



Town of Witless Bay
Residential Subdivision Development
Design Manual

Approved by the Town Council of Witless Bay through resolution
number 2024-157 on June 12 , 2024

May 2024

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PREAMBLE

This document is intended to support Part IV Subdivision of Land conditions of the Witless Bay Development Regulations 2013-2023 and provide further information regarding the engineering design standards and submission of plans and documents with respect to proposed residential subdivisions located within the Town of Witless Bay Municipal Planning Area boundaries. It should be noted that the requirements of this document do not constitute the only conditions of subdivision development in the Town of Witless Bay (Town), and those who wished to subdivide land for residential purposes should contact other regulatory agencies that may have jurisdiction over the extent and content of the proposed work.

The main focus of this document is to assist property owners, Developers and Consulting Engineers in the preparation of drawings for submission and design standards for Town approval.

This document outlines the Town's minimum residential subdivision development requirements. Where unusual design situations arise, good engineering judgment should prevail.

The Town reserves the right to approve and/or require modifications to the requirements of this document where site conditions warrant and it is deemed by the Council to be in the best interest of Witless Bay.

The Town reserves the right to amend and/or revise these requirements of this document and the onus shall be on the Developer to ensure that all plans submitted for approval is in full adherence to the latest edition of this document. Where a Developer has obtained a prior approval in principle for a particular development but has not submitted a formal application for approval, and subsequent revisions are made to the design standards then the most recent edition of the standard shall apply regardless of what standards may have been in effect at the time the approval in principle may have been granted. Similar conditions apply for phased development, the last edition of design standards in force at the time of construct shall apply.

All construction work undertaken shall be performed in accordance with the requirements of the Municipal Water, Sewer and Roads Master Construction Specifications, Latest Edition, as published by the Province of Newfoundland and Labrador. This Publication is available on the Department web site at the following link.

<https://www.gov.nl.ca/ti/mi/mwsr/#spec>.

1. DEFINITIONS

For the purpose of this manual, the following definitions apply:

1.1 Construction Approval

Construction Approval means a permit which gives the Developer approval to proceed with construction work as per the development agreement.

1.2 Consulting Engineer

Consulting Engineer means a Professional Engineer, registered in the Province of Newfoundland and Labrador, retained by the Developer, to be responsible for design and supervision of the Works.

1.3 Coordinate Survey System

Coordinate Survey System means a system established for referencing land surveys and is based on Newfoundland 3° (degree) Modified Transverse Mercator projection.

1.4 Developer

Developer means a person or company who has applied for, and has been granted, approval by the Town to subdivide or service an existing parcel of land.

1.5 Development Approval

Development approval means a permit giving the Developer approval to proceed to the final design stage of a project.

1.6 Development Regulations

Development Regulations means The Town of Witless Bay Development Regulations 2013-2023 as amended from time to time.

1.7 Easement

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.

1.8 Survey

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

1.9 Town

Town means the Town of Witless Bay.

2. DEVELOPMENTAL APPROVAL

As part of the initial development application, the Developer will be required to accompany the application form with a property survey, subdivision plans and information for the evaluation of Council.

2.1 Requirements

The Developer will be required to submit one hard copy and a digital copy (AutoCAD) of the proposed subdivision plan showing the street and lot layout, water courses, buffers and public open space. This plan shall be at a scale of 1:500 and have contours at one (1) metre intervals. The Developer will also be required to submit a hard copy and digital copy of a location plan at a scale of 1:2500. Location plan shall indicate the proposed street layout and shall locate the position of the proposed development within the municipal boundaries of the Town.

2.2 Development Approval

The preliminary subdivision plan will be reviewed for the following:

1. **Lot Layout:** The plan will be reviewed for lot frontages, lot depths and lot areas of each lot for compliance to the land use zone.
2. **Access:** The plan will be evaluated for impact on traffic flows and ease of access to and from the subdivision.
3. **Storm System:** 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.
4. **Internal Street Layout:** The street layout will be reviewed for general conformance to the design criteria as given in the Development Regulations. Approval at this stage is preliminary and will not prohibit further changes that may become necessary during the detailed design.
5. **Public Open Spaces:** The provision for open space within a residential subdivision development shall be the responsibility of the developers. Council shall require either the dedication of 10 percent of suitable land in new residential areas for open space or the developer to pay a fee equal to the value of land to be conveyed prior to the issuance of any building permit for any approved lot in the residential subdivision and/or the conveyance of any public works such as roads. Alternatively, Council may accept a combination of both land and cash value equivalent to the aforementioned requirements. The assessed value shall be determined by the Municipal Assessment Agency. All required infrastructure for stormwater management, water courses, water buffer zones and wetland areas identified by the Department of Environment and Climate Change in conjunction with the Town and in consultation with the Town's engineer, shall not be included and/or constitute lands negotiated under the Town's open space requirements.

