



I N D E X

1.0	Introduction	2
2.0	Watermain Design	2
2.1	General	2
2.2	Design Flows	2
2.3	System Pressures	4
2.4	Hydraulic Design	4
2.5	Watermains	5
2.6	Valves	6
2.7	Fire Hydrants	7
2.8	Service Connections	7
2.9	Cathodic Protection	8
2.10	Water Meters	8
3.0	Sanitary Sewer Design Criteria	9
3.1	General	9
3.2	Design Flows	9
3.3	Sanitary Sewer Pipe Design	10
3.4	Manholes	12
3.5	Sewer Services (Laterals)	13
4.0	Storm Sewer Design Criteria	15
4.1	General	15
4.2	Stormwater Conveyance	15
4.3	Drainage Design Methods	16
4.4	Design Flows	17
4.5	Storm Drain Pipe Design	19
4.6	Manholes	21
4.7	Catchbasins	22
4.8	Storm Services	23
4.9	Stormwater Management	24
5.0	Lot Grading and Drainage	26
5.1	Introduction	26
5.2	General	26
5.3	Residential Lot Grading	26
5.4	Driveways	27
5.5	Rear Lot Swales and Rear Yard Catchbasins	27
6.0	Roadways, Sidewalks and Access.....	29
6.1	General	29
6.2	Geometric Design Standards	29
6.3	Sidewalks	30
6.4	Curbs	31
6.5	Driveways	31
6.6	Bicycle Paths and Bicycle Lanes.....	31
6.7	Roadway Illumination	31



1.0 INTRODUCTION

The design guidelines included within this sub-section of the manual have been prepared in accordance with current Ministry of Environment guidelines for the design of public water, sewer and storm drainage infrastructure. Guidelines have also been included in this manual relating to lot grading, drainage, roadways and vehicular access points.

The purpose of the design guideline is to assist developers and engineers in understanding the minimum acceptable level of servicing required in the design for new public infrastructure.

2.0 WATERMAIN DESIGN CRITERIA

2.1 General

All watermain upgrades or extensions in the Town of Perth will be reviewed in accordance with the guidelines of the Ministry of Environment and the details of this manual. New potable water systems will be reviewed to ensure that adequate flows (domestic and fire) and pressures will be available to meet the needs of both existing and future development within the municipality.

2.2 Design Flows

2.2.1 General

The design flow criteria provided are intended to act as guidelines for new site and subdivision developments within the municipality. All watermains and appurtenances shall be designed and constructed in accordance with municipal standard drawings and specifications.

2.2.2 Design Water Demand

The system shall be designed to meet the greater of either of the following demands:

- maximum demand plus fire flow; and
- maximum hourly demand.



2.2.3 Population Densities

Where lands are zoned for a specific use and detailed site or subdivision concept plans are not available, the following population densities shall apply:

<u>Land Use Category</u>	<u>Persons/Hectare</u>
Single Family Dwellings	25
Semi Detached and Duplex	25
Townhomes	60
Apartments – Low Density	100

Where lands are zoned for a specific use and a detailed site or subdivision plans is available, the calculation of population for the proposed development shall be based on the following:

<u>Type of Housing</u>	<u>Persons/Unit</u>
Single and Semi Detached	3.8
Townhomes	3.5
Apartments – 1 Bedroom	2.0
Apartments – 2 Bedroom	3.0
Apartments / Condominiums (Seniors)	1.3

2.2.4 Per Capita Demand

Average Daily Demand:

Residential	450 l/capita.day
Commercial	28,000 l/ha.day
Industrial	35,000 to 55,000 l/ha.day
Institutional	*refer to MOE guidelines

Maximum Daily Demand:

Residential	2.0 x avg.day
Commercial	1.5 x avg.day
Industrial	1.5 x avg.day
Institutional	1.5 x avg.day

Maximum Hourly Demand:

Residential	2.2 x max.day
Commercial	1.8 x max.day
Industrial	1.8 x max.day
Institutional	1.8 x max.day



2.2.5 Fire Flow Demand

The level of fire protection to be provided in the public right of way is ultimately the decision of the Town of Perth. In general, designs for fireflow demand should meet the requirements of the Fire Underwriters Survey for central supply systems. Should these fireflow requirements not be achievable, the municipality will consider the minimum flows outlined within the Ministry of Environment “Guidelines for the Design of Water Distribution Systems”.

In all circumstances, the level of fire protection provided on private property shall meet all requirements of the Ontario Building Code.

2.3 System Pressures

The distribution system shall be designed so that the following pressures are maintained:

- The static pressure at any point in the system shall not be less than 275 Kpa (40 psi), excluding periods of fireflow demand;
- The static pressure at any point in the distribution system shall not exceed 550 Kpa (80 psi); and
- During periods of fireflow, the static pressure at any point in the system shall not be less than 140 Kpa (20 psi).

2.4 Hydraulic Design

2.4.1 Friction Factors

The following Hazen-Williams “C” values shall be used for the design of new water systems regardless of pipe materials:

<u>Pipe Diameter (mm)</u>	<u>“C” Factor</u>
150	100
200 to 250	110
300 and over	120

2.4.2 Hydraulic Network Analysis

All proposals to expand the existing water distribution shall be subjected to a hydraulic network analysis completed by a professional engineer in good standing with the Professional Engineers of Ontario. Network models shall be calibrated to actual system flows and pressures as determined by hydrant flow tests conducted by an independent testing agency according to National Fire Protection Agency - NFPA Guideline 291 – “Fire Flow Testing and Marking of Hydrants”.



Town of Perth crews will meet with testing agencies and operate municipal hydrants during fire flow testing. This service is generally provided at no cost to the proponent provided that a copy of the results will be forwarded to the Environmental Services Department.



2.5 Watermains

2.5.1 Location

Watermains shall generally be offset a distance of 3.0m to street centerlines where sanitary sewers are typically located. In addition, watermains should be located on the south and east sides of the street where sunlight exposure is greatest. Locations within bedrock areas may be given special consideration, however details shall ultimately comply with the guidelines of the Ministry of Environment.

Watermain installations shall be discouraged within easements in residential yards. If looping is required between dead end streets within a subdivision, then a dedicated corridor of suitable width (registered easement or block) may be used provided the corridor offers unobstructed access to the utility for operation, maintenance and emergency repair.

2.5.2 Sizing

Watermain sizes shall generally be governed by the minimum system pressures and peak flow demands reviewed within the hydraulic network analysis report (see subsection 2.4).

In all cases the minimum watermain sizes shall comply with the following:

Residential Areas

- 150mm minimum; or
- An exception of 50mm will be permitted, provided the main is located on a cul-de-sac, less than 90m in length, where no more than 6 residential units are serviced.

Commercial / Industrial / Institutional Areas

- As determined by hydraulic network analysis.

2.5.3 Depth of Cover

Minimum depth of cover for new watermains shall be 2.1m as measured from the top of the pipe to the road or ground surface.

2.5.4 Clearance Requirements

Public Health

Horizontal and vertical separation between public watermains and sewers (sanitary and storm) shall meet all requirements of the Ontario Ministry of Environment. All requests to reduce separation requirements will be subject to the review and approval of the province.

Utilities



Spatial separation between watermains and public utilities is necessary to ensure that the system can be readily accessible for operations, maintenance and emergency repairs. Reasonable attempts shall be made within new designs to ensure that the minimum accepted clearances of the municipality are maintained at all times. Where clearances are not reasonable to achieve, the designer shall bring the concern to the attention of the Environmental Services Department. Refer to the Standard Drawings for further details.



Structures

Special consideration shall be made regarding the design of watermains adjacent to existing or planned structures (bridges, foundations, retaining walls, etc...) to ensure that open cut excavations can be reasonably facilitated without extensive shoring, sheet piling, or structural support work.

2.5.5 Thrust Restraints

All plugs, caps, tees, crosses, bends, and reducers shall have thrust blocks or mechanical restraint mechanisms of approved design.

All watermains shall be designed with thrust restraint mechanisms suitable to withstand the maximum operating pressure plus the transient pressure to which the main may be subjected. The value of the transient pressure shall not be less than the pressure surge that would be created by an instantaneous stoppage of a water column moving at 0.6m/s. The design pressure utilized in thrust restraint calculations shall in no case, be less than 1,035 Kpa (150 psi). Refer to the Town of Perth Supplemental Specifications for further details.

2.5.6 Construction in Fill Areas

Watermains shall not be laid in fill areas unless engineered fill has been placed and compacted to 100% standard proctor in 0.3m lifts and regular field density tests have been verified along the trenchline by an independent testing agency. All tees, bends and branch valves in fill areas shall be tied with mechanical restraints and shall include thrust blocks as appropriate.

2.6 Valves

2.6.1 Type

All line valves shall be resilient wedge gate valve style in accordance with the Town of Perth Supplemental Specifications.

2.6.2 Sizes

Line valves shall, in all instances, be the same diameter as the watermain.

2.6.3 Location and Spacing

Unless otherwise approved, line valves shall be located as follows:

- minimum of two valves at a tee intersection;
- minimum of three valves at a cross intersection;
- no further than 200m apart in low density residential areas;
- at the ends of all watermains subject to future extensions, and
- at both ends of any easements or corridors between streets.

Individual valves shall generally be located 1.5m from the adjacent tee or cross being served unless otherwise approved.



2.6.4 Valve Boxes and Chambers

All valves 250mm and smaller shall be installed in valve boxes. Valves 300mm and larger in size shall be installed in valve chambers unless otherwise approved.

2.7 **Fire Hydrants**

2.7.1 Spacing and Location

Hydrant spacing shall not exceed the spacing outlined on the following table:

<u>Land Use</u>	<u>Spacing</u>
Single family residential areas where lot frontage at the street line exceeds 15m	125 m
Single family residential areas where lot frontage at the street line is less than 15m	110 m
Commercial, Industrial, and High Density Residential Areas	90 m

Hydrants shall, wherever possible, be located at or near street intersections, subject to the specified spacing requirements. For mid block installations, hydrants should be located on common lot lines between properties, provided that no other utility or easement is located within 3.0m of the installation.

Refer to the Standard Drawings for further details regarding hydrant setbacks from curbs, sidewalks and driveways.

2.7.2 Hydrant Valves and Boxes

Isolation valves are required on all fire hydrant leads. Valves and valve boxes shall generally be located 1.5m from the hydrant unless otherwise approved. Hydrant valves should be located outside of paved road surfaces and concrete sidewalks whenever possible. Refer to the Standard Drawings for further details.

2.8 **Service Connections**

2.8.1 Service Sizes

The minimum size for all residential water service connections shall be 20mm diameter. Water service for multi-family, commercial, industrial and institutional uses shall be specifically sized in accordance with Ontario Building Code requirements.



2.8.2 Service Locations

Residential water services for single family, duplex and townhomes shall be located in accordance with the applicable Standard Drawing included in this specification.

Each property fronting a street shall have a separate water connection from the main. This service connection will be owned and operated by the Corporation from the main to the shut-off valve located at the property line. Service lines located between the property line and the house will be the sole responsibility of the property owner. No services shall be branched or extended across any part of one property to serve another lot.

All water services larger than 25mm shall be installed in a separate service trench from the sanitary sewer connection from the watermain to the property line.

2.8.3 Corporation Stops

All water services 50mm and smaller shall be fitted with a corporation stop of equivalent size at the watermain.

2.8.4 Curb Stops and Posts

All water services 50mm and smaller shall be located in landscaped areas and shall have curb stops and telescopic shut-off posts installed at the property line. Refer to the Standard Drawings for further details.

2.9 **Cathodic Protection**

All new watermains in the Town of Perth shall be constructed with cathodic protection in place, regardless of site soil conditions. Refer to the Supplemental Specifications for details.

2.10 **Water Meters**

All properties connected to the water distribution system shall be fitted with publicly owned meters to monitor the quantity of water used by each individual customer. Meter sizes shall be determined by the property owner under consultation with the staff from the Environmental Services Department. Meters shall initially be installed at the cost of the customer, however future maintenance and replacement costs shall be the sole responsibility of the Corporation.



3.0 SANITARY SEWER DESIGN CRITERIA

3.1 General

All sanitary sewer upgrades or extensions in the Town of Perth will be reviewed in accordance with the guidelines of the Ministry of Environment and the details of this manual. New sanitary sewers will be reviewed to ensure that adequate capacity will be available to serve the needs of both existing and future development within the municipality.

3.2 Design Flows

3.2.1 General

The design flow criteria provided are intended to provide guidelines for new site and subdivision developments within the municipality. All sanitary sewers and appurtenances shall be designed and constructed in accordance with municipal standard drawings and specifications.

3.2.2 Population Densities

Where lands are zoned for a specific use and detailed site or subdivision concept plans are not available, the following population densities shall apply:

<u>Land Use Category</u>	<u>Persons/Hectare</u>
Single Family Dwellings	25
Semi Detached and Duplex	25
Townhomes	60
Apartments – Low Density	100

Where lands are zoned for a specific use and a detailed site or subdivision plans is available, the calculation of population for the proposed development shall be based on the following:

<u>Type of Housing</u>	<u>Persons/Unit</u>
Single and Semi Detached	3.8
Townhomes	3.5
Apartments – 1 Bedroom	2.0
Apartments – 2 Bedroom	3.0
Apartments / Condominiums (Seniors)	1.3



3.2.3 Population Flows and Peaking Factors

Land Use

Average Residential Flow	350 l/capita.day
Commercial	28,000 l/ha.day
Industrial	35,000 to 55,000 l/ha.day
Institutional	*refer to MOE guidelines

Peaking Factors

Peak Residential Factor (Max = 4.0, Min = 2.0)	Harmon Formula	1	+	$\frac{14}{(4 + P^{1/2})}$
Peak Commercial Factor		1.5		
Peak Industrial Factor		*refer to MOE guidelines		
Peak Institutional Factor		1.5		

3.2.4 Extraneous Flows

All sanitary collection systems shall incorporate an allowance for extraneous flows anticipated to enter the sewer system. The minimum flow used in calculations shall be 0.28 l/s/ha.

3.3 **Sanitary Sewer Pipe Design**

3.3.1 Pipe Flow Formulas

The capacity of new sanitary sewers will be calculated using Manning's equation on the basis of the pipe flowing full, where

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

Q = Design flow in m³/s

A = Cross section area of pipe in m²

R = Hydraulic Radius of pipe in m

S = Slope of sewer in m/m

n = Roughness coefficient

The value of the Manning constant "n" utilized in all calculations shall be 0.013 for both concrete and PVC pipe.



3.3.2 Minimum Pipe Size

The minimum pipe diameter for sanitary sewers shall be 200mm for residential areas and 250mm for all other areas.

3.3.3 Velocity and Grade

The minimum full flow velocity for sanitary sewers shall be 0.6 m/s and the maximum full flow velocity shall be 2.4 m/s.

All sewers shall be designed and constructed using the following minimum slopes:

<u>Pipe Diameter (mm)</u>	<u>Minimum Grade (%)</u>	<u>*Minimum Desired Grade (%)</u>
200	0.40	0.50
250	0.28	0.40
300	0.22	0.30
375	0.15	0.25
450	0.12	0.12
525	0.10	0.10
600	0.08	0.08

*The designer should make reasonable efforts to meet the minimum desired grades listed above in order to improve cleansing velocities and minimize long term maintenance requirements (flushing and cleaning).

3.3.4 Location of Sewers

Sanitary sewers shall generally be located on the centerline of the public road. Locations within bedrock areas may be given special consideration, however details shall ultimately comply with the guidelines of the Ministry of Environment.

Sanitary sewers installations shall be discouraged within easements in residential yards. If sewers cannot be maintained within roadways, then a dedicated corridor of suitable width (registered easement or block) may be used provided the corridor offers unobstructed access to the utility for operation, maintenance and emergency repair.

