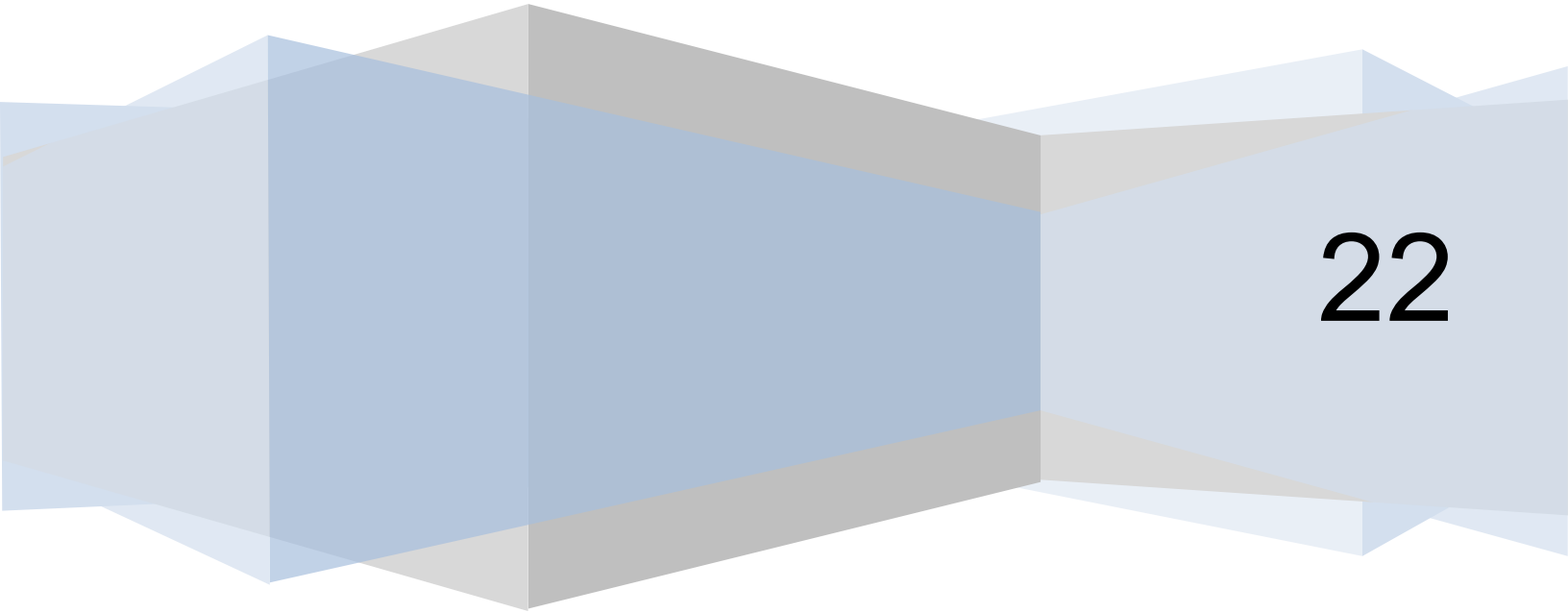
City of Peterborough

Engineering Design Standards

Asset Management & Capital Planning Division

December 2022



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1.0 Introduction

The information contained herein comprises the Engineering and Construction Standards for the City of Peterborough (City). Included are design specifications and requirements, which are to be utilized for the design of works within the City on municipally owned road allowances, municipally owned property and for municipally owned infrastructure on easements as well as projects subject to municipal approval or contributing to the municipal system. The design information contained in this manual is intended to provide guidance beyond legislative and standard design practices for use in the City. There will be specific situations where the design will depart from these practices as it is not possible nor is it the intention of the City to anticipate every situation.

It is intended that these standards will assist engineers, land use planners, contractors and developers in preparing designs intended for City of Peterborough infrastructure or approval. All other provincial standards and regulations not contained within this City specific document shall be adhered to as it is not the intention to repeat all applicable legislation and standards herein.

These specifications and drawings may be revised from time to time as considered necessary by the City. It will be the responsibility of the professional engineer who is performing the design and contract administration for the work to verify that the design and installation of these systems will be in accordance with the latest revision of these specifications.

We welcome feedback and/or enquiries on this document. Please direct enquiries to Joe Burke, Water Resources and Municipal Engineer at jburke@peterborough.ca .

1.1 Definitions

For the purpose of these specifications, the following definitions will be recognized:

a) **“AODA”** means Accessibility for Ontarians with Disabilities Act.
b) "**City”** shall mean The Corporation of the City of Peterborough.
c) "**Contractor**" means a person, partnership, or corporation who contract to undertake the execution of work commissioned by the City.
d) **“Curb Ramp”** means a ramp that is cut through a curb or that is built up to a curb.
e) **“Depressed Curb”** means a seamless gradual slope at transitions between sidewalks and walkways and highways and is usually found at intersections (IASR 80.26 & 80.27).
f) "**Developer**" shall mean the Owner or party specifically named in a Development Agreement or in a Subdivision Agreement.
g) **"City Engineer"** shall mean the Commissioner – Infrastructure and Planning Services for the City of Peterborough or their designate.
h) **“IASR”** means Integrated Accessibility Standards Regulation 191/11.
i) **"Inspector"** means the person(s) authorized and supplied by the City to see that the installation is executed according to the specifications and the approved plan(s).

j) **"Main"** means every sewer pipe, except services and portions of private sewers, installed on the public road allowance or on any other land upon which the City has obtained easements.
k) **"OPSD"** means Ontario Provincial Standard Drawings.
l) **"OPSS"** means Ontario Provincial Standard Specifications.
m) **"OBC"** means Ontario Building Code.
n) **"Subdivider"** means the Owner or Party specifically named in a Subdivision Agreement.
o) **"TWSI"** means Tactile Walking Surface Indicator which includes both Tactile Attention Indicators (having raised truncated domes) and Tactile Directional Indicators (having raised elongated bars).
p) **"Sidewalk"** means a walkway for pedestrians on City property, located adjacent and parallel to a street.
q) **"Walkway"** means a pedestrian path, excluding sidewalks.

1.2 Metric Usage

All plans, drawings, specifications, details, descriptions, notes or any other terms included in the Engineering drawings, specifications and tender package are to be dimensioned or referred to in the Metric system of measurement.

1.3 Location of Utilities

All works to be constructed within a City road allowance are to be located in accordance with the appropriate City of Peterborough Drawing from standards USD100.01 thru USD100.09. The City must approve locating works in non-standard locations.

Prior to construction of works on public property, the Owner or their agent must obtain a Municipal Consent, Cut Permit from the Public Works Division and a Temporary Use of Road Allowance from the Traffic Division.

In situations where the road will be assumed by the City at a future date, and the works are in a non-standard location, this deviation must also be approved by the City.

SEWERS

A.1 Sanitary Sewers

A.1.1 General

Unless otherwise stated within this document, the City of Peterborough recognizes the July 1984 release of the Ministry of Environment (MOE) Guidelines for the Design of Sanitary Sewage Systems (Guidelines) and the July 28, 2022 Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval as the standards by-which all-sanitary work shall conform unless criteria is exceeded by the City of Peterborough standards contained herein.

A.1.2 Definitions

Public Sewage System:
A series or collection of pipes, that transports wastes of domestic origins, which is suitable for treatment at a sewage treatment facility.

Private Sewage System:
A sewage system (or systems), with a total design capacity of 10,000 litres per day or less encompassing the entire property, shall be designed, constructed, operated and maintained in accordance with Part 8 of the Ontario Building Code.

A sewage system (or systems), with a total design capacity encompassing the entire property area greater than 10,000 litres per day, falls under the jurisdiction of the Ministry of the Environment.

New private sewage systems within the city will only be permitted on a limited and an exceptional basis such as the lack of a public sewer in the vicinity.

A.1.3 Non-Permitted Flows

Connections from foundation, weeping tile drainage or roof drainage are not permitted to enter the sanitary sewer system or any hazardous waste as defined under the EPA Regulation 347.

A.1.4 Sanitary Sewers on Private Property

The Ontario Building Code (OBC) regulates sanitary sewers on private property. Where there are no specific regulations in the OBC, details from this manual will apply.

A.1.5 Drainage / Sub-Drainage Area Plans

The developer is responsible for preparing a sanitary drainage area plan, showing the upstream area that must be accommodated in the proposed sewer(s) and also showing

the sub-areas within the present, proposed development, which must be accommodated at each manhole.

The sub-areas must include the road allowance(s) and must extend to the downstream end of the run in order to calculate the flow to be accommodated in that run.

Note: All areas and populations are to be shown for each drainage/sub-drainage areas.

A.1.6 Design Calculations

Calculations demonstrating that there is sufficient capacity in the proposed new system as well as the existing system downstream of the development where requested by the City Engineer, must be presented where new flows will be introduced to the sanitary sewer system. For small to medium sized developments downstream capacity assessment is generally to be extended to the first trunk sewer (375mm in diameter and greater). Larger developments must continue the capacity assessment downstream into the trunk sanitary sewer system to a location as determined by the City Engineer, typically on a case by case basis upon review of the additional flows vs. known existing capacity constraints of the trunk sanitary sewer system. For development applications, the extent of analysis is typically determined through the City's pre-consultation process. Calculations must be provided on an appropriate design chart and should be accompanied by legible sanitary sewer area plan showing catchment areas and landuses. Calculated peak flows should not exceed 80% of the 'just full' pipe capacity of new or existing sewers.

A.1.7 External Sewershed Limits and Drainage Areas

When the design abuts undeveloped or un-serviced areas, the external sewershed limit to be designed for shall be identified. Topography, existing and proposed infrastructure / corridors, and the current City limits will influence the final sewershed to be implemented.

All areas and populations are to be shown for all sub-drainage areas within external sewershed limits. Available Official Plan and Secondary Plan status shall be used for population projection and landuses.

A.1.8 Pipe Design

To determine the peak domestic sewage flow rate for which the sewer is to be designed, use the following equation:

$$Q(d) = \frac{P \cdot q \cdot M}{86.4} + IA$$

Where,

'Q(d)' - Peak domestic sewage flow including extraneous flows, (litres/sec).
'P' - Design population, (in 1000's)

'q' - Average daily per capita domestic flow as per Section A.1.9 (l/day/capita)
'M' - Peaking factor (as derived from the Harmon Formula)
The minimum peaking factor shall be 2.0.

$$M = \left(1 + \frac{14}{4 + P^{1/2}}\right) > 2.0$$

'I' - Unit of peak extraneous flow (Infiltration), 0.28 l/s/ha.
'A' - Gross tributary area in hectares.

The Manning formula, which is most commonly used for calculating sewer capacity, is to be used as follows:

$$Q = \frac{1}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

Where:
Q = Flow capacity of sewer (m^3/s)
A = Cross Sectional Area of Flow (m^2)
R = Hydraulic radius of pipe (area/wetted perimeter) (m)
S = Sewer slope (m/m)
n = Manning Roughness co-efficient

The values for the roughness co-efficient required shall be 0.013 for new sewers. Older sewers in rough or poor condition should use a co-efficient of 0.015.

Sanitary sewers for all new construction shall be designed such that the design flow rate does not exceed 80% of the calculated just full sewer capacity.

A.1.9 Design Flows

Daily Design flows should be as follows:

a) Residential

(i) Per Capita Flow
- For new infrastructure use 450 l/day/capita
- Note: Any use of average daily flows different from the ones mentioned above must be pre-approved by the City's Engineering Division.
- Peak the average flow using the Harmon formula per A.1.8;

(ii) Population

1) Lot Basis: (Typically preferred and to be implemented for most studies)
   a. Single Family = 3.5 people/ unit

b. Semi-Detached, Three or more Bedroom Townhouse = 3.5 people/unit
c. Two Bedroom Townhouse = 2.4 people/unit
d. Two to Three Bedroom Apartments = 2.0 people/unit
e. Bachelor or One bedroom Apartments = 1.6 people/unit

2) Area Basis: Where undertaking future growth studies of subdivision lands, assume a population density of 60 persons per hectare.

b) Commercial / Institutional
- Average flow 1.15 l/s/ha;
- Use higher design flows for point sources known to have significantly greater flows than the average design allowance; (e.g. car washes or other high water uses).
- Peak using a factor of 2.5 resulting in peak flows of 2.9 l/s/ha.

c) Industrial
- Sewage discharges from industrial areas vary greatly with the types of industry expected to be present within the catchment area. If the user is known, the sewage loading rates arising from that type of use should be implemented for sewer design. In the absence of any knowledge of proposed uses, the following flows should be assumed as a minimum.

- Flow Allowance (Average Flows)
  a. Light Industrial = 0.41 l/s/ha
  b. Medium Density = 0.64 l/s/ha

- The above average flows should use a peaking factor as noted in Appendix B of July 1984 MOE manual. Extraneous flows should be added at rate of 0.28 l/s/ha.

d) Schools

Elementary
Average flow 0.35l/s/100 students
Peak using a factor of 1.5 resulting in peak flows of 0.52 l/s/100 students
Secondary
Average flow 0.491/s/100 students
Peak using a factor of 1.5 resulting in peak flows of 0.74 l/s/100 students

e) Infiltration (extraneous flows) to be added to discharges from a) to d).
- 0.28 l/s/ha for typical sanitary sewer assessments.
- In certain circumstances, higher inflow or infiltration rates, either by a per hectare basis, or point source(s) may be required to be implemented within the calculations due to known extraneous sources or sensitive receiving sewers.

A.1.10 Minimum Pipe Diameter

Minimum pipe diameter for gravity sewer main typically shall be 250 mm. In special circumstances such as upstream ends of runs with small design flows, a minimum sewer size of 200mm may be permitted by the City Engineer provided that the site conditions merit the use of the smaller pipe.

The hydraulic capacity of a gravity sewer should be based on consideration of factors such as projected in-service roughness, slope, pipe material and actual in–service flows. Sewers shall be designed so that the velocity when flowing full is not less than 0.75 m/s for self-cleaning purposes, and the maximum velocity at the peak design flow is not greater than 3.0 m/s to minimize turbulence and erosion. If the design flow depth within the sewer is less than 30% of the pipes diameter (0.3D), the actual flow velocity should be calculated using the Hydraulic Elements Graph or other means and the minimum allowable calculated velocity is 0.6 m/s. Velocities where design flow is greater than 0.3D, can be calculated assuming full pipe flow.

For smaller diameter low pressure or vacuum sewer collection systems, the designer shall provide hydraulic calculations and/or supporting information to verify the proposal.

All new sanitary sewer pipe design shall be based upon design flows not exceeding 80% of the full flow capacity of the sewer.

A.1.11 Minimum Pipe Slope

All gravity sewers between manholes shall be laid with uniform slopes equal to or greater than 0.5% for all local sewers. Due to the expected limited flow, the first sewer run should be at a preferred minimum slope of 1.0%. Reductions in slopes are permissible for trunk sanitary sewers.

Slopes slightly less than 0.5% or those resulting in less than the recommended 0.75 m/s velocity, when flowing full, may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater. The proponent shall give written assurance to the City of Peterborough that any additional sewer maintenance required as a result of reduced slopes will be provided.

The manhole outlet pipe diameter shall not be reduced to be smaller than the inlet pipe diameter, even to account for increased slope in the outlet line. In retrofit situations, where the minimum slope cannot be achieved due to site constraints, lower than minimum slopes may be allowed.

If the proposed slope is less than the minimum slope of the smallest pipe (or minimum 250mm pipe size) which can accommodate the peak wastewater design flow, the actual depths and velocities at average, and peak wastewater design flow for each design section of the sewer shall be calculated by the designer and submitted to the City of Peterborough.

A.1.12 Sanitary Proximity to Watermains

MECP Guidelines require 0.5m vertical or 2.5m horizontal clearances between sewers and watermains. In some circumstances it may be prudent for the PUC/City jointly to decide by what means/best practice one main crosses the other in addition to MECP design guidelines. Watermain bends may be required at sewer/watermain pipe crossings while sometimes it may be more appropriate to change the grade of a sewer, depending on the circumstances.

A.1.13 Pipe Cover and Bedding Material

To prevent freezing and damage due to frost as well as ensuring gravity connected foundations, the distances between the finished ground elevation (typically centerline of road) and the obvert of the pipe shall be:

- 2.75 m for residential, commercial and industrial areas.
- 2.50 m for industrial areas.

Where these minimum protective covers cannot be achieved, special precautions in the selection of pipe, bedding and insulation material may be permitted.

Pipe bedding for class A, B and C soils shall conform to City of Peterborough standard CP410.04 being compacted to 100% Standard Proctor Density.

For concrete pipe, the maximum allowable cover permitted on concrete pipe to be constructed under a Municipal or Capital Works Project is to be based on OPSD 807.010, 807.030, 807.040, and 807.050. Where the pipe required exceeds the OPSD charts, a pipe design sealed by a Professional Engineer must be submitted to the City for approval.

For PVC sewers, the maximum allowable cover shall be as per OPSD 806.040.

A.1.14 Pipe Material

Pipe size, class, material and type shall conform to City standards and all sewer pipes, pipe joints and connections shall be designed to withstand a pressure of at least 45 psi without leakage. The following is an overall list of sewer pipe approved for use on City projects sizes certified by CSA.

PVC
All polyvinyl chloride (PVC) pipe shall be manufactured in accordance with OPSS 1841 and be certified to the standard specification C.S.A. B182.2-02 for PVC Sewer Pipe and Fittings and standard specification C.S.A. B182.4-02 for Profile PVC Sewer Pipe and Fittings. The typical maximum size of PVC pipe is 600 mm. PVC fabricated and moulded fittings shall be C.S.A. certified.

All PVC pipe used within the City streets shall be DR or SDR series pipe. Any alternate proposed to this material must be approved by the Engineering Department.

Concrete
All concrete pipe shall be reinforced and manufactured in accordance with OPSS 1820, which includes CAN/CSA standards specification A257.2-M92 and certification under the Ontario Concrete Plant Prequalification Program administered by the OPS, MTO, MEA and the OCPA. Concrete pipe shall be used, but not limited to, pipe sizes greater than 600 mm.

A.1.15 Maintenance holes

Maintenance holes shall meet OPSD700 Series Requirements (monolithic bases and tapered tops) and be designed for appropriate diameter and height.

A.1.15.1 Standards

Maximum spacing (measured horizontally)	110m normal; 140m maximum in special cases.
Location	Generally road centreline or offset 1.5m from centerline with deep storm sewers
Manhole Frame and Grate	To be set to base asphalt grade until the surface asphalt is placed
Maximum drop without drop structure	0.61m
Minimum drop *	0.025m for straight to 44 degree bends 0.06m for 45 to 90 degree bends

* Invert drops should be appropriate to account for the velocity head, transition, and bend losses within manholes. Where there is a change in pipe size, the minimum invert drop shall equal the change in pipe sizes.

Manholes shall be used at all changes in horizontal alignment, grade, pipe sizes, on the property line for new commercial services (control manholes) and at the termination of a sewer (including temporary termination).
Maximum allowable change indirection of flow through manhole:

- Pipe diameters less than 675mm - 90^0
- Pipe diameters greater than or equal to 675mm - 45^0

Inlet and outlet pipes, including outlets for future extensions shall be securely set into structure's concrete base and walls using factory installed rubber gaskets (boots) (for PVC piping) so that the structure is watertight to withstand a pressure of at least 45 psi without leakage. For concrete sewers, the pipe is to be supported by a concrete cradle for ¾ of a length of a full pipe segment or the full length of a partial pipe segment. The outlet for future extensions is to have a watertight plug installed.

Where the manholes are placed lower than 600mm below the seasonally high groundwater table or where the seasonally high groundwater table is not known, the manholes shall be externally wrapped with a waterproof membrane placed around all pre-cast joints, including joints between the maintenance hole frame and cover, with a minimum 300mm wide strip. Where required, adequate provision shall be made to prevent flotation.

Frost straps (either external or external and at least 2 between each section) shall be provided to hold manhole sections together. External straps shall extend vertically from top to bottom and for deep maintenance hole for deep maintenance holes, extended at least 1m below frost depth.

A.1.15.2 Maintenance Hole Sizing

Precast maintenance hole diameter requirements are as follows:

a) 1200 mm diameter, See OPSD 701.010, 701.030, 701.031, and 701.032 for details and additional design information.
b) 1500 mm diameter, See OPSD 701.011, 701.040, 701.041 for details and additional design information.
c) 1800 mm diameter, See OPSD 701.012, 701.050, and 701.051 for details and additional design information.
d) 2400 mm diameter, See OPSD 701.013, 701.060, and 701.061 for details and additional design information.
e) 3000 mm diameter, See OPSD 701.014, 701.070, and 701.071 for details and additional design information.
f) 3600 mm diameter, See OPSD 701.015, 701.080, and 701.081 for details and additional design information.

A.1.15.3 Maintenance Hole Frames and Grates

Maintenance hole frames and covers are required for all maintenance holes and shall conform to OPSD 401.010 Closed (Type A) unless otherwise specified. See OPSD 401.010 for details and additional design information.

Manholes shall be located away from any overland stormwater overland flow route or ponding areas. Where this is not possible, watertight maintenance hole lids in accordance with OPSD 401.030 are required when sanitary maintenance holes are located, within areas of an overland storm flow routes at a minimum of the 25 year rainfall event and areas where exposed to significant hydraulic head in the 100 year event. Where more than one consecutive maintenance hole is sealed representing a sewer length greater than 250m, adequate ventilation shall be provided.

Lockable maintenance hole covers are required to reduce access by the public. They can be located through park blocks, open space blocks, or pumping stations. See OPSD 401.060 for details and additional design information.

Note: All efforts must be taken to ensure maintenance hole frames and covers are to be clear of curb and gutters on bends in the road for new construction.

A.1.15.4 Maintenance Hole Steps

Maintenance hole steps are required for access and are to conform with one of the following:

a) Maintenance Hole Steps – Hollow See OPSD 405.010 for details and additional design information.
b) Maintenance Hole Steps – Solid See OPSD 405.020 for details and additional design information.

Note:

- All steps are to be galvanized steel or aluminum; and
- A detail or restoration plan is required for the relocation of maintenance hole steps within existing maintenance holes, where applicable.

A.1.15.5 Maintenance Hole Safety Landings

A maintenance hole safety landing is required at an appropriate mid-point depth of the maintenance hole, when the depth of the maintenance hole is between 5.0 and 10.0 metres. Additional safety landings are required at appropriate third-point depths, when the maintenance hole is equal to or greater than 10.0m to 15.0m deep.

Note: Incoming pipes are to be below safety landings, where possible.

A.1.15.6 Benching

All maintenance holes require benching at the bottom of the maintenance hole and should conform to OPSD 701.021. Benching height should be increased to obvert where applicable to increase hydraulic benefit as required. Where benching is different from OPSD 701.021, a benching detail is required.

A.1.15.7 Adjustment Units

Maintenance hole adjustment units are required on all maintenance holes to ensure that proper grade is provided between the top of the maintenance hole and the maintenance hole lid. All manhole grate adjustments shall be as per CPD 408.01 and CP408.02. A minimum of one and a maximum of three adjustment units to a maximum height of 300mm shall be placed as per CPD 408.01. Ensure that the difference in grade between the maintenance hole lid and the first ladder rung does not exceed 600 mm. Clay brick will not be allowed for use as maintenance hole adjustment units.

A.1.15.8 Maintenance Hole Maintenance Access

A 3.6m wide hard surface (typically asphalt) access is required for maintenance vehicles and equipment used to access and service sanitary sewers within easements, open space areas, designated blocks and existing right-of-ways (i.e. boulevards). Adequate curves and turn-around facilities are required for maintenance vehicles to maneuver. Slopes (8% maximum) cross-falls (2% minimum) and drainage of access roads are also to be addressed in the design. A 0.6 metre separation is required between the maintenance access and the top/bottom of any slopes; fences; and property line(s).

A.1.15.9 Maintenance Hole Construction Practices

The void between the sewer pipe and the cored hole of the precast maintenance hole section shall be filled with an approved unshrinkable water tight grout. Pre booted maintenance holes or watertight manufactured rubber boots must be used.

All precast maintenance hole section joints shall contain an approved rubber watertight gasket. Where works are cast-in-place, sealing is required only at the point of connection between the individual components of the maintenance hole structures.

All joints between bricks are to be completely filled with concrete mortar. Bricks are to be parged on the outside. Parging shall contain an approved bonding agent.

All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with the manufactures specifications.

A minimum 300 mm vertical/horizontal clearance between openings on the inside of the maintenance hole is required for all sewer and service connections.

Granular Bedding shall conform to OPS specifications.

Where adjacent maintenance holes are located less than 2.4 metres apart, the area between the adjacent maintenance holes shall be backfilled with granular material. The backfill shall be compacted to 100% standard Proctor Density or as specified in the soils report (if available), or as approved by the City Engineer.

Sanitary sewer maintenance holes shall be tested for leakage as OPSS 407.07.24.

A.1.16 Private Service Connections

All service connections shall be constructed to be watertight. Where required, the riser pipe on the sanitary service pipe should be installed at a maximum 1:1 slope where feasible, before transitioning to a nominally horizontal installation. The

transition from the nominally horizontal section to the steep section should be completed with a long radius bend.

A.1.16.1 Minimum Size and Grade

a) The minimum diameter and grade of a service for residential, single family and semi-detached lots is 100 mm @ 2.0%. Service shall be green in colour.
b) The minimum diameter and grade of a service for a residential multi-family block is 150 mm diameter @1.0%.
c) The minimum diameter and grade of a service for a non-residential block is 150 mm diameter @ 1.0%.
d) The minimum diameter and grade of a service for a commercial block is 150 mm diameter @ 1.0%.
e) The minimum diameter and grade of a service for an institutional block is 200mm diameter @1.0%.

Note: The actual size of the service required for multi-family, non-residential, commercial and institutional blocks is dependent on the potential maximum development of the property.

In addition to the above noted minimum size and grades, private sanitary service connections shall comply with the minimums outlined in Part 7, OBC

A.1.16.2 Connections to Sewer / Maintenance Holes

The sanitary connection shall always be below the storm connection and should be installed with a green pipe (storm is white). Foundation drains, roof leaders and area drains shall <u>not</u> be connected to the sanitary sewer. All sanitary service laterals greater than 4.0m deep shall incorporate a riser such that the service lateral at the property line is not deeper than 3.5m or shallower than 2.40m.

a) Residential
   Services 100 mm and 150mm in diameter must be connected to the main sewer. No sanitary services are to be constructed into any sanitary maintenance hole unless otherwise approved by the City of Peterborough and with proper maintenance hole benching.
b) Multi-family, Commercial, Institutional and Industrial
   Services 200 mm in diameter and larger are to be connected to the main sewer at maintenance holes.
c) Connections to Existing Sewers for Lot Infill Situations
   i) In a situation where a lot severance or lot infill condition exists, and a new sanitary service will be connected to an existing sanitary mainline, the advocate of the severance/infill, or his agent, must determine if the existing sanitary sewer is a combined or poorly separated sewer and is therefore at risk of surcharging, or if the sewer is a dedicated sanitary sewer but has a history of surcharging. This information may be obtained from the

Engineering and Construction Division, if available. If it is determined that there is a surcharge risk, the development advocate must provide surcharge protection to his development.

ii) When connecting services to existing sewers in a lot infill situation, connections must be made utilizing an 'Inserta Tee' or approved equivalent.

A.1.16.3 Vertical Clearance

A minimum clearance of 500mm under/over storm sewers and watermains is to be provided.

A.1.16.4 Service Cleanouts

On private property or property lines, sanitary building sewers and private sewers shall be provided with cleanouts/maintenance holes, in accordance with Part 7 of the OBC. Cleanout/maintenance holes shall be located off of the right-of-way.

A.1.16.5 Pipe Material

Refer to Section A.1.14.

A.1.16.6 Depth and Bedding

The minimum depth of a sanitary service shall be 2.4 metres from the finished property line elevation to the obvert of the pipe.