If the subdivision development plans meets the Town's Development Regulations and generally meets sound planning and engineering principles, a recommendation for a conditional subdivision development approval or permit will come forward to Council for consideration.

2.3 Subdivision Development Agreement

If the subdivision development application is approved by the Council, the Town will then require a series of detailed plans including engineering information for further detailed review. Upon their review, if the Town deems the plans and information satisfactory, the Developer will enter into a subdivision development agreement with the Town prior to construction commencing on the property.

3. DETAILED PLANS

3.1 General

The subdivision is to be designed and constructed in accordance with the Town's most recent Development Design Manual and the most recently updated version of the Government of Newfoundland and Labrador's *Municipal Water, Sewer and Roads Master Construction Specifications*.

The following detailed plans will be required to be submitted as part of the next stages of review by the Town:

3.1.1 The Subdivision Plan

The Plan should be drafted as per the standard Subdivision Plan and shall show the following items:

- a) Storm system layout-invert information to be provided at this stage;
- b) Well, septic tank and disposal field location;
- c) Street alignment information;
- d) Lot layouts and numbering;
- e) Right-of-ways, easements and carriageways;
- f) Canada Post locations;
- g) Driveway locations;
- h) Open space areas;
- i) Benchmark locations and elevations;
- j) Direction of flow for storm systems;
- k) Detention pond location;
- l) Dry hydrants; and
- m) Trailways.

3.1.2 Master Survey Plan

The Plan should be drafted as per the standard Master Survey Plan and shall show the following items:

- a) Street alignment information including coordinates for PI and street intersections;
- b) Lot metes and bounds, areas, and numbers;
- c) Right-of-ways and easements;
- d) Canada Post locations;
- e) Driveway locations;
- f) Open space areas; and
- g) Benchmark locations and elevations.

3.1.3 Plan and Profile Drawings

Plan and profile drawings shall show all streets and stormwater systems to be constructed. Detailed drawings are required and must be approved for any items not covered by the Standard Drawings in the Town's Development Design Manual or the *Municipal Water, Sewer, and Roads Specification*.

3.1.4 Lot Grading Plan

All approved development applications will have the following conditions with respect to Lot Grading Plans:

1. After receipt of Service NL approval for the septic design, which will indicate dwelling and septic system locations, a Lot Grading Plan shall be developed and submitted to the Town using the Town's Lot Grading Plan criteria (see Lot Grading Plan Criteria below). The Lot Grading Plan shall be prepared by a certified Newfoundland Land Surveyor, a Professional Engineer (licenced to practice in NL), an Architect (licenced to practice in NL, or by an Engineering Technician/Technologist (AETTNL certified). For those lots located in approved subdivisions, the individual Lot Grading Plan shall be prepared based on, and in keeping with, the overall approved subdivision Lot Grading Plan. **The Lot Grading Plan must be received by the Town before any conditional approval to develop can be issued.**

2. Prior to any landscaping (sodding) of the lot, a Lot Grading Plan Certificate of Completion must be submitted to the Town and stamped by a professional engineer, surveyor, architect or engineering technician as outlined above. The development security deposit will not be released until the Certificate of Completion is received by the Town. Any permits issued for outbuilding, fence, patio, walkways, swimming pools etc., shall be constructed without disruption to the Lot Grading Plan so as to not adversely affect the drainage patterns within the lot or adjacent and/or nearby properties.

