



VILLAGE OF BELCARRA
Subdivision and Development Bylaw
Bylaw No. 492, 2015



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VILLAGE OF BELCARRA
Subdivision and Development
Bylaw No. 492, 2015



A BY-LAW TO REQUIRE AND REGULATE THE PROVISION OF WORKS AND SERVICES IN RESPECT OF THE SUBDIVISION AND DEVELOPMENT OF LAND IN THE VILLAGE OF BELCARRA.

WHEREAS a municipality may, by bylaw pursuant to s. 938 of the *Local Government Act*, regulate and require the provision of works and services in respect of the subdivision of land, and require as a condition of the approval of a building permit or subdivision that the owner of the land provide works and services on the land being developed or subdivided and on the adjacent highway, all in accordance with the works and services standards established in the bylaw;

NOW THEREFORE the Council of the Village of Belcarra ENACTS AS FOLLOWS:

1.0 CITATION

This bylaw may be cited as "Village of Belcarra Subdivision and Development Bylaw No. 492, 2015".

2.0 REPEAL

Village of Belcarra Subdivision Servicing and Development Bylaw No. 133, 1989 is repealed.

3.0 INTERPRETATION

- 3.1 Unless otherwise stated, references in this bylaw to Acts, regulations or other enactments are references to Acts, regulations or other enactments of the Province of British Columbia, as amended or replaced from time to time.
- 3.2 All references in this bylaw to any bylaw or policy of the Municipality are references to the bylaw or policy as amended or replaced from time to time.
- 3.3 Metric units are the standard units of measure in this bylaw. If metric units are not noted, metric units are to be assumed.
- 3.4 In this bylaw, unless the context otherwise requires:

Approving Officer: means the person appointed by the Council from time to time, as the Approving Officer for the Municipality pursuant to the *Land Title Act*.

Building Inspector: Means a person appointed as a building inspector for the Municipality.

Developer: means the Owner, or authorized agent of the Owner, of land in respect of which a subdivision application or building permit application is made.

Drilled Well: means a mechanically drilled and cased conduit into an aquifer that is protected against the introduction of surface water or surface contaminants and capable of producing a sustainable yield, meeting both the water quality parameters of the British Columbia Drinking Water Standards for water that is safe for human consumption and water quantity capable of producing the minimum daily yield specified within the Village of Belcarra Building and Plumbing Code Regulation Bylaw.

Highway: means a highway as defined in the *Community Charter*.

Municipal Water System: means a system owned and operated by the Municipality for the supply and distribution of water.

Municipality: means the Village of Belcarra.

Owner: means owner as defined in the *Community Charter*.

Parcel: means parcel as defined in the *Community Charter*.

Potable Water: means a drilled well which complies with the Village of Belcarra water quality and quantity regulations of the Village of Belcarra Building and Plumbing Code Regulation Bylaw.

Security: means cash, irrevocable letter or credit or a performance bond.

Superintendent of Public Works: means the person appointed as the superintendent of public works for the Municipality.

Value: when used with reference to Works and Services, means the value determined from unit prices and quantities contained within the contract documents executed between the Developer and the contractor installing the works and services, or, where there is no such contract, then the value estimated by the Developer's engineer based upon prevailing unit prices; and agreed to by the Approving Officer.

Works and Services: means any public service, facility or utility required by this bylaw and without restricting the generality of the foregoing includes the construction of access roadways, lanes, curbs, gutters, and sidewalks; the supply and distribution of water; the collection and disposal of sewerage; and the collection of drain water.

4.0 ADMINISTRATION AND ENFORCEMENT

- 4.1 No person shall subdivide or develop land in the Municipality except in accordance with the provisions of this bylaw.

4.2 The Superintendent of Public Works is authorized to enter at all reasonable times upon a property or premises to inspect it in connection with his or her duties under this bylaw and to ascertain whether the provisions of this bylaw are being complied with.

4.3 Schedules A and B, attached to this bylaw, form part of this Bylaw.

5.0 WORKS AND SERVICES REQUIRED IN RELATION TO SUBDIVISION AND DEVELOPMENT

5.1 The Works and Services required by this bylaw are:

5.1.1 Highways and lanes, boulevards including landscaping, boulevard crossings, culverts, transit bays, sidewalks, walkways, street lighting and conduits and vaults for underground wiring;

5.1.2 Water supply and distribution systems within the Village of Belcarra Local Service Area No. 1 must be provided by connection to the Municipal water system and in the case of any other parcel must be provided by a drilled well that supplies potable water in accordance with the requirements of the Municipality's Building and Plumbing Code Regulation Bylaw;

5.1.3 Sewage collection and disposal systems; and,

5.1.4 Drain water collection systems,

all in accordance with the standards set out in Schedule A to this bylaw.

5.2 No person shall subdivide land in the Municipality unless the Developer has provided the Works and Services required by this bylaw to the satisfaction of the Superintendent of Public Works or the Developer has:

5.2.1 entered into an agreement with the Municipality to construct and install the Works and Services by a date specified in the agreement; and

5.2.2 provided to the Municipality security in an amount equal to 150% of the value of the Works and Services.

5.3 Section 5.2 does not apply:

5.3.1 in relation to a subdivision that does not create any additional Parcels if the Approving Officer, in consultation with the Superintendent of Public Works, determines that the water supply and distribution system and the sewage disposal system for each parcel affected by the subdivision are adequate to serve the proposed parcels; or

5.3.2 in relation to Works and Services of any type, if the Superintendent of Public Works determines that the need for the Works or Services is not directly attributable to the subdivision, or to the buildings likely to be constructed in the subdivision.

- 5.4 No person shall construct or place a building or structure in the Municipality for which a building permit is required unless the Developer has provided the Works and Services required by this bylaw to the satisfaction of the Superintendent of Public Works or the Developer:
- 5.4.1 has entered into an agreement with the Municipality to construct and install the Works and Services by a date specified in the agreement; and
 - 5.4.2 provided to the Municipality security in an amount equal to 150% of the value of the Works and Services.
- 5.5 Section 5.4 does not apply:
- 5.5.1 If the value of construction that is the subject of the building permit does not exceed \$300,000 including applicable taxes as estimated by the Building Inspector; or,
 - 5.5.2 If, in relation to Works and Services of any type, the Superintendent of Public Works determines that the need for the Works and Services is not directly attributable to the subdivision, to buildings likely to be constructed in the subdivision, or to the buildings for which a building permit application has been made.

6.0 WORKS AND SERVICES AGREEMENTS

6.1 The Superintendent of Public Works may:

- 6.1.1 from time to time, prescribe the form of agreement to be used where the Municipality is entering into an agreement pursuant to section 5.2 or section 5.4, provided that each such agreement shall require the Developer to:
- a) maintain the Works and Services for a period of at least one year following the completion of construction, and to repair and make good all defects and deficiencies appearing in the works and services during that period;
 - b) provide to the Municipality throughout the maintenance period performance Security in the amount determined by the Superintendent of Public Works;
 - c) carry third party liability insurance in an amount and form acceptable to the Superintendent of Public Works, in respect of claims arising out of death, personal injury or damage arising from the construction of the Works and Services; and
 - d) indemnify the Municipality and save it harmless in respect of all costs and expenses it may incur as a result of faulty workmanship or defective material in the Works and Services in respect of which the Municipality has provided notice to the Developer prior to the Municipality's final acceptance of the Works and Services;
- 6.1.2 execute and deliver such agreements on behalf of the Village, and

- 6.1.3 require that such agreements be drafted in a form that is registrable under s. 219 of the *Land Title Act* against title to the land being subdivided or built upon.

7.0 CONSTRUCTION AND MAINTENANCE OF WORKS AND SERVICES

- 7.1 All works and services required by this bylaw shall be constructed and installed at the expense of the Owner in accordance with the standards set out in Schedule A, except to the extent that such standards may have been varied by development variance permit or a board of variance order, and in accordance with any technical specifications the Superintendent of Public Works may prescribe from time to time.
- 7.2 Before commencing construction of any Works and Services, unless the Developer has entered into an agreement under s. 5.2 or s. 5.4 the Developer shall provide to the Municipality a damage Security in an amount equal to 10% of the value of the Works and Services or \$30,000, whichever is greater.
- 7.3 For a maintenance period of one year after completion or substantial completion of the required works and services the Developer shall:
- 7.3.1 maintain the works and services;
 - 7.3.2 repair and make good all defects and deficiencies appearing in the works and services; and,
 - 7.3.3 provide to the Municipality performance security in an amount equal to 10% of the value of the works and services.
- 7.4 If the Developer fails to maintain and repair the works and services during the one year maintenance period the Municipality may undertake the required work and deduct all costs from the security provided under s. 7.3 above.
- 7.5 The Developer shall request in writing an "end of maintenance" inspection not sooner than ten months from the date of acceptance of the Works and Services, and the Municipality shall perform such an inspection within three weeks of receiving such a request. The Municipality shall then notify the Developer of any required remedial work in writing. Upon satisfactory completion of the required work the Municipality shall notify the Developer accordingly and shall return the security, less any costs that have been incurred by the Municipality in respect of the work.
- ## **8.0 INSURANCE AND INDEMNITY**
- 8.1 The Developer shall carry third party liability insurance in respect of the insured's activities on Municipal highways and statutory rights of way:

- 8.1.1 effective before the commencement of work until a date not less than 12 months after the date of acceptance, by the Municipality, of completion of all required works and services;
 - 8.1.2 with a limit of liability of not less than \$5,000,000.00 inclusive for bodily injury, sickness, death and property damage including loss of property;
 - 8.1.3 including coverage by the Insurance Corporation of British Columbia of all owned and non-owned motor vehicles with a limit of liability of not less than \$5,000,000.00 inclusive for bodily injury, sickness, death and property damage.
- 8.2 The Developer shall, at the request of the Approving Officer, provide evidence of valid Workers Compensation Board coverage for all employees involved in the construction and installation of the Works and Services.
- 8.3 The Developer shall indemnify and hold harmless the Municipality from any and all claims for damages arising from activities of the Developer, his agents and his employees in the construction and installation of Works and Services.

9.0 APPLICATION REQUIREMENTS AND FEES

- 9.1 An Owner who wishes to subdivide land shall pay to the Municipality all fees in accordance with the Village of Belcarra Fees and Charges Bylaw.
- 9.2 An Owner who wishes to subdivide land shall provide to the Approving Officer such information as the Approving Officer may require, including without limitation drawings and specifications bearing the seal of a British Columbia Professional Civil Engineer, to establish that the proposed subdivision can be provided with Works and Services in accordance with this Bylaw.
- 9.3 An Owner who wishes to Develop land shall provide to the Building Inspector such information as the Building Inspector may require, including without limitation drawings and specifications bearing the seal of a British Columbia Professional Civil Engineer, to establish that the proposed subdivision can be provided with Works and Services in accordance with this Bylaw.

10.0 SEVERABILITY

If any provision of the bylaw is for any reason held to be invalid by the decision of any court of competent jurisdiction, the invalid portion shall be severed and the declaration of invalidity shall not affect the validity of the remaining provisions of this bylaw.

READ A FIRST TIME on October 5, 2015

READ A SECOND TIME on October 5, 2015

READ A THIRD TIME on

ADOPTED by the Council on

Mayor Ralph E. Drew

Lorna Dysart
Chief Administrative Officer

This is a certified a true copy of
(cited name)

Chief Administrative Officer

Schedule A - Standards

Comprising of:

- | | |
|---------------|---|
| Part 1 | Design Criteria |
| Part 2 | Supplementary Standard Drawings |
| Part 3 | Supplementary Specifications |
| Part 4 | Master Municipal Construction Documents (bound separately) shall be the current edition. |

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PART 1 – DESIGN CRITERIA

1.0 GENERAL

TO ALL USERS OF THIS SCHEDULE:

The "Design Criteria Schedule" is the criteria to which all designs for Public Works within the Village of Belcarra should conform. The Village has adopted the Master Municipal Construction Documents.

If when using this Manual, you have questions as to the meaning or interpretation, please contact the Village of Belcarra office at 604-937-4100.

Engineers offering their services, directly or through land developers, will be required to accept responsibilities for their designs by completing and attaching the following statement to their drawings:

"I..... Professional Engineer, registered in the Province of British Columbia, hereby certify that the works as herein set out on the attached drawings have been designed to good engineering standards and in substantial compliance with Schedule A of the Village of Belcarra's current Subdivision and Development Bylaw.

.....
(Signature)

.....
(Professional Registered Seal)

1.1 Design Engineer’s Responsibilities

The Design Criteria set out by the Village shall be considered minimum standards and shall not relieve the Professional Engineer of his professional responsibilities and from satisfying himself of the adequacy of his design.

1.2 Existing Services

Existing service information is available from the Village. These records are made available on the understanding that the Village cannot guarantee their accuracy. Where critical conditions prevail, verification must be made by the designer or user by an appropriate field survey.

1.3 Design and Construction Details

1.3.1 The purpose of this section is to outline the minimum standards and requirements the Village will accept for the submission of quality design and as-built drawings for Works and Services.

1.3.1.1 Whenever Works and Services are required or proposed, the Consulting Engineer shall arrange for a pre-design meeting to review the requirements for the proposed Development to ensure understanding and conformance by the Consulting Engineer of the latest Village standards, specifications and policies.

1.3.1.3 All submissions for design of Works and Services shall comply with the following:

- a) All applicable requirements of this Schedule; and
- b) All applicable requirements of Village Bylaws.

1.3.1.4 The Consulting Engineer shall be responsible for the coordination of civil design works of the Development with the design of the BC Hydro, FortisBC Gas, telecommunication infrastructure and the Street Tree and Landscaping plans for that Development. Conflicts in the horizontal and vertical planes for all service connections and mains shall be resolved between the Consulting Engineer, the appropriate utility and the Landscape Architect.

1.3.2 Survey Information

1.3.2.1 All surveys shall be conducted safely with minimal nuisance to traffic or the public at large. The Developer must obtain permission from any Owner before entering private property.

1.3.2.2 All elevations shall be from geodetic datum. Information regarding the location and elevation of existing Integrated Survey Monuments within the Village may be obtained from the Public Works department.

- 1.3.2.3 Originating benchmarks and Integrated Survey Monuments shall be noted on all applicable plans.
- 1.3.2.4 Copies of legible field notes shall be made available to the Village upon request.
- 1.3.2.5 Centrelines (or offset lines) are to be marked and referenced in the field, and all changes shall be keyed to the legal posting.
- 1.3.2.6 All existing improvements such as survey monuments, manholes, catch basins, storm sewer culvers, driveways, fire hydrants, water mains, water storage tanks, wells, sewerage systems, utility poles and existing dwellings including addresses, fences, trees, hedges and unusual ground formations shall be noted.
- 1.3.2.7 Where applicable, or as requested by the Engineer, cross-sections are required. The sections shall include locations and elevations of:
- a) Centreline of pavement;
 - b) Edge of pavement;
 - c) Top of curb;
 - d) Back of sidewalk;
 - e) Edge of shoulder;
 - f) Ditch invert;
 - g) Top of ditch banks including high and low watermark(s);
 - h) Property line;
 - i) An existing ground elevation 3 meters inside property line and 5 metres beyond cut or fill slopes.
- 1.3.3 Drawing Submissions
- 1.3.3.1 All drawings shall be prepared in accordance with the following requirements and all other applicable requirements of this Schedule.
- 1.3.3.2 All drawings shall clearly identify the Works and Services in sufficient detail. Drawings shall be inked and use minimum 80CL size Leroy lettering or digital CAD equivalent.
- 1.3.3.3 All new Works and Services are to be shown in bold lines.
- 1.3.3.4 Specific notes pertaining to the construction of Works and Services are to be shown on the specific service drawing separate from standard notes.
- 1.3.3.5 Baselines or chainages are to be referenced to at least one legal property pin on each sheet.
- 1.3.3.6 Offsets are to be shown to both sides of the Highway or Statutory Right-of-Way or to one side with the Highway or Statutory Right-of-Way width noted.

