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1.0 INTRODUCTION

This document is intended to detail minimum design and construction criteria for private streets within which public or municipal services are to be placed under a suitable easement agreement and for Public Streets and municipal services which are to be owned and maintained by the Municipality of the County of Richmond. These Specifications shall apply to all developments proposing new streets and associated storm water drainage systems as well as water distribution and sanitary sewer systems.

This document should be read in conjunction with "Standard Specification for Municipal Services as published by the Nova Scotia Road Builders Association, the Nova Scotia Consulting Engineers Association and the Joint Committee on Contract Documents.

These Specifications are intended to give Design Engineers and Municipal Staff guidance on the selection of criteria that will lead to cost-effective construction and reasonable annual maintenance costs. These Specifications have been prepared for setting minimum design and construction standards for Municipal Services Systems within the Municipality of the County of Richmond; to list and suggest limiting values for items upon which an evaluation of such designs will be made by the reviewing authority; and to establish uniformity of practice in the Municipality. A complete documentation of all parameters relating to the design and construction of municipal services is beyond the scope of this document; however, an attempt has been made to touch upon the parameters of greatest importance and to present the policies and accepted procedures of the Municipality.

These Specifications shall apply to all private or public developments proposing municipal sanitary sewer, water and storm drainage systems and proposed municipal streets.

The purpose of this document is to provide guidance for Design Engineers in the provision of Municipal Services meeting these criteria, but also consistent with cost effective installation, operation and maintenance. The design of these services, when submitted to The Municipality of the County of Richmond must be under the seal of a Professional Engineer in accordance with the *Engineering Profession Act. R.S., c. 148, s. 1.*

This document is not intended to eliminate the necessity for detailed design; rather it is intended to provide minimum standards for the materials, design criteria and method of construction to be utilized in the installation of municipal services. Further, it is not the intention of the Municipality to stifle innovation. Where, in the judgment of the Design Engineer, variations from this document are justified or required and where the Design Engineer can show that alternate approaches can produce the desired results, such approaches will be considered for approval. In considering requests for variations from these design criteria, the Municipal Engineer or designate, shall take into consideration such factors as safety, nuisance, system

maintenance, capital costs, operational costs, life cycle costs, environmental issues, and natural topography. All variations to these design criteria will be filed by the Municipal Engineer.

2.0 DESIGN REVIEW AND APPROVAL PROCESS

All designs for proposed public streets or private streets containing public services shall be prepared and submitted by the Developer in a suitable format to the Municipal Engineer for review and approval. Developers shall pay all costs related to preparation and submission of design documents and engagement of a qualified Design Engineer and no reimbursement for these costs will be provided by the Municipality.

Each submission shall be accompanied by an acceptable Design Brief from the Design Engineer that describes the proposed development and includes all relevant design assumptions and parameters for the proposed municipal services. The Design Brief shall also include a statement from the Design Engineer that the submission is in accordance with these Specifications except, if there are variations, the Design Engineer shall indicate clearly, in all appropriate documents and plans included with the submission, the specific variances from the design standards identified in these Specifications.

Acceptance by the Municipality of the County of Richmond of the design of proposed municipal services does not relieve the Design Engineer of the responsibility for proper design, nor does it imply that the Municipality has checked the design exhaustively for compliance with this document. The Design Engineer retains full responsibility and liability for his/her work as a Professional Engineer. Where the Municipality has accepted a design which does not comply with these standards and where the Design Engineer has not brought variations from this document to the attention of the ME, the provisions of this document stand.

All proposed municipal services shall conform to this document as well as any more stringent requirements established by other authorities having jurisdiction within the Municipality of the County of Richmond. In addition to these Specifications, and in any case where this document requires expansion or clarification, the latest revisions of all applicable and relevant codes and standards shall be used for reference by the Design Engineer. These documents include, but are not limited to, the latest editions of the following:

- "Standards Specification for Municipal Services", prepared by the Nova Scotia Road Builders Association and the Nova Scotia Consulting Engineer Association;
- "Standard Specifications" - Nova Scotia Department of Transportation and Infrastructure Renewal;
- "Specifications for Subdivision Roads in Urban and Rural Areas" - Nova Scotia Department of Transportation & Public Works;
- Subdivision By Law - Municipality of the County of Richmond;
- CSA Standards - Canadian Standards Association (CSA);
- The National Building Code (NBC) of Canada;
- "Geometric Design Standards for Canadian Roads and Streets" -Transportation Association of Canada
- "Erosion and Sediment Control handbook for Construction Sites" - Nova Scotia

Department of Environment and Labour.

All design documents prepared proposed municipal services within the Municipality of the County of Richmond shall contain a clause requiring the Applicant and the Applicant's contractors and sub-contractors to carry out all work in compliance with all applicable Municipal, Provincial and Federal Regulations, including, but not limited to, the Nova Scotia *Occupational Health and Safety act. 1996, c. 7, s. 1.*

Available recorded engineering drawings of existing municipal services that may assist the Design Engineer may be provided for information only. Design Engineers are responsible for verifying recorded information in the field prior to any detailed design.

No municipal services shall be constructed until proper design documents have been submitted by the Design Engineer and approved by the ME as part of the municipal approval process. The ME's decision shall be final and binding in matters of design and construction. No alternatives to the construction of the design are permitted unless approved in writing by both the Design Engineer and the ME. Approval of the design of the proposed development is provided in written format by the ME.

All permits and approvals from the Nova Scotia Departments of Environment and Labour and Transportation & Infrastructure Renewal or other applicable regulatory authorities shall be obtained by the Applicant before submission to the ME. Copies of permits and approvals shall be submitted by the Applicant to the ME for consideration by the ME as part of the municipal approval process.

At the earliest opportunity after receipt of Approval, a meeting between the Municipality of the County of Richmond and the Applicant and Design Engineer (or other Professional Engineer who will be inspecting the construction) shall be arranged prior to commencing construction of all services being turned over to the Municipality. Construction documents shall be submitted to the Municipality and must include all pertinent requirements stipulated in the Municipality's approval documents or required by other agencies.

Upon completion of construction, a satisfactory, reproducible copy of recorded drawings showing the location of municipal services (reviewed and revised as per the Municipality's comments) and three paper copies shall be provided to the ME.

The Municipality of the County of Richmond may periodically revise the design criteria, guidelines and specifications contained in this document to conform to advances and improvements in engineering practices. The changes will be noted in a revision record and will be available to users of this document. It is the responsibility of the Design Engineer to remain current with revisions to this document.

The Municipality of the County of Richmond reserves the right to reject a proposed development if the subject development is outside the service area of the existing public municipal services as determined by the ME.

In the situation where a Developer is proposing the installation of public municipal services on an easement to be provided by the Developer in favour of the Municipality, the following conditions related to the easement shall apply:

1. Upon completion of construction of the proposed public municipal services and confirmation of the Municipal Engineer's satisfaction, the Developer shall execute an irrevocable easement agreement in favour of the Municipality, on terms satisfactory to the Municipality, and in priority to any other interest.
2. The said easement shall provide and enable access by Municipal forces to the proposed municipal services and associated items within the easement, for purposes of operation, repair and maintenance.
3. The Developer shall have drafted and prepared, at his/her own expense, such documents as are necessary to effect and record the easement, and each of the said documents shall be subject to the Municipality's approval.
4. The Developer shall have his/her solicitor(s) provide written confirmation to the Municipality that the easement agreement creates a legally binding, enforceable easement in priority to any other interests to the property and that in all respects it has been properly and effectively registered within the Land Registration System.
5. The Developer shall be responsible for all costs related to preparing and registering the easement agreement, for legal opinions, and for any and such other legal services as the Developer may require or incur in relation to this Agreement.
6. Where the Municipality is not satisfied with the easement and / or the easement agreement, the Municipality may deny acceptance of the municipal services.
7. On completion of the above construction and installation and execution of the easement, the municipal services and associated items within the easement shall all become the exclusive property of the Municipality, together with the benefit of any warranties or guarantees on the said municipal services and associated items.
8. The Developer shall execute and provide any and all documents required by the Municipality to confirm and affect transfer of ownership of the municipal services and associated items.

3.0 SUBMISSION REQUIREMENTS

This section is intended to assist the Design Engineer, acting on behalf of the Developer to prepare a submission for the approval of municipal services. This section should be read in conjunction with the Subdivision Bylaw for the Municipality of the County of Richmond.

3.1 PROVINCIAL APPROVAL

A copy of any Approval to Construct from Nova Scotia Department of Environment for services under their jurisdiction will be required prior to Tentative Approval. An application for tentative approval of municipal services in addition to the minimum requirements of the Subdivision By-law must also conform to the following:

3.1.1 SANITARY SEWER SYSTEMS

3.1.1.1 General

Plan indicating tributary service areas, existing sanitary sewer system, and proposed sanitary sewer system. The proposed sewer system shall include: manhole locations, size of mains, flow direction, and connection point(s) to the existing system.

Technical Specifications are required and contract documents if applicable.

3.1.1.2 Gravity Systems

• Plan and profile drawings. Scale to be at least 1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').

• Cross sections and detail drawings.

• Design Brief in tabular form with the following design information:

- population density
- peak flow
- design flow
- pipe size
- slope
- minimum and maximum flow velocity
- depth of flow
- easements or right of way necessary to carry out the proposed work

3.1.1.3 Pump Station and Force main

Detail drawing for each lift station giving 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, system and pump curves.

