THE MUNICIPALITY OF THE

DISTRICT OF CHESTER

MUNICIPAL SPECIFICATIONS
Approved by Council
MAY 26, 2008

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Whenever, in any part of these Specifications, the following terms are used, the intent and meaning will be interpreted as follows:

Act. Means the Municipal Government Act

Approval. The approval of the Engineer. The Engineer's decision will be final and binding in matters of design and construction.

Board. Means the Nova Scotia Utility and Review Board

Development Officer. The Development Officer for the Municipality of the District of Chester acting directly, or through an assistant or representatives duly authorized by the Development Officer, and acting only within the scope of the particular duties assigned or within the tested scope of the authority.

Engineer. The engineer of the Municipality of the District of Chester and includes a person acting under the supervision and direction of the Engineer.

Forcemain. A section of sanitary sewer through which sewage is either pumped or flows by gravity under a low pressure head.

Public Highway. Any street or road owned and maintained by the Municipality, a Town or the Province excluding designated controlled access highways pursuant to Section 20 of the Public Highways Act.

Inspection. Field inspection by the Engineer at various stages of construction.

Lateral. A service pipe for either sanitary sewage, storm water or potable water that extends from the main to the property line.

Main Line. A main line refers to the primary pipeline in a water or sewer system. In the case of a sewer line a main line includes both collection and trunk lines, and in the case of a water main includes both distribution and transmission lines.
Maintenance Period. One year from the date of final approval of a subdivision as issued by the Engineer. For final asphaltic paving or chip seal courses, the maintenance period shall extend one year from the date of approval by the Engineer.

Municipality. The Municipality of the District of Chester

Natural Watercourse. The bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, whether it contains water or not.

Professional Engineer. A Professional Engineer who is a member of the Association of Professional Engineers of Nova Scotia.

Roadway/Street. It includes the whole right-of-way which is reserved for use in constructing the roadway and its appurtenances.

Run-off. Overland flow that occurs when the rainfall rate exceeds the soil's capacity to absorb water.

Sanitary Sewage. Wastewater from residential, industrial, institutional, and commercial buildings, excluding storm water runoff and ground water.

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Set Back. As defined by the Land Use Bylaw or the Subdivision By-law of the Municipality.

Services. All of the sanitary sewer, storm sewer, and water systems.

Storm Sewer. A buried drain for conveyance of storm water that includes the storm sewer main, manholes, laterals, catch basins, and catch basin leads.

Sub-Base Course. The crushed rock or aggregate which is placed immediately upon the subgrade.

Subdivision. The division of any area of land into two or more parcels, and includes a re-subdivision or a consolidation of two or more parcels.

Subgrade. That portion of the roadbed upon which the sub-base course is to be placed.

Tributary Area. The area that contributes runoff flow to an inlet or given point immediately downstream of the contributing area.

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2.0 SCOPE

This Section is intended to assist the applicant for subdivision approval and prepare a submission for the approval of municipal services. This section must be read in conjunction with the Subdivision By-Law.

2.1 TENTATIVE APPROVAL

2.1.1 General

A copy of the Permit to Construct from Nova Scotia Department of Environment will be required prior to approval of Tentative Plan.
The following information is required with an application for tentative approval of subdivisions:

2.1.2 General Service Plan

Plan indicating proposed road layout, tributary service areas, and existing and proposed services; including pipe sizes, valves, hydrants, manholes, lift stations, directions of flow, and points of connection to existing systems.

2.1.3 Drainage Plan

Plan indicating contributing area, the area tributary to each inlet, natural watercourse, and existing and proposed storm drainage systems; including run-off rates at each inlet and outlet, pipe/culvert size, and other relevant features. Lot grading plans and minimum basement elevations may be required for areas prone to flooding.

2.1.4 Survey Plan

Tentative plan of survey in accordance with the Subdivision Bylaw, showing proposed lot layout and all proposed public highways, road reserves, and easements to be transferred to the Municipality.
Proposed roads shall be identified alphabetically with preferred street names provided in the covering letter.

2.1.5 Detailed Design Drawings

Plan and profile drawings (1:500 horizontal, 1:50 vertical), drawing size D (600 mm x 915 mm overall dimensions) indicating lot layout, manhole locations, lateral locations, valves, hydrants, pipe size, material, and slope, horizontal and vertical road alignment data, existing and proposed road center line profiles, and proposed ditch profiles.

Cross section elements if different than standard.

Details for lift stations indicating pump data, invert elevations for gravity inlet, overflow, and force main, float elevations, base elevation, top elevation, wet well size, bypass piping arrangement, and other relevant details.

Details for environmental control measures and other relevant details as required or as requested by the Engineer.
Provide three copies of all submissions.

2.1.6 Design Submission

Depending on the size of the proposed subdivision development, the following information may be required by the Engineer:
Design summary for the sewer system in tabular form giving population density peak flow, design flow, pipe size, slope, minimum and maximum velocity, and depth of flow.

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Design summary for the water system in tabular form giving population density, domestic demand, fire flow requirements, maximum and minimum static pressures under normal operating conditions, and residual pressures under fire flow conditions.

Design information for the storm drainage system in tabular form giving runoff rates at each inlet and outlet, design flow, pipe, culvert, or channel size, and depth of flow.

Design information in tabular form for lift stations and force mains giving minimum, maximum, and peak flow rates, pipe size, velocity in force main, and pump cycle time, system and pump curves for lift stations and force mains.

Erosion and sedimentation control plan.

2.2 FINAL APPROVAL

The following information is required for final approval of municipal roads and services:

2.2.1 Record Drawings

Reproducible record drawings stamped by a Professional Engineer. Plan and profile and detail drawings in accordance with those submitted for tentative approval are required. A drainage plan is also required.

Record drawings prepared on a CAD system must be submitted in both hard and electronic format. Hard copies must be on a high quality bond paper (l set) and mylar (1 set). Electronic copies are to be submitted on floppy disc or compact disc and be saved in AutoCAD “dwg” or “dxf” format. Record drawings prepared manually must be submitted on both high quality bond paper (1 set) and mylar (1 set).

2.2.2 Deeds and Easement Documentation

Warranty Deed for all road right of ways and road reserves.

Easement agreements for water, sanitary sewer, and storm drainage easements.

Title certificate by developer's solicitor for land and easements being transferred. A copy shall be provided to the Municipal Solicitor

Legal Plan of Subdivision submitted for final approval.

2.2.3 Maintenance Deposit

Statement of construction costs.

Statutory declaration from developer indicating that all accounts for labor and material used in the construction of the subdivision and statutory liens have been paid in full.

Maintenance deposit in the form of cash or certified cheque for 10% of construction costs, to be held for the duration of the warranty period. (OR in accordance with Subdivision Bylaw)

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2.2.4 Road Completion Agreement and Bond for Street Completion

In accordance with the Subdivision Bylaw.

2.2.5 Operation and Maintenance Manuals

O & M Manuals are required for pumps and other similar equipment.

2.2.6 Certificate of Compliance

A Certificate of Compliance is required from a Professional Engineer stating that the roads and services have been constructed in accordance with the approved plans and these specifications.

2.2.7 Inspection and Testing Reports

The following inspection and testing results as applicable, must be provided as a matter of course:

- Video inspection tape and report for sanitary sewer.
- Test results for air and deflection testing of the sanitary sewer, stamped by a Professional Engineer.
- Test results for hydrostatic leakage tests for water lines, stamped by a Professional Engineer.
- Bacteriological test results for water lines.
- Sieve Analysis for base and sub-base gravel.
- Compaction test results on trench compaction, sub-grade, sub-base, and base courses.
- Test results for asphaltic concrete paving or chip seal will be required after completion, and prior to release of standby letter of credit.

2.3 LISTING PROCEDURE FOR SUBDIVISION ROADS

Before the constructed roads are accepted for listing, the Municipality must receive confirmation from the Nova Scotia Department of the Environment that all their requirements have been met.

When the preceding information has been submitted and approved, the developer may then officially request the Municipality take over the road system in the subdivision. The request should be accompanied by 4 copies of a final plan showing the entire subdivision, its boundaries and road layout. The Engineer may then recommend that the Municipality officially list the roads in the subdivision.

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3.1 SCOPE

This section specifies the requirements for a central sanitary sewer collection system. A sanitary sewer consists of main lines, laterals, force mains and appurtenances (including manholes and lift stations).

In addition to these design criteria, all sanitary sewage systems shall conform to the *Nova Scotia Department of the Environment Standard and Guidelines for the Collection, Treatment and Disposal of Sanitary Sewage*. No systems shall be constructed until the design has been approved by the Engineer and by the Nova Scotia Department of the Environment.

3.2 DESIGN CRITERIA

1. General The sanitary sewage system shall be designed for flows generated from all lands within the Serviceable Area which are naturally tributary to the drainage area as determined from topographic plans. In addition, lands within the Serviceable Area which are tributary by pumping or regarding which are at present or anticipated to flow through the design area are to be included.
Design shall be based on an appropriate population density according to land use.

2. Design Flows

Sewer Collection Mains shall be sized to conduct the domestic peak hourly water demand. Unless data is supplied by flow metering, the design sewage flow shall be calculated as follows:

Average Dry Weather Flow (Q_A) shall be calculated on the basis of an allowance of 75 Imperial Gallons per person per day (340 Litres per person per day).

Design Peak Flow (Q_P) shall be based on the peak wet weather flow according to the following:

$Q_P = MQ_A + IA$

Where M = Peaking Factor, determined using the Harman formula:

$M = 1 + \frac{14}{4+P^{0.5}}$, where P = design population in thousands

And IA = Infiltration Allowance, determined as follows:
I= a minimum of 1080 Imperial Gallons per acre per day (12096 Litres per hectare per day);

A = tributary area in Acres (Hectares) as defined in the Definitions section.

The Engineer reserves the right to request flow and other engineering calculations prior to approval to install a sewer system.

3.3 CONVENTIONAL GRAVITY SYSTEMS

1. Main Line

Pipe Material Polyvinyl Chloride (PVC), SDR 35 shall be used for sanitary sewer main installations within the Municipality, unless otherwise approved by the Engineer.

Hydraulic Sanitary sewer mains shall be designed to convey the calculated Design Peak Flows. The Designer hall ensure that surcharging of the system does not occur during such peak flow conditions by taking into consideration such factors as energy loss at manholes. The capacity of the sanitary sewer mains is to be calculated using the "Manning Formula" or an appropriate nomograph.

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A Manning roughness coefficient (n) equal to 0.011 shall be used for PVC pipe.
Sewers shall be designed to maintain a minimum velocity of 2 feet per second (0.6 meters per second) and a maximum velocity of 15 feet per second (4.6 meters per second) when operating under Design Peak Flow conditions from the tributary area when fully developed.

Pipe Size No sanitary sewer main shall be less than 8 inches (200 mm) in diameter.

Minimum Slope Sanitary sewer mains shall generally have a minimum slope of 1 percent. Under special conditions slopes less than 1 percent may be permitted. Slopes less than 1 percent will only be considered where the depth of flow will be at least 30 percent of the diameter of the pipe for Design Peak Flow. In no case shall the slope be reduced to less than 0.75 percent.

Calculations shall be presented, in a tabular form to indicate depths and velocities at minimum, average and maximum daily wastewater flow for the different sizes of sewer proposed.

High Velocity Protection Where velocities greater than 15 feet per second (4.5 meters per second) are attained, special provision shall be made to protect against displacement of pipe and structures by erosion and shock.

Depth In general, the sanitary sewer shall be installed at a sufficient depth to provide service by gravity flow from all proposed lots within the proposed subdivision and to provide service to adjoining lands.

The minimum depth of sanitary sewer mains shall not be less than 4 feet (1.2 meters).

The depth of sanitary sewer mains shall not normally exceed a maximum of 14 feet (4.5 meters). However, under special conditions, if full and justifiable reasons are given (such as elimination of a pumping station), the maximum depth of sanitary sewer mains may be increased to 18 feet (5.5 meters).

Location Where possible, all sanitary sewer pipe and appurtenances shall be located within a street owned by the Municipality or the Nova Scotia Department of Transportation and Public Works. If approved by the Engineer, sanitary sewer mains may be installed within an easement granted in favour of the Municipality. The actual width of the easement shall depend upon the depth of any pipe lines contained within the easement. The minimum width of any such easement shall be 20 feet (6 meters).

Depending upon the length and location of the easement, the Engineer may require a travel way to be provided within the easement for access and maintenance purposes.

Where a need is identified by the Engineer to accommodate future upstream lands naturally tributary to the drainage area, an easement shall be provided from the edge of the street right-of-way to the upstream limit of the subdivision.

Joints All joints on gravity lines shall be bell and spigot as recommended by the manufacturer.

Alignment All sanitary sewer mains shall be laid with a straight alignment between manholes.

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2. Manholes

General A manhole shall be provided on a sanitary sewer at the end of each line, at any change in pipe size, slope or horizontal alignment and/or at all pipe intersections.

Hydraulic Losses The following criteria shall be used for pipe elevation and alignment in sanitary sewer manholes to account for hydraulic losses through the manhole:

a) Minimum drop across manholes of similar diameters shall be:

Straight run - 0.10 feet (30 mm)

Deflections up to 45 Degrees - 0.10 feet (30 mm)
Deflections 45 to 90 Degrees - 0.20 feet (60 mm)

b. The Crown of a downstream pipe shall not be higher than the crown of an upstream pipe.

Minimum Diameter The minimum internal diameter of a manhole shall be 42 inches (1065 mm).

Maximum Spacing The distance between manholes shall not exceed 400 feet (120 m) for sewer main diameter of 15 in. (375 mm) or less. For sewer mains greater than 15 in (375 mm) in diameter, the maximum spacing shall be 500 ft. (150 mm).

Location All sanitary sewer manholes shall be positioned so as to minimize the inflow of surface water or ground water. Manholes shall not be located at or near drainage ditches or roadway low points.

In some situations where manholes cannot be easily located to minimize inflow, the use of berms and/or water-tight frames and covers may be permitted by the Engineer.

Drop Manholes Where the difference between invert elevations of any two pipes entering and leaving a manhole is greater than 3 feet, either an internal or external drop chamber shall be provided.

Frames & Covers The following manhole frames and covers are approved for use:

(a) IMP Type R10 for manholes within a public road allowance.
(b) IMP R12 bolt down frame and cover for manholes in all easements or park areas.
(c) Secure frames to manhole risers with cast in place concrete.

Lateral If services are designed to enter manholes the maximum number entering any manhole shall be limited to 3. All entrances shall be cast into the manhole by the manufacturer and be complete with watertight gasket joints.

3. Service Laterals

General In any subdivision for which tentative or final approval is being sought, a single sanitary sewer lateral shall be provided by the developer to each lot at the time of installation of services. The lateral shall extend from the main to the property line.

In the case of duplexes, semi-detached, row houses, or other similar development where each dwelling unit has road frontage, one lateral shall be installed to each unit.

Pipe Material Polyvinyl Chloride (PVC), SDR 28 shall be used for sanitary sewer service laterals. Pipe for sanitary sewer laterals shall be white in color.

Pipe Size Minimum size lateral piping shall be 4 inches (100 mm) in diameter.

Clean-out Service laterals with a total length greater than 85 feet (25 metres) shall be installed complete with a wye type clean-out or approved manhole in locations approved by the Engineer.

Minimum Slope Sewer laterals shall have a minimum slope of 2 percent.

Depth The depth of sanitary sewer laterals shall not be less than 4 feet (1.2 metres) below a traveled way (such as a driveway or street) or less than 3 feet (1 meter) below the bottom of a ditch.

To minimize future maintenance costs, all service laterals shall be eliminated from the deep section of the sewer main either by installation of a rider sewer for lateral connections or by the installation of all laterals at manholes.*Connection to Mains* Service connections to an existing main in service shall be made using the approved saddles listed below:

(i) PVC Main - PVC gaskted strap on, in line or wye tee.
(*ii*) Concrete/A.C. Main - Daigle D-50

All saddles shall be fitted with a gasket and a double stainless steel strap and shall not protrude into the main.

Service connections to any newly constructed main shall be made using the approved service tee/wyes with gaskets.

For laterals greater than 6 inches (150 mm), connection to the sewer main shall be made by installing a manhole on the sanitary sewer main.

Any service connection requiring a major change in horizontal or vertical alignment shall be constructed using a maximum of one horizontal and one vertical bend per service lateral unless an approved manhole structure or "wye" type clean-out is provided. All bends shall be long radius type with a maximum deflection of forty-five degrees.

The center line of any service connection shall be located at an angle of 45 degrees above the horizontal at the main.

Joints Sewer joints shall be designed to prevent infiltration and to prevent the entrance of roots, and shall be made in accordance with the manufacturer"s recommendations.

Repairs Repairs to pipe damaged after installation will be accepted only if carried out in accordance with the manufacturer"s recommendations and after the damaged section has been retested.

Ground-water Movement The designer shall assess the possible change in groundwater movement caused by the use of pervious bedding material and shall be responsible for the design of corrective measures to prevent flooding as a result of this groundwater movement. Clay plugs at service lateral trenches may be required for low lying lots and impervious soils.

3.4 ALTERNATIVE SEWER SYSTEMS

1. Acceptable Systems

The following collection systems designed to collect septic tank effluent will be considered for

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takeover.

Small diameter gravity sewers
Septic Tank Effluent Pump Systems

2. Design of Systems

Design of systems shall meet provincial and federal standards and the Water Environment Federation Manual of Practice FD 12 Alternative Sewer Systems and the requirements of the Municipal Specifications.

The design documents shall include a design brief which shall include modeling of systems based on several scenarios including one pump and all pumps operating. The design documents shall include details and capacities for all components including septic tanks, pumps and chambers.

3. Design Flows

To account for limitations in controlling occupancy rates in a dwelling or the use of multiple dwellings on any lot the designer shall add a 30 % allowance to the estimated flow rates. This flow estimate shall also include an allowance for infiltration and inflow.

4. Proprietary Systems

Proprietary systems shall be proposed as a last resort. Collection systems of a proprietary nature shall have technical and parts support located in Nova Scotia. Pumps and controls shall be interchangeable with other pump manufacturers.

