Making a difference...together

CAPITAL REGIONAL DISTRICT (CRD)
WATER ENGINEERING SPECIFICATIONS

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All persons utilizing these documents are advised to visit the Capital Regional District website Water Engineering Specifications | Capital Regional District to ensure that all specifications and drawings are the current version.

Contents

REVISION	DATE	UPDATES
v0	2025.08.27	Engineering Specification release in new format.
v1	2026.03.13	Revised meter boxes Standard Drawings 2.3 and 2.4 to replace saw dust insulation for Reflectix Insulation. Updated Schedule A1 – Design Criteria – Section 7 Fire Hydrants. 7.1.4 to replace “Single family” with “Low Density (One and Two Family)”, and “Maximum Hydrant Spacing” with “Maximum Spacing Between Hydrants”. Updated Schedule A – Design Standard & Guidelines – Section 6.8.13 Standard Notes removed “gas”. Added 6.8.14 “Maintain a minimum of 1.50 m clear horizontal and 0.15 m clear vertical separation between water services and gas services except where noted and approved by the CRD”.

Contents

1. GENERAL INFORMATION

1.1 SCOPE AND APPLICABILITY

.1 The Capital Regional District (CRD) Water Engineering Specifications and accompanying appendices and schedules (listed under section 1.2) shall

.1 apply to the design and installation of all waterworks infrastructure connected to potable water supply and distribution systems owned and operated by the CRD. This includes waterworks extensions and service additions.

.2 apply to other infrastructure that may impact CRD Infrastructure or be impacted by CRD Infrastructure.

.2 These specifications are to be applied in conjunction with all applicable bylaws and policies of the CRD.

1.2 LIST OF ACCOMPANYING SCHEDULES AND APPENDICES

Schedule A	Design Standards and Guidelines
Schedule A1	Design Criteria
Schedule B	Pre-Construction Submittals
Schedule C	Construction Standards
Schedule D	Post Construction Submittals
Appendix A	Approved Standard Materials
Appendix B	Standard Forms
Appendix C	Standard Drawings

1.3 USE OF THE CRD WATER ENGINEERING SPECIFICATIONS

.1 The most current version of the CRD Water Engineering Specifications shall be used and is found on the CRD website (Water Engineering Specifications | Capital Regional District). Criteria and standards defined in this manual shall be the minimum acceptable for preparation of all engineering designs and drawings for the expansion of and connection to any potable water infrastructure owned and/or operated by the CRD.

.2 The CRD Water Engineering Specifications include all CRD Water Engineering Specification parts, appendices and schedules.

.3 It is the Applicant's responsibility to verify the most current criteria are being used prior to initiating and submitting detailed design.

.4 The CRD Water Engineering Specifications shall form part of the CRD Waterworks Extension Agreement discussed further in Part 2 and as found in *Appendix B* on the CRD website.

1.4 USE OF MASTER MUNICIPAL CONSTRUCTION DOCUMENTS

.1 CRD Water Engineering Specifications shall be used for all design and construction. MMCD supplementary specifications and supplementary detail drawings may be used if and when applicable but should be confirmed with the CRD Infrastructure and Water Services (IWS).

.1 CRD Water Engineering Specifications shall govern over MMCD; and

.2 CRD Water Engineering Specifications shall govern over any other construction documents.

1.5 RESPONSIBILITY FOR DESIGN

.1 The Consulting Engineer, retained by the Applicant, shall be fully responsible to ensure that designs meet the design criteria, accepted engineering principles, and are adequate for the site conditions and anticipated use.

.2 The Consulting Engineer shall exercise best practice professional judgment on technical matters in the best interests of the CRD, regulatory agencies and the public.

.3 Where appropriate, Consulting Engineers are encouraged to seek innovative and superior solutions, to achieve the best possible technical and economical solutions.

.4 A Consulting Engineer who wishes to adopt criteria not specifically included in, or in variation with, the CRD Water Engineering Specifications, shall justify the proposed change in a signed and sealed letter or report submitted to the CRD for review and approval. The proposed change must detail that the proposed change is equivalent to, or better than, that contained in the CRD Water Engineering Specifications.

.1 A variance will only be granted under written approval by the CRD and is not guaranteed.

.5 The Consulting Engineer shall be satisfied that the design criteria are applicable, and shall apply more stringent criteria where appropriate. The Consulting Engineer is fully responsible for designing to standards which may exceed the CRD Water Engineering Specifications when specific site conditions dictate that more stringent performance measures are required.

1.6 INTERPRETATION OF THE DESIGN CRITERIA DUE TO CONFLICTS

.1 Where conflict arises in interpretation of design criteria, the CRD reserves the unilateral right to make final decisions about the interpretation of the intent of the CRD Water Engineering Specifications. This also includes the acceptability of changes proposed by the Applicant's Consulting Engineer.

.1 Final decisions, interpretations, and approvals will be provided by the CRD to the Applicant and/or their Consulting Engineer in writing; and

.2 Neither the Applicant nor their Consulting Engineer shall have any claim for costs or damages based on a CRD decision, interpretation and approval or rejection of a submission.

1.7 REVISIONS TO THE CRD WATER ENGINEERING SPECIFICATIONS

.1 The criteria and design parameters contained in the CRD Water Engineering Specifications are subject to constant review and re-evaluation by the CRD. The CRD reserves the right to make revisions, additions, and deletions to the CRD Water Engineering Specifications as they deem necessary.

.2 The CRD encourages submissions from Consulting Engineers wishing to amend the CRD Water Engineering Specifications. Such submissions shall be in a report format, signed and sealed by the Consulting Engineer, and shall include:

.1 clear and concise expression of concern; and

.2 suggestions for alternatives including benefits and recommendations proposed to address improvements to the CRD Water Engineering Specifications.

.3 The CRD may, at its sole discretion, review, assess, reject, accept, or adopt in whole or in part, submissions and/or recommendations from a Consulting Engineer for inclusion within the CRD Water Engineering Specifications at a future date.

1.8 REQUIREMENTS FOR APPROVALS

.1 The Applicant, in consultation with their Consulting Engineer, shall arrange for and secure all necessary approvals from the CRD, appropriate regulatory agencies and authorities which are mandated to regulate and approve such works or portions thereof.

.2 The Applicant, in consultation with their Consulting Engineer, shall be fully responsible for compliance with all the requirements of the CRD and other relevant regulatory agencies and authorities which are mandated to regulate and approve such works or portions thereof.

END OF PART 1 – GENERAL

Contents

2. GENERAL INFORMATION

2.1 APPLICANT RESPONSIBLE FOR ALL COSTS

.1 All costs shall be at the Applicant's expense for:

- .1 new development and servicing;
- .2 all extensions and upgrades to existing Infrastructure due to new development; and
- .3 any required changes to existing Infrastructure due to new development.

.2 The Applicant's costs shall include, but not be limited to:

- .1 concepts and pre-design;
- .2 permits and approvals;
- .3 public and private consultation;
- .4 engagement of all parties whom have interest, right or statutory responsibility/involvement in the extensions and/or upgrades;
- .5 survey;
- .6 design;
- .7 necessary land acquisitions in favour of the CRD;
- .8 materials and construction;
- .9 utility relocates;
- .10 inspection and engineering services;
- .11 post construction submittals;
- .12 project completion; and
- .13 warranty, guarantees, securities and bonding.

2.2 APPLICANT RESPONSIBILITY – CRD INFRASTRUCTURE & WATER SERVICES REVIEW

.1 The CRD, its employees, agents, approving authorities, and regulatory agencies shall not assume responsibility for any submission by the Applicant or their Consulting Engineer and any resulting approvals or Approval in Principle being granted.

- .1 Review, approvals and Approval in Principle of submissions does not relieve the Applicant or his Consulting Engineer from full responsibility for the design and construction.

.2 The Applicant and their Consulting Engineer shall assume full responsibility and liability for any faulty design, workmanship or any resulting damage irrespective of cause.

.3 The Applicant and Consulting Engineer shall indemnify and save harmless the CRD, its employees, agents, approving authorities and regulatory agencies from any and all claims and actions due to design and construction.

2.3 CRD WATERWORKS EXTENSION AGREEMENT

.1 Prior to development and Infrastructure work the Applicant shall enter into a Waterworks Extension Agreement, as found in *Appendix B – Standard Forms* on the CRD Website, with the CRD.

.2 The most current edition of the CRD Water Engineering Specifications (as found on the CRD web site) shall form part of the CRD Waterworks Extension Agreement.

2.4 ENGINEER-CLIENT AGREEMENT

.1 The Applicant shall provide a Declaration of Engineer-Client Agreement as found in *Appendix B – Standard Forms* on the CRD Website, prior to submitting designs for review.

.1 A Consulting Engineer shall be hired by the Applicant for all aspects of extension and/or upgrading including the final responsibility as Engineer of Record;

.2 The Consulting Engineer shall carry errors and omission insurance in an amount of no less than $3,000,000 (three million dollars) as required by the CRD;

.3 Copies of the Consulting Engineer's insurance coverage shall be attached to the Engineer-Client Agreement.

2.5 ENGINEER REQUIREMENTS

.1 The Consulting Engineer shall be in good standing and registered with the Engineers and Geoscientists of BC (EGBC) and be currently practicing in the appropriate engineering discipline specific to waterworks construction.

.1 By way of the Consulting Engineer's seal, the Consulting Engineer is certifying that the works have been designed, inspected, constructed and tested to good engineering standards and in accordance with the latest edition of the CRD Water Engineering Specifications;

.2 The Consulting Engineer is required to seal and certify all submissions including drawings, reports, calculations, testing, inspection reports or other such information as required by the CRD that is to be submitted as part of the design, part of construction and part of project closeout;

.3 As and when required, the Applicant shall retain any other necessary professional to undertake design, inspection, testing and record keeping with plans and submissions to be signed and sealed by the professional and submitted to the CRD; and

.4 The Applicant's Consulting Engineer shall be the coordinating professional.