1.3.3.7 All drawings shall be signed and sealed by the Consulting Engineer responsible for the design and construction supervision of the Works and Services.

1.3.4 Plan Information

1.3.4.1 Typically, all drawings should be oriented to view northward or westward with chainages increasing from left to right and from bottom to top with North at the top or right side of the drawing. Information on plans shall include:

- a) The municipal project "SUB" Number and reference file number(s), noted in the lower right-hand corner of all drawings;
- b) The legal layout of roads and properties;
- c) The legal descriptions of all properties included in the Development;
- d) Dimensions to the nearest 0.01 meters;
- e) Existing house numbers of parcels adjacent to the proposed works and services; and
- f) All registered and proposed Statutory Rights of-Way, covenants and easements.

1.3.5 Engineering Design Drawings

1.3.5.1 For residential and Subdivision Developments, a complete set of engineering design drawings of proposed Works and Services shall include, in the following sequence:

- a) Cover Sheet - noting:
 - i. The Consulting Engineer's name, address, phone, and fax numbers;
 - ii. Developer's name, address, phone, and fax numbers, including contact name
 - iii. Surveyor's name, address, phone, and fax numbers;
 - iv. The legal description and address of the lands involved;
 - v. A location plan insert approximately 100mm square and at 1:4000 scale showing all proposed roads and proposed Subdivision layouts in relation to surrounding lands;
 - vi. A drawing index (for smaller projects, general notes may be included on the cover sheet, otherwise general notes shall be on a separate sheet or on the appropriate utility sheet);
 - vii. Benchmark details; and
 - viii. Date and Revision dates.
- b) Key Plan - at a 1:1000 or 1:500 scale - noting:
 - i. All proposed Works and Services including service connections, appurtenances such as hydrants, valves, manholes, catch basins, street lights, driveway to each Parcel and post boxes complete with offsets, locations and dimensions;

- ii. If more than one sheet is required, note the westerly or southerly portion first and identify as Key Plan "A" with additional plans noted as "B" and "C", etc.; and
 - iii. The Development site shall be outlined with a bold line. Village infrastructure, including all works with a Statutory Right of Way, must be identified separately from private infrastructure. Clarity of ownership is important.
- c) Rainwater Management Plan (SWMP) at 1:1000 scale noting:
- i. The full catchment area to the nearest adequate downstream connection point for the site to be developed;
 - ii. The post-Development contour lines at maximum 1 metres intervals. The contour lines should be the pre-Development contour lines at the existing boundary or as designed by the Consulting Engineer. Existing topographic information shall extend a minimum 30 metres outside the Development boundary;
 - iii. A directional arrow on each Parcel indicating the prevailing post-Development slope of the land;
 - iv. The proposed minor (10-year return) Drainage System complete with inlet and outlet structures, catch basins and connections(s) to existing , adequate Drainage Systems;
 - v. The proposed major (100-year return) post-Development flood route(s) and Drainage System, complete with connections to existing, adequate Drainage Systems;
 - vi. The storm detention facility location, size, volume, area of catchment, release rate and head on orifice;
 - vii. A legend noting all items shown on the SWMP;
 - viii. A design table, noting information for each segment of proposed main including the catchment area (in hectares), run-off coefficients, time of concentration, rainfall intensity, major and minor flow volume, pipe size, slope and capacity of both existing and proposed; and
 - x. Water courses, creeks, streams, ponds, lakes, wetlands, dry channels including setback boundaries as per guidelines set by the Ministry of Environment or Department of Fisheries and Oceans.
- d) Road Works and Water Mains – may be on the same plan and profile drawings and shall be at a scale of 1:500 horizontal and 1:50 vertical noting:
- i. Existing and proposed elevations and locations of:
 - 1) The centre line proposed and existing roadways;
 - 2) Proposed and existing curbs and gutters and sidewalks
 - 3) All curves at appropriate arc locations; and

- 4) All existing and proposed catch basins including lid elevations;
 - ii. BC, EC, arc lengths and "k" value design details of all vertical and horizontal curves;
 - iii. All water mains and appurtenances including valves, hydrants, bends, tees, tie-in locations, test points, blow offs, air valves etc.;
 - iv. The full pipe shall be shown in profile;
 - v. All water main crossover points with sewers and other utilities, including clearance and protection details;
 - vi. The size, class, type, length and slope of each continuous water main pipe section; and
 - vii. Joint resistant and thrust block design tables.
- e) Storm Sewers - shall be on plan/profile drawings and shall be at scale of 1:500 horizontal and 1:50 vertical noting:
- i. All sewer mains and appurtenances including cleanouts, inspection chambers, manholes, catch basins, etc.;
 - ii. Symbols on profile denoting the service connection location and elevations at the property line;
 - iii. The major Drainage System hydraulic grade lines (HGL) on the profile;
 - iv. The full pipe shall be shown on the profile;
 - v. Rim elevations of all manholes catch basins and cleanouts;
 - vi. The size, class, type, length and slope of each continuous pipe section;
 - vii. Chainages and invert of each appurtenance shall be shown on profile;
 - xi. All crossover points with other sewers, water mains and utilities including clearance and protection details;
 - xii. Storm detention system, information calculations and construction details, if not provided on the SWMP;
 - xiii. Water course, creeks, streams, ponds, lakes, wetlands including setback boundaries as per guidelines set by the Ministry of Environment or Department of Fisheries and Oceans; and
 - xiv. At least one property line shall be located by chainage relating to the mains on each sheet.
- f) Road Cross-Sections – The scale shall be at 1:100 horizontal and 1:50 vertical. Plans shall include:
- i. Cross sections every 20 metres and shall show proposed construction over existing conditions to 10 metres beyond property line of the Statutory Right-of-Way for highway purposes; and
 - ii. Additional sections may be required or requested where large cuts or fills are involved.

- g) Lot Grading Plan Plans shall be at a scale of 1:500 or 1:250 noting:
- i. Pre-Development ground contours in dashed lines;
 - ii. Post-Development ground contours (1 metres intervals) in solid lines;
 - iii. Elevations in the corners of each proposed Parcel;
 - iv. Elevations at the proposed rear building line of each proposed Parcel;
 - vi. Drainage swales. Typically swales are required on the uphill side of all downhill properties;
 - vii. Catch basins and lawn basins complete with rim elevations;
 - viii. Proposed retaining walls including height, length, face surface area, top of wall (TOW), bottom of wall (BOW), elevations, drainage, type of construction, geotechnical details with reports and certifications by qualified geotechnical consultants. Note: the Developer shall construct all retaining walls that are integrals to lot grading designs;
 - ix. All areas near a sudden drop off or cut and fill in excess of 1.5 metres deep shall be identified and located clearly and accurately; and
 - x. All drainage courses, creeks, streams, ponds and wetland areas with setback boundaries identified and located by legal survey and protected by physical structures such as fences walls or permanent barriers.
- h) Construction Details
- i. All constructions details that are not covered or specifically detailed in the Construction Specification and Standard Details Drawings shall be provided on the drawings pertinent to the utility. Where there is a Village standard or detailed drawing, a reference to the standard is acceptable. Reference to MMCD standards is acceptable.
- i) Pavement Marking and Street Traffic Advisory Plan – shall be at a scale of 1:500, or 1:250, or 1:100 noting:
- i. Pavement markings including, arrows, edge of pavement lines, median, pedestrian cross walks and traffic movement islands, centre line and lane markings; and
 - iii. Street and traffic signs including, directional arrows, advance warning signs and checkerboards, street name signs and traffic advisory signs.
- j) For any other development, including a Building Permit for non- residential development.
- i. Cover sheet per subsection (a);
 - ii. Site servicing plan per subsection (b), Key Plan;

- iii. Rainwater Management Plan per Subsection (c);
- iv. Offsite/frontage Road Works and Water Mains per subsection (d);
- v. Offsite/frontage Storm Sewers per subsection (e);
- vi. Lot grading plan per subsection (h); and
- ix. Erosion control plans.

k). Other information

The following additional information shall be noted on pertinent drawings:

- i. All existing underground utilities complete with size, type of material, inverts, off-sets and notes detailing connections
- ii. and tie-ins, by whom, how and at whose expense;
- iii. All existing structures, including houses, sheds, fences, poles, pole anchors, overhead or underground encroachments, wells, septic tanks and septic fields, with notations indicating their fate (i.e., to be demolished, removed, filled, etc.);
- iv. The Consulting Engineer shall consult with outside utility agencies where applicable to ensure that the design, construction and installation of the franchise utility infrastructure are possible without interference with proposed Works and Services. All revisions to either Works or Services or franchise utility designs shall be coordinated by the Consulting Engineer. Any further dedications, Statutory Rights-of-Way, covenants, easements etc. that are required to provide appropriate franchise utility designs are the responsibility of the Developer.

1.3.6 Design Submission Sequence

1.3.6.1 The Consulting Engineer shall arrange a pre-design meeting with the Village at which preliminary information and concept plans will be reviewed for initial comment.

1.3.6.2 The first and subsequent submissions of the Consulting Engineer(s) shall be in the form of an unrestricted PDF electronic file consisting of the proposed Works and Services including the Pavement Marking and Traffic Advisory plans together with two sets of full size paper plans.

1.3.6.3 Design drawings shall be accompanied by:

- a) All applicable calculations for the design of the proposed watermains and storm sewers including detention/retention facilities.
- b) Two bound copies of a detailed geotechnical report in print form, and
- c) Three Paper sets of franchise utility final design drawings previously reviewed by the Consulting Engineer.

1.3.6.4 Subsequent design submissions shall consist of:

- a) A complete construction class A cost estimate (this may accompany first submission) sealed by the Consulting Engineer,
- b) All previous submission "red lined" marked sets with all changes highlighted in yellow (any "red lined" marks not revised shall be accompanied by a memorandum outlining the reasons why the change was not made);
- c) Any revisions or changes by the Consulting Engineer not part of the earlier submissions shall be identified and described in a memorandum explaining the changes; and
- d) All items "red lined" by the Village shall be addressed by the Consulting Engineer. Failure to do so will result in submissions being returned.

1.3.6.5 The final submission shall consist of:

- a) A new cost estimate marked "FINAL SUBMISSION ESTIMATE";
- b) Five (5) complete sets of paper plans of the proposed Works and Services, signed and sealed by the Consulting Engineer;
- c) Signed "Waterworks Construction Permit" from Fraser Health Authority; One (1) set of drawing files in DWG or DFX format on compact disk (CD) or other digital format acceptable to the Approving Officer.

1.3.7 As Built Drawing Information

1.3.7.1 The as-built drawings shall show the Works and Services as they have been constructed in order to provide accurate and detailed information when adding to or maintaining the Works and Services shown in the plans.

1.3.7.2 The drawings shall be the original AutoCAD design drawings, amended to reflect the actual constructed roadway, underground infrastructure and all other constructed works. "As-built" drawings must contain as much original design as possible and reflect all of the work performed including removed and abandoned infrastructure. The Construction Revisions block, must describe in adequate detail what was removed or changed.

1.3.7.3 The following procedures shall be followed in the submission of as-built drawings:

- a) The Consulting Engineer shall submit an unrestricted PDF electronic file of the Works and Services, showing all works as constructed (except for the road cross-section sheet(s);
- b) The as-built submission will be returned to the Consulting Engineer for revisions if necessary. The Consulting Engineer shall re-submit the PDF electronic file for review and acceptance;
- c) The key plan showing the as-constructed off-sets of and locations of all Works and Services including service connections;

- d) The road works, water main, sanitary sewer plans showing elevations, inverts and off-sets as constructed. Profiles of the utilities shall state pipe materials, bedding and backfill used with chainages referenced to at least one legal posted Parcel line on each sheet.
- e) The Rainwater Management Plan as constructed;
- f) The lot grading plans showing as-constructed ground elevations at all Parcel corners, rear building envelope line, back of curb or sidewalk, and any changes in grade across the Parcel. The MBE, GPE, lawn basins, manholes and swales and any other feature that may affect the construction of a building on the Parcel shall be identified. Uniform grades between Parcel corners will be assumed to a tolerance of ± 150 mm;
- g) Any plans and details for PRV station, pump stations etc., complete with any operating manuals, Letters of Assurance, Schedules B1, B2, and C-B for structural, electrical and geotechnical aspects of the construction etc.;
- h) A final geotechnical report addressing all recommendations and details of the primary report, confirming construction techniques, applications and details including placement and compaction of fill materials in excess of 1.5 metres, stability of cut and fill slopes and embankments equal to or steeper than 2V:1H; and
- i) A geotechnical report including Letters of Assurance, Schedules B1, B2 and C-B for structural confirmation of all retaining walls in excess of 1.2 metres in height; and

When the Approving Officer is satisfied with the as-built drawings submission the Consulting Engineer shall submit the following:

- j) One set of drawings on 24lb coated bond paper identified in bold letters with the word "AS-BUILT" in the revision block complete with the date;
- k) A letter with the following certification noted:
 - i. "I certify that these as-built drawings represent the Works and Services that have been supplied, constructed and installed in substantial conformance with the intent of the designs as accepted by the Engineer dated _____."; and
 - ii. The seal and signature on the letter shall be that of the Consulting Engineer who was personally responsible for the design and inspections. The Village will return one (1) set to the Consulting Engineer upon acceptance noting acceptance of as-built drawing;
- i) One (1) set of drawing files in DWG or DFX format and multi-page PDF file on Compact Disk (CD);
- m) All plan(s) and record drawing(s) on 24lb coated bond paper will take precedence over digital information; and
- n) Upon acceptance by the Village the Engineer may authorize a Security Deposit reduction to reflect the acceptance of the as-built drawings.

1.4 Utility Rights-of-Way

1.4.1 The minimum width of rights-of-way shall be:

- a) 3 metres for a single service
- b) 5 metres for two utilities in separate trenches
- c) 6 metres for three utilities in separate trenches

1.4.2 In all cases the width of rights-of-way shall be sufficient to permit an open excavation without impacting on adjacent structures. In considering this, the following widths are required:

- a) When the Utility rights-of-way are adjacent to a road right-of-way or another utility right-of-way and:
 - i. single services - 2 times the depth to the top of the pipe (minimum 3.0m)
 - ii. two or more services - 2 times the depth to the top of the pipe plus the centreline to centreline distance between the outside services (minimum 5.0m)
- b) When the Utility right-of-way, is located on private property and is not adjacent to another Village property, or right-of-way, the minimum width shall be increased to 5.0 metres and the right-of-way width should be such that proper sloping of the trench (according to WCB Regulations) is allowed and adjacent to the building footing is not endangered. A cross section of the proposed trench (es) shall be shown, indicating the minimum safe elevation of adjacent building footings based on a safe angle of repose from the limits of the excavation.

1.5 Utility Separation: Water-Sanitary Sewer

1.5.1 Water Supply Interconnections

There shall be no physical connection between any public water supply system and any private water supply system, any sewer or sewer appurtenance, and any pipe network used for industrial or commercial process systems.

1.5.2 Horizontal Separation (as specified by the Department of Health, B.C.)

Whenever possible, sanitary sewers and storm sewers shall be laid at least 3 metres horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 3 metres, a sanitary sewer and storm sewers may be laid closer than 3 metres to a water main if:

- a) It is laid in a separate trench.

- b) It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth.
- c) In either case the elevation of the crown of the sanitary sewer shall be at least 0.5 metres below the invert of the water main, and the joint of the water main shall be wrapped with an approved material by the Engineer.
- d) In any case where the minimum 3 meters separation cannot be maintained, specific approval is required from the Department of Health of B.C.