3.3.5 Minimum Depth of Cover

Sanitary sewers shall generally be laid at a sufficient depth to receive sewage from basements by gravity drainage and to prevent freezing or damage from frost action.

The minimum cover over any sanitary sewer main shall be 1.8m. Where minimum cover cannot be achieved, insulation for frost protection shall be provided in accordance with the Supplemental Specifications.

3.3.6 Combined Sewers



Combined sewers which collect surface drainage still remain in operation within the municipality and ultimately these systems must be phase out in accordance with Ministry of Environment policy. Special design considerations must be given for any new development proposed within a designated combined sewer service area. No development proposal shall be permitted which results in the net increase of surface drainage directed into a combined sewer system.

3.3.7 Clearance Requirements

Public Health

Horizontal and vertical separation between public watermains and sewers (sanitary and storm) shall meet all requirements of the Ontario Ministry of Environment. All requests to reduce separation requirements will be subject to the review and approval of the province.

Utilities

Spatial separation between sanitary sewers and public utilities is necessary to ensure that the system can be readily accessible for operations, maintenance and emergency repairs. Reasonable attempts shall be made within new designs to ensure that the minimum accepted clearances of the municipality are maintained at all times. Where clearances are not reasonable to achieve, the designer shall bring the concern to the attention of the Environmental Services Department. Refer to the Standard Drawings for further details.

Structures

Special consideration shall be made regarding the design of sanitary sewers adjacent to existing or planned structures (bridges, foundations, retaining walls, etc...) to ensure that open cut excavations can be reasonably facilitated without extensive shoring, sheet piling, or structural support work.

3.4 Manholes

3.4.1 Location and Spacing

Manholes shall be provided at the following locations along a sanitary sewer main:

- at all changes in grade;
- at all changes in direction;
- at all changes in pipe material;
- at all intersecting sewers; and
- at the end of all terminal sections.

Manholes shall generally be spaced at a maximum of 120m in order to recognize the limitations of cleaning and inspection equipment.

3.4.2 Manhole Sizes

The minimum size of manhole for sanitary sewers shall be 1200mm diameter. Refer to the Ontario Provincial Standards and Specifications for details regarding manhole sizing relative to pipe diameter.



**CORPORATION of the TOWN of PERTH
ENGINEERING DESIGN GUIDELINES**

SECTION 1.0



3.4.3 Minimum Drops in Manholes

The following criteria shall be used to address hydraulic losses across manholes:

- Obvert of the upstream pipe shall not be below the obvert of the downstream pipe;
- Minimum drop for a straight run shall equal the grade of the pipe;
- Minimum drop for a 45 degree turn shall be 30mm;
- Minimum drop for a 90 degree turn shall be 60mm; and
- Outside drop structures shall be provided where the difference in inverts in a manhole are greater than 600mm.

3.4.4 Manhole Bases and Benching

All sanitary manholes bases shall be pre-fabricated and pre-benched to Ontario Provincial Standards and Specifications. Pour in place manhole bases or benchwork will not be accepted for new construction.

All pipe connections into manhole bases shall be done through pre-manufactured flexible, rubber gasketed joints. All gaskets shall be cast in place style. The use of boot connectors and mechanical clamps will not be approved for new sanitary sewer construction.

3.4.5 Manhole Appurtenances

All manhole appurtenances including but not limited to steps, safety landings, risers, and top sections shall be designed to meet applicable Ontario Provincial Standards and Specifications.

3.5 **Sewer Services (Laterals)**

3.5.1 Minimum Size and Grade

The minimum size for sanitary sewer connections shall be 125mm for residential and 150mm for all other non residential uses. Unless otherwise approved, each property shall be designed to have a separate sanitary service from the residence to the main.

The minimum grade for service connections, 150mm and smaller, shall be 2% from the main to the building line. The maximum grade of any service connection shall be 8%.

3.5.2 Service Locations

Sanitary services for new single family residential, duplex and townhouse units shall be designed and located in accordance with the applicable Standard Drawings contained within this manual.

Each property fronting a street shall have a separate sewer connection from the main. This service connection will be owned and operated by the Corporation from the mainline to the property line. Sanitary service lines located between the property line and the house will be the sole responsibility of the property owner. No services shall be branched or extended across any part of one property to serve another lot.



3.5.3 Connections

Connections to new sewer mains must be completed using pre-manufactured tee fittings. Connections to existing mains shall be completed by coring the pipe and installing an approved saddle connection. The invert of all new connections must be completed at or above the springline of the receiving sewer.

Small diameter service connections into manholes are generally discouraged for a variety of maintenance concerns. Sanitary services will only be permitted in manholes where it is demonstrated that: a) alternative options are not available or are cost prohibitive, b) the flow will not adversely affect the flow of the main sewer; and c) the maximum drop provisions are satisfied.

3.5.4 Service Manholes

Monitoring manholes may be required at the property line for select high density residential, commercial, industrial and institutional sewer services. The designer is advised to review the Sewer Use Bylaw for applicable regulations and restrictions.

3.5.5 Sanitary Pump Stations

This section under review.

3.5.6 Sanitary Forcemains

This section under review.



4.0 STORM SEWER DESIGN CRITERIA

4.1 General

All storm sewer upgrades or extensions in the Town of Perth will be reviewed in accordance with the guidelines of the Ministry of Environment and the details of this manual. New storm sewers will be reviewed to ensure that adequate capacity will be available to serve the needs of both existing and future development within the municipality.

While the Town of Perth, Rideau Valley Conservation Authority and the Ministry Environment are typically the most frequent approval authorities with respect to most stormwater designs, other agencies may have jurisdiction regarding the work including but not limited to the following:

- Department of Fisheries and Oceans (DFO);
- Parks Canada;
- Ministry of Natural Resources (MNR);
- Ministry of Transportation of Ontario (MTO);
- Canadian Pacific Railway (CPR);
- County of Lanark;
- Tay Valley Township; and
- Township of Drummond North Elmsley

Design consultants are advised to consult with the Environmental Services Department to identify particular agencies which may serve as an approval agency for final stormwater designs.

4.2 Stormwater Conveyance

All new storm drainage systems shall consist of the following:

- i) The Minor System – shall consist of ditches and underground storm sewers which are designed to convey flows of a 5 year return frequency. These systems provide drainage service by addressing run-off from more frequent, lower intensity rainfall events.
- ii) The Major System – shall consist of surface floodways, roadways and watercourses which convey flows of a 100 year return frequency. Major flood path routing is required to protect private and public property from flood damage and maintain public health and safety.

4.2.1 Minor System Design

The design of the minor drainage system shall provide unsurcharged conditions up to the 1:5 year storm. The minor system shall include capacity for connection of foundation drains or weeping tiles and the storm sewers shall be of appropriate depth to provide connection to foundation drains. A hydraulic gradeline analysis shall be completed and submitted to the municipality for review.

4.2.2 Major System Design



The design of the major system shall be such that runoff is conveyed within the boundaries of municipal road allowances, blocks or easements. A continuous overland flow route is to be identified on the engineering drainage plans. The maximum allowable depth of flow where pedestrian or vehicle traffic takes place or may be expected is 300mm.

Major system flows must outlet to a watercourse or stormwater management facility (temporary park storage or stormwater management pond). If the major system discharges to a watercourse, ditch, culvert etc... the designer must ensure that the receiving system has adequate capacity. The designer must also take into consideration all necessary measures to protect the outlet from the impact of erosion and ensure that the proposed works comply with all regulatory agency requirements (ie. MOE, DFO, MNR, Conservation Authority etc....).

4.3 Drainage Design Methods

Numerous calculation methods and software tools are available to designers to perform hydraulic and hydrologic analyses for drainage catchments and watersheds. The tools available range in complexity from simple spreadsheet models to more complex dynamic models which simulate actual flow conditions. This section provides a description of the most common stormwater models utilized in the municipality and outlines the limitations for each method.

4.3.1 Rational Method

The Rational Method is the most common method used for designing storm sewers under steady state and free flow conditions. The Rational method uses Manning's equation to determine peak flows and pipe capacity. This method is generally acceptable for designing new storm sewers provided that the drainage area is less than 40 ha and the outlet is not submerged.

4.3.2 Modified Rational Method

The Modified Rational Method (MRM) is a method widely used by designers to calculate storage rates over various rainfall average periods using the Intensity Duration Frequency (IDF) curve. This method is often used when on-site storage requirements are stipulated to match post development flows to pre development rates. The stored rate is identified as being the inflow rate less the allowable release rate. The storage volume is then computed by multiplying the stored rate by the averaging period on the IDF curve. The largest of the storage volumes therefore becomes the required storage volume.

A sample of typical MRM calculations are provided below:

<u>Averaging Period (min)</u>	<u>Intensity (mm/hr)</u>	<u>Inflow Rate (l/s)</u>	<u>Release Rate (l/s)</u>	<u>Stored Rate (l/s)</u>	<u>Storage Volume (m³)</u>
10	183	127	28	99	59
20	111	77	28	49	59
30	83	58	28	30	54
40	67	47	28	19	46
50	57	40	28	12	36



* Required storage based on assumed target release rate of 28 l/s = 59 cubic meters.



4.3.3 Dynamic Computer Models

When stormwater management is used in designing a storm sewer system, a dynamic computer model should be used that simulates inflow hydrographs and the effects of storage attenuation should it be proposed. A dynamic model will help ensure the 5 year level of service will be satisfied and it will also ensure that the system will be protected from the effects of critical surcharge during a 100 year storm event.

A dynamic computer model is preferred for modeling the capacity of existing systems as it will provide realistic results by accounting for the impacts of limited catchbasin capture, depression storage, spatial and temporal variations, times of concentration etc.... When designing large sewer systems (catchments area > 40 ha) , computer models or hydrograph based simulation methods must be used unless the designer can adequately justify as to why an alternate method should be applied.

If a hydrologic and/or hydraulic model is proposed to evaluate the capacity of an existing system, the model should be calibrated based on actual flow data. If rainfall data is used in the analysis, the designer may have access to the Town's rain gauge data which is logged electronically in 5 minute intervals.

When choosing a computer model (ie. DDSWMM, XPSWMM, SWMHYMO, EXTRAN etc.), it is important to consider the data and model limitations. The selection of a proper model application will be the responsibility of the designer and will need to be pre-approved by the Town of Perth.

4.4 **Design Flows**

The details contained within this section will only outline the general requirements for the review of storm sewer designs using the Rational Method. This design format is the most common approach and serves to meet the needs for the scale of most forms of development within the municipality.

4.4.1 Run-off Calculations

The peak rate of flow from an area can generally be calculated using the Rational Formula as follows:

$$Q = 2.78 A I R$$

Where Q = Peak Flow in l/s

A = Area in hectares

I = Average rainfall intensity in mm/hr (at Time of Concentration)

R = Runoff coefficient

4.4.2 Drainage Areas



The drainage area utilized in the design of a new storm sewer should include all lands which will reasonably or naturally drain to the system including future development areas recognized within the Official Plan. The Environmental Services Department will ultimately approve the limits for all drainage areas included in design reports.



4.4.3 Rainfall Intensity

All storm sewer systems shall be designed for a Design Storm Frequency of 1 in 5 year storm occurrence using the most recent rainfall and IDF (Intensity/Duration/Frequency) curves from the McDonald Cartier Airport as developed by the Meteorological Services of Canada. The IDF curves, are included in the Standard Drawings for reference.

IDF Curve Equations are as follows (Intensity in mm/hr):

100 Year Intensity	$1735.688 / (\text{Time in min} + 6.014)^{0.820}$
50 Year Intensity	$1569.580 / (\text{Time in min} + 6.014)^{0.820}$
25 Year Intensity	$1402.884 / (\text{Time in min} + 6.018)^{0.819}$
10 Year Intensity	$1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 Year Intensity	$998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 Year Intensity	$732.951 / (\text{Time in min} + 6.199)^{0.810}$

4.4.4 Runoff Coefficients

The following range of run-off coefficients shall be considered reasonable for design purposes:

Residential – Single Family Homes	0.40 to 0.45
Residential – Semi Detached	0.45 to 0.60
Residential - Townhomes	0.50 to 0.70
Apartments	0.50 to 0.70
Commercial Areas	0.70 to 0.95
Institutional Areas	0.40 to 0.75
Industrial Areas	0.65 to 0.75
Asphalt or Concrete	0.90 to 1.00
Brick or Interlock	0.70 to 0.85
Roofs	0.90
Undeveloped Grassed Areas	0.15
Grassed Areas Maintained	0.25

4.4.5 Time of Concentration

The time of concentration is the time required for flow to reach a particular point in a storm drainage system from the most distant path of travel in the drainage basin. This value includes not only the travel time in the sewers, but also the inlet time or the time require to flow overland into the storm system.



Inlet times should be calculated rather than arbitrarily selected. The calculation must be based upon the overland flow route which will exist when the sewer system and basin has been fully developed to its limits. The time of concentration may be determined using one of the following methods:

- i) **Uplands Method** – This method consists of estimating the flow velocity over the basin to determine the time of concentration. This method utilizes the linear relationships between velocity and slope for various types of terrain (forest, woodland, pasture, cultivated, bare, grassed, paved etc....).
- ii) **Bransby Williams Formula** – In watersheds with an impervious coefficient (C) value of 0.4 or greater, the Bransby Williams Formula can be used. It takes into account area, shape, length and slope of the watershed. Sample formula as follows:

$$T_c = (0.057 \times L) / (S^{0.2} \times A^{0.1})$$

T_c = Time of Concentration (min)
L = Watershed Length (m)
S = Watershed Slope (%)
A = Watershed Area (ha)

- iii) **Airport Formula** - For watersheds with runoff coefficients less than 0.4, the Airport Formula, which was developed for airfield drainage, can be used. Where the watershed length is made up of widely differing surfaces (ie. paved and grassed), the T_c for each surface should be determined and added to give the overall T_c. Sample formula as follows:

$$T_c = 3.26 \times (1.1 - C) \times L^{0.5} / S^{0.33}$$

T_c = Time of Concentration (min)
C = Runoff Coefficient
L = Watershed Length (m)
S = Watershed Slope (%)

Once the Time of Concentration has been determined, the rainfall intensity may be determined using the Intensity, Duration, Frequency curves. A T_c less than 10 minutes is not recommended as it may provide unrealistically high peak flows. The curves are presented in the Standard Drawings.

4.5 Storm Drain Pipe Design

4.5.1 Pipe Flow Formulas

The capacity of new storm sewers will be calculated using Manning's equation, where

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

Q = Design flow in m³/s

A = Cross section area of pipe in m²

R = Hydraulic Radius of pipe in m



S = Slope of sewer in m/m

n = Roughness coefficient

The value of the Manning constant “n” utilized in all calculations shall be 0.013 for both concrete and PVC pipe. A constant of 0.024 shall be used for corrugated steel pipe (where use of such materials have met with the prior approval of the municipality).

4.5.2 Hydraulic Grade Lines

In general, storm sewers must be designed to convey design flows when flowing full with the hydraulic grade line (HGL) at or below the crown of the pipe. In some instances, however the HGL may be elevated to local boundary conditions.

Storm sewers must be designed to account for hydraulic losses due to bends, junctions, and pipe transitions.

HGL calculations are required where surcharge conditions may occur due to backwater from stormwater ponds, outlets, downstream systems, or as requested by the municipality.

4.5.3 Minimum Pipe Size

The minimum pipe diameter for mainline storm sewers shall be 300mm. The minimum pipe size for catchbasin leads shall be 200mm (single structure) and 250mm (double structure).

4.5.4 Velocity and Grade

The minimum full flow velocity for storm sewers shall be 0.8 m/s and the maximum full flow velocity shall be 6 m/s. All minimum grades shall be selected on the basis of meeting listed velocity ranges.

4.5.5 Location of Sewers

Storm sewers shall typically be located in a common trench with the sanitary sewer on the opposite side of the road from the watermain. Locations within bedrock areas may be given special consideration, however details shall ultimately comply with the guidelines of the Ministry of Environment.

