



## **Town of Torbay Engineering Design Guidelines for Subdivisions**



Revised July 2016

## **FORWARD**

These guidelines shall be read and considered in its entirety and used in conjunction with the latest edition of the following publications:

1. Government of Newfoundland and Labrador Municipal Water and Sewer and Roads Master Construction Specification.
2. Transportation Association of Canada Road Design Manual (metric edition).
3. Transportation Association of Canada Uniform Traffic Control Devices for Canada (metric edition).
4. Town of Torbay Municipal Plan and Development Regulations.
5. Town of Torbay Recreation Master Plan.
6. Town of Torbay Open Space Management Strategy.
7. Government of Newfoundland and Labrador Private Sewage Disposal and Water Supply Standards.
8. Government of Newfoundland Groundwater Assessment and Reporting Guidelines for Subdivisions Serviced by Individual Private Wells.

In any case where standards in the above noted publications are below those stated in the Town's Subdivision Design Guidelines, the Town's Subdivision Design Guidelines shall be used as the accepted standard.

These Engineering Design Guidelines for Subdivisions Regulations are adopted by Resolution of Council, this 13<sup>th</sup> day of February, 2017.

Resolution No. # 035-17.



Ralph Tapper  
Mayor



N. Dawn Chaplin  
Chief Administrative Officer / Town Clerk

Under section 413 of the *Municipalities Act 1999*, the Town Council of Torbay adopts the Town of Torbay Engineering Design Guidelines for Subdivisions Regulations as approved (or as amended).

SIGNED AND SEALED this 16<sup>th</sup> day of February, 2017



Mayor:  (Council Seal)

Clerk: 



TOWN OF TORBAY  
ENGINEERING DESIGN GUIDELINES FOR SUBDIVISIONS

ENGINEERING DESIGN GUIDELINES FOR SUBDIVISIONS REVISION LISTING		
Original Adoption	<b>February 2014 – Motion 085-14</b>	<b>Rev 0</b>
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1.0	DEVELOPMENT POLICY .....	1
1.1	Definitions .....	1
1.1.1	Town .....	1
1.1.2	Subdivision .....	1
1.1.3	Stage I Work .....	1
1.1.4	Stage II Work .....	1
1.1.5	Developer .....	1
1.1.6	Development Permit .....	1
1.1.7	Consulting Engineer .....	1
1.1.8	Construction Permit .....	1
1.1.9	Urban Areas .....	2
1.1.10	Rural Areas .....	2
1.2	Development Approval .....	2
1.2.1	Requirements .....	2
1.2.2	Approval .....	2
1.3	Final Approval for Construction .....	3
1.3.1	General .....	3
1.3.2	Requirements .....	3
1.3.3	Approval .....	5
1.3.4	Subdivision Development Agreement .....	5
1.4	Financial Requirements .....	5
1.4.1	General .....	5
1.4.2	Assessments .....	5
1.4.3	Development Fee .....	6
1.4.4	Securities .....	6
1.5	Approval to Proceed .....	7
1.5.1	Schedule .....	7
1.5.2	Acceptance of Stage 1 Work .....	7
1.5.3	Town Inspections .....	8
1.5.4	Stage 1 Maintenance Period .....	8
1.5.5	Building Permits .....	8
1.5.6	Stage 1 Maintenance Pre-Expiry Inspection .....	8
1.6	Acceptance of Stage 2 Work .....	9
1.6.1	Town Inspections .....	9
1.6.2	Stage 2 Maintenance Period .....	10
1.6.3	Acceptance of Stage 2 Work .....	10
1.6.4	Release of Stage 2 Security .....	10
1.6.5	Stage 2 Maintenance Pre-Expiry Inspection .....	10
2.0	SURVEYING .....	10
2.1	Definitions .....	10
2.2	Survey Plan .....	10
2.3	Survey Details and Accuracy .....	12
2.4	Street, Walkway and Lot Identification .....	13
2.5	Survey Information .....	13
2.6	Benchmarks .....	13
3.0	DRAFTING .....	15

3.1	Drawing Preparation.....	15
3.1.1	CADD Drawings.....	15
3.1.2	Size of Drawings.....	15
3.1.3	Scale.....	15
3.1.4	Grid Reference.....	16
3.1.5	True North Arrow .....	16
3.1.6	Plan Orientation .....	16
3.1.7	Final Plan .....	16
3.2	General Conditions.....	17
3.2.1	Street Names .....	17
3.2.2	Intersection Identification.....	17
3.2.3	Percent (%) Grades .....	17
3.2.4	Accuracy of Measurements .....	17
3.2.5	Geodetic Datum .....	17
3.2.6	Irregular Boundary Line Measurements .....	17
3.2.7	Revisions to Plan .....	17
3.2.8	Signing of Plans.....	18
3.2.9	Procedure Revision.....	18
4.0	EASEMENTS .....	18
4.1	General .....	18
4.2	Design.....	18
4.3	Acceptance .....	18
4.4	Restoration.....	19
5.0	STREETS .....	19
5.1	Street Classification.....	19
5.2	Other Street Classifications.....	19
5.3	Street Design Criteria .....	19
5.4	Cul-de-Sacs .....	21
5.5	Crest Vertical Curves .....	22
5.6	Sag Vertical Curves.....	22
5.7	Intersections.....	22
5.8	Driveways.....	23
5.9	Side Ditches.....	23
5.10	Guide Rail Barriers.....	23
5.11	Street Signs, Markings and Traffic Control Devices .....	24
5.12	Other General Requirements.....	24
6.0	STORM SEWERS .....	25
6.1	Design Drainage Area .....	25
6.2	Drainage Plan .....	25
6.3	Runoff.....	25
6.4	Runoff Coefficient.....	26
6.5	Rainfall Intensity .....	26
6.6	Capacity of Pipe .....	28
6.7	Minimum Size.....	28
6.8	Velocity (When Pipe Flowing Full) .....	28
6.9	Minimum Gradient.....	29
6.10	Change of Size.....	29

6.11	Clearance .....	29
6.12	Location .....	29
6.13	Earth Load .....	29
6.14	Superimposed Load .....	29
6.15	Storm Sewer Service Pipe .....	29
6.16	Manholes .....	30
6.17	Special Structures .....	30
6.18	Outfalls .....	30
6.19	Catch Basins .....	30
6.20	Head Walls .....	31
6.21	Stormwater Detention .....	31
6.21.1	Deliverables .....	32
6.22	Construction .....	35
6.23	Inspection and Testing .....	35
6.24	Revisions of Procedure .....	35
7.0	<b>SANITARY SEWERS .....</b>	<b>36</b>
7.1	Design Drainage Area .....	36
7.2	Drainage Plan .....	36
7.3	Evaluation of Design Flows .....	36
7.4	Capacity of Pipe .....	38
7.5	Minimum Size .....	38
7.6	Velocity: (When Pipe Flowing Full) .....	38
7.7	Change of Size .....	39
7.8	Clearance .....	39
7.9	Location .....	39
7.10	Earth Load .....	39
7.11	Superimposed Load .....	39
7.12	Manholes .....	39
7.13	Building Sewer .....	40
7.14	Storm Water .....	40
7.15	Easements .....	40
7.16	Construction .....	40
7.17	Inspection and Testing .....	40
7.18	Standard Drawings and Specifications .....	40
7.19	Revisions of Procedure .....	40
8.0	<b>WATER SYSTEMS .....</b>	<b>41</b>
8.1	<b>General .....</b>	<b>41</b>
8.1.1	Definitions .....	41
8.1.2	General Procedure .....	41
8.1.3	Final Plans .....	41
8.2	<b>Design Criteria and Location .....</b>	<b>41</b>
8.2.1	Dead-Ends .....	41
8.2.2	Size of Water Pipe .....	41
8.2.3	Depth of Cover .....	41
8.2.4	Material .....	42
8.2.5	Location of Water Pipes .....	42
8.2.6	Location of Valves .....	42



8.2.7	Valve Chambers.....	42
8.2.8	Hydrants.....	43
8.3	Water Service Pipe .....	44
8.3.1	Depth of Cover.....	44
8.3.2	Oversized Water Service Pipes.....	44
8.3.3	Water Service Pipes on Private Property.....	44
8.4	Connections to Existing Water Systems .....	44
8.4.1	Service Interruption .....	44
8.4.2	Scheduling of Connection.....	44
8.4.3	Other Connections .....	44
8.4.4	Prohibited Cross-Connections .....	44
9.0	PROJECT RECORD DOCUMENTS.....	45
9.1	Record Drawings.....	45
9.2	Engineering Reports.....	45
10.0	NOTES REGARDING LOT GRADING PLANS: .....	46

## **LIST OF APPENDICES**

<b>APPENDIX A</b>	TYPICAL LOT GRADING PLAN
<b>APPENDIX B</b>	LOCAL STREET CROSS SECTIONS
<b>APPENDIX C</b>	SANITARY SEWER CALCULATIONS FORM
<b>APPENDIX D</b>	STORM SEWER CALCULATIONS FORM
<b>APPENDIX E</b>	HOUSE SERVICING INFORMATION FORM
<b>APPENDIX F</b>	SANITARY/STORM SEWER TEST RECORD
<b>APPENDIX G</b>	MANHOLE TEST RECORD
<b>APPENDIX H</b>	HYDROSTATIC PRESSURE TEST RECORD
<b>APPENDIX I</b>	TOWN INSPECTION FORM
<b>APPENDIX J</b>	TOWN DEVELOPMENT APPROVAL CHECKLIST
<b>APPENDIX K</b>	SUPPLEMENT TO GOVERNMENT OF NEWFOUNDLAND AND LABRADOR MUNICIPAL WATER, SEWER AND ROADS MASTER CONSTRUCTION SPECIFICATION



## **1.0 DEVELOPMENT POLICY**

### **1.1 Definitions**

#### **1.1.1 Town**

The "Town" refers to the Town Council for the Town of Torbay.

#### **1.1.2 Subdivision**

A concept proposal to subdivide property into building lots. It generally shows topographic information, natural features, such as rivers and vegetation, and the proposed lots and streets. It involves the construction of new streets and infrastructure for public use and requires the execution of a development agreement.

#### **1.1.3 Stage I Work**

Stage I work consists of all work relating to installation of water, sanitary and storm sewer systems, construction of all street right of ways including base course asphalt, curb and gutter (if required), and development of open space areas and accesses to these areas.

#### **1.1.4 Stage II Work**

Stage II work consists of all work relating to the construction of above ground work including but not limited to surface course asphalt, landscaping, sidewalks (if required), tree planting (if required) and walkways.

#### **1.1.5 Developer**

A person(s) or company who has applied for and has been granted approval to develop a subdivision or service an existing parcel of land.

#### **1.1.6 Development Permit**

Gives the Developer approval to proceed to the final design stage of project.

#### **1.1.7 Consulting Engineer**

A professional engineer registered and licensed in the Province of Newfoundland and Labrador and retained by the Town or Developer to be responsible for design and supervision of the work. Where a Consulting Engineer represents both the Town and the Developer, then it is the expressed understanding of the Town that the Engineer will promote and protect the Town's interest at all times.

#### **1.1.8 Construction Permit**

The Construction Permit gives the Developer approval to proceed with construction work as per development agreement. (See Section 1.3.4).

### **1.1.9 Urban Areas**

Areas of the Town that have been semi serviced with either water or sanitary sewer and areas that are fully serviced with water, sanitary sewers and storm sewer services.

### **1.1.10 Rural Areas**

Areas of the Town that are not connected to the Town's services and provide their own on-site servicing, usually involving well water and septic systems.

## **1.2 Development Approval**

### **1.2.1 Requirements**

The applicant will be required to submit a concept subdivision plan showing the connecting streets, internal streets and lot layout, water courses, abutting developments, buffer, trails, legal boundaries and easements, and public open space. This plan should be a 1:500 scale and have contours at one (1) metre intervals. The applicant will also be required to submit a location plan (1:2500 scale). Plans submitted shall include one hard copy and one digital copy in both PDF and CADD forms.

### **1.2.2 Approval**

The subdivision plan will be reviewed by the Town for the following:

- a) Lotting Plan – development standards as per zoning plan including; lot area, side yards, setbacks, grading and driveways.
- b) Access - The plan will be evaluated for impact on traffic flows and ease of access to and from the subdivision.
- c) Water Supply - For areas serviced by municipal water, the water supply to the subdivision will be evaluated to determine if adequate pressures and flows exist in the Town's system. If onsite wells are to be used, a groundwater assessment may be required by the Department of Environment and Conservation.
- d) Sanitary Sewer Generation - The Town's system will be evaluated to determine if the current configuration has the capacity available to accommodate the calculated flows to be generated.
- e) Storm Sewer Generation - The Town's system will be evaluated to determine if the current configuration has the capacity available to accommodate the calculated flows to be generated. The Developer will be responsible for providing the Drainage Plan. Stormwater detention may be required to maintain net zero runoff as per section 6.20.
- f) Internal Street Layout - The street layout will be reviewed for general conformance to the design criteria as given in the Subdivision Design Guidelines. Approval at this stage is preliminary and will not prohibit further changes that may become necessary during the detailed design.

- g) Written Approval from Department of Transportation and Works if connecting to a DTW owned road.

If upon review of the above a deficiency is determined to exist then:

- a) The application may be recommended for rejection.
- b) The applicant may be required to undertake further studies to determine the extent of any problems and corrective action required.
- c) The application may be recommended for Development Approval subject to the applicant taking any necessary corrective action as determined by the Town. If there have not been any problems noted during the review then the application will be recommended for Development Approval. Developmental Approval shall be valid for one year only from the date of granting by the Town during which time an application for Final Approval shall be submitted.

### **1.3 Final Approval for Construction**

#### **1.3.1 General**

The subdivision is to be designed and constructed in accordance with the Town's Development Regulations, the Government of Newfoundland's Municipal Water, Sewer and Road Master Construction Specifications, and any other provincial or federal regulations and /or terms and conditions as deemed necessary by the Town.

#### **1.3.2 Requirements**

The application for Final Approval for construction should be made within one year of the granting of the Developmental Approval; otherwise the approval will be revoked. The application must also be accompanied by the following:

- a) Subdivision Plan – The plan should be drafted as per the standard Subdivision Plan with the following items shown:
  - Boundary Survey
  - water, sanitary and storm sewer layout (invert information is not required);
  - street alignment information (coordinates for PI and street intersections are not required);
  - lot metes and bounds, area, and number;
  - right of ways, easements and carriageways;
  - Canada Post locations;
  - driveway locations;

- open space areas;
  - bench mark locations and elevations;
  - Grid Control Monuments;
  - direction of flow for sanitary and storm sewer systems,
  - curve data,
  - Master Survey Plan as per Section 2.2; and
  - natural drainage courses.
- b) Engineering Drawings – Plan and profile drawings showing all streets, water mains, and sewers to be constructed. Detailed drawings are required for any items not covered by the Standard Drawings in the Municipal Water, Sewer and Roads Specification Book.
- c) Typical Lot Grading Plan. (See Appendix A)
- d) Sanitary Sewer Calculations – Calculations are to be submitted on standard forms and accompanied by a detailed drainage plan. (See Appendix C)
- e) Storm Sewer Calculations – Calculations (See Appendix D) are to be submitted on standard forms and accompanied by a detailed drainage plan. Stormwater detention may be required to maintain net zero runoff as per section 6.20.
- f) Federal Fisheries & Oceans – Copies of any approvals required for works under the jurisdiction of Fisheries & Oceans Canada.
- g) Provincial Environment & Conservation – Copies of any approvals required for works under the jurisdiction of the Department of Environment & Conservation.
- h) Canada Post – Copies of approval for the proposed Canada Post locations.
- i) Legal plan and descriptions for utility easements or an agreement of understanding between the applicant and the respective utility provider. The legal information shall be incorporated on the Subdivision plan, once received.
- j) Existing site conditions, i.e. depth of bog, rock outcrops, etc.
- k) A copy of all current deeds to the property for review by the Town's solicitor
- h) A copy of the approval letter from Department of Transportation and Works if connecting to a DTW owned road.