.2 The Consulting Engineer shall be responsible for all aspects of pre-design, design, testing, inspection, and certification in the best interests of:

.1 the general public, and all water users;

.2 CRD;

.3 Island Health Authority (IHA); and

.4 municipal, district, provincial and federal authorities.

2.6 AUTHORIZATION FOR CRD TO ENTER A WORK SITE

.1 All employees, appointees and agents of the CRD are authorized to enter, at all reasonable times, upon any property to ascertain whether the requirements of the CRD Water Engineering Specifications are being met.

2.7 WORK ON A DEVELOPMENT SITE

.1 No Infrastructure development may be undertaken until all construction/design plans are approved by:

.1 All the various relevant approving authorities, regulatory agencies, jurisdictions;

.2 Specifically, IHA has approved the drawings and has issued a waterworks construction permit; and

.3 Specifically, the CRD has provided the Applicant with reviewed and returned final design

plans complete with a CRD signature and stamp “Reviewed” and thereby Approved in Principle.

2.8 CRD CONSTRUCTION COMPLETION CERTIFICATE

.1 Upon completion of all site work by the Applicant’s Contractor, the Applicant must apply for a CRD Construction Completion Certificate.

.2 The Applicant’s application shall be a single submission complete with the following:

.1 A cover letter on the Applicant’s letterhead requesting a CRD Construction Completion Certificate;

.2 A CRD Construction Completion Certificate (See *Appendix B – Standard Forms* – Construction Completion Certificate) prepared by the Applicant;

.3 A current Work Safe BC clearance letter from the Applicant’s Contractor;

.4 A current Statutory Declaration in a form acceptable to the CRD;

.5 Hydrant and valve data forms (valve data for control valves, air valves and check valves only);

.6 Sealed Record Drawings;

.7 Waterworks construction costs;

.8 Operations and Maintenance manuals if applicable;

.9 Construction inspection reports; and

.10 Warranty bond.

.3 Upon receipt of the application from the Applicant, the CRD shall have 10 business days to make a determination of its completion.

.1 If the application is incomplete, the CRD shall reject the application and notify the Applicant. The Applicant shall re-apply with a new complete submission; and

.2 The Applicant shall have no claim for costs or damages based on a CRD decision, interpretation and/or denied/approved application.

.4 Upon final review and acceptance by the CRD, the CRD shall sign and issue the CRD Construction Completion Certificate.

.1 The date of issue of the CRD Construction Completion Certificate shall be the effective date of the start of the warranty period between the Applicant and the CRD.

2.9 STATUTORY DECLARATION

.1 A sworn Statutory Declaration in a form acceptable to the CRD shall be provided by the Applicant to the CRD at the same time the request for a CRD Construction Completion Certificate is submitted to the CRD.

.2 The Statutory Declaration shall state:

.1 all amounts for labour, subcontracts, products, services, construction machinery and equipment have been paid in full;

.2 there are no claims outstanding or pending relating to the Work; and

.3 the Applicant shall indemnify and safe harmless the CRD from any and all claims that may arise relating to design and/or construction.

2.10 ASSUMPTION OF CRD OWNERSHIP

.1 The CRD will only assume ownership of the Infrastructure in publicly gazetted roads, statutory rights-of-way registered in favour of the CRD and property owned by the CRD.

END OF PART 2 – POLICIES AND PROCEDURES

Contents

3. Definitions

The following definitions shall apply to the CRD Water Engineering Specifications. (See PART 1 – GENERAL – Sec 1.3 – Use of the CRD Water Engineering Specification)

3.1 "AGREEMENT"

means the CRD Waterworks Extension Agreement. Unless otherwise specified, the CRD Waterworks Extension Agreement shall be governed by the laws of British Columbia.

3.2 "APPLICANT"

means a person who is the Owner (or assigned to act on behalf of the Owner) of an authorized property who desires to develop the property under the CRD Waterworks Extension Agreement.

3.3 "APPROVAL (APPROVED) IN PRINCIPLE"

means submission has been reviewed for general compliance with the CRD Water Engineering Specifications. Documents stamped with "Reviewed" implies that it has been Approved in Principle. Approval of dimensions, accuracy/competency of design and general construction features are not implied by the CRD. The CRD shall not be responsible for any errors or omissions in design and/or construction.

3.4 "APPROVING AUTHORITY/OFFICER"

means a public body or officer with powers to enforce statutes, regulations, codes and by-laws, and to issue consents, approvals, licenses and permits.

3.5 "BOARD"

means the CRD Board of Directors.

3.6 "CLIENT"

means same as Applicant.

3.7 "COMMISSION"

means the Juan de Fuca Water Distribution Service Commission or any other CRD Commission or Committee that chooses to adopt the CRD Water Engineering Specifications, either in whole or in part.

3.8 "CONSULTING ENGINEER"

means the person, firm, or corporation identified as such in the Engineer-Client Agreement, who is acting on behalf of the Applicant, singularly or jointly, responsible for the preparation of: proposals, reports, associated documents, consultation, design submissions and detailed engineering designs and drawings, and for the execution, implementation, and certification of such designs for water infrastructure utilities and services to be incorporated in the CRD. This definition shall also include Design Engineer, Engineer of Record and Coordinating Professional. The Consulting Engineer shall be registered with the Engineers and Geoscientists of British Columbia (EGBC) and be currently practicing in the appropriate engineering discipline.

3.9 "CONTRACTOR"

means the person, firm or corporation identified as such in the Agreement documents and is referred to as if singular in number and masculine in gender. The term Contractor means the Contractor, or his authorized representative as designated by the Applicant or CRD IWS in writing, which shall undertake the installation of Infrastructure on behalf of either the Applicant or the CRD.

3.10 "CRD"

means the Capital Regional District.

3.11 "CRD CONSTRUCTION COMPLETION CERTIFICATE"

means a CRD IWS issued Certificate indicating agreement between the Applicant and CRD that construction works are complete, and all statutory holdback money has been returned by the Applicant to the Applicants Contractor and no claims/encumbrances exist. The CRD Construction Completion Certificate signals the start of the Warranty period between the Applicant and the CRD.

3.12 "CRD IWS"

means "Capital Regional District Infrastructure & Water Services Department".

3.13 "CRD ENGINEER"

means the professional engineer and any person designated to assist in carrying out his/her duties as authorized by the General Manager of the CRD IWS to review and accept: proposals, reports, documents, design submissions, detailed engineering drawings and site reviews pertinent to water infrastructure development in the CRD.

3.14 "CRD WATER ENGINEERING SPECIFICATIONS"

means the most current version of the CRD Water Engineering Specifications found on the CRD web site (Water Engineering Specifications | Capital Regional District), and include all CRD Water Engineering Specification parts, appendices and schedules.

3.15 "DESIGN DRAWINGS"

means signed and sealed drawings prepared by the Applicant's Consulting Engineer in accordance with the CRD Water Engineering Specifications.

3.16 "ENGINEER-CLIENT AGREEMENT"

means a binding agreement between the Applicant and a Consulting Engineer wherein the Applicant engages the services of a Consulting Engineer to provide the level of engineering service required by the CRD Water Engineering Specifications.

3.17 "GENERAL MANAGER"

means the person appointed by the Board as General Manager of the CRD IWS, or any agent or employee of the CRD who has been authorized to act on behalf of the General Manager.

3.18 "HIGHWAY"

means a street, road or lane open to public use and maintained by the authority having jurisdiction and a common Property access road within a strata plan, over which a statutory right of way is registered in favour of the CRD for purposes of operation of the Waterworks but does not include a private right of way on private Property.

3.19 "IHA"

means Island Health Authority.

3.20 "INSPECTOR"

means the Consulting Engineer or his representative who shall undertake inspections and tests as the Consulting Engineer considers necessary, of any work being carried out under the Agreement.

3.21 "INFRASTRUCTURE"

means all existing and proposed property, facilities, pipe networks, service connections, appurtenances and any other associated works such as pump stations, reservoirs, vaults, etc. (waterworks) which are required to provide a complete operational water distribution system to the boundary line of any property. Infrastructure shall only be located within publicly gazetted roads, rights-of-way or easements that are registered in favour of the CRD or within property owned by the CRD.

3.22 "MMCD"

means the latest edition of the Master Municipal Construction Documents as published by the Master Municipal Construction Documents Association.

3.23 "OTHERS INFRASTRUCTURE"

means all other existing and proposed infrastructure that includes, but is not limited to, all private and public utilities and structures, not owned by the CRD.

3.24 "RECORD DRAWINGS"

means design drawings signed and sealed by the Consulting Engineer, which have been revised to reflect all changes in design that were incorporated into the actual construction of the waterworks infrastructure.

3.25 "SECURITY"

means a prepayment by the Applicant to the CRD in the form of cash, certified cheque, irrevocable letter of credit or bond in a form acceptable to the CRD equal to 120 per cent (120%) of the estimated amount of the cost of installing and paying for the infrastructure required by the Waterworks Extension Agreement. Cost of the work shall be based on the Consulting Engineers signed and sealed class "A" cost estimate.

3.26 "STATUTORY DECLARATION"

means a signed solemn declaration made in writing conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the Canada Evidence Act. The Statutory Declaration shall be declared before a Commissioner for taking Affidavits for British Columbia or a Notary Public in and for the Province of British Columbia. The Statutory Declaration shall be in a form acceptable to the CRD Infrastructure and Water Services.