3. Lot Grading Plan Criteria:

- a) A title block containing:
 - i. Name of subdivision
 - ii. Name of building permit owner
 - iii. Name of firm or individual and address of the professional preparing the plan, scale and date;
- b) Legend;
- c) North Arrow;
- d) Dimensioned property limits and house location;
- e) Finished floor elevation;
- f) Finished garage floor elevation;
- g) Top of foundation wall elevations (all locations) ;
- h) Finished basement floor elevation;
- i) Proposed lot elevations for each lot corner, front and back of house, and 3m from the back of the house;
- j) Driveway location, length, width, and proposed grades;
- k) Driveway to be paved from the edge of the roadway to the property line when any part of the driveway grade is greater than 7%. Driveway must be paved when there is sidewalk;
- l) Arrows indicating the direction of all surface drainage;
- m) Location and elevation of swales;
- n) Location of garages, decks, porches, patios, etc. ;
- o) Location of terraces and retaining walls;
- p) Location of well and septic system;
- q) Floor area;
- r) Building line setback;
- s) Side yard width;
- t) Rear yard depth;
- u) Lot frontage.

The appropriate tolerances are as follows:

- 0 to 150mm below final grade before topsoil

- Within 150mm above or below final grade after topsoil

Elevations not within tolerance may be accepted at the discretion of Council when the landscaping is graded to match existing conditions or infrastructure and positive drainage is maintained.

4. MASTER SURVEY PLAN REQUIREMENTS

4.1 Survey Plan

A Survey plan shall be drawn with reference points using the NAD83 coordinate system. Any documents submitted using the old NAD27 coordinate system shall be converted prior to submittal. The survey plan shall include:

- a) The name of the owner and Registry of Deeds number of all abutting lands;
- b) The length and bearing of each line of any transverse which connects any point on the boundary of the subdivision with a Coordinate Monument;
- c) The radius, central angle, length of arc, point of curve and point of tangency shall be given for each curved line and clearly indicated;
- d) Each street, walkway, right-of-way, easement, stormwater detention and dry hydrant;
- e) Each lot, and corresponding lot number;
- f) The length, bearing and internal angle of each line of the boundary of, and the area in square metres to the nearest centimetre of:
- g) The land, if any, which is reserved for park, playground, buffers and public purposes;
- h) The width to the nearest centimetre of each street;
- i) The geometry of connections between existing streets and streets of the subdivision;
- j) The location of any existing structure which is to remain;
- k) Every watercourse and its direction of flow;
- l) All information necessary for the calculation and layout of any curved line;
- m) The date of compilation;
- n) The date and description of revision, if any;
- o) The name of the subdivision;
- p) All existing streets, roads, lanes and intersections in the immediate area and their official names as designated by the Town;
- q) The location and extent of rock outcrops;
- r) The location, point description and results of any test borings;
- s) At least two (2) centerline points of known chainage related to the Provincial Coordinate Survey System;
- t) The monument location, number and elevation of the Town benchmark used; and
- u) Manhole numbers to be assigned by using the last four whole numbers of the easting and the suffix "R" for storm sewer manholes.

4.2 Certification of Plan

A survey plan shall be certified by a Registered and Licensed Newfoundland Land Surveyor.

4.3 North Arrow

A north arrow shall be placed in the upper right-hand corner of the plan and grid northing and easting lines and coordinates must be shown.

4.4 Title Block

The title block for the plan should be on the right-hand side of the plan.

4.5 Orientation

Plan shall always be easily readable when viewed upwards from the bottom edge of the plan.

5. DRAFTING

5.1 Plan Preparation

5.1.1 Cover Sheet

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

- a) Project Name;
- b) Key Plan;
- c) Name of Consulting Engineer and Sub-consultants;
- d) Name of Developer;
- e) List of Drawing Names and Numbers;
- f) Date of Issue, revisions; and
- g) "As-Built" or "Record Drawing" note when applicable.

5.1.2 Drafting Symbols

Standard drafting symbols shall be used on all plans. Where no standard symbols exist for an item, the symbol and its meaning shall be clearly indicated on the plan legend.

5.1.3 Road Names

All existing roads shall be clearly identified. Proposed Roads, which names have not been approved by the Town, shall be identified by letter (i.e. Road "A",) Names of the proposed roads can be submitted by the Developer for approval by the Authority.

5.1.4 Datum

All elevations shall be referred to the Provincial Geodetic Data. The location, description, and elevation of the reference Benchmark (BM) shall be indicated on the drawing.