### **1.3.3 Approval**

The detailed subdivision design will be reviewed for conformance with the Town's regulations. If any non-conformances are noted the applicant will be required to make necessary revisions and resubmit the drawings for approval.

If plans conform to guidelines then Final Approval will be recommended and the applicant will be asked to submit two hard copies and one digital copy in the latest AutoCAD format of the Subdivision Plan and Engineering Drawings. Approval will **not** be recommended until review has been completed without any noted problems.

Final Approval is valid for a period not exceeding one year but may be renewed once for a further period not exceeding one year. Final Approval shall not prevent the Town from thereafter requiring the correction of any errors or revisions to items which were not noted at the time of application.

The granting of Construction Approval shall not prevent the Town from thereafter requiring the correction of any errors not noted or evident at the time of application.

Revisions to the approved Subdivision Plan(s) or Engineering Drawings shall not be made without the prior approval of the Town. Upon approval of any revision, one hard copy and one digital copy of the revised drawing shall be submitted.

### **1.3.4 Subdivision Development Agreement**

When the Subdivision Plan and Engineering Drawings have received Final Approval for construction from the Town along with the Town's solicitor's approval for the title to the property, the subdivision developer shall enter into a binding agreement with the Town.

## **1.4 Financial Requirements**

### **1.4.1 General**

Prior to Final Approval for construction being granted to any subdivision, all applicable assessments, levies and the Development Fee, if applicable, must be paid in full.

In addition, all required securities in a form acceptable to the Town must be provided.

### **1.4.2 Assessments**

- a) Capital Recovery Assessments – All outstanding assessments on the property to be developed as recorded by the Town must be paid in full prior to the Subdivision Development Agreement being executed.

The assessments may be for items as determined by the Town:

- water, sanitary, and storm sewer systems;
- street improvements;

- sidewalks;
  - oversizing; and
  - recreational or as otherwise required by the Town.
- b) **Trunk Sewer Assessments** – If the subdivision is within the drainage areas of a Sanitary Trunk Sewer, for which there is an assessment registered, then the assessment must be paid prior to the execution of the Subdivision Development Agreement. This assessment is an area assessment ratio and is a fixed rate per hectare serviced.

#### **1.4.3 Development Fee**

The Development Fee (if any) applicable to the subdivision being developed will be determined by Council. Refer to most recent version of Town's tax and fee structure.

#### **1.4.4 Securities**

- a) **Stage I Security** can be in the form of a certified cheque or bond and to be in the amount of 120% of the estimated cost of the Stage I works, and must be in place prior to issuance of a construction permit.

**Stage I Warranty Security** can be in the form of a certified cheque or bond and will be equal to 10% of the value of Stage I work and must be in place prior to the acceptance of Stage I works, and shall remain in effect for twelve (12) months following the date of the letter of acceptance for STAGE I works.

- b) **Stage II Security** can be in the form of a certified cheque or bond and to be in the amount of 120% of the estimated cost of the Stage II works, and must be in place prior to issuance of a construction permit.

**Stage II Warranty Security** can be in the form of a certified cheque or bond and will be equal to 10% of the value of Stage II work and must be in place prior to the acceptance of Stage II works, and shall remain in effect for twelve (12) months following the date of the letter of acceptance for STAGE II works.

One thousand dollars (\$1,000.00) of the Stage II security will be retained for each undeveloped lot (at the time of Stage II acceptance) to cover possible damages to the curb and gutter and surface course asphalt. The Developer shall initiate the review of securities held until permit to occupy is granted.

## **1.5 Approval to Proceed**

### **1.5.1 Schedule**

Stage 1 works shall not commence until Final Construction Approval has been issued, all financial requirements have been met, and the Subdivision Agreement has been executed.

The Developer must provide full time site inspection during underground works for all serviced subdivisions, part time inspection for underground works in unserved subdivisions, and part time inspection for all surface works. Failure to provide supervision will result in the rejection of all uninspected work until uncovered and inspected and in the subdivision being issued a stop work order until proper supervision is provided.

All work shall be in accordance with the Government of Newfoundland and Labrador Municipal Water, Sewer and Road Specifications and/or any other Regulatory authorities and/or terms and conditions as deemed necessary by the Town and the municipalities supplementary document (See Appendix K)

### **1.5.2 Acceptance of Stage 1 Work**

Upon the completion of the Stage 1 work, the subdivision developer will forward the documents listed below to the Town for review and acceptance:

- a hard copy of the as-built engineering drawings;
- a hard copy of the as-built subdivision plan;
- a hard copy of the as-built lot grading plan;
- digital copies (both PDF and in the latest version of AutoCAD) of all as-built information;
- a copy of the House Servicing Information Form (See Appendix E) for each approved building lot, with lot and civic numbers designated;
- a copy of the videotape of the television inspection of the storm and sanitary sewer systems;
- a copy of the television inspection analysis report;
- a copy of the results of the water tightness for the sanitary sewer system; (See Appendix F)
- a copy of the results of the deflection test results for the sanitary sewer system;
- a copy of the results of the sanitary sewer manhole exfiltration tests;



- a copy of the verification that the water system has been swabbed;
- a copy of the results of the pressure/leakage tests on the water system;
- a copy of the test results summary sheet;
- a copy of all granular testing for subgrade to full limit of street ROW;
- a copy of base course asphalt testing;
- a copy of the results of concrete tests for curb and gutter (if applicable);
- Fire flow test results as required by the town; and
- A copy of the commissioning reports for all pressure reducing valves, lift stations, pressure boosting systems and so on.

The Town will accept Stage 1 work when:

- All Stage 1 work has been completed to the satisfaction of the Town after all noted deficiencies are corrected; and
- Acceptable Stage 1 maintenance security has been provided.

#### **1.5.3 Town Inspections**

Upon receipt of the above noted documents, the Town will perform an in-house review of the video inspection of the storm and sanitary systems. In addition, the Town's Engineer will perform field inspections of the water and sewer system. All deficiencies noted during the various inspections must be corrected before the Town will accept Stage 1 work.

#### **1.5.4 Stage 1 Maintenance Period**

When all Stage 1 work has been completed to the satisfaction of the Town, the subdivision developer shall provide a one year maintenance security to the Town in the amount of ten percent (10%) of the value of Stage 1 work. The maintenance security must be in a form acceptable to the Town. The Stage 1 maintenance period shall start on the date of acceptance of Stage 1 work by the Town.

#### **1.5.5 Building Permits**

Building Permits will not be issued until Stage 1 work has been accepted by the Town or acceptable security established.

#### **1.5.6 Stage 1 Maintenance Pre-Expiry Inspection**

Prior to the expiration of the Stage 1 maintenance period, the Town will re-inspect the Stage 1 work. Any deficiencies noted during these inspections must be corrected by the

subdivision developer, at their own expense, prior to the expiration of the Stage 1 maintenance period. Should deficiencies not be corrected within thirty (30) days of the Developer being notified, the Town reserves the right to complete the work and deduct twice the value of the deficiencies as determined by the Town of Torbay from the Development securities.

## **1.6 Acceptance of Stage 2 Work**

Stage 2 shall not commence until Stage 1 has been accepted by the Town. The Town will not accept responsibility for damage to any Stage 1 works until all Stage 2 works have been completed and accepted by the Town. The surface course asphalt shall not be placed without the approval of the Town Engineer and his/her designate. This normally doesn't happen until 95% of the lots are completed.

Upon completion of the Stage 2 work, the subdivision developer will forward the documents listed below to the Town for review and acceptance:

- a copy of the results of the surface asphalt tests;
- a copy of the results of concrete tests for curb and gutter and sidewalk (if applicable);
- copies of the required as-built benchmark and gridline information;
- copies of legal plans and description of street rights-of-way, easements and open spaces (including site grading, privacy fencing, tree planting, etc.), as applicable;
- the deed to all lands to be deeded to the Town in a form suitable for registration and approval by the Town's solicitor;
- Correction of all noted deficiencies;
- Master Survey of Development, both plan and description, as per the Town's requirements;
- Video Inspections of sanitary and storm sewers prior to placement of surface course asphalt;
- Letter of Certification and signed As-Built Drawings from Project Engineer verifying that all work has been completed in accordance with all plans, specifications, approvals, etc; and
- A copy of the geotechnical report outlying all sieve analysis, compaction tests, asphalt tests, Phase 1 'ESA' and so on as required for the completion of the works.

### **1.6.1 Town Inspections**

Upon the receipt of the above noted documents, the Town will perform an inspection of the Stage 2 works. All deficiencies noted during this inspection must be corrected before the Town will accept Stage 2 work.

### **1.6.2 Stage 2 Maintenance Period**

When all Stage 2 work has been completed to the satisfaction of the Town, the subdivision developer shall provide a one year maintenance security to the Town in the amount of ten percent (10%) of the value of Stage 2 work. The maintenance security must be in a form acceptable to the Town. The Stage 2 maintenance period shall start on the date of acceptance of Stage 2 work by the Town.

### **1.6.3 Acceptance of Stage 2 Work**

The Town will accept Stage 2 work when:

- all Stage 2 work has been completed to the satisfaction of the Town; and
- acceptable Stage 2 maintenance security has been provided.

### **1.6.4 Release of Stage 2 Security**

Upon the acceptance of Stage 2 work, the Town will release any Stage 2 security being retained, except that the sum of \$1,000.00 will be retained for each lot that is not completely developed. This money will remain on deposit with the Town as asphalt damage security until such time as all building lots are completely developed. The amount of this security may be reduced periodically as building lots develop.

### **1.6.5 Stage 2 Maintenance Pre-Expiry Inspection**

Prior to the expiration of the Stage 2 maintenance period, the Town will re-inspect the Stage 2 work. Any deficiencies noted during this inspection must be corrected by the subdivision developer prior to the expiration of the Stage 2 maintenance period.

## **2.0 SURVEYING**

### **2.1 Definitions**

Survey means the determination of any point or the direction or length of any line required in measuring, laying off or dividing land for the purpose of establishing boundaries or title to land.

Newfoundland and Labrador Provincial Co-ordinate Survey System means a system established for referencing land surveys and is based on the three degree transverse Mercator grid projection (NAD 83) for the province of Newfoundland.

Co-ordinate monument means any marker established for the Provincial Co-ordinate Survey System.

### **2.2 Survey Plan**

A survey plan shall include:

- a) The name of the owner of all abutting lands.

- b) The length, in metres, and bearing defining all boundaries and any line connecting a boundary of the subdivision with a Provincial Control Monument.
- c) Each street, walkway and easement.
- d) Each lot and its number.
- e) The length, in metres, bearing of each boundary line, and the area in square metres or hectares of:
  - the land being subdivided;
  - each street, walkway and easement;
  - each lot and its number; and
  - the land, if any, which is reserved for park, playground, buffers, and public purposes.
- f) The radius, central angle, the length of arc, the point of curve and the point of tangency shall be given for each curved line and clearly indicated on the survey plan.
- g) The relevant curve data of connections between existing streets and streets of the subdivision.
- h) The location of any existing structure which is to remain.
- i) Every water course and its direction of flow.
- j) All information necessary for the calculation and laying out of any curved line.
- k) The date of compilation.
- l) The date of revision, if any.
- m) The name of subdivision.
- n) All existing streets, roads, lanes and intersections in the immediate area and their official names as designated by the Town.
- o) The location and extent of rock outcrops, bogs or marshes.
- p) The location and results of any geotechnical borehole or test pit;
- q) At least two (2) center line points of known chainage related to the Provincial Co-ordinate Survey System.
- r) The location and elevation of the Bench Mark used.
- s) The radius, central angle, the length of arc, beginning and end of curve, and the point of tangency shall be given for each curved line and clearly indicated on the survey plan.

- t) Manhole numbers shall be assigned by using the last four whole numbers of the easting and the suffix “S” for sanitary sewer manholes and “R” for storm sewer manholes.

The survey plan shall be of a size within the following limits:

- **MAXIMUM** – Size designation, A0, which represents 841 mm wide x 1189 mm long;
- **MINIMUM** – ANSI D (22x34 or 558.8mm x 863.6mm) is a commonly used size by most engineering firms as it allows drawings to be printed half scale on 11x17 drawings
- **LEGAL SIZE** – Size designation P4, which represents 215 mm wide x 355 mm long.

**NOTE:** Refer to National Standards of Canada CAN 2-9.60 M and CAN2-9.61 M for paper size designations.

A survey plan shall:

- a) be to a scale of 1:500,
- b) show a Key Plan to locate the subdivision as it is related to adjacent streets of the Town with a scale of 1:2500, and
- c) be stamped and signed by a Newfoundland Land Surveyor who has a Certificate of Authorization from the Association of Newfoundland Surveyors in the Province of Newfoundland and Labrador.

### **2.3 Survey Details and Accuracy**

- a) All surveys are to be completed using total station or GPS technology.
- b) All boundary line dimensions to be shown to at least two decimal places with all angles shown to the nearest 30 seconds or better.
- c) The accuracy of dimensions shall be as follows:
  - stationing – to the nearest centimeter,
  - elevations – to the nearest centimeter, and
  - horizontal distances – to the nearest centimeter.

“More or Less” dimensions shall not be accepted, except along a water boundary or other irregular boundary, in which case a “tie line” between the adjoining boundary end points shall show the bearing and the distance.

- d) Contours shall be shown to determine the proper elevations for all streets, roads, easements and walkways in relation to the proposed lot layout.
- e) For street or streets proposed in undeveloped areas, preliminary contours may be taken from the latest issue of the Province of Newfoundland Topographic Series Maps.

- f) For the section of a proposed access street, being within 150 m of the existing streets, and which leads into an undeveloped area, the existing vertical alignment conditions (contours) shall be obtained from actual field surveys.
- g) All Vertical Control shall be related to the Province of Newfoundland Approved Datum.
- h) Information shown on a survey plan shall be sufficiently detailed to permit any point on any surveyed line to be accurately located in the field.
- i) The accuracy of closure shall be not less than 1:10,000.

#### **2.4 Street, Walkway and Lot Identification**

When the roadway and street (street line to street line) have been constructed and the subdivision or area involved is ready for acceptance, each public lot, easement, walkway and street shall be identified by an iron or steel pin driven into the ground at each corner, beginning of curve, and end of curve, unless these points fall upon solid rock. In such cases, a hole shall be drilled into the rock to accommodate a steel pin or plug anchor in quick set cement.

