Seeding must be carried out during the desirable months for seeding of May, August or September. Boulevard grading and sodding on road allowances adjacent to parklands shall be completed at the same time as the park seeding.

Maintenance

The Developer shall be responsible for the maintenance, fertilizing and mowing of the parklands until “Final Acceptance”.

5 Geotechnical Report Requirements

In new developments, the Owner shall engage a Geotechnical Engineering Consultant to prepare a report on the existing soil conditions which is to include:

1) The identification, description and limits of the existing soil regimes, including the extent of topsoil and its suitability for reuse.
2) The suitability of native materials for trench backfill.
3) The conditions under which the native material may be used as trench backfill.
4) The procedures to be used for high moisture contents and water table levels, which may affect the proposed servicing or structural works of the concerned area and surrounding lands.
5) The extent of native material which is unsuitable for trench backfill and the procedure for dealing with it such that it will not affect the structural stability of the proposed municipal services.
6) Areas and procedures to be followed where blasting may be required with due consideration to surrounding structures and services.
7) The road material depths for pavement design.
8) Any special recommendation for bedding materials.
9) Potential corrosive or chemical problems that may affect services or structures (e.g. high sulphates) and the method of resolving such problems.
10) Recommendations in dealing with filling conditions within the road allowances, on building lands, in the construction of berms etc.
11) Identification of problem areas and recommendations for mitigating procedures regarding the stability of existing slopes and the extent of unstable soils or conditions.
12) Any special recommendations to be followed in the design and construction of building foundations including recommended foundation elevations in relation to the groundwater elevation.
13) The engineering properties of the native material including frost susceptibility, natural moisture content, compaction characteristics, relative density and structural integrity.
14) Recommendations for achieving proper compaction.
15) Recommendations for dealing with deep excavation of trenches.
16) Recommendations for dealing with septic or well systems that may be affected by the proposed building and servicing works.
17) Confirmation sufficient boreholes have been taken to establish definite requirements and recommendations for the servicing and building works. In general the geotechnical report must identify minimum bearing capacity of the native soil (i.e. 75 kPa) preferably on a hole-by-hole basis. Boreholes located in the area of proposed underground municipal services are to be taken to a depth of at least one (1) meter below the deepest trench.

Requirements and recommendations contained within this report along with borehole logs and grain size analysis of the native soils are to be incorporated by the engineering consultant into his first submission to the City. Any such requirements and recommendations not incorporated are to be drawn to the City's attention with specific reasons.

During construction, the Owner is to retain a geotechnical consultant to supervise the installation of bedding and the backfilling of all trenches within road allowances and easements. A trench backfill certification is required to indicate sufficient tests have been carried out to obtain a representative report as to the compaction of the backfill and the backfill is in compliance with City specifications and requirements.

A final subgrade certification is to confirm the final subgrade conditions are equal to or better than those anticipated in the preparation of the pavement design. If these conditions are less than what was anticipated, the Owner and the City are to be immediately advised with a new pavement design recommendation.

Where grading operations require the placement of "engineered fill" the Geotechnical Engineer must certify the fill located at 1.0m below finished grade and deeper has been sufficiently compacted to assure a minimum bearing capacity of 75 kPa and a 98% Standard Proctor Density.

6 Site Plan Developments

6.1 General Requirements

Site Plan Agreement

The Developer of lands under Site Plan Control, as specified in the City's Official Plan, may be required to enter into a "Site Plan Agreement" with the City prior to the commencement of construction of any building or service within the parcel of land. For all proposed site plan developments, the Developer shall secure site plan approval from the City.

City of Orillia Requirements

Drawings showing grading and the location, size, grade, invert elevations, material and bedding requirements for all storm, sanitary and water main service connections shall be prepared and submitted to the City for approval. Engineering drawings shall also be prepared for all sanitary and storm sewers and water mains required to be constructed within road allowances or registered easements to service the subject property. These drawings are to be prepared to the City requirements.

The City is also responsible for the collection of revenue for water consumption and therefore the "metering" arrangement for the subject property shall be approved by the City.

6.2 Submission Requirements

Professional Engineer

The Developer shall retain a qualified Professional Engineer to prepare all engineering drawings and to supervise the construction of all engineering services. The Consulting Engineer shall act as the Developer's representative in all matters pertaining to the design and construction of the services in the development. The requirement for a Professional Engineer to carry out design services for a site plan shall only be specific to those developments where water, sanitary and storm services, grading works, roadworks in public right-of-way and retaining walls are proposed. The Consulting Engineer shall be required to submit a Retainer Letter to the City in the format included in these criteria outlining their duties and responsibilities.

Submission Sets

Five (5) Site Plan drawing sets and supporting calculations shall be submitted to the City, for approval, comprised of the following:

a) Site Plan

b) Site Grading Plan
c) Site Services Plan
d) Drainage Area Plan
e) Elevation Plan
f) Erosion and Sedimentation Control Plan
g) Landscaping Plan
h) Geotechnical Report

Depending on the complexity of the proposed development, requirements of the above drawings may be combined, or waived, at the discretion of the City.

Additional Site Plan drawings shall be prepared when requested by the City. Prior to receiving a building permit, all plans must be approved by the City.

Supporting documents may be required as follows; Stormwater Management Report, Traffic Impact Assessment, Functional Servicing Report, Noise Report, Hydrogeological Report, Floodplain Study, Environmental Assessment Report and Archaeological Impact Study as determined on an individual site plan basis.

6.3 Drawing and Design Requirements

6.3.1 General Requirements

All Site Plan drawings shall be prepared from one base plan prepared at a minimum scale of 1:500 and which contains the following information:

a) A key plan at a scale of 1:10,000 showing the site location
b) A north arrow
c) Site statistics
d) Street names, lot and Registered Plan numbers, and property dimensions
e) Road widenings
f) Easements
g) Vehicular loading and parking facilities
h) The outline of all buildings with the building numbers and unit numbers indicated and garage locations within the unit
i) Storage areas and enclosures for garbage and waste materials
j) Fire routes, truck delivery and other large vehicle drive paths
k) Walkways and ramps
l) Proposed roadways /driveways and all points of access
m) Adjacent lands
n) Existing land features (trees, watercourses, roads, services, etc.)

o) The reference benchmark (geodetic) used to establish vertical control and the site benchmarks to be used for construction.

6.3.2 Site Servicing Plan and Design

The Site Services Plan shall show, at a minimum, the location, size and grade (as applicable) of the following services and information:

a) all existing underground services on the streets and easements adjacent to the property.
b) storm and sanitary service connections to the property with grade and invert information
c) water main connections to the property
d) the basement and finished floor elevations of all proposed buildings
e) storm, sanitary and water main services with length, grade, material and bedding requirements to be constructed within the development
f) proposed sanitary and storm maintenance holes with invert and rim elevations
g) hydrants, valves and water meters within the development
h) sanitary, storm and water service connections to individual units, as applicable
i) roof water leaders and method of discharge
j) all construction notes required to describe the construction detail or requirements
k) the locations of prime and reserve tile-bed areas, including mantles (where required)
l) proposed wells and septic beds to be decommissioned;
m) illumination standards
n) proposed landscape features

Stormwater Management

Stormwater management techniques shall be employed on all sites in accordance with requirements identified in this document. As identified in the City of Orillia Official Plan, for lands located within the Lake Simcoe watershed, the developer shall be required to "evaluate at appropriate geographic scales, anticipated changes in phosphorus loadings between pre-development and post-development and evaluates how phosphorus loading will be minimized."

As a guideline, the degree of control on the quantity of run-off from a proposed development shall be:

The post-development peak flow shall not be greater than the corresponding pre-development peak flow for the 1:5 year, 1:10 year, 1:25 year and 1:100 year storms. Other regulatory agencies may require other storm flows to be analyzed (i.e. 2 year and/or Regional flows).

Where on site stormwater quantity controls are required, a stormwater management report addressing the points listed below must be submitted:

- a control device (orifice) must have a diameter of no less than 75mm in order to prevent clogging of the opening;
- control devices shall be installed on the upstream side of the maintenance hole;
- storm connections from the building roof and foundation drains must be made downstream of the maintenance hole and/or catch basin inlet controls;
- ponding limits and available storage are to be depicted on the site servicing drawings, and the maximum ponding depth in parking areas is not to exceed 200mm;
- an overland flow route shall be clearly marked on drawings. The grading of parking lots and landscaped areas must provide a safe path for the overland flow route to the surrounding municipal right of way during storms exceeding the design storm event;
- roof drains can be utilized with controlled discharge;
- details and concepts are to conform to the Urban Drainage Design Guidelines, set out by the MOE;
- on-site stormwater management facilities may require a Certificate of Approval from the MOE. Two completed MOE Application forms are to be submitted to the City signed by the developer and consultant, in accordance with MOE requirements.

Site Servicing Design

a) All sanitary and storm sewers shall be designed in accordance with the requirements of the Ontario Building Code and the City Design Criteria. The provisions of the Ontario Water Resources Act, R.S.O., 1990, may apply to sanitary and storm sewer works.
b) All storm sewers shall be located within the limits of the roadway.
c) All storm sewer connections shall be sized according to the requirements of the Ontario Plumbing Code and shall be installed on a minimum grade of 2.0%. Goss traps shall be placed in parking lot catch basins, located adjacent to fuelling areas. Rainwater leaders shall discharge onto grassed or landscaped areas.

The rainwater leaders from all commercial, industrial, institutional and high density residential buildings should be discharged onto grassed or garden areas. Alternatively rainwater leaders may be directed to on-site detention facilities to achieve the necessary stormwater quantity control as calculated in the stormwater management report.

a) Yard catch basins shall be provided where required for drainage of landscaped areas.
b) Catch basin maintenance holes may be used for roadway drainage.
c) All water mains shall be designed in accordance with the requirements of the Ontario Plumbing Code, NFPA 24 and City Engineering Design Criteria.

   The water main design shall be submitted to the City of Orillia Fire Department for approval of the water main layout and the hydrant locations. The provisions of the Ontario Water Resources Act may apply to the water main works.
d) Where requested, easements for utilities shall be provided at no cost to the utility company.

6.3.3 Site Grading Plan and Design

The site grading plan shall show, as a minimum, the following information:

a) The drainage of the site is to be self-contained
b) The grading of the site is to be compatible with the elevation of the surrounding lands
c) All grassed embankments shall have a maximum slope of 3:1
d) The grade of grassed or other landscaped areas shall have a maximum slope of 12% and a minimum slope of 1%
e) Swales on grassed areas shall have a minimum slope of 1.5% and a maximum slope so the velocity for the flow contained does not exceed 1.25 metres per second
f) The maximum suggested length for any drainage swale is 75 m
g) The minimum depth for any drainage swale shall be 150 mm
h) The maximum depth for any drainage swale shall be 750 mm
i) The maximum side slope on any drainage swale shall be 3:1
j) All driveways shall have positive drainage from the streetline to the roadway.
k) centreline grades at 15 m intervals along all existing streets bounding the property and existing grades
l) a legend indicating which are existing and proposed elevations
m) contours at maximum 0.5 m intervals to indicate the existing elevations of the site. These contours are to extend to a minimum distance of 15 m beyond the property limits to indicate the grading and drainage patterns of the adjacent lands
n) cross sections as required to clarify the proposed grading, particularly in relation to adjacent lands
o) proposed elevations on paved areas, around proposed buildings, along swales, along roadways, parking areas, driveways, catch basin rim elevations, and any other elevations necessary to establish the grading and drainage patterns for the development. Arrows to be used to indicate direction of the surface drainage
p) a typical roadway cross section to indicate the pavement and granular base design
q) roadway dimensions and curb radii
r) concrete curbs
s) embankments, retaining walls, stairs, play areas, swimming pools, etc.
t) curb depressions, with dimensions
u) sidewalk

6.3.4 Roadway Design

Roadway Design

a) All roadways shall be required to satisfy Fire Access Route Design as per OBC 3.2.5.6 and designed in accordance with the most recent engineering requirements of the City.

b) The minimum pavement design for all roadways shall be:

a. subgrade compacted to 95% Proctor Density

b. 300 mm. compacted depth of Granular "B"

c. 300 mm. compacted depth of Granular "A"

d. 50 mm. compacted depth of HL8 Asphalt base course

e. 40 mm. compacted depth of HL3 Asphalt surface course

c) All driveways shall be paved with asphalt or an approved alternate from the edge of the roadway to the garage. The minimum asphalt pavement design for all driveways shall be:

a. subgrade compacted to 95% Proctor Density

b. 150 mm. compacted depth of Granular "A"

c. 50 mm. compacted depth of HL3 asphalt

d) The minimum width of a roadway for two way traffic with no street parking shall be 6.0 m from E/P to E/P.

e) All roadways serving multiple-family projects shall be designed to facilitate passage of emergency and service vehicles. Curb returns having an 8.0 m. radius and inside bends having at least a 12.0m. radius are required. On dead end streets provision shall be provided for vehicle turning.

f) The minimum grade for any roadway shall be 0.5% and the maximum grade shall be 8.0%.

g) The minimum grade for any driveway shall be 1% and the maximum grade shall be 8.0%. This maximum grade creates an undesirable condition and should be used only when necessary due to site conditions.

h) The location of driveway entrances on City streets shall be such that the minimum sight distance is maintained in both directions. The following criteria will apply to new driveway entrances:

Posted Speed Limit	Minimum Sight Distance
km/h	metres
40	45
50	65
60	90
70	120
80	150

6.3.5 Landscaping Requirements

A Landscaping Plan shall be prepared by a qualified Landscape Architect if required by the City. The Landscaping Plan shall show all landscaping details as required by the Site Plan Agreement. A schedule of plant species and sizes is to be identified on the landscaping plan.

All maintenance holes, catch basins, hydrants, valves, streetlights and other servicing features that appear above grade shall also be shown on the landscaping plan.

6.3.6 Waste Collection Design Standards

6.3.6.1 General Information

This section is meant to provide information for developers about the City's requirements for the provision of Waste Collection Services. These requirements must be met before the City will provide Waste Collection Services.

All requirements of Municipal Code Chapter 877 (Solid Waste Management) must be complied with for Waste Collection Services.

6.3.6.2 Definitions

The following definitions apply to Waste Collection Design Standards:

- **"Collection Services"** means services provided by the City for removal of Waste from Serviced Units within the City.
- **"Director of Environmental Services"** means the Director of Environmental Services for the City of Orillia, or his or her designate, authorized to act on his or her behalf.
- **"Private Road"** includes any Roadway that is not assumed by the City or the Province of Ontario.
- **"Service Provider"** means the contractor and its agents and employees retained by the City to provide Waste Collection Services.
- **"Serviced Unit"** includes any Residential Dwelling Unit and Multiple Residential Dwelling Unit within the City.
- **"T-turnaround"** refers to a "T"-shaped area that allows vehicles to reverse direction through a 3-point turn.
- **"Turning Radius"** means the minimum radius required for a vehicle to turn around.
- **"Waste"** means garbage, brush, leaf and yard waste, green bin organics, and recycling box/cart materials, as amended from time to time.

6.3.6.3 General Requirements

Outlined in the following section are the general requirements which must be adhered to for Waste Collection Services to be provided.

- The City will only provide Waste Collection Services if the requirements set out in this guideline manual to provide proper access for collection vehicles are adhered to.
- Private roads have the required widths, and road strength, turning radii, means of access, and means of egress required for the waste collection vehicles, appropriate overhead clearance, the road is clear of snow and ice, unobstructed access to the waste to be collected.
- The City reserves the right to revoke Collection Services to any Serviced Unit that does not adhere to the requirements as laid out in this document.
- For detailed information on Waste Collection Services and schedules, please refer to the City's website at www.orillia.ca.

6.3.6.4 Waste Collection from Residential Developments with Serviced Units Fronting on a Public Road

For Serviced Units fronting on a public road, Waste Collection Services will be provided subject to the following requirements:

a) The roadway is designed to accommodate collection vehicles. Road layouts are designed to permit continuous collection by the collection vehicle without reversing. Where the requirement for continuous collection cannot be met, a cul-de-sac or a "T"-turnaround may be permitted consistent with the Fire Access Route Design as per OBC 3.2.5.6.
b) All roads are designed to have a minimum width of approximately 6 metres. The turning radius from the centre line must be a minimum of approximately 13 metres on all turns.

The developer will be responsible for the collection and disposal of Waste until the City grants Collection Services.

6.3.6.5 Waste Collection from Multi-Unit Residences/ Residential Dwelling Units

For residences fronting on a Private Road, Waste Collection Services will be provided, subject to the following requirements:

a) The roadway is designed to accommodate collection vehicles. The internal road layout is designed to permit continuous collection without reversing. Where the requirement for continuous collection cannot be met, a cul-de-sac or a "T"-turnaround may be permitted consistent with the Fire Access Route Design as per OBC 3.2.5.6.
b) Private roads have the required widths (approximately 6 metres), and road strength, turning radii (approximately 13 metres), means of access, and means of egress required for the waste collection vehicles, appropriate overhead clearance, the road is clear of snow and ice, unobstructed access to the waste to be collected. Any variation from the requirements would have to be acceptable to the Service Provider and the Director of Environmental Services.

For multi-unit complexes (apartments/condos) that have at least nine Serviced Units, the City provides centralized collection service of garbage bins, 360 litre recycling carts, and 46 litre bin carts for collecting organics (food scraps). In order for the complex to receive garbage collection service,

recycling and green bin organics collection must be provided. The site design should include enough space for each collection method. The recommended space to allocate is as follows:

- 4 m² per garbage bin.
- 1 m² per recycling cart (to determine the number of carts needed, divide the total number of residential units by 7 – so a 28 unit apartment would need to plan to have space for at least 28/7 = 4 recycling carts).
- 0.25 m² per green bin cart (a building should plan to have at least five or more green bin carts available for tenants).

6.3.6.6 Gates

New or existing developments that are to construct gates must meet any one of the following criteria in order to receive (or continue to receive) Waste Collection Services:

- The gates automatically open for larger vehicles including waste collection vehicles (e.g., entry/exit loop system, line of sight towers, etc.);
- The gates automatically open via two-way radio frequency through the collection driver keying in the radio transmitter on the collection truck (City's radio frequency is 169.96500 MHz); or
- The gates remain open on the scheduled collection day(s) for the development. Note that there could be more than one collection day for multi-unit residential developments. Please also note that collection is normally delayed by one day during weeks with statutory holidays.

The following gate activation methods are not acceptable:

- Using keys to manually unlock a gate;
- Manually entering a code in a keypad for the gate; and
- Providing a remote opener chip for collection trucks.

All gates are to be designed to have a minimum width of approximately 6 metres. The turning radius from the centre line must be a minimum of approximately 13 metres on all turns.

6.3.6.7 Design Standards Waste Collection Services

This clause is to be set out in subdivision agreement, condominium documents, and development agreement and included in all agreements of purchase and sale or lease if the developer wishes to receive Waste Collection Services from the City.

The developer is required to comply with the City's Waste Collection Design Standards. Failure to comply could result in Waste Collection Services being withheld or suspended.

6.4 "As-Constructed" Drawings

After all construction is complete, the design drawings shall be amended to incorporate the changes and alterations made during construction to ensure the drawings as amended represent the services

and conditions as constructed. One set of “As-Constructed” drawings must be submitted to the City within one year of final completion and prior to the final security reduction.

6.5 Certification

Upon completion of construction the Consulting Engineer shall provide written certification to the City that all works have been constructed in accordance with the approved plans and specifications and in accordance with good engineering practices.

The wording is to be followed by the Professional Engineers stamp and signature.

6.6 Final Inspection

Upon completion of all construction the Developer shall request the City to carry out a final inspection of the works. All deficiencies found during this final inspection shall be immediately corrected by the Developer. This final inspection is carried out for the benefit of the City and shall in no way relieve the Developer of his obligations under the Condominium Act and the Site Plan Agreement.

7 Landscaping Implementation Procedures

Once the infrastructure of the subdivision is in place and housing is under construction, the developer must hire a landscape contractor to install the approved landscape components. The Landscape Architect shall inspect and certify the installation.

7.1 Streetscape Works

The developer is required to hire a contractor to install the landscape elements called for in the approved landscape plans. The Consulting Landscape Architect will inspect the work, report on progress to the City and provide the City with as-built drawings. An important part of the Landscape Architect's duties will be to maintain a Summary Chart documenting the history of each new tree planted in the parcel of land being developed. At the appropriate times, the City will conduct its own inspections. All streetscape works are to be guaranteed and maintained until assumption of services or 24 months whichever is longer.

7.2 Naturalization Works

As with streetscape works, the process begins with the developer hiring a contractor to install the landscape elements called for in the approved landscape plans. The developer's Landscape Architect will supervise the work and report on progress to the City. At the appropriate times, the City will conduct its own inspections. All naturalization works are to be guaranteed and maintained until assumption of services or 24 months whichever is longer.

7.3 Maintenance Agreement for Naturalization Areas

Carrying out a maintenance program for the first two years after planting the naturalization areas will significantly reduce the mortality rate of the trees, shrubs, grasses, etc. and help to establish healthy vegetative cover.

At the time of planting, the planting details and specifications should be followed faithfully. This means, among other things, the proper transportation and handling of plant material, the use of fertile planting soil, the proper staking of trees and the proper installation of rodent protection.

Maintenance shall include:

- apply appropriate fertilizer to promote growth;
- prune dead or diseased tissue;
- remove dead plant material;

- replace dead coniferous naturalization species to maintain a minimum live-stocking standard of 90%;
- replace dead deciduous and shrub naturalization species to maintain a minimum live-stocking standard of 90%;
- suppress weed growth around new trees and shrubs by adding mulch and/or removing weeds by hand. Weeds shall not be cut down with a power trimmer.

An assessment of plant material is to be carried out annually by the Landscape Architect between mid-July and early September and reported to the developer, the contractor and the City in the form of a Naturalization Assessment Report. Plant vigour can be determined by a visual inspection of the current year's foliage.

The initial inspection and assessment will be conducted in the summer following the planting. It will take account of the survival and condition of the plants. It will also include a summary of the maintenance operations performed. Finally, the assessment will propose any additional maintenance measures thought necessary, and recommended where, the following spring, plants need to be replaced or new plants added.

The second assessment will be conducted the following year, and will provide similar information to the first.

The third and final assessment will take place just prior to assumption. The final report will provide a complete summary of the initial plantings, as well as a record of the replacements and maintenance services carried out during the guarantee period. The report will also make note of any additional work that should be performed prior to the City conducting their own final inspection.

8 Standard Drawings Index

In general, OPSD's shall be used and referenced by the designer. The suitability of any particular OPSD shall be determined by the City.

The City Standard Drawings which form part of this document have been developed to reflect specific requirements of the City and shall take precedence over OPSD's.

1. ROADS

Sheet 1	- TYPICAL CROSS SECTION FOR 2 LANE COLLECTOR
Sheet 2	- TYPICAL CROSS SECTION FOR 2 LANE INDUSTRIAL
Sheet 3	- TYPICAL CROSS SECTION FOR 2 LANE LOCAL
Sheet 4	- TYPICAL CROSS SECTION FOR 4 LANE ARTERIAL
Sheet 5	- TYPICAL CROSS SECTION FOR 5 LANE ARTERIAL
Sheet 6	- TYPICAL COMMON UTILITY TRENCH CROSS SECTION FOR 2 LANE LOCAL
Sheet 7	- TYPICAL COMMON UTILITY TRENCH CROSS SECTION FOR 2 LANE COLLECTOR
Sheet 8	- TYPICAL COMMON UTILITY TRENCH CROSS SECTION FOR 4 LANE ARTERIAL
OPSD 310.010	- CONCRETE SIDEWALK
OPSD 310.020	- CONCRETE SIDEWALK ADJACENT TO CURB AND GUTTER
OPSD 310.030	- CONCRETE SIDEWALK RAMPS AT INTERSECTIONS
OPSD 350.010	- URBAN, INDUSTRIAL, COMMERCIAL AND APARTMENT ENTRANCES
OPSD 351.010	- URBAN RESIDENTIAL ENTRANCE
OPSD 500.020	- TURNING BASINS FOR TERMINATED URBAN ROADWAYS, RESIDENTIAL
OPSD 500.030	- TURNING BASINS FOR TERMINATED URBAN ROADWAYS, INDUSTRIAL AND COMMERCIAL
OPSD 600.010	- CONCRETE BARRIER CURB WITH WIDE GUTTER
OPSD 600.040	- CONCRETE BARRIER CURB WITH STANDARD GUTTER
OPSD 600.100	- CONCRETE MOUNTABLE CURB WITH NARROW GUTTER
OPSD 912.532	- GUIDE RAIL SYSTEM, STEEL BEAM, BARRICADE, INSTALLATION
OBC 1997 3.2.5.6	- FIRE ACCESS ROUTE DESIGN
OBC 1990 3.2.5.7	- FIRE ACCESS ROUTE DESIGN
STREET LIGHTING STANDARDS	
BOULEVARD TREE LIST	

2. SEWERS, WATER MAIN AND APPURTENANCES

OPSD 400.100	- CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, PERFORATED OPENINGS
OPSD 400.110	- CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE FLAT GRATE FOR CATCH BASINS, PERFORATED OPENINGS
OPSD 400.120	- CAST IRON, SQUARE FRAME WITH BIRDCAGE GRATE FOR CATCH BASINS
OPSD 401.010	- CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES
OPSD 403.010	- GALVANIZED STEEL HONEYCOMB GRATING FOR DITCH INLETS
OPSD 404.020	- ALUMINUM SAFETY PLATFORM FOR CIRCULAR MAINTENANCE HOLES
OPSD 405.010	- MAINTENANCE HOLE STEPS - HOLLOW
OPSD 701.010	- PRECAST CONCRETE MAINTENANCE HOLE – 1200 mm DIAMETER
OPSD 701.011	- PRECAST CONCRETE MAINTENANCE HOLE – 1500 mm DIAMETER
OPSD 701.012	- PRECAST CONCRETE MAINTENANCE HOLE – 1800 mm DIAMETER
OPSD 701.013	- PRECAST CONCRETE MAINTENANCE HOLE – 2400 mm DIAMETER
OPSD 701.021	- MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES
OPSD 705.010	- PRECAST CONCRETE CATCH BASIN 600 X 600 mm
OPSD 705.030	- PRECAST CONCRETE DITCH INLET 600 X 600 mm
OPSD 705.040	- PRECAST CONCRETE DITCH INLETS 600 X 1200mm
OPSD 707.010	- PRECAST CONCRETE MAINTENANCE HOLE MANUFACTURED TEE
OPSD 708.020	- SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE
OPSD 708.030	- CATCH BASIN CONNECTION FOR FLEXIBLE MAIN PIPE SEWER
OPSD 802.010	- FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION
OPSD 802.013	- FLEXIBLE PIPE EMBEDMENT AND BACKFILL ROCK EXCAVATION
OPSD 802.030	- RIGID PIPE BEDDING, COVER AND BACKFILL, TYPE 1 OR 2 SOIL – EARTH EXCAVATION
OPSD 802.031	- RIGID PIPE BEDDING, COVER AND BACKFILL TYPE 3 SOIL – EARTCH EXCAVATION
OPSD 802.032	- RIGID PIPE BEDDING, COVER AND BACKFILL TYPE 4 SOIL – EARTH EXCAVATION
OPSD 802.033	- RIGID PIPE BEDDING, COVER AND BACKFILL ROCK EXCAVATION
OPSD 804.030	- CONCRETE HEADWALL – FOR PIPE LESS THAN 900 mm DIAMETER
OPSD 804.040	- CONCRETE HEADWALL – FOR SEWER OR CULVERT PIPE CULVERT PIPE OUTLET
OPSD 804.050	- GRATING FOR CONCRETE ENDWALL
OPSD 809.010	- PERFORATED PIPE SUBDRAIN IN GRANULAR TRENCH MAIN STORM SEWER CONNECTION TO DRAINAGE STRUCTURE
OPSD 810.010	- RIP-RAP TREATMENT FOR SEWER AND CULVERT OUTLETS
OPSD 810.020	- RIP-RAP TREATMENT FOR DITCH INLETS

OPSD 1003.010 - CAST-IN-PLACE MAINTENANCE HOLE DROP STRUCTURE TEE

OPSD 1003.020 - CAST-IN-PLACE MAINTENANCE HOLE DROP STRUCTURE WYE

OPSD 1003.030 - INTERNAL DROP STRUCTURE FOR EXISTING MAINTENANCE HOLES

OPSD 1006.010 - SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER

OPSD 1006.020 - SEWER SERVICE CONNECTIONS FOR FLEXIBLE MAIN PIPE SEWER

OPSD 1103.010 - CONCRETE THRUST BLOCKS FOR TEES, PLUGS, AND HORIZONTAL BENDS

OPSD 1103.020 - CONCRETE THRUST BLOCKS FOR VERTICAL BENDS

OPSD 1104.030 - 25 mm BLOW OFF INSTALLATION

OPSD 1105.010 - HYDRANT INSTALLATION

WATER SAMPLING STATION

3. LOT SERVICING DETAILS

SINGLE

TOWNHOME

SEMI/LINK

4. EROSION CONTROLS

OPSD 219.110 - LIGHT-DUTY SILT FENCE BARRIER

OPSD 219.130 - HEAVY-DUTY SILT FENCE BARRIER

OPSD 219.210 - ROCK FLOW CHECK DAM – V-DITCH

OPSD 219.211 - ROCK FLOW CHECK DAM – FLAT BOTTOM DITCH

STONE MUD MAT DETAIL

5. FENCED WALKWAYS

FENCING DRAWING NO. 72-STD-14

REMOVABLE BOLLARDS

P-GATES

6. TYPICAL SUMMARIZED ENGINEERING DESIGN STANDARDS

TYPICAL GENERAL NOTES

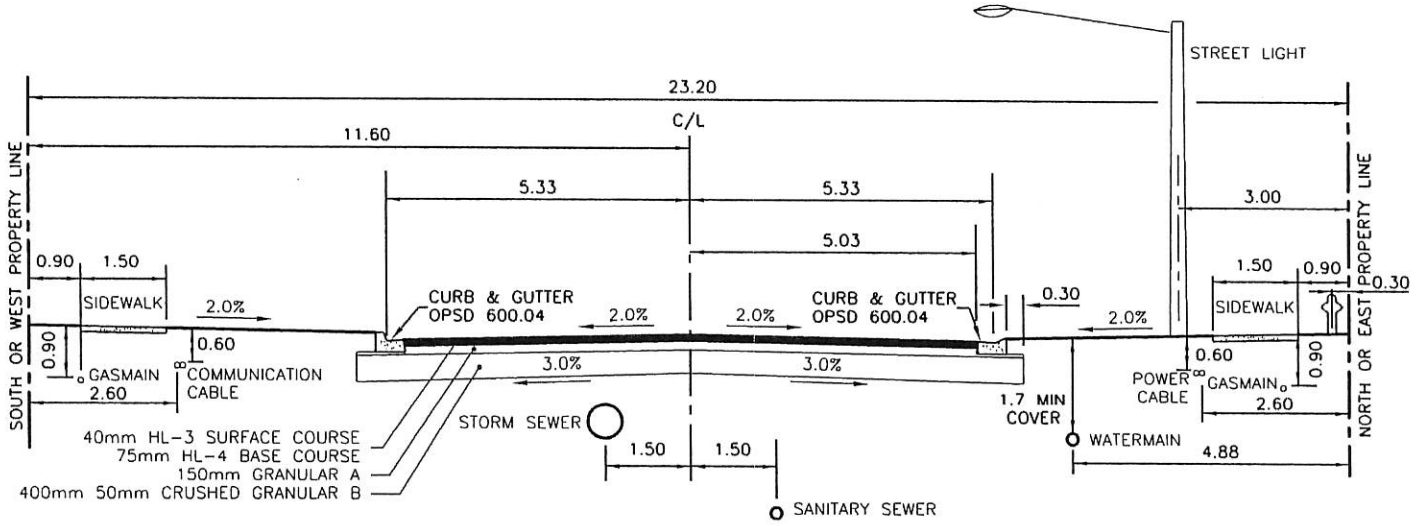
MATERIAL SPECIFICATIONS FOR WATER MAIN AND APPURTENANCES – REVISED DECEMBER 1, 2011

MATERIAL SPECIFICATIONS FOR SEWER MAINS AND APPURTENANCES FOR STORM AND SANITARY – REVISED JULY 22, 2011

7. TYPICAL CONSULTING ENGINEERS "RETAINER LETTER"

SAMPLE TEMPLATE

ROADS



TYPICAL ROAD CROSS SECTION FOR 2 LANE COLLECTOR

SCALE: NOT TO SCALE	DESIGN BY: N/A DRAWN BY: WH CHECKED BY: RLT APPROVED BY: RLT DATE: SEPT. 7, 99 PLOTTED: DEC. 21, 99	THE CORPORATION OF THE CITY of ORILLIA PUBLIC WORKS DEPARTMENT	TITLE TYPICAL ROAD CROSS SECTION FOR 2 LANE COLLECTOR	FILE: N/A SHEET: 1 PLAN No: N/A ACAD FILE: SK_TYPRD.DWG

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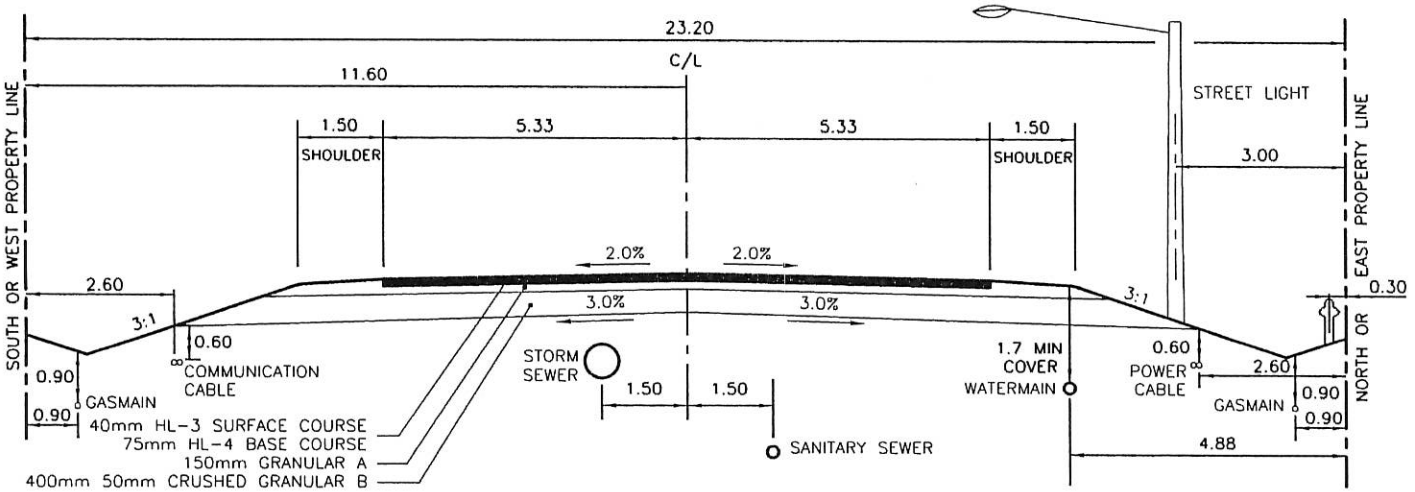

TYPICAL ROAD CROSS SECTION FOR 2 LANE INDUSTRIAL

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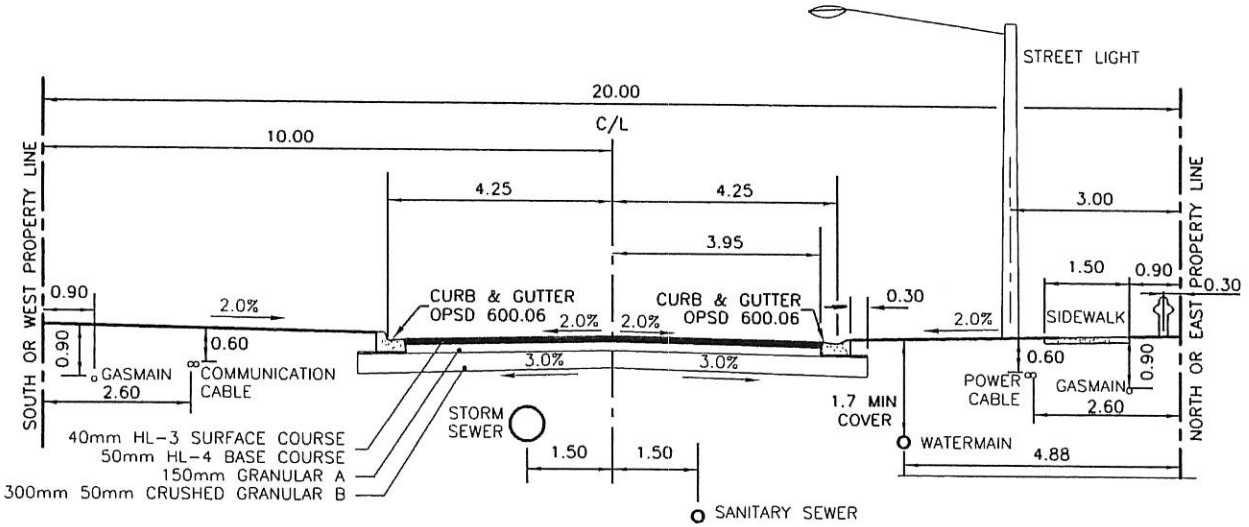

TYPICAL ROAD CROSS SECTION FOR 2 LANE LOCAL

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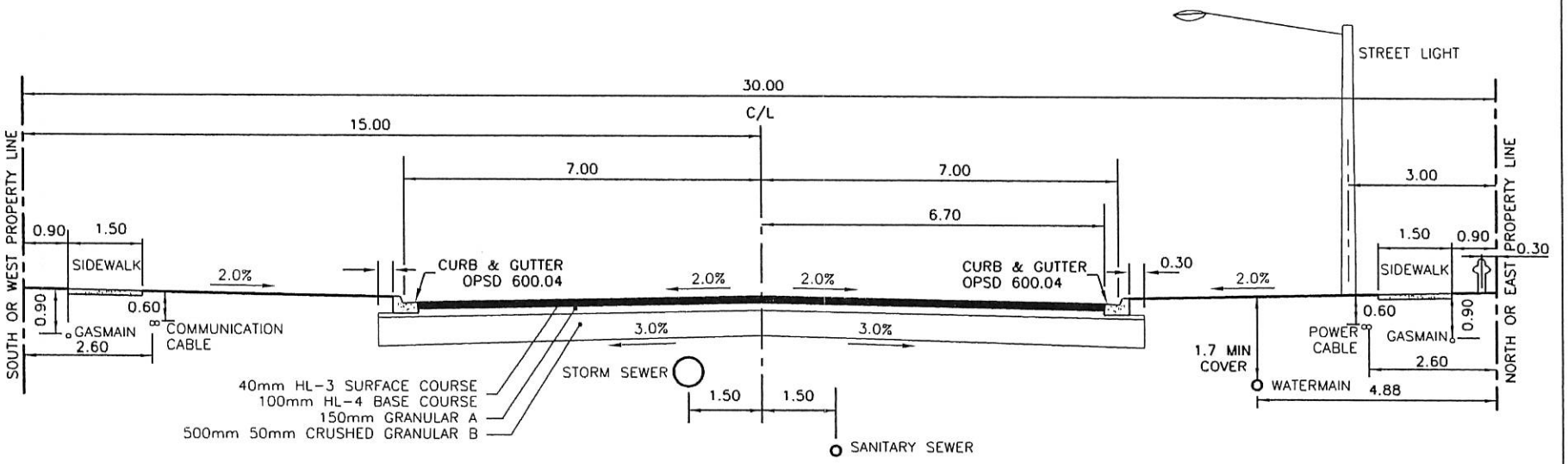

TYPICAL ROAD CROSS SECTION FOR 4 LANE ARTERIAL

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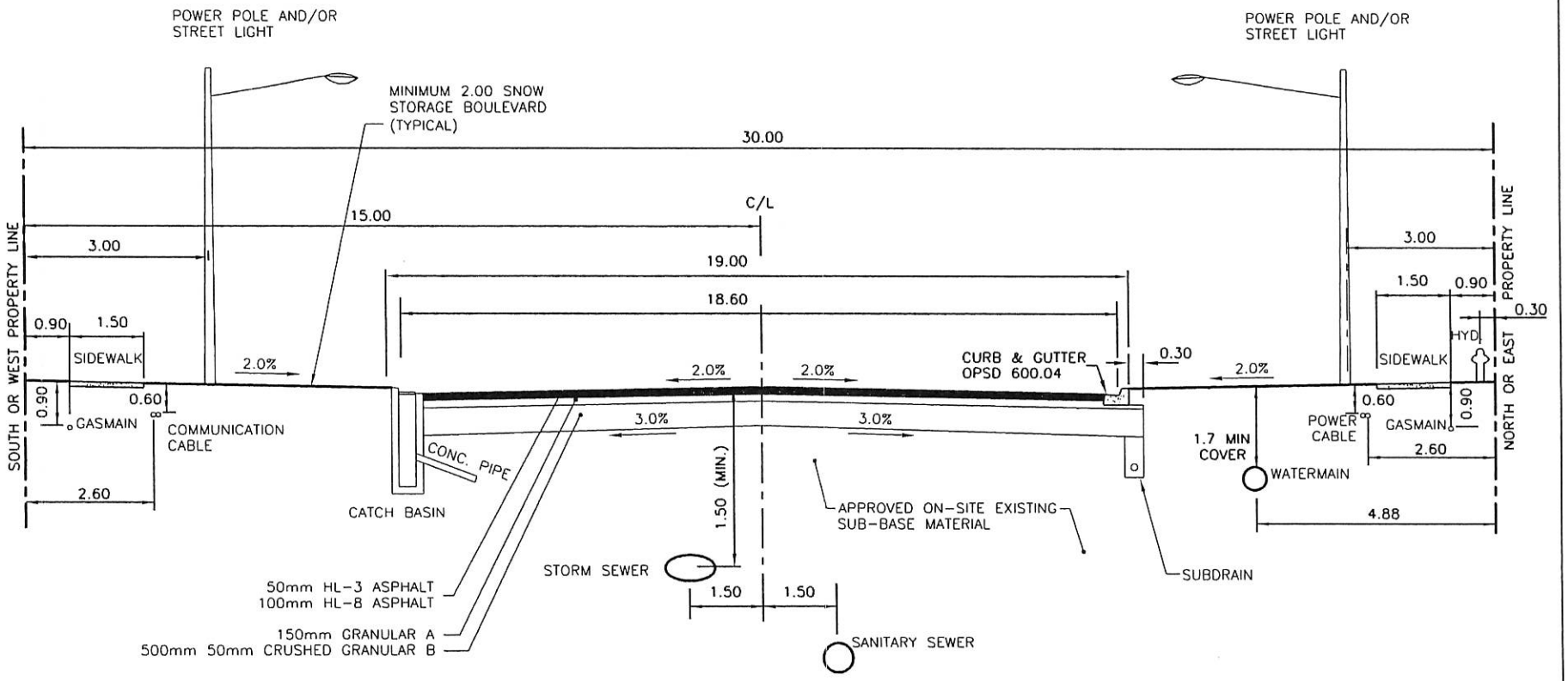

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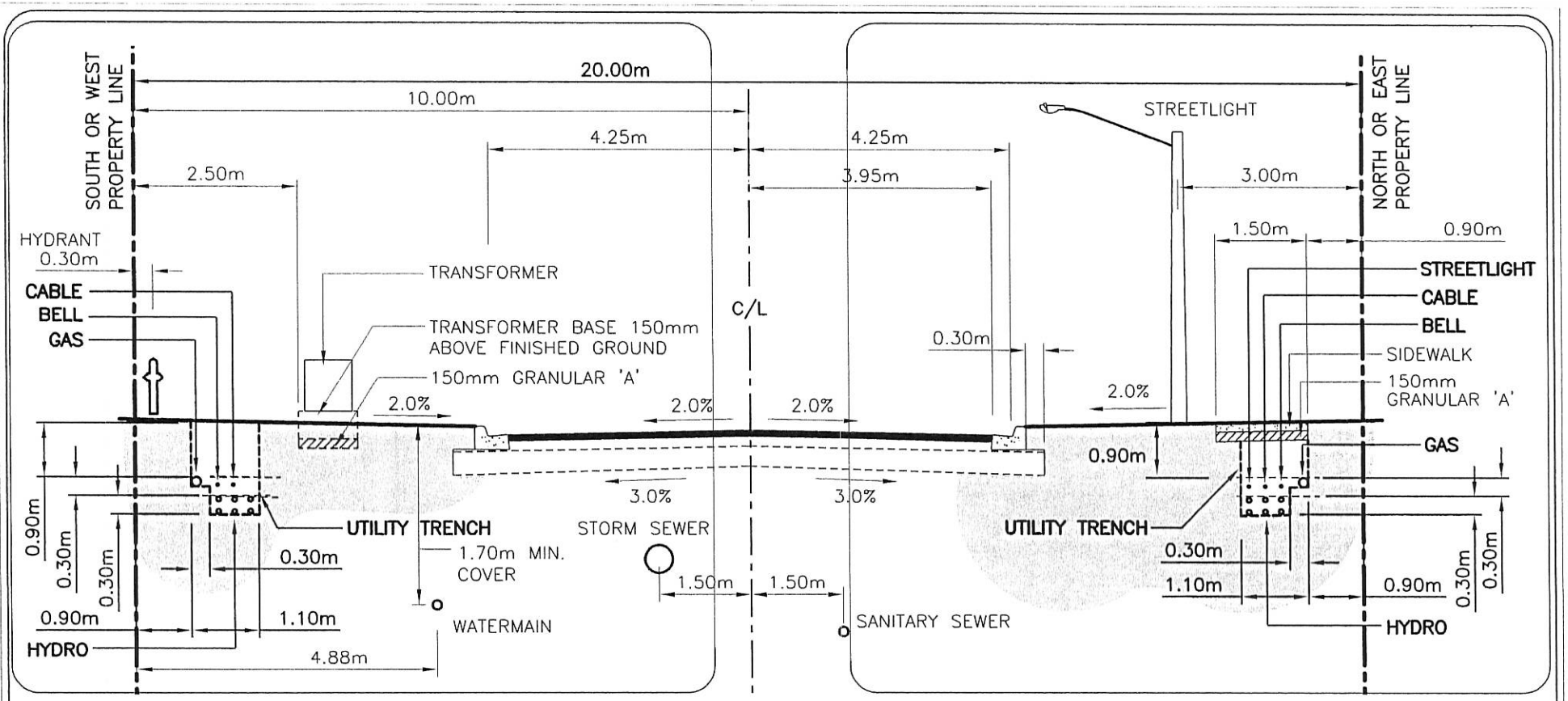

NOTES:

1. TRENCH BACKFILL TO BE SELECT SUBGRADE MATERIAL COMPACTED TO MIN. 95% SPDD.
2. UTILITY PEDESTALS SHALL BE PLACED BETWEEN PROPERTY LINE AND SIDEWALK PROVIDED 0.5m SIDEWALK CLEARANCE IS MAINTAINED.
3. TREES ARE TO BE PLANTED 3.0m MIN. FROM HYDRO TRANSFORMER VAULTS.
4. SPECIFIC TREE LOCATIONS TO BE DETAILED ON SEPARATE COMPOSITE UTILITY PLAN.
5. OWNER/DEVELOPER TO CONTACT CITY OF ORILLIA FOR APPROVED SPECIES LIST.