5.1.5 Revisions

When any plan or drawing is revised, the date of revision and the initials of the draftsman performing the revision must be noted in the appropriate section of the Title Block. The revision identification number must be placed in the drawing in the area of the drawing that is affected by the revision.

5.1.6 Sealing of Plans and Drawings

All plans and drawings must bear the seal of a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador.

6. ROADS

6.1 Road Classification

The Town of Witless Bay Road classifications are as follows:

- a) Arterial Open Ditches (AOD)
- b) Collector Open Ditches (COD)
- c) Local Open Ditches (LOD)
- d) Local Curb and Gutter (LCG)

6.2 Design Criteria

6.2.1 General

Roads should be designed to provide the safest and smoothest traffic flow possible. The criteria provided in Table 1 are the minimum requirements; specific combinations of horizontal and vertical alignments may dictate a variance in the noted criteria.

Table:1 Road Design Criteria

Design Parameter	Arterial Open Ditches (AOD)	Collector Open Ditches (COD)	Local Open Ditches (LOD)	Local Curb & Gutter (LCG)
Maximum Gradient	As per Department of Transportation and Infrastructure Standards	10%	10%	10%
Minimum Gradient		1%	1%	1%
Min. Right of Way		20m	20m	15m
Min. Pavement Width			10m	6m
Min. Shoulder Width		1.5m	1.5	N/A
Min. Sidewalk/Pathway Width	1.5m	1.5 m	1.5m	1.5m
Min. Ditch Bottom Width	As per Department of Transportation and Infrastructure Standards	1m	1m	N/A
Min Ditch Side Slopes		2(H):1(V)	2(H):1(V)	N/A
Min. Back Slope		2(H):1(V)	2(H):1(V)	N/A
Min. Road Centerline Radius		35m	35m	35m
Max. Super elevation		0.06m/m	0.06m/m	0.06m/m
Min. Stopping Sight Distance		As per TAC Geometric Design Guide		
Intersection Sight Distance		As per TAC Geometric Design Guide		
Min. K-Value Crest of vertical curves		7	7	7
Sag vertical		11	11	11
Min Length of Vertical Curve		As per TAC Geometric Design Guide		
Min. K-Value for Drainage Crest of vertical curves		40	40	40
Sag vertical		30	30	30
Min. Intersection Spacing		60m	60m	60m
Min. Intersection Turning Radius	10m	10m	10m	

6.2.2 Design Criteria

Table 3-1 contains design criteria for each road classification. 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 Association of Canada.

6.2.3 Southern Shore Highway

Where development fronts the Southern Shore Highway, the Developer must meet the requirements of and obtain permits from the Department of Transportation and Infrastructure

6.2.4 Roads and Road Rights of Way to extent to Property Boundary

All roads and road right of ways identified on the plans shall, as applicable, extend to the limit of the property boundary and the conveyance of the road or road right of way to the Town shall extend to the limit of the property boundary.

6.2.5 Cul-de-sacs / Dead End Streets

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

- (a) cul-de-sacs are restricted and used only where land access is not possible by through streets.
- (b) the use of a cul-de-sac shall be approved by the Town.
- (c) the measurement of the length of a cul-de-sac shall be from the road ROW to the beginning of the bulb.
- (d) the turning circle of a cul-de-sac bulb shall have a driving surface diameter of not less than 30m at the outer edge of the asphalt.
- (e) The maximum length of a cul de sac will be 300 m
- (f) the maximum exit gradient for cul-de-sacs shall be +/- 5%.
- (g) No cul-de-sac shall be located so as to appear to terminate a collector street.

6.2.6 Intersections

The following criteria apply to a road intersection.

- (a) wherever possible, intersections shall be of a "T" type configuration unless otherwise determine by the Town.
- (b) Maximum number of street approaches to any one intersection shall be four (4).
- (c) the minor approach to an intersection shall have a maximum vertical alignment of 2% for a minimum distance of 10 m from the curb line of the major road.
- (d) the desirable angle of intersection shall be 90°, the minimum permissible angle shall be 75°.
- (e) the minimum offset distances between minor road center lines for intersections on the same or opposing side shall be 60 m.