A.1.16.7 Marking and Recording of Service Connections

All sanitary sewer connections shall be inspected and tested at the same time as the sanitary sewer mains and recorded on the as-built drawings as to the location at the main and location and elevation at the property line. The terminus of services shall be identified at the surface with 2"x4" (38mm x 89mm) wood stakes placed from the service invert to 450mm above grade and painted green for the top 300mm of the stake. Plugged or capped service connections shall be marked on the top surface of the last 3m of the upstream end of the pipe with yellow PVC adhesive tape (50mm wide) labeled continuously in black lettering (40mm wide):

"CAUTION SANITARY SEWER"

A.1.16.8 Easements

Easements are required for all sewers to be assumed or potentially assumed by the municipality located on privately owned property.

Easement widths are determined by the depth of cover from the final surface elevation to the invert of the sewer given soil types, site constraints and the desire to conduct future pipe replacement without the use of trench boxes. The absolute minimum width of a sewer easement is 3.0m.

A.1.16.9 Quality Control

Sanitary sewers should be leakage tested in accordance with Ontario Provincial Standard Specifications (OPSS.MUNI.410).

All service laterals, tees or stubs shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Such plugs or caps will be readily removable and their removal shall provide a socket suitable for making a flexible jointed service connection or extension.

If a segment of the system fails during leak testing, the source of the leak should be identified and all defective material shall be repaired or replaced to the satisfaction of the City. The repaired or replaced sections shall be retested until acceptable results are obtained. During retesting, maintenance holes shall be tested separately from pipe sewers.

Sewers are to be cleaned and flushed and inspected by closed circuit video and the original tapes are to be provided to the City as per CP 409.01.

Deflection testing shall be completed for all new flexible sewers waiting at least 30 days after backfilling, but prior to paving. Mandrel testing shall be performed as per OPSS.MUNI 438. Equipment used to perform the Mandrel tests shall be specifically designed for the pipe material tested. Pipe segments failing the deflection tests shall be removed and replaced.

A.1.17 Force Mains

At design pumping rates, a desired cleansing velocity of at least 0.90 m/s shall be maintained (0.6m/s minimum) and the maximum velocity shall not exceed 3.0m/s. The minimum force main diameter for raw wastewater shall not be less than100 mm.

Friction losses through force mains shall be designed based on the Hazen-Williams formula (recommended) or the Darcy-Weisbach equation. When the Hazen-Williams formula is used and data is not otherwise available, the following values for "C" shall be used:

Material	C - Factor
Unlined steel pipe, Concrete Pipe	100
PVC, HDPE, Lined ductile iron	120

When initially installed, force mains may have a significantly higher "C" factor.

A combination of air and vacuum relief valves shall be placed at all high points in the force main to prevent air locking and to relieve negative pressures on forcemains. At a minimum, the air/vacuum relief valves shall conform to AWWA Standard C512-15 Air Release, Air/Vacuum and Combination Air Valves for Water and Wastewater Service, as amended from time to time. Fittings and isolation valves shall be stainless steel.

Cleanouts / drain chambers shall be placed at all low points in the forcemain to facilitate maintenance. Wherever feasible, drain valves may be drained to adjacent gravity sewers or wet well.

Force main design shall include transient analysis and consider the provision of water hammer relief. A hydraulic transient analysis shall be undertaken as part of the design process considering the worst case scenario involving the most critical pump and forcemain-in-service combination. The analysis shall be completed using hydraulic models based upon the final sizes and layouts of pumps and forcemains including locations of air/vacuum release valves. Based upon the hydraulic transient analysis, devices shall be provided, if necessary, to protect the forcemain such as, but not limited to, surge valves, surge tanks, etc. The forcemains shall be designed so that the pipes and joints are able to withstand the maximum operating pressure plus the surge pressure that would be created be stopping a water column moving at the higher of 0.6m/s or the theoretical velocity in the forcemain. The forcemain shall be designed such that pipes, joints, fittings, and valves are able to withstand full vacuum pressure.

Restrained joints shall be provided at all bends, tees and termination points of the forcemain and connections for all forcemains. A licensed engineer shall complete the calculation to determine the number of joints to be restrained beyond the bend, fitting, tee, etc. In the case of non-restraining mechanical and/of slip-on joints, restraint shall be provided by adequately sized thrust blocks positioned on all plugs, caps, tees, line valves, reducers, wyes, and bends deflecting 22.5 degrees or more.

Pipe and joints shall be equal to water main strength materials suitable for design conditions. The force main, reaction blocking, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater lift stations and any other transient pressures shall be added to the normal operating pressures when calculating the thrust forces. The need for surge protection chambers shall be evaluated.

The City Engineer shall approve all force main pipe materials including pipes, fittings, valves, etc. which shall also meet OPS criteria. Nitrile gaskets or equivalent shall be specified for soils contaminated with hydrocarbons.

Force mains should enter the gravity sewer system at a point not more than 200 mm above the flow line of the receiving maintenance hole. The alignment of the incoming forcemain at the gravity sewer entry manhole shall be 180 degrees to the outgoing sewer.

For flows greater than 30 l/s, transition manholes shall be provided at forcemain discharge points to provide smooth transition into the receiving gravity sewer system. No other gravity sewers shall enter the transition maintenance hole. The sewer connecting the transition maintenance hole to the downstream maintenance hole shall be sized to flow at 50% design flow capacity.

Force main construction near streams or water works structures and at water main crossings shall meet applicable requirements.

The force main shall be appropriately identified when they are constructed of material that may cause the force main to be confused with potable water mains. Force main shall be appropriately tested to ensure there is no leakage.

All new forcemains longer than 150m shall be provided with swab launching ports and/or flushing ports. Swab catching ports may be required. Isolation valves shall be provided as required to facilitate maintenance. Non-return valves may be required when forcemains are connecting to a common forcemain.

Hydrostatic testing shall be performed to all new (and rehabilitated/repaired) forcemains in accordance with OPSS.MUNI 412 at a minimum pressure of 1.5 times the maximum operating pressure. Water used in the hydrostatic testing shall be disposed to the sanitary sewer system as per all of the applicable requirements for disposal. The maximum pressure shall be measured and recorded at the lowest point along the length of the pipe being tested.

B.1 Storm Sewer System

City of Peterborough Standard Drawings and Specifications shall be adhered to at all times. Where the City has no standard or specification, the City of Peterborough recognizes the July 1984 release of the Ministry of Environment Guidelines for the Design of Storm Sewer Systems and the July 28, 2022 MECP Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval as the guidelines by-which all storm sewer work shall conform to. Otherwise, OPSS or OPSD shall apply.

B.1.1 Definition and Use

Storm systems may consist of one or any combination of pipes, ditches, culverts, open channels and storm water management facilities that convey storm water.

Storm sewers shall be designed to collect storm water discharge from pervious and impervious areas both on private and public lands. Storm drainage connected to buildings on private property requires a building permit before installation.

B.1.2 Location and Alignment

All works to be constructed within a City road allowance are to be located in accordance with the appropriate City of Peterborough Drawing from standards USD100.01 thru USD100.13. The City must approve locating works in non-standard locations.

Storm sewers connected to buildings on private property are regulated by Part 7 of the OBC. Where there are no specific regulations in the OBC, details from this document shall apply.

Connections to existing storm sewer systems shall be made at manholes. Where no manhole is present a new manhole is required on the City's main. Connections between storm sewer pipes on private property, where not at a manhole or catchbasin, shall be made with manufactured 'Tees" and only with approval from the City engineering department and only if sewer is not defined as a *building sewer* 200mm or greater. Control manholes for private sewers shall be placed on the front property line or just inside the property if placement on the property line is not possible.

B.1.3 Drainage / Sub Drainage Area Plans

Drainage/sub-drainage area limits for sewer designs are to be in accordance with approved grading plans to the proposed maintenance holes (or catchbasins if applicable) located on the R.O.W.

Note: All areas and runoff coefficients are to be shown for each drainage/sub-drainage areas.

B.1.4 External Watershed Limits and Drainage Areas

When design abuts undeveloped areas, identify the external watershed limit to be designed for, typically following contour lines. Developed external areas should encompass the entire sewershed.

Note: All areas, runoff coefficients and time of concentrations are to be shown for all drainage areas within external watershed limits.

B.1.5 Design Chart

Storm sewer design calculations are to be completed on an appropriate Storm Sewer Design chart.

B.1.6 Design Requirements and Location

Rainfall intensities for storm sewer design shall be derived from the IDF curve parameters A, B, and C provided in Table B.1.7.1.

Storm sewers shall be designed as a separate sewer system. Effluent from sanitary sewers or any potentially contaminated drainage from industrial, agricultural or commercial operations shall not be discharged into storm sewers. Contaminated drainage means, the introduction of any foreign, undesirable physical, chemical or biological substance into the environment, which results or is likely to result in deleterious effects.

Unless otherwise directed by the City Engineer, storm sewers in new subdivisions shall be designed as deep storm sewers with approximately 3.0m of cover where private gravity service connections are required. An acceptable alternative to the deep sewer system is the provision of a separate foundation drainage system (generally with smaller pipes) with gravity service connections as well as a traditional storm sewer system with shallow pipes. Where physical constraints do not allow for either above noted system, a shallow system may be approved with pipe typically having a 1.25m depth of cover.

The alignment of the storm varies depending on the type of road and whether or not deep storm sewers are to be implemented. Typically, deep storm sewers are offset 1.5m on one side of the centreline with the sanitary sewer offset 1.5m from the other side of the centreline. Shallow storm sewers, particularly those less than 450mm in diameter, are typically located 0.31 metres within the curb face. Storm sewers are generally to the north or west of the centerline.

MOE Guidelines require 0.5m vertical or 2.5m horizontal clearances between sewers and watermains. In some circumstances it may be prudent for the PUSI/City jointly to decide by what means/best practice one main crosses the other in addition to MOE design guidelines. Watermain bends may be required at sewer/watermain pipe crossings while sometimes it may be more appropriate to change the grade of a sewer, depending on the circumstances.

The capacity of the minor storm sewer systems shall typically be designed to carry the peak flow resulting from a one (1) in five (5) year rainfall event. Where gravity foundation service connections exist, the five year design flow must not exceed 75% of the just full pipe capacity.

Where gravity service connections exist or are proposed, a 100 year hydraulic grade line analysis must be undertaken, to determine peak 100 year water levels within a potentially surcharged storm sewer system. A minimum freeboard of 1.00m must be provided between the computed 100 year hydraulic grade line and the minimum basement floor level in conjunction with the use of backflow preventers. Where the change in grade has the potential for hydraulic jumps, additional freeboard shall be provided. The implementation of flow regulating ICDs may be permitted by the City Engineer to reduce 100 year storm sewer flows on a case by case basis only at low points in the road, however in all instances, the 5 year flow must pass through the ICD unencumbered with minimal backwater head and no surface ponding. Pipe sizes should be increased elsewhere to accommodate the 100 year flow with appropriate hydraulic grade line elevations.

The major system design shall be based on a one in 100 year rainfall event and should include assessment of road sags and boulevard overflows into stormwater management ponds and watercourses. 100 year boulevard overflows with a catchment greater than 5.0 hectares shall be designed with a 100 year peak flow rate that is the greater of that determined from Table B.1.7.1 or the 6 hour design storm noted in Section F.4.10.1. In determining the major system flow, the capacity of the minor (storm sewer) system shall be considered and a maximum 50% inlet capacity restriction at depressions and roadway sags shall be considered. The maximum ponding depth shall not exceed 300mm as measure to the centerline of the road.

B.1.7 Peak Flow Calculation and Storm Sewer Design

The design area shall include all areas, which reasonably or naturally drain to the system. To calculate the peak rate of runoff from an area, the Rational Method shall be used as follows:

$$Q = K \cdot A \cdot i \cdot C$$

Where:

‘Q’ - is peak flow (l/s)
‘K’ - is 2.78
‘A’ - is the area (hectares)

'i' - is the rainfall intensity (mm/hour) calculated as follows:

$$i = \frac{A}{(Tc + B)^C}$$

Where: A, B and C are per Table B.1.7.1.

Table B.1.7.1

	A	B	C
2 Year	662	7.5	0.79
5 Year	1098	10.1	0.83
10 Year	1560	13	0.86
25 Year	2010	14	0.88
50 Year	2200	14.6	0.87
100 Year	2507	14.8	0.88

Please note that the above A, B, C values shall be used for storm sewer design only, or other calculations involving design storms of less than 3 hours duration. Stormwater Management Reports for Site Plans, Subdivisions and other proposed submissions to the City should use 6 hour City design storm hyetographs noted in Section F.4.10.1 or other data rainfall directly from the Environment Canada 2006 Peterborough Airport IDF curves.

The time of concentration (Tc) should be calculated rather than relying upon arbitrary minimum and maximum times. Where this is not practical, a ten (10) minute time of concentration (Tc) shall be used except when the zoning requires the use of a runoff coefficient of 0.75 or higher in which case five (5) minute time of concentration (Tc) shall be used.
'C' - is the co-efficient of run-off

The runoff co-efficient or "C" for storm drainage shall be adequately demonstrated through calculation. In the absence of site specific calculations and where permitted, runoff co-efficients shall be per Table B.1.7.2 for the 5 year design.

Table B.1.7.2

Parks – over 4.0 ha	0.20
Parks – 4.0 ha and under	0.25
Single family residential-15m lots	0.55
Single family residential-12m lots	0.65
Single family residential-9m lots	0.75
Semi-detached	0.80
Townhouses	0.85
Apartments	0.90

Schools and Churches / Industrial	Varies
Commercial	0.90
Heavily Developed Areas	0.90
Asphalt, Concrete, Roofed Areas	0.95

25 to 100 year runoff co-efficients shall be increased to account for soil saturation. Increase co-efficients for the 25, 50, and 100 year storms by 10%, 20%, and 25% respectively up to a maximum value of 0.95.

B.1.7.1 Flow Velocities and Minimum Slope

Storm sewer flow velocities shall not be less than 0.75 m/s when flowing full and 0.6m/s at design depth. Minimum longitudinal slope shall be 0.5%. The preferred maximum velocity is 3.0 m/s with an absolute maximum acceptable velocity of 6.0 m/s. Where flow velocities exceed 4.5m/s, additional protection against erosion, scouring and pipe displacement must be provided. Sewers with velocities less than 0.75m/s may be considered, provided that appropriate measures are implemented to facilitate the more frequent flushing and maintenance needs.

B.1.7.2 Pipe Cover

The minimum depth of cover to pipe crown shall be 1.2 m. Excessive cover should be avoided except under special circumstances.

Minimum pipe cover for deep sewers shall be based upon providing gravity connections including hydraulic grade line freeboard for storm services.

For concrete pipe, the maximum allowable cover permitted on concrete pipe to be constructed is to be based on OPSD 807.010, 807.030, 807.040 and 807.050. Where the pipe required exceeds the OPSD charts, a pipe design sealed by a Professional Engineer must be submitted to the City for approval.

For flexible pipe, the maximum allowable cover permitted shall be as per OPSD or manufacturers specifications.

B.1.7.3 Gravity Pipe Design

The minimum pipe diameter for storm sewers shall typically be 250 mm. Smaller sizes may be permitted by the City Engineer in special cases for limited catchment areas where other constraints limit pipe size or capacity. Minimum pipe diameter for catchbasins leads shall be 250mm with the exception of double catchbasins which shall be 300mm.

The obvert of the inlet pipe at all new maintenance holes shall be higher than or equal to the obvert of the outlet pipe unless approved otherwise by the City

Engineer. Appropriate invert elevation drops to account for the velocity head, transition and bend losses within manholes should be provided.

An outlet pipe from a manhole is not permitted to be smaller than the incoming pipe even if the outlet pipe has adequate capacity due to greater slope. Allowances may be granted by the City Engineer in special circumstances to allow a smaller outlet pipes on privately owned property in the event other regulatory agencies (e.g. MTO) require this for stormwater retention.

The Manning equation shall be used to calculate the required hydraulic capacity of a gravity sewer as follows:

$$Q = \frac{1}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

Where:

'Q' - Flow capacity of sewer (l/s)
'A' – Cross Sectional Area of Flow (m^2)
'R' - Hydraulic radius of pipe (Area/Wetted Perimeter, (m))
'S' - Sewer slope (m/m)
'n' – Manning's roughness co-efficient

The value for the Manning's roughness co-efficient shall typically be 0.013. For older sewers in poor condition, a value of 0.015 may be more applicable.

Storm sewer designs should be completed in chart form on appropriate design sheets or a similar format and should be accompanied by storm sewer area plans clearly showing catchment areas and runoff co-efficients used in the design.

A minimum of 300mm clearance is required between outside pipe barrels at all pipe crossings (with the exception of watermains) where the diameter of the pipe crossing over is less than or equal to 1000mm. Where the diameter of the pipe crossing over is greater than 1000mm, the required pipe bedding will govern the required clearance. The minimum vertical clearance between a storm sewer and watermain is 500mm.

Unless otherwise permitted by the City Engineer, maximum allowable change in direction of flow:

- Pipe diameters less than 600 mm - 90^0
- Pipe diameters greater than or equal to 600 mm - 45^0

Where external drainage areas are included in the subdivision sewer design, the sewer must extend to the subdivision limits abutting the properties containing this external drainage area. This may require a rear yard catchbasin and storm sewer easement.

Storm sewers are required on all streets within a subdivision. Sewers must extend at least half way across the frontage of every lot and block within the subdivision.

A maintenance hole safety landing is required at an appropriate mid-point depth of the maintenance hole, when the depth of the maintenance hole is between 5.0 and 10.0 metres. Additional safety landings are required at appropriate third-point depths, when the maintenance hole is equal to or greater than 10.0m to 15.0m deep.

Note: Incoming pipes are to be below safety landings, where possible.

Provide a safety/rodent grate on all storm sewer inlets and outfalls.

Leakage testing on all storm sewers shall be conducted in accordance with OPSS 410.07.16. Deflection testing, if deemed necessary, shall be in accordance with OPSS 410.07.16.05.

Cleaning, flushing, and CCTV inspection shall be carried out in accordance with CP 409.01.

B.1.7.4 Hydraulic Grade Line Determination

While the primary design standard for storm sewers in the City of Peterborough is gravity flow for the 5 year rainfall event, a hydraulic grade line (HGL) analysis is often necessary to ensure that storms of greater intensity do not result in water levels that cause flooding or exit the minor system at points of concern.

Storm sewers with gravity services require an HGL assessment to ensure that atmospheric pressure water levels in a 100 year rainfall event have a minimum of 1.00m freeboard in relation to proposed basement levels. All basements with gravity storm connections shall be equipped with back flow preventers.

Design flows should be prepared in a similar manner as noted in Section B.1.7, adjusting rainfall intensities and runoff co-efficients to reflect the applicable year return period (e.g. 100 year storm).

Hydraulic Grade Line determination should begin at the downstream end of the system with a known hydraulic grade line or water surface level such as the calculated level within a stormwater management pond for the given return period. Pipe friction losses can be evaluated with a rearranged form of the Manning’s equation. Minor losses at bends, junctions, outfalls, and stormwater management ponds must be accounted for.

Minor Losses

The exit loss at the outfall from the minor system must be accounted for in the assessment as follows:

$$H_o = 1.0\left[\frac{{V_s}^2}{2g} - \frac{{V_d}^2}{2g}\right]$$

Where,
$H_o = headloss\ at\ outfall\ (m)$
$V_s = Velocity\ of\ outfall\ sewer (m/s)$
$V_d = Downstream\ Velocity\ (m/s - zero\ in\ ponded\ water)$
$g = acceleration\ due\ to\ gravity\ (9.81\ m/s^2)$

Entrance Losses (where applicable) can be calculated as follows:

$$H_e = k_e\left[\frac{V_s^2}{2g}\right]$$

Where,
$H_e = entrance\ head\ loss (m)$
$k_e = entrance\ loss\ co-efficient\ (0.50\ for\ headwalls)$
$V_s = velocity\ within\ sewer$ (m/s)
$g = acceleration\ due\ to\ gravity\ (9.81\ m/s^2)$

Losses at Manholes (including bends and junctions) can be approximated as follows:

Straight through flow with no change in pipe size, head loss = 0.02m
Bends from 0 to 45 degrees = 0.04m
Bends from 45 to 90 degrees = 0.06m

Alternatively, bend losses can be determined as follows:

$$H_b = 0.0033d\left[\frac{{V_o}^2}{2g}\right]$$

Where,
$H_b = bend\ loss\ (m)$
$d = angle\ of\ deflection\ in\ degrees$
$V_o = velocity\ in\ the\ outlet\ pipe\ (m/s)$
$g = acceleration\ due\ to\ gravity = 9.81\ m/s^2$

Where there is a significant change in flow velocity in the upstream and downstream pipes such as at change in pipe size, head loss can be calculated as follows:

$$H_v = \frac{K(v_1^1 - v_2^2)}{2g}$$

Where,
$H_v = loss\ at\ manhole\ due\ to\ velocity\ change$
$v_1 = flow\ velocity\ in\ downstream\ sewer$
$v_2 = flow\ velocity\ in\ upstream\ sewer$
$K = velocity\ change\ co-efficien$
$= 0.1\ for\ increasing\ velocity\ change\ and\ 0.2\ for\ decreasing\ velocity$
$g = acceleration\ due\ to\ gravity = 9.81\ m/s^2$

Pipe Friction Losses

Pipe friction losses should be calculated as the product of the friction slope times the pipe length as follows:

$$H_f = \left[\frac{n^2 L}{R^{1.33}}\right] V_s^2$$

Where,
$n = Mannings\ roughness\ co-efficient\ (typically\ 0.013)$
$L = Pipe\ length\ (m)$
$V_s = sewer\ velocity\ (m/s)$
$R = hydraulic\ radius\ (m)$

The hydraulic grade line analysis is typically done in a tabular form, comparing the calculated water surface elevation with the critical design limitations (e.g. basement floor levels). The calculated pipe friction and minor losses should be tabulated and the 100 year HGL plotted on the plan and profile drawings.

B.1.7.5 Inlet Control Devices

Inlet control devices (ICD's) are objects placed over storm sewer inlets or pipe to regulated the quantity of runoff entering the storm sewer system.

The use of ICD's on privately owned property is a commonly accepted stormwater management practice to limit peak flows draining from properties.

The use of ICD's on municipal storm sewers typically will not be permitted. One possible exception is at sag locations where the storm sewer has residential gravity service connections. Excessive storm sewer loading at these locations are to be avoided as not to adversely impact hydraulic grade line levels. Readily maintainable ICD's will be permitted at these locations provided the design of the ICD allows for the 5 year flow to freely drain through the regulator. The permitted use of ICD's at sag locations will be reviewed on an individual case by case basis.

B.1.8 Maintenance Holes

Manholes shall be used at all changes in horizontal alignment, grade, pipe size and at the termination (including temporary termination) of a sewer. In any of these situations, the use of catchbasins as manholes is not permitted. Control manholes are required at the front property line (or just inside the front property line where not possible on the property line) for all Site Plans and connections to the main line sewer shall be at manholes.

Manholes on private property connected to storm sewers defined as building sewers are to be constructed as defined in the Ontario Building Code which supercedes this document. Location of manholes shall adhere to the Ontario Building Code Section 7.4.7.2 (5) and (6). Refer to Ontario Building Code Section 7.4.7.3 for the definition of manhole.

Manholes shall meet OPSD700 Series Requirements and be designed for appropriate diameter and height. Pre-cast manholes shall be constructed using monolithic bases and taper cones. Where there is insufficient space for a taper cone, a pre-cast flat top may be used.

B.1.8.1 Maintenance Hole Spacing

Unless otherwise approved by the City Engineer, the maximum spacing between maintenance holes when the pipe is 250-975mm diameter shall be 110m measured horizontally. For pipe sizes greater than 975mm, the maximum spacing shall be 130m.

B.1.8.2 Maintenance Hole Sizing

All sizing of storm pre-cast maintenance holes are based on the incoming and outgoing pipe sizes. Structures shall conform to the following requirements:

a) 1200 mm diameter, See OPSD 701.010, 701.030, 701.031, and 701.032 for details and additional design information.
b) 1500 mm diameter, See OPSD 701.011, 701.040, and 701.041 for details and additional design information.
c) 1800 mm diameter, See OPSD 701.012, 701.050, and 701.051 for details and additional design information.
d) 2400 mm diameter, See OPSD 701.013, 701.060, and 701.061 for details and additional design information.
e) 3000 mm diameter, See OPSD 701.014, 701.070, and 701.071 for details and additional design information.
f) 3600 mm diameter, See OPSD 701.015, 701.080, and 701.081 for details and additional design information.

B.1.8.3 Maintenance Hole Frames and Grates

Maintenance hole frames and covers are required for all maintenance holes and shall conform to OPSD 401.010 Closed Type 'A' unless otherwise specified. See OPSD 401.010 for details and additional design information.

Lockable maintenance hole covers are required to reduce access by the public. They can be located through park blocks, open space blocks, pumping stations or pollution control plants. See OPSD 401.060 for details and additional design information.

B.1.8.4 Maintenance Hole Steps

Maintenance hole steps are required for access and are to conform to one of the following:

a) Maintenance Hole Steps – Hollow See OPSD 405.010 for details and additional design information.
b) Maintenance Hole Steps – Solid See OPSD 405.020 for details and additional design information.

Note:

- All steps are to be galvanized steel or aluminum; and
- A detail or restoration plan is required for the relocation of maintenance hole steps within existing maintenance holes, where applicable.

B.1.8.6 Maintenance Hole Safety Landings

A maintenance hole safety landing is required at an appropriate mid-point depth of the maintenance hole, when the depth of the maintenance hole is between 5.0 and 10.0 metres. Additional safety landings are required at appropriate third-point depths, when the maintenance hole is equal to or greater than 10.0m to 15.0m deep.

Note: Incoming pipes are to be below safety landings, where possible.

B.1.8.7 Drops in Maintenance Hole Structures

Minimum drop shall be:

a) 0.02m for straight run with no change in pipe size;
b) Equal to the difference in pipe diameter if the pipe size increases. In no case should the downstream invert elevation exceed the upstream invert elevation;
c) On the basis of the following where there is a change in direction: Where the bend is 45 degrees or less, 0.04m

Where the bend is 45 to 90 degrees, 0.06m

Storm drop structures are required when the difference in invert elevations between the upstream and outlet sewers in the maintenance hole is equal to or greater than 0.61 m.

B.1.8.8 Benching

All storm maintenance holes require benching at the bottom of the maintenance hole. Maintenance holes with benching should conform to OPSD 701.021. Benching height should be increased to obvert to increase hydraulic benefit as required. Where benching is different from OPSD 701.021, a benching detail is required.

B.1.8.9 Adjustment Units

Maintenance hole adjustment units are required on all maintenance holes to ensure that proper grade is provided between the top of the maintenance hole and the maintenance hole lid. Maintenance hole adjustments shall adhere to CPD 408.01. A minimum of one and a maximum of three pre-cast adjustment units to a maximum height of 300mm shall be used. Ensure that the difference in grade between the maintenance hole lid and the first ladder rung does not exceed 600 mm. Clay brick will not be allowed for use as maintenance hole adjustment units.

B.1.8.10 Maintenance Hole Access

A 3.6m wide hard surface (e.g. asphalt or in some cases gravel) access is required for maintenance vehicles and equipment used to access and service storm and sanitary sewers within easements, open space areas, designated blocks and existing right-of-ways (i.e. boulevards). Adequate curves and turn-around facilities are required for maintenance vehicles to maneuver. Slopes (10% maximum) cross-falls (2% minimum) and drainage of access roads are also to be addressed in the design. A 0.6 metre separation is required between the maintenance access and the top/bottom of any slopes; fences; and property line(s)

B.1.8.11 Maintenance Hole Construction Practices

For PVC sewer pipe, the manhole must have pre-manufactured rubber connections (boots). Concrete pipe must have concrete cradles as per OPSS for ¾ of the length of a full pipe segment or the entire length of a partial pipe segment.