5. System Maintenance

Home Owners connected to an alternative sewer systems shall enter into a maintenance agreement with the Municipality of Chester for routine removal of septic tank sludge. Easements as requested by the Municipality shall be provided by the lot owners or developer. The costs of maintenance and upkeep of systems shall be borne by the lot owners through an area rate.

6. Easements

Upon turnover of the system to the Municipality easements shall be provided sufficient for maintenance of all components.

7. System Access

All system components must be accessible by rubber tired or small track type excavation equipment. Off street systems shall include an access road along the system route.

Water tights access chambers must be provided to allow for emergency bypass and system flushing. Provide conventional pre-cast manholes at extreme ends of a gravity collection system. At minimum 100 m intervals provide Y type cleanouts protected with steel plates.

8. Screening

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All septic tank effluent must be screened for solids with diameter equal to or larger than 1/16" prior to discharge into the collection system.

9. Submission Requirements

Provide all information required by the Section 2 of the Municipal Specifications.
Provide typical pipe bedding details for gravity and pressure sewers.
Provide plan and profile drawings for gravity and pressure sewers.
Provide NSDEL approvals for sewerage systems.
On drawings provide details and specifications for septic tanks and pump chambers for each lot. Include uplift protection details for chambers and on which lots high groundwater will impact tank uplift. Include a table of tank inlet elevations and lowest dwelling floor elevations to be serviced. Indicate if filters are required at septic tank outlet.
Where municipal sewer systems are proposed along private roads, the road surface and structure shall be suitable for maintenance vehicles and equipment.
Provide a sample of the blanket service easements for maintenance of sewer systems.

10. Materials and Installation

As a minimum all materials for Alternative Sewer Systems are to be in accordance with the Municipal Services Specifications and Section 3.4.

Private Pumping Systems

Discharge piping in wet well to be fitted with two swing type check valves, a ball valve and union.

Public Pumping Stations

See Clause 3.5 of this Specification.

Piping

See Section 3.3.3.

Gravity piping from dwelling to tankage to be 4-inch diameter PVC DR 28 to CSA B182.1. Pressure piping from pump chamber to distribution piping to be 1.5 inch diameter, PVC series 160.

Piping for alternative pressure sewers shall be PVC series 160 or HDPE DR 11

Install pressure lines with minimum 1.6 meters of cover to prevent freezing or insulate.

Where laterals cross under ditches provide minimum cover of 3 ft (1 m) at ditch invert. Provide steel pipe sleeve for protection and insulation to prevent freezing or frost heave.

Tanks

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All chambers shall conform to CAN/CSA-B66-00, capable of sustaining the intended loadings and are to be watertight. Prior to backfill, test chambers by filling with water. Tanks are acceptable if leakage is zero over a 24 hour period. Repair any visual leakage. Provide clean out riser and cover. Set cover 3 inches above finished grade. Any tanks installed which may be impacted by high groundwater should be fibreglass or polyethylene and anchored to prevent uplift.

Bed tanks and chambers on 6 inch thick layer of gravel. Seal inlet and outlet pipes with cement mortar.

Provide minimum 2 percent slope on gravity piping between building plumbing and tankage.

In addition to O-Ring Gaskets, all joints in septic tanks, pump chambers and access manholes are to be sealed on the outside wrapped with a 300 mm wide butyl sealing strip or equivalent.

Manholes
See Section 3.3.2.

Valves
Metal valves and other appurtenances shall be manufactured with non corroding materials and as a minimum be epoxy coated.

3.5 PUMPED SYSTEMS

General

Pumping stations shall be provided when, in the opinion of the Engineer, a gravity system is not possible or is not economically feasible.

Sewage pumping station structures and electrical and mechanical equipment shall be protected from physical damage from the 1 in 100 year flood. Sewage pumping stations should remain fully operational and accessible during the 1 in 50 year flood.

During preliminary location planning, consideration shall be given to the potential of emergency overflow provisions and as much as practically possible, the avoidance of health hazards, nuisances and adverse environmental effects.

Unless otherwise approved by the Engineer, all pumping stations, pumps, and forcemains shall be designed for the ultimate sanitary sewer peak flows from the tributary drainage area. In the selection of pumps, both present and future conditions shall be considered, and pump overloading situations shall be avoided.

Design parameters such as the roughness coefficient of pipe and flow volumes can vary over time, and such variances shall be considered in the selection of the pumps.

Pumping Stations

Type

Pumping stations with an ultimate capacity of 75 l/s or less may be submersible type.

Pump Capacity

All pumping stations shall have a minimum of two pumping assemblies. If only two pumps are provided, each shall be capable of handling the expected Design Peak Flow. Where three or more units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that, with the largest unit out of service, the remaining units will have capacity to handle maximum sewage flows, taking into account head losses with parallel operation. The pump control circuitry shall be designed to automatically alternate pumps for each pump cycle. Run time meters shall be provided to record run time for two pumps operating simultaneously.

Wet Well --

The wet well shall be designed to allow for a minimum cycle time for each pump of fifteen

minutes

Size For a duplex station, the volume in cubic feet, between pump start and pump stop shall be 0.5 times the pumping rate of one pump, expressed in US gallons per minute. The wet well size and control settings shall be appropriate to avoid heat build-up in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention time. The wet well shall be designed for a maximum retention time of 30 minutes to avoid septic conditions.

Phased Development In situations of phased development, the effects of minimum flow conditions shall be investigated to ensure that the retention time in the wet well will not create an odour or septic problem.

Structural Design The wet well structure shall be designed for all external loads, including bearing capacity with the wet well full, and lateral earth pressure and hydraulic uplift with the wet well empty.

Pump Manu-facturers The following pumps and pump manufacturers are approved for use in sewage pumping stations in the Municipality:

(a) Submersible pumps manufactured by "ITT Flygt" or "Gorman Rupp."
(b) Self priming pumps manufactured by "Gorman Rupp".

All pumps shall be solids handling type complete with electric motors.

Emergency Overflows Each pumping station shall be provided with an emergency overflow arrangement acceptable to both the Engineer and DOE. The invert of the overflow pipe at the pumping station shall be lower than the invert of any sanitary sewer laterals at the property line. As well, the invert of the overflow pipe shall be at an elevation high enough to prevent backflow from surface runoff or during extreme high tides.

All pumping stations shall be provided with an emergency bypass valve chamber. The piping arrangement of all pumping stations shall be designed to facilitate use of an emergency pumping facility.

To prevent or minimize overflows, each pumping station shall be designed with a retention capacity calculated on the basis of Peak Design Flow for a duration related to frequency and length of power outages for the area.

In the absence of reliable data regarding the frequency and length of power outages, minimum retention capacity of 4.5 hours at Design Peak Flow shall be provided. An auxiliary power supply which meets the requirements of the Engineer may be used as a substitute for retention capacity at the pumping station.

Safety Precautions The pumping station and appurtenances shall be designed in such a manner to ensure the safety of operations, in accordance with all applicable Municipal, Provincial and Federal regulations including the Occupational Health and Safety Act. All moving equipment shall be covered with suitable guards to prevent accidental contact.

Equipment that starts automatically shall be suitably and visibly posted with warning signs to ensure that the operators are aware of this condition. Lock-outs on all equipment shall be supplied to ensure that the equipment is completely out of service when maintenance or servicing is being carried out.

Pump Selection Pumping equipment shall be selected to perform at maximum efficiencies under normal operating conditions. Pumping stations, wet wells and dry wells shall be designed such that all pumps will operate under a continuous positive prime condition during the entire pump cycle.

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(This criteria will not apply to pumping stations designed to use Gorman Rupp self priming pumps). System head calculations and curves shall be provided for the following operating conditions:

(a) C=100 and low water level in the wet well.

(b) C-120 and medium water level over the normal operating range in the wet well.

(c) C=130 and overflow water level in the wet well.

Curve (b) shall be used to select the pump and motor since this most closely represents normal operating conditions. The extreme operating ranges will be given by the intersections of curves (a) and (c) with the selected pump curve. The pump and motor shall be capable of operating satisfactorily over the full range of operating conditions.

Surcharge Pumping stations shall be designed such that the incoming sewers will not surcharge under the peak flow conditions.

Flow Velocity Suction and header piping shall be sized to carry the anticipated flows. Flow velocities shall be:

(a) Minimum cleansing velocity of 2.6 feet per second (0.8 meters per second).

(b) Maximum velocity of 6.6 feet per second (2.0 meters per second).

Regardless of the above conditions, piping less than 4 inches (100 mm) in diameter is not acceptable, unless otherwise approved by the Engineer.

Piping Pumping station internal piping shall be either ductile iron Class 54 with coal tar epoxy lining or stainless steel, Type 316 or 316L, 11 Gauge. Regular steel pipe spool pieces will not be permitted.

Threaded flanges shall be used for all ductile iron pipe joints, fittings and connections within the station. Pressed or rolled vanstone neck flanges shall be used for all stainless steel pipe joints, fittings and connections. All piping within the pumping station shall be properly supported and shall be designed with appropriate fittings to allow for expansion and contraction, thrust restraint, etc.

Wet Well Inlet Only one inlet will be permitted into the wet well. If more than one sewer main flows to a pumping station site, a manhole shall be provided outside of the pumping station to collect the flow from the contributing mains.

Hydraulic Analysis A hydraulic transient analysis shall be undertaken to ensure that transients (water hammer) resulting from pumps starting, stopping, full load rejection during power failure etc, do not adversely affect the pipe or valves in the system.

Valves Hand operated gate or plug valves shall be provided on discharge piping to allow for proper maintenance. Ball check or swing check valves shall be provided on the discharge lines between the isolation gate valve and the pump. Check valves shall be accessible for maintenance.

Ventilation Forced ventilation shall be provided for pumping station wet wells and dry wells. Ventilation may be continuous at a rate of 12 air changes per hour or intermittent at a rate of 30 air changes per

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hour.

Access & Access hatchways and doorways shall be provided to allow adequate maintenance and servicing.

Removal All pumping stations shall be provided with an acceptable device for the removal of pumps and motors for repair and maintenance. Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well. All locks shall be keyed to the Municipality"s standard key system.

Electrical Electric motors less than 10 horsepower shall be 208 volt, 3 phase; electric motors 10 horsepower and larger shall be 600 volt, 3 phase. Single phase pumps will only be permitted if in the opinion of the Engineer three phase power is not feasible. All pumping station control equipment shall be mounted in a CSA Type 3 enclosure that is weather tight, heated and rated NEMA4. Alternatively, control equipment may be mounted in an Aboveground, Pre-packaged Valve Enclosure as manufactured by Gorman Rupp.

Control Package

Controller, Floats and appurtenances to be suitable for 4 float, duplex operation with alternating pump cycles. Flygt Model Alpha 2, CEMA 3 controller with DLT-22 monitoring. Float levels to include pumps off, pump on, 2nd pump on, high water alarm. Control shall include:

- Alarm light
- Elapsed time meter for each pump
- Seal failure indicators for each pump
- Phase failure protection
- Automatic Lead/Lag pump alternator
- Time delay for lag pump
- Panel heater complete with thermostat.

All components shall be CSA approved and the complete assembly shall meet CSA requirements for the type of equipment.

Liquid Level Regulators

Flygt float switches,ENM-10
One each for pump off, lead pump on, lag pump on, and high level alarm.
CSA approved type.
Each regulator complete with sufficient, continuous cable to permit positioning at any level in the wet well with at least three feet to spare.
Maximum voltage 250 V AC.
Maximum operating temperature 50° C.
Minimum operating temperature 0° C.

Conduit

Service entrance shall be rigid steel, CSA approved, hot dip galvanized above grade; rigid PVC below grade, conforming to CSA C22.2 No. 136.
Branch feeders shall be rigid steel, hot dip galvanized, sized in accordance to CSA standards.

Wiring

CSA approved, sized according to equipment manufacturer's stated full load current or as shown on the drawings.

Alarm Light

Red Globe alarm light complete with wire cage protection mounted generally as shown on top of control panel assembly.

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Include alarm resets.
Alarm shall be activated for the following conditions:
- High liquid level
- Pump failure
- Pump leakage failure

Control Panel Support

Reinforced concrete control panel support.

Control Panel Enclosure

Control panel to be complete with weatherproof insulated CEMA 3 enclosure.
No side or top entry permitted.
Minimum 14 gauge stainless steel.
Insulated with minimum 3/4 inch double aluminium faced insulating foam.
- Finish exposed edges with aluminium tape.
- Ensure solid bond to enclosure throughout.

Gasket seal doors.
Enclosure to have padlock hasp and full length stainless steel piano hinges.
Provide heater of 50-75 watts output for control panel enclosure.
- Thermostat with 5°C minimum setting.
- None burning exposed surface.

Install a duplex outlet in the control panel enclosure c/w:
- Separate protected 120 volt circuit.
- Ground fault protection.

Electrical Service Enclosure

Electrical service meter socket to be mounted on Utility Pole and come complete with CEMA 3 weatherproof enclosure and disconnect switch suitable for service provided.
Service connection to meet requirements of NSPI.

Electrical service from the NSP supply to the control panel and between the control panel and the pumping station shall be through buried conduit. Each pump cable shall be installed in a separate conduit and a spare conduit shall be provided for future use. All conduits entering or leaving shall be adequately sealed to protect against corrosion from water intrusion or harmful gases.

The enclosure shall include a connection for temporary standby generator in the event of power outages.

Indication & Control Devices

A hinged sub panel shall contain the following control devices:
Hand-off-Auto selector switch, neon running lights, running hour meter, start counter and ammeter for each pump.
Overload and alarm reset buttons for the controller

Site Considerations Whenever possible, all pumping stations and control panels shall be within the street right-of-way in an appropriate area specifically designated for that purpose. The ownership of this property shall be deeded to the Municipality. All pumping station land shall be graded such that ponding of water does not occur. The elevation of the top of the wet well shall be no less than 4 inches (100 mm) and no more than 6 inches (150 mm) above the finished grade of the pumping station lot. Adequate areas for vehicular access and parking shall be paved; all other

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exposed areas shall be sodded.

O & M Three copies of the pumping station operation and maintenance manual shall be prepared in a form *Manual* acceptable to the Engineer, and provided to the Engineer prior to acceptance of the pumping station. This manual shall contain the following as a minimum:

(a) System description
(b) Design parameters, system hydraulics and design calculations (including curves)

(c) As constructed civil, mechanical and electrical drawings
(d) Pump literature, pump curves and operating instructions
(e) Manufacturer"s operation and maintenance instructions of all equipment
(f) Name, address, and telephone number of all equipment suppliers and installers
(g) Information on guarantees/warranties for all equipment

All special tools and standard spare parts for all pumping station equipment shall be provided by the contractor prior to acceptance of the system by the Engineer.

Forcemain

Pipe PVC DR18 and Ductile Iron Class 350 pipe are approved for use for all sanitary sewer force mains in the Municipality.

The hydraulic losses in the force main shall be calculated using the Hazen-Williams Formula or an appropriate nomograph using roughness coefficients (C) of 100, 120 and 130 as set out above under "Pump Selection".

Limiting Velocities The force main shall be designed such that a minimum cleansing velocity of 2 feet per second (0.6 meters per second) is maintained. The maximum velocity in any force main shall not exceed 8 feet per second (2.4 meter per second). Regardless of the above conditions, piping less than 4 inches (100 mm) in diameter is not acceptable, unless otherwise approved by the Engineer.

Minimum/ Maximum Depth Force mains shall have a minimum cover of 5 feet (1.5 meters) and a maximum cover of 8 feet (2.4 meters). The depth of cover shall be measured from the design grade at finished surface to the crown of the pipe line.

Slope Force mains shall be installed at uniform slopes to minimize accumulation of air and wastewater gases. Under no circumstance, shall any force main be installed at zero slope.

Location Force mains shall not be located in a common trench with a water main and the soil between them shall be undisturbed. Force mains crossing water mains shall be laid to provide a minimum vertical distance of 1.5 feet (450 mm) between the outside of the force main and the outside of the water main. The water main shall be above the force main. At crossings, one full length of water pipe shall be located so both joints will be as far from the force main as possible. Special structural support for the water main and force main may be required.

Termination Force mains shall terminate at a manhole on the gravity sewer system, and at a point not more than 2 feet (0.6 meters) above the flow line of the receiving manhole. A 45 degree bend may be utilized to direct the flow downward.

Valves Where high points in the force main profile can not be avoided, automatic air relief and vacuum valves shall be installed in a manhole to prevent air locks in the pipe. Air relief valves may be required at other locations along the profile if, in the opinion of the Engineer, there is a potential for accumulation of air and gases at such other points. Blow-offs (drains), housed in manholes,

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shall be provided at all low points in the force main system as directed by the Engineer.

Air Relief Heavy duty type cast iron body valves with bronze trim and combination of small orifice and large *& vacuum* orifices shall be used. Small orifice size shall be 3.2 mm. Valves shall be suitable for operation at *Valves* 150 psi (1 MPa) working pressure and shall have flanged ends. Operation shall be through independent floating stainless steel buoy balls located in both orifices.

Orifices shall be capable of expelling air at a high rate during filling and at a low rate during operation and shall admit air while draining the pipeline. Seats shall be replaceable.

Valves shall have no moving parts except for stainless steel balls which shall remain in the throat area discharging air without blowing shut or collapsing the balls.
Valves shall not leak in the closed position when pipe is being filled.

Changes in Direction Any change in direction which is in excess of the pipe joint deflection tolerance will require a suitable fitting as approved by the Engineer. Thrust blocks shall be provided at any change of direction and *in* shall be designed considering the operating pressure, surge pressure, peak flow velocity and in-situ material which the thrust block bears against. Thrust blocks shall be constructed of "ready mix" concrete and shall have a minimum 28 day compressive strength of 3000 psi (20 MPa). In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the force main through the use of stainless steel tie rods securely embedded in concrete. The use of restrained joints is not permitted unless used in conjunction with a thrust block and of a design acceptable to the Engineer.

Pipe Installation Repairs to pipe after installation will only be accepted if carried out in accordance with the manufacturer"s recommendations and shall be re-tested in accordance with this section.

Installation

General Installation shall be in accordance with the NSRBA/ NSCEA Standard Specification for Municipal Services.