3.27 "WATERWORKS EXTENSION AGREEMENT"

means the executed Agreement between the CRD and the Applicant for infrastructure development. The Agreement supersedes all prior negotiations, representations or agreements, either written or oral. The Agreement may be amended only as mutually agreed upon between the parties.

3.28 "WATERWORKS AND/OR THE WORK"

means same as Infrastructure.

3.29 "WARRANTY PERIOD"

means a guarantee period of one calendar year duration by the Applicant, from date of issue of a CRD Construction Completion Certificate, to remedy and repair/replace defective materials, equipment and workmanship. Defective materials, equipment and workmanship shall be solely determined by the CRD.

END OF PART 3 – DEFINITIONS

Contents

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 This section shall govern the preparation of Design Drawings and Standards for Waterworks Infrastructure owned by the CRD and operated by CRD IWS.

.1 All Design Drawings are subject to review and acceptance by the CRD and IHA;

.2 All Design Drawings are subject to review and acceptance by all other regulatory agencies and jurisdictions that may be impacted by water Infrastructure development;

.3 Generally, water Infrastructure drawings are a part of a larger subdivision design. Water Infrastructure drawings shall conform to the general overall Design Drawings. When possible, for water Infrastructure development, Design Drawings shall conform to the latest edition of the MMCD Civil 3D templates and standards unless otherwise approved by the CRD; and

.4 Design details are to be in accordance with the CRD Approved Standard Materials and CRD Standard Drawings.

.2 This section is not intended to be a substitute for sound engineering knowledge and experience. Water distribution system and water Infrastructure designs shall be prepared under the direction of a Consulting Engineer who has the appropriate knowledge, skill and experience.

.1 The Consulting Engineer shall exercise best practice professional judgment on technical matters in the best interests of the CRD, Regulatory Agencies and the Public; and

.2 Standards contained in this section are provided to assist in making these judgments but should not be used as a substitute. The standards are general and are not expected to cover all cases.

1.2 INFORMATION AND RECORD DRAWINGS PROVIDED BY CRD

.1 CRD Record Drawings can be obtained by completing the BC 1 Call.

.2 Any information and Record Drawings provided by the CRD with respect to existing water system Infrastructure shall be used as a guide and provided as a courtesy.

.3 The CRD will not accept responsibility or guarantee correctness or adequacy of any information provided. Verification of supply, capacity, locations, elevations, and materials shall be checked by site investigation, site survey or subsurface investigation undertaken by the Applicant at the Applicant's expense.

.1 Confirmation of the location of property boundaries, water Infrastructure, Others Infrastructure, and all other underground/overhead utilities shall be the sole responsibility of the Applicant;

.2 The CRD will not accept responsibility for the accuracy of property boundaries and Infrastructure information obtained from base plans and drawings; and

.3 The CRD will not accept responsibility for the accuracy of water models. Data shall be verified by field tests, if required.

1.3 INDEPENDENT UTILITIES

.1 Independent utilities are independent of the CRD, municipalities and other local governments and typically include:

.1 electrical power;

.2 communications (telephone and cable);

.3 gas; and

.4 may include sanitary and storm sewers.

.2 Design consideration shall include consideration of independent utilities.

1.4 REQUIRED RIGHTS-OF-WAY

.1 Prior to acceptance of the Design Drawings, any required rights-of-way, whether within or outside the proposed development, shall be:

.1 obtained and registered by the Applicant; or

.2 a Letter of Undertaking from the Applicant's Lawyer stating that the CRD shall receive rights-of-way at registration of the development.

1.5 OTHER AUTHORIZATION, APPROVALS AND PERMITS

.1 Where authorization, approval and/or permits are required from municipalities, other local governments, senior governments and other authorities having jurisdiction, it is the Applicant's responsibility to obtain these. All permits must be in place prior to start of construction.

.2 Developments adjacent to, affected by construction or affecting the following will require plans for design approval to be submitted to the appropriate municipal/non-municipal authority including, but not limited to, the following:

.1 CRD (departments other than CRD IWS);

.2 IHA - Public Health Engineer;

.3 Municipality having jurisdiction;

.4 Fire District having jurisdiction;

.5 Hydro, telephone and cable providers, any other communications providers, gas provider and railways;

.6 West Shore Environmental Services (Operates City of Langford sanitary sewer system);

.7 BC Transportation Finance Authority (Galloping Goose trail corridor);

.8 Ministry of Environment;

.9 Ministry of Agriculture;

.10 Ministry of Forests, Lands & Natural Resources;

.11 Ministry of Transportation and Infrastructure;

.12 Department of National Defence;

.13 Indigenous and Northern Affairs Canada; and

.14 First Nations.

.3 Other authorities who provide approval are in addition to those of the CRD and are required prior to design approval.

1.6 PRELIMINARY MEETING PRIOR TO DETAILED DESIGN

.1 If required by the CRD, due to the scope of work, the Applicant shall be required to attend a preliminary design meeting on completion of conceptual design.

1.7 PRE-DESIGN REPORT

.1 If required by the CRD the Applicant shall submit a pre-design report based on conceptual design for review by the CRD prior to proceeding to detailed design. The pre-design report shall include:

- .1 description of works, proposed costs, options, and recommendations:
  - .1 if required, a pipe/fitting corrosion report(s); and
  - .2 if required for fire protection requirements, submit a complete set of design calculations including theoretical fire flows.
- .2 procedures to be used to prepare plans and specifications that will meet the design standards set out in the Engineering Specifications;
- .3 criteria to be used where there are no appropriate standards in the CRD Water Engineering Specifications;
- .4 status and requirement for any other authorizations, approvals and permits; and
- .5 clarification of any items unresolved at the preliminary meeting.

.2 Pre-design reports may be required for pump stations, meter stations, reservoirs, pressure control stations, trunk pipelines, stream crossings, bridges, retaining walls, road crossings and any other Infrastructure works as determined by the CRD.

.3 Pre-design report submission shall be signed and sealed.

1.8 PUBLIC OPEN HOUSE

.1 The Applicant or their representative may be required to conduct or alternatively attend a public open house as and when required by the CRD.

.2 Overheads, plans, information packages and drawings may be required by the Applicant at the Applicant's cost.

1.9 OPERATION AND MAINTENANCE MANUALS

.1 Operation and Maintenance (O&M) manuals shall be provided for all pump stations, meter stations, pressure control stations, reservoirs, water intakes, disinfection facilities, water treatment plants, and any other Infrastructure works as required by the CRD.

.2 The Consulting Engineer shall prepare two complete sets of O&M manuals (to CRD standard format) using Contractor provided data, and one complete digital (PDF) set.

- .1 O&M manuals shall be in heavy duty catalogue style binders with full length metal hinges, complete with embossed cover and embossed spine.
- .2 Complete Equipment Data Matrix (using the CRD standard excel spreadsheet). Submission of Equipment Data Matrix is required prior to commissioning.

2. DRAWING SUBMISSIONS

2.1 GENERAL REQUIREMENTS

.1 The Consulting Engineer shall prepare interim and final Design Drawings and submit these to the CRD and IHA concurrently.

.2 After review, comments will be returned by email to the Consulting Engineer for revisions.

.3 When all comments have been addressed, the Consulting Engineer shall submit revised Design Drawings to both the CRD and IHA for final review.

2.2 INTERIM DESIGN SUBMISSIONS

.1 Interim design submissions shall be made at reasonable intervals as determined by the CRD depending on complexity of the water Infrastructure development.

.2 Interim designs will be required until all aspects of design are complete and the CRD and IHA has fully reviewed and accepted the design in principle.

.3 Interim design submissions shall generally consist of one full size sealed paper copy, and a DWF or unlocked PDF file containing complete design and drawings. Other submittals and clarifications may be required at the CRD's request.

.4 The CRD shall review the interim design submissions and if necessary, provide the Consulting Engineer with comments, in writing.

2.3 FINAL DESIGN SUBMISSION

.1 When the Consulting Engineer has, in his opinion, completed a final design, a final submission shall be made to the CRD and IHA pending a review.

.2 Submission shall consist of:

- .1 One full size sealed paper copy, and a DWF or unlocked PDF file containing the complete set of drawings; and
- .2 Where the design specifically involves a pump station or reservoir it is mandatory to submit a copy of the contract specifications with the Consulting Engineers final Design Drawings. At the CRD's request other specifications may be required.

.3 When the CRD is satisfied that all design requirements are complete and drawings are fully updated, one full digital set of drawings will be returned to the Consulting Engineer signed and marked "Reviewed" and thereby Approved in Principle.

.4 No construction shall be undertaken until:

- .1 the CRD has returned Design Drawings signed and marked "Reviewed".
- .2 other regulatory bodies, authorities and jurisdictions have approved the design and agree that construction may move forward; and
- .3 IHA has returned approved drawings and has issued a Waterworks Construction Permit.

.5 CRD Approval in Principle is good for 180 calendar days.

- .1 At the expiration of 180 days CRD, Approval in Principle is withdrawn and becomes null and void.
  - .1 if the Applicant wishes to continue with water Infrastructure works after the 180-day expiry, the Applicant shall first meet with the CRD representative for direction.

2.4 REJECTION OF SUBMISSIONS

.1 Conceptual design, predesign reports, Design Drawings at any stage, O&M manuals, inspection reports and any other submission may be rejected for lack of critical information, conflicts, unresolved design problems or incomplete submissions.

.2 It is intended that design and drawing information for existing and proposed Infrastructure is fully described and indicated on all the drawings and submissions.

- .1 CRD IWS shall have final say on completeness.

3. DESIGN SURVEY

3.1 SURVEY GENERAL REQUIREMENTS

.1 The design survey shall be undertaken in a manner as to not cause a nuisance to traffic, public or any other user. Appropriate traffic/pedestrian control measures shall be in place for all surveys, as required.