#### **2.5 Survey Information**

Prior to Stage I work acceptance, a copy of all plan information regarding permanent subdivision survey monuments, street lines, boundary lines, easements, and walkway locations, will be presented to the Town.

Survey information shall be clear, concise, neat and accurate, properly labelled and signed by a Newfoundland Land Surveyor, registered for the current year.

#### **2.6 Benchmarks**

- a) The Developer shall supply brass plugs to be used as benchmarks.
- b) The Town shall assign numbers to the benchmarks.
- c) The plugs with wedges shall be placed in the concrete curb flush with the concrete. Prior to setting, the plug hole will be filled with quick-set cement. Then, with the use of a mallet and a wooden block, the plug and wedge will be driven into the hole.
- d) All benchmarks shall be intervisible and co-ordinated using the 3 degree Modified Transverse Mercator Projection. The traverse closure shall be a minimum of 1:10,000. Crown land reference monuments and their co-ordinates shall be listed when running the traverse.
- e) The maximum distance between benchmarks shall be 300 metres.
- f) Benchmarks must be established from other Town benchmarks or geodetic benchmarks and end at the same or different Town benchmarks that have acceptable elevation values. All lines beginning and ending in existing benchmarks with known elevations.

- g) Benchmarks must be established by spirit levels done to third order standards with a minimum accuracy 24 mm/k where k=the distance in kilometres between benchmarks measured along the leveling route. If the misclosure of discrepancy exceeds the allowable, the line shall be re-leveled.
- h) If using spirit levels the method used will be three wire method (mean of the reading for the three wires). The difference of elevation is the mean of the two running where:

$$\text{Mean} = \frac{(F) - (B)}{2}; \quad \text{where} \quad \begin{array}{l} F = \text{foresight} \\ B = \text{backsight} \end{array}$$

The Contractor/Surveyor will perform all necessary adjustments of the level loops.

If using GPS technology the base station must occupy a provincial control survey marker, a geodetic benchmark or a previously established Town benchmark.

A mask angle of 10 degrees or higher above the horizon shall be used.

A check must be observed to another Control Survey Marker by the rover immediately after the base station is setup and before the station is taken down.

When taking measurements at a new benchmark, the GPS rover shall be set up on a tripod, to avoid excess movements, and a minimum of 30 individual epochs shall be observed on two separate occasions at least four hours apart to help maximize accuracy and precision.

- i) The original field notes for the horizontal, vertical control and completed description sheets shall be submitted to the Town. If using GPS, a GPS Report outlining the system used should be submitted.
- j) All notes shall be on loose leaf paper (100 mm x 165 mm) with the cover sheet showing the name of the firm, date, name of observer and recorder.
- k) The Town shall supply description sheets for the drafting of a reference plan for each benchmark.
- l) The description sheet shall be prepared in a fashion that will produce clear and legible copies. A minimum of three ties shall be shown to reference the benchmark. The reference plan does not have to be to scale, however, all lettering and numbering must be done using current AutoCAD software.
- m) All benchmarks and benchmark information shall be shown on the subdivision plan.
- n) If the work does not meet the above criteria, the Contractor/Surveyor's work shall be returned for corrections.



### **3.0 DRAFTING**

#### **3.1 Drawing Preparation**

##### **3.1.1 CADD Drawings**

All drawings, including construction and as-built drawings, shall be prepared using computer-aided design and drafting (CADD). Manually drafted drawings are not acceptable.

##### **3.1.2 Size of Drawings**

All drawings in any one development shall be the same size. The Prime Consultant shall co-ordinate the drawing size with any/all sub-consultants.

- **MAXIMUM** – Size designation A0, which represents 841 mm wide x 1189 mm long.
- **MINIMUM** – ANSI D (22x34 or 558.8mm x 863.6mm) is a commonly used size by most engineering firms as it allows drawings to be printed half scale on 11x17 drawings.

**NOTE:** Refer to National Standards of Canada CAN 2-9.60 M and CAN2-9.61 M for paper size designations.

##### **3.1.3 Scale**

All CAD drawings shall be drawn full size and plotted as a reduced scale. The scale of the:

a) Engineering plan shall be:

- Plan – 1:500, or as approved by the Town;
- Profile – ratio of vertical to horizontal of 1:10; and
- Cross-section and details to a scale that will fully illustrate the subject matter.

b) Survey plan shall be:

- 1:500, or
- as approved by the Town.

c) Drainage plan shall be:

- 1:500,
- 1:1000
- Or 1:2500

- as approved by the Town.

d) Key Plan shall be:

- 1:2500

e) Detail plan shall be to a scale that will fully illustrate the subject matter.

#### **3.1.4 Grid Reference**

Drawings shall be prepared using NAD83 (North American Datum 1983). Grid lines at 200 metres shall be shown and northings and eastings indicated.

#### **3.1.5 True North Arrow**

A north arrow shall be placed in the upper right hand corner of each drawing, indicating True North.

#### **3.1.6 Plan Orientation**

Survey plans shall be drawn using the developments actual coordinates based upon NAD83. Title Plans shall be oriented such that the top of the sheet is approximately North.

##### **Layering**

Data on each drawing shall be fully layered according to standard engineering practice.

##### **Cover Sheet**

A cover sheet shall be provided for each drawing set and shall contain the following information:

- Project Name
- Key Plan
- Name of Consulting Engineer and Sub-Consultants
- Name of Developer
- List of Drawing Names and Numbers
- Date of Issue
- "As-Built" or "Record Drawing" Note when Applicable

#### **3.1.7 Final Plan**

When the plan has been checked and approved by the Town the computer generated plan shall be compiled to show the finished information only, omitting drafting construction lines and layout work.

## **3.2 General Conditions**

### **3.2.1 Street Names**

All streets shall be identified and printed within the street lines. Actual street names shall be used when available. Proposed street names to be submitted to the Town prior to incorporating in drawings. The Town will forward names to the St. John's Regional Fire Department office for review. Upon approval by St. John's Regional Fire Department and council, the developer will be advised of approved street names.

### **3.2.2 Intersection Identification**

At intersection streets or where the continuation of the streets are on other plans, the following note shall be shown on the plan:

"For Continuation, See Plan No. \_\_\_\_\_".

### **3.2.3 Percent (%) Grades**

Percent (%) grades (slopes) shall be shown for all appropriate services to two (2) decimal places.

### **3.2.4 Accuracy of Measurements**

All distances shall be measured to the nearest centimetre.

### **3.2.5 Geodetic Datum**

Elevations shown on any plan shall be referred to the provincial Geodetic Datum and the reference benchmark (BM) along with its location, description and elevation shall be shown in the reserved area above the Title Block.

### **3.2.6 Irregular Boundary Line Measurements**

The accuracy of dimensions shall be as follows:

- stationing – to the nearest millimetre,
- elevations – to the nearest centimetre, and
- horizontal distances – to the nearest centimetre.

"More or Less" dimensions shall not be accepted, except along a water boundary or other irregular boundary, in which case a "tie line" between the adjoining boundary end points shall show the bearing and the distance.

### **3.2.7 Revisions to Plan**

- a) If plans are revised, amended or altered, the Draftsman's (draftsperson) initial date of revision and brief description shall be noted in the revision area of the Title Block.
- b) All corrections and changes shall be shown within a revision cloud on the drawing.

### **3.2.8 Signing of Plans**

All Engineering plans shall be stamped and signed by a Professional Engineer registered with license to practice with the Association of Professional Engineers and Geoscientists of Newfoundland and Labrador.

All Survey plans shall be stamped and signed by a registered Land Surveyor, licensed in the Province of Newfoundland and Labrador.

### **3.2.9 Procedure Revision**

This procedure is subject to change without notice, and the onus lies with the user to ensure that they are in possession of the latest revision.

## **4.0 EASEMENTS**

### **4.1 General**

Easement means an incorporeal right, distinct from ownership of the soil, vested in the Town and consisting of a use of another's land for any Public service or utility (Newfoundland Power, Bell Aliant, Rogers, Eastlink, etc.).

When sewers, surface drainage or water system pipes are to be installed other than in a street or walkway, an easement shall be provided over such installations.

The owner of the easement land shall not construct any type of structure over such easement area.

### **4.2 Design**

The width of any easement shall be based upon the type and number of services proposed to be installed.

The width of any easement shall be based upon the type and number of service pipes to be installed in the easement. A minimum width of three metres must be provided between each edge of the easement and the centerline of the pipe nearest that edge, unless otherwise approved by the Town.

The alignments for any easement shall be dependent upon the type of service to be installed.

### **4.3 Acceptance**

Acceptance of services within an easement shall be carried out as outlined under the requirements for primary service acceptance.

All easements shall be covered by legal agreement as determined and approved by the Town's Solicitor.

#### **4.4 Restoration**

When the Town carries out work within easement, it shall be responsible for restoring the area as close as possible to its original condition or as otherwise stipulated in the Easement Agreement.

This procedure is subject to change without notice, and the onus lies with the user to ensure that he is in possession of the latest revision.

### **5.0 STREETS**

#### **5.1 Street Classification**

Streets shall be classified as shown in the following table:

	<b>ARTERIAL</b>	<b>COLLECTOR</b>	<b>LOCAL</b>
TRAFFIC SERVICE	Traffic movement first consideration	Traffic movement and land access of equal importance	Traffic movement second consideration
LAND SERVICE	Land access second consideration		Land access first consideration
PARKING	On-street parking may be permitted under certain circumstances	On-street parking is usually permitted	On-street parking is usually permitted
RANGE OF TRAFFIC DESIGN VOLUME (A.D.T.)	12,000 – 30,000	1,000 – 12,000	Less than 1,000
VEHICLE TYPE	All types but trucks may be limited	All types with truck limitations	Passengers and service vehicles, large vehicles restricted
CONNECTS TO	Arterials, Collectors, Freeways, Some Locals	Arterials, Collectors, Locals	Collectors, Locals

#### **5.2 Other Street Classifications**

Local streets could be further classified as:

- a) Urban (fully serviced), and
- b) Rural (unserved).

#### **5.3 Street Design Criteria**

Streets shall be designed in accordance with the minimum requirements as outlined in the following table:

STREET CLASSIFICATION						
	ARTERIAL	COLLECTOR	LOCAL			
			URBAN	RURAL		
1. Design Speed in km/h	50 km/h – 80 km/h	50 km/h – 80 km/h	30 km/h – 50 km/h	30 km/h – 50 km/h		
2. Street grade max. = min. =	10% 1%	10% 1%	10% 1%	10% 1%		
3. Street Right of Way Width*	25 m	20.6m	15m	20.6m** 23.6m**		
4. Radius	90 m	90 m	50 m*****	50 m*****		
5. Maximum super-elevation	0.06 m/m	0.06 m/m	0.06 m/m	0.06 m/m		
Minimum super-elevation	0.02 m/m	0.02 m/m	0.02 m/m	0.02 m/m		
6. Minimum stopping sight Distance	65 m	65 m	45 m	45 m		
7. Pavement Widths*	21.5 m	13.5 m	10.5 m	7.6 m		
8. “K” value – Vertical curve.  Crest - sag -	  7 11	  7 11	L = Length in metres should not be less than design speed in kilometres per hour.			
9. Minimum length of Vertical Curve	L – Length in metres should not be less than design speed in kilometres per hour.					
10. Vertical Curve (Length for Drainage)	Crest: K = 60 Sag: K= 30					
11. Minimum Passing Sight Distance	350 m	350 m				
12. Minimum Distance Between Intersections	400 m	60 m	60 m	60 m*****		
13. Min. Curb Radius at Intersections	15 m	9 m	8 m	8 m		
14. Concrete Sidewalks	Both Sides	Both Sides	***	****		
15. Street lighting (Minimum requirements)	1.5 cd/m <sup>2</sup> or 22 lx	1.0 cd/m <sup>2</sup> or 15 lx	1 cd/m <sup>2</sup> or 10 lx	1 cd/m <sup>2</sup> or 10 lx		

\* Pavement widths and Right-of-Way widths are minimum. The Town may request wider pavement or Right-of-Way widths in certain conditions.

\*\* May need to widen depending on field conditions or if the town requires a pedestrian walkway.

\*\*\* Minimum of one side. Addition of a second sidewalk to be determined by the Town.

\*\*\*\* Number of sidewalks to be determined by the Town.

\*\*\*\*\* Crescent and Cul de sacs may have a centerline radius of 30m if less than 200m in length.

\*\*\*\*\* DTW approval required when connecting to a DTW owned road.

**NOTES:**

1. Minimum grade permitted with curb and sidewalk is 2.0%.
2. Lumens/sq. metre is commonly called "lux" or lx.

3. Curb and gutter and/or sidewalk may be requested at discretion of Council.
4. Table 5.3 contains design criteria for a number of street design parameters. The values shown may generally be considered minimum and should be increased where physically and economically possible. For specific situations that are not covered by this procedure, designers are referred to the latest editions of the Manual of Geometric Design Standards for Canadian Roads and the Urban supplement to the Geometric Design Guide for Canadian Roads, produced by the Transportation Associations of Canada
5. A super elevation of 3% is required for all streets with grades between 1% and 2%.
6. Council may accept a deviation in the 20.6m right of way in areas where it is not possible to obtain a 20.6 meter right of way depending on circumstances.

#### **5.4 Cul-de-Sacs**

Because of the negative effects of cul-de-sacs on the efficiency of service delivery, their use should be restricted to instances where land access is not possible through streets.

The following additional criteria apply to cul-de-sacs:

- a) Street line turning circle radius of 17.25m ROW;
- b) Pavement width, turning circle, radius of 15.25m at Face of curb Turning circle;
- c) Maximum length of 200 m in serviced areas and 300 m in unserviced areas (an emergency access). This is measured along the street center line from the street line of the intersecting street to the start of the turning bulb;
- d) Transitional street line radius of 15.25 m into street line turning circle;
- e) Low back curb and gutter to extend around the entire perimeter of the cul de sac bulb (in areas where curb and gutter is required);
- f) May have a vertical alignment within the intersection approach of not more than 4% grade for a minimum distance of 10m from the curb line of the intersecting road;
- g) Maximum grade across the cul de sac bulb shall be 5%.

#### **Temporary Access**

- A temporary secondary access must be provided if, as a result of the staging of development, a situation develops where the ultimate street network is not completed and a length of street greater than 200m (for serviced areas) exists with only one access to an existing public street. Or a length of street greater than 300m (for unserviced areas) exists with only one access to an existing public street
- The temporary access must have a minimum width driving surface of 8m. The driving surface must consist of at least 100mm Class 'A' road gravel material. If the temporary access is to be in place through a winter season, the temporary access must be paved, or must be satisfactorily maintained by the subdivision developer.



### **Temporary Turn Around**

- A temporary turn-around area must be provided at the end of all street that are temporarily terminated in dead ends.
- A temporary turn-around area must have a minimum radius of 15.00m
- The temporary turn-around area must have a minimum of 40mm of asphalt.

### **5.5 Crest Vertical Curves**

The minimum length of crest vertical curves to provide minimum stopping distance for each road class is to be determined in accordance with the Transportation Association of Canada (T.A.C.) Design Handbook.