1.5.3 Vertical Separation

Where sewer and water mains cross, the sewer shall be below the water main with a minimum clearance of 0.5 metres. Where trench lines cross at different elevations, the support for the upper pipe shall be adequately designed to span the trench width.

1.5.4 Alternate Conditions

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sanitary sewer shall be either constructed of iron pipe or encased in concrete over a length extending 3m either side of the water main and be pressure tested to assure water-tightness.

1.6 Utility Separation: Storm-Sanitary Sewer

1.6.1 Sewers in Common Trench

Storm and sanitary sewers may be installed in a common trench, provided that the design has taken into account interference's with service connections, stability of the benched portion of the ditch, conflict with manholes, and in no case should the horizontal clearance between sewer pipes, be less than 1.0 m or the horizontal distance between manholes be less the 0.3 m, whichever is greater.

1.7 Completion Certificate

Upon completion of the installation of the required Works and Services; prior to the acceptance of same by the Village of Belcarra, the Supervising Engineer shall furnish to the Approving Officer a certificate, bearing his professional seal, to the effect that the said Works and Services have been installed in general conformance with the approved drawings and specifications.

1.8 Insurance

The Applicant shall hold harmless the Village of Belcarra from any and all claims for damages arising from activities of the Applicant, his agents and his employees in the construction and installation of Works and Services; and for this purpose the Approving Officer will require proof of insurance which shall:

- a) Be entirely at the expense of the Applicant;

- b) Extend from an effective date prior to the commencement of work until a date not less than 12 months after the date of acceptance, by the Village of Belcarra, of completion of all required works and services;
- c) Have a limit of liability of not less than \$5,000,000.00 inclusive for bodily injury, sickness, death and property damage including loss of property;
- d) Where the activities of the Applicant, his agents and his employees involve the operation of any form of motor vehicle, include coverage by the Insurance Corporation of British Columbia of all owned and non-owned motor vehicles with a limit of liability of not less than \$5,000,000.00 inclusive for bodily injury, sickness, death and property damage, and
- e) Provide evidence of valid Workers Compensation Board coverage.

PART 1 – DESIGN CRITERIA**2.0 WATER DISTRIBUTION**

2.1 General Water Distribution Requirements

All works shall be designed in accordance with the Village of Belcarra Waterworks Bylaw No. 456, 2012 and the following requirements.

2.2 Pre-Design Requirements

Adequacy of available water supply must be confirmed by the Engineer prior to designing any extension of the Water Distribution System. The Engineer must submit a sealed letter confirming the above along with a copy of all calculations to the Village for review. The Engineer must also take into account the available pressure of the system.

2.3 Water Demand

'A' = average domestic consumption = 500 litres per capita

'D' = maximum day domestic consumption = 2 x 'A'

'H' = peak hour demand = 4 x 'A'

Table 2.4 suggests flow estimates for some categories, and should be used as a guide only.

2.4 Typical Range of Water Demand

User	Range of Demand L/ (person or unit)/d
Assembly, hall, per seat	6-10
Camp:	
Children's, central toilet and bath	160-200
Day, no meals	40-70
Luxury, private bath	300-400
Trailer with private toilet and bath, per unit (2-1/2 persons)	500-600
Institution:	
Average Type	400-600
Hospital	700-1200
Lodging House and Tourist Home	120-200
Motel	400-600
Office	40-60
Picnic Park, with flush toilets	20-40
Restaurant (including toilet), Average type, per seat	120-180
School:	
Day, with cafeteria or lunchroom	40-60
Day, with cafeteria and showers	60-80
Self-Service Laundry, per machine	200-400
Store:	
First 7.5m of frontage	1600-2000
Each additional 7.5m of frontage	1400-1600
Swimming Pool, toilet and shower	40-60

2.5 Fire Flow

Table 2.8 summarizes, on the basis of zoning, the fire flow requirements for properties served by the Village of Belcarra water system. For fire flow needs provided by hydrants refer to Hydrants.

Interim fire flow values may be used if it can be proven that full design flows will be available as a result of eventual extension of the Village of Belcarra water system.

An alternative fire flow criteria may also be used where a proposed RS subdivision fronts an existing water main which can provide 30 litres per second fire flow (at 14m residual pressure) in addition to the peak day demand and where the subdivision wishes to provide sprinkler systems. The subdivision could proceed subject to sprinkling specification of the National Fire Protection Association NFPA 13D and the Subdivision Bylaw.

2.6 Design Flows

The "Design Flows" shall be the greater of the following rates:

Maximum day demand plus fire flow (D & F)

= 1.000 litres/capita/day, plus the applicable fire flow.

In this case a minimum 14m hydraulic head must be maintained as residual pressure at street level.

OR

Peak hour demand: (H)

= 2.000 litres/capita/day.

In this case a minimum of 28m hydraulic head must be maintained as residual pressure at street level.

2.7 Analysis

The analysis of the existing network system shall be determined using, the Hazen-Williams formula,

with the following "C" values.

C = 115 for all mains 250mm and larger

C = 100 for all mains 200mm and smaller

The starting point and the available head are as follows:

For feeder mains or major grid main design, the starting point is at the pertinent pump station or PRV station and the input head is the discharge head at the station.

2.8 Fire flow & Design Requirements

For subdivisions served by the Village of Belcarra water system and those not served by the Village of Belcarra Water System.

Flow	Land Use	Zoning	Design Fire Flow (F) litres/sec.	Interim Fire (f) litres/sec.
Residential				
	Single Family	RS-1	60	45
	Single Family	RS-2	60	45
	Cluster Housing	RS-2, RS-3	120	90
Suburban				
	Rural & Recreational	A-1	60	45
	Campgrounds		60	45
Institutions		P-1	90	65
Commercial &, Industrial				
	Isolated Commercial		90	65
	Small Grp. Commercial		120	90

2.9 Water Mains and Appurtenances

2.9.1 Design

Pipes and fittings shall be designed so as to withstand all stresses, internal as well as external, such as structural stresses caused by static pressure and by dynamic forces resulting from changes in direction of flow. Thermal stresses, transient stresses from water hammer and stresses induced by vertical loads and impact of traffic.

a) Mains

i. Size

The minimum size water main servicing a fire hydrant shall be 200mm diameter.

The flow characteristics of the selected pipe conveying design flow shall be as follows:

- hydraulic grade in mains larger than 250mm diameter not to exceed 0.5%.
- velocity of flow not to exceed 2m/s; and
- residual head, throughout the system, at the street level not to fall below 28m

under peak hour flow (or 14m under fire flow)

ii. Location

Distribution mains shall be located within the road right-of-way as shown on the pertinent Standard Drawings.

Wherever possible, water mains shall be looped. In proposed cul-de-sac, onto which another cul-de-sac will back, the water main shall be extended to full length of any permanent access to provide for looping of water mains.

To eliminate stagnant water conditions, water mains should be terminated at the last hydrant, and a small diameter service line should loop to houses being serviced beyond the hydrant.

iii. Depth

Minimum cover over any pipe shall be 1.0 metre.

iv. Grade

Minimum slope on a main shall be 0.1%.

When the slope of a water main exceeds 8%, provision shall be made to anchor the pipe.

b) Gate valves

i. Size

The valves shall be the same diameter as the main.

ii. Location

Gate valves on Distribution mains 250 and 300 mm diameter shall not be spaced greater than 200 metres apart.

iii. Configuration

At road intersections, line valves shall be installed at the projected lot line.

Normally, 3 valves will be required at an "X" intersection and 2 at a "T" intersection.

c) Hydrants

Hydrants shall not be spaced more than 100 metres apart.

Hydrant location will be dependent upon the need for fire protection. Considering that a hydrant can deliver a maximum flow of some 60 l/s, sufficient number of hydrants shall be provided within 100 metres of the property to meet the fire flow requirements.

Hydrants should be located at road intersections. 1.0 metre from property line with pumper nozzle at right angles to the curb. The locations chosen shall meet the approval of the Sasamat Volunteer Fire Department Fire Chief.

Fire Hydrants shall follow the following standards.

- i. Hydrants shall conform to American Water Works Association Standard for dry barrel fire hydrants (AWWA C502).
- ii. Hydrants shall be Terminal City
- iii. Hydrants shall be compression type.
- iv. The internal main valve opening must be a minimum of 133mm.
- v. The main operating stem, hose and pumper outlet threads must conform to the British Columbia fire hose thread for 64mm fire hose couplings and allied fittings. The threads of the 100mm pumper outlet shall have an outside diameter of 118mm and six threads per 25mm.
- vi. The hydrant shall be automatic self draining.
- vii. The main operating stem must operate in a counter-clockwise direction.
- viii. The main 100mm pumper outlet shall have installed a Stortz or equivalent self-locking twist on fitting complete with cap and securing chain. The Stortz or equivalent self-locking twist on fitting shall be equipped with Allen set screws to prevent removal without a special tool, special tools must be supplied.
- ix. The operating spindle nut must be a 38mm pentagon nut that operates in a counter-clockwise direction.
- x. The colour of the hydrant will be red.

d) Air Valves

Air valves are not required on water mains in accordance with the Standard Drawings. Water mains larger than 300mm diameter require double acting air valves at all summits in the main. The air valve size shall be 0.125mm diameter per mm diameter of main.

e) Blow-Downs and Blow-Offs

50mm blow-offs and blow-downs shall be installed in accordance with Standard Drawings.

f) Thrust Blocks

Thrust or reaction blocks shall be provided on tees, bends, and caps. Unless site conditions indicate otherwise, the size shall be calculated on the basis of undisturbed soil bearing strength of 70 kPa and a system operating pressure of 830 kPa. Standard drawings may be used as a guideline only. Reverse Acting Anchor blocks shall be used on all caps (including temporary caps) and also blowoffs. The Engineer is responsible to design the Reverse Acting Anchor blocks.

g) Service Connections

i. General

38mm diameter Type K Soft Copper service connections for new lots are required and shall be located at the centre of the property. Service connections will be terminated at the property line and shall not be more than 30m in length.

Where a water service is being installed in a common trench with other services, the depth of the water service at property line shall not be less than that stipulated in the B.C. Plumbing Code or the Village of Belcarra Waterworks Bylaw, whichever is more restrictive, and unless otherwise approved, be not deeper than 1.5 metres. In all cases, as a condition for servicing the property, precautionary, backflow preventors shall be incorporated into the meter setters to eliminate the possibility of cross-connection contamination.

All connections require a shut-off valve at the property line and a check valve, both the same diameter as the connection pipe. For all metered connections a valved 'meter by-pass line', the same diameter as the meter is required.

ii. Metered

In general, metered connections shall be provided to each individual dwelling.

The required water meter shall be a Sensus Pearle or its predecessor. All meters are to be placed at or adjacent to the property line. See MMCD Standard Drawing Wd2.

h) Fire Lines

Connections to a sprinkler system or for other fire control facilities shall be sized appropriately. The designer shall ensure that the existing water main is adequate for the flow desired at the point of connection.

i) Test Points and Chlorination

For the purpose of pressure testing and chlorination of all new mains, a minimum of one test point shall be installed beside a line valve on each section of the mains. These test points shall consist of a 20mm Corporation Stop with a female outlet threaded for iron pipe. The Corporation Stop installed for the purpose of an air valve may be used as a test point or as a bleed point. Locations of the test points shall be optimized to ensure thorough sterilization of a newly installed water main.

A Hydrant Use Permit shall be obtained for all newly constructed and reconstructed water lines. The Hydrant User Permit application and associated fee are pursuant to Belcarra Water Rates and Regulations Bylaw as amended from time to time.

PART 1 – DESIGN CRITERIA

3.0 ROADS**3.1 General Road Requirements****3.1.1 Road Classification**

Arterial roads are to be determined by Village Council.

3.1.2 Standard Cross-Sections

Required highway dedication, pavement widths and sidewalks are to be determined by the Village.

The general arrangement of the road cross-section features and the utilities to be constructed within the road right-of-way, are to be in accordance with the Standard Drawings. When existing utilities are already in place and not conforming to these standard arrangements, this requirement is waived and a special design is required. For subdivision servicing designs, appropriate arrangements must be made with other utilities to ensure for servicing, of the site in the event that Village required dedication widths do not accommodate the specific requirements of other utilities.

3.1.3 Design Requirements

The design parameters for internal and peripheral roads will differ according to the land use adjacent to the proposed road. These parameters are given in Table 3.1.4 following, for any given land use, within or peripheral to the subdivision. The parameters apply to geometrics, street lighting, and pavement design. Actual traffic counts should be used when available.

3.1.4 Roadway Design Standards
Table 3.1.4

Road Land Use	Classification	
RS-1 RS-1A, RS-2 CI-1, PR-1, PP-1, R-1, W-1, W-2, W-3	Local:	Limited
		Through
	Collector:	Limited
		Through

3.2 Road Design Components

3.2.1 Geometric Road Design

a) General

Pavement widths, shoulders or curb type, and right-of-way width, are to conform with the Standard Drawings. The design speed governs horizontal and vertical geometrics. All road classifications shall be designed in accordance with the "Manual of Geometric Design Standards for Canadian Roads" RTAC latest edition.

b) Grades

Maximum longitudinal grades shall be:

Local Residential Roads – 12% which may be increased to 15% with appropriate allowances for emergency vehicle access and other measures as requested by the Municipal Engineer and accepted by the Approving Officer.

Downhill Cul-de-sacs	8%
Collector Roads	8%

Minimum longitudinal grade shall generally be 0.5%; exception is accepted in totally flat areas. Where a minimum grade of 0.4% along the edge of pavement shall be provided, with the centreline grade remaining flat. Sufficient drainage must, in any event, be provided.

c) Cross-Slopes

Standard cross-slopes on streets shall be 2.5% with the crown point to the centre of the pavement. Where extreme topography applies, limited local roads may be designed with cross-slopes from 1% to 5% and with one way crossfalls. When existing streets, arterial or other classes, are being widened and existing driveways and private property levels dictate, crossfall on the widening may be varied to 4% maximum, 1% minimum to effect economy and minimize adverse effects to existing properties.

Flood path routing requirements should be addressed in overall design.

d) Vertical and Horizontal Curves

Special consideration must be given to provide adequate sight distance and transition distance when combining horizontal and vertical curves.

Vertical curves may be omitted where the algebraic difference in grades does not exceed 2% for local roads and 1% for other streets.

The minimum centreline radius for curvature on local roadways is 50-metres, subject to adequate sightlines and other design constraints. The curve should have a minimum 20-metre tangent between any road intersection and the curve and 'S' curves must have 20-metre tangent separating and shall be signed (curve ahead, 30 km/h).

The minimum allowable radius horizontal curve for any design speed depends on the maximum rate of super elevation and on the side friction that can be developed between the tires and the pavement.

e) Intersections

i. Curb Returns

Ultimate curb returns shall be 9 metre radius on local and collector roads and 7 metre radius at intersections with arterial roads. Curb returns for arterial roads shall be a 7 metre radius.

To accommodate interim conditions at intersection of major roads radii should be sufficient to accommodate a WB 15 design vehicle.

ii. Crossing Sight Distance

Particular attention shall be given to the minimum 'Crossing Sight Distance' requirements and the maximum allowable approach grades and grade transitions on minor roads at intersections.

Crossing Sight Distance, required to provide a vehicle sufficient time to cross the major road before the arrival of an approaching vehicle, shall be calculated by the formula given in the RTAC Geometric Design Manual.

iii. Grade and Cross Slope

For a 50 km/h design speed, the maximum allowable grade of a minor road at an intersection is 3.5%. Cross slopes on through streets may be reduced to a minimum of 0.5% within the intersection.

iv. Location

Intersections should be as near as possible to right angles.

A collector road shall not intersect an arterial road at an angle of less than 70 degrees.

Intersections on curves should be avoided. The most difficult problems are with intersections on the inside of curves.