.1 Approvals from the jurisdictions having authority (Municipality, Provincial, etc.) may be required prior to any site surveys; and

.2 Approval from the registered property owner is required before entry onto any private property.

3.2 SURVEY COORDINATES AND DATA GATHERING

.1 All surveys shall be referenced (e.g., scale factor, translation, rotation) to NAD83/UTM Zone 10N with elevation referenced to the Geodetic Survey of Canada (GSC) datum.

.2 The design survey shall gather detailed existing ground level topography and the location of all water Infrastructure, other Infrastructure, structures, existing features, controls, and property pins.

.1 The design survey shall determine all the controlling elements to be used as the basis for the project design.

4. DESIGN CONSIDERATIONS

4.1 EXTERNAL PIPE/FITTING CORROSION REPORT

.1 At the request of the CRD a pipe corrosion report shall be prepared by the Consulting Engineer at the Applicant's expense on prevention of corrosion of ductile iron, copper, grey iron and/or steel pipe and fittings used for construction of the Infrastructure.

.1 The corrosion report shall be subject to an engineering analysis of the potential of external pipe corrosion due to graphitization, pitting corrosion, galvanic corrosion, microbiologically influenced corrosion, corrosion due to dissimilar electrolytes and/or stray current corrosion. The report shall outline the construction methods to provide maximum corrosion protection requirements based on the latest best management practices; and

.2 A geotechnical report may also be required for sites with adverse soil conditions, contaminated soils, groundwater, or other such conditions which, in the opinion of the CRD, require special attention.

.2 All recommendations provided in the report shall become requirements for design and subsequent construction of water Infrastructure.

4.2 CORROSION PROTECTION REQUIRED FOR BURIED METALS

.1 Design shall provide for external corrosion protection of all buried metals, pipe fittings and restraints.

.2 As a minimum, corrosion protection shall be with a petrolatum based wax and tape coating system approved for potable water per AWWA C217.

.3 At the request of the CRD other corrosion protection systems may be required.

4.3 CRD SUPPLEMENTARY APPROVED MATERIALS

.1 An Approved Standard Materials List is provided by the CRD and is to be incorporated into

waterworks Infrastructure work. Refer to *Appendix A – Approved Standard Materials* on the CRD Website.

4.4 CRD SUPPLEMENTARY DETAIL DRAWINGS

.1 Detail Drawings are provided by the CRD and are to be incorporated into the design. Refer to *Appendix C – Standard Drawings* on the CRD Website.

4.5 UTILITY NOTIFICATION AND CONFLICT RESOLUTION

.1 Owners of overhead and underground utilities shall be contacted by the Applicant early in the pre-design stage.

.1 Utilities shall be detailed on drawings; and

.2 Utility conflicts shall be resolved by the Applicant and utility.

4.6 SEISMIC DESIGN STANDARDS

.1 Seismic design consideration may be required by the CRD, at the Applicant's expense.

4.7 SYMBOLS FOR SERVICES

.1 All services shall generally be shown using symbols consistent with the overall Design Drawings.

.2 All symbols shall be clear, legible and subject to meeting Approval in Principle of the CRD.

4.8 EXISTING INFRASTRUCTURE

.1 Existing water mains, sanitary sewers, drain sewers, force mains, ditches, pavement, curbs, sidewalks, underground wiring, gas, poles, trees, service connections, other underground utilities including all other appurtenances and any other Infrastructure shall be indicated in plan and profile:

.1 dimensioned from existing iron pins or lot lines;

.2 be generally shown lighter and subordinate to proposed improvements;

.3 extend beyond work area limits to provide sufficient detail for transitions and connections; and

.4 shall be clear, legible and subject to meeting Approval in Principle of CRD IWS.

4.9 PROPOSED WATER INFRASTRUCTURE

.1 Proposed water Infrastructure shall be indicated in plan and profile.

.1 shall be fully dimensioned and detailed with offsets from existing iron pins and property lines;

.2 be generally shown as bolder and standing out from existing Infrastructure;

.3 extend beyond work area limits to provide sufficient detail for transitions and connections; and

.4 shall be clear, legible and subject to meeting Approval in Principle of the CRD.

5. UTILITY RIGHTS-OF-WAY

5.1 GENERAL

.1 Utility rights-of-way locations should be selected to avoid environmentally sensitive areas such as watercourses, wetlands, wildlife migration corridors and forested areas.

.2 All proposed rights-of-way for new Infrastructure shall be shown clearly standing out from existing rights-of-way. These shall be tied to iron pins in each lot, together with their width, permitted use, and the note "acquire" or "proposed". Rights-of-way documents shall be prepared as detailed in these specifications.

.3 All existing rights-of-way or easements and their permitted uses shall be confirmed through the Land Titles Office and be shown clearly on the Design Drawings. Registration numbers shall be shown.

.4 A statutory rights-of-way drawing detailed as “acquire or proposed” shall also be prepared and submitted to the CRD as an independent figure drawing specific to the statutory rights-of-way.

5.2 RIGHTS-OF-WAY TO BE ACQUIRED

.1 Where the CRD will assume responsibility for maintenance and/or ownership, the Applicant shall be responsible for all costs and preparation of all rights-of-way documents.

.2 The Applicant must grant, or acquire, statutory rights-of-way in favour of the CRD in such locations and with such dimensions as necessary to accommodate the water Infrastructure and services required to serve a Subdivision or Development and the rights-of-way must be in a form acceptable to the CRD.

.1 Where a single right-of-way is required, the minimum acceptable width is 6.0 m; and

.2 A water main shall be located a minimum of 1.50 metres from the edge of the rights-of-way. The rights-of-way shall be registered using the language provided in the CRD standard rights-of-way documents, *Refer to Appendix B – Standard Forms,* Standard Rights-of-Way Part 1 and Part 2.

.3 A right-of-way shall be located within a single property, preferably adjacent and parallel to property boundaries and shall be clear of proposed building sites and improvements.

.4 A right-of-way shall be provided by the Applicant for the eventual extension of the water main as required by CRD IWS.

5.3 PRE-EXISTING EASEMENTS AND RIGHTS-OF-WAY

.1 If water Infrastructure development is within an existing easement or rights-of-way, the Applicant shall, at their own expense before proceeding with construction, obtain any amendments necessary to permit the construction, reconstruction, inspection, operation, repair, maintenance and use of the water Infrastructure.

5.4 EASEMENTS AND RIGHTS-OF-WAY MUST BE DEPOSITED AND REGISTERED

.1 Rights-of-way and easement documents must be deposited and registered in the Land Title Office before the Subdivision plan is signed and/or the building permit issued. Alternatively, the Applicant may provide a solicitor's undertaking, satisfactory to the CRDs solicitor, that the Subdivision plan and rights-of-way documents will all be deposited in the sequence required by the CRD’s solicitor and that, if not possible, the Subdivision plan will immediately be returned directly to the Approving Officer.

6. DRAWING STANDARDS AND GUIDELINES FOR ALL DRAWINGS

6.1 DRAWING STANDARDS

.1 When water Infrastructure works are a small part of an overall larger design and development:

.1 Generally, water Infrastructure Design Drawings shall be of the same standard as all the

other civil drawings within a larger development. All drawings shall be clear, legible and subject to meeting the approval of the CRD.

.2 When water Infrastructure works are the only portion of the design and development.

.1 Design drawing standards shall conform to the latest edition of the MMCD Design Guideline Manual unless otherwise approved by the CRD; and

.2 For uniformity, civil drawings shall conform to the MMCD Civil 3D templates and standards unless otherwise approved by the CRD.

6.2 DESIGN DRAWING PACKAGE

.1 A design drawing package shall include:

.1 General:

.1 Project cover sheet complete with key plan, designer's name, address telephone number, project number, site location, legal description, and an index of the Design Drawings;

.2 Legend; and

.3 General Notes.

.2 Plans:

.1 Plan drawings complete with profile drawings.

.3 Sections:

.1 Cross sections where warranted.

.4 Standard details:

.1 Details of components.

6.3 GENERAL DRAWING INFORMATION AND CALCULATION SUBMISSION

.1 A north arrow, existing and proposed street names shall be shown on the Design Drawings. The north arrow shall be generally oriented towards the top of the sheet.

.2 Unless otherwise approved by the CRD, all design plans shall be prepared on ANSI D sized sheets.

.3 Unless otherwise approved by the CRD, provide plan and profile on the same sheet meeting the following requirements:

.1 Plan view shall be in the lower half of the page and profile in the upper half; and

.2 The use of the plan on one sheet and profile on a second sheet shall not be accepted.

.4 Pump station, meter station, reservoir, pressure control station, other structures – provide detailed Design Drawings including key plans and location plans together with sealed copies of design calculations for each structure.

.5 Special detail plans as required.

.6 Irrigation details and specifications if applicable.

6.4 SCALES

.1 All drawings and dimensions shall use metric units and provide sufficient detail and display to fully describe the design.

.2 When the water design is part of a larger overall development, scale size shall coordinate with the

larger overall Design Drawings of which the water design is only a small part of.

.3 Generally:

.1 Plans/Profiles: H 1:250 & V 1:50 or H 1:500 & V 1:100. (5 x exaggeration of vertical scale);

.2 Cross Sections: 1:100;

.3 Details: 1:20; and

.4 Or as determined by the CRD.

.4 Any deviation in scale size shall be approved by the CRD prior to any detail drawing submission.

6.5 TOLERANCES

.1 Shall be sufficient for the purposes of the design drawing to meet design constraints and shall provide the required accuracy to construct the Infrastructure.