The vertical curve should be made longer than the minimum values given whenever this can be done without jeopardizing drainage and cost factors.

### **5.6 Sag Vertical Curves**

The minimum length of sag vertical curves so as to provide minimum stopping sight distance for each road class is to be determined in accordance with the Transportation Association of Canada (T.A.C.) Design Handbook.

Vertical curves with lengths greater than those given in the standard drawing should be used whenever this can be done without jeopardizing surface drainage and cost factors.

For Longitudinal Drainage on sag vertical curves, the minimum desirable gradient should be achieved within 15 m of the low point of the sag. This results in a maximum K value of 40 for sag vertical curves and a minimum K value of 80 for crest vertical curves.

### **5.7 Intersections**

The maximum number of street approaches to any one (1) intersection shall be four (4).

Intersections on the same side or opposing of street shall not be less than 60 m apart, despite conditions of existing infrastructure.

Intersections shall be:

- a) of "T" type design where possible,
- b) have a vertical alignment within the intersection approach of not more than 2% grade for a minimum distance of 10m from the curb line of the intersecting road,
- c) the desirable angle of intersections shall be 90°. The minimum permissible angle of intersection shall be 75°, and
- d) have a minimum center line distance between adjacent opposite intersections:

- on local streets to Collector Streets of 60 m, and
- on Collector Streets to Collector Streets of 60 m.
- The minimum intersection sight distance from the minor street for the critical turning movement, measured within the street right-of-way shall be:
  - 85m for intersections with local streets, and
  - 125m for intersections with collector streets.

All curb circles shall be a minimum of eight (8) meters radius unless otherwise required.

When two (2) streets (or more) intersect, only one (1) street may have a curved horizontal alignment; all other streets at this intersection shall have a minimum tangent section of 30.5 m as measured from the point of the street line intersection to the first point of horizontal curvature on each approach street line.

#### 5.8 Driveways

All residential lots shall have a low back curb of 6.2m in width, starting at a point 0.5m from the property line. Widths greater than this may be approved at council's discretion, but in no case shall be greater than 50% of the lot frontage.

Driveways must not be located within 12m of the centerline of an intersection on the abutting street.

Corner Lots may be permitted to have a driveway access from the flanking street as per the approved subdivision plan.

#### 5.9 Side Ditches

Side ditches shall be constructed along both sides of streets that do not have piped storm drainage systems. In all cases, the invert of the ditch shall be below sub-grade of the street and shall conform to the following dimensions:

- Minimum Bottom Width            1.0 m,
- Minimum Depth                    1.0 m, and
- Maximum Side Slope                2:1.

The maximum flow velocity for unlined ditches shall be 3 m/sec. In cases where the velocity is 3 m/s or greater, additional erosion control acceptable to the Town must be used.

#### 5.10 Guide Rail Barriers

In fill areas greater than 1.5 m, traffic and/or pedestrian barriers shall be constructed along the affected areas, in accordance with the guidelines established by the Transportation Association of Canada.

### **5.11 Street Signs, Markings and Traffic Control Devices**

All street signs, markings and traffic control devices shall conform to the latest version of the Transportation Association of Canada manual entitled "Uniform Traffic Control Devices for Canada" (metric edition).

### **5.12 Other General Requirements**

- a) Tangent distances between horizontal reverse curves shall not be less than 50 m.
- b) Tangent distances in meters between horizontal curves following the same direction should not be less than four (4) times the design speed in km/h.
- c) Horizontal alignment of streets shall be such that the center line and curb lines shall be symmetrical with their street lines.
- d) Vertical alignment of streets shall be considered as symmetrical unless otherwise instructed by the Town.
- e) In areas where there are no curbs or sidewalk structures installed, the road is to be constructed to Modified RLU 60 standard.
- f) In rural areas where no other trail ways have been identified for development, a 3 meter wide pedestrian trail way is to be developed on one side of the proposed roadway on the inside of the drainage ditch. The trail way shall be constructed to the Town's normal trail standards as determined by the Recreation Department.
- g) All streets shall have a minimum 150 mm crowned roadway cross-section and in no case should the crowned roadway cross-section be less than 2%.
- h) No driveway (ramp) shall be permitted to enter into a proposed designated limited access freeway, arterial or major street.
- i) Curb and gutter is required in all areas serviced with storm sewers.
- j) Paraplegic ramps shall be required at all intersections with sidewalks.
- k) These guidelines are subject to change without notice, and the onus lies with the user to ensure that they are in possession of the latest revision.
- l) All streets shall have a minimum of 150 mm Class "B" and 75 mm Class "A" granulars, 37.5mm base course and 37.5mm surface course asphalt. Additional granulars and asphalt may be specified as determined by the Town's Engineer. In the absence of an acceptable geotechnical report completed by a qualified testing agency core sampling of all asphalt street surface shall be carried out by the developer or his designate on all placed asphalt surfaces on all subdivision streets and cul de sacs at 20m intervals. More cores may be warranted if testing results dictate.

- m) At intersections a 5.6m green belt will be required, beyond the street right of way, on the flanking street.

**Landscaping Requirements and urban forestry.**

- Refer to Town's Landscaping requirements (if applicable).
- The developer shall only remove those trees that are necessary for development and only after consultation and approval from the town's recreation and leisure services department. Tree replacement and/or relocation may be required.

**6.0 STORM SEWERS**

**6.1 Design Drainage Area**

The drainage area may be determined from contour plans and shall include any fringe areas not provided for in adjacent storm drainage areas, as well as other areas which may become tributary by reason of regrading.

**6.2 Drainage Plan**

The drainage plan shall be based on design elevations. The plan of the drainage area shall be to a scale of 1:1250 or 1:2500, depending on the size of the area and shall show generally:

- a) streets;
- b) lots;
- c) water courses and direction of flow;
- d) proposed storm sewers with manholes numbered consecutively for design reference (using the last four digits of the Easting and the suffix 'R'.
- e) tributary areas to each manhole, size of the area in hectares and the runoff coefficient clearly shown therein;
- f) contour lines having an interval not exceeding one meter;
- g) existing topographical spot elevations shown on proposed site and adjacent properties;
- h) proposed surface drainage; and
- i) design elevations.

**6.3 Runoff**

Computations shall be based on the Rational Method Formula:

$$Q=R.A.I.N.$$

where Q = maximum rate of runoff, l/s  
 R = runoff coefficient  
 A = area tributary to the point of design, ha  
 I = average rainfall intensity, having duration equal to the time of concentration of the drainage area, mm/hr  
 N = constant = 2.778

Standard design forms shall be used for all calculations.

#### 6.4 Runoff Coefficient

The value of the coefficient shall be obtained by correlating the ratio of impervious to pervious surfaces. The minimum coefficients for fully developed areas shall be as follows:

LAND USE	RETURN PERIOD (yrs.)	
	10	25-100
<b>Developed</b>		
Residential: Single Family	0.30	0.50
Residential: Semi-Detached	0.40	0.60
Residential: Town-Housing/Apartments	0.60	0.75
Paved Parking Areas	0.90	1.00
Industrial	0.60	0.90
Commercial	0.70	0.90
Institutional	0.70	0.80
Parks	0.25	0.45
<b>Undeveloped</b>		
Pasture/Range	0.30	0.50
Cultivated Land	0.35	0.55
Forest/Woodlands	0.25	0.45
Lakes/Ponds/Wetlands	1.00	1.00

Design of Local Storm Sewers	Rural Local	Trunk Sewers and Collectors	Major Structures and Arterial
Return Period (in years)	10	25	50 – 100*
Duration (in minutes)	10 min max.	TOC	TOC

\*All major bridges and structures that have significant consequences in the event of failure will be assigned a return period on a case by case basis.

#### 6.5 Rainfall Intensity

The rainfall intensity shall be based on a 1 in 10 year return period and a duration of ten (10) minutes for suburban residential areas. Trunk Sewers, bridges and other critical structures as determined by the Town shall be on a 1:25, 1:50, or 1:100 year return period with a duration equal to the time of concentration. The design intensity must be obtained from the most up-to-date data available from Environment Canada for the St. John's area.

TIME OF CONCENTRATION (Min.)	RAINFALL INTENSITY (mm/hr)	
	10 Year	25 Year
0 – 9.9		
10 – 14.9	0.30	0.50
15 – 29.9	0.40	0.60
30 – 59.9	0.60	0.75
60 – 119.9	0.90	1.00
> or = to 120	0.60	0.90

### Time of Concentration

The time of concentration shall be calculated using the following equation

$$T_c = \left( 2.1873 \frac{L n}{\sqrt{S}} \right)^{0.467}$$

Where,

$T_c$  = time of concentration in minutes

$L$  = maximum length of travel (in minutes) from the most remote part of the basin to the outlet.

$S$  = mean slope of the main drainage channel (m/m)

$n$  = roughness coefficient selected from Table below.

### Roughness Coefficient for Calculation of Time of Concentration

LAND USE	RETURN PERIOD (yrs.)	
	10	25 - 100
<b>Developed</b>		
Residential: Single Family	0.060	0.055
Residential: Semi-Detached	0.050	0.045
Residential: Town-Housing/Apartments	0.040	0.035
Paved Parking Areas	0.020	0.015
Industrial	0.030	0.015
Commercial	0.040	0.015
Institutional	0.050	0.015
Parks	0.100	0.070
<b>Undeveloped</b>		
Pasture/Range	0.400	0.350
Cultivated Land	0.200	0.150
Forest/Woodlands	0.600	0.500
Lakes/Ponds/Wetlands	0.800	0.700

## 6.6 Capacity of Pipe

**Manning's formula shall be used to determine the capacity of storm sewer pipes:**

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

where

Q =	discharge, m <sup>3</sup> /s
A =	cross-sectional area of flow, m <sup>2</sup>
R =	hydraulic radius, m
S =	slope, m/m
N =	coefficient of roughness, dimensionless

The capacity of ditch culverts shall be determined using the Inlet Control or Outlet Control nomographs contained in the AISI "Handbook of Steel Drainage & Highway Construction Products".

All storm mains shall consist of corrugated high-density polyethylene pipe (HDPE), unless otherwise permitted by the Town, and roughness coefficients used shall be as follows:

PRODUCT	DIAMETER	MANNINGS “n”
Dual Wall (smooth interior)	100 mm – 1500 mm	0.015
Single Wall (corrugated interior)	100 mm – 200 mm	0.016
	250 mm	0.017
	300 mm – 375 mm	0.018
	450 mm – 600 mm	0.020
	750 mm	0.021
	900 mm	0.022
	1050 mm	0.023
	1200 mm -1500 mm	0.024

## 6.7 Minimum Size

Driveways .....	450 mm
Street Sewers .....	300 mm
Catch Basin Leads .....	Single 300 mm
	Double 300 mm
Building Sewer .....	100 mm

### 6.8 Velocity (When Pipe Flowing Full)

Minimum .....	1 m/s
Maximum .....	5 m/s for diameters up to and including 825 mm and 6 m/s for diameters larger than 825 mm



## **6.9 Minimum Gradient**

The minimum allowable pipe gradient shall be the gradient required to produce the minimum acceptable velocity of 1.0 m/s at design peak flow. In no case, shall the minimum gradient be less than 0.5%.

## **6.10 Change of Size**

No decrease of pipe size from a larger size upstream to a smaller pipe downstream shall be allowed regardless of the increase in grade.

## **6.11 Clearance**

A minimum of 150 mm clearance is required between outside barrels at all sewer pipe crossings.

In subdivisions where there is a storm sewer system then the sanitary and storm mains shall be in the same trench and the watermain shall have a 3m horizontal separation from the sewermain. In a subdivision where there is no storm sewer system then the watermain and sewermain shall be in the same trench. A minimum of 450 mm separation in vertical and horizontal direction is required between the sewer pipe and water pipe. If the 450mm clearance cannot be achieved then a 3m horizontal separation must be maintained.

## **6.12 Location**

Storm sewers shall be located such that manholes are placed in the center of driving lanes, wherever possible.

Manholes shall be located at every change of horizontal and vertical alignment, size and material of the sewer.

## **6.13 Earth Load**

Earth load shall be calculated by using the Marston Formula.

## **6.14 Superimposed Load**

The effect of concentrated and distributed superimposed loads shall be evaluated by generally accepted formulae.

## **6.15 Storm Sewer Service Pipe**

Separate storm sewer service pipes shall be provided for each separately owned dwelling unit.

Storm sewer pipes must not be located within 3.0m of the side boundary of a building lot. Storm sewer service pipes must connect to the storm sewer main and not to a storm sewer manhole.

Storm sewer service pipes, storm water drains, roof drains, foundation drains, etc shall not be connected to any part of the sanitary sewer system.

#### **6.16 Manholes**

All manhole openings must be located on the upstream side of the manhole.

In manholes where the vertical distance between the invert of the outlet and the invert of the inlet pipe is 600 mm or more, an internal vertical drop pipe shall be provided at manholes. However, the drop manhole should be avoided and used only when it is not economically feasible to steepen the incoming sewer or by using other means.

Special manholes shall be fully designed and detailed.

Maximum distances between manholes unless otherwise specified shall be 90 m for 700 mm pipe or smaller and 120 m for pipe greater than 700 mm.

Manholes to be placed 5mm below base course asphalt grade for the duration that base course asphalt is on the street.

Manholes to be adjusted to 5mm below finish course asphalt grade immediately prior to placement of finish course asphalt.

Manhole Tests shall be performed as per Manhole Test Record (See Appendix G).

#### **6.17 Special Structures**

Inlet and outfall structures including headwalls, stilling chambers, etc., shall be fully designed and submitted in detail. In each case, topography shall be shown as well as the protective works necessary to counteract erosion of the site at the structure. Grates shall be provided on all inlet and outlet structures and shall be fully designed, detailed and approved by the Town.

#### **6.18 Outfalls**

All storm outfalls which empty into a ditch or water course must receive approval from Fisheries and Oceans Canada and the Provincial Department of Environment and Labour. Where outfalls are submerged or are likely to be submerged under design flow conditions, the designer shall take the hydraulic gradient into consideration and shall undertake backwater calculations and submitted to the Town for review.

#### **6.19 Catch Basins**

Special catch basins and inlet structures shall be fully designed and detailed.

The lead shall have a minimum 2% grade and shall discharge directly to an existing or proposed manhole located within 30 m of the catch basin.

Recess catch basins shall not be used.

Catch basins shall be located and spaced in accordance with conditions of design and shall provide for expected maximum flow.

Standard location for catch basins at street intersections shall be immediately upstream of sidewalks or pedestrian crosswalks and at all low points between intersections.

Spacing shall not exceed 90 m for road grades up to 3%, 65 m for road grades up to 6% and 50 m for road grades greater than 6%.

Catch basins are to be depressed 30 mm with respect to the gutter grade.

Precast catch basins conforming to specifications A.S.T.M. C478-64T are permitted.

## 6.20 Head Walls

All headwalls to be reviewed and pre-approved by the Town to determine if a handrail is required.