3.6 INSPECTIONS & TESTING

General Sewers and force mains shall be tested in accordance with the requirements of the Nova Scotia Department of the Environment. The Engineer shall be notified at least 24 hours in advance of all proposed tests, and tests shall be performed in the presence of the Engineer, or his representative, and a representative of Municipality of the District of Chester.

Manholes Manholes, catch basins, and valve chambers will be inspected by the Municipality at the completion of construction and again prior to the end of the maintenance period.

All manholes shall be tested for leakage using either a hydrostatic or air vacuum method.

Any part of the system failing the above tests or found deficient shall be repaired, retested and inspected to the satisfaction of the Engineer.

Deflection Testing Sewers shall be tested for deflection after trenches are backfilled and compacted.

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Leakage Testing In accordance with the NSCEA/NSRBA Municipal Services Specification.

Video Inspection Closed Circuit Television Inspections shall be carried out at the following times:

(a) At completion of construction and prior to subdivision endorsement of acceptance of the work by the Municipality.

(b) Two months prior to the end of the twelve maintenance period.

A color camera shall be used for Television Inspections and full color VHS format video tape records shall be provided.

4.1 SCOPE

This section specifies the requirements for a central water distribution system. A water distribution system consists of water mains, laterals and appurtenances, including pumping stations, pressure control facilities and reservoirs, which is designed to convey and distribute an adequate supply of potable water for domestic consumption and fire protection.

References The following reference standards and organizations are supplementary to these specifications:

- "Water Supply For Public Fire Protection" prepared by the Fire Underwriters Survey-Insurer's Advisory Organization (IAO)
- National Fire Protection Association (NFPA)
- American Water Works Association (AWWA)
- Canadian Standards Association (CSA)
- National Building Code (NBC)
- Canadian Plumbing Code (CPC)
- Underwriters Laboratories of Canada (ULC)

NSDOE Water distribution systems shall conform also to any requirements established by the Nova Scotia Department of the Environment. No system shall be constructed until the design has been approved by the Engineer and by the Nova Scotia Department of the Environment.

Quality Assurance

Water quality is monitored and maintained by the Municipality, and the system shall be designed such that the quality is maintained and water is distributed to the customers at an adequate pressure to supply their needs.

4.2 DESIGN CRITERIA

Demand The following domestic demand rates shall be used for water distribution systems design:

(a) Average daily demand: 80 Imperial Gallons per capita per day (364 liters per capita per day).

(b) Maximum daily demand: 200 Imperial Gallons per capita per day (909 liters per capita per day).

(c) Maximum hourly demand: 320 Imperial Gallons per capita per day (1456 liters per capita

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per day).

Fire flow demand shall be established in accordance with the latest edition of Fire Underwriter's Survey publication, "Water Supply for Public Fire Protection: A Guide to Recommended Practice".
Water distribution systems shall be designed to supply fire flow demand plus maximum daily demand, or the maximum hourly demand, whichever is greater, unless otherwise approved by the Engineer.

Design Population

Water distribution systems shall be designed based upon appropriate population projections. The design population and assumed domestic demand shall be clearly stated in the calculations submitted for review and approval.

Hydraulic Analysis

Hydraulic analysis of the distribution system shall be carried out by the design engineer; the Engineer will provide the design engineer with the hydraulic grade line at the point of supply to be used for the design analysis.

The hydraulic analysis of the distribution system shall be based upon the Hazen-Williams Formula or an appropriate nomograph, using a pipe friction factor of C=120 for PVC pipe and C-100 for ductile iron pipe.

Water distribution systems shall be designed and sized such that a minimum residual pressure of 20 psi (150 kPa) is maintained at all points in the water distribution system during a fire flow condition. The system shall be designed to maintain a minimum residual pressure of 40 psi (275 kPa) during maximum hourly demand conditions.

The Engineer reserves the right to request flow and other engineering calculations prior to granting approval to install a water system.

Limiting Velocities

The water main shall be sized such that the maximum velocity in the pipe shall not exceed 5 feet per second (1.5 meters per second) during maximum hourly domestic flow conditions or 8 feet per second (2.4 meters per second) during fire flow conditions.

Minimum Pipe Size

The water distribution system shall be sized as outlined in the above clauses. However, in no instance shall the main be smaller than 8 inches (200 mm) in diameter for dead-end lines in excess of 300 feet (90 meters) in length.

Over sizing Over sizing of water mains to accommodate the water supply requirements of future off-site development may be required as instructed by the Engineer.

4.3 WATER MAIN

Looping Water distribution systems shall be designed to provide looping of water mains where permitted by road or easement layout.

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Type of Pipe Pipe shall be: Ductile Iron pipe Class 350 conforming to AWWA C151, cement mortar lined to AWWA C104; or Polyvinyl Chloride (PVC) conforming to AWWA C900, DR18.

Fittings shall be gray iron or ductile iron conforming to AWWA C110, cement mortar lined to AWWA C104, with a minimum working pressure rating of 1035 kPa (150 psi).

Ductile iron pipe joints shall be mechanical or push-on conforming to AWWA C111; or flanged where indicated conforming to AWWA C110 with Class 125 flanged ends conforming to ANSI B16.1.

Mechanical joint restraints for ductile iron pipe up to 16 in. (400 mm) shall consist of ductile iron follower gland conforming to AWWA C153 and AWWA C111, with multiple wedge restraining mechanism, minimum working pressure rating of 350 psi (2410 kPa), and twist off lugs with a minimum factor of safety of 2:1. Joint restraints for pipe larger than 16 inches shall be as approved by the Municipality.

Minimum/Maximum Cover

All water mains shall be designed with a minimum cover of 5 feet (1.5 meters).
In no situation shall the depth of cover over the water main exceed 8 feet (2.4 meters). The depth of cover shall be measured from the design grade at finished surface to the crown of the pipe line.

Location Waterlines installed in the same trench as sewer lines shall be installed to one side on a shelf of undisturbed earth, and a horizontal and vertical separation of at least 12 in. (300 mm) shall be maintained between the crown of the sewer line and the bottom of the water line. If the vertical separation cannot be maintained, the two lines shall be installed in separate trenches with a minimum horizontal separation 10 feet (3 m).

Under no circumstances shall a water main be installed in the same trench as a sewer force main. Water mains and sewer force mains shall be installed with a minimum horizontal separation of 10 feet (3 m), maintaining undisturbed soil between the trenches.

All water main and appurtenances shall be located within a street owned either by the Municipality or the Nova Scotia Department of Transportation and Public Works or within an easement, of minimum 20 foot (6 meter) width, granted in favor of the Municipality. Depending on the length and location of the easement, the Engineer may require a travel way to be provided within the easement for access and maintenance purposes. Water mains shall be installed as close as possible to the centerline of the easement.

Where a need for water mains to accommodate future development on adjacent lands is identified, easements shall be provided from the edge of the street right-of-way to the property boundary of the subdivision.

Changes in Direction

Any change in direction which is in excess of the pipe joint deflection tolerance shall require a suitable fitting as approved by the Engineer. Thrust blocks shall be provided at any change in direction and shall be designed considering the operating pressure, surge pressure, peak flow velocity and in-situ material which the thrust block bears against. Thrust blocks shall be constructed of “ready mix” concrete and shall have a minimum 28 day compressive strength of 3000 psi (20 Mpa).

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In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the water main through the use of stainless steel tie rods securely embedded in the concrete. The use of restrained joints is not permitted unless used in conjunction with a thrust block and of a design acceptable to the Engineer.

Polyethylene Encasement

Encasement, when required by the Engineer, shall be 200 micron polyethylene tube or sheet conforming AWWA C105.

Trench Drainage Relief System

The designer shall assess the possible change in groundwater movement caused by the use of pervious bedding material and shall be responsible for the design of corrective measures to prevent flooding as a result of this groundwater movement. Water mains installed in a single trench or in areas where sanitary sewer and/or storm sewer mains are not installed shall require a "Trench Drainage Relief System" to lower the hydraulic grade line of the groundwater in the trench below the invert of the water main.

4.4 SERVICE LATERALS

Number All water distribution system laterals from the main line to the property line shall be provided by the developer or the property owner. A single service lateral shall be installed to each existing lot or potential future lot which could be created under the zoning in effect at the time of installation of services except that duplex or semi-detached units lots may be serviced by a common service lateral from the main to the street line with individual curb stops for the two units at the street line.

Location Where possible, service laterals shall not be installed in private driveways, parking areas, or other traveled areas.

Pipe Material and Size Service lateral pipe shall be either of the following materials:

- Copper tubing conforming to ASTM B88, Type K annealed, minimum working pressure of 150 psi (1035 kPa).
- Polyethylene tubing conforming to CSA B137.10-M, type PE, Series 160.

All water service pipe between the corporation stop and curb stop shall be a minimum of 3/4 inch (19 mm) in diameter.

A single pipe designed to service duplex or semi-detached units shall be 1 inch (25 mm) diameter minimum; the individual service pipes from the curb stop to the buildings shall have a minimum inside diameter of 0.75 in. (19 mm).

Where service laterals from the curb stop to the serviced building may exceed 200 feet (55 meters) in length, 1 inch (25 mm) diameter minimum service pipe shall be installed.

Service Fittings

Corporation and curb stops shall be brass conforming to ASTM B 62 with compression type joints. Threads on corporation stops shall conform to AWWA C800. All service connections on PVC mains shall include a service clamp (saddle) with bronze body, confined "o"-ring seal

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cemented in place, stainless steel straps suited for the main size, and outlet threads conforming to AWWA C800.

Service connection joints shall be compression type, with a minimum pressure rating of 150 psi (1035 kPa). For polyethylene tubing, joints shall conform to CSA B137.1-M with stainless steel liners.

For services which are longer than 66 feet (20 meters), the number of compression couplings used shall be kept to a minimum. Compression couplings shall not be used within 5 feet (1.5 meters) of the foundation of any serviced building.

Service boxes shall be adjustable with cast iron bottom section, cast iron lid with recessed nut, and internal stem to suit the depth of bury.

Minimum Cover All service laterals shall be installed with a minimum cover of 1.5 meters (5 feet).

4.5 VALVES

General All connections to an existing water system shall be valved so that the system can be isolated by the valve at the start of the extension. The connection to the existing water system shall be coordinated through the Engineer.

Type Valves on water mains 12 in (300 mm) and smaller shall be mechanical joint gate valves conforming to AWWA C509, minimum working pressure rating of 200 psi (1380 kPa), with cast iron body and resilient rubber seat. Cast iron adjustable height valve boxes shall be provided on all valves 12 in. (300 mm) and smaller.
Valves larger than 12 in (300 mm) shall be: gate valves conforming to AWWA C500, minimum working pressure rating of 150 psi (1035) kPa, with cast iron body and bronze mounted mechanism; or butterfly valves conforming to AWWA C504, Class 150B, minimum pressure rating of 150 psi (1035 kPa), with cast iron body and mechanical joint ends. Valves larger than 12 in (300 mm) shall be installed in precast or cast-in-place valve chambers.

All meter chambers, air release chambers, and other special works shall be as approved by the Engineer.

Connections to Existing Mains

Tapping sleeves and valves shall be provided for connections to existing water mains where required by the Engineer.

Valve Locations Valves shall be provided on the water mains at the following locations:

(a) Where required to adequately isolate sections of the water system as determined by the Engineer.
(b) On each leg of cross or tee junctions
(c) At intervals of 1320 feet (400 meters) on water main sections where there are no junctions.

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(d) At the edge of right-of-way for all domestic and sprinkler services

4.6 BACKFLOW PREVENTION DEVICES

Where Required

Backflow prevention devices shall be provided on new services if there is a risk of contamination of the potable water supply. Premises which require backflow prevention devices include, but are not limited to, the following:

- Industrial, commercial and institutional buildings;
- Apartment buildings larger than four units;
- Sprinkler service lines.

Location Backflow prevention devices shall be installed downstream of water meters. A water distribution connection will not be permitted between a water meter and a backflow prevention device.

Where a meter by-pass is required, a backflow prevention device shall be installed on the main service line and on the by-pass line.

Products Backflow prevention devices shall conform to CSA B64-M88.

4.7 FIRE HYDRANTS

Spacing/Location

Fire hydrants shall be spaced in accordance with the publication "Water Supply for Public Protection". In no case shall the spacing exceed 500 feet (150 meters).

The following are desirable hydrant locations:

a. At high points on the water main profile unless an automatic air release valve is required at that location.
b. At low points on the water main profile.
c. At road intersections
d. Near the middle of long blocks.
e. At the end of dead-end streets or cul-de-sacs greater than 90 meters (300 feet) in length.

Fire hydrant laterals shall have a minimum diameter of 6 inches (150 mm) and shall be provided with a gate valve between the hydrant and the tee from the main. The depth of bury of hydrant laterals shall be 5 feet (1.5 meters).

Hydrants shall be provided with adequate drains to prevent freezing.

Fire hydrants shall be dry barrel type, conforming to AWWA C502 and shall be two piece with safety break-away flange and stem. The safety flange shall be installed above the ground but it shall be no higher than 6 inches (150 mm) above finished grade.

Hydrants shall have two one-half (2.5) inch hose nozzles and one standard pumper nozzle with an outside diameter of four and fifteen sixteenths (4-15/16) inches.

4.8 INSULATION

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Insulation shall be placed where, due to special circumstances, the depth of bury is less than 5 feet. Insulation shall conform to CAN/CGSB 51.20M, type 4, expanded polystyrene.

Insulation of a main shall consist of insulation over the top of the pipe, with clean dry sand filling the annular space between the pipe and insulation.

4.9 PUMPING AND STORAGE FACILITIES

Differences in ground elevations or distance from the source of supply, may require that the water system pressure be boosted in certain areas to provide adequate pressure and flows to meet domestic and/or fire flow requirements.

To accomplish this, a pumping station may be required to service a specific and defined area of a water distribution system which is generally isolated from the remainder of the system. All pumps and pump houses shall meet the requirements set by the Engineer.

Water pumping and storage facilities shall be designed in consultation with the Engineer.

4.10 INSTALLATION

GeneralInstallation shall be in accordance with the NSRBA/ NSCEA Standard Specification for Municipal Services.

4.11 INSPECTIONS AND TESTING

Valve Operation

Existing valves, not part of new construction, shall be operated only by the Municipality.

Notice The Municipality of the District of Chester shall be notified 24 hours in advance of all filling, flushing, or chlorination operations for new construction.

Requirements Testing shall be carried out with the following additional requirements:

(a) All services, hydrants, mains, and other appurtenances shall be included in the system test.

(b) Testing shall be performed in presence of the Engineer, or his representative, and a representative of the Municipality of the District of Chester. Test results shall be sealed and submitted by a Professional Engineer registered or licensed to practice in Nova Scotia.

(c) All water used for pipe testing shall be the responsibility of the contractor and shall be chlorinated potable water.

Hydrostatic Pressure Test

Mains and services shall be flushed before testing. The duration of each hydrostatic pressure test shall be at least (2) hours, and the pressure shall be maintained at a minimum of 200 psi (1380) kPa throughout the test period.

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Pressure gauges shall be liquid filled type, minimum 100 mm (4 inch) face diameter, graduated in psi, accuracy 3% at maximum reading.

There shall be no leakage or drop in pressure for the duration of the test.

The test must be conducted with all proposed service laterals installed to the property line.

Should any section of the pipe exhibit leakage, the contractor shall, at his own expense, locate and repair the defects, and re-test the section.

Disinfection All water mains shall be chlorinated in accordance with AWWA C651.

Chlorination of any water system may proceed only after the system has been successfully pressure tested, with the test witnessed by a Municipality of the District of Chester representative.

All water mains shall be flushed before and after chlorination. De-chlorination of the water mains shall be the responsibility of the contractor. De-chlorination procedures shall satisfy the requirements of the Nova Scotia Department of Environment and the Municipality.

After chlorination and de-chlorination are complete, water samples shall be delivered to the Nova Scotia Department of the Environment for bacteriological testing. Chlorination shall be repeated if necessary.
Bacteriological test results shall be forwarded to the Engineer.

5.1 GENERAL

A drainage system receiving, carrying and controlling discharges on response to rain and snow which includes overland flow, sub-surface flow, groundwater flow and snow melt. A storm drainage system may consist of ditches, culverts, swales, subsurface interceptor drains, roadways, curb and gutters, catch basins, manholes, pipes or conduits, retention ponds, lateral lines to the lots from pipes or conduits to street lines, watercourses, floodplains, canals, ravines, gullies, springs and creeks.

The design criteria contained in this section are included to illustrate the more common aspects encountered in the design of storm drainage systems. Any storm drainage system within the Municipality shall be designed to achieve the following objectives:

- to prevent loss of life and to protect structures and property from damage due to a major storm event
- to provide safe and convenient use of streets, lot areas and other land during and following rain and snow events;
- to adequately convey storm water flow from upstream sources;
- to mitigate the adverse effects of storm water flow, such as flooding and erosion, on downstream properties
- to preserve natural water courses;
- to minimize the long term effect of development on receiving watercourses and on groundwater.

In the Municipality such storm drainage systems are typically owned, operated and/or maintained by either, the Municipality, TPW, DOE, private landowners, or a combination of any of these groups.

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All storm drainage systems shall conform to any requirements established by DOE. No system shall be constructed until the design has been approved by the Engineer and by DOE.

5.2 DESIGN APPROACH

5.2.1 MINOR DRAINAGE SYSTEM

The minor drainage system is the system which is used for initial storm water flows, or for flows generated in high-frequency rainfalls. The minor drainage system shall be designed to provide safe and convenient use of streets and properties, to minimize street maintenance costs and to provide convenience to the public. Where a piped system is required, all pipes within the system shall be designed to carry the runoff from the minor storm without surcharge.

5.2.2 MAJOR DRAINAGE SYSTEM

The major drainage system is the path which storm water will follow during a major storm, when the capacity of the minor drainage system is exceeded. The minor and major drainage systems together shall be capable of carrying the runoff from the major storm. Systems shall be designed to control the flow of storm water in a major storm so as to prevent basement flooding and damage to property, streets and structures. Easements may be required for the identification and protection of certain elements of the major drainage system.