The installation of mainline storm sewers shall be discouraged within easements in residential yards. If storm sewers cannot be maintained within roadways, then a dedicated corridor of suitable width (registered easement or block) may be used provided the corridor offers unobstructed access to the utility for operation, maintenance and emergency repair.

4.5.6 Minimum Depth of Cover

The minimum cover over any storm sewer main shall be 1.5m. Where minimum cover cannot be achieved, insulation for frost protection shall be provided in accordance with the Supplemental Specifications.

4.5.7 Combined Sewers



Combined sewers which collect surface drainage still remain in operation within the municipality and ultimately these systems must be phase out in accordance with Ministry of Environment policy. Special design considerations must be given for all new development proposed within a designated combined sewer service area. No development proposal shall be permitted which results in the net increase of surface drainage directed into a combined sewer system.

4.5.8 Clearance Requirements

Public Health

Horizontal and vertical separation between public watermains and sewers (sanitary and storm) shall meet all requirements of the Ontario Ministry of Environment. All requests to reduce separation requirements will be subject to the review and approval of the province.



Utilities

Spatial separation between storm sewers and public utilities is necessary to ensure that the system can be readily accessible for operations, maintenance and emergency repairs. Reasonable attempts shall be made within new designs to ensure that the minimum accepted clearances of the municipality are maintained at all times. Where clearances are not reasonable to achieve, the designer shall bring the concern to the attention of the Environmental Services Department. Refer to the Standard Drawings for further details.

Structures

Special consideration shall be made regarding the design of storm sewers adjacent to existing or planned structures (bridges, foundations, retaining walls, etc...) to ensure that open cut excavations can be reasonably facilitated without extensive shoring, sheet piling, or structural support work.

4.6 Manholes

4.6.1 Location and Spacing

Manholes shall be provided at the following locations along a storm sewer main:

- at all changes in grade;
- at all changes in direction;
- at all changes in pipe material;
- at all intersecting sewers; and
- at the end of all terminal sections.

Manholes shall generally be spaced at a maximum of 120m in order to recognize the limitations of cleaning and inspection equipment.

4.6.2 Manhole Sizes

The minimum size of manhole for storm sewers shall be 1200mm diameter. Refer to the Ontario Provincial Standards and Specifications for details regarding manhole sizing relative to pipe diameter.

4.6.3 Manhole Construction and Benching

The requirement to include benching as part of storm manhole construction will generally be reviewed on a case by case basis.

Benched Manholes - Benching of storm manholes will generally be required as follows:

- On all storm sewers, regardless of diameter, which outlet into a recognized stormwater management facility which is designed for the collection and treatment of suspended sediments; and
- On all storm sewers 525mm and greater in diameter.



Where benching is required, manhole drops shall be in conformance with MOE guidelines and applicable Ontario Provincial Standards and Specifications.



Sump Manholes - Sump manholes (0.3m) will generally be required as follows:

- On the first segment of storm sewer in any system which collects surface water from a roadside drainage ditch; and
- On all storm sewers, 450mm and smaller, which do not outlet into a recognized stormwater management facility which is designed for the collection and treatment of suspended sediments.

All storm manholes bases shall generally be pre-fabricated to Ontario Provincial Standards and Specifications. Pour in place manhole bases will generally not be accepted for new construction. All pipe connections into manhole bases shall be done through pre-manufactured flexible, rubber gasketed joints.

4.6.4 Manhole Appurtenances

All manhole appurtenances including but not limited to steps, safety landings, risers, and top sections shall be designed to meet applicable Ontario Provincial Standards and Specifications.

4.7 **Catchbasins**

4.7.1 Catchbasin Locations

Catchbasins shall be designed with 600mm deep sumps and shall be provided at regular intervals along roadways, at intersections and at low points. Double catchbasins should be installed at locations of high run-off and at “absolute” sag points where alternate surface drainage outlets do not exist.

Catchbasins installed as part of new construction should be clear of pedestrian crossing points and driveway depressions where possible.

4.7.2 Catchbasin Spacing

Catchbasin spacing in conventional road drainage systems (normal crown) shall be spaced individually to meet the following criteria:

<u>Asphalt Surface Area of Roadway (m2)</u>	<u>Road Gradient (m)</u>
500	0 – 3%
350	Greater than 3%

Some stormwater management systems use inlet control at catchbasins to achieve controlled release rates and as such these design areas may use less frequent spacing. In all cases, the designer must justify spacing which exceeds the above basic criteria.

4.7.3 Ditch Inlets



Ditch inlets are to be designed to capture run-off from rural areas (roadside ditches) and are therefore subject to large flow rates. Ditch inlet design should carefully consider grate selection, debris, sediment loading, erosion and ongoing maintenance requirements. Gratings used over ditch inlets shall generally have a hydraulic capacity which is 200% of the design flow rate.

4.8 Storm Services

4.8.1 Minimum Size and Grade

The minimum size for storm sewer connections shall be 100mm.

The minimum grade for service connections shall be 2% from the main to the property line.

4.8.2 Service Locations

Storm services for new single family residential, duplex and townhouse units shall be designed and located in accordance with the applicable Standard Drawings contained within this manual.

Each property fronting a street shall have a separate storm sewer connection from the main. This service connection will be owned and operated by the Corporation from the mainline to the property line. Storm service lines located between the property line and the house will be the sole responsibility of the property owner. No services shall be branched or extended across any part of one property to serve another lot.

4.8.3 Pipe Connections

Connections to new storm mains must be completed using pre-manufactured tee fittings. Connections to existing mains shall be completed by coring the pipe and installing an approved saddle connection. The invert of all new connections must be completed at or above the springline of the receiving sewer.

4.8.4 Roof Drains

The connection of roof downspouts to a foundation drain collection system is not permitted. Roof drains and downspouts should discharge to the surface as far away as is practical from the foundation wall to help minimize seepage into the foundation drains and storm sewers. Rain barrels and infiltration trenches are among some of the environmentally sound practices recommended by the Ministry of Environment for managing roof drains.

Roof drainage connections to the sanitary sewer are strictly prohibited.

4.8.5 Foundation Drainage

The MOE generally recommends that foundation drainage be directed to either the surface of the ground or to a storm sewer system, if one is available.



Foundation drains should not surcharge. In the design of new storm sewer systems, the underside of footing elevation must be a minimum of 0.3m above the 100 year hydraulic grade line of the pipe. In these cases, both the HGL and the top of footing elevation must be shown on the design plan. For older service areas, the use of a sump pump, in addition to a backwater valve, may be required to protect homes from high groundwater hydrostatic pressures around the foundation wall during extended surcharge periods.

Storm backwater valves, or backflow prevention devices, should be installed as recommended by the Ontario Building Code on all new foundation drain systems connecting to a storm sewer system to minimize the potential for backups. Backwater valves are to be located inside the building at a location that will allow for ease of access and maintenance.

Connections between foundation drains and sanitary sewers are strictly prohibited.



4.9 Stormwater Management

4.9.1 General Guidelines

Policies contained within the Town of Perth Official Plan currently require that all forms of urban development undertake stormwater management as a preventative approach to protect water resources (quality and quantity).

The key principals which Council has endorsed in it's support of stormwater management practices are as follows:

- a) The natural hydrological characteristics are maintained, and where possible, enhanced as the means to protecting the base flow of watercourses.
- b) That the natural infiltration of water on lands which are to be developed, is maximized.
- c) That proposed development will not result in increased downstream flooding or erosion, or cause adverse effects on receiving streams.
- d) To ensure that alterations to natural drainage systems are prohibited or at least minimized by maximizing the retention of natural vegetation and by leaving stream channels in their natural form.
- e) That sanitary and storm sewers are separated.
- f) That fish and wildlife habitat is protected, enhanced or restored including habitat linkages where affected by the discharge or outlet of drainage facilities.
- g) That a sustainable environmental approach is utilized in protecting water resources.
- h) That water quality will be monitored on an ongoing basis as the means to evaluating the effectiveness of stormwater management practices.

It is the intent of this standard to incorporate stormwater management controls into the development review and approval process. Proponents of development will be required to plan for and undertake stormwater management which complies with the above principals as well as any master drainage plans.

Proponents are requested to use the design framework contained within the Ministry of Environment – Stormwater Management Planning and Design Manual – 2003. This manual is published on the Ontario Ministry of Environments' website (www.ene.gov.on.ca) and is available at no cost. Section 4.0 of the MOE manual provides a broad range of stormwater management applications and identifies the associated opportunities and constraints for each approach. Designers should preconsult with the Rideau Valley Conservation Authority and the Environmental Services Department on stormwater management alternatives before advancing with final detailed design work.

4.9.2 Quantity Controls



The following guidelines represent the basic criteria which designers should strive for in addressing stormwater controls for new site developments:

The layout of the land to be developed shall provide a design of stormwater flow and detention in such a manner that the rate of runoff shall not exceed that which existed prior to the development. Unless otherwise approved, the maximum allowable release rates into the storm system shall not exceed a 5 year pre-development rate of run-off. Any run-off greater than the allowable release rate must be stored on site for return periods up to and including the 100 year event. Where developments fall within the split of separate watersheds, the pre-development flows to each area shall be preserved.

Site storage methods for stormwater may include, but are not limited to the following:

Parking Lot Storage – This method is the most economical, low maintenance system and is widely used in new developments with surface parking. Parking lots are graded in such a way that the required storage can be achieved within the lot and released at a controlled rate through site storm drainage systems.

Storage Ponds – Some sites which have a reasonable complement of greenspace can construct a landscaped pond on the site. Flow from the site is directed to the pond where it is retained prior to entering the storm system. This method is less practical on small urban developments due to the design area requirements.

Underground Storage – In areas where surface storage is not feasible, underground reservoirs, such as large diameter pipes or soakaway devices can be used. The disadvantage of this type of system is the high capital cost and regular maintenance commitments.

Roof Storage – Buildings with flat roofs can use rooftop ponding to supplement surface or underground storage. Runoff from the roof area is allowed to typically pond up to a depth of 100mm deep for a limited period of time. Flow control weirs are installed at all roof drains to achieve the required ponding depth. Such design proposals must be accounted for in the buildings structural design.

The Town of Perth acknowledges that different forms of development offer different opportunities and constraints for the retention of stormwater. In practice, stormwater retention for residential subdivisions should not take place in private rear yards or on public roadway surfaces.

4.9.2 Quality Controls

Stormwater quality is not addressed by this document as it is an area that is generally legislated and/or regulated through the Ministry of Environment, Rideau Valley Conservation Authority, Ministry of Natural Resources and the Department of Fisheries and Oceans.



Stormwater quality (basic, normal or enhanced) should be evaluated with the relevant technical agency and appropriate measures should be included within all stormwater designs. Where public stormwater quality systems are proposed, the designer must consult with the municipality regarding operational and maintenance commitments. The Town of Perth reserves the right to reject any proposed public owned stormwater management alternatives which carry high capital, operational or long term maintenance costs.

4.9.3 Erosion and Sediment Controls

All stormwater management reports shall include direction to Owners and Contractors regarding the minimum requirements to be satisfied to address erosion and sediment controls during construction. Reference shall be made to the best practices contained within the MOE - Stormwater Management Planning and Design Manual – 2003 as well as details contained within the Ontario Provincial Standard Specifications.



5.0 LOT GRADING AND DRAINAGE

5.1 Introduction

The following design guidelines have been provided to assist in the preparation of individual lot grading plans as well as comprehensive grading plans which may be required through the approval of a severance or plan of subdivision.

These guidelines are intended to complement all other existing designs standards and planning documents and /or best practices.

These design guidelines will generally be applicable for the majority of locations within the municipality. However, because of unique topography in certain areas, exception to these design parameters will be considered.

5.2 General

The following lot grading principles shall be employed in the development of all site grading plans.

- Lot grading and resulting drainage patterns shall not adversely affect either adjacent or downstream lands. If a property currently receives drainage from another property, the lot grading shall account for this drainage in the design.
- Lot grading is to be implemented to facilitate ease of maintenance and maximize use of land.
- All existing perimeter ground elevations of the subject property shall remain undisturbed unless otherwise approved.
- Lot drainage shall be contained within the subject property and discharged to an existing municipal rear yard swale, storm sewer drainage system, or directly into a natural watercourse in a manner acceptable to the municipality and relevant environmental agencies.
- No alterations to existing boundary elevations on adjacent lands shall be undertaken unless written agreement with the adjacent property owner has been obtained and submitted in a format acceptable to the Town of Perth.
- If during construction, alterations to the grading have to be made to drain water across either adjacent and / or downstream properties, letters of acceptance from the affected property owners must be received with the final lot grading plan.

5.3 Residential Lot Grading

The grading for individual residential lots shall be developed using the following minimum standards:

- Drainage flows shall be directed away from structures.



- Drainage flows which are carried around building structures are to be confined to defined swales located as far from the building structure as possible;
- Minimum front and rear yard lot gradient is two (2) percent.
- Maximum gradient for amenity areas (rear yards) is five (5) percent.
- Maximum side yard gradient is thirty three (33) percent which represents a 3 horizontal to 1 vertical slope.
- The maximum slope of embankments between properties shall be 3 horizontal to 1 vertical. Failing this a retaining wall or terracing shall be constructed to the satisfaction of the municipality.

5.4 Driveways

The grading for individual driveways shall be developed using the following minimum standards:

- The gradient of a driveway shall be calculated from the back of curb or edge of pavement to the front of the garage or level portion of the driveway. The future provision of a sidewalk (if applicable) must be taken into consideration when calculating the grade of a driveway.
- The minimum grade for a driveway shall be two (2) percent.
- The maximum grade for a driveway shall be eight (8) percent.

5.5 Rear Lot Swales and Rear Yard Catchbasins

Rear yard catchbasins and associated pipework will typically be located within public owned easements registered against title. Ownership, operations and maintenance of these facilities will remain the sole responsibility of the municipality. Rear yard swales within new plans of subdivision are typically owned and maintained by the private landowners. The design of these facilities shall ultimately meet the following requirements:

- Drainage ditches and swales for rear yards shall be designed using the principal of open channel flow.
- Unless specifically designed for stormwater management purposes, all lot drainage swales and ditches shall have a minimum slope of 1.5% and a minimum depth of 150mm. The maximum allowable depth of a swale and ditch shall be 600mm. The maximum side slope of a swale/ditch shall be 3 horizontal to 1 vertical.
- Rear yard swales which have a gradient of less than 1.5% should be avoided where possible. Swales with a gradient of less than 1.5% shall be fitted with a 150mm geotextile wrapped perforated subdrain. All subdrains must discharge to a positive outlet.



- Rear yard swales may be constructed fully within one lot or may be designed to straddle property lines.
- The maximum flow allowable in a side yard swale shall be that from 6 rear yards.
- The maximum flow allowable in a rear yard swale which discharges directly onto the road allowance shall be that from 6 rear yards.
- The maximum distance that flow shall travel in a rear yard swale before it is collected by a rear yard catchbasin (or other approved unit) shall be 90m unless otherwise approved.
- Rear yard catchbasins are to be avoided wherever practical. If for practical reasons, a rear yard catchbasin is unavoidable, the catchbasin and lead shall be designed to municipal standards. Furthermore, all that portion of the catchbasin structure and the lead itself shall be located entirely within one lot, wherever practical.
- Where catchbasins and catchbasin leads are required in a rear yard, easements granted to the municipality shall be 1.2m wide along the limit of each abutting lot or 2.4m wide where there is no abutting lot. Easement agreements for associated drainage works shall be prepared by the Town solicitor and shall be registered on title with full cost recovery to the proponent.