6.6 KEY PLAN

.1 A key plan shall show project location and organization of the drawings including:

.1 adjacent streets and existing lots with streets named;

.2 property being subdivided shown shaded;

.3 north arrow; and

.4 if a subdivision is to be developed in stages, each proposed stage shall be clearly outlined, and order of development indicated.

6.7 SITE PLANS, PLAN & PROFILE SHEETS

.1 Shall show all existing and proposed services including drainage, water, sanitary, road, street lighting, gas and hydro, on a legal base plan including:

.1 civic address with the property being subdivided shown shaded c/w legal description;

.2 plan of adjacent streets and existing lots with streets named and legal information of adjacent lots given;

.3 north arrow; and

.4 plan of adjacent streets and existing lots with streets named and legal information of adjacent lots given.

6.8 STANDARD NOTES

.1 In addition to project specifications, the following standard notes shall appear on all drawing submissions where applicable:

.1 Construction shall not commence without the following:

.1 The CRD has returned Design Drawings signed and marked Approved in Principle;

.2 Other regulatory bodies, authorities and jurisdictions have approved the design and agree that construction may move forward; and

.3 IHA has returned approved drawings and has issued a Waterworks Construction Permit.

.2 Contractor shall be registered with Work Safe BC;

.3 All water Infrastructure construction and materials shall be in accordance with CRD Water Engineering Specifications, CRD Standard Drawings and MMCD Standards;

.4 Water mains shall be Ductile Iron Pressure Class 350 to AWWA C151; or PVC DR18 to AWWA C900 or AWWA C905 or other material, approved in advance, on a case by case basis by CRD IWS;

.5 Provide a minimum 0.9 m and maximum 1.2 m of cover for water mains;

.6 Mark water mains below grade using a metallic detectable reinforced underground utility marking tape as per approved materials list. The tape shall be minimum 0.15 m wide, metallic blue in colour and shall be marked "CAUTION: WATER LINE BURIED BELOW". Install tape on top of the pipe bedding 300 mm above the top of the pipe;

.7 Maintain a minimum of 3.0 m horizontal clear separation and 0.45 m clear vertical separation between water mains and all sanitary sewers/services and drain sewers/services except where noted and approved by the CRD . Sanitary sewer mains/services shall not cross over water mains. For a sanitary force main, where the above-noted separations cannot be achieved, the force main shall be gasketed pressure rated pipe with a minimum DR 28 PVC or alternatively minimum DR 17 HDPE;

.8 Maintain a minimum of 3.0 m horizontal clear separation and 0.45 m clear vertical separation between water services and sewer services, sanitary or storm/drain. In special circumstances, where a sanitary sewer or storm drain service is lower than a water service by more than 0.45 m in elevation the horizontal offset may be reduced to no less than 1.0 metres except where noted and approved by the CRD. IHA approval is required for any reduction in the separation;

.9 For crossing of existing sewers, where the water main does not have the required 0.45 m vertical separation, wrap water main joints with petrolatum based wax and tape coating system approved for potable water per AWWA C217 3.0 m either side of the sewer main. Where a vertical separation of 0.15 m cannot be achieved, special mitigative measures shall be approved by the CRD;

.10 All metals, pipe fittings and restraints shall be wrapped with petrolatum based wax and tape coating system approved for potable water per AWWA C217;

.11 Where new catch basin (CB) leads do not have a 0.45 m vertical separation, wrap CB lead joints with petrolatum tape per AWWA C217;

.12 Maintain a minimum of 1.50 m clear horizontal and 0.15 m clear vertical separation between water mains and electrical conduits, gas mains and telephone conduits except where noted and approved by the CRD;

.13 Maintain a minimum of 1.0 m clear horizontal and 0.15 m clear vertical separation between water services and electrical and telephone services except where noted and approved by the CRD;

.14 Maintain a minimum of 1.50 m clear horizontal and 0.15 m clear vertical separation between water services and gas services except where noted and approved by the CRD;

.15 All backflow devices must be registered and tested at the time of installation, and annually thereafter, by a Certified Tester as per CRD Cross Connection Control Bylaw No. 3516;

.16 Contractor shall conduct a pressure test in accordance with CRD Water Engineering Specifications to AWWA standards and in the presence of CRD personnel;

.17 Contractor shall flush and disinfect water mains in accordance with AWWA Standards and as approved by the CRD. Water samples for health tests to be collected and processed by the CRD. Provide 24-hour notice to the CRD for sample collection;

.18 Neutralize chlorine solutions in accordance with Ministry of Environment and Fisheries and Oceans Canada regulations prior to discharge to any drainage course;

.19 Contractor shall provide 24-hour notice to the CRD prior to proceeding with any water Infrastructure work;

CRD shall schedule an available time at their discretion;

.20 Where practical, service lines and meter boxes shall be installed to finished grade, outside of driveways or paved areas; and

.21 Any temporary or permanent connection to the Juan de Fuca Water Distribution System or the CRD Supply System shall be performed by CRD personnel only.

6.9 ADDITIONAL WATERWORKS INFORMATION

.1 In addition to the preceding information provide the following information as part of the Waterworks Plan:

.1 The size, type and class of pipe or DR ratio, and class of bedding;

.2 Provide location of fire hydrants, horizontal distance of isolation valve from hydrant and other related appurtenances;

.3 Location of rock cuts and maximum depth of rock excavation;

.4 The offset of the water main centreline from the property line;

.5 If designed, deflection of pipe complete with the specific pipe manufacturers name that has approved deflection of their pipes;

.6 Extent of work required of the CRD in making the connection to the existing Infrastructure;

.7 Water services invert including horizontal reference to lot corner iron pin;

.8 Invert location of all bends, reducers, couplings, fittings, hydrant tees, structures, pipe material and all appurtenances; and

.9 Valve inverts including horizontal reference to two fixed points.

6.10 PUMP STATIONS, METER STATIONS, PRESSURE CONTROL STATIONS & RESERVOIRS

.1 In addition to the preceding information Design Drawings shall include the following information as a minimum:

.1 All facilities shall have a civic address provided by the municipality or electoral area prior to acceptance;

.2 Plan view of the station detailing all pipe work, meters, valves, etc., within the station, architectural, mechanical and structural details, ventilation, controls, lighting, electrical disconnects, SCADA, drainage, etc.;

.3 Schematic drawings of pipe work shall augment detailed Design Drawings;

.4 Section view of the station showing finished ground, station and pipe work elevations related to geodetic datum, drainage, hatches, etc.;

.5 Location plan showing legal (street/intersection) location of station;

.6 Site plan showing topographic details and all utility information for approximately a thirty (30) metre radius around the station;

.7 Material list of each item detailing manufacturer, pressure class, size, dimensions (if applicable), ordering information, etc.;

.8 Pump curve (for pump stations) showing the total dynamic head (as geodetic elevation) on the y axis in metres and on the x axis the flow in litres per second; and

.9 Commissioning/start-up plan and pump tests.

6.11 MECHANICAL ROOM (IF APPLICABLE AND AS APPROVED BY THE CRD)

.1 In addition to the preceding information Design Drawings shall include the following information as a minimum:

- .1 Overall Plan View;
- .2 Provide overall site plan with location of water service from the connection to water main in the public rights-of-way to location of water entry to building;
- .3 Show location of water pipe through building by emphasizing using a bold line, the water service from entry to building to mechanical meter room;
- .4 Show remote readout and wiring;
- .5 Detailed Mechanical Room to include the following:
  - .1 Backflow prevention assemblies;
  - .2 Wiring for remote readout;
  - .3 Strainers are required for all compound meters and fire line meters 50 mm and larger; and
  - .4 Bypass with valves and hose bib.

.2 Mechanical rooms are special case only and generally not acceptable. Mechanical rooms shall be rejected or approved on a case by case basis by the CRD.

6.12 REQUIREMENTS FOR OTHER UTILITIES

.1 In addition to the preceding information, complete details of all other utilities shall be obtained from the appropriate utility company and shown, including the following:

- .1 Existing utilities;
- .2 Utility offset from property line and/or iron pin;
- .3 Lot service connections and other appurtenances; and
- .4 Existing and proposed poles shall be dimensioned from the pole centre to property line and/or pin.

END OF SCHEDULE A – DESIGN STANDARDS & GUIDELINES

Contents

1. GENERAL

1.1 General Requirements

.1 This section shall govern the design criteria for waterworks Infrastructure owned and operated by the CRD.

.2 This section shall be read in conjunction with Schedule A – Design Standards & Guidelines.

2. CRITERIA

2.1 Water Distribution System Pressure Required

.1 Water pressure must be consistent with existing pressure zones.

.2 The water system shall be designed to provide acceptable domestic water pressure at the property line on each parcel as follows:

.1 Maximum Desired System Static Pressure:
830 KPa (120 psi):

.1 Up to 1035 KPa (150 psi) may be allowed in special circumstances subject to approval by the CRD; and

.2 In areas where static pressure in the existing water supply system exceeds 1035 KPa (150 psi.), materials and fittings used shall be consistent with the anticipated pressures.

.2 Minimum Desired System Static Pressure in the main:
415 KPa (60 psi), and;

.3 Minimum System Dynamic Pressure at the property line at peak hour:
280 KPa (40 psi), and;

.4 Minimum System Dynamic Pressure in the main at max day plus fire flow conditions:
140 KPa (20psi).

.3 Where new water Infrastructure and extensions would impact the service level to existing customers, the Applicant shall be required to upgrade the existing distribution system to provide acceptable water supply and pressure as determined by the CRD.

