

4.0 Design Criteria

4.1 General

The following design criteria shall apply as minimum requirements unless specifically noted otherwise in the Development Agreement, superseded by Provincial or Federal legislation, or reports/studies from a geotechnical investigation.

4.2 Regulatory Requirements and Submittals

The Consulting Engineer shall make all applications and submissions necessary to obtain an Environmental Compliance Approval (ECA), including addendums, from the Ministry of the Environment, Conservation and Parks (MECP) for all works proposed prior to commencing any work on-site.

Upon completion of the works and prior to maintenance securities being released, the Town of Essex shall be provided with electronic copies in PDF and Word format, as well as three (3) hard copies of a complete & detailed Operating & Maintenance Manual and separate Project Documentation Manual all bound in 3-“D” ring binder(s) that include the following:

- O&M documentation for all components and equipment used on the project including warranty information, commissioning reports and signed letters of certifications from suppliers regarding installation, service and operation (training to be included for operations staff).
- Annual maintenance report templates for all control and pump equipment including voltage, current and Megger results from the manufacturer.
- Contingency plans to address potential malfunctions and/or emergency site conditions.
- Operational controls narrative.
- Standard Operating Procedures and/or Operations Manual covering the operation of the pump station.
- Environmental Compliance Approval (ECA).
- Three (3) copies of full size project “construction record” drawings in both printed form and PDF & AutoCAD electronic formats on USB drive.
- Final electrical inspection certificate from electrical safety authority (ESA).
- MECP Form 1
- Copy of final commissioning report from Engineer for watermain, pump station and stormwater.
- All spare parts shall be turned over to the Town of Essex or its operating Authority.

4.3 Roads

Asphalt pavement structures shall consist of the following minimum material thickness:

- Local Roads:
 - Granular 'A' Base - 400 mm (On Native)
 - Granular 'A' Base - 450 mm (On Engineered Fill)
 - Superpave 19.0 Base Asphalt - 135 mm at curb; 75 mm at centreline
 - Superpave 12.5 Surface Asphalt - 40 mm at curb; 40 mm at centreline
- Collector Roads:
 - Granular 'A' Base - 400 mm (On Native)
 - Granular 'A' Base - 450 mm (On Engineered Fill)
 - Superpave 19.0 Base Asphalt - 135 mm at curb; 75 mm at centreline
 - Superpave 12.5 Surface Asphalt - 40 mm at curb; 40 mm at centreline
- Industrial Roads:
 - Granular 'A' Base - 450 mm (On Native)
 - Granular 'A' Base - 450 mm (On Engineered Fill)
 - Superpave 19 Base Asphalt - 175 mm at curb; 75 mm at centreline
 - Superpave 12.5 Surface Asphalt - 50 mm at curb; 55 mm at centreline

These minimum thicknesses apply unless otherwise determined based on the results of a geotechnical investigation.

Granular 'A' materials shall meet the minimum requirements of OPSS 1010 and shall be compacted to a minimum 100 percent of the Standard Proctor maximum dry density. Recycled material shall not be used for granular road base.

Asphalt materials shall consist of asphalt cement having a penetration grade of 85-100 and shall conform to OPSS 1101. A qualified material testing company shall be retained by the Contractor to design the asphalt and pavement mixes, which must be submitted to the Town of Essex for review. The use of recycled asphalt in the final product shall not exceed 15 percent.

Pavements shall be designed to provide adequate drainage of stormwater runoff as well as drainage of the granular road base. Accordingly, the following minimum standards shall apply:

- Subdrains with Filter Sock:
 - SUB -DRAIN 150mm diameter heavy-duty perforated Big 'O' for all roads.
 - Constructed continuously along the back of curbs at a gradient equal to the longitudinal pavement slope (or minimum 0.30 percent) and connected to roadway catch basins or other appropriate outlet. Refer to standard detail in **Appendix B**.

- Curb-Inlet Catch Basins:
 - OPSD 610.030 (with bars).
 - Catch basins placed at intersections for proper drainage and spaced for road drainage from no more than 90m per catch basin per lane.
 - Curb inlet catch basins must have frame and grate on all road types. With bars (See **Appendix B**).
 - Placed at intersections for proper drainage.
 - Spacing for road drainage no more than 383m² asphalt catchment area per catch basin.
 - Regular catch basins (OPSD 705.010) to be used where curb inlets are obstructed from installation.
- Longitudinal Grade:
 - Desirable minimum: 0.5%
 - Absolute minimum: 0.3%
 - Maximum: 5.0%
- Road Radius:
 - Minimum turning radius: 9 m
 - Minimum cul-de-sac radius, including temporary cul-de-sacs for subdivision phasing: 12m
- Crossfall:
 - Desirable: 3.0%
 - Minimum: Concrete 2.0%; Asphalt 3.0%
- In intersection areas and cul-de-sacs:
 - Desirable minimum 1.0% with absolute minimum being 0.6%
- Concrete Curbs and Gutters:
 - OPSD 600.04 (with modified gutter depth)

4.4 Sidewalks/Recreation ways

Concrete sidewalks shall be constructed in accordance with OPSS 351 and OPSD 310.01, 310.030. Sidewalks shall be constructed through driveways/entrances unless noted otherwise herein. Sidewalk widths shall be:

- Residential:
 - 1.5m wide, increased to 1.8 m wide when constructed adjacent to curb and gutter
 - Minimum thickness 150 mm at road radius and driveways, 125 mm elsewhere
 - Base Material 150 mm of Granular 'A'

- Commercial, Industrial, Institutional:
 - 1.5 m wide, increased to 1.8 m wide when constructed adjacent to curb and gutter
 - Minimum Thickness 150 mm at road radius and driveways, 125 mm elsewhere
 - Base material 200 mm of Granular 'A'

All sidewalks shall be constructed through driveways and thickened accordingly. Expansion joints shall only be used when abutting facilities. At any intersection, concrete sidewalk ramps and asphalt multi use pathway ramps shall comply with OPS 310.030. Furthermore, **Figure S5** of **Appendix B** shall be included in the referenced drawings. The Accessibility for Ontarians with Disabilities Act (AODA) was established in 2005 outlining accessibility standards for organizations, including Municipalities.

Ontario Regulation 119/11, Accessibility for Ontarians with Disabilities Act (AODA), was amended by Ontario Regulation 413/12 to include Part IV.1, Design of Public Space Standards (Accessibility Standards for the Built Environment). The amendment to the regulation came into force January 1, 2013 by municipalities among other obligated organizations. The Act does not require existing sidewalks or wheelchair ramps to be retrofitted or replaced.

In order to comply with the Act requirements, the exterior path must have a minimum clear width of 1500 mm. This width can be reduced to 1200mm to serve as a turning space where the exterior path connects with a curb ramp. Where the curb ramp is provided at a pedestrian crossing, it must have tactile walking surface indicators that:

- have raised tactile profiles
- have a high tonal contrast with the adjacent surface
- are located at the bottom of the curb ramp
- are set back between 150mm and 200mm from the curb edge
- are a minimum of 610mm in depth
- extend the full width of the curb ramp

The Developer shall install all sidewalks at the time of completion of the underground services to the minimum specifications outlined in this section, and must meet new requirements, including all utilities, and road construction (up to base asphalt). The Developer is responsible for sidewalk damage during maintenance period. For developments, any review and approval of development drawings includes the requirement for tactile walking surface indicators at all municipal sidewalk curb ramps. Additionally, the required type to be used is the Access Tile tactile system, part # ACC-R-2436-XX, epoxy coated (yellow). The Town of Essex may require a delay in the schedule to install sidewalks based on the level of building activity and/or to allow for the consolidation of utility trenches as determined by the Director of Infrastructure.

Developers will be responsible to maintain and repair damaged sidewalks, for one year from the Town of Essex “acceptance of services”. The Developer shall also include sidewalks shown on the lot grading sheets submitted to the Town of Essex, prior to the issuance of building permits to home builders.

Recreation ways shall be a minimum of 2.44 metres wide. The minimum asphalt thickness shall be 80mm Superpave 12.5, and 100mm Superpave 12.5 at driveways. The minimum Granular ‘A’ thickness shall be 250mm. The base is to be 300mm wider than the asphalt on each side. Recreationways shall also be constructed through driveways and thickened accordingly.

4.5 Sanitary Sewers

Sanitary sewers and appurtenances shall be constructed in accordance with the approved contract documents prepared by the Consulting Engineer. The minimum design criteria are noted below. Imported Granular ‘B’ backfill per OPSS 1101 shall be used beneath all pavements and within 1 metre of the back of curb.