NOT TO SCALE

DESIGN BY:	JWG
DRAWN BY:	WH
CHECKED BY:	JWG
APPROVED BY:	JWG
DATE:	MAR. 03, 05
PLOTTED:	MAR. 15, 05

THE CORPORATION OF THE
CITY of ORILLIA
PUBLIC WORKS DEPARTMENT

TITLE

TYPICAL ROAD CROSS SECTION FOR 2 LANE LOCAL

COMMON UTILITY TRENCH

FILE: N/A

SHEET: 1

PLAN No: N/A

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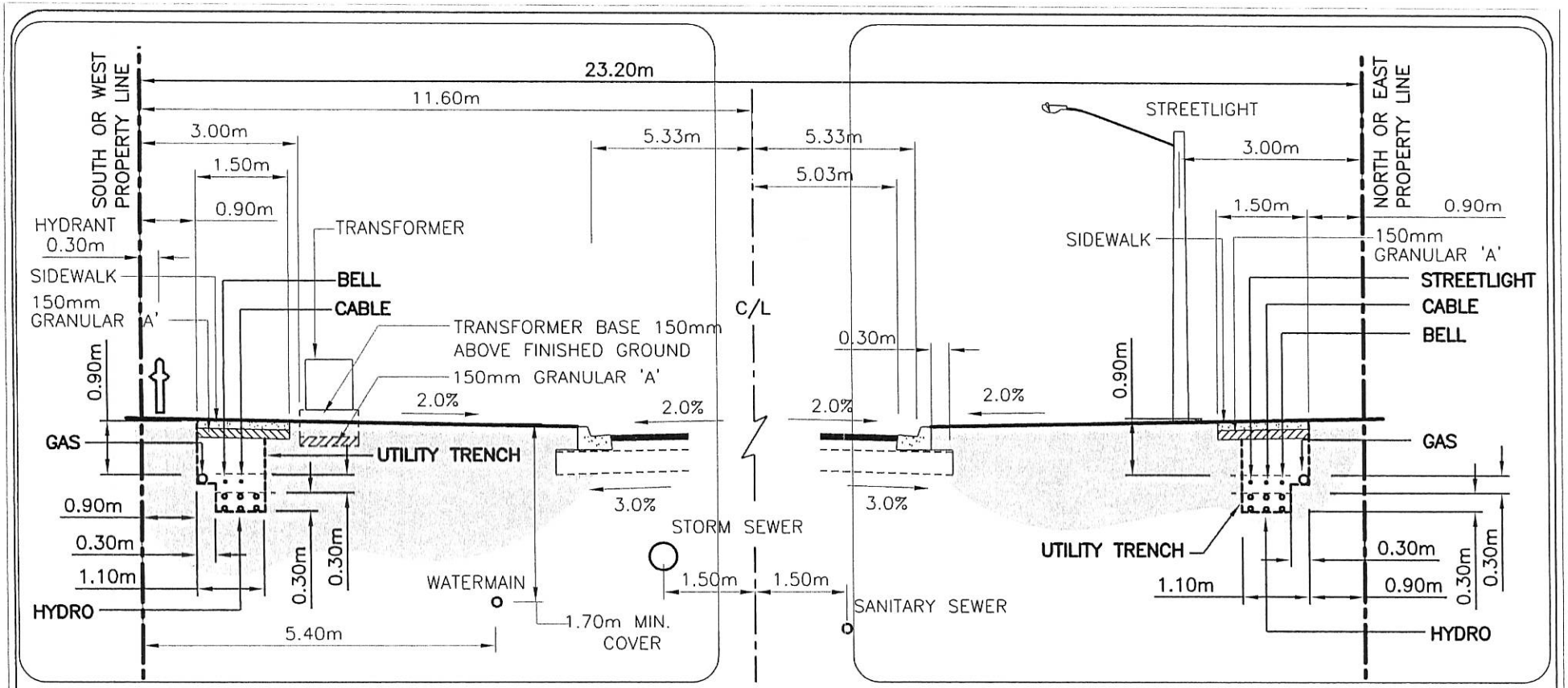

NOTES:

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2. UTILITY PEDESTALS SHALL BE PLACED BETWEEN PROPERTY LINE AND SIDEWALK PROVIDED 0.5m SIDEWALK CLEARANCE IS MAINTAINED.
3. TREES ARE TO BE PLANTED 3.0m MIN. FROM HYDRO TRANSFORMER VAULTS.
4. SPECIFIC TREE LOCATIONS TO BE DETAILED ON SEPARATE COMPOSITE UTILITY PLAN.
5. OWNER/DEVELOPER TO CONTACT CITY OF ORILLIA FOR APPROVED SPECIES LIST.

NOT TO SCALE

DESIGN BY:	JWG
DRAWN BY:	WH
CHECKED BY:	JWG
APPROVED BY:	JWG
DATE:	MAR. 03, 05
PLOTTED:	MAR. 15, 05

THE CORPORATION OF THE
CITY of ORILLIA
PUBLIC WORKS DEPARTMENT

TITLE
TYPICAL ROAD CROSS SECTION FOR 2 LANE COLLECTOR
COMMON UTILITY TRENCH

FILE: N/A
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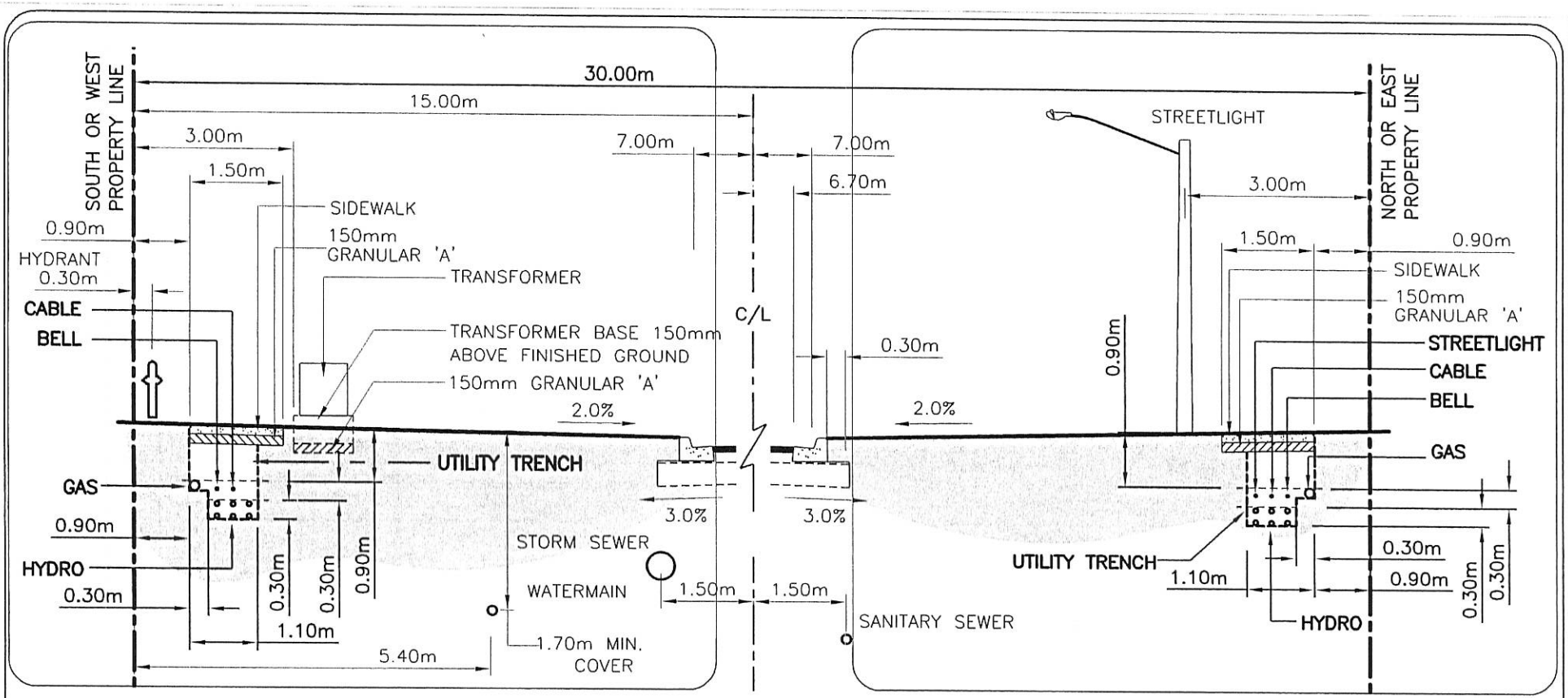

NOTES:

1. TRENCH BACKFILL TO BE SELECT SUBGRADE MATERIAL COMPACTED TO MIN. 95% SPDD.
2. UTILITY PEDESTALS SHALL BE PLACED BETWEEN PROPERTY LINE AND SIDEWALK PROVIDED 0.5m SIDEWALK CLEARANCE IS MAINTAINED.
3. TREES ARE TO BE PLANTED 3.0m MIN. FROM HYDRO TRANSFORMER VAULTS.
4. SPECIFIC TREE LOCATIONS TO BE DETAILED ON SEPARATE COMPOSITE UTILITY PLAN.
5. OWNER/DEVELOPER TO CONTACT CITY OF ORILLIA FOR APPROVED SPECIES LIST.

NOT TO SCALE

DESIGN BY:	JWG
DRAWN BY:	WH
CHECKED BY:	JWG
APPROVED BY:	JWG
DATE:	MAR. 03, 05
PLOTTED:	MAR. 15, 05

THE CORPORATION OF THE
CITY of ORILLIA
PUBLIC WORKS DEPARTMENT

TITLE
TYPICAL ROAD CROSS SECTION FOR 4 LANE ARTERIAL
COMMON UTILITY TRENCH

FILE: N/A
SHEET: 3
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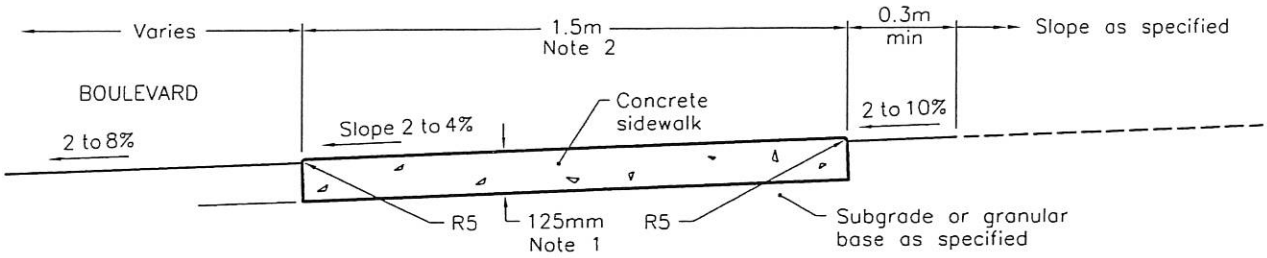

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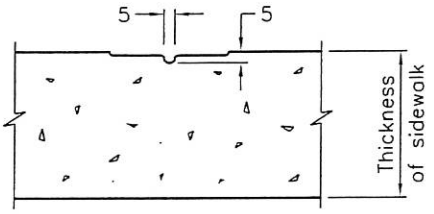

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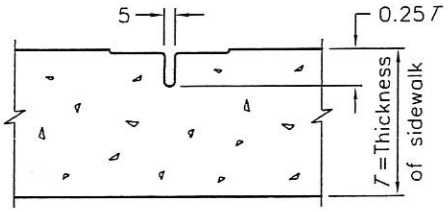

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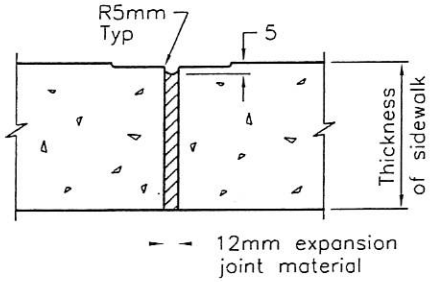
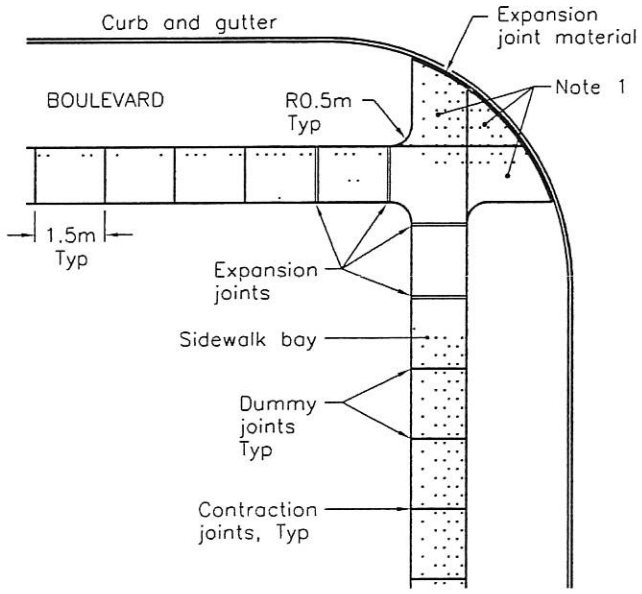


EXPANSION JOINT



JOINT LAYOUT

NOTES:

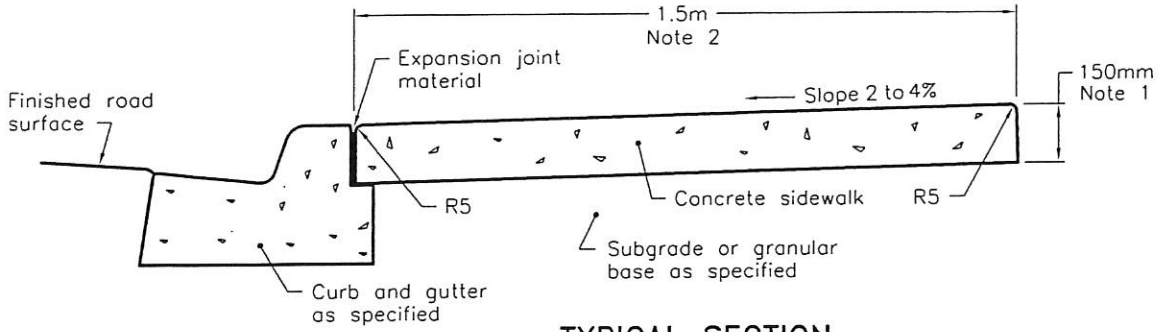
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be increased to 2.4m at schools, bus stops, and other high pedestrian areas.

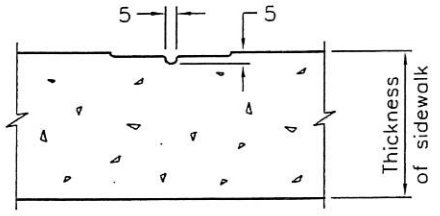
A This OPSD to be read in conjunction with OPSD–310.030.

B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev	1
CONCRETE SIDEWALK			
	OPSD – 310.010		



TYPICAL SECTION



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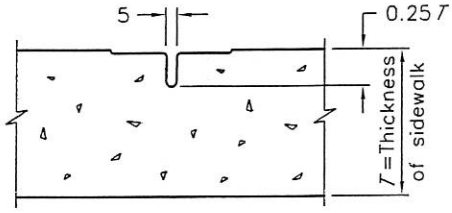
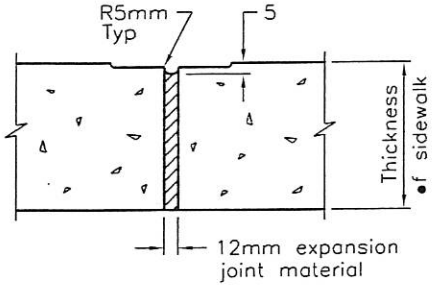
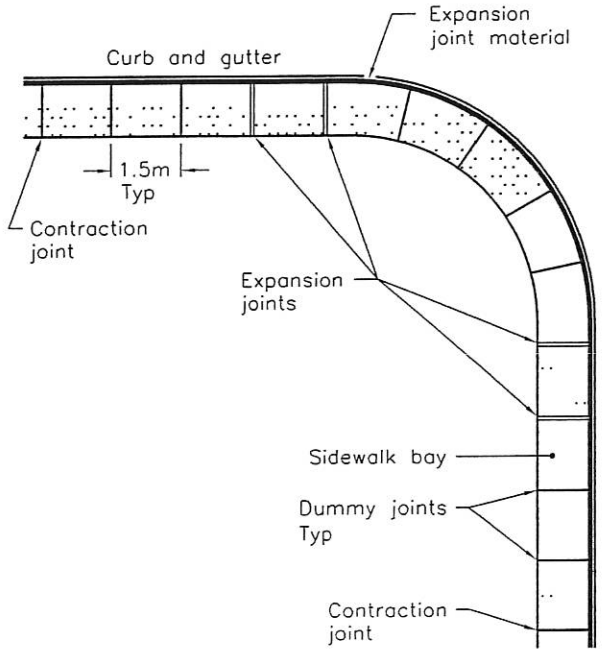


CONTRACTION JOINT



EXPANSION JOINT



JOINT LAYOUT

NOTES:

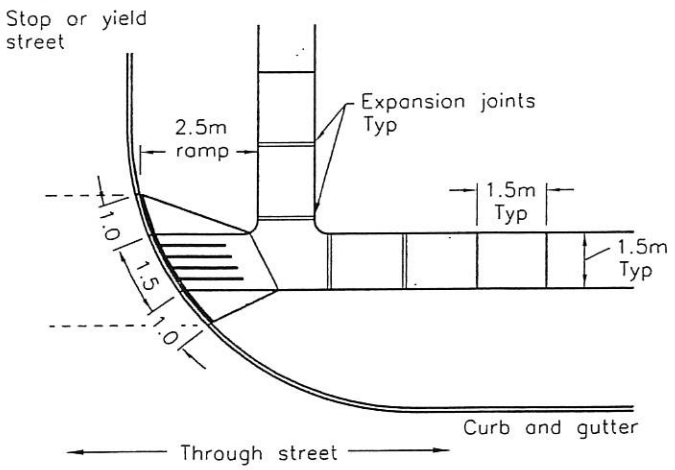
1 At commercial and industrial driveways, the thickness shall be 200mm.

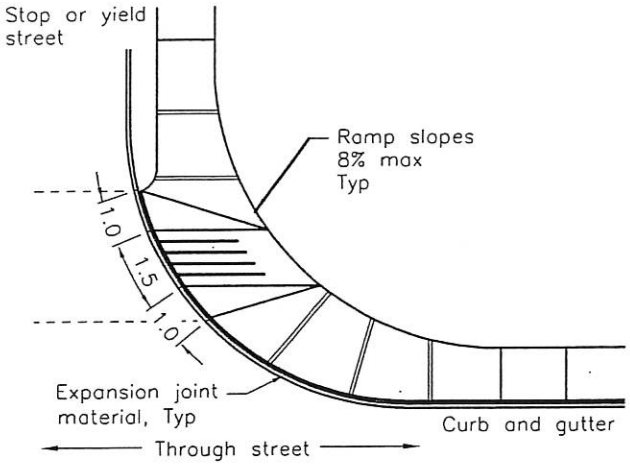
2 Sidewalk width shall be increased to:
- 1.8m on major roadways
- 2.4m at schools, bus stops, and other high pedestrian areas.

A This OPSD to be read in conjunction with OPSD-310.030.

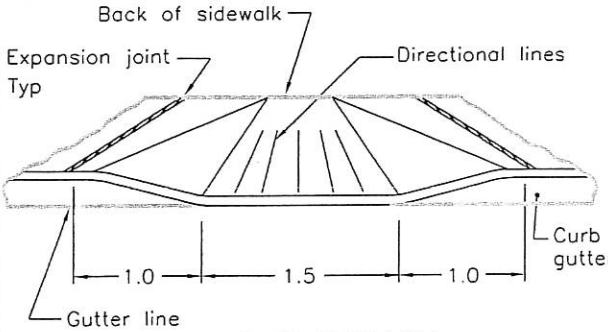
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev	1
CONCRETE SIDEWALK ADJACENT TO CURB AND GUTTER			
	OPSD – 310.020		

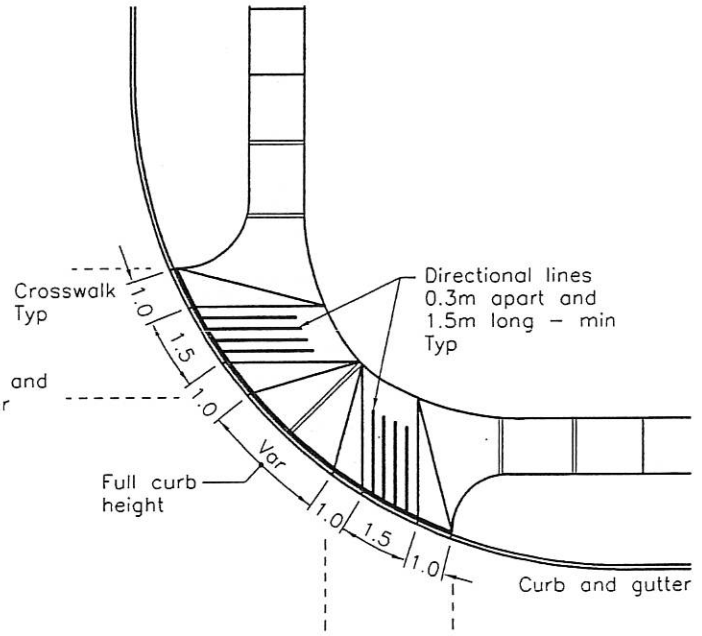




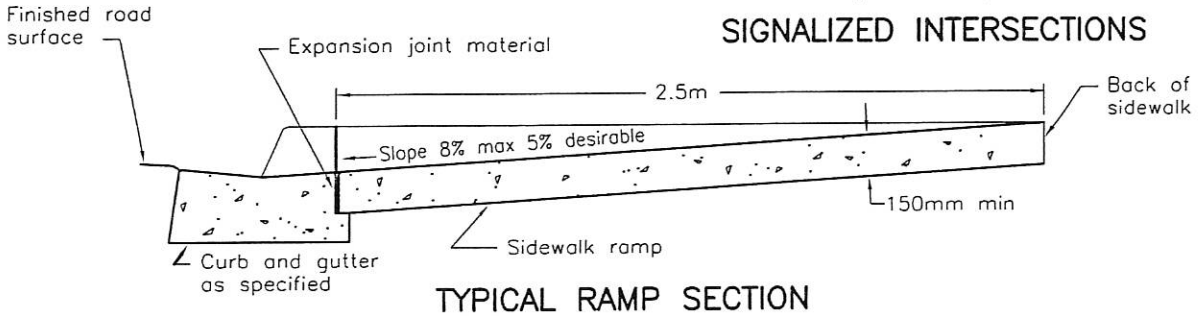
UNSIGNALIZED INTERSECTIONS



RAMP ELEVATION



SIGNALIZED INTERSECTIONS



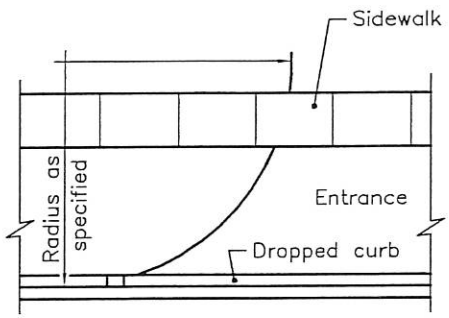
TYPICAL RAMP SECTION

NOTES:

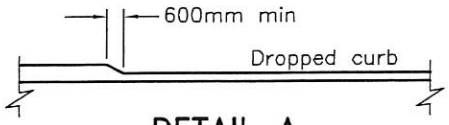
A Directional lines shall be 10x10mm made with grooving tool having a 15mm radius.

B All dimensions are in millimetres or metres unless otherwise shown.

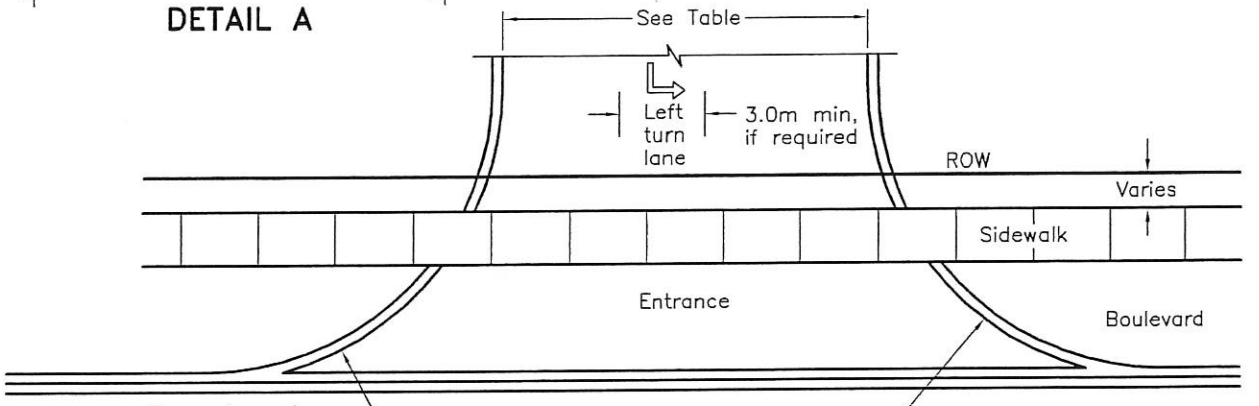
ONTARIO PROVINCIAL STANDARD DRAWING	1993 10 01	Rev	
CONCRETE SIDEWALK RAMPS AT INTERSECTIONS	Date _____		
	OPSD – 310.030		



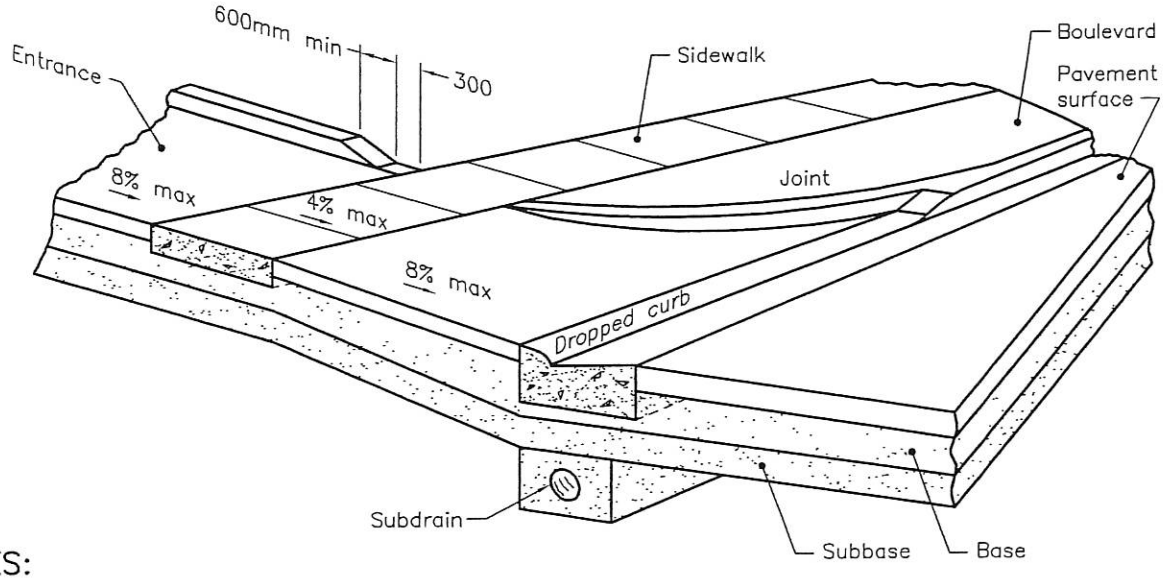
DRIVEWAY DIMENSIONS						
LAND USE	WIDTH m				RADIUS m	
	One–Way		Two–Way			
	min	max	min	max	min	max
Light Industrial, Commercial, and Apartment	4.5	7.5	7.2	12.0	4.5	12.0
Heavy Industrial	5.0	9.0	9.0	15.0	9.0	15.0



DETAIL A



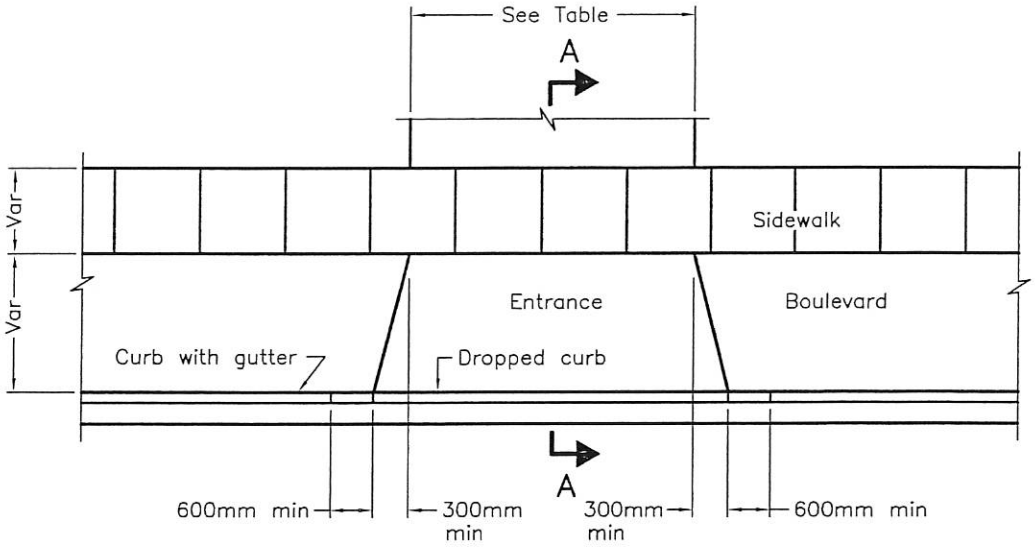
PLAN



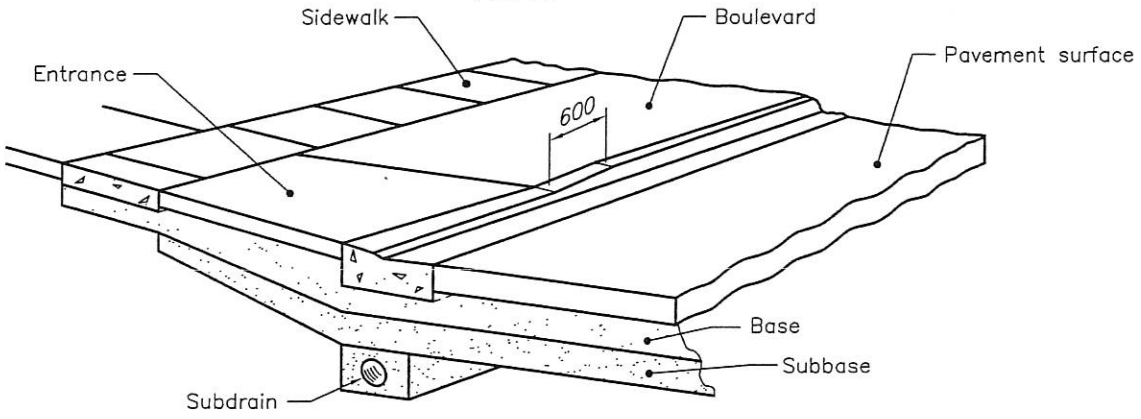
NOTES:

A All dimensions are in millimetres unless otherwise shown.

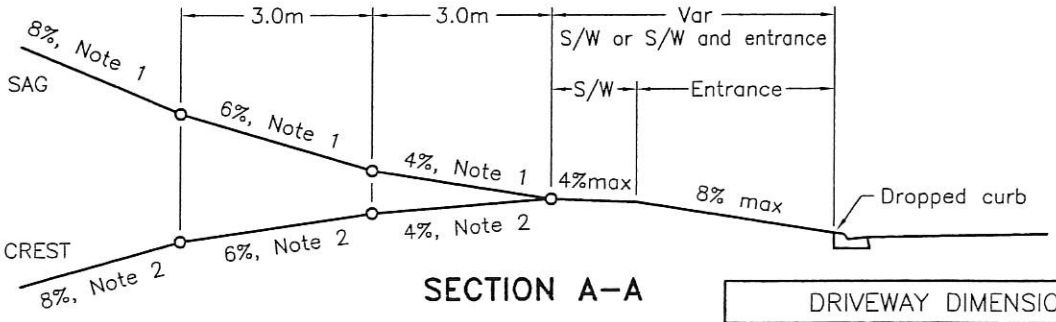
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev 1
URBAN INDUSTRIAL, COMMERCIAL, AND APARTMENT ENTRANCES		OPSD 350.010



PLAN



ISOMETRIC VIEW



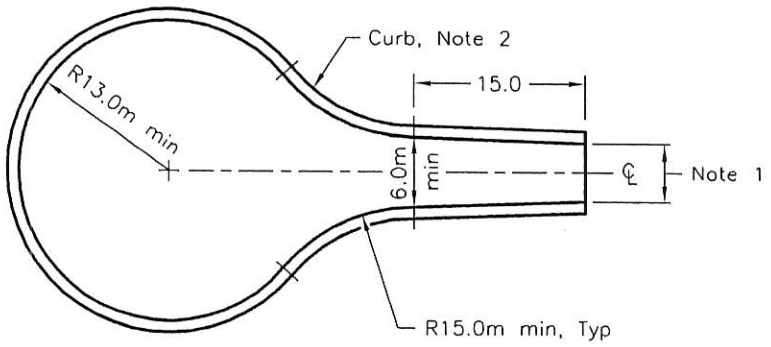
SECTION A–A

DRIVEWAY DIMENSIONS				
LAND USE	WIDTH m			
	Single		Double	
	min	max	min	max
Residential	3.0	4.3	6.0	7.3

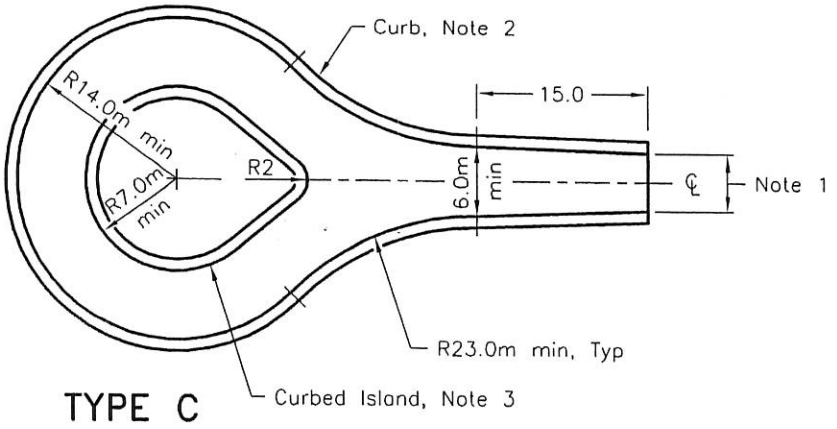
NOTES:

1 Maximum upgrade shall be 10%.
2 Maximum downgrade shall be 8%.
A All dimensions are in millimetres unless otherwise shown.

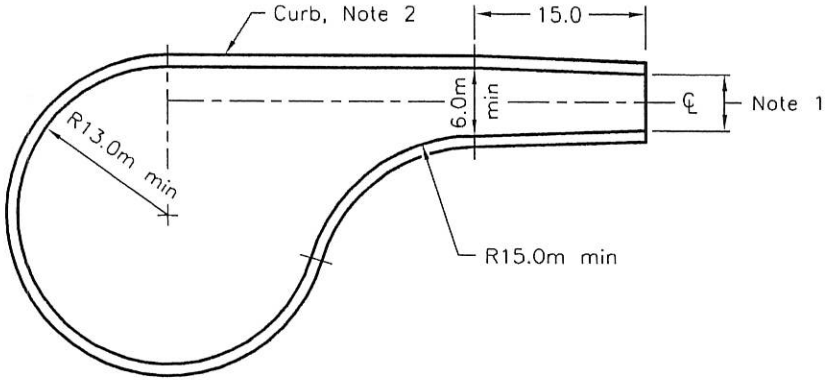
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	1
URBAN RESIDENTIAL ENTRANCE			
	OPSD 351.010		



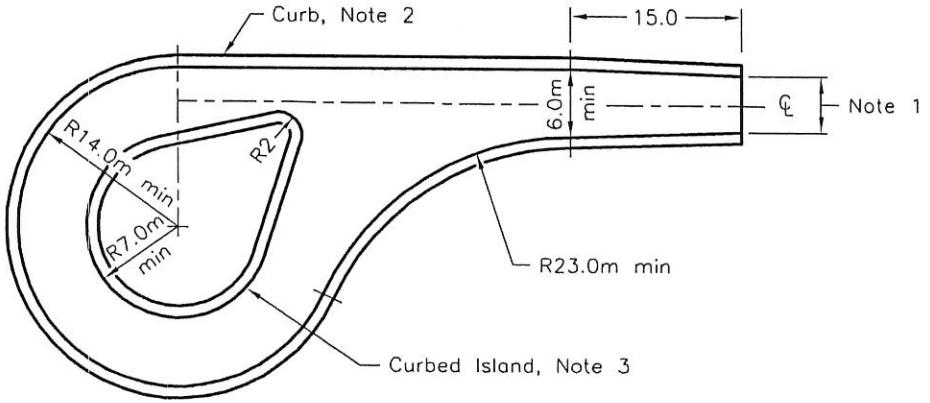
TYPE A



TYPE C



TYPE B



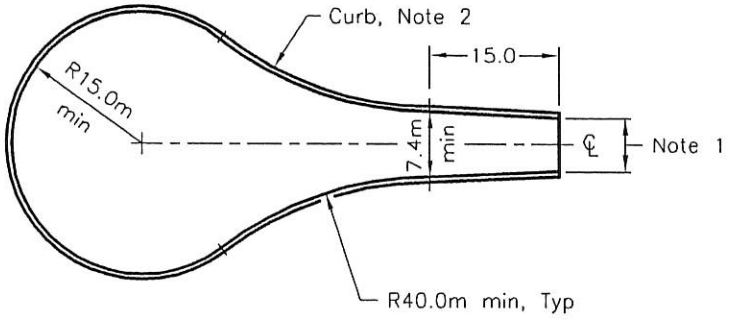
TYPE D

NOTES:

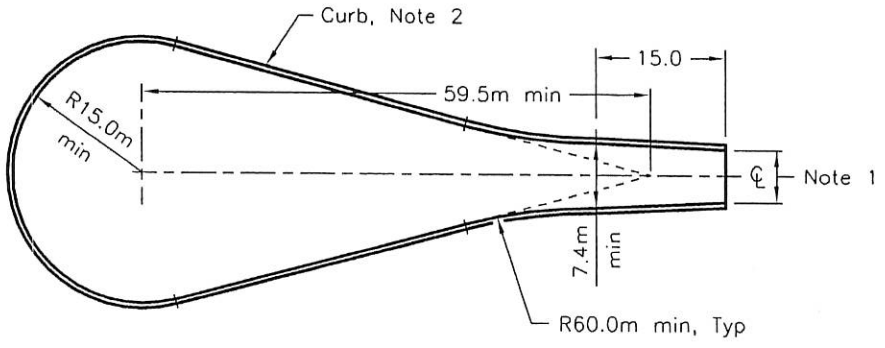
1 Width of pavement to match terminated roadway.
2 Type of curb to match terminated roadway.
3 Island curb shall be according to OPSD 600.090.

A Drainage and grading as specified.
B All dimensions are in metres unless otherwise shown.

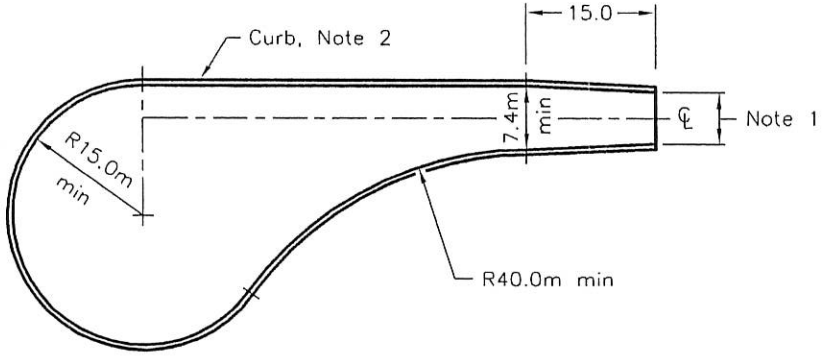
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	0
TURNING BASINS FOR TERMINATED URBAN ROADWAYS RESIDENTIAL			
	OPSD 500.020		



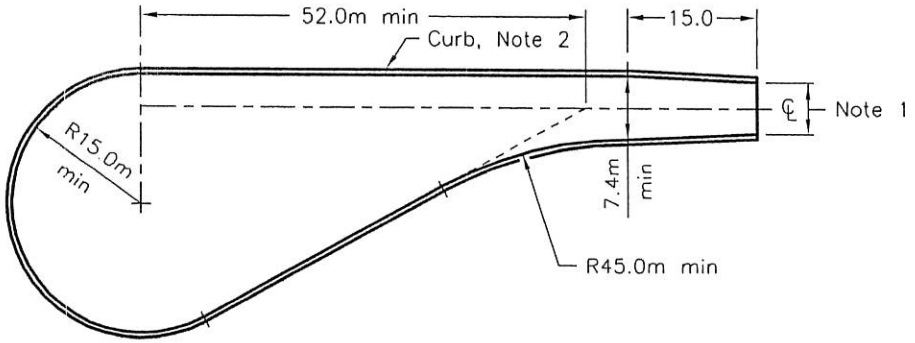
TYPE A



TYPE C



TYPE B



TYPE D

NOTES:

1 Width of pavement to match terminated roadway.
2 Type of curb to match terminated roadway.

A Drainage and grading as specified.
B All dimensions are in metres unless otherwise shown.

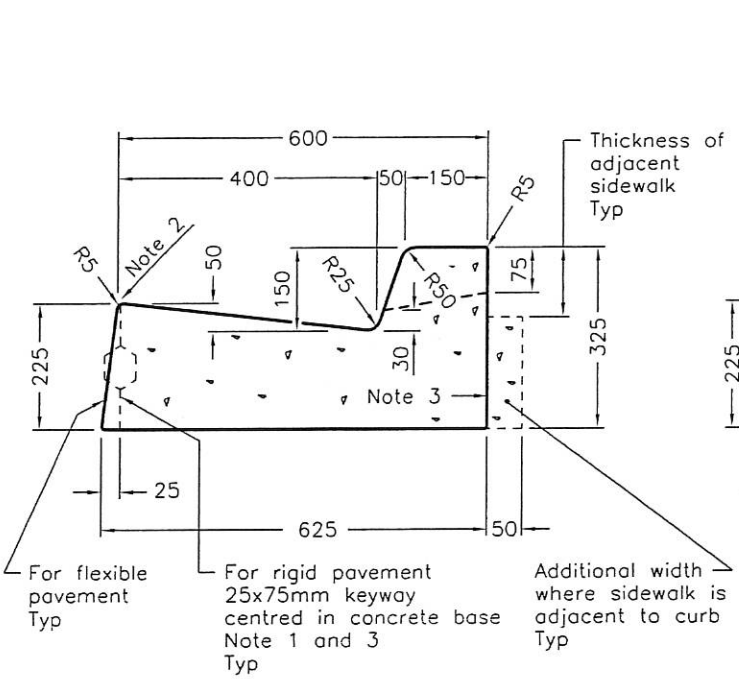
ONTARIO PROVINCIAL STANDARD DRAWING

TURNING BASINS FOR TERMINATED URBAN ROADWAYS INDUSTRIAL AND COMMERCIAL

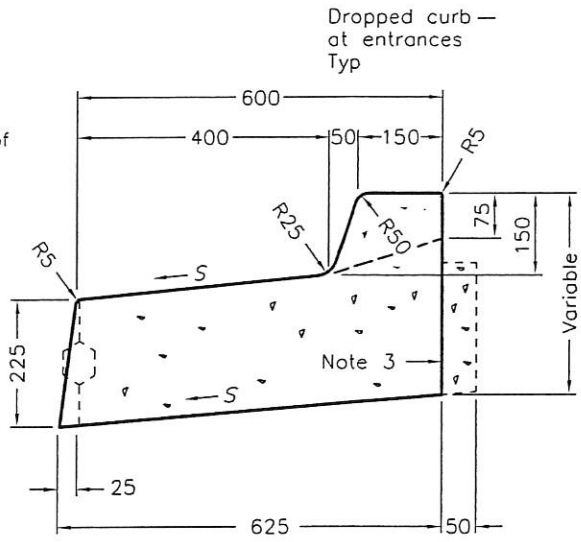
Nov 2009 | Rev 0

ONTARIO STANDARDS - MUNICIPAL - PROVINCIAL

OPSD 500.030



TANGENT



SUPERELEVATED

LEGEND:

S – Rate of pavement superelevation in percent, %.

NOTES:

1 When curb and gutter is adjacent to concrete pavement or base, this drawing is to be used in conjunction with OPSD 552.010 and 552.020.

2 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.

3 For slipforming procedure, a 5% batter is acceptable.

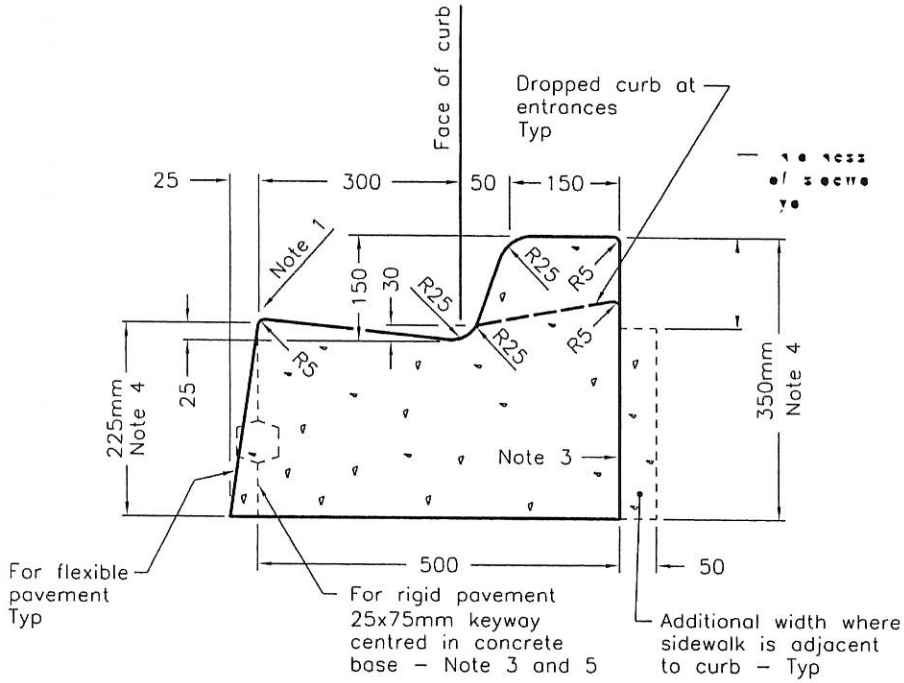
A Treatment at entrances shall be according to OPSD 351.010.