6.0 ROADWAYS, SIDEWALKS AND ACCESS

6.1 General

This section identifies the Town of Perth's standards for the design of roads, walkways, and access to properties. The Geometric Design Guide for Canadian Roads, published by the Transportation Association of Canada shall be used in all situations where the Town of Perth Engineering Standards and Specifications do not provide necessary direction or where variances to the standards are warranted. In all cases, sound engineering design and practices must be applied.

6.2 Geometric Design Standards

The Town of Perth Official Plan currently has three basic road classifications which consist of: arterial roads, collector roads, and local roads. For the purposes of this design manual, design guidance will only be provided for the design of new collector and local roads created by Plan of Subdivision. The design and construction of new roads by the municipality will otherwise be addressed under the appropriate schedule of the Municipal Class Environmental Assessment.

6.2.1 Right of Way Widths

Right of way widths shall be in conformance with the requirements of the Official Plan.

Collector roads shall have sufficient rights of way to accommodate utility alignments, sidewalks, and special access requirements such as turning lanes. Collector road right of ways shall generally be 20m, increasing to 26m at intersections with arterials. Adequate rights of way shall be provided at all corner cut-off (sight triangles) and turn around locations.

Local roads shall have a right of way width of 20m. This standard may be reduced to help accommodate infill development provided the street carries a low volume of traffic and it is not a through street.

6.2.2 Road Widths

Street widths shall be designed to Transportation Association of Canada guidelines to consider a broad range of factors which shall include: classification, function, adjacent land use, AADT, service vehicles, cyclists, on-street parking etc.

The minimum width for the construction of any residential roadway shall be 8.5m unless otherwise approved in a Council approved Community Design Plan. Typical cross sections for local residential roads have been included in the Standard Drawings section of this manual.

6.2.3 Cul-de-sacs

Cul-de-sacs are generally discouraged in the planning of new subdivision developments due to the discontinuities created within the road network and the elevated service and maintenance costs it causes the municipality.



Where permitted, cul-de-sacs shall generally be no longer than 150m and shall be designed to provide for the continuous forward movement of all service vehicles inclusive of road maintenance and fire fighting vehicles. All cul-de-sacs must be designed to satisfy the requirements of the Ontario Building Code for fire routes.

The minimum curb radius for a cul-de-sac bulb shall be 14m. Where an island feature is proposed, the minimum curb radius shall be increased to 16m. Refer to the applicable standard drawing for details.

6.2.4 Intersections

Particular attention shall be given to the design of all intersections. The designer should employ good engineering practice in assessing the following concerns:

- approach grades and grade transitions
- crossing sight distance
- design speed(s)
- intersection cross slopes
- curb returns
- intersection alignment
- turning movements
- vehicle storage (left turn slots)

Specifically, grades of major and minor roads at intersections shall be adjusted where topographic or other conditions dictate the use of maximum or near maximum permissible grades. Such adjustments are essential to provide reasonable stopping opportunities during extreme roadway icing conditions.

6.2.5 Vertical and Horizontal Alignments

All horizontal and vertical curves shall be based on TAC guidelines using a minimum design speed of 50km/h. All details for curves shall be included on design plans and profiles inclusive of EC, BC, PVI, k values, internal angle, radius, tangent length etc...

6.2.6 Road Crowns

Standard road crowns on streets shall be 2%, with the crown point located in the centre of the roadway pavement. Where extreme topography is involved, certain local roads may be designed with cross slopes from 1% to 3% or with one way cross fall.

6.2.7 Structural Design Considerations

The structural designs for new roadways shall be based on the greater of the following:

- The minimum asphalt and granular thicknesses included on the applicable standard drawing (where available), or
- The minimum asphalt and granular thicknesses included within a geotechnical report prepared by a Geotechnical Engineer, licensed in the Province of Ontario.

All roadways shall be constructed on approved subgrade as determined by field review by the geotechnical engineering firm responsible for design.



6.3 Sidewalks

The requirement for sidewalks on new roadways will ultimately be defined by the policies contained within the Official Plan, in combination with the development review process for new subdivisions. Where sidewalks are required, the following design criteria shall apply.

Sidewalks shall be constructed of concrete and shall be a minimum 1.5m in width. Sidewalks shall be 125mm thick in all locations and shall be increased to 150mm at driveways and access points. Reinforcing mesh should be included in all walkways within a driveway crossing.

All sidewalks shall be set back from curblines wherever possible outside of the downtown commercial core. The resulting boulevard strips between curbs and sidewalks should be 2.0m wide or a minimum of 1.5m to support growth of grass boulevards. Curbside construction should be avoided for all new installations.

New sidewalks shall be designed in a manner to provide for barrier free accessibility at all street intersections, private and public parking lots, community mailboxes and other locations specified by the Environmental Services Department.

6.4 Curbs

All new curb construction on streets shall be concrete barrier style with concrete gutter. Refer to the applicable standard drawings for details. Mountable curb construction may be permitted on reconstruction projects where significant grading and drainage constraints exist.

6.5 Driveways

All new driveways shall be in conformance with the requirements of the Town of Perth Zoning Bylaw. The bylaw currently governs regulations pertaining to number, width, angle, and distance from intersecting streetlines. Driveway designs must also comply with the requirements of the Ontario Building Code where such access is a designated fire route.

The minimum grade for a driveway shall be 2% and the maximum grade shall be 8%.

All driveways shall have a minimum clearance of 1.5m from structures such as hydrants, streetlights or utility pedestals.

6.6 Bicycle Paths and Bicycle Lanes

Bicycle paths and cycling lanes, where required, shall be designed to Transportation Association of Canada guidelines.

6.7 Roadway Illumination

This section under review.



I N D E X

1.0	Scope	2
2.0	Survey Information	2
3.0	Engineering Drawing Specifications.....	3
3.1	Drawing Format	3
3.2	Existing Base Plan Information	4
3.3	Engineering Drawings – Site Plan Control	4
3.4	Engineering Drawings – Plans of Subdivision / Public Rights of Way	7
4.0	Engineering Reports	11
5.0	Drawing Submission Requirements	12



1.0 SCOPE

- 1.0.1 The purpose of this section is to provide clear direction to landowners, developers, consultants and contractors regarding the minimum standards and submission requirements needed to facilitate engineering design review and approval. These specifications relate to all designs for infrastructure works proposed to be constructed on private or public lands through contractual agreements and/or Planning Act approvals with the Municipality. It is the specific intent of the Environmental Services Department to require quality plan and report submissions in order to expedite reviews in a timely manner and provide a high quality of service. It is recommended that whenever engineering submissions are required, the Consultant arrange for a pre-consultation meeting with the Department to ensure compliance with the latest municipal standards, specifications, and policies.
- 1.0.2 Incomplete or substandard submissions will be returned to the Consultant without comment on the drawings and with a short letter of explanation as to why the drawings are being returned. A subsequent re-submission which remains incomplete or sub-standard will result in a request to meet with the Consultant, the applicant, and the Director, Environmental Services or his/her designate.
- 1.0.3 All submissions shall reflect and comply with the requirements outlined by the following:
- (a) all applicable Federal and Provincial Acts and Regulations;
 - (b) all applicable policies contained within the current Official Plan;
 - (c) all applicable regulations contained within the current Zoning Bylaw;
 - (d) all applicable Municipal Bylaws relating to the works; and
 - (e) all current guidelines, standards, and specifications of the Town of Perth.

2.0 SURVEY INFORMATION

- 2.0.1 For the preparation of design submissions, any information received from the Municipality relating to existing services should be used as a guide only. All locations and elevations of existing works must be verified through field locates and geodetic surveys. The Municipality takes no responsibility for the exactness of service information obtained from record drawings.
- 2.0.2 All elevations shall be shown in metric geodetic datum in order that it may be related to Ministry of Natural Resources topographic records and the regulatory flood limits of the Tay River or its tributaries. Elevations submitted in imperial format will not be accepted.
- 2.0.3 All survey work shall be tied into legal survey bars and approved monuments or municipal benchmarks. Benchmark numbers, locations and elevations can be obtained by contacting the Town of Perth Environmental Services Department.



- 2.0.4 All surveys shall be conducted in a safe manner so as not to create a nuisance to traffic or the public at large. Copies of legible field notes shall be made available to the Municipality upon request.
- 2.0.5 Where applicable, cross sections will be required. The section shall include centreline, edge of pavement or gutter line, edge of shoulder, ditch invert, top of ditch, property line, and an existing ground elevation inside property line.

3.0 ENGINEERING DRAWING SPECIFICATIONS

3.1 Drawing Format

All engineering drawing submissions shall be prepared in accordance with the following minimum standard requirements, *unless otherwise approved*:

- (a) All drawings are to be prepared in an electronic format compatible with the current version of Autocad in use by the municipality;
- (b) Standard sheet sizes shall be A1 (metric) or D (imperial) in order to allow integration with existing record management systems;
- (c) All drawings submitted for plan review shall be plotted at an appropriate metric scale (typically 1:200, 1:250, 1:300 or 1:500 scale). Drawing scales should be consistent between the various drawings in a set where possible;
- (d) All profile drawings submitted for plan review shall be plotted at an appropriate metric scale (typically 1:25 or 1:50 vertical scale);
- (e) Drawings are to include a north arrow and should be oriented with true (magnetic) north to the top or right side of the drawing;
- (f) Legal property lines including bearings and distances, registered easements, road names, civic addresses are to be identified;
- (g) A revision block is to be included on all plans and shall track drawing changes and applicable dates;
- (h) Standard drafting procedures shall be used for dimensioning, arrowheads, line densities etc. Lettering shall be upper case and shall have a minimum font size of 2.5 mm for legibility and reproduction. All new civil works shall be drafted in bold lines; and
- (i) Stamps, signature and date by a member in good standing with the Association of Professional Engineers of Ontario.



3.2 Existing Base Plan Information

All engineering design drawing submissions shall document the following underlying existing base plan information irregardless as to whether or not they are impacted by the proposed works:

- (a) Topography, natural features (ie. streams, rock outcrops etc...), trees, vegetation and abutting land uses included within a 5m strip abutting the property;
- (b) Existing watercourses, swales, culverts, retaining walls, and embankments;
- (c) Location of existing buildings / accessory facilities and vehicular and pedestrian entrances;
- (d) Location of existing parking spaces, aisles, driveways, sidewalks, walkways and garbage disposal facilities;
- (e) Abutting road right of way width and centerline including any municipal installations including but not limited to: traffic islands, utility poles, streetlights, fire hydrants, valve boxes, catch basins, manholes, sidewalks, transformers, signs etc...,
- (f) Existing driveways to the subject site and driveways of adjacent properties including those properties on the opposite side of the road from the subject site;

3.3 Engineering Drawings – Site Plan Control

This section sets out the details which should appear on each drawing submitted as a condition of obtaining Site Plan Approval. This section may be used as a checklist when preparing drawings to ensure that the Municipality's requirements are fulfilled. Please note that this is a standard list which covers drawings prepared in conjunction with most forms of development. Additional detail may be required for certain projects. The Town of Perth reserves the right to request additional drawing detail where it is deemed necessary.

3.3.1 Site Servicing Plan

- (a) Location, size, and details of any existing water, sanitary or sewer services to the property;
- (b) Location, size, length, material, proposed grade, class of pipe and invert for all proposed private or public storm and sanitary sewer connections;
- (c) Location, size, length, material, class of pipe and obverts for all proposed private or public water connections;
- (d) Approximate location of proposed water meter facilities for non-residential uses;
- (e) Rim elevations, inverts and ID's for all proposed catch basins and manholes;



- (f) Locations of all proposed hydrants, valves and firefighting connections (siamese connections);
- (g) Proposed ditches, swales, headwalls and culverts (where applicable);
- (h) Site lighting details (pole heights/fixture details/conductor locations);
- (i) Location and offsets of all existing and proposed overhead and underground utilities including but not limited to: Hydro One, Bell Canada, and Cogeco Cable;
- (j) Location and offsets of all existing and proposed natural gas facilities;
- (k) Location of all existing and proposed Canada Post facilities;
- (l) Location and width of any easements proposed in conjunction with the works;
- (m) References to Town of Perth or Ontario Provincial Standard Specifications to clarify applicable standard of construction;

3.3.2 Grading Control Plan

- (a) Existing and proposed contours or spot elevations throughout the site, along the property line and on abutting properties within 5m of the subject property;
- (b) Identification of applicable geodetic benchmark;
- (c) Elevations of existing and proposed catch basins, manholes and culverts on site, within adjacent road allowance and on abutting properties within 5m of the subject property boundary;
- (d) Proposed method of site drainage and storm water management, including direction of surface flows (including arrows showing the percent of slope);
- (e) Location and detail of surface water outlets;
- (f) Location and detail of swales with grade indicated as a percentage;
- (g) Proposed material, elevations and grading details for driveways, ramps, walkways and curbs (show curb radii);
- (h) Cross sectional details of curbs and pavement for parking areas and designated fire lanes/loading areas (as per the details defined in the Ontario Building Code);
- (i) Location and extent of proposed curb and road cuts;
- (j) Construction details for proposed retaining walls or similar features;
- (k) Spot elevations at top and bottom of curbs, breaks in slopes, high points etc...;
- (l) Finished ground elevation at building line;



- (m) Top of foundation and underside of footing elevations;
- (n) Regulatory flood elevation for receiving watercourse (where applicable); and
- (o) References to Town of Perth or Ontario Provincial Standard Specifications to clarify applicable standard of construction.

3.3.3 Storm Water Management / Drainage Area Plan

A Storm Water Management / Drainage Area Plan may be required for multifamily, commercial or industrial developments where post development run-off is proposed to be controlled to pre-development levels. These details may be included on the Grade Control Plan provided that the overall information remains clear and legible for review. The following information must be included on all Storm water Management and Drainage Area Plans:

- (a) Existing and proposed contours or spot elevations throughout the site, along the property line and on abutting properties within 5m of the subject property;
- (b) Identification of applicable geodetic benchmark;
- (c) Elevations of existing and proposed catch basins, manholes and culverts on site, within adjacent road allowance and on abutting properties within 5m of the subject property boundary;
- (d) Proposed method of site drainage and storm water management, including direction of surface flows (including arrows showing the percent of slope);
- (e) Proposed ponding elevations for the 5 year and 100 year rainfall event where storm water storage is proposed;
- (f) Location and detail of swales with grade indicated as a percentage;
- (g) Finished ground elevation and entry elevations at building line;
- (h) Top of foundation and underside of footing elevations;
- (i) Regulatory flood elevation for receiving watercourse (where applicable);
- (j) Location of orifice controls including manufacturer specifications and dimensions; and
- (k) Details for all contributing drainage areas including run-off coefficient values.

3.3.4 Sight Lighting Plan (Photometrics)

A Site Lighting Plan may be required for commercial or industrial developments. The Environmental Services Department should be contacted regarding special lighting design requirements. The following information must be shown on the Lighting Plan:



- (a) Location, height and direction of exterior lighting;
- (b) Wiring layout from hydro service to all fixtures;
- (c) Fixture details (ie. sectional view specifying manufacturer, materials etc...); and
- (d) Illumination pattern and footprint for proposed fixture layout (may be required).

3.4 Engineering Drawings – Plans of Subdivision / Public Rights of Way

This section sets out the typical details for each of the engineering drawings typically submitted for subdivisions and/or servicing extensions within easements / public rights of way. This section may be used as a checklist when preparing drawings to ensure that the Municipality's requirements are fulfilled. Please note that this is a standard list which covers drawings prepared in conjunction with most forms of development. Additional detail may be required for certain projects. The Town of Perth reserves the right to request additional drawing detail where it is deemed necessary.

3.4.1 Cover Sheet

- (a) Details to include the Consultant's address and phone number, the project name, the legal description of the lands involved, a location plan at a 1:5000 scale, and a drawing index.
- (b) The location plan shall note all proposed roads subject to construction and/or the proposed subdivision layout

3.4.2 General Plan of Services

A General Plan of Services shall be prepared for all new subdivisions at a 1:500 or 1:750 scale and shall provide an overview of all newly proposed servicing and road construction. Details shown of the General Plan of Services shall generally be consistent with all of the "plan view" details shown on the Plan and Profile Drawings.