All precast maintenance hole section joints shall contain an approved rubber gasket.

All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with the manufactures specifications.

A minimum 300 mm vertical/horizontal clearance between openings on the inside of the maintenance hole is required for all sewer and PDC connections.

Manholes and Catchbasins are to be set to base asphalt grade until surface asphalt is placed in new construction only. When the catchbasin is constructed the concrete curb will be stopped 1.25m from the centre of the structure and a temporary asphalt curb will be constructed adjacent to the catchbasin until the surface asphalt is in place. When the catchbasin is set to final grade, the temporary asphalt curb will be removed and the concrete curb will be poured. Catchbasin manholes are to be constructed directly on the main line where pipe size is 375mm in diameter or less for shallow systems. All catchbasin manholes shall be equipped with benching.

All maintenance hole frame and covers shall be adjusted to the finished road grade as per CPD 408.01.

Where adjacent maintenance holes are located less than 2.4 metres apart, the area between the adjacent maintenance holes shall be backfilled with granular material. The backfill shall be compacted to 100% standard Proctor Density or as specified in the soils report (if available), or as approved by the City Engineer.

Storm sewer maintenance holes shall be tested for leakage as per OPSS 407.07.24.

B.1.9 Catchbasins

Catchbasins meeting OPSD 700 series requirements shall be provided at sufficient intervals and frequency to allow for the interception of runoff into the minor system up to the intended design capacity.

B.1.9.1 Location

a) Street – At appropriate locations to provide proper drainage design. On street corners and intersections, the catchbasin is to be located 0.6 m from the BC or EC of the curvature, and where feasible, upstream of all pedestrian crossings. Double catchbasins shall be provided at all road sags. Every effort should be made to avoid locating catchbasins at driveways, accessible parking spaces, access aisles, exterior passenger loading zones, pedestrian walkway zones, and conflicts with lot servicing.
b) Lot/Rear Yard - The catchbasin and lead are to be located 0.5 m from the property line, entirely on one lot or block.

c) Parks - Catchbasins are to be located to minimize flow across pathways and provide positive drainage from park facilities.

B.1.9.2 Minimum Lead Diameter and Grade

a) Street - The minimum diameter and grade of a catchbasin lead on a street is 250 mm @ 0.7% (velocity of 1.0 m/s) (300 mm for a double catchbasin @ 1.0%).
b) Lot - The minimum diameter and grade of a catchbasin lead in a rear yard is 300 mm @ 0.5% (velocity of 1.0 m/s).
c) Parks - The minimum diameter and grade at the catchbasin lead in a park is 250mm at 0.7% (velocity of 1.0m/s) and is dependent on catchment area.

B.1.9.3 Spacing and Location

The desired maximum distance between catchbasins, or from a crest in a road to a catchbasin is 90 metres, measured along the curb line for each side of the road. In areas where the longitudinal road grade exceeds 4%, the maximum spacing shall be 60 metres.

The appropriate spacing of catchbasins should also be determined to allow for the adequate inlet capacity of gutter flows into the pipes to provide the assumed minor system capacity. Catchbasin inlet rating curves to be used are attached in the Appendix.

B.1.9.4 Types of Catchbasins

a) Catchbasin - 600 mm x 600 mm or 600mm x 1450 mm
Catchbasins (CB) or Double Catchbasins (DCB) are to be constructed on all streets and some rear yards. See OPSD 705.010 or 705.020 (DCB) for details and additional design information in additional to these standards. A double catchbasin with side inlets is required where drainage is received from more than one direction, at a low point and when spacing exceeds the maximum allowable.
b) Catchbasin Maintenance Hole
Catchbasin maintenance holes (CBMH) are to be constructed on streets or in green spaces as required. Similar to catchbasins, locating CBMHs within accessible parking spaces, access aisles, exterior passenger loading zones, pedestrian walkway zones, and in front of driveways should be avoided.
c) Ditch Inlet Catchbasins
Ditch inlet catchbasins (DICB) are to be constructed for receiving ditch, swale and overflow drainage into the storm sewer system. They also can be used within stormwater management ponds. See OPSD 702.040 and OPSD 702.050 or OPSD 705.030 and OPSD 705.040 for details and additional design information.

B.1.9.5 Depth of Cover

The minimum depth of cover over a catchbasin lead is to be 1.2 m. The depth of storm sewers may also be controlled by residential storm service requirements. Where minimum depths cannot be achieved, and therefore frost protection is warranted, insulation is required.

B.1.9.6 Allowable Ponding

a) No surface ponding is allowed to develop under a 5-year design storm event.
b) Ponding on major overland flow routes shall not exceed 300 mm on streets (as measured to the centerline) and must be contained within the road allowance. More typical road cross-sections would limit flood depth to approximately 150mm above the centreline, but in all cases, ponded runoff must not extend beyond the right of way. Ponding on rear yard catchbasins must not result in less than 300mm freeboard on adjacent lowest building grades. Other regulatory agencies may require less depth of ponding (e.g. Otonabee Region Conservation Authority for safe access under regulatory flood conditions).

B.1.9.7 Catchbasin Frame and Grates

a) Catchbasin Cast Iron Frame and Flat Square Grate
   To be constructed in conjunction with a catchbasin - 600 mm x 600 mm and a catchbasin maintenance hole. See OPSD 400.020 for details and additional design information.
b) Catchbasin Cast Iron Curb Inlet Overflow Plate
   To be constructed in conjunction with a curb inlet catchbasin. See OPSD 400.090 for details and additional design information.
c) Ditch Inlet, Galvanized Steel, Honey Comb – Grating
   To be constructed in conjunction with a ditch inlet catchbasin. See OPSD 403.010 for details and additional design information.
d) Openings in surface grates located in a pedestrian path of travel must not allow passage of an object that has a diameter of more than 20mm. (IASR 80.23.5). Elongated openings in surface grates must not be orientated longitudinally with the direction of travel.

B.1.9.8 Catchbasin Maintenance Hole Steps

a) Maintenance Hole Steps - Hollow
   To be constructed in conjunction with a pre-cast catchbasin maintenance hole. See OPSD 405.010 for details and additional design information.
b) Maintenance Hole Steps - Solid
   To be constructed in conjunction with a catchbasin maintenance hole. See OPSD 405.020 for details and additional design information.

B.1.9.9 Catchbasin Connections

Catchbasin leads typically are connected to the main line at storm manholes. Where permitted, catchbasin lead connections shall be as follows:

a) Catchbasin Connection - Rigid Pipe Sewer
   To be constructed in conjunction with a catchbasin - 600 mm x 600mm. See OPSD 708.010 for details and additional design information.
b) Catchbasin Connection - Flexible Pipe Sewer
   To be constructed in conjunction with a catchbasin - 600 mm x 600mm. See OPSD 708.030 for details and additional design information. Connections must have factory installed rubber gaskets (boots).

B.1.9.10 Catchbasins Adjustment Units

Catchbasin frame adjustment to final grade shall be as per CPD 408.02. A minimum of one and a maximum of three pre-cast adjustment units to a maximum depth of 300mm shall be used.

B.1.9.11 Catchbasin Lead Material

Unless otherwise approved, flexible catchbasin leads are constructed. The pipe material shall be PVC SDR35.

B.1.9.12 Catch Basin Subdrains

150mm perforated pipe subdrains shall be provided on both sides of the road at the gutter line parallel to the road grade in accordance with CPD 405.01. Positive drainage should be continuous within the subdrain which may require connection to catchbasins at different locations than where pre-cast knockout holes exist. Pipe subdrains shall be capped at the upstream end with a pre manufactured end cap. Pipe subdrains shall be fully bedded in Modified Granular ‘B’ as specified on CPD 405.01.

B.1.9.13 Records

All storm sewer connections shall be inspected at the same time as the storm sewer mains and recorded on the as-built drawings. Typically, the connections are measured from the centre of the downstream manhole

B.1.10 Easements

Easements are required for all storm sewers to be assumed or potentially assumed by the municipality located outside the road allowance on privately owned property. Easements are also required for private building services crossing property lines onto

other private lands associated with a municipal agreement in accordance with the Ontario Building Code.

Easement widths are determined from the depth of cover between the surface and the invert of a sewer and is dependent on soil types and physical constraints. For a rear yard catchbasin draining to the street, the drainage easement shall be 3.3m wide on the side property line resulting in the easement and minimum building side yard setback of 1.50m (on the side furthest from the sewer) or 1.80m (on the side closest to the sewer) offset from the subject property line. The storm sewer should be offset 0.50m on one property. In other cases, the minimum width of a sewer easement at a depth of up to 2.4 metres shall be 4.8 metres (2.4 metres each side of sewer).

Special consideration should be given to easement width and impact on adjacent footings. The Consultant shall undertake this analysis.

B.1.11 Materials

B.1.11.1 Pipe

The selection of pipe material, pipe classes and bedding types should be based on loading conditions. Storm Sewer pipe shall have been manufactured in conformity with the latest standards by the American Society of Testing Materials (ASTM) or the Canadian Standards Association (CSA).

- Polyvinyl Chloride (PVC) sewer main pipe and fittings shall conform to CSA standard B182.2 for DR 35 pipe and shall have bell and spigot joints with rubber gaskets. Typical maximum allowable size is 600mm. PVC fabricated and moulded fittings shall be C.S.A. certified. All PVC pipe used within the City of Peterborough Streets or to be assumed by the City shall be DR or SDR series pipe.

- All concrete pipe shall be reinforced and manufactured in accordance with OPSS 1820, which includes CAN/CSA standards specification A257.2-M92 and certification under the Ontario Concrete Plant Prequalification Program administered by the OPS, MTO, MEA and the OCPA. Concrete pipe shall be used, but not limited to, pipe sizes greater than 600 mm.

B.1.11.2 Fittings

All sewer fittings shall comply with CSA 182.1, 182.2 and ASTM 3034 and be either solvent welded or gasketed.

B.1.12 Storm Sewer Inlet and Outlet Structure

Headwalls are typically required at the end of all storm sewer systems, which provide for a transition from the storm sewer to an open channel, river, creek, SWM pond or other

receiving body of storm water. In some cases headwalls are required at the inlet of a storm sewer and/or large storm drain.

B.1.12.1 Types of Headwalls

The following headwall designs are based on the velocity and in certain cases the diameter of the storm sewer, which was taken from Municipal Works Design Manual (Municipal Engineers Association - MEA) and Ontario Provincial Standard Drawings.

There are two types of headwall designs and they are as follows:

a) With pipes diameters under 900 mm and no chute blocks are deemed necessary - see OPSD 804.030 for details and additional design information.
b) For pipes 600mm and greater with chute blocks or for pipes 900mm and greater, -see OPSD 804-040 for details and additional design information.

B.1.12.2 Concrete Strength

The concrete for all headwalls is to have a minimum strength of 30 MPa with a 5% to 7% air entrainment and 70 to 90 mm slump.

B.1.12.3 Chamfers

All exposed corners of all headwalls should be chamfered 25 mm or more depending on the size of the headwall.

B.1.12.4 Weeping Tiles

Weeping tiles are to be provided on each side at the base of the sewer outlet and extended through the headwall. On larger headwalls they are placed on the side or wing walls.

B.1.12.5 Grill/Grates

Hot dipped galvanized grills/grates are to be placed over the storm inlets and outlets horizontally or vertically as required and should be fixed to the headwall with anchor bolts. Grills and grates shall comply with OPSD 804.050.

B.1.12.6 Railing

A railing guard is required on all headwalls, which either exceed 600mm in wall height or 1.0 m in elevation difference as measured from the top of the headwall to the proposed top of slope. All headwalls are to have a swale at the top of the structure to allow for surface drainage.

B.1.12.7 Riprap / Rock Protection

Riprap (or an equivalent erosion protective surface) is to be constructed at the end of all headwalls of all storm sewer systems and is to be placed in accordance with OPSD 810.010 and the following design criteria:

a) on the bottom and sides up to design water levels;
b) downstream until the projection of the side walls meet the channel side slopes at half the design water depth of flow; and
c) for headwalls at creeks and rivers, extend rip rap or gabion protection to creek or river.

Protection is to provide a smooth hydraulic flow for headwall discharge and creek or river flows.

Note: Riprap design information etc. is to be in compliance with OPSS-1004. Rip rap is to be sized as per design velocities. The minimum size of riprap is 100 mm and the maximum size is 200 mm.. Rock protection shall be well graded in sizes ranging from 100mm to 500mm. In all cases, filter cloth of adequate strength shall be placed between the exposed soils and the rip rap.

B.1.13 Private Service Connections

B.1.13.1 Minimum Size and Grade

a) In new subdivisions, minimum service size is 150mm. PVC storm services shall be white in colour.
b) The minimum diameter and grade of a service for a residential multi-family block is 150 mm diameter @1.0%. 150mm PVC storm services shall be white in colour.
c) The minimum diameter and grade of a service for a non-residential, commercial or industrial block is 250 mm diameter @ 1.0%.

Note: The actual size of the service required for multi-family, non-residential, commercial and institutional blocks is dependent on the flows.

In addition to the above noted minimum size and grades, private storm service connections shall comply with Part 7, OBC where applicable.

B.1.13.2 Connections to Sewers / Maintenance Holes

a) Single Family Residential

The 150mm PVC SDR 28 storm services for single family residential properties shall be coloured white and connected to the main line by way of pre-manufactured tees. The depth of the storm service at the property line may be dependent on the depth of the storm sewer within subdivisions. Lots within

subdivisions with shallower main line sewers or high main line hydraulic grade lines shall be pumped to a crested point in the service high enough to prevent backwater from surcharged sewers to enter the structure. No foundation or roof drainage shall be allowed to drain into the sanitary sewer system. Duplex storm services shall also be a minimum of 150mm in diameter and coloured white.

b) Commercial, Institutional and Industrial

Services shall be properly sized and designed to convey internal design flows and shall be a minimum of 250 mm in diameter at the street line, unless otherwise approved by the City Engineer. Storm services connected to buildings shall also comply with Part 7 OBC. Most new construction is subject to stormwater management requirements as part of the municipal Site Plan Approval process. (See Section F). Connections to the main line shall be located at manholes, and where none exist, new manholes will have to be installed, unless otherwise approved by the City Engineer. New service connection to main lines will also require control manholes located just inside the property line.

c) Connections to Existing Sewers for Single Family Residential Lot Infill Situations

Where possible, foundation drains shall be connected to existing storm sewers, however, it is recognized that some existing areas may not have adequate minor systems and foundation drainage will be pumped to an elevated connection or the ground surface if a service is not practical. The location of the foundation outlet should be carefully chosen as not to adversely impact municipal sidewalks, multi-use trails, site walkways and adjoining properties and it typically should be located to outlet onto pervious surfaces. Proposed foundation outlet must be shown on the Site and Grading Plan detailed in Section E and approved by the City.

B.1.13.3 Service Cleanouts

On private property, storm building sewers and private sewers shall be provided with cleanouts/maintenance holes. Cleanout/maintenance holes shall be located off of the right-of-way in accordance with Part 7 of the OBC.

B.1.13.4 Pipe Material

Storm services are typically PVC SDR28 for 125mm to 150mm (white in colour) and PVC SDR35 above 150mm in diameter. Also refer to Section A.1.14.

B.1.13.5 Marking and Recording Residential Service Connections

All storm service connections shall be inspected and tested at the same time as the storm sewer mains and recorded on the as-built drawings as to location at both the main and at the property line and elevation at the property line. The terminus of

plugged or capped services shall be identified at the surface with 2”x4” (38mm x 89mm) wood stakes placed from the service invert to 450mm above grade and painted red for the top 300mm of the stake.

B.1.14 Third Pipe Collection Systems

Third pipe collection systems shall be designed to collect water only from foundation drains.

The minimum size of the third pipe main shall be 200mm and minimum slopes shall be 1.0% where feasible. Service laterals shall be 150mm and white in colour.

Foundation drain collection pipes shall be installed at sufficient depth greater than frost penetration and to typically allow for gravity foundation drainage. Maintenance hole spacing shall be a maximum of 150m.

Similar to storm sewers, all material used in the foundation drain sewers shall meet OPS specifications.

B.1.15 Non-Piped Storm Conveyance Systems

a) Culverts shall be designed to convey the 25 year flow without headwaters exceeding the obvert of the pipe. On arterial and major collector roads, culverts must be designed to convey 100 year flows with a minimum of 300mm freeboard prior to the overtopping of the road.
b) Road ditches shall be sized to convey the 1 in 25 year flow.
c) Channels shall be designed to convey the 1 in 100 year flow typically without overtopping of the banks. Where overtopping is unavoidable, a hydraulic analysis shall be undertaken which must prove no adverse impacts on adjoining properties. Channel linings shall be designed to resist 100 year flow velocities without scour.

B.1.16 Quality Control

Storm sewers should be leakage tested in accordance with Ontario Provincial Standard Specifications (OPSS.MUNI.410).

All service laterals, tees or stubs shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Such plugs or caps will be readily removable and their removal shall provide a socket suitable for making a flexible jointed service connection or extension.

If a segment of the system fails during leak testing, the source of the leak should be identified and all defective material shall be repaired or replaced to the satisfaction of the City. The repaired or replaced sections shall be retested

until acceptable results are obtained. During retesting, maintenance holes shall be tested separately from pipe sewers.

Sewers shall be cleaned and flushed annually or more frequently if building construction is occurring, at the Developer's expense.

Sewers are to be cleaned and flushed and inspected by closed circuit video and the original tapes are to be provided to the City as per CP 409.01.

Deflection testing shall be completed for all new flexible sewers waiting at least 30 days after backfilling, but prior to paving. Mandrel testing shall be performed as per OPSS.MUNI 438. Equipment used to perform the Mandrel tests shall be specifically designed for the pipe material tested. Pipe segments failing the deflection tests shall be removed and replaced.

C Road and Surface Works

C.1 Road Cross-sections

Geometric design standards for the various roads are shown in Table C.1. Where not specified in these standards, additional design elements shall be as per Transportation Association of Canada (TAC) standards.

The charted pavement thickness designs are to be considered as a minimum only. Actual pavement thickness design is to be provided by a geotechnical consultant retained by the developer: When poor soil conditions exist, the depth of base and sub-base (Granular "A" and Granular "B") may be increased by the City Engineer.

Granular "B" refers to Granular "B" Type I Modified.

Standard road cross-sections are shown in Standard Drawings USD-100.01 to USD 100.10 attached in the Appendix.

Table C.1 Geometric Standards for Road Design

Element		**Indust.**	**30**	**30**	**26**	**26**	**23**	**20**	**20**	**18.5**	**16.5**
Right-of-Way		26m	30m	30m	26m	26m	23	20m	20m	18.5m	16.5m
Pavement Width (curb/curb)		8m (rural)	18m	14m	14m	10m	10m	10m	8.5m	8.5m	8.0m
Curb Radius at Intersection		10.7m	12.0m	12.0m	12.0m	10.7m	10.7m	10.7m	10.7m	10.7m	10.7m
Min. Grade		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Maximum Grade		6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	8.00%	8.00%	8.00%
Crown (mm)		130	250	200	200	140	140	140	120	120	110
Sidewalk (typical)	Width (m)		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Side location		Both	Both	Both	Both	Both	Both	Both	Both	One
	O/S from P/L (m)		1.0	2.7	1.0	1.0	1.0	1.0	1.0	0.85	0.85
	Cross slope		2%	2%	2%	2-5%	2-5%	2-5%	2-5%	2-5%	2-5%
Boulevard	Width (m)	8	6	8	6	8	6	5	5.75	5	5.0m
	Cross slope	2.5:1	2-4%	2-4%	2-4%	2-6%	2-6%	2-6%	2-6%	2-6%	2-6%
Roadbase	Gran "A" (mm)	150	150	150	150	150	150	150	150	150	150
	Gran "B" (mm)	300	600	450	450	300	300	300	300	300	300
Surface Asphalt HL1 (mm)		50 (HL3)	50	50	50	50	50	50	50	50	50
Binder Asphalt HDBC (mm)		100	100	100	100	100	100	100	50	50	50
Min. K Values Crest		12	15	15	15	12	12	12	12	12	12
Min. K Values Sag		10	10	10	10	10	10	10	8	8	8

Please note that the 16.5m right of way is contrary to the City's Official Plan and will require an Official Plan Amendment and specific City Council approval prior to its implementation. Where the 16.5m section is permitted, as well as the 20m right of way with a 10m travelled road, is to be implemented, it shall be in conjunction with the use of rear laneways.

The 18.5m local right of way is no longer permitted for the creation of new roads as per the November 29, 2021 Council adopted Official Plan. It has been left in this document as a standard for legacy approved Draft Plan of subdivisions implementing the 18.5m section. Any Draft Plan of Subdivisions approved after December 31, 2021 shall use the 20m local road standard.

The noted curb radii at intersections may vary pending potential design factors and constraints.

For newly created roads the right of way width shall be as follows:

i. Local Roads: 20m
ii. Minor Collector Roads: 23m
iii. Major Collector Roads: 26m
iv. Low Capacity Arterial Roads: 30m
v. Medium Capacity Arterial Roads: 30m
vi. High Capacity Arterial Roads: 36m

Where a property is subject to a planning approval such as a Plan of Subdivision, Site Plan Approval or a Consent (Severance), abutting road widenings shall be conveyed at no cost to the City to meet the widths noted in Schedule I of the Official Plan, or where the roads are not listed in Schedule I, the right of way widths noted above based upon road classification. The road widening shall typically be taken equally on both sides of the road unless topographic encumbrances preclude equal takings. In the case of severances, the prescribed road widenings shall be taken from both the retained and severed parcels. The daylighting triangles noted in Section C.2.1 are to be conveyed to the City at no cost in addition to the road widenings where both are applicable.

C.2 General Geometric Design Standards

Use a vertical curve where the road grade change is greater than 1.0%.

K values as low as 4.0 may be permitted on local roads at intersections to facilitate catchbasin placement and minimize surface ponding.

Provide a negative grade of 1% to 2% from the edge of pavement, at the intersection, for a minimum distance of 5m, on all road profiles where internal streets intersect with all collectors and through roads, wherever it is feasible to do so. Only single catchbasins will generally be required at these low points, unless specific capture rates are required as part of the storm system design.

All curb and gutter sections shall be as per OPSD 600.010.

Minimum gutter gradient shall be 0.50% except at turning circles where a minimum gradient of 1.0% is to be implemented. Where 1.0% cannot be achieved, interim catchbasins shall be implemented.

Industrial roads are generally designed with a rural cross-section as noted on USD 100.01. The maximum roadside ditch side slope shall be 2.5:1 (3:1 preferred). Ditch inverts are to be placed typically at 0.90m below the centreline of road, providing for a minimum of 150mm below the lowest granular/sub-grade interface level. Desired minimum longitudinal ditch grade is 1.0% with an absolute minimum of 0.5%. The minimum depth of ditch in relation to the right-of way grade shall be 300mm. In areas where an urban cross-section is desired, the minimum road width (curb to curb) shall be 10.0m.

Temporary turning circles are required where the road is to continue in the future. The minimum required right-of-way and pavement radii are 18m and 12.5m respectively.

C.2.1 Sight Triangles

The minimum road widening daylighting triangles be as follows:

Local to local street: 5.0m x 5.0m.
Local to collector street: 5.0m x 8.0m
Collector to collector street: 8.0m x 8.0m
Collector to arterial street: 8.0m x 12.0m
Arterial to arterial street: 12.0m x 12.0m

Daylighting triangles in the City's downtown core will typically be 5.0m x 5.0m regardless of the street classification due to available land considerations.

C.2.2 Traffic Signs

All street signs shall be as per the latest City of Peterborough "Sign & Posts Standard Specifications and Drawings". The proposed type and location of sign shall be shown on the project drawings.

Typical street name signs shall be 150mm wide double sided with 100mm reflectorized letters as per USDTR-5000.13 and are to be placed at all intersections at right angles to the flow of traffic. Oversized street name signs on light standards shall conform to CP 4000.02. Post-mounted signs located in a pedestrian path of travel shall have minimum head room clearance of 2.1m (IASR 80.23.2).

All traffic control, warning and advisory signs are to be installed perpendicular to the flow of traffic upon completion of the base course of asphalt and shall conform to the latest "Manual of Uniform Traffic Control Devices for Ontario.

C.2.3 Street Lighting

Street lighting shall be in accordance with the latest edition of the TAC Guide for the Design of Roadway Lighting or approved equivalent.

Streetlight Luminaires shall be Cree XSP High Output Series LED, 3000K colour temperature and having 7 pin adaptive photo control receptacle with house shields full cut off and being dark sky compliant. The adaptive control unit shall be DimOnOff Inc. Model No. RME-ELS.

For standard design configurations, refer to the following approved list of streetlight luminaires and poles. Any variations from the noted items must be approved by the City Engineer.

C.2.3.1 Decorative Street Light Poles

Unless otherwise approved, decorative street light poles shall be direct embedment 9.44m octagonal concrete poles as manufactured by Stresscrete, Black Eclipse in colour, with a polished finish. Scroll arms shall be 1.83 long as manufactured by Alumnous (or approved equivalent), black in colour.

C.2.3.2 Typical Street Light Poles

Unless otherwise approved, typical street light poles shall be direct embedment 10.7m Class C pre-stressed round concrete poles with natural finish and factory coated with a silane sealer as manufactured by Stresscrete or approved equivalent. Arm shall be 2.4m tapered elliptical aluminum with bracket assemblies.

C.2.4 Pavement Markings

All pavement markings (2 coats) are to be in compliance with CP 710 – City of Peterborough Pavement Markings – Standard Specifications.

C.2.5 Tapers, Lane Widths and Storage Length

The road design geometric parameters shall comply with the latest TAC Standards.

C.2.6 Transit Standards

All collector and arterial streets shall be designed with the consideration for conveyance of City buses. Specific transit routing shall be determined by the City's General Manager of Transit Services.

Standard structural details for Transit Pads can be found on Drawing CPD 351.02.

C.2.7 Electrical Specifications for Traffic Signals

Please refer the City of Peterborough Electrical Standard Specifications and Standard Drawings document for detailed design and construction requirements.

C.2.8 Sidewalks, Curb Ramps, Depressed Curbs

Concrete sidewalks shall be constructed as per CPD351.01.

The typical sidewalk width shall be 1.50m but shall increase in width to 2.0m where the sidewalk is located within 1.0m of the travelled roadway. Additionally curb face sidewalks may also include Edge Zones, Furniture Zones and Frontage Zones as applicable in some commercial areas. Sidewalks shall have a minimum width of 2.4m at schools, transit stops, and other high pedestrian areas.

Sidewalks, curb ramps, and depressed curbs shall comply with Integrated Accessibility Standards Regulation 191/11, as amended (IASR regulation).

C.2.9 Multi Use Trails

Multi Use Asphalt Trails (3.0m width Typ.) shall be constructed as per CPD M1.1.

D. Subdivision Guidelines:

D.1 Draft Plan Submission

Draft Plan approval including draft plan conditions must be issued by the City of Peterborough prior to any subdivision engineering review being initiated by the City Engineer.

D.1.1 Draft Plan

The Draft Plan should illustrate all aspects required under the Planning Act, and should also clearly identify the following: right of way widths including cul-de-sac radii, adjoining property lines and streets including the far side of the right of way and hanging property lines intersecting the opposite side of the streets, daylighting triangles, reserves, floodplain limits and wetland boundaries where present, all park and service blocks, existing vegetative cover, geodetic contours at 0.5 m intervals (1.0m intervals may be permitted in steeper areas), alignment angles at intersections where not at 90 degrees, existing swales and drainage courses, existing building in close proximity, adjoining property uses.