- (f) the minimum intersection sight distance from the minor road for the critical turning movement, measured within the road right-of-way shall be:
 - (i) 85 m for intersections with local roads

- (ii) 125 m for intersections with collector roads
- (iii) When two or more roads intersect, only one road may have a curved horizontal alignment.
- (g) All other roads at the intersection shall have a tangent section of minimum length of 30 m, measured from the point of intersection of the road lines to the first point of horizontal curvature on the approach road line.

6.2.7 Temporary Turn-Around Areas

A temporary turn-around area must be provided at the end of all roads that terminate in dead-ends. The temporary turn-around area must have a minimum diameter of 30.0m.

The temporary turn-around area must be hard-surfaced with a minimum of 150 mm of compacted Class "A" road gravel.

Temporary turning circles are to be conveyed to the Town as opposed to providing an easement to the Town.

6.2.8 Cross-Sections

Road cross-sections shall be symmetrical about the road center line, unless otherwise approved by the Town of Witless Bay.

6.2.9 Cross-Slope

All local roads shall have a minimum crown of 2%. Where curb and gutter is present 3% crown is suggested.

6.2.10 Driveway Access

Driveway access shall be indicated for all development, including culvert sizes. Minimum driveway culvert size shall be 450 mm unless a larger culvert is required based on storm sewer flow analysis.

6.2.11 Curb and Gutter

Curb and gutter shall be installed on any road where any portion the longitudinal vertical gradient is 4% or greater or in the opinion of the Town, such that uncontrolled surface drainage will pose a threat to the road surface or roadbed.

6.2.12 Back slopes

Where the specified roadway back slope extends beyond the designated limits of the Road Right of Way, the Developer shall provide a suitable retaining structure and/or terraces to accommodate the vertical difference between the back slope grade and the existing ground profile.

- a) The minimum allowable backslope in common material shall be 1V:1.5H
- b) The minimum allowable backslope in rock shall be 4V:1H

7. WATER SUPPLY AND SANITARY SEWERAGE SYSTEMS

7.1 General

Currently, the Town has no municipal water or sanitary servicing.

Private water and sanitary sewerage systems for developed lots shall be reviewed and approved by Service NL and may require an engineering study prepared by a Professional Engineer registered to practice in Newfoundland and Labrador. Approval for these systems shall be in accordance to the following documents published by the Government of Newfoundland and Labrador:

1. *Private Sewage Disposal and Water Supply Standards*; and
2. *Groundwater Assessment and Reporting Guidelines for Subdivisions Serviced by Individual Private Wells*.

Private water and sanitary sewerage systems for developed lots shall be designed and constructed in accordance with the Government of Newfoundland and Labrador's *Private Sewage Disposal and Water Supply Standards* by an approved designer. In the case of water and sewerage systems supporting multiple residences, or if the sewage flows are larger than 4546 L/day, then the water and sewerage works shall be designed and constructed in accordance with the Government of Newfoundland and Labrador's *Guidelines for the Design, Construction, and Operation of Water and Sewerage Works*. The developer must submit to the Town, approvals from Service NL prior to awarding Construction Approval.

8. STORM SEWERS

8.1 Determination of Storm Runoff

8.1.1 Design Drainage Area

The drainage area for storm sewer design purposes may be determined from topographical mapping showing contour lines having an interval not exceeding one meter.

The design drainage area shall include fringe areas not provided for in adjacent storm drainage areas, as well as other areas which may become tributary through re-grading of adjacent lands.

8.1.2 Drainage Plan

A plan of the design drainage area must be submitted for Town review and approval.

The drainage area plan shall be to a scale of 1:2500 or as approved. The drainage area plan shall generally show the following information.

- (a) roads.
- (b) developed location.
- (c) Watercourses, wetlands, ponds, and coastal shorelines including the direction of flow.
- (d) the size and grade of proposed ditches, culverts and other related drainage structures.
- (e) tributary areas to each drainage structure, the size of the tributary area in hectares and the runoff coefficient for each tributary area.
- (f) direction of flow for proposed surface drainage.
- (g) all down gradient watercourses affected by the proposed development, including an analysis of the capacity of all down gradient structures and waterways to indicate that the existing structures have the capacity to accommodate the increased flows from the proposed development.