3.4.3 Plan and Profile Drawings

Plan and profile drawings shall be prepared for all new roads, watermains, sanitary sewers and storm drains *unless otherwise approved*. These drawings shall also apply to mainlines to be constructed or upgraded within public easements. Plan and profile drawings shall be prepared at a 1:500 or 1:250 scale (plan view) and 1:50 or 1:25 vertical scale (profile). Details shall include, but not be limited to the following:

- (a) Baseline (usually roadway centerline) c/w chainage at 20m intervals;
- (b) Limits of all proposed construction;
- (c) Existing and proposed surface treatments within the work area;



- (d) Bedrock elevations to be shown on all profiles for new streets;
- (e) Existing and proposed road centerline and gutter elevations;
- (f) Roadway gradients, including details on horizontal and vertical curves (BC, EC, Station, k values etc...);
- (g) Curb and sidewalk locations and details;
- (h) Existing and proposed watermains details including location, pipe size, material, depth of cover, obvert elevations, and vertical clearances at crossings;
- (i) Location and elevation details for all existing and proposed valves, hydrants, fittings, services, curb stops etc...;
- (j) Location and details pertaining to cathodic protection;
- (k) Existing and proposed sewers (storm and sanitary) including location, length, pipe size, material, pipe gradient, invert elevations, and vertical clearances at critical crossings;
- (l) Location and elevation details for all existing and proposed manholes, catchbasins, culverts, ditch inlets, headwalls, service laterals etc...;
- (m) Minimum underside of footing for all new lots adjoining a proposed street;
- (n) Typical detail for all new service trenches including clearances and offsets from property lines;
- (o) Existing and proposed public easements for underground water, sewer and drainage services;
- (p) Existing trees, shrubs and hedges to be retained within the work area;
- (q) Proposed streetlight locations and offsets;
- (r) Existing hydro and telecommunication poles within the work area;
- (s) Existing fences and buildings within the work area; and
- (t) References to Town of Perth or Ontario Provincial Standard Specifications to clarify applicable standard of construction.

3.4.4 Grading and Drainage Plan

Grading and Drainage Plans shall be prepared for all new subdivisions and shall provide guidance for lot level grading at the Building Permit stage. These drawings shall be prepared at a 1:500 or 1:250 scale. Details shall include, but not be limited to the following:

- (a) Pre Development contour lines at 0.5m intervals. These contours shall extend a minimum 30m outside of the development limits;



- (b) Existing corner lot elevations (uncircled) and proposed corner lot elevations (circled). These elevations are to be shown with accuracy to two decimal points (ie. 100.00m);
- (c) All proposed building envelopes (typical) with the Minimum Underside of Footing elevation, and front/rear terrace elevations identified;
- (d) The typical drainage configuration of each lot (split / rear-to-front / front-to-rear) with the overland gradient indicated as a percentage (with directional arrow);
- (e) Typical details for driveways (left or right side) with maximum grade expressed as a percentage;
- (f) Retaining walls and terracing details (typically where lot grades are at or in excess of 3:1 slope);
- (g) Baseline for all roadways c/w chainage and elevations at 20m intervals. High points and low points also to be identified;
- (h) Manhole (storm and sanitary) catchbasin and ditch inlet locations complete with rim elevations;
- (i) Elevation, grade and cross sectional details (typical) for all ditches and swales;
- (j) Major system (1 in 100 year) drainage routing;
- (k) Regulatory flood elevations (flood plain) for adjacent streams or watercourses where applicable;
- (l) Erosion and sediment control details (check dams/filter cloth dams etc...); and
- (m) References to Town of Perth or Ontario Provincial Standard Specifications to clarify applicable standard of construction.

3.4.5 Sanitary Drainage Area Plan

Sanitary Drainage Area Plans shall be prepared for all proposed public sewers and shall provide details in support of calculations submitted for review and approval by the Ontario Ministry of Environment. These drawings shall be prepared at a 1:500 or 1:250 scale. Details shall include, but not be limited to the following:

- (a) Plan view of subdivision or service area including network of sewer pipes (with size/grade/length noted) and manholes;
- (b) Minor and major catchment boundaries complete with ID's for new sanitary sewer collection system;
- (c) Residential population and area (hectares) for each minor catchment area; and
- (d) Commercial, industrial and institutional areas (hectares) for each minor catchment area.



3.4.6 Storm Drainage Area Plan

Storm Drainage Area Plans shall be prepared for all proposed public storm drains and shall provide details in support of calculations submitted for review and approval by the Ontario Ministry of Environment. These drawings shall be prepared at a 1:500 or 1:250 scale. Details shall include, but not be limited to the following:

- (a) Plan view of subdivision or servicing area including network of storm sewer pipes (with size/grade/length noted), manholes, catchbasins, ditch inlets and culverts;
- (b) Minor and major catchment boundaries complete with ID's for new storm drainage collection system;
- (c) Drainage area (hectares) for each minor catchment area;
- (d) Balanced run-off coefficient (Rational Method) for each catchment area; and
- (e) Major system routing (overland flow).

3.4.7 Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan may be required for new development where significant excavation and grading activities are proposed. These details may be included on the Grading and Drainage Plan provided that the overall information remains clear and legible for review. The following information must be included in all Erosion and Sediment Control Plans:

- (a) Locations for all straw bales, silt fencing or check dams to be constructed in advance of site excavation works;
- (b) Any special requirements pertaining to the stockpiling and handling of construction aggregates;
- (c) Any special requirements necessary to prevent silt and sediment from entering into sanitary or storm sewers;
- (d) Any special requirements dictated by the local Conservation Authority; and
- (e) References to the applicable Ontario Provincial Standard Drawings governing construction.



3.4.8 Composite Utility Plan

A Composite Utility Plan shall be prepared for all subdivisions or road extensions and shall be prepared at a 1:500 or 1:250 scale. Details shall include, but not be limited to the following:

- (a) Correct lot configuration and numbering as shown on the registered plan or property survey;
- (b) Location of all roads, curbs, sidewalks, watermains, sanitary sewers, storm drains, private services and related appurtenances;
- (c) Location of all existing and proposed streetlights, including fixture and pole specifications, mounting base details and conductor locations;
- (d) Existing and proposed hydro, telecommunications, cable and Canada Post facilities including utility poles, transformers and service boxes;
- (e) Location, cross sectional detail and offsets for all joint use utility trenches and individual service locations;
- (f) Existing and proposed natural gas facilities including valves;
- (g) Proposed building footprints and driveway locations (left or right side) complete with clearances; and
- (h) Typical road cross section complete with trench offsets for underground services and private utilities.

3.4.9 Legend, Details and Notes Sheet

A Legend, Details and Notes Sheet should include details for all construction which is not covered or specifically detailed in the Town of Perth or Ontario Provincial Standards and Specifications. Where there is a municipal standard, it is expected that this sheet refer the works to the Town or OPS specification. It is not necessary to include or provide details of any work(s) for which there is a standard drawing.

4.0 ENGINEERING REPORTS

Pursuant to the requirements contained within the Official Plan, the Environmental Services Department may require the submission of various engineering reports in order to review the impact of new development on existing public infrastructure. The terms of reference for such studies are typically discussed in a preconsultation meeting for an application filed for Official Plan Amendment, Zoning Bylaw Amendment, Plan of Subdivision, Site Plan Control or Consent. A brief description of the various reports has been provided below for reference:



- (a) Conceptual Site Servicing Study – An engineer’s report which reviews the adequacy of existing water, sewer and drainage infrastructure to support new development or redevelopment without creating environmental or operating problems elsewhere in the system.
- (b) Stormwater Management Report – It is the specific intent of the municipality that all new forms of development manage stormwater in accordance with the objectives of the Official Plan and the Best Management Practices published by the Ontario Ministry of Environment. A stormwater management report reviews the pre-development drainage condition and identifies those measures which may be required to mitigate run-off quality and quantity for the post development condition.
- (c) Transportation Impact Study – A Transportation Impact Study (TIS) may be required for new forms of development which generate significant volumes of traffic or take direct access from an arterial road corridor. A TIS will review the impact of the development on the existing road network and will recommend those measures which may be required to maintain acceptable levels of service and/or ensure continued public safety.
- (d) Geotechnical Study – A Geotechnical Study may be required to examine existing soils and groundwater levels and demonstrate that conditions are suitable for new development and/or new public roadways.
- (e) Noise Control / Vibration Study – A Noise Control / Vibration Study may be required where a site is within a set proximity to a railway or a Provincial Highway. Abatement measures for noise or vibration would be identified within the report and would typically be implemented as a condition of the site development.

5.0 DRAWING SUBMISSION REQUIREMENTS

5.0.1 Design Submission – Site Plan

The first design submission for engineering review and approval as a condition of Site Plan Control shall consist of the following:

- (a) Survey Plan (1 copy);
- (b) Site Servicing Plan (3 sets);
- (c) Grading Control Plan (3 sets);
- (d) Stormwater Management / Drainage Area Plan (3 sets, if required);
- (e) Site Lighting Plan (3 sets, if required);
- (f) Engineering Reports – (3 copies each, if required);

Note: All submissions subsequent to the first submission shall address each of the red-line comments provided by the municipality. Where design changes cannot be accommodated, the Consultant shall provide written clarification, with reasons stated.



5.0.2 Design Submission – Subdivisions or Works on Public Rights of Way

The first design submission for engineering review and approval for a Plan of Subdivision or a servicing extension in a Public Right of Way shall consist of the following:

- (a) Survey Plan (1 copy);
- (b) Cover Sheet (2 sets);
- (c) General Plan of Services (2 sets, if required);
- (d) Plan and Profile Drawings (2 sets);
- (e) Grading and Drainage Plan (2 sets);
- (f) Sanitary Drainage Area Plan (2 sets);
- (g) Storm Drainage Area Plan (2 sets);
- (h) Erosion and Sediment Control Plan (2 sets, if required);
- (i) Composite Utility Plan (2 sets);
- (j) Legend, Details and Notes Sheet (2 sets);
- (k) Conceptual Site Servicing Study (including detailed calculations) –(2 copies);
- (l) Stormwater Management Report (2 copies);
- (m) Transportation Impact Study (2 copies, if required);
- (n) Geotechnical Study (2 copies); and
- (o) Noise Impact Study (2 copies, if required).

Note: All submissions subsequent to the first submission shall address each of the red-line comments provided by the municipality. Where design changes cannot be accommodated, the Consultant shall provide written clarification, with reasons stated.



I N D E X

1.0	General	2
1.1	Ontario Provincial Standards	2
1.2	Supplemental Specifications	2
1.3	Definition of Owner or Engineer	2
1.4	Environment	2
1.5	Safety	5
1.6	Traffic Control	5
1.7	Emergency and Maintenance Measures	6
1.8	Materials	6
1.9	Layout	6
1.10	Work Hours	6
1.11	Temporary Field Office	6
1.12	Sanitary Facilities	6
1.13	Contractor's Supervision	7
2.0	Site Preparation	7
3.0	Excavation	7
3.1	Temporary Stockpiling of Material	7
3.2	Surplus Excavated Material	7
3.3	Trench Widths	8
3.4	Open Trenching	8
3.5	Trenchless Excavation	8
3.6	Measurement and Payment	8
4.0	Backfilling and Compaction	9
4.1	Bedding	9
4.2	Backfill Material	9
4.3	Imported Backfill	9
4.4	Backfill Under Materials	10
4.5	Measurement and Payment	10
5.0	Watermains	11
5.1	Ontario Provincial Standards and Specifications	11
5.2	Project Coordination	11
5.3	Temporary Water Distribution System	12
5.4	Materials	13
5.5	Watermain Installation	16
5.6	Service Connections	19
5.7	Field Testing and Acceptance	21
5.8	Water Meter and Water Service Installations.....	26
6.0	Sewers	28
6.1	Ontario Provincial Standards and Specifications	28
6.2	Sewer Installation	28
6.3	Manhole and Catchbasin Installation	28
6.4	Service Connections	30
6.5	Commissioning Sewers	33



1.0 GENERAL

These specifications apply to all infrastructure works which are commissioned directly by the Town of Perth or are carried out by private development as part of a development agreement with the municipality (eg. Site Plan or Subdivision). Payment descriptions contained within this section of the Engineering Standards and Specifications Manual may therefore not apply under all circumstances.

1.1 Ontario Provincial Standards

All construction work shall be carried out in the Town of Perth in accordance with the Ontario Provincial Standards (OPS) as referenced herein or in the Contract Documents. The Town of Perth Design Guidelines and Supplemental Specifications are supplemental to the Ontario Provincial Standards and thus take precedence over the related specifications (OPSS's) and drawings (OPSD's). This section of the Engineering Standards and Specifications manual has been laid out in a manner consistent with the format of the Ontario Provincial Standards for ease of review for designers.

1.2 Supplemental Specifications

These specifications may be altered on a project or Municipal specific basis within the Special Conditions or Special Provisions section of the Construction Contract.

1.3 Definition of Owner, Engineer and Works Inspector

Ontario Provincial Standards and Specifications – Section GC 1.04 – Definitions is amended by addition of the following:

Wherever the words “Town” or “Corporation” or “Local Operating Authority” appear in this specification, it may be interpreted as meaning the “Corporation of the Town of Perth”.

Wherever the word “Engineer” or “Contract Administrator” or “Director” appears in this specification, it shall be interpreted as meaning the “Director, Environmental Services or his/her designate”.

Wherever the word “Works Inspector” appears in this specification, it shall be interpreted as meaning the “Senior Superintendent, Environmental Services or his/her designate”.

1.4 Environment

1.4.1 Contractor's Supervision

The Contractor shall maintain on the site at all times, a competent Superintendent fully qualified to properly direct the progress of the work including the coordination of work



of subcontractors. The Contractor shall nominate the Superintendent for the project in writing. Instructions given to the Superintendent shall be deemed to be given to the Contractor.

1.4.2 Blasting

The Contractor shall provide a comprehensive pre-blast survey of all buildings and wells within 100 m from all blasting operations. The pre-blast survey shall determine the Contractor's liability for damage and all damage attributed to the Contractor's blasting operations shall be repaired at the Contractor's expense unless the damage can be shown to have existed prior to the Contractor's blasting.

If anyone beyond 100 m of the blasting operation shows concern or the Contractor feels there might be a problem, then these places shall also have a pre-blast survey. When pre-blast surveys have been completed, the Contractor shall inform the Contract Administrator in writing of the properties in which the inspections were performed. No blasting shall commence until the Contract Administrator has granted authorization and advance notice has been made to the Perth Fire Department.

Upon completion of the job, the Contractor shall provide the Contract Administrator with 2 copies of a signed release from the surveyed owners certifying their property has been left in a satisfactory condition.

1.4.3 Restrictions to Open Burning

Open burning will not be permitted within the municipality. Arrangements shall be made by the Contractor to dispose of all brush and clean wood debris at the Town's landfill site on Wildlife Road during normal operating hours of the facility. Payment for disposal will be included under the applicable tender item.

1.4.4 Discharges to Public Sewers

No Contractor shall discharge water, regardless of the source, to any storm or sanitary sewer without the prior approval of the Contract Administrator. Lab testing of source waters may be required prior to allowing discharges to a public sewer where, in the opinion of the Contract Administrator, a contamination concern may exist. All discharges to the public sewer system must ultimately be in compliance with the Sewer Use Bylaw in force and effect.

1.4.5 Use of Public Water Supply

All potable water used for construction purposes shall be obtained, for a fee, from the Perth Water Treatment Plant located at 15 Sunset Boulevard. Water may be supplied from on-site hydrants for hydrostatic testing, flushing or disinfection of new watermains



provided that all hydrants and valves are operated exclusively by Town of Perth forces.