Table 1: Sanitary Design Criteria

Design Component	Design Criteria	
Population Density	Low-Medium Density Residential 3 persons per unit High Density Residential Based on anticipated use	Dry industrial 35 persons per hectare Commercial Based on anticipated use
Average Domestic Flow Peaking Factor	450 litres per capita per day Harmon formula applied to average domestic flow $(1+14)/(4+P^{0.5})$ P = population in thousands Minimum Peaking Factor = 2.0	
Extraneous Flow	0.21 litres per hectare per second	
Minimum Velocity for Pipe Flowing Full	1.0 m/s for first run, 0.6 m/s for remaining	
Maximum Velocity	3.0 metres per second	
Manning’s Coefficient of Roughness	0.013 (Smooth Wall Pipe)	
Minimum Pipe Size	200 mm diameter	
Maximum Manhole Spacing	90 m preferred, maximum 120 m	
Minimum Manhole Size	1200 mm	
Benching	To be in accordance with OPSD 701.021	

Design Component	Design Criteria
Other Manhole Notes	All manholes are to be equipped with Cretex Inflow Dish with water tight gasket and diffuser valve
Drop Structure	Bowl Type, minimum 1500 mm maintenance holes, minimum height of 600 mm from the inlet pipe invert to the bottom of channel
Minimum Service Connection Size	Single – 125 mm diameter All cleanouts require a 125 mm metal cap
Minimum Service Grade	2%
Other Servicing Notes	<ul style="list-style-type: none"> All services shall include a tee and a cleanout at the property line The cleanout should project more than 0.3m above the ground level for inspection and should have a minimum separation distance of 1.5 m from an adjacent service Service connections to manholes are not permitted Double connections and tee-wye connections are generally not permitted, however the first two services on the first run of sewer are required to be wyed Residential services must have a backflow preventor.
Pipe Material	PVC DR35 – sanitary sewer (<450mm) PVC DR28 – sanitary private services Concrete (65-D min.) – reinforced for sewers 450 mm diameter or larger

Design submissions must include the following:

- A drainage plan showing all relevant land uses within each sub drainage area and calculation information (design parameters such as area, population and lots shall be shown).
- Design calculations indicating land use, densities, design flows, velocities, capacities, pipe sizes, etc. on the sanitary design sheets.
- Profiles should show size, type, strength classification, length, inverts of pipes, location, diameter and rim elevation of maintenance hole.
- Sampling manholes

The Consulting Engineer shall confirm the availability and location of an appropriate outlet with the Town of Essex, shall complete the final design and obtain a Certificate of Approval from the Ministry of the Environment, Conservation and Parks (MECP) prior to construction. Work on private property shall conform to the ECA.

4.5.1 Private On-Site Wastewater Treatment Facilities

In those instances where land is designated for development in the Town of Essex Official Plan and an extension of servicing from an existing municipal wastewater treatment facility is not available or practical at the time that development wishes to proceed, the Town of Essex will consider the use of a private on-site wastewater treatment facility in compliance with the relevant Town of Essex Official Plan policies, the County of Essex Official Plan, and the 2020 Provincial Policy Statement (PPS).

Where a site is approved for a private on-site wastewater treatment facility, the Town of Essex will require, as a condition of site plan approval, that the Developer agree to connect to the municipal wastewater treatment facility where services are available as determined by the Town of Essex. The Town of Essex will also require that the appropriate buy-in fee or development charge be paid by the Developer at site plan approval.

A separate agreement would be required for the operation of the plant. The Developer would be responsible to maintain the plant while it is operating within normal parameters for at least 6 months. The Town of Essex would then take over operation following that time period.

4.5.2 Sanitary Pumping Stations

Sanitary pumping stations shall be designed and constructed in accordance with the Town of Essex approved construction drawings and specifications prepared by a Professional Engineer licensed in the Province of Ontario.

Drawings and specifications shall meet the following minimum design criteria. Please note that the Town of Essex shall reserve the right to amend and/or impose additional requirements to those noted herein at any time.

Where pumping stations are approved, stainless steel products and appurtenances will be selected over galvanized and other treated surfaces to minimize the effects of corrosion from sewage and weather. All pumping stations will be provided with an emergency power outlet suitable for use with portable emergency generators to be used by the Public Works Department in the event of a power failure to the pumping station. All stations will be equipped with alarm systems connected by telephone lines to the Town's water treatment plant, all at the Developer's expense. Permanent back-up generators may be required, at the Developer's expense, and at the discretion of the Town.

Refer to the typical sanitary sewer pump station drawing depicted in **Figures SA3-SA5 in Appendix B** which shall serve as the basis of design within the Town of Essex. These standard drawings shall also serve as a reference to assist the Consulting Engineer in the design and preparation of detailed construction drawings.

Contemplated changes/deviations/customization of the design/arrangement/configuration depicted in these drawings to suit a specific design/situation/circumstance/location/etc. shall first be reviewed with and approved by the Town of Essex on a case by case basis prior to implementation.

The sewage retention period shall be adequate to allow for transportation time and shall not be less than 4 hours under average daily flow rates plus infiltration.

4.5.2.1**Site Selection**

The site shall be accessible from a municipal street and sized to provide for the parking of vehicles used for inspecting and maintaining the station. Access must also be provided for a standby electrical generating system where required. Access shall also be provided for the storage or removal of snow. All access roads and parking areas shall be paved with asphalt. Minimum lot size shall be based primarily on being able to remove and replace entire station without encroaching on adjacent private property and shall take into consideration a minimum 1:1 soil slope during excavation while meeting the objectives in the paragraph above. Site shall be graded to ensure proper surface drainage and landscaped to be compatible with the surrounding neighborhood. Landscaping design shall be submitted and approved by the Town for any areas adjacent to road right of ways. Any associated buildings shall be designed to be permanent, durable and aesthetically pleasing and compatible with other buildings in the area.

4.5.2.2**Pumping Station Design**

Pumping stations shall be designed in accordance with Ministry of Environment (MOE) guidelines and specifications herein. Wet well submersible pump stations shall also be designed in accordance with Ministry of Environment Specification No.3 – Standard Specification for Submersible Sewage Pumps – Issue No. 2 – March 1984 and specifications herein. The specifications herein will supersede the MOE guidelines should there be any contradictions between the two documents. All pump stations shall be fitted with an external electrical weatherproof plug for connection of a mobile emergency standby electrical generator in a manner suitable to and approved by the Town. Permanent emergency standby electrical generator facilities shall be provided in all cases where flooding and backup of sewage into private buildings can occur and where the uses of mobile emergency standby electrical generators are not practical or desired by the Town. The need and type of emergency standby power shall be reviewed with the Town and MOE Regional Staff early in the design stage. The sewage retention period shall be adequate to allow for transportation time and shall not be less than 4 hours under average daily flow rates plus infiltration. One or more pumps capable of pumping the peak design flow with an additional stand-by pump (this is known as firm capacity).

System head calculations shall be undertaken in accordance with MOE Guidelines for Design of Sanitary Sewage Systems and MOE Specification No. 3 as noted herein and per the following:

- Hazen-Williams Coefficient of C=120 for low water level, C=130 for median water level and C = 140 for high water level conditions
- Minimum force main velocity of 0.76 meters per second (2.5 feet per second)
- Maximum force main velocity of 2.3 meters per second (7.5 feet per second)
- Minimum pump cycle time of 10 minutes

Only pumps manufactured by Xylem Flygt shall be used in the Town. The use of alternative manufacturers must be approved by the Town on a case by case basis due to or to suit specific circumstances.

Pumping stations shall generally be circular in design and constructed of precast or cast in place reinforced concrete using Type 20 cement. They shall have a minimum inside diameter of 3.0 meters and shall include at minimum, the following items all of which are to be detailed in the projects construction drawings and specified in the project's specification documents. Refer also to details in the typical sanitary pump station drawings contained herein for reference and additional requirements in **Figures SA-3, SA-4, and SA-5**.

- **Access hatches** shall be of the lockable, single leaf, insulated roof scuttle design of aluminum construction with a minimum clear opening of 762 mm x 914 mm, and fitted with Type 316 stainless steel hardware complete with continuous piano hinge, gas assist springs, hold open arms with handles, flush recessed lock with provisions for padlock and designed to withstand minimum live load of 150 pounds per square foot using min. 6mm thick aluminum tread plate all as manufactured & supplied by MSU Mississauga or approved equal.
- **Pump/Equipment hatches** shall be of the lockable, single leaf cast-in-place design of aluminum construction with a minimum clear opening of 914 mm x 914 mm for 3000 mm diameter chambers and 914 mm x 1220 mm for 3600 mm diameter chambers to allow complete removal and replacement of pumps. Hatches shall be fitted with Type 316 stainless steel hardware complete with stainless steel hinges, gas assist springs, hold open arms with handles, flush recessed lock with provisions for padlock and designed to withstand minimum live load of 150 pounds per square foot using min. 6mm thick aluminum tread plate. Hatch shall also come complete with hinged orange colour safety grate and retractable safety post & chain all as manufactured & supplied by MSU Mississauga, Flygt or approved equal.
- **Access ladders** shall be fabricated, heavy duty design of aluminum construction having a width of 500 mm. Ladder shall be supported off chamber wall using flanged brackets at maximum spacing of 1200 mm and Type 316 stainless hardware. Top of ladder shall be fitted with heavy duty, retractable, double post access rails all as manufactured & supplied by MSU Mississauga or approved equal.