5.2.3 DOWNSTREAM EFFECTS OF STORM WATER CONTROL FACILITIES

The downstream storm system shall have the capacity to convey discharge from its fully developed watershed. Mitigative measures may be required to the downstream system to reduce adverse impacts.

If an investigation determines that a storage facility is required, it shall be appropriately designed. The design shall address factors such as watercourse protection, erosion and sediment control, impact on adjacent property, maintenance requirements, public safety, access, liability and nuisance. Storage facilities shall be planned and designed to encompass larger facilities rather than facilities serving larger properties.

Storage facilities shall be designed to control the peak runoff conditions for storm events with different return frequencies including the major storm.

5.2.4 **DESIGN PARAMETERS**

5.2.4.1 Basis of Design

The storm system shall be designed for flows from all lands within the watershed in which the system is situated, and lands anticipated being tributary to the watershed, either by future development or regarding.

5.2.4.2 Design Flow

The design is to be based on the larger of winter or annual flow. Submit calculations and size storm sewers as follows:

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I) ordinary residential, commercial, or industrial land use: annual (year-round) rainfall data.
II) where the duration is greater than six hours: winter precipitation and ice/snow melt data.
III) where the design area includes a significant proportion of undeveloped land: annual and winter data.

5.2.4.3 Downstream Effects

The downstream storm system shall have the capacity to convey discharge from the fully developed watershed.

5.2.5 **DESIGN STORM FREQUENCIES**

The following frequencies shall be used for design of storm drainage systems in the Municipality:

I) Piped systems and road driveway culverts: minor storm.
II) The combined capacity of the major drainage system and the minor drainage system: major storm
III) The design capacity of watercourses (including the floodplain), culverts for watercourse, drainage systems where a minor drainage system is not provided, and roadside ditches: major storm
IV) Driveway and road culverts; 1:10 year storm.

5.3 METEOROLOGIC DATA

Acceptable rainfall data to be used to calculate runoff flows are as follows:

- intensity-duration-frequency curves - most current information from the Atmospheric Environment Service for area closest to project.
- synthetic design storms - hyetograph of the Chicago type distribution with: r=0.5, 2 and 24 hour storm duration; intervals of 5 minutes and 1 hour for the 2 hour and 24 hour storm durations.
- historical design storms - historical flood records or from runoff simulations for historical storms (required to verify the performance of storage facilities and major structures.)

5.4 RUNOFF METHODOLOGY

The designer must determine the best runoff calculation method to be used. The designer must also calibrate and verify for local conditions. The designer shall provide for future reference the reason why a certain method is selected. The Engineer may request that a second method be used as verification or checking of the results.

The Rational Method may be used for drainage areas less than 20 hectares and for the preliminary design of Storm Drainage Systems servicing larger areas.

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Generally, the Rational Method shall not be used for the design of storage facilities, except that the modified Rational Method may be used for the design of storage facilities for highly impervious areas, and shall use the graphical hydrograph method.

5.5 STORM DRAINAGE REPORT

A storm drainage report shall be prepared and included as part of the submission for any land development to deal with storm water and drainage issues related to the development. The report shall include site engineering analysis to a level consistent with the size of the development, its location within the drainage basin, and the sensitivity of the area's drainage system. The report shall include details of the safety implications of the proposed system, and an examination of the potential for erosion in the downstream receiving streams due to increased peak and total flows and flow velocities as a result of the development.

The storm drainage report shall also include drainage plans and detailed runoff calculations. The calculations shall include input information showing sub-watersheds, rainfall abstraction, antecedent moisture conditions and schematization of the system for pre and post development and all storm water management alternatives; and output information which shows the main step of the calculations and the peak discharge at key points in the system.

The drainage plans shall show the location of the proposed development within the topographic drainage area, the drainage area tributary to the proposed and existing storm drainage system(s), boundaries of all drainage sub-areas, contours at intervals not exceeding 2 m, site layout including proposed streets and lots, locations of proposed storm drainage system(s) and storm water management facilities, location of outfalls or connections into existing services, hydrologic and hydraulic data table and any other information required by the Engineer.

TABLE 1
RECOMMENDED COEFFICIENT OF RUNOFF VALUES FOR VARIOUS SELECTED LAND USES

Description of Area	Runoff Coefficients
Business	
Downtown	0.75 to 0.95
Neighborhood 0.50 to 0.70	
Residential	
Single-family	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Suburban	0.25 to 0.40
Residential (1/2 acre lots or more)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial	
Light	0.50 to 0.80
Heavy	0.60 to 0.90

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Parks, Cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.40
Railroad yard	0.20 to 0.40
Unimproved	0.10 to 0.30

It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surfaces in the drainage area. This procedure is often applied to typical "sample" blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type, currently in use are:

Character of Surface	Runoff Coefficients
Street	
Asphalt	0.70 to 0.95
Concrete	0.80 to 0.95
Drives and walks	0.75 to 0.85
Roofs	0.75 to 0.95
Lawns, sandy soil	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, heavy soil	
Flat, 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

The coefficients in these two tabulations are applicable for storms of 5 to 10 year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have proportionally smaller effect on runoff.

Winter Runoff Coefficient (All areas and surfaces with summer coefficients less than or equal to 0.80)	0.80

Source: Hydrology, Federal Highway Administration, HEC No. 19, 1984.

5.6 LOCATION

No storm drainage shall be carried on, through, or over an approved residential lot within a subdivision. All storm drainage shall be carried by either an unconfined natural watercourse, excavated ditch, or storm sewer.

All excavated ditches and storm sewers within a subdivision shall be located either within a right of way or on an easement in favor of the Municipality. The minimum width of an easement is 20 ft (6.1 m).

Where subdivision storm drainage flows onto abutting land other than through a natural watercourse, a right of way or easement in favor of the Municipality shall be provided.

Where a need is identified by the Engineer to accommodate future upstream development, and where no future road reserve is available, a drainage right of way or an easement in favor of the Municipality shall be provided.

Natural watercourses shall not be carried in roadside ditches or piped roadside storm drainage systems.

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Discharge to Adjacent Properties:

All storm drainage shall be self contained within the subdivision boundaries, except natural run-off from undeveloped areas.

All run-off from the developed limits of a subdivision must be directed to either a natural watercourse or storm drainage system owned by the Municipality or the Nova Scotia Department of Transportation and Public Works.

Discharge of run-off to adjacent properties other than in a natural watercourse is prohibited unless the developer obtains consent in writing from the adjacent property owner(s), and drainage easements over such natural property are provided in favour of the Municipality.

5.7 SYSTEM COMPONENTS

Buried Storm Drainage Systems

Velocity
The minimum design velocity for storm sewers shall be 2 fps (0.6 m/s). Consideration shall be given to initial minimum cleansing velocity for phased development.

The maximum design velocity for storm sewers shall be 15 fps (4.5 m/s) for pipes up to and including 30" (750 mm) in diameter. The maximum design velocity for storm sewer pipes greater than 30" (750 mm) in diameter shall be 20 fps (6 m/s).

Pipe Size
The minimum diameter for a storm sewer main shall be 12" (300 mm).

The minimum diameter for a catch basin lead shall be 10" (250 mm).

Pipe sizes shall not decrease in the downstream direction unless approved by the Engineer.

Depth
The minimum depth for a storm sewer main located within the road right of way is 4 ft (1.2 m).

The minimum depth for storm laterals at the property line is 4 ft (1.2 m).

Manholes
Manholes shall be installed at all changes in grade or alignment, at all intersections and at intervals not exceeding 400 feet (120 meters).

The minimum internal diameter of a manhole shall be 42 inches (1050 mm).

Service Laterals
All laterals from the storm sewer main to the property line shall be provided by the developer or owner and shall have a minimum grade of 2 percent.

Catch Basins
Catch basins shall be installed at the curb of the street and shall be adequately spaced to prevent ponding on the street and to prevent water from entering on or flowing in the travel lanes during storm

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events corresponding to the design of the Minor Drainage System. In no case shall the spacing of the catch basins exceed 330 feet (100 meters).

Catch basin leads shall be connected to a storm drainage main at a manhole.

Inlets
Vertical grates shall be installed at inlets.

Outfalls
The design of outfalls shall take into consideration such factors as public safety, erosion control, appearance, etc. Horizontal grates shall be installed at outfalls.

Ditches/Open Channel Drainage System
Roadway ditches shall conform to the standard cross section for local subdivision roads and shall have adequate capacity for the 1 in 100 years storm.

Velocity
To prevent erosion, the maximum velocity during a 1 in 100 year storm event in ditches or open channels shall not exceed the values given in Table 2.

Culverts
The size of culverts (including driveway culverts) shall generally be as shown on the approved engineering drawings. The minimum size for any other culvert shall be 18".

The minimum depth of bury for any driveway culvert is 12" (300 mm). The minimum depth of bury for any other culvert is 20" (500 mm).

Culverts other than driveway culverts shall be designed for the 1 in 100 year peak flow with a headwater depth not greater than the diameter of the pipe.

Driveway culverts generally do not require grating. Storm sewer out falls, and culverts greater than 50 feet (15 m) require inlet and outlet grating.

All culverts shall be reinforced concrete pipe to ASTM C76-M or CAN/CSA A257.2.

Minor Drainage System Connections

Roof Drains
Roof drains shall discharge on the ground surface and shall not be connected to a storm drainage system.

Foundation Drains
Where a buried storm drainage system exists, foundation drains will normally be connected to the main by laterals. The invert of the lateral at the property line must be at least 2 feet (610 mm) above the top of the main at the point of connection.

Where a buried storm drainage system does not exist, Section 9.14 of the National Building Code of Canada, latest revision, shall apply.

Under no circumstance shall foundation drains direct storm water to the street surface, sidewalk or adjacent property.

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TABLE 2
SUGGESTED MAXIMUM PERMISSIBLE MEAN CHANNEL VELOCITIES IN STRAIGHT, UNIFORM CHANNELS

Channel	Mean Channel Velocity fps (metres per second)
Fine sand	1.5 (0.46)
Coarse sand	2.5 (0.76)
Fine gravel	6.0 (1.83)
Earth	
Sandy silt	2.0 (0.61)
Silt clay	3.5 (1.07)
Clay	4.0 (1.22)
Grass-lined earth	
Bermuda grass -sandy silt	6.0 (1.83)
-silt clay	8.0 (2.44)
Kentucky Blue grass -sandy silt	5.0 (1.52)
-silt clay	70 (2.13)
Poor rock (usually sedimentary)	10.0 (3.05)
Soft sandstone	8.0 (2.44)
Soft shale	3.5 (1.07)
Good rock (usually igneous or hard metamorphic)	20.0 (6.10)

5.8 EROSION AND SEDIMENT CONTROL

An Erosion and Sediment control plan shall be provided in compliance with Provincial regulations, and a copy submitted to the Engineer. The plan shall address measures during construction of roads, services, and houses, as well as long term measures after the completion of development.

The Erosion and Sediment Control Plan, as well as control measures taken, shall comply with the Erosion and Sedimentation Control Handbook for Construction Sites, as prepared by the Nova Scotia Department of the Environment.

During construction, surface water flows across the construction site must be minimized. Exposed soils within ditches and on cut and fill slopes shall be permanently stabilized by hydroseeding or equivalent within two weeks after final grades are reached. Temporary stabilization measures such as application of straw or wood chips shall be used to prevent erosion of exposed soils during construction and prior to reaching finished grades. These measures are required to prevent downstream sedimentation of watercourses and within culverts.

Long term environmental protection measures to be addressed in the subdivision design may include but

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are not limited to:

minimization of erosion and sediment transport
protection of outfall areas
utilization of wetland areas for filtration of storm water run-off
minimization of disruption to natural watercourses

6.1 SCOPE

This section specifies the requirements for all Municipal **Public** Highways within the Municipality of the District of Chester.

A Municipal Public Highway consists of the wearing surface, shoulders, road bed and all slopes, ditches, channels, waterways and structures necessary for proper drainage and protection, owned by the Municipality of the District of Chester.

The design and location of all sewers, water mains, electrical, telephone and such utilities located within the right-of-way of the Public Highway shall be in accordance with the appropriate specification section(s) and must be approved by the Municipal Engineer prior to their construction.

With the exception of street cross section, the Engineer may consider variances to these specifications.

6.2 STREET CLASSIFICATION AND CHARACTERISTICS

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Table 6.1 provides the classes of Public Highways applicable to development within the Municipality of Chester.

The subdivision bylaw(s) regulates the minimum lot sizes and development character. The lot size and the development character may dictate the appropriate road classification and characteristics. The following criteria shall be considered in determining which design and construction standard will apply to a particular development.

In areas serviced with central sewers and with lot sizes less than 930 to 1110 Sq. M. (10,000 to 12,000 sq. ft), Public Highways shall be constructed to the urban standard.

Public Highways for rural lots with on-site sewage disposal shall be constructed to the rural standard.

A design brief prepared by the Developer"s consultant shall be submitted addressing the design intent including rationalization of the selected road type and length. The design brief shall address issues such as capacity, parking and maintenance.

The final decision on the street category and parking allowances rests with the Engineer.

6.3 DESIGN CRITERIA

6.3.1 General

This section covers the more common aspects for design and construction of Public Highways within the Municipality of the District of Chester. In cases where this section needs to be expanded or additional specifications are required, the "Geometric Design Guide for Canadian Roads and Streets", the "Manual of Uniform Traffic Control Devices for Canada" in the latest edition as published by Transportation Association of Canada (TAC), and the Nova Scotia Motor Vehicle Act and Regulations shall be used. Specific design criteria are listed in Table 6.1, the standard details and in the following clauses.

6.3.2 Design Speed

In accordance with Table 6.1

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Typically a design speed of 30 to 50 km/hr, will be used for all Municipal Public Highways unless the intended use of the road requires a higher design speed as determined by the Municipal Engineer.

6.3.3 Right-of-Way

Typically the minimum right-of-way width is 66 feet (20 m) except in the case of a fully serviced subdivision with curb & gutters and storm sewers, where a width of not less than 50 feet (16 m) may be accepted by the Engineer.

Any property susceptible to damage as a result of construction must be within the right-of-way. All side slopes must be included within the right-of-way. Cross sections at minimum 20 meter intervals shall be provided to illustrate that the right-of-way width is adequate for the design road. As a minimum cross sections shall include the existing ground elevations and all elements of the typical road cross section.

An exception to benching back slopes may be considered by the Municipal Engineer where a geotechnical report is provided supporting the proposal.

In all subdivision designs, an acceptable right-of-way access to adjacent property must be provided and deeded to the Municipality. The access roads must not be more than 1310 ft (400 m) apart. In addition, access roads will be located along the boundary of the subdivision for which approval is being sought in such a manner as to not prejudice development of adjacent land.

Where a roadway can be extended to service adjacent or future development, sufficient right-of-way shall be provided for the "Local" road standard.

6.3.4 Road Layout

Roads must be laid out where reasonably possible in prolongations of other roads, either in the same subdivision or in adjacent subdivisions. Road designs should recognize and incorporate natural features such as watercourses, wet areas, unique wildlife habitats, and rock outcrops.
Unless there are unique circumstances, the minimum length of a road considered for acceptance as a public highway is 500 ft (150 m).

Cul-de-sacs are not to be used when the land can be effectively serviced by other road layouts. All cul-de-sacs must end in a permanent or temporary turn around area as approved by the Engineer. The grade of the turning area shall not exceed 4%.

6.3.5 Intersections

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Reference Table 6.1

All intersections shall have adequate sight triangles at approaches. For additional guidance refer to TAC Chapter 2.3. Intersections shall be designed to ensure adequate width is available for manoeuvring and turning for emergency and service vehicles.

The maximum centerline distance between intersections for local and collector streets shall not be more than 1312 ft (400 m).

Where Municipal Public Highways meet existing classes of provincial highways, the intersection must be approved by the Provincial Department of Transportation and Public Works.

All intersecting roads must intersect at an angle of 70 to 90 degrees for a minimum distance of 100 ft (30 m) from the intersection measured from the respective center lines.

Offset intersections will not be permitted.

A maximum of four streets will be permitted at an intersection.

6.3.6 Horizontal Alignment

Reference Table 6.1

Horizontal curves shall be designed to ensure adequate width is provided for manoeuvring and turning for emergency and service vehicles.

Tangent distances between horizontal curves turning the same way shall not be less than 131 ft (40 m).

6.3.7 Vertical Alignment

Reference Table 6.1

Grades at intersections shall not exceed 4% for at least 50 ft (15 m) measured from the shoulder of the intersecting road.
Local streets generally shall not be super-elevated unless there are safety or drainage concerns.

TABLE 6.1

Characteristic	Minor Collector	Local - 50 km/hr	Low Volume - 30 km/h *	Low Volume - 30 km/h * One Way
Traffic service & function	Traffic movement of equal importance with land access.	Land access first consideration, traffic movement second consideration.	Aesthetics first, land access second, traffic third	Aesthetics first, land access second, traffic third
Maximum number of lots or dwelling units	N/A	N/A	30	30
Maximum street length	N/A	N/A	Cul-de-sac - 400 m Crescent - 800 m	Crescent - 400 m

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Parking	Permitted	Permitted - one side	Not permitted	Permitted – One Side
Average daily volume	Up to 3,000	Less than 1000	Less than 300	Less than 300
Average running speed	30 - 50 km/h	30-50 km/h	15-30 km/h	15-30 km/h
Vehicle types	All types with truck limits	Passenger and service vehicles, with limits on large vehicles,	Passenger and service vehicles	Passenger and service vehicles
Design speed (km/hr)	50	50	30	30
Right-of-way widths – minimum	20 to 25	16 to 20	16 to 20	16 to 20
Min. Grade (%)	1	1	1	1
Max. Grade (%)	8	8 to 10	10	8
Min Centerline Radius (m)	See TAC	100m	30	30
Min. Sight Distance (m)	85	65	45	45
Typical Road Cross Section	As Per Municipal Engineer	See Detail nos. 3 & 5	See Detail nos. 2 & 4	See Detail nos. 4 & 14
Min. Centerline Distance Between Intersections Same Sides Opposite Sides	 150 60	 75 45	 75 45	Not Applicable
Min. K Factors	20	7	2	2
	20	12	4	4
Min. Curb Radius	10	7.5	7.5	7.5
Max. Cul-De-Sac Length	N/A	400	N/A	N/A

(*) Public Highways, which connect to Local Public Highways, typically permanent cul-de-sacs and crescents with no opportunity for extension.