## 6.21 Stormwater Detention

Stormwater detention systems will be required for new developments to ensure there is a net zero runoff from the proposed development if the 100-year, 24-hour post-development peak discharge rate exceeds the 100-year, 24-hour pre-development peak discharge rate unless the Town determines that stormwater detention is not necessary based on hydrologic/hydraulic analysis. The stormwater detention system shall be designed to temporarily store the difference in volume between the 100-year 24-hour post-development runoff and the 100-year 24-hour pre-development runoff while limiting the post-development runoff rate to the pre-development runoff rate. A copy of the calculations must be submitted to the Town for approval.

The design approach for the detention system will be dictated by the **design storm detention flow (DSDF)**.

- For DSDF less than 25 l/s, no detention is required.
- For DSDF between 25 – 50 l/s, buried pipe detention structures with outlet control orifices less than 200mm in diameter must be avoided unless no other option exists. In this instance the following detention systems are encouraged.
  - Surface detention pond (minimum 15 m<sup>3</sup> volume)
  - Expanded ditch design (minimum 15 m<sup>3</sup> volume)
  - Natural percolation into the subsurface soils (geotechnical report required)
  - Enhancement of existing wetlands (additional landscaping may be required to conserve the wetland).
- For DSDF greater than 50 l/s then XPSWMM Modelling software must be employed to simulate the design storms and to demonstrate the effectiveness of the detention structure(s). The detention systems noted above for DSDF between 25 – 30 l/s will be entertained for flows greater than 50 l/s if the designs can be shown to be viable.

- Other alternate or innovative systems for storm water detention will be entertained on a case by case basis. In such circumstances, the developer will be required to submit concept drawings and general calculations to support the request.
- All detention systems must have an outlet control device with an orifice dedicated to the pre-development flow and an overflow orifice / channel in the event that the pre-development flow orifice should block or fail.

#### **6.21.1 Deliverables**

The following items must be submitted to the Town for review when stormwater detention is required for a particular development (all information must be georeferenced to the NAd83 coordinate system):

- (a) PDFs of all pre-development and post-development drainage areas used in modeling which denote all proposed infrastructure, existing infrastructure in the immediate area, overall drainage area, subcatchments, watercourses, and contours. Note: infrastructure is defined as streets and driveways, buildings, manholes, catchbasins, ditch inlets, headwalls, bridges, culverts, open channels, etc.
- (b) ArcGIS polygon shape files containing the pre-development and post-development drainage areas with subcatchments. There must be two fields included in the shape file attribute table containing (i) the area, in hectares, and (ii) the percent impervious for each subcatchment.
- (c) An ArcGIS polygon shape file for the proposed buildings.
- (d) An ArcGIS polygon shape file for the proposed streets, parking areas and driveways. The area of the street/parking areas must include curb, gutter, and sidewalk.
- (e) An ArcGIS point shapefile containing a 1m elevation grid of the proposed development containing, but not limited to: lot grading elevations, street elevations (centerline, gutter, top of curb, back of sidewalk), side sloping, etc. Note: elevations should not be provided within the footprint of any proposed buildings.
- (f) PDFs of all construction drawings including: Plan & Profile drawings for the proposed infrastructure; Detail drawings of the proposed detention facility, outlet control devices, and emergency overflow; and an overall plan indicating the proposed development in its entirety indicating adjacent infrastructure/structures in close proximity.
- (g) A fully functioning electronic XPSWMM model, or models, with all associated model files and supporting computations for all scenarios used to size and design the storm sewer infrastructure and detention facility.
- (h) A summary report in PDF providing: (i) a tabular summary for each post-development scenario of the post-development peak flows into and out of the detention facility, the corresponding pre-development flow, the maximum elevation of the water surface within the facility, and the flow through emergency overflow;

(ii) if nodal storage is used then a table must be included containing the design Elevation(m)-Storage Area(ha) curve for the detention facility; and (iii) the recommended maximum storage detention volume and elevation required for the facility.

### Drainage Area Plans

Plans of the design drainage area must be submitted for review and approval for both the pre and post development scenarios. The drainage area plans shall, as a minimum, show the following information:

- Streets, buildings and structures
- Proposed building lots
- Contours at 1m intervals and labelled every 5m
- Existing topographic elevations
- Water courses (including direction of flow)
- Location and size of proposed storm water infrastructure
- For each land use indicate: zoning, area (in hectares) and CN
- Tributary areas

### Submissions:

The developer shall be required to submit the following to the Town and any other governing authorities for review and approval:

- Copies of superimposed pre and post development hydrographs which clearly indicate peak discharges for both conditions and required storage detention volume
- Calculations for any weighted curve numbers
- Calculations for time of concentration(s)

After the above requirements have been reviewed and approved, the developer will be required to submit a detailed design of the proposed detention system.

### Definitions

**Active storage:** The temporary storage volume provided in a storm water pond. In a wet pond this is the storage between **PWL** and **HWL**.

**Aquatic Bench:** Those shallow areas (0.5m deep) around the edge of a permanent pool of a storm water detention facility that support aquatic vegetation – both submerged and emergent.

**Detention storage:** The temporary storage and gradual release of storm water in a storage element.

**HWL:** The high water elevation in the wet pond for the 100-year event.

**Inactive Storage:** Often referred to as “dead storage”, it is the volume of water between the pond bottom and the PWL.

**Permanent pool:** The portion of a storm water pond which retains a permanent volume and depth of water.

**PWL:** The permanent water elevation created by the inactive storage of a permanent pool.

**Sediment Forebay:** A permanent pool that is designed to facilitate maintenance and improve sediment removal by trapping larger particles near the inlet of the pond. The forebay is designed to be the deepest area of the pond to minimize the potential for particle re-suspension and prevent conveyance of the suspended material to the outlet.

### **Level of Service**

Storm water detention facilities must be designed to provide adequate flood protection and storage volume for storm water control. All storm water facilities must be designed to provide active storage for the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year return period 24-hour design storms.

### **Overland Drainage Routes**

Overland and underground drainage routes that direct flows from the design storm events to the storage detention facility must be provided.

An emergency overland escape route or overflow from all storage detention facilities must be provided. In general, the escape route or overflow must provide a minimum capacity equal to the pre-development flow. The appropriate capacity will be determined at the time of design. Optionally and with the approval of the town’s engineer, additional freeboard may be considered in cases where it is difficult to establish an escape route. The additional freeboard would provide a higher level of service overall.

Sanitary sewer manholes must be located outside of impoundment (pond) areas. Whenever possible, sanitary sewer manholes should not be located within the overland drainage route.

Sanitary sewer manholes located within overland drainage routes must have bolt down, sealed covers.

### **Wet Pond Storage Detention Facilities**

Wet ponds are impoundment areas used to temporarily store storm water runoff in order to: promote settlement of runoff pollutants, restrict downstream discharge to or below predevelopment levels, to minimize downstream flooding and reduce erosion potential. Wet

ponds are similar to natural lakes and ponds in that there is always a permanent body of water. During runoff events, additional temporary storage is provided above the permanent water level. After the runoff event, the water level gradually recedes back to its original pond level. Wet ponds may be constructed by an embankment or through excavation of a depression. Design of the facility usually includes the upper stage (above PWL), where the volume from runoff events is stored, and then lower stage (below PWL), where sedimentation is promoted. It is the lower stage that provides the pond's primary source of water quality enhancement. Sediment fore bays are required on all wet ponds to help confine settlement for larger pollutant particles.

In general, the detention pond should be designed to target a maximum average velocity of 0.3 m/s with a minimum retention time for 1.0 hour for the design storm flow rate. The detention pond design must avoid short circuit flows so that the average velocity of 0.3 m/s can be applied.

#### **6.22 Construction**

All related works shall be done in accordance with Master Construction Specification of the Department of Municipal & Provincial Affairs.

#### **6.23 Inspection and Testing**

During construction and prior to acceptance by the Town as part of its sewer system, the Town shall make inspections, at the Developer's expense, of all completed sewers and appurtenances. Also, before acceptance, a video inspection shall be carried out at the Contractor's expense on all sewers by a company competent in this work and a video record of the inspection is to be provided to the Town.

#### **6.24 Revisions of Procedure**

This procedure is subject to change without notice and the onus lies with the Consulting Engineer to ensure that he/she is in possession of the latest revision.



## **7.0 SANITARY SEWERS**

### **7.1 Design Drainage Area**

The drainage area may be determined from contour plans and shall include all other areas which may become tributary by reason of regrading or pumping.

### **7.2 Drainage Plan**

Plan of the design area shall be to a scale of 1:2000 or 1:5000 depending on the size of the area and shall show generally:

- a) streets;
- b) lots;
- c) the size and grade of the sanitary sewers with manholes numbered consecutively for design
- d) reference (using the last four digits of the Easting and the suffix 'S' ex: **3333S** ; and
- e) tributary areas for each manhole, size of the area in hectares and ultimate average population per hectare clearly shown therein.

### **7.3 Evaluation of Design Flows**

Standard design forms shall be used for all calculations. A sample of these shall be obtained from the Town's Consultants. (Included in Appendices)

The design of all sanitary sewers shall be based on the Peak Dry Weather flow. A typical computation of Peak Dry Weather flow is shown in Table 2 and some of its parameters explained in the following items.

The minimum rate of infiltration for which capacity shall be provided is 22,500 L/ha/d.

The design flows from developments of single family residence shall be based on an average population density of 80 people per hectare.

Flow computations shall be based on Table 1 as follows:



**TABLE 1**

LAND USE	AVERAGE SEWER FLOWS	CAPACITY FACTOR	PEAKING FACTOR
Residential	275 L/c/d	1.1 to 4.0	$1 + \frac{14}{4 + p^{\frac{1}{2}}}$
Commercial Core	90,000 L/ha/d	1.0 to 1.5	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$
Light Commerce	28,000 L/ha/d	-	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$
Institutional	34,000 L/ha/d	-	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$
Hospitals	168,500 L/ha/d	-	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$
Heavy Industrial	168,500 L/ha/d	-	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$
Light Industrial	39,000 L/ha/d	-	$0.8 \left( 1 + \frac{14}{4 + p^{\frac{1}{2}}} \right)$

where:

AVERAGE SEWER FLOW is a predicted flow based on ninety (90%) percent of water consumption.

CAPACITY FACTOR is the ratio of probably maximum density to predicted average density. It shall be used for multiplying the estimated ultimate average population density in order to obtain the design population "P". This factor recognizes that the distribution of future population within specific sewer areas is less certain for smaller areas than larger areas, and sparsely developed areas than densely populated areas. Capacity factors for different tributary areas are shown in attached Table 1.

PEAKING FLOW FACTOR is the ratio of the peak rate of flow to the average rate of flow. It is based on the Harmon Formula,

$$M = 1 + \frac{14}{4 + p^{\frac{1}{4}}}$$

where "p" is the tributary design population in thousands for residential areas. For other than residential the design population "p" can be termed as an equivalent population and is computed by dividing the unit non-residential sewage flow by the average unit residential sewage flow of 275 L/c/d.

**TABLE 2 - EXAMPLE**

No.	Item	Amount	Units	Comments
1	Tributary area	20	Hectares	
2	Average population density	80	Persons/ha	For single family residential development = 80 persons/ha
3	Tributary design population, p	1600	Persons	Row 1 x Row 2
4	Average per capita sewage flow rate	275	l/person/day	For single family residential development = 275 l/person/day
5	Average sewage flow	5.1	l/s	(Row 3 x Row 4)/86,400
6	Peak flow factor	3.66	Dimensionless	1 + (14/ (4 + SQRT(p)))
7	Peak sewage flow	18.7	l/s	Row 5 x Row 6
8	Infiltration allowance rate	22,500	l/ha/day	Minimum infiltration rate = 22,500 l/ha/day
9	Infiltration allowance	5.2	l/s	(Row 1 x Row 8)/86,400
10	Average dry weather flow	10.3	l/s	Row 5 + Row 9
11	Peak dry weather flow (PDWF)	23.9	l/s	Row 7 + Row 9

#### 7.4 Capacity of Pipe

Manning's Formula shall be used to determine the capacity of sanitary sewer pipes:

$$Q = \frac{AR^{2/3}S^{1/2}}{n}$$

where Q = discharge m<sup>3</sup>/s  
A = cross-sectional area of flow, m<sup>2</sup>  
R = hydraulic radius, m  
n = coefficient of roughness, dimensionless

All sanitary mains shall consist of PVC pipe, unless otherwise permitted by the Town, and the roughness coefficient used shall be 0.013.

#### 7.5 Minimum Size

Of street sewer .....200 mm  
Of building sewer .....100 mm

#### 7.6 Velocity: (When Pipe Flowing Full)

Minimum .....1 m/s  
Maximum ..... 5 m/s for diameter up to and including 825 mm and 6 m/s for diameters larger than 825 mm

## **7.7 Change of Size**

No decrease in pipe size from a larger size upstream to a smaller size downstream shall be allowed regardless of the increase in grade.

## **7.8 Clearance**

A minimum of 150 mm clearance is required between outside pipe barrels at all sewer pipe crossings.

In subdivisions where there is a storm sewer system then the sanitary and storm mains shall be in the same trench and the watermain shall have a 3m horizontal separation from the sewermain. In a subdivision where there is no storm sewer system then the watermain and sewermain shall be in the same trench. A minimum of 450 mm separation in vertical and horizontal direction is required between the sewer pipe and water pipe. If the 450mm clearance cannot be achieved then a 3m horizontal separation must be maintained.

## **7.9 Location**

Sanitary sewers shall be located such that manholes are placed in the centre of driving lanes wherever possible.

Manholes shall be located at every change of grade, alignment, size or material of the sewers.

Manholes shall be spaced a maximum of 90 m apart for sewers smaller than 700 mm diameter and 120 m apart for sewers over 700 mm diameter.

## **7.10 Earth Load**

Earth load on sewers shall be calculated by using the Marston Formula.

## **7.11 Superimposed Load**

The effect of concentrated and distributed superimposed loads shall be evaluated by generally accepted formulae.

## **7.12 Manholes**

All manhole chamber openings must be located on the upstream side of the manhole.

All pipes turning at a greater angle than 45° in a manhole require a 150 mm drop.

In manholes where the vertical distance between the invert of the outlet and the invert of the inlet pipe is 600 mm or more, an internal vertical drop pipe shall be provided at manholes. However, the drop manhole should be avoided and used only when it is not economically feasible to steepen the incoming sewer or by using other means.

Special manholes shall be fully designed and detailed.

Manholes to be placed 5mm below base course asphalt grade for the duration that base course asphalt is on the street.

Manholes to be adjusted to 5mm below finish course asphalt grade immediately prior to placement of finish course asphalt.

Manhole Tests shall be performed as per Manhole Test Record (See Appendix G).

#### **7.13 Building Sewer**

Separate and independent building sewers shall be provided for every single family house, each unit in a semi-detached, and each apartment building, office building, factory or similar building.

#### **7.14 Storm Water**

Storm sewer service pipes, storm water drains, roof drains and foundation drains shall not be connected to any part of the sanitary sewer.

#### **7.15 Easements**

When sewers are proposed to be installed other than in a street, an easement of sufficient width shall be provided. Minimum width is six (6) metres except where otherwise approved by the Town.

#### **7.16 Construction**

All related works shall be done in accordance with the current Master Construction Specification of the Department of Municipal and Provincial Affairs.