Intersections near the crests of hills should be avoided.

v. Spacing

It is desirable to keep the number of intersections on arterial streets to a minimum. Nevertheless, too few intersections results in overloading of the turning movements and serious congestion. A minimum of one major intersection to the arterial system should be provided when 800 dwelling units share a single access to the arterial road. Special requirements should be reviewed with a Traffic Engineer.

The ideal spacing for traffic signals in order to allow linking at speed limits of 50 km/hr is about 400m. Major intersections should, therefore, be spaced about 400m apart. Lesser intersections should be spaced at multiples of 200m.

Where T-intersections are staggered along an arterial, the minimum spacing between them shall be 60 metres as measured between near property lines of the staggered intersecting streets.

f) Left Turn Channelization

i. Ultimate Design

A 30:1 left turn taper should be used for 50 Kph design speed and a 40:1 taper should be used for higher speeds. The 20:1 left turn taper is a minimum and unless there are definite limiting factors a more gentle taper is desired to make driving more comfortable. Standard Drawings show a range of channelization dimensions. Successive turn bays should be a minimum 150 metres apart from end of taper.

The minimum length of storage for left turning vehicles is 30 metres. and should be calculated as the formula:

$$SL = 2 (V_c \times V_L), \text{ where}$$

$$V_c = \frac{vph}{cph}$$

AND

SL = segment length (metres)

V_c = vehicles per cycle

V_{ph} = vehicles per hour

Cph = cycles per hour

VL = design vehicle length (use 7.5 metres)

If successive intersections calling for left lane tapers are less than 400 metres apart, the jog in and back out results in undesirable alignment and the curb should be carried straight through unless property damage, etc., is so severe as to warrant minimum treatment.

Alignment shifts to avoid features to be preserved or for other design reasons must be treated carefully. When deflection angles are small such shifts result in abrupt "kinks" in driving alignment unless the shift is effectively limited to 1 to 100 range. Long curves to approximate the 1 to 100 shift must still be used to avoid "apparent" links visible only to a driver's line of sight.

On raised medians the curb at the bulb should be set back 0.6 metres from the travelled lane to improve entry to the channelized area.

ii. Interim Design

The above notes refer to consideration of ultimate curb lines and design. Many required designs are on interim stage for two lanes plus left turn, four lanes tapering to two, or even four lanes plus left tapering to two lanes. The same considerations apply to these interim designs, and the designer is referred to Standard Drawings.

g) Driveways

Driveway crossings shall conform to Drawings R-6.

Unless otherwise provided, the elevation of the driveway at property line shall not vary by more than 300mm from the elevation of the centreline of the road.

The maximum grade on the driveway should be 25% as shown on drawing R-8. Driveway grade changes are to be designed so that vehicles will not "hang up" or "bottom out".

At intersections the near side of the driveway shall be located no closer than 6 metres from the property corner of the intersecting streets.

h) Cul-de-sacs

Cul-de-sacs shall not exceed 600 meters in length, shall have a right of way width of 20 meters and a terminal area large enough to accommodate a circle with the radius of 15.25 metres. Permanent cul-de-sacs and emergency access shall conform to the Standard Drawings.

i) Temporary Alternate Access

Where alternate access is required on temporary dead end roads, it shall have a minimum width of metres and have structural capability to support 9.1 tonne axle loading.

3.2.2 Pavement Structural Design

a) General

The following criteria shall be followed for structural design of Belcarra roads.

Asphalt Pavement Design - accepted references

"A Guide to the Design of Flexible and Rigid Pavements in Canada - RTAC"

Asphalt Overlays and Pavement Rehabilitation The Asphalt Institute MS – 17

b) Road Life

The structural design of the road pavement shall be adequate for a 20 year life under the expected traffic conditions for traffic counts for each class of road.

c) Asphalt Pavement Design

i. Requirement

Regardless of the method of design used, the maximum Benkelman Beam deflection (corrected for seasonal variation) on the finished pavement when tested for final acceptance shall be not greater than 1.8mm for local roads. Axle maximum deflections on other road classes will be in accord with the Traffic Design Number as determined by traffic counts for a 20 year life design.

The minimum total flexible pavement structure thickness for any local road shall be in accord with Standard Drawings regardless of the structural design requirements determined by the Benkelman Beam or CBR method of design.

Other than for isolated shoulder widening, whenever a pavement is being widened, a minimum overlay of 25mm of asphalt for blending and levelling purposes shall be required over the full pavement width to the centreline of the pavement.

Two lifts of asphalt are required, the first being a 50mm thick asphalt base and a final 30mm thick asphalt overlay lift with tack coat after one year of construction or 90% of the homes complete.

ii. Method

Road reconstruction and asphalt overlay design shall be based on the analysis of the results of Benkelman Beam tests and test holes carried out on the existing road which is to be upgraded, or by the CBR asphalt pavement design method.

The design for new roads shall be based on the analysis of the results of Benkelman Beam tests and test holes carried out on adjacent roads having similar subgrade soil conditions as the proposed road or by the CBR asphalt pavement design method. The results shall be supplemented by analysis of material taken from test holes dug on the proposed road site at intervals of approximately 80 metres including soils classification, carried out by a qualified soils testing company.

Benkelman Beam tests shall be carried out in accordance with the procedures outlined in the Association of Roads and Transportation of Canada "Technical Publication No. 12".

Seasonal variation of Benkelman Beam results is not normally a factor in Belcarra. In the event of readings in freeze - thaw or extended wet periods of weather, a seasonal correction factor = 1.2 should be applied to produce most probable spring rebound (MPSR) values for design

d) Driveways

Asphalt pavement driveways shall be 75mm minimum asphalt pavement thickness on minimum 100mm thick base material (typical for residential zoning).

e) Shoulders

When called for, gravel shoulders shall be load carrying shoulders in accord with the Standard drawings. They will have a minimum base thickness of 100mm.

f) Off-Site Road Cuts

All off-site road cuts shall be repaired after one year in accordance with the current addition of the MMCD.

PART 1- DESIGN CRITERIA

4.0 WALKWAYS AND CURB

4.1 General Walkway and Curb Requirements**4.1.1 Walkway**

Walkways shall be constructed in accordance with the Standard Drawings and built in accordance with Official Community Plan Naturescape Guidelines. Rural walkways shall be surfaced with a minimum 175mm thickness of compacted road mulch.

4.1.2 Design Parameters**a) Alignment**

Walkways shall be contained within the road allowance. The walkway should be curve linear in character with vertical changes in elevation. Modifications to alignment are allowed to preserve features such as ornamental trees and street furniture, or to avoid obstacles such as hydrants and poles. Any modification to alignment must be approved by the Village.

b) Clear Width and Width

The clear width of the walkway should be 1.5 meters and the clear height should be 2.5 meters as shown in Standard Drawings. In exceptional circumstances a clear width of 1.2 metres is allowed around permanent features, subject to the approval of the Village.

c) Crossfall

The walkway crossfall should be 1% sloping from the property line toward the curb. Crossfall may be permitted to vary up to $\pm 5\%$ to suit property elevations. Where the walkway grade slopes toward the property line, adequate drainage shall be provided.

PART 1 – DESIGN CRITERIA**5.0 STREET LIGHTING**

The provision of Street Lighting shall not be required. (Note: Should the applicant propose to install Street Lighting within a Village road allowance and the Village agrees with such installation, then Street Lighting shall be provided in accordance with the standards outlined in this Section.)

5.1 General Street Lighting Requirements**5.1.1 Continuity and Conformity**

For the requirements for street lighting refer to Table 3.1.4. The intensity, of illumination (horizontal lux) and the uniformity of illumination shall comply with that specified in Table 5.1 and the design specifications of Illuminating Engineering Society, American National Standards Association.

In no case shall the standard be less than the following specific requirements. Installation of lighting components shall be in accordance with Standard Drawings.

5.1.2 Light Sources

The source of light shall be LED illumination. A light source different from LED illumination shall be used only when approved by the Village.

5.1.3 Illumination

Lighting levels given in Table 5.1 are for average illumination on the roadway when light source is at its lowest output.

5.1.4 Layout and Spacing

Care should be taken to ensure that spacing of Luminaries favour intersections and pedestrian walkways.

5.2 Materials**5.2.1 Lamp Standards**

Unless special decorative street lights are required, lamp standards and associated bases shall be constructed and erected in compliance with the drawings and specifications of the MMCD and Standard Drawings.

Strict adherence to clearances from high voltage power (as specified in the Electrical Code) is required. Davit type lamp standards shall be either 9.1 or 7.6 metres in height. Post top type lamp standards shall be 7.62 metres in height.

5.2.2 Luminaires

The choice of Luminaires within neighbourhood subdivisions shall be consistent with existing luminaires.

b) Post-Type Lamps

Post-top type installations shall use McGraw-Edison "Styled P.T.D." or "Traditionaire", or Powerlite . "Twist Pak Refractor Globe Primate" Luminaires.

5.2.3 Appurtenances

Design of street light base, service base, service panels and DIP services should conform to Standard Drawings unless otherwise approved by the Village.

5.2.4 Street Light Spacing

TABLE 5.1: RESIDENTIAL ZONES

<u>Street Width</u>	<u>Light Level</u>	<u>Pole Height</u>	<u>Layout</u>	<u>Wattage</u>	<u>Uniformity (Minimum)</u>	<u>Distribution (I.E.S.)</u>	<u>Spacing (Maximum)</u>
7.0	5-7 lux	7.62m	One Side	100 W	6:1	Type II M, S.C.	55.0 m

PART 1 – DESIGN CRITERIA

6.0 DRAINAGE

6.1 General Drainage Requirements**6.1.1 Introduction**

All drainage systems in the Village of Belcarra shall be designed using an overall "Storm Water Management concept, the primary objective is to limit the effect of peak flows on property, receiving streams and watercourses, and to preserve the natural beauty and environment, characteristic of Belcarra,.

6.1.2 Drainage System

The drainage system in the Village shall consist of two components, the minor and the major systems.

- a) The "minor system" consists of underground conduits, open channels and watercourses to convey a 5 year return flow.
- b) The "major system" consists of surface flood paths, roadways and watercourses to convey the 100 year return flow. In special conditions where surface flood paths cannot be established, pipes and culverts of the minor system may be enlarged to accommodate the major system flow.

6.1.3 Village Drainage Facilities

The presence of an existing Village drainage facility does not imply that it has adequate capacity to receive the design flow nor does it indicate that the drainage pattern of this facility is necessarily acceptable to the Village. Existing undersized drainage facilities shall be upgraded to accommodate the appropriate flow, as described in following sections. The upgrading work may be deferred only when approved by the Village.

Design flows for existing and proposed drainage facilities shall be computed on the basis of the catchment areas established by the Village. Existing condition flow shall mean the accumulative effect of the flows from undeveloped areas, based on an assumed grassland condition and the flow from existing developed areas. Existing developed areas with detention shall be considered as undeveloped area of grassland condition.

To restrict the conveyance of settleable solids from development sites to the Village drainage system, a drainage and erosion control facility is required prior to construction to ensure all construction site runoff is directed to temporary facilities to remove silts and sediments.

6.2 Hydrology

6.2.1 Design Methods

The following criteria shall be used for the design of all drainage works within the Village.

For tributary areas up to 4.0 hectares, the 5 year return flow and 100 year flow may be computed by the Rational Method as set out in the following section.

For tributary areas larger than 4.0 hectares, the 5 year return flow, 100 year flows and storage requirements shall be computed by a dynamic computerized model program. Stormwater modelling shall be completed for both pre-development and post-development flows. Acceptable hydraulic models will be determined by the Approving Officer.

For all tributary areas, detention storage is to be based on the 1:10 year return period storm event. For tributary areas up to 4.0 hectares, storage volumes shall be 30 cubic metres per lot. For tributary area larger than 4.0 hectares, the computerized model shall be used to determine storage.

Both the Rational Formula and computerized model have in common the following data requirements.

Design Return Period

Drainage Area

Time of Concentration

An assessment of the 1 hour duration rainfall event

a) Design Return Period

The 5 year return flow shall be used for the design of the minor drainage system and the 100 year return flow shall be used for the design of the major system (ditches and road culverts). The 10 year return period shall be used for detention storage.

b) Drainage Area

The extent of the tributary drainage areas of the storm drainage system under design shall be in accordance with the natural contours of the land; subject to the overall drainage areas established by the Village.

It must be stressed that it is the designer's responsibility, to confirm the extent of the drainage areas prior to final design, and to incorporate the designs for the minor and major flows into an overall co-ordinated system.

c) Time of Concentrationi. Formula

Overland flow and flow in storm sewers and ditches, channels or watercourses shall be considered in computing the time of concentration by using the following formula

$$T_c = \frac{C_t L n}{12 s^{0.5}}$$

WHERE

T_c = Time of concentration in minutes

C_t = Concentration coefficient depending on the type of flow

= 0.5 for natural watercourses or ditches

= 1.4 for overland flow

= 0.5 for storm sewer flow

L = Length of watercourse, conduit or overland flow in metres, along the drainage path from the furthest point in the basin to the outlet

n = Channel friction factor

= 0.050 Natural channels

= 0.030 Excavated ditches

= 0.016 Overland flow on smooth paving

= 0.400 Overland flow on natural areas

= 0.013 Pipe

s = Basin slope in metre/metre

Where possible, actual flow velocities in storm sewers shall be used to calculate T_c values.

A composite value for T_c shall be calculated in cases where the type of flow along the longest path varies or the slope changes.

ii. Overland Sheet Flow Time in Undeveloped Basins

The maximum overland sheet flow distance for undeveloped basins is 300 metres but it shall be reduced to 250 metres for basins less than 20 hectares. The minimum overland flow time shall not be less than 15 minutes.

iii. Inlet Time in Developed Basins

Inlet times for various development conditions are given to ensure uniformity in unit runoff and storage computations.

Lot Size m ²	Minimum Inlet Time (minutes)	Maximum Inlet Time (minutes)
4000	15	30

6.2.2 Rational Method

a) Formula

$$Q = RAIN$$

WHERE:

- Q = Flow in cubic metres per second,
- R = Product of runoff coefficient and adjustment factor (see table below). Adjustment factor is the approximate ratio of the theoretical 5 year flow and 5 year storm.
- A = Drainage area in hectares,
- I = Rainfall Intensity in mm/hr,
- N = 0.00278

DESCRIPTION OF AREA	RUNOFF COEFFICIENT	ADJUSTMENT FACTOR
COMMERCIAL	0.90	0.70
INDUSTRIAL	0.90	0.70
RESIDENTIAL	0.76	0.75
PARKS	0.50	0.85
INSTITUTION;	0.80	0.73

b) Rainfall Intensity

Standard Drawings have been prepared showing rainfall intensity distribution in the Village and are included within the Master Drainage Plan. If this information is not available then the Village will provide an acceptable alternative.

c) Infiltration

Infiltration rates in Belcarra are typically very low due to a high percentage of rock hard glacial tills and clay. The infiltration rate is dependent on the degree of imperviousness. The following table gives ranges relative to land use and a specific infiltration rate should be selected knowing the actual impervious area of the development area.

<u>Type of Land Use</u>	<u>Percent Impervious</u>	<u>Infiltration Rate (mm/hr)</u>
Natural, undeveloped	0	0.50
Parks, agricultural	0	0.50
Residential	50	0.25
Commercial, industrial	90	0.10
Parking lot, rooftop	100	0.00

6.2.3

Computer Model Programa) Program

The computer model is a probability, matrix of various return period flows for different values of:

Time of Concentration
Storage Coefficient
Infiltration
Regional Runoff Index

b) Time of Concentration (Tc) - Maximum and Minimum Values

Ranges of Tc may be input to the computer model by assuming physical differences in the nature of the flow. To obtain a minimum value, the overland flow time or inlet time could be reduced to reflect channelization which might occur during heavy rainfall. To increase the Tc to a maximum value a longer overland flow distance can be assumed. Minimum and maximum values of Tc should be used to determine the sensitivity of the results.

c) Storage Coefficient (S)

The unit hydrograph storage coefficient (S) basically defines the shape of the hydrograph and is a function of the intrinsic storage of the drainage basin (which is dependent on basin land development). It varies somewhat from storm to storm, but a relationship between S and Tc has been determined which is dependent on the degree of basin development.

d) Infiltration - F

The infiltration rate is dependent on the degree of imperviousness. The following table gives ranges relative to land use and a specific infiltration rate should be selected knowing the actual impervious area of the development area.