6.3.8 Design Limits

Where streets are required to service future or adjacent property the design shall include sufficient detail to illustrate that the extension is compatible with adjacent topography and can be constructed in accordance with this specification. The designs shall include profiles and sections for a minimum of 328 ft (100 m) length beyond the development boundary.

6.3.9 Access

A maximum of 50 lots may receive final approval prior to a second access being provided.

6.3.10 Stopping Sight Distance

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Reference Table 6.1

Minimum stopping and turning sight distances shall be as defined by the TAC Geometric Design Guide.

6.3.11 Medians

Medians will be considered for residential subdivisions based on the following.

Medians shall be delineated with concrete curb for Urban Streets. For Rural streets non-curbed medians may be approved provided issues such as drainage, safety, landscaping and maintenance are addressed to the Engineers satisfaction.
TAC Section 2.2.5 “Medians and Outer Separations” and Section 2.3.11 “Median Openings – U-Turns and Emergency Vehicles” shall be satisfied.
Medians shall not restrict access or egress at driveways, intersecting streets or road reserves.
Medians shall be landscaped with low maintenance shrubs, trees and grasses.

6.3.12 Guard Rails

Guard Rails are required on fills 10 ft (3 m) or greater (unless a slope of 6:1 can be provided) and in other hazardous areas. Refer to Standard Drawings for details of guardrail construction and location.

6.3.13 Street Signage

Signage installation including stop signs, street signs and all other required signs shall be the responsibility of the developer and shall be installed in accordance with the approved road design prior to conveyance of the road to the Municipality.

6.3.14 Bridges

Bridges are designed and constructed to Canadian Standards Association (CSA) specification "S6 Design of Highway Bridges";

6.3.15 Extension of Existing Public Highways

Where a proposed extension to an existing road increases traffic volumes so as to change the classification of the exiting street as shown in Table 6.1, the Developer shall upgrade the existing road to a suitable standard.

6.3.16 One Way Streets

One way streets shall be considered provided they satisfy the following.

They connect to a two way street at both ends.
Form a crescent not exceeding 1312 ft. (400 m) in length from centerline of connecting streets.
Adequate lane widening shall be provided to ensure manoeuvring and turning for emergency and service vehicles.
Do not compromise safety or access.
Do not connect to a road reserve.
Satisfy the typical cross section details for one way streets.
Adequate intersection sight triangles are provided.
Do not serve any more than the equivalent of 30 single family homes.
That adequate off street parking is provided.
The one way street may not be dead ended as a result of development phasing.

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6.4 INSPECTION AND TESTING

6.4.1 A preconstruction meeting is required before construction work begins on any Municipal Public Highway. Inspections may be carried out at any time, however, inspection reports by the developer"s engineer are required at the following stages:

(1) After clearing and grubbing (pre-culvert and drains);

(2) After completion of sub-grade and installation of drainage structures and other buried services;

(3) Prior to paving;

(4) Prior to Municipality takeover of roads

6.4.2 Reporting

All results of laboratory and field density tests shall be submitted to the Engineer.

6.4.3 Sub-grade

Sub-grade material shall be placed and compacted to the specified minimum density attained using the "Control Strip" method. Additional guidance on the Control Strip method may be found in the DOT Standard Specification for Highway Construction and Maintenance (April 1996), Division 2, Earthworks.

At least one field density test shall be taken for every 500 ft (150 m) of roadway sub-grade.

6.4.4 Soft Spots

All "soft spots" in the sub-grade shall be removed to full depth and replaced with approved backfill.

6.4.5 Trenches

Pipe bedding, cover and backfill in trenches shall be to the depth and width indicated in the details. Field density tests shall be taken within a section of trench to determine level of effort required to achieve the specified compaction for each of the following.

1. Pipe bedding
2. Pipe cover material
3. Trench backfill excluding final 12 inches (300 mm) to sub-grade; and
4. Final 12 inches (300 mm)

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Compaction within trenches may proceed using the compactive effort determined for each of the above provided there is no change in materials, equipment or site conditions. Such a change will require re-determination of the compactive effort. Quality control testing of compaction within trenches shall be as required for site soil conditions or as directed by the Engineer.

Moisture content of sub-grade and trench backfill materials must be controlled to obtain the specified compaction.

6.4.6 Gravels

At least one field density test shall be taken for every 100 ft (30 m) of roadway gravels for each gravel lift.

6.4.7 Asphalt Concrete

Prior to paving, the developer shall provide the Municipality with a letter signed by a Professional Engineer which states that the aggregates(s) and asphalt cement has been sampled and tested, and that the asphalt concrete mix design meets the specification.

A minimum of one series of tests per day or for each 500 tonnes of asphalt concrete shall be performed. The series of tests shall include all of the following:

1. Marshall Stability, kN
2. Marshall Flow, x 0.25 mm
3. Voids in Mineral Aggregate (VMA), %
4. Air Voids, %
5. Asphalt Cement Content, %
6. Gradation of Extracted Aggregate

There shall be at least one field density test per day for each 500 tonnes (metric) of asphalt concrete placed. Each lift for every individual road shall have at least one field density test taken.

6.4.8 Curbing

At least one set (3) of concrete test cylinders (6 inch x 12 inch) shall be taken for every 328 ft (100 m) (linear) of curbing and tested for compressive strength at 7 days (1) and 28 days (2).

6.5 STREET CONSTRUCTION

6.5.1 Construction Limits

All road accesses and road reserves to adjacent property must be constructed to the property lines.

6.5.2 Contract Specifications

Contract specifications shall be developed in conjunction with "Standard Specifications for Municipal Services" as published by the Nova Scotia Road Builders Association & Consulting Engineers of Nova

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Scotia Joint Committee on Contract Documents. These specifications shall take precedence where there is a conflict with the Standard Specification for Municipal Services.

6.5.3 Clearing and Grubbing

All grubbing materials under the road bed shall be removed. In no case shall grubbing material be buried in roadway fills.

The right-of-way shall be cleared to the outside edges of the ditch back slopes and as required for overhead utilities. All brush, trees and cuttings shall be disposed of in such a manner as to give a neat appearance to the cleared area, but in no circumstances are the cuttings to be disposed of in the roadway fills.

6.5.4 Roadway

Roadbeds shall be constructed including pavements in accordance with the Typical Cross Section.

Roadway culverts, under drains, driveway culverts, and storm drainage systems where required, shall be provided and placed by the developer. The ends of all pipes shall be rip-rapped with 12 to 18-inch (300 - 450 mm) diameter flat stones. The right-of-way shall be left properly drained and should the work, as performed, create pockets of isolated water holes, this drainage condition shall be rectified.

Roadside ditches shall be constructed by the developer unless storm sewers are provided.

Culvert sizes shall be provided by the developer based on ditch flows. The minimum allowable culvert size shall be 16 inch (400 mm) diameter.

Topsoil, peat and other unsuitable materials under the roadbed must be removed prior to placing embankment material. Rock cuts will be excavated too at least 1 ft (300 mm) below the sub-grade and backfilled with material satisfactory to the Engineer. Water pockets will not be left in the bottom of rock cuts. All backfill in cuts or embankment must be with graded material approved by the Engineer. The top 12 inches (300 mm) of sub-grade must be free of rocks larger than 6 inches (150 mm) maximum dimension.

The Sub-grade must be well-drained and compacted using the Control Strip method described in Section 6.7. Any unsuitable material including soft or yielding material shall be removed, replaced with suitable material, and compacted.

SECTION 7 – SMALL SEWERAGE SYSTEMS *February 14, 2008*

7.1 General – Guidelines

The design, construction and operation of sewage treatment systems shall meet the most current standards and reflect Federal and Nova Scotia regulations, guidelines and standards.

7.2 Reference Documents

Atlantic Canada Standards and Guidelines Manual for the Collection, Treatment, and disposal of Sanitary Sewage.
Nova Scotia Department of Environment and Labour On-site Sewage Disposal Systems Technical Guidelines.
Nova Scotia Regulations Respecting On-site Sewage Disposal Systems.
Nova Scotia Standards and Guidelines Manual for the Collection, Treatment, and disposal of Sanitary Sewage.
Alternative Sewer Systems, Manual of Practice No. FD-12, Water & Environment Federation

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7.3 Submissions

In addition to any reports or subject matter required by federal and provincial regulators the developer shall submit a preliminary design report completed by an engineer with at least five years past experience in the design, construction and operation of the proposed collection, treatment and disposal systems.

7.3.1 Preliminary Design

A preliminary design report shall be provided for review and comment and as a minimum include the following.

1. To scale schematic(s) of the overall development encompassing all the lands owned by the developer including proposed collection systems and its components.
2. To scale schematic layout of the proposed collection, treatment and disposal system components, including settling and pump chambers, filters, site access, security fencing, proposed buffers and separations to existing and proposed dwellings, wells, and watercourses.
3. Design calculations, including estimated flow rates and sizing of key treatment components.
4. A receiving water capacity study the contents of which must support the proposed concept development.
5. Design standards.
6. The phasing of the collection and treatment systems.
7. The estimated capital cost of the systems.
8. The estimated man power requirements for system operation.
9. The estimated operating costs of the systems, including but not limited to sampling and analysis, power, communications, reporting, sludge removal and disposal, routine repairs and long term replacement.
10. Groundwater Impact assessment.
11. certification from the manufacturer confirming that they have reviewed the design documents and support the recommended design solutions.

7.3.2 Final Design and Tender Documents

A final design report including tender documents, construction specifications, detail drawings shall be provided to the Municipality for review and comment.

Copies of all applications, correspondence, including all commitments with regulators shall be provide to the Municipality.

7.3.3 Minimum Submission Requirements

1. To scale drawings showing location, size, specification, capacity, materials of construction, installation specifications of system components, fencing, driveway and access roads, underground

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piping and electrical layout, property lines, features such as water courses and wet lands, adjacent wells or dwellings.

2. A profile thru the process train showing existing and finished ground elevation, tops and bottoms of tanks, tops of access and maintenance covers, pumping units or wet wells, vents, control panel supports, above and below grade piping c/w inverts, high groundwater level, etc.

3. Control panel details, and enclosures, electrical line drawings completed with service, meter, disconnects, site lighting. Indicate method of electrical equipment protection from supply surges and lightning strikes.

4. Foundation, bedding, backfill and insulation details for all piping, conduit, tanks, structures, manholes, chambers etc.

5. Pump curves complete with system curves illustrating the various operating conditions for all pumping units.

6. A schedule summarizing the system components, treatment efficiencies, anticipated effluent quality and capacity in terms of usgpm and number bedroom which can be serviced by the component.

7. Tank access cover details.

8. Driveway and parking lot structure

9. groundwater monitoring well(s)

10. Provide or reference on drawings installation and start-up specifications.

11. Any and all requirements listed in the Federal and provincial guidelines for sewage treatment systems.

12. Items required in Clause6 of this specification and any other items requested by the Municipal Engineer.

7.4 Acceptable Systems

7.4.1 Collection

Reference the Municipal Specifications Section 3, Subsection 3.4 “Central Sewer Systems – Alternative Sewer Systems”

7.4.2 Pre-treatment

Settleable and floating solids separation by properly sized two-compartment septic tanks with effluent screens.

7.4.3 Treatment

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The Municipality of Chester will consider taking ownership of conventional on-site disposal systems meeting NSDEL regulations and guidelines or re-circulating sand filters as manufactured and serviced by the following companies:

a. Orenco, now sold and serviced by Atlantic Purification Systems
b. Zoeller, now sold and serviced by Acrotech Instrumentation Pumps &Controls

The selection of a treatment system shall reflect the overall development. Developments smaller than 20-single family units, shall include an analysis of conventional on-site disposal systems in clusters and compared to re-circulating sand filter treatment options. The analysis shall consider the life cycle costs to the Municipality. Systems with lower operating and life cycle costs will take preference.

Other treatment systems may be considered for addition to these specifications on application to Council, accompanied by the appropriate review fee. Council shall consider costs of operation, quality of effluent produced, and appropriateness to climatic conditions in Nova Scotia, as they compare to the treatment systems referred to herein.

7.4.4 Disposal

Where feasible treated effluent shall be discharged into suitable existing soils thru drip irrigation systems, alternatively and if approved by NSDEL disposal into a contour type drain field would also be considered acceptable. Drain field separation must meet the minimum separations for on-site systems in accordance with the NSDEL regulation

7.5 General Design and Construction Considerations

Typical specifications for re-circulating sand filters and drip irrigation systems are provided in Appendices B and C respectively. These specifications represent the Municipality's minimum requirements. These standards do not replace accepted engineering practice or Federal and Provincial regulations and guidelines.

Site Security – The entire treatment system must be enclosed in a fenced compound. The site must be protected with chain link fence and access provided with double hinged gates.

Provision for Future Expansion – The fenced area is to include areas for future expansion.

Flow Monitoring – Flow monitoring acceptable to the Municipality must be provided in the form of an ultrasonic level sensor and recorder using a weir or flume.

Remote monitoring – provide digital telephone dialer and monitoring system acceptable to the Municipality and equal to "Guard – It" as manufactured by RACO Remote Alarms and Control

Warranties and takeover – The developer must warranty the systems for three years.

Access to Tankage - Must be via hinged assess covers, complete with locking hasp. Covers and chimney sections are to be insulated.

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Location Requirements – the location of filters, tanks and chamber small meet the separation requirements for septic tanks as specified in the NSDEL regulations for on-site systems. The designer shall provide sufficient documentation to show that the proposed separations will not result in odour complaints.

Observation and sampling ports – Easily accessible sampling points on the discharge of systems shall be provided

7.6 Operation and Maintenance

7.6.1 Management –

An acceptable management plan shall be established prior to the issuance of a permit for the installation of the systems. The management plan shall include the operation and maintenance requirements for the treatment system (including frequency of service inspections, treatment standard to be met, and maintenance reporting requirements) The documents shall be provided in three ring binders complete with a table of contents.

7.6.2 User's Manual –

A user's manual for the treatment system must be developed and/or provided by the system designer at the time of the subdivision application. These materials must contain the following, at a minimum:

1. Diagrams of the system components and their location;

2. Explanation of the general system function, operational expectations, and owner responsibility;

3. Names and telephone numbers of the system designer, the Approving Authority, component manufacturer, supplier/installer, and/or the management entity to be contacted in the event of a failure;

4. Specifications of all electrical and mechanical components installed;

5. Information on the maintenance requirements of the system and service item schedule for but not limited to septic tanks, dosing and re-circulating tanks, sand filter unit, pumps, switches, alarms, disposal system, etc. ;

6. Information on "Trouble-shooting" common operational problems that might occur. This information should be as detailed and complete as needed to assist the system owner to make accurate decisions about when and how to attempt corrections of operational problems, and when to call for professional assistance.

7. Information on the procedures for filter media replacement and disposal.

8. For proprietary devices, a complete operation and maintenance document must be developed and provided by the manufacturer. The document must include all the appropriate items mentioned above, plus any additional general and site-specific information useful to the system owner, and/or the maintenance provider. A copy of this document must also be provided to the Municipality prior to the issuance of a subdivision approval.

9. Minimum Maintenance Schedule – In tabular form provide maintenance requirements for the treatment and disposal systems.

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7.6.3 Warranty schedule –
At a minimum, the following service items must be completed by a manufacturer's representative (with the assistance of Municipal staff) at six, twelve and twenty four months after the system is put into use. A report including the following parameters shall be forwarded to the Municipality.

Inspect septic tank for structural integrity, effluent filter, evidence of ground water intrusion, and proper sizing. Inspect and clean the effluent filter and pump the septic tank as needed.
Inspect tanks for structural integrity, clean the screened pump vault, and inspect and clean the pump switches and floats. Pump the accumulated sludge from the bottom of the tank if necessary.
Inspect and test for malfunction of electrical equipment such as timers, counters, control boxes, pump switches, floats, alarm system, junction box, or other electrical components, and repair as needed.
Check floats for improper setting or failure.
Check monitoring ports for ponding.
Evaluate laterals for residual pressure at the distal ends, equal distribution, and need for cleaning.
Inspect the pumps and basins for infiltration, structural problems, and improper liquid level. Check for pump malfunctions, including problems related to dosing volume, pressurization, breakdown, clogging, burnout, or cycling. Pump the accumulated sludge from the bottom of the pump basin if necessary.

7.6.4 Warranty Period -
When inspections or any other observation reveals a failing system; or a documented history of long-term, continuous ponding of wastewater within the systems, the Developer must take one of the following actions:

Repair or modify the system;
Expand the system; or
Reduce the wastewater strength or hydraulic flows at the source.

APPENDICES

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(A.1) Blasting shall be conducted in a manner which conforms to Municipal Bylaws and Provincial Regulations.

(A.2) A contractor must provide evidence that a pre-blast survey, addressing all affected properties have been conducted by the contractor's insurers. The contractor shall also provide evidence of insurance in accordance with GC-20 of the Standard Specifications for Municipal Services. The policy shall be in the joint names of the Contractor and the Municipality and include a blasting endorsement.

(A.3) A contractor shall employ a qualified blasting consultant to monitor blasting operations throughout the duration of the blasting.

(A.4) Appropriate seismographic equipment shall be used for blast monitoring.

(A.5) Permissible blasting tolerances:

a) peak particle velocity of less than 0.5 inches per second and;

b) air shock waves of less than 120 decibels.

These tolerances are the maximum permissible. Should blasting operations result in damage or disturbance to private property, the Contractor shall adjust operations to mitigate these effects. In addition the Municipality shall be notified of such damage or disturbance no later than 24 hours after the occurrence.

(A.6) Drilling or blasting operations shall not be conducted between the hours of 8:00 o'clock in the forenoon and 6:00 o'clock in the afternoon (Monday-Friday inclusive).

(A.7) A copy of all blasting data obtained from the site seismographic monitoring shall be submitted to the Municipality on a weekly basis.