D.1.2 Functional Servicing Report

Accompanying the Draft Plan submission, shall be a Functional Servicing Report for the proposed development which, among other things, shall include the following:

- All roadway location and alignments and intersections, including right of way widths and intended road classifications.
- Parkland, open space and stormwater management blocks.
- Existing and proposed watercourses and channelization
- Any known floodplain and wetland boundaries.
- Confirmation with Peterborough Utilities of adequate water servicing and Hydro One for electrical servicing.
- Preliminary grading plans including proposed road centerline elevations at a minimum 40 metre spacing. The drawing should have both existing and proposed grades to allow a proper comparison.
- Geotechnical and hydro-geotechnical reports including slope stability and potential existing well and septic system impacts. Hydro-geotechnical reports should make estimations of seasonally high groundwater table in relation to the proposed preliminary grading plans, servicing trenches, and stormwater management facilities. Field saturated hydraulic conductivity should be determined to derive applicable design soil infiltration rates at appropriate locations. A preliminary water balance assessment based upon expected development intensity shall also be included, if not contained with the preliminary stormwater management report.
- Preliminary stormwater management reports including water quantity, quality and sediment and erosion control designs. Size of SWM block should be confirmed

and consideration of maintenance access and buffers included. Water balance design shall be included if not part of the Hydro-geotechnical report. Preliminary LID design within the rear yards of the lots shall be included as part of the report.

- Preliminary storm drainage reports including major system flows and road centerline grades every 30 metres.
- Preliminary sanitary sewer assessment including confirmation of downstream capacities, and required pumping station locations where applicable.
- Confirmation with Bell/Enbridge/Cogece/PUSI/PDI/Hydro One of available servicing.
- In areas where the proposed subdivision is located within a portion of a larger area to be developed, the Functional Servicing Report must consider how the servicing of the subject application does not limit or encumber future development.
- Tree Preservation Plan
- Traffic Study (if applicable)
- Noise Study
- Parking study (if applicable)

D.2 Subdivision Engineering Plans

D.2.1 General Requirements:

In general, a complete set of engineering drawings shall include the following in a similar sequence:

A) Title Page
B) Servicing Plans
C) Lot Grading Plans
D) Plan and Profile Drawings
E) Storm Sewer Catchment Area Plan
F) Sanitary Sewer Catchment Area Plan
G) Erosion and Sediment Control Plan
H) Tree Preservation Plan
I) Stormwater Management Pond Plan
J) Landscape Plan and/or Tree Planting Plans
K) Composite Utility Plan
L) Lighting Photometrics Plan
M) Standards and Specifications Plan.

The general requirements of each type of drawing are discussed in Section D.2.3.

D.2.2 First Submission

In addition to two sets of the engineering drawings signed and sealed by a professional engineer, the first submission shall include the following:

A) One copy of the signed Draft Plan of Subdivision.
B) One copy of the Draft Plan Conditions.
C) A covering letter providing an overview of the submission and confirmation that all drawings reflect Draft Plan conditions.
D) A copy of a geotechnical report and hydro-geotechnical report (updated from the functional servicing report reflecting detailed design parameters) indicating soil and groundwater conditions, recommendations for pavement and sub-base design, building foundation requirements, including requirements for engineered fill, estimate of water balance confirmation with the proposed subdivision and stormwater management designs, expected seasonally high groundwater levels in relation to proposed infrastructure and final grading, and provision of infiltration rates for site LID designs on the rear lots. The water balance design alternatively may be contained within the stormwater management report.
E) Storm Sewer Design Charts for both 5 year flows and 100 year hydraulic grade line calculations.
F) Sanitary Sewer Design Charts.
G) Stormwater Management Report. The stormwater management report shall be signed and stamped.
H) Traffic study, if an update from the Draft Plan stage is requested by the City.

The City Engineer may return the submission to the consultant without review or comments for the following reasons:

- The submission is substantially incomplete or not adequately reviewed by the consultant.
- The submitted package does not reflect the Draft Plan and/or the requirements of the Draft Plan conditions.
- The submission does not conform to the City's engineering design standards or fails to implement previous commentary from City staff.

A reply letter (and possibly a marked up copy of the engineering drawings) will be sent back to the engineering consultant for their review and revision.

D.2.3 Second and Subsequent Submissions

In addition to two sets of the revised signed and sealed engineering drawings, the following is required:
A) A covering letter indicating how all comments have been addressed.
B) Revised Storm Sewer Design Charts.(if applicable)
C) Revised Sanitary Sewer Design Charts.(if applicable)
D) Revised Stormwater Management Report. (if applicable)
E) A construction cost estimate for the proposed works. **
F) A draft copy of the Surveyor's M Plan and R plan for easements (if applicable).
G) Completed and signed MOECC ECA application forms for storm and sanitary sewers and stormwater management facilities. Watermain applications to the MOE are processed through PUSI**.

H) An Asset Valuation Table for all capital assets to be assumed by the City of Peterborough.**

** Items E), G) and H) above, are usually completed once the subdivision is approaching final design and approval. This may not be the case at second submission. The Capital Asset Valuation Table may be requested to be provided at subdivision Interim Acceptance. The timing requirement of the Asset Valuation Table will be described in the Subdivision Agreement.

It is the desire of the City to limit the engineering approval process to three submissions prior to final approval. Adequate review of plans and specifications as well as the inclusion of detailed covering letters should be provided to assist in this goal.

D.2.4 Engineering Drawings

All drawings shall be neat and legible and shall be drawn on either A1 (891mm x 594mm) or Architectural D (914mm x 610mm) paper. The plans shall be drawn to metric scale and the default units, where not otherwise noted, shall be in metres. All drawing should list original benchmark used in the pre engineering topographic as well as at least one geodetic benchmark within or closely adjacent to the property.

All plans should show existing property lines and utilities abutting the property in either broken or lighter linetypes.

The title block of each drawing shall clearly identify the project name and phase, consulting engineer and contact information, the designer and draftsperson, scale, geodetic benchmarks, north arrow, date, legend, key map with drawing area depicted, engineer signed and sealed, and shall have a complete list of revisions.

D.2.4.A Title Page

The Title Page shall contain the following:

- A key plan outlining the project location in relation to surrounding streets and major features. The key plan shall contain a north arrow.
- A drawing index list of the plans contained within the engineering set.
- The name and contact information of the developer and engineering consultant.

D.2.4.B Servicing Plan(s).

The Servicing Plan(s) shall be drawn at a scale of 1:500. In the event the entire subdivision cannot be contained on one sheet, additional drawing(s) shall be provided and the plans may overlap. The Servicing Plan shall contain the following:

- The proposed lot and block layout, dimension, and numbering matching the final M Plan.
- Lot frontage dimensions.

- Driveway locations.
- Storm sewers and catchbasins, manholes and catchbasin manholes.
- Sanitary sewers and manholes.
- Watermains and hydrants.
- Roads, curbs, sidewalks and multi-use trails.
- Storm, sanitary and water services for each lot.
- All external watermains, sanitary sewers, storm sewers and drainage courses that are required to service the subdivision.

D.2.4.C Lot Grading Plan(s)

The Lot Grading Plan(s) shall be drawn at a scale of 1:500. In the event the entire subdivision cannot be contained on one sheet, additional drawing(s) shall be provided and the drawing areas may overlap. The subdivision lot grading plans provide the framework for overall subdivision drainage and individual building site and grading plans. Lot Grading Plans shall include the following:

- The proposed lot and block layout, dimensions, and numbering matching the final M Plan.
- Lot dimensions on all lot lines.
- Existing and proposed lot and block corner elevations.
- Existing contour lines (lightened but legible) at a 0.5m vertical interval.
- Drainage arrows on all lots indicating general proposed lot grading patterns.
- Catchbasins, storm manholes, and storms sewers including pipe sizes, and drainage outfalls, and outlines of stormwater management facilities.
- Sanitary sewers and manholes, watermains, valves and hydrants, particularly the above ground features.
- General drainage pattern arrows of adjoining properties.
- Proposed front and rear building grading elevations for each lot.
- Lots requiring engineered fill should be indicated on the plans.
- Slope locations and top and bottom of slope elevations.
- Side lot line elevation break points in split drainage lots.
- Proposed retaining walls including top and bottom grades.
- Proposed longitudinal swale slopes for all lot lines of adjoining properties.
- Proposed centreline elevations every 20 metres on the even 20 metre chainage as well as at horizontal and vertical start and end of curves and at all crests and sags.
- Detailed existing and proposed elevation information required where proposed subdivision abuts existing development.
- Rear yard catchbasin locations and top of grates with dimensioned offsets and easements outlined.
- Proposed Lot Grading Types e.g. A, B, C, WO etc. shown for each lot. General lot grading schematics are required for each lot type which may be shown on either the Lot Grading Plan or the Standards page.

- Rear yard sheet drainage patterns directing drainage to the side lot lines of downstream through drainage lots.
- The high and low curb elevation at intersections where a high curb point is required to ensure min. 0.5% slope to adjacent catchbasins.
- Proposed lot servicing.
- Driveway locations and widths.
- Travelled road curbing, sidewalk/multi-use trail, and tactile attention indicators where required.
- Minimum basement elevations on each lot where applicable. Title block with full legend, north arrow, and complete revision block.
- Vertical Benchmark and UTM information required within title block. At least one vertical benchmark and two UTM horizontal control points must be established and shown within or adjacent to the site.
- Any applicable easements.
- Fencing around Open Space and Parkland blocks. Unless otherwise requested by City staff, fencing shall be 1.5m high commercial grade black vinyl coated chain link fence.
- General LID information.
- Contractor staging areas to remain after Interim Acceptance.
- Key Plan

D.2.4.D Plan and Profile Drawings

Plan and Profile drawings are required for all streets, pipe outfalls, easements and watercourses. The Plan and Profile Drawing(s) shall be arranged within the set such that all streets have their own drawing(s). The Plan and Profile drawing shall be drawn at a scale of 1:500 horizontally and 1:50 vertically. Where a street requires more than one plan, match lines with stationing should be provided with NO overlap of information. The plan and profile portions of the drawing should be in line vertically with each other and shall have consistent stationing. Plan and Profile Drawings should include the following:

- The proposed lot and block layout within the plan component
- Lot frontage dimensions on all lots and blocks.
- Chainage stationing shown every even 20 metres on the profile component (in sync. with grid lines) and 100 metres on the plan component.
- Chainage stationing at all road intersections for both roads.
- Existing ground profile along centre of right of way and existing left and right elevation marks corresponding to the edge of the right of way at even 20 metre stations.
- Proposed centerline profile including all longitudinal slopes, crest and sag K values, PVI station and elevations and vertical curve lengths. Horizontal centerline radii and BC and EC data should be shown on the plan portion. Where change in vertical grade is less than 1.5%, no vertical curve is required.

- Where plan and profile is an extension of an existing road, show profile extending at least 40 metres into the existing road to ensure proper profile transition. Lesser distances of existing road may be permitted where there is little change in the grade. The limits of construction including stationing must be shown on both the plan and profile portion.
- All storm sewer, sanitary sewer, and watermain information including structures such as manholes, catchbasins, hydrants, valves, etc., should be shown. The profile portion should include: size, material type, class, length and slope of pipes, manholes sizes, related OPSD numbers, and inverts at manholes, catchbasin lead crossings, etc. Non-standard manhole details or manhole benching must be shown on the drawings.
- Grading details of cul-de-sac where minimum gutter grades are proposed.
- Watermain bends and vertical clearances must be shown at crossings.
- All water, storm and services should be shown (in different linetypes) as well as driveway locations.
- All manholes, catchbasin manholes and catchbasins shall be numbered as provided by the City after second submission with stationing indicated and shall include all pipe inverts and top of grating information.
- Rear yard catchbasin profiles shall be drawn in conjunction with the proposed surface lot grading and minimum underside of footing. Manholes required at the main line intersection with rear yard catchbasins.
- Title block required with street name indicated and stationing limits where more than one plan is required to encompass a street. Where the final street name has been established prior to ‘As Built’ submittal, the ‘As Built’ drawing should indicate the final street name. Revision Block should list all revisions and dates.
- Vertical Benchmark and UTM information required within title block. At least one vertical benchmark must be shown within or adjacent to the site and at least two fixed UTM horizontal control points are needed. Where additional benchmarks have been established within the subdivision since final approval, these benchmarks should be indicated on the drawing prior to ‘As Built’ submission.
- Road, boulevard, sidewalk/multi-use trails and right of way widths, sidewalk/multi-use trail locations and curb and right of way radii at intersections and bends.
- Curb ramps, depressed curbs, tactile attention indicators where required, gates, bollards, and surface materials.
- In addition to all of the required manholes to meet typical City Design Standards, an additional straight-through manhole with similar upstream and downstream sloped sewers shall be provided between the subdivision and the existing City sanitary sewer system, or at any other appropriate location(s), as deemed by the City, for the purposes of flow monitoring from the new subdivision. The manhole must either include or allow for the insertion of flow monitoring equipment.
- Above ground utility information.

D.2.4.E and F Storm and Sanitary Sewer Area Drawings

These drawings can either be drawn at 1:500 in relation to the Lot Grading Plans or can be drawn at either 1:750 or maximum 1:1000 to encompass a greater area. Storm Sewer Area drawings shall outline and indicate the tributary area and runoff coefficient for each location (typically a catchbasin) being analyzed. The Sanitary Sewer Area drawing should outline and indicate catchment areas and assumed population parameters (and landuses where mixed) for each manhole. The storm and sanitary sewer design sheets shall be consistent with these drawings.

D.2.4.G Tree Inventory and Preservation Plan

The Tree Inventory and Preservation Plan should contain the following components created using AutoCAD or Arc Map, which will be included with the other elements of the subdivision (or site plan) and grading layout and provided as a PDF. The following guidelines are subject to revision and amendment as required to reflect industry best practice. Please confirm with Urban Forestry Staff for the current version.

- Tree Inventories and Tree Preservation Plans will be prepared by one the following: a Certified Arborist that is a member in good standing with the International Society of Arboriculture (An ISA Certified Arborist), An Arborist qualified with the Ontario Ministry of Training, Colleges and Universities (MTCU), a Registered Professional Forester (R.P.F). A collaborative assessment is required for Woodlands.
- Based on the scope and complexity of a development site, an Arborist report may be required to provide a detailed analysis and interpretation of the information generated in the Tree Inventory. The Arborist report will include a Tree Inventory and Preservation Plan and include additional information not provided in the Tree inventory assessment of the potential impacts of the proposed development on existing trees. It must also provide recommendations and the methodologies for the protection of trees to remain, including such maintenance measures before during and after construction that promote the long-term health of the retained trees.
- The Tree Inventory Information including tree locations will be overlaid on the grading plan and site plan, and the plan must be updated with any changes made through the associated application review process.
- Inventory all trees which have a Diameter at Breast Height (DBH) equal to or greater than 7.5 cm, on the subject site including trees located on the subject lands that will be impacted by development and any trees within 6 meters of the property line on adjacent properties (including trees with a tree canopy that crosses the shared property line that may be impacted by the proposed development). This includes the physical injury to the trunk, crown and roots of a

tree, the impacts of construction related traffic, material storage, grading which extends 6 meters beyond the limit of site disturbance.

- All trees must be identified on site using numbered metal tags affixed with aluminum nails.
- The report should reference Federal and Provincial Regulations such as the Endangered Species Act and the Migratory Birds Convention Act. or other relevant policy or legislation.
- Trees should not be assessed as groups or compartments unless deemed Woodlands, as agreed to by the City's Urban Forestry Staff. Double or multi stem trees will be recorded as one tree by measuring the root flare of all stems.
- The details for each tree should include the tree Species Variety/Cultivar Name in both common and scientific forms. The extent of the crown (drip line) and or the extent of the Tree Protection Zone (TPZ) in meters, Ownership (example private, neighbor, city, shared), Physiological condition, Structural condition, and (ratings to be used Good, Fair, Poor, and Dead), Retain or Remove, significant structural or physiological defects, and any relevant comments.
- Include on the topographic survey the current elevation at the base of each tree and the proposed grade in brackets afterwards, conceptual site plan layout, property lines, existing structures and/or features, together with trees to be removed and retained and tree protection zones.
- The plan should show the existing trees on site. Trees to be preserved and protected shall be illustrated with solid lines showing the tree canopy/drip line. Trees to be removed will be illustrated with a X. Plan should be prepared in black and white using line types and weights and clear symbology shown in a comprehensive legend.
- The plan should also include details for tree preservation measures including fencing and signage which should be in conformance with City of Peterborough Specifications CPD 801.05 and CPD 801.06 unless otherwise permitted by the City. All existing trees, which are to remain, shall be fully protected with staked/anchored fencing, erected a minimum 1.0 metres beyond the drip line or at the discretion of City staff.
- Where Woodlands may be impacted by development the report must be signed by a Registered Professional Forester. A comprehensive Woodlot Inventory must include an inventory of all trees and tree regeneration on the subject site and delineated as compartments or distinct areas. A sampling procedure may be used to estimate the tree inventory within each of the following DBH classes (5 – 10cm, 11 – 20cm, > 20cm) in the area of interest. A fixed area plot sampling procedure is recommended which samples at least 5% of the area of interest. The plots must be located in areas which are representative of the vegetation communities and their locations illustrated on a map. Internal undeveloped openings 20 metres or less in width are to be included in the calculation of woodland area. Internal undeveloped openings more than 20 metres wide but less than 0.2 hectares in area would be included in the calculated woodland area. Include on the Plan the perimeter of the drip line of the Woodland area. Identify and label any retained Woodland area as a separate polygon from any proposed removed Woodland area. All trees of any tree species and condition

located in the overstory or understory including regeneration are included in the assessment of the number of trees per hectare when confirming “Woodlands” under Section 1 Definitions of the Forestry Act.

- The City will require a three for one replacement ratio for each tree removed on a development site. Where it has been determined that compensation tree planting cannot be accommodated on the lands due to physical space limitations or restrictions the Applicant/Owner will be required to pay fees to compensate for the loss of trees on the subject lands. All funds will then be applied to the purchase and planting of trees on municipal land.
- For trees located outside of landscaped settings, such as Woodlands, trees are valued based on the cost to replace them with the same species using nursery stock sizes and quantities listed in Schedule B of the Woodland Conservation Bylaw 17-121. This is based on the average installed cost and is updated annually to reflect the average industry cost to replant Trees.

D.2.4.H Sediment and Erosion Control Plan

The Sediment and Erosion Control Plans should indicate all proposed erosion control measures including details and timing of installation, inspection, maintenance and removal. The Sediment and Erosion Control Plans are typically prepared in conjunction with the Lot Grading Plans and Stormwater Management Reports. Temporary stockpiling areas must be noted on the plan. The design of the controls shall be in accordance with the 2019 Toronto and Region Conservation Authority Erosion and Sediment Control Guide for Urban Construction.

D.2.4.I Stormwater Management Pond Plan

The stormwater management Pond Plan should provide enough information in both plan and profile to properly construct the approved proposed stormwater management basin. Horizontal scale shall be a standard even value. Stormwater Management Pond drawings should include the following:

- Location, size, grading, and berming for the proposed facility. Maximum allowable slopes are 3:1 and slopes within 3 horizontal metres of the permanent pool level should be 5:1 maximum with 7:1 preferred.
- Permanent pool, extended detention, 5 and 100 year ponding levels as well as regulatory floodplain elevations (where applicable) should be indicated.
- Seasonally high groundwater table levels.
- Details and elevations of inlets and outlets including overflows must be provided. Pipe inlets should be above the 5 year level and pond outlets should be outside of the regulatory floodplain and at the very least above the 100 year level. Valve operated gravity permanent pool drainage is preferred by the City to facilitate maintenance.
- The proposed berm widths and berm compaction and any water liner requirements should be noted.

- Proposed maintenance access roads, easements, pipe, valve and overland outfall details.
- Sediment Drying Areas.
- Vegetative cover and any proposed wet pond plantings and vegetative landscaping.
- Proposed walkways, multi-use trails, benches, gates, bollards associated with the SWM pond.
- Adequate buffer from any pond infrastructure to a property line.
- Any fencing requirements requested by City staff. Typical fencing shall be 1.5m high commercial grade black vinyl coated chain link fence.

D.2.4.J Landscape Plan

- The Landscape Plan (or Tree Planting Plan) shall be drawn at a scale of 1:500 and should indicate location, species and specifications of the proposed boulevard trees, parkland plantings and any landscape areas for the subdivision including turf grass (applicably labeled as sod or seed), fencing, benches, shade structures, hardscape landscape features, surface materials, play places, trails, sports fields, wayfinding signage, transit stop amenities, bike racks and waste/recycling bins.
- Traffic signs, light poles, and surface utility features should also be provided on the Landscape Plans.
- The Landscape Plan shall be prepared by a Landscape Architect in good standing with the Ontario Association of Landscape Architects.
- Landscape and tree specifications, locations, and spacing shall be in conformance with City of Peterborough Specifications CP 801.01, CP 801.02, CPD 801.01, CPD 801.02, CPD 801.03 and CP 801.04. The selection of trees shall conform to City of Peterborough Specification 801.02 which outlines a recommended list of species which should be conformed to unless permitted by the City. Desired biodiversity targets include a maximum of 10% of the same species, maximum of 20% of the same genera, maximum 30% of the same family.

D.2.4.K Composite Utility Plan

- The Composite Utility Plan shall be drawn at a scale of 1:500 and shall detail and locate all underground electrical, CATV, Enbridge Gas, and Bell Canada servicing including trenching details, road crossing, street lights, Bell and CATV pedestals, transformers and other street ‘furniture’ such as hydrants and proposed Canada Post box locations.
- The final composite utility plan shall be signed by all utilities including Hydro One whom have their own standards for Composite Utility Plans.
- Building envelopes
- Road crossing details
- Driveway location and widths, sidewalks/multi-use trails and curb ramps. Driveways should be offset a minimum of 1.0m from transformer pads.

- Boulevard Trees and driveways should be shown on these plans.
- Specifications and locations for underground ducts for street lighting. (50mm PVC rigid ducting typically required).
- Traffic signs

D.2.4.L Street Lighting Photometrics Plan

- The Street Lighting Photometrics Plan shall illustrate the lighting levels (metric units) on all proposed streets within the subdivision at a maximum grid spacing of 2.5 metres.
- The drawings should clearly demonstrate that the lighting levels meet TAC Guide for the Design of Roadway Lighting Standards or approved equivalent.
- The design approach (i.e. Luminance or Illuminance) should be stated on the drawing as well as Average Luminance (or Illuminance) and Uniformity Ratios for all streets.
- The assumed streetlight luminaires and pole type and height should be consistent with the electrical drawings and Section C.2.3 of these standards. Pole locations should be consistent with the Composite Utility Plans and approved road cross-sections.
- A signed and sealed covering letter or report in support of the design should accompany the plans.
- The City may also request lighting calculations be provided for sidewalks, multi-use trails, walkways, exterior passenger loading zones, and off-street parking lots on City owned land.

D.2.4.M Standards Drawing

- The standards page should illustrate all specifications, drawing notes, OPSD numbers, bedding details, right of way cross-sections including pavement and sub-base design, and any other non-standard details not shown on other plans.
- The general lot grading configuration types should be illustrated on the Standards page if they are not otherwise shown on the Lot Grading Plans.

D 2.5 Subdivision Stormwater Management Criteria

All subdivision proposals within the City of Peterborough require stormwater management reports to be submitted as part of the integral design of the proposed development. Stormwater management designs should contain runoff quantity, runoff quality, water balance, low impact development, erosion control (watershed), and construction erosion and sediment control components. Alternatively, the water balance calculations/design (where completed) may be contained within the subdivision's hydrogeological study. We do expect that the City's ongoing Watershed Plan will be completed and adopted in the near future at which time, will provide further/updated guidance and design targets for stormwater management design criteria, upon which will lead to further updates to these stormwater management design standards contained herein.

The City of Peterborough recognizes the Ministry of the Environment's Stormwater Management Planning and Design Manual (March 2003), the Credit Valley Conservation / Toronto and Region Conservation Authority Low Impact Development Stormwater Management Planning and Design Guide (2010), the February 2015 Stormwater Management Interpretation Bulletin, the Toronto and Region Conservation Authority Erosion and Sediment Control Guide for Urban Construction (2019) and Appendix A of the City's Stormwater Management System Environmental Compliance Approval (August 2022) as the standards by-which all subdivision development shall adhere for stormwater management control. Stormwater management reports for subdivisions also require the approval from the Otonabee Region Conservation Authority.

D.2.5.A Stormwater Management Quantity Control

Stormwater quantity controls for subdivisions shall be implemented for the 2 to 100 year design events. Additionally, development within the Bear's Creek watershed shall also provide all stormwater quantity control for the Regional (Timmins) rainfall event.

Rainfall hyetographs shall be derived from the 2006 Peterborough Airport IDF rainfall data.

Designers of subdivision stormwater management systems within the City of Peterborough should consider the following design criteria:

- Peak regulated post-development flow must not exceed pre-development conditions.
- The 6 hour (SCS Type II hyetograph as outlined in the Appendix) should be modeled for the 2 to 100 year rainfall events.
- 100 year frequency - 12 and 24 hour duration Chicago or SCS Type II rainfall events should also be assessed to confirm the volumetric and outlet performance of stormwater quantity facilities. Chicago storms implementing IDF curve parameters should be modified to ensure that total rainfall depths are at least 98.4mm and 108.7mm respectively for the 12 and 24 hour durations. SCS Type II 12 and 24 hour hyetographs and IDF curve parameters are also attached in the Appendix for the 100 year event.
- 1 hour – 100 year duration rainfall events shall also be used for urban catchment peak flow determination in the absence of attenuation. The total rainfall depths should not be lower than the tabulated results from the 2006 Peterborough Airport IDF data. If IDF curve fitting parameters are implemented, the 100 year valuations from Table B.1.7.1 shall be used for rainfall events of less than 3 hours duration.
- The subdivision's geotechnical report should be referred to in the selection of the pervious area modeling parameters. In the absence of any site specific soils information, assume SCS Hydrological Soils Group 'B' conditions for pervious areas. Pre and post-development pervious areas can be modeled with applicable runoff co-efficients, runoff Curve Numbers or Horton infiltration values may also

be used. In no case should the pre-development pervious runoff co-efficient be greater than the post-development value.

- Pervious initial abstraction should range from 2.5mm-5.0mm.
- Impervious areas for both pre and post-development conditions should include all impervious surfaces including roofs, roads, driveways, sidewalk/multi-use trails etc. All impervious surfaces should be considered directly connected unless draining to significant pervious areas (e.g. roof drainage to the rear yards) prior to outletting onto the roads or into the storm sewer systems. In all cases, the assumed modeled impervious ratios should reflect the intensity of the proposed subdivision including prescribed building lot coverages.
- Watershed areas generally should include the site area and any external areas draining into the subject property including future developed lands. Drawings clearly showing the pre and post-development catchment areas drawn to an even scale must be submitted as part of the report.
- Temporary post-development peak attenuation runoff storage to meet pre-development peak flows is typically provided in the form of a stormwater management pond, often integrated with a stormwater quality wet pond. All reports should include the proposed basin's elevation-discharge-storage relationship.
- All stormwater management facilities shall outlet to an adequate receiving watercourse or storm sewer. To ensure assumed pond performance, the outlet should be above the receiving watercourse's 100 year flood level, with an outlet above the Regional flood level preferred.
- In the case of wet ponds, a maximum of 5:1 slopes (7:1 preferred) are required within 0.5 vertical metres of the permanent pool level. Maximum of 3:1 slopes are required elsewhere. Fencing of the wet pond having reasonable slopes is not typically required.
- 5 and 100 year maximum facility ponding levels should be noted on the plans.
- Stormwater management facility storm sewer inlets typically must be placed above the maximum 5 year ponded level in the pond, unless site conditions preclude this preferred level.
- Headwalls should be implemented at all pipe inlets and outlets.
- The 100 year overland flow from the adjacent road or channel draining into the pond must be hydraulically calculated (using HEC-2 or HEC-RAS for example) and the extent and elevation of the flow path must be provided. Specific detailed grading details of the curb, sidewalk/multi-use trails and boulevard should be shown on the plans. All runoff must remain within the road right of way or SWM block. Lot grading of adjacent properties will have to be verified and adjusted to ensure that 100 year flows do not encroach onto privately owned property.
- Significant road sags and worst case right-of-way sections must be hydraulically modeled to ensure 100 year spill elevations do not encroach onto privately owned properties, nor exceed 0.30m as measured from the centreline of the road. Adjacent lot grading may have to be adjusted to suit.
- The report should contain all relevant sample calculations and pre and post-development computer model output.