B Outlet treatment shall be according to the OPSD 610 Series.

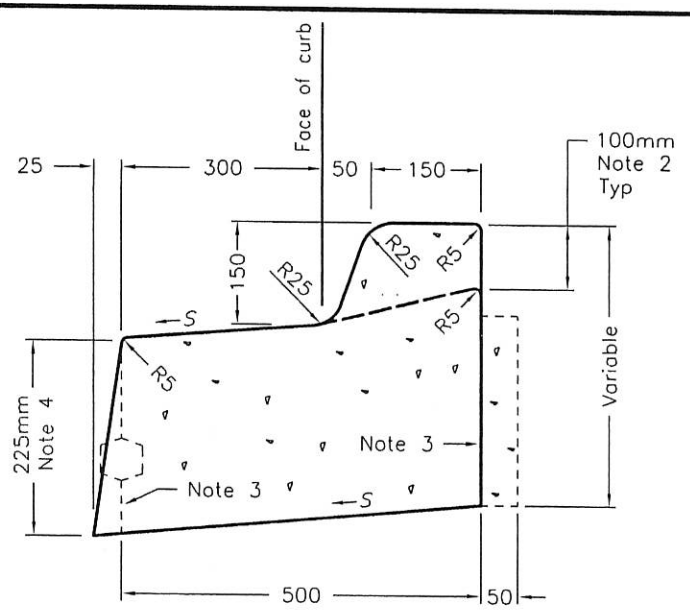
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.

D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
CONCRETE BARRIER CURB WITH WIDE GUTTER			
	OPSD 600.010		



TANGENT



SUPERELEVATED

LEGEND:

S – Rate of pavement superelevation in percent, %.

NOTES:

1 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.
2 Where sidewalk is continuously adjacent, reduce the dropped curb at entrances to 75mm.
3 For slipforming procedure, a 5% batter is acceptable.
4 For composite pavement the depth of concrete curb to be adjusted to depth of concrete pavement.
5 When tie bars are specified, refer to OPSD 552.010 and 552.020 for details.

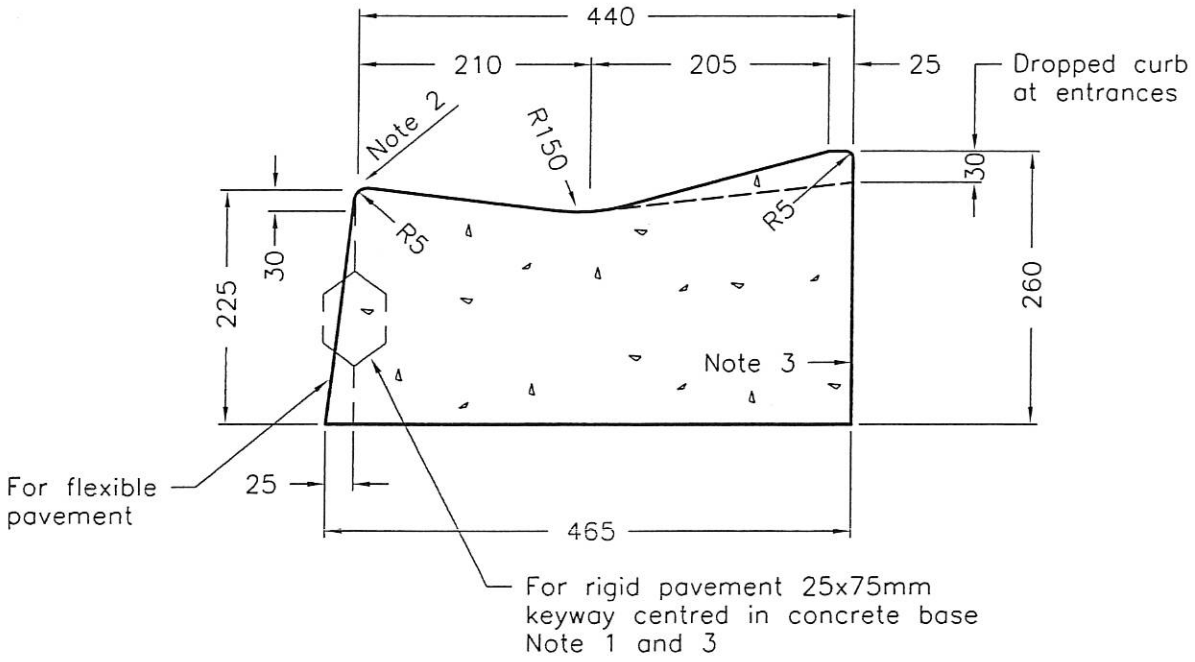
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

CONCRETE BARRIER CURB WITH STANDARD GUTTER

Nov 2006 | Rev 1

OPSD 600.040



NOTES:

1 When curb and gutter is adjacent to concrete pavement or base, this drawing is to be used in conjunction with OPSD 552.010 and 552.020.

2 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.

3 For slipforming procedure, a 5% batter is acceptable.

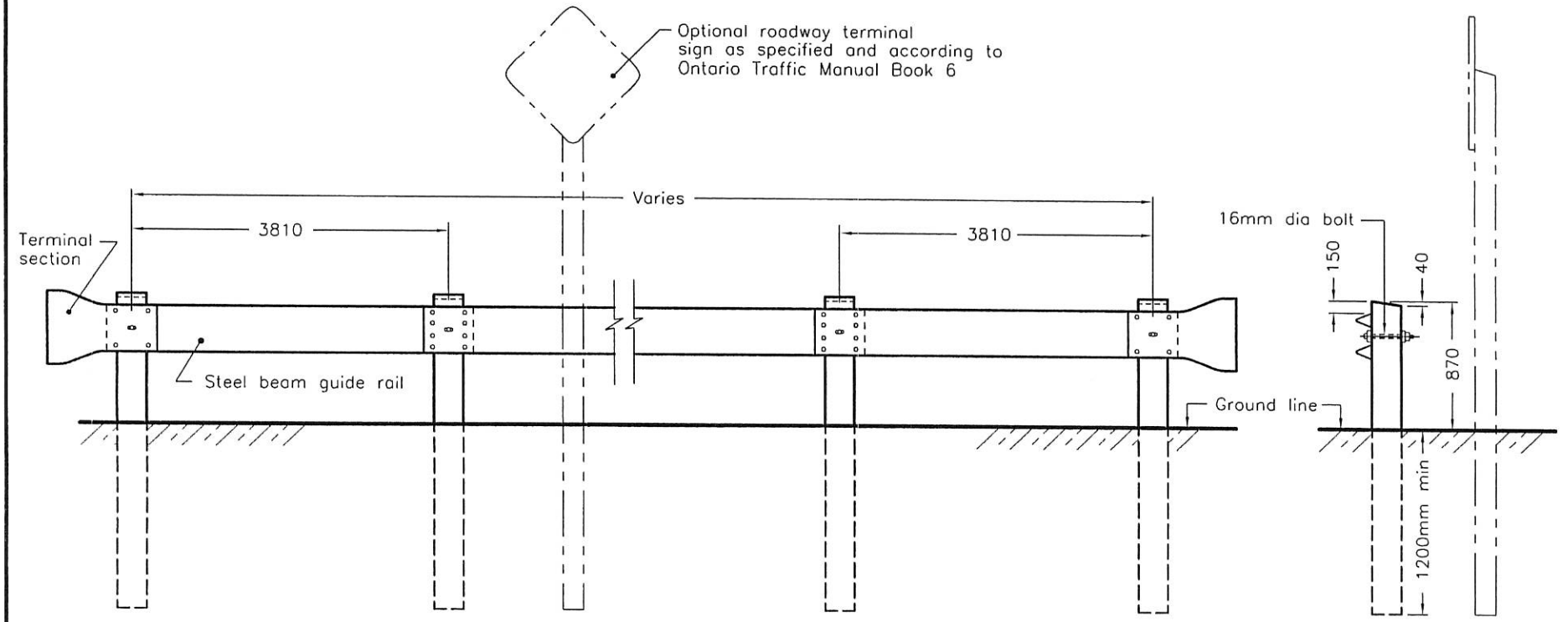
A Treatment at entrances shall be according to the OPSD 351.010.

B Outlet treatment shall be according to the OPSD 610 Series.

C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.

D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
CONCRETE MOUNTABLE CURB WITH NARROW GUTTER			
	OPSD 600.100		



ELEVATION

SIDE

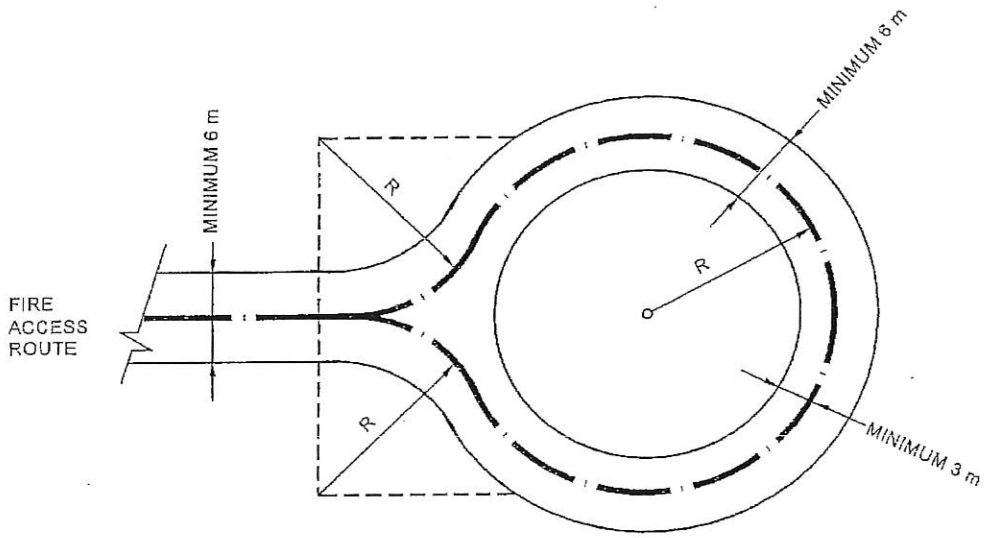
NOTES:

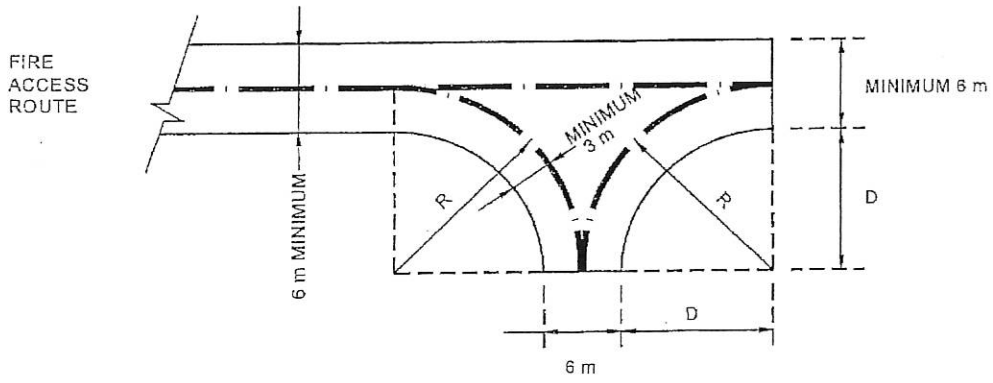
A Steel beam guide rail mounting heights shall be as specified.
B This OPSD to be read in conjunction with OPSD 912.101.
C Posts: Size 200x200mm nominal, 190x190mm ±1.5mm dressed, tops to have 25mm chamfer.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev	1
GUIDE RAIL SYSTEM, STEEL BEAM BARRICADE INSTALLATION			
	OPSD 912.532		

3.2.5.6. ACCESS ROUTE DESIGN

EXAMPLES OF TURN AROUND FACILITIES

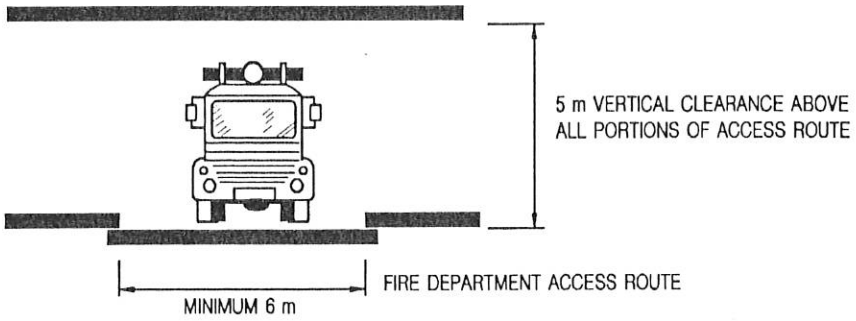


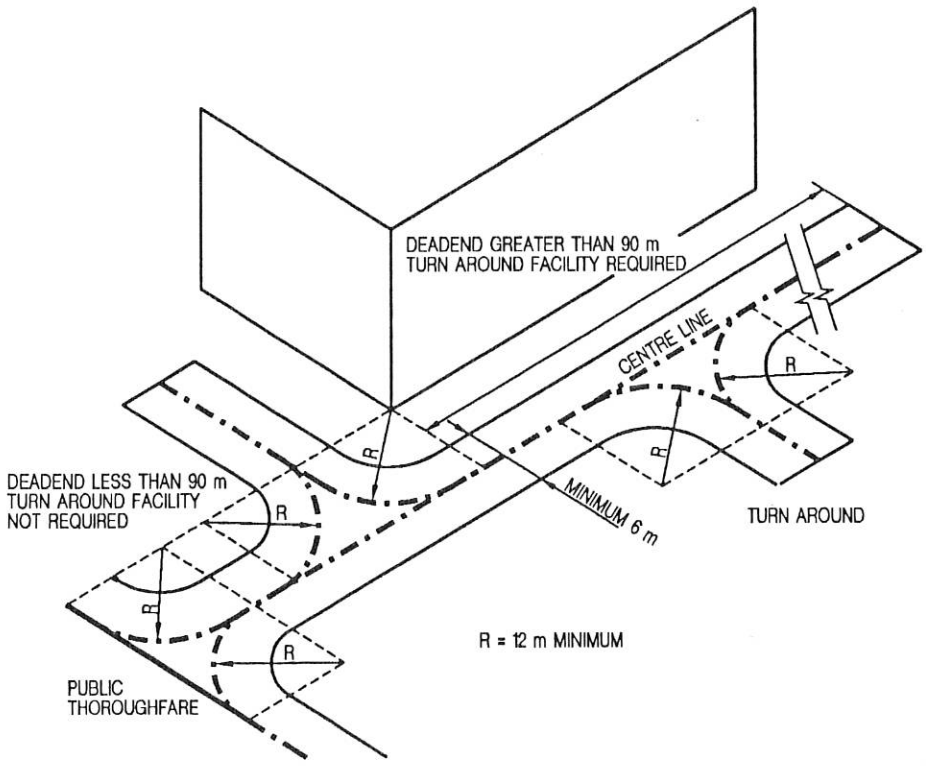


R: MINIMUM 12 m

D: DISTANCE DEPENDS ON FIRE DEPARTMENT VEHICLE SIZE

≧ 15m.


5 m VERTICAL CLEARANCE ABOVE
ALL PORTIONS OF ACCESS ROUTE
FIRE DEPARTMENT ACCESS ROUTE
MINIMUM 6 m


DEADEND GREATER THAN 90 m
TURN AROUND FACILITY REQUIRED
CENTRE LINE
R
R
R
DEADEND LESS THAN 90 m
TURN AROUND FACILITY
NOT REQUIRED
R
MINIMUM 6 m
TURN AROUND
R
R
R = 12 m MINIMUM
PUBLIC
THOROUGHFARE

City of Orillia
Public Works – Engineering Division

STREET LIGHTING STANDARDS

1. GENERAL

-The illuminance method as outlined in the American National Standard Practice for Roadway Lighting ANSI/IES RP-8, 1983 or latest edition is to be used as a guideline.

-One sided street lighting as opposed to a staggered layout is to be used.

-Street lighting is to be on same side as sidewalk, generally on north and east side.

-Cul-de-sac bulbs require two street lights.

-Intersections are to be illuminated to the sum of the individual roadway requirements.

-On curved road sections, spacing is to be reduced by 30%.

2. STREET LIGHTING DESIGN

a) Local Road

For standard cross-section (attached) the following requirements apply:

-pole spacing; 45 m.

-pole height; 9.1 m.

-luminaire: 100 watt high pressure sodium.

-bracket length; 3.0 m.

Illumination calculations from a Consulting Engineer are required for non-standard cross-section.

b) Collector and Arterial Roads

-Illumination calculations from a Consulting Engineer are required.

-Lamp lumen depreciation factor of 0.9 and luminaire dirt depreciation factor of 0.8 is to be used.

3. MANUFACTURERS/DETAILED SPECIFICATIONS

a) Luminaires

-For local road, Durastar series 20 is to be used.

-Landmark luminaries of appropriate wattage are to be used on collector and arterial roads.

-Individual photocells are required.

b) Poles

-For local road, Stresscrete Catalogue #TEC-30-BPR-CSA or approved equal is to be used.

-Stresscrete or approved equal poles of appropriate height and class are to be used on collector and arterial roads.

c) Brackets

-For local road, tapered single elliptical aluminum bracket, Sylvannia RE10MA, or approved equal is to be used.

-Tapered single elliptical aluminum brackets of appropriate length are to be used on arterial and collector roads.

d) Fuses /Wiring

-Electrical connection to each street light shall be by an individual run from the closest transformer to the fixture.

-Wire from street light to transformer shall be 2 No. 10 Type NMW-10 suitable for direct burial.

-Each wire shall be identified by closest street address where fixture is located.

-Wire marker to be written on self-laminating vinyl cable marker.

-Fixture shall be individually protected by a fuse suitable for purpose and be located in the transformer vault.

-Fuse holder shall be GEC English Electric Type SC32H

-Fuse shall be GEC English Electric Type CNS10

May 31st , 1993
(Revised May 2nd , 2005)

BOULEVARD TREES SPECIFICATIONS

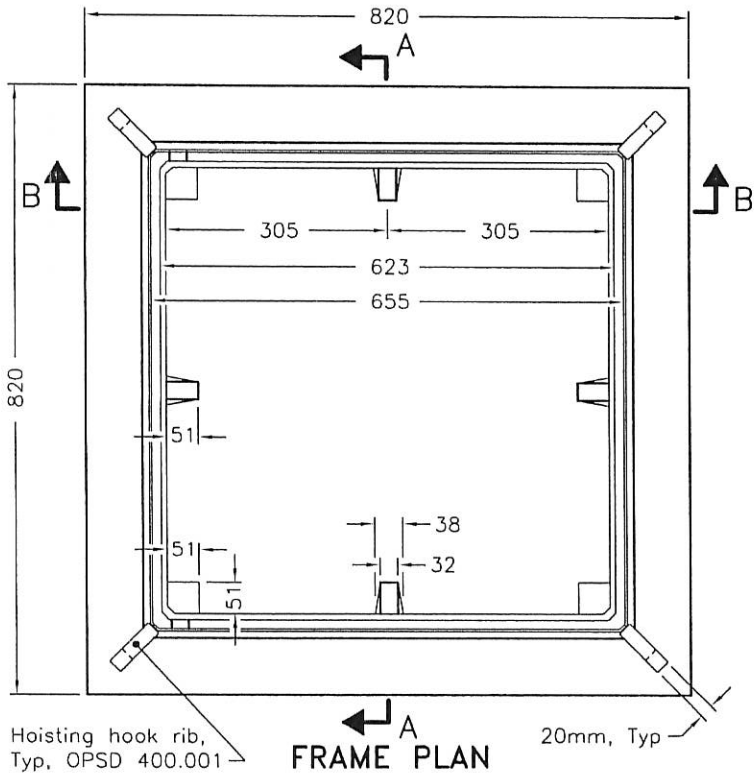
COMMON NAME	BOTANICAL NAME	MAXIMUM HEIGHT		MAXIMUM WIDTH		MAINTENANCE LEVEL	ZONE	PRIME PLANTING TIME	SELECTED TREE (INITIAL SIZE) 40mm or greater
		meters	feet	meters	feet				
rab Apple	Malus Snowdrift	7	23	7	23	Medium	2	Fall/Spring	Short & Ornamental
rospector Elm	Ulmus wilsoniania "Prospector"	13	43	10	33	Medium	4	Fall/Spring	Disease resistant
ccolade Elm	Ulmus japonica x wilsoniana "Morton"	21	69	18	59	Medium	4	Fall/Spring	Disease resistant
erviceberry-Juneberry (N)	Amelanchier canadenisis	8	26	3	10	Low	3	Fall/Spring	Samll red fruit
ory Silk Tree Lilac	Syringa reticulata "Ivory Silk"	7	23	5	16	Low	3	Fall/Spring	White Flowers
utumn Blaze Pear	Pyrus calleryana"Autumn Blaze"	10	33	8	26	Medium	4b	Fall/Spring	Ornamental pear
ttle Leaf Linden	Tilia cordata	15	49	8	26	Medium	3	Fall/Spring	a.k.a "lime tree"
reenspire Linden	Tilia cordata "Greenspire"	15	49	10	33	Low	3	Spring	Strong growing
mur Maple	Acer Ginnala	6	20	6	20	Low	2	Spring	Tall Shrub, Short Tree
utumn Blaze Maple	Acer x freemanii "Jeffersred"	16	52	12	39	Low	4	Spring	Red-Silver hybrid
ed Maple "Cultivars"	Acer rubrum "Subspecies"	15	49	5 to 13	<42	Low	3	Spring	
ed Maple (N)	Acer rubrum	20	66	12	39	Low	3b	Spring	Tolerates wet soil
ugar Maple (N)	Acer saccharum	20	66	15	49	Medium	4	Spring	Varietals available
in Oak	Quercus palustris	21	70	12	40	Low	4	Fall/Spring	Grows well in urban (acidic soil)
nglish Oak	Quercus robur	18	59	16	52	Low	4b	Fall/Spring	Fast Growing
Vhite Oak (N)	Quercus alba	20	66	12	39	Low	3	Fall/Spring	Slow Growing
urr Oak (N)	Quercus macrocarpa	20	66	20	66	Low	3	Fall/Spring	Very Hardy
lanetree, Am. Sycamore	Plananus occidentalis	20	66	20	66	Low	4	Fall/Spring	Golfball-size fruit
hademater Locust	Gleditsia triacanthos "Shademaster"	16	52	10	33	Medium	4	Fall/Spring	Honey locust varietal
lackberry (N)	Celtis occidentalis	20	66	18	59	Low	3	Fall/Spring	Very Hardy
ginkgo	Ginkgo Bilboba	16	53	11	36	Low	4	Fall/Spring	Very Slow Growing
ther* (see staff)_____							<5a		

N) Native Species

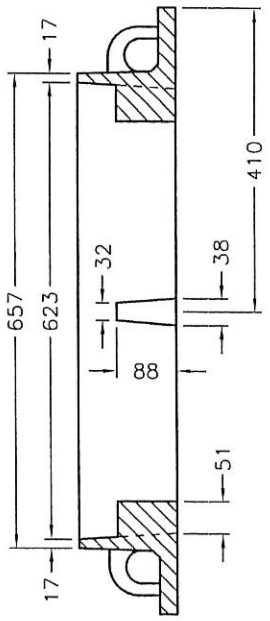
City will consider alternative species other than those listed above, but applicant must submit a request and receive approval.

* Orillia's Zone is 5a and lower

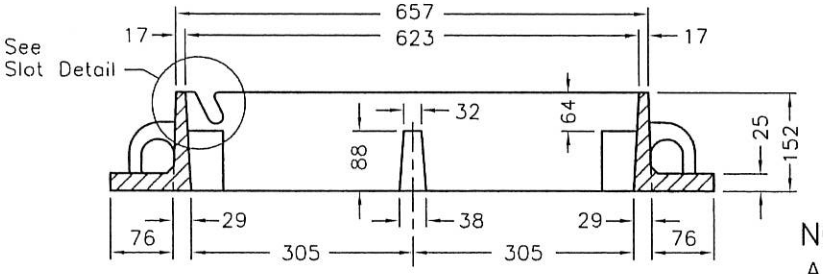
SEWERS, WATERMAIN AND APPURTENANCES



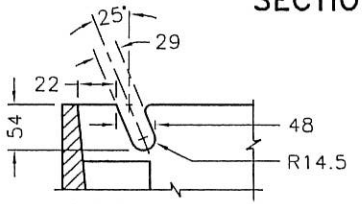
FRAME PLAN



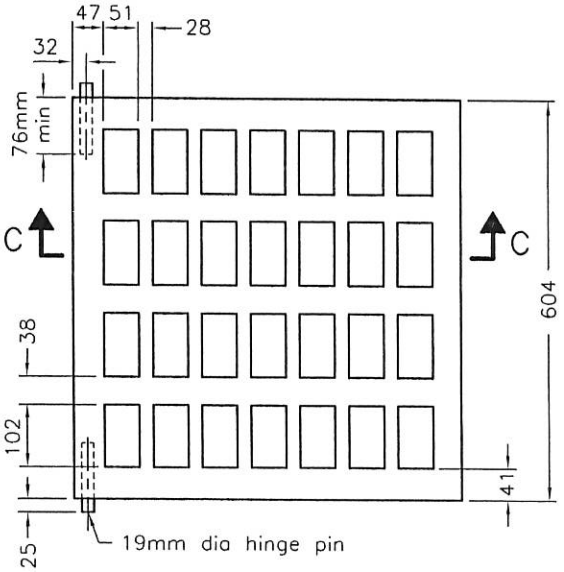
SECTION A–A



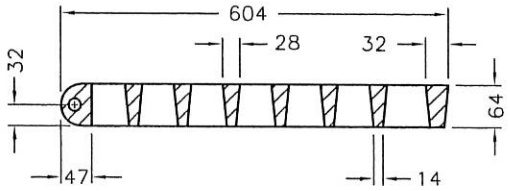
SECTION B–B



SLOT DETAIL



GRATE PLAN



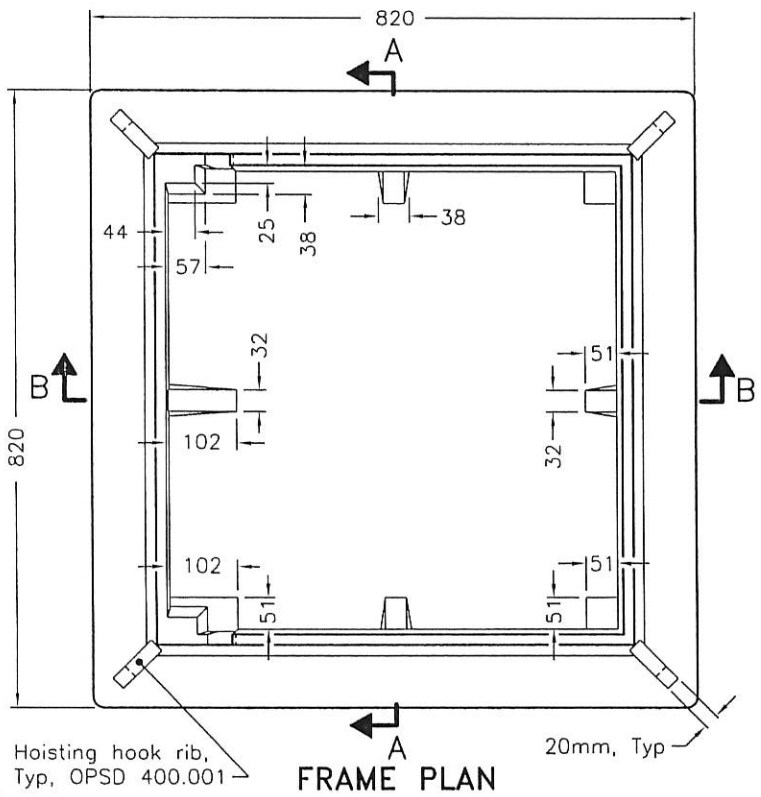
SECTION C–C

NOTE:

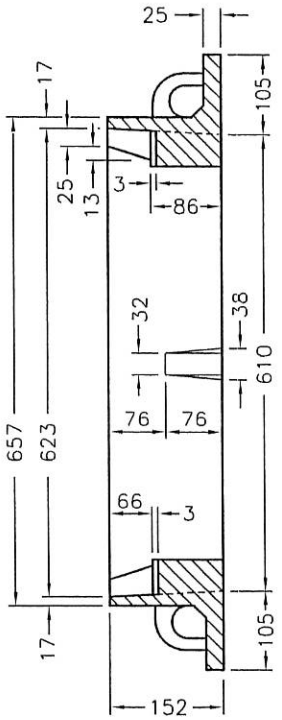
A This OPSD to be read in conjunction with OPSD 610.010 and 610.020.

B All dimensions are in millimetres unless otherwise shown.

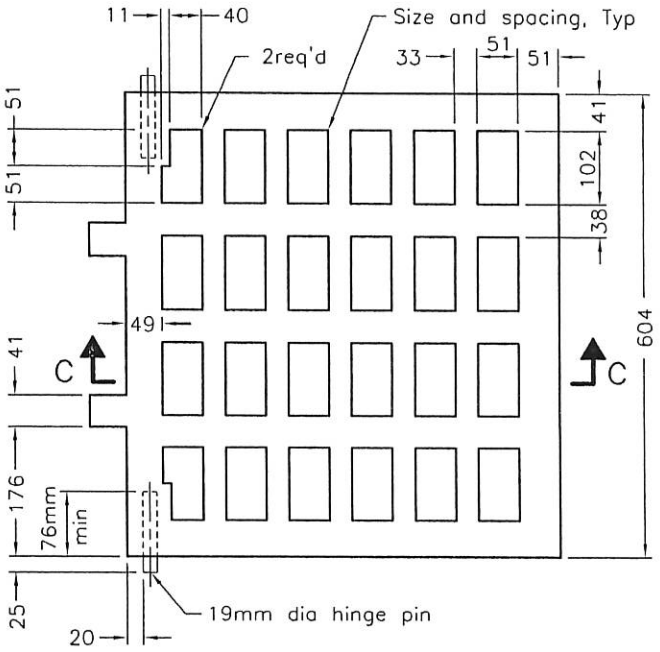
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev	1
CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, PERFORATED OPENINGS			
	OPSD 400.100		



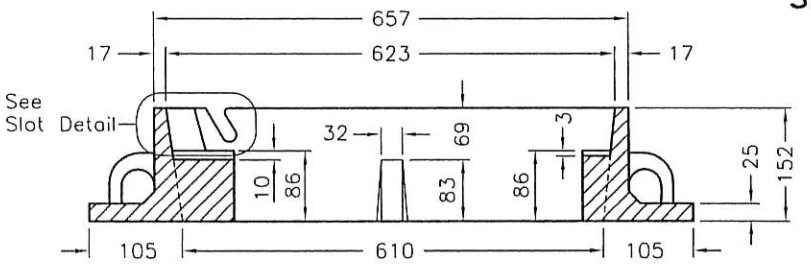
FRAME PLAN



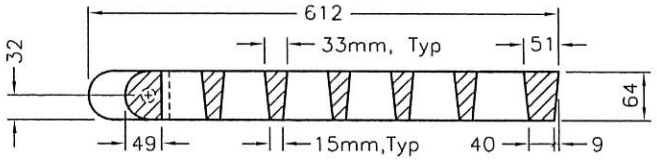
SECTION A–A



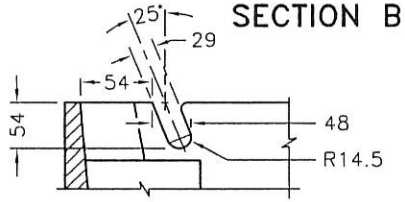
GRATE PLAN



SECTION B–B



SECTION C–C



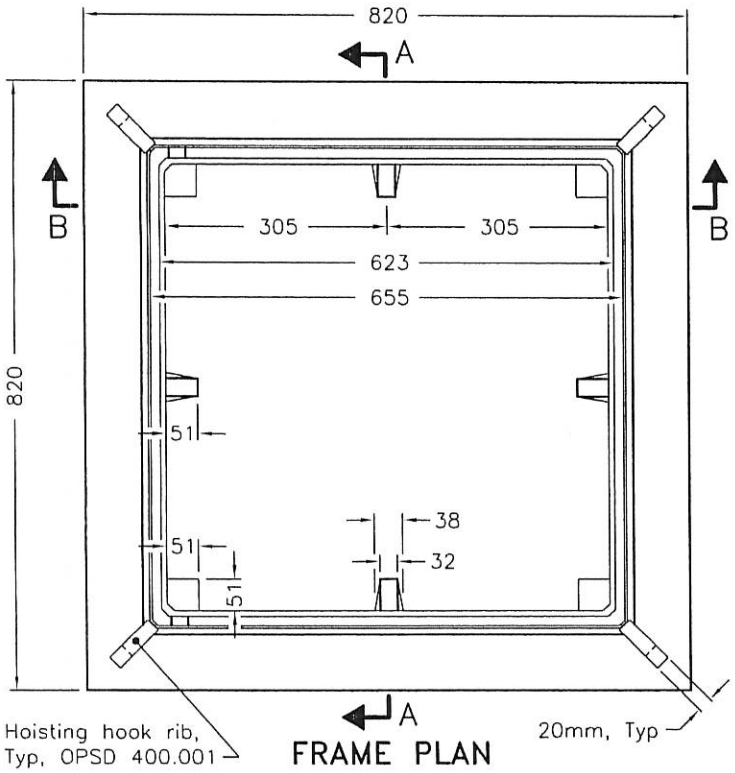
SLOT DETAIL

NOTES:

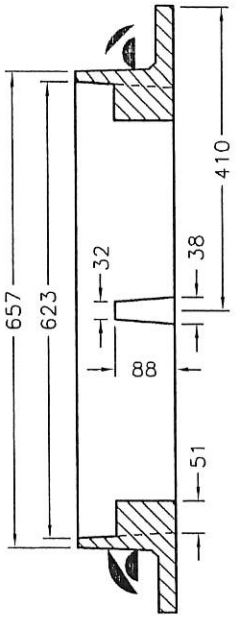
A This OPSD to be read in conjunction with OPSD 610.010 and 610.020.

B All dimensions are in millimetres unless otherwise shown.

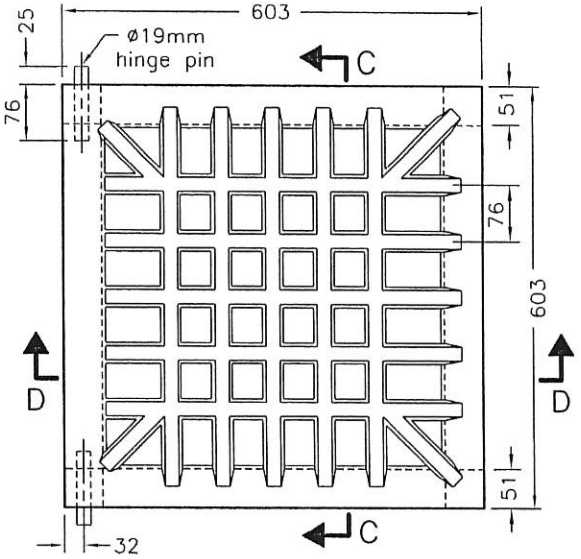
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev	1
CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE FLAT GRATE FOR CATCH BASINS, PERFORATED OPENINGS			
	OPSD 400.110		



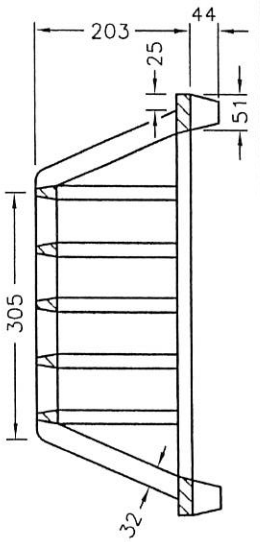
FRAME PLAN



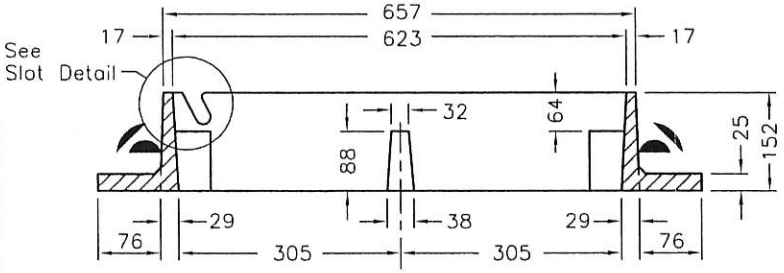
SECTION A–A



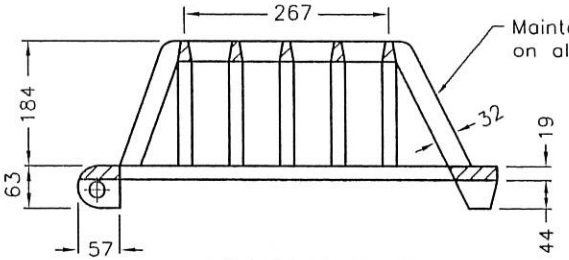
GRATE PLAN



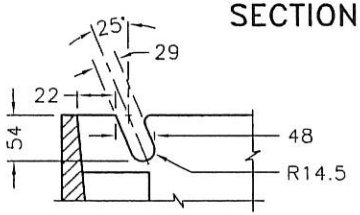
SECTION C–C



SECTION B–B



SECTION D–D



SLOT DETAIL

NOTES:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

CAST IRON, SQUARE FRAME WITH BIRDCAGE GRATE FOR CATCH BASINS

Nov 2007	Rev	1

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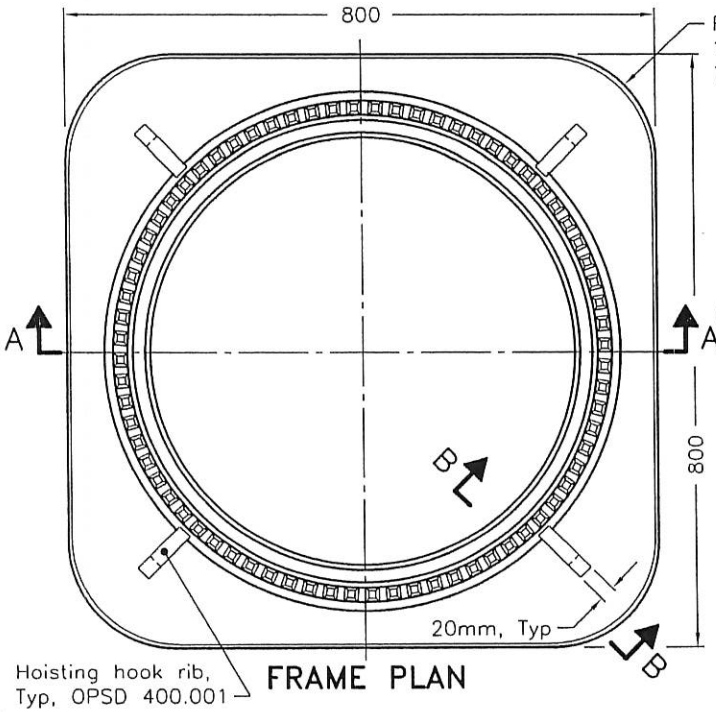
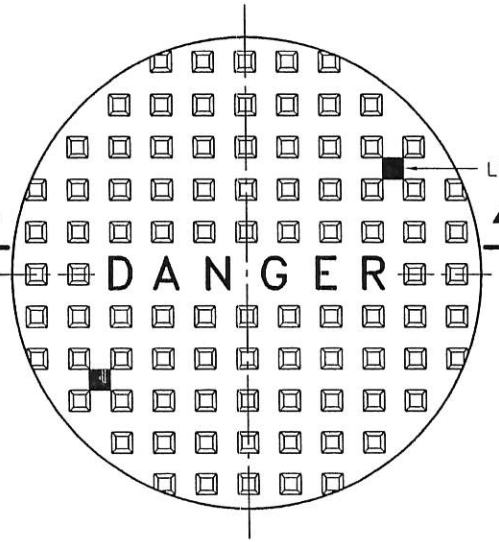
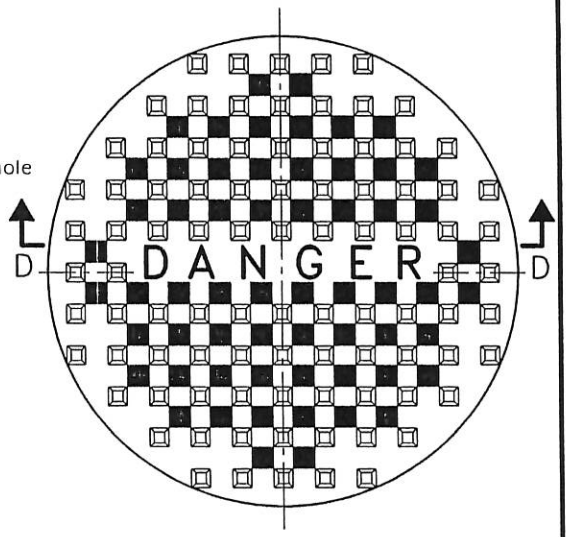
OPSD 400.120



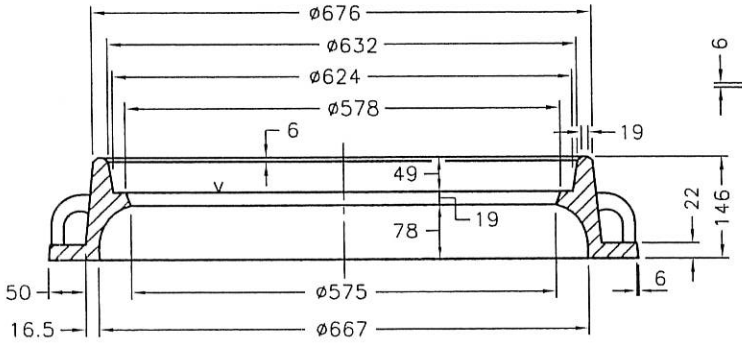
FRAME PLAN



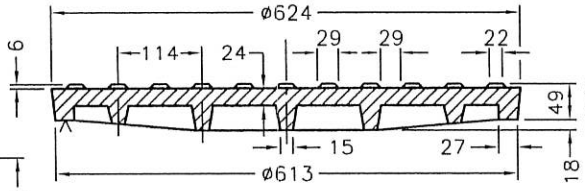
TYPE A
CLOSED COVER



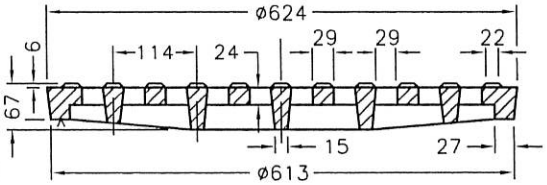
TYPE B
OPEN COVER



SECTION A–A



SECTION C–C

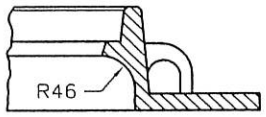


SECTION D–D

NOTES:

A Covers shall be Type A or Type B as specified.

B All dimensions are in millimetres unless otherwise shown.



SECTION B–B

ONTARIO PROVINCIAL STANDARD DRAWING

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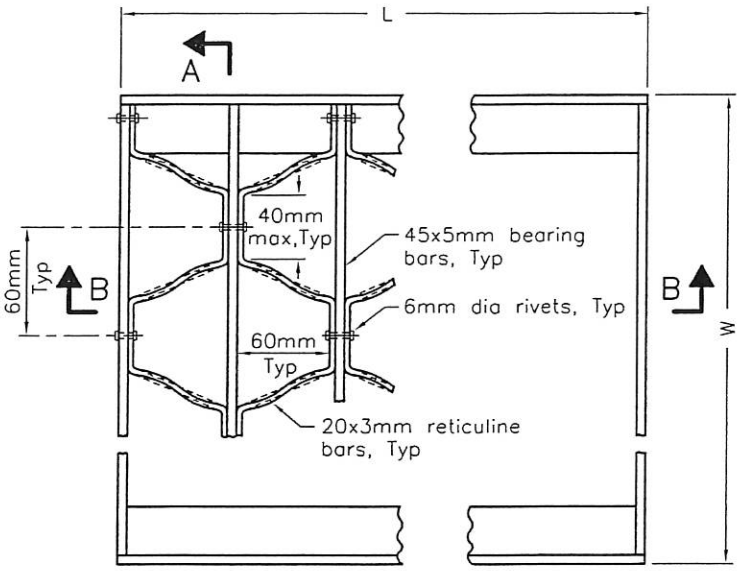
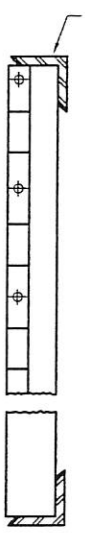
CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPSS

OPSD 401.010

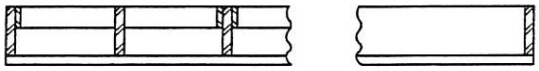


PLAN OF GRATE

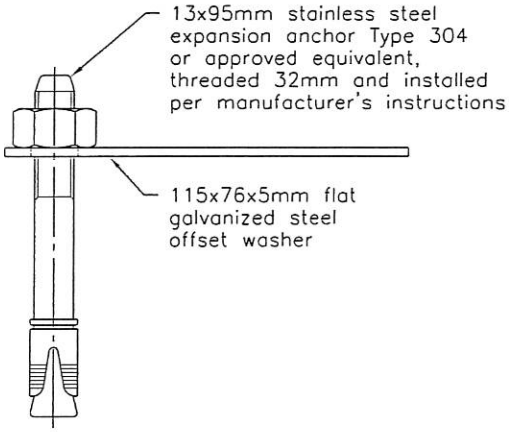


SECTION A–A

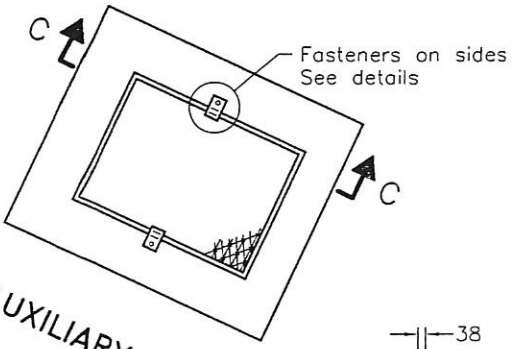
Grating Type	Grating Size	
	Length L	Width W
A	762	768
B	1338	768
C	1465	768



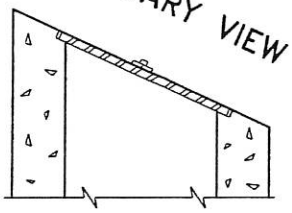
SECTION B–B



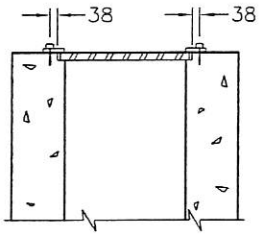
FASTENER DETAIL



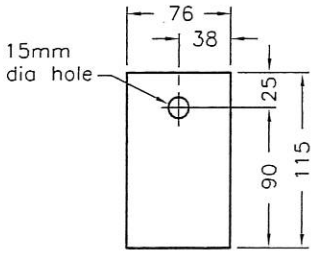
AUXILIARY VIEW



SECTION C–C



FASTENER EMBEDMENT DETAIL



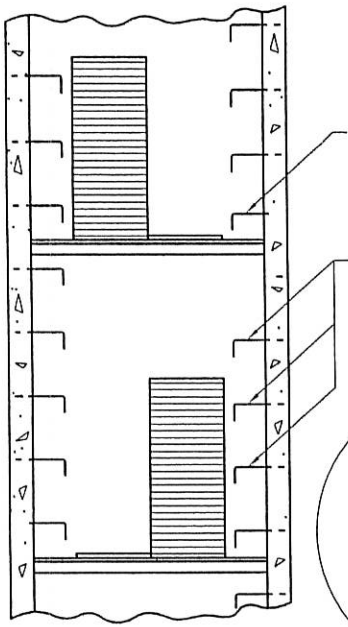
OFFSET WASHER DETAIL

NOTES:

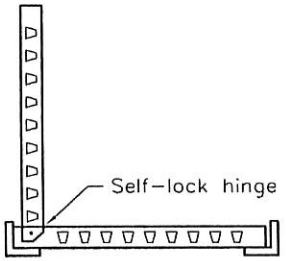
A Fastener to be inserted to maintain minimum concrete cover requirements.