- **Platforms** shall be fabricated and of all aluminum construction (T-6061) with Type 316 stainless steel hardware complete with channel & angle support framing and “close mesh (4.76mm)” aluminum “serrated” grating fastened to framing using Type 316 stainless steel hold down clips at minimum 500mm centers (min of 4 hold down clips per panel). Provide hinged grating section for access to lower level having minimum clear opening of 762 mm x 914 mm fitted with aluminum or stainless steel hinges and lifting handles All edges and holes through grating shall be banded. Platform shall also be fitted with safety handrail of welded double rail design and aluminum alloy 6063-T6 or 6351-T6 construction with clear anodized finish. Pipe rails shall be 38mm diameter, IPS Schedule 40 complete with bottom flanged posts at max spacing of 1800 mm and 150 mm high x 6 mm thick aluminum kick plates fastened to bottom of posts. Platform shall also be fitted with 1040 high aluminum post & chain assembly for personnel safety around the hinged grating section. Removable posts shall be set in floor sockets & fitted with two rows of Type 316 stainless steel chain on 3 sides complete with stainless steel eyehooks and spring loaded hooks to engage the eyehooks.
- **Sewage pumps** shall be of the non-clog submersible design with separate pump base discharge connection and dual sliding rail system. Pumps to be rated for 600 volts, 3 phase, 60 hertz operation and certified for Class 1, Group D, Division 1 hazardous environments. Each pump to be equipped with a mix flush valve and lift chain of hot dip galvanized steel construction. In addition, each pump to be fitted with leakage detectors capable of sensing stator over temperature and liquid in stator housing complete with automatic reset once the fault has cleared, LED fault indications, dedicated dry output contact closures for temperature and leakage faults using Flygt Mini-CAS II Supervision relay. Pump power cables to be supported from stainless steel cable support grips above with min. 3 meters slack after installation. Pump surfaces to be finished with an epoxy coating system for corrosion protection. Provide a chain hoist with sufficient load chain and grip eye lifting device for proper removal and installation of each pump. All as manufactured and supplied by Xylem/Flygt Canada – Npump.
- **Pump rails** shall be of Schedule 80 hot dip galvanized steel piping construction. Intermediate and upper guide bar holders including pump lift chains and chain hooks shall also be of hot dip galvanized steel construction with Type 316 stainless steel hardware.
- **Pump discharge piping** shall be to ASTM A-774/778 Type 316L stainless steel welded construction, I.D. pipe size with minimum thickness of 11 gauge (3.2mm) (0.125-inch). Fittings shall be prefabricated, smooth flow, long radius type. Joints shall be welded except at valves & equipment where flanged type backing flanges and rolled van stone collars are to be used. Backing flanges to be min. hot dip galvanized steel construction drilled to ANSI B16.1, Class 125, thickness T3 for 150 psi test pressure. Victaulic couplings and victaulic

flange adaptors of hot dip galvanized steel construction are to be used where shown on the typical sanitary pump station drawings contained herein. All joint fasteners to be Type 316 stainless steel. All piping and fittings to be pickled and passivized after fabrication and field welding to achieve a consistent finish and appearance. As manufactured and supplied by Douglas Barwick Inc. or approved equal.

- **Gate valves** shall be of the resilient wedge type to AWWA C509 Class 200W and/or AWWA C515 Class 250W with manual handwheels and gear operators. Manual square nut operators and stainless steel extension stems shall be implemented where shown on the typical sanitary pump station drawings contained herein. Valve to be of ductile iron construction, bronze mounted with rubber encapsulated modified wedge disk and nonrising stem with O-ring seals and flange x flange ends drilled to ANSI B16.1, Class 125. Valve to open by turning counterclockwise. All exposed fasteners to be Type 316 stainless steel. The exterior and interior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy coating system. As manufactured by Mueller, Clow, American AVK or approved equal.
- **Swing check valves** shall be of the rubber flapper design to AWWA C508. Valve shall be full globe style body with domed access cover and flexible disc made of Buna-N (NBR) and steel reinforcement with disc accelerator. Body shall be of ductile iron construction with all stainless steel trim and flange x flange ends drilled to ANSI B16.1 Class 125. Valve shall be fitted with screw type backflow actuator to enable opening of valve during no flow conditions and a mechanical indicator to provide disc position indication on valve. All exposed fasteners to be Type 316 stainless steel. The exterior and interior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy coating system. As manufactured by Val-Matic - Surgebuster Swing Check Valve Series 7200.
- **Curved sluice gate** shall be fabricated from Type 316L stainless steel to AWWA C501 requirements. Gate shall consist of wall thimble, gate frame, yoke, threaded stem, stem extension and stem guides all constructed from Type 316L stainless steel and assembled using Type 316 stainless steel fasteners and hardware. Stem guide liner, side & top seals to be constructed from polyethylene with bottom seal from neoprene rubber. Leakage rate shall not exceed 0.05 l/gpm per linear foot of seal against both seating and unseating head. Gate to be controlled with manual operator on top of chamber using pedestal constructed of hot dip galvanized steel with geared hand crank and aluminum stem cover with graduated window for valve position indication. All hardware and fasteners to be Type 316 stainless steel. As manufactured and supplied by Armttec, Fontaine or Rodney Hunt.
- **Sewage air release & vacuum break valve** shall be suitable for air release and vacuum break functions during pipeline filling, pipeline drawing, water column separation, normal operation and surge alleviation. Body to be compact single chamber design of stainless steel and/or epoxy coated construction with all fasteners and hardware in Type 316 stainless

steel. Float, seat and all moving parts to be of Type 316 stainless steel construction. Valve shall incorporate over-pressure safety feature and optional 6mm ports fitted with Type 316 stainless steel ball valves, nipples and caps. As manufactured by Vent-O-Mat - Series RGX.

- **Vent pipes** for both shallow and deep chamber levels of hot dip galvanized steel construction complete with 180 degree gooseneck having a bolted flange arrangement fitted with both bird & insect screens sandwiched between the flanges. Vents shall have min. inside diameter of 100mm for 3000mm diameter chambers and 150mm diameter for 3600mm diameter chambers.
- **Above Ground Free Standing Fixed Davit Bases** are for general purpose use for most applications. These are either attached to concrete or other structural materials such as steel. Review exact socket requirements with Town at time of specification preparation.
- **All fasteners and hardware** including brackets in interior & exterior of pump chamber shall be minimum Type 316 stainless steel construction.
- **All thrust restraint and pipe support brackets** including fasteners shall be of minimum Type 316 stainless steel construction.
- **Levels sensor** shall be of the ultrasonic type. The level transmitter shall be equipped with auxiliary relays (minimum three) configurable to control pumps for drawing down the pumping well in a lead-lag process and automatically alternate pump duty. Level transducer is to be supported from its own cable using a strain relief cord grip and hung within a 150mm diameter PVC standpipe accessible from above the top slab via the equipment hatch or dedicated access cover (so as to avoid having to enter the chamber) all as shown and detailed in the typical sanitary pump station drawings contained herein. As manufactured and supplied by Siemens-Milltronics Multi-Ranger 100 w/XPS-15.
- **Alarm Float Switches** shall be micro tilt switch type Ex approved version with sufficient cable length to reach control panel without splices and complete with Type 316 stainless steel horizontal hanger, stainless steel or PVC strain relief cord grips and Type 316 stainless steel sway and control rings all as manufactured and supplied by Xylem Flygt Canada.

All pumping stations shall be fitted with electrical service entrance & pump control panels and mounted on standalone aluminum channel support system positioned minimum 1500mm from closest edge of pump chamber (to avoid Class 1 Division 1 or 2 hazardous environment classification). Electrical & controls work shall conform to the following requirements and be detailed in the projects construction drawings and specified in the project's specification documents.

Refer also to details in the typical sanitary pump station drawings contained herein for reference and additional requirements.

- Supply & Installation of electrical & control works shall meet the minimum requirements of Ontario electrical safety code.
- Electrical and control works shall be designed and constructed in accordance with approved detailed construction drawings & specifications prepared and sealed by a Professional Electrical Engineer licensed in the Province of Ontario competent in undertaking this type of work. Refer to details in the typical sanitary pump station drawings contained herein for reference and additional requirements.
- Electrical design shall include procurement and coordination of both the power supply from electrical supply authority and telephone lines from Bell Canada.
- Electrical design shall also include provisions (external plug) for connecting a portable/mobile emergency standby generator set in a manner acceptable to the Town of Essex for installations where a permanent emergency standby generator will not be provided.
- Panels shall be fitted with automatic dialer and/or SCADA equipment to relay alarms to the Town's operating authority. Exact requirements are to be reviewed with the Town and their operating authority early in the design stage.
- Service entrance shall be 600 volts, 3 phase, 60 hertz of sufficient capacity to meet pump station requirements. 3 phase power shall be implemented where available and desirable by the Town.
- All current protection must be accomplished thru the use of thermal/ magnetic circuit breakers having sufficient interrupting ratings.
- Each sewage pump to be controlled thru a Hand-Off-Auto selector switch and monitored with an hour meter.
- External alarm light for high-high level float switch with push-to-test lamp push button.
- All electrical & control panels, cabinets, enclosures, boxes, fasteners and all hardware shall be of Type 316 stainless steel construction.
- All pumps and associated wiring from the wet well shall be continuous without splices and terminate to a junction box (with terminal strips) located prior to the EYS fittings in accordance with the Electrical Safety Code. Wet well wiring to continue from the junction box through EYS fittings into the pump control panel.
- All electrical equipment to be manufactured and supplied by Allen Bradley, Siemens, Square D or approved equal. Electrical components shall be in full compliance with the NEMA standards and have a NEMA rating identification (IEC components with NEMA equivalent ratings are not acceptable).