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PART 1 - GENERAL

1.1 Description

This Section specifies requirements for labour, equipment, engineering, furnishing, testing and installing Re-circulating Sand Filters (RSF).

The intent is that the RSF systems, their controls and components be designed, supplied and commissioned by a company experienced in the use of RSF for the disposal of waste water. The responsibility for the proper installation, commissioning, operation and functioning of the system shall lie with that company. The intent is that the components will be installed and commissioned prior to Municipal acceptance.

1.2 References

1. CSA C22.2 No.100 Electric Motors and Generators
2. CEMA MG1 for Motors and Generators.
3. Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
4. ASTM C117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
5. ASTM C136-84a, Method for Sieve Analysis of Fine and Coarse Aggregates
6. ASTM D422-63(1990), Method for Particle Size Analysis of Soils
7. ASTM D4318-84, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
8. CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.
9. CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire.
10. CAN/CSA-B182.1-M87, Plastic Drain and Sewer Pipe and Pipe Fittings
11. NEMA Enclosures.

1.3 Shop Drawings

Submit shop drawings for all equipment in this section, in metric units, with imperial units in brackets, including:

1) General layout and dimensional drawings of all pipe, equipment assemblies and components.
2) Materials of construction
3) Locations and types of gauges, valves and control valves.
4) Supports and anchor requirements.
5) Head / Discharge, efficiency, rpm and performance curves for pumps clearly indicating operating point and any limitations to operation.
6) Motor sizes, electrical loads and electrical schematics.
7) Control panel, panel wiring, system logic and Electrical Single Line diagrams
8) Instrumentation equipment
9) Provide NS P.Eng stamp on pre-engineered units.

Submit shop drawings for all components, aggregate and granular material, PVC liner and septic tanks.

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1.4 Samples

Inform the Consultant of proposed source of aggregates and filter media. Submit to Consultant sieve analysis test result for proposed RSF media (one per 50 tonnes or part thereof) at least 1 week prior to commencing work. For filter media / sand, mark Uniformity Coefficient and D10 Effective Size on the sieve analysis.

Provide supplier certification that each load of material delivered to site meets grain size distribution specified herein. If grain size distribution does not meet these specifications, obtain certification from Approved System Supplier, that the non conformance is suitable for this application.

1.5 Maintenance Material and Spares

Provide, in the maintenance manuals, a complete list of recommended spare parts and lubricants for use on the equipment supplied, including the intended components to which they apply. Storage and shelf life requirements and the name and address of local suppliers.

- Supply spare parts for any component supplied which would require replacement as part of regularly scheduled maintenance within the first two years of service.

- Supply three spare disconnect fuses and one spare of each different fuse supplied with the equipment.

1.6 Warranty

The Developer shall provide a security for a three year duration in a form acceptable to the Municipality covering all design, construction and manufacturing malfunctions related to the equipment supply and installation including any and all mechanical, electrical, instrumentation components within any system.

The warranty shall include treatment performance. Any system not meeting the manufacturers stated performance shall constitute grounds for the Municipality to cash the Developers security.

1.7 Qualifications

Equipment selected for the system shall only be from companies who maintain services and parts departments from which service, repairs and replacements may be obtained quickly at all times. Mechanical aspects of the equipment offered shall have been tried and tested by actual construction and operation of mechanisms of the exact type comparable size and operating in similar service for a period of at least five years.

- Equipment used in the system shall be designed and built for the intended service. Each piece of equipment shall be complete in every respect and shall include every part necessary for the highest degree of strength, durability, convenience of maintenance and reliability. Materials of construction shall be selected for suitability for the particular duty required at this site.

- Components and assemblies shall conform to or exceed industry standards and norms.

- Equipment used in the installation shall have relevant CSA certification.

--

1.8 Documentation and Operations / Maintenance Manuals

- Provide 3 bound copies of O&M manuals, tabbed and indexed for each piece of equipment supplied and for the system as a whole. Approved shop drawings shall form a part of the manuals. Include start up and operations procedures, trouble shooting directions, repair directions, recommendations on scheduled replacement and maintenance requirements and any other requirements to operate and maintain the system in the best possible working condition.

- Provide a marked-up set of drawings to serve as record drawings for the completed work, reflecting construction / installation alterations from the contract drawings or shop drawings.

1.9 Supervision, Commissioning and Training

- Provide supervision for installations directly affecting the proper functioning of equipment supplied under this section but performed by others. Direct, inspect and certify these aspects of the work undertaken by others.

- Commission the components of the equipment supplied under this section and the system as a whole. Provide a factory-trained technician to inspect the installation, make final adjustments, and certify and commission the equipment when the system, plant piping and other related components are ompleted.Test, adjust and retest equipment and the system as often as it takes to provide a complete, integrated and functioning system. Return to site to trouble shoot the equipment and system if problems arise after commissioning.

- Provide a minimum of one day's training to the Municipality's operators of the RSF system on the operation and maintenance requirements of the equipment. This training shall be in the field, hands on training and shall cover, but not be limited to, issues such as adjustments, repairs, scheduled maintenance and technical training in the use of control functions of the control panel.

- Provide a Certificate of Installation to the Engineer when the equipment and system has been satisfactorily installed.

1.10 Approved System Supplier

The proponent shall submit for review and approval adequate documentation supporting the selected system manufacturer and supplier.

1.11 Environmental Approval

Provide technical process information and projected performance as may be required by environmental agencies.

1.12 Performance Requirements

The system is required to provide polishing treatment to a septic tank effluent from domestic waste water.

For residential applications the BOD5 should be estimated to be 230 mg/l.

The system shall reduce BOD and SS concentrations to levels suitable for the disposal system or option. Regardless of the influent quality, an RSF effluent with a quality of 10/10 BOD/SS will be acceptable.

PART 2 – DESIGN

2.1 General

The system will comprise a number of components supplied by Approved System Manufacturer and Supplier in keeping with their design principles and recommendations. It is anticipated that components such as pipe exterior to the bed, granular material and septic tanks would be obtained locally in accordance with the design drawings and the Approved System Manufacturer and Supplier recommendations.

--

2.2 Recirculation Ratio

Shall fall within the range of 3:1 to 5:1

2.3 Recirculating Tank

The tank volume shall be equal to 150% of the daily wastewater design flow rate. If other tank volumes are proposed then the designer shall support the selected volumes with calculations.

2.4 Re-circulating Pump

The re-circulating pump shall be sized on the average daily flow, recirculation ratio, number of cycles, duration of cycle and anticipated backflow.

The pump shall be controlled by both adjustable timers and float switches.

All systems shall be equipped with two pumps in the re-circulating chamber.

2.5 Filter Bed Sizing

Provide a multi-cell configuration for all systems.

2.6 Filter Bypass

The sand filter shall be designed with a bypass that allows for filter maintenance in the event the filter clogs.

2.7 Design Calculations

Calculations shall be submitted to confirm the above and to confirm pipe sizing and pump selection.

2.8 System Freezing

The designer and manufacturer shall include all measures to ensure the system does not freeze.

PART 3 – MATERIALS

3.1 General

The system will comprise a number of components supplied by Approved System Manufacturer and Supplier in keeping with their design principles and recommendations. It is anticipated that components such as pipe exterior to the bed, granular material and septic tanks would be obtained locally in accordance with the design drawings and the Approved System Manufacturer and Supplier recommendations.

--

3.2 Granular Materials

Pea Gravel & Washed Rock

Pea Gravel and Washed Rock shall be composed of crushed or uncrushed, screened rock. Materials for Pea Gravel and Washed Rock shall consist of hard, durable stone particles, in conformance with this specification. Pea Gravel and Washed Rock shall be free from flat, elongated or other objectionable pieces and shall be approved by the Approved System Manufacturer and Supplier representative and / or Consultant prior to utilization. Material shall be delivered to the site well washed

Gradation: Pea gravel and washed rock shall be tested in accordance with ASTM C 117 and C 136. Washed rock shall conform to the gradation requirements listed in Table 1 and Pea Gravel shall conform to the gradation requirements listed in Table 2.

Table 1 - Washed Rock Gradation

Sieve size, mm	Percent Passing
25 (1” sieve)	100
19 (3/4" sieve)	90-100
9.5 (#3/8" sieve)	0-40
4.76 (#4 sieve)	0-10

Table 2 - Pea Gravel Gradation

Sieve size, mm (Sieve #)	Percent Passing
12.5 (1/2" sieve)	100
9.5 (3/8" sieve)	50 - 100
4.76 (#4 sieve)	6 - 84
2.38 (# 8 sieve)	0 - 24
1.19 (#16 sieve)	0 - 1
0.59 (#30 sieve)	0 - 1
0.149 (#100 sieve)	0 - 1

--

Physical Properties

Pea Gravel and Washed Rock shall conform to the properties listed in Table 3.

Table 3 - Physical Properties

Property	Test Method	Acceptable Value
Absorption, % max.	ASTM C 127	1.75
Micro-Deval, % max.	DOT&PW, TM-1	25

Filter Media

Filter media shall meet the gradation requirements listed in Table 4. It shall have a Uniformity Coefficient C_u = 2 (+/- 1) and an Effective D_{10} size of 2 (+/- 0.5mm)

Media must be from natural local (Nova Scotia) available sources.

Table 4 - Filter Media Gradation

Sieve size, mm (Sieve #)	Percent Passing
9.5 (3/8 sieve)	100
4.76 (#4 sieve)	70 - 100
2.38 (# 8 sieve)	5 - 78
1.19 (#16 sieve)	0 - 4
0.59 (#30 sieve)	0 - 2
0.297 (#50 sieve)	0 - 1
0.149 (#100 sieve)	0 - 1
0.074 (#200 sieve)	0 - 1

--

3.3 Components (per each RSF)

1. Effluent filter.

2. Pumps - Duplex effluent pumps in biotube pump vault with filter cartridge controlled by 3 float switches. Connect pump cables in accordance with NSPI specifications. Pump discharge pipe to be PVC Sch 40 with welded socket fittings including a PVC ball valve isolation valve and PVC check valve for each pump.

3. Access Risers – minimum 750 mm diameter c/w insulated gaskted lid which can be accessed via pad lockable hasp (s) For distributing valve riser, include 50 mm thick rigid insulation around the riser. For pump risers, include splice box. Tank risers to include riser tank adapters, preferably cast into the tank opening (fixing with stainless steel Hilti anchors and neoprene gasket – watertight, acceptable alternate) c/w two part adhesive for bonding and sealing risers watertight. Where pipe and conduit passes through risers, use water tight pipe grommets.

4. Pipe

    1. Pressure – Appropriately sized PVC Schedule 40.

    2. Gravity – 100 mm PVC DR 28 perforated, or Class 125 PVC – slotted with 6.5 mm wide slots at 100 to 150 mm c/c in the under drain zone

5. Plastic Membrane - 30 mil PVC liner with heat welded seams and pipe boot flanges welded to liner where pipe penetrations occur.

6. Control Panel & Enclosure –

    Where acceptable to NSP enclose all controllers and instrumentation in a PVC or stainless steel NEMA 4X enclosure, mounted on 200 x 200 mm pressure treated posts adjacent to pump chambers. The control panel shall be mounted inside the enclosure and be suitable for alternating 2 pump control c/w motor contactors, DIN rail-mounted, ON/OFF pump circuit breakers with thermal magnetic trip, current sensor, control relays as required, pump fail indicator light c/w manual reset, remote alarm, test switch, self adjusting panel heater, green pump run light, power light, elapsed time meter for each pump, event counter and surge arrestor. The enclosure shall also be sized to enclose flow metering and telephone dialing equipment.

3.4 Side Support (Shoring) for bed construction

Marine Grade Plywood – 20 mm thick.

3.5 Rigid Board Insulation

CAN/CGSB 51.20-M, Type 4, Rigid, closed-cell, expanded Polystyrene; DOW- SM. Provide insulation 50 mm thick in riser lids and around distributing riser sides. For buried pipe less than 1.2 m of cover, provide 25mm thickness per each 300 mm or part thereof less than 1200 mm. Provide inverted U as shown on the drawings where pipe has less than 300 mm cover.

3.6 Septic Tanks

Pre-engineered, pre-cast concrete, watertight. Provide pipe connections by cast in wall gaskets. Co-ordinate riser openings and risers to ensure adapters are built-in at the time of the pour.

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3.6 Alarms

Provide a NEMA 4 red flashing light unit (push to silence) and an intermittent 80 dB warble tone horn (push to silence) as part of the panel logic to sound and flash in response to the panel alarm. Mount these units on the pump support posts. A general system failure or high-high water level should initiate the panel alarm and telephone dialer.

PART 4 - EXECUTION

4.1 General

The layout and installation of the RSFs is to be as shown on the drawings. Installation shall be under the direction, guidance and instruction of the Approved System Manufacturer and Supplier.

Co-ordinate mechanical, electrical and instrumentation connections. Carry out installations in a workmanlike manner and take precautions to ensure proper alignment of equipment, pipe connections and preset openings.

4.2 Liner

Liner shall be protected by a minimum of 150mm envelop of sand.

4.2 Site Grading

The final grades around the perimeter of all system components shall slope away over a distance not less than 2.0 meters and at a depth of not less than 150 mm.

4.3 Tanks

After the tanks are installed, the pipes are connected and the risers installed, and before backfilling, cap pipe connections, supply and fill each tank with uncontaminated water to the top of the riser. Let sit for 6 hours (or less if leaks are evident) and check for leaks. Seal and repair leaks and retest. Continue this process until tanks and connections are leak free.

4.5 RSF System

1. Install filter liner, bed, boots, pipe, media, components, orifice plates, valves, valve hats, risers, distributing valves, fittings and appurtenances in accordance with the drawings and in accordance with Approved System Manufacturer and Supplier requirements and recommendations.

2. Install pumps, pump controls, re-circulating valve and bio-tubes in accordance with the manufacturer's recommendations. Install each pump control panel fastened two 200x200 wolmanized timber posts so that panels are about eye height.

3. After the installations are completed and power supplied, fill each pump chamber to an operational level with uncontaminated water. Test each RSF for proper operation, checking for leaks, alarms and the like.

4. Confirm the pump head and capacity. Supply temporary pressure gauges and the like, as required to perform the tests.

4.6 Completion

Complete the system in accordance with Clause 1.9. Supervision, Commissioning and Training.

END OF SECTION

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STANDARD DETAIL DRAWINGS

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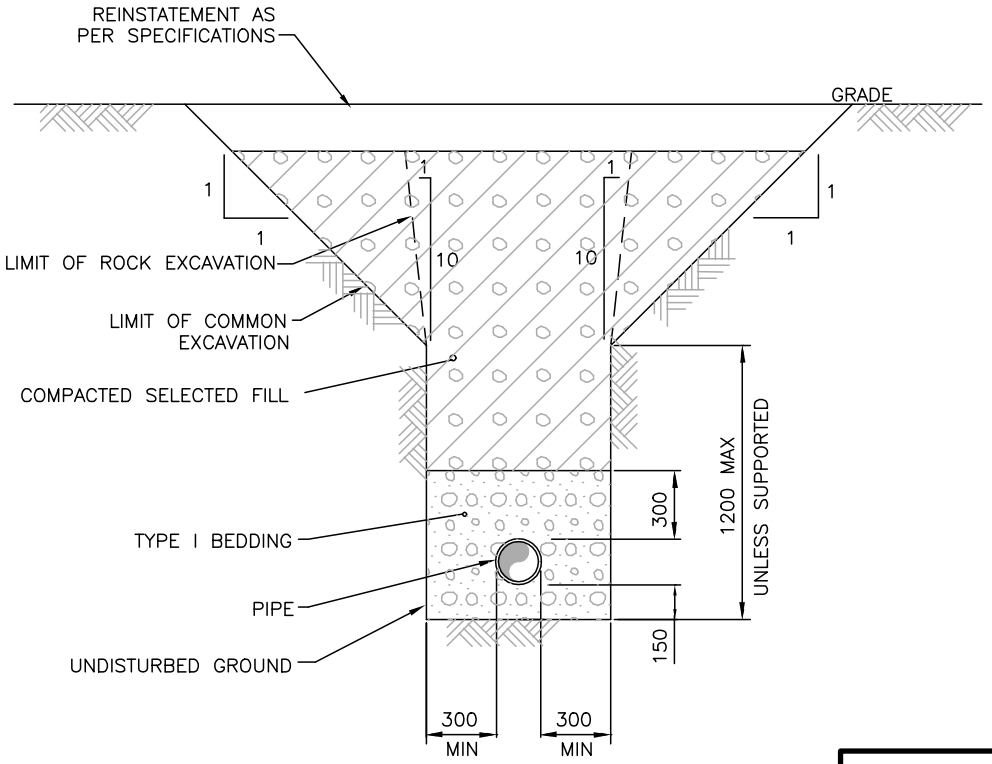


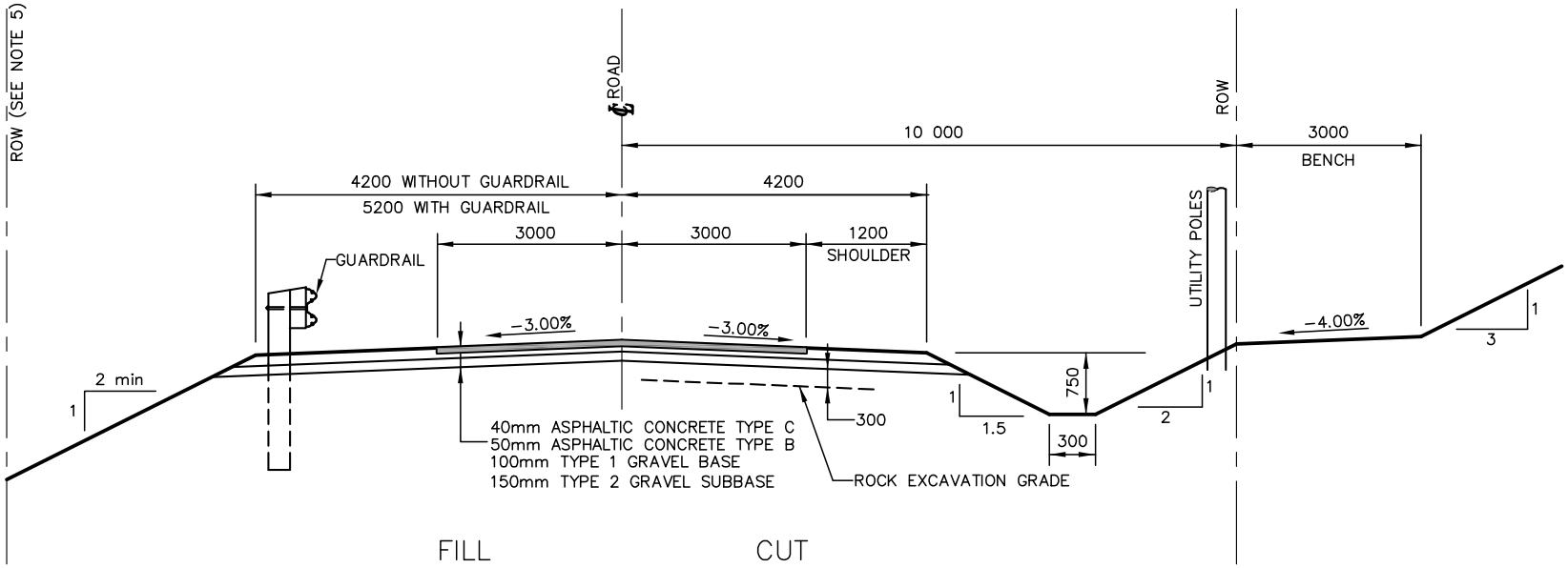
NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS.