<u>Type of Land Use</u>	<u>Percent Impervious</u>	<u>Infiltration Rate</u> (mm/hr)
Natural, undeveloped	0	0.50
Parks, agricultural	0	0.50
Residential	50	0.25

6.3 Storm Sewers and Appurtenances6.3.1 Designa) Storm Sewersi. Formula

The hydraulics of storm sewers shall be calculated using Manning's Formula with the value of 'n' as follows:

Concrete Pipe & PVC Pipe 0.013

Corrugated metal pipe

Unpaved 0.024 - 0.33

25% Paved 0.021 - 0.028

100% Paved 0.013

(Note: Use manufacturers values for helical pipe)

ii. Size

The minimum storm sewer pipe diameter shall be 200 mm in diameter, except where ditches discharge directly into a storm sewer where the minimum shall be 300 mm. Driveway culverts shall be minimum 450 mm in diameter.

iii. Velocity

The minimum velocity shall be 0.6 m / second when flowing half full.

There are no maximum allowable velocities. The designer shall ensure that supercritical flow does not occur where grades exceed 15%, scour protection may be needed and anchor blocks will be

required as shown in the Standard Drawings. These criteria shall be modified to meet local conditions and special requirements.

iv. Curvilinear Sewers

Pipes between two consecutive manholes may be laid on a defined curve.

v. Surcharged Sewers

Surcharged sewers to convey the design flows are permitted under the following conditions:

Where temporary discharge to an existing ditch with a submerged outlet is required to allow for a future extension of the sewer at an adequate depth.

Surcharged sewers shall have the 5 year hydraulic grade line shown on the drawings and all storm sewers shall have the 100 year hydraulic grade line indicated.

vi. Depth

Storm sewers shall be installed at a depth, to be able to service properties on both sides of the roadway where economically feasible. Elevation of storm sewers at upstream tributary points must be of sufficient depth to service all of the tributary lands. Pipe installations that have less than 1 m cover, or deeper than allowable for Class III pipe, or have different bedding than specified in the Standard drawing shall be specially designed for their specific conditions.

vii. Groundwater

Storm sewer connections to other utility trenches shall be provided where there is any possibility of ground water concentration.

b) Manholes

Manholes are required at:

- every 150 metres for pipes less than 900mm diameter
- every 300 metres with a mid-block cleanout for pipes less than 900mm diameter
- every 400 metres in pipes 900mm diameter or larger
- every change of pipe size

- every change of line or grade that exceeds $1/2$ the maximum joint deflection recommended by the manufacturer or where the radius of curvilinear alignment is less than 30 metre
- all sewer confluence's

The crown of pipes entering a manhole shall be set at or above the crown of the outlet pipe.

Hydraulic losses are to be calculated through manholes with significant change of grade or alignment or at confluence of several pipes. Drops are not required in manholes without change of grade or alignment. A minimum drop of 30mm shall be provided where the inlet is not at 180 degrees to the outlet.

c) Catchbasins

Catchbasins to storm sewers shall be provided at regular intervals along a roadway, at intersections and at low points. Inlets shall be spaced to collect 500 m^2 of pavement drainage on road grades up to 3% and 350 m^2 on grades over 3%.

Catchbasins shall be used in conjunction with swales as shown on the drawings.

d) Ditches

i. Depth

Ditches adjacent to travelled roadways shall not exceed 1 m in depth.

ii. Shape

Ditches shall be trapezoidal in shape having maximum side slopes of 1.5 H: 1 V and a minimum bottom width of 0.3 m.

The minimum grade of a ditch shall be 0.5%. The maximum velocity in an unlined ditch shall be 1 m/s. Higher velocities may be permitted where soil conditions are suitable or where erosion protection has been provided. On steep slopes, grade control structures may be used.

iii. Ditch R.O.W.

Minimum right-of-way width for a ditch shall be 5 m. Ditch right of way shall be sufficiently wide to provide a 2.5 m access road for maintenance vehicles in addition to the width required for the ditch.

iv. Minimum Length

Ditches less than 10 m in length shall be enclosed unless otherwise directed.

e) Culverts

i. Minimum diameter

Minimum culvert diameter shall be 450 mm unless hydraulic modelling demonstrates that a smaller size is adequate to the satisfaction of the Municipal Engineer.

ii. Hydraulics

Culverts crossing all roads shall be designed to accommodate the major flows with either by inlet or outlet control. (Twin systems are preferred.) Surcharging to optimize channel storage is preferred, provided the back water profile does not intersect habitable property.

Driveway culverts shall be designed to accommodate the minor flow unless otherwise indicated.

Reference: Handbook of Culvert Design American Concrete Pipe Association

f) Inlet and Outlet Structures

i. General

Standard Drawings shall be used as a guide for designing inlet and outlet structures for storm sewers and culverts.

Outlets for culverts and storm sewers, having discharge velocities greater than 1.5 m/s require rip rap or an approved energy dissipating structure to control erosion.

ii. Structural Design

The structural requirements for inlet and outlet structures, given on Standard Drawings are the minimum requirements only. Generally, structures exceeding 1m in height or 2 m in width should receive individual structural design.

iii. Trash Screens and Safety Grillage Trash screen is required at:

The entrance to every storm sewer or culvert of less than 450 mm diameter, over 30 m in length, when the inlet minor flow velocity exceeds 2 m/s.

Every 1 Km of natural watercourse, preferably at a road culvert
Not closer than 1 metre from all openings in the culvert

g) Flow Control Structures

For the design of flow control structures for storm water storage facilities, the orifice and weir equations may be used. Minimum orifice size shall be 50 mm in diameter except for orifices in catchbasins for parking lot storage where the actual size calculated shall be used. In this case alternative measures to prevent blockage of the orifice should be taken such as a wire mesh basket covering the orifice.

6.3.2 System Construction

a) Pipe Materials

Storm sewer and culvert pipes shall meet the requirements described in the MMCD and Belcarra supplementary specification. Under normal circumstances, concrete pipe, PVC or asbestos cement may be used. With weak soil conditions, asbestos bonded asphalt coated corrugated metal pipe may be permitted.

b) Bedding and Backfill

Pipe shall be laid on bedding, in accordance with Specification that will give adequate support to the pipe under the design conditions. Furthermore, where "Open Joints" are used, Bedding shall be limited to 25 mm gravel, 19 mm Crushed Gravel or 32 mm Crushed Gravel, the gradation of which are as per Specifications.

c) Manholes

i. Sump Manholes

Where ditches discharge into a storm sewer system, the initial manhole shall be of a sump type as per Standard Drawings. Except under special conditions, ditches discharge into a storm sewer systems of 600 mm diameter or larger do not require sump manholes. Where a manhole sump is used in lieu of catchbasin sumps, the sump manhole shall serve no more than 5 upstream catchbasins.

ii. Non-sump Manholes

All non-sump manholes shall be channelled and benched. A special enlarged detail shall be provided for manholes of special design.

iii. Specification and Design

Refer to MMCD Standard Drawings.

d) Catchbasins

Catchbasin shall be of the grillage sump or non sump design as per the Standard Drawings. Non sump catchbasins may be only used where sump manhole is used in lieu.

Leads shall be 200 mm in diameter (minimum) for single basins and 250 mm (minimum) in diameter for double basins. Double catchbasins shall not be connected directly together but rather one basin will be "Y" ed into the lead of the other. Catchbasin leads should be taken into manholes wherever possible. Maximum length of 200 mm diameter lead shall be 30 m.

Catchbasin grates are to be set 30 mm below the gutter line. The gutter and blacktop are to be shaped to form a dish around the inlet.

e) French Drains

French drains shall only be used where topography and soils are suitable as supported by a soils report carried out by a qualified soils testing company.

French drains located adjacent to roads shall be extended well below the road base. The material for french drains shall be a clear round drain rock in an envelope of approved filter material. A min. 150 mm diameter P.V.C. perforated pipe shall be placed at the bottom of the trench. The drain shall be finished with 100 mm of open graded topsoil and covered with sod.

f) Swales

Swales shall be used in storm sewer road allowance where there is no curb and gutter to direct the minor flow towards catchbasins or the storm sewer system.

Swales shall also be used in conjunction with proper lot grading to convey lot runoff, as well as to convey minor flows and to direct major flows within rights-of-way.

g) Erosion Control

Temporary sediment basins and channels for erosion control at construction site shall be designed so that the minimum detention time is 10 minutes. The depth of the basin shall not exceed 300 mm.

h) Sediment Basins

Sediment basins shall be provided within any natural watercourse, channel or storm sewer where the silt load is detrimental to the hydraulics of the facility. Construction of such facilities immediately upstream of a road culvert is desirable, to provide ready access for cleaning and maintenance.

6.4 Flood Proofing and Site Drainage

6.4.1 Major Flow Routing

All overland flows, in excess of 0.05 m³/sec shall have specifically designed flow routes that are protected and preserved by restrictive covenants or rights-of-way. The major flow routing shall normally, be provided along roads and in natural watercourses. In some cases the major flow may also be carried alongside the road in grassed swales, and across country in rights-of-way.

In special circumstances, or where desired to enable lower building elevations, the pipes and culverts, which form a part of the minor system, may be enlarged or supplemented to accommodate the major flow. All habitable areas of buildings shall be above the major flow hydraulic grade line, except where specific flood prevention measures have been taken.

The proportion of flow to be carried along the major routing shall be the total major flow as computed by the computer model program less the flow carried in the minor system.

Where the road is used to accommodate major flow, it shall be formed, graded and sufficiently, depressed below the surrounding property lines to provide adequate hydraulic capacity. On arterial roads, the 100 year hydraulic grade line shall not be higher than centreline of the pavement with the maximum flow depth not to exceed 300 mm. On collector and local roads, the entire roadway, may be used as a major flood path with the maximum flow depth not to exceed 300 mm.

Where roads are used for major flows, care shall be taken to lower the intersection to allow flows to pass over the cross street. Where major flow routes turn at intersections similar care in the road grading design is required.

Major flow routes begin at the building lots and good lot grading shall be followed. Backyards of single family housing developments shall not normally be used for routing the major flow.

In areas where surface major flow routes cannot be provided, a pipe system will be designed to accommodate the required major flow, and sufficient inlet capacity will be provided to accommodate introduction of the major flow into a piped system.

Major flow routing over 0.05 m³/s shall be shown on the storm water control plans and sufficient design shall be carried out to provide assurance to the Village that no serious property damage or endangering of public safety will occur under major flow conditions. The discharge point from the development for the major flow route shall be co-ordinated with the downstream routing to outfalls. Where major flow outfalls to a receiving watercourse, the velocity shall not exceed 1.5 m/s or an energy dissipater shall be provided to minimize erosion.

The use of catchbasin inlet control devices to separate major and minor hydraulic grade lines may be allowed subject to the satisfaction of the Village regarding the suitability of such control devices. Where catchbasin inlet control devices are used, building elevations may be controlled by the hydraulic grade line occurring in the minor system.

6.5

Storm Water Storage Alternatives

The basic requirements for the storm water storage include a containment location of defined area and volume, with a restricted outlet designed to maintain the discharge to the downstream storm sewer at the pre-development level equivalent to grass condition for a 5 year return flow.

Various methods and combination of methods can be considered, except that individual on-site storage for single family dwellings is not permitted.

a) Roof Top

The use of roof top storage with controlled outflow drain should be considered for industrial, commercial and institutional developments with flat roof tops. Appropriate building code requirements covering rain loading shall be followed (National Building Code, 1985, Part 4, Commentary). 1).

The release rate from roof top shall be controlled by roof top detention device or on-site flow control chamber as per the Standard Drawings. Manufacturers charts can usually be consulted to obtain flow rates for given ponding depths.

b) Parking Lot or Work Yard

Large paved parking lot or work yard areas can be used as storage in many areas. The allowable depth is a function of safety and convenience to users. In the immediate vicinity of car parking ponding depths should not exceed 150 mm.

Flow Control Chambers shall be used in conjunction with this storage as per the Standard Drawings.

c) Rock-filled Pit

Large, deep rock pits covered with grass, connected with swales which will empty into storm sewers or dispose by infiltration may be used depending upon soil conditions. In case of ground disposal by infiltration, the 24 hour sustained percolation rate should exceed or equal the designed release rate from the proposed development site.

d) Underground Storage

Tanks, pipes, or culverts may be used as storage facilities. An access point shall be provided for regular maintenance.

e) Detention Basin

i. Location

Detention basins may, with the approval of the Village be located on park, open space (or land that is to be dedicated as such) or on private open space within the development. Where private open space is used for detention purposes a restrictive covenant shall be registered against the land for that purpose. The use of on-site storage on residential lots is not permitted

ii. Shape and Side Slopes

Regular shaped basins smoothly graded into the surrounding topography are preferred. The side slopes of the basin shall not exceed 1 (vertical) in 4 (horizontal) and both top and bottom edges of the side slopes shall be rounded to blend with surrounding lot grades. Side slopes shall not encroach onto adjacent lots.

iii. Depth and Freeboard

The maximum depth of detention basins shall be 1 metre with 0.3m of freeboard.

iv. Hydraulics

A dry detention basin is typically designed as an off-stream facility. Flow control shall be achieved by the use of an orifice or weir, and the preferred type outlet control structure. The outlet of the flow control chamber shall be sized to pass the 5 year pre-development flow.

v. Spillways

A spillway, or equivalent outlet, shall be provided at the 5 year high water elevation. Where overflow provision, to control the 5 year high water level, is provided within the flow control chamber the spillway shall be set at 150mm above the 5 year high water level. The spillway shall form part of the overland major system, and where possible the major flow should be directed through the detention basin. Spillway surfacing may be concrete, turf stone, or equivalent erosion resistant material that is both aesthetically acceptable and easy to maintain. Spillway slope shall not exceed 4 (horizontal) to 1 (vertical) and shall not be less than an adequate grade for self-draining. Where the spillway also acts as a walkway access to the pond/park area the spillway shall be designed and constructed to standard walkway requirements with adequate allowance for the hydraulic capacity required.

vi. Inlet/Outlet Control Structures

Inlet / outlet structures should be as unobtrusive as possible, and should preferably be a catchbasin(s) of sufficient number for the inflow/outflow involved. Attention should be paid to the ability to gain vehicular access to the control manhole for the purposes of maintenance and silt removal.

vii. Landscaping

The minimum requirement for landscaping is the establishment of a good grass cover on 150mm of topsoil, additional landscaping features such as shrubs or tree planting are encouraged. The use of paved or cobblestone bases may also be considered; however, cobblestone bases are not considered suitable for ponds located on park or public open space areas. For basins located on park or open space all landscaping details must have the approval of the Village

viii. Subsurface Drainage

All landscaped detention pond bases shall be provided with underdrains at a maximum spacing of 6 metres. Underdrain details are required drawings. To ensure adequate drainage grassed pond bases shall have a minimum slope of 2% Details as shown in the Standard Drawings - Detention Basin Details.

ix. Log Rail - Mowing Strip - Fencing

Where a detention area fronts a road a log rail barrier, together with a gate or removable restriction posts shall be constructed for the

length of the frontage. Details of the log rail barrier, gate and removable restriction posts are shown in the Standard Drawings.