- Minimum 3-pair phone line system to facilitate alarm monitoring system.
- Alarm monitoring system as follows:
 - DSC alarm system and minimum zone requirements and features as follows:
 - Key pad entry and delay of 30 seconds
 - Monitor A/C power failure within 30 second delay on dial out
 - Monitor door security
 - Monitor door entry and closing
 - Monitor high level float (first stage)
 - Monitor high-high level float (second stage)
 - Monitor pump failure for each pump
 - Test signal programmed for 1700 hours daily
 - Entire alarm system to be supplied and wired by Security One Alarm Systems
 - All zones to be monitored 24 hours and programmed to dial out to Security One Alarm Systems
 - Alarms to also be monitored at Denis St. Pierre WPCP thru the plant's existing SCADA system receiving signals from the DSC alarm network. Retain the services of the Town's approved system integrator to program the new alarms into the SCADA system.

During the maintenance period, the Developer will be responsible for all costs incurred by the Town excluding hydro, telephone and Security One monitoring services. Hydro, telephone and Security One monitoring services to be set up through the Town's Infrastructure Services Department for all storm & sanitary pump stations. Should any major repairs to a pump station that is under maintenance be required, the Town will advise the Developer who will be given opportunity to make repairs through their contractor within reasonable time period. Should Developer not carry out repairs within reasonable time period, as determined by Town, then the Town will carry out all required repairs and all costs incurred shall be assessed to and be borne by the Developer.

4.6

Storm Sewers and Stormwater Management

Storm sewers and appurtenances shall be constructed in accordance with the approved contract documents prepared by the Consulting Engineer. The minimum design criteria are noted below:

Table 2: Storm Design Criteria

Design Element	Design Criteria
Design Method	Rational Formula
Standard Return Period	1 in 5 years Storm Event
Rainfall Intensity	$I = a / (t+b)^c$ (Check AES Windsor Airport data for parameters)
Run-off Coefficients	Asphalt, concrete, roof area = 0.95 Gravel = 0.70 Grass – Sandy Soil = 0.15 Grass – Clay Soil = 0.20 Residential Single Family = 0.60 Residential Single Family (lot size under 500m ²) = 0.70 Residential Semi-Detached = 0.70 Residential Townhouse = 0.80 Industrial/Commercial = 0.90
Minimum Velocity for Pipe Flowing Full	0.80 metres per second
Manning's Roughness Coefficient for Storm Sewers	0.013 (Smooth Wall Pipe)
Minimum Cover	1.07 metres
Maximum Manhole Spacing	Less than 900 mm diameter: 120 metres 900 mm diameter or greater: 150 metres
Minimum Manhole Size	1200 mm
Benching	To be in accordance with OPSD 701.021
Minimum Service Connection Size	Single – 150 mm diameter Double connections not permitted All cleanouts require a 150mm metal cap
Pipe Material Main Lines Services	450 mm or less: PVC or Reinforced Concrete Greater than 450 mm: Reinforced Concrete (65-D min.) PVC SDR28
Additional Notes	Other pipe materials will be considered in rural areas if requested in writing at the discretion of the Director of Infrastructure. All services shall include a tee and cleanout at the property line. The cleanout shall not project more than 0.3 m above ground level for inspection. Check valves are required on sump pump discharge lines.

Please note that the parameters indicated in **Table 2** are subject to change in accordance with latest revision of the Windsor/Essex Stormwater Management Standards Manual (found [here](#)).

Class 'B' bedding and cover material shall be Granular 'A', compacted to 98 percent of the Standard Protector Maximum Dry Density, to the dimensions detailed on the Contract Drawings. The bedding should extend minimum 150mm below the sewer pipe to at least 300mm above the pipe.

All new developments shall have their downspouts outlet onto the finished grade of the lot with storm water directed away from the building without impacting adjacent properties. Splash pads should be used to prevent erosion at the downspout outlet. Downspouts should only be connected to the storm sewer system if health and safety is a concern due to slips, trips and/or falls.

The Consulting Engineer shall confirm the availability and location of an appropriate outlet with the Town of Essex and shall complete the final design and obtain a Certificate of Approval from the Ministry of the Environment, Conservation and Parks (MECP) prior to construction. Work on private property shall conform to the ECA.

Design plans submitted must include the following:

- A drainage area plan showing catchment areas (to include design parameters, i.e. area and runoff coefficient).
- Design calculations indicating design flows, slopes, velocities, capacities, pipe sizes, runoff coefficients, etc.
- Profiles should show size, type, strength classification, length, inverts of pipe, location, and rim elevations of maintenance holes, catch basins, etc.
- Details of grading, berms, catch basins or other facilities to handle storm drainage on public reserve parcels. These features are to be incorporated in an overland drainage plan for the subdivision. If a subdivision is being constructed in phases, each phase requires detailed overland flow routes and temporary drainage conditions.

4.6.1 Stormwater Pumping Stations

Stormwater pumping stations shall be designed in accordance with Ministry of Environment, Conservation and Parks (MECP) and the Windsor/Essex Region Stormwater Management guidelines (found [here](#)) and specifications herein.

During the maintenance period, the Developer will be responsible for all costs incurred by the Town of Essex that are associated with the pump station. Hydro, telephone, and Security One monitoring services to be set up through the Town of Essex for all storm and sanitary pump stations.

Should any major repairs to a pump station that is under maintenance be required, the Town of Essex will advise the Developer who will be given the opportunity to make repairs through their contractor within a reasonable time period. Should Developer not carry out repairs within a reasonable time period, as determined by the Town of Essex, then the Town of Essex will carry out all required repairs and all costs incurred shall be assessed to and be borne by the Developer.

4.6.2 Storm Water Management Guidelines

Storm water management facilities shall be constructed in accordance with the approved contract documents as well as the approved Storm Water Management Plan, prepared by the Consulting Engineer and approved by the Town of Essex and the Essex Region Conservation Authority (ERCA). The minimum design criteria are noted below:

- The Storm Water Management Plan shall be prepared to address the specific Municipal, Regional (ERCA) and Provincial (MECP and NDMNRF) requirements to control stormwater quantity and quality.
- In all cases, stormwater quality measures shall be incorporated to address provincial water quality guidelines, including short term measures to control soil erosion during construction of site services. As a minimum standard of quality control, suspended solid removal via settling, filtration or hydrodynamic separation is required. Pre-consultation with ERCA and the Town of Essex is required to identify any specific water quality objectives for the watershed and receiving watercourse(s).
- It is recommended that watershed adopt an allowable release rate based on the hydraulic capacity of the receiver(s). This approach relies upon a hydraulic analysis.
- In the absence of watershed planning studies or drainage plans, pre-consultation with ERCA and the Town of Essex is mandatory to discuss and confirm an appropriate allowable release rate.
- The stormwater management facility shall be designed to current Best Management Practices and subject to the approval of the Town of Essex, MECP and ERCA.
- On-site measures to control stormwater quantity for industrial and commercial developments will be permitted, including temporary parking lots.
- Rooftop storage is not permitted due to a lack of municipal control over the practice. Green roof infrastructure may be acceptable with supporting maintenance agreement and restrictive covenant with owner to prevent alteration to system. However, while green roof infrastructure may be acceptable and even encouraged where appropriate, the available storage capacity of any rooftop system will not be accounted for in the required available storage for any particular site/development since maintenance and prevention of alterations to the system cannot be guaranteed even with agreements in place.

- Where it can be demonstrated that the design outflow from the storage facility will never be impeded by its receiver, then the storage volume requirements can be determined via a hydrodynamic analysis, which considers the varying outflow rate in response to the stage-outflow relationship of the flow control element(s).
- Runoff coefficients must be in accordance with **Table 2** under **Subsection 4.6** of this development manual. To identify the soil type for the subject site, please refer to the Essex Region Conservation Authority Public Interactive Mapping.
- For sites less than 2 hectares, the Modified Rational Method may be accepted. However, the 100-year runoff coefficient must be based on equation 3.3.2.2 in the Windsor/Essex Region Stormwater Management Standards Manual.
- Stormwater infrastructure should be evaluated based on a “stress test” event, which is defined as 150 mm of rainfall. Supporting discussion and rationale for the proposed increase is provided in Section 3.9 of the Windsor/Essex Region Stormwater Management Standards Manual. For rural conditions, use an SCS Type II distribution. For urban conditions, use a Chicago 100-year 24-hour distribution with uniform distribution of the additional 42 mm.
- The lowest opening into a building should be a minimum of 0.3 m above the Regulatory Flood Level or on-site calculated 100-year water storage elevation, whichever is greater. The lowest opening elevation should also consider the “stress test” assessment. Additional floodproofing measures may be warranted based on Building Code requirements and/or site-specific risks and potential for damages. Refer to Section 1.5 of the Windsor/Essex Region Stormwater Management Manual for discussion related to risk.
- Surface ponding on roads and parking lots shall not exceed 0.3 m in depth or less (under 1:100 year storm event conditions). For high traffic roadways, lower depths may be required.
- Side slopes shall be no steeper than 6:1 (horizontal: vertical) within 3.0 m on either side of the normal water level (NWL). Average slope from NWL to top of bank shall be no steeper than 5:1.
- Stormwater ponds shall have backflow prevention for outlets into high risk flooding areas.