Municipality of Chester

Typical Trench Detail

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager
Dwg. No. 1	Not to Scale	Drawn By: CTP



Notes:

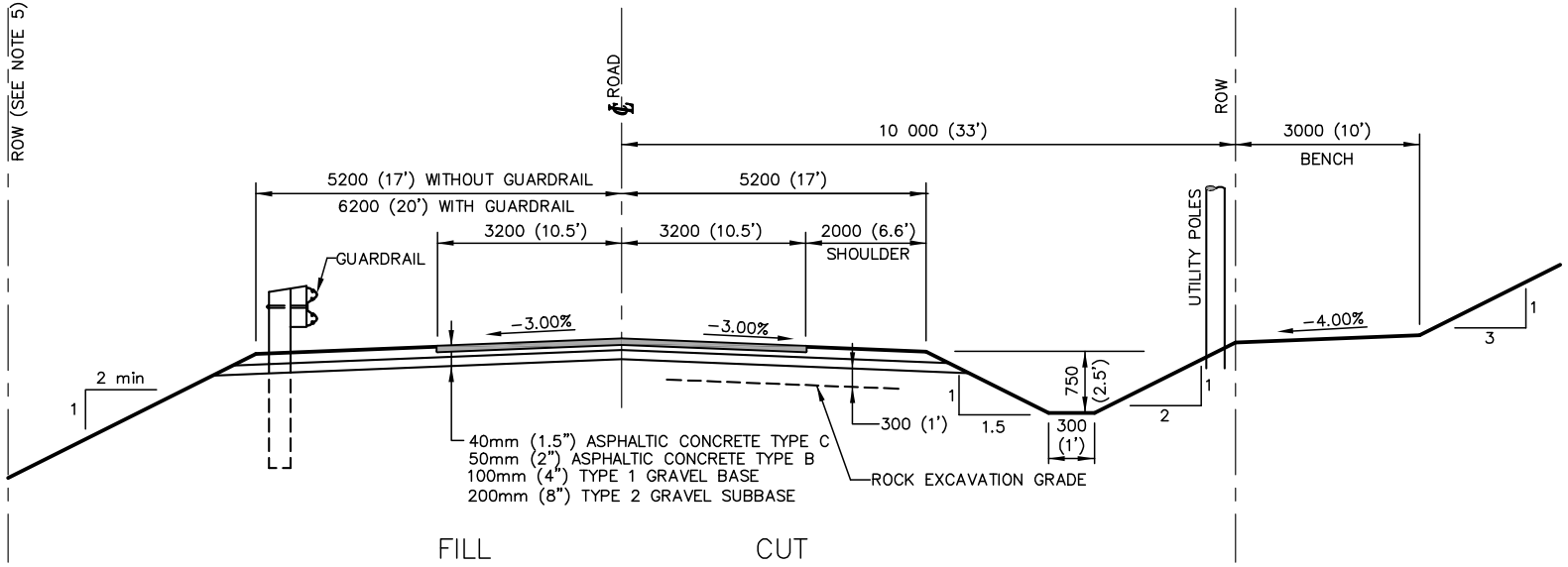
1. All dimensions are in millimeters.
2. Provide 30m taper between 4200mm and 5200mm shoulders.
3. Areas within ROW not asphalt or gravel to be hydroseeded.
4. Provide rip–rap lining at all ditches susceptible to erosion. As a mimimum, where ditch slopes exceed 5%, line with 150mm rip–rap.
5. Right of way to include fill slopes and any drainage works.
6. Side embankment slopes illustrated are minimums. More gentle slopes shall be required for less stable materials.
7. Provide additional road bed and slope stabilization as required by Geotechnical Report.
8. On sections where sidewalk may be required in the future, the shoulder width shall be increased by a minimum of 1000mm, or as otherwise required by the Engineer.
9. Gravel and asphalt thicknesses are minimums measured after compaction to specified densities.

Municipality of Chester

Typical Cross–section Rural – Low Volume

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 2	Not to Scale	Drawn By: CTP



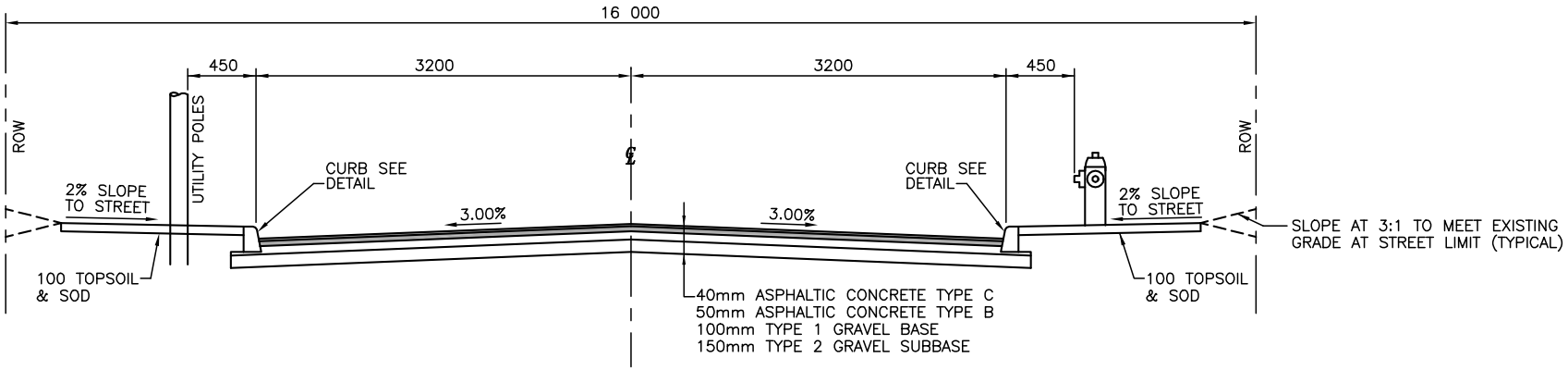
Notes:

1. All dimensions are in millimeters.
2. Provide 30m taper between 5200mm and 6200mm shoulders.
3. Areas within ROW not asphalt or gravel to be hydroseeded.
4. Provide rip–rap lining at all ditches susceptible to erosion. As a minimum, where ditch slopes exceed 5%, line with 150mm rip–rap.
5. Right of way to include fill slopes and any drainage works.
6. Side embankment slopes illustrated are minimums. More gentle slopes shall be required for less stable materials.
7. Provide additional road bed and slope stabilization as required by Geotechnical Report.
8. On sections where sidewalk may be required in the future, the shoulder width shall be increased by a minimum of 1000mm, or as otherwise required by the Engineer.
9. Gravel and asphalt thicknesses are minimums measured after compaction to specified densities.

Municipality of Chester

Typical Cross–section
Rural – Local 50 km/h

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager
Dwg. No. 3	Not to Scale	Drawn By: CTP



Notes:

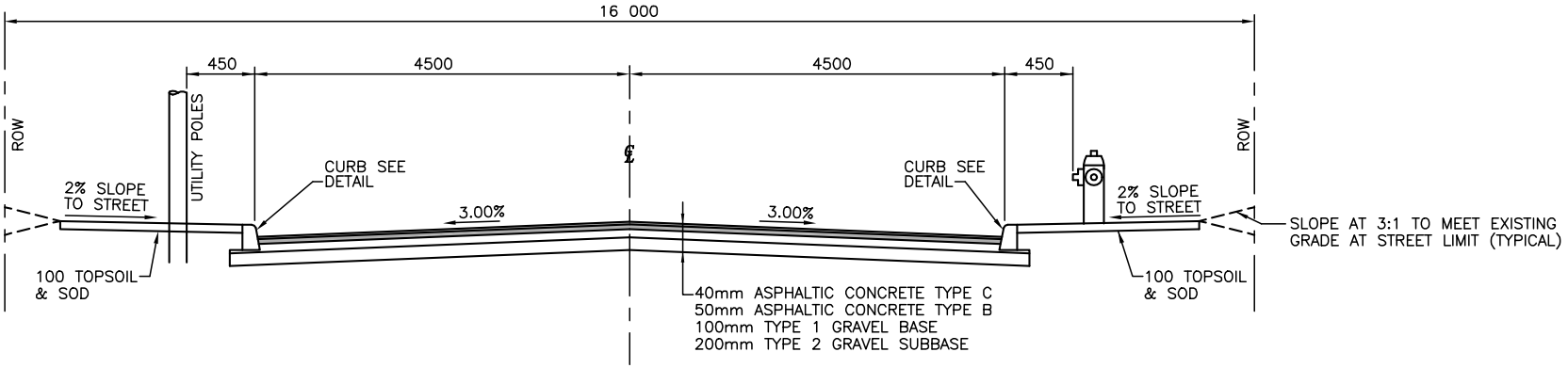
1. All dimensions are in millimeters.
2. Provide additional road bed and slope stabilization as required by Geotechnical Report.
3. Provide 1500mm wide sidewalk where directed.
4. Curb to NSRBA/NSCEA specification No. 02630–02
5. Concrete: 35MPa, 0.4 water to cement ratio, 5% to 8% entrained air.
6. Gravel and asphalt thicknesses are minimums measured after compaction to specified densities.

Municipality of Chester

Typical Cross–section
Urban – Low Volume

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 4	Not to Scale	Drawn By: CTP



Notes:

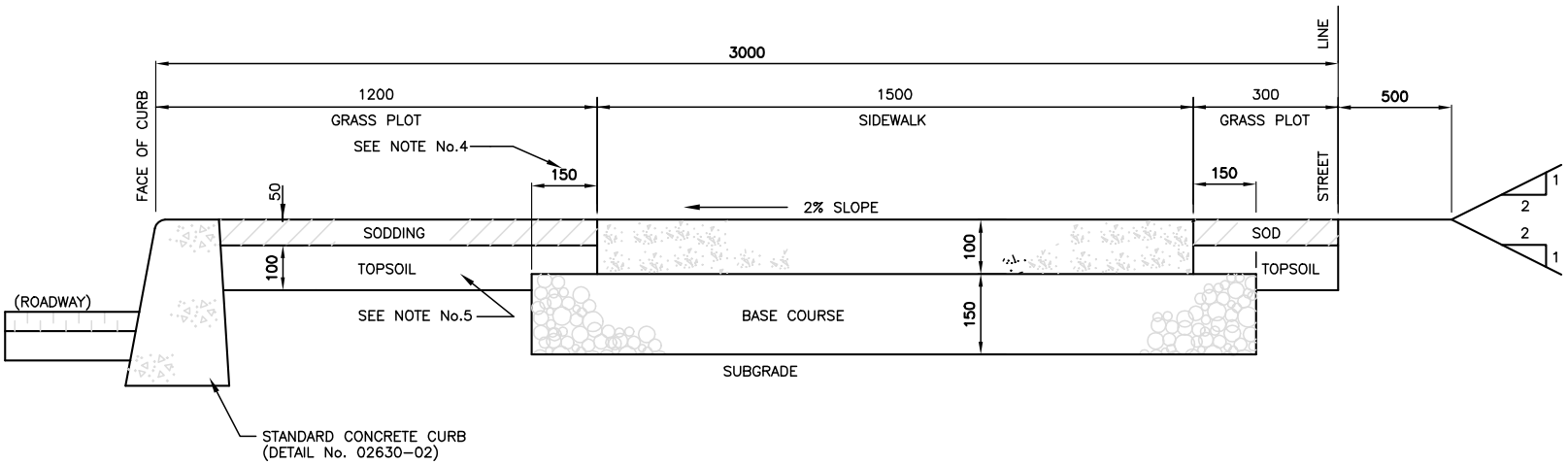
1. All dimensions are in millimeters.
2. Provide additional road bed and slope stabilization as required by Geotechnical Report.
3. Provide 1500mm wide sidewalk where directed.
4. Curb to NSRBA/NSCEA specification No. 02630–02
5. Concrete: 35MPa, 0.4 water to cement ratio, 5% to 8% entrained air.
6. Gravel and asphalt thicknesses are minimums measured after compaction to specified densities.

Municipality of Chester

Typical Cross–section
Urban – Local 50 km/h

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 5	Not to Scale	Drawn By: CTP



NOTES

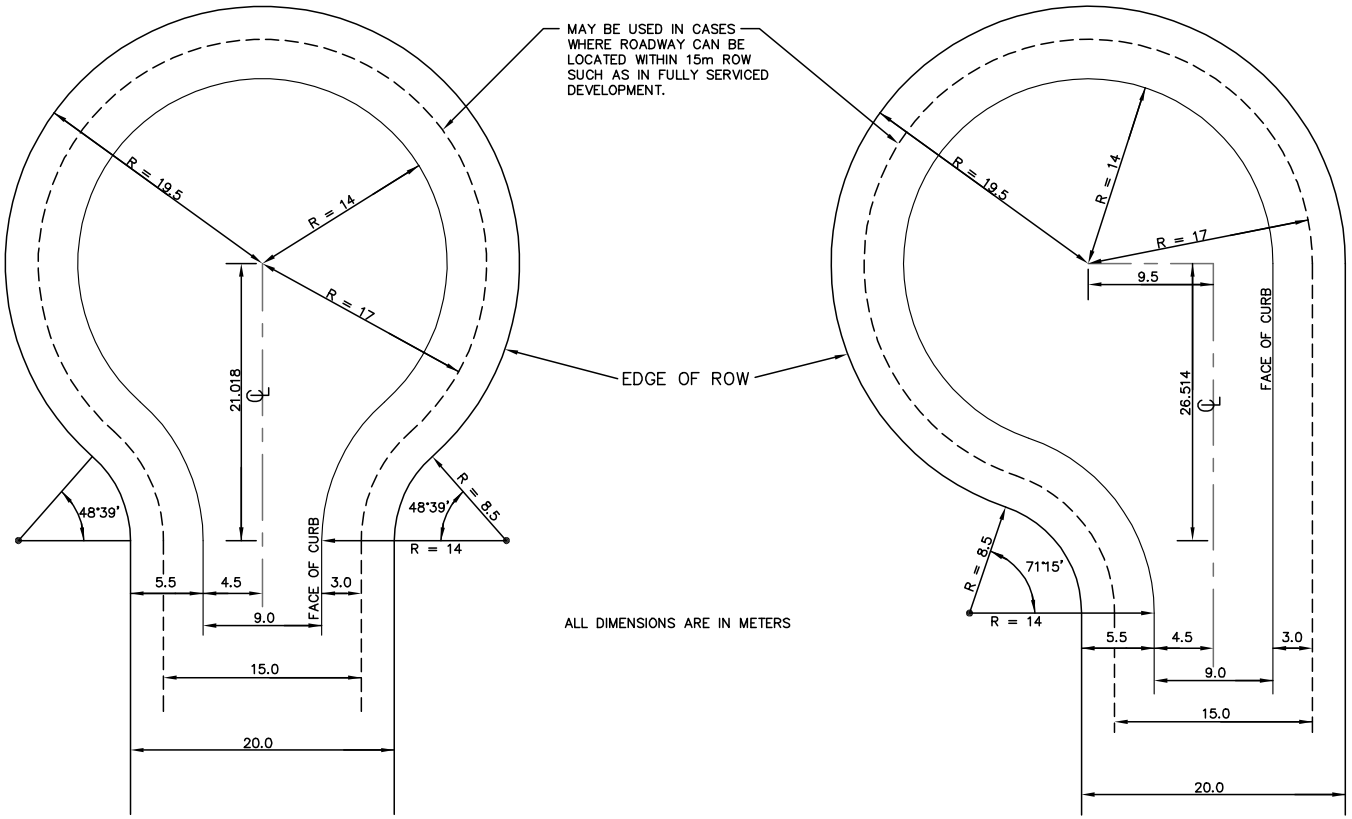
1. NORMAL THICKNESS OF CONCRETE SIDEWALK TO BE 100.
2. THICKNESS OF CONCRETE SIDEWALK THROUGH DRIVEWAY AREA TO BE 150.
3. 152 x 152 M.W. 18.7 x M.W. 18.7 (WELEDE WIRE FABRIC) TO BE USED IN ALL COMMERCIAL TYPE DRIVEWAYS.
4. THE BASE COURSE SHALL EXTEND 150 MINIMUM ON EACH EDGE OF THE SIDEWALK STRUCTURE.
5. TOPSOIL TO BE TREATED WITH FERTILIZER AND LIME AS DETAILED IN SPECS.
6. SIDEWALK ABUTTING HIGH DENSITY AREA SHALL HAVE FULL WIDTH (3.000) SIDEWALK.
7. SIDEWALK ABUTTING COMMERCIAL AREAS SHALL HAVE FULL WIDTH (3.000) AND 150 DEPTH.
8. ALL DIMENSIONS ARE MILLIMETERS.
9. CONCRETE: 35MPa, 0.4 WATER TO CEMENT RATIO, 5% TO 8% ENTRAINED AIR.