Where the detention area abuts rear yard fences a 450mm wide asphalt mowing strip shall be installed. Where adjacent lots are undeveloped, fencing acceptable to the Village is required.

x. Obstructions

B.C. Hydro kiosks or other surface obstructions should not be located in park or detention pond areas.

6.6

Storm Water Control Plans

Storm Water Control Plans are two dimensional representations of the characteristics of a drainage basin. They are required in order to assess the impact of a proposed development on an existing drainage area. Storm Water Control Plans present information on major topographical features, 100 year flood routing, and plan views of minor drainage systems.

The Developer must provide as a condition of development, a Storm Water Control Plan sealed by a Professional Engineer. Only small developments which do not change the drainage routing may be deemed exempt by the Village.

The Storm Water Control Plan should contain the following:

- a) The development area within the drainage basin, (a minimum of 400 metres external to the site) including all major topographical features of the area, such as roads, natural watercourses, and low or poorly drained areas.
- b) 100 year flood routing, external and internal to the site, along the development and connection points.
- c) Contour plan of the pre-developed area at 1.0 metre intervals at 1:2500 metric scale.
- d) Plan of the minor system indicating size, grade and flow.
- e) Location and size of all detention facilities.
- f) All areas of major ($\pm 2\text{m}$) cut or fill.
- g) The area in hectares of development and the area of any lands draining into or through development site.
- h) Any existing or proposed drainage facilities.
- i) 100 year flood routing in or through the development and at points where other flood routes are met.
- j) Drainage calculations sheets.

6.7

Natural Watercoursesa) Environmental Concerns

The following design criteria is given as a guide to be applied to fisheries streams, but in all cases, the specific requirements of the Environmental Agency having jurisdiction shall govern.

For more information on silt/sediment control measures, refer to the Land Development Guidelines for the Protection of Aquatic Habitat published by Ministry of Environment and the Department of Fisheries and Oceans Canada.

b) Maximum Velocity in Culverts

The maximum allowable velocity for minor flow in a culvert located in a watercourse should not exceed 1m per second for culverts over 25m long and 1.2m per second for culverts under 25m long

Several methods may be employed to reduce the velocities in culverts to acceptable limits. Corrugated metal pipe can be used to an advantage and baffles may be installed at intervals in the pipe. On watercourses of concern to Fish and Wildlife Branch, open bottom corrugated steel pipe arch is recommended.

c) Grade Control Structures

Grade control structures may be allowed in the watercourse. The maximum rise permitted for the structure is 0.6 m with 0.3 m being the optimum. A lined pool, below the jump or rise, at a depth of 1.5 times the jump height must be provided.

d) Critical Fisheries Periods

In general, no construction is permitted in fisheries watercourses between September 15 and July 15. This must be verified with the Ministry of Environment when applying for approval to construct works.

e) Senior Government Agencies

All designs of proposed works in natural watercourses shall be submitted (by the designer) to the Water Rights Branch of the Ministry of Environment for approval. This agency will forward the application to other concerned agencies for comment prior to issuing approval.

Other senior agencies may be contacted independently by the designer, however, their sole approval of proposed works is not sufficient to start construction as a formal approval by the Water Management Branch of the Ministry of Environment is required.

1. Ministry, of Environment Lower Mainland Region Water Management Branch
2. Provincial Government Fish & Wildlife Branch
3. Fisheries and Oceans Canada Habitat Management Unit

f) Toxic Materials

Care must be taken to insure that no toxic materials are employed and that such materials as concrete and fine soils are not permitted to enter the watercourse. In no case will sand / cement bags be permitted as riprap or wall structures on watercourses of concern to Fish & Wildlife Branch.

g) Flood Proofing

To insure that large scale flooding will not occur to dwellings adjacent to natural watercourses, the Designer must determine what affects downstream obstructions would have on the level of the watercourse. i.e. should a road cross culvert be plugged, to what height will the water rise before the water discharges over the roadway and what effect will this have on adjacent properties? It must be shown that the basement elevation in the adjacent development will not be affected by such flooding.

PART 1 – DESIGN CRITERIA**7.0 SEWAGE DISPOSAL**

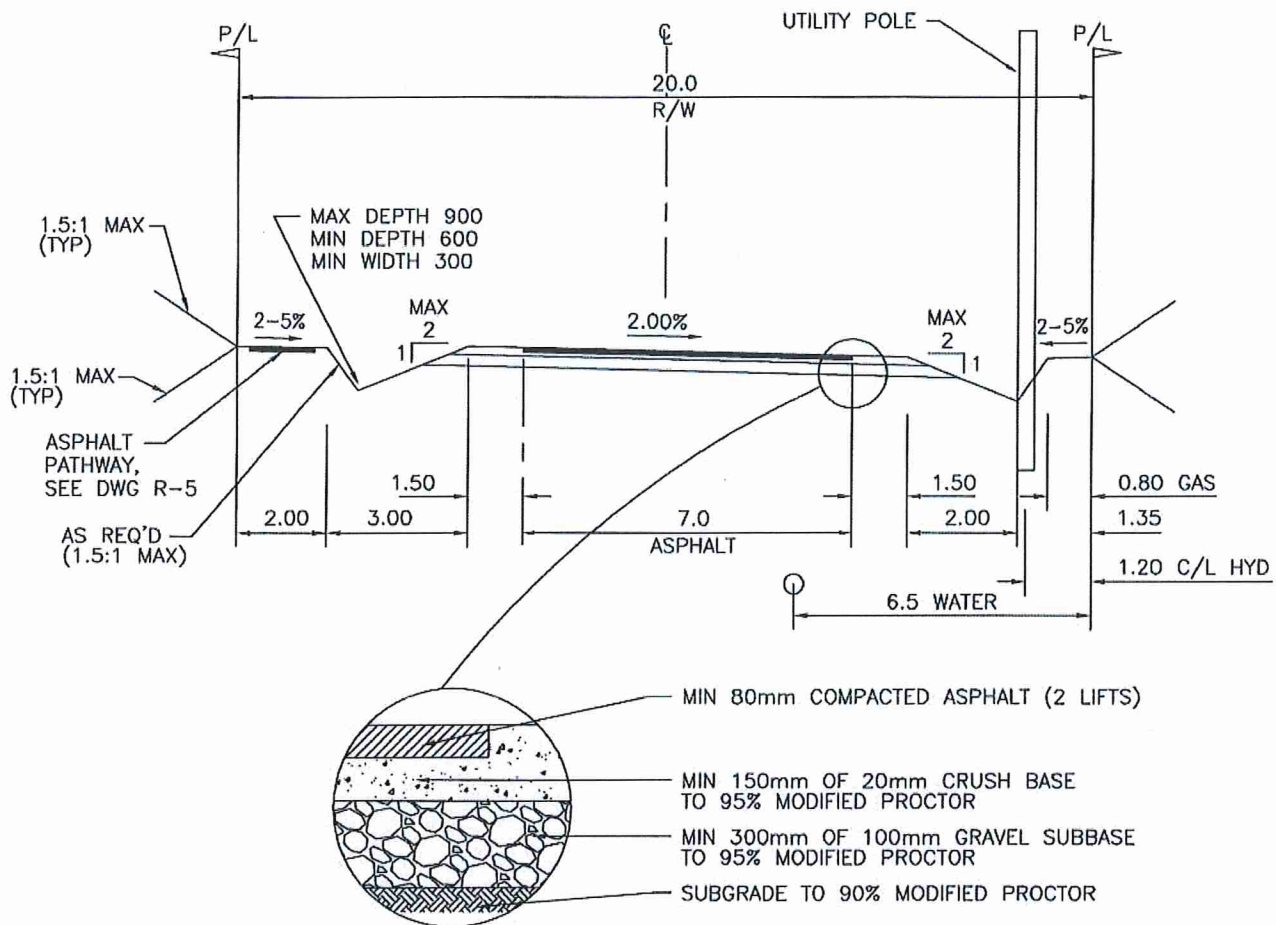
- 7.1 The Owner shall demonstrate to the satisfaction of the Approving Officer the feasibility of sewage disposal by means of a private in ground sewerage disposal system for each of the parcels in the proposed subdivision. The sewerage system for each parcel shall be located on the parcel and shall be designed for a three bedroom dwelling. When sewage flows beyond 1,363 litres/day are anticipated, the Owner may provide further assessment data in order to demonstrate additional absorption field sites and restrictive covenant areas. Otherwise, the covenant area will be restricted to serve as a primary site for a single three bedroom dwelling.
- 7.2 Evidence as to the feasibility of the proposed sewage disposal shall be provided for all treatment methods by the Owner to the Approving Officer and shall be certified by a Professional Engineer with experience and expertise in the field. The Professional Engineer will provide the Village with a Letter of Assurance that the required information and documents have been filed with, and in a form acceptable to, the Health Authority. The Letter of Assurance shall also include the statement that "The design is in complete compliance with the Village of Belcarra Sewerage System Standards for Subdivision".
- 7.3 The sewerage system shall be designed in accordance with the current "Sewerage System Standard Practice Manual" prepared by the British Columbia Onsite Sewage Association with no deviation from any critical standard.
- 7.4 Treatment method. The treatment method may be Type 1, Type 2 or Type 3.
- 7.5 Absorption field restrictive covenants. All proposed parcels, including parcels with existing dwellings, will require a restrictive covenant to protect the absorption field site. Covenants must be registered with a reference plan and shall be acceptable to the Municipality.
- 7.6 Breakout point. Where an area has been identified with a downslope breakout point, the absorption field shall be located at least either 15 metres or 7.5 metres from the breakout point. The distance will depend upon the type of treatment and type of native soils. The additional 15 metre or 7.5 metre downslope area should be included in the proposed covenant area.
- 7.7 Permeability of soil. The maximum percolation rate in the proposed restrictive covenant area must not exceed 30 minutes per inch or be less than 1 minute per inch. The hydraulic conductivity rate must not exceed 4.5 cm/day or 300 cm/day
- 7.8 The minimum native mineral soil depth in the proposed restrictive covenant area shall be 0.45 meters for slopes of 0-15% and 0.6 meters for slopes of 16-30%.
- 7.9 The maximum slope within the proposed restrictive covenant area shall be 30%.

- 7.10 Wet season assessments may be required at the discretion of the Approving Officer to confirm the seasonal high water table.
- 7.11 Parcels with existing dwellings. For proposed subdivisions with existing dwellings the following is required:
- a) A copy of the existing sewerage system permit or filing.
 - b) The Professional Engineer will provide the Village with a Letter of Assurance that the required information and documents have been filed with, and in a form acceptable to, the Health Authority.
 - c) The Approving Officer may include requirements for the existing system in the PLR.
- 7.12 Maintenance Covenants. A maintenance covenant shall be registered in a form acceptable to the Municipality. A sample covenant is available from the Village of Belcarra.

PART 2 – SUPPLEMENTARY STANDARD DRAWINGS

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

1.0 R-1 RURAL ROAD



NOTES

1. THE STRUCTURAL ROAD ELEMENTS SHOWN ARE THE MINIMUM REQUIREMENTS. SOILS TEST RESULTS SHALL BE USED TO DESIGN ROAD STRUCTURE.
2. ALL UTILITY SERVICES AND SERVICE CONNECTIONS SHALL BE INSTALLED PRIOR TO PAVING.
3. ANY PERMANENT WORKS ON PRIVATE PROPERTY SHALL BE PROTECTED BY REGISTERED EASEMENT OR RIGHT-OF-WAY.
4. DITCHES SHALL BE PIPED PAST UTILITY POLES AND FIRE HYDRANTS WHERE REQUIRED.
5. A MINIMUM OF 7.0m FROM CURB WILL BE COMPACTED ASPHALT.
6. TOPSOIL AND SEED DITCH SLOPES AND ALL DISTURBED AREAS.
7. PROVIDE 1.5m WIDE COMPACTED GRAVEL SHOULDER, WITH 100mm - 20mm CRUSH BASE.
8. COMPACTED ASPHALT TO BE LAID IN 2 LIFTS, 50mm BASE COURSE AND 30mm OVERLAY WITH TACK COAT AT END OF MAINTENANCE PERIOD OR WHEN 90% OF HOMES ARE CONSTRUCTED.



VILLAGE OF BELCARRA

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TITLE

**RURAL ROAD
20.0 R/W**

DWG NO.

R-1

APPROVED

DATE

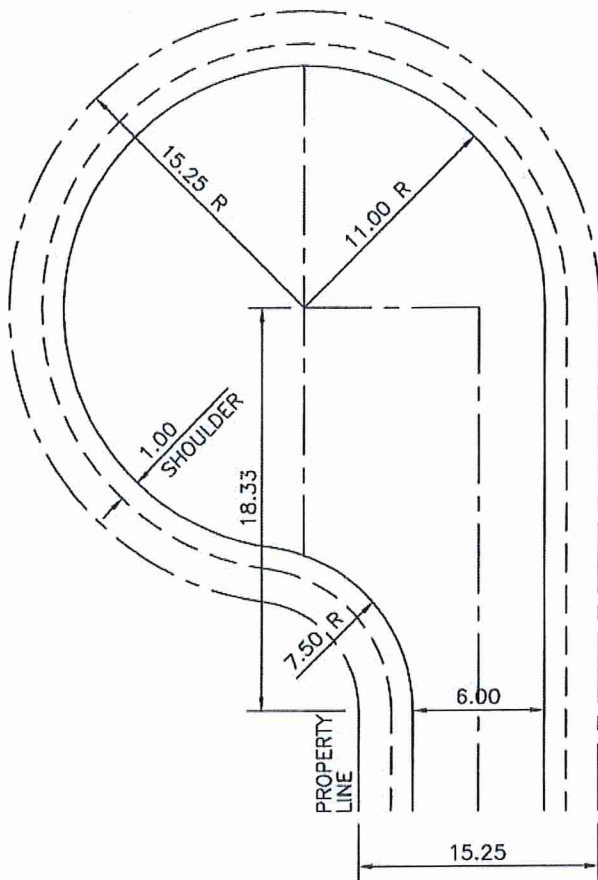
APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWING

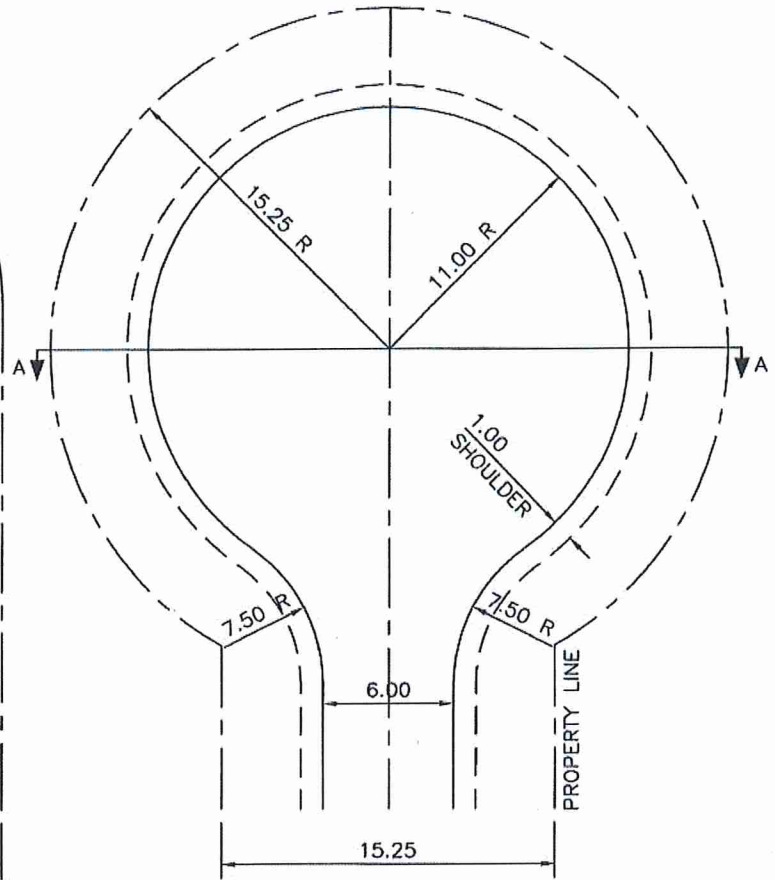
2.0 R-2 RURAL HALF ROAD

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

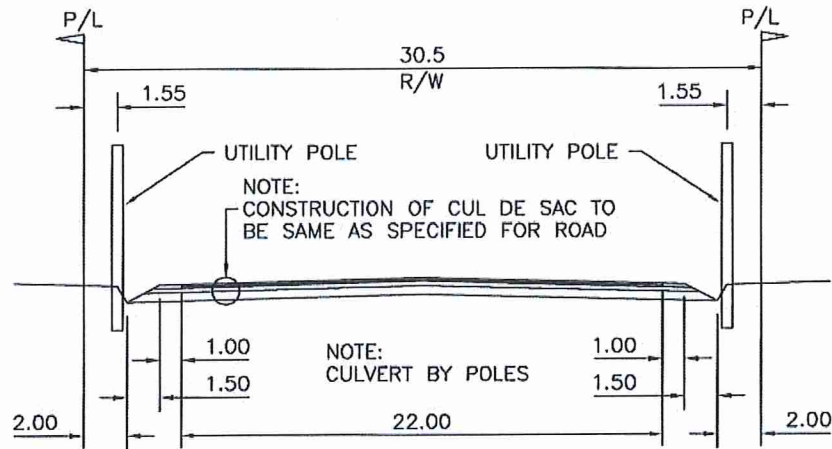
3.0 R-3 CUL-DE -SAC



P-LOOP CUL-DE-SAC
(TO BE USED UPON APPROVAL OF VILLAGE)



TYPICAL CUL-DE-SAC



SECTION A-A



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TITLE

CUL-DE-SAC

DWG NO.