D.2.5.B Stormwater Management Quality Control

Stormwater quality control is required both during (temporary) and after (permanent) construction.

Temporary sediment and erosion stormwater quality controls are to be implemented during construction to ensure that downstream water quality effects from the exposed soils are minimized. A separate Erosion and Sediment Control Plan shall be prepared as outlined in Section D.2.3.H. Temporary sediment and erosion controls shall be designed in accordance with the 2019 TRCA Erosion and Sediment Control Guide For Urban Construction.

Permanent water quality controls following the guidelines of the March 2003 MOE Stormwater Management Planning and Design Manual, the February 2015 Interpretation Bulletin, and Appendix A of the August 2022 City of Peterborough Stormwater Management System must be provided as part of the submitted stormwater management report.

While end of pipe wet ponds were traditionally the most implemented water quality control measures in the past, the City of Peterborough now encourages the maintenance of existing hydrological patterns and addressing water quality controls as close as possible to where the precipitation falls to meet water quality control. Low Impact Development (LID) practices noted in the 2010 CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide will be reviewed with greater weight for due consideration as part of the ‘treatment train’ approach to water quality. LID requirements are noted in Section D.2.5.D. The City’s Stormwater Management System Environmental Compliance Approval requires ‘control’ of the 90^{th} percentile rainfall event and if conventional methods are necessary, then suspended solids control is to be implemented.

Typically, ‘Enhanced’ (80% TSS removal) is the water quality control target to be achieved for end of pipe solutions, however, ‘Normal’ (70% TSS removal) may be considered acceptable on a case by case basis with sufficient justification.

Traditionally, the most common form of end of pipe permanent water quality control for subdivisions is the Wet Pond, integrated with the stormwater quantity control noted above. Due to inherent high long term maintenance and clean out costs associated with maintaining MOECC (or City SWM System) ECA compliance, wet ponds will only be accepted for catchment areas greater than 5 hectares and alternative means of achieving water quality control are encouraged to be investigated such as the use of a dry pond with an oil grit separator(s) inlet.

Where wet ponds are proposed, the subdivision hydrogeology report should include boreholes within the location of the stormwater management report to provide information on existing soil types and groundwater levels at this location to ensure no interaction between the permanent pool and groundwater. To maintain the

permanent pool, a clay liner (or adequate equivalent) is typically proposed. In the event that native or alternative material is proposed, documentation from a geo-technical engineer as to the hydraulic conductivity of the material in relation to the retention of a permanent pool must be provided. Collars should be placed around outlet pipes to prevent seepage along the perimeter of the pipes.

Wet ponds proposed within the Byersville Creek watershed may not be accepted by the City arising out of concerns in relation to thermal effects on the cold water stream. Any proposed wet pond within the catchment must include designs to ensure thermal impacts on the watercourse will be minimal.

While reduced lot grading is an acceptable form of lot level control by the Ministry of Environment, the City of Peterborough' s Lot Grading standards conflict with reduced grading. Reduced lot grading will only be approved on a case by case basis in limited areas.

Proposed oil – grit separator manholes shall be tested and certified to meet the requirements of the Canadian ETV Program for OGS Performance Testing Protocol for Canada.

D.2.5.C Water Balance Design

In the interim until such time as the City's Watershed Plan is completed and adopted, the City of Peterborough requires a water balance analysis for subdivision applications in order to estimate impacts on the hydrologic cycle in terms of infiltration and runoff if the 90th percentile rainfall event is not 'controlled' as defined in Appendix A of the City's Stormwater Management System ECA.

Methodologies such as Thornwaite and Mather based upon location, monthly rainfall and temperature records, vegetation, and soils may be used to complete the water balance in lieu of detailed groundwater modeling.

For consistency in applications, an annual total precipitation depth of 855mm (Based upon 1981 - 2010 Peterborough Airport Climatic Data) an adjusted potential evapo-transpiration of 570mm, and total water surplus of 285mm may be used. Infiltration factors can be determined from the sum of Topography, Soils and Cover values tabulated in Table 2 of the 1995 MOEE Hydrogeological Technical Information Requirements for Land Development Application or Table 3.1 of the MOEE Stormwater Management Planning and Design Manual.

A 10 to 20% precipitation loss due to evaporation may be assumed on impervious surfaces. Assumptions for quantity of imperviousness should be related to the specific subdivision application under full build out conditions.

Where there is more than one drainage outlet (stream catchment for example), the calculations must be subdivided for pre and post-development conditions for each

basin and adjusted for changes in drainage patterns, slopes, soil, vegetation, and imperviousness arising from the proposed development.

D.2.5.D Low Impact Development (LID) Design

Low Impact Development (LID) shall be required as part of the stormwater management system for subdivision applications. The 2010 CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide provides approaches to LID design and should be referred to in conjunction with proposed development applications.

We are anticipating that the MECP will be releasing its LID stormwater management guidance document (currently in Draft form) in the very near future. The August 2022 City of Peterborough Stormwater Management System Environmental Compliance Approval design criteria (attached in the Appendix) includes aspects of the LID guidance document.

While the City's Stormwater Management System ECA design criteria does not include a category titled 'LID', the Water Balance and Water Quality components refer to a 'control' of the 90th percentile rainfall event. Said 'control' refers to a hierarchical design approach as follows where each level is provided to the feasible limit prior to proceeding to the next level:

1. Retention (infiltration, reuse, or evapotranspiration)
2. LID Filtration
3. Conventional Stormwater Management

The 90th percentile rainfall event for the City is defined as having a depth of 27mm.

It should be noted that the City is in the process of completing it's Watershed Plan which will provide further refinement and guidance of its Stormwater Management ECA design and performance criteria. In the interim prior to its completion, we are providing interim standards which should be implemented as part of engineering submission of subdivision applications. Due to the inherent need for the decentralized nature of LID implementation over large areas, it would likely require the use of privately owned lands within the subdivision. LID within the road right of ways, parkland blocks, open space blocks, and SWM pond blocks will have to be considered as well as components of an overall complete design.

Where 90th percentile rainfall event 'control' is proposed on privately owned single family residential lots as a part of the overall SWM solution, we would suggest that infiltration of all runoff arising from the first 27mm of rainfall within the lots be implemented as follows:

- Rear draining lots; LID catchment shall consist of side and rear yards draining to the back of the property and at least the rear half of the total roof area.

This may be best achieved with an infiltration feature along the rear property line.

- Front draining lots; LID catchment of ¾ of roof area directly into a soakaway pit on the lot, typically in the rear yard. The downspouts shall have overflow protection at grade in the event, the soakaway pit is full.

The City will allow some increases in the post-development scenario initial abstraction and/or depression storage parameters as part of the stormwater quantity control modeling to account for the proposed LID features, with the inclusion of appropriate safety factors. It should be noted that the City's SWM System ECA require the inclusion of easement access to the privately owned features to ensure their continual operation

For more centralized stormwater retention features, 'control' to 90th percentile rainfall events (27mm) shall be in accordance with the 2010 CVC TRCA Low Impact Development Stormwater Management Planning and Design Guide.

D.3 Servicing, Building Permits and City Assumption of Subdivisions

After the subdivision engineering drawings are approved, the roads and services are installed followed by the construction of the buildings. The developer's obligations in relation to the subdivision construction, interim maintenance, and prior to subsequent assumption by the City of Peterborough are detailed in each individual Subdivision Agreement between the developer and the City. The Subdivider's Engineer is expected to provide full time resident construction supervision during the servicing of the project and to ensure compliance with all engineering construction drawings and reports.

D.3.1 Building Permit Availability

In general, building permits for subdivisions will not be issued until such time as the City issues an Interim Acceptance Certificate, however in most subdivision agreements, the City will allow up to 10% of the building lots to commence construction of unoccupied Model Homes prior to Interim Acceptance with a reduced set of requirements to facilitate marketing of the individual developments. Conditions for issuance of building permits for Model Homes and Interim Acceptance are as follows:

D.3.1.A Model Homes

The conditions on which the City generally will issue permits for the construction of unoccupied Model Homes are as follows:

- The Subdivider shall have constructed a minimum 6.1 metre access road from an open public road to the lot upon which the model home is to be constructed. The access shall be paved to the base course asphalt stage with full curb and gutter.

- The Subdivider shall construct a gravel turning circle, or approved equivalent, at the end of any such access road, in accordance with the Building Code Act.
- An in-service fire hydrant shall be located within 90 metres of the model house, based on vehicular travel distance.
- At the time of commencement of construction of a model house, no portion of a model house shall be constructed within 15.0 metres of any other building with an unfinished exterior, other than another model house.
- Water services shall not be turned on.
- The Subdivider shall maintain, at its sole cost, the access road and turning circle, including snow ploughing, until issuance of the Interim Acceptance Certificate for the fronting public street.
- The Subdivider covenants and agrees that no model house shall be occupied for residential purposes prior to the issuance of the Interim Acceptance Certificate for the fronting public street.

Typically, the City requires a letter from the Subdivider's Engineer indicating the above conditions are met, prior to the issuance of Model Home Permits.

Model homes used as sales offices shall have a barrier free path of travel to the building entrance.

D.3.1.B Interim Acceptance

Building Permits are typically available after an Interim Acceptance Certificate is issued by the City after the fulfilment of the following requirements, and a specifically worded written certification from the Subdivider's engineer individually detailing how they have been completed:

- Storm sewer, sanitary sewer, and water distribution systems have been completed and the sewers connected to outlets all to the satisfaction of the City Engineer.
- Interim 'As Constructed' road Plan and Profile drawings showing 'As Constructed' locations, inverts, lengths and slopes of all storm and sanitary sewers and structures, sewer lot service locations redrawn as measured to the downstream manhole and invert elevations and locations at the property line. The City requires that both the plan and profile components of the drawings be significantly re-drawn to accurately reflect the 'As Constructed' conditions. The submitted 'As Constructed' drawings must be signed and sealed by a professional engineer. Once the 'As Constructed' drawings are reviewed and approved by the City of Peterborough, they shall be provided on a CD or DVD in digital form in both PDF format and AutoCAD (DWG) or MicroStation (DGN) format in the proper UTM coordinate system.
- 'As Constructed' storm and sanitary sewer design calculations/charts have been provided to the City Engineer based upon the 'As Constructed' pipe slopes. Design flows arising out of minor changes to the manhole and catchbasin

locations need not be altered from the approved design sheets, but pipe flow capacities based on 'As Constructed' slopes should be modified.

- Leakage and deflection testing of the sanitary and storm sewers have been certified and submitted by the Subdivider's Engineer in accordance with the current edition of the City's Unit Price Contract Supplemental Information Package (and MECP Design Criteria as well as City Engineering Design Standards) and approved by the City Engineer. Notification must be given to the City of the leakage and deflection testing 48 hours in advance giving the City the opportunity to be present during the testing.
- The full width of the road allowances have been rough graded, the granular base, all manhole and catchbasin adjustments to base course level, full asphalt base and full curb and gutter have been completed, including temporary turning circles at the termination of road allowances where necessary, all trenched road crossings have been completed and restored, and the streets have been connected to an existing assumed street, and all emergency accesses have been completed to base asphalt. There should be unencumbered access for any emergency vehicles to all lots within the subdivision.
- An overall composite utility plan, signed and approved by all utility companies, showing the various utility services has been completed if not previously submitted.
- An 'As Constructed' survey of the stormwater management facility has been completed and submitted to the City and that the water quality design parameters and stage-storage-discharge are in conformance with the approved design.
- The lots have been rough graded to within 750 mm. of finished grade in conformity with the general lot grading plan and further specific elements of the plan have been established, such as rear yard swales common to and crossing through several lots, as deemed essential by the City Engineer so that subsequent builders may conform readily to the plan.
- The Subdivider has erected an adequate and legible sign at or near the subdivision entrance clearly depicting the land use designations within the Subdivision and on the immediately abutting lands and the arterial and collector streets as recited in the Official Plan. Temporary sedimentation pond lots and Stormwater Management facilities shall also be clearly shown and labelled on the signs. The size, content and location of each sign shall be approved by the City Engineer in advance of erection.
- The Subdivider has erected temporary street name signs and traffic control signs at all intersections to the satisfaction of the City Engineer. The street name signs shall be located and orientated properly for both streets and shall be labelled on both sides.
- The Subdivider has marked the municipal address and lot number on the water service markers at each lot or block.
- A Capital Asset Table indicating values for the infrastructure placed to date as well as any proposed infrastructure to be placed prior to final acceptance.

In addition to the above, the following, largely involving the Subdivider's Engineer, is also required prior to Interim Acceptance:

- The Subdivider has made arrangements to maintain the Public Services and emergency routes to the satisfaction of the City Engineer. Satisfactory arrangements shall include an undertaking by the Subdivider's Engineer that the Public Services, including stormwater management and sedimentation and erosion control facilities, will be inspected on a weekly basis and/or after rainfall events and that deficiencies will be immediately rectified to the satisfaction of the City Engineer and that contact information for the contractor for subdivision maintenance is provided.
- The Subdivider has posted an irrevocable Letter of Credit to secure completion of its remaining obligations pursuant to the Subdivision Agreement to the satisfaction of the City Engineer, which typically includes Lot Grading Certification and completion of Surface Works. Additionally, all of the outstanding invoices for work performed by the City pursuant to the Subdivision Agreement must be paid in full.
- A written acknowledgement from the City of Peterborough Fire Chief or their designate has been received to the effect that the Subdivider has made satisfactory arrangements for the sequence of building construction so as to create fire breaks during the period of construction and further that adequate access is available for Fire Department vehicles. The Subdivider's Engineer typically provides a Fire Break Plan for submission to the City's Fire Department to assist in this process.
- A written acknowledgement from Peterborough Utilities Services Inc. has been received to the effect that the water distribution system, including the fire hydrants, is complete and operable.
- The City Engineer is satisfied that the Subdivider is in compliance with the approved stormwater management and sedimentation and erosion control measures. The Subdivider's Engineer is typically required to provide a certification confirming that the stormwater management system will not cause any adverse impacts, in terms of water quantity and quality, downstream of the Subdivision.

D.3.2 Stormwater Management Pond Performance Monitoring

Typical Subdivision Agreements will have wording requiring the the Subdivider to perform quality and quantity performance monitoring with respect to all stormwater management facilities and infrastructure. Such monitoring shall be undertaken and completed to the satisfaction of the City Engineer and all equipment used for monitoring shall be considered stormwater management infrastructure and given to the City through the assumption process. Such monitoring shall be performed by the Subdivider during construction of all public services and until all the public services, including the stormwater management facilities and infrastructure, are assumed by the City.

Where in the opinion of the City Engineer, the results of the quality and/or quantity performance monitoring, whether performed by the Subdivider or the City,

substantiate the need for remedial measures at any time prior to the assumption of the facility, the Subdivider shall carry out any remedial measures identified as necessary. Generally, the public services shall not be assumed until the Subdivider has completed the remedial measures demonstrating adequate performance to the satisfaction of the City Engineer.

The specific requirements of the pond's performance monitoring are stated in the Subdivision Agreement, but typically include the following:

- The Subdivider's Engineer shall monitor the existing forebay sediment levels on a monthly basis (April 1 to November 30) and main cell sediment levels on an annual basis until assumption of the subdivision by the City. Sediments shall be removed from the forebay on an annual basis, unless the Subdivider's Engineer demonstrates that the accumulated sediment volume is less than 25% of the forebay permanent pool volume. To estimate the volume of forebay sediments, at least five uniformly distributed measurements of sediment depth shall be taken within the forebay. Sediments shall be removed from the main cell when the accumulated sediment volume is greater than 25% of the main cell permanent pool volume. The Subdivider's Engineer shall estimate the volume of main cell sediments using at least five measurements of sediment depth along a mid section along the length of the facility. A rod with flat bottom plate shall be used to estimate the sediment levels in a wet condition.
- A permanent metric staff gauge shall be installed adjacent to the storm sewer inlet headwall, so that the zero reading is at the permanent pool elevation. Outlet and inlet structures shall be inspected on a monthly basis to ensure they are not blocked due to sediments or debris. The Subdivider's Engineer shall complete the monthly inspection reports and provide the reports at the request of the City along with the instructions to the site contractor for any remedial work. This inspection shall be undertaken in dry weather conditions, at least 72 hours after any significant rainfall event. The monthly reports shall include a staff gauge reading to determine any fluctuations in the permanent pool elevation.
- Prior to final assumption of this subdivision phase, performance monitoring shall be undertaken to verify that the facility is functioning in accordance with the MECP (or City Stormwater Management System) Environmental Compliance Approval (ECA) and/or the approved engineering plans. Performance monitoring shall commence after at least 50% of the dwellings have been constructed within the contributing watershed. The facility shall be monitored for a minimum of two seasons immediately prior to final assumption. One season is defined as continuous water level monitoring within the facility from early May 1 to October 31. Water levels shall be measured using a data logger and pressure transducer. The data logger shall record water levels every 15 minutes and average hourly levels. The elevation of the transducer shall be referenced to a geodetic benchmark. The monitoring equipment shall be installed immediately after substantial completion of the facility.
- After each season, the data shall be reviewed in conjunction with rainfall data throughout the City. The rainfall and water level data for 5 to 8 significant events

shall be processed in a graphical format to display the fluctuation in water levels over time. The resulting data shall be analyzed by the Subdivider's Engineer to assess the following in comparison to the approved engineering design:
• permanent pool or normal water level;
• fluctuation in water levels in response to rainfall events;
• facility drain down time after erosion control events.

- The expected design water levels for the permanent pool, erosion control, 2 year, and 5 year events shall be included on the graphs for comparison to the actual levels. The results of the analysis and a report by the Subdivider's Engineer shall be submitted to the City including any recommendations for remedial works to be undertaken on the facility to ensure proper performance with respect to erosion and quantity control. If any remedial works are undertaken after the second season of monitoring, additional seasonal monitoring will be required until the facility is performing to the satisfaction of the City. The City reserves the right to require additional monitoring until the facility is performing satisfactorily.
- On a yearly basis, at least three (3) sets of water samples shall be taken upstream, downstream and within the facility to assess the Total Suspended Solid (TSS) concentrations. The samples shall be taken within 12 hours after a significant rainfall event. The samples shall be submitted to an accredited laboratory for analysis. The laboratory results for the TSS concentrations and a report by the Subdivider's Engineer shall be submitted to the City to confirm that the facility is not releasing excessive sediment levels in keeping with the MOE ECA. Samples shall be taken for the period from substantial completion to final assumption of the facility.
- During the construction period, the Subdivider's Engineer is required to inspect the erosion and sedimentation control facilities on a weekly basis, or forthwith following rainfall events of 13 millimetres or greater, and immediately rectify any deficiencies within 24 hours to the satisfaction of the City Engineer. Where overland drainage occurs, the erosion and sediment control works shall be inspected and maintained to ensure their structural integrity. Sediment build-up attributed to this subdivision should be removed from the downstream storm sewer system as directed by the City Engineer.
- Prior to final assumption, the facility shall be drained and all sediments shall be removed from the forebay and main cell. A second topographic survey shall be completed after all sediment removal. This topographic survey shall be submitted to the City, along with a comparative analysis to the Environmental Compliance Approval (ECA) issued by the MOE. The results should verify that all sediments have been removed from the facility.

D.3.3. Subdivision Assumption

The mechanism for subdivision assumption by the City is detailed in the Subdivision Agreement. The Subdivider, typically through their Engineer, may request a Final Acceptance Certificate upon completion of the following:

- The public services outlined in the Subdivision Agreement have been completed in a satisfactory manner based on an inspection by the City and have been fully paid for. In general, the surface asphalt will not be permitted to be placed until after a minimum of one full winter season after the completion of binder asphalt and a minimum of 75% of the buildings are completed.
- The Subdivider has provided a certificate of Current Value, from the Subdivider's Engineer, establishing the value of the Public Services being assumed by the City upon expiry of the Warranty Period.
- The Subdivider has provided the City Engineer with one full set of final "As Constructed" drawings showing the Public Services including completed surface asphalt and sidewalk/multi-use trails. These drawings must be provided in a digital form on a CD or DVD in PDF format and AutoCAD (DWG) or MicroStation (DGN) format in the proper UTM coordinate system. The "As Constructed" drawing set should include the final "As Constructed" Stormwater Management drawing set arising out of a recent (within 90 days) detailed survey of the pond undertaken soon after the pond has been drained and all sediment removed from both the forebay and the main cell.
- Within 3 months prior to final lift of surface course asphalt, the Subdivider has performed full length closed circuit television (CCTV) inspections and sewer ratings of the sanitary and storm sewers in accordance with the City's Unit Price Contract Supplemental Information Package (current edition). All defects shall be reported by the Subdivider's Engineer to the City and recommended repairs and shall be approved by the City Engineer. Upon completion of the required repairs, a final set of CCTV inspection videos and ratings shall be submitted for approval along with a certification from the Subdivider's Engineer that the videos were reviewed and all sewers and structures appear to be in accordance with City standards noted above. The City shall be given 3 weeks to review and approve the final video submission prior to placement of surface asphalt.
- The Subdivider has provided written confirmation from an Ontario Land Surveyor that all standard iron bars within the Subdivision, as shown on the registered plan, have been located, made visible, are flush to grade and, if necessary, replaced.
- Upon the City Engineer's provision to the Subdivider a certificate indicating that the Public Services have been completed to the satisfaction of City Engineer (herein referred to as the "Final Acceptance Certificate"), the Subdivider shall continue to be solely responsible for the maintenance of the Public Services in a state of good repair for twelve (12) months following the date of the Final Acceptance Certificate (herein referred to as the Warranty Period) and shall promptly remedy any defects in the work appearing within such period. The Warranty Period shall not expire until the final inspection has been arranged by the Subdivider and carried out by the City, and any defects identified by the final inspection have been repaired by the Subdivider. In the latter part of the Warranty Period, City staff will prepare a report to City Council in relation to the acceptance of the subdivision as Council Approval will be required prior to assumption. Within fourteen (14) days of the final inspection, or the repair of any defects identified by the final inspection performance security shall be returned to

the Subdivider and the City shall acknowledge in writing that the Public Services have been fully assumed by the City.

E. Residential Site Plans and Lot Grading

E.1 General

These Residential Lot Grading and Site Plan standards are provided as an update to and are to be read in conjunction with the April 2001 City of Peterborough Lot Grading and Drainage Policies and Guidelines. A Site and Grading Plan is required as part of the building permit process for every new residence to be built within the City of Peterborough to ensure municipal by law compliance and proper drainage design.

Most new houses within the City are built within plans of subdivisions that have been designed and pre-graded to accommodate new residences within the lots to facilitate their construction. The general grading designs within subdivisions are typically shown on the general subdivision Lot Grading Plans. Infill lots and properties created by severance, however, do not have the benefit of engineered grading design and will be treated separately within these standards.

E.2 General Subdivision Lot Grading Plans

The general Lot Grading Plans are prepared by the developer as part of the set of engineering drawings for the subdivision. Typically, these plans show lot corner, lot line high point, and approximate building elevations as well as general drainage patterns. The required information on general subdivision Lot Grading Plans is outlined in Section D.2.3.C.

E.3 Detailed Individual Residential Lot Grading and Site Plan Requirements

The detailed individual house Site and Grading Plans are typically prepared by a professional engineer hired by the builder in order to reflect the specific house style to be placed on the specific building lot. The Lot Grading and Site Plan is prepared to demonstrate both City zoning by-law conformance and municipal lot grading standards. Typically, the plans are prepared with one proposed building per page, on letter (8.5”x11”) or legal (8.5”x14”) size sheets of paper. The required information on the drawings include the following items divided into the two components on the plan:

Zoning By-Law:

- The property boundary properly drawn and dimensioned.
- North arrow and scale (typically 1:200 or 1:250).
- Street name and Lot number and/or municipal address and Subdivision Name.
- Hanging property lines and adjoining lot numbers.
- Building dimensions and siting location including offset dimensions to all property lines.
- Driveway location and width. Driveway location must be consistent with that shown on approved subdivision plans and width must be in conformance with City by-laws.

- Demonstration of two parking stalls per lot, where required.
- Lot area, building footprint and lot coverage meeting by-law requirements.

Grading Design:

- The travelled street line(s) and sidewalk/multi-use trails (if applicable).
- Adjacent houses near side lot lines (if applicable).
- House entrance locations.
- Elevation Benchmark, typically geodetic and at same elevation datum as subdivision drawings
- Lot corner elevations (typically derived from Lot Grading Plan).
- House grades at all corners, garages, entrances, and at significant changes in grade.
- Proposed garage slab elevation and driveway slopes usually measured at the middle of the driveway from the garage slab to the front property line
- Any proposed window wells.
- All proposed swale inverts, slopes and drainage directions in the side and rear yards including any drainage breaks or significant gradient changes and, in the case of side yard swales, adjacent to the corner of the houses. All rear yard apron swales must be continuous and the high point of the swale must be indicated on the plan.
- High points and top and bottom of slopes.
- In the rare instance where foundation storm services do not exist, sump pump discharge points should be shown.
- The top of foundation, bottom of footings (including any lowered footings), and basement slab elevations.
- General drainage directions of all areas of the proposed lot.
- Finished floor level and number of risers at the entrance.
- Any patios, decks, platforms or verandahs proposed.
- Rear lot catchbasin top of grate elevations or drainage easements if they exist.
- General drainage patterns of adjoining lots where necessary.
- Any trees to be protected.
- Above ground utilities
- Any water quality control LID measures within the lot required by the subdivision's approval shall be detailed.
- "As Constructed" service locations.
- Walkways and retaining walls where applicable.

E.4 Lot Grading Design Parameters

A 0.6m strip of undisturbed ground shall be maintained along the boundaries of the subdivision where abutting lands are not owned by the subject developer. Existing grades must be maintained and disturbance of adjoining lands will not be permitted.

The minimum slope of driveways shall be 2% and the maximum slope from the garage to the front property line shall be 10% maximum as measured at the middle of the driveway. The driveway grades must be compatible with the proposed side yard swale elevations.

The maximum slopes of all surfaces (outside of walkways and driveways) shall be 3 : 1. All steeply sloped areas shall be identified on the plan. Where the difference in gradient cannot be achieved within a 3 : 1 slope, a retaining wall is required. Details of the wall should be provided. Where the height of the wall exceed 0.6m, a guard is required along the top of the wall.

Minimum surface slopes shall be 2.0%. 3.0% is preferred.

The minimum lot line and internal swale gradient shall be 2.0%. Slope and drainage direction must be shown for all swales. Front draining lots shall have a minimum slope of 3.0% from the rear lot line to the rear building envelope to allow for the rear yard apron swale.

The minimum swale depth shall be 0.15m and the maximum permissible depth is 0.50m. The maximum swale side slope is 3 : 1. The minimum swale depth must be maintained around the full perimeter of the building grade for front draining lots. Side yard swale inverts are typically placed on the property line.

The maximum allowable length of a rear yard swale without a catchbasin and storm drain is 90m. The maximum area contributing to the rear yard swale shall be 0.50 ha. The maximum flow in any side yard swale, and rear yard swales which discharge onto the road allowance is the lesser of:

- four (4) backyards or;
- 750 m^2.

The proposed building grades must be a minimum of 0.15 metres below the adjoining foundation height. A minimum frost cover of 1.25m must be maintained as measured from the building grade to the bottom of the footing. Adjust top of foundation wall details to accommodate barrier free access, where required by OBC. Provide a level area adjacent to entrance doorways, where required by OBC 3.8.3.4.(1).(c).