B All dimensions are in millimetres unless otherwise shown.

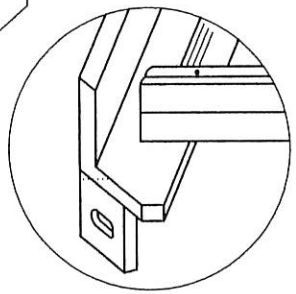
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev	1
GALVANIZED STEEL HONEYCOMB GRATING FOR DITCH INLETS			
	OPSD 403.010		



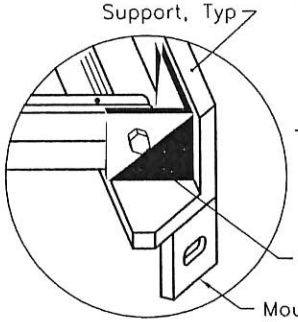
GRATING OPEN
SECTION A–A



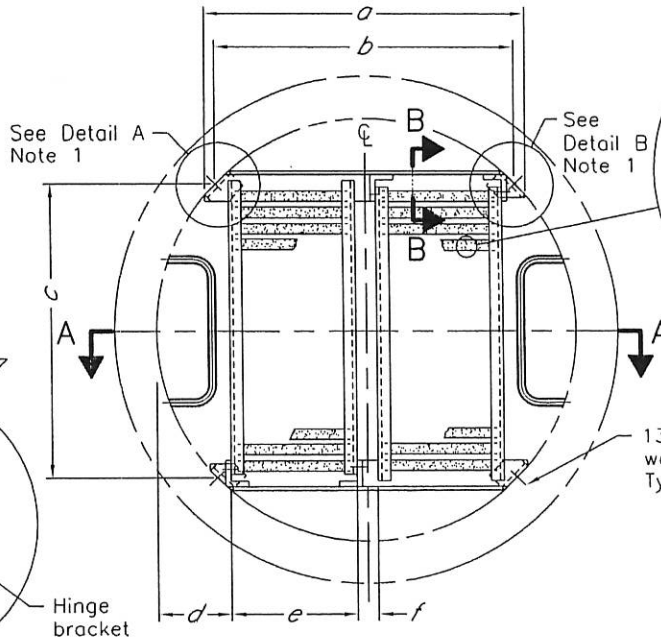
OPEN POSITION
SIDE VIEW



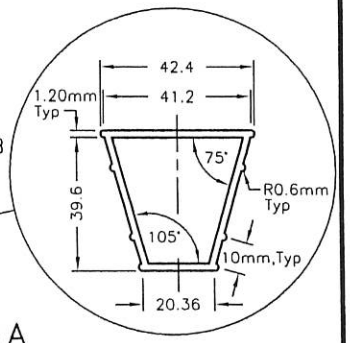
DETAIL A



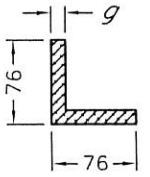
DETAIL B



DETAIL OF GRATING AND BOLT–ON SUPPORT
PLAN



GRATING RUNG DETAIL



SECTION B–B

NOTES:

1 All hinge brackets and mounting brackets shall be welded all around to support angle.

A All aluminum in contact with concrete shall be thoroughly coated with asphalt paint.

B Maintenance hole depth between 5.0m and 10.0m, grate shall be placed at midpoint. Maintenance hole depth between 10.0m and 15.0m, grates shall be placed at third–points.

C All fasteners shall be 304 stainless steel.

D All welding shall be according to CSA W47.2 and W59.2.

E All dimensions are in millimetres unless otherwise shown.

MH Diameter	No of Grates	*a*	*b*	*c*	*d*	*e*	*f*	*g*
1200	2	900	850	850	225	352	65	10
1500	2	1128	1078	1078	311	419	65	12
1800	3	1344	1293	1293	308	360	65	12
2400	4	1774	1724	1724	401	360	65	12

ONTARIO PROVINCIAL STANDARD DRAWING

ALUMINUM SAFETY PLATFORM FOR CIRCULAR MAINTENANCE HOLES

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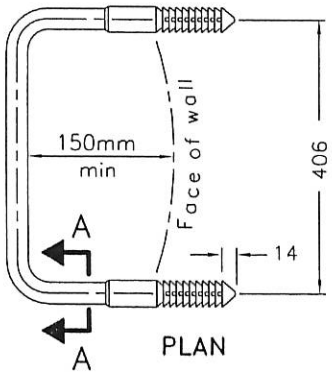
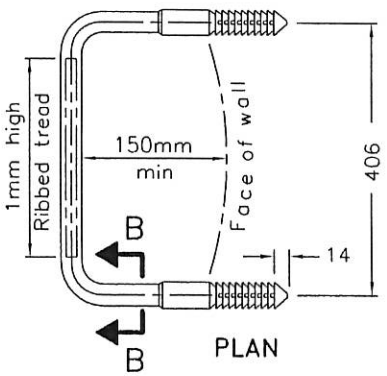
ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPS

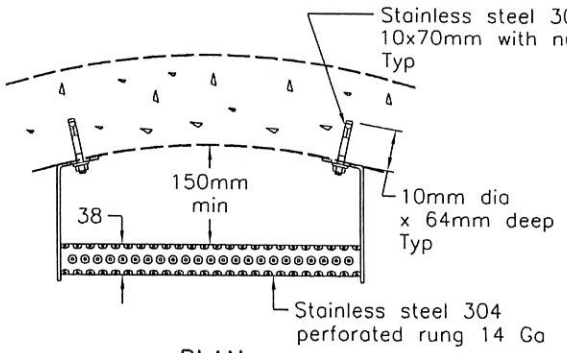
OPSD 404.020



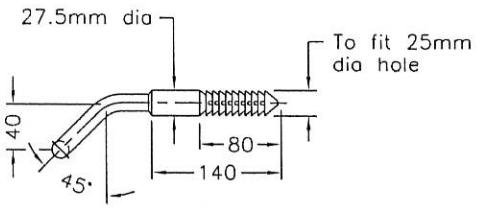
PLAN



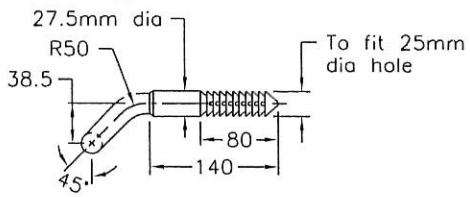
PLAN



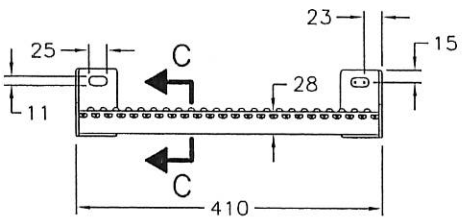
PLAN



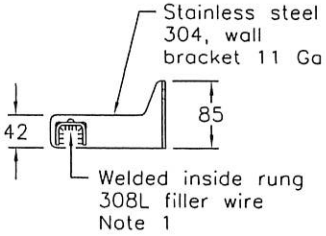
SIDE VIEW



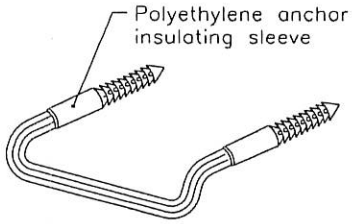
SIDE VIEW



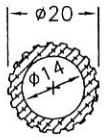
FRONT VIEW



SECTION C–C

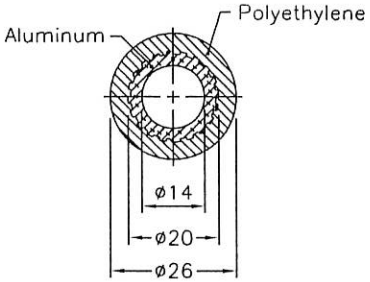


AUXILIARY
VIEW



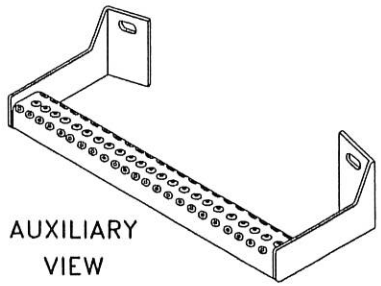
EXTRUDED
CIRCULAR SECTION A–A

CIRCULAR ALUMINUM



SECTION B–B

CIRCULAR ALUMINUM WITH
POLYETHYLENE ENCASEMENT



AUXILIARY
VIEW

RECTANGULAR STAINLESS STEEL

NOTE:

1 The company undertaking welded fabrication shall be certified according to CSA W47.1. All welding shall be according to CSA W59.

A All dimensions are in millimetres unless otherwise shown.

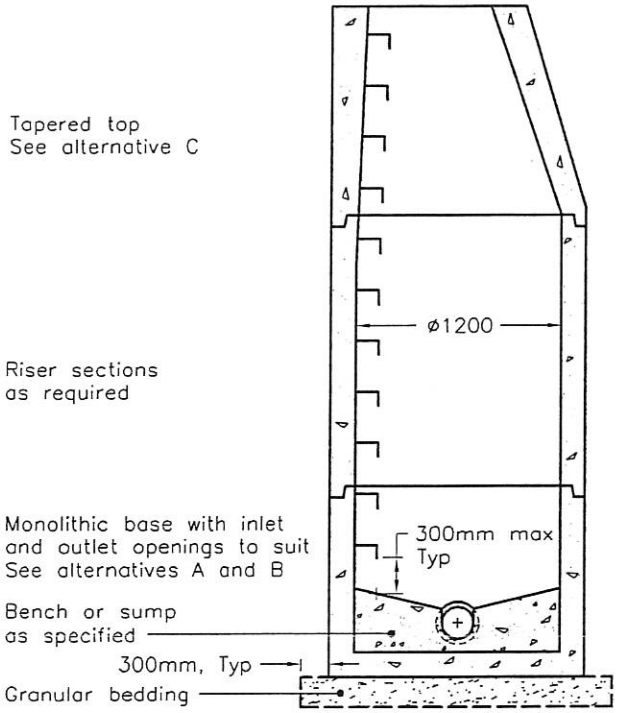
ONTARIO PROVINCIAL STANDARD DRAWING

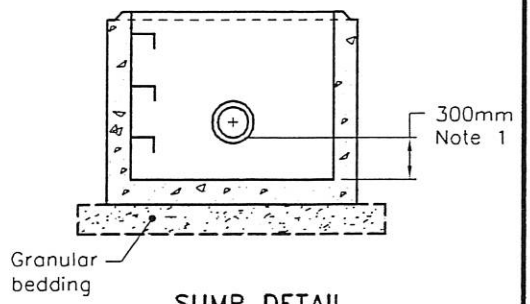
MAINTENANCE HOLE STEPS

HOLLOW

Nov 2008 | Rev 2

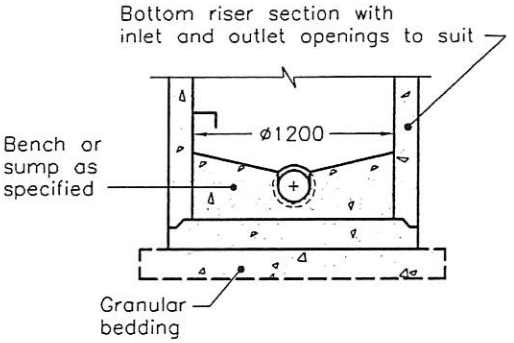
OPSD 405.010



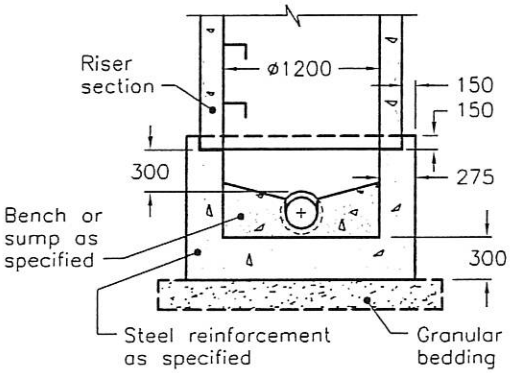


SUMP DETAIL

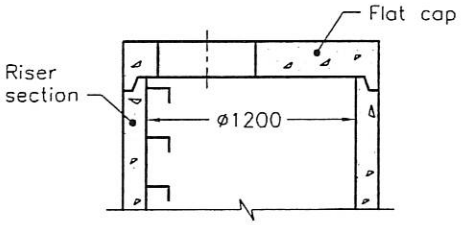
ALTERNATIVES



A PRECAST SLAB BASE



B CAST-IN-PLACE BASE



C PRECAST FLAT CAP

NOTES:

1 The sump is measured from the lowest invert.

A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.

B Precast concrete components shall be according to OPSD 701.030, 701.031, and 701.032.

C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.

D Pipe support shall be according to OPSD 708.020.

E For benching and pipe opening details, see OPSD 701.021.

F For adjustment unit and frame installation, see OPSD 704.010.

G All dimensions are nominal.

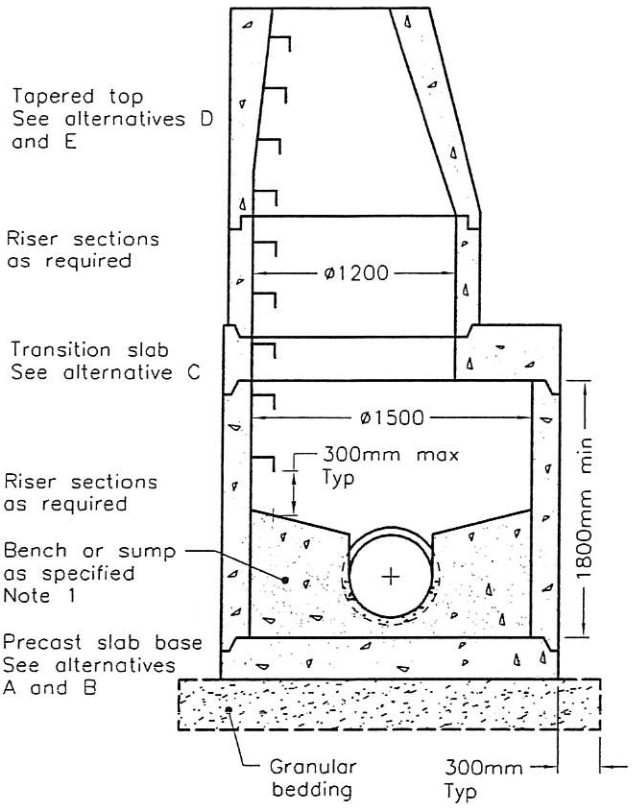
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2009 | Rev 4

PRECAST CONCRETE MAINTENANCE HOLE

1200mm DIAMETER

OPSD 701.010



NOTES:

1 For sump detail see OPSD 701.010.

A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.

B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.040, 701.041, 703.011, 703.021, and 706.010.

C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.

D Pipe support shall be according to OPSD 708.020.

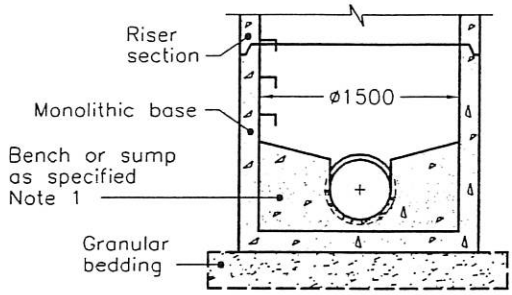
E For benching and pipe opening details, see OPSD 701.021.

F For adjustment unit and frame installation, see OPSD 704.010.

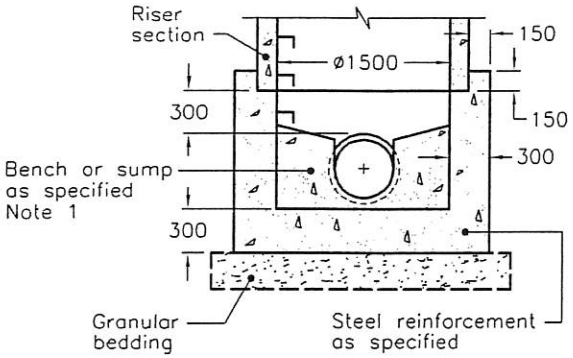
G All dimensions are nominal.

H All dimensions are in millimetres unless otherwise shown.

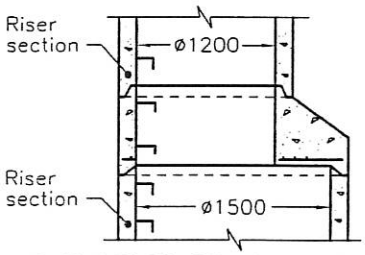
ALTERNATIVES



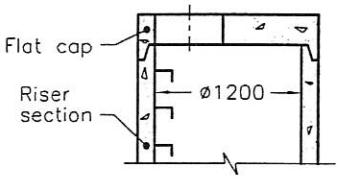
A PRECAST MONOLITHIC BASE



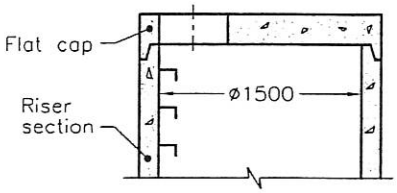
B CAST-IN-PLACE BASE



C TAPERED TRANSITION SLAB



D 1200mm PRECAST FLAT CAP



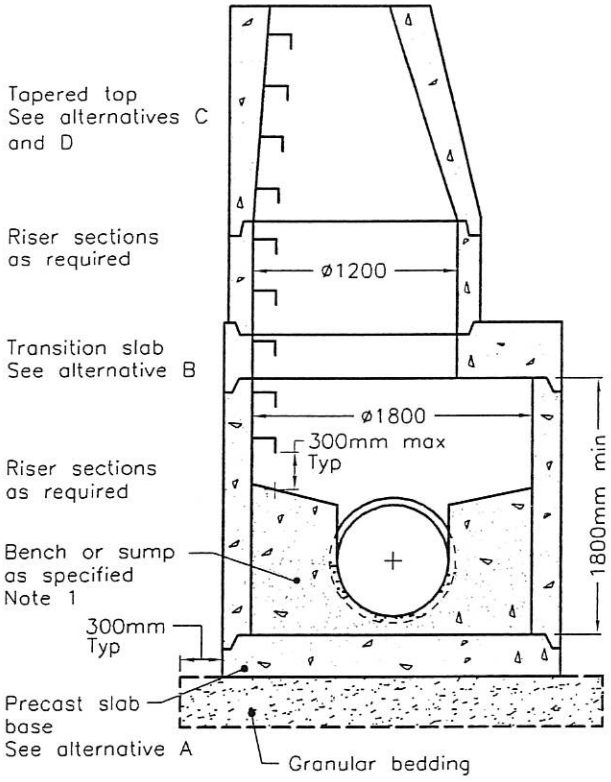
E 1500mm PRECAST FLAT CAP

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2009 | Rev 4

PRECAST CONCRETE MAINTENANCE HOLE

1500mm DIAMETER

OPSD 701.011



NOTES:

1 For sump detail see OPSD 701.010.

A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.

B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.050, 701.051, 703.012, 703.022, and 706.020.

C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.022.

D Pipe support shall be according to OPSD 708.020.

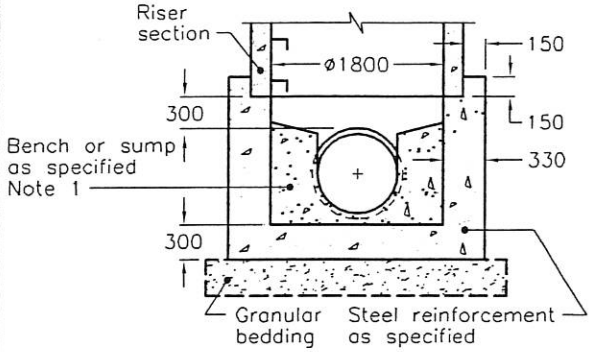
E For benching and pipe opening details, see OPSD 701.021.

F For adjustment unit and frame installation, see OPSD 704.010.

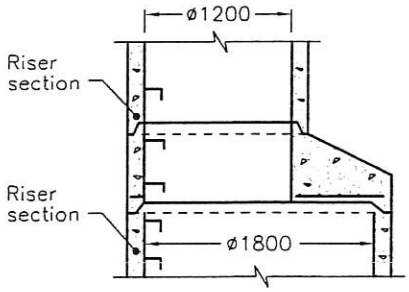
G All dimensions are nominal.

H All dimensions are in millimetres unless otherwise shown.

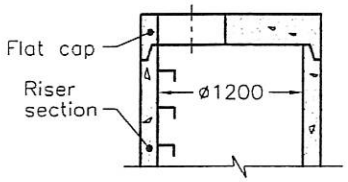
ALTERNATIVES



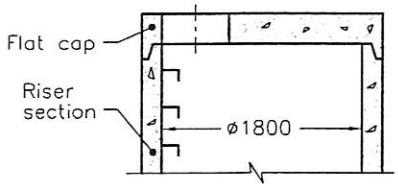
A CAST-IN-PLACE BASE



B TAPERED TRANSITION SLAB



C 1200mm PRECAST FLAT CAP



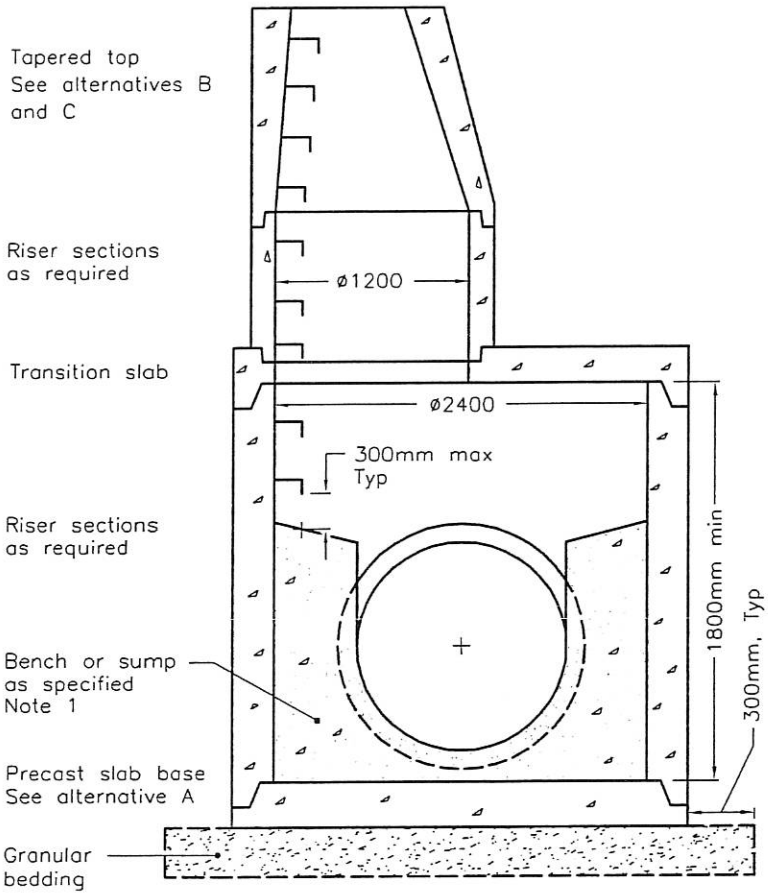
D 1800mm PRECAST FLAT CAP

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2009 | Rev 4

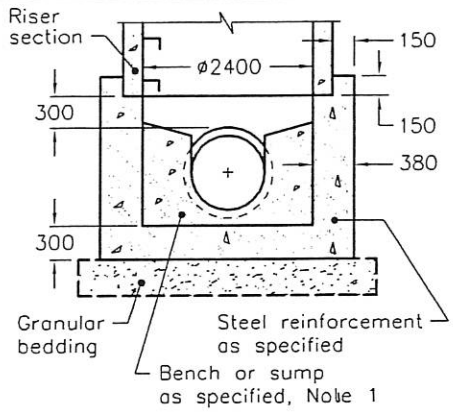
PRECAST CONCRETE MAINTENANCE HOLE

1800mm DIAMETER

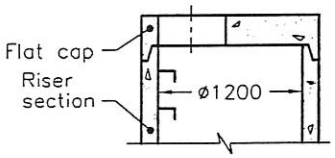
OPSD 701.012



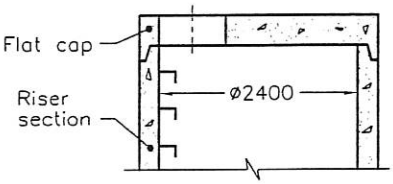
ALTERNATIVES



A CAST-IN-PLACE BASE



B 1200mm PRECAST FLAT CAP



C 2400mm PRECAST FLAT CAP

NOTES:

1 For sump detail see OPSD 701.010.

A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.

B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.060, 701.061, 703.013, 703.023, 706.030 and 706.031.

C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.

D Pipe support shall be according to OPSD 708.020.

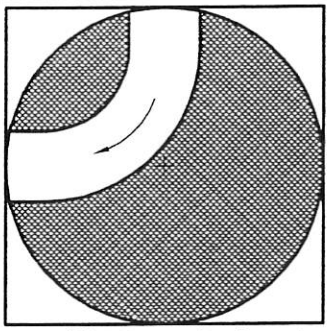
E For benching and pipe opening details, see OPSD 701.021.

F For adjustment unit and frame installation, see OPSD 704.010.

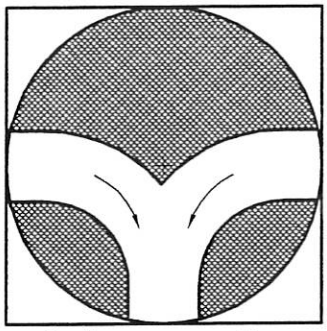
G All dimensions are nominal.

H All dimensions are in millimetres unless otherwise shown.

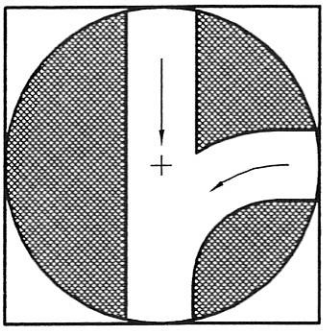
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	4
PRECAST CONCRETE MAINTENANCE HOLE 2400mm DIAMETER			
	OPSD 701.013		



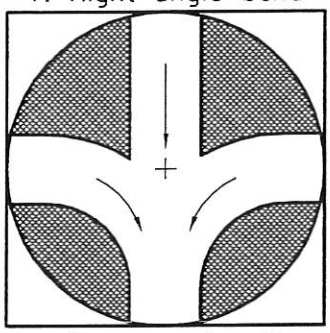
1. Right angle bend



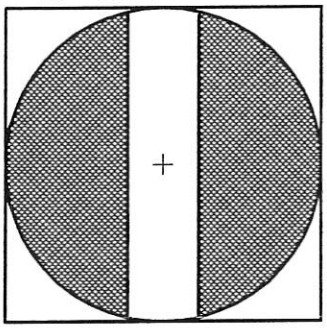
2. Tee connection



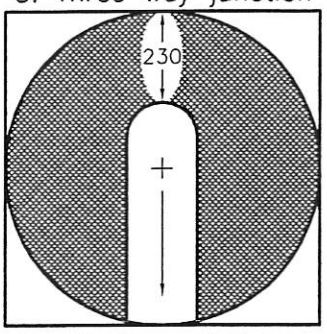
3. Three way junction



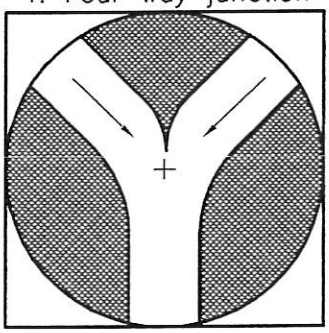
4. Four way junction



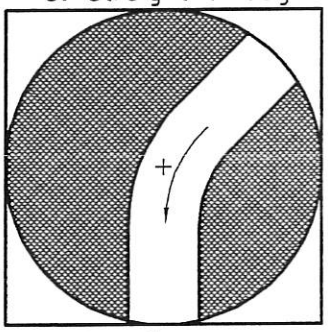
5. Straight through



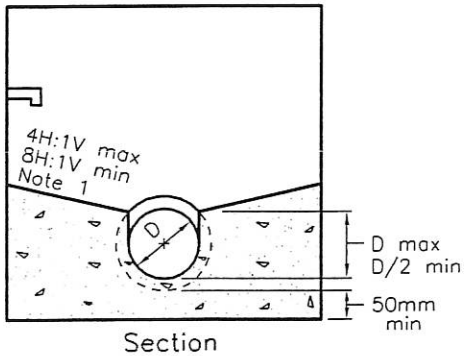
6. Dead end



7. Wye connection



8. 45° bend



Section

MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No.7	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2195	3085	2730	2195	3085

NOTES:

1 Slopes shall be maintained from the outlet hole opening for top of benching.

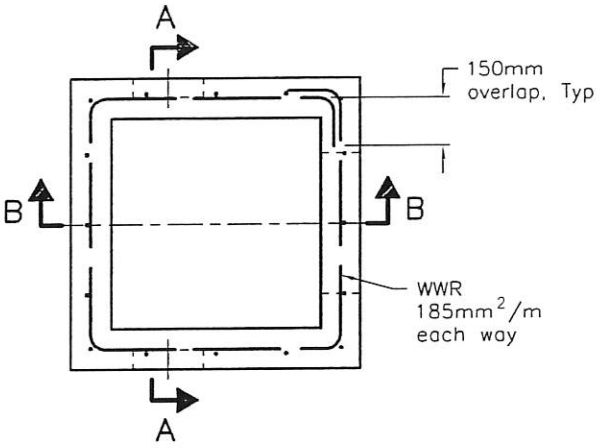
A Concrete for benching shall be 30MPa.
B Benching shall be given wood float finish, channel shall be given steel trowel finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1200mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2009 | Rev 3

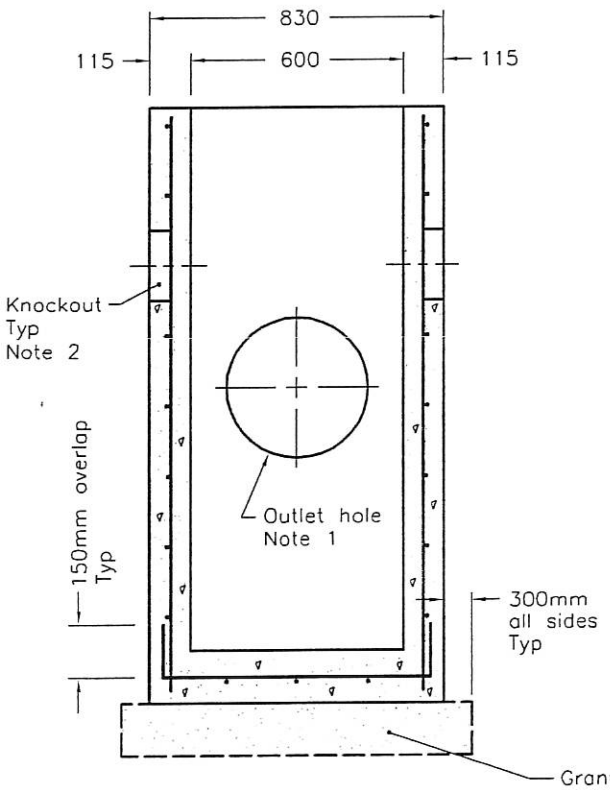
MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES

OPSD 701.021

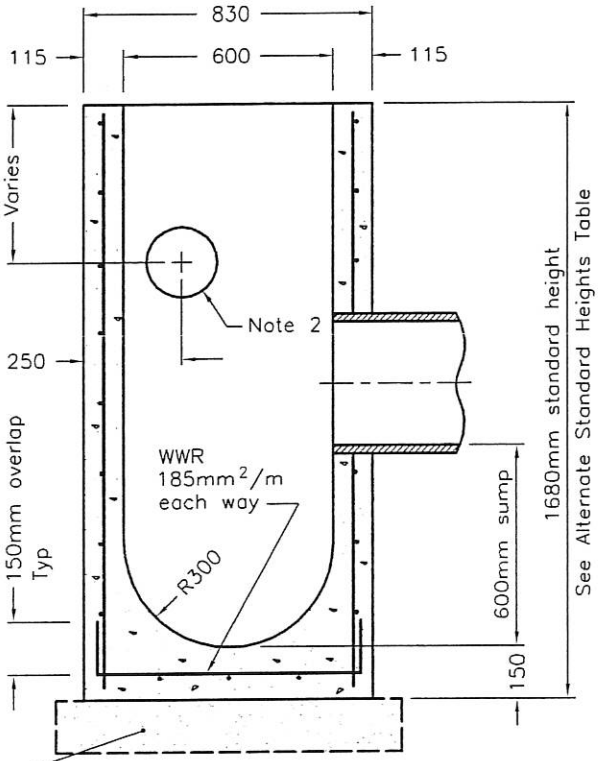
ALTERNATE STANDARD HEIGHTS	
ALTERNATE	DIMENSION
A	1980
B	1830
C	1520
D	1380



PLAN



SECTION A–A



SECTION B–B

Granular bedding

NOTES:

1 Outlet hole size 525mm diameter maximum, location as required.

2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.

A Centre reinforcing in base slab and walls ±20mm.

B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.

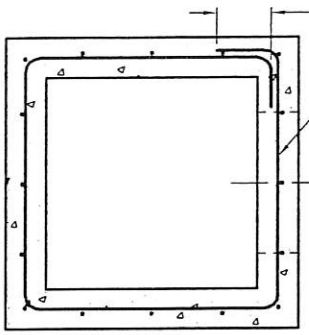
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.

D Pipe support shall be according to OPSD 708.020.

E All dimensions are nominal.

F All dimensions are in millimetres unless otherwise shown.

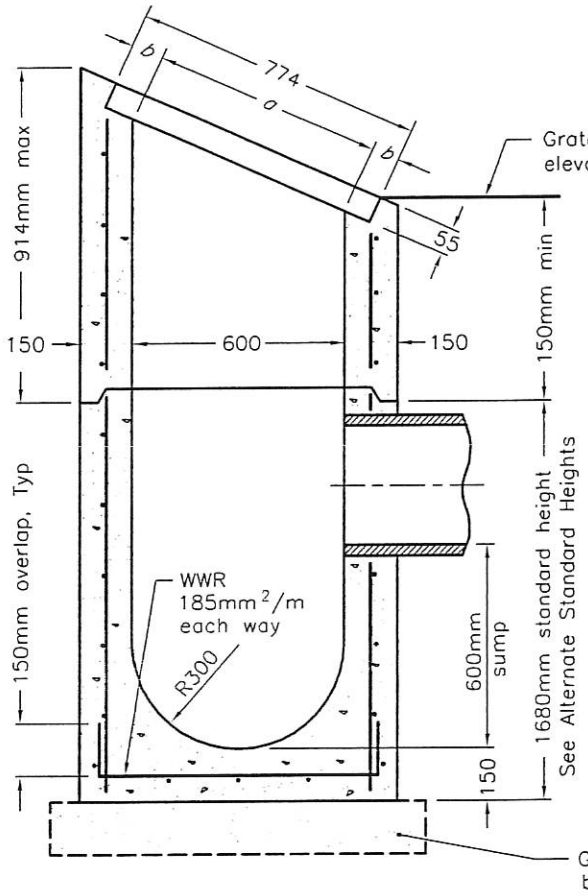
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	2
PRECAST CONCRETE CATCH BASIN 600x600mm			
	OPSD 705.010		



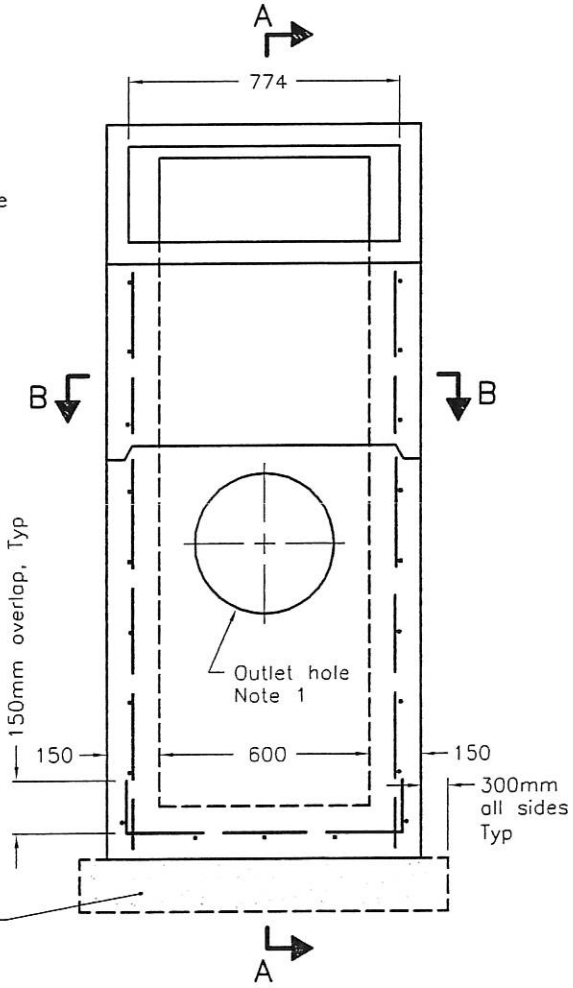
SECTION B–B

Alternate Standard Heights	
Alternate	Dimension
A	1980
B	1520
C	1380

Opening Dimensions			
Grate		*a*	*b*
Type	Slope		
A	2H:1V	670	52
	3H:1V	632	71
	4H:1V	618	78
	6H:1V	608	83
	HOR	600	87



SECTION A–A



FRONT VIEW

NOTES:

1 Outlet hole size 525mm maximum diameter, location as required.

A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.

B Center reinforcing in wall and slab ±25mm.

C Granular backfill shall be placed to a minimum thickness of 300mm all around the ditch inlet.

D Grating shall be according to OPSD 403.010.

E Pipe support shall be according to OPSD 708.020.

F All dimensions are nominal.

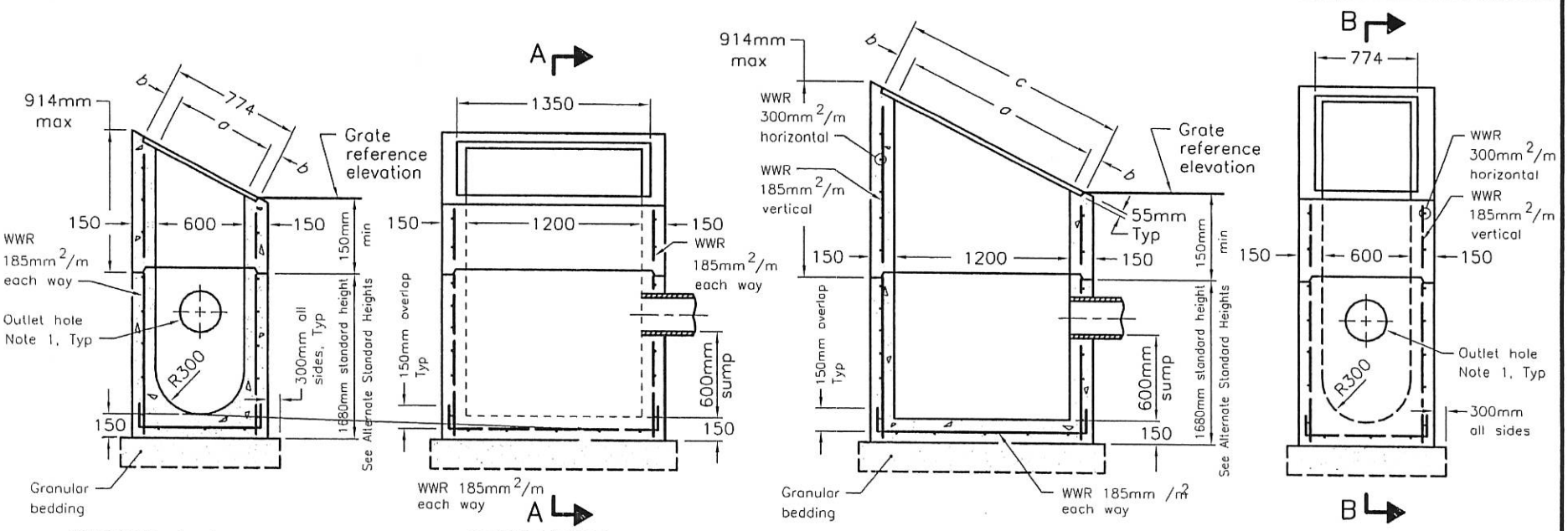
G All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2009 | Rev 2

PRECAST CONCRETE DITCH INLET

600 x 600mm

OPSD 705.030



Opening Dimensions			
Grate		*a*	*b*
Type	Slope		
B	2H:1V	670	52
	3H:1V	632	71
	4H:1V	618	78
	HOR	600	87

Alternate Standard Heights	
Alternate	Dimension
A	1980
B	1520
C	1380

Opening Dimensions				
Grate		*a*	*b*	*c*
Type	Slope			
C	2H:1V	1341	66	1473
	3H:1V	1265	104	1473
	4H:1V	1237	118	1473
B	6H:1V	1216	65	1346
	HOR	1200	73	1346

NOTES:

1 Outlet hole size 525mm maximum diameter, location as required.

A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.
B Center reinforcing in wall and base slab ±25mm.
C Lap riser horizontal wires 300mm. Laps shall be placed at corners.
D Granular backfill shall be placed to a minimum thickness of 300mm all around the ditch inlet.
E Grating shall be according to OPSD 403.010.
F Pipe support shall be according to OPSD 708.020.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

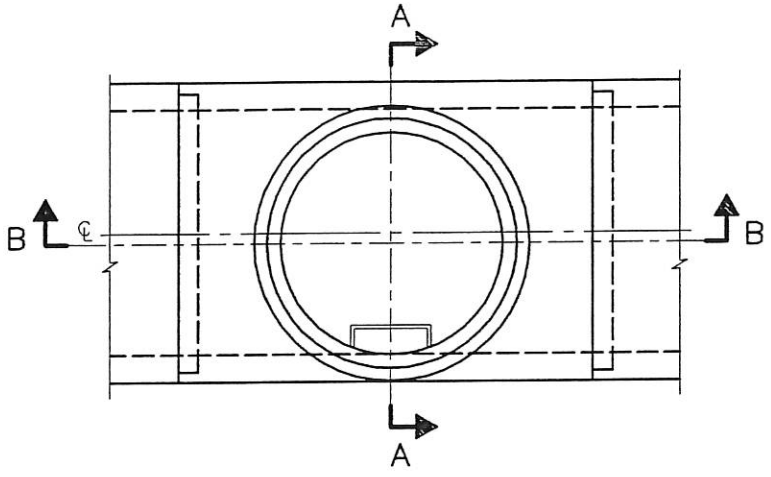
PRECAST CONCRETE DITCH INLETS

600 x 1200mm

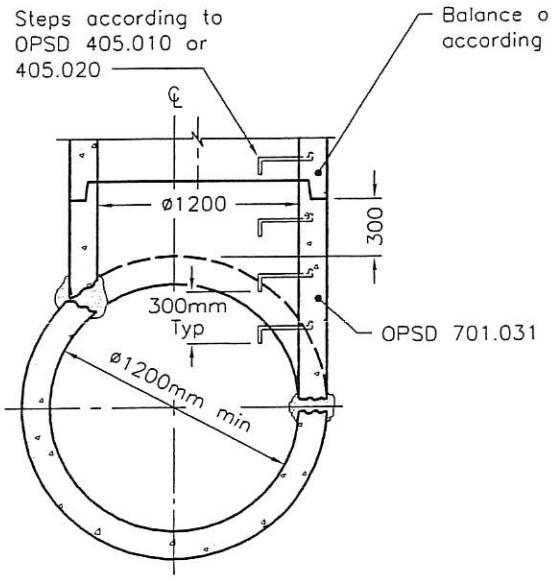
Nov 2009 | Rev 2

ONTARIO STANDARDS · MUNICIPAL - PROVINCIAL · OPS

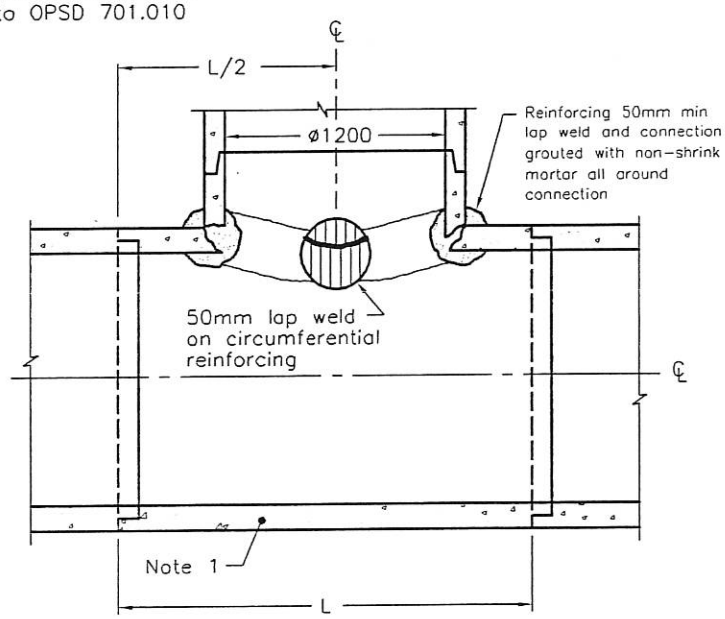
OPSD 705.040



PLAN



SECTION A–A



SECTION B–B

NOTES:

1 Sewer pipe shall be according to CAN/CSA A257.2, class to match that of the higher class adjacent pipe.

A Bedding for MH tee shall match pipe bedding either side of tee.

B Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole tee.

C Minimum steel in connection shall equal area of steel in pipe.

D Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.