Design information in tabular form with the following design information:

- Minimum, average, and peak flow rates;
- Pipe size and velocity in force main;
- Pump cycle time
- Easements or right of way necessary to carry out the proposed work

3.1.2 WATER SYSTEMS

Plan indicating existing and proposed water system, including pipe diameter and material, valve location, and hydrant location.

Technical Specifications are required and contract documents if applicable.

Plan and Profile drawings. Scale to be at least 1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').

Design Brief providing information in tabular form with the following design information:

- population density
- domestic demand
- fire flow requirements
- maximum and minimum static pressures under normal operating conditions
- residual pressures under fire flow conditions.
- easements or right of way necessary to carry out the proposed work

3.1.3 STORM DRAINAGE SYSTEMS

Plan indicating the contributing area, the area tributary to each inlet, and the existing and proposed storm drainage system.

A Design Brief showing the calculation of flows and required storage for retention and detention ponds.

Technical Specifications are required and contract documents if applicable.

Plan and profile drawings1:500 Horizontal (1"=50'), 1:50 Vertical (1"=5').

Cross sections and detail drawings.

Subdivision lot grading plans and plans indicating minimum basement elevations for lots, which may be prone to flooding and/or water damage.

Design Brief containing information in tabular form with the following design information:

- runoff rates at each inlet from minor and major rainfall events;
- design flow from minor and major rainfall events;
- pipe, culvert or channel size;
- minimum and maximum flow velocity from minor and major rainfall events;
- depth of flow in channels from minor and major rainfall events;
- easement or rights of way necessary to carry out the proposed work.

Assessments of impact on services from upstream development and downstream storm water capacity.

Erosion and Sedimentation control measures if applicable.

3.1.4 PUBLIC STREETS

Plan and profile drawings indicating the following:

- Existing and proposed profiles of road centre line.
- Proposed grades (%)
- Horizontal and vertical curve data sufficient to ensure compliance with these specifications.
- Detail showing proposed road cross section elements including right of way width to accommodate cut and fill operations.
- Spot elevations of any watercourse, prominent rock formation, areas subject to flooding and other natural features within or immediately adjacent to the proposed street Right of Way.
- Sizes of roadway and driveway culverts

3.2 FINAL ACCEPTANCE

3.2.1 GENERAL

Digital "as-built" drawings in AutoCAD® compatible format and reproducible "as-built" drawings stamped by a Professional Engineer with three paper copies.

Summary of service installation costs for each of the services.

Easement documentation including property description and plan.

Warranty deeds and registration costs for all property to be transferred to the Municipality, including property descriptions and plans.

Statutory Declaration indicating that all labour and materials used in the construction of the subdivision have been paid in full.

Operation and Maintenance Manuals.

3.2.2 SANITARY SEWER SYSTEMS

Video inspection and report in a format approved, in advance, by the ME.

Design Engineer approved Shop Drawings

Pipe test report

Pump Station startup report. Startup to be carried out in the presence of ME or his/her designate.

Professional Engineer's Certification of Inspection.

3.2.3 WATER SYSTEMS

Records of water distribution system hydrostatic leakage tests and certification of compliance as per NSDOE Approval to Construct.

Design Engineer Approved Shop Drawings

Professional Engineer's Certification of Inspection.

Acceptable Bacteriological test results.

3.2.4 STORM DRAINAGE SYSTEMS

Design Engineer approved Shop Drawings

3.2.5 PUBLIC STREETS

3.2.5.1 Requirements

Before the constructed roads are approved and accepted for listing, the Municipality must receive confirmation from the Nova Scotia Department of Transportation & Infrastructure Renewal that all their requirements have been met. In addition a certification shall be required from a Professional Engineer confirming the roads and drainage systems within the subdivision have been constructed in accordance with the approved specifications and plans and these Specifications. Submissions must include:

- Particle Size Analyses, Fractured Faces, Absorption, LA Abrasion, Plasticity Index and Micro-Deval for base and sub-base gravels
- Compaction tests results on sub-grade, sub-base, and base courses at a minimum of every 50 meters for each lift of material placed.
- Test results for asphaltic concrete paving, mix design, compaction results
- Test results for curb and gutter construction including tests on Sub grade, sub-base, base course materials and concrete tests.
- As-built drawings of the road construction.

3.2.5.2 Listing Procedure

When the preceding specifications have been satisfactorily adhered to, as determined by the ME, the ME then will recommend to the Development Officer that the proposed municipal street(s) be approved. The Development Officer will not approve a Final Plan of Subdivision with proposed municipal street (s) until the street (s) have been approved by the ME. It is the approval of the Final Plan of Subdivision that officially lists the street (s) in the subdivision. The request should be accompanied by six (6) copies of a final plan showing the entire subdivision, its boundaries, and road and drainage layout. The developer will also have a deed prepared deeding all rights-of-way to the Municipality.

4.0 DEFINITIONS

"Approval" means a written approval issued by the Municipal Engineer (ME). The decision of the ME will be final and binding in all matters of design and construction. However, the ME does not certify any installations, procedures, equipment, or materials nor does he/she approve or evaluate testing laboratories. Approvals will be based on compliance with these Specifications and/or other appropriate standards as indicated throughout this document. Tentative Approval and Final Approval are as set out in the Municipality of the County of Richmond Subdivision By-Law;

"Area of land" means any existing lot or parcel as described by its boundaries;

"Arterial road" means a road intended to move a relatively large volume of traffic at medium to high speeds used where traffic movement is the primary consideration and land access secondary;

"Base course" means the crushed rock or aggregate which is placed immediately upon the sub-base course;

"Collector road" means a road intended to collect traffic from local streets and move it to the arterial, used where traffic movement and land access are of equal importance;

"Department of Environment" means the Nova Scotia Department of Environment or its successors;

"Department of Transportation" means the Nova Scotia Department of Transportation and Infrastructure Renewal or it successors;

"Design Brief" means a detailed report prepared by the Design Engineer which contains a description of the proposed development as well as information on relevant design parameters for all road and associated drainage infrastructure. This document is intended to assist the Municipal Engineer with the review of the design of the proposed development.

"Design Engineer or Designer or Engineer" means the Professional Engineer representing the Applicant, who has affixed his/her professional seal to the engineering drawings, plans, and specifications for the proposed development and/or is the Professional Engineer who is responsible for ensuring the services are constructed to meet and satisfy the approved design. This person must be registered with the Association of Professional Engineers of Nova Scotia and/or licensed to practice engineering, and must be in good standing in the Province of Nova Scotia;

"Developer or Applicant" means the owner of the area of land on which public municipal services are proposed and includes anyone acting on his/her behalf with his/her written consent;

"Diameter" means the nominal internal diameter of the pipe unless noted otherwise;

"Drainage plan" means a detailed Storm Water Management plan, including, but not limited to drawings and calculations of storm water runoff and the catchments, drainage courses and channels, including floodplains and wetlands, for one or more parts of an area of drainage for all lands tributary to, or carrying drainage from.

"Floodplain" means the low lying area adjoining a watercourse that is subject to flooding, as defined in the *Municipal Government Act* and includes:
"Floodway" meaning the inner portion of a flood risk area where the risk of flooding is greatest, on average once in twenty years (1 in 20) and where flood depths and velocities are greatest.

- "Floodway Fringe" meaning the outer portion of a flood risk area, between the floodway and the outer boundary of the flood risk area, where the risk of flooding is lower, on average once in one hundred years, and flood waters are shallower and slower flowing.

"Highway" means the whole right-of-way which is reserved for use in constructing the roadway and its appurtenances, the boundaries being determined by the Municipality of the County of Richmond.

"Inspection" means a field inspection by the Applicant's or Owner's Engineer at various stages of construction;

"Lateral" means the pipe which conveys water from foundation drainage systems to a public storm sewer on a public street;

"Local Road" means a road which has the main function of providing land access;

"Lot" means any parcel to be created by the filing of a plan of subdivision;

"Municipality" means the Municipality of the County of Richmond;

"Municipal Engineer (ME)" means, in these Specifications, where there is a reference to the ME, shall mean the ME appointed by the Municipality. The ME may, with the approval in writing of the Municipality, authorize a representative to act in his or her absence;

"Municipal Road Services Systems" include storm sewers and subdivision roads which are, or are to be, owned, operated and maintained by the Municipality;

"Professional "Engineer" means a Professional Engineer who is a member in good standing of the Association of Professional Engineers of Nova Scotia;

"Province" means Her Majesty the Queen in right of the Province of Nova Scotia;

"Provincial Regulation: means the requirements and provisions of the Province of Nova Scotia contained in any Provincial Statute or in any Regulation or Order made pursuant to the authority of any Statute of Nova Scotia;

"Public street" includes any street or road owned and maintained by the Municipality or the province; and

- "municipal public street" means any street or road owned and maintained by the Municipality; and
- "provincial public street" means any street or road owned and maintained by the Department of Transportation excluding designated controlled access highways pursuant to Section 20 of the *Public Highways act R.S., c. 371, s. 1;*
- consists of an earthen and gravel road bed, an asphalt surface and all necessary slopes, storm sewers, culverts, ditching, channels, and associated structures necessary for proper road drainage