For additional information regarding stormwater management requirements, please refer to the Windsor/Essex Region Stormwater Management Standards Manual (found [here](#)).

In regards to SWM facility access, a maintenance pathway around the pond should be provided for cleanout purposes. A minimum setback of 3-5m should be implemented from the property line to the top of bank for equipment access.

The Consulting Engineer shall obtain an ECA from the Ministry of the Environment, Conservation and Parks (MECP) as well as approval from the Essex Region Conservation Authority (ERCA) prior to commencing with construction.

4.6.3 Considerations for Climate Adaptation

The Consulting Engineer should refer to the **Town of Essex Climate Control Adaptation Plan** (Essex CCAP) (found [here](#)) when undertaking stormwater management design for a new development. Some of the main takeaways are as follows:

- **Reducing Overland Flow:** Limit impermeable surfaces as much as possible and utilize more pervious surfaces in landscaping in order to reduce the amount of overland flow.
- **Drainage Issues:** Prescribed buffer strips and xeriscaping should be considered to reduce peak drainage flows.

The following identifies examples for LID stormwater control measures based on land use type, any alternative measures are encouraged for review by The Town of Essex:

Municipal Right-of-Way or Easement

- **Third Pipe Systems:** Consisting of a perforated stormwater exfiltration pipe laid in a granular bedding. This system may be constructed as part of the storm sewer system or as a perimeter French drain in the boulevard. Third pipe-systems are designed for both conveyance and infiltration of stormwater runoff.
- **Bioretention Systems:** A vegetated basin that collects stormwater at the source for infiltration and filtration. Bioretention systems can be covered with landscaped plantings and mulch, or grass (naturalized or sod). Bioretention has an advantage over other practices because it can vary in size, shape and placement. They can be designed to accommodate large volumes of stormwater runoff or designed to treat small drainage areas. Most bioretention systems will require an underdrain and an overflow catch basin connected to the storm sewer.
- **Infiltration Swales or Dry Swales:** Swales may be designed to convey stormwater runoff as part of the minor or major system. In favourable soil conditions, the infiltration swale may be able to retain stormwater runoff at-source whereas the dry swale will result in slower flow rates in comparison to a storm sewer system.

Single Family Residential

Within single family subdivisions, LID features are to be located within the municipal ROW or dedicated municipal easement, where they can be accessed and maintained. These LID features may include permeable pavers, rain gardens/bioretention systems, or rainwater harvesting systems.

- **Rainwater Harvesting System:** This system intercepts, conveys and stores rainfall for future use. The rain that falls upon a catchment surface, such as a roof, is collected and conveyed into a storage tank. For residential uses, rain barrel storage tanks typically range from 190 to 400 litres in size. Rainwater harvesting systems provide the combined benefit of conserving potable water and reducing stormwater runoff. When harvested rainwater is used to irrigate landscaped areas, the water is either evapotranspired by vegetation or infiltrated into the soil, thereby helping to maintain pre-development water balance.

Multi-family, Commercial, and Institutional Sites

Bioretention system, bioswales, rain gardens, green roofs, permeable pavers, rainwater harvesting systems, or any other LID features are encouraged for multi-family, commercial and institutional sites. In large parking lot areas, it is recommended that planters be used as small scale LID units to capture and treat a portion of the parking lot runoff through filtration and infiltration. The infiltration type planter box shall be designed to infiltrate 200 gallons over a 48 hour period.

- **Green Roofs:** A roof of a building that is partially or completely covered with vegetation and growing mediums for plants, trees, shrubs, grasses and flowers planted over a waterproofing membrane. It may also include additional layers such as a root barrier, drainage and irrigation systems.

4.7 Watermains

Design and installation shall be in accordance with the Town of Essex requirements and provincial regulation. A network analysis and transient pressure analysis may be required if requested by the Town of Essex. Watermain and appurtenances shall be constructed in accordance with the approved contract documents prepared by the Consulting Engineer. The Consulting Engineer shall obtain the Fire Chief's approval for Fire Hydrant location. The minimum design criteria are noted below:

Minimum Pipe Size: 150 mm diameter

Minimum Cover: 1.5 metres

Hydrant Spacing: At intersections and spaced at maximum 150 metres

Valve Spacing: At intersections and spaced at maximum 250 metres

Lot Service Connections: Minimum - 19 mm; Maximum - 250 mm

Table 3: Watermain Material Specifications

Specifications	
Watermains	<ul style="list-style-type: none"> PVC DR18, Class 150, AWWA C900-905
Fittings	<ul style="list-style-type: none"> Ductile Iron, cement or epoxy lined, Class 250 or PVC Class 150, DR18, to AWWA C907, certified to CSA B137.2, colour coded blue. All fittings to be M.J. type or push-on type.
Joints	<ul style="list-style-type: none"> Bell and Spigot with rubber rings to SATM D3139. Restrained with mechanical restraint devices.
Fasteners	<ul style="list-style-type: none"> All fasteners to include Duratron sacrificial zinc bolt caps
Denso Corrosion Prevention System	<ul style="list-style-type: none"> Anti-corrosion material consisting of Paste Primer, Mastics and Petrolatum tape that complies with CSA Z-245-30 and is CFIA approved. All materials to be from the same manufacturer to ensure compatibility and optimal performance. Additional coating of Denso Paste must be applied to the outside of the Denso tape installation to provide additional barrier and to facilitate closing of all seams. Denso Corrosion Prevention Systems to be used on all gate valves, all fittings, all restraint systems & fasteners, and all mechanical & flanged joints.
Mechanical Joint Systems	<ul style="list-style-type: none"> T-bolts and nuts, low alloy steel in accordance with ANS/AWWA C11/A21.11 All bolts and nuts on mechanical joint system shall include Protecto caps at every bolt 90 grams, 20mm diameter.
Flanged Joints System	<ul style="list-style-type: none"> Nuts, bolt and washers for all flanged joints shall be Type 304 stainless steel conforming to ASTM A193, Grade B8M, Class 1 and ASTM 194, Grade 8M nuts.
Gate Valves and Boxes	<ul style="list-style-type: none"> AWWA C509, Class 200W Iron body, bronze mounted, modified wedge disc. Non rising stem with O-ring seals. Open by turning counter-clockwise. 50mm square operating nut extended to within 150mm of finished grade with mechanical joint to ANSI A21.11. All valves 100mm or larger to be installed with galvanized operating rod extensions to within 150mm of the top of the valve box. For tapping gate valve or connection to flanged outlets, ends shall be flanged and mechanical joints to ANSI B16.1 and ANSI A21.11 <p><u>Approved Models:</u></p> <ul style="list-style-type: none"> Mueller Canada resilient wedge gate valve. Equivalent resilient wedge gate valve approved by Essex Water Department.

Specifications

Fire Hydrants	<ul style="list-style-type: none"> • Hydrants shall conform to AWWA C502. • Each hydrant shall have 2-65mm hose nozzles and one 117mm pumper nozzle with 'Storz' type pumper outlet configuration. • Drainage holes to be plugged unless otherwise directed by the Water Department. • Anti-tampering devices must be installed on new hydrants until the majority of construction is complete. • Staging for Flow Testing is as follows: <ul style="list-style-type: none"> ○ All new watermain work must be 100% complete including all tie-ins, services, etc. ○ The Contractor shall be responsible for providing a certified and competent contractor to complete flow tests of all newly installed hydrants in accordance with NFPA 291. ○ Flow test results are to be submitted electronically to the Town of Essex for review and approval before painting. ○ Once flow tests have been approved, the contractor shall be responsible for painting all barrels and caps for all newly installed hydrants in accordance to NFPA 291. Colour coding is based on flow test results. (Figure W-4, Fire Hydrant Flow Colour Codes). • The underground ductile iron shall be coated with bitumen or epoxy, and shall be encased with 8 mil thick polyethylene encasement as per AWWA C105. • All hydrants shall have a secondary gate valve to isolate from the system. • All fire hydrants to have reflective placards, supplied by Essex Water Department. <p><u>Approved Models:</u></p> <ul style="list-style-type: none"> • Mueller Century
Restraining devices	<ul style="list-style-type: none"> • Provide thrust restraint on all fittings such as valves, bends, tees, and pipe bells that are liable to draw off or blow off. • Thrust restraints shall be concrete thrust blocks and/or mechanical restraint devices. • All elbows, tees, valves, hydrants to be restrained. • Where mechanical restraint devices are used, the watermain joints shall be restrained at three (3) pipe lengths away from both sides of the joint.
Concrete Thrust Blocks	<ul style="list-style-type: none"> • To OPSD 1103.01, 1103.02 and standard detail in contract drawings for pipe sizes of 350mm diameter and smaller. • Shall conform to OPSS 1350 with a nominal minimum 28 day compressive strength of 20 MPa. • Type 20 Portland cement shall be used in all cases. • A polyethylene bond breaker shall be used against the fitting and all joints and bolts to be protected. • Shall be used in conjunction with the mechanical restraint equipment where required.