2.2 Water Demand

.1 Residential – Number of People per Unit

Land Use	Description	Average Occupancy
Low Density	Any residential development with a gross density of less than of 20 units/hectare	3.2 persons/unit
Medium Density	Any residential development with a gross density of greater than 20 units/hectare and less than 50 units/hectare.	2.8 persons/unit
High Density	Any residential development with a gross density more than 50 units/hectare.	1.8 persons/unit

.2 Average Day Demand

Average Day Demand	545 Litres/capita/day
Commercial/Institutional/ Institutional	18.7 m^3/day/ha 1.87 L/day/m^2

.3 Peaking Factors

Maximum Day	2.5 times Average Day Demand
Peak Hour	1.4 times Maximum Day Demand*
* For small isolated areas, higher peak hour demand may be required, as determined by the CRD.	

.4 Reservoirs

.1 See section 20.2 Storage

2.3 WATER VELOCITY

.1 Unless otherwise approved by the CRD the max allowable design velocity shall not exceed:

.1 distribution lines at Peak Hour flow – 2.0 m/s;

.2 distribution lines – Maximum Day plus Fire Flow – 3.5 m/s; and

.3 pump supply, reservoir, feeder mains and transmission mains – 2.5 m/s.

2.4 FIRE FLOW

.1 Fire flow requirements shall be calculated in accordance with the latest "Water Supply for Public Fire Protection – A Guide to Recommended Practice", published by the Fire Underwriters Survey (FUS).

.2 Should a participating municipality, jurisdiction or service area have fire flow requirements greater than FUS, the greater fire flow requirement shall prevail and be used in design.

3. WATER MAINS

3.1 GRADE

.1 All water mains shall be installed to a designed grade in general conformance to the right-of-way grades. Grades shall be straight lines between defined deflection points.

.2 No water main shall be laid flat and where possible shall have a minimum grade of not less than 0.1%. Design grade shall minimize the high points to avoid installation of air release valves.

.3 When the grade equals or exceeds 10%, provide anchorage, joint restraints, trench dams and trench drainage in accordance with CRD Standard Drawings complete with drain pipe. Provide a geotechnical engineering report where appropriate and when required by the CRD.

3.2 DEPTH OF BURY

.1 Subject to approval by the CRD, cover over all water mains and services measured from the top of the pipe/tube to the exposed surface (finish grade) over the pipe shall not be:

.1 less than 0.9 m., or

.2 greater than 1.2 m.

.2 Special consideration is required for frost and mechanical protection in cases where minimum depths cannot be attained such as at bridge crossings and in chambers.

3.3 UNDERGROUND UTILITY MARKING TAPE

.1 All new water mains shall have reinforced detectable marking tape installed above the water main in accordance with the CRD Standard Details Drawings. Acceptable marking tapes are listed in *Appendix A – Approved Standard Materials*.

3.4 WATER MAIN LOCATION

.1 Water mains shall be located within a road allowance or statutory right-of-way not less than 1.5 meters from edge of road allowance or statutory right-of-way. A greater offset may be required by the CRD for water mains with cover greater than 0.9 m. A greater offset may also be required based on requirements of Local, Provincial or Federal levels government or their agencies that may have jurisdiction.

.1 In all cases, the width of rights-of-way shall be sufficient to permit an open excavation with side slopes in accordance with the WorkSafe BC Regulations, without impacting or endangering adjacent structures and property. Adequate offset from property boundaries and structures shall be provided so that no caging or shoring is required for future maintenance works;

.2 The Applicant's Consulting Engineer shall provide cross sections indicating the minimum safe distances to adjacent building footings based on a safe angle of repose from the limits of the excavation; and

.3 In no case shall the right-of-way width be less than 6.0 m.

.2 Where water Infrastructure and appurtenances requiring maintenance are located within a right-of-way, provide maintenance road access from a public road. The maintenance access must be sufficiently wide and structurally adequate to support the maintenance vehicles for which the access is intended.

.3 Other than locations where a water main may extend to the limits of the development for future connection and the water main crosses perpendicular to a side walk/curb and gutter location, water mains shall not be located under sidewalks/curb and gutter or where sidewalks/curb and gutter may be constructed in the future.

.4 The water main shall extend at least 1.2 m beyond the pavement or back of sidewalk, whichever is further, at the extreme end of a cul-de-sac.

.5 Where the Applicant requesting service does not have a water main fronting the property, the Applicant shall be responsible for all costs to supply and install the water main along the full frontage of the property to be developed and any extension required to the most convenient existing water main that will provide an adequate supply of water, all of which shall be to the approval of the CRD.

.1 Water mains shall extend across the full width of each lot and extend to the boundaries of the subdivision plan to provide for further extension and connection beyond the subdivision where such extension is feasible.

.6 Where pipes of the same pressure zone intersect, and a connection will not impair supply in the pipe, the pipes shall be joined with appropriate fittings to create an active loop.

.7 A water main crossing under a water course, arterial highway, designated public roads and railways shall be installed in a carrier pipe. Trenchless installation shall be required unless otherwise accepted by the CRD.

3.5 LOOPING OF WATER MAINS

.1 Where the final road pattern prevents the looping of the water main network within the roadway, a water main may be required to be looped through a statutory right-of-way registered in favour of the CRD.

.1 The loop portion of the water main shall be a minimum of 150 mm diameter or as directed by the CRD; and

.2 No services shall be connected to the loop portion of the water main within the right-of-way.

.2 Where dead ends are unavoidable, and as approved by the CRD, flush out/blow-offs are required.

.1 Temporary dead ends may be approved by the CRD in select circumstances. Temporary dead ends require a means of flushing acceptable to the CRD.

.3 Where practical, and approved by the CRD, a hydrant may serve a secondary role as a blow-off.

3.6 HYDRAULIC ANALYSIS

.1 Use a proven network analysis computer model based on the Hazen-Williams formula. Hydraulic analysis must be based on the Hazen-Williams formula using a “C” coefficient of 120.

.2 The CRD reserves the right to amend the coefficient at any time prior to and during design.

.1 The Applicant shall have no claim for loss or damages due to amendment of the coefficient.

3.7 DEFLECTION OF PIPE

.1 Subject to Approval in Principle by the CRD curved alignments parallel to property lines may be designed.

.1 Maximum joint deflections shall be limited to half the maximum deflection specified by the pipe manufacturer; and

.2 The Consulting Engineer shall confirm the pipe manufacturer/product complete with allowable deflection and provide details on the drawings.

3.8 HORIZONTAL SEPARATION FROM OTHER UTILITIES

.1 Unless otherwise required by the CRD and IHA, horizontal separation of Water Mains/Services from other buried utilities are as follows:

Utility	Water Main Minimum Horizontal Separation (meters)	Water Service Minimum Horizontal Separation (meters)
Sanitary Mains/Services	3.0	1.0
Storm Mains/Services	3.0	1.0
Gas	1.5	1.5
Electrical	1.5	1.0

.2 In special circumstances, specifically in rock or where the soils are determined to be impermeable, lesser separation than 3.0 m may be permitted only if jointly approved by the CRD and the IHA and provided that:

.1 the sewer main and water main/service are installed in separate trenches and the water main/service invert is at least 0.45 m above the crown of the sanitary sewer or storm sewer and the joints of the water main/service are wrapped an approved petrolatum tape system installed to manufacturers specifications and in accordance with the latest version of AWWA Standards C217, and C214 or C209.

.3 Where it is necessary for the water main/service to cross other underground utilities, the crossing shall be made at an angle of no less than 45 degrees.

.1 the joints of the water main/service, shall be wrapped with an approved petrolatum tape system installed to manufacturers specifications and in accordance with the latest version of AWWA Standards C217, and C214 or C209; and

.2 As a minimum the water main/service joints shall be wrapped for the entire length of the watermain/service until the water main/service is greater than 3.0 m horizontal distance as measured perpendicular from the utility.

.4 Horizontal separation shall be measured perpendicular from the closest side of the storm or sanitary main/service.

.5 Where it is not possible to obtain the horizontal separation indicated above, the Consulting Engineer shall identify the problem horizontal separation and provide a solution subject to review and acceptance by both the CRD and the IHA.

.1 The CRD and IHA may suggest a solution to the Consulting Engineer at their discretion; and

.2 The Applicant shall have no claim for loss or damage for rejection of the Consulting Engineer's solution and any subsequent re-design.

3.9 VERTICAL SEPARATION FROM OTHER UTILITIES

.1 Unless otherwise required by the CRD and IHA vertical separation of Water Mains/Services from other buried utilities are as follows:

Utility	Water Main Minimum Vertical Separation (meters)	Water Service Minimum Vertical Separation (meters)
Sanitary Mains/Services	0.45	0.45
Storm Mains/Services	0.45	0.45
Gas	0.15	0.15
Electrical	0.15	0.15

.2 Where a Water Main/Service crosses a sanitary sewer or storm sewer the sewer shall be below the water main/service.

.3 Where it is not possible to obtain the vertical separation indicated above, the Consulting Engineer shall identify the problem vertical separation and provide a solution subject to review and acceptance by both CRD IWS and IHA.

.1 The CRD and IHA may suggest a solution to the Consulting Engineer at their discretion;

.2 The CRD and IHA may request the sewer to be constructed of pressure rated pipe of the same or greater pressure rating of the water main with fused joints and hydrostatically pressure tested to same test pressure/duration as the water man with zero leakage and zero drop in test pressure; and

.3 The Applicant shall have no claim for loss or damage for rejection of the Consulting Engineer's solution and any subsequent re-design.

3.10 PIPE SIZE

.1 The water distribution system is a pipe network of transmission mains, feeder mains and distribution mains.

.1 Design size of the pipes shall be determined by the requirements of the overall network and not the individual needs of an Applicant;

.2 Off-site waterworks improvements may be required to meet the servicing requirements of the overall network at the Applicant's cost; and

.3 Proposed pipe sizes shall be reviewed by the CRD prior to acceptance by the CRD.