8.1.3 Zero Net Runoff

The construction of impervious surfaces such as roads, driveways and roofs associated with development increases surface runoff and decreases infiltration. These increases in surface runoff can impact downstream development and infrastructure, and could result in the initiation and/or aggravation of flooding and erosion. In order to equitably share the costs of controlling surface runoff and mitigate the risks of flooding and channel erosion between existing, proposed and future developments, the Town requires all new developments to incorporate best practices to restore the post-development rainfall-runoff response of the development as close as practicable to predevelopment conditions. This matching of runoff to predevelopment conditions would maintain the hydrologic integrity of the development with the intention of maintaining the hydrologic integrity of the entire watershed.

The developer shall provide infrastructure and methodologies to ensure there is no increase in the rate of stormwater flow from the site for any of the design storm events with return periods from 2 years to 100 years and durations from 1 hour to 24 hours, i.e., Net Zero Runoff. The design shall be submitted and reviewed by the Town, in consultation with the Town's Engineer and the Water Resources Division of the Department of Environment, Climate Change and Municipalities, and Conservation, and the Federal Department of Fisheries and Oceans.

8.1.4 Runoff Calculation

The volume of storm water runoff shall be calculated using the Rational Method. The formula for the Rational Method is as follows:

$Q = R A I N$, where

- Q = maximum rate of storm water runoff, in liters per second
- R = the appropriate runoff coefficient, dimensionless
- A = the area that is tributary to the point of design in hectares
- I = the rainfall intensity, in millimeters per hour
- N = 2.778, a dimensionless constant

The calculations of storm water runoff must be submitted to the Town, or it’s Agent, for review. The calculations must be submitted both in hard copy format and electronic format.

Computer modelling using The Storm Water Management Model (SWIMM) Runoff Algorithm is an acceptable method.

8.1.5 Runoff Coefficient

The values of the runoff coefficient to be used in the Rational Method calculation shall be selected from Table 2 for the appropriate land use and return period. The designer must use professional judgement when selecting the appropriate “C” value. Generally larger areas with low slopes will have the lowest “C” value and smaller areas with moderate to steep slopes will have the highest “C” value.

Table 2: Runoff Coefficients for Rational Method

Land Use	Run off Coefficient
Residential: Single Family	0.3 to 0.5
Residential: Semi-Detached	0.4 to 0.6
Residential: Town-Housing/Apartments	0.6 to 0.75
Paved Parking Areas / Concrete	0.8 to 0.95
Industrial	0.5 to 0.9
Commercial	0.5 to 0.9
Institutional	0.5 to 0.9
Roofs	0.7 to 0.85
Parks / Playgrounds / Cemeteries	0.1 to 0.25
Agriculture Land	
Bare packed soil - Smooth	0.3 to 0.6
Bare packed soil – Rough	0.2 to 0.5
Cultivated Land	
No crop	0.3 to 0.6
With crop	0.2 to 0.4
Pasture / Range	0.15 to 0.50
Undeveloped	0.1 to 0.3
Lakes/Ponds/Wetlands	1

Lawns 0 to 7% slope	0.1 to 0.25
Lawns > 7% slope	0.25 to 0.35

8.1.6 Rainfall Intensity

The minimum value of rainfall intensity to be used in the Rational Method calculation shall be determined from Table 3. The values provided below are the rainfall intensity values as published by Environment and Climate Change Canada for St. John's based on a 1 / 25 year storm duration. The designer is required to check the Environment and Climate Change Canada website for the latest publication.

Table 3: Rainfall Intensity for Rational Method

Time of Concentration(min.)	Rainfall Intensity (mm/hr.)
5 min	108.2
10 min	76.8
15 min	72.3
30 min	44.6
> 60 min	29.5

The following parameters shall apply to the determination of design storm return period and duration.

8.1.7 Time of Concentration

The time of concentration shall be calculated using the following equation.

$$t_c = \{2.1873 L n / S^{0.5}\}$$

Where:

t_c = time of concentration (in minutes)

L = maximum length of travel (in meters) 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 4.