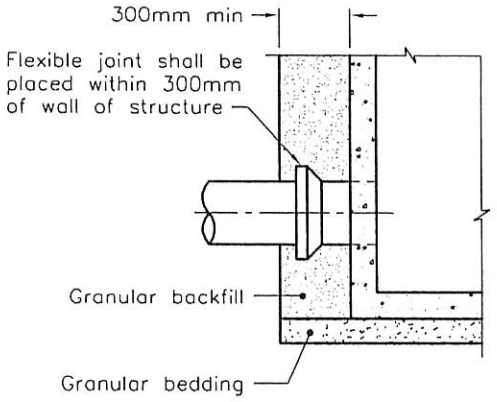
E All dimensions are nominal.

F All dimensions are in millimetres unless otherwise shown.

LEGEND:

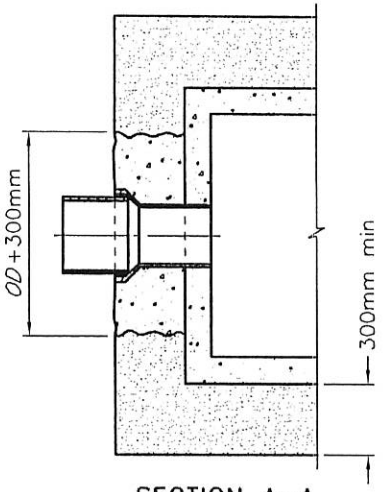
L = Standard length of pipe

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2009	Rev	2
PRECAST CONCRETE MAINTENANCE HOLE MANUFACTURED TEE			
	OPSD 707.010		

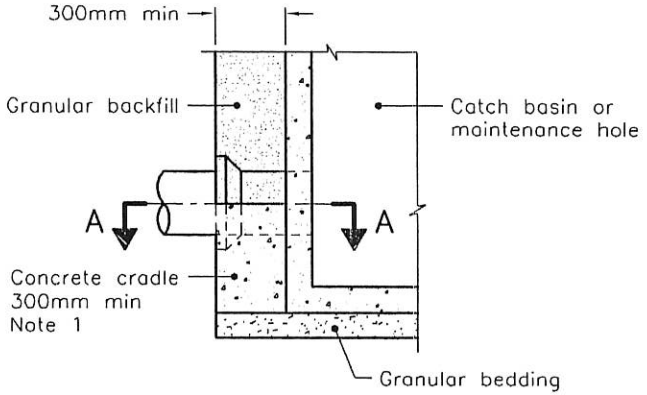


ELEVATION

FLEXIBLE JOINT
RIGID AND FLEXIBLE PIPE



SECTION A–A



ELEVATION

CONCRETE CRADLE
RIGID PIPE

For installation of these connectors refer to manufacturer's instructions.

A full length of pipe may be used in conjunction with a flexible watertight connector.

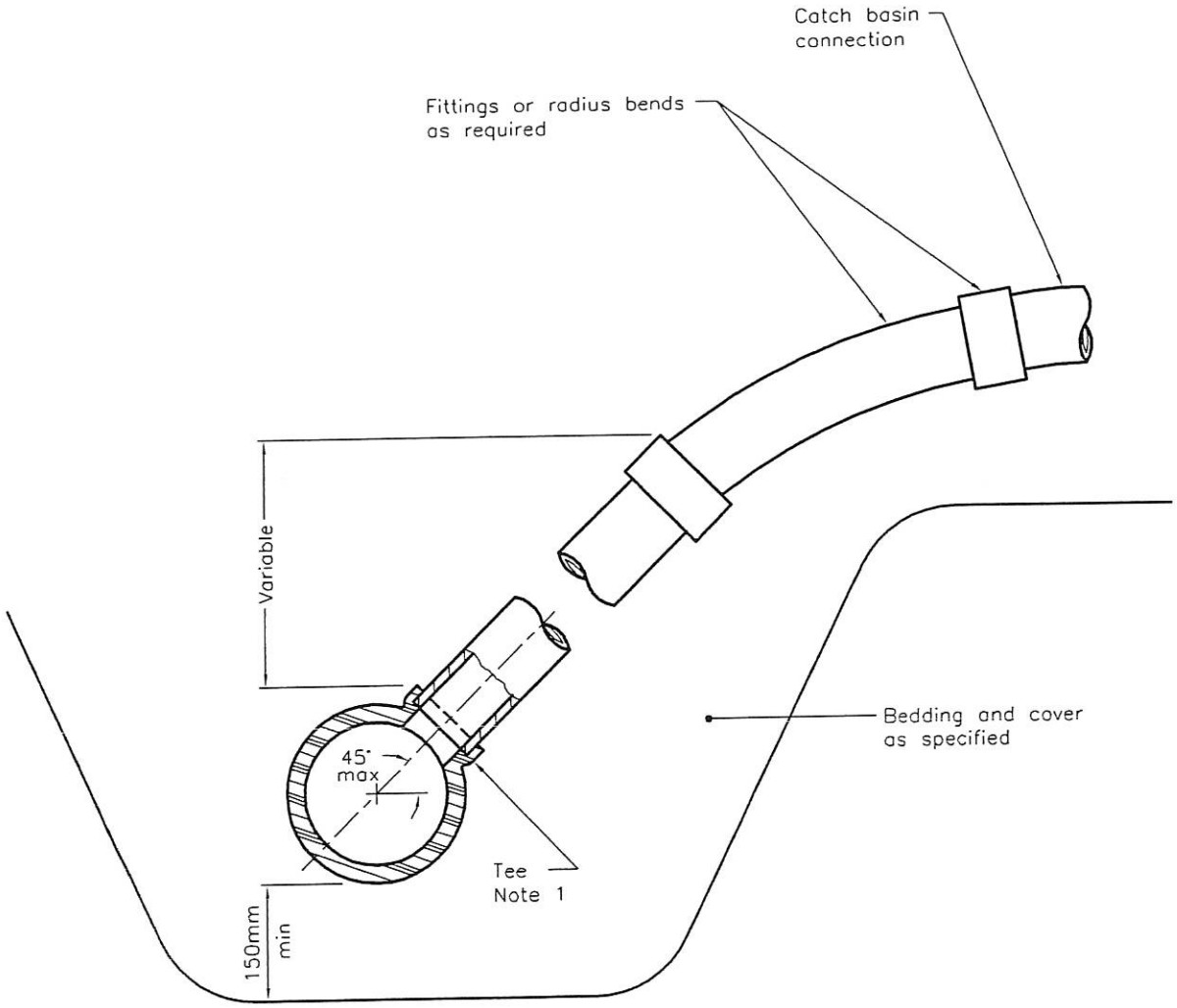
FLEXIBLE, WATERTIGHT CONNECTOR
RIGID AND FLEXIBLE PIPE

NOTES:

1 Pipe shall be supported with concrete or unshrinkable fill to the first pipe joint.

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	3
SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE			
	OPSD 708.020		



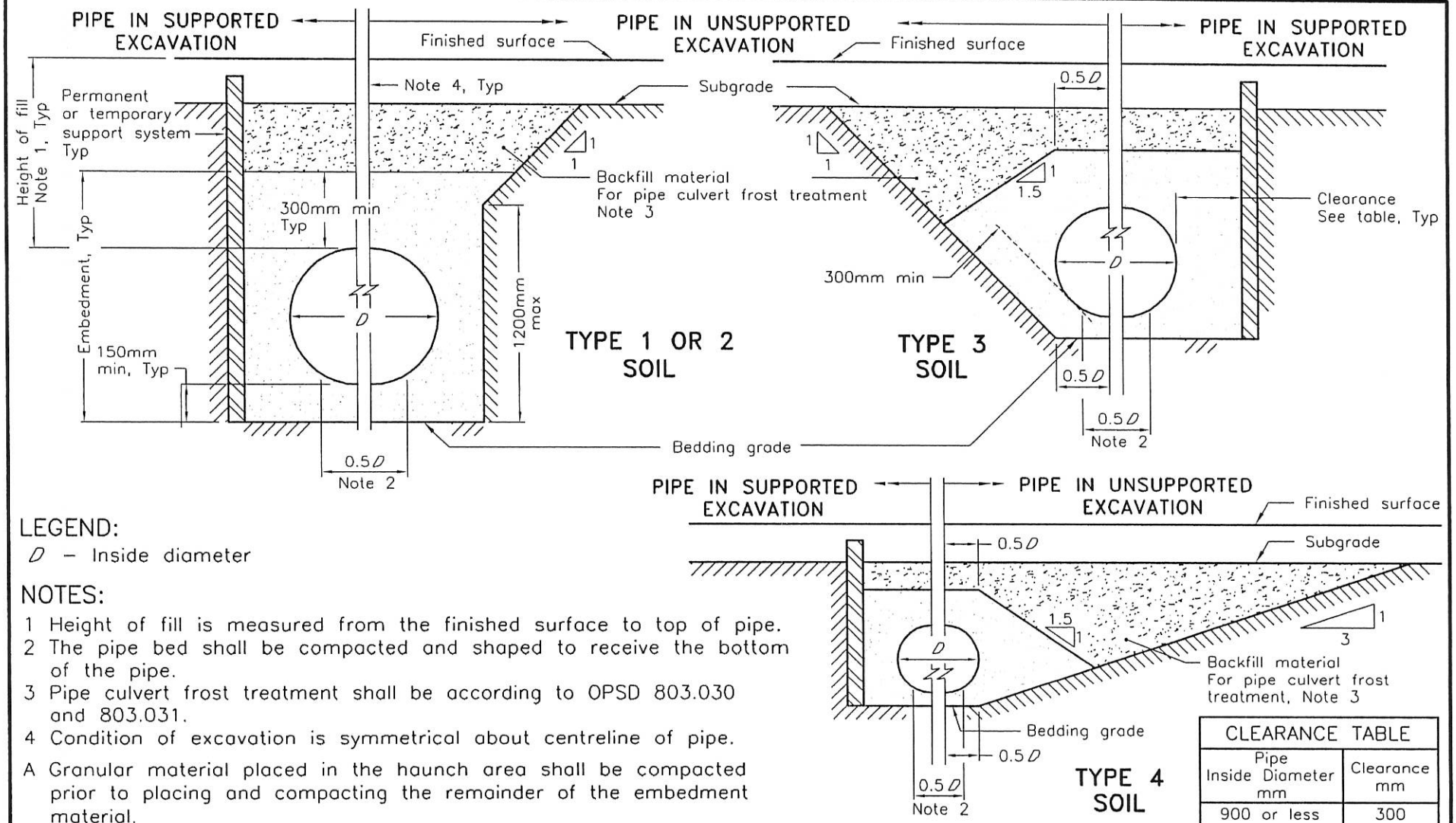
NOTES:

1 For catch basin connections 300mm in diameter or less, factory made tees shall be used.

A For catch basin connections greater than 300mm, maintenance holes shall be used at the main sewer.

B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	2
CATCH BASIN CONNECTION FOR FLEXIBLE MAIN PIPE SEWER			
	OPSD 708.030		



LEGEND:

D – Inside diameter

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.

A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.

B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

C All dimensions are in metres unless otherwise shown.

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

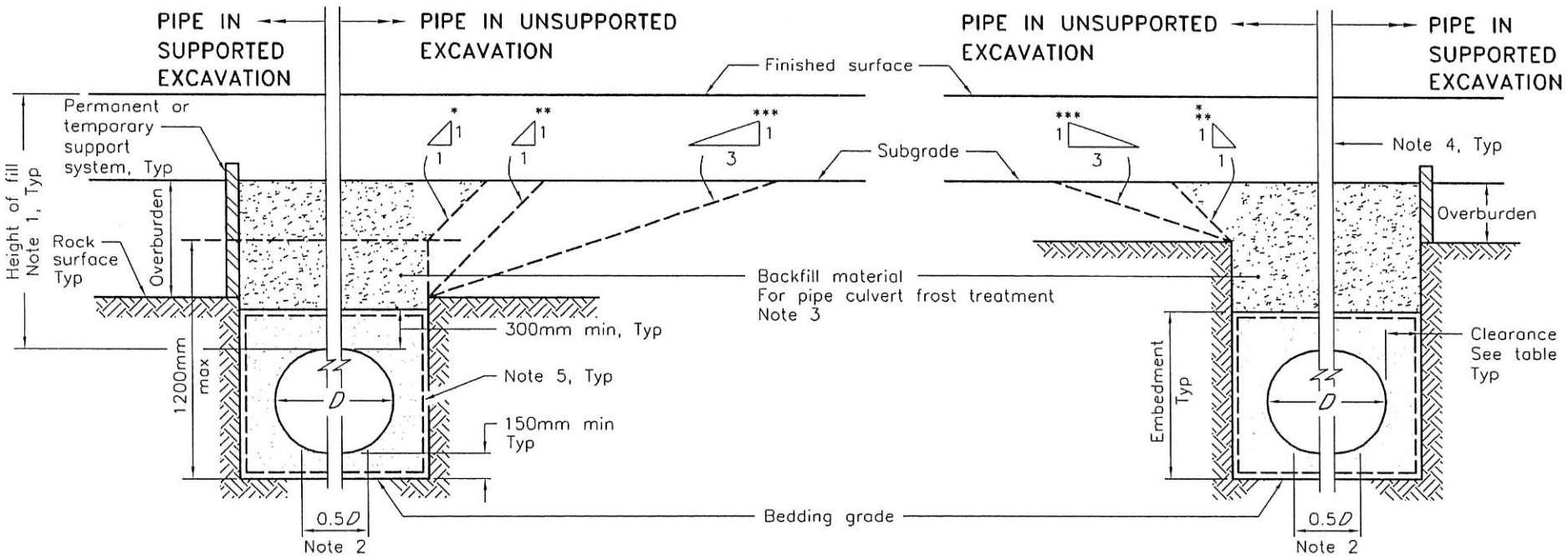
ONTARIO PROVINCIAL STANDARD DRAWING

FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION

Nov 2010 | Rev 2

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPS

OPSD 802.010



ORIGINAL ROCK < 1200mm ABOVE TRENCH BOTTOM

ORIGINAL ROCK ≥ 1200mm ABOVE TRENCH BOTTOM

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.
5 Embedment material shall be wrapped in non-woven geotextile when specified.

A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
C Fractured rock to be treated as Type 1 soil.
D All dimensions are in metres unless otherwise shown.

LEGEND:

D – Inside diameter
* – Type 1 or 2 soil
** – Type 3 soil
*** – Type 4 soil

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

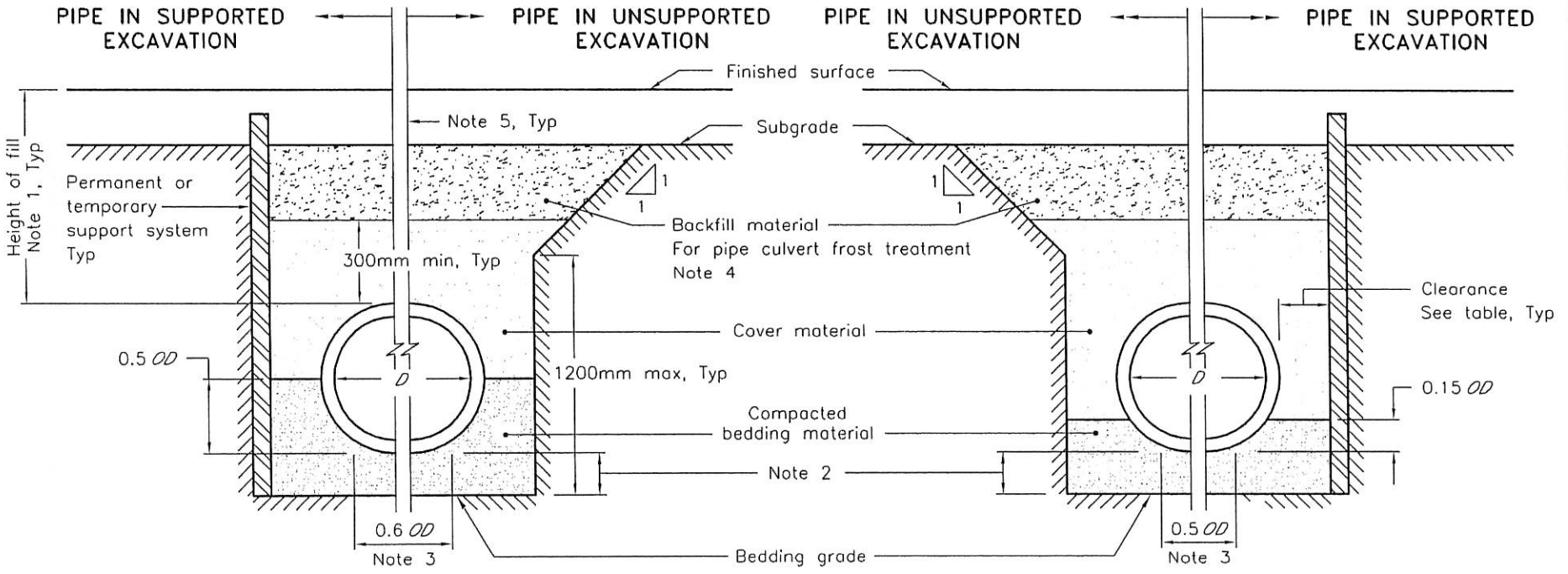
ONTARIO PROVINCIAL STANDARD DRAWING

FLEXIBLE PIPE EMBEDMENT AND BACKFILL ROCK EXCAVATION

Nov 2010 | Rev 2

ONTARIO STANDARDS · MUNICIPAL - PROVINCIAL · OPS

OPSD 802.013



CLASS B BEDDING

CLASS C BEDDING

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.15*D*. In no case shall this dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.

A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

B All dimensions are in metres unless otherwise shown.

LEGEND:

D – Inside diameter
OD – Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

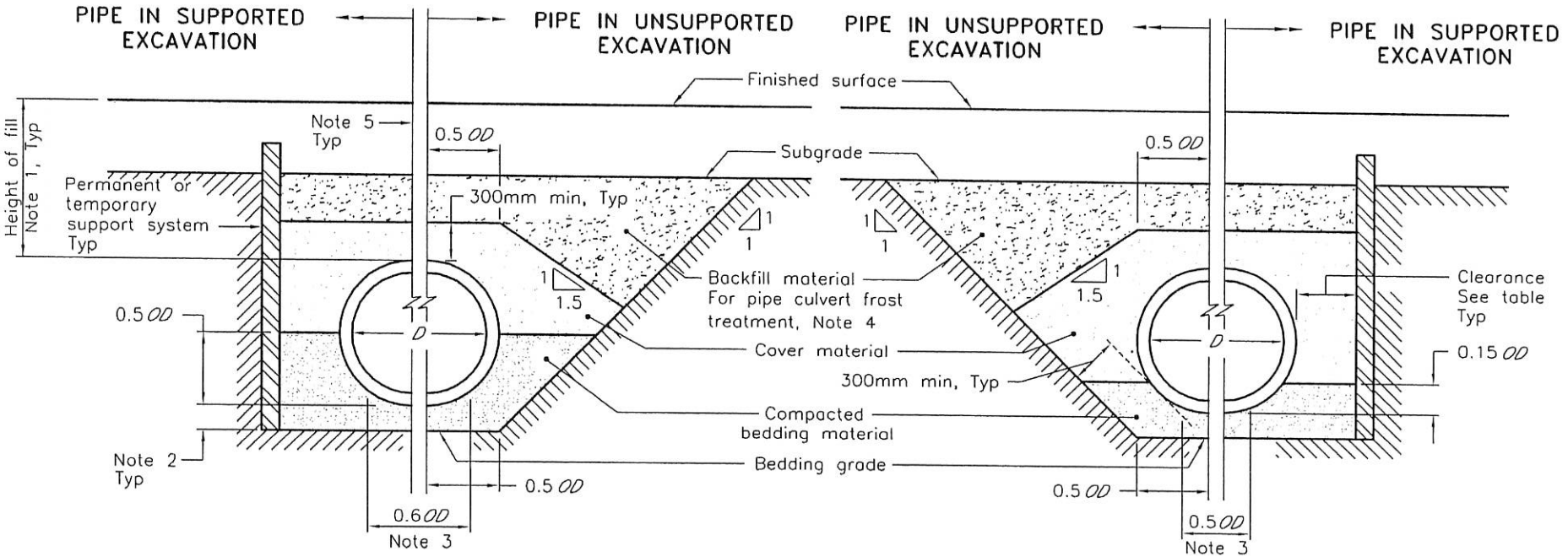
ONTARIO PROVINCIAL STANDARD DRAWING

RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 1 OR 2 SOIL – EARTH EXCAVATION

Nov 2010 | Rev 2

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPS

OPSD 802.030



CLASS B BEDDING

CLASS C BEDDING

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.15*D*. In no case shall this dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
B All dimensions are in metres unless otherwise shown.

LEGEND:

D – Inside diameter
OD – Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

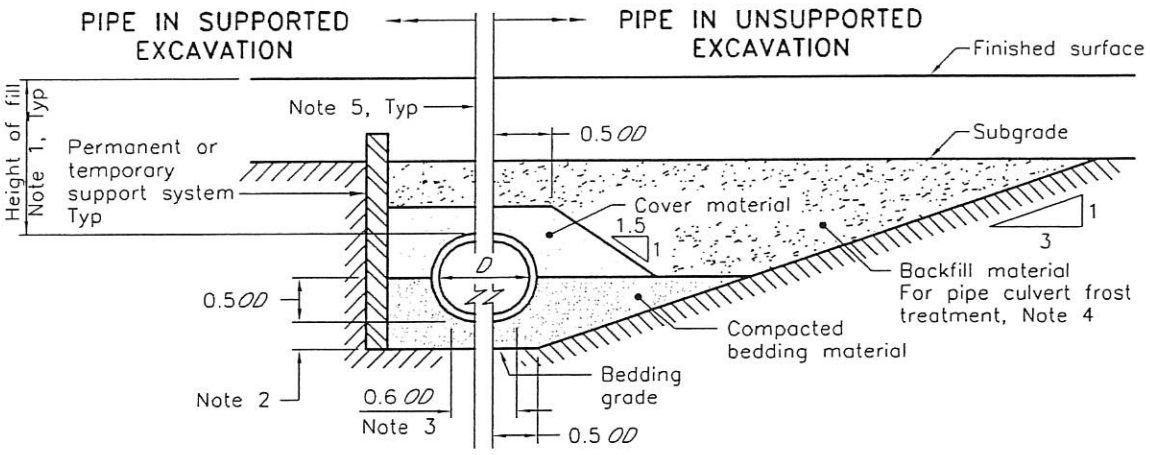
ONTARIO PROVINCIAL STANDARD DRAWING

RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 3 SOIL – EARTH EXCAVATION

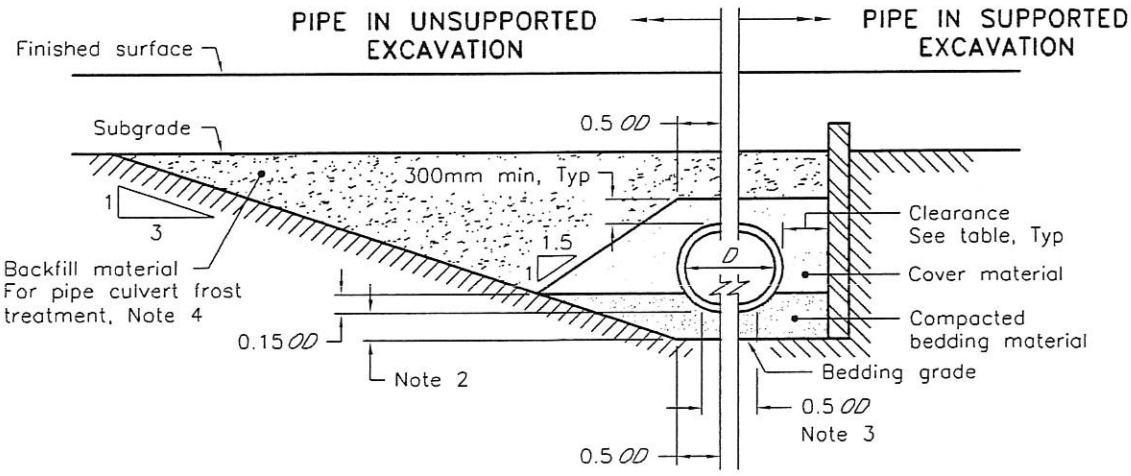
Nov 2010 | Rev 2

ONTARIO STANDARDS MUNICIPAL – PROVINCIAL

OPSD 802.031



CLASS B BEDDING



CLASS C BEDDING

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

LEGEND:

D – Inside diameter

OD – Outside diameter

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.

2 The minimum bedding depth below the pipe shall be 0.15*D*. In no case shall this dimension be less than 150mm or greater than 300mm.

3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.

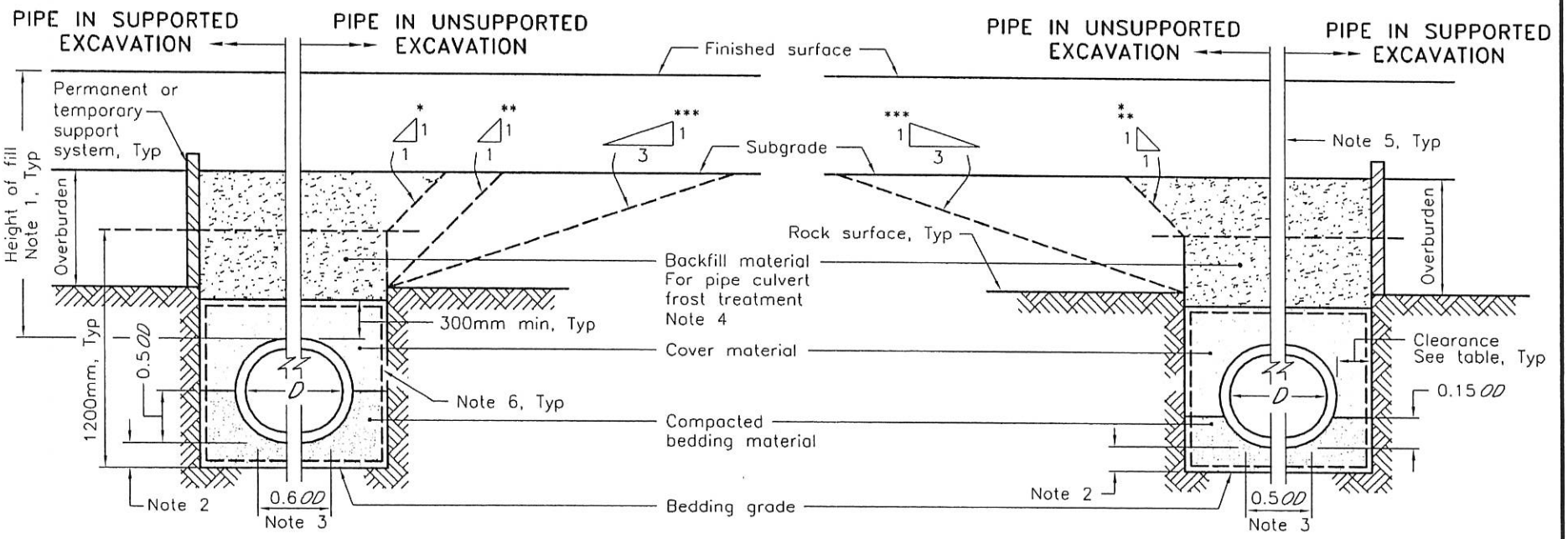
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.

5 Condition of excavation is symmetrical about centreline of pipe.

A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2010	Rev	2
RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 4 SOIL – EARTH EXCAVATION			
	OPSD 802.032		



NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.25*D*. In no case shall this dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
6 Embedment material shall be wrapped in non-woven geotextile when specified.

A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
B Fractured rock shall be treated as Type 1 soil.
C All dimensions are in metres unless otherwise shown.

LEGEND:

D – Inside diameter
OD – Outside diameter
* – Type 1 or 2 soil
** – Type 3 soil
*** – Type 4 soil

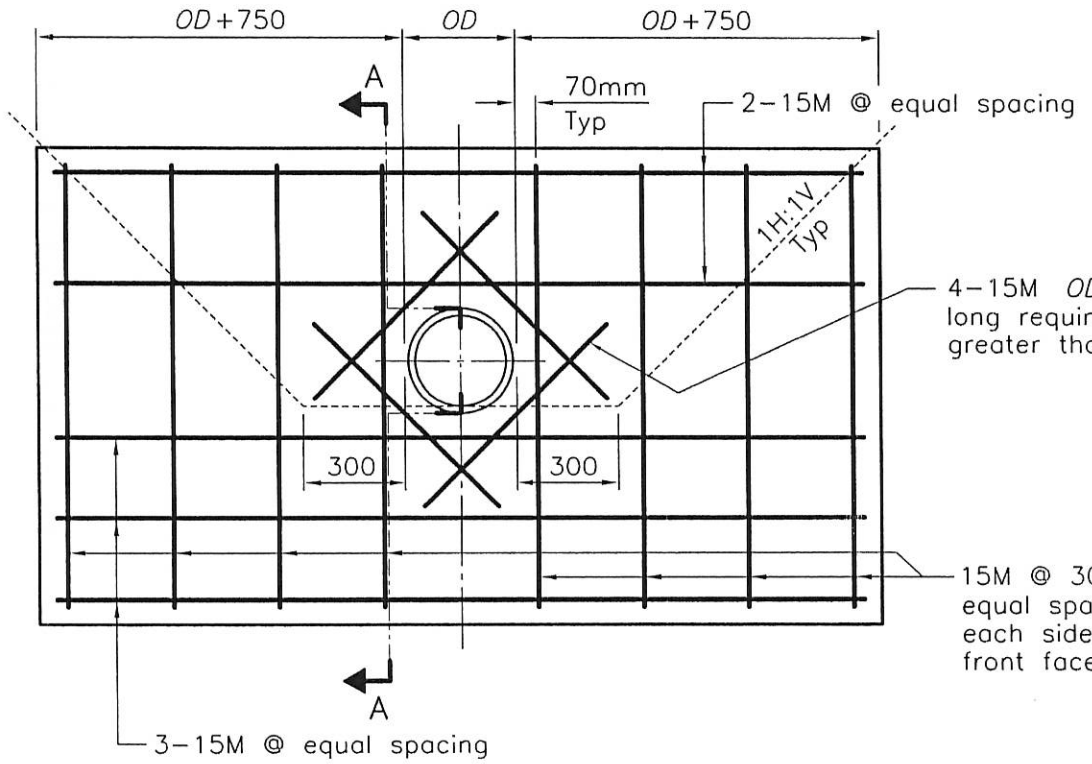
CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING

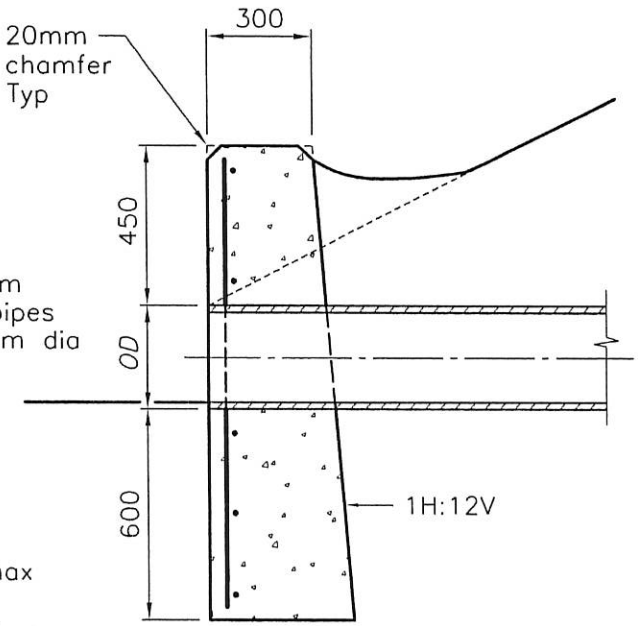
RIGID PIPE BEDDING, COVER, AND BACKFILL ROCK EXCAVATION

Nov 2010 | Rev 2

OPSD 802.033



FRONT ELEVATION



SECTION A–A

LEGEND:

OD – Outside diameter of pipe

NOTES:

A This OPSD to be read in conjunction with OPSD 3940.150.

B If a steel grate is required, refer to OPSD 804.05.

C Class of concrete: 30MPa.

D Cover to reinforcing bars 75mm ± 20mm.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

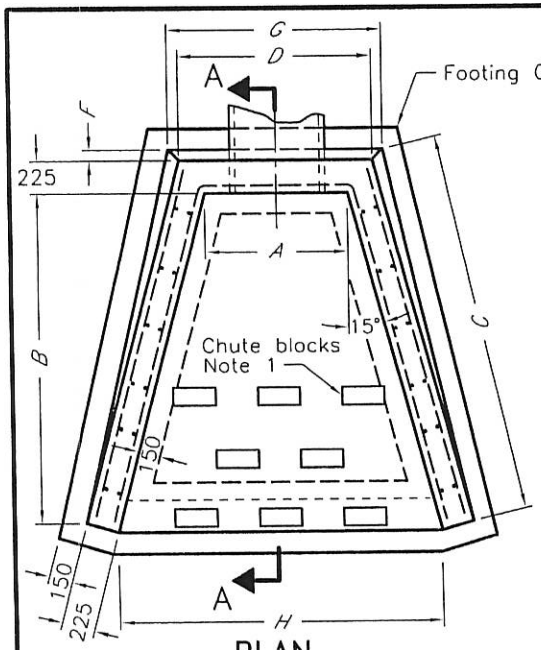
CONCRETE HEADWALL

FOR PIPE LESS THAN 900mm DIAMETER

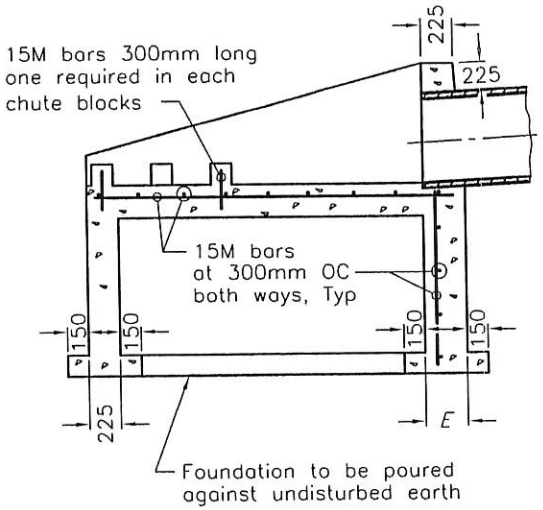
Nov 2006 | Rev 1

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPS

OPSD 804.030

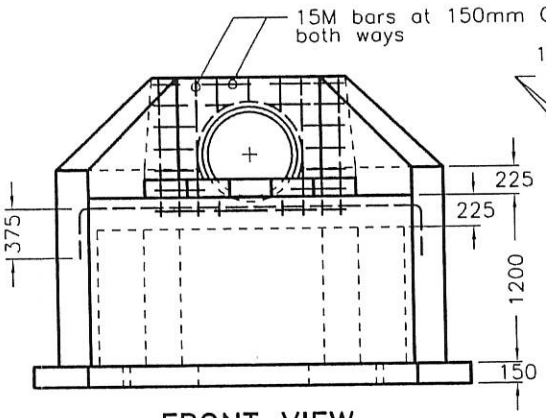


PLAN

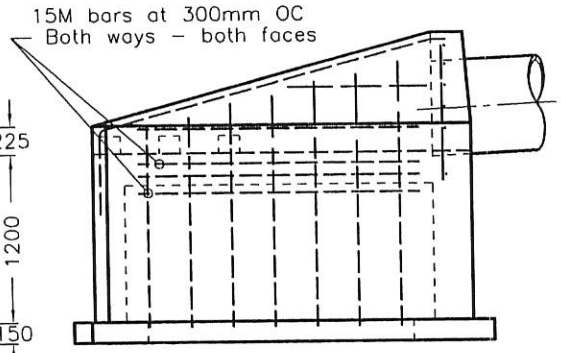


SECTION A–A

PIPE DIA	ENDWALL DIMENSIONS							
	A	B	C	D	E	F	G	H
600	1050	2400	2725	1400	300	75	1525	2350
675	1125	2400	2725	1475	300	75	1600	2425
750	1200	2400	2725	1550	300	75	1675	2500
825	1275	2400	2725	1625	300	75	1755	2575
900	1350	2400	2725	1700	300	75	1825	2650
975	1425	2400	2725	1775	375	150	1975	2725
1050	1500	3000	3400	1850	375	150	2050	3100
1200	1650	3000	3400	2000	375	150	2200	3250
1350	1800	3000	3400	2150	375	150	2350	3400
1500	1950	3000	3400	2300	375	150	2500	3550
1650	2100	3000	3400	2450	375	150	2650	3700
1800	2250	3000	3400	2600	375	150	2800	3850
2400	3000	3000	3400	3350	375	150	3550	4600



FRONT VIEW



SIDE VIEW

NOTES:

1 Poured concrete chute blocks 300x200x100mm high.

A This OPSD to be read in conjunction with OPSD 3940.150.

B Class of concrete: 30MPa.

C Cover to reinforcing bars: 75mm ±20mm.

D Granular backfill to be placed to 300mm min thickness on all sides.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

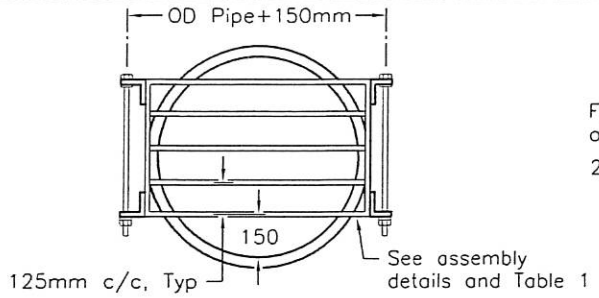
CONCRETE HEADWALL

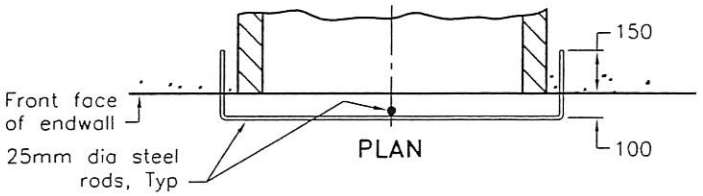
FOR SEWER OR CULVERT PIPE OUTLET

Nov 2006 | Rev 0

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPSS

OPSD 804.040





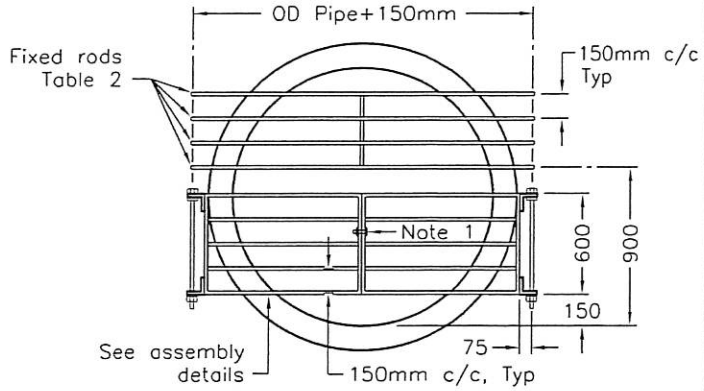
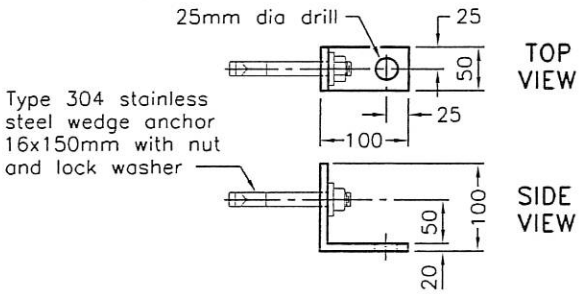


TABLE 1 – NUMBER OF RODS IN FRAME	
PIPE DIA	No of RODS
450	1
525	1
600	2
675	3
750	3
825	4
900	4
975	5
1050	6
1200	7

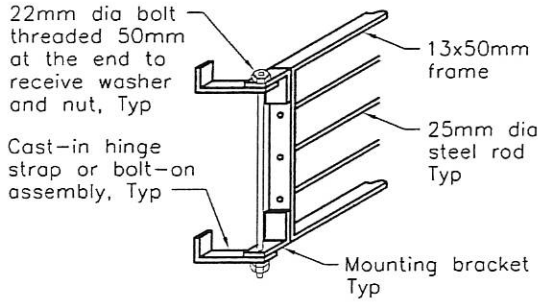
PIPE DIA up to 1200mm

TABLE 2 – NUMBER OF RODS IN FIXED UPPER FRAME	
PIPE DIA	No of RODS
1350	1
1500	2
1650	3
1800	4
1950	5
2100	6
2250	7
2400	8

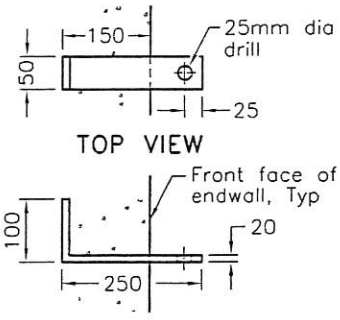
PIPE DIA 1350 to 2400mm

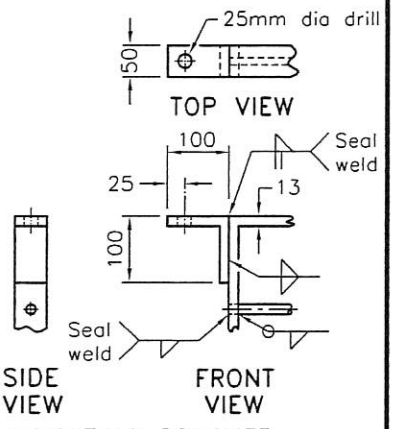


BOLT–ON ASSEMBLY DETAIL



ASSEMBLY





CAST–IN HINGE STRAP ASSEMBLY DETAILS

NOTES:

1 Grates shall be secured by either a bolt and nut or a locking device as specified.

A Metal surfaces shall be either painted with 2 coats of self priming abrasion resistant immersion grade epoxy or hot dip galvanized as specified.

B Frame, hinge strap, mounting bracket, and steel rods shall be medium grade steel.

C All welding shall be according to CSA W59.

D All dimensions are in millimetres unless otherwise shown.

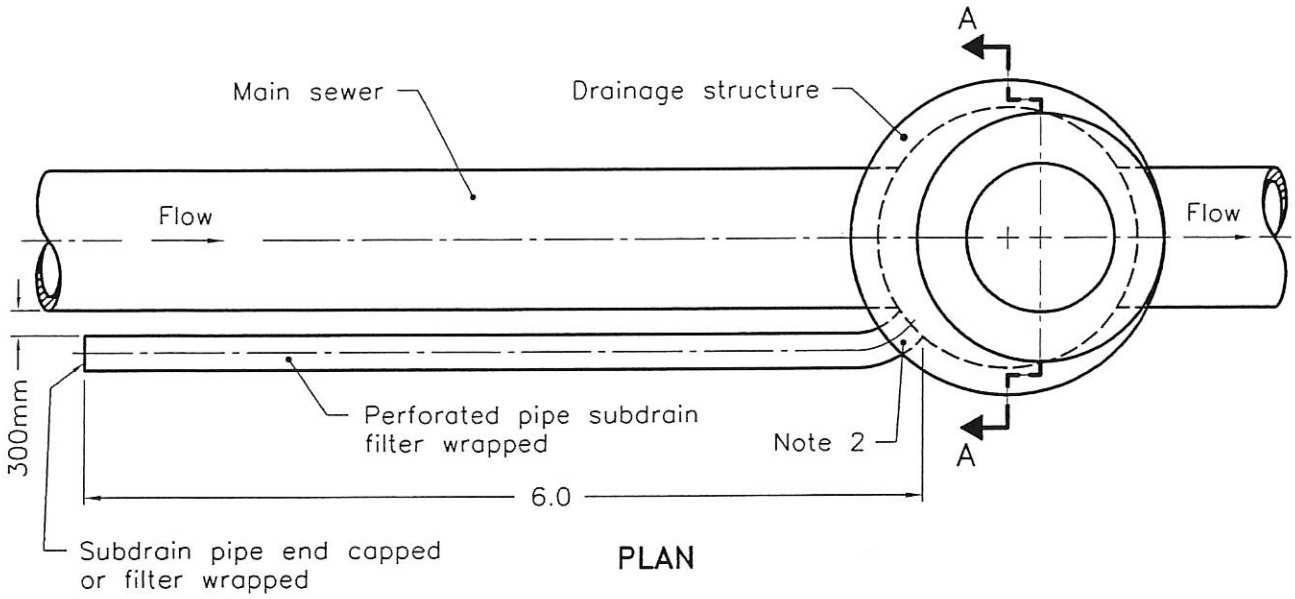
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev	0

GRATING

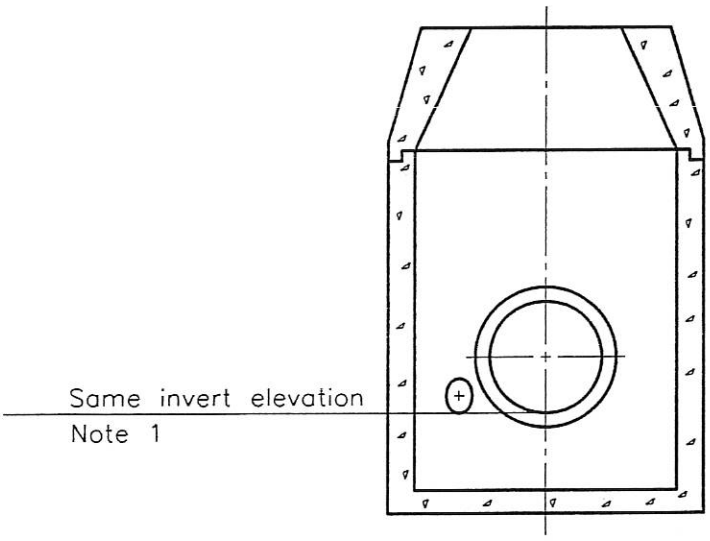
FOR CONCRETE ENDWALL

ONTARIO STANDARDS · MUNICIPAL – PROVINCIAL · OPSS

OPSD 804.050



PLAN



SECTION A–A

NOTES:

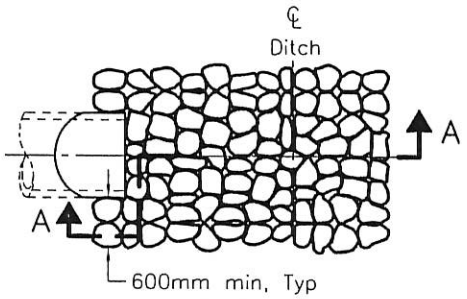
1 Where concrete bedding is used for the main sewer, the pipe subdrain shall be placed 150mm above the top of such bedding.

2 Subdrain pipe shall be cored into maintenance hole.

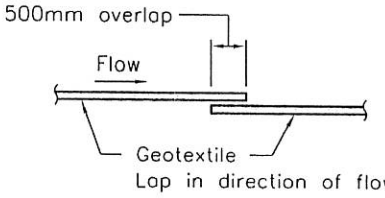
A Maintenance hole benching shall accommodate pipe subdrain, as required.