Specifications	
	<ul style="list-style-type: none"> The sized and position will vary according to pipe size, fitting type, test pressure, and soil conditions.
Mechanical Thrust Restraint Devices	<ul style="list-style-type: none"> Unflange Series 1500 or Star Series 4000 for PVC pipe at gray/ductile iron fittings and valves 150 to 300 mm diameter. Uniflange Series 1350/1360 or Clow Series 350/360 or Star Series 1200 (as applicable) at PVC fittings 150 to 300 mm diameter. Connect all valves to other appurtenances using 12mm diameter stainless steel threaded rods, washers, and nuts. Fastening hardware on thrust restraining systems shall be either epoxy coated, stainless steel or hot dip galvanized including bolts, rods, washers and nuts.
Tracer Wire and Installation	<ul style="list-style-type: none"> All plastic pipe to include #12 AWG Superflex - 1230 CCS Tracer Wire (Blue) by Copperhead Industries with SnakeBite locking connectors. Insulating mastic tape to be used to wrap connector (Plymoute Bishop 10 polyseal). <i>Installation:</i> Tracer wire shall be laid immediately alongside and at the bottom of the new watermain pipe. Tracer wire must run outside the valve box and inserted through the hole provided at the top of the valve box. A minimum 6 inch lead (tail pipes) must be provided at the end of the valve box/curb for tracing purposes. Tracing wire to be fastened to the curb box with "tape only". Tracer wire at hydrants are to be terminated in an access box as shown in Appendix B, Figure W-16. Care must be taken not to damage the plastic coating. No bare copper wire shall be exposed. The Contractor shall provide protection of the tracer wire at all splices. Contractor shall use jell filled caps when joining tracer wire. "Dryconn waterproof connector" manufactured by King Innovation or similar product approved by the Town of Essex representative. Upon completion of the watermain, the tracer wire will be tested by the Town of Essex and any breaks in continuity must be repaired by the contractor at his expense.
Private Services	<ul style="list-style-type: none"> Copper, Type 'K' Poly must have a tracer wire installed with it from the main to the curbstop, accessible at the service box. Service saddles to be double bolt [s.s] stainless steel. All private service fittings to be lead-free brass, compression type. Curbstops to be non-draining, to AWWA C-800-89.

Specifications

	<ul style="list-style-type: none"> • Excess water service line coiled at property line is not permitted as the goose-neck provides sufficient slack. Water service connections are to be a direct connection to the house with no coiling. • Curbstops to be lead-free brass type • No. 7 service box and rod. Curb box to be arch type with brass pentagon plug, with stainless steel rod and pin. • See Appendix B, Figure W-18, W-19 for meter pit details. • Unless approved by the Town of Essex, all services larger than 25 mm shall have backflow preventative devices installed within the building and must be accessible. • Minimum 19 mm dia.
Installation	<ul style="list-style-type: none"> • All watermain pipes shall be delivered to the work area with end covers at both ends and a tamper evident seal on only the bell end, as required by OPSS 441. • The connection of a new watermain into the existing water distribution infrastructure shall utilize a tapping sleeve, unless otherwise approved by the Manager of Environmental Services, or the designate. • All new mains shall be swabbed using high density foam swabs. • New watermain shall be beeded in sand, with no large or sharp aggregate, from 150 mm below the pipe invert to 150 mm above the pipe crown.
Flushing, Testing, and Disinfection	<ul style="list-style-type: none"> • All service connections to be dry tapped before pressure testing and chlorinating. • See Appendix B for chlorination and testing procedures.
Preparation of Trench and Dewatering	<ul style="list-style-type: none"> • The trench shall be excavated to the alignment and depth prescribed by the Engineer, and shall be refilled at the Contractor's expense with material acceptable to the Engineer, in such a manner as the Town of Essex Representative or designate may direct. • The width of the trench shall meet the requirements of the Occupational Health & Safety Act and be sufficient to permit the pipe to be laid and joined property, and the backfill to be placed and compacted. • The Contractor shall furnish, put in place and maintain such sheeting and bracing as may be required to support the sides and roof of the excavation and to prevent any movement that can in any way injure personnel, pipe or appurtenances, diminish the necessary width of the excavation, or otherwise injure or delay the work or endanger adjacent structures. • If the Town of Essex Representative or designate is of the opinion that at any point inadequate support has been provided, they may order additional supports put in at the expense of the Contractor. Compliance with such order shall not release the Contractor from his responsibility for the adequacy of such supports. • If voids are formed outside the sheeting they shall be immediately filled and rammed with suitable material. If necessary, additional sheeting shall be driven outside the existing sheeting to prevent settlement of the adjacent ground.

Specifications

	<ul style="list-style-type: none"> • Where sheeting and bracing is to be removed, it shall be done so that adjacent facilities and properties are not damaged. All voids left or caused by the withdrawal of sheeting shall be immediately refilled with suitable material and compacted. • Where timber or steel is used in sheeting, bracing or coffer damming has been left in place for the convenience or to serve the interests of the Contractor, the Contractor shall receive no additional payment.
Separation from Stormwater and Sewage Works	<ul style="list-style-type: none"> • Sewers and watermains located parallel to each other shall be constructed in separate trenches, maintaining a clear horizontal separation distance of at least 2.5 m measured from pipe edge to pipe edge. Exceptions are as follows: <ul style="list-style-type: none"> ○ Under unusual conditions, where a significant portion of the construction will be in rock, or where it is anticipated that severe dewatering problems will occur or where congestion with other utilities will prevent a clear horizontal separation of 2.5 metres, a watermain may be laid closer to a sewer, provided that the elevation of the crown of the sewer is at least 0.5 metres below the invert of the watermain. Such separation shall be of in-situ material or compacted backfill. ○ Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested, in accordance with Division 701 of the OPSS (Ontario Provincial Standards Specification, published by Ontario Ministry of Transportation) at a pressure of 350 kPa, with no leakage. ○ In rock trenches, facilities should be provided to permit drainage of the trench to minimize the effects of impounding of surface water and/or leakage from sewers in the trench. • Under practicable conditions, watermains shall cross above sewers with sufficient vertical separation to allow for proper bedding and structural support of the watermain and sewer. • When it is not possible for the watermain to cross above the sewer, the watermain passing under a sewer shall be protected by: <ul style="list-style-type: none"> ○ Providing a vertical separation of at least 0.5 metres between the invert of the sewer and the crown of the watermain; sewer and the crown of the watermain ○ Providing adequate structural support for the sewers to prevent excessive deflection of joints and settling, and ○ Ensuring that the length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer. • Alternatively, when adequate vertical separation cannot be achieved with crossings of watermain and sewer, either the watermain or the sewer line should be encased in a watertight carrier pipe which extends 3m (10 ft) on both sides of the crossing, measured perpendicular to the watermain.

Specifications	
	<ul style="list-style-type: none"> No watermain shall pass through or come in contact with any part of a sewer access/maintenance hole, septic tank, tile field, subsoil treatment system or other source of contamination.
Notification to Users	<ul style="list-style-type: none"> Residents or commercial and industrial establishments that will be without water service for any period of time during the progress of the work are to receive at least 24 hours' notice from the Town of Essex. Where work is completed by a contractor, notice is to be provided by the Contractor performing the work.
Connection to Existing Watermain	<ul style="list-style-type: none"> The work shall be to furnish all labour and equipment to connect to existing watermains, saw-cutting of existing mains and abandoning of existing mains (including capping). The Contractor shall also excavate the trenches to the required dimensions; sheet, brace and support the adjoining ground or structures where necessary; and handle all drainage or groundwater. The Contractor shall provide a minimum of two (2) working water pumps at all times for the purpose of removing water from the excavation site. All work related to isolating of existing mains, shutdown of existing water valves will be performed by the Town of Essex Water Services Department. The Contractor shall notify and coordinate this work with the Town of Essex Water Services Department as part of this item. When a watermain tie-in is required, a maximum of one (1) length of watermain pipe will be allowed (at a time) to be disinfected for the purpose of putting the watermain back into service, the same day. This work will be at the discretion of the Town of Essex Water Operator "ONLY". All work completed under this provision, shall be witnessed by the Town of Essex Water Service Department. A minimum of 24 hours notice shall be given by the Developer for scheduling purposes. The Town of Essex must approve the tapping equipment and methods. The Contractor shall note that the supply and installation of all caps and blow-offs required and as detailed on the contractor drawings shall be incidental to this item. In order to properly swab and flush watermains, the Contractor shall install full size blow-offs at the end of new watermains, as indicated on the contract drawings and directed by the Town of Essex Representative or designate. Subsequent to flushing and swabbing, the Contractor shall remove full size blow-offs and install permanent 50 mm diameter blow-offs. Contractor to note that all blow-offs are to be restrained to the last fitting.
Lead-Free Materials	<ul style="list-style-type: none"> All materials that come into contact with potable drinking water shall meet NSF 61 and NSF 372. All brass in contact with potable water will be heavy wall design made no lead material as defined in section 4 of current C800 specification. Treading will be in accordance with latest revisions of AWWA C800 specifications.