Table 4: Roughness Coefficient for Calculation of Time of Concentration

Land Use	Roughness Coefficient (n)
Residential: Single Family	0.055
Residential: Semi-Detached	0.045
Residential: Town-Housing/Apartments	0.035
Paved Parking Areas	0.015
Industrial	0.015
Commercial	0.015
Institutional	0.015
Parks	0.070
Pasture/Range	0.350
Cultivated Land	0.150
Forest: Deciduous	0.500
Forest: Coniferous	0.700

8.2 Storm Drainage Pipe Design

8.2.1 Hydraulic Capacity

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

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

Where:

Q = discharge, m³/s

A = cross-sectional area of flow, m²

R = Hydraulic radius, m

S = slope, m/m

n = coefficient of roughness, dimensionless

8.2.2 Coefficient of Roughness

The coefficient of roughness to be used in Manning's Formula shall be no less than the following for design purposes.

Corrugated and spiral rib steel pipe (helical profile)

200 mm to 500mm Ø = 0.015

600 mm Ø = 0.016

900 mm Ø = 0.018

1200 mm Ø = 0.020

1400 mm Ø & larger = 0.025

Corrugated and spiral rib steel pipe (annular profile)
All diameters = 0.024

HDPE pipe (smooth wall interior)
100mm - 450mm = 0.010
525mm – 1200mm = 0.012

For pipe sections and diameters not listed above the designer should consult the manufacturer's technical information for the proper Manning's number.

8.2.3 Minimum Pipe Size

The minimum diameter of storm sewer pipes shall be as follows:

- (a) Driveway Culvert: 450 mm \varnothing unless calculations require larger.
- (b) Storm Sewer pipe: 375mm \varnothing .

8.2.4 Velocity

The minimum acceptable velocity at design peak shall be 0.75 m/s. The maximum acceptable velocity at design peak flow shall be as follows:

- (a) 6.0 m/s: pipes greater than 600 mm and less than 1200 mm in diameter
- (b) 7.5 m/s: pipes with diameters greater than 1200 mm.

8.2.5 Minimum Gradient

The minimum allowable pipe gradient shall be the gradient required to produce the minimum acceptable velocity of 0.75 m/s at design peak flow, except that in no case shall the minimum gradient be less than 0.5%.

8.2.6 Change of Pipe Size

No decrease of pipe size from a larger size upstream to a smaller size downstream shall be allowed under any circumstances.

8.2.7 Downstream Impact

Provide hydraulic analysis for all existing downstream structures that shall be affected because of the increased runoff from the proposed development. Downstream analysis shall be based on a 1:100 year design storm analysis. Where analysis suggested that the existing structure is unable to accommodate the increased flow, then the Developer shall either provide for onsite detention sufficient or upgrade the effected structures.

8.2.8 Maintenance Location

Maintenance holes shall be located at every change of horizontal and vertical alignment, at every change of pipe size and/or material, and at dead ends. Maximum spacing on maintenance holes shall not be more than 100m.

8.2.9 Maintenance Hole & Catch Basin Design

Catch basins shall be designed and constructed in accordance with the latest edition of the Municipal Water, Sewer, and Roads Master Construction Specifications.

8.2.10 Maintenance Hole Catch Basin Location

Maintenance Holes and catch basins shall be located and spaced in accordance with conditions of design and shall provide for the expected maximum flow. The locations shall be adequate to prevent on-street ponding of storm water during storms having a 1 in 25 year return period.

Catch basins are to be located at all street intersections and all catch basins located in low points shall be double catch basins.

8.2.11 Catch Basin Spacing

The maximum permissible spacing for catch basins draining streets shall be 100 m.

8.2.12 Catch Basin Leads

Catch basin leads shall have a minimum diameter of 200 mm.

Catch basin leads shall have a minimum grade of 2%.

9. EASEMENTS

9.1 General

9.1.2 Provision of Easements

When surface drainage culverts, ditches, swales are to be installed at locations other than in public rights-of-way, an easement shall be provided, the Developer shall grant title to the easement to the Town at no cost to the Town.

9.1.3 Building Prohibition

The Owner of any lands upon which an easement has been granted shall not construct any type of structure over such easement lands and the Developer shall be required to include and make the buyer aware of any easements prior to the sale of any land within the proposed development , furthermore the Developer shall include in the sales agreement clear instructions to the buyer of the existence of all easements and the buyer shall be required to provide written notification to the Town of their knowledge of the existence of the easement and that restrictions imposed by such easement.