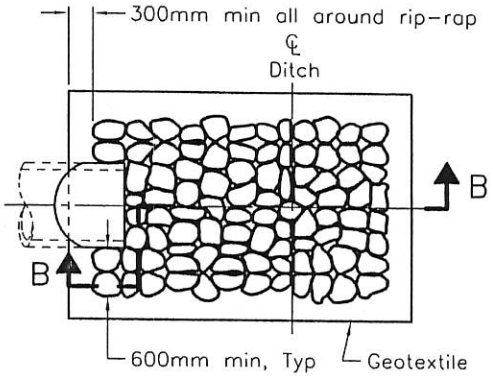
B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 2	
PERFORATED PIPE SUBDRAIN IN GRANULAR TRENCH MAIN STORM SEWER CONNECTION TO DRAINAGE STRUCTURE			OPSD 809.010

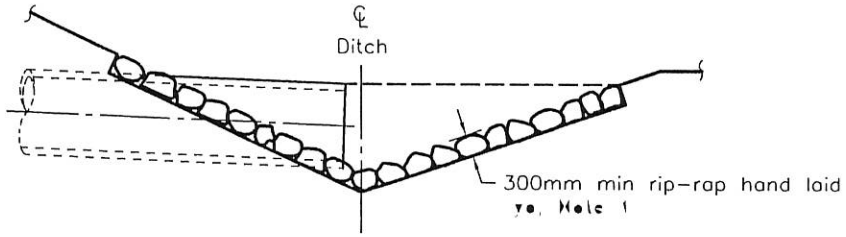


PLAN
CUT OR FILL

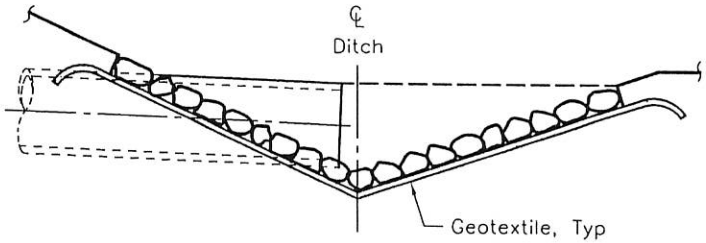




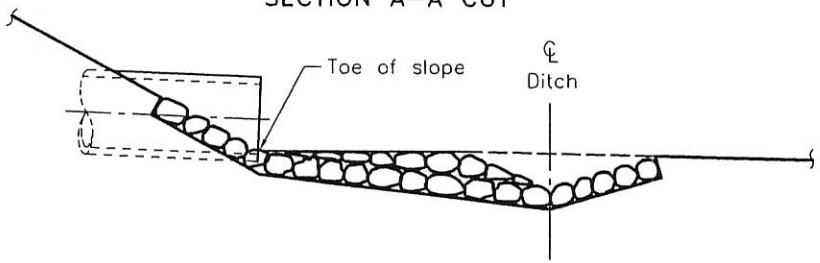
PLAN
CUT OR FILL



SECTION A–A CUT

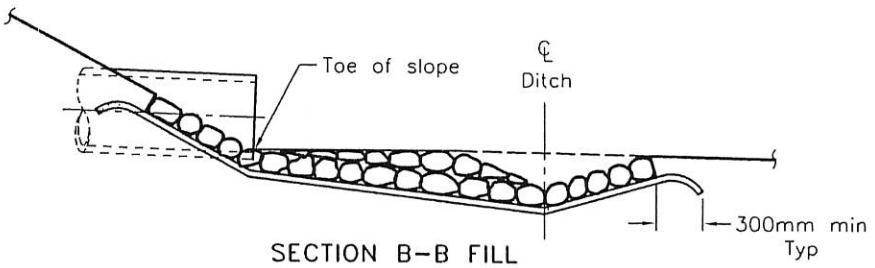


SECTION B–B CUT



SECTION A–A FILL

TYPE A – WITHOUT GEOTEXTILE



SECTION B–B FILL

TYPE B – WITH GEOTEXTILE

NOTES:

1 The thickness of the rip–rap layer shall be at least 1.5 times the rip–rap mean diameter.

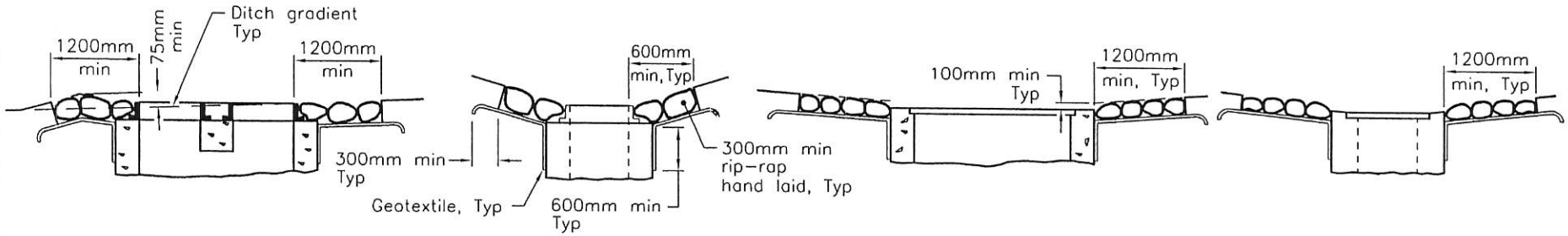
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

RIP–RAP TREATMENT FOR SEWER AND CULVERT OUTLETS

Nov 2007 | Rev 1

OPSD 810.010

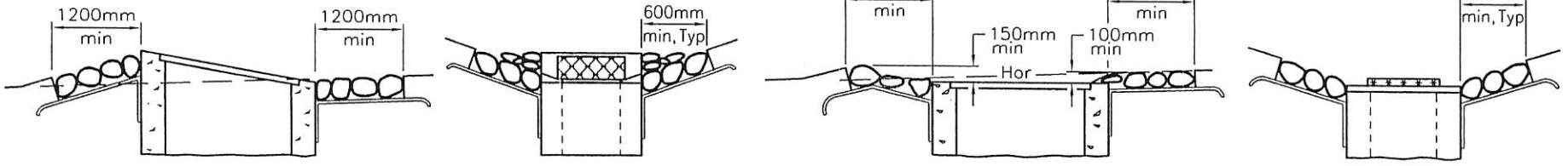


Ditch Longitudinal Section — Ditch Cross-Section

TWIN INLET–INTERMEDIATE

Ditch Longitudinal Section — Ditch Cross-Section

SINGLE INLET–SUMP

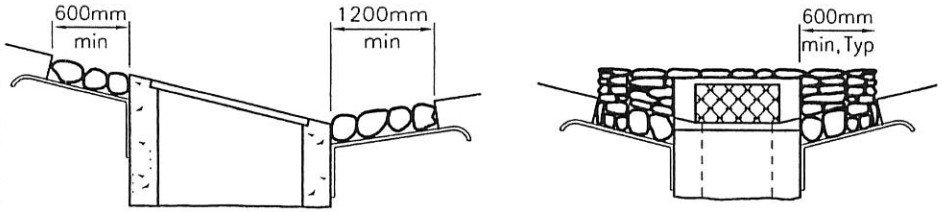


Ditch Longitudinal Section — Ditch Cross-Section

SINGLE INLET–INTERMEDIATE

Ditch Longitudinal Section — Ditch Cross-Section

SINGLE INLET–INTERMEDIATE



Ditch Longitudinal Section — Ditch Cross-Section

SINGLE INLET–END OF DITCH

NOTES:

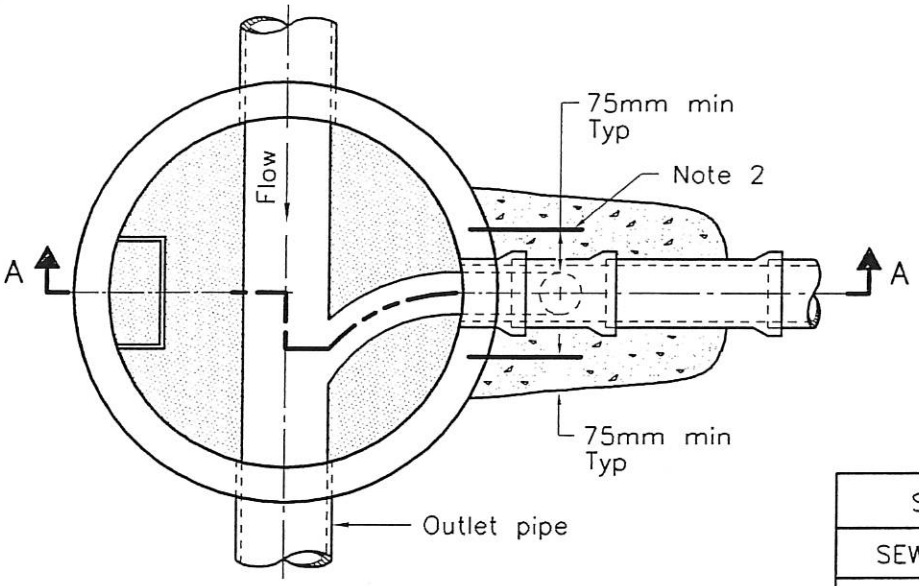
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

RIP–RAP TREATMENT FOR DITCH INLETS

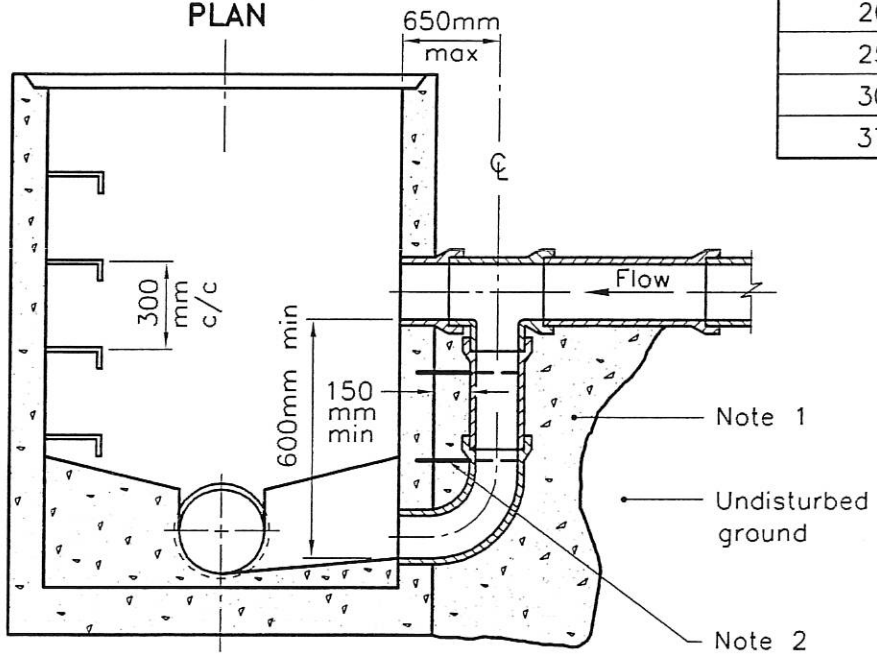
Nov 2007 | Rev 1

OPSD 810.020



PLAN

SIZE OF DROP PIPE	
SEWER ID	DROP PIPE ID
200	200
250	200
300	250
375	300



SECTION A–A

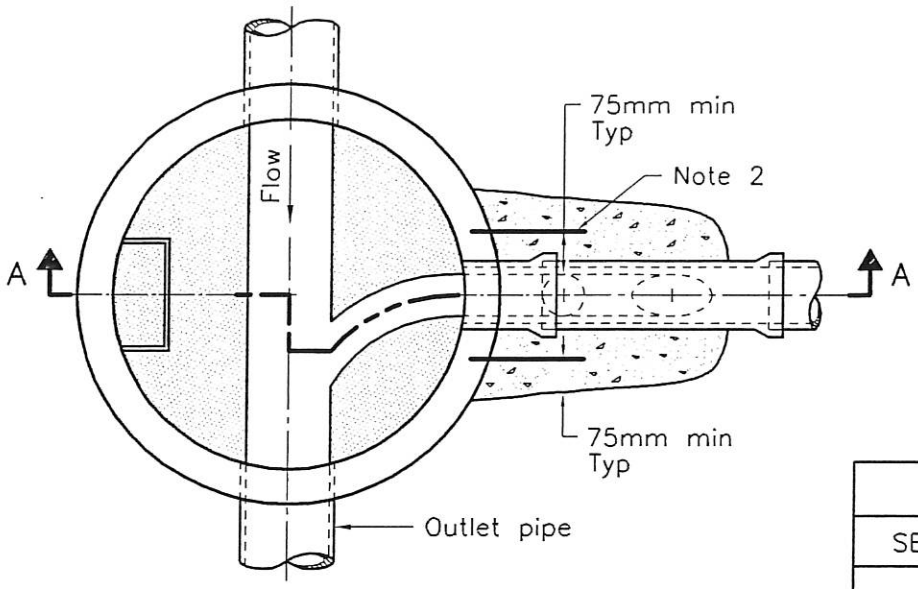
NOTES:

1 Concrete shall be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.

2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.

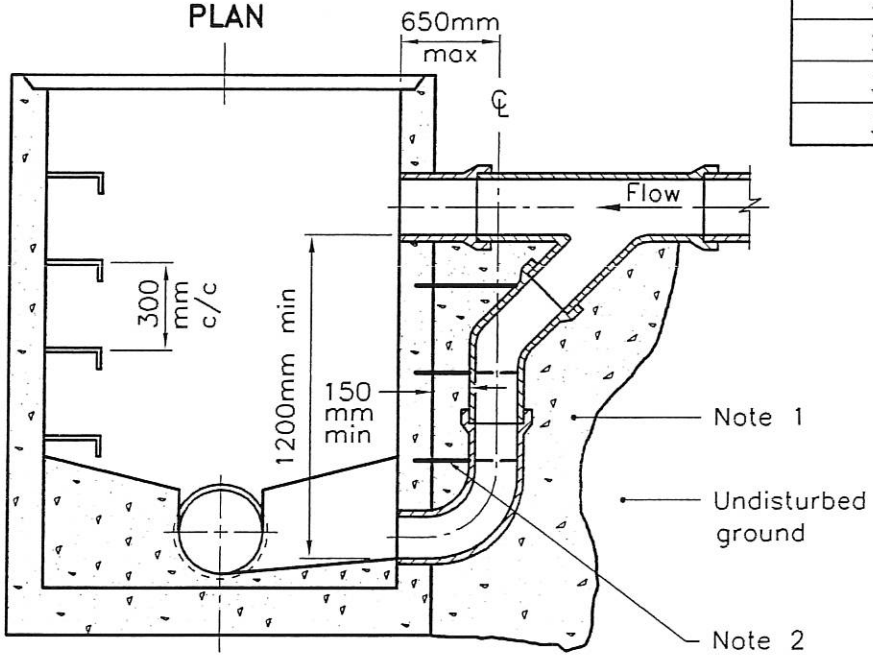
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	2
CAST–IN–PLACE MAINTENANCE HOLE DROP STRUCTURE TEE			
	OPSD 1003.010		



PLAN

SIZE OF DROP PIPE	
SEWER ID	DROP PIPE ID
200	200
250	200
300	250
375	300



SECTION A–A

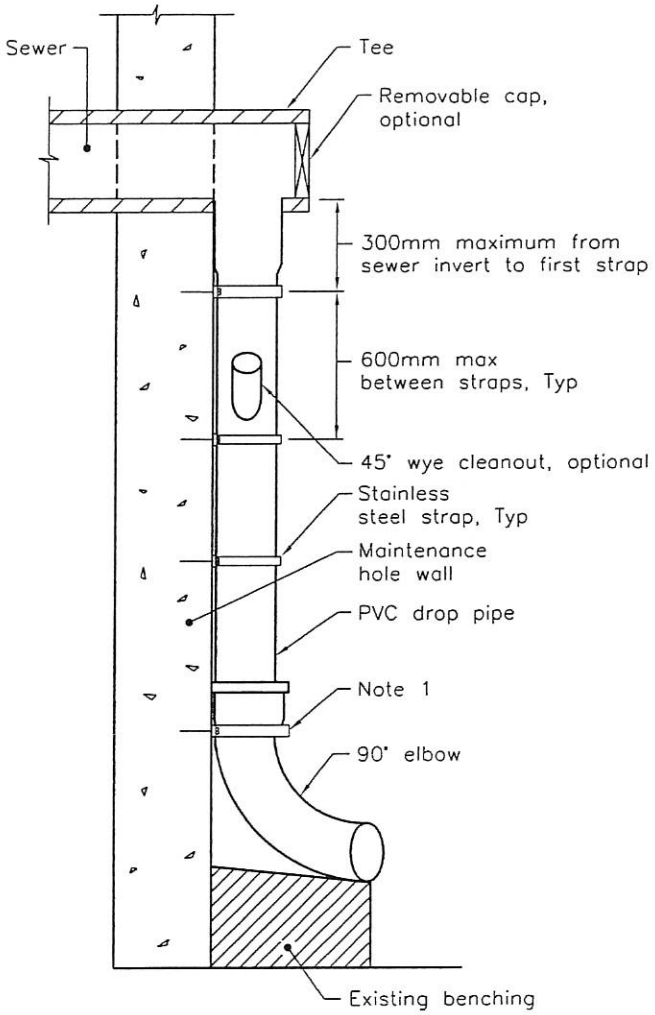
NOTES:

1 Concrete shall be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.

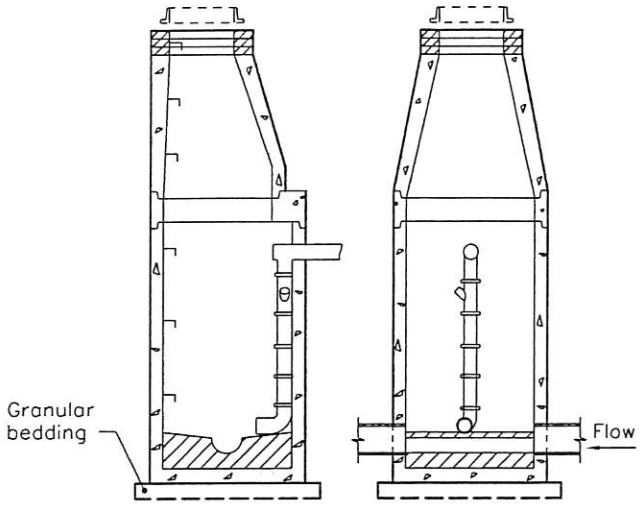
2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.

A All dimensions are in millimetres unless otherwise shown.

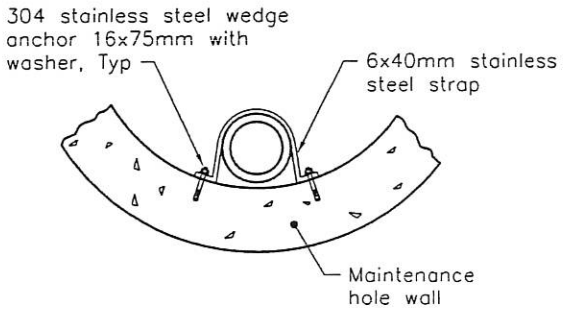
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	2
CAST–IN–PLACE MAINTENANCE HOLE DROP STRUCTURE WYE			
	OPSD 1003.020		



INTERNAL DROP STRUCTURE DETAIL



MAINTENANCE HOLE IN SECTION



FASTENER DETAIL

NOTES:

1 At the elbow, a stainless steel strap is required at bottom of bell.

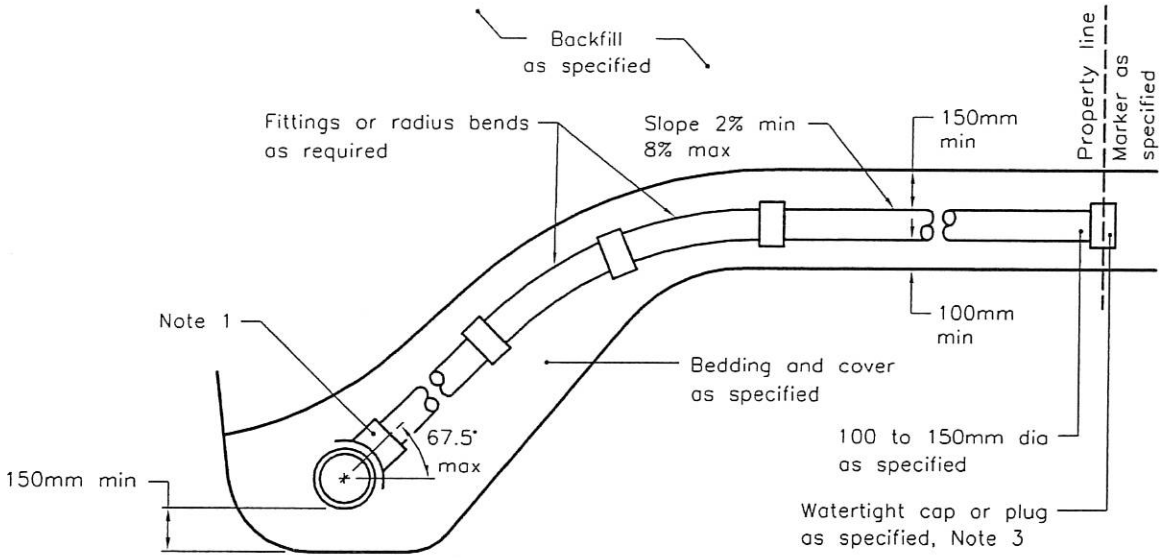
A Internal drop structure shall be used on existing maintenance holes 1500mm diameter and larger with a minimum height of 600mm from the inlet pipe invert to the top of benching. The existing benching shall be modified as required.

B Drop pipe shall be one size smaller than the incoming sewer with a minimum 150mm diameter and maximum of 375mm diameter.

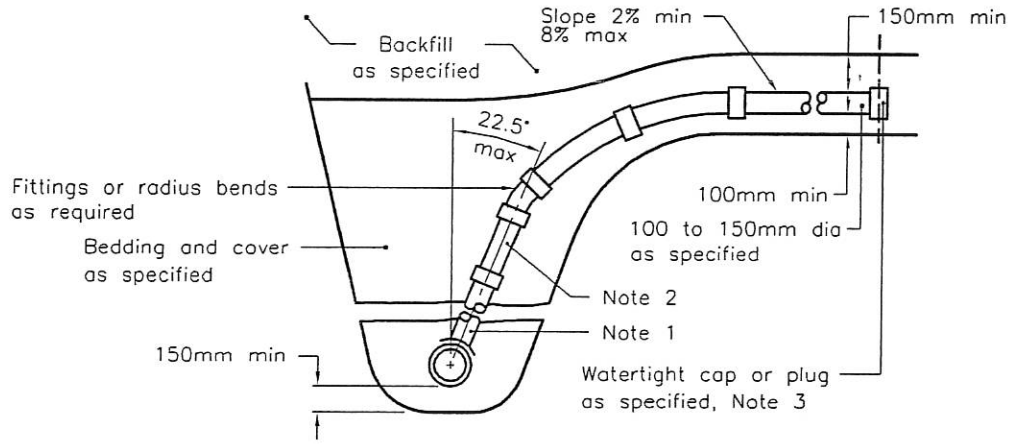
C Straps shall not be placed within 150mm of any maintenance hole section joint.

D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 2
INTERNAL DROP STRUCTURE FOR EXISTING MAINTENANCE HOLES		OPSD 1003.030



CONNECTION WITHOUT VERTICAL RISER



CONNECTION WITH VERTICAL RISER

NOTES:

1 Sewer service connections to the main pipe sewer shall be made using factory made tees, strap-on-saddles, or other approved saddles.

2 Vertical risers shall be as specified.

3 Cap or plug at property line shall be adequately braced.

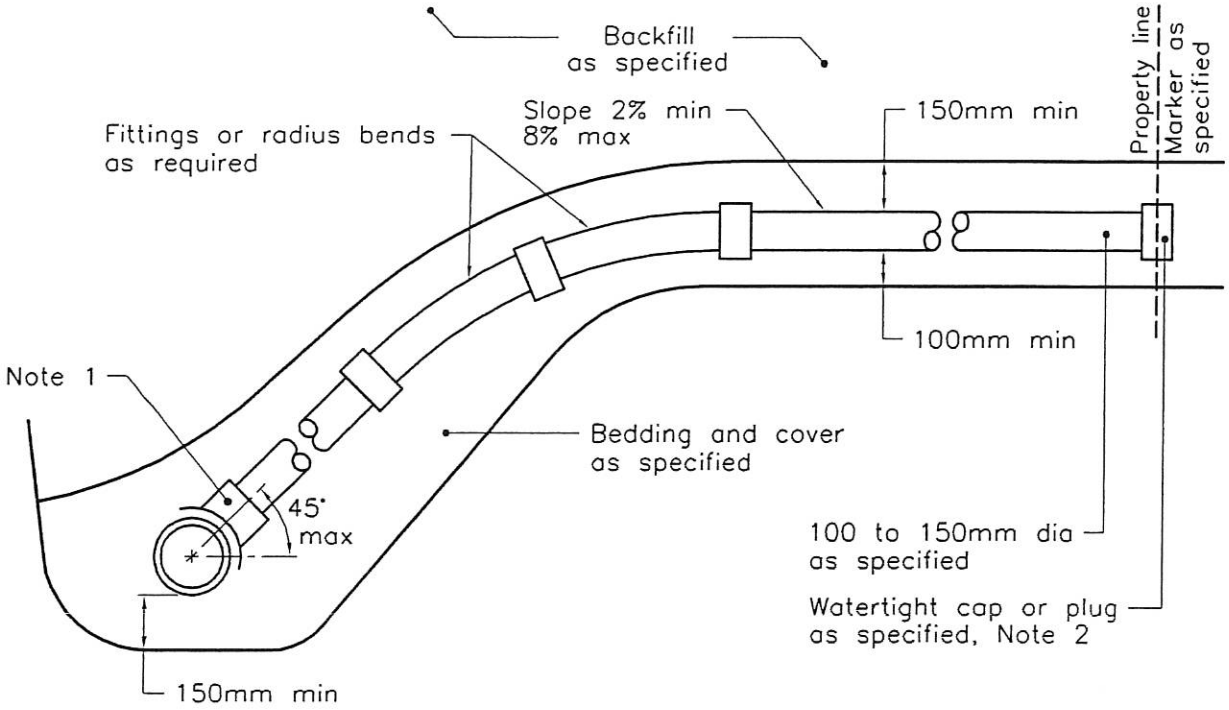
A Maintenance holes shall be used at the main sewer to connect service connections greater than or equal to 200mm.

B For new construction, saddles shall be installed on the main pipe before that pipe is laid.

C Approved cut-in tool shall be used for field made connections.

D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	2
SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER			
	OPSD 1006.010		



NOTES:

1 Sewer service connections to the main pipe sewer shall be made using factory made tees or wyes, strap-on-saddles, or other approved saddles.

2 Cap or plug at property line shall be adequately braced.

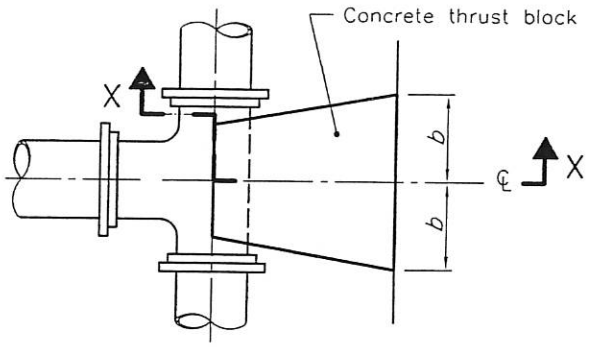
A Maintenance holes shall be used at the main sewer to connect service connections greater than or equal to 200mm.

B For new construction, saddles shall be installed on the main pipe before that pipe is laid.

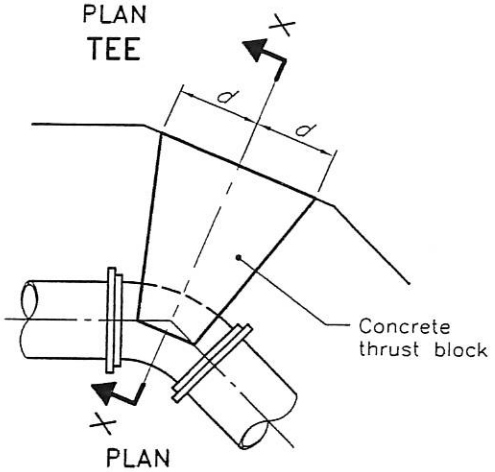
C Approved cut-in tool shall be used for field made connections.

D All dimensions are in millimetres unless otherwise shown.

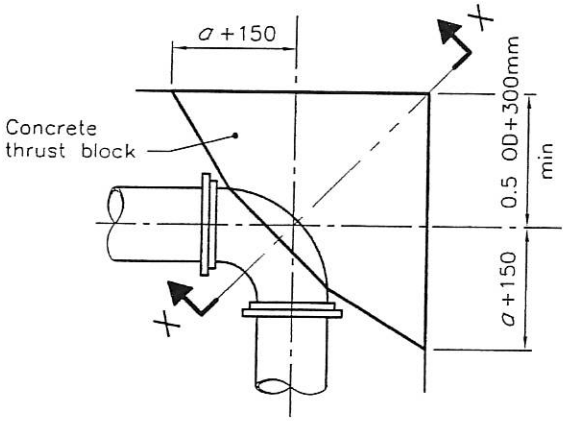
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev	2
SEWER SERVICE CONNECTIONS FOR FLEXIBLE MAIN PIPE SEWER			
	OPSD 1006.020		



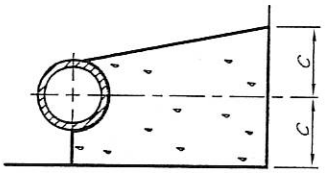
PLAN
TEE



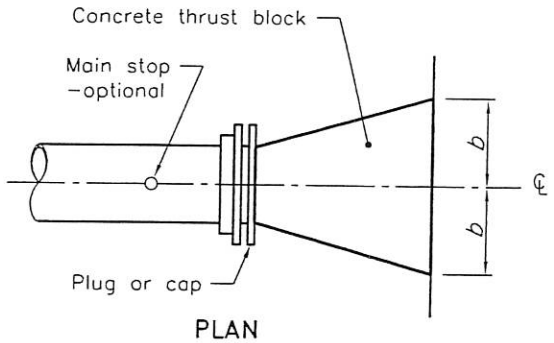
PLAN
TYPICAL BEND



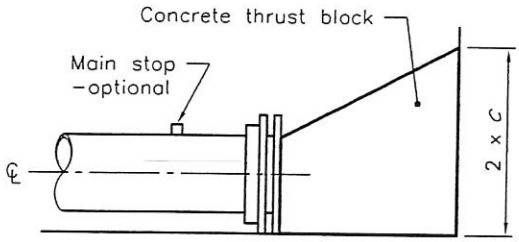
PLAN
90° BEND



SECTION X–X



PLAN
DEAD END



ELEVATION
DEAD END

MINIMUM DIMENSIONS				
PIPE DIA	*a*	*b*	*c*	*d*
100	150	250	150	200
150	250	350	200	250
200	300	550	200	450
250	400	650	250	550
300	450	700	350	650
350	500	800	400	700

NOTES:

A Concrete shall be placed to within 50mm of the face of the bell.

B Bond breaker to be used between concrete and fittings.

C This blocking design applies only where 1035kPa pressure is not exceeded.

D This blocking design applies where the soil has a safe allowable bearing capacity of 100kPa as verified by a geotechnical investigation.

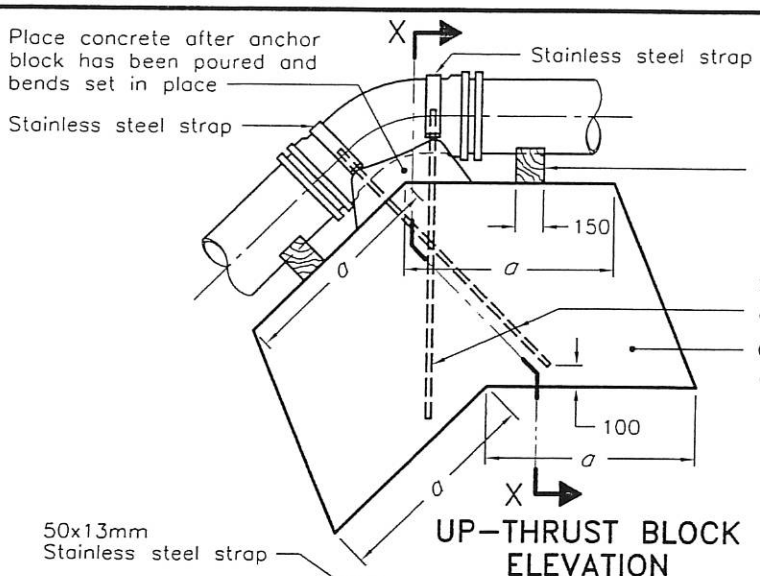
E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

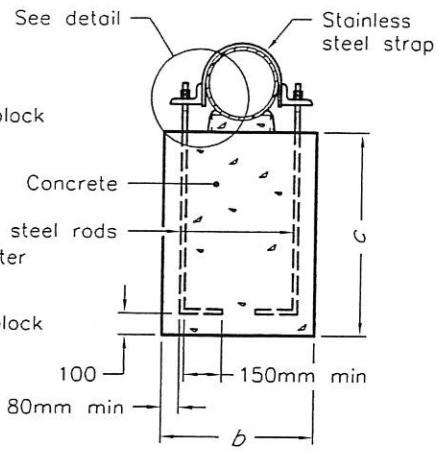
Nov 2006 | Rev 1

CONCRETE THRUST BLOCKS FOR TEES, PLUGS, AND HORIZONTAL BENDS

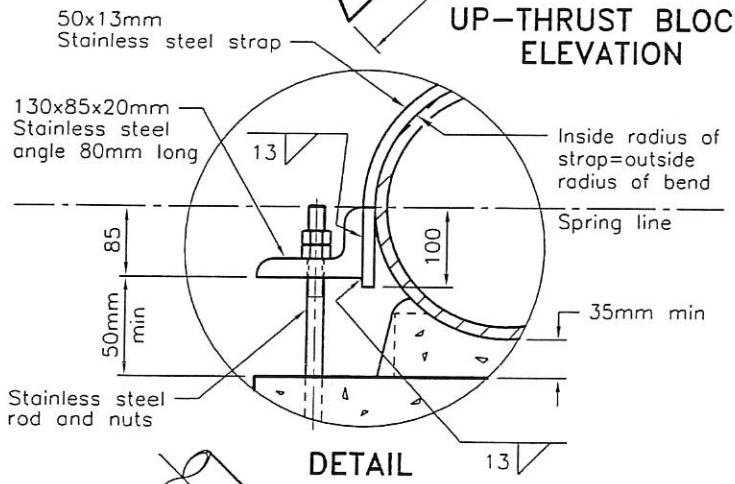
OPSD 1103.010



UP–THRUST BLOCK ELEVATION

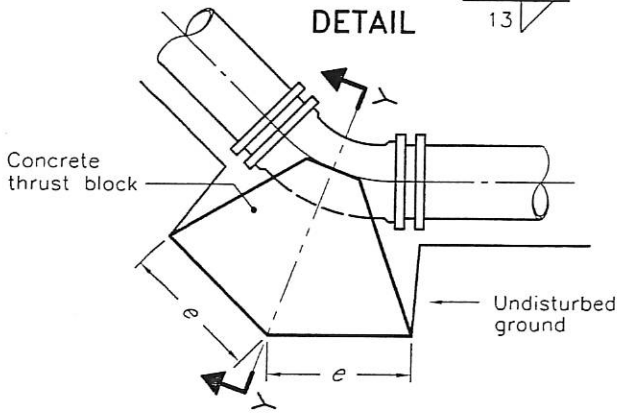


UP–THRUST BLOCK SECTION X–X

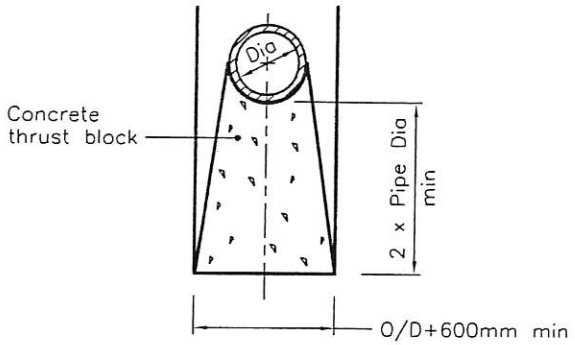


DETAIL

MINIMUM DIMENSIONS					
PIPE DIA	*a*	*b*	*c*	*d*	*e*
100	450	600	750	13	150
150	600	900	900	13	300
200	600	900	1500	13	450
250	900	900	1500	20	600
300	1200	900	1650	20	800
350	1200	1200	1650	25	1000



DOWN–THRUST BLOCK ELEVATION



DOWN–THRUST BLOCK SECTION Y–Y

NOTES:

A Concrete shall be placed to within 50mm of the face of the bell.

B Bond breaker to be used between concrete and fittings.

C This blocking design applies only where 1035kPa pressure is not exceeded.

D This blocking is for bends up to 45° for up–thrust and 90° for down–thrust.

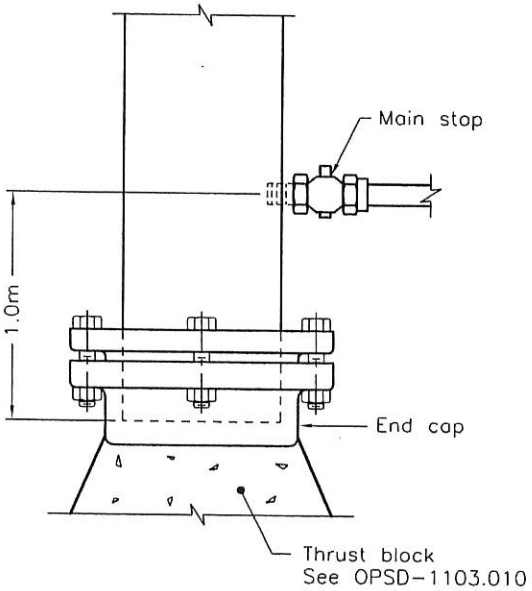
E This blocking design applies where the soil has a safe allowable bearing capacity of 100kPa as verified by a geotechnical investigation.

F All dimensions are in millimetres unless otherwise shown.

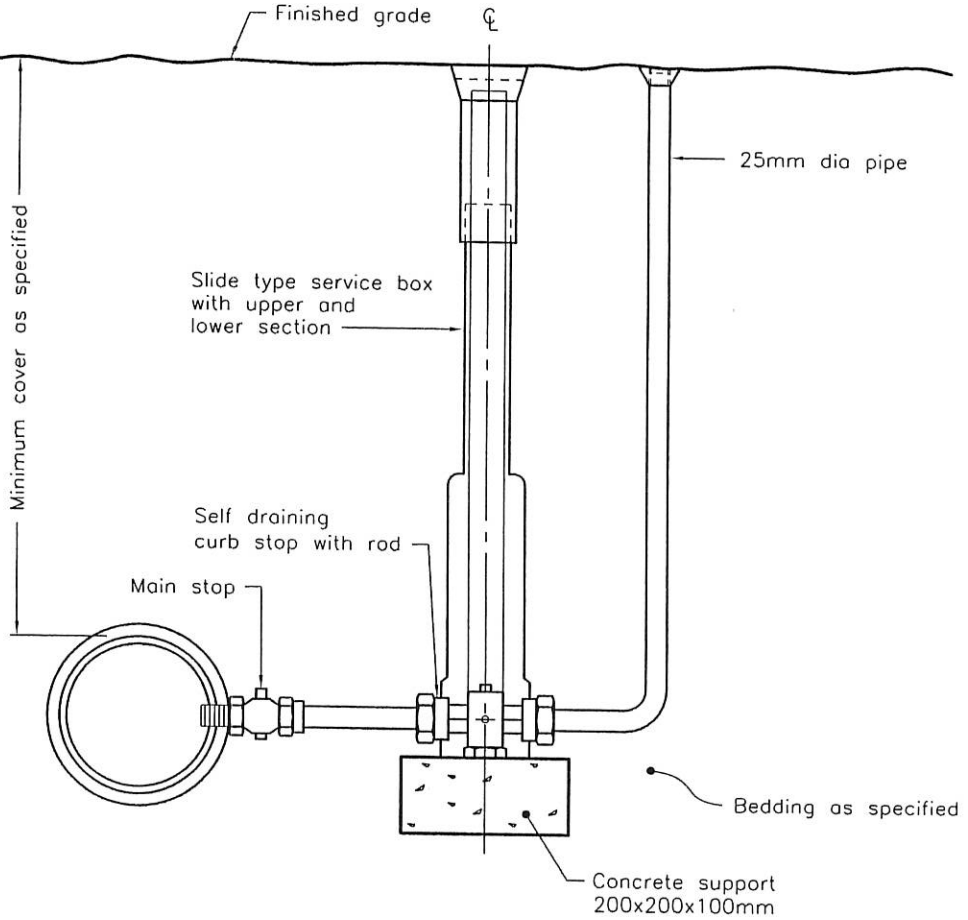
ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 2

CONCRETE THRUST BLOCKS FOR VERTICAL BENDS

OPSD 1103.020



PLAN OF
WATERMAIN END



NOTES:

A Blow off connections to plastic watermains to be made using service saddles or factory made tees.

B All dimensions are in millimetres unless otherwise shown.

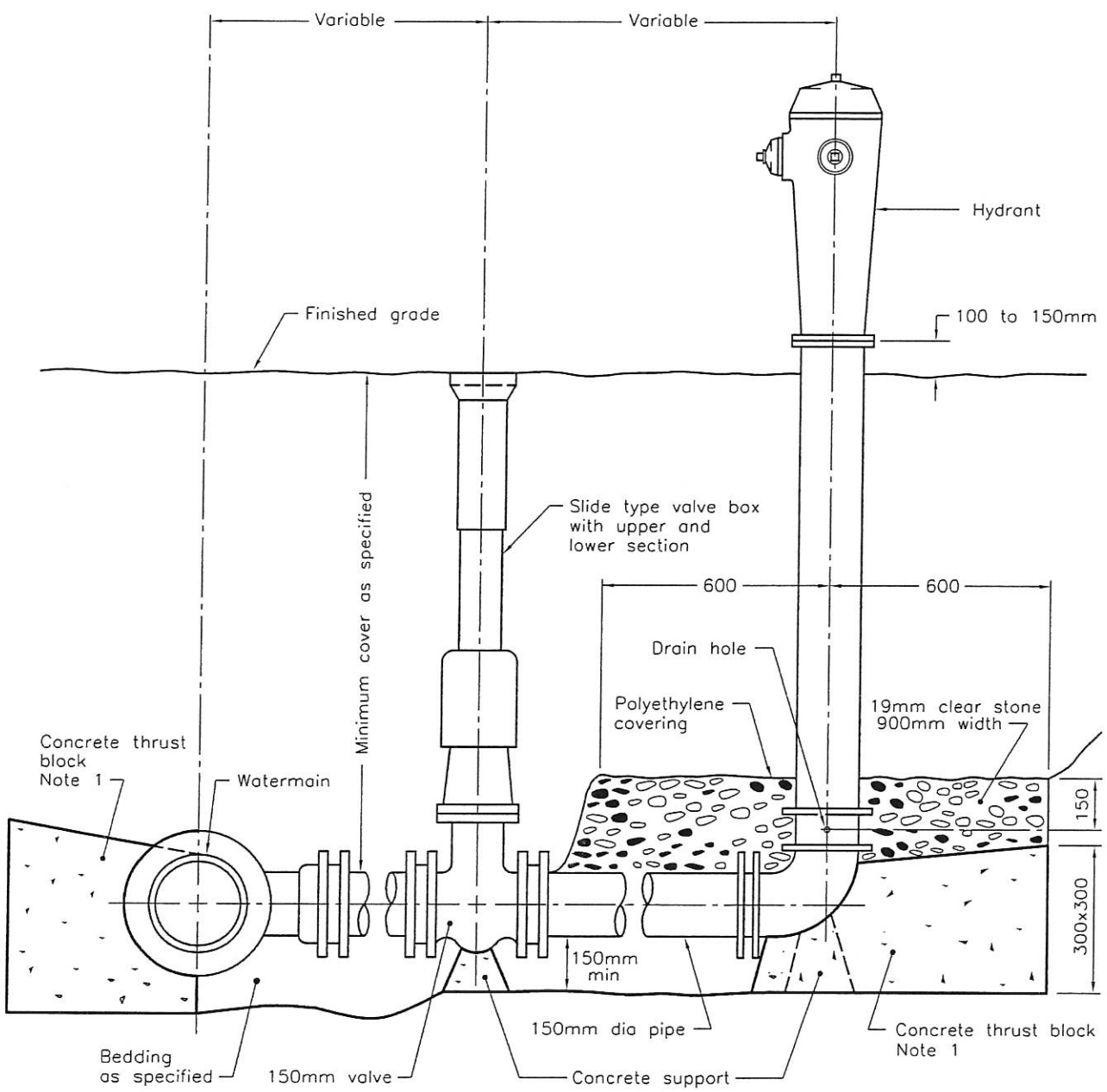
ONTARIO PROVINCIAL STANDARD DRAWING

25mm BLOW OFF

INSTALLATION

Nov 2006 | Rev 1

OPSD 1104.030



NOTES:

1 All concrete thrust blocks to be poured against undisturbed ground.

A Bond breaker to be used between the concrete and the fittings and appurtenances.

B Bolts and nuts for buried flange to flange connections are to be stainless steel.

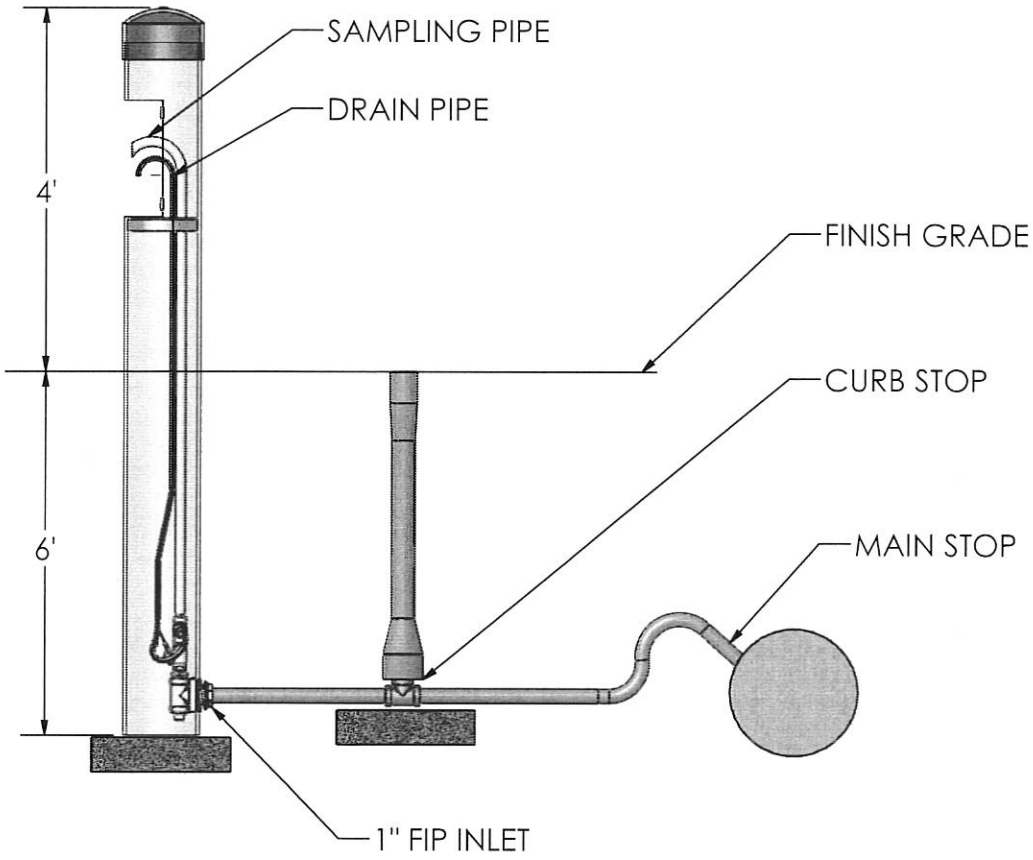
C When required, flange of standpipe extensions not to be in frost zone.