1.4.6 Dust Control

The Contractor shall take such steps as may be required to prevent dust nuisance wherever it would affect traffic or cause damage or discomfort to residents of the area in which his work is being carried out. Where the work requires sawing of asphalt or sawing or grinding of concrete, blades or grinders of the wet type shall be used together with sufficient quantities of water to prevent the incidence of dust.

Where the work results in tracking of mud onto adjacent roadways, the Contractor shall immediately remove such materials and ensure a continuous clean surface on the adjacent roadway as directed by the Town.

1.4.7 Disposals at Town Landfill Site

Arrangements may be made by the Contractor to dispose of all spoil concrete and asphalt debris at the Town's landfill site on Wildlife Road during normal operating hours of the facility. Payment for disposal will be included under the applicable tender item. The Contractor is however, advised to keep the materials fully segregated for disposal (ie. no mixed loads of asphalt and concrete).

1.4.8 Garbage Collection

If the occupation of a street by the Contractor prevents, in the opinion of the Town, the Municipality's garbage collector from carrying out the collection of garbage and/or recyclables on his regular route, the Contractor shall remove the garbage from the area to the garbage disposal site at his expense or make arrangements with the Town's waste collection contractor to have garbage and/or recyclables set out in designated areas with blue boxes returned to the correct property owner.

1.5 Safety

No excavations regulated under provincial legislation shall commence until the Contractor has notified the Ministry of Labour in accordance with the Provincial Occupational Health and Safety Act and Regulations for Construction Projects, and no excavation shall commence on any street without the written approval of the Contract Administrator.

The Contractor assumes full responsibility for conforming with all legislation regarding the safety of his employees and the public on this contract, and all notices required to



comply with the legislation. The Contractor will be deemed to be the Constructor for the duration of the construction work..

1.6 Traffic Control

The Contractor shall provide the appropriate traffic control signage and/or appropriately attired flag persons, as required during the course of construction to comply with the safety requirements of latest edition of the M.T.O. publication “Book 7 – Ontario Traffic Manual Temporary Conditions, Field Edition”. Failure to comply with these requirements may result in the issuance of a stop work order.

The Contractor must provide access for emergency services and local traffic at all times unless exempted by the Contract Administrator. If during the course of the work, significant excavations necessitate a full lane closure, the Town of Perth will authorize the closure provided that 48 hours notice is provided to enable the appropriate notices to be released to emergency services.

1.7 Emergency and Maintenance Measures

Whenever the construction site is unattended by the Contractor, the name, address, and phone number of a responsible official of the contracting firm, shall be given to the Contract Administrator. The official shall be available at all times and have the necessary authority to mobilize workmen and machinery to take any action as directed by the Contract Administrator in case emergency or maintenance measures are required; regardless whether the emergency or requirement for maintenance was caused by the Contractor’s negligence, act of God, or any cause whatsoever.

Should the Contractor be unable to carry out immediate remedial measures required, the Town will carry out the necessary repairs , the cost of which shall be charged to the Contractor.

1.8 Materials

The Contractor shall be responsible for supplying materials required to complete the work in accordance with the specifications. The source of supply and quality of all materials supplied by the Contractor must be approved by the Town of Perth prior to their use in the contract.

1.9 Layout

Construction layout shall be as specified in the Contract Documents.



1.10 Work Hours

Work Hours shall be as specified in the Contract Documents.

1.11 Temporary Field Office

Temporary Field Office shall be as specified in the Contract Documents.

1.12 Sanitary Facilities

Clean, sanitary bathroom accommodations shall be provided on site and shall be located and maintained such that they are not offensive to any property owner or member of the public. All bathroom locations shall be pre-approved with the Contract Administrator.

1.13 Contractor's Supervision

The Contractor shall maintain on the site at all times, a competent Supervisor fully qualified to properly direct the progress of the work including the coordination of work of subcontractors. The Contractor shall nominate the Site Foreman in writing. Instructions given to the Supervisor shall be deemed to be given to the Contractor.

2.0 SITE PREPARATION

Site Preparation shall be as specified in the Contract Documents.

3.0 EXCAVATION

This subsection provides direction on excavation operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents and the Construction Drawings.

3.1 Temporary Stockpiling of Material

When insufficient space is available to allow placing of excavated material on the right-of-way, the Contractor shall load, haul, and stockpile such excavated material at an off-site location arranged for by and at the sole expense of the Contractor. When the underground work has been installed, the Contractor shall, at the Contractor's



expense bring back as much acceptable material so removed as may be required to properly re-fill the trench.

The Contractor shall provide a letter from the temporary off-site disposal site property owner accepting the material, placement and grading and releasing the municipality of any responsibility to the satisfaction of the Contract Administrator.

3.2 Surplus Excavated Material

Material excavated during the construction of the works, which is surplus to the requirements for backfilling and which cannot be disposed of on municipal property adjacent to the site, as determined by the Contract Administrator, shall be disposed of at locations arranged by the Contractor, and at the sole expense of the Contractor.

The Contractor shall provide a letter from the disposal site property owner accepting the material, placement and grading and releasing the municipality of any responsibility to the satisfaction of the Contract Administrator.

3.3 Trench Widths

Unless otherwise specified, the trench width at the top of pipe shall be as specified in the construction drawings or related standard drawing details. Trench side slopes shall conform to the requirements of the Occupational Health and Safety Act. Failure to comply with these requirements may result in the issuance of a stop work order.

3.4 Open Trenching

Unless otherwise authorized by the in the Contract Documents or Construction Drawings, all underground works shall be constructed by open trench method. Hand digging shall be carried out as part of all open trench activities to protect existing buried services and ensure safe working conditions. When or where required by the Contract Administrator, the Contractor shall use close sheeting or a trench boxing to minimize disturbance in accordance with the Occupational Health and Safety Act.

Except by permission of the Contract Administrator, the maximum length of open trench when laying piped municipal services shall be a maximum of 100m or the distance necessary to accommodate the amount of pipe which can be reasonably installed and backfilled in a single day, whichever is smaller. Any trenches which are to be left open overnight must be completely cordoned off from the public with snow fence, regardless of location, to the satisfaction of the Contract Administrator.

3.5 Trenchless Excavations



Trenchless Installations shall be conducted in accordance with the Contract Documents and the Construction Drawings. The Contractor may elect to use trenchless techniques, however, written approval shall be obtained in advance from the Contract Administrator.

3.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable, will be in accordance with the Ontario Provincial Standards.

4.0 BACKFILLING AND COMPACTION

This subsection provides direction on the placement, backfilling and compaction operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents and the Construction Drawings. Backfilling and compaction shall be carried out in a manner to not damage or dislodge the pipe, related appurtenances, or adjacent utilities.

4.1 Bedding

The Contractor shall confirm the specified type of bedding and obtain the Contractor Administrator's approval before any backfilling operations are undertaken. Backfilling and compaction shall be carried out continuously and immediately after the specified bedding material has been placed and approved by the Contract Administrator.

Bedding material for municipal and private water, sewer and storm sewers shall be Granular "A" compacted to 95% Standard Proctor Density. Recycled asphalt shall not be used as any part of the bedding material.

Where conditions warrant, and with the Contract Administrator's approval, the Contractor shall sub-excavate to achieve a more stable base and replace with Granular "A" compacted to 95% Standard Proctor Density.

4.2 Backfill Material

The trench above the specified bedding zone shall be backfilled with select subgrade material excavated from the trench or obtained elsewhere on the project, and shall be placed in layers not exceeding 300mm, and shall be compacted to 95% Standard Proctor Density.



Unless otherwise specified in the Contract Documents, where the trench is situated within an existing roadway, the top 600mm of the trench shall be backfilled with 450mm Granular “B” material and 150mm of Granular “A” material compacted in 150mm loose lifts to a density of 100% Standard Proctor Density. Unless otherwise specified in the Contract Documents, existing asphalt shall be reinstated to equal pre-construction depths or a minimum thickness of 80mm, whichever is greater.

4.3 Imported Backfill

Where select subgrade material is not suitable in the sole opinion of the Contract Administrator, and there is not select subgrade surplus material from other sections of the work, the Contract Administrator may order that the trench be wholly or partially backfilled with imported materials as approved by the Contract Administrator.

4.4 Backfill Under Utilities

Unless otherwise specified in the Contract Documents or by the Utility having jurisdiction, backfill under the trench under existing utilities shall be completed using controlled density fill approved by the Contract Administrator. The fill shall be extended as specified from the bottom of the trench or that level at which full compaction is achieved to the underside of the utility being supported. The controlled density fill shall in all instances be placed across the entire trench width of the trench and shall extend a minimum of 150mm on each side of the utility being supported as measured along the length of the trench. The existing utility shall be wrapped with a polyethylene bond breaker.

4.5 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable, will be in accordance with the Ontario Provincial Standards.

5.0 WATERMANS

This section provides direction on project coordination and notification requirements and also describes how watermains, service connections and associated appurtenances are to be installed, commissioned and tested to meet technical requirements of the Contract Documents.

5.1 Ontario Provincial Standards and Specifications



All watermain construction shall be installed in accordance with the Ontario Provincial Standard Specifications 701 except as amended or extended herein.

5.2 Project Coordination

This sub-section defines responsibility with respect to project coordination objectives required prior to, during and following the water system construction.

5.2.1 Notification to Local Operating Authority

The Contractor shall notify the Contract Administrator at least 3 working days (or 72 hours) prior to the commencement of any work that may affect the existing water distribution system.

5.2.2 Notification to Water Users

The Contractor shall consult with the Contract Administrator regarding the scope of any planned waterworks which may affect the existing potable water system. Discussions shall include: area of disruption, level of effort, and estimated duration of any disruption in service.

The Town of Perth shall be responsible for notifying active customers and as such will require at least two (2) full working days notice prior to the scheduled interruption. Such notices will be prepared on Town letterhead and delivered by hand.

5.2.3 Shutting Down and Charging Mains

Only personnel from the Environmental Services Department shall operate valves on existing watermains for the purpose of controlling water. No person other than the local operating authority shall shut down or charge any section of existing watermain or operate any valve for the purpose of controlling water from existing mains.

The Contractor shall provide the Town with at least two (2) full working days advance notice when a change in control of the water is required. All necessary water supply interruptions shall be scheduled in cooperation with the local operating authority during normal working hours. If the Contractor elects to have the local operating authority make system changes after normal working hours, the Contractor may be responsible for additional costs to have personnel available on site.

The Contractor shall operate only those valves, hydrants, and curb stops installed in their contract limits during the construction period and prior to the date when the system has been connected and commissioned with the existing distribution system.



5.2.4 Water Interruption

The Contractor shall take all reasonable measures to ensure that water service is not interrupted before 9:00 am and after 4:00 pm. The Contract Administrator reserves the right to require that specified customers not be interrupted or that the interruption is limited to a certain time span. The Contract Administrator also reserves the right to require that any water interruptions be conducted outside of normal working hours.

5.2.5 Deviations In Work

Wherever existing structures, sewers, drains or other utilities present obstructions in the design grade or alignment of the work to be installed, the Contract Administrator will consult with the design engineer on alternatives. Where changes are required, the Contract Administrator may direct the realignment with mechanical joint bends, removals or reconstruction in such a manner as may be deemed appropriate.

5.2.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable, shall be considered to be included in the watermain installation.

5.3 Temporary Water Distribution System

In the event that existing water users must be taken out of service for a period exceeding 8 hours, or at the discretion of the Contract Administrator, a temporary water distribution system shall be provided by the local operating authority to all interrupted users.

The temporary water system will be adequately sized to provide water pressures normal to the existing water distribution system including the supply to fire suppression systems in serviced buildings. The distribution piping shall be installed with appropriate ramping or burial such that the piping will: a) not be endangered by equipment or traffic flow, b) not pose a hazard to pedestrians, c) maintain barrier free access, and d) be constructed to safeguard against vandalism and tampering. Isolation valves are required at the source water connection and at all branches.

The connection of the temporary water system to the existing distribution system shall be done in a secure location and be vandal and tamper resistant. A backflow preventer is required to separate the two systems as long as the temporary system is in service. The backflow preventer shall be a double check or a reduced pressure



type assembly and shall be installed, maintained and field tested in accordance with the latest edition of CAN/CSA-B64.10.

After the temporary water service is installed in its final location, the system shall be subjected to all of the disinfection and bacteriological testing standards and protocols identified by this manual. Once water samples have satisfied chlorine residual and bacteriological standards and protocols, the system may be flushed, charged and connected to the water users.

In the event that corrective action is needed to the temporary water distribution system outside of normal working hours, the local operating authority will take all necessary corrective actions. If any corrective actions are the direct result of the Contractor's equipment or actions, then the Contractor shall be responsible for any costs incurred by the local operating authority.

Unless otherwise provided for in the Contract Documents, the full costs to develop temporary water services will be borne directly by the proponent of the work. If the requirement for temporary servicing is the direct result of a development approval, then all associated costs will be incurred by the registered landowner for the site or subdivision development proposal.

5.4 Materials

This subsection provides guidance on the material specifications to be used in the construction of watermains and their appurtenances in the municipality. While this section does not include a comprehensive list of all possible items, it addresses those key components which are considered to be of direct interest to the operating authority. The Contractor should consult with the Contract Administrator to obtain a copy of the current Approved Products List prior to placing orders.

5.4.1 Ductile Iron Pipe

Ductile iron pipe may be used for watermains ranging in size from 150mm to 250mm, however all trunk feeds 300mm and larger must be constructed using ductile iron materials. Used pipe shall not be allowed in any installation.

Ductile iron pipe shall be manufactured in accordance with AWWA Specification C150 (ANSI-A21.50) and AWWA Specification C151 (ANSI-A21.4). All pipe shall be Class 52 – with cement mortar protective lining to AWWA Specification C104 (ANSI-A21.4).

Ductile iron pipe shall be supplied with Tyton push-on joints manufactured in accordance with AWWA Specification C111 (ANSI-A21.11). All pipe shall be supplied with binding straps or locking wedges to maintain electrical continuity.



All Ductile Iron Pipes shall be polyethylene encased in approved size and type wrap as described by AWWA Specification C105 (ANSI-A21.5), method A.

5.4.2 PVC Pipe

PVC pipe may be used for watermains ranging in size from 150mm to 250mm only. Used pipe shall not be allowed in any installation.

PVC pipe shall be manufactured according to Canadian Standards Association Standard CSA B137.3 or AWWA Specification C900, Pressure Class 150. The piping shall be blue in colour and show no evidence of chalking or exposure to UV radiation or non-compatible chemicals.

5.4.3 Service Connection Pipe, Fittings and Appurtenances

All pipe for service connections shall be type K soft copper conforming to ASTM B88. Kinked or distorted tubing will not be accepted.

Main stops, saddles, curb stops, and brass couplings shall be supplied to the product specifications included in the Approved Products List.

Service boxes shall be adjustable to meet a range of 1.83m to 2.15m, and shall include a rod length of 1.18m with hexagon plug. Rod and key shall be stainless steel.

5.4.4 Valves and Valve Boxes

All valves shall be mechanical joint with non rising stem and shall open by operating in a counter clockwise direction.

All valves, 150mm to 300mm in size shall be resilient wedge gate valves conforming to AWWA Specification C509 and be supplied by a manufacturer approved by the Town of Perth..

Valve boxes shall be screw type complete with adjusting lugs inside the top section and be supplied by a manufacturer approved by the Town of Perth..

5.4.5 Hydrants

All hydrants shall have two 62.5mm nozzles at 180 degrees and one 112.5mm pumper nozzle and one 150mm mechanical joint inlet. All hydrants must also have a 32mm square operating nut, tapped drain parts, open counter clockwise, and be painted yellow. Hydrants are also to include a branch tee, valve and pipe equivalent in size to the inlet on the hydrant and shall be manufactured for a 2.0m trench depth.



All hydrants shall conform with AWWA Specification C502 and be supplied by a manufacturer approved by the Town of Perth.