9.1.4 Easement Width

The width of any easement shall be based upon the type and number of service pipes to be installed in the easement. A minimum easement width of 6.0 m must be provided, and any infrastructure placed in this easement shall be installed in the centre of the easement.

9.1.5 Alignment

The alignment of any easement shall be dependent upon the alignment of the pipe to be installed.

9.1.6 Agreement

All easements shall be covered by a legal agreement which outlines the purpose of the easement.

10. POST-CONSTRUCTION

10.1 Deliverables

Prior to acceptance by Council, the Developer shall provide the following list of deliverables.

10.1.1 Open Space

As determined by the Council, a deed of conveyance transferring the 10% open space as required by the Town or the cash in lieu of the open space or a combination of open space and cash in lieu up to the 10% value of the land.

10.1.2 Road Sub-Grade

- (a) Letter from the Developer's Design Engineer responsible for preparation of the design that the roadwork has been completed in compliance with the approved design drawings and that the sub-grade has been compacted in compliance with the latest edition of the Municipal Water, Sewer, and Roads Master Construction Specifications.
- (b) Letter from the Developer's Design Engineer that all ditches are free draining, constructed to the required cross-sections and that acceptable erosion mitigation is in place to protect ditches from erosion and scour under design flow conditions.

10.1.3 Road Granular Placement

- (a) Provide certified copy from an accredited geotechnical testing agency that all granular compaction testing has been done in compliance with the latest edition of the Municipal Water, Sewer, and Roads Master Construction Specifications. Test results shall indicate thickness of granular, compaction achieved, source of granular production, date and time of testing, results of any retesting.
- (b) Provide gradation curve for granular materials placed in roadway.

10.1.4 Asphalt Placement

- (a) Provide certified copy of mix design used for the asphalt placed on the roadway.
- (b) Provide certified copy from an accredited geotechnical testing agency of asphalt compaction testing to ensure compliance with asphalt placement specification contained in the latest edition of the Municipal Water, Sewer and Roads Master Construction Specifications. Test results shall as a minimum include, thickness measurements of the compacted asphalt at 30m intervals at the centerline and left and right shoulders, compaction achieved, placement temperature and a minimum of 2 Marshall Test of the placed asphalt.

10.2 As-Built Drawings

10.2.1 General Requirements for As-built Drawings

The as-built drawings must be stamped by a Consulting Engineer, signed and dated to indicate the as-built information. As-built drawings must be provided in hard copy (2 copies) and electronic copy.

10.2.2 Submission of Computer Graphic Files

Computer graphic files of the as-built construction drawings must be submitted must be in Autocad DXF format and PDF Format. Manually-drafted drawings will not be accepted.

10.2.3 As Built Drawings

- (a) As built drawings prepared by the Consulting Engineer and certified as being correct.

- (b) As Built to include:
 - (i) Final centerline profile
 - (ii) Roadway and driveway Culvert inlet and outlet elevations
 - (iii) Left and right Ditch profiles where appropriate
 - (iv) Final road cross section template
 - (v) Shoulder width measurements.
 - (vi) Curb and gutter elevations when installed
 - (vii) Maintenance Hole and catch basin locations and pipe inverts when installed.

10.2.4 Letters of Clearance

- (a) Letter of clearance from such authorities as:
 - (i) Fisheries and Oceans Canada and the Provincial Department of Environment and Climate Change related to work done in and around streams or other water bodies.
 - (ii) Department of Transportation and Infrastructure with regard to intersections with roads under their jurisdiction.
 - (iii) Newfoundland Power with respect to easements.
 - (iv) Canada Post with respect to the location of community mail boxes units.
 - (v) Other Governing Agencies or Authorities deemed necessary by the Town.
 - (vi) Final Inspection Certificate by Town's Consultant.

11. SOURCES

The following sources should be referred to in the preparation of residential subdivision plans and information:

1. Transportation Association of Canada Road Design Manual (metric edition).
2. Town of Witless Bay Municipal Plan and Development Regulations.
3. Government of Newfoundland and Labrador's *Municipal Water, Sewer and Roads Master Construction Specifications*.
4. Government of Newfoundland and Labrador Private Sewage Disposal and Water Supply Standards.
5. Government of Newfoundland Groundwater Assessment and Reporting Guidelines for Subdivisions Serviced by Individual Private Wells.