R-3

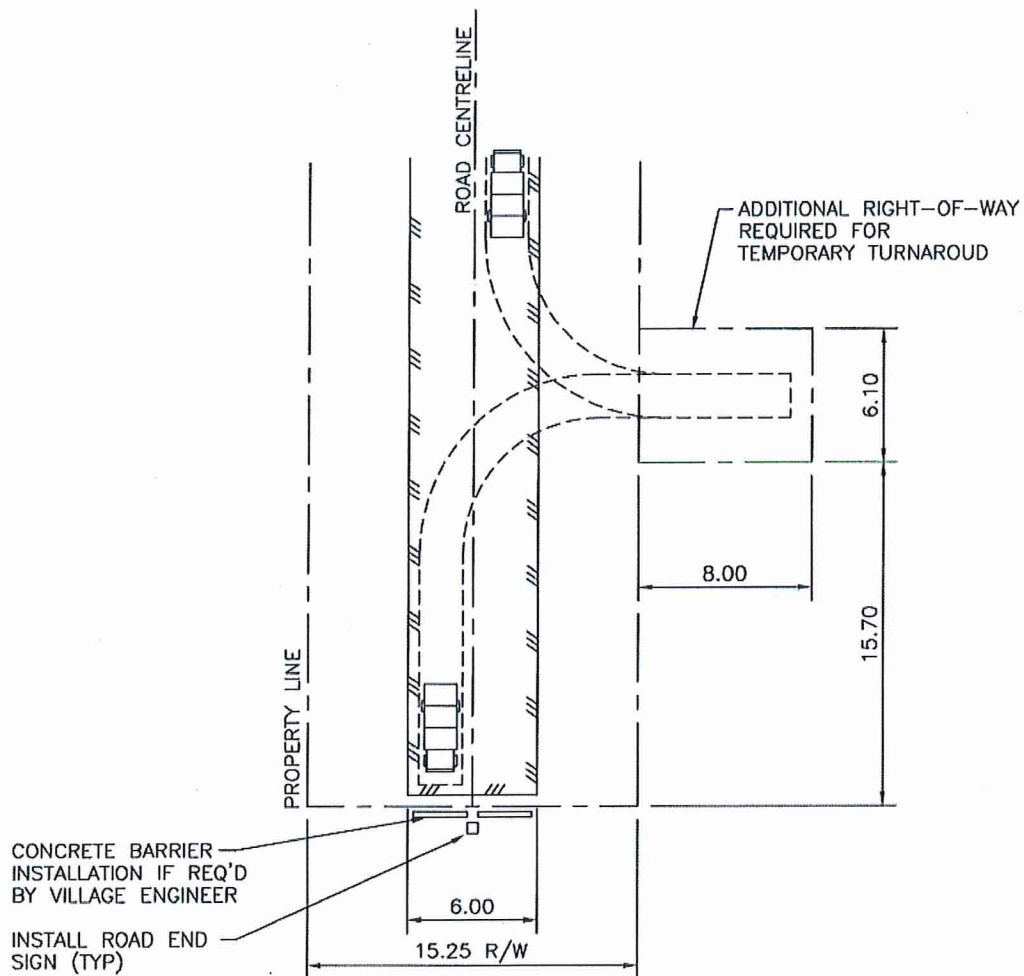
APPROVED

DATE

APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

4.0 R-4 TEMPORARY TURNAROUND



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TITLE

TEMPORARY
TURNAROUND

DWG NO.

R-4

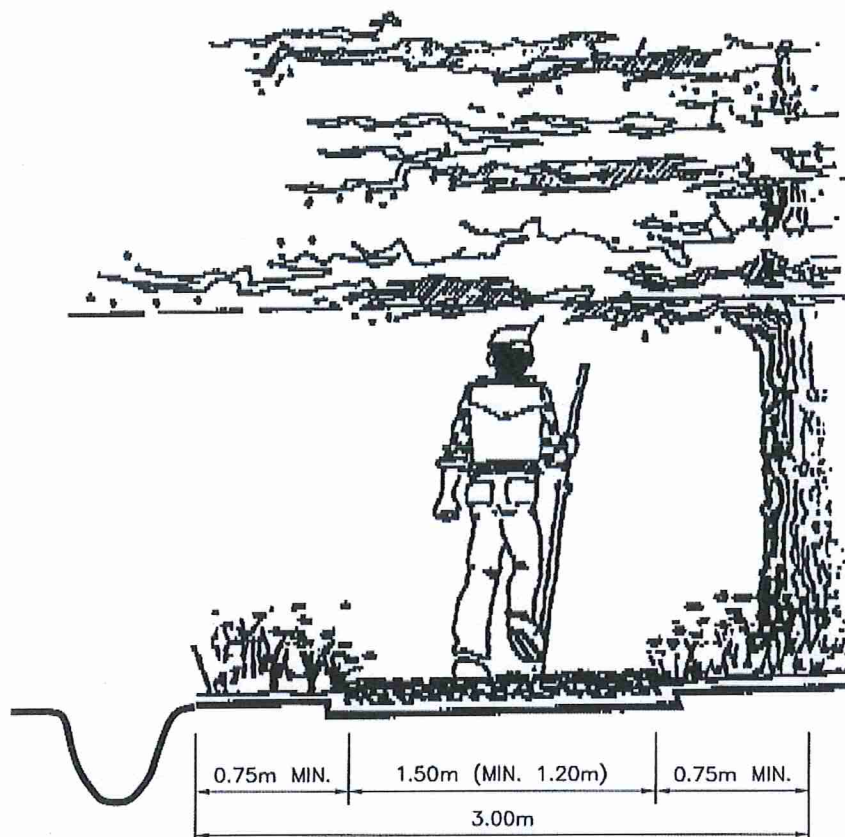
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DATE

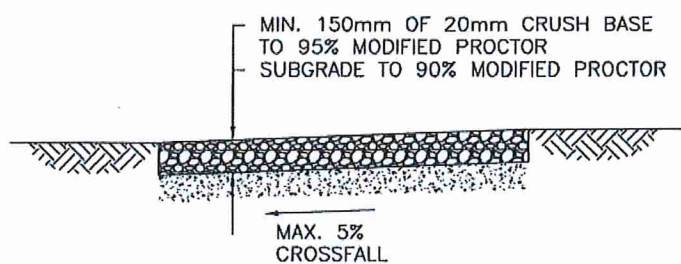
APRIL 2004

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

5.0 R-5 RURAL WALKWAY



TYPICAL WALKWAY



TYPICAL WALKWAY CONSTRUCTION



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TITLE

**RURAL
WALKWAY**

DWG NO.

R-5

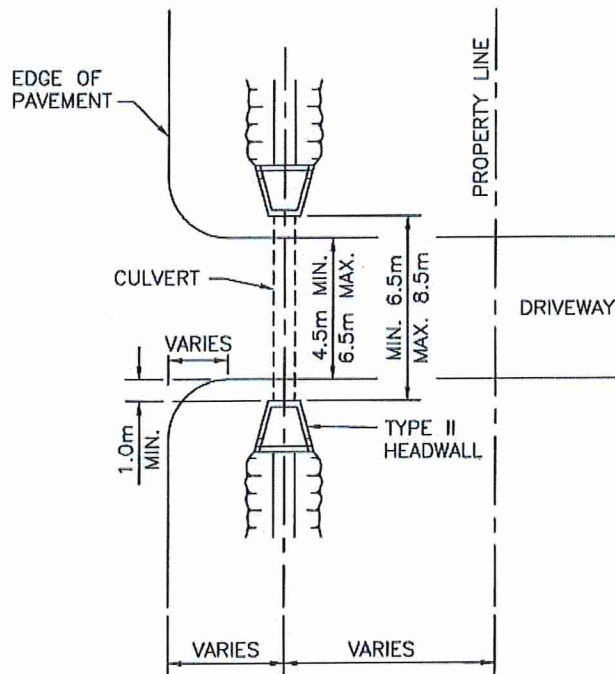
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DATE

APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

6.0 R-6 DRIVEWAY CULVERT



1. APPROVED CULVERT MATERIALS

- (a) CONCRETE (PLAIN OR REINFORCED) WITH BELL END UP HILL
- (b) DOUBLE WALL (SMOOTH INTERIOR) CORRUGATED POLYETHYLENE
- (c) SDR 35 PVC

NOTE: ABOVE MATERIALS MUST BE 450mm (18 INCHES) MIN. INSIDE DIAMETER. CULVERT SHALL BE INSTALLED TRUE TO LINE AND GRADE. FOR COVER LESS THAN 300mm (12 INCHES), CONCRETE PIPE IS REQUIRED. THE DITCH BOTTOM MUST BE 0.9m (36 INCHES) BELOW THE PAVEMENT EDGE.

2. HEADWALLS SHALL BE PRECAST TYPE II AS PER DRAWING R-7. NOT TO EXCEED AN EXPOSED HEIGHT OF 300mm.

3. PIPE INSTALLATION AND BACKFILL

- (a) PIPE SHALL BE PLACED STRAIGHT AND CENTRED IN THE TRENCH.

- (i) CONCRETE PIPE – BELL END PLACED UP HILL;
- (ii) PVC PIPE SHALL BE GASKETED

- (b) BACKFILL MATERIAL SHALL CONSIST OF CRUSHED ROCK OR COARSE SAND AND GRAVEL MIXTURE. WITH PRIOR APPROVAL FROM THE PUBLIC WORKS DEPARTMENT, SUBSTITUTION OF NATIVE MATERIAL MAY BE USED PROVIDED ITS COMPACTED TO 95% OF MAXIMUM DENSITY.

4. PIPE INSTALLATION AND BACKFILL

IT IS REQUIRED TO HAVE THE DRIVEWAY APRON SURFACED FROM THE EDGE OF THE ROAD TO THE PROPERTY LINE. THE SURFACE MAY BE HOT MIX ASPHALT, REINFORCED CONCRETE OR CONCRETE PAVERS. FOR HOT MIX ASPHALT, MINIMUM 75mm THICKNESS ON A MINIMUM 100mm COMPACTED GRAVEL BASE.



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TITLE

**DRIVEWAY
CULVERT**

DWG NO.

R-6

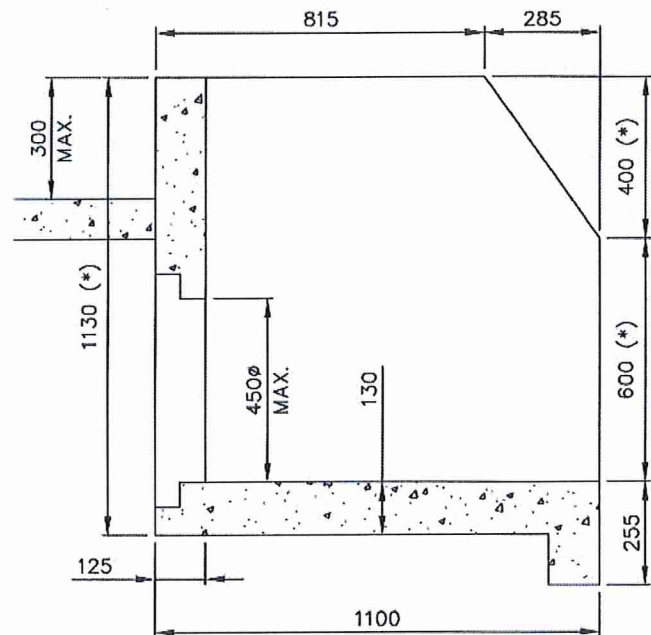
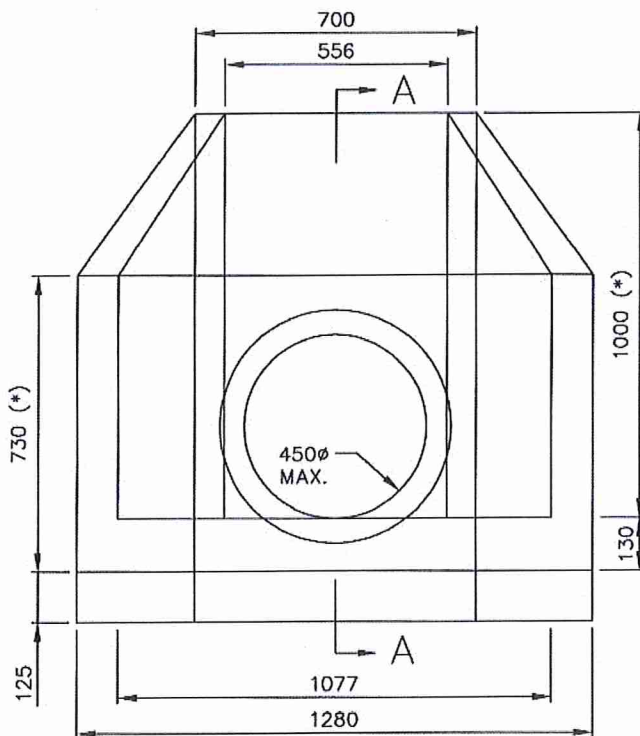
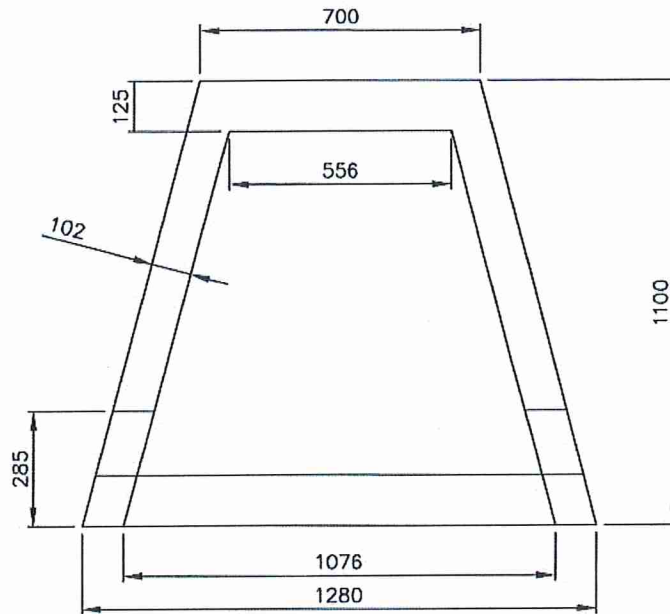
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DATE

APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

7.0 R-7 TYPE II HEADWALL STRUCTURE



NOTES:

1. PRECAST HEADWALL AS MANUFACTURED BY LANGLEY CONCRETE TILE OR A.E. CONCRETE.
2. HEADWALL DIMENSIONS (*) TO BE MODIFIED TO PROVIDE MAXIMUM 300mm PROJECTION ABOVE FINISHED ROAD GRADE. TOP TO BE SAWCUT OR UNIT PRECAST TO SUIT FIELD DIMENSIONS.