"Public Municipal Services" include water distribution systems, storm drainage systems, sanitary sewer systems, and other services that serve more than one household and which are owned, operated and maintained by the Municipality;

"Public Sewer System" means any sewer system which is owned by the Municipality;

"Public Water System" means any water system which is owned by the Municipality;

"Public Water Utility" means the water utility owned and operated by the by the Municipality;

"Registry of Deeds" means the office of the Registrar of Deeds for the County of Richmond;

"Right-of-way easement" means an easement for right-of-way and access unrestricted in use extending to and having access to a public street, and where not totally located within the area of land proposed to be subdivided, the right-of-way easement shall be assignable and perpetual and clearly granted by deed or easement registered in the Registry of Deeds for this Municipality, or declared to exist for the benefit of the land proposed to be subdivided by order of a court of competent jurisdiction, and in either case the easement shall have a minimum width of 6.1 meters (20 feet);

"Roadbed" means the portion of the roadway extending from shoulder line to shoulder line, in other words, the sub grade and shoulders considered as a unit;

"Roadway" means the portion of highway included between the outside lines of gutters or side ditches including all the appertaining structures, and all slopes, ditches channels, waterways, etc. necessary for proper drainage and protection;

"Sanitary Sewage" means the used water from a community consisting of liquid which conveys solids from residential, industrial, institutional and commercial buildings excluding storm drainage or groundwater;

"Sanitary Sewage Collection System" consists of pipes, manholes, pumps, service laterals, equipment, buildings and structures for the collection and pumping of sanitary sewage operated by the Municipality of the County of Richmond. The system is designed to convey sewage from its point of origin to its place of disposal or treatment.

"Service easement" means an allotment of land required to maintain and repair public municipal services. In the event that storm sewers, channels, water distribution systems, sanitary sewer systems or other public services are installed outside of public rights-of-way (ROW), the applicant shall provide a service easement in favor of the Municipality. The service easement shall be constructed to provide access by maintenance vehicles including service trucks and heavy equipment.

"Sewer lateral" as used throughout this document is synonymous with Building Service Connection as defined by the Municipality. Storm sewer lateral means the pipe which conveys foundation drainage to the main storm sewer.

"Sewer" means pipe or conduit for carrying storm water or surface run-off and includes all sewer drains, storm sewer, clear water sewers and storm drains.

"Stormwater" means water from precipitation of all kinds, and includes water from the melting of snow and ice, groundwater discharge and surface water;

"Stormwater system" means a method or means of carrying storm water, including ditches, swales, sewers, drains, canals, ravines, gullies, retention ponds, streams, watercourses, floodplains, ponds, springs, creeks, streets or private roads, roadways or driveways;

"Storm sewer or storm sewer systems: means the system consisting of all pipes, mains, ditches, equipment and structures for collecting and pumping storm water and surface runoff water, excluding sewage, operated by the Municipality. It is designed to collect and convey storm runoff from its points of origin to its points of discharge into a natural drainage system;

"Street" means the entire width between the boundary lines of a street, road or highway and includes a public thoroughfare in an urban setting with buildings or residential dwellings more or less continuously housed on each side of it along its limits;

"Sub-Base course" means the crushed rock aggregate which is placed immediately upon the sub grade;

"Subdivider" means the owner of the area of land proposed to be subdivided or consolidated and includes anyone acting with the owner's written consent;

"Subdivision" means the division of any area of land into two or more parcels and includes a re-subdivision and a consolidation of two or more parcels;

"Subdivision road" means the whole right-of-way which is reserved for use in constructing the roadway including all appertaining structures, roadbed, gravels, asphalt, slopes, ditches and channels required for proper drainage and protection;

"Subgrade means the portion of the roadbed upon which the sub-base course is to be placed;

"Surveyor: means a registered member in good standing of the Association of Nova Scotia Land Surveyors;

"Wastewater" means any liquid waste containing animal, vegetable, mineral or chemical matter in solution or suspension carried from industrial sectors.

"Watercourse" means a lake, river, stream, ocean or other body of water as defined in the *Municipal Government Act;*

"Water Distribution system: means the system which includes transmission and distribution mains, pumping stations, reservoirs, water service laterals, hydrants and appurtenances which carry potable water for domestic and/or fire protection purposes as provided and controlled by the Municipality;

"Water Service Lateral" means pipe that conveys water from a water main within the street right-of-way to the street line or limit of the right-of-way and or easement;

Wearing surface" means the exposed material placed directly upon the base course which comprises the traveling surfaces.

5.0 STORMWATER MANAGEMENT

5.1 Scope

This section specifies the requirements for storm water drainage control systems that are associated with Public Streets. A stormwater system would typically receive, attenuate as required, convey and regulate flow in response to a rainfall or snow melt event which includes overland flow, sub-surface flow, and groundwater flow. In consideration of the design for a stormwater management/drainage system the following objectives are to be followed:

- Provide control measures that protect the public in that risk to life is reduced and property damage from a storm event response is minimized and/or mitigated
- Provide for safe access and egress to Public Streets including adjacent lots during a major storm event
- Maintain and preserve natural watercourses, wetlands and floodplains and their associated features through the minimizing the long term effects of development on the receiving water system
- Convey stormwater from adjacent properties and from onsite developments in a manner that mitigates adverse effects to downstream property and receiving waters
- Design such facilities to meet the requirements of the Nova Scotia Department of the Environment and Labour. No system shall be constructed until approval has been issued for the design by both the ME and the NSE.

5.2 Design Elements

5.2.1 Storm Drainage Systems

Drainage system are defined as either Minor or Major Flow Conveyance systems. A Minor Drainage System consists of road surfaces, curb and gutter, catch basins, storm sewers and manholes, foundation drain laterals, outfalls, ditches, swales, and culverts. These systems would convey the runoff response from a 1 in 5 year return frequency event over the catchment area. A major Drainage System consists of roads, gutters, ditches, roadways culverts, stormwater retention facilities, watercourses and floodplains. These elements would typically have control and conveyance characteristics for the runoff response from a 1 in 100 year storm frequency event over the catchment area.

5.2.2 Design Storms

Minor drainage systems shall be designed to accept and convey the runoff peak flow rate from the 1 in 5 year storm frequency event. The 1 in 100 year storm frequency event shall be utilized in sizing the major flow system in that ditching, roadways, engineered drainage channels and outfalls shall have capacity to accept and convey the peak flow from this return frequency.

5.3 Stormwater Management Controls

Stormwater management controls facilities typically include retention ponds, depressed parking lots, over sized channels, oversized sub-surface pipes, constructed wetlands and flood plains that are utilized to attenuate and discharge runoff in a controlled manner. Stormwater management controls are integrated within the plan of subdivision and form part of the drainage system. These facilities are typically situated upstream of the outlet from the development site. The Municipality of the County of Richmond require that stormwater management facilities be considered in urban development forms where imperviousness exceeds typical rural residential land use. All developments that consider urban sized minimum lots will be subjected to stormwater control.

Stormwater retention facilities shall be constructed with the provision for 2.0 meter high fence (Chain Link) installed around its perimeter complete with access gate. The facility shall be established with vegetation or rock lining such that erosion and slumping are mitigated. The facility shall have side slopes that can be maintained by municipal staff.

5.4 Downstream Drainage Systems

All developments including road system and their associated drainage shall consider the downstream receiving drainage feature in a manner that demonstrates that the development flow, once discharged, will not cause impacts associated with erosion, sediment deposition, flooding and increases in high flow duration. This may be achieved by either controlling the upstream discharge to pre-development flow rates (peak flow an duration) or investigating the downstream channel system and demonstrating that the development flow when combined with the flow from the downstream channel catchment does not cause and increase in erosion potential, increase in flood levels or extent of flooding. The Design Engineer shall undertake the necessary analysis to demonstrate that either condition will exists once development occurs. Mitigative measures may be required to address downstream impacts.

5.5 Precipitation Data

Intensity Duration Frequency Curves for each return frequency shall be obtained from Atmospheric Environment Service (AES) Canada for the station closest to the development site. Depending on the methodology utilized in determining the runoff response, the Design Engineer shall indicate parameters and coefficients utilized in support of peak flow determination and runoff volumes. This detail shall be submitted in the Design Brief that supports the submission and application for a road system development or appropriate plan of subdivision.

5.6 Design Methodology

In determining the drainage system and development runoff response, the Design Engineer has

many options that are acceptable to the Municipality of the County of Richmond as well as the Department of Transportation Infrastructure Renewal. The following approaches are acceptable.

5.6.1 Rational Method

The Rational Method can be applied to drainage catchments that are 260 hectares in size or smaller. It can also be applied in determining preliminary conditions for large catchments. The Rational Method is used in determining peak flow rates for various storm frequency intensities. Winter conditions must be considered when identifying worst case peak flow response.

5.6.2 SCS TR 55 Method

The Soil Conservation Service Technical Report 55, 1975 may be applied if approved by the Municipal Engineer. This approach utilizes a dimensionless hydrograph with runoff curve numbers for representative soil conditions to establish peak flow response and runoff volumes.

5.6.3 Event Based Modelling

The Municipality will also accept analysis completed utilizing an accepted computer based model that utilized IDF data as provided by AES. Some representative models include MIDUSS, PCSWMM and HYMO developed logic which assist the Design Engineer in determining and optimizing the elements of storm water routing, attenuation and controlled discharge. The Design Engineer is required to include in the Design Brief input and output including hydrographs and routing results when confirming stormwater management facility design criteria.