5.4.6 Watermain Fittings

All fittings (100mm and greater) shall be ductile iron conforming to AWWA Specification C110 (ANSI 21.10) with mechanical joints conforming to AWWA Specification C111 (ANSI 21.11).

All fittings shall be cement lined in accordance with AWWA Specification C104 (ANSI 21.4).

5.4.7 Tracer Wire

Tracing wire shall be 12 gauge single conductor insulated wire and shall be placed top centre on all non-metallic watermain lines from the commencement of the project to the completion.

5.4.8 Joint and Thrust Restraint

Concrete used for non mechanical thrust restraint shall conform to OPS Specifications. Mechanical joint restraint mechanisms shall be supplied by a manufacturer approved by the Town of Perth.

5.4.9 Corrosion Protection Systems

Corrosion protection for metallic and non-metallic mains shall be accommodated by installing threaded zinc caps on each alternating bolt found at every mechanical joint fitting, coupling, and restraint mechanism.

5.4.10 Bolts, Nuts and Washers

All bolts, nuts and washers shall be stainless steel or cadmium coated.

5.4.11 Measurement and Payment

Measurement and payment, where applicable, for each of the materials listed in this section shall be considered to be included in the unit price for watermain installation within the Contract unless otherwise specified.



5.5 Watermain Installation

This subsection provides direction on the watermain installation operations that the Contractor is required to perform to meet the technical requirements of the municipality.

5.5.1 Watermain Laying Tolerances

The allowable laying tolerance from the approved Construction drawings, for all sizes of watermain pipe, shall be 50mm horizontal and 25mm vertical.

Notwithstanding the above, all watermain shall have a minimum depth of cover of 2.0m and a maximum depth of cover of 2.4m.

5.5.2 Shut Down Precautions

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug or other means approved by the Works Inspector. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

5.5.3 Joint and Pipe Deflection

The deflection of all joints shall not exceed that which is recommended by the pipe manufacturer. Pipe barrels shall not be deflected to any degree or placed under lateral or vertical stress.

5.5.4 Joint and Thrust Restraint

Joint and thrust restraint, poured in place or mechanical shall be installed: a) as shown on the applicable standard drawing; b) as shown in the construction drawings, c) at all horizontal and vertical bends, and d) as directed by the Contract Administrator.

Mechanical joint restraints shall be installed: a) in areas where thrust blocking to undisturbed soil is impractical; b) in areas of settlement, and c) as directed by the Contract Administrator. Retaining rings shall be installed in accordance with the manufacturer's recommendations. In the Town of Perth, all joints within 10m of any fitting shall be fully restrained.

5.5.5 Tracer Wire



Tracing wire shall be placed on all non-metallic watermain lines from the commencement of the project to the completion. The tracer wire shall be: a) 12 gauge single conductor insulated wire, b) stripped only at the extremities of the installation, c) taped to the top centre of the pipe at each end and attached to fittings at changes in direction; and d) exposed at fire hydrant barrels.

The tracer wire on non-metallic systems shall not be connected to new or existing metallic watermain piping and/or associated fittings connected to the metallic watermain. Such practice ensures that existing corrosion protection systems are not interconnected.

5.5.6 Setting Hydrants

Unless otherwise specified, hydrants shall be connected to the main with a mechanical joint tee, a 150mm branch, and a 150mm independent gate valve. Horizontal and vertical bends shall not be installed on the hydrant lead unless approval is provided in writing by the Contract Administrator.

Clear crushed stone shall be provided for adequate barrel drainage. Filter fabric or landscape cloth shall be installed over the drainage bed at the base of the fire hydrant. Joint restraints and thrust blocking shall be provided as shown on the applicable standard drawing.

Unless otherwise specified, all hydrants shall be installed plumb and positioned so that the front of the barrel is no more than 0.3m from the property line with the hydrant nozzles parallel to the property line. No part of any fire hydrant shall encroach on private property. The centre of the hydrant branch valve shall be located 1.5m from the near face of the hydrant unless otherwise specified. Flange elevations shall be designed to be situated 0.15m above finished grade.

Fire hydrants shall be bagged immediately following installation and shall remain so until the watermain has been commissioned to the satisfaction of the Contract Administrator.

5.5.7 Setting Valves and Fittings

Valves, fittings and other accessories shall be fitted and joined to the pipe in the manner consistent with OPS Specifications. Valves are to be installed level and are to be set on hardwood blocks so as to not interfere with attachment bolts.

5.5.8 Setting Valve Boxes and Chamber Lids



The top of the valve box must be set 20mm below the finished grade of the wear course asphalt. The valve boxes shall be set on clear stone with the base not resting on the valve. The boxes shall be provided with 100mm x 100mm markers during construction extending approximately 1m above finished grade and clearly marked "Valve Box". The markers must not interfere with the operation of the valve in any way.

Valve chamber lids shall be adjusted so that when tested by a 3m straight edge placed in any direction on the surface, the measured distance between the straight edge (asphalt surface) and the frame is no greater than 7mm.

5.5.9 Measurement and Payment

Measurement and payment, where applicable, for the installation of watermains, hydrants, valves, and related appurtenances shall be as specified within the Contract Documents.

5.6 **Service Connections**

This subsection provides direction on the installation of service connections in order to meet the technical requirements of the municipality.

5.6.1 Installation

Unless otherwise specified, service connections shall be in accordance with the applicable standard drawings of the municipality.

5.6.2 Live Tapping

Service connections shall be completed under pressure (live tapping) for the following:

- a) all service connections under 50mm and smaller on ductile iron watermains;
- b) all service connections under 50mm on PVC watermains; and
- c) all connections utilizing a tapping sleeve and valve.

Live taps shall be completed by Town forces on existing watermains at full cost recovery. Live taps onto newly commissioned watermains shall be completed by the Contractor. All taps shall be inspected to ensure a drip tight connection prior to backfilling.



5.6.3 Tapping Connections 100mm and Larger

All tapping of watermains for connections larger than 100mm shall be performed by a designated tapping Contractor approved by the Town of Perth. Such tapping works will be arranged through the Town of Perth. All tapping shall be done only when the watermain is under pressure and the work shall be inspected for a drip tight connection prior to backfilling.

5.6.4 Corporation Stops

Corporation stops shall not be spaced closer than 1m and shall be wet tapped at the ten o'clock or two o'clock positions and left fully open. A goose neck must be formed into the service pipe.

5.6.5 Service Lateral Installations

New services onto existing watermains will be installed from the main to the property line by Town forces at full cost recovery. Services off of newly commissioned mains shall be installed from the main to the property line by the Contractor.

Copper water services will be installed with a minimum cover of 2.0m from the main to the street line in front of each lot. The service shall not have any compression couplings between the main and the property line of the customer unless the service length exceeds 20m. Where union couplings are required they shall not be installed under gravel or asphaltic road surfaces.

Service boxes shall be installed plumb and shall be marked during construction with a 4 x 4 stake clearly marked with blue paint extending a minimum 1m above grade. The Contractor must assume full responsibility for the safe keeping of these boxes during construction.

5.6.6 Pressure Testing

All new service laterals 50mm and larger shall undergo hydrostatic testing in accordance with OPSS 701. Where the service laterals are less than 20m in length this requirement may be waived at the discretion of the Contract Administrator.

5.6.7 Disinfection

All new service laterals shall be super-chlorinated and thoroughly flushed afterwards. All services 100mm and larger shall be sampled to ensure these services pass the



chlorine residual and bacteriological requirements for new watermains as per AWWA Standard C651-05.

Where existing services are connected to a new watermain, within the watermain trench, the Contractor shall ensure that the new service material is free of dirt and debris and the connection is made under as clean conditions as possible. The Contractor shall make arrangements to thoroughly flush the service through an inside or outside hose bib for a minimum of 3 to 5 minutes or until the water runs clear and chlorine residuals have reduced to levels normal to the existing distribution system. If there is any question as to the water quality, the Contract Administrator may request a water sample for bacteriological analysis to the standards outlined for new watermains. In the event that the water sample is adverse, the Contractor shall take whatever corrective action is deemed necessary by the Contract Administrator.

5.6.8 Measurement and Payment

Measurement and payment, where applicable for the installation of water services and related appurtenances shall be as specified within the Contract Documents.

5.7 Field Testing and Acceptance

This subsection provides information on the procedures and testing requirements to be followed by the Contractor to complete the commissioning of the watermain.

5.7.1 General

In order for a watermain to be considered for acceptance by the Contract Administrator, the following procedures and tests shall be successfully completed in the presence of the Town Works Inspector.

- swabbing
- hydrostatic test
- disinfection
- dechlorination
- chlorine residual and bacteriological tests
- final connection
- tracer wire conductivity test
- valve positioning

5.7.2 Source Water Connections for Watermains



This sub-section provides information on submission requirements and procedures to be followed by the Contractor in order to acquire approval to complete the Source Water Connection for the testing and/or commissioning of a new watermain system.

Connection Plan

Prior to the use of municipal water for testing and/or commissioning the new water system, the Contractor shall submit a plan detailing the source water connection location to the Contract Administrator for approval. The Contractor may also include the intended plan for pressure testing and chlorination with the submission of the connection plan. The Contractor shall allow one (1) week for review and approval.

Physical Separation

All connection points between the existing water distribution system and new watermains shall be kept physically separated until the watermain has successfully passed commissioning and testing requirements.

Use of Fire Hydrants

Source water connections from fire hydrants are discouraged unless the Contractor can demonstrate that the fire hydrant has been disinfected and thoroughly flushed. The Local Operating Authority assumes no responsibility for the quality of water obtained from a fire hydrant. After disinfection, the fire hydrant shall be pressurized at all times that it serves as a source of potable water.

Temporary Connection and Backflow Preventer

To facilitate watermain commissioning, a temporary connection to the existing water distribution system shall be made through the use of a temporary or “jumper” connection equipped with a backflow preventer. The connection to the existing water distribution system shall be done in a secure location and be vandal and tamper resistant and shall be no larger than 50mm in diameter. The backflow preventer shall be a double check or reduced pressure type assembly and shall be installed, maintained and field tested in accordance with the latest edition of CAN/CSA-B64.10.

The existing distribution system and the backflow preventer shall be physically disconnected from the test section during hydrostatic testing.



Connection Point Relocation

In the event that the connection point of the new watermain to the existing watermain distribution system is in a location that is impractical to install a temporary jumper connection to carry out testing requirements, the Contractor may elect to relocate the connection point to a more suitable location. This situation may occur if the connection point to the existing system is within the traveled portion of a roadway, would raise safety concerns, or may cause environmental or property damage if left open or leaves pipe work exposed aboveground. The Contractor shall carry out the disinfection of the watermain installed to relocate the connection point in accordance with AWWA 651, and the procedures outlined under "Final Connections for New Watermains".

5.7.3 Swabbing

Prior to disinfection, all sections of watermain shall be swabbed using a minimum of three passes with a foam swab. Swabs shall be polyurethane with a density of 24.7 kg/m³ have a minimum diameter 50mm larger than the inside diameter of the watermain and a minimum length of one and a half times the diameter. The Contractor shall complete all swabbing under the supervision of the Works Inspector. If in the opinion of the Works Inspector, the amount of debris exiting the main is excessive, the procedure shall be repeated at no cost to the Local Operating Authority.

5.7.4 Hydrostatic Testing

Hydrostatic pressure testing shall be in accordance with OPSS 701.

5.7.5 Chlorination for Disinfection

Upon successful completion of hydrostatic testing for the new watermain, the main shall be flushed with source water. After flushing is complete, source water shall be allowed to flow, at a controlled rate, into the new main. Liquid chlorine shall be applied so that the chlorine solution is a minimum of 50 mg/L throughout the entire section.

The main shall be left charged with the chlorine solution for a minimum of 24 hours. After 24 hours, the chlorine residual shall be tested. If the chlorine residual is less than 25 mg/L, the chlorination procedure shall be repeated. If the chlorine residual is greater than 25 mg/L the main shall be flushed with source water to clear the chlorinated water. Prior to disposal to the environment, an approved neutralizing chemical shall be applied to all chlorinated water used for disinfection, testing and flushing.



5.7.6 Bacteriological Testing

Upon successful completion of the chlorination procedure, the main shall be flushed and recharged with source water until the chlorine residual is equal to that of the source water or between 0.2 mg/L and 4 mg/L. The main shall be left charged for a minimum of 24 hours. After 24 hours, samples shall be taken for bacteriological testing. The main is not to be flushed prior to taking these samples. Chlorine residuals may also be taken at this time, however they are not necessary. Samples for bacteriological testing shall be taken by the Works Inspector from points every 350m along the new main, including one sample at the end of the new main and every branch (excluding fire hydrants) greater than 6m in length. All sampling ports shall be copper or stainless steel lines 25mm and smaller and brought a minimum of 1.0m above the surface. The Contractor shall be available to operate underground valves as necessary during sampling.

If the bacteriological tests indicate contamination, the entire chlorination procedure shall be repeated. If the tests pass, the main shall be re-flushed with source water prior to carrying out connections to the existing distribution system.

5.7.7 Final Connections to Existing Water Distribution System

After the pressure, leakage, chlorine residual and bacteriological tests have passed the Contractor shall obtain written approval from the Contract Administrator to make the final watermain connection to the existing watermain distribution system.

If a temporary water system has been installed, it shall not be removed until after the Contract Administrator has accepted the final connection of the new watermain to the existing municipal system.

A minimum of two working days notice will be required prior to the final connection to determine if any special measures shall be taken and/or an appropriate licensed Town employee is required to oversee the works. The Contractor will be responsible for all costs for call outs of municipal staff if the Contractor fails to notify the municipality that the connection will not take place as scheduled. The Contract Administrator shall be present to witness the entire final connection process of the new watermain to the existing water distribution system.

Watermains shall be cut back to remove all temporary taps. The Contractor shall disinfect the connection watermain as outlined and shall, using all means possible, dewater the watermains and trench in a controlled manner to not allow backflow into the watermains. Town forces may, at their discretion, flush water through a nearby fire hydrant to remove elevated chlorine residuals following the connection.



If trench water, dirt or debris has entered the watermain during the final connection, the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Contract Administrator.

The Contract Administrator may request the Contractor to submit written procedures for completing the final connection, including the method of dewatering to ensure the existing or new water system is not contaminated.

5.7.8 Connections Equal to or Less than One Pipe Length

For a final connection length less than or equal to one pipe length, the new piping, fittings and valves required for the connection shall be spray – disinfected and swabbed with a minimum 1% and maximum 5% solution of chlorine just prior to being installed. The Contractor shall ensure that the workers undertaking the disinfection process thoroughly wash their hands with soap and use hygienic practices.

5.7.9 Tracer Wire Conductivity Test

After the installation of base asphalt or final grading, the Contractor shall demonstrate the integrity of the underground tracer wire by applying a conductivity signal and confirming the signal on all watermains. The Contract Administrator shall witness the conductivity tests.

The intent of this test is to confirm that the tracer wire has been installed on all non-metallic watermains and services as specified. Specifically, the test shall demonstrate the integrity and continuity of the tracer on all watermains and services.

A continuity signal shall be applied to the tracer wire and the signal confirmed over the entire length of the tracer wire installed. The signal shall be detectable for a distance at least 300mm from either side of the signal connection point. At no time shall there be a break in the continuity of the tracer wire.

Acceptable means of undertaking the conductivity test include using traditional locating techniques and/or determining if a low voltage electrical current travels from the connection point to test points.

5.7.10 Valve Positioning

The Contractor shall demonstrate that all valves, both main line and service, are in the final positioning as outlined in the Contract Documents.



5.7.11 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable for commissioning of the water system shall be included within the watermain installation.

5.8 Water Meter and Water Service Installations

This subsection provides information on the procedures for the installation of water meters and services inside new building structures following the commissioning of new watermains.