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TITLE

**TYPE II HEADWALL
STRUCTURE**

DWG NO.

R-7

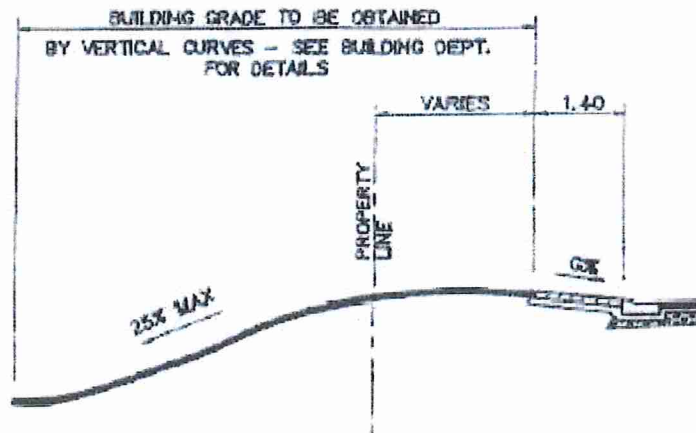
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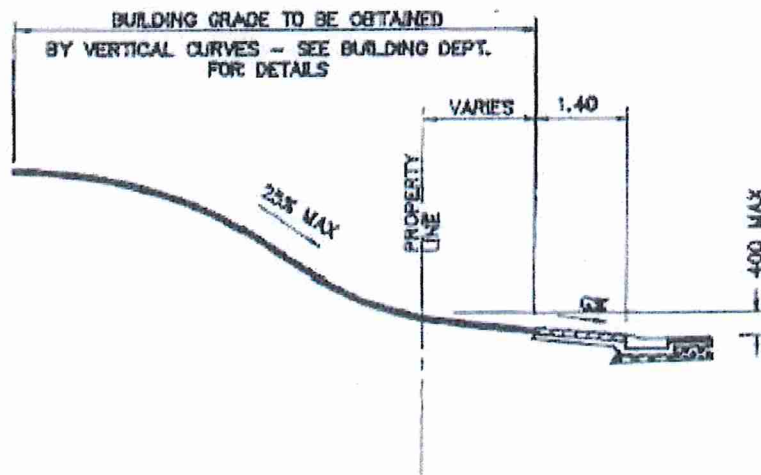
APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

8.0 R-8 TYPICAL DRIVEWAY DETAILS



DRIVEWAY BELOW STREET



DRIVEWAY ABOVE STREET

NOTE: G = 2 FOR ROLLOVER CURB & GUTTER
G = 9 FOR BARRIER CURB & GUTTER



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TITLE

**TYPICAL DRIVEWAY
DETAILS**

DWG NO.

R-8

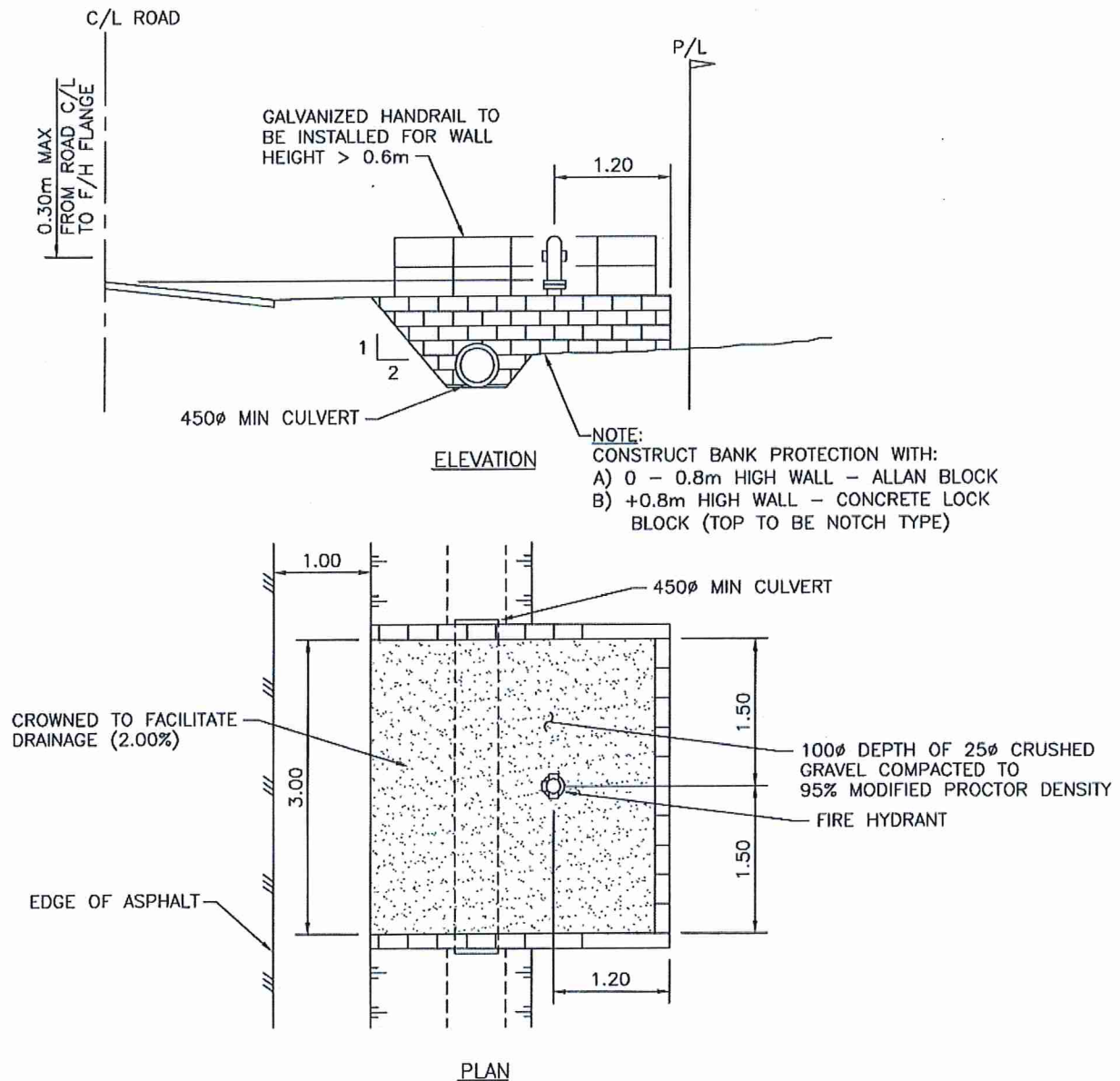
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DATE

APRIL 2013

PART 2- SUPPLEMENTARY STANDARD DRAWINGS

9.0 W-1 RURAL FIRE HYDRANT ASSEMBLY



NOTE

IN RURAL AREAS WHERE A DITCH IS REQUIRED IN A CUT, THE AREA AS SHOWN ABOVE SHALL BE RETAINED BY SUITABLE SIDESLOPES OR WALLS.



VILLAGE OF BELCARRA

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TITLE

**RURAL FIRE HYDRANT
 ASSEMBLY**

DWG NO.

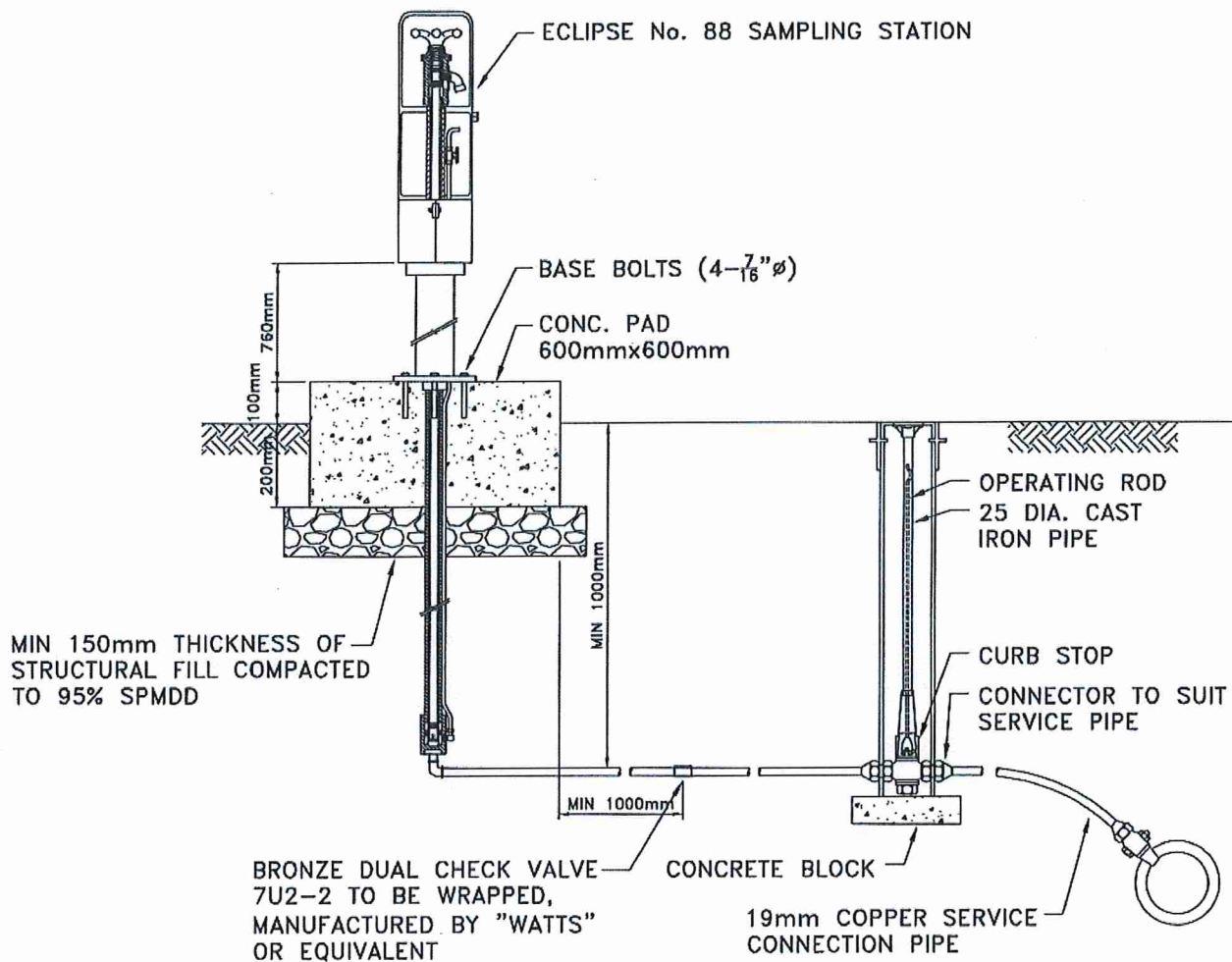
W-1

APPROVED

DATE

APRIL 2013

10.0 W-2 WATER SAMPLING STATION



NOTES:

1. ALL WORK TO BE IN STRICT ACCORDANCE WITH MMCD W2b.
2. STATION TO BE LOCATED AWAY FROM POTENTIAL VEHICULAR DAMAGE OR PROTECTED IN A MANNER ACCEPTABLE TO THE VILLAGE.



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TITLE

**WATER SAMPLING
STATION**

DWG NO.

W-2

APPROVED

DATE

APRIL 2013

PART 3 – SUPPLEMENTARY SPECIFICATIONS

PART 3 – SUPPLEMENTARY SPECIFICATIONS**1.0 WATER METER SETTER**

- 1.1 MMCD drawing W2d delete notes 3 and 4. Add note 3 for connections up to 38mm. The pre-approved meter setter is a Ford VBHH76-15B-41-66 and idler is also required. Water meters shall be installed by the Village at the Building Permit stage at the cost to the Builder.

Schedule B – Development Application Requirements

DEVELOPMENT APPLICATION REQUIREMENTS

Note: Items listed are required at the time of submission of application. If any of the required documents are not included the Village will not accept the application. Please note, all drawings need to be provided to the Village of Belcarra in pdf format on disk.

	APPLICATION TYPE	REQUIRED ITEMS
1	Subdivision, Rezone, Development Variance Permit	A-K
A.	Completed development application form Including signatures of authorisation of all property owners	
B.	State of Title Certificate or Title Search For each parcel affected in the application, including copies of any right-of-ways, restrictive covenants, easements, etc. that are registered on title. No older than 30 days.	
C.	Application Fee Based on the current effective Fee Schedule	
D.	Water Supply If the lots are not proposed to be serviced by the municipal water system then proof of an acceptable water source from a Professional Engineer must be provided confirming that each lot is able to obtain potable water and meet the requirements of Schedule L of the Village of Belcarra Building and Plumbing Code Regulation Bylaw.	
E.	Preliminary Sewerage System Design and Report Prepared by a Professional Engineer with experience in sewerage disposal. The report shall identify building envelopes and shall confirm that a sewerage system meeting the requirements of the Village of Belcarra Subdivision and Development Bylaw may be constructed on the lot.	
F.	Preliminary Subdivision Plan Plan showing all lot dimensions, zoning requirements, and building envelopes prepared by a B.C.L.S. (24 x 36 and 11 x 17)	
G.	Letter of Intent Detailing the proposal	
H.	Site Plan Prepared by a Professional Engineer illustrating a North Arrow, PID, legal description of every existing and proposed parcel, bearings and dimensions and setback of all existing buildings and structures to be retained on site, sources of domestic water on the site and all water sources within 30m of the proposed site, sewerage systems with their offset distance from the lot lines, building envelopes indicating all Zoning Bylaw setbacks, the location and dimensions of all streets, registered easements, covenants, encroachments and right-of-ways, existing and proposed street names, location of the natural boundary of any existing watercourse(s) including the elevation of the crest and toe if slope at regular intervals, approximate location of all existing and proposed utility services, approximate extent of area available for sewerage disposal surrounding the test holes, locations of any on-site water sources to be developed, locations of sewerage-disposal systems on adjacent properties within 30m of any external lot line of the proposed. (24 x 36 and 11 x 17)	
I.	Tree and Topographic Survey Conducted by a B.C.L.S. and identifies the overall health and quality of the trees (over 1.0m) on or adjacent to the subject site, all natural or made-made features such as ponds, bridges, traverse lines with hub numbers, etc. Also, identifies the site elevations including grades at each corner of the lot(s) and contours at one metre intervals. (24 x 36 and 11 x 17)	
J.	Site Photos Colour photos of the site. Illustrating key features such as site access points, watercourses, slopes, trees, etc.	
K.	Preliminary Geotechnical Report A preliminary geotechnical report shall be submitted which confirms the suitability of the lands for the intended purposes. The report shall be sealed by a Professional Engineer licensed to practice in BC.	