E.5 Infill Lot Grading Plans

Infill lot of records never developed or created by severance are properties typically located within established neighbourhoods with no pre-engineered grading design and thus require additional detail and attention in the grading design to ensure compatibility with surrounding lands. An assessment of existing conditions is essential in preparing a suitable design and thus a thorough topographic survey of the subject site will be required. Typical details on such a pre-engineered survey include the following:

- Benchmark elevation and location.

- Dimensions of property lines.
- Existing elevations along all property lines and corners.
- Abutting house locations and elevations (if possible).
- Abutting property drainage details.
- Elevations and locations of existing roads, curbs, sidewalk/multi-use trails and all boulevard features.
- Significant trees within and immediately adjacent to the subject property.
- The storm sewer system within the street line or any other adjoining drainage outlet.
- LID features required to meet Section D.2.5.D of these standards.

All new house construction shall be provided with foundation storm services (white SDR 28 – minimum 135mm diameter) connected to the storm sewer system, if an adequate storm sewer exists. Due to uncertainty of 100 year hydraulic grade elevations within the storm sewer system all foundation drainage should be sump pumped up to an elevation above grade (typically within the floor joists) before draining into the storm sewer system in order to prevent backwater from entering the basement.

If no adequate storm sewer system exists, then the sump drainage outlet location shall be provided on all plans. The sump location and lot grading shall be designed as to minimize impacts on adjoining properties.

All drawings shall be signed and sealed by a professional engineer licensed to practice in the Province of Ontario and require the information noted in Sections E.3 and E.4. Side yard swales may be required to be placed within the subject property to provide proper drainage and not adversely impact adjoining properties.

E.6 Building Permits, Approvals and Verification

E.6.1 Building Permit Requirements

Residential building permits (as they pertain to Site and Grading Plans) are generally issued in a two stage process as follows:

1. The residential Site and Grading Plan is prepared by the builder's engineer (or other design professional such an Ontario Land Surveyor or Architect) following the design standards outlined in Section E and in general conformity with the lot grading patterns established on the subdivision Lot Grading Plan for the particular house and lot in question. This plan is forwarded to the subdivision engineer for review and approval. The builder's engineer may also be the subdivision engineer.

2. The subdivision engineer reviews and, if acceptable, approves of the Site and Grading Plan for the particular lot. If revisions to the plan are requested, the plan is re-submitted to the subdivision engineer.

3. The approved Site and Grading Plan is then submitted to the City as part of the building permit application for review.

4. If approved, the first stage of the building permit is issued for the foundation. The construction within the first phase may include all foundation works and main floor to allow for back fill. No vertical lumber for wall construction is to occur until the second stage permit is issued.

5. The elevation of the ‘As Built’ top of foundation, the garage opening and any other significant openings (such as the basement floor level of a walkout house) must be measured by either the builder’s engineer or land surveyor. If all measured parts of the foundation are within a tolerance of +150mm to -50mm of the design elevations as noted on the approved Site and Grading Plan, then the ‘As Built’ foundation is considered to be in compliance with the approved drawings. A letter comparing proposed and ‘As Built’ foundation elevations shall be submitted to the city and, if approved by the City, the second stage permit will be issued allowing for the balance of house construction.

6. If the ‘As Built’ foundation measurements are outside of the acceptable range, a revised Site and Grading Plan, including possible foundation alterations, must be submitted to the subdivision engineer and the City for approval which accommodates the ‘As Built’ foundation conditions within these design standards in conjunction with the general subdivision Lot Grading Plan.

E.6.2. Lot Grading Certificates

Subdivision agreements within the City of Peterborough contain clauses requiring the Subdivider (through their engineer) to certify that each lot is graded in accordance with the approved Site and Grading Plan. Through the agreement, the subdivider is generally given one (1) year from the date of occupancy to provide the Lot Grading Certificate. The Lot Grading Certificate shall include the following:

a) An ‘As Built’ topographic survey of the site shall be provided indicating post sod ‘As Built’ elevations at key locations on the lot (generally in the location of the proposed elevations on the approved Site and Grading Plan), including lot corners, building grades, swale location and elevations, garage floor, localized high points, transition in swale slopes, etc. ‘As Built’ lot, driveway and swale slopes should be indicated as well.

b) The ‘As Built’ topographic survey shall be overlaid on the approved Site and Grading Plan and where there are differences between the proposed and ‘As Built’ elevations or slopes, the proposed values shall be stroked out and overlaid with the ‘As Built’ numbers.

c) Almost invariably, there will be some discrepancy between the approved and ‘As Built’ grading. The subdivision engineer shall provide a brief (signed and stamped) written certification for each lot attached to the ‘As Built’ survey specifically indicating that the ‘As Built’ conditions are in general conformance with, and meet

the intent of, the approved Site and Grading Plan. Where the final grades are considered more than slightly different than proposed, an explanation of why the 'As Built' grading should be accepted must be provided.

d) The City will review the submitted certificates for acceptability and may require revisions to the grading prior to acceptance.

The subdivision agreements will generally require that all Purchase and Sale Agreements contain wording that clearly states to the homeowner that the Subdivider, or his engineer, or contractor shall have the right to enter upon any lot within the subdivision within one year of occupancy to undertake the required 'As Built' measurements and remedies, if necessary.

Through the subdivision agreement, a Letter of Credit valuation will be requested from the subdivider for Lot Grading Certificates, generally to a sum based upon a per lot valuation. Partial reductions in the Letter of Credit value may be provided by the City pending receipt of a number of acceptable Lot Grading Certificates. Final subdivision assumption by the City will not take place prior to the receipt and approval of all Lot Grading Certificates within the development, however the return of any lot grading deposits to the homeowner should not be directly related to City assumption.

E.6.3 Swimming Pools

Grading plans prepared by a professional engineer must be submitted as part of all inground swimming pool permits within all subdivision plans registered after April 2004. The approved "As Built" grading plan prepared for the Lot Grading Certificate should be revised to show the location, grading and drainage for the proposed swimming pool as not to adversely impact drainage both within the subject lot and onto neighbouring properties.

F. Site Plan Approval

F.1 General

The Council of the City of Peterborough passed By-Law 1985-211 to designate the entire land area of the City of Peterborough to be subject to Site Plan Control.

All development applications of 5 or more residential units or non residential building additions of more than 100 square metres are subject to Site Plan Control. The ultimate goal of this process is to have applicants enter into Site Plan agreements with the City. Development applicants are required to submit Site Plans and Building Elevations drawings to the Planner, Urban Design conforming to the standards outlined in Section F. The drawings are circulated to various City departments and neighbouring property owners for their review and input. Applicants and their consultants are encouraged to contact the City's Planner, Urban Design for more information in relation to the Site Plan Approval process, application forms, and applicable processing fees. Applicants should be made aware that road right-of-way widenings may be required to be conveyed to the municipality at no cost, where the City's Official Plan permits.

In general, Site Plans that include more than 50 residential units or non-residential developments in excess of 2,500 square metres of new building area require City of Peterborough council approval.

F.2 Submission Format

The Site Plan Application submission typically contains the following:

i. Completed Site Plan Application Form.
ii. Application Processing Fee.
iii. Five (5) complete sets of full size drawings are required for Site Plan submission. The drawings should be on standard size drawing sheets large enough to legibly provide all the applicable information.
iv. A 8.5" x 11" (letter sized) and 11"x17" (ledger sized) reductions of the Site Plan drawings for circulation purposes.
v. A current property boundary survey prepared by an Ontario Land Surveyor.
vi. Site Plan submission drawings shall include Site Plans, Building Elevations, Landscape Plans, Lighting, and other miscellaneous drawings as required by the City, related to the scope of the proposed development works.
vii. Grading Plan, Site Servicing Plan, and Stormwater Management Report, if required. These drawings and reports must be signed and sealed by a professional engineer licensed to practice in the Province of Ontario.
viii. Drawings for external site works required for the development.
ix. Any other reports deemed to be necessary by the Planner, Urban Design or arising out of the Pre-Consult process.

F.3 Building Elevation Drawings

The building elevation drawings shall be prepared to show what all the exterior faces of the structure will look like, including building openings, roof lines, exterior veneer material, exterior mechanical equipment and foundation outlines. The elevation drawings may be drawn in an even metric or imperial scale, however, metric dimensions and heights must be shown, optionally in conjunction with imperial units, if an imperial scale is provided.

F.4 Site Plan Drawing Requirements

The Site Plan Drawings shall be drawn at an even metric scale (1:100, 1:125, 1:150, 1:200, 1:250, 1:300, and 1:400) filling up as much of the drawing sheet as possible. 1:500 drawings may be permitted in exceptional circumstances, but most typical Site Plan drawings are preferred to be drawn at either 1:200 or 1:250. Typical Site Plan drawing sheet sizes are Architectural ‘D’ size (24”x36” or 610mm x 915mm) or metric A1.

F.4.1 Base Plan Information

The Site Plan shall contain the following base information:

- Property boundary information including azimuths and distances as derived from an Ontario Land Surveyor drawing.
- Full title block including date of drawing, scale, north arrow, and geodetic benchmark.
- Any easements on the subject property.
- Hanging property lines, landuses, and building locations within adjoining properties.
- Key Plan illustrating the location of the subject parcel in relation to the adjoining street layout.
- Location of all existing on-site buildings, parking lots, driving surfaces, walkways, significant tree and landscaped areas, utility and lighting poles, signs, etc.
- Locations of all adjacent streets, including travelled road, boulevard entrances, curb cuts, sidewalks/multi-use trails, depressed curbs, tactile walking surface indicators, right-of way dimensions, culvert, manholes, catchbasins, utility poles, fire hydrants and other miscellaneous street furniture.
- Location of all adjacent stormwater drainage features, if any exist.
- Existing geodetic elevations grades at regular intervals and at the following locations: finished floor of buildings, building corners, edge of asphalt, top of curbs and sidewalk, ramps, staircases, existing roads, sidewalks/multi-use trails, walkways, entrances, top and bottom of slopes and retaining walls, manholes, catchbasins, ditches, and on all property lines. Where there is a separate Grading Plan as part of the Site Plan Application submission, the elevations may be shown on the Grading Plan and, therefore, are not required to also be shown on the Site Plan.

- Existing services and utilities on both the site and the adjoining road right of way. If a separate Servicing Plan is to be prepared, the existing servicing information is not required on the Site Plan.

F.4.2 Site Statistical Information

The Site Plan shall contain the following statistical information on the Site Plan:

- Existing zoning on the property.
- Existing Site Area and Proposed Site Area, if different from existing (as a result of a road widening, severance, or merger for example).
- Existing and proposed building coverage in both in terms of absolute area and percentage of site area. Building coverage calculations should confirm by-law compliance.
- Parking calculations specifically demonstrating City by-law and IASR compliance by noting both required and proposed parking quantities.
- Loading space required and proposed calculation quantities and sizes.
- Ontario Building Code classification and fire protection requirements of all existing and proposed buildings.
- Comparison of provided and required zoning regulations.
- Detailed compilation of floor areas, residential unit quantity, type, and number of barrier-free units.

F.4.3 Proposed Site Layout

The Site Plan shall contain the following Site Layout information:

- Proposed building dimensions and offsets to all property lines in conformance to City By-laws.
- All parking stall, entrance and aisle location and dimensions, as required by the City Zoning By-Law and IASR Sections 80.32 to 80.39.
- All surface types. (i.e. asphalt concrete, sod, landscaped, etc.)
- Curb radii at entrances and turns.
- Landscape strip widths.
- Any road widening requested by the City as permitted by the City’s Official Plan.
- Proposed sign sizes, height, and property line offsets.
- Principal building entrances.
- Barrier free path of travel from the Accessible Parking stall(s) to the main entrance with specific elevations and slopes demonstrating compliance with the Ontario Building Code and IASR, Sections 80.32 to 80.39. In lieu, the grading information can be placed on a separate Grading Plan (if provided). Accessible parking spaces shall be located in a manner that avoids the need to travel behind parked cars and along drive aisles to get to and from main accessible building entrance to parked vehicles.

- Accessible Parking stall access aisles shall be marked with high tonal contrast diagonal lines. Signage shall be in accordance with Section 11 of Regulation 581, Accessible Parking for Persons with Disabilities.
- Loading stall dimensions.
- Garbage enclosure location, dimensions and details.
- OBC compliant exterior passenger loading zones, access aisles and curb ramps, where provided.
- Rest areas (benches), waste/recycling bins, bicycle racks, mobility aid (i.e. wheelchair, scooter) storage areas, as applicable
- Design Vehicle turning templates where applicable. All gas station and automobile dealerships must provide truck turning off tracking information for the applicable truck.
- Other miscellaneous dimensions and offsets which demonstrate compliance with all regulations of the municipality's by-laws.
- Some common typical Site Plan components sizes include the following:
    i. Parking Stalls; 2.7m x 5.7m typically, smaller residential parking lots in the City's core may use 2.5m x 5.5m (See Section 4.3.1 of the City's by-law).
    ii. Accessible Parking Stalls: Type 'A' - 3.4m wide + 1.5m access aisle along flankage + 'Van Accessible' signage. Type 'B' 2.7m wide plus 1.5m access aisle along flankage. Access aisles may be shared between two adjoining parking stalls.
    iii. Parallel parking stalls; 2.7m by 7.0m.
    iv. Driving Aisles – 90 degree parking; 6.4m min. (6.0m aisles permitted in smaller residential parking lots in the City's core – See Section 4.3.1 of the City's by-law).
    v. Driving Aisles – 0 to 45 degree parking; 3.6m min.
    vi. Loading Spaces: 3.6m x 6.0m or 3.6m x 12.0m as detailed in Section 4.6 of the City's by-law.
    vii. Walkways; minimum width 1.5m typical where not curb faced, 1.8m where automobile bumpers may overhang walkway. Width to suit areas with curb ramps to accommodate a minimum 1.1m deep turning space at the top of the ramp.
    viii. Drive aisle entrance curb radii: 7.5m preferable where possible.
    ix. Curb height; 150mm typical. All curbing shall be tapered to grade within 300mm of a sidewalk.
    x. Drive aisle width to suit site conditions and expected use. Typically, 7.5m minimum to 9.1m maximum should be provided for two way traffic flow.
    xi. Drive through aisle width; 3.4m, minimum inside radius of 4.57m.
    xii. Minimum 1.67m x 1.67m level area adjacent to building entrances.

F.4.4 Proposed Site Grading

The Site Plan (or separate Site Grading Plan) shall contain the following information:

- Existing and proposed on-site elevations (geodetic metric units referencing project benchmark) at regular intervals (20 metres maximum spacing).
- Existing and proposed elevations along all property lines, roads, catchbasins, manholes, parking lot high points, corners, drive aisle entrances, building entrances, ditches, curbs and curb cuts, sidewalks/multi-use trails walkways, ramps, stairs, on-site and adjacent corners of buildings and floor levels, edges of driving surfaces, top and bottom of curbs, retaining walls, and slopes.
- Proposed grading must match the adjoining property existing ground elevations at the property boundary. No fill or cutting will be permitted on adjoining properties unless written permission is received from the affected property owner.
- The slopes of all surfaces should be provided on the drawings. All slopes should conform to the following general criteria:
    i. Sidewalk/multi-use trail, walkway crossfall; 2% typical and preferred, 5% maximum.
    ii. Sidewalk/multi-use trail and walkway longitudinal slope; 5% maximum except where aligned adjacent to a municipal road where it can match the road slope.
    iii. Barrier Free Path of Travel; As per Ontario Building Code and the IASR.
    iv. Asphalt Parking Lots; 1% minimum, 6% maximum (4% maximum slope laterally to parking stalls).
    v. Barrier free parking stalls, exterior passenger loading zones, and their access aisles; 1.0% preferred, 3.0% maximum.
    vi. Landscaped areas (outside of walkways); 2% minimum, 3:1 maximum. Where steeper slopes are required to meet grade, provide a retaining wall (including applicable guards) to reduce slopes
    vii. Swales; 2% minimum gradient preferred, maximum side slope 3:1.
- Geodetic benchmark description location and elevation. In the event the primary benchmark is not located immediately adjacent to the site a second or temporary benchmark must be provided on the plan.

F.4.5 Proposed Site Servicing

Site Plans (or separate Site Servicing Plans) should include the location and description of all existing and proposed known site services and street utilities as follows. Servicing easements may be requested for any existing, proposed, or potential future underground or overhead services as may be required.

Some Site Plan developments require external works to provide adequate servicing and/or access to the development. All external works drawings shall in accordance with City of Peterborough standards and specifications contained herein.

F.4.5.1 Sanitary Services

- Proposed site developments that will significantly introduce or increase sanitary sewer flows must confirm existing downstream capacity (80% of full pipe

capacity) exists within the municipal sanitary sewer system for the proposed use of the site. The limit of the downstream assessment will vary with the proposed location and land use, generally extending to the downstream trunk sanitary sewer. The extent of the study will be determined by City staff as part of the pre-consultation process during the rezoning process (where applicable) or Site Plan Approval. Proportional financial contributions for the upgrade of downstream sanitary infrastructure may be requested from applicants where conveyance capacity constraints are found.

- Sanitary servicing must conform to Part 7 of the Ontario Building Code, both in terms of flow loading and pipe size and slope as well as cleanout and manhole locations. Typically control manholes are required to be located on the sanitary services at the front property line or just inside the property line, if required.
- Where flow determination is outside of the scope of the Ontario Building Code, peak flows shall be determined as per Section A.1 of these standards.
- Plans should detail manhole (or cleanout) locations, top of grate elevation, all invert directions and elevations, sewer size, material, length, and slope, any elbows, connection to municipal sanitary sewers.
- Where basements are existing or proposed, specific municipal sewer sizes and inverts as well as inverts at the building are required.
- Private septic systems generally are not permitted within the City, but will be considered in exceptional circumstances (usually on the fringes of the city where public sanitary sewers do not exist in the vicinity, or are not in a favourable location, or elevation).

F.4.5.2 Storm Sewer Servicing

- Proposed Site Plan Control development applications are subject to the city's stormwater management requirements detailed in Section F.4.10.
- Storm servicing must comply with Part 7 of the Ontario Building Code.
- Plans should detail catchbasin and manhole locations, top of grate elevations, invert direction and elevations, pipe length, slope, and material, elbows, connection to roof or foundation drains, flow restrictors, and connection to municipal drainage system. Catchbasins shall not be located in pedestrian crossing areas.
- Minimum Storm Sewer size connecting to the City's municipal system is 250mm. Minimum preferable slope = 0.5%.
- Control storm manholes required at front property line. Oil/grit separator manholes cannot act as a control manhole.
- Sites Plans with basements and stormwater management inlet control devices must detail sump pumping to ensure no adverse impacts on the structure.

F.4.5.3 Electrical/Bell/Cable/Gas Servicing

- Plan should detail all existing and proposed underground and overhead utility locations, utility pole, anchor, and transformer locations.

- Provide a minimum of 2.1m overhead clearance over exterior paths of travel. Where not provided, a rail or other barrier that is cane detectable must be provided around the object that is obstructing the headroom clearance (IASR 80.23.2)

F.4.6 Landscape Design and Tree Preservation

- All landscaping designs must be approved by the Planner, Urban Design. Site Plan submission may require Landscape Plans prepared by licensed Landscape Architects.
- All significant existing trees and shrubs should be located, identified, and shown to be protected where applicable on the Site Plan (or separate Landscape and/or Tree Preservation Plan) as noted in Section D.2.4.G of these standards.
- Landscape Plans should also show fencing, benches, shade structures, hardscape landscape features, surface materials, transit stop amenities, bike racks, waste recycling bins.
- Locations and specifications of proposed plant and ground materials, including the following: on-centre location and periphery outline for deciduous and coniferous trees and shrubs, outline of groundcover areas, label turfgrass areas and indicate whether sodded or seeded.
- Proposed Tree Planting shall be as per City of Peterborough Specifications CP 801.01 and CP 801.02 as well as drawings CPD 801.01, CPD 801.02, CPD 801.03, and CPD 801.04.
- Topsoil shall be fertile, friable sandy loam capable of sustaining vigorous plant growth with an acidity range of 6.5 pH to 7.5 pH and free from any plant growth inhibiting compounds. Topsoil shall be free from clay lumps and other extraneous matter. Stones shall be less than 25 mm in diameter shall comprise no more than five percent (5 %) of the topsoil by volume. Areas where topsoil is to be placed shall be fine graded to a uniform surface and the surface shall be loosened to a depth of 75 mm and shall be free of all vegetation, debris, and stones. Topsoil shall be placed to a uniform depth of 150 mm.
- Sod shall conform to the Canadian Sod Growers Specification for Number One Grade Turfgrass and shall be seeded and established in nursery sod fields. Sod shall be of sufficient density that no surface soil is visible. Where required, sod should be staked to the grade to avoid movement. Stakes for fastening sod to the earth grade shall be a minimum 150 mm in length.
- Where practical, use deciduous trees to provide shade for pedestrian paths of travel and along south facades of buildings

F.4.7 Lighting Design

Site Plan (or separate Electrical Plan) shall indicate the following:

- Location of all exterior light fixtures both wall mounted and freestanding pole mounted or bollard type.
- Location and type of lighting for site and building signage.
- Type of luminaire, light levels, and wattage.

- Lighting shall be directed as not to glare or otherwise adversely impact adjoining properties.
- Lighting shall accommodate safe access from sidewalks/multi-use trails, walkways, accessible parking spaces, exterior passenger loading zones, transit stops, and parking areas to site buildings, facilities and amenities.

F.4.8 Refuse Collection Facilities

The Site Plan shall indicate the following:

- Location and type of exterior collection bins and how truck access is provided. In many case, on-site City collection of wastes may not be possible.
- In order for on-site collection to be considered by the City and its contractors, adequate side clearance within the parking aisles must be provided in order to allow for side loading and hydraulic lifting of recycling carts with adequate offsets from parking stalls to allow for uncertainty of cart side loading.
- Collection facilities shall be located and configured as to eliminate the need for reversing maneuvers by waste collection vehicles while on the property.
- In circumstances where significant reversing is required by site conditions/design, private collection of garbage will be required and all recyclables shall be placed curbside at a location designed for such purpose.
- Detail drawings of the refuse enclosures.

F.4.9 Landscape Structures

The Site Plan shall outline the following:

- Location, height, and type of all fences or freestanding walls.
- Location, type, height and detailed drawings (including guards) of all retaining walls. Retaining walls greater than 1.0m in height are required to be signed and sealed by a professional engineer licensed to practice in the Province of Ontario.
- Location and height of all elevated decks, stairs, railings and ramps.
- Location and height of trellises, pergolas, gazeboes and other non-enclosed structures.
- Fencing, benches, shade structures, hardscape landscape features (e.g. seat walls), transit stop amenities, bike racks, waste recycling bins where these features are not shown on the Landscape Plan.

F.4.10 Stormwater Management

Site Plan applications are required to have stormwater management designs that provide for both runoff quantity and quality control and LID to minimize any adverse effects arising from the proposed design. Stormwater quantity control is typically provided to control flows up to the 100 year storm while quality control should comply with the March 2003 MOE Stormwater Management Planning and Design Manual.

F.4.10.1 Stormwater Management Quantity Control

Site Plans that increase the amount of impervious surface area must provide for measures that ensure that peak post-development flows do not exceed pre-development levels.

For most Site Plans, the city will require that at least the following storms be modeled to assess the pre to post-development flow comparison. The City may request that additional storms be analyzed on some of the larger Site Developments.

i. 2 year – 6 hour; 38.7mm
ii. 5 year – 6 hour; 52.48mm
iii. 100 year – 6 hour; 89.9mm

The above rainfall depths were derived from the 2006 Peterborough Airport rainfall IDF data. SCS Type II distributions shall be used for the modeling for both pre and post-development scenarios. Where allowed in special cases, the use of alternative rainfall events requiring IDF curve fitting parameters that yield total rainfall depths lower than from that listed above, the rainfall hyetographs shall be adjusted to meet the minimum depths noted above. The 6 hour SCS Type II hyetographs and 100 year IDF curve fitting parameters are attached in the Appendix.

In addition to the above storms, developments within the Bears Creek watershed will also be required to control peak flows for the Regional (Timmins Flood).

Stormwater management reports requiring approval of the Otonabee Region Conservation Authority may require a wider range of storm events to be modeled. Applicants are advised to contact ORCA in this regard.

Stormwater Management quantity control design criteria within the City of Peterborough should consider some of the following:

- Peak regulated post-development flow must match or be lower than pre-development conditions.
- In absence of any site specific soils information, assume SCS Hydrological Soils Group ‘B’ conditions for pervious areas. Pre and post-development pervious areas should be modeled with runoff co-efficients ranging from 0.20 to 0.25 or runoff Curve Numbers (CN values) of approximately 65. Horton infiltration values may also be used. In no case should the pre-development pervious runoff co-efficient be greater than the post-development value.
- Initial Abstraction should range from 2.5mm-5.0mm.

- In no case should the post-development time to peak (or time of concentration) be greater than the pre-development time to peak (or time of concentration).
- Impervious areas for both pre and post-development conditions should include all impervious surfaces including roofs, 100 year ponding areas, driving surfaces, paving stones, curbs, sidewalk/multi-use trails, and walkways etc.
- Watershed areas generally should include the site area and any external areas draining into the subject property. Drawings clearly showing the pre and post-development catchment areas drawn to an even scale must be submitted as part of the report.
- Site design shall not block existing incoming drainage, fill in existing known flood storage areas, nor redirect runoff onto adjoining properties.
- Temporary runoff storage may include parking lot, rooftop, underground, landscaped berms, etc. all contained within the subject property. All reports should include the proposed basin(s) elevation-discharge-storage relationship chart(s).
- Parking lot storage should not exceed a depth of 0.30m. Depths in excess of 0.30m may be permitted in limited areas on certain parking lots in a case by case basis, depending on the proposed landuse.
- Site Plans with proposed rooftop storage, should specifically detail roof drains, slopes, scupper height, number and location of drains, and number of drain notches. Site Plan agreements for sites proposing rooftop storage will contain specific wording that requires the project Mechanical Engineer to certify that the design and ‘As Built’ proposed rooftop flow controls and storage volumes are consistent with the stormwater management design.
- Runoff should not be directed onto privately owned property unless written permission is received from all affected property owners, and the City of Peterborough.
- The extent of 100 year (or Regional) proposed ponded runoff must be shown on the Site Plan (or Grading Plan and/or Stormwater Management Plan as applies).
- A minimum freeboard of 100mm must be provided above the 100 year (or Regional) ponding level where the containment crest is adjacent to privately owned property.
- 100 year overflow may be directed onto City owned right of ways through driveways lower than the finished floor elevation or other low points, however, all the 5 year flows must be discharged through the proposed site storm sewer as are flows up to the 50 year event preferred, unless conditions are encouraged. 100 year overflow arrows shall be provided.
- The report should contain all relevant sample calculations and pre and post-development computer model output.
- Applicants are encouraged to provide ponded water areas away from buildings, sidewalks, multi-use trails, walkways, pedestrian crossings, accessible parking spaces, exterior passenger loading zones, access aisles,

and, in the case of gas stations, gasoline tank farms and pump islands. Sanitary manholes located within ponding areas shall have water tight lids.

F.4.10.2 Stormwater Management Quality Control

Stormwater quality control is required both during (temporary) and after (permanent) construction.

Temporary sediment and erosion stormwater quality controls are to be implemented during construction to ensure that downstream water quality effects from the exposed soils are minimized.

Permanent water quality controls following the guidelines of the March 2003 MOE Stormwater Management Planning and Design Manual as well as the February 2015 Interpretation Bulletin must be provided as part of the submitted stormwater management report.

Lot Level and Conveyance Controls outlined in the March 2003 MOE documentation as well as Low Impact Development (LID) practices noted in the 2010 CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide will be considered and encouraged as part of the 'treatment train' approach to stormwater quality.