D This OPSD is to be read in conjunction with OPSD 1103.010 and 1103.020.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
HYDRANT INSTALLATION			
	OPSD 1105.010		

TEST TAP



- Sampling stations shall have a 1/2" (13mm) 316 stainless steel waterway. (No Lead)
- Sampling stations shall be equipped with a 3/8" (9.5mm)316 stainless steel vent tube. This is used to pump standing water from unit after use, preventing freezing and bacteria growth.
- The enclosure shall be made from plastic pipe with a lockable access door.
- The enclosure shall protect all components from corrosive soil and ground water.
- After the water is turned off at the curbstop, all working parts shall be removable without digging
- Sampling stations will be equipped with a 1" (25mm) FIP inlet for the connection to the watermain.
- Standard Test Tap is designed for a 1.8 meter (6 feet) bury and a 1.2 meter (4 feet) pedestal. (Alternate lengths available)

Typical Install from Watermain to Test Tap Sampling Station

¾" (19mm) mainstop, ¾" (19mm) domestic pipe to a ¾" (19mm) curbstop, ¾" (19mm)domestic pipe to Test Tap.

Notes
1. The Test Tap should rest on a concrete slab. 30cm X 30cm Patio slab is acceptable.
2. The Curbstop should rest on a concrete slab. Small patio slab is acceptable.
3. If no-lead fittings (mainstop, curbstop etc) are used to connect the Test Tap to the watermain this would provide a complete no-lead sample point.

COMMENTS:

APPLICATION | DO NOT SCALE DRAWING

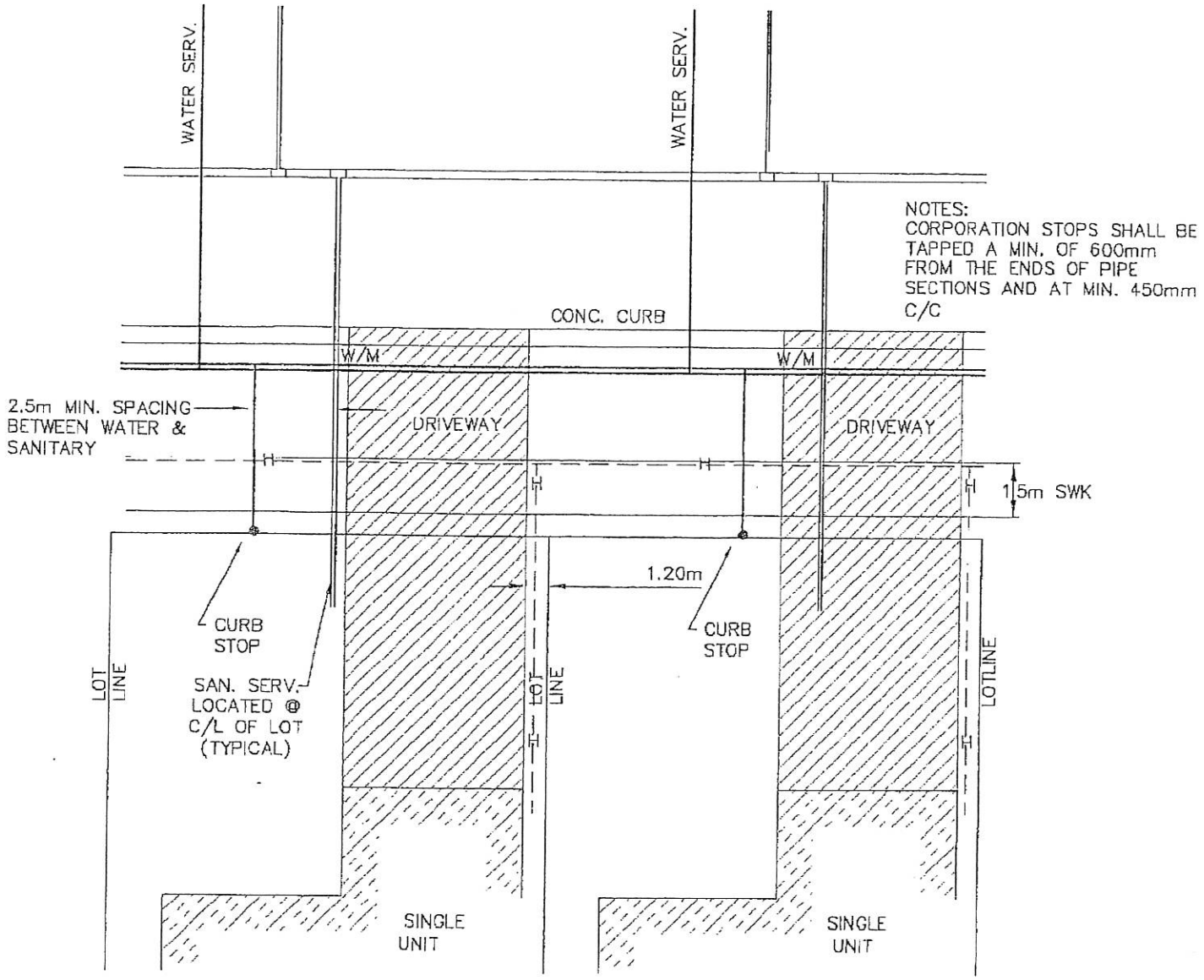
	NAME	DATE
DRAWN		
CHECKED		
Q.A.		

SAMPLING STATION

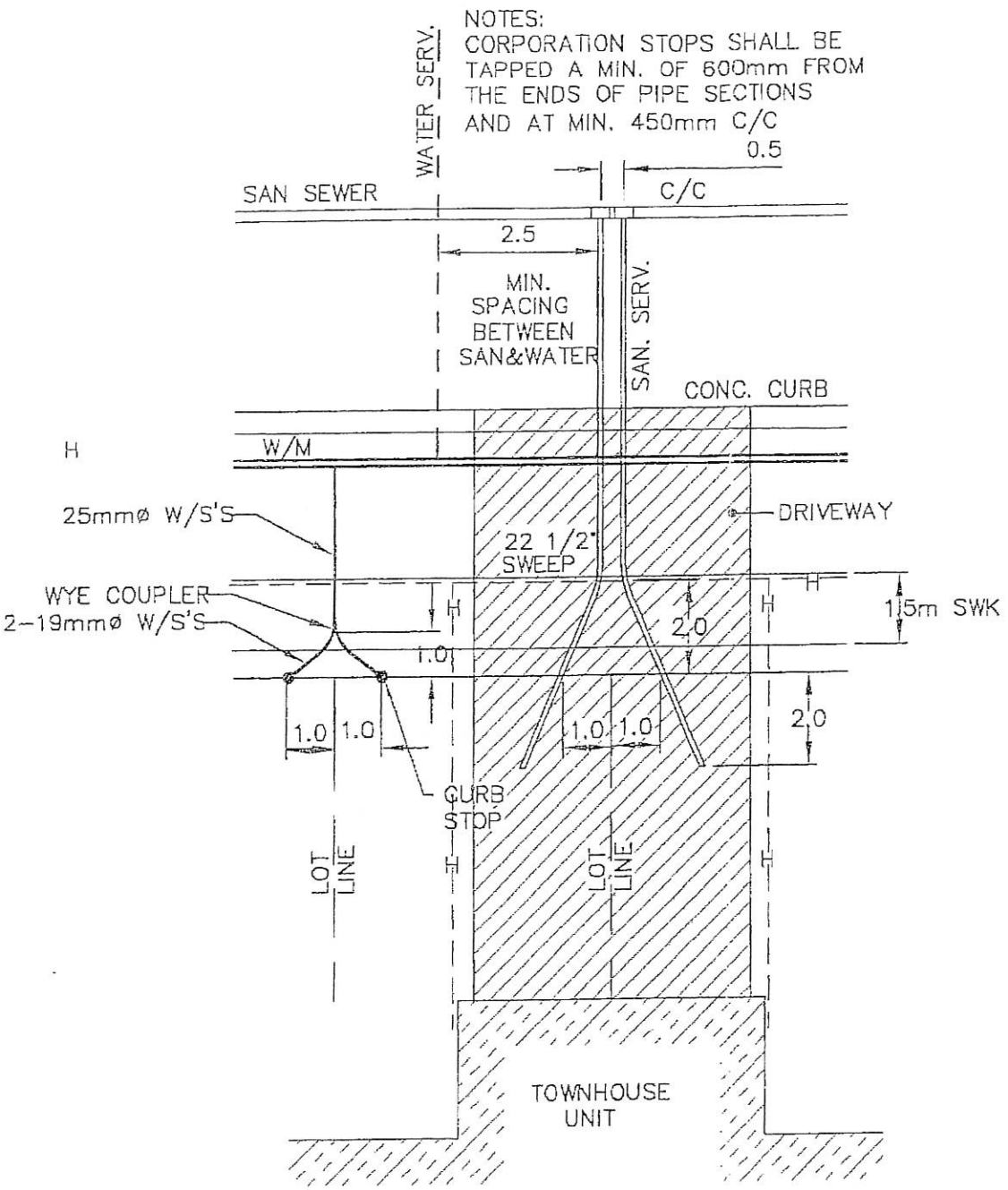
SIZE	DWG. NO.	REV.
A	SS1	A

SCALE: NTS | SHEET 1 OF 1

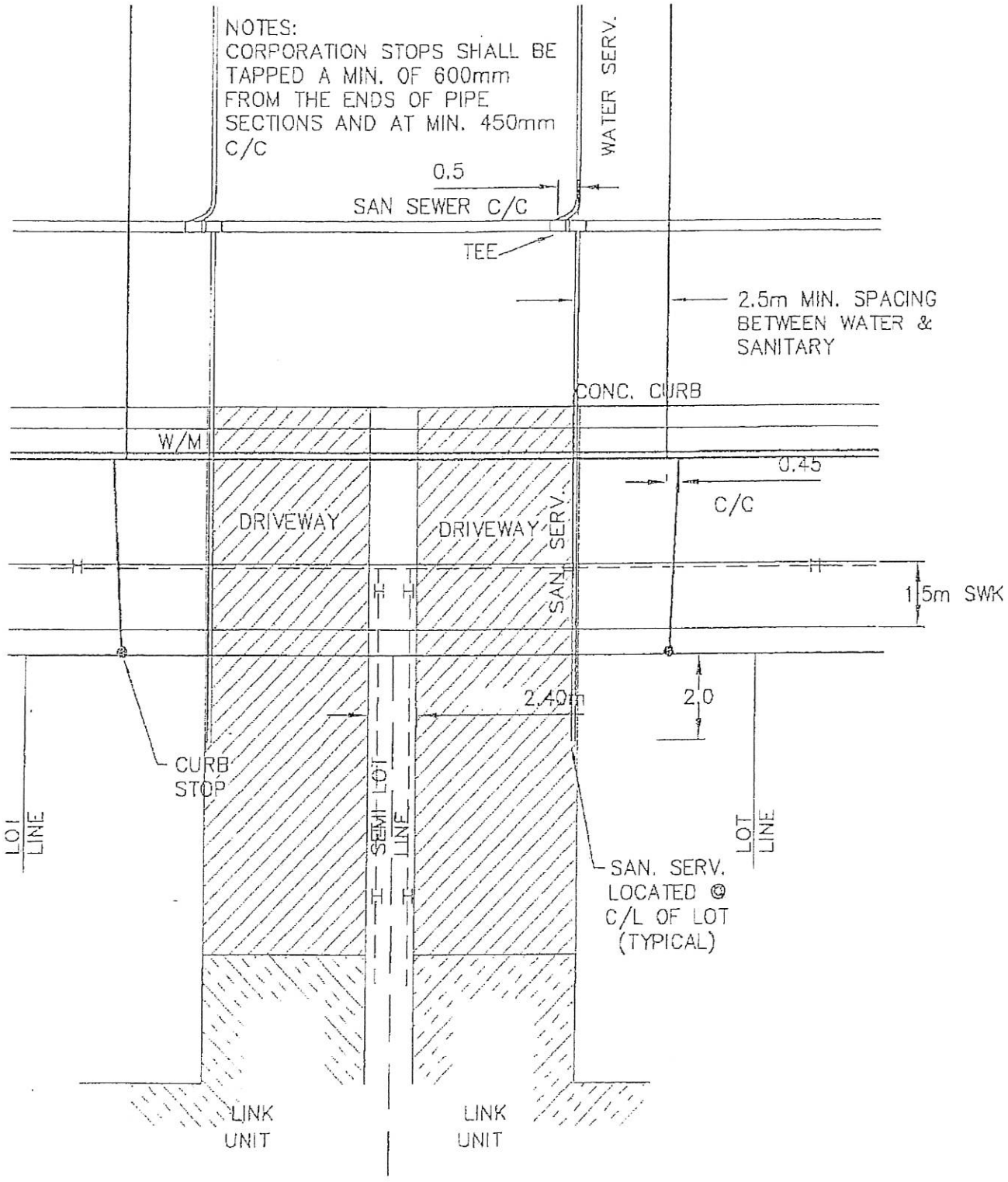
LOT SERVICING DETAILS



THE CORPORATION OF THE **CITY OF ORILLIA** DEPARTMENT OF PLANNING & DEVELOPMENT	ENGINEERING DESIGN STANDARDS RESIDENTIAL DEVELOPMENT **LOT SERVICING DETAIL – SINGLE**		
	DATE: AUGUST 2011	DRAWN: GH/ic	SCALE: N.T.S.



THE CORPORATION OF THE CITY OF ORILLIA DEPARTMENT OF PLANNING & DEVELOPMENT	ENGINEERING DESIGN STANDARDS RESIDENTIAL DEVELOPMENT		
	LOT SERVICING DETAIL – TOWNHOME		
	DATE: AUGUST 2011	DRAWN: GH/ic	SCALE: N.T.S.



THE CORPORATION OF THE

CITY OF ORILLIA

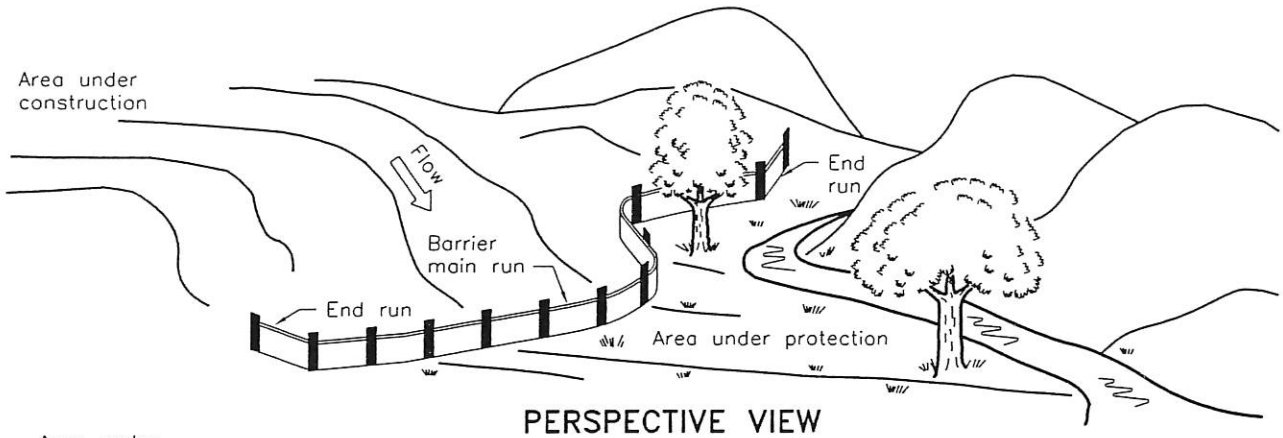
DEPARTMENT OF
PLANNING & DEVELOPMENT

ENGINEERING DESIGN STANDARDS
RESIDENTIAL DEVELOPMENT

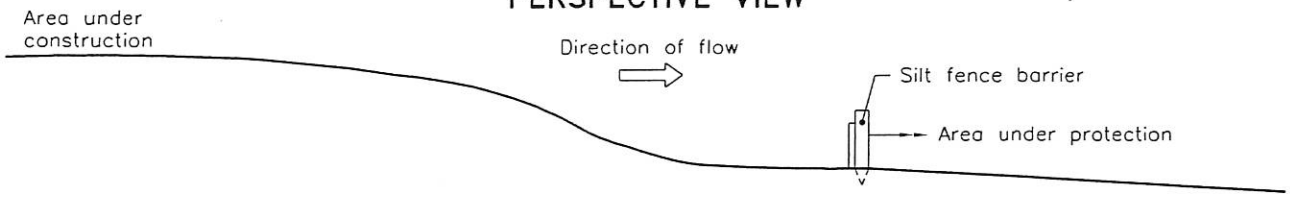
LOT SERVICING DETAIL – SEMI/LINK

DATE: AUGUST 2011	DRAWN: GH/ic	SCALE: N.T.S.

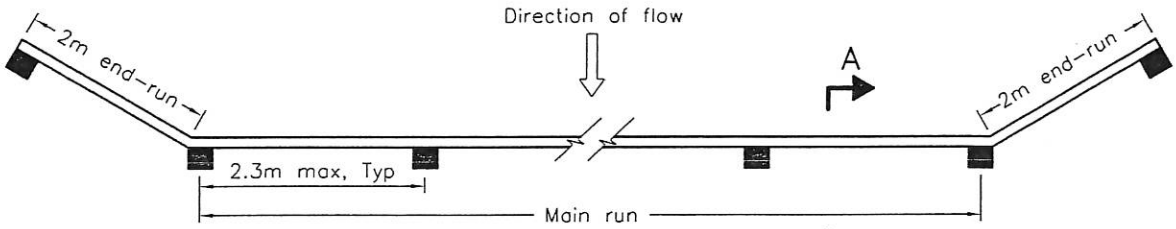
EROSION CONTROLS



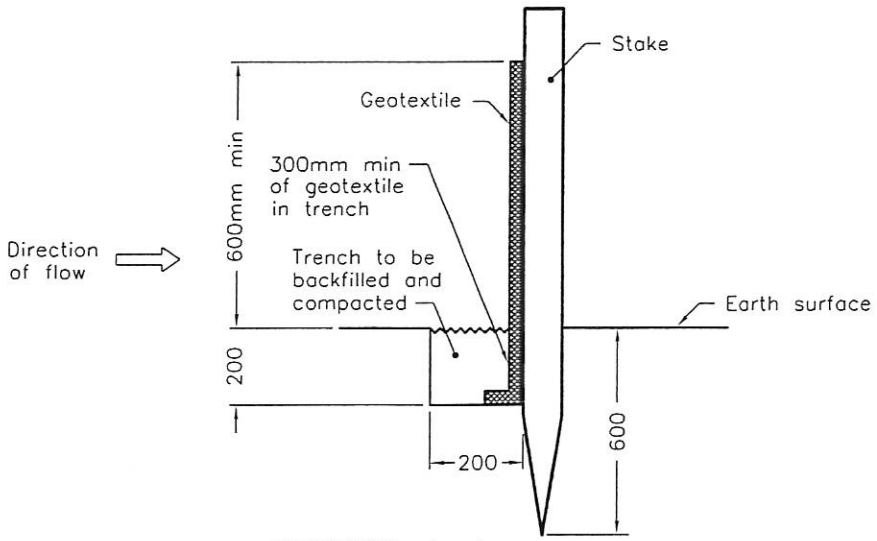
PERSPECTIVE VIEW



SECTION



PLAN

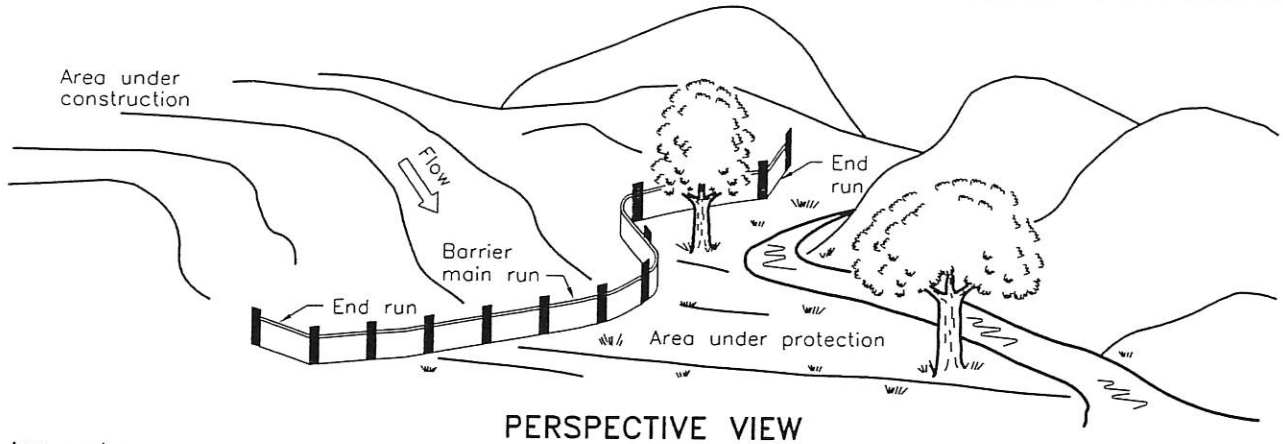


SECTION A–A

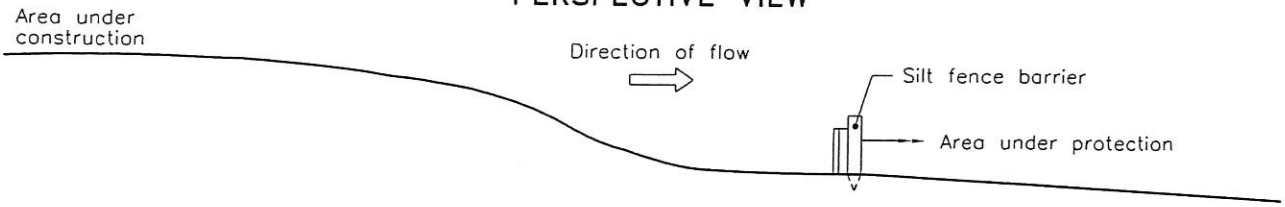
NOTE:

A All dimensions are in millimetres unless otherwise shown.

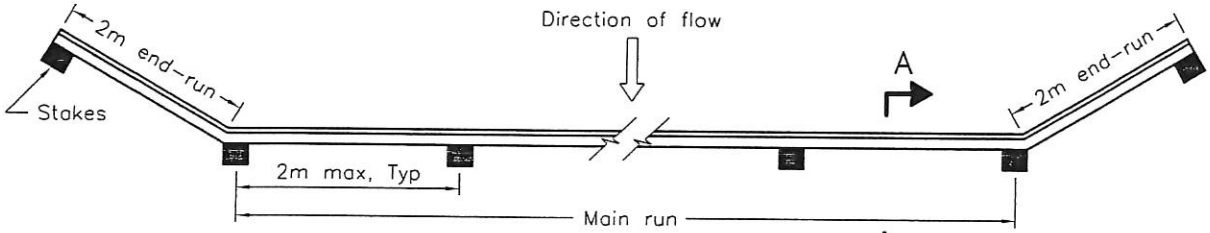
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
LIGHT–DUTY SILT FENCE BARRIER			OPSD 219.110



PERSPECTIVE VIEW

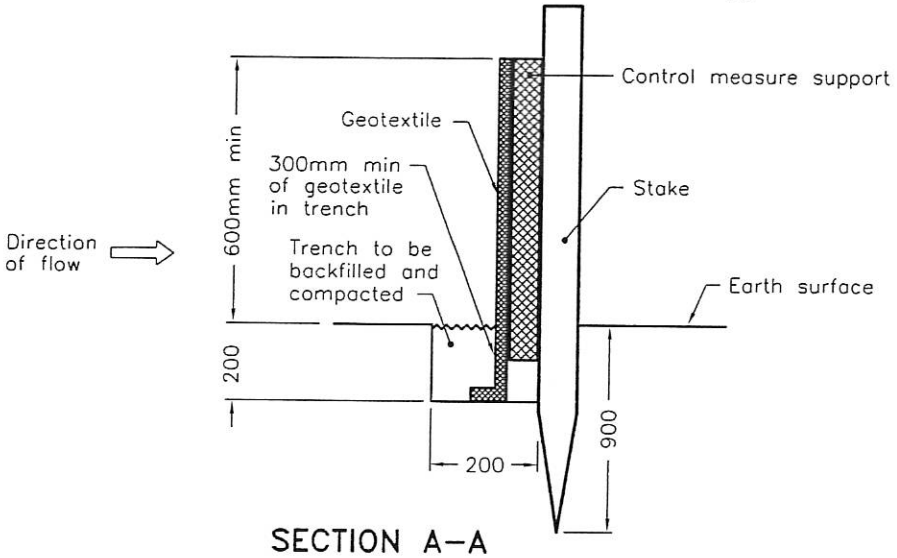


SECTION



PLAN

A

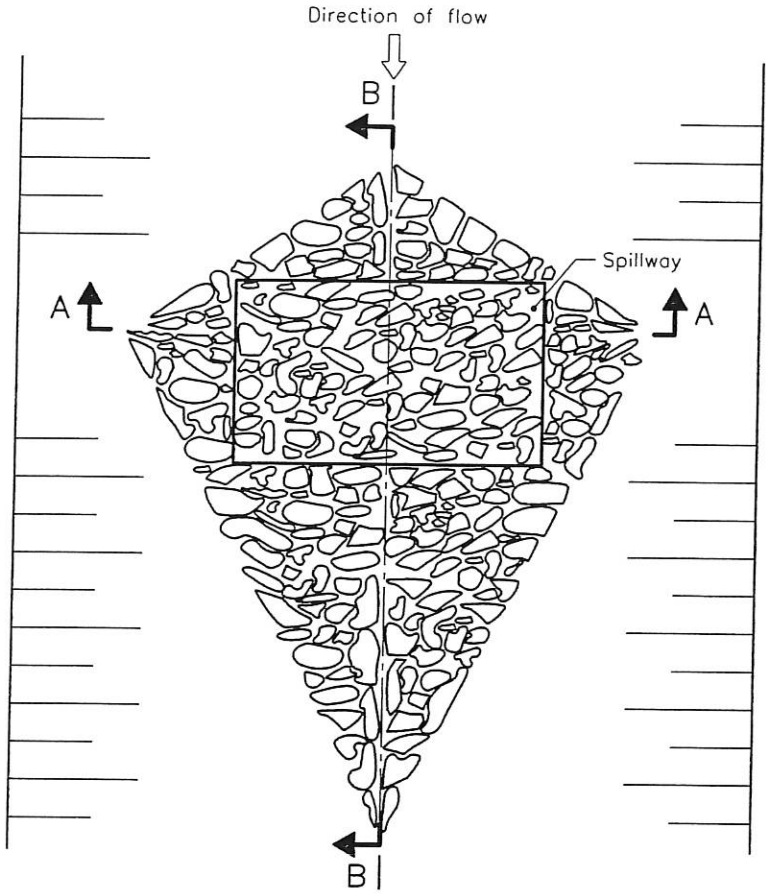


SECTION A–A

NOTE:

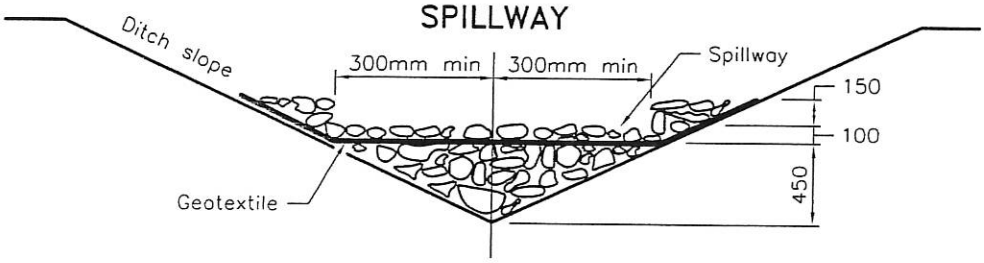
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
HEAVY–DUTY SILT FENCE BARRIER			
	OPSD 219.130		

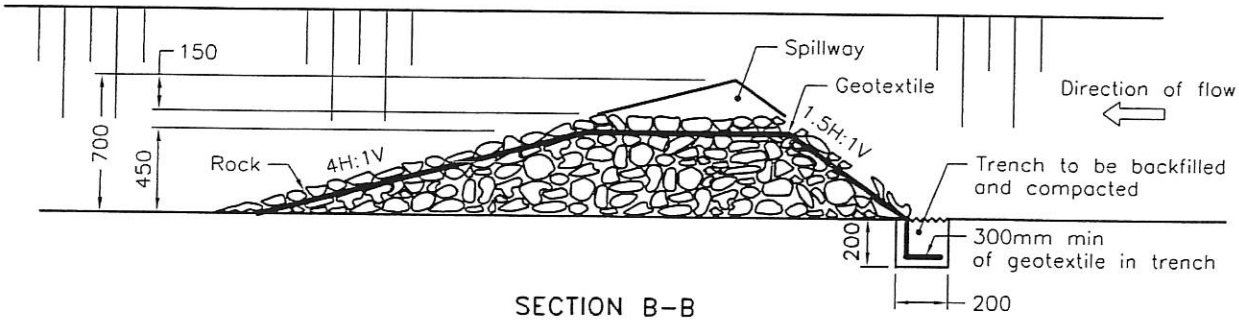


PLAN

SPILLWAY



SECTION A–A

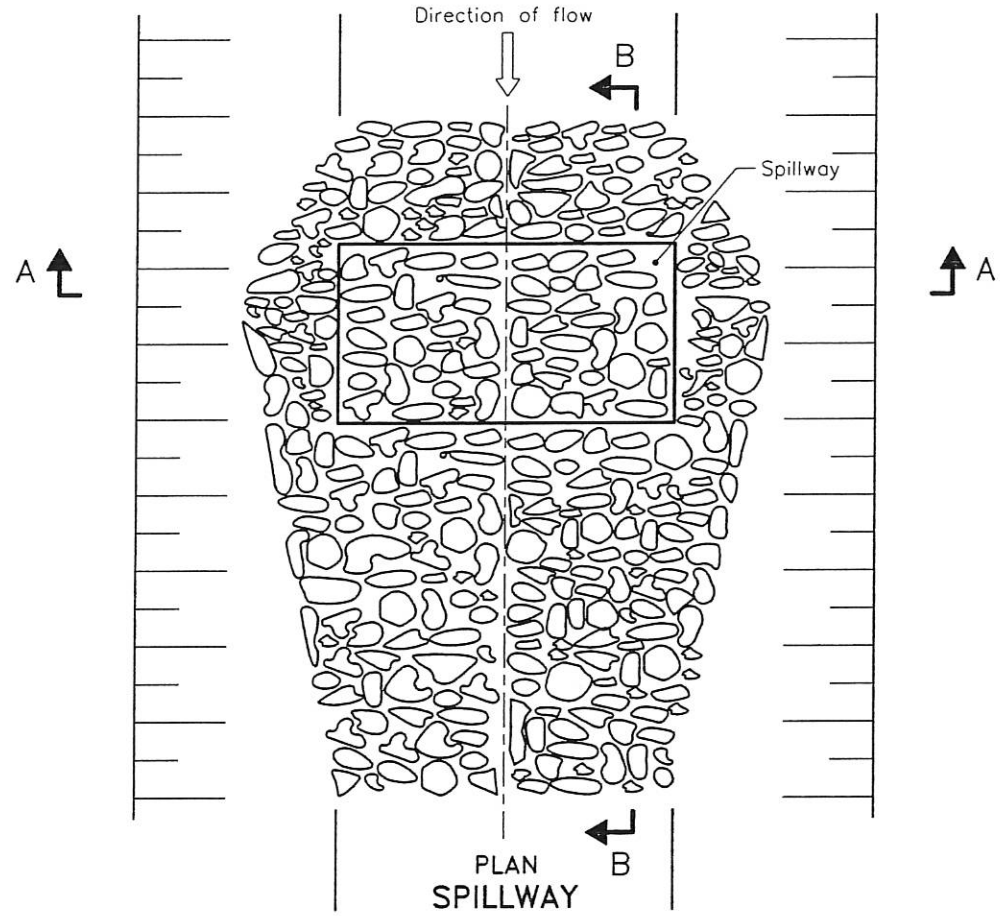


SECTION B–B

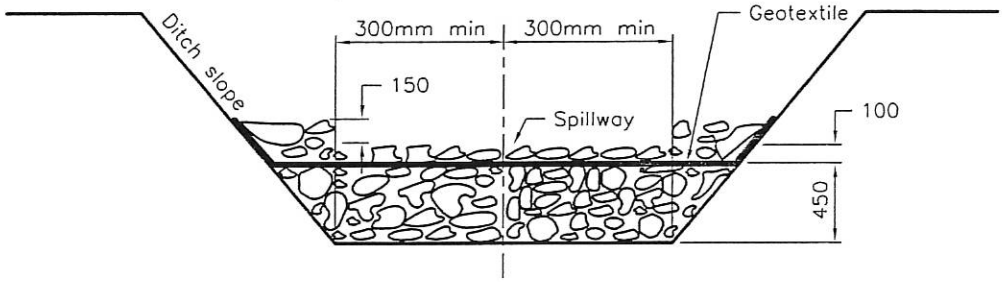
NOTE:

A All dimensions are in millimetres unless otherwise shown.

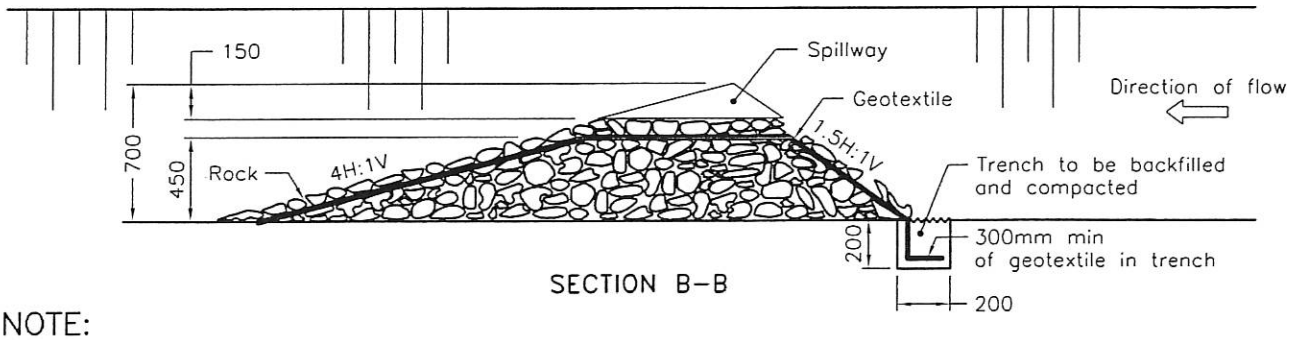
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
ROCK FLOW CHECK DAM V–DITCH			
	OPSD 219.210		



PLAN
SPILLWAY



SECTION A–A

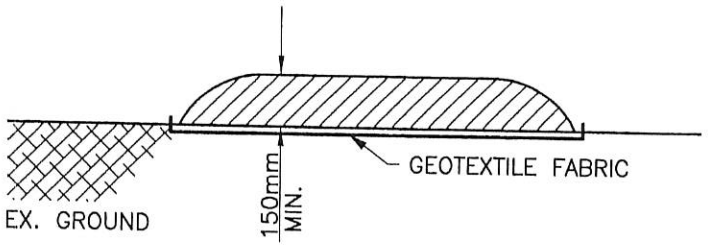


SECTION B–B

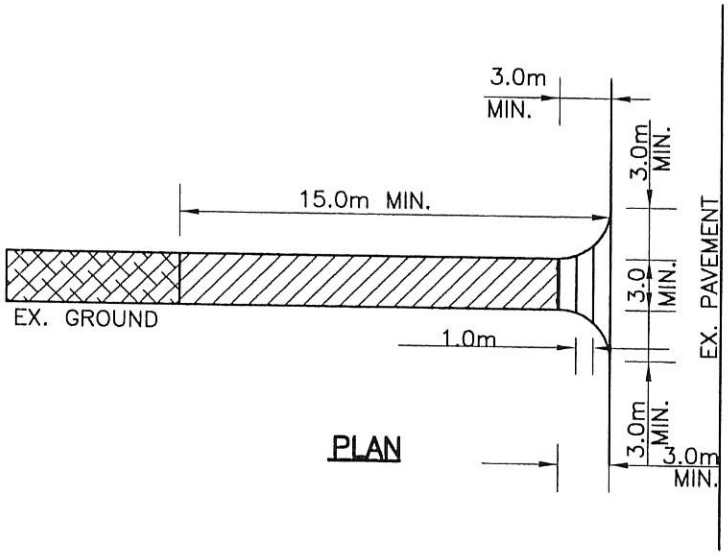
NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
ROCK FLOW CHECK DAM FLAT BOTTOM DITCH			
	OPSD 219.211		



PROFILE



PLAN

STONE SIZE

THE STONE PAD SHALL BE A MIN. 150mm THICK. USE 50ømm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 10m FROM ADJACENT ROAD & 150mmø STONE FOR REMAINDER OF STONE PAD.

LENGTH

AS REQUIRED BUT NOT LESS THAN 15m (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 10m MIN. LENGTH WOULD APPLY).

WIDTH

3m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC

(TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

SURFACE WATER

ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

MAINTENANCE

THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING

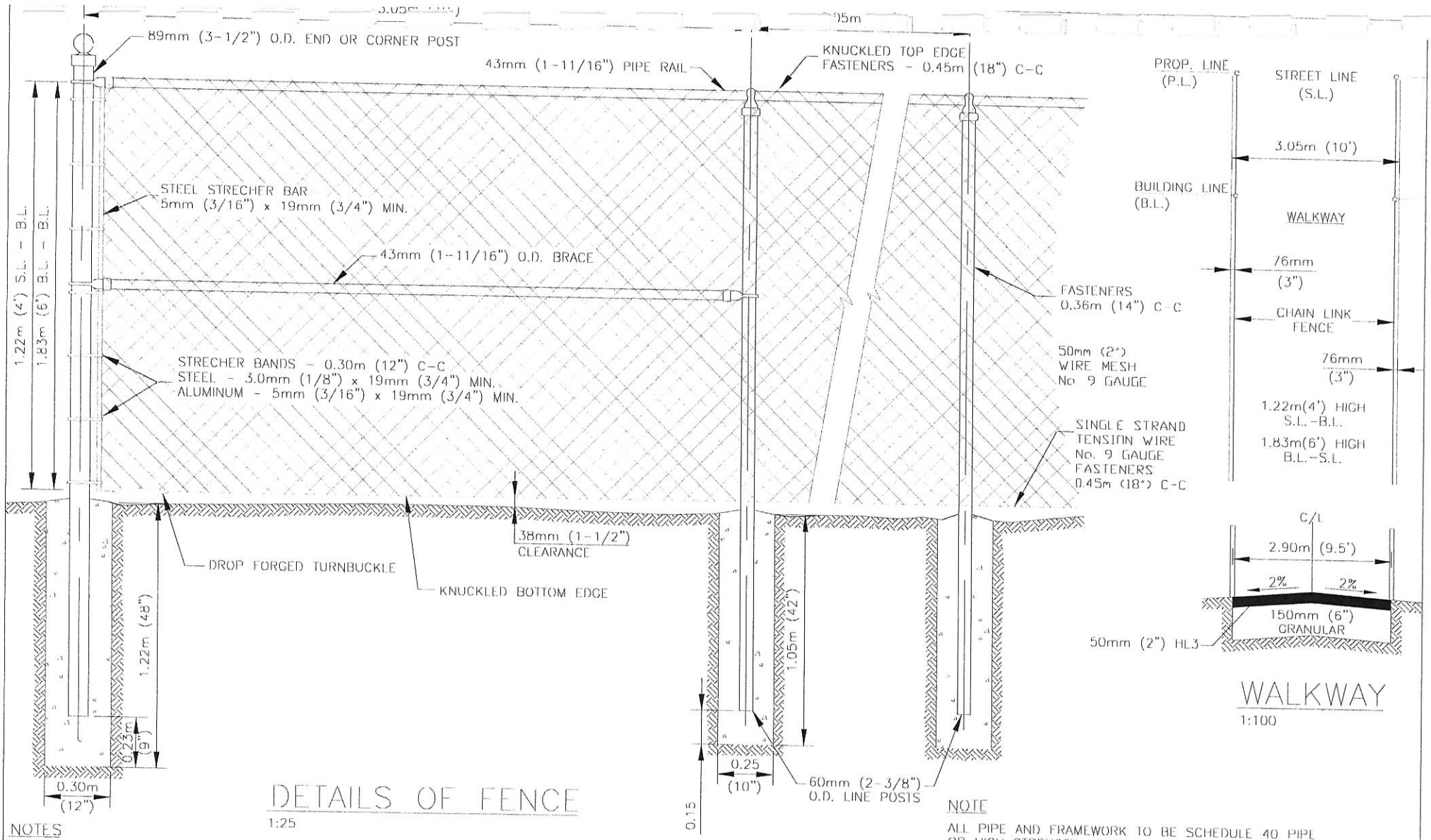
WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

STONE MUD MAT DETAIL

SCALE: NTS

FENCED WALKS



DETAILS OF FENCE

1:25

WALKWAY

1:100

NOTES

1. RUNS OF FENCE MORE THAN 152m (500') ARE TO HAVE A 89mm (3-1/2") O.D. INTERMEDIATE STRAINING POST WITH 43mm (1-11/16") O.D. BRACES, SIMILAR TO THOSE USED AT ENDS AND CORNER POSTS, IN TWO DIRECTIONS. ONE OF THESE STRAINING POSTS WITH BRACES SHALL BE INSTALLED FOR EVERY 152m (500') OR FRACTION THEREOF.
2. LENGTH OF POSTS - 1.83m (6') HIGH SECTION - LINE POST 2.67m (8'9")
   - CORNER & STRAINING POSTS 2.90m (9'6")
   - 1.22m (4') HIGH SECTION - END POSTS 2.29m (7'6")
   - LINE POSTS 2.06m (6'")
3. TIE WIRES - #9 GAUGE ALUMINUM MINIMUM.
4. WALKWAY TO BE COMPOSED OF 150mm (6") CONSOLIDATED C.B.C. "A" & 50mm (2") HL3.

NOTE

ALL PIPE AND FRAMEWORK TO BE SCHEDULE 40 PIPE OR HIGH STRENGTH HOLLOW STRUCTURAL SECTION 2.54mm WALL WITH MECHANICAL PROPERTIES SIMILAR TO A.S.T.M. SPECIFICATION A-36.

NO TUBING, CONDUIT OR OPEN SEAM MATERIAL WILL BE PERMITTED.

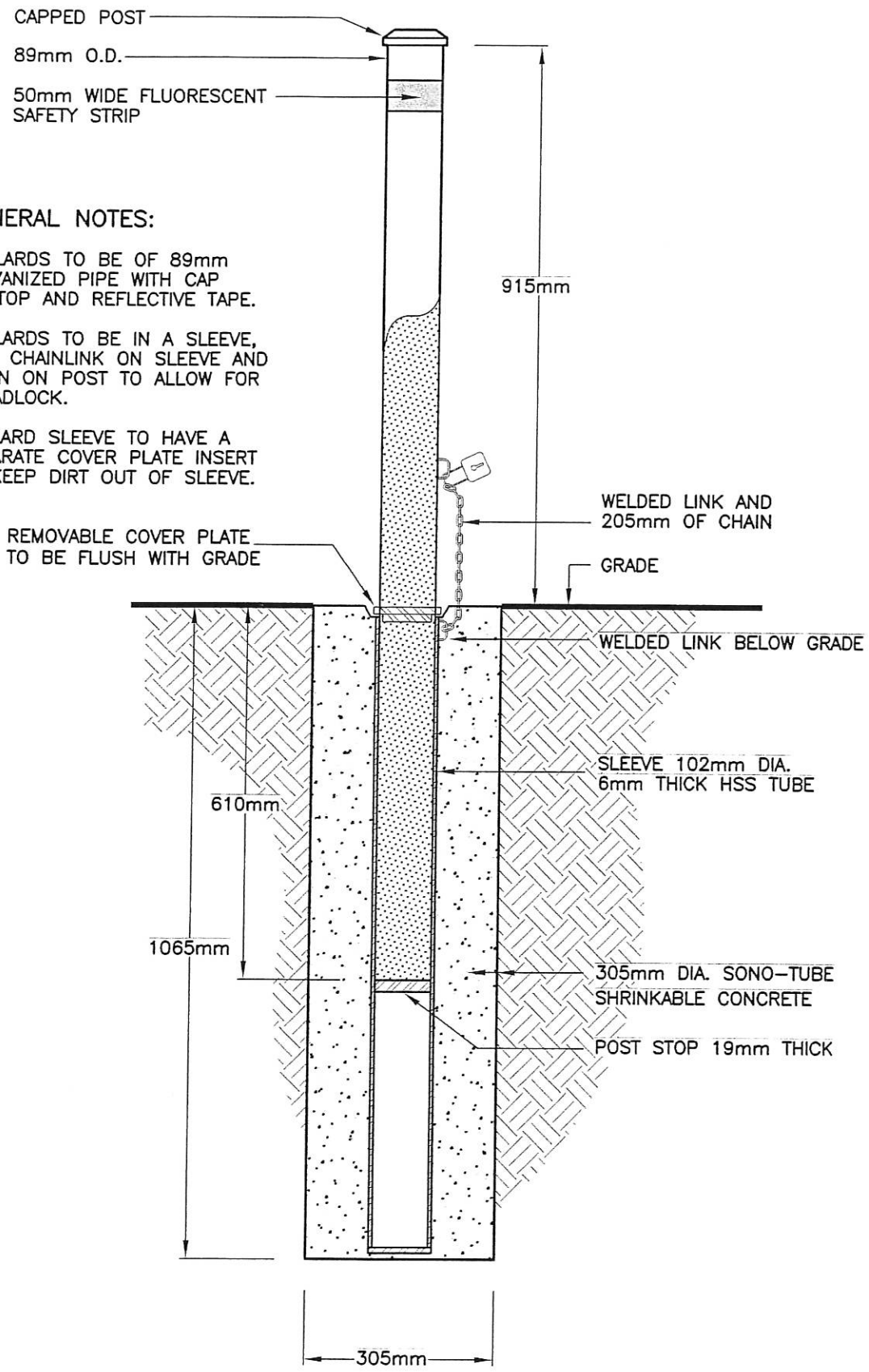
THE CORPORATION OF THE CITY OF ORILLIA

PARKS AND RECREATION DEPARTMENT

3.05m (10') FENCED WALKWAY & PARK PERIMETER FENCING DETAIL

DRAWN: C. KRUSKA	SCALE: AS SHOWN
CHECKED: K. MacKINNON	DWG. No.: 72-STD-14
DATE: FEBRUARY 2001	

UPDATED JUNE 2003

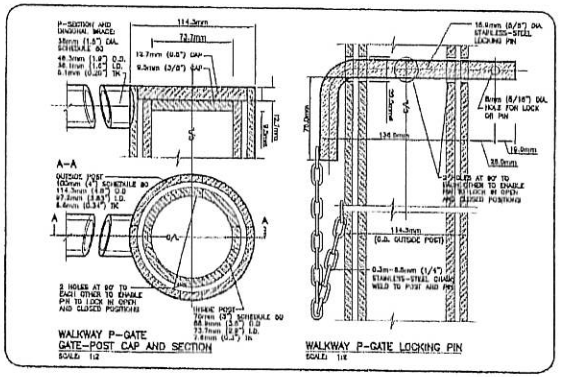


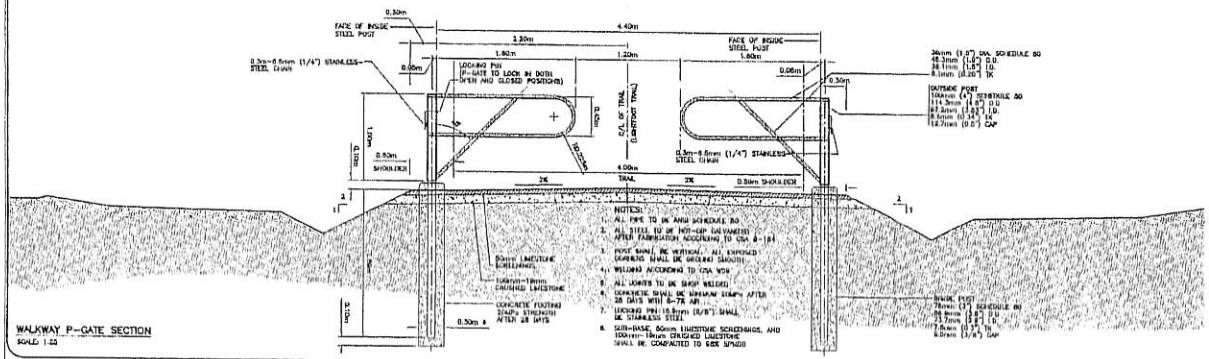
GENERAL NOTES:

1. BOLLARDS TO BE OF 89mm GALVANIZED PIPE WITH CAP ON TOP AND REFLECTIVE TAPE.
2. BOLLARDS TO BE IN A SLEEVE, WITH CHAINLINK ON SLEEVE AND CHAIN ON POST TO ALLOW FOR A PADLOCK.
3. BOLLARD SLEEVE TO HAVE A SEPARATE COVER PLATE INSERT TO KEEP DIRT OUT OF SLEEVE.