5.6.4 Retention Facilities

The Municipality may require the installation of a stormwater storage and control facility. When required, these facilities can be designed using the Storage - Indication Method or a Stage Storage Discharge approach.

Where a retention facility or control structure is designed into a drainage system it must be able to provide outlet control for both the minor and major storm events. The 1 in 5 year peak flow shall be controlled by an outlet control device situated at an appropriated elevation in the facility, while the 1 in 100 year peak flow can be discharged via a larger size structure or via an overflow spillway, or combination of both. The major storm flows shall discharge to a downstream receiver that has capacity to convey the discharged waters.

All stormwater management facilities shall have support documentation submitted for approval which includes operation and maintenance requirements as well as physical details including elevations, pipe sizes, perimeter fencing, vegetation outlet details. Design drawings should reflect the bulk of the detail.

5.7 Design Requirements

5.7.1 Location

Proposed stormwater drainage systems for a road and subdivision development shall not discharge onto, through and over private property. Storm drainage shall be conveyed within pipes, ditching, open watercourses or combination of these systems. Ditching and storm sewers within a roadway or subdivision shall be located within a road right-of-way or an easement that is in favour of the Municipality. The minimum width of any easements shall be 6.0 metres. Natural watercourses shall not be contained with roadside ditching or oversized roadside storm drainage systems. Watercourses that exist on development land shall be integrated into the planned subdivision and road design such that preservation is achieved.

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

5.7.2 Discharge to Adjacent Properties

All storm water runoff from subdivisions and roads shall be contained and controlled within the development property, except where a natural watercourse conveys waters from undeveloped lands across the developing lands to adjacent properties. All runoff from the developing lands shall be directed to either a natural watercourse at the appropriate controlled discharge rate or within a storm drainage system owned by the Municipality or Transportation Infrastructure Renewal.

Discharge of development runoff to adjacent properties not within a natural watercourse is only permitted if approval is granted by the NSEL, the Developer obtains in writing consent from the adjacent landowner and drainage easements in favour of the Municipality are established and filed within the Registry of Deeds.

5.7.3 Storm Sewers

Storm sewer pipes shall be designed to carry, without surcharging, the peak flow from a 1 in 5 year frequency storm event. These pipes will assist in conveying the major storm events in conjunction with overland flow routes.

Storm sewers shall be designed to provide a minimum cleansing velocity of 0.60 m/s. The maximum velocity for a storm sewer shall be 4.6 m/s for pipes up to and including 750mm in diameter. Pipes greater than 750mm diameter shall maintain velocities not exceeding 6.1 m/s .

Storm sewers shall be a minimum diameter of 300mm. Catchbasin leads are permitted to be a minimum of 250mm in diameter.
Storm sewers constructed within road right-of-ways shall maintain a minimum depth of 1.5 meters.

Manholes shall be installed within the sewer system at all changes in alignment, grade, at all intersections and on straight sections at a 150 metre interval. Manholes shall be constructed of concrete and be a minimum of 1200mm in diameter. Manholes shall meet minimum standards for concrete strength.

Storm drainage laterals from the storm sewer to the road right- of-way limits shall be installed at a minimum grade of 2.0%. Laterals are permitted to have a minimum depth of 1.0 meter. Storm laterals from residential dwellings shall be a minimum of 100mm in diameter and be PVC DR 26 material. Commercial developments may require laterals greater than 100mm in diameter. The Design Engineer shall determine the appropriate diameter.

Laterals installed in subdivision development shall be marked with a 50 x 100mm (2"x4") wood board that extends below grade and labeled as Storm with the depth to lateral indicated.

Catch basins shall be installed within the curb and gutter system or asphalt roadway at low points and at adequate spacing along curb line to prevent ponding on the streets during rainfall events equivalent to the minor storm. Spacing of catchbasins shall not exceed 100 metres. Catchbasin leads shall be connected to the storm sewer system at a manhole. All catchbasin inlets shall have suitable vertical grates to prevent large debris from entering the storm sewer system.

Storm sewer outfalls shall consider the receiving water feature and incorporate where applicable erosion protection, a headwall structure and a suitable grate to prevent public access.

5.7.4 Open Channel Drainage Systems

Roadways ditching shall be constructed in accordance with the standard cross-section for subdivision roads and shall have capacity to carry flow from the contributing drainage area under the 1 in 100 year storm frequency event. Flow velocities within ditching shall be controlled in a manner that eliminates in channel erosion.

5.7.5 Culverts

Roadway culverts shall be a minimum of 450mm in diameter and shall be installed with a minimum cover of 500mm. Culverts greater than the minimum shall be designed to convey the 1 in 100 year peak flow with a headwater depth not greater than the diameter of the culvert.

All culverts shall be either corrugated steel pipe (CSP) to CAN3-G401-M galvanized, or reinforced concrete pipe to ASTM C76-M or CAN/CSA A 257.2 as defined in the Standard Municipal Services Specifications. Alternate types may be approved by the Municipal Engineer.

5.7.6 Foundation/Roof Drains

All roofs drains shall discharge to the surface and away from the building. Roof drain connection to the storm sewers is not permitted within the Municipality of the County of Richmond.

Foundation drains shall be connected to the local storm sewer system with proper connection and alignment in accordance with standard practice. Foundations drains will maintain an elevation at the property line which is above the storm sewer elevation. Foundation drains shall not direct drainage and runoff to the street surface, sidewalk or adjoining property.

5.8 Erosion & Sediment Control

An Erosion and Sediment (E & S) control plan shall be developed and provided in accordance with the requirements of the Nova Scotia Department of Transportation and Infrastructure Renewal and the Department of Environment and Labour. The Municipal Engineer shall also be provided with a copy of this plan.

The E & S Control Plan shall identify measures that are required to control and mitigate the movement of sediment from the construction of roads, stormwater management facilities, installation of services and driveways.

During construction control of runoff shall be minimal such that flow across the construction site shall be controlled to a minimum.

The E & S Control Plan and its measures shall comply with the Erosion and Sediment Control handbook for Construction Sites as issued by the Nova Scotia Department of the Environment and Labour.

Long term environmental protection measures shall be considered in the subdivision development and completion such that the following areas of concern are addressed:

- Protection of wetlands and watercourses in accordance with the NSEL Guidelines
- Erosion and Sediment transport is minimized.
- Storm drainage outfalls are protected from scour and erosion through the application of stone armouring and vegetation establishment.
- Integration of low lying wet areas (non sensitive wetlands) for the filtration of stormwater runoff where appropriate and acceptable
- Integration of settling and deposition within stormwater control facilities to reduce sediment migration and the release of urban pollutants downstream.

6.0 PUBLIC STREETS

6.1 Scope

This section specifies the requirements for the design of all Municipal Public Streets within the Municipality of the County of Richmond. All required storm water drainage systems associated with public streets shall be designed and constructed in accordance with Section 5.0 of these Specifications.

6.2 Design Specifications

The function of locating streets and building lots relative to topographical features constitutes the practice of engineering as defined by the Engineering Profession Act of Nova Scotia. As such, the design of subdivisions and their services when submitted to the Municipality of the County of Richmond must be sealed by a Professional Engineer registered in the Province of Nova Scotia.

6.2.1 Design Standards

These Specifications cover the more common aspects of design encountered in subdivision development. In cases where these Specifications require further detail and direction, the "Geometric Design Standards for Canadian Roads and Streets " as published by the Transportation Association of Canada shall be referenced as a guide.

Generally, right-of-ways shall be 20 metres in width and accommodate road design for a maximum speed of 50 km/hr within all planned subdivisions unless otherwise approved by the Municipal Engineer. All roads shall be finished with an asphaltic concrete surface. The planning of subdivision roads and streets shall consider the natural topography, natural watercourses and drainage features, wetlands, natural habitats and the existence of rock outcropping.

When establishing street names, consultation with the Municipality shall be undertaken to ensure that duplicate names or names similar to existing names are not selected. All street signs shall be erected by the Developer in the material, size and location as stipulated by the Municipality.

Roadway and street construction typically occurs between May 1 and December 1 of any given year as established by provincial weight restrictions and the availability of materials in early winter. The Municipality may consider times earlier or later than these dates providing that asphalt is available in early December or weight restrictions on public roadways are lifted prior to May 1.

6.2.2 Construction Requirements

The following specifications apply to the design and construction of Public Streets:

- The subgrade of any new road shall be constructed of native or imported material that achieves minimum compaction requirements and drainage. Compaction testing of the subgrade shall be undertaken by an approved third party testing firm and

results of testing shall be provided to the Municipal Engineer by the Developer. In the event that unsuitable materials including peat, soft mucks or other organics are encountered during construction, this material shall be removed and replaced with suitable material to depths and compaction that will support the road base system.