#### **7.17 Inspection and Testing**

During construction and prior to acceptance by the Town as part of its sewer system, the Town shall make inspections, at the Developer's expense, of all completed sewers and appurtenances. Also, before acceptance, a video inspection shall be carried at the Contractor's expense on all sewers by a company competent in this work and a video tape record of this inspection be provided to the Town.

#### **7.18 Standard Drawings and Specifications**

Standard Drawings and Specifications are as detailed in the Department of Municipal and Provincial Affairs Master Construction Specification.

#### **7.19 Revisions of Procedure**

This procedure is subject to change without notice and the onus lies with the reader of document to ensure that he/she is in possession of the latest revision.

## **8.0 WATER SYSTEMS**

### **8.1 General**

#### **8.1.1 Definitions**

- a) Water system means an assembly of pipes, fittings, control valves and appurtenances which conveys water to water service pipes and hydrants.
- b) Water service pipe means a pipe that conveys water from a water system to the inner side of the wall through which the pipe enters the building

#### **8.1.2 General Procedure**

The water system shall be designed, drawn, installed and constructed in accordance with the Master Construction Specification of the Department of Municipal and Provincial Affairs.

#### **8.1.3 Final Plans**

At the completion of the installation of the subdivision's water system and prior to primary services acceptance, "As-Built" signed Engineering Plans shall be provided to the Town.

### **8.2 Design Criteria and Location**

#### **8.2.1 Dead-Ends**

The water system shall be so designed to exclude any dead-ended pipe, so far as is reasonably possible.

#### **8.2.2 Size of Water Pipe**

The usual size of pipe shall be 200 mm with the minimum size being 150 mm for short connections between pipes in the system.

150 mm diameter mains may be used on cul-de-sacs and crescents less than 200 m in length. In no case shall the total length of 150mm diameter pipe exceed 200m. A minimum of 200 mm diameter mains shall be used for all local mains.

The size of a main feeder pipe shall be a minimum of 300 mm and the actual size will be governed by the maximum design flow with consideration for future demands.

#### **8.2.3 Depth of Cover**

All water pipe shall have a minimum cover of 2000 mm in relation to the final finished Street grade.

For streets not paved prior to December 1 of any year, sufficient depth of gravel of an approved grade shall be placed over the water system trenches to give a minimum cover of 1800 mm over each water pipe.

#### **8.2.4 Material**

All water pipe shall be in accordance with Department of Municipal Affairs Master Specifications.

#### **8.2.5 Location of Water Pipes**

All water pipes shall normally be laid on the quarter point of the street right-of-way.

In subdivisions where there is a storm sewer system then the sanitary and storm mains shall be in the same trench and the watermain shall have a 3m horizontal separation from the sewermain. In a subdivision where there is no storm sewer system then the watermain and sewermain shall be in the same trench. A minimum of 450 mm separation in vertical and horizontal direction is required between the sewer pipe and water pipe. If the 450mm clearance cannot be achieved then a 3m horizontal separation must be maintained.

Where a water pipe is to be laid in a trench, other than in a Town street, the subdivider shall grant to the Town by deed and plan, at his cost, title to the Easement. Such Easement shall not be less than six (6) metres in width and its location shall be approved by the Town.

#### **8.2.6 Location of Valves**

Valves at street intersections shall be located in the roadway at street line intersections.

Four (4) valves shall be required at each normal four-way street intersection. If there are more or less than four (4) streets meeting at any intersection, the appropriate number of valves shall be installed to allow complete isolation of the system.

On straight runs in a residential area, the maximum distance between valves shall be 180 m.

Valves for hydrants shall be located within the carriageway of the street and shall be located minimum of two (2) metres from the hydrant.

#### **8.2.7 Valve Chambers**

All valves less than 400 mm shall be enclosed in a standard screw type adjustable box. The cover of the box shall have the term "WATER" printed on it for valves in the water system and the term "HYDRANT" for valves on hydrant branches.

All valves of 400 mm and larger shall be installed in a chamber constructed of reinforced concrete or made from a 1500 mm diameter prefabricated concrete manhole. Access frames and covers for these chambers shall be of cast iron, providing a clear opening of

750 mm in diameter with two (2) countersunk lifting rings in the cover. The term "WATER" shall be imprinted on the cover. Access ladders shall be provided in the chamber.

#### **8.2.8 Hydrants**

Hydrants shall be placed behind the sidewalk and within the limits of the street right-of-way.

Hydrants shall be placed on the extension of the boundary line between 2 building lots, (if the driveways are not located on the same side) 1700mm behind the curb line or 400mm behind the sidewalk; whichever is greater, and spaced not more than 140 m apart. No dwelling unit shall be located more than 70m from a hydrant.

Hydrants shall not be located in the bulb area of a cul de sac street.

The minimum distance from the edge of a driveway to the centre of a hydrant shall be 1.5m.

Hydrants shall be installed so that the top of the standpipe flange will be from 100 mm - 150 mm above the finished road grade.

The branch pipe to the hydrant shall be 150 mm in diameter and shall include a 150 mm branch valve located one metre from the centre line of the water pipe in the street. The hydrant valve shall be restrained to the main.

Although dead-ended pipes are not desirable, if unusual conditions exist and warrant the installation of a dead-ended pipe, a hydrant shall be installed in its proper location from the dead end water main.

Hydrants shall be installed at all high points in profile on a transmission main, if an air release chamber is not provided and drain down pipes must be installed at low points.

The minimum distance from the center of a utility pole to the center of a hydrant shall be 3.6m (in order to maintain a 2:1 slope at a 1.8m depth).

Before any water service pipe is connected to the water system on any street, the Developer shall have already installed the water system, swabbed, sterilized and tested same as required in the Pipe Laying Specifications of Master Construction Specification of the Department of Municipal & Provincial Affairs.

In unserviced development areas of the Town, Council may require that the developer install a dry hydrant for firefighting purposes. This will depend on site conditions and availability of a reservoir in the area as determined by the Town.

### **8.3 Water Service Pipe**

#### **8.3.1 Depth of Cover**

All water service pipes from the pipe in the street to and including the standard service box at the street line location shall be supplied and installed by the developer so that there will be a minimum cover of 1,500 mm and a maximum cover of 2,000 mm in relation to the finished street surface and such installation must be approved by the Town prior to backfilling.

#### **8.3.2 Oversized Water Service Pipes**

Water service pipes larger than 20 mm shall be of a size and material as approved by the Town.

#### **8.3.3 Water Service Pipes on Private Property**

Must be installed so that there will always be a minimum cover of 1500 mm both prior to and following landscaping.

### **8.4 Connections to Existing Water Systems**

#### **8.4.1 Service Interruption**

A connection of the developer's water system to any part of the existing water system must be carried out to cause the least interruption to existing service and each such connection must be approved by the Town. A connection of 100mm diameter pipe or greater shall be by a tapping sleeve and valve. All connections shall be pressure connections.

#### **8.4.2 Scheduling of Connection**

The Town will assist in the scheduling of any such connection and will carry out the actual work if the developer wishes to make the actual connection the work must be done under the supervision of a Town's Water Inspector at the developers cost. (See Appendix H) for Standard Hydrostatic Pressure Test Record.

#### **8.4.3 Other Connections**

Whenever an existing water system is within reasonable distance from a proposed subdivision, and an interconnection is practical, the developer shall be required, at his cost, to install the necessary pipe and interconnect the water system in his subdivision to the existing water system.

#### **8.4.4 Prohibited Cross-Connections**

No pipe, or private water service pipe, cross-connection will be made from the existing water system to the municipal water system in a subdivision which is connected to some other source of supply.



## **9.0 PROJECT RECORD DOCUMENTS**

### **9.1 Record Drawings**

During all Stages of construction, record the following information:

- a) Horizontal and vertical location of all underground utilities and appurtenances referenced to final surface elevation. Items that must be recorded include, but are not limited to: finish grades, manholes, catch basins, all inlet/outlet invert elevations, fire hydrants, valves, curb stops, bends, tees, reducers, centrelines of all long stretches of uninterrupted pipe, and centrelines and edges of all duct banks and underground utility lines.
- b) Type of sidewalk and or curb and gutter shall remain as per original design and approval.
- c) Street cross sections shall remain as per original design and approval.
- d) A table containing Northing and Eastings of all Manholes, Valves, Hydrants, and Chambers.
- e) All cover and invert elevations shall be noted for manholes and catch basins.
- f) Field changes of dimension and detail.
- g) Changes made by change order or field order.
- h) Benchmarks as required by the Town.
- i) The month and year of completion of the construction shall be shown on each plan for Phase 1 and Phase 2 work.

At completion of the project, a digital copy of the Record Documents in the latest version of AutoCAD must be submitted to the Town for review, along with one hard copy. Digital submission must include all point data as indicated above, as well as applicable linework connecting these points. The data must be clear and concise, using separate layers and notes as necessary. Separate layers for linework must include, but not be limited to: water main, sanitary main, storm main, duct banks, street lighting ducts, edge of pavement, curb line, and back of sidewalk.

### **9.2 Engineering Reports**

At completion of the project, a copy of all engineering reports must be submitted to the Town for review. Reports for submission must include, but not be limited to:

- a) Sieve Analysis, Proctor Density and Field Density reports for Class 'A' and Class 'B' granular material;
- b) Sieve Analysis, Marshall Test, and Field Density reports for asphalt;

- c) Slump Test, Air Entrainment Test and Compressive Strength Test reports for concrete works;
- d) Pressure/Leakage Test, Disinfection and Swabbing reports for water main;
- e) Infiltration/Exfiltration Test, Deflection Test, and video inspection results for sanitary and storm main;
- f) Water, Sanitary and Storm lateral connection information for residential lots or existing homes; and
- g) Surface Inspection Summary, including items such as manholes, catch basins, valves, curb stops, hydrants, signage, traffic control devices, and overall site cleanliness.

#### **10.0 NOTES REGARDING LOT GRADING PLANS:**

- All lots shall be graded at a minimum of 2% away from the dwelling to prevent any ponding of water and to ensure positive drainage.
- Concrete foundations shall be a minimum of 600mm above the curb (high back) at the high side of the lot.
- On a side sloping lot, the concrete foundation shall be a minimum of 400mm above the curb grade, at the high corner of the lot.
- Garage floors shall be a minimum of 400mm above the curb at the centre line of the garage.
- All slopes should be 2:1 horizontal to vertical measurements (See Appendix A).
- Any retaining walls installed as part of the approval of the development shall be certified by the engineer of record. Any guards issued shall meet current edition of the 1995 National Building Code. All walls above 1.2m must have a fence.
- Swales and ditches, if required, shall be located on legal easements. Hydraulic calculations may be necessary to confirm swale design. Maximum cross section slope of a swale shall be 2H:1V.
- Cut off ditches and drainage shall be provided between the new development and adjacent vacant land unless hydraulic calculations prove otherwise.
- Provide as built grades for any existing adjacent lands. Adequate grades to be provided to clearly show that drainage issues (either excessive run off or ponding) will not be caused by the new development to existing areas.
- Cross sections through lots (as per the attached) may be necessary if determined necessary by the reviewing of the grading plan.

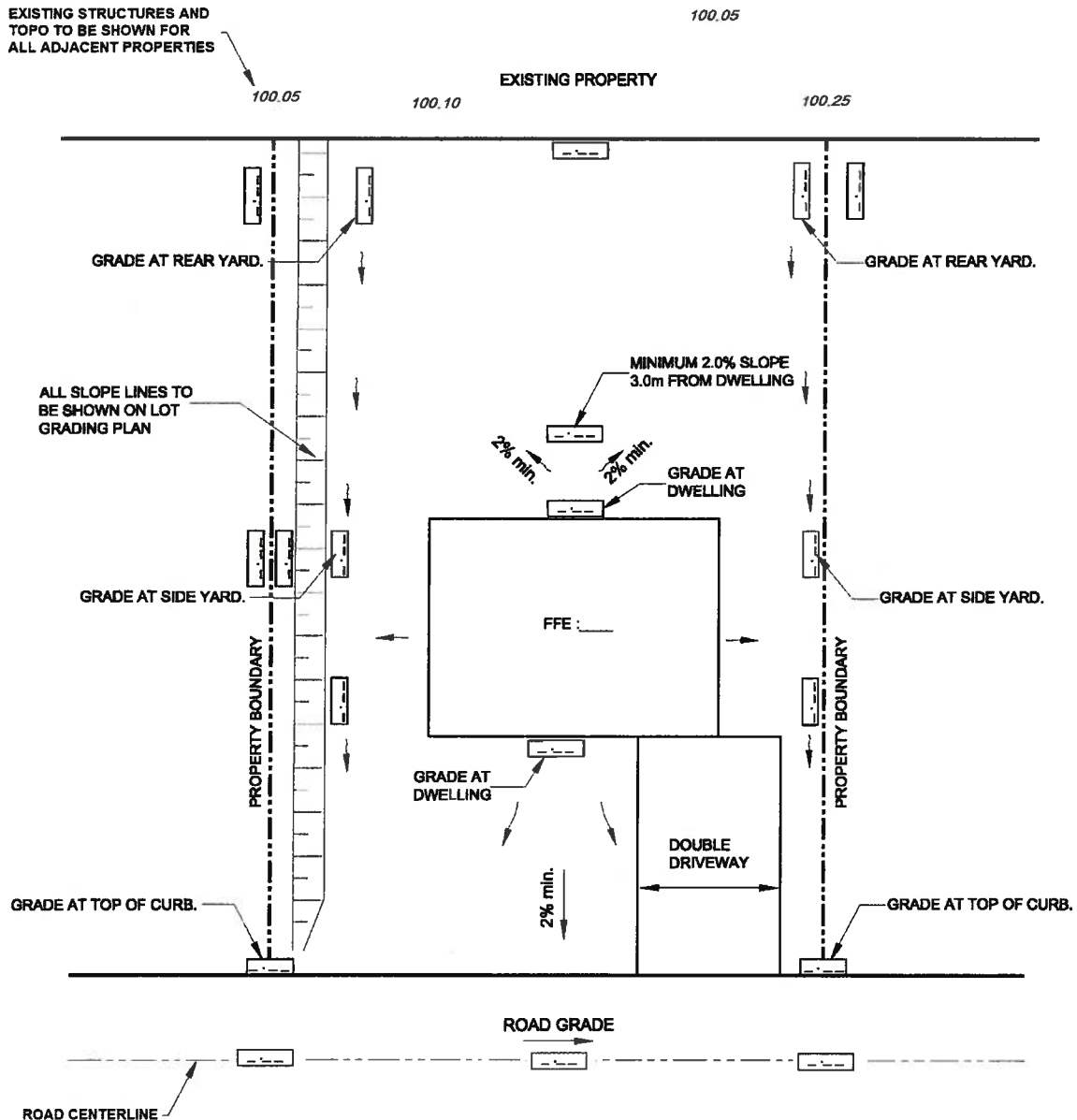
- When dealing with grade differential on lots (either left and right or front and rear) which exceed 1.2m but less than 2.4m, the designer should keep in mind that typical house construction is either, level foundation at the top, 1.2m high knee walls, or 2.4m high (walk out) knee walls. Typical house designs should be reviewed with the builder(s) and grading indicated accordingly to accommodate such elevations.
- Whenever there is a grading differential less than 1.2m (either left and right or front and rear), the designer should keep in mind that frost walls may be necessary to maintain front protection which maintains the grading of the lot.