Specifications

- Parts not in contact with potable water may be made of other material suited for buried water services as specified in AWWA C800.
- All Ball valve, couplings and adapters will be pressure rated for 300 PSI.
- Ball valves will be supplied with blowout proof stainless steel stems with double SBR or NBR O-ring stem seal.
- Stem and cap assembly will be two-piece design and will withstand minimum 200 ftp of torque.
- Ball seats will be made with unfilled Teflon for resilience and minimal friction.
- Ball will be uncoated lead free cast brass design.
- All waterworks fittings and ball valves will be guaranteed for a minimal 40 years against factory defects.
- All fittings will have a lifetime guaranteed against lead leach ate from the casting.
- All ball valve will be factory tested in the open and closed position.
- Yield Strength, Tensile Strength and percentage of elongation will be similar to 85-5-5-5 (Red Brass).
- No lead fittings will be Cambridge Brass or approved equal.

Design and installation shall be to the satisfaction of the local water and fire departments.

The Consulting Engineer shall obtain a Certificate of Approval from the Ministry of the Environment, Conservation and Parks (MECP) prior to construction. This will include completion of “Form 1 – Record of Watermain Authorized as a Future Alteration”. Work on private property shall conform to the Ontario Building Code.

4.7.1 Water Sampling Station

All new watermain shall be equipped with water sampling stations as detailed in **Appendix B, Figure W-1**. One station will be required for developments up to 100 lots, and an additional sampling station may be required for every additional 100 lots or less. The location of the water sampling stations shall meet the approval of the Manager of Environmental Services and shall be shown on the construction drawings.

4.8 Street Lighting and Power Distribution

4.8.1 Design Criteria

The minimum design criteria for the design of street lighting and power distribution are noted below. All materials shall be compliant with Canadian Standards, as a minimum, and suitable for its intended application. The project Designer shall verify all existing services to the best of their knowledge and coordinate all new lighting, power distribution and communication services to avoid conflicts with other trades.

4.8.2 Submission Requirements for Outdoor Lighting

Every development requires the submission of an Outdoor Lighting Plan, the designer must submit the following information as a minimum for review by the Town of Essex:

- Location of all buildings, structures, property lines, parking, loading and amenity areas.
- Location of all lights, poles and transformer units.
- Mounting height, quantity, orientation and arrangement of all lighting.
- Type of light source.
- Manufacturer's catalogue information and detail of the fixture.
- Illumination levels for all proposed fixtures.
- Calculation summary indicating the minimum value, maximum value, maximum-to-minimum ratio and average-to-minimum ratio.
- Submission should include the project name, designer and date whether on a cover sheet or on the drawings itself.
- Include all external lighting to the site under evaluation where it may be considered to be a relevant contribution to the new site.
- Extend photometric analysis past site property lines to evaluate any horizontal illumination that would contribute to light trespass onto neighbouring properties.
- All other relevant information.

4.8.3 Power Distribution

The power distribution system consisting of the primary and secondary power feeders, transformers and underground infrastructure shall be designed in accordance with the appropriate power supply authority requirements. The Developer is responsible to obtain the approval of the appropriate power supply authority prior to construction.

4.8.4 General Lighting Notes

- Street lighting design shall be based on road and pedestrian classification as defined by the authority having jurisdiction. Classifications may be found within the Illuminating Engineering Society of North America (IESNA) standards for roadway lighting (RP-8-00), and luminaire classification system for outdoor luminaires (TM- 15-11), and/or the Transportation Association of Canada (TAC) guide book. The designer is responsible to review the latest edition of all codes and standards to ensure all lighting levels, intensity and uniformity ratios are achieved.
- Every effort should be made to align street lights with side lot lines between parcels. Designer shall follow the Town of Essex cross section details.
- Electrical ground grid or rods to be installed as per all applicable local codes, regulations and/or standards.

- Distribution patterns may vary depending on the design application. Other distribution patterns may be accepted upon review of a complete photometric drawing submission to the Town of Essex provided by the Designer.
- It is the Designer's responsibility to ensure the appropriate pole height, class and diameter are specified in order to suit the application and maintain the lighting levels as recommended by standards noted in note 1. If changes to the specified poles noted above are required, the Designer shall contact the Town of Essex with the Designer's recommendations to be approved prior to implementation.
- All new subdivisions and/or roadways shall be designed with LED lighting. Where new phases are constructed off existing subdivisions and/or roadways, contact the Town of Essex for direction.
- The Developer is responsible for the illumination of all newly created intersections.
- The joint IESNA (Illuminating Engineering Society North America) and IDA (International Dark Sky Association) societies MLO (Model Lighting Ordinance) BUG system (Backlight-Uplight-Glare) was implemented to provide a more accurate and consistent rating system for light fixtures that will provide enhanced control with glare and light trespass and will reduce overall light pollution than the conventional full, semi and non "cutoff" rating system. The BUG system was released as an IES Technical Memorandum TM-15. The BUG rating system employs zones of intended use and evaluates the desired light fixture by % of total lumens at various angles in specified defined quadrants that represent backlight, uplight and glare.
- The Designer will attempt to implement fixtures that will be rated in accordance with the joint IDA and IES lighting design guideline to minimize light pollution and to better evaluate the proposed light fixture, utilizing fixtures that are compliant with the ratings of the zone intended for use.

4.8.5

Streetlight Materials

Street Lighting Luminaires – Light Emitting Diode (LED)

- Standard (Refer to **Figure E-1** in **Appendix B**)
 - Cobrahead style, small body with 12, 24 or 36 LEDs or medium body with 48, 60 or 72 LEDs as required providing adequate illumination, Type II Max throw, distribution, with glass lens. The luminaire driver current will be based upon the design fixture selected, with a 4000K colour temperature complete with NEMA or 7-pin photocell receptacle and control. Assembly to come with 120V driver or otherwise to suit site conditions. Colour to match the pole noted below. LED Roadway Lighting, "RoadFocus" by Signify.
 - Cobrahead Style, small body with 12, 24, or 36 LEDs as required providing adequate illumination, ANZ high distribution, with glass lens. The luminaire driver current will be based upon the design fixture selected, with a 4000K colour temperature for residential/minor collector and industrial cul-de-sacs (as defined in RP-8, latest revision),

complete with NEMA or 7-pin photocell receptacle and control. Assembly to come with 120V driver or otherwise to suit its site conditions. Colour of the luminaire to match the pole noted below. LED Roadway Lighting, “NXT” series luminaire. Catalogue number NXT-xxS-0-7-4AH.

- **Decorative – Glass Option (Refer to Figures E-2 and E-3 in Appendix B)**
 - Acorn style, 100W (525 mA) solid state LED source or as otherwise required to provide adequate illumination, with clear prismatic glass refractor, Type III asymmetric distribution, 4000 K colour temperature, standard finial, shorewood style cover and NEMA twistlock receptacle and DTL twistlock photocell control. Modern style swing open housing. Assembly to come with auto-sensin 120 V driver or otherwise to suit site conditions. Colour to match the pole noted below. Holophane, Grandville Classic Utility “Postlite LED” luminaire. Catalogue number GVD3-P50-40K.

Poles

- **Standard (Refer to Figures E-4 in Appendix B)**
 - Class A (light duty), spun concrete, round symmetrically tapered shaft, direct buried style, mould finish, suitable for a standard elliptical arm. Overall pole length shall be 30’-0”. Stresscrete catalogue number E-300-APR-G-MOO.
 - Class A (light duty), spun concrete, round symmetrically tapered shaft, direct buried style, etched Eclipse finish, suitable for a standard elliptical arm. Overall pole length shall be 30’-0”. Stresscrete catalogue number E-300-APR-G-E11.
- **Decorative (Refer to Figures E-4 in Appendix B)**
 - Class A (light duty), prestressed concrete, octagonal symmetrically straight shaft with flared base, direct buried style, polished “Midnight Lace” finish complete with a 35” outside diameter tenon and 40” height. Pole length above finished grade shall be 18’-0”. Stresscrete catalogue number KBH18-E10-DB-140-35/40.
 - Class A (light duty), prestressed concrete, octagonal symmetrically straight shaft with flared base, direct buried style, polished “Eclipse Black” finish complete with a 35” pitsode diameter tenon and 40” height. Pole length above finished grade shall be 18’-0”. Stresscrete catalogue number KBH18-E11-DB-140-35/40.

Arms

- **Standard (Refer to Figures E-5 in Appendix B)**
 - Side mounted tapered elliptical aluminum arm. Overall arm length shall be 4’-0” or as otherwise required to suit the application, and approved by the Town of Essex.

4.8.6 Light Intensity Standards

- The following Principles are to be adopted for the lighting of private and public lands, subject to Site Plan approval, in the Town of Essex:

- Contribute to personal safety
 - Support the supervision of secure areas
 - Assist in way finding
 - Conserve energy
 - Preserve the experience of the night sky
 - Respect the privacy of residential space
 - Respect animal habitat
 - Heighten the enjoyment of public space and night time activity
 - Apply the above listed guiding principles consistently
- To insure the provisions of adequate and safe, full cut off lighting levels, bonding for the provision of on-site lighting may be required as a condition of site plan approvals.
 - Lighting plans and photometric data including IES format files (as required) must be prepared, and all lighting be installed and maintained by the Developer, in accordance with lighting plans, to their best ability (for all development sites of 2300 m² building lot, or greater) which will be approved and enforced by the Town of Essex.
 - The Sign By-law 1350 (as amended), shall be reviewed with regards to externally lit billboards and electronic changing copy signs and their impact on the night sky and traffic safety.
 - The lighting requirements for public right-of-ways and other publicly owned lands will be reported by the Town of Essex Administration to Council on every application.