Typically 'Enhanced' (80% TSS) water quality controls are required for each particular site for end of pipe proposals. Existing drainage infrastructure may have to be retrofitted to provide stormwater quality control for site reconstruction proposals.

Proposed oil – grit separator manholes shall be tested and certified to meet the requirements of the Canadian ETV Program for OGS Performance Testing Protocol for Canada. Calculations supporting the implementation of a specified oil – grit separator manhole shall include ETV specific specifications.

F.4.10.3 Low Impact Development (LID) Controls.

The City requires the use of LID as part of the stormwater management design for Site Plan Approval submissions. Applicants are encouraged to review the Low Impact Development (LID) practices noted in the 2010 CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide as part of their review of various design options.

Prior to release of the anticipated MOECC LID stormwater management guidance document in the near future, the City has an interim design target for the infiltration of the first 15mm of rainfall, where feasible. Parking lots and roadways will require adequate pre-treatment of runoff prior to infiltration. Some land-use surfaces with high pollutant potential will be precluded for low impact

development design or infiltration, however, clean roof surfaces within these land-uses should have LID measures in place.

Special attention to detail on selection of permeable surfaces shall be considered at areas with expected pedestrian use, such as sidewalks, multi-use trails, walkways, accessible parking spaces, and exterior passenger loading zones and their access aisles both in terms of joint spacing and winter maintenance.

Due the variance in site configurations and land availability for LID in specific residential, commercial, industrial, and institutional development applications, specific guidance of City requirements will be provided as part of the pre-consultation process required for all rezoning, subdivision and site plan approval applications. Applicants are encouraged to review City comments provided in the pre-consultation process for direction and suggestions in relation to their particular development application.

Boreholes to demonstrate soil types, ground water level monitoring and in-situ infiltration testing are typically undertaken as part of the LID design. On smaller applications, the City may not require this field work.

G. Municipal Consent

The Municipal Consent process is a mechanism that provides for the orderly review and approval of utility infrastructure works within the City owned lands.

The goal of the process is to allow for the installation of the various utility's below and above ground infrastructure, while eliminating conflicts with other utility's plant and protecting the best interest of the City and minimizing inconvenience to the public.

The expectation from the City is that the convenience to the Public must always be provided for in all aspects of carrying out the proposed work by the applicant under the Municipal Consent submission. No portion of any street, sidewalk, multi-use trail, walkway, park, open space, or boulevard, shall be occupied or obstructed to any greater areal extent or duration than is absolutely necessary to complete the works.

G.1 Municipal Consent Process

a) Utilities proposing new infrastructure within the City's right of ways must prepare plans detailing the scope of the work, including locations, dimensions to property lines and travelled roads of the proposed works, existing travelled roads, street furniture, driveways, trees, sidewalks, multi-use trails, walkways, catchbasins, manholes, poles, etc. and any known underground utilities.

b) Said plans are to be circulated to all of the other utilities for review, comment, revision request, or clearance. Typically, a minimum of three weeks must be provided to allow comments from the other utilities. Any conflicts or revision requests must be undertaken to resolve other utility concerns.

c) Concurrent with the utility circulation, the plans may be forwarded to the City's Infrastructure and Planning Services Department for review. Confirmation must be provided to the City that the other utilities have no issues with the proposed work. The actual correspondence between the various utilities need not be forwarded to the City. Plans may be forwarded to the City for initial review at the same time as the initial utility circulation for initial screening and City comment, however, detailed review will only commence upon receipt of utility clearance notification from the applicant.

d) Any above ground or flush street furniture including vaults, pedestals, poles, anchors, overhead wires etc. proposed within residential areas must be reviewed with the adjacent or directly affected property owners. Confirmation that the affected adjacent residential property owners have reviewed the design without concerns or comments must be forwarded to the City in these instances. Part of the purpose of the owner notification is to provide the opportunity for the owner to provide information to the utility and City that may not be readily apparent in the design and review of proposed infrastructure. In the event that a resolution cannot be found with

the affected property owners, and no other reasonable options appear to be feasible, the City will make a decision on the acceptability of the proposal. Generally speaking, upon review of the proposal and an assessment of all reasonable alternatives, if there is no valid basis of the owner's objections, the MC will be looked at favourably by the City.

e) After written Municipal Consent is granted by the City, the applicant must obtain a Cut Permit from the City of Peterborough's Public Works Division and a Temporary Use of Road Allowance Permit from the City's Traffic Department.

APPENDIX

6 Hour SCS Type II Intensity Hyetographs
2006 Peterborough Airport Weather Station
(mm/hr)

Time (min.)	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
0	0	0	0	0	0	0
15	1.6	2.1	2.5	2.9	3.3	3.6
30	1.6	2.1	2.5	2.9	3.3	3.6
45	2.3	3.2	3.7	4.4	4.9	5.4
60	2.3	3.2	3.7	4.4	4.9	5.4
75	2.3	3.2	3.7	4.4	4.9	5.4
90	2.3	3.2	3.7	4.4	4.9	5.4
105	3.9	5.2	6.2	7.3	8.1	9.0
120	3.9	5.2	6.2	7.3	8.1	9.0
135	4.6	6.3	7.4	8.8	9.8	10.8
150	4.6	6.3	7.4	8.8	9.8	10.8
165	23.2	31.4	36.9	43.7	48.9	53.9
180	60.4	81.78	95.9	113.7	127.0	140.2
195	8.5	11.5	13.5	16.0	17.9	19.8
210	8.5	11.5	13.5	16.0	17.9	19.8
225	3.9	5.2	6.2	7.3	8.1	9.0
240	3.9	5.2	6.2	7.3	8.1	9.0
255	3.1	4.2	4.9	5.8	6.5	7.2
270	3.1	4.2	4.9	5.8	6.5	7.2
285	2.3	3.2	3.7	4.4	4.9	5.4
300	2.3	3.2	3.7	4.4	4.9	5.4
315	1.6	2.1	2.5	2.9	3.3	3.6
330	1.6	2.1	2.5	2.9	3.3	3.6
345	1.6	2.1	2.5	2.9	3.3	3.6
360	1.6	2.1	2.5	2.9	3.3	3.6

12 and 24 Hour – 100 Year SCS Type II Hyetographs
2006 Peterborough Airport Weather Station
(mm/hr)

12 Hour - (98.4mm)		24 Hour - (108.7mm)	
Time Ending (hours)	Intensity	Time Ending (hours)	Intensity
0	0	0	0
2	2.5	2	1.2
3	3.0	4	1.4
3.5	3.9	6	1.7
4	3.9	7	0
4.5	5.9	8	4.4
5	7.9	8.5	0
5.5	11.8	9	5.9
5.75	47.2	9.5	3.5
6	129.9	9.75	0
6.5	17.7	10	7.8
7	7.9	10.5	5.0
7.5	5.9	11	6.7
8	5.9	11.5	10.4
10	3.4	11.75	45.2
12	2.0	12	120.0
		12.5	15.7
		13	8.0
		13.5	1.5
		14	8.9
		16	3.3
		20	2.0
		24	1.3

The above noted values should be reduced to smaller time steps in the hydrograph computations.

IDF Curve Parameters: Parameters for design storm of less than 3 hour durations shall use curve fitting valuations outlined in Table B.1.7.1. For design storm hyetographs requiring IDF curve equations for the 100 year frequency - 12 and 24 hour durations, the following parameters may be used.
A = 1697.0
B = 10.51
C = 0.808

Street Catchbasin Inlet Capacities

A. Single Catchbasins on Longitudinal Slope

Head From Bottom of Gutter (m)	Catchbasin Inlet Flow per Longitudinal Road Slope (cms)			
	<=0.5%	0.51-1.49%	1.50-3.00%	>3.00%
0.00	0	0	0	0
0.06	0.005	0.007	0.010	0.012
0.065	0.008	0.012	0.014	0.018
0.07	0.010	0.014	0.018	0.022
0.08	0.013	0.023	0.029	0.033
0.09	0.023	0.035	0.040	0.044
0.10	0.034	0.046	0.052	0.054
0.104	0.036	0.050	0.056	0.058
0.11	0.042	0.055	0.061	0.062
0.15	0.062	0.084	0.091	0.086
0.50	0.068	0.092	0.100	0.095

B. Double Catchbasins on Longitudinal Slope

The inlet flow values for a double catchbasin on a longitudinal slope can be determined by multiplying the single catchbasin values in the above table by a factor of 1.17.

C. Catchbasins in Sags

Depth of Ponding	Catchbasin Inlet Flow (cms)	
	Single Grate	Double Grate
0.00	-	-
0.01	0.0004	0.0012
0.02	0.0017	0.0028
0.03	0.0040	0.0050
0.04	0.0070	0.0098
0.05	0.0110	0.0158
0.06	0.0171	0.0256
0.07	0.0250	0.0365
0.08	0.0347	0.0530
0.09	0.0464	0.0709
0.10	0.0600	0.0908
0.11	0.0726	0.1083
0.12	0.0853	0.1256

0.13	0.0971	0.1415
0.14	0.1082	0.1548
0.15	0.1184	0.1683
0.16	0.1278	0.1820
0.17	0.1363	0.1931
0.18	0.1441	0.2111
0.19	0.1510	0.2280
0.20	0.1569	0.2440
0.22	0.1671	0.2749
0.24	0.1768	0.3067
0.26	0.1860	0.3395
0.28	0.1946	0.3727
0.30	0.2027	0.4054

D. Ditch Inlet Catcbasins

Use Chart 4.20 of the MTO Drainage Management Manual.

Appendix A – Stormwater Management Criteria

1.0 Applicability of Criteria

1.1 The criteria listed under Table A1 of this Appendix applies to all drainage areas greater than 0.1 ha, with the construction erosion and sediment control criteria applying also to sites <0.1 ha;

1.2 Despite condition 1.1 of Appendix A, if some or all of the criteria listed under Table A1 of this Appendix have been assessed for and addressed in other adjacent developed lands to the project site through a subwatershed plan or equivalent study, then those criteria may not be applicable to the project site.

Table A1. Performance Criteria

Water Balance [1]	**FOR DEVELOPMENT SCENARIOS** [2] **Assessment Studies:** i) Control [3] as per the criteria identified in the water balance assessment completed in one or more of the following studies [15], if undertaken: a watershed/subwatershed plan; Source Protection Plan (Assessment Report component); Master Stormwater Management Plan, Master Environmental Servicing Plan; Class EA, or similar approach that transparently considers social, environmental and financial impacts; or local site study including natural heritage, Ecologically significant Groundwater Recharge Areas (EGRA), inflow and infiltration strategies. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; OR **IF Assessment Studies in i) NOT completed:** ii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iii) Control [3] the runoff from the 90th percentile storm event. **Lake Simcoe Watershed Municipalities:** iv) Control [3] as per the evaluation of anticipated changes in water balance between Pre-development and post-development assessed through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If it is demonstrated, using the approved water balance estimation methods [7], that the site's post to Pre-development water balance cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use Lake Simcoe and Region Conservation Authority's (LSRCA) Recharge Compensation Program [9]. **FOR RETROFIT SCENARIOS** [10] **Assessment Studies:** i) Control as per criteria identified in the water balance assessment completed in one or more of the following studies: a watershed/subwatershed plan, Source Protection Plan (Assessment Report component), Master Stormwater Management Plan, Master Environmental Servicing Plan,

	Class EA, or local site study including natural heritage, EGRA, inflow and infiltration strategies, if undertaken. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; **OR** ii) If constraints [11] identified in i), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14]. **IF Assessment Studies in i) NOT completed:** iii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iv) Control [3] the runoff from the 90th percentile storm event.
Water Quality [1]	**FOR DEVELOPMENT SCENARIOS** [2] All of the following criteria must be met for development scenarios: **General:** i) Characterize the water quality to be protected and Stormwater Contaminants (e.g., suspended solids, nutrients, bacteria, water temperature) for potential impact on the Natural Environment, and control as necessary, **OR** ii) As per the watershed/subwatershed plan, similar area-wide Stormwater study, or Stormwater management plan to minimize, or where possible, prevent increases in Contaminant loads and impacts to receiving waters. **Suspended Solids:** i) Control [3] 90th percentile storm event and if conventional methods are necessary, then enhanced, normal, or basic levels of protection (80%, 70%, or 60% respectively) for suspended solids removal (based on the receiver). **Phosphorus:** i) Minimize existing phosphorus loadings to Lake Erie and its tributaries, as compared to 2018 or conditions prior to the proposed development, **OR** ii) Minimize phosphorus loadings to Lake Simcoe and its tributaries. Proponents with development sites located in the Lake Simcoe watershed shall evaluate anticipated changes in phosphorus loadings between Pre-development and post-development through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If, using the approved phosphorus budget tool [12], it is demonstrated that the site's post to Pre-development phosphorus budget cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use LSRCA's Phosphorus Offsetting Policy [9]. **FOR RETROFIT SCENARIOS** [10] i) Improve the level of water quality control currently provided on site; **AND** ii) As per the 'Development' criteria for Suspended Solids, **OR** iii) **If 'Development' criteria for Suspended Solids cannot be met**, Works are designed as a multi-year retrofit project, in accordance with a rehabilitation study or similar area-wide Stormwater study, such that the completed treatment train will achieve the 'Development' criteria for Suspended Solids or local needs[14], within ten (10) years; **OR**

	iv) If constraints [11] identified in ii) and iii), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies.
Erosion Control (Watershed) [1]	**FOR DEVELOPMENT SCENARIOS** [8] i) As per erosion assessment completed in watershed/subwatershed plan, Master Stormwater Management Plan, Master Environmental Servicing Plan, Drainage Plan, Class EA, local site study, geomorphologic study, or erosion analysis; **OR** ii) As per the Detailed Design Approach or Simplified Design Approach methods described in the Stormwater Management Planning and Design Manual: a. The Detailed Design Approach may be selected by the proponent for any development regardless of size and location within the watershed provided technical specialists are available for the completion of the technical assessments; or considered more appropriate than the simplified approach given the size and location of the development within the watershed and the sensitivity of the receiving waters in terms of morphology and habitat function. b. The Simplified Design Approach may be adopted for watersheds whose development area is generally less than twenty hectares AND either one of the following two conditions apply: 1) The catchment area of the receiving channel at the point-of-entry of Stormwater drainage from the development is equal to or greater than twenty-five square kilometres; or 2) Meets the following conditions: • The channel bankfull depth is less than three quarters of a metre; • The channel is a headwater stream; • The receiving channel is not designated as an Environmentally Sensitive Area (ESA) or Area of Natural or Scientific Interest (ANSI) and does not provide habitat for a sensitive aquatic species; • The channel is stable to transitional; and • The channel is slightly entrenched; **OR** iii) In the absence of a guiding study, detain at minimum, the runoff volume generated from a 25 mm storm event over 24 to 48 hours. **FOR RETROFIT SCENARIOS** [10] i) If approaches i-iii) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of erosion control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14].
Water Quantity (Minor and Major System) [1]	i) As per municipal standards, Master Stormwater Management Plan, Class EA, Individual EA and/or ECA, as appropriate for the type of project [13]
Flood Control (Watershed Hydrology) [1]	**FOR DEVELOPMENT SCENARIOS** [2] i) Manage peak flow control as per watershed/subwatershed plans, municipal criteria being a minimum 100 year return storm (except for site-specific considerations and proximity to receiving water bodies), municipal guidelines and standards, Individual/Class EA, ECA, Master Plan, as appropriate for the type of project [13].

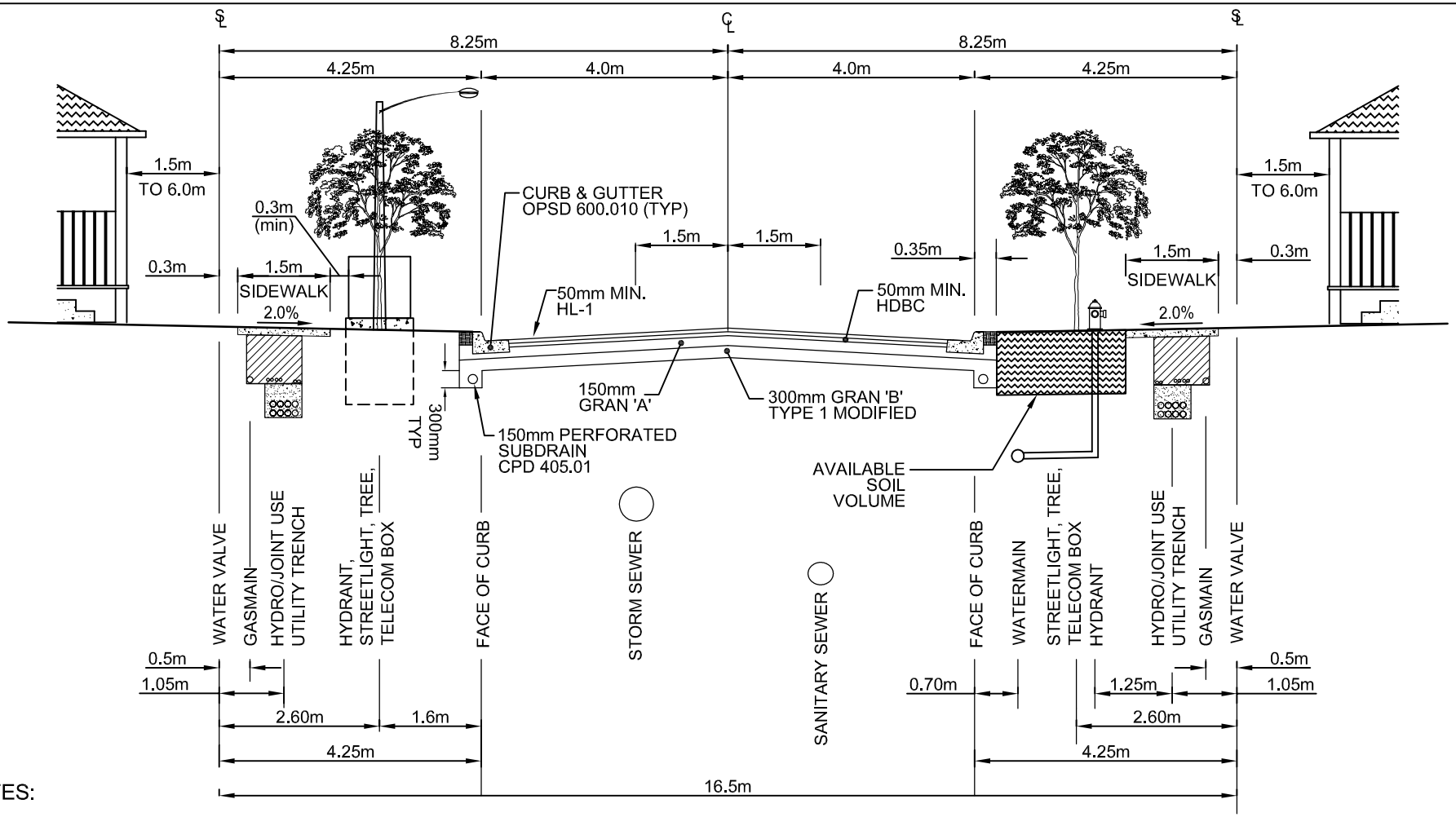
	FOR RETROFIT SCENARIOS [10] i) If approaches i) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of flood control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies.
Construction Erosion and Sediment Control	i) Manage construction erosion and sediment control through development and implementation of an erosion and sediment control (ESC) plan. The ESC plan shall: a. Have regard to Canadian Standards Association (CSA) W202 Erosion and Sediment Control Inspection and Monitoring Standard (as amended); OR b. Have regard to Erosion and Sediment Control Guideline for Urban Construction 2019 by TRCA (as amended). ii) Be prepared by a QP for sites with drainage areas greater than 5 ha or if specified by the Owner for a drainage lower than 5 ha. iii) Installation and maintenance of the ESC measures specified in the ESC plan shall have regard to CSA W208:20 Erosion and Sediment Control Installation and Maintenance (as amended). iv) For sites with drainage areas greater than 5 ha, a QP shall inspect the construction ESC measures, as specified in the ESC plan.
Footnote	1. Where the opportunity exists on your project site or the same subwatershed, reallocation of development elements may be optimal for management as described in footnote [3]. 2. Development includes new development, redevelopment, infill development, or conversion of a rural cross-section into an urban cross-section. 3. Stormwater volumes generated from the geographically specific 90th percentile rainfall event on an annual average basis from all surfaces on the entire site are targeted for control. Control is in the following hierarchical order, with each step exhausted before proceeding to the next: 1) retention (infiltration, reuse, or evapotranspiration), 2) LID filtration, and 3) conventional Stormwater management. Step 3, conventional Stormwater management, should proceed only once Maximum Extent Possible [8] has been attained for Steps 1 and 2 for retention and filtration. 4. Recharge is the infiltration and movement of surface water into the soil, past the vegetation root zone, to the zone of saturation, or water table. 5. Pre-development is defined as the more stringent of the two following scenarios: 1) a site's existing condition, or 2) as defined by the local municipality. 6. Major Development has the same meaning as in the Lake Simcoe Protection Plan, 2009. 7. Currently, the approved tool by LSRCA for calculating the water balance is the Thornthwaite-Mather Method. Other tools agreed upon by relevant approval agencies (e.g., LSRCA, municipality, or Ministry) may also be acceptable, subject to written acceptance by the Director. 8. Maximum Extent Possible means maximum achievable Stormwater volume control through retention and LID filtration engineered/landscaped/technical Stormwater practices, given the site constraints [11]. 9. Information pertaining to LSRCA's Recharge Compensation Program and Phosphorus Offsetting Policy is available on LSRCA's website (lsrca.on.ca), or in "Water Balance Recharge Policy for the Lake Simcoe Protection Plan", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority and "Phosphorus Offsetting Policy", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority.

	10. Retrofit means: 1) a modification to the management of the existing infrastructure, 2) changes to major and minor systems, or 3) adding Stormwater infrastructure, in an existing area on municipal right-of-way, municipal block, or easement. It does not include conversion of a rural cross-section into an urban cross-section. 11. Site constraints must be documented. A list of site constraints can be found in Table A2. 12. Tools for calculating phosphorus budgets may include the Ministry's Phosphorus Tool, the Low Impact Development Treatment Train Tool developed in partnership by TRCA, LSRCA, and Credit Valley Conservation (CVC), or other tools agreed upon by the LSRCA and other relevant approval agencies including the municipality. 13. Possible to look at combined grey infrastructure and LID system capacity jointly. 14. Local needs include requirements for water quality, erosion, and/or water balance retrofits identified by the owner through ongoing operation and maintenance of the stormwater system, including inspection of local receiving systems and the characterization of issues requiring remediation through retrofit controls. 15. All studies shall conform with Ministry policies. If any conclusions in the studies negate policy, then the project will require a direct submission to the Ministry for review through an application pertaining to a Schedule C Notice.

Table A2. Stormwater Management Practices Site Constraints

	Site Constraints
a)	Shallow bedrock [1], areas of blasted bedrock [2], and Karst;
b)	High groundwater [1] or areas where increased infiltration will result in elevated groundwater levels which can be shown through an appropriate area specific study to impact critical utilities or property (e.g., susceptible to flooding);
c)	Swelling clays [3] or unstable sub-soils;
d)	Contaminated soils (e.g., brownfields);
e)	High Risk Site Activities including spill prone areas;
f)	Prohibitions and or restrictions per the approved Source Protection Plans and where impacts to private drinking water wells and /or Vulnerable Domestic Well Supply Areas cannot be appropriately mitigated;
g)	Flood risk prone areas or structures and/ or areas of high inflow and infiltration (I/I) where wastewater systems (storm and sanitary) have been shown through technical studies to be sensitive to groundwater conditions that contribute to extraneous flow rates that cause property flooding / Sewer back-ups;
h)	For existing municipal rights-of-way infrastructure (e.g., roads, sidewalks, utility corridor, Sewers, LID, and trails) where reconstruction is proposed and where surface and subsurface areas are not available based on a site-specific assessment completed by a QP;
i)	For developments within partially separated wastewater systems where reconstruction is proposed and where, based on a site-specific assessment completed by a QP, can be shown to: i Increase private property flood risk liabilities that cannot be mitigated through design; ii Impact pumping and treatment cost that cannot be mitigated through design; or

iii Increase risks of structural collapse of Sewer and ground systems due to infiltration and the loss of pipe and/or pavement support that cannot be mitigated through design.
j) Surface water dominated or dependent features including but not limited to marshes and/or riparian forest wetlands which derive all or a majority of their water from surface water, including streams, runoff, and overbank flooding. Surface water dominated or dependent features which are identified through approved site specific hydrologic or hydrogeologic studies, and/or Environmental Impact Statements (EIS) may be considered for a reduced volume control target. Pre-consultation with the MECP and local agencies is encouraged;
k) Existing urban areas where risk to water distribution systems has been identified through assessments to meet applicable drinking water requirements, including Procedures F-6 and F-6-1, and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
l) Existing urban areas where risk to life, human health, property, or infrastructure has been is identified and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
m) Water reuse feasibility study has been completed to determine non-potable reuse of Stormwater for onsite or shared use;
n) Economic considerations set by infrastructure feasibility and prioritization studies undertaken at either the local/site or municipal/system level [4].
Footnote: 1. May limit infiltration capabilities if bedrock and groundwater is within 1m of the proposed Facility invert per Table 3.4.1 of the LID Stormwater Planning and Design Guide (2010, V1.0 or most recent by TRCA/CVC). Detailed assessment or studies are required to demonstrate infiltration effects and results may permit relaxation of the minimum 1m offset. 2. Where blasting is more localized, this constraint may not be an issue elsewhere on the property. While infiltration-based practices may be limited in blasted rock areas, other forms of LID, such as filtration, evapotranspiration, etc., are still viable options that should be pursued. 3. Swelling clays are clay soils that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content. 4. Infrastructure feasibility and prioritization studies should comprehensively assess Stormwater site opportunities and constraints to improve cost effectiveness, environmental performance, and overall benefit to the receivers and the community. The studies include assessing and prioritizing municipal infrastructure for upgrades in a prudent and economically feasible manner.



NOTES:

1. STANDARD STREETLIGHT LOCATION ON OPPOSITE SIDE OF ROAD AS WATERMAIN WHERE POSSIBLE.
2. TYPICAL MINIMUM DEPTH OF UTILITY CROSSING SHALL BE 1.0m (TO CLEAR SUBDRAIN)
3. THIS CROSS SECTION REQUIRES COUNCIL APPROVAL TO BE UTILIZED.
4. ROOT DEFLECTORS REQUIRED WHERE <1.0m SEPARATION TO UTILITY TRENCH PROPOSED.
5. MINIMUM TOPSOIL DEPTH TO BE 0.3m.