Municipality of Chester

Typical Sidewalk Section

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 6	Not to Scale	Drawn By: CTP

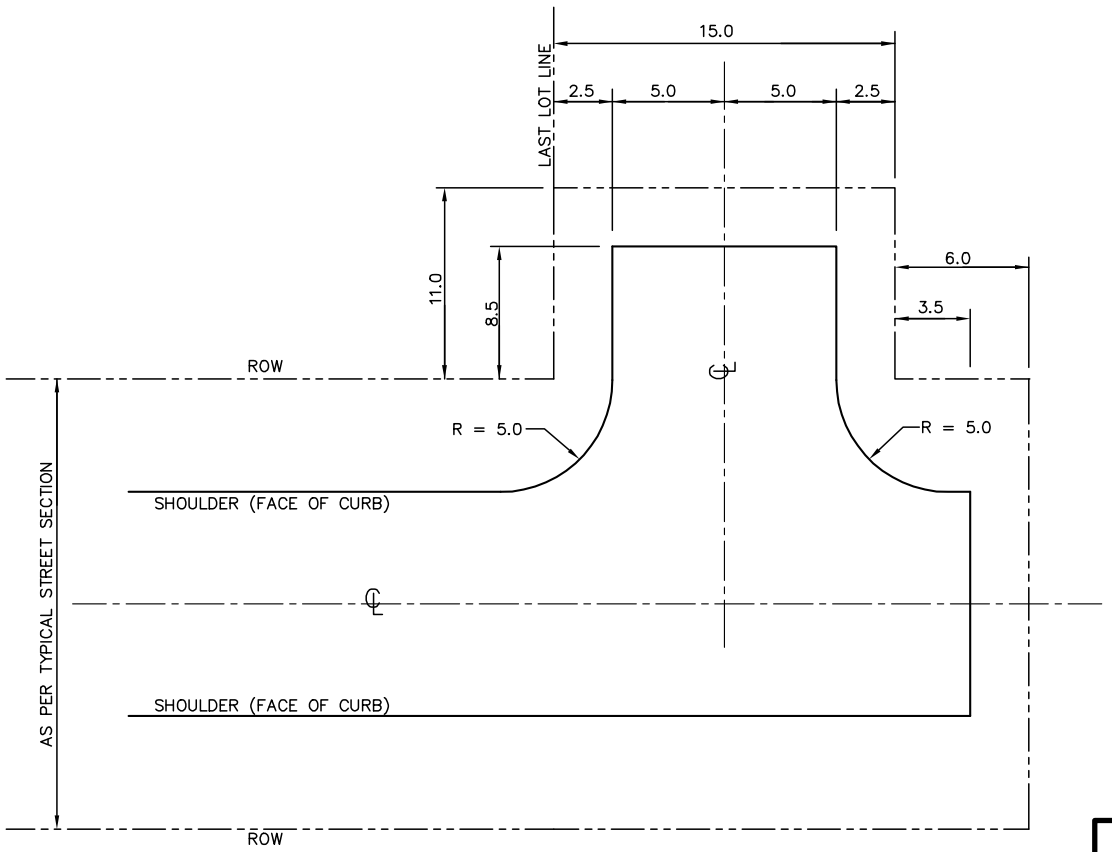


Municipality of Chester

Standard Cul-de-sacs

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 7	Not to Scale	Drawn By: CTP



NOTES:

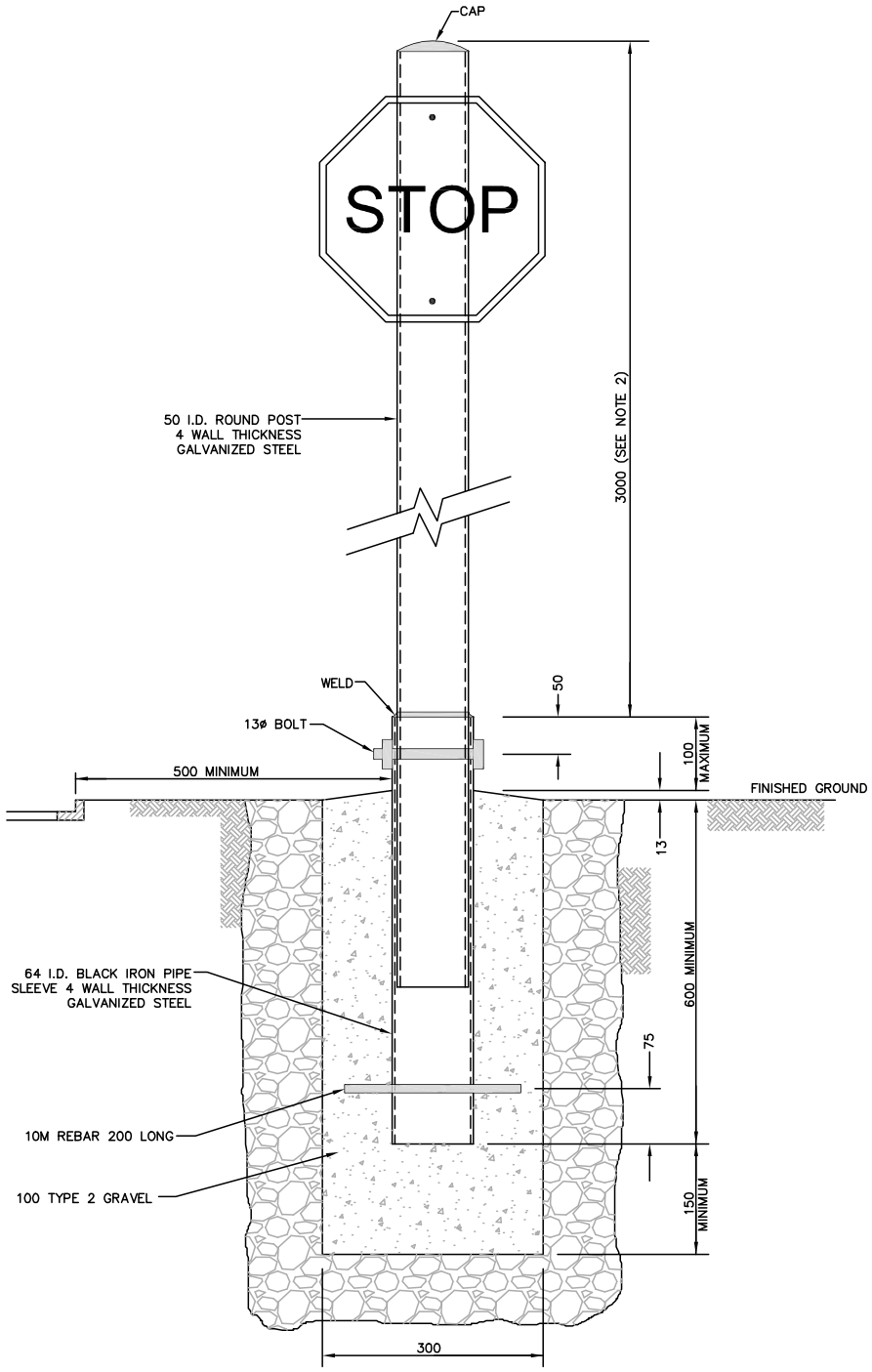
1. TEE TO BE ON LEFT SIDE WHERE POSSIBLE.
2. ALL DIMENSIONS ARE METERS.

Municipality of Chester

Temporary Turning Tee

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 8	Not to Scale	Drawn By: CTP



NOTES:

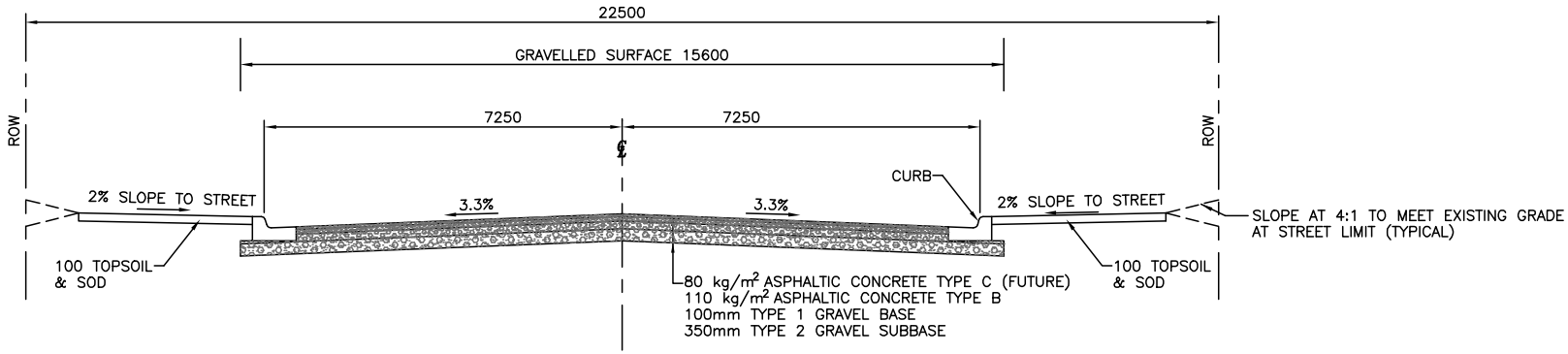
1. CONTRACTOR TO SUPPLY AND INSTALL POST OF REQUIRED LENGTH WITH BOLTS. WORKS DEPARTMENT TO WELD THE POST AND INSTALL APPROPRIATE SIGNS.
2. POSTS WITHIN OR AT INTERSECTION TO BE 3600 IN HEIGHT.
3. CONCRETE TO BE 35 MPa.

Municipality of Chester

Typical Sign Post

Approved:_____	Approved:_____
Municipal Engineer	Operations Manager

Dwg. No. 9	Not to Scale	Drawn By: CTP



NOTE:

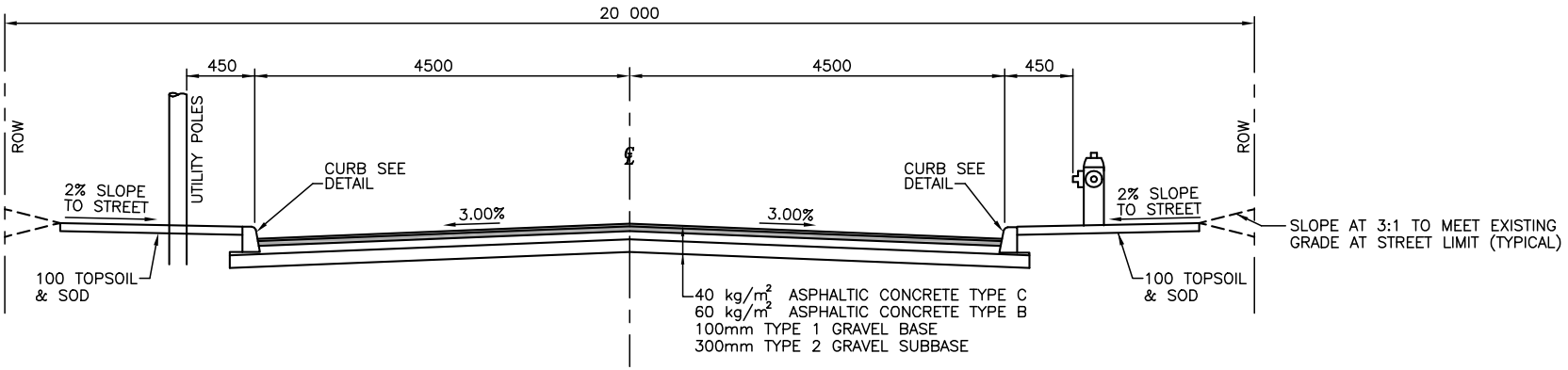
1. SUBGRADE TO BE PREPARED IN ACCORDANCE WITH CONSTRUCTION SPECIFICATONS OUTLINED IN NOVA SCOTIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR SUB-DIVISION ROADS IN URBAN AND RURAL AREAS. (LATEST EDITION)
2. GRAVELS TO BE COMPACTED TO 98% STANDARD PROCTOR.
3. ALL DIMENSIONS ARE IN MILLIMETERS.

Municipality of Chester

Typical Cross-section
22.5m ROW

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

Dwg. No. 10	Not to Scale	Drawn By: CTP



Notes:

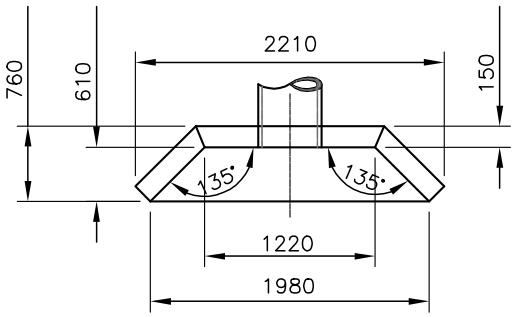
1. All dimensions are in millimeters.
2. Provide additional road bed and slope stabilization as required by Geotechnical Report.
3. Provide 1500mm wide sidewalk where directed.
4. Curb to NSRBA/NSCEA specification No. 02630–02
5. Concrete: 35MPa, 0.4 water to cement ratio, 5% to 8% entrained air.

Municipality of Chester

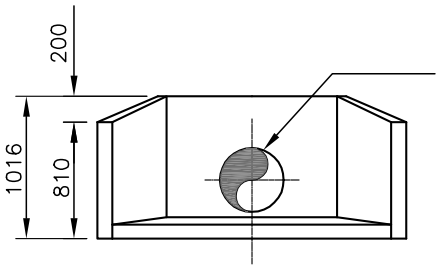
Typical Cross–section
Urban–Local Collector

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager

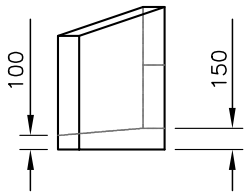
Dwg. No. 11	Not to Scale	Drawn By: CTP



PLAN



END ELEVATION



KVM CONSULTANTS LIMITED
PHONE (902) 864-2267
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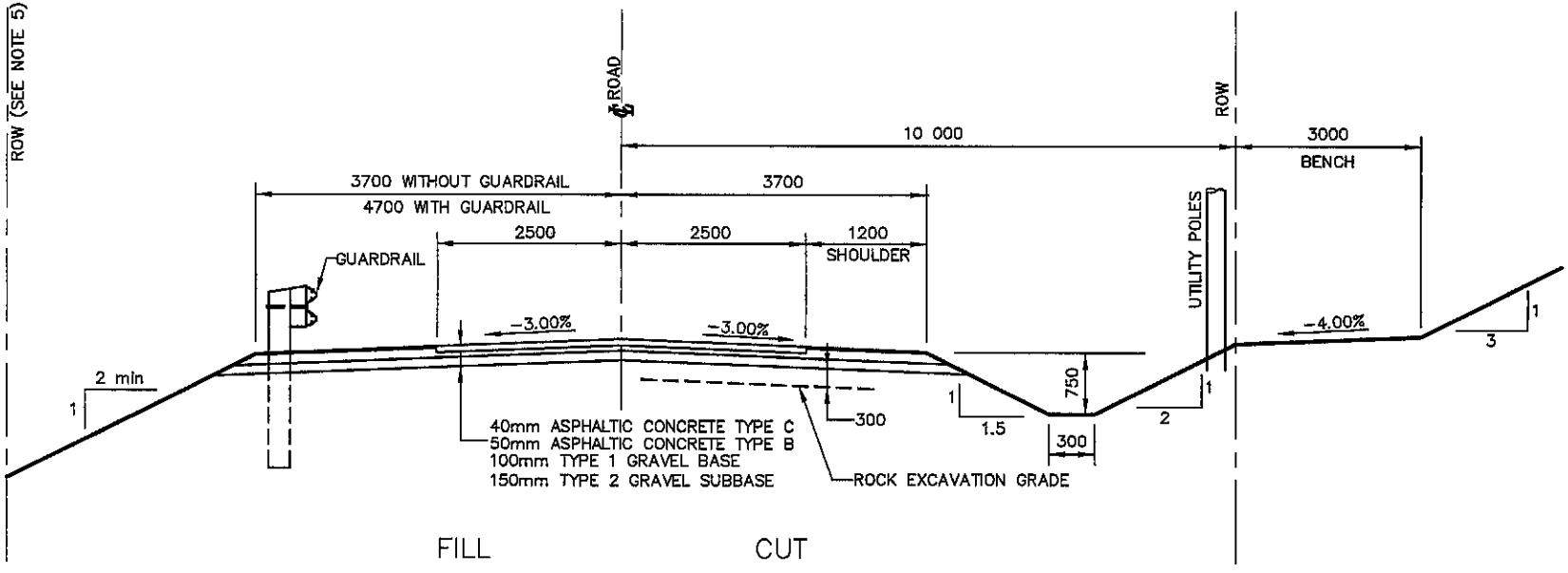
Municipality of Chester

TYPICAL DRIVEWAY CULVERT and PRECAST CONC HEADWALL DETAILS

File SD-012	NOT TO SCALE	DATE: DEC 2003



Notes:

1. All dimensions are in millimeters.
2. Provide 30m taper between 3700mm and 4700mm shoulders.
3. Areas within ROW not asphalt or gravel to be hydroseeded.
4. Provide rip-rap lining at all ditches susceptible to erosion. As a mimimum, where ditch slopes exceed 5%, line with 150mm rip-rap.
5. Right of way to include fill slopes and any drainage works.
6. Side embankment slopes illustrated are minimums. More gentle slopes shall be required for less stable materials.
7. Provide additional road bed and slope stabilization as required by Geotechnical Report.
8. On sections where sidewalk may be required in the future, the shoulder width shall be increased by a minimum of 1000mm, or as otherwise required by the Engineer.
9. Gravel and asphalt thicknesses are minimums measured after compaction to specified densities.

Municipality of Chester

Typical Cross-section
Rural – One Way Road

Approved: _____	Approved: _____
Municipal Engineer	Operations Manager
Dwg. No. 14	Not to Scale	Drawn By: CTP