- Organic materials including roots, stumps, limbs, sod or other vegetative matter shall not be placed in roadway fills or allowed to remain in roadway fills.
- The minimum top road surface width (edge of asphalt to edge of asphalt) shall be 9.0 metres (29.53 feet) and be contained within the right-of-way. The roadbed shall have a top width of 10 metres after gravel has been applied.
- The traveled surface shall have both a sub-base and base course of crushed screened gravels. The sub-base shall conform to Gravel Type 2, Division 3, Section 2 of the Nova Scotia Department of Transportation and Infrastructure renewal Standard Specifications. The sub-base course must be a compacted depth of not less than 250mm (10"). The Base course gravels shall conform to Gravel Type I Division 3, Section 2 of the Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specifications. The base course must be a compacted depth of not less than 150mm (6").
- Compaction of sub-base and base gravels shall be verified by an approved third party testing firm and results of testing shall be provided to the Municipal Engineer by the Developer. Minimum compaction of gravels shall be 98% Standard Proctor Density.
- Asphalt Concrete shall be in accordance with Division 4, section 4 for Class "C" Asphalt Concrete as identified in the Nova Scotia Department of Transportation and Public Works Standard Specifications shall be required. Minimum depths on public roadways shall be 75mm (3").
- All Public Streets within the Municipality shall be constructed within a 20m (65.6 ft.) Right-of-way.
- All Public Streets within the Municipality shall be surfaced with asphalt concrete as specified above.
- During construction of streets the Developer shall arrange for the complete inspection and testing of the road construction at intervals to the satisfaction of the Municipal Engineer and shall give reasonable notice to the Municipal Engineer of testing dates, location and time of day. (Minimum of 24 hour notice required). In addition, the Developer shall permit the Municipal Engineer to inspect the installation at any time to verify or confirm testing results.

A typical road cross-section detailing the requirements is attached at the end of this Standard.

6.2.3 Right-of-way Limits

The minimum right-of-way width for the Municipality of the County of Richmond Subdivision roads is 20 metres (65.6 ft). Generally this width is sufficient to accommodate roadways systems and their drainage network. In certain instances the Municipality may require additional width to allow for maintenance, sloping , traffic movements and construction. A lesser right-of-way width may also be considered by the Municipality when the proposed street is fully serviced with

asphalt, curb & gutter, sanitary and storm sewers, watermain and a stormwater control systems. This should be discussed with the Municipal Engineer when making such considerations.

All slopes (cuts of fills) that are not eliminated when final lot construction occurs shall be located within the right-of-way limits. Ditching and back slopes steeper that 2:1 sloping to a ditch bottom shall also be included within the right-of-way.

When developing a subdivision and there is potential for adjacent lands to be developed in the future, access right-of-ways to adjacent property shall be provided and deeded to the Municipality. Access roads must not be more than 400 metres apart and shall be located along the boundary in such a way as to not limit development of adjacent lands. The Municipality will require the construction of a cul-de-sac in accordance with section 6.2.4. for the access roads.

6.2.4 Layout

Roads shall be planned out where reasonably possible in prolongation of existing roads, either in the same subdivision or adjacent lands. The minimum roadway length that will be accepted by the Municipality is 150 metres (500 feet).

Roads shall maintain a cross fall of a minimum of 3.0 % and a minimum horizontal profile of 0.50% and a maximum profile of 8.0 %.

Cul-de-sacs shall end in permanent or temporary turn around areas as approved by the Municipal Engineer. The grade of the cul-de-sac bulb shall not exceed 4.0 %. The maximum length of a cul-de-sac shall be 230 metres. In areas lacking planned streets with which to connect to, the cul-de-sac shall include the prolongations in accordance with Section 5.2.3., where extensions to adjoining lands for future streets are feasible. Where no future traffic connections are feasible, the end of the cul-de-sac shall include a 6.0 metre easement/access to adjacent lands for emergency vehicle access, the installation of future sewers extensions and pedestrian access.

Boulevards may be considered within residential subdivisions and consultation with the Municipal Engineer is recommended.

Guard rails are required on all roadways/streets that have fills greater than 3.0 meters and other hazardous areas unless an acceptable slope can be provided. Guard Rail shall be installed in accordance with the NSTPW Plate # H87-66.

6.2.5 Intersection with Provincial Highways

Where Public Streets meet existing classes of provincial highways, the minimum distances between these intersections shall be as follows:

Provincial Road Class	Minimum Distance between Intersections (m)	Minimum Distance between Intersections (ft.)
Local Roads	100	328
Collector roads	150	500
Arterial Roads	300	1000

Where a subdivision road intersects a provincial public street, that intersection shall be approved by the Nova Scotia Department of Infrastructure Renewal. Stopping Sight Distances at intersections in accordance with design speeds identified in the TAC manual shall be considered.

Within a subdivision the minimum distance between the intersection of internal local roads shall be 75 metres measured from centre line to centre line.

All intersecting roads must intersect at an angle between 70 to 90 degrees for a minimum distance of 15 metres (50 feet) back from the intersection point.

6.2.6 Vertical Alignment

Straight or gently rolling grades with proper vertical curves are required to provide adequate stopping sight distances in accordance with Nova Scotia Department of Transportation and Infrastructure Renewal. All road designs shall indicate a profile and the proposed grades through the transition in the vertical curve. A maximum grade of 8.0% will be considered by the Municipality, except when difficult circumstances arise a greater slope may be considered. Minimum road profile grades are 0.50 % and grades at intersections shall not exceed 2.0% for at least 15 metres measured from the shoulder of the intersecting road.

The vertical curve length for both sag and crest shall not be less than the minimum values specified in the TAC Manual or as specified by the Department of Transportation and Infrastructure Renewal.

Side slopes in cut and fill areas shall be a minimum of 2:1. Lesser slopes may be required depending on soils and stability.

6.2.7 Horizontal Alignment

Horizontal curves at a design speed of 50 km/hr shall have a minimum radius of 100 metres. Horizontal Curves of collector roads shall be super elevated according the values established in the TAC manual (Table 2.1.2.3) and/or set by the Nova Scotia Department of Transportation and

Infrastructure Renewal.

6.2.8 Concrete Works

For those public streets to be constructed with full servicing including curb and gutter and sidewalk, the following shall apply:

- Portland Cement Concrete Curb shall be 450mm in width from asphalt edge to back of curb and be 270 mm in height at back of curb. Curb shall be placed on compacted Type I gravels having a depth of 150mm as a minimum. Curb shall be formed to allow for catch basin and vertical grate installation. Front of curb at asphalt edge shall be 4.50 metres from the centre line of the asphalt except in turning lanes and transition areas.
- Portland Cement Concrete sidewalk shall be 1.50 metres in width, placed on 150mm of compacted Type 1 gravels and placed with a 2.0% cross fall towards the curb and gutter. The sidewalk edge closest to the asphalt shall be typically 1.20 metres from the asphalt edge.
- All concrete shall meet Municipal Standards and Specifications for minimum compressive strength and be supplied, placed and finished to the depths specified with a broom finish. Concrete test cylinders shall be taken when concrete is delivered to the site and tested by a third party laboratory. The Developer shall arrange to have the testing representative on site during scheduled concrete pours.

6.2.9 Driveway Entrances

Driveway entrances shall be installed in accordance with Nova Scotia Department of Transportation and Infrastructure Renewal policies and standards. The Developer shall be responsible for all aspects of construction including supply and installation of appropriately sized culverts (minimum 450mm diameter), backfill gravel materials, culvert rip rap end treatments, labour and traffic control.

The Developer shall notify the TIR Road Maintenance Supervisor when work is to commence. Once the driveway is installed, the Municipality and Transportation and Infrastructure Renewal representative will be contacted to undertake an inspection. If the inspection indicates that the driveway does not satisfy policies and standards, the Developer will be notified of the deficiencies and asked to undertake the necessary corrections.

If the driveway is not properly installed after two inspections, the Municipality reserves the right to remove the entrance.

6.3 General Requirements

In addition to the above requirements, the Developer shall:

Save and hold harmless the Municipality of the County of Richmond against any and all claims for personal injury and/or property damage of whatsoever nature, both during and after the execution of work covered in this section, where in the opinion of the Municipality, any such

claims arises from the execution of the work.

- Bear all costs during the installation of pipe or other work undertaken on existing and proposed shoulders, curbs, ditches, culverts, pavements and other installations and all subsequent damage costs to the road/street that are, in the opinion of the Municipality, attributable to the work under this section.
- Provide on completion of work near and on the road shoulder, be left in a neat condition and dressed with gravel 20mm in size or smaller.
- Complete all work in accordance with the standards and specifications identified to the satisfaction of the Municipality of the County of Richmond.

7.0 SANITARY SEWAGE SYSTEM

7.1 Scope

The sanitary sewerage collection system must meet the requirements of the Municipality of the County of Richmond and the Nova Scotia Department of Environment before the system will be considered for municipal ownership and operation. The following are minimum requirements to consider in the system design and are intended to provide a directive to the Design Engineer responsible for the design and construction of sanitary sewage collection system in Richmond County.

This section specifies the requirements of a central sanitary sewer collection system. The system consists of gravity collection piping, service laterals, pressure sewers and appurtenances (including manholes and pumping stations) owned and maintained by the Municipality. Sanitary sewage is defined as the wastewater from residential, industrial, institutional and commercial buildings within a community, but excluding storm water runoff or ground water.

In addition to the following 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. Sanitary systems shall not be constructed until the design has been approved by the Municipal Engineer (ME) and by the Nova Scotia Department of the Environment.