\*See Appendix A for a typical lot grading plan.

**APPENDIX A**  
**TYPICAL LOT GRADING PLAN**



## TYPICAL LOT GRADING PLAN



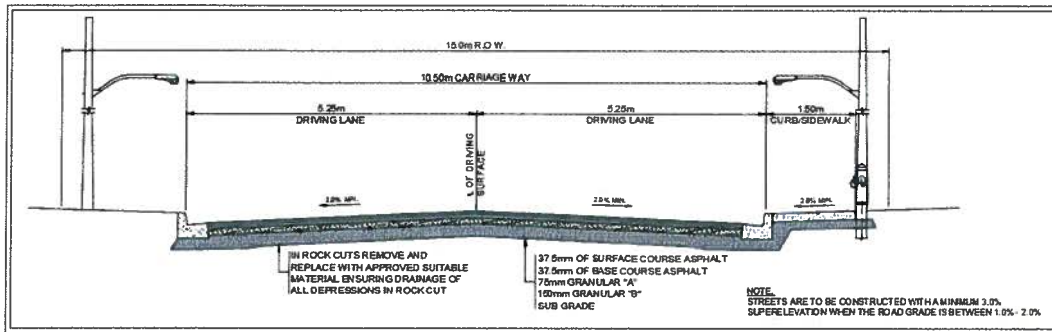
- ALL GRADES TO SLOPE A MINIMUM OF 2% AWAY FROM DWELLING
- TOPO SURVEY ELEVATIONS OF EXISTING ADJACENT PROPERTIES ARE TO BE SHOWN ON LOT GRADING PLAN
- EXISTING MAPPING CONTOURS TO BE SHOWN

**APPENDIX B**

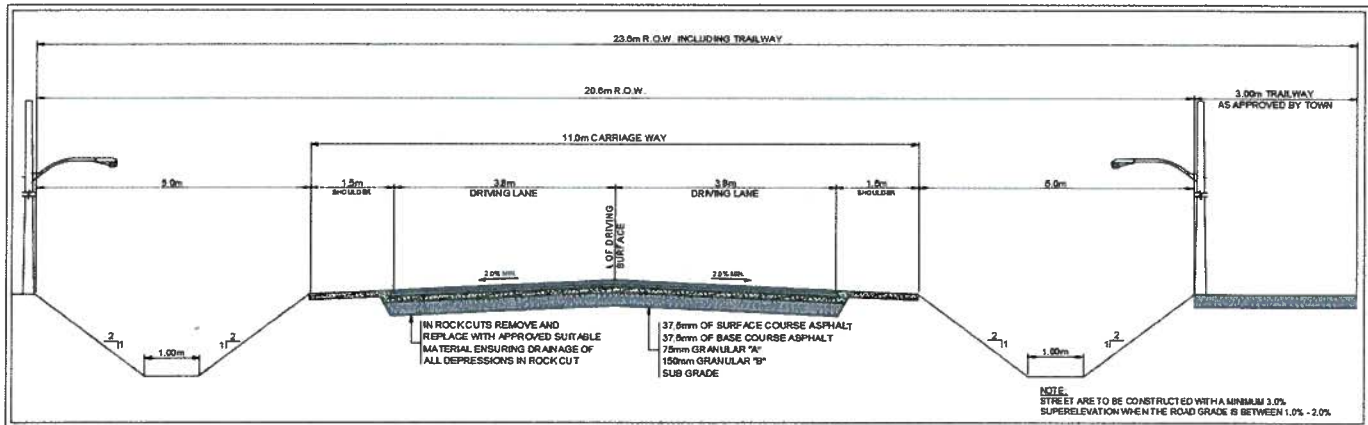
**LOCAL STREET CROSS SECTIONS**



## LOCAL STREET CROSS SECTIONS



LOCAL URBAN STREET CROSS SECTION



LOCAL RURAL STREET CROSS SECTION

**APPENDIX C**

**SANITARY SEWER CALCULATIONS FORM**





PROJECT:

Rev A yy-mm-dd

JOB #:

# CALCULATIONS FOR CAPACITIES OF SANITARY SEWER

LOCATION	Area #	Manhole #		Length m	Area		Land Use	Average Population Density persons/Ha	Tributary Design Population persons	Average Per Capita Sewage Flow Rate L/day	Average Sewage Flow L/s	Peak Flow Factor	Peak Sewage Flow L/s	Infiltration Allowance Rate L/Ha/day	Infiltration Allowance L/s	Average Wet Weather Flow L/s	Peak Wet Weather Flow L/s	Pipe Data					Actual PDW Velocity m/s	Additional Capacity Available L/s
		From	To		Increment Ha	Total Ha												Dia. m	Slope %	Manning Coe.	Full Flow Capacity L/s	Full Velocity m/s		
Street Name	1	####S	####S	1	1.00	1.00	R1	80	80,000	275	0.25	4.27	1.09	22,500	0.26	0.52	1.35	0.200	1.00%	0.015	28.43	0.90	0.44	27.1
Street Name	2	####S	####S	1	1.00	2.00	R1	80	160,000	275	0.51	4.18	2.13	22,500	0.52	1.03	2.65	0.200	1.00%	0.015	28.43	0.90	0.56	25.8
Street Name	3	####S	####S	1	1.00	3.00	R1	80	240,000	275	0.76	4.12	3.15	22,500	0.78	1.55	3.93	0.200	1.00%	0.015	28.43	0.90	0.63	24.5
Street Name	4	####S	####S	1	1.00	4.00	R1	80	320,000	275	1.02	4.07	4.14	22,500	1.04	2.08	5.18	0.200	1.00%	0.015	28.43	0.90	0.68	23.2

**APPENDIX D**

**STORM SEWER CALCULATIONS FORM**



PROJECT:

Rev A yy-mm-dd

JOB #:

**CALCULATIONS FOR CAPACITIES  
OF STORM SEWER**

LOCATION	Area No.	From	To	Length M	Tributary Area			Time of Concentration						Pipe Capacity				Additional Capacity Available L/S
					Increment Ha.	Total Ha.	Runoff Coe.	Inlet Min.	Section Min.	Total Min.	Rainfall mm/hr.	Runoff L/S	Dia. M	Slope %	Mann. Coe.	Capacity L/S	Velocity M/S	
Street Name	A#	Existing	####R	1.0	1.00	1.00	0.60	10	0.0	10.0	53.00	88.34	0.450	1.00	0.0150	250.7	1.4	162.4
Street Name	A#	####R	####R	1.0	2.00	2.00	0.30	10	0.0	10.0	135.30	225.52	0.450	1.00	0.0150	250.7	1.8	25.2
Street Name	A#	####R	####R	1.0	3.00	3.00	0.30	10	0.0	10.0	135.30	338.28	0.450	1.00	0.0150	250.7	1.6	-87.6
Street Name	A#	####R	####R	1.0	4.00	9.00	0.30	10	0.0	10.0	135.30	1,014.83	0.450	1.00	0.0150	250.7	1.6	-764.1
Street Name	A#	####R	####R	1.0	5.00	5.00	0.30	10	0.0	10.0	135.30	563.80	0.450	1.00	0.0150	250.7	1.6	-313.1
Street Name	A#	####R	HW	1.0	6.00							1,666.97	0.450	1.00	0.0150	250.7	1.6	-1,416.2

**APPENDIX E**

**HOUSE SERVICING INFORMATION FORM**



## HOUSE SERVICING INFORMATION FORM (1 OF 2)

Street Address: \_\_\_\_\_

Owner of Property: \_\_\_\_\_

Person Interviewed: \_\_\_\_\_

Project: \_\_\_\_\_

Contractor: \_\_\_\_\_

Interviewer: \_\_\_\_\_ Date: \_\_\_\_\_

Services to be installed: \_\_\_\_\_

Does house have basement: ( ) Yes ( ) No ( ) Crawl Space

Does owner plan to install a basement in future: ( ) Yes ( ) No

Existing lowest floor elevation: \_\_\_\_\_

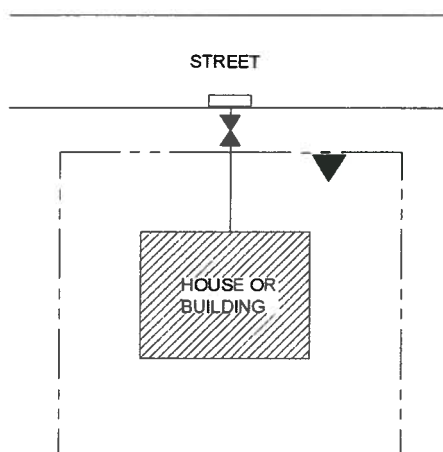
Elev. of exist. Sewer from house where owner wishes to connect: \_\_\_\_\_

Water level of existing well: \_\_\_\_\_

History of well: \_\_\_\_\_

Additional comments: \_\_\_\_\_

### REQUESTED LOCATION OF SERVICES



#### ON SKETCH LEFT INDICATE:

- LOCATION OF WELL
- REQUESTED LOCATION FOR WATER SERVICE (\*W)
- REQUESTED LOCATION FOR SEWER SERVICE (\*S)
- REQUESTED LOCATION FOR STORM SEWER (\*R)
- TIE IN REQUESTED LOCATION OF SERVICES TO HOUSE OR BUILDING.
- FENCES ETC.



CURB STOP LOCATE BETWEEN STREET RIGHT OF WAY AND BACK OF SIDEWALK (IF REQUIRED).



DRIVEWAY LOCATION



TOP OF CURB AT CENTER OF LOT

### SERVICE LOCATION APPROVAL

I the undersigned, (Home owner), do agree with the proposed location for the requested services, as indicated on the above sketch.

Home Owner \_\_\_\_\_  
SIGNATURE

REPRESENTATIVE SIGNATURE



## HOUSE SERVICING INFORMATION FORM (2 OF 2)

### COMPANY USE ONLY:

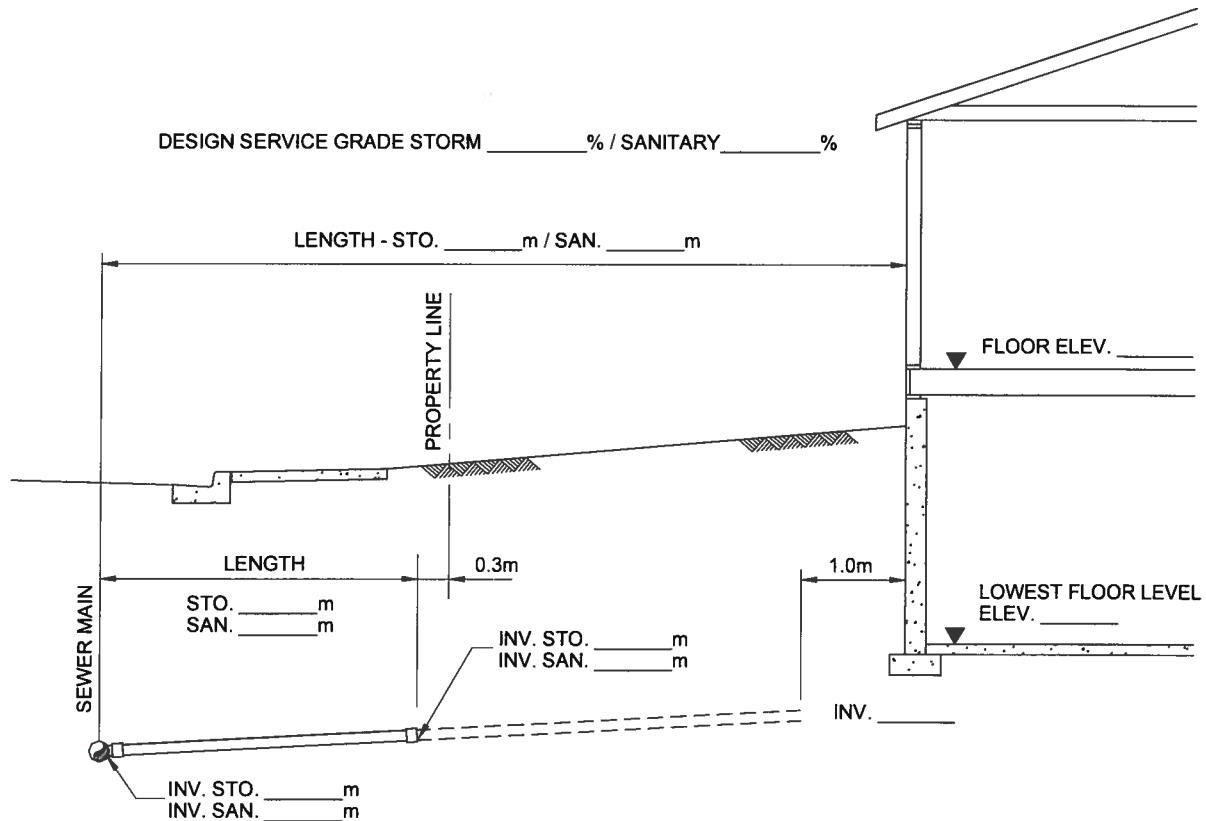
NAME OF HOME OWNER:

STREET ADDRESS

DATE OF INSTALLATION

SKETCH OF HOUSE, INDICATE LOCATION OF: WELL, UNDERGROUND PIPING, ALIGNMENT OF NEW SEWER AND WATER, (AND STORM SEWER) SERVICES, TIES TO CURB AND/OR SEWER(S) (AS BUILT)

PLAN



LONG RADIUS BEND USED YES ( ) 1 or 2

NO ( )

LENGTH OF VERTICAL RISER PIPE USED WITH LONG RADIUS BEND - - - m

SIZE OF WATER SERVICE \_\_\_\_\_ l

SIZE OF SEWER SERVICE \_\_\_\_\_ l

SIZE OF STORM SERVICE \_\_\_\_\_ l

### SECTION FOR SANITARY AND/OR STORM SERVICING

#### NOTE

GRADE SHEETS MUST BE COMPLETED AND GRADES FOR SERVICE LINES GIVEN TO CONTRACTOR FOR EVERY SERVICE PRIOR TO INSTALLATION

**APPENDIX F**

**SANITARY/STORM SEWER TEST RECORD**

[illegible]



**APPENDIX G**

**MANHOLE TEST RECORD**



# MANHOLE TEST RECORD

[illegible]

**APPENDIX H**

**HYDROSTATIC PRESSURE TEST RECORD**

[illegible]