All Site Plan applications, in their review and approval, shall be consistent with the Guiding Principles in Recommendation and implement as required the techniques included in “Techniques to Implement Lighting Guiding Principles”, **Section 4.8.7** below.

4.8.7 Techniques to Implement Lighting Guiding Principles

- Contribute to personal safety
 - Provide minimum illumination in accordance with Table 1: Illumination Requirement
 - Locate lamps so as to avoid glare
 - Provide additional shielding of lamp fixtures to avoid glare
 - Provide uniform lighting without sudden light to dark transitions
 - Provide overlap of light distribution
 - Provide illumination to articulate steps
 - Coordinate spacing and height of lamps with landscaping to ensure lighting coverage is not interrupted
- Support the supervision of secure areas
 - Provide illumination in accordance with Table 7: Illumination Requirements

- Provide good colour rendering for identification purposes using acceptable street lighting standards outline in Section 6
- Provide sufficient lighting coverage including building recesses or inside corners
- Assist in finding way
 - Provide illumination to improve legibility of notes, landmarks and circulation areas
 - Align lamps in consistent, recognizable and unambiguous patterns
 - Provide a uniform and modest brightness along paths of travel
- Conserve energy
 - Maintain light levels within recommended range set out in Table 1: Illumination Requirements
 - Employ alternatives to best conserve energy
 - Dim down lighting to minimum levels after normal operating hours (where required/ requested)
- Preserve the experience of the night sky
 - Light pollution is considered undesirable and many feel that it reduces the enjoyment of night sky.
 - Provide full cut-off lighting (zero percent of peak intensity radiating above 90 degrees and 10 percent of peak intensity above 80 degrees) or employ low cut-off where full cut-off lighting alternatives are not feasible, as approved by the Town of Essex. As LED fixtures can't be fully evaluated in terms of full, semi-cutoff or non-cutoff terms, and as the movement towards anti-light pollution increases, a new system has been implemented jointly by IESNA and IDA to evaluate luminaires. The MLO (Model Lighting Ordinance) uses the BUG (note 8) rating of the fixture shall be in compliance with TM-15, issued by IESNA and IDA.
 - For all area lighting, luminaries should be equipped with devices for re-directing light such as shields, visors or hoods.
 - Beacon lights are strongly discouraged unless the application requires such lighting, and as approved by the Town of Essex.
- Respect the privacy of residential space
 - Locate lamps to direct light away from neighbouring properties
 - Provide supplementary shielding of lamps to direct light away from neighbouring properties
 - Provide lamp fixture mounting heights that avoid glare to the vantage point of neighbouring residential units
 - Provide recessed light fixtures that avoid glare to the vantage point of neighbouring residential units
- Respect animal habitat

- Direct illumination away from abutting Municipal Parks and naturalized areas on abutting private lands
- Heighten the enjoyment of public space and night time activity
 - Provide minimum illumination to encourage night time use
 - Minimize glare using shielding of fully recessed light fixtures, as required
 - Reveal the salient features of a site using a combination of diffused and spot lighting
- Apply the above listed standards consistently
 - Provide photometric plans and lamp specifications for use by Municipal staff in the review of site plan applications and for inclusion in site plan development approval agreements

Illuminance determines the amount of light incident on a surface, measured in lux or footcandles. Illuminance levels provide an effective method of measuring the performance of a lighting design therefore Designers shall use the Illuminance method for their analysis.

Illuminance uniformity is measured by the ratios Maximum to Minimum and Average to Minimum. These ratios provide a measure of the consistency of lighting across a site and provide assurance that the illuminance is within a range that the human eye can properly discern all objects in its field of view.

The following chart indicates the required illuminance levels for various types of facility's or usages.

Table 4: Illuminance Requirements

Uses	Horizontal Illumination (footcandles)		Vertical Illumination (footcandles)	
	Min.	Max.	Min.	Max.
Uncovered Parking Area	0.5	4.0	0.5	4.0
Covered Parking Area	2.0	10.0	5	25.0
Covered Outdoor Area	0.5	10.0	5	25.0
Walkway	0.5	2.0	0.5	5.0
Principle Building Entrance	3.5	8.0	3.5	8.0
Loading and Garage Storage Area	1.0	2.0	5.0	25.0
Covered Gas Pumping Area	5.0	25.0	5.0	50.0
Outdoor Active Recreation Facility Values vary per recreational activity and shall be verified with IESNA standards (latest edition)	1.0	150.0	1.0	150.0
Auto Dealership Display	1.0	8.0	1.0	8.0

Uses	Horizontal Illumination (footcandles)		Vertical Illumination (footcandles)	
	Min.	Max.	Min.	Max.
Outdoor Storage Yard	1.0	2.5	1.0	2.5
All Non-residential uses at normal non-business hours (11:00 pm to 5:00 am) and when employees other than security personnel are not present	0.5	2.0	0.5	2.0
All other uses	0.5	2.0	0.5	10.0

None of the minimums noted above apply to adjacent property lines.

Illumination levels at all property lines shall be as close to 0.0 foot-candles as possible to respect private properties surrounding the area.

Fully shielded is assumed in all references.

Luminaires will be full cut-off unless otherwise provided with IESNA BUG rating.

4.8.8 Other Services

Other services such as, but not limited to, voice, data, and television shall be coordinated by the Designer unless otherwise advised. These services and associated conduit routing shall be clearly identified in road crossings, on cross-sections, etc.

4.9 Backfill and Compaction

Trench backfill and compaction shall generally be in conformance with the minimum requirements outlined in the OPSDs for Trench Backfill Details, as well as the Excess Soil Regulations (O-Reg 406.19). For all open cut trenches within the roadway, approved granular shall be used. Granular trench backfill should be brought up 50 mm to 100 mm above subgrade. This process is to ensure that during road cut operations, granular trenches are fully exposed in the subgrade. Based on site specific soil conditions, geotechnical recommendations for alternative degrees of native backfill compaction should be confirmed by a qualified geotechnical engineer. Recycled materials are acceptable, provided they meet provincial requirements.

The following OPSDs should be referenced as required: OPSD 802.010, 802.013, 802.014, 802.020, 802.023, 802.024, 802.030, 802.031, 802.032, 802.033, 802.034, 802.050, 802.051, 802.052, 802.053 and 802.054.

4.10 Restoration and Landscaping

Restoration of all boulevard areas disturbed as a result of the construction of site services shall be completed to match the existing conditions or 100 mm topsoil and nursery sod for maintained lawn areas. Restoration of all boulevard areas disturbed as a result of the construction of site services shall be completed to match the existing conditions, but not less than 100 mm topsoil and hydroseed or mulch for maintained lawn areas.

The Developer must have a landscape plan prepared by a professional landscaping firm and it is to be reviewed and approved by the Town of Essex (if determined to be required during pre-consult meeting). The following guidelines should be considered by the landscape firm in the landscape design for median/ boulevard areas:

- The plan should be designed with low maintenance features in mind.
- The plan should strive to provide environmental benefits for the community.
- The plan should have tree and plant species that are native, diverse, disease resistant, and have high climate adaptability.
- The plan should create a more aesthetically pleasing environment.
- The plan should include additional features such as trees, shrubbery, landscape stone or mulch, decorative rocks, and other pleasing features.
- The plan should enhance a sense of personal safety and reduce the opportunity of crime by facilitating the unobstructed observation of public spaces and areas (Crime Prevention through Environmental Design).

The general principles of CPTED are outlined below:

Natural Surveillance: Criminals do not want to be seen. Barriers like shrubs, clutter, or shadows can impair visibility/view corridors. The correct placement of these barriers prevents loss of natural surveillance/self-policing.

Territoriality: Owners tend to protect their space through visible border definition. Fences, pavement treatments, and art murals are some ways of expressing ownership. Identifying intruders and law breakers is easier in well-defined spaces.

Access Control: Properly located entrances, exits, fencing, and lighting can discourage criminal behaviour. It may be a tasteful, well placed sign, or a parking lot with highly visible pavement markings.

Target Hardening: Use motion-activated flood lighting in the “back” of public areas.

Activity Management: Encouraging legitimate activity in public spaces discourages crime. Increase the sense of natural surveillance and sense of ownership.

Behaviour Engineering: Changes in the placement and arrangement of physical attributes influences behaviour; essentially “Architectural Risk Management.”

The Developer will also make an effort to salvage any existing landscaping located within the public right-of-way and in the interest of public relations, wherever practical offer to transplant and/or replace plantings to the abutting owners.

4.11 Recycled Materials

Only recycled material approved by the Province and the Town of Essex may be used. Developers shall contact the Town of Essex for the current list of approved material.

The Town of Essex reserves the right to request engineering and environmental reports on the acceptability of the recycled material for specific intended uses at the Developer's expense.

4.12 Other Utilities

The Consulting Engineer will be responsible to coordinate the efforts of other public utilities as a result of conflicts with proposed services and/or upgrading to accommodate the new development. Other utilities include hydro, gas, bell, cable and Canada Post Services.