7.2 Design Requirements

7.2.1 Gravity Systems

The sanitary sewage system shall be designed for flows generated from all lands within the proposed service area which are naturally tributary to the drainage area as determined from topographic plans or surveyed information. Any lands within the servicing area can contribute by pumping or grading works, which are presently or anticipated to flow through the subject design area, are to be considered in the calculated flows for the sanitary conveyance system being designed.

The design of the system shall take into consideration future extensions so that sewers shall be designed and installed at sufficient depth to service adjoining lands.

The sanitary sewage system shall be designed utilizing the standard criteria outlined below unless actual flow measurement has been conducted:

(i) Design shall be based on appropriate population densities according to the land use for the area being considered.

(ii) Average Dry Weather Flow shall be calculated on the basis of an allowance of 340 liters per person per day.

(iii) Design Peak Flow shall be calculated on the basis of the Harman Peaking factor and infiltration allowance as identified in Sections 2.3.2.3 and 2.3.3 of the Atlantic Canada Standards and Design Manual.

Pipe
Polyvinyl Chloride (PVC), SDR 35 shall be used for sanitary sewer main installations in the Municipality, unless other wise approved by the ME.

Hydraulic Design
Sanitary sewers shall be designed to convey the calculated Design Peak Flows without surcharging. The capacity of the sanitary sewers is to be calculated using the "Manning Formula" or an appropriate nomograph. A Manning Roughness coefficient (n) equal to 0.010 shall be used for PVC pipe.

Under Design Peak Flow conditions from the tributary area when fully developed, sanitary sewage flow velocities shall be a minimum of 0.6 meters per second and a maximum of 4.5 meters per second.

Minimum Pipe Size& Slope
Sanitary sewer piping shall not be less than 200 mm in diameter. Sanitary sewers shall have a minimum slope of 0.50%. Slopes less than 0.50% percent will be considered only where the depth of flow within the sewer pipe will be at least 30 percent of the diameter of the pipe under the Design Peak Flow condition. Sewer laterals shall have minimum slopes of 2.0%.

High Velocity Protection
Where velocities greater than 4.5 meters per second are unavoidable, provisions shall be made to protect against displacement by erosion and shock.

Depth
Sanitary sewers shall be installed at a sufficient depth to provide service by gravity flow to all proposed lots within the proposed subdivision and provide service to adjoining lands. The depth of sanitary sewer mains shall be 2.0 metres and not normally exceed a maximum of 4.5 metres. The depth of the sanitary sewer laterals shall not be less than 1 meter. In general, sewers shall be deep enough to prevent freezing while receiving sewage from basements.

Location& Alignment
Where possible all sanitary sewer pipe and appurtenances shall be located within a street right-of-way owned by the Municipality of the County of Richmond or the Nova Scotia Department of Transportation & Infrastructure Renewal. If approved by the ME, sanitary sewer mains may be installed within an easement granted in favor 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 6.0 meters.

All sanitary sewer pipes shall be located as close as possible to the center line of the street or easement. Depending upon the length and location of the easement, the ME may require an access surface within the easement for maintenance purposes.

Where a need is identified by the ME or preceding planning documents to accommodate future upstream lands naturally draining to the service area, an easement shall be provided from the edge of the street right -of-way to the upstream limit of the subdivision.

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

Manholes

A manhole is to be provided on a sanitary sewer at any change in pipe size, slope or horizontal alignment and/or at all pipe intersections. The spacing between manholes is not to exceed 100 meters. The following criteria shall be used for pipe elevation and alignment in sanitary sewer manholes to account for hydraulic losses through the manhole.

Minimum drop across manholes for pipes of similar diameters shall be:

(i) Straight run - 30mm
(ii) Deflections up to 45 degrees - 30 mm
(iii) Deflections 45 to 90 degrees - 60 mm

The obvert of a downstream pipe shall not be higher than the obvert of an upstream pipe.

A drop manhole shall be constructed when the vertical drop between pipe inverts in the manhole exceeds 900mm. Drop Manholes shall be either an exterior drop structure when the manhole is 1050mm in diameter or an interior drop for manholes larger than 1050mm in diameter.

The minimum internal diameter of a manhole shall be 1050mm. All sanitary sewer manholes are to be positioned to minimize infiltration of surface water or ground water. Manholes shall not be located at or near drainage ditches and swales and roadway gutters or low points. In some situations where manholes cannot be easily relocated from the areas noted above, the use of grading and/or water-tight frames and covers may be permitted by the ME to isolate manholes from water conveyance systems.

Service Laterals

Minimum size lateral piping shall be 100mm in diameter. Laterals greater than 100mm require connection to the sewer via a manhole situated on the sanitary sewer line. Service laterals shall be constructed with white PVC SDR 28 pipe conforming to CSA standards.

Service laterals shall be installed according to the following provisions:

- In any new subdivision a single sanitary sewer lateral shall be provided by the developer to each existing or potential lot at the time of installation of services. The

lateral shall extend from the sewer to the property line of the road right-of-way or service easement as appropriate.

- Lateral connections to the sewer pipe shall be made using acceptable engineered saddle or tee in accordance with manufacturer's specifications and approved by the ME.
- The lateral shall be laid at a minimum slope of 2.0 percent.
- Service laterals exceeding 30 meters in length shall be installed complete with a wye type clean-out in locations approved by the ME.
- The depth-of sanitary sewer laterals shall not be less than 1 meter within the street right-of-way.
- Lot owners must obtain a sewer connection permit from the Municipality of Richmond County before connecting to the service stub.
- All sewer laterals shall be capped at the lot line and marked with 50x100 mm wooden stake indicating depth of bury and marked "SEWER".

Joints

Sewer pipe joints shall be meet manufacturer, AWWA and Municipal Specifications and minimize infiltration and root penetration.

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 within the piped system as a result of groundwater movement. The need for clay plugs within service lateral trenches may be required for low lying area.

7.2.2 Pumped Systems

General

Pumping stations shall be considered by the Engineer and ME when a gravity sewer conveyance system is neither possible nor economically feasible. Sewage pumping station structures and electrical and mechanical equipment shall be placed above the 1 in 100 year flood elevation and remain fully operational and accessible during the 1 in 25 year flood elevation.

During the siting of a pumping station facility, consideration should be given to the potential of emergency overflow provisions and the avoidance of health hazards, nuisances and adverse environmental effects. Unless otherwise approved by the ME and NSE, all pumping stations, pumps, and forcemains shall be designed to accommodate the ultimate sanitary sewer flows from the tributary drainage area as described above. Pump selection shall consider both existing present and future flow conditions with avoidance of surcharge conditions. Changes to the roughness coefficient of sewer pipe and variations in flow volumes should also be considered.

Pump Station Wet Well Size

Wet wells are to be designed in accordance with the pump manufacturer's recommendations. For any pumping station, the wet well shall be of sufficient size to allow for a minimum of 4 cycles

per hour for each pump. For a duplex station the volume in cubic metres between pump low level and high level alarms shall be a minimum of 4 times the average daily flow for the serviced area. Additional capacity above this volume shall be as minimum the average daily flow volume over a 2 hour power. If typical power outage durations are known for this area and they exceed the two hour limit, than that time duration shall be utilized in sizing the emergency volume component. 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. Reference to section 3.2.5 of the Atlantic Canada Standards and Design Manual provides specifics regarding float control settings.

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

Pump Manufactures
Pump manufactures approved by the Municipality for use in sewage pumping stations include Submersible pumps manufactured by "ITT Flygt" and Self priming pumps manufactured by "Gorman Rupp". Alternates may be considered through consultation with the ME.

Submersible Pumps shall be designed to minimize the deposition of solids in the wet well using flush valves manufactured by ITT Flygt or approved equal (one hydraulically operated flush valve per pumping station). Pumps shall be designed specifically for pumping raw, unscreened, domestic sanitary sewage and be non-clog solids handling type and grinder pumps complete with electric motors.

Emergency Overflows
Pumping stations shall be designed to prevent or minimize the passing of raw sewage. This may be attained by the storage requirements identified above, additional storage available within the trunk sewer and the provision for temporary power hook-up to a portable generator. The generator must be able to provide adequate power such that pumps can discharge at the design rate.

All pumping stations shall be fitted with or connected to an emergency bypass valve.

Pumping stations 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 power outages, minimum retention capacity of 2 hours at Average Daily Flow shall be provided.

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

designed 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.

Phased Development
In situations of phased development, the effects of minimum flow conditions shall be investigated to ensure that the retention time in the pumping station wet well will not result in an odor or septic problems. The pumping equipment and associated level controls will be set to operate the pumping station at a minimum of six cycles per hour and in accordance with manufacturer's recommendations.

Pump Selection
Pumping equipment is to be selected to perform at maximum efficiencies under normal operating conditions. Pumping stations, wet wells and dry wells are to be designed such that all pumps will operate under a continuous positive prime condition during the entire pump cycle. System head calculations and curves shall be provided for the extreme operating conditions of high and low water levels in the wet well, as well as the normal operating range in the wet well. The curve representing the normal operating conditions shall be used to select the pump and motor, however, the pump and motor shall be proven to be capable of operating satisfactorily over the full range of operating conditions.

Flow Velocities
Suction and header piping shall be sized to carry the anticipated flows. Flow velocities shall have a minimum cleansing velocity of 0.8 meters per second and a maximum velocity of 1.5 meters per second for suction lines and 2.5 meters per second for discharge lines.