**APPENDIX I**  
**TOWN INSPECTION FORM**



Town Of Torbay  
P.O. Box 1160, Torbay, NL A1k 1k4  
Telephone: (709) 437-6532

Date of receipt of application: \_\_\_\_\_ Inspection fee receipt: \_\_\_\_\_

**General information: applicant and property location:**

Applicant's Name \_\_\_\_\_ Property Tax # (PID) \_\_\_\_\_

Street Address \_\_\_\_\_ Telephone # \_\_\_\_\_

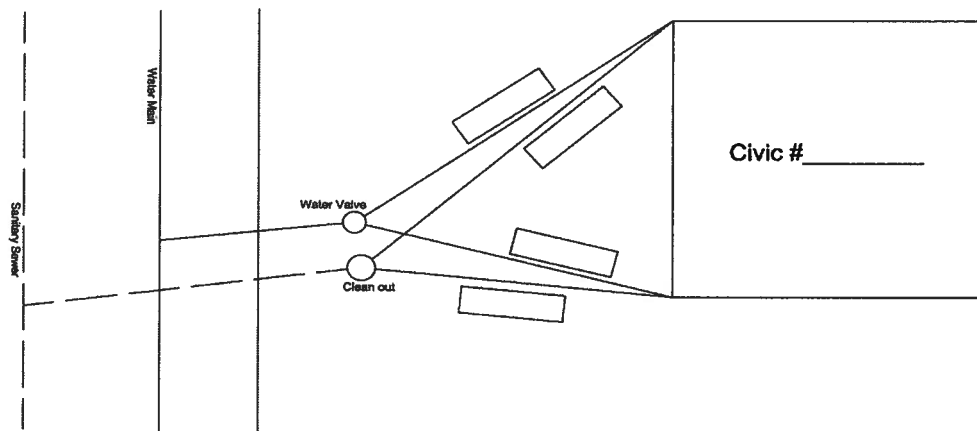
Mailing Address \_\_\_\_\_ Contractor \_\_\_\_\_

**Type of structure to be serviced:**

RESIDENTIAL \_\_\_\_\_ COMMERCIAL \_\_\_\_\_ NUMBER OF UNITS \_\_\_\_\_

**Inspection Report:**

1. Depth of sewer pipe \_\_\_\_\_ Street \_\_\_\_\_ Building \_\_\_\_\_
2. Depth of water pipe \_\_\_\_\_ Street \_\_\_\_\_ Building \_\_\_\_\_
3. Does the installation have a rock free base? YES No
4. Is the service connection line and grade uniform? YES No  
(Minimum grade ¼ inch in 2 feet)
5. Are the manufacturer's recommendations satisfied?  
Spigot insertion distance into bell YES No  
Maximum deflection at joints YES No  
Number of long sweep bends used YES No
6. Are there to be illicit connections to systems? YES No  
Description \_\_\_\_\_
7. Sewer line taken in from property line (time/date) \_\_\_\_\_  
Size/Type: \_\_\_\_\_
8. Existing Septic Tank Pumped and in filled. Yes No N/A
9. Water line taken in from property line (time/date) \_\_\_\_\_  
Size/Type: \_\_\_\_\_



Inspector's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## **APPENDIX J**

### **TOWN DEVELOPMENT APPROVAL CHECKLIST**

## DEVELOPMENT APPROVAL CHECKLIST

Planning And Development

FOR INTERNAL USE ONLY

Name	Developer:		Applicable		Date	Comments
	Development :		Yes	No		
Review/Approvals	Subdivision Proposal Submitted					
	Reviewed by DOP					
	Amendment Required					If yes, go through amendment process
	Public Works Department Review					
	Recreation Department Review					
	EHIV Review (Dept Enviroment)					
	Reviewed by PLUD Committee					
	Approved/Motion by Council					
	Approval In Principal Letter					
	Letter Received from Applicant to Continue					
	Estimates of Legal and Engineering to Applicant					
	Deposits for Engineering and Legal Received					
Development Approved/Reviewed by	Proposal Sent by the Town to the Following	Public Works Department Review				
		Recreation Department Review				
		Engineering Review				
		Drawings				
		Drainage				
		Security Estimates				
		EHIV Review (Dept Environment)				
		911 System (street names)				
		Open Space Assessment (Land Values)				
		Town Solicitor (verifv title)				
	Proposal Sent by the Developer to the Following	Service NL (Septic)				
		Dept Environment				
		Department of Transportation & Works				
		Department of Fisheries & Aquaculture				
		Dept Environment (H <sub>2</sub> O Study)				
		Newfoundland Power				
		Canada Post				
		Other Towns				
Notes						



## DEVELOPMENT APPROVAL CHECKLIST

Planning And Development

FOR INTERNAL USE ONLY

Name	Developer:	Applicable		Date	Comments
	Development :	Yes	No		
Development Agreement	Reviewed by CAO				
	Reviewed By Town Solicitor				
	Reviewed by Applicant				
	Sent to Applicant for Signatures				
	Returned with Sureties/Fees/Insurances				
	Executed by Town				
	Copy sent to Developer				
	Lot Approval Letters Issued				
	Copy sent to Town Solicitor (registration)				
Development Fees	Application Fee \$ 100/lot				
	Road Service Levv Fee \$ 1000/lot				
	Recreation Assessment Levv \$ 400/lot				
	Stage A Public Works Security				
	Stage B Public Works Security				
	Open Space Assessment				
Notifications	Insurance/ Clearances				
	Assessment Clerk				
	Canada Post				
	Planning (Map Update)				
	Emergency Services (911, TVFD, RNC, Paramedics)				
	Phone/Cable Companies				
	Elections Canada				
Inspections/Deeds	Mapping Companies				
	Open Space Turn Over (Solicitors Legal Review)				
	Newfoundland Design First Inspection				
	Refund of Stage A Security				
	Newfoundland Design Second Inspection				
	Road Turn Over(Solicitors legal review)				
Notes	Refund of Stage B Security				

## **APPENDIX K**

### **SUPPLEMENT TO GOVERNMENT OF NEWFOUNDLAND AND LABRADOR MUNICIPAL WATER, SEWER AND ROADS MASTER CONSTRUCTION SPECIFICATION**

## **SUPPLEMENT TO:**

### **GOVERNMENT OF NEWFOUNDLAND AND LABRADOR MUNICIPAL WATER, SEWER AND ROADS MASTER CONSTRUCTION SPECIFICATION**

**Note: This section details areas where the Town of Torbay's Municipal Engineering Standards differ from the Provincial Government's Master Specification.**

#### **1.1 SECTION 01001     DEFINITIONS (Added)**

**1.1.1             ENGINEER**        Shall mean Consulting Engineer registered in the Province of Newfoundland and Labrador, retained by the Developer to be responsible for design and supervision of the work.

**1.1.2             OWNER**            Owner, where used in the Master Specifications, refers to the Developer, a person or company who has applied for and has been granted approval to subdivide or service an existing parcel of land.

#### **1.2 SECTION 01005             GENERAL INSTRUCTIONS (Reference to Town Engineer added)**

**1.2.1**            Where a Contractor is required to install storm or sanitary sewer mains beginning at an existing manhole or section of existing main, the Contractor shall install a temporary 6 mm mesh screen over the outlet pipe of the first downstream existing manhole to prevent silt and gravel from entering the existing system from the new work. If this location is not appropriate, the Engineer may choose a more suitable location, to be approved by the Town's Engineer.

#### **1.3 SECTION 01570     TRAFFIC REGULATIONS (Added)**

**1.3.1**            Traffic detours shall not be implemented unless the owner receives the prior written approval of the Town. The owner shall request approval at least 14 days in advance of the proposed implementation of the detour.

**1.3.2**            Traffic detours shall be applicable to through traffic movements only. The owner shall provide adequate means whereby access is maintained to properties fronting on closed sections of streets.

#### **2.1 SECTION 02702             PIPE SEWER CONSTRUCTION**

- 1) Delete item 2.4.1 as shown in Government Master Specification and substitute the following:

**2.4.1** All house/building sewer service pipe to be SDR 28. All PVC storm mains to be perforated with two rows of 13 mm diameter holes, 400 mm on centre, 45° and 315° from the pipe invert.

- 2) Delete item 3.4.1 as shown in the Government Master Specification and substitute the following:

**3.4.1** Place Type 1 granular bedding materials on all storm and sanitary services.

- 3) **3.7.13** Delete the items as shown in the Government Master Specification and substitute as follows:

1. **Scope of work:**

The work covered by this specification consists of furnishing all materials, labour, supervision, equipment and plant; to perform all work necessary for the television inspection of the gravity sewer lines as specified.

2. **When Television Inspection Required:**

A Color HD Television inspection will be required:

- (a) for all new sewers (sanitary and storm). Sewers are to be inspected prior to acceptance of Stage I works and ten months from the date of acceptance or before placing of surface course asphalt, whichever occurs first.
- (b) When any proposed construction project may conceivably damage, disrupt or otherwise disturb any portion (or an appurtenance) of the municipality's sewerage system, a pre-construction and post-construction inspection of the system will be required.

Inspection requirements shall be determined based on the following criteria:

- (i) Any sewer running parallel to the proposed construction area and within 5m of same, shall be inspected if blasting is required or anticipated.
- (ii) When blasting is not required, any sewer running parallel to the proposed construction and is within 3m of same shall be inspected.

3. **Arrangement for inspections:**

The Contractor will arrange all pre-construction and post-construction television inspections.

4. **Pre-Construction Inspection of Sewers:**

In the area of the proposed construction, all building services connected to the sewer main shall be assumed to be in reasonable structural

condition if they have been functioning properly in the past. If a malfunction of a building service is caused, the contractor will be held responsible for any repairs. As an alternate to the previously outlined pre-construction inspection requirements, the Contractor may accept the sewer line conditions noted in a previous TV inspection report for the affected area, which may be presently on file, however, to permit utilization of a past report, the following criteria must be met:

- (a) The TV inspection report shall be less than 3 years old;
- (b) No major construction works shall have been undertaken in the immediate area since this inspection.

**5. Post-construction inspection of sewers:**

The post-construction inspection must be completed within thirty days of completion of the works, and in any case before the work is accepted. The TV inspection contractors shall record both the pre-construction and post-construction inspections on video tape, as outlined. Upon completion of the post-construction inspection, the CD's will be submitted to the Engineer.

**6. Evaluation of inspection results:**

The results of the TV inspection will be evaluated by the Engineer for determination of any damage as a result of the construction project. The sewer system and its appurtenances will be assumed to be damaged by a construction project under the following conditions:

- (a) The excavation is of sufficient proximity and depth;
- (b) In bedrock, to cause damage to sewers by blasting tremors or rock movement.

**7. Repair of damaged sewers:**

All damage incurred by the sewer system due to the construction project shall be repaired by the contractor in accordance with the Town standards. Upon completion of these repairs, a subsequent verification inspection shall be undertaken to assess the quality of the repairs.

**8. Definitions:**

- (i) "Clean" shall mean the removal of all sand, grease and all other solid or semi-solid material from the length of pipe connecting two manholes.
- (ii) "Building service" shall mean the sewer line (lateral) extending from the building to the sewer main.

**9. Television Equipment:**

Television equipment shall consist of a self-contained camera and a monitoring unit connected by a 3 wire coaxial cable. The camera shall be small enough to ensure passage through a 150 mm sewer, shall be water proof, and shall have a self-contained remotely controlled lighting system capable of varying the illumination of the interior of the sewer line for inspection and photographic purposes.

Picture quality shall be such as to produce a 1080P Colour HD picture showing the entire periphery of the pipe. All videos submitted must be on CD Read only Colour format. An audio description of the inspection must also be provided, as well as a written report.

10. **Television inspection:**

The television inspection shall be performed on one sewer line section at a time. Each sewer line section being inspected shall be isolated where necessary from the remainder of the line by the use of a line plug to ensure total viewing of the periphery of the pipe. The inspection shall be performed in the direction of the flow, where possible.

An inspection record prepared by the Engineer shall be kept, showing the exact location of each point of infiltration, fault and building service observed by the camera. The Engineer reserves the right to take pictures of the television monitor, as long as such photographing does not interfere with the Contractor's operations and work. Sewer lines 1050 mm in diameter or greater may be inspected by walking through the pipe. Video pictures shall be recorded with a hand held television inspection camera. In addition, still pictures may be taken with a 35 mm camera. Sections found to have deficiencies are to be re-taped after deficiencies have been rectified, therefore, taping of new work will show no deficiencies.

11. **Accommodation for Viewing:**

The Contractor shall provide the accommodation for no less than two people, for the purpose of viewing the monitor, while the inspection is in progress.

12. **Records:**

An Inspection Record, in log form, shall be maintained during the television inspection by the Engineer. This log shall show the exact location of each leak, fault and building service. The location shall include the distance away from the referenced manhole and also the position as referenced to the axis of the pipe.

Further, a detailed technical description shall be accompanied with photographs as supporting data for each leak or fault noted in the Inspection Report. The term leak or fault is hereinafter defined as:

- (a) Any sewer pipe joint which displays a gap or spread, offset, or signs of infiltration.
- (b) any building service which has water entering around the junction of the lateral to the sewer line section or a steady flow entering the line section through the sewer lateral.
- (c) Any building service exhibiting a pronounced protrusion into the sewer line section.

- (d) Any section of the sewer which is crushed, broken or displays cracks which are either parallel or perpendicular to the axis of the pipe (longitudinal cracks or shears).
- (e) Any variance in the grade of the sewer line section.

The final TV inspection report for each section will be submitted by the Engineer in the format as noted in item 201.16 - Standards for Television Inspection Records. In addition to the normal inspection report format, the Contractor shall record all the television inspection on video tape. These CD's shall be submitted to the Municipality. The written inspection report will be prepared by the Engineer.

All photos and video pictures shall be of excellent quality and resolution. They should present a clear picture of the condition of the pipe with a precise and distinct definition of all observations, i.e., leaks, faults, cracks, obstructions, etc.

**13. Threading of Sewers:**

A 6mm nylon rope or equivalent may be installed in the sewer not more than one day in advance of the inspection, in order that the camera traction cable may be drawn through the sewer. The rope shall be tightly secured to the manhole ladders, making sure the line is taut, leaving no slack in the sewer line.

**14. Site Safety:**

Manhole barricades are required around all open manholes, in addition to Traffic Control, as per Division 7. Manhole barricades shall be as per Form 741. Prior to entering manholes and sewer lines, the contractor shall ensure that dangerous gases are not present. The Contractor shall keep a gas meter and air blower at the site to ensure the safety of the workmen when they are working inside the manholes and sewer lines.

**15. Flow Control:**

When sewer line flows are above the minimum requirements (1/4 of the pipe diameter) to effectively conduct the inspection, one or more of the following methods of flow control shall be used:

Plugging or Blocking

A sewer line plug shall be inserted into the line at a manhole upstream from the section to be inspected. The plug shall be designed so that all or any portion of the sewage flows can be released. During the inspection portion of the operation, flows shall be shut off or substantially reduced in order to properly inspect the pipe at the invert. After the inspection is complete, flows shall be restored to normal.

Pumping or By-passing

When adequate flow control cannot be obtained by the plugging method, pumps or siphons shall be used to divert all or a portion of the flows as may be necessary to perform the inspection, as approved by the

Engineer. Excess sewage flows shall be transported through a pipe or by tank trucks to the nearest or most economical disposal area.

**16. Standards for Television Inspection Reports:**

Within ten working days following completion of a TV inspection on a section of sewer, a final television inspection video on this section shall be submitted by the Contractor to the Engineer. The Engineer shall prepare and submit a final television inspection report to the Municipality.

The 10" x 11 1/2" enclosure for the final report will meet the following specifications:

- the report shall be suitably bound;
- only letter-sized paper (8 1/2 x 11) will be used;