.2 The water system shall be designed based on the water distribution system pressure and flows required. Design shall provide day to day domestic requirements for pipe diameter, system capacity and velocity specified in this section to meet the following conditions:

.1 New distribution and transmission water mains serving industrial properties shall be a minimum of 250 mm diameter;

.2 New distribution and transmission water mains serving multifamily (high density), commercial, or institutional properties must be a minimum of 200 mm diameter;

.3 Distribution water mains in residential areas (low to medium density) shall be a minimum of 150 mm diameter;

.4 Un-looped water mains serving single family residences on cul-de-sacs where no water main extension is planned and with no fire hydrants may be 100 mm diameter; and

.5 For distribution systems with fire hydrants, the minimum distribution water main pipe size is 150 mm diameter. Pipe size will increase dependent on the property and area serviced.

3.11 ABANDONED PIPE

.1 Generally, all abandoned disused pipe shall be removed if within 0.5 m from the edge of any new water main trench zone. Pipe left in place shall be securely capped.

.1 The end of abandoned disused pipe shall be cut square and plugged with 20 MPa concrete. No concrete shall extend into the new water main trench zone; and

.2 At the discretion of the CRD, abandoned pipe shall additionally be completely filled with a flowable concrete mixture (controlled density fill) with an unconfined compressive strength of 2 MPa to prevent collapse of the old pipe.

3.12 CROSS CONNECTION CONTROL

.1 Design shall reflect the requirements the most recent edition of the CRD Cross Connection Control Bylaw No. 3516.

4. WATER SERVICES

4.1 GENERAL

.1 Water services including all related meters, meter boxes/chambers, shutoff valves and check valves shall be installed in the road allowance fronting the lot to be serviced or in a statutory-right-of-way. Generally, water services shall be complete with a shutoff, meter box/chamber, meter, and backflow preventer.

.1 Services 50 mm and larger diameter shall be supplied with an appropriate backflow prevention device according to the most recent edition of the CRD Cross Connection Control Bylaw No. 3516;

.2 Meters shall be installed by the CRD in all cases;

.3 Specifically, for 50 mm diameter services, the CRD shall require a meter setter to be installed by the Applicant; and

.4 Backflow prevention devices should be located on private property as close to the property line as possible.

.2 For new water mains not yet taken over by the CRD it is the Applicants responsibility to provide and install the water services complete with a water meter box or chamber/vault as required.

.3 For existing water mains owned and operated by the CRD, the CRD typically installs services complete with meter boxes. Chambers/vaults if required shall be installed by the Applicant.

.1 The CRD will install and stub-off the service line into the water meter box. The Applicant shall be responsible for all connections from the water meter box and downstream. The Applicant shall provide service line into meter box. CRD shall install meter.

.4 Service size should be calculated based on the designated land use including sprinkler systems and/or on-site hydrants, where applicable.

.5 Depth of cover for water services shall be the same as for water mains.

.6 Water services shall be installed from the water main to the property line, using the shortest practical route, and generally, perpendicular to the main. Water service tubing shall be detailed as one continuous piece between the corporation stop and curb stop for all services 50 mm or less in diameter.

.7 A water service shall be no more than 30 m long measured along the service from the water main to property line. Services greater than 30 m long are required to be approved by the CRD.

.8 Water meters shall be owned and maintained by the CRD.

.9 The minimum size of a service line servicing any one property shall be 19 mm in diameter.

4.2 SINGLE-FAMILY LOW DENSITY

.1 Service connections shall be provided to each lot and sized to suit water demands. Generally, this will include services 25 mm diameter and less.

.2 Water meter boxes shall be installed between 300 mm and 600 mm outside of the front property line and a minimum of 1.0 m from the property corner.

.3 A water meter box shall not be located within a driveway or area subject to traffic, where practical.

.4 The water meter box location shall be at the discretion of the CRD.

.5 A water meter complete with a backflow device shall be supplied and installed by the CRD at the Applicant's expense.

.6 Water services shall be a minimum of 19 mm diameter.

.7 Subject to approval by the CRD, a single-family duplex lot or two adjacent single-family lots may be provided with one single service connection at the main splitting into two separate connections adjacent to the property line.

.1 Dual service size shall be minimum 25 mm diameter from the water main;

.2 Service size shall be minimum 19 mm diameter from dual service to each meter; and

.3 Each dwelling unit shall have its own dedicated water meter.

.8 All services shall be installed with an approved meter box and dual check valve assembly unless otherwise approved by CRD IWS.

.9 Reference – CRD Standard Drawings.

4.3 MULTI FAMILY, COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL

.1 A service connection shall be provided to the property and sized to suit water demands.

.1 Properties shall be serviced with one meter;

.1 For combined domestic and fire line systems, the combined service shall be branched off to separate fire and domestic lines near the property line and a meter shall be provided on the domestic connection only.

.2 Multifamily properties that have frontage on a Highway with a watermain may be serviced with individual services/meters to each unit.

.2 On all potable water services, provide a meter with lockable bypass piping, which will allow the meter to be repaired without loss of water supply to the building. Install an approved testable backflow preventer.

.3 A water service designed and sized to be 50 mm or less in diameter may be installed with a water meter box. Offsets from property line will be the same as for single family residential services.

.1 For water services greater than 50 mm diameter a meter chamber/vault is required.

.4 The chamber/vault shall be installed within a Statutory Right-of-Way in favour of the CRD within the Applicant's property, adjacent to the front property line and a minimum of 2.0 m from the property corner or according to local bylaw set backs, whichever is greater.

.1 Generally, a water meter chamber/vault shall not be located within a driveway, parking lot or area subject to traffic; and

.2 The water meter chamber/vault location shall be at the discretion of the CRD.

.5 A water meter shall be supplied and installed by the CRD at the Applicant's expense. Properties will be supplied with a water meter only.

.6 An appropriate backflow prevention device shall be installed on private property after the water meter chamber/vault. Installation of an appropriate backflow device shall be the responsibility of the Applicant.

.7 For a fire line service (i.e. no domestic connection), a double check valve assembly shall be installed as close to the property line as possible.

.8 Where it is not practical to install a meter chamber in a statutory right-of-way, the CRD may consider a mechanical room to install a water meter.

.1 In all cases there shall be a right of access granted to the CRD to access all meter locations including meters installed in a mechanical room.

.9 Reference – CRD Standard Drawings.

4.4 STRATA

.1 The CRD will take ownership and operation of Infrastructure within a right-of-way registered in favour of the CRD through a strata only if there is a benefit to the CRD water system via looping or a potential system improvement i.e., water quality.

.2 Where the CRD will not be taking over ownership and operation of the water main on private property there shall be provisions for bulk metering and installation of an appropriate backflow preventer at the property line.

.3 Where the CRD will take over ownership and operation of the water main and service on private property, installation and cost shall be by the Applicant with a metered service to each strata property.

.4 A chamber/vault shall be installed within a statutory right-of-way in favour of the CRD within the Applicant's property, adjacent to the front property line and with a minimum of 2.0 m from the property corner or according to local bylaw set backs, whichever is greater.

.5 Generally, a water meter chamber/vault shall not be located within a driveway, parking lot or area subject to traffic.

.6 The water meter chamber/vault location shall be at the discretion of the CRD.

.7 A water meter shall be supplied and installed by the CRD at the Applicant's expense. Properties will be supplied with a water meter only.

.8 An appropriate backflow prevention device shall be installed on private property after the water meter chamber/vault. Installation of an appropriate backflow device shall be the responsibility of the Applicant.

.9 Where it is not practicable to install a meter chamber in a Statutory Right-of-Way, the CRD may consider a mechanical room to install a water meter.

.1 In all cases there shall be a right of access granted to the CRD to access all meter locations including meters installed in a mechanical room.

.10 Service shall be as for single family residential, or commercial, industrial, Institutional, multi – family, as applicable.

.11 Reference – CRD Standard Drawings.

4.5 IRRIGATION

.1 Irrigation services may be required by the Local or other governments having jurisdiction. The CRD has no involvement with when and where an irrigation service may be required.

.2 All irrigation services shall be sized to suit water demand and individually metered followed by an approved testable backflow preventer.

.3 Reference – CRD Standard Drawings.

4.6 WATER SAMPLING STATIONS

.1 Shall be as required, as requested by the CRD.

.2 Reference – CRD Standard Drawings.

4.7 ABANDONING WATER SERVICES

.1 Services equal to or less than 50 mm diameter that are no longer required shall be disconnected at the water main by the CRD at the Applicant's cost. The water main typically shall remain live.

.1 The corporation stop, and service saddle shall remain in place;

.2 The corporation stop shall be fully closed, the service tube disconnected and cut back 1.0 m from the corporation stop and the corporation stop capped with a suitable bronze cap; and

.3 The entire service saddle and corporation stop shall be cleaned off and wrapped with a petrolatum tape/paste system suitable for potable water systems meeting AWWA standards.

.2 Services greater than 50 mm diameter that are no longer required shall be disconnected at the water main by the CRD at the Applicant's cost. Subject to review by the CRD, the water main may require depressurization for abandonment of the service.

.1 The service valve shall be closed and permanently capped off;

.2 The valve box shall be removed;

.3 The service pipe shall be removed a minimum of 1.0 m from the water main and capped; and

.4 Wrap all metals with a petrolatum tape/paste system suitable for potable water systems meeting AWWA standards.

5. MATERIALS

5.1 GENERAL

.1 Approved Materials are listed in *Appendix A – Approved Standard Materials*.