Piping
Pumping station internal piping shall be either PVC piping, ductile iron Class 54 with coal tar epoxy lining or stainless steel, Type 316 or 316L, 11 Gauge. Regular steel pipe spool pieces are not 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 and thrust restraint. Piping less than 100 mm in diameter is not acceptable, unless otherwise approved by the ME.

Inlet Arrangements
If more than one sewer enters the pump station site, a manhole shall be provided outside of the pump station so that a single sewer can enter the wetwell from the upstream collection system.

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

Valves
Hand operated gate or plug valves shall be provided on discharge and/or suction piping to allow for proper maintenance. A check valve shall be provided on the discharge lines between the isolation gate valve and the pump. Gate and Check valves shall be accessible for maintenance and be located within a dry chamber situated adjacent the wet well or above grade within a secure enclosure.

Ventilation
Continuous ventilation to the surface ambient air may be acceptable for submersible pumping stations. Ventilation system for self-priming pumping stations must meet approval by the ME and the NSE. Mechanical ventilation will be required for pump stations with pump pits below the ground surface.

Access and Removal
Adequate access hatchways and doorways shall be provided. All pumping stations shall be provided with an acceptable lifting device(s) for the removal of pumps and motors for repair and maintenance. Submersible pumps shall be readily removable and replaceable via guide rails without dewatering the wet well or disconnecting any piping in the wet well. Lift hatches must be able to be "locked-in" in the upright position.

A non-corroding working platform shall be constructed in the wet well of each submersible station to provide access to check valves and gate valves. The platform shall be set on a concrete lintel cast integrally with the station walls. Alternatively, a separate valve chamber shall be provided. Locks shall be keyed alike to the Municipality standard system.

Pumping Arrangements
All pumping stations shall have a minimum of two pumping assemblies. Each shall have the same capacity, with each pump capable of handling the expected Design Peak Flow.

Where three or more units are provided, they shall be designed to pump actual flow conditions and must be of such capacity that, with any one unit out of service, the remaining two units will have capacity to handle maximum sewage flows, taking into account head losses with parallel operation.

Electrical
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.

Electric motors less than 10 horsepower shall be 208 volt, 3 phase. Electric motors greater than 10 horsepower shall be 600 volt, 3 phase. Single phase pumps will be permitted only if in the opinion of the ME three phase power is neither available nor feasible.

All pumping station control equipment is to be mounted in a CSA Type 3 Nema enclosure. Supervisory Control and Data Acquisition (SCADA) system for pumping stations is required and must be integrated with the HMI control system established at the Arichat Water Treatment Plant Facility.

All wiring shall be in accordance with the requirements of the Canadian Electrical Code and NSPI requirements. Heating shall be provided to maintain ambient temperatures in the dry side of the pumping station.

Electrical service from the transmission source (overhead power lines) to the control panel and between the control panel and the pumping station shall be contained within 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 must be adequately sealed to protect against water entering as well as corrosion from harmful gases.

Site Considerations

Pumping stations and control panels shall be within the street right-of-way in an area suitable for pumping station operation. The ownership of this property shall be deeded to the Municipality. Lands that accommodate pumping stations shall be graded in a positive manner to shed surface water away from the pumping station. The elevation of the top of the wet well shall be 150 mm above the finished grade of the site. All exposed areas shall be stabilized with material common to the area.

Operations and Maintenance Manual

Three copies of the pumping station operations and maintenance manual must be prepared and submitted to the ME. This manual shall include as a minimum:

- A System description
- Design parameters, system hydraulics and design calculations (including curves)
- As constructed civil, mechanical and electrical drawings
- Pump literature, pump curves and operating instructions
- Manufacturer's operation and maintenance instructions of all equipment
- Name, address, and telephone number of all equipment suppliers and installers
- Information on guarantees/warranties for all equipment.
- All special tools and standard spare parts for all pumping station equipment are to be provided by the contractor prior to acceptance of the system by the ME.

7.2.3 Sanitary Forcemains

Pipe
Acceptable pressure forcemain pipe includes PVC SDR 26, HDPE and Ductile Iron Class 52 pipe. Smaller piping may be considered for smaller tributary areas with supporting calculations. Smaller diameter forcemains must be approved by the ME and the NSE.

The hydraulic losses in the force main shall be calculated using the Hazen-Williams Formula or an appropriate nomograph assuming a roughness coefficient of C = 120 for any type pipe material.

Limiting Velocities
The force main shall be designed such that a minimum cleansing velocity of 0.6 metres per second is achieved and a maximum velocity of 2.5 metres per second is maintained.

Minimum/Maximum Depths
Force mains shall have a minimum cover of 1.5 meters and a maximum cover of 2.4 meters. The depth of cover shall be measured from the design grade at finished surface to the obvert of the pipe.

Slope
Forcemain slope does not significantly affect the hydraulic design or capacity of the pipeline itself. Under no circumstance, however, shall any forcemain be installed at zero slope. Zero slope installation results in difficult testing and accumulation of air and wastewater gases.

Location
Force mains shall not be located in a common trench with a watermain. The soil between a forcemain and a watermain shall be undisturbed and have a minimum separation width acceptable to the NSE. Forcemains crossing water mains shall be laid to provide a minimum vertical distance of 450 mm between the forcemain and watermain external pipe wall surfaces. The watermain shall be above the forcemain.

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 watermain and force main may be required including concrete and/or a pipe encasement over the watermain.

Termination
Force mains should enter the gravity sewer system at a point not more than 600mm above the flow line of the receiving manhole.

Valves
To prevent air locks in the pipe, automatic air relief and vacuum valves shall be located in a manhole at all high points of the forcemain system or in such other locations as directed by the

ME. Blow offs should be provided at all low points in the forcemain system as directed by the ME.

Changes in Direction

Any change in direction which is in excess of the pipe joint deflection tolerances, shall require a suitable fitting as approved by the manufacturer. Thrust blocks shall be provided at any change of 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 20MPa. In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the forcemain through the use of stainless steel tie rods securely embedded in concrete.

8.0 WATER DISTRIBUTION SYSTEM

8.1 Scope

This section specifies the requirements for municipal water distribution systems. A water distribution system consists of watermains, service laterals and appurtenances. The system is designed to convey and distribute an adequate supply of potable water for domestic, institutional, commercial, industrial and in certain areas for fire protection purposes.

Standards and organizations supported by these specifications include:

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

Water distribution systems shall conform to the requirements established by the Nova Scotia Department of the Environment and the Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of drinking Water Supply Systems. Systems shall not be constructed until the design has been approved by the ME and by the Nova Scotia Department of the Environment.

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

8.2 Design Requirements

System Requirements

Water distribution systems shall be designed to accommodate as a minimum the maximum daily demand unless otherwise approved by the ME. The ME may require that the system also provide fire flows. Hydraulic analysis of a proposed water distribution system shall be carried out by the proponents Design Engineer using the hydraulic grade line elevation for the area being serviced. Hydraulic Grade Line calculations shall be provided by the Design Engineer.

Fire flow demand shall be established in accordance with the latest requirements contained in "Water Supply for Public Fire Protection, a Guide to Recommended Practice", as prepared by the Fire Underwriter's Survey Insures Advisory Organization. Water distribution systems shall be designed to accommodate Average daily demand of 410 1iters per capita per day; Maximum daily demand: 615 liters per capita per day and Maximum hourly demand: 1025 liters per capita. per day.

Water distribution systems shall be designed for a gross population density of 45 persons per hectare. In developments where the anticipated population exceeds or is anticipated to exceed the population density of 45 persons per hectare or in areas of commercial or industrial development, the domestic demand shall be adjusted accordingly. The design population or assumed domestic demand must be clearly specified in the calculations submitted for review and approval.

Pressures
Water distribution systems shall be designed and sized such that during a fire flow condition a residual positive pressure of 150 kPa (20 psi) is maintained at all points in the water system.

For any water system extension, it is desirable to maintain minimum residual water pressure of 240 kPa (35psi) at all points along the distribution mains in the water system during maximum hourly demand conditions. Maximum water pressure during minimum demand periods shall not exceed 620 kPa (90 psi) unless approved otherwise by the ME.

Calculations to determine residual water pressure shall be based on the Hydraulic Grade Line of the water distribution system being considered.

Pipe Type
PVC DR18, DR26, PE and Ductile Iron Class 52 pipe are approved for use for all water mains in the Municipality. The Hazen-Williams Formula *or* an appropriate nomograph using a pipe friction factor of C = 120 for PVC and C = l00 for ductile iron shall be used in the design calculations of the water distribution system.

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

Looping
Where reasonable and possible, water distribution systems shall be designed to provide looping of watermains. Subdivision planning documents shall consider layouts that provide for future looping of watermains.

Pipe Sizes
Watermain pipe diameter shall be of a minimum diameter to convey maximum hourly demand while maintaining a minimum system pressure of 35 psi at all point on the extension. Watermain sizing shall consider future development requirements and make provision for over sizing as necessary to maintain fire flows as identified above.

Cover
All water mains shall be designed with a minimum cover of 1.5 meters in common material or at suitable depth to prevent freezing of either the water main or the services. Alternatives to maintain minimum frost protection including the placement of appropriate insulation may be considered by the ME. The depth of cover over the water main shall not exceed 2.4 meters. The depth of cover shall be measured from the design grade at finished surface to the obvert of the watermain or serviced being considered.