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SERVICE LOCATIONS
AND CROSS SECTION
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DATE SEPTEMBER 2017 REV. 0

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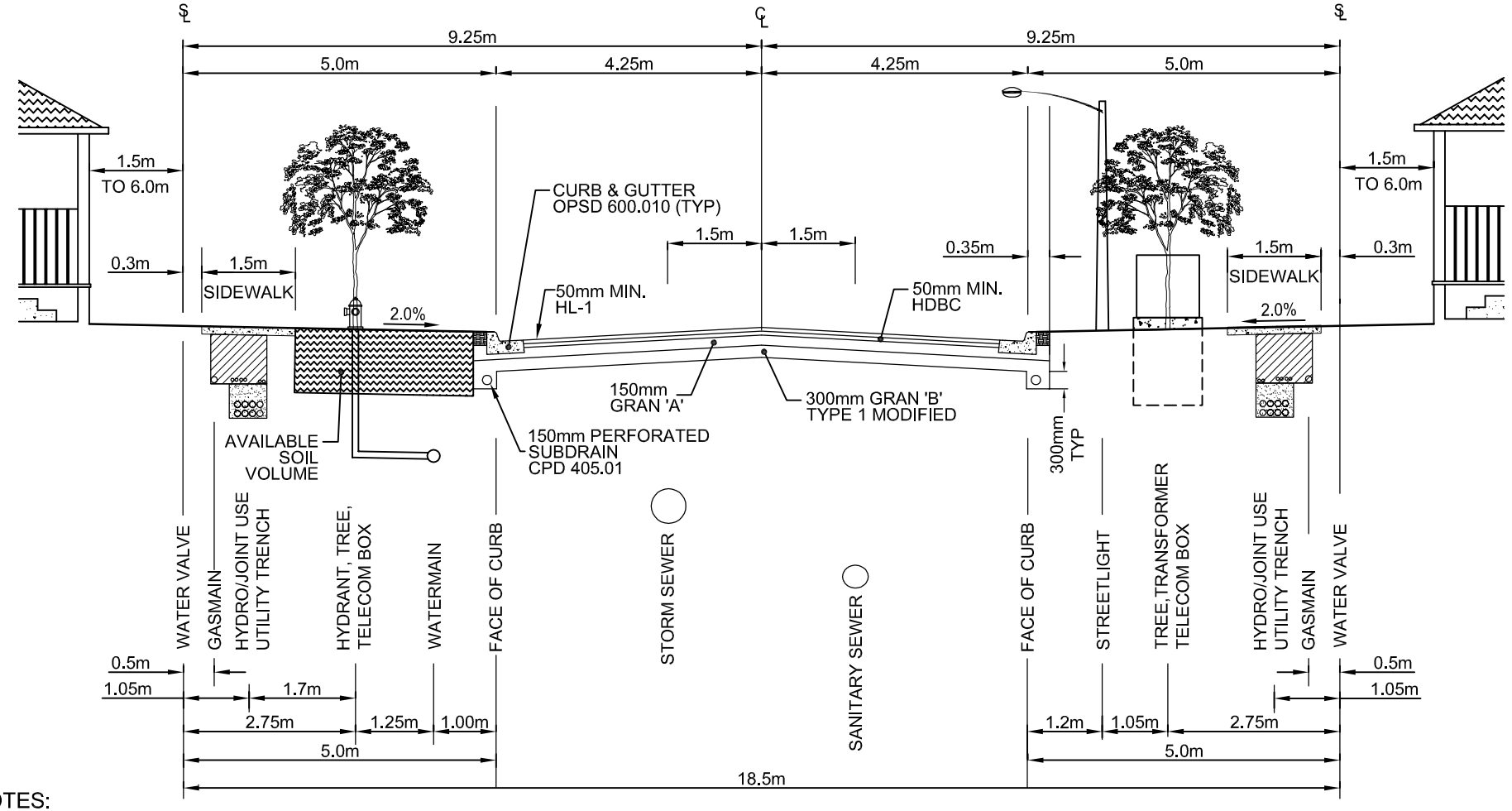

NOTES:

1. STANDARD STREETLIGHT LOCATION ON OPPOSITE SIDE OF ROAD AS WATERMAIN WHERE POSSIBLE.
2. TYPICAL MINIMUM DEPTH OF UTILITY CROSSING SHALL BE 1.0m (TO CLEAR SUBDRAIN)
3. ROOT DEFLECTORS REQUIRED WHERE <1.0m SEPARATION TO UTILITY TRENCH PROPOSED.
4. MINIMUM TOPSOIL DEPTH TO BE 0.3m.

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SERVICE LOCATIONS
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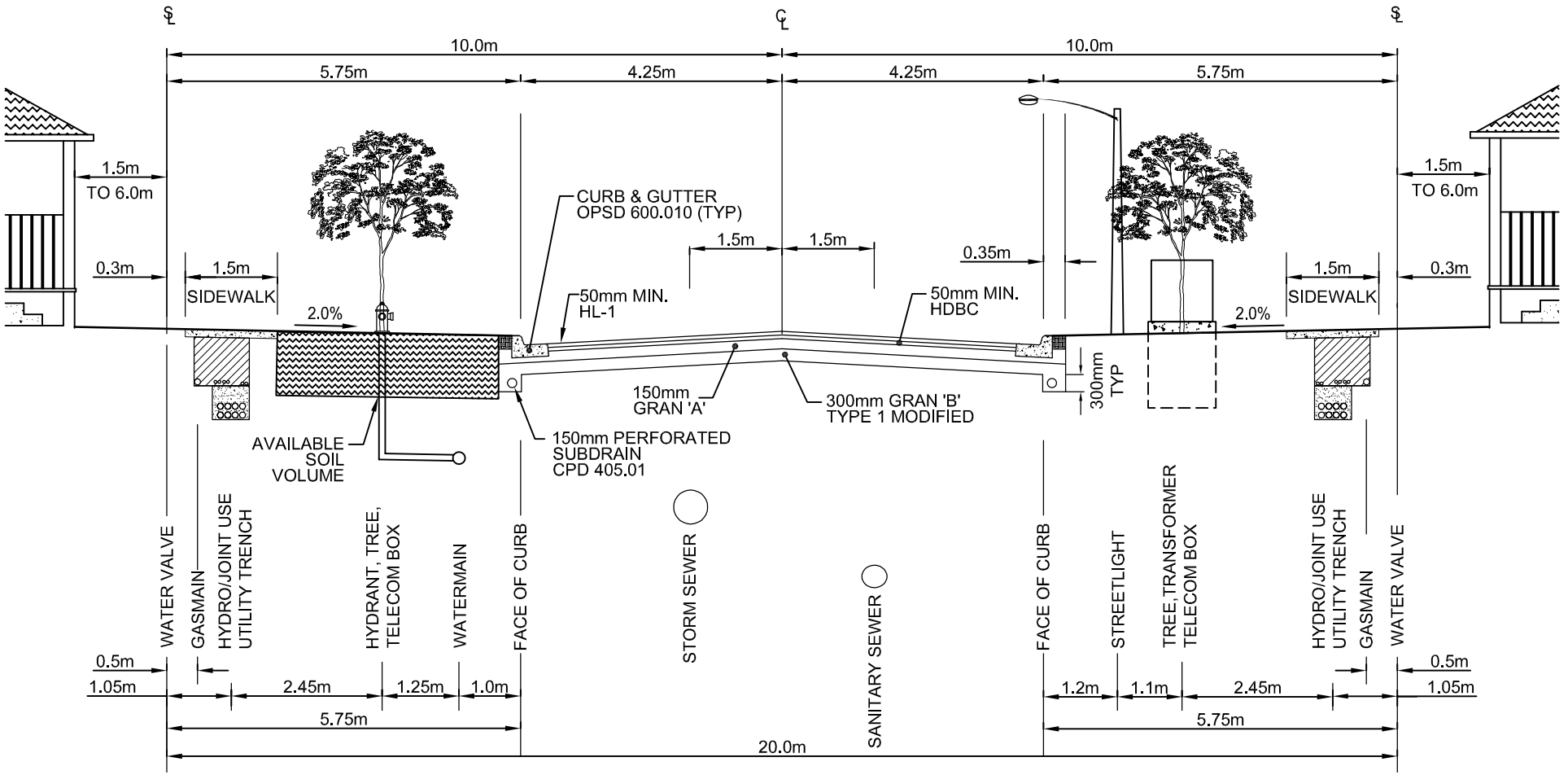

NOTES:

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SERVICE LOCATIONS
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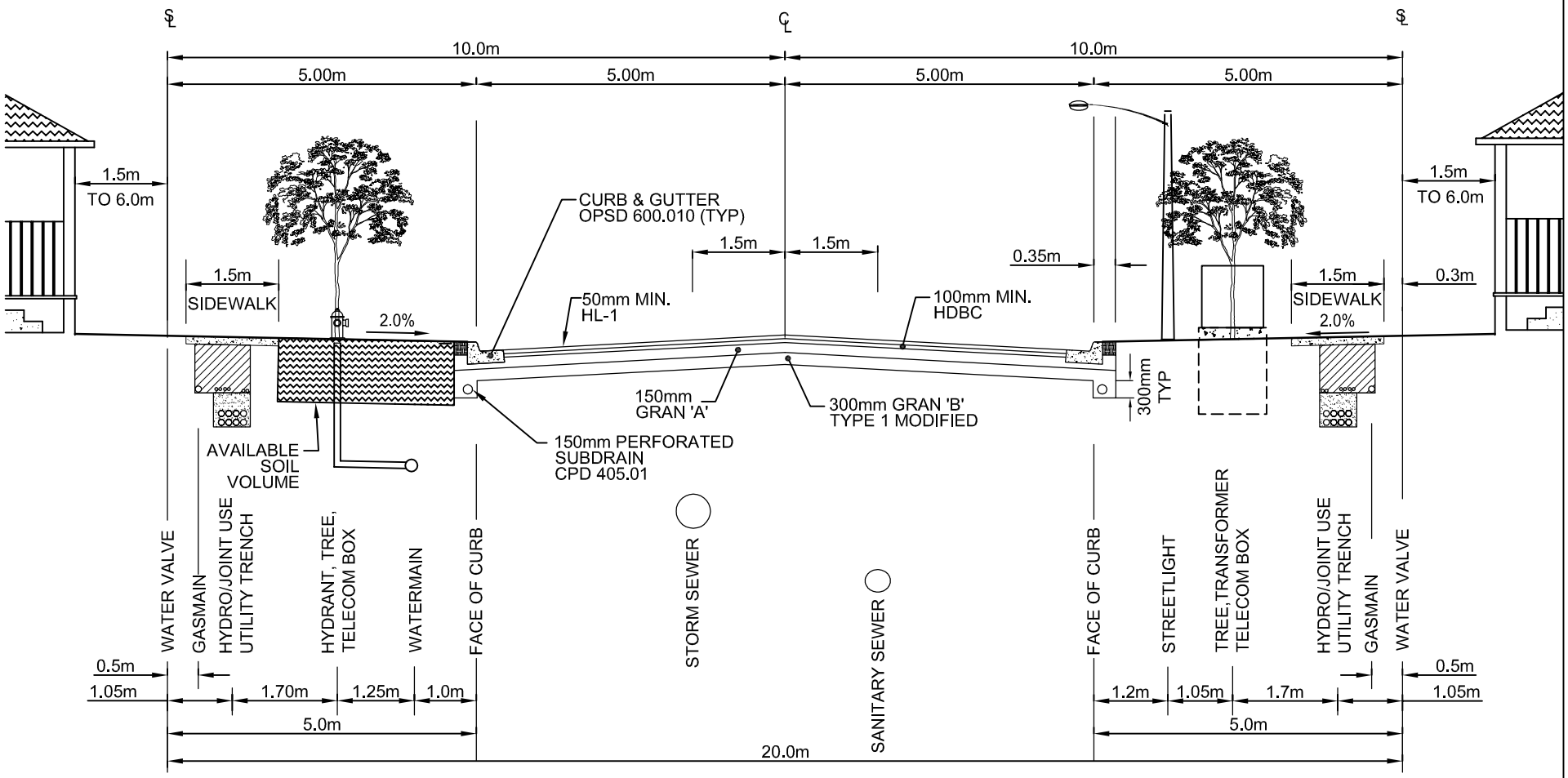

NOTES:

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SERVICE LOCATIONS
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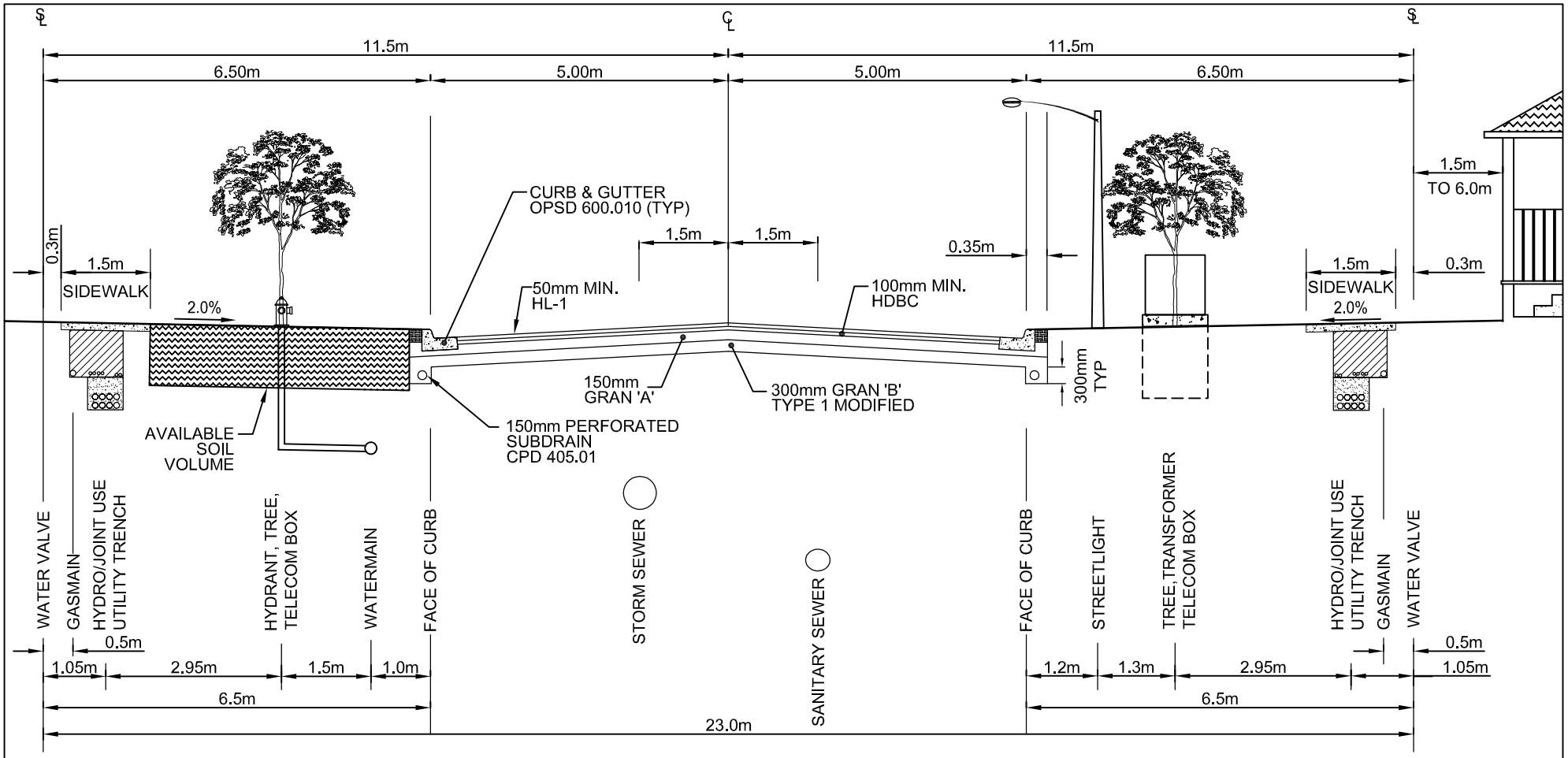

NOTES:

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SERVICE LOCATIONS
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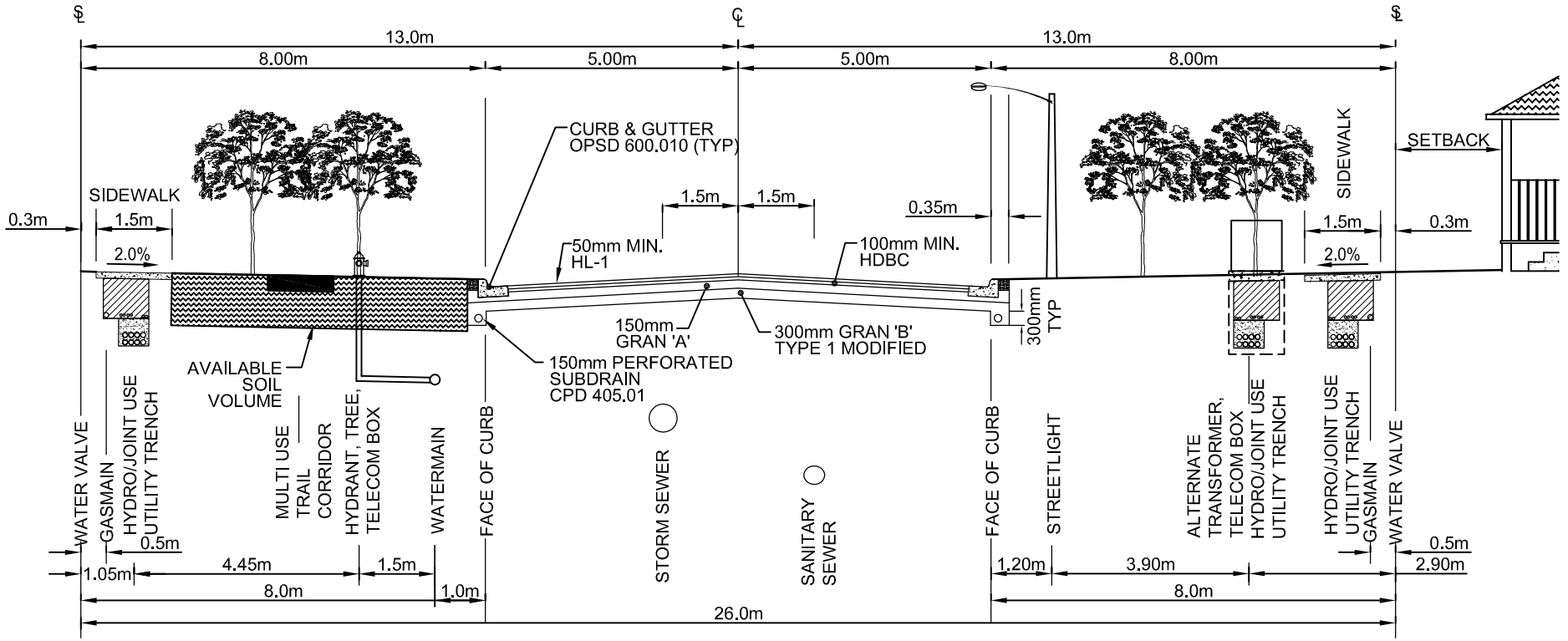

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SERVICE LOCATIONS
AND CROSS SECTION
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DATE SEPTEMBER 2017 REV. 0

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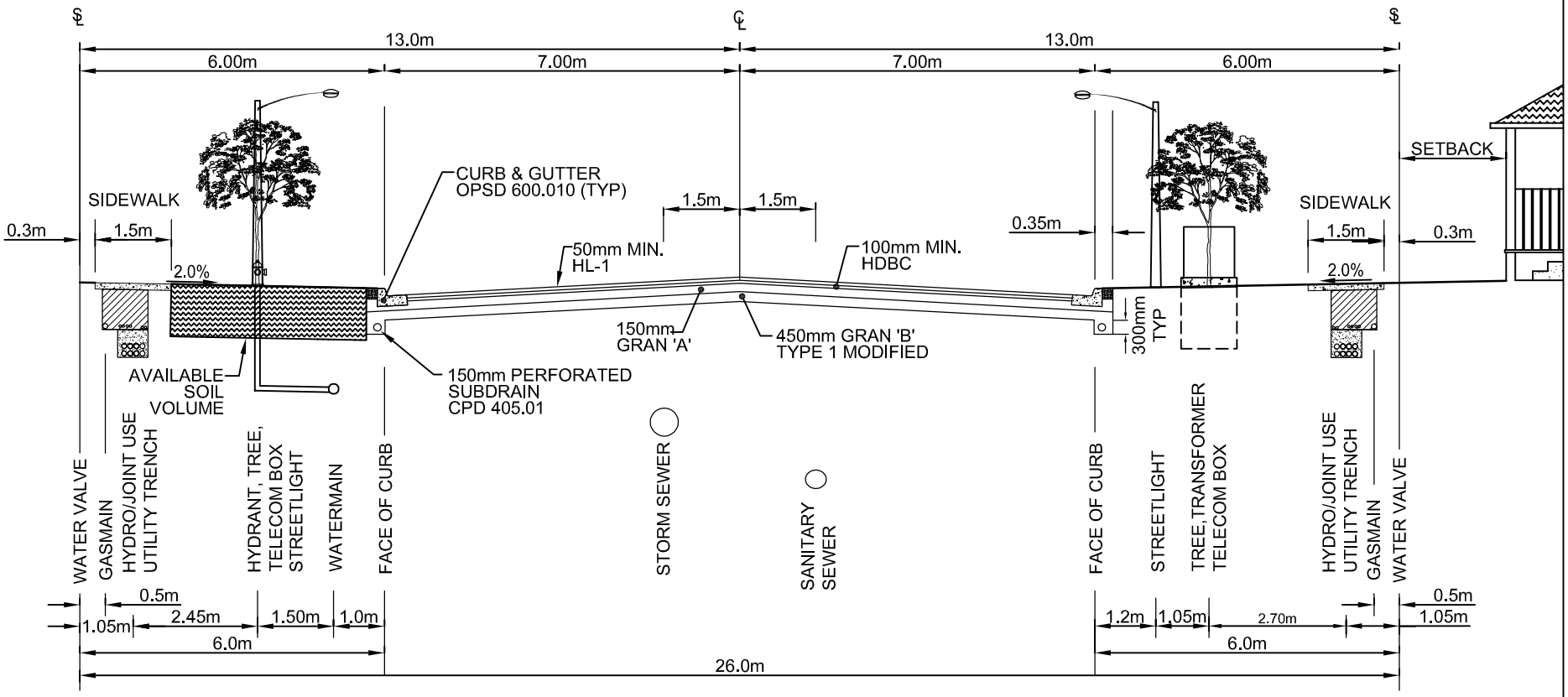

NOTES:

1. STANDARD STREETLIGHT LOCATION ON OPPOSITE SIDE OF ROAD AS WATERMAIN WHERE POSSIBLE.
2. TYPICAL MINIMUM DEPTH OF UTILITY CROSSING SHALL BE 1.0m (TO CLEAR SUBDRAIN)
3. ROOT DEFLECTORS REQUIRED WHERE <1.0m SEPARATION TO UTILITY TRENCH PROPOSED.

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SERVICE LOCATIONS
AND CROSS SECTION
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DATE SEPTEMBER 2017 REV. 0

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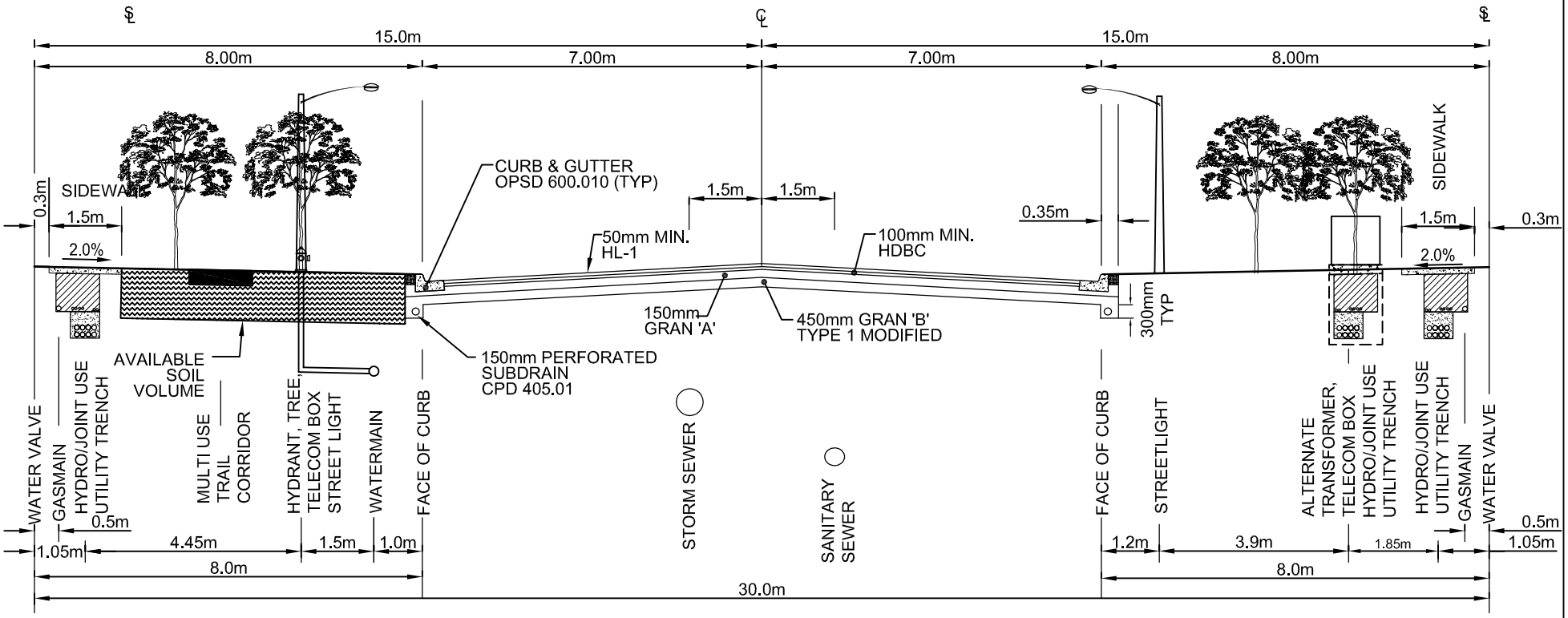

NOTES:

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UTILITY SERVICES DEPARTMENT

SERVICE LOCATIONS
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30.0m. R.O.W. - 14.0m ROAD
SCALE 1:125

DATE SEPTEMBER 2017 REV. 0

USD-100.09

December 2022 City of Peterborough Engineering
Design Standards Revision Log

The following is a list of the sections with significant revisions between the February 2022 and the updated December 2022 City of Peterborough Engineering Design Standards

A.1.14 – Minimum leakage specification for sanitary sewer pipe material as provided by MECP ECA design criteria.

A.1.15.1 - Minimum leakage specification, frost straps and joint wrapping for sanitary manholes as provided by MECP ECA design criteria.

A.1.16.9 - Revisions to sanitary system leakage and deflection testing to meet MECP ECA design criteria.

A.1.17 - Sanitary Forcemain revisions reflecting MECP ECA design criteria.

B.1.6 - Major storm drainage system wording.

B.1.7.1 - Small revision to minimum design velocities.

B.1.9.1 a) - Accessibility revisions to catchbasin locations.

B.1.9.4 b) - Accessibility revisions to catchbasin manhole locations.

B.1.12.6 - Conflicting information in OPSD reference resolved.

B.1.13.1 - Minimum storm service size for single detached dwellings as per MECP ECA design criteria.

B.1.16 - Revisions to storm sewer system leakage and deflection testing to meet MECP ECA design criteria.

C.2.6 - Revisions to Transit Standards reflecting updated IPS organization chart.

C.2.8 - Curb face sidewalk zones as per Accessibility.

D.2.4.C - Subdivision Lot Grading Plans Accessibility and fencing revisions.

D.2.4.D - Subdivision Plan and Profile Drawings Accessibility revisions and MECP ECA design criteria sanitary monitoring manhole added.

D.2.4.I - Accessibility and fencing revisions for subdivision SWM pond drawings.

D.2.4.J - Accessibility revisions to subdivision Landscape Plans.

D.2.4.L - Accessibility revisions to subdivision Street Lighting Plans.

D.2.5 - MECP SWM System ECA design criteria revisions.

D.2.5.B - Subdivision Stormwater Management Quality Control MECP SWM System ECA design criteria revisions.

D.2.5.C - Subdivision Water Balance Design MECP SWM System ECA design criteria revision.

D.2.5.D - Subdivision Low Impact Development MECP SWM System ECA design criteria revisions.

F.4.3 - Accessibility Proposed Site Layout revisions.

F.4.4 - Accessibility Proposed Site Grading revisions.

F.4.5.1 – Downstream sanitary capacity study limits.

Appendix – City of Peterborough Stormwater Management System ECA Appendix A Design and Performance Criteria added.