5.8.1 Domestic Water Service

The water service, watermain or sprinkler service shall be installed under the supervision of Town forces and shall surface immediately upon entry into the building. This practice ensures that maintenance, repairs and inspection costs shall be minimized. The water service line shall be installed within a conduit beneath the footing and shall protrude 0.6m (2 feet) above the finished floor elevation. An isolation valve shall be placed inside the building immediately after the service surfaces within the building.

5.8.2 Water Meter

The Town of Perth shall install one water meter per residential or commercial unit per water service. Installation details shall be in accordance with the Standard Drawings shown in Section 5.0. Each meter shall be fitted with a remote reader to allow unobstructed access for taking readings. In cases of alterations to existing residential properties, where two or more separate living units are created, the municipality will supply and invoice on a maximum of two meters per service from the municipal watermain. This policy shall apply to services 25mm and smaller and does not apply to new construction. New construction will require an individual meter for each service installed.

6.0 SEWERS

This section provides direction on how sanitary and storm sewers and their associated appurtenances are to be installed, commissioned and tested to meet technical requirements of the Contract Documents.

6.1 Ontario Provincial Standards and Specifications

All watermain construction shall be installed in accordance with the Ontario Provincial Standard Specifications 410 except as amended or extended herein.



6.2 Sewer Installation

This sub-section provides direction on the sewer installation operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

6.2.1 Laying Tolerance

The allowable laying tolerance from the approved Construction drawings, for all sizes of sewer pipe, shall be 25mm horizontal, 5mm vertical for slopes less than 1% and 10mm vertical for slopes greater than 1%.

Additionally, pipes shall be installed with no visible ponding.

6.2.2 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable for the installation of sewers will be in accordance with the Ontario Provincial Standards.

6.3 Manhole and Catchbasin Installation

This sub-section provides direction on the installation of manholes and catchbasins that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

6.3.1 Manhole Lid Adjustment Tolerance

Manhole frames and lids shall be adjusted so that when tested by a 3m straight edge placed in any direction on the surface, the measured distance between the straight edge (asphalt surface) and the frame is no greater than 7mm.

6.3.2 Adjustment Unit Parging

The inside of adjustment units must be parged on all sanitary sewer manholes. Parging of adjustment units on storm manholes will not be required.



6.3.3 Manhole Connections

Flexible, water tight adaptors shall be used to connect flexible and rigid pipe into all new storm and sanitary sewer manholes. Pipe shall be installed flush with the inside wall of the manhole. The use of boot connectors and mechanical clamps will not be permitted for sanitary manhole connections.

At existing manholes, the opening shall be cored and the connection made as per a new manhole.

Only concrete brick and appropriate mortar shall be used to fill the void around concrete pipes. Clay bricks, stones and rubble shall not be used. The inside wall of the opening shall have a smooth mortar finish. Parging of brick and mortar connections shall be completed on the exterior of connections.

Flexible pipe with watertight adaptors shall not be parged.

6.3.4 Manhole Benching

All sanitary sewer manholes shall be pre-fabricated and pre-benched up to a minimum of the springline of the pipe. All benching shall slope up and away from the pipe at 8% slope.

Benching of storm manholes, where required by design, shall be pre-fabricated and pre-benched up to a minimum of 3 / 4 of the pipe height. All benching shall slope up and away from the pipe at 8% slope.

All catchbasin manholes shall be fitted with a 600mm sump.

6.3.5 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable for the installation of manholes and catchbasins will be in accordance with the Ontario Provincial Standards.

6.4 Service Connections

This subsection provides direction on the installation of service connections the Contractor is required to perform to meet the technical requirements of the Contract Documents.

6.4.1 Installation



New services from existing sewers will be installed from the main to the property line by Town forces at full cost recovery. Services off of newly commissioned sewers shall be installed from the main to the property line by the Contractor.

Lateral service connections for sewers shall be installed in the locations specified on the drawings, in accordance with the municipality's standard location, or as directed by the Contract Administrator.

6.4.2 Minimum Pipe Length

Pipe for lateral service connections shall be installed in 4m minimum lengths with one cut off to terminate at the property line. The second last pipe shall be shortened to ensure that the last service pipe is not less than 1.2m in length.

6.4.3 Line and Grade

The line and grade for all service lateral connections shall be as specified on the drawings as provided by the Contract Administrator. In general, all sewer lateral service connections to service private land shall be constructed at 2% minimum and 8% maximum grade.

6.4.4 Mainline Connections

Service connections to new storm and sanitary sewer mains must be completed using pre-manufactured tees or wye fittings.

Service connections to existing storm or sanitary sewer mains shall be completed by coring the pipe and installing an approved strap on saddle connection.

6.4.5 Manhole Connections

Service connections into existing manholes are generally discouraged. Where a connection is the only reasonable alternative to service a property, the design and details shall be discussed and approved by the Contract Administrator.

6.4.6 Caps

Water-tight rubber caps shall be installed at the ends of all lateral service connections. All caps shall be as specified by the pipe manufacturer to ensure a watertight seal.



6.4.7 Markers

The ends of all lateral service connections (and the location of caps) shall be marked by extending a pressure treated 4 x 4 timber marker from the cap to a height of 1m above finished grade. The exposed end of the marker stakes shall be painted green for sanitary and red for storm.

6.4.8 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable for the installation of service and related appurtenances will be in accordance with the Ontario Provincial Standards.

6.5 Commissioning Sewers

This subsection provides information on the testing requirements and procedures to be followed by the Contractor to complete the commissioning of the sewer system.

6.5.1 General

In order for a sewer to be considered for acceptance by the Contract Administrator, the following procedures and tests shall be successfully completed in the presence of the Works Inspector.

- leakage
- visual inspection
- cleaning and flushing
- CCTV inspections

6.5.2 Leakage

Leakage tests shall be carried out on all new sanitary sewers in accordance with OPS specifications. The preferred method of testing sanitary sewers within the Town of Perth is low pressure air testing.

6.5.3 Visual Inspection

Sewers, manholes and related appurtenances shall be cleaned of all foreign materials either by flushing, the use of cleaning buckets, by hand or a combination of all three methods. The sewers shall be inspected by the Contract Administrator for alignment



and obstructions. Ponding in gravity sewers will not be accepted. Regardless of the results of the tests as hereinafter provided all visible or detectable leaks in sanitary or storm sewers shall be repaired by the Contractor as a prerequisite to the acceptance of sewers.

6.5.4 Cleaning and Flushing

Sewer sections shall be cleaned using a combination unit with a high velocity jet approved by the Contract Administrator. Contractors may obtain potable water, at a nominal cost, from the municipal filling station located at the Perth Water Treatment Plant at 15 Sunset Boulevard. The cleaning equipment shall have a selection of two or more high velocity nozzles. The nozzles shall be capable of producing a scouring action in all sizes of pipe. The combination unit shall include a water tank, debris tank, suction mechanism and hydraulically driven hose reel. Cleaning equipment shall be capable of removing dirt, grease, rocks, sand and other materials and obstructions from the sewer lines and manholes by use of a vacuum system. The Contractor shall make as many passes as are necessary to clear all debris from the main.

During cleaning operations satisfactory precautions shall be taken so that the water pressure created does not damage or cause flooding on public or private property. In older sections of the municipality, it may be necessary to reduce pressures to less than 7,000 kPa to prevent water damage to homes.

Care shall be taken by the flushing Contractor to ensure that the downstream sections of sewer are appropriately blocked so that materials being flushed and vacuumed are not passed onto the next downstream reach. At the end of each flush, a back-flush shall be completed on the last section of sewer to ensure that no build-up of debris has occurred. All water and debris removed from cleaning operations shall be disposed of in accordance with provincial legislation and MOE guidelines.

If in the opinion of the Contract Administrator, it is determined that further cleaning is required, the Contractor shall re-clean and re-inspect the sewer at no additional cost to the municipality.

6.5.5 CCTV Inspections

Inspections shall be carried out by the Contractor after the placement of base course asphalt and/or finished grading, using television cameras and video recording equipment as specified in OPS 409. A continuous record of the internal condition of the piping system shall be provided in digital format as specified by the municipality.

Acceptance of sewer line cleaning shall be made upon successful completion of the television inspection and shall be to the satisfaction of the Contract Administrator. If



**CORPORATION of the TOWN of PERTH
SUPPLEMENTAL SPECIFICATIONS**

SECTION 3.0

CCTV inspections show the cleaning to be unacceptable, the Contractor is required to re-clean and re-inspect the sewer until accepted.

When interruptions of upstream sewer section flows are necessary to effectively conduct inspections, the Contractor shall, subject to the approval of the Contract Administrator, control flows using plugging and blocking methods.

6.5.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment, where applicable for the commissioning of the sewer system will be considered to be included in the payment for sewer installation.



I N D E X

1.0	General	2
2.0	Engineering Supervision	2
3.0	Testing and Quality Assurance	3
4.0	Substantial Completion	5
5.0	As-Built Submission	5
6.0	Warranty	5
7.0	Final Acceptance	6



1.0 GENERAL

The details included within this sub-section of the manual are intended to provide guidance for both developers and consulting engineers regarding the protocols for engineering supervision, records management (as-builts) and final acceptance of newly constructed public water, sewer and road infrastructure. The requirements outlined within this section generally pertain to all infrastructure that is located within a public right of way or easement and is ultimately intended to be assumed by the Corporation of the Town of Perth.

2.0 ENGINEERING SUPERVISION

- a) Prior to construction, the developer and/or owner shall provide a letter to the Town of Perth confirming the name of the engineering firm that has been retained to assume responsibility for the design, inspection, and as-built certification of new public infrastructure for the duration of the construction period. Any appointed engineer shall be licensed to practice in the province of Ontario and shall be a member in good standing with the Professional Engineers of Ontario.
- b) The engineering consultant shall be responsible for the layout, inspection, and certification of all public services which are to be constructed by the proponent as part of the overall site plan or subdivision development proposal. The engineering consultant will also be required to ensure that all materials used during construction are in conformance with the municipality's Approved Products List.
- c) Engineering supervision shall consist of general and sufficient resident inspection to ensure that the works and services are constructed in accordance with the approved design drawings. Sufficient inspection shall range from a minimum of one site visit per day during construction to full time resident inspection for major developments. The level of inspection will be determined between the consultant and the Director, Environmental Services or his/her designate before construction begins. The consultant shall submit copies of inspection reports on a weekly basis to the Corporation. Failure to provide adequate engineering supervision will result in the issuance of a Stop Work Order.
- d) The Town of Perth Works Inspector will periodically inspect the work and assist in the coordination of the work with any related works to be completed by Town forces. Such periodic inspections shall not relieve the consultant of his/her responsibilities to carry out regular inspections. The Works Inspector will bring to the attention of the consultant the use of any unacceptable materials or construction practices. If remedial actions are not taken to the satisfaction of the Director, Environmental Services or his/her designate a Stop Work Order may be issued.



- e) If the Consultant wishes to make any changes in the approved design either before or during the execution of the work, he/she shall first submit a “change order” request showing the proposed revisions to the Works Inspector. If approval is granted for the revision, the changes shall be recorded in the final as-constructed records pertaining to the project.

- f) The attention of the consultant is drawn to the safety regulations contained within the Occupational Health and Safety Act regarding excavations. All municipal employees have been instructed not to enter excavations which are not properly braced; therefore no approval will be given to installations which cannot be inspected because of unsafe working conditions.

3.0 TESTING AND QUALITY ASSURANCE

The consulting engineer shall be responsible for ensuring that adequate testing and quality assurance works are carried out during construction in order to demonstrate compliance with the end specifications outlined within the Ontario Provincial Standards and Specifications and the Town of Perth Engineering Standards and Specifications.

The minimum quality assurance testing requirements are outlined as follows:

<u>STAGE OF CONSTRUCTION</u>	<u>REQUIREMENT</u>	<u>RESPONSIBILITY</u>
*Pipe Bedding and Backfill	Compaction Testing	Geotechnical Consultant
Watermain Activation	Hydrostatic Test / Disinfection / Tracer Conductivity	Consulting Engineer / Town Works Inspector
Subgrade Inspection / Approval	Proof Roll / Other	Geotechnical Consultant
*Granular B	Proof Roll / Compaction Testing	Consulting Engineer and/or Geotechnical Consultant
*Granular A	Proof Roll / Compaction Testing	Consulting Engineer and/or Geotechnical Consultant
Sanitary Sewers	Pressure Testing / CCTV Inspection	Consulting Engineer / CCTV Contractor
Storm Sewers	CCTV Inspection	Consulting Engineer / CCTV Contractor
*Curb and Sidewalk Construction	Bedding Compaction / Concrete Testing	Consulting Engineer / Soils Consultant / Contractor
*Hot Mix Asphalt	Mix Designs / Field Supervision / Sampling	Consulting Engineer / Soils Consultant / Contractor



Grading / Stormwater Management	Inspection and Certification	Consulting Engineer
Final Inspection	Joint Field Inspection	Consulting Engineer / Town Works Inspector

* Note: Consultant to determine frequency of field tests or lab samples through discussions with Town Works Inspector.

4.0 SUBSTANTIAL COMPLETION

Works constructed as part of development proposals shall be deemed to be substantially complete when the works have: a) been constructed to the approved designs specifications, b) satisfied all applicable quality assurance testing and specifications, and c) are placed into public service. The date of Substantial Completion for new plans of subdivision shall define the point at which the Municipality will consider the lands “serviced” and therefore the point at which the final release of building permits will be authorized. The Town of Perth’s determination of Substantial Completion as part a “development agreement” shall be fully independent and exclusive of any contracts which may exist between the developer and/or owner and it’s Contractor.

5.0 AS-BUILT SUBMISSION

The engineering consultant will be required to submit an as-built drawing package to the municipality within 2 weeks following the determination of Substantial Completion. This drawing submission shall include the following:

- a) Two (2) sets of the record drawings in A1 size paper format marked “As-constructed”, bearing the original signature, date and seal by the engineer overseeing construction;
- b) One (1) set of the as-constructed drawings in mylar format;
- c) One (1) set of the as-constructed drawings scanned in TIFF format and one (1) set of the digital files compatible with the current or lower version of Autocad in use by the Town;
- d) Letter of certification from the engineer of record certifying that: “all water, sewer, drainage, roadway and streetlighting infrastructure has been constructed to the best of his/her knowledge in accordance with the municipal specifications and details outlined within the approved engineering designs”;
- e) Copies of any Operation and Maintenance Manuals which may be required by the municipality for specialized infrastructure (ie. pumpstations, stormwater ponds etc....); and



- f) Written confirmation from a construction trade newspaper, as defined by the Construction Lien Act of Ontario, that a copy of the Certificate of Substantial Performance of the work has been published in accordance with the requirements of the Act.

6.0 WARRANTY

The developer and/or owner shall be responsible for and shall execute at his/her sole expense all work, repair, alterations, or replacements as required to remedy any defect, fault or deficiency in the work within the period referred to as the warranty period extending twelve (12) months from the date which the municipality deems the works to be substantially complete. In the case of roadways paved with two lifts, the warranty period shall extend a period of twelve (12) months from the date upon which the wear course of asphalt has been placed and accepted.

All such works or repairs during the period of warranty shall be executed as the need becomes apparent, or upon written request by the Director, Environmental Services or his/her designate. Should the owner or applicant fail to execute the works within seven (7) days from the date of written request, the Town of Perth may be entitled to remedy the works and recover costs using securities held.

7.0 FINAL ACCEPTANCE

Works constructed as part of development proposals shall be deemed to have final acceptance once: a) as-built records are complete, b) the 12 month warranty period has expired, and c) a site inspection by the Works Inspector has determined that any and all deficiencies and defects in the works have been rectified. The Town of Perth's determination of Final Acceptance as part a "development agreement" shall be fully independent and exclusive of any contracts which may exist between the developer and/or owner and it's Contractor.