Location
All water pipe shall normally be placed in a separate trench. In some situations it may be necessary to place watermain in a trench with a gravity sewer. In this instance a minimum horizontal separation of 300 mm from the gravity sewer is required. The watermain shall be placed above the sewer on a bench of undisturbed earth. The top (obvert of the sewer shall be at least 300 mm below the bottom (invert) of the water main. Where a water main must be installed parallel to a sewer main, and at a lower elevation than the sewer the water main must be installed in a separate trench. The soil between the trenches must be undisturbed.

Where a watermain must cross under a gravity sewer the section of watermain pipe that that crosses under the sewer must be placed within an encasing pipe. The watermain section length should be centered at the crossing point. The watermain encasement may require sealing depending on the installation conditions. Approval by the ME and the NSE is required for all installations described above.

All water pipe and appurtenances shall be located within a street right of way owned by either the Municipality or the Nova Scotia Department of Transportation and Public Works or within an easement, of minimum 6 meter width granted in favor of the Municipality. Depending on the length and location of the easement, the ME may require a vehicle access for maintenance purposes. Watermains shall be installed as close as possible to the centerline of the easement. Where planning documents identify future development on adjacent lands, easements shall be provided from the edge of the street right-of-way to the property boundary of the subdivision being considered.

Valving
Connections to existing water systems 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 with and approved by the Municipality. Valves shall be mechanical joint, double disc, or resilient seal gate valves and shall conform to AWWA standards. All valves must be accessible through valve boxes or chambers.

Valves shall be provided on the watermains where required to adequately isolate sections of the water system as identified by the ME. At watermain junctions including four way connections four valves shall be provided one on each leg of the cross. At a watermain tee arrangement three valves shall be provided one on each leg. On straight lengths of watermain one valve shall be placed every 400 meters.

Pipe Changes in Direction

Any change in pipe direction which is in excess of the pipe joint deflection tolerance shall require a suitable fitting as approved by the ME. 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 20 Mpa.

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 may be permitted in conjunction with a thrust block. The design of this arrangement must be approved by the ME. Gradient restraint anchor blocks for pipes installed at grades steeper than 16% and shall be provided in accordance with pipe material and specifications.

Approved thrust restraint shall be provided for valves on PVC pipe over 150mm diameter. Thrust blocks shall be provided for service lateral connections over 100 mm diameter.

Fire Hydrants

Fire hydrants shall be provided at spacing in accordance with the requirements as contained in the Municipal standards publication. In no case shall the maximum spacing exceed 150 meters. Hydrants should be considered at high points of the water main profile unless an automatic air release valve is required at that location, at low points of the water main profile, at roadway intersections and at the end of dead-end streets or cul-de-sacs greater than 90 meters in length. Hydrants shall be placed within a subdivision such that all buildings have fire coverage.

All fire hydrants shall be Canada Valve or approved equal and shall be equipped with two standard 63.5 mm hose nozzles and one FD pumper nozzle with an outside diameter of 125.41 mm.

Fire hydrant laterals shall have a minimum diameter of 150 mm and include a gate valve and valve box. The hydrant base shall be fitted with appropriate plug drain to eliminate groundwater effects. Drain plug to be removed upon direction by ME.

Air Relief and Vacuum Valves

Air relief valves and vacuum valves shall be installed in a manhole structure at high points located on long distribution lines and at such other locations as required by good engineering design practice and as approved by the ME.

Service Laterals

All services shall be installed with a minimum cover of 1.5 meters in common material or a suitable depth to prevent freezing of the service. Where that depth is not achievable a method of insulating, approved by the ME, may be used to achieve the equivalent depth of burial. In no case will the depth of burial be less than 1 meter.

All water distribution system laterals from the main line to the property line shall be provided by the Developer. A single service lateral is to be supplied to each existing lot or potential future lot which could be created under the zoning in effect at the time of installation of services. Whenever possible, services laterals shall not be installed in private driveways or other traveled areas.

In order to avoid high friction losses in service piping, the maximum length of any 19 mm diameter service lateral shall be limited to 55 meters from the curb stop to the building being serviced. Services longer than 55 meters shall require at least 25 mm diameter piping.

Services in excess of 20 meters in length shall have the number of compression couplings kept to a minimum. Compression couplings shall not be used within 1.5 meters of the foundation of any serviced building.

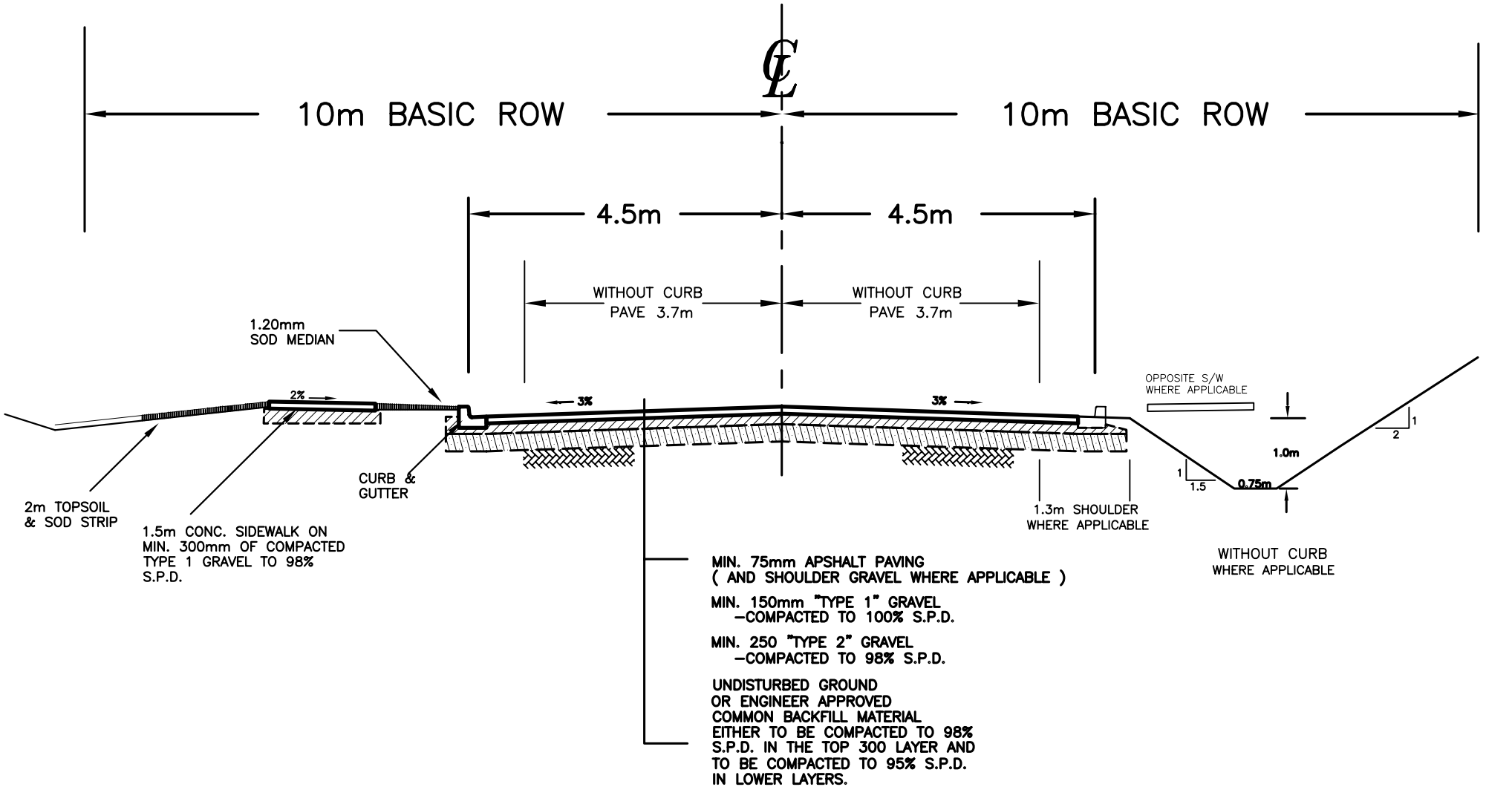
All water service connections between the corporation-stop and curb stop shall be sized to carry the maximum hourly demand while maintaining a minimum residual pressure of 35 psi, but in all circumstances, the diameter of the service lateral shall be a minimum of 19 mm in diameter (Polyethylene) Kitec or Municipex PE piping. Services for future development are to be brought to the property line, capped, and marked with a 50mm x 100mm (2"x4") member marked "WATER".

Backflow Prevention Devices

Backflow prevention devices are required on new services if there is a risk of contamination of the potable water supply. Backflow devices shall be installed in accordance with the applicable standard specifications at Industrial and commercial buildings, Apartment buildings larger than four units and at Sprinkler service lines.

Testing/Flushing/Disinfection

All watermain once installed shall be pressure tested, flushed and disinfected in accordance with Municipal Specifications and NSE requirements. Disinfection shall consider the use of Calcium Hypochlorite, chlorinated lime or liquid bleach at the appropriate concentrations to achieve minimum disinfection. Contractor to ensure adequate disinfection and delivery of necessary samples for testing and confirmation of achieved disinfection.



TYPICAL ROAD SECTION