REMOVABLE BOLLARD SPECIFICATIONS

SCALE: 1:10





PUBLIC WORKS DEPARTMENT

THE CORPORATION of the CITY of ORILLIA

DESIGN BY: MG
DRAWN BY: NH
CHECKED BY: MB
APPROVED BY: PGU
DATE: NOV. 29, 10
PLOTTED: NOV. 29, 10

BORLAND AND BAY STREET RECONSTRUCTION

LACLIE STREET TO LAKE COUCHICHING
DETAIL 3

RWS-10-37

D3

09-15

00L2DPK03.DWG

TYPICAL SUMMARIZED ENGINEERING DESIGN STANDARDS

GENERAL NOTES

1. DRAWINGS

1.1 THE NOTES ON THIS SHEET APPLY TO ALL WORKS UNDER THIS CONTRACT UNLESS OTHER WISE NOTED ON THE PLAN AND PROFILE DRAWINGS AND/OR SPECIFIC DETAIL DRAWINGS.

1.2 THE STANDARD DRAWINGS OF THE CITY OF ORILLIA, ORILLIA HYDRO DISTRIBUTION, ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS (OPSS) AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) CONSTITUTE PART OF THE PLANS OF THIS CONTRACT.

1.3 ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY CITY OF ORIILLIA AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS.

1.4 THE STANDARD DRAWINGS INCLUDED WITH THESE PLANS ARE PROVIDED FOR CONVENIENCE ONLY AND ARE NOT TO BE CONSTRUED TO BE A COMPLETE SET FOR THE PURPOSE OF THE CONTRACT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL RELEVANT STANDARD DRAWINGS AND SPECIFICATIONS AS REQUIRED FOR THIS CONTRACT.

2. MEASUREMENTS

2.1 ALL DIMENSIONS ARE IN METRES (m), EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETRES (mm), UNLESS SPECIFIED OTHERWISE.

2.2 ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.

3. GENERAL

3.1 EXISTING SERVICES AND UTILITIES SHOWN ON THE CONTRACT DRAWINGS ARE BASED ON THE BEST INFORMATION AVAILABLE AND THEIR LOCATIONS ARE NOT GUARANTEED. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS HE WISHES WITH THE UNDERSTANDING THAT THE OWNER DISCLAIMS ALL RESPONSIBILITY FOR ITS ACCURACY AND/OR SUFFICIENCY. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.

3.2 A ROAD OCCUPANCY PERMIT IS REQUIRED FROM THE MUNICIPAL WORKS DEPARTMENT 72 HOURS PRIOR TO THE COMMENCEMENT OF WORK WITHIN ANY CITY RIGHT-OF-WAY. THE CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN FOR APPROVAL BY THE ENGINEER AND THE CITY OF ORILLIA AT 20 JAMES STREET WEST.

3.3 PRIOR TO COMMENCING ANY WORK, INSTALL SNOW FENCING ALONG THE DRIP LINE OF THE DESIGNATED TREES AS SHOWN ON THE DRAWINGS. REFERENCE SHOULD ALSO BE MADE TO THE TREE PRESERVATION REQUIREMENTS AS SHOWN ON THE LANDSCAPE ARCHITECT'S PLAN. MAINTAIN THE FENCE AT ALL TIMES TO ENSURE THAT ACCESS TO THE AREA BENEATH THE TREES IS PREVENTED. STORAGE OF EQUIPMENT AND SUPPLIES SHALL NOT BE PERMITTED WITHIN THIS AREA.

3.4 ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY'S DIRECTOR OF MUNICIPAL WORKS.

3.5 NATIVE MATERIAL, SUITABLE FOR BACKFILL, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.

3.6 GRANULAR MATERIAL, USED FOR BACKFILL, SHALL BE PLACED IN LAYERS 150mm IN DEPTH MAXIMUM AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).

3.7 UTILITY CROSSINGS, WHERE REQUIRED, SHALL BE SUPPORTED AS PER THE APPLICABLE UTILITY COMPANY CONCERNED.

3.8 THE CONTRACTOR IS RESPONSIBLE (IF REQUIRED) FOR SUPPORTING ANY EXISTING UTILITIES AND/OR STRUCTURES IN ACCORDANCE WITH THE SPECIFICATIONS OF THE UTILITY COMPANY CONCERNED.

3.9 ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE CITY MUNICIPAL WORKS DEPARTMENT. ALL GRASS AND VEGETATION COVERED AREAS SHALL BE RESTORED BY PLACING 100mm OF SCREENED TOPSOIL AND No.1 NURSERY SOD UNLESS NOTED OTHERWISE.

3.10 WRITTEN PERMISSION SHALL BE OBTAINED BY THE DEVELOPER FROM THE OWNERS OF THE LANDS EXTERNAL TO THE SUBJECT PROPERTY PRIOR TO UNDERTAKING ANY WORK ON THEIR PROPERTY. THE WORK TO BE UNDERTAKEN ON THESE LANDS INCLUDES TREE REMOVAL AND CONSTRUCTING SERVICED ROADWAYS. GRADING AS REQUIRED TO MATCH EXISTING GROUND INTO THE PROPOSED STREET LINE ELEVATIONS SHALL BE DONE AT A MAXIMUM SLOPE OF 3: 1. FURTHERMORE, ALL DISTURBED AREAS WITHIN THE ADJACENT LANDS SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER.

3.11 ALL GRADING MUST CONFORM TO THE CITY OF ORILLIA LOT GRADING POLICIES CURRENTLY IN EFFECT.

3.12 ALL REMOVALS ARE TO BE CARRIED OUT IN ACCORDANCE WITH OPSS 510.

3.13 DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS 517 AND 518 TO MAINTAIN ALL TRENCHES IN A DRY CONDITION. ALL ENGINE DRIVEN PUMPS ARE TO BY ADEQUATELY SILENCED FOR OPERATION IN RESIDENTIAL AREAS.

THE CORPORATION OF THE
CITY OF ORILLIA
DEPARTMENT OF
PLANNING & DEVELOPMENT

ENGINEERING DESIGN STANDARDS
RESIDENTIAL DEVELOPMENT
GENERAL

DATE: AUGUST 2011	SCALE: N.T.S.	SECTION: 1-3
DRAWN: GH/ic		

4. ROADS

CITY OF ORILLIA GRANULAR "B" 50mm CRUSHED GRAVEL	
SIEVE	% PASSING
53.0mm	100
37.5mm	85-100
26.5mm	70-100
19.0mm	60-90
13.2mm	50-90
4.75mm	35-65
1.18mm	20-45
300um	5-25
75um	0-10
% CRUSHED	40% MINIMUM

4.1 THE ROAD PAVEMENT STRUCTURE SHALL CONSIST OF A MINIMUM OF THE FOLLOWING:

8.5m ROAD	14.0m ROAD (COLLECTOR)
- 40mm HL3 ASPHALT	- 40mm HL3 ASPHALT
- 50mm HL4 OR HL8 ASPHALT	- 2-50mm LIFTS HL4 OR HL8
- 150mm GRANULAR. "A"	- 150mm GRANULAR. 'A'
- 300mm CRUSHED GRANULAR. "B"	- 500mm CRUSHED GRANULAR. 'B'

GRANULAR "B" SHALL BE AS PER CITY OF ORILLIA SPECIFICATIONS:

4.2 NATIVE SUBGRADE SHALL HAVE A CROSSFALL OF 3%.

4.3 NATIVE SUBGRADE TO BE COMPACTED TO MINIMUM 95% SPMDD AND SHALL BE PROOF ROLLED AND APPROVED BY THE SOILS CONSULTANT PRIOR TO INSTALLATION OF GRANULAR. ALL GRANULAR MATERIAL SHALL BE COMPACTED TO 100% SPMDD.

4.4 THE ROAD BASE SHALL INCORPERATE A 3.0m MIN. 100mm PERFORATED SUBDRAIN C/W FACTORY INSTALLED FILTER FABRIC AT 1.0% SLOPE FROM EACH SIDE OF EVERY CATCHBASIN, MIN. 0.15M BELOW SUBGRADE OR IN ANY AREAS DEEMED NECESSARY BY THE ENGINEER.

4.5 JOINTS WITH EXISTING ASPHALT TO BE SAW CUT STRAIGHT AS DIRECTED BY THE ENGINEER PRIOR TO PLACEMENT OF NEW ASPHALT.

4.6 ALL CURB AND GUTTER SHALL BE CONSTRUCTED AS PER THE ENGINEERING DRAWINGS AS FOLLOWS:
- SINGLE STAGE CURB AS PER OPSD 600.040 FOR COLLECTOR AND ARTERIAL ROADS AND MOUNTABLE CURB WITH NARROW GUTTER AS PER 600.100 FOR LOCAL ROADS.
- CURB TERMINATIONS AS PER OPSD 608.010.

4.7 ALL CURBS SHALL BE DEPRESSED AT ALL WALKWAY, DRIVEWAY AND SIDEWALK LOCATIONS.

4.8 ALL CURB RADII TO BE 9.0m AT THE EDGE OF ASPHALT, UNLESS SHOWN OTHERWISE.

4.9 CONCRETE STRENGTH FOR CURB AND GUTTER TO BE 30MPa AT 28 DAYS.

4.10 TEMPORAY ASPHALT CURB SHALL BE PLACE BEHIND ALL CB'S DURING BASE COURSE PLACEMENT. ASPHALT CURBS SHALL BE REPLACED WITH CONCRETE CURBS FOR THE FINAL ASPAHLT LIFT.

4.11 SIDEWALKS TO COMPLY WITH OPSD 310.010 AND ARE TO BE 1.5m WIDE. MINIMUM THICKNESS AS FOLLOWS:
- RESIDENTIAL DRIVEWAY, 150mm
- COMMERCIAL DRIVEWAY, 200mm (REINFORCEMENT AS PER OPSS IF REQUIRED)
- WHEN NO DRIVEWAY IS PRESENT, 125mm

4.11 SIDEWALKS TO BE CONSTRUCTED ON 150mm GRANULAR "A" BEDDING UNLESS OTHERWISE SPECIFIED BY THE DIRECTOR OF MUNICIPAL WORKS.

4.12 CONCRETE STRENGTH FOR SIDEWALK TO BE 30MPa AT 28 DAYS.

4.13 SIDEWALK RAMPS TO COMPLY WITH OPSD 310.030.

4.14 WALKWAYS TO COMPLY WITH CITY OF ORILLIA STANDARD AND SHALL BE CENTERED WITHIN THE WALKWAY BLOCKS AS SHOWN ON THE PLANS. THE WIDTHS OF THE BLOCKS ARE AS SHOWN ONTHE PLANS.

4.15 THEY WALKWAY SURFACE SHALL CONSIST OF 2.8m WIDE HL3 ASPHALT COMPACED TO 50mm THICNESS ON A BSE OF 200mm THE COMPACTED GRANULAR "A". THE REMAINDER OF THE WALKWAY BLOCK SHALL BE FINISHED WITH A 100mm TOPSOIL AND No.1 NURSERY SOD, AND SHALL BE SHAPED WITH A 150mm DEEP SWALE ON EITHER SIDE OF THE WALKWAY SURFACE SO AS TO PROVIDE POSITIVE DRAINAGE, OR AS SHOWN OTHERWISE. (SEE DETAIL ON SD-4)

4.16 WALKWAY GATES SHALL BE INSTALLED AT THE STREETLINE END(S) OF ALL WALKWAYS SET BACK 1.0m FROM STREET LINE AS DETAILS SHOW. MAXIMUM SPACING BETWEEN POSTS SHALL BE 1.5m. WALKWAYS ARE TO BE FENCED ON BOTH SIDES AS DETAILS SHOW.

4.17 DRIVEWAYS TO BE CONSTRUCTED WITH A MINIMUM OF 50mm HL3 ASPHALT ON A MINIMUM OF 300mm GRANULAR 'A' FOR RESIDENTIAL OR ALTERNATIVE EQUIVALENT MATERIAL AS APPROVED BY THE DIRECTOR OF MUNICIPAL WORKS.

4.18 DRIVEWAY GRADES TO BE A MINIMUM OF 0.5% AND A MAXIMUM OF 7.0%. DRIVEWAY WIDTH TO BE:

RESIDENTIAL	COMMERCIAL/INDUSTRIAL
SINGLE – 4.0m	THROAT WIDTH – 9.0m
DOUBLE - 6.0m	CURB RETURN – 6.0m (URBAN)

TRIPLE-(< 50% OF LOT FRONTAGE) CURBS RETURN -8.0 (SEMI-URBAN)
ENTRANCE DETAILS AS PER OPSD 351.010 AND PAVED TO STREETLINE

4.19 TEMPORARY DEAD END BARRICADE TO BE AS PER OPSD 912.532

THE CORPORATION OF THE
CITY OF ORILLIA
DEPARTMENT OF
PLANNING & DEVELOPMENT

ENGINEERING DESIGN STANDARDS
RESIDENTIAL DEVELOPMENT
ROADS

DATE: AUGUST 2011	SCALE: N.T.S.	SECTION: 4
DRAWN: GH/ic		

5. SANITARY SEWERS

5.1 SANITARY SEWER TO BE LOCATED 1.5m OFF CENTRELINE OF THE ROAD UNLESS NOTED OTHERWISE.

5.2 MAXIMUM PIPE DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY CSA, OPS OR MANUFACTURERS RECOMMENDED SPECIFICATIONS. FLEXIBLE PIPE SHALL BE PVC DR35 OR APPROVED EQUIVALENT, WITH RUBBER GASKET TYPE JOINTS AND SHALL CONFORM TO CSA (B-182.2, 3, 4). RIGID PIPE SHALL BE REINFORCED CONCRETE WITH STRENGTH OF 100N/mm/m CONFORMING TO CSA STANDARD A257.2-M1982 CLASS 100D. PIPE JOINTS ARE TO BE RUBBER GASKET AS PER CSA STANDARD A257.3.

5.3 FLEXIBLE SEWERS SHALL BE CONSTRUCTED WITH BEDDING AND BACKFILL AS PER OPSD 802.010 (GRANULAR "A" FOR BEDDING, AND COVER MATERIAL TO BE SAND, GRANULAR 'A' OR QUARRY SCREENINGS PENDING A REVIEW BY THE ENGINEER). RIGID SEWERS SHALL BE CONSTRUCTED WITH CLASS "B" BEDDING (GRANULAR "A" MATERIAL) AS PER OPSD 802.030, 802.031 AND 802.032 AS APPLICABLE. MATERIAL MAY BE REPLACED ONLY BY APPROVAL OF THE DIRECTOR OF MUNICIPAL WORKS.

5. 4 IN WET AREAS, FLEXABLE PIPE MAY BE LAID ON A 10mm CLEAR STONE BED, RIGID PIPE MAY BE LAID ON A 20mm CLEAR STONE BED. CLEAR STONE MUST BE WRAPPED IN GEOTEXTILE FIBRIC (TERRAFIX 270R OR APPROVED EQUAL).

5.5 NO FLEXIBLE PIPE SEWERS WILL BE INSTALLED WITH A DEPTH OF COVER GREATER THAN 6.0m UNLESS SPECIFICALLY APPROVED BY THE DIRECTOR OF MUNICIPAL WORKS.

5.6 TRENCH BACKFILL SHALL BE SELECT NATIVE MATERIAL OR IMPORTED SUBGRADE MATERIAL IF DIRECTED BY THE ENGINEER.

5.7 PRECAST MAINTENANCE HOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010 (1200mm). PRECAST MAINTENANCE HOLES GREATER THAN 5.0m DEEP SHALL BE CONSTRUCTED WITH SAFETY PLATFORM IN ACCORDANCE WITH OPSD 404.020. FRAME AND COVER SHALL BE IN ACCORDANCE WITH OPSD 401.010 TYPE "A" AND MARKED "SANITARY". STEPS AS PER OPSD 405.010, ARE TO BE HOLLOW CIRCULAR ALUMINIUM.

5.8 MAINTENANCE HOLE TOPS (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE, AND THEN ADJUSTED TO FINAL GRADE WHEN TOP LIFT OF ASPHALT IS PLACED. GRADE AND CROSSFALL ADJUSTMENT SHALL BE MADE USING "THE ADJUSTABLE" (BIBBY-STE-CROIX C50M-ONT) CONFORMING TO MULLER CANADA A-J633 OR APPROVED EQUIVALENT.

5.9 ALL CONNECTIONS TO THE SANITARY MAIN SHALL BE MADE WITH PRE-MANUFACTURED APPROVED TEES.

5.10 MAINTENANCE HOLES BENCHING SHALL CONFORM TO OPSD 701.021.

5.11 DROP STRUCTURES SHALL CONFORM TO OPSD 1003.01 AND 1003.02. ALTERNATIVELY, AND SUBJECT *TO* THE APPROVAL OF THE DIRECTOR OF MUNICIPAL WORKS, CONSIDERATION WILL BE GIVEN TO PRECAST MANHOLES COMPLETE WITH PRECAST DROP SECTIONS.

5.12 THE EXISTING SANITARY FLOWS ARE TO BE MAINTAINED AT ALL TIMES BY A METHOD APPROVED BY THE CITY.

5.13 MAINTAINANCE HOLES SHALL BE ABANDONED BY REMOVAL OF THE UPPER SECTIONS (BASE CAN REMAIN).

5.14 ABANDONED SANITARY SEWERS SHALL BE FILLED WITH NON-SHRINK FILL, OR REMOVED.

6. SANITARY SERVICE LATERALS

6.1 SANITARY LATERAL CONNECTIONS TO BE LOCATED AS SHOWN UNLESS DIRECTED BY THE ENGINEER.

6.2 PIPE TO BE MINIMUM 100mm PVC SDR28, RUBBER GASKET TYPE JOINTS AND SHALL CONFORM TO CSA (B-182.2, 3, 4) (COLOURED) FOR A RESIDENTIAL HOUSE, AND MINIMUM 150mm0 PVC SDR28 FOR INDUSTRIAL AND COMMERCIAL DEVELOPMENTS.

6.3 MINIMUM DEPTH OF LATERAL *AT* PROPERTY LINE SHALL BE 2.4m MEASURED FROM THE SEWER OBVERT TO FINISHED GROUND SURFACE ELEVATION UNLESS NOTED OTHERWISE.

6.4 MINIMUM PIPE SLOPE TO BE 2.0%, MAXIMUM 8.0% (SEE OPSD 1006.02).

6.5 SANITARY LATERAL CONNECTIONS ARE TO BE EXTENDED 2.0m BEYOND STREETLINE INTO THE LOTS AND PLUGGED.

6.6 THE LOCATION OF THE END OF EACH LATERAL ARE TO BE MARKED WITH A 50mm x 100mm WOOD MARKER PAINTED GREEN, EXTENDING FROM SERVICE INVERT TO 300mm ABOVE PROPOSED FINISHED GROUND LEVEL.

6.7 ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE WITH PRE-MANUFACTURED, APPROVED TEES.

7. STORM SEWERS

7.1 MAXIMUM PIPE DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY CSA, OPS OR MANUFACTURERS RECOMMENDED SPECIFICATION. FLEXIBLE PIPE SHALL BE PVC DR35 OR APPROVED EQUIVALENT, WITH RUBBER GASKET TYPE JOINTS AND SHALL CONFORM TO CSA (B-182.2, 3, 4). RIGID PIPE SHALL BE REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 65N/mm/m CONFORMING TO CSA STANDARD A257.2-M1982 CLASS 650 AND OPSD 807.01. PIPE JOINTS ARE TO BE RUBBER GASKET AS PER CSA STANDARD A257.3.

7.2 ALL STORM LATERALS SHALL BE PLUGGED. THE LOCATION OF THE END OF EACH LATERAL IS TO BE MARKED WITH A 50mm x 100mm WOOD MARKER PAINTED WHITE, EXTENDING FROM SERVICE INVERT TO 300mm ABOVE PROPOSED FINISHED GROUND LEVEL.

7.3 ALL STORM PIPES WITH A DEPTH OF COVER EQUAL TO OR GREATER THAN 6.0m SHALL BE REINFORCED CONCRETE PIPE. ALL STORM PIPES WITH AN INSIDE DIAMETER GREATER THAN 900mm, IRRESPECTIVE OF DEPTH, SHALL ALSO BE REINFORCED CONCRETE PIPE.

7.4 STORM SEWERS ARE TO BE LOCATED GENERALLY 1.5m OFF CENTRE LINE UNLESS OTHERWISE SPECIFIED.

7.5 STORM SEWERS SHALL BE CONSTRUCTED AS PER OPSD 802.030, 802.031 AND 802.032 (AS APPLICABLE) WITH CLASS "B" BEDDING (GRANULAR "A" MATERIAL) FOR RIGID PIPE AND OPSD 802.010 (GRANULAR "A" TYPE 2 BEDDING AND COVER MATERIAL TO BE SAND, GRANULAR 'A' OR QUARRY SCREENINGS PENDING A REVIEW BY THE ENGINEER) FOR FLEXIBLE PIPE, UNLESS APPROVED OTHERWISE BY THE DIRECTOR OF PUBLIC WORKS.

7.6 TRENCH BACKFILL SHALL BE SELECT NATIVE MATERIAL OR IMPORTED SUBGRADE MATERIAL AS PER OPSS 1010, IF DIRECTED BY THE ENGINEER.

7.7 PRECAST MAINTENANCE HOLES SHALL BE 1200mm DIAMETER UNLESS OTHERWISE SPECIFIED, AND SHALL BE IN ACCORDANCE WITH OPSD 701.010, 701.011, 701.012 AND 701.013. PRECAST MAINTENANCE HOLES GREATER THAN 5.0m DEEP SHALL BE CONSTRUCTED WITH A SAFETY PLATFORM IN ACCORDANCE WITH OPSD 404.020. FRAME AND COVER SHALL BE IN ACCORDANCE WITH OPSD 401.010 TYPE "B" AND MARKED "STORM". STEPS AS PER OPSD 405.010, ARE TO BE HOLLOW CIRCULAR ALUMINIUM.

7.8 CATCHBASINS TO BE 600mm SQUARE PRECAST CONCRETE TO OPSD 705.010, OR WHERE SPECIFIED, 600mm x 1450mm PRECAST CONCRETE TO OPSD 705.020. FRAME AND GRATE TO OPSD 400.110. DITCH INLET CATCHBASINS TO BE AS PER OPSD 705.030 OR 705.040, AS SPECIFIED COMPLETE WITH FRAME AND GRATE TO OPSD 403.010. DITCH INLET CATCHBASIN SLOPES ARE TO BE 3:1 UNLESS NOTED OTHERWISE.

7.9 PLACE ALL CATCHBASIN LATERALS AT 2% GRADE UNLESS OTHERWISE NOTED. PIPE SIZE IS TO BE A MINIMUM 300mm FOR SINGLE, 375mm FOR DOUBLE AND TO BE PVC DR35.

7.10 ALL CONNECTIONS TO THE STORM MAIN SHALL BE MADE WITH A STORM MANHOLE OR APPROVED FACTORY TEE CONNECTION AS PER OPSD 708.010. CATCHBASIN LATERALS CONNECTED TO MANHOLES SHALL HAVE A MAXIMUM INVERT TO INVERT DROP OF 900mm.

7.11 MAINTENANCE HOLE BENCHING, SHALL CONFORM TO OPSD 701.021. PIPE SUPPORT AT MANHOLES AND CATCHBASINS ARE TO BE AS PER OPSD 708.020.

7.12 MAINTENANCE HOLE AND CATCHBASIN TOPS ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN TOP LIFT OF ASPHALT IS PLACED. GRADE AND CROSSFALL ADJUSTMENT SHALL BE MADE USING "THE ADJUSTABLE" (BIBBY-STE-CROIX C50M-ONT) CONFORMING TO MUELLER CANADA A-J633 OR APPROVED EQUIVALENT.

7.13 PRECAST CONCRETE MAINTENANCE HOLE TEES, SHALL CONFORM TO OPSD 707.010.

7.14 PRIVATE REAR LOT CATCHBASINS SHALL CONFORM TO ACO DRAIN 620 SERIES POLYESTER POLYMER CONCRETE C/W GRATE AND TRASH BUCKET.

7.15 PLACE 3 m, 100 mm PERFORATED SUBDRAIN C/W FILTER SOCK AT 1.0% SLOPE FROM EACH SIDE OF EVERY CATCHBASIN AT MINIMUM OF 0.15 m BELOW SUB-GRADE UNLESS OTHERWISE SPECIFIED.

8. WATERMAINS

8.1 WATERMAIN MATERIAL IS TO BE POLYVINYL CHLORIDE, (PVC) CLASS 150 (DR18) OR DUCTILE IRON CLASS 52. TRACER WIRE (#12 TWU) SHALL BE INSTALLED ALONG THE ENTIRE LENGTH OF PVC WATERMAIN, BROUGHT UP AT EACH VALVE BOX, CHAMBER, AND HYDRANT, AND CONNECTED TO A FLANGE. TAPE IS TO BE USED TO AFFIX THE WIRE TO THE PIPE.

8.2 PVC PUSH-ON FITTINGS MEETING AWWA SPECIFICATIONS C-907 AND CSA B137.2, MAY BE USED ON PVC WATERMAIN 150mm - 200mm IN DIAMETER. DUCTILE IRON FITTINGS SHALL BE IN ACCORDANCE WITH AWWA C153 OR AWWA C110. MECHANICAL JOINTS SHALL CONFORM TO AWWA C111.

8.3 ALL MECHANICAL JOINT FITTINGS SHALL HAVE SACRIFICIAL ANODES "PROTECTO CAPS" INSTALLED ON EVERY BOLT.

8.4 WA TERMAIN TO BE LOCATED AS SHOWN ON THE CONTRACT DRAWINGS.

8.5 THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATERMAIN AND THE SANITARY/STORM SEWER IS TO BE 2.5m.

8.6 A MINIMUM OF 0.5m VERTICAL CLEARANCE BETWEEN THE WATERMAIN AND ALL UTILITIES MUST BE KEPT WHILE STILL MAINTAINING A MINIMUM DEPTH OF COVER AT ALL TIMES.

8.7 WATERMAINS SHALL BE INSTALLED WITH A MINIMUM COVER OF 1.7m OVER THE MAINS. 75mm OF STYROFOAM H160 OR APPROVED EQUAL INSULATION TO BE PROVIDED TO PROTECT WATERMAIN AT ALL STORM AND CB LEAD CROSSINGS WITHIN 300mm FREE TO FACE.

8.8 THE CONTRACTOR SHALL INFORM THE CITY OF ORILLIA NO LESS THAN 48 HOURS IN ADVANCE OF COMMENCING WORK.

8. 9 WATERMAIN SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.031 CLASS 'B' (GRANULAR "A" BEDDING) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF MUNICIPAL WORKS. COVER MATERIAL TO BE SAND, GRANULAR 'A' OR QUARRY SCREENINGS PENDING A REVIEW BY THE ENGINEER.

8.10 COPPER AND POLYETHYLENE SERVICES 19mm - 50mm IN DIAMETER SHALL BE EMBEDDED IN SAND 100mm ABOVE AND BELOW TO CONFORM TO OPSS 1004.05.05.

8.11 ALL FILL AREAS SHALL BE FILLED TO SUB-GRADE PRIOR TO INSTALLATION. FILL AREAS SHALL BE COMPACTED TO A MINIMUM OF 95% STANDARD PROCTOR DENSITY PRIOR TO THE INSTALLATION OF THE WATERMAIN.

8.12 WHERE THE WATERMAIN ELEVATION EXCEEDS THE ELEVATION OF ANY OTHER UTILITY/SERVICE AND WHERE THE VERTICAL SEPARATION BETWEEN THE WATERMAIN AND WHERE THE OTHER SERVICE EXCEEDS THE HORIZONTAL SEPARATION, THE WATERMAIN SHALL BE RESTRAINED.

8.13 PIPE DEFLECTION SHOULD BE USED WHEREVER POSSIBLE TO MINIMIZE THE USE OF BENDS. WHEREVER IT IS NECESSARY TO DEFLECT FROM A STRAIGHT LINE, EITHER IN THE VERTICAL OR HORIZONTAL PLANE, THE AMOUNT OF DEFLECTION SHALL NOT EXCEED THE MANUFACTURER'S SPECIFICATIONS.

8.14 CONCRETE THRUST BLOCKS ARE TO BE INSTALLED AT ALL TEES, BENDS, HYDRANTS, ENDS OF MAINS AND CONNECTIONS 100mm AND LARGER AS PER OPSD 1103.010 AND 1103.020

8.15 AT ALL THRUST BLOCK LOCATION IN FILL AREAS, ALL SEGMENTS OF THE FITTING AND THE WATERMAIN SHALL BE TIED USING EMCO UNDERGROUND BELL JOINT CLAMPS OR EQUIVALENT, OR TIE-RODS INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. WHERE THE DEFLECTION ANGLE AT THE THRUST BLOCK IS MORE THAN 45', ADDITIONAL TIE-ROD ASSEMBLIES SHALL BE INSTALLED FOR AT LEAST 10m AT EACH SIDE OF THE THRUST BLOCK. IMPORTED GRANULAR FILL (GRANULAR "B" OR EQUIVALENT) IS TO BE USED BEHIND THE THRUST BLOCK AND FOR A MINIMUM DISTANCE OF 2m ON EACH SIDE OF THE THRUST BLOCK. THE IMPORTED GRANULAR FILL IS TO BE COMPACTED TO A MINIMUM OF 100% STANDARD PROCTOR MAXIMUM DRY DENSITY. PRIOR TO CONSTRUCTION OF THE THRUST BLOCKS, THE CONTRACTOR SHALL OBTAIN THE WRITTEN APPROVAL FOR THE BACKFILL FROM A QUALIFIED GEOTECHNICAL ENGINEER. TIE-RODS AND CLAMPS SHALL BE GIVEN TWO COATS OF BITUMASTIC PAINT.

8.16 FIRE HYDRANTS TO BE CANADA VALVE OR AKV MODEL 2780, CONFORMING TO OPSD 1105.D10 C/W 115mm I.D. PUMPER NOZZLE AND CHAINS. HYDRANT TEES TO BE ANCHOR STYLE WITH ADJUSTABLE FLANGE. DRAIN HOLES SHALL BE PLUGGED. HYDRANT BARRELS ARE TO BE PAINTED RED, BONNETS AND PORT CAPS TO BE PAINTED WITH PRIMER, PRIVATE HYDRANTS TO BE PAINTED YELLOW.

8.17 HYDRANT FLANGE ELEVATIONS SHALL BE SET AT A GRADE THAT WILL GIVE A FLANGE ELEVATION OF 50mm - 100mm ABOVE THE FINAL GRADE.

8.18 HYDRANTS SHALL BE LOCATED A MINIMUM OF 1.0m FROM THE EDGE OF DRIVEWAYS, ROADWAYS, UTILITIES, OR OTHER ABOVE GRADE OBSTACLES.

8.19 HYDRANTS SHALL BE INSTALLED ON ALL DEAD-END WATERMAINS. AT THE DISCRETION OF THE CITY OF ORILLIA'S REPRESENTATIVE, A 50mm BLOW-OFF MAY BE UTILIZED INSTEAD OF A HYDRANT.

8. WATERMAINS (cont.)

8.20 ALL VALVES ARE TO BE RESILIENT SEAT GATE VALVES COMPLETE WITH SLIDER TYPE VALVE BOX. VALVES SHALL BE LOCATED AT INTERSECTIONS IN THE BOULEVARD BEHIND THE CURB RADIUS (UNLESS OTHERWISE SHOWN).

8.21 VALVES IN EXCESS OF 1.7m IN DEPTH SHALL REQUIRE A VALVE STEM EXTENSION.

8.22 THE OPERATION OF FIRE HYDRANTS AND/OR VALVES ON POTABLE WATER BY OTHER THAN MUNICIPAL WORKS DEPARTMENTS IS PROHIBITED.

8.23 THE CONTRACTOR IS RESPONSIBLE FOR ALL TIE-INS INCLUDING MATERIALS, EXCAVATION AND BACKFILL AS REQUIRED TO FACILITATE THE SWABBING AND TESTING OF THE NEW WATERMAINS UNDER THE SUPERVISION OF THE CITY OF ORILLIA. ONE INITIAL TIE-IN COMPLETE WITH CONTROL VALVE MAY BE INSTALLED IN PLACE OF A BY-PASS COMPLETE WITH CHECK VALVE AND SHUT OFF.

8.24 THE CONTRACTOR WILL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH THE NEW WATERMAINS. ANY SWABBING, PRESSURE TESTING, CHLORINATING AND FLUSHING BEYOND THE INITIAL PROCEDURE WILL BE THE CONTRACTORS RESPONSIBILITY. PRESSURE TEST WATERMAINS TO 1035kPa (150psi) FOR TWO HOURS, WITHOUT PRESSURE DROP. WATERMAINS ARE TO BE SWABBED AND CHLORINATED BY THE CONTRACTOR, UNDER THE SUPERVISION OF THE ENGINEER. UPON SUCCESSFUL TEST RESULTS OF THE CONTRACTORS INSTALLED SYSTEM, THE TEMPORARY BYPASSES ARE TO BE REMOVED. CHLORINATE AT 50mg/L CONCENTRATION FOR 24 HOURS. COLLECT SAMPLES FOR BACTERIOLOGICAL TESTING. SAMPLES ARE TO BE COLLECTED BY A "CERTIFIED OPERATOR". ALL PRIVATE SIDE WATERMAIN DESIGNATED AS FIRELINE AND/OR COMBINATION DOMESTIC AND FIRELINE SHALL BE TESTED IN CONJUNCTION WITH 1997 O.B.C. ARTICLE 7.2.11.1 WHICH REFERENCES NFPA 24.

9. WATER SERVICES

9.1 ALL RESIDENTIAL SERVICE FITTINGS SHALL BE COMPRESSION COPPER CONNECTIONS. DOUBLE BOLT AND BROAD BAND STAINLESS STEEL SERVICE SADDLES TO BE USED ON PVC WATERMAINS FOR TAPPING 19mm - 52mm, AND ON DUCTILE IRON WATERMAINS FOR TAPPING 38mm - 52mm.

9.2 ALL DOMESTIC CONNECTIONS SHALL BE A MINIMUM OF 19mm IN DIAMETER, TYPE "K" SOFT COPPER TUBING, MUNICIPEX POLY TUBING, OR APPROVED EQUIVALENT.

9.3 A MINIMUM HORIZONTAL SEPARATION OF 2.5m SHALL BE MAINTAINED BETWEEN WATER AND SEWER SERVICE LATERALS, UNLESS SHOWN OTHERWISE.

9.4 THE MINIMUM DEPTH OF COVER IS 1.7m.

9.5 WATER SERVICES SHALL BE INSTALLED TO AVOID DRIVEWAY APPROACHES.

9.6 SERVICE BOXES SHALL BE LOCATED ON THE STREET LINE IN RESIDENTIAL AREAS (REFER TO DETAIL ON SD-2).

9.7 NO COUPLINGS WILL BE ALLOWED BETWEEN THE CURB STOP AND MAIN STOP.

9.8 SERVICE TAPPINGS OFF AN EXISTING CHARGED WATERMAIN MAY ONLY BE DONE BY THE CITY OF ORILLIA AT THE OWNERS EXPENSE.

9.9 ALL SERVICE CONNECTIONS TO PVC WATERMAINS MUST USE APPROVED SADDLES. DIRECT TAPS ARE NOT PERMITTED.

9.10 INSULATE WATER SERVICES AT UTILITY CROSSINGS WITH STYROFOAM HI-40 INSULATION WHERE 0.5m SEPARATION CANNOT BE MAINTAINED. (REFER TO DETAIL ON DWG SD-3)

9.11 SERVICE TAPPINGS SHALL BE PLACED AT A MINIMUM SEPARATION OF 1.0m AND A MINIMUM OF 0.6m FROM JOINTS.

MATERIAL	FEATURES	MANUFACTURER
Combination Air Release and Vacuum Valve	F.I.P. Thread x F.I.P. Thread (Ball type).	Golden Anderson Ind. Inc., Cla-val Val-matic, Apco, A.R.I.
Valve Boxes (grass surface)	130mm cover extension 300mm (12) extension 450mm (18) screw or slider type, upper/lower section.	Bibby, Concord, Domestic Foundry
Valve Boxes (asphalt surface)	MVB Composite Valve Box	Mueller Canada
HYDRANTS		
Fire Hydrant	Open left. Cap chains or cables. 1.98m (6½ ft) Trench Hydrant Red. Bonnet & caps to have primary base coat paint only (not the epoxy top coat), post type dry barrel, compression shutoff with ball valve closing with flow. M.J. elbow, 130mm or 115mm valve ball, 2 CSA standard hose connections (62mm nominal) 1 CSA pumper connection 4½", breakaway flange, plugged.	Mueller B50-B24 A.V.K. Model 2780 D-67-M Concord Premier Canada Valve Century
MISCELLANEOUS		
Restraining Glands (DI)	Colour code black for Ductile Iron use.	EBBA Iron, Magotteaux, Canada Pipe, Romac
Restraint Device (PVC)	Colour code primer for PVC and uses as per manufacturer recommendation.	EBBA Iron, Concord, Clow, Romac, Tyler Union (TUF GRIP).
Cathodic Protection (nuts and caps)	99.9% high grade zinc, steel core, coated with low resistant depolarizing material, 175 grams ASTM B-418-73-type II. Sac washers and nuts required on every other bolt or restraining rod.	Protecto Caps, (Maple Agencies), Duratron.
Metallic CautionTape	Mylar marking tape c/w metallic backing; Lineguard type 2 max bury of 150mm. "Caution Watermain" colour code orange.	Lineguard Mtn Systems, Heath Survey Consultants, Enviro Supply.
Tracer Wire (Open Trench)	#12 TWU stranded copper.	Electrical Suppliers, Canada Wire, Phillips, Pirrelli, Maple, Bushart.
Tracer Wire (Directional Drill)	Approved wire for trenchless drilling and pulling operations Copperhead directional drill wire or approved equal	Copperhead Industries
Tie Rods (19mm)	Galvanized or Painted with Bituminous Paint c/w sac washers, nuts and caps, wrapped with Denso product	N/A

MATERIAL	FEATURES	MANUFACTURER
WATER SERVICE MATERIALS		
Service Tees (Pre-tapped)	Injection molded PVC push-on fittings for 150mm dia. and 200mm dia. PVC pipe Allowable Service Sizes: 20mm, 25mm, 40mm and 50mm dia.	Ipex
Service Boxes	Cast Iron boots only.	Domestic Fdry, Mueller, Emco, Clow.
Service Box Rods	Stainless steel with brass cotter pins.	Mueller, Hepsur, Clow.
Service Saddles (DI) (If permitted)	a) For Ductile Iron Watermain, to be Double Bolt, Broad Band, Stainless Steel Service Saddles for tappings 38mm to 52mm. Approved manufacturers are: Smith & Blair (catalogue 372 DB for up to 300mm dia. watermains), Cambridge Brass (catalogue Teck 403 DB for up to 400mm watermains) and Robar (catalogue 2616 DB for watermains up to 300mm and 2626 DB for 400mm dia. watermains).	
Service Saddles (PVC) (if permitted)	b) For P.V.C. Watermain, to be AWWA thread, Broad Band, Stainless Steel Service Saddles for tappings 19mm to 52mm. Approved manufacturers are: Smith & Blair (catalogue 372 DB for use up to 300mm dia. watermains), Ford (catalogue FS 303 DB for use up to 400mm dia. watermains), Cambridge Brass (catalogue 403 DB for use up to 400mm watermains) and Robar (catalogue 2616 DB for use up to 300mm dia. watermain and 2626 DB on 400mm dia. Watermains). For 19mm to 25mm single bolt accepted. For 38mm to 52mm double bolt required.	
Blue 904 Pex or Municipex Water Services	To be c/w tracer wire	IPEX, Rehau
Copper Service Material (only where specified)	Type K. Soft copper. Min. 19mm	Wolverine or equivalent
Main Stop	AWWA thread. Compression 19mm, 25mm, 38mm, 52mm. NO LEAD	Cam. Brass, Mueller, Emco, Ford
Curb Stops	Compression, ball type. 19mm, 25mm, 38mm, 52mm. NO LEAD	Cam. Brass, Mueller, Emco, Ford
Couplings	Compression 19mm, 25mm, 38mm, 52mm. NO LEAD	Cam. Brass, Mueller, Emco, Ford
Sampling Station	Installed with 150mm dia. PVC pipe around stand pipe with Ferno coupling to connect 150mm dia. PVC to station base	Kupferle Model 88 for freezing climates

CITY OF ORILLIA

MATERIAL SPECIFICATIONS FOR STORM AND SANITARY MAINS AND APPURTENANCES

MATERIAL	FEATURES	MANUFACTURER
PIPE		
Concrete	OPS	Hanson
PVC		
Gravity	As per design or minimum as follows c/w manhole adapters: OPSS 1841 Ultrarib and smooth wall	Ipex, Royal Pipe, Rehau, National Pipe.
100mm 150mm 200mm 250mm 300mm	SDR 28 SDR 28 SDR 35 SDR 35 SDR 35 Gasket BXS, 4m in length.	Duchesne Pipe Ltd.
Forcemain	CSA B137.3 AWWA C905	
PE	Storm Sewer Only	
Gravity	320 KPa OPSS 1840	Big 'O' Ideal KWH Plasti-Drain Ltee.
Pressure	OPSS 1842	
FITTING	Gasket BXS or BXB	Ipex, Le-Ron, Multi-Fitting, Carson, National Pipe.
TEES	Gasket Bell	Ipex, Le-Ron Multi-Fitting, Carson, National Pipe
CONNECTIONS / LATERALS	Universal fitting for aftermarket sewer connections to existing sewer lines	Ipex
PLUGS & CAPS	Optional Depending on Application.	Ipex, Multi-Fitting, Carson, National Pipe.
MANHOLES	Precast concrete. Top section – cone or flat cap depending on bury.	Hanson Duracon.

MATERIAL	MATERIAL	MANUFACTURER
Frames	The Adjustable by Mueller Model AJ633-R	Mueller
Covers	OPSD 401.010 Type 'A' All lids to have the "storm" or "sanitary" on them as appropriate.	Wotherspoon, Domestic, Concord, Mueller
Manhole Adjustment Rings	Polypropylene	Turner
	Polyethylene	Ipex
Connection to Existing Services	Eccentric connection only	Ipex, Royal

TYPICAL CONSULTING ENGINEERS

"RETAINER LETTER"

TYPICAL CONSULTING ENGINEER'S *"RETAINER LETTER"*

(Engineer's Letterhead)

Municipality
Address,

Attention: Name, Manager of Development

Dear Sirs,

1. Retainer

   This will confirm that our firm has been retained by (name of company) to act as consulting engineers for the (name of project).

2. Engineering Provisions

   In submitting this letter, we confirm that we have read the engineering provisions of the City of Orillia for developments attached hereto as Schedule "E-1" and can confirm that the writer is experienced in the field of municipal engineering services.

3. Terms of Retainer

   The terms of our retainer with the (name of company) are as follows:

   a) Plans and Specifications – Prepare plans and specifications for the construction of all storm, water and sanitary services and general lot grading...etc.

   b) Cost Estimates – Prepare cost estimates for the services to be constructed from the engineering drawings.

   c) Approvals – Obtain all necessary approvals to construct.

   d) Coordination – Coordinate the installation of services to avoid conflicts with regards to telephone, cable T.V., underground hydro, electrical services, as well as any other services shown on the engineering drawings.

   e) Composite Utility Plan – Prepare a "composite Utility Plan" for the above services.

   f) On-Site Inspections – Perform all on-site inspections for municipal and internal servicing and provide general supervision during construction.

   g) Certification – Certify that the construction of the municipal and internal servicing is in accordance with the accepted design drawings and specifications.

   h) As Constructed Drawings – Submit certified "as constructed" drawings after acceptance of the municipal and internal services.

   i) Change in Retainer – If, at any time during the project:
      i) the terms of our retainer are changed by our client, or
      ii) if we become aware that we will not be able to give post-construction certification, we will notify you within 24 hours

Yours truly,

(Subdivider's Engineer)

cc: City Solicitor – (for the project)
City Planner – (for the project)

NOTES TO THE ABOVE:

1. **The consulting engineer's letter must SPECIFICALLY MENTION those services which the person is providing, i.e. Design, inspection, approval, etc.**