.2 Where applicable, all materials shall conform to CSA standards and meet NSF 61 (NSF/ANSI 61 Drinking Water System components).

.3 High Density Polyethylene (HDPE) pipe may be used in limited circumstances subject to approval by the CRD.

.4 Stainless steel pipe shall conform to the latest edition of AWWA C220 Stainless Steel Pipe100 mm and larger. All stainless-steel pipe shall be type 316L unless otherwise approved by the CRD. All piping 100 mm and larger in chambers shall be a minimum of Schedule 10S. Piping less than 100 mm may be Schedule 40 SS – type 316L unless otherwise approved by the CRD.

.5 Fittings used shall meet or exceed the pressure class of pipe.

.6 All water service tubing joints shall be compression type. Runs of tubing shall be of one full length with no joints from corporation stop to curb stop.

.7 Single broad strap stainless steel service saddle and bronze bushings to match the pipe and connection sizes shall be provided for each proposed water service connection.

.8 A valve box shall be provided with each gate valve and as required for other appurtenances.

.9 Reference – CRD Standard Drawings.

6. FITTINGS

6.1 GENERAL CONFIGURATION AND TYPE

.1 Generally, all fittings and appurtenances shall have standard push on bell and spigot (to AWWA C111 Tyton), flange, or mechanical joints.

.2 All fittings shall conform to CRD Water Engineering Specification, *Appendix A – Approved Standard Materials.*

.3 The design pressure rating of all fittings shall meet or exceed the pressure class of the pipes they are connected to.

7. FIRE HYDRANTS

7.1 LOCATION AND SPACING

.1 Hydrants shall be in the boulevard and should preferably be located at or near a street intersection; otherwise they may be located on the projection of the property line dividing two lots. Consult with the local Fire Department and CRD to confirm proposed hydrant locations.

.2 A hydrant shall not be located within 3 m of a utility pole, light standard or other obstructions or within 1 m of underground utility or open ditches.

.3 Hydrants shall be located a minimum of 1.2 m from face of curb and a maximum of 2.5 m.

.4 Hydrant spacing shall be the most conservative of either the Fire Underwriters Survey Guide or the following:

Zoning	Maximum Spacing Between Hydrants (meters)
Low Density (One and Two Family) residential areas with more than 3.0 meters separation between houses	150
Low Density (One and Two Family) residential areas with less than 3.0 meters separation between houses	90
Industrial, commercial, institutional, apartments/multi-family residential or other high-density areas	90

.5 Reference – CRD Standard Drawings.

7.2 General Configuration and Type

.1 Fire hydrants shall conform to the CRD Engineering Specification, *Appendix A – Approved Standard Materials.*

.2 Hydrants shall conform to the latest version of AWWA C502, Dry Barrel Fire Hydrants and shall be rated for a minimum working pressure of 1380 kPa (200 psi).

.3 Fire hose connection ports shall comply with the requirements of the fire department of the jurisdiction where the water Infrastructure is installed.

.4 All hydrants shall be thrusted including the tee on water main and fully restrained.

.5 Hydrants shall be self-draining unless groundwater conditions dictate otherwise. The Consulting Engineer shall apply best practices for cross connection control.

8. VALVES

8.1 Location and Spacing

.1 In general, valves shall be located at intersections and shall be positioned so that the distance between valves is not more than 300 m. Valves shall also be provided between hydrants so they may be isolated in the case of a line break.

.2 A minimum of two valves are required at a tee intersection and a minimum of three valves are required at a cross-intersection.

.1 Valves at intersections shall be flanged to the tee or cross.

.2 Valves shall be located so that each section of the main may be isolated without affecting adjacent mains and so that not more than one hydrant is isolated by a valve; and

.3 Where deemed necessary by the CRD, additional valves may be required.

.3 Two valves shall be provided at a hydrant assembly:

.1 A gate valve, flanged to a flanged tee on the hydrant lead. Hydrants shall not be flanged to the main or gate valve; and

.2 A gate valve flanged to the flanged tee at the main acting as a mainline valve.

.4 Not more than 1 hydrant isolated and not more than 20 service connections isolated.

.5 Line valves or hydrant valves shall not be located within 0.60 m of a curb line, in a ditch, or above another utility.

8.2 GENERAL CONFIGURATION AND TYPE

.1 Valves to fittings shall be flange connection. The position of the valve in line shall be vertical.

.2 Valves to pipe shall be bell and spigot (Tyton) connection.

.3 Valves shall be the same size and class of the pipe in which they are installed up to and including 300 mm diameter. For mains larger than 300 mm diameter, and if approved by the CRD, valves may be one diameter size smaller.

.4 Gate valves shall be installed complete with a valve box and sleeve.

.5 Extension pieces complete with valve riser guide shall be used where valve bury is deeper than 1.2 m below finished grade. Valve nut extension rods shall be a minimum 600 mm below finished grade.

.6 On service connections, greater than 50 mm diameter, a gate valve the same size of the service complete with valve box for surface access shall be flanged to an appropriate tee fitting on the water main to act as the corporation stop.

.7 Resilient seat gate valves without a gear box, conforming to the latest version of AWWA C509, shall be used for all pipes.

.8 Valves shall have a 31 mm (1¼ inch) square operating nut. Valves shall open to the right (clockwise).

.9 Use of butterfly valves requires approval by the CRD.

.10 Valves shall conform to the CRD Water Engineering Specification, *Appendix A – Approved Standard Materials*.

8.3 WATER MAIN VALVE BOXES

.1 All buried gate valves shall be installed with a valve box and shall be approved by the CRD and be:

- .1 cast iron and telescoping so that surface loads are not transmitted to the valve body or pipeline; and
- .2 a minimum of 400 mm of adjustment shall be available on all valve boxes.

.2 Valve box lids shall have a non-rocking fit and extend a minimum of 70 mm into the valve box from the lid.

.3 Valve box risers shall be minimum DR35 – 150 mm diameter PVC Pipe.

.4 Reference – CRD Standard Drawings.

9. AIR VALVES

9.1 LOCATION AND SPACING

.1 Where required by the CRD, combination air valves shall be installed at the high points of all mains of 200 mm diameter and larger, except as follows:

- .1 Where the difference in elevation between the high point and low point of the water main is less than 600 mm;
- .2 Where it can be shown that air pockets will be carried by typical flows; and
- .3 Where active service connections are suitably located to dissipate entrapped air.

.2 The Consulting Engineer shall minimize the requirement for air valves through good design.

.3 Reference – CRD Standard Drawings.

9.2 GENERAL CONFIGURATION AND TYPE

.1 All air valves shall be combination air release valves. Bushings, reducers and unions to be used in the valve connection shall be brass manufactured to ASA specification A 40.2 using ASTM B62 Bronze. Nipples shall be standard brass and threaded at both ends.

.2 Air valves for water mains greater than 300 mm diameter shall be approved by the CRD.

.3 Typical air valve sizes, subject to design analysis, are as follows:

.1 100 mm to 300 mm diameter pipe – 25 mm; and

.2 Larger than 300 mm diameter pipe – minimum 50 mm or special design.

.4 The Consulting Engineer shall apply Best Practices for cross connection control.

.5 All combination air valves shall conform to CRD Water Engineering Specification, *Appendix A – Approved Standard Materials.*

10. FLUSH OUTS AND BLOW OFFS

10.1 GENERAL CONFIGURATION AND TYPE

.1 A 100 mm flush valve blow-off or 50 mm flush valve blow-off shall be installed on all dead-end mains.

.2 Shall conform to the CRD Water Engineering Specification, *Appendix A – Approved Standard Materials.*

.3 Where practical, and approved by the CRD, a hydrant may serve a secondary role as a flush out and blow-off.

.4 Reference – CRD Standard Drawings.

11. CHAMBERS

11.1 GENERAL CONFIGURATION AND TYPE

.1 Drains from chambers or manholes containing valves, blow-offs, meters or other appurtenances shall be connected directly to a storm drain. Chambers or manholes may be drained to the surface or to absorption pits, subject to adequate soil conditions. The Consulting Engineer shall apply best practices for cross connection control.

.2 Chambers or manholes containing valves, blow-offs, meters, or other appurtenances should allow adequate room for maintenance, including headroom and side room.

.3 Access openings must be suitable for removing valves and equipment. The chamber is to be provided with a drain complete with backflow prevention, to prevent flooding of the chamber.

.1 Rock pits may be considered subject to suitable soil and groundwater conditions; and

.2 A pumping system may be required for drainage.

.4 Adequate venting, lighting and heating may be required. Access and ventilation must meet Work Safe BC requirements.

.5 Where suitable all chambers shall be designed with stairs and suitably opening hatches to mitigate issues with confined spaces.

.6 Shall conform to the CRD Water Engineering Specification, *Appendix A – Approved Standard Materials.*

12. TEMPORARY TEST POINTS

12.1 GENERAL CONFIGURATION AND TYPE

.1 Temporary test points shall be detailed on all Design Drawings.

.2 As necessary, provisions shall be provided for flushing and cleaning of the mains and services.

.3 As necessary, provisions shall be provided for hydrostatic pressure testing, disinfection, and bacterial testing:

.1 An air valve connection may be used as a test point after the corporation stop;

.2 A service connection may be used as a test point after the curb stop; and

.3 For the purposes of bacterial testing no test point (sample location) shall be spaced greater than 330 m from adjacent test points (sample location) or as per AWWA standards, whichever is the lesser.

13. THRUST BLOCKS

13.1 GENERAL CONFIGURATION AND TYPE

.1 The Consulting Engineer shall confirm design for thrust blocking and provide thrust blocks at all fittings as required such as bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs.

.2 The Consulting Engineer shall consider potential future excavations near the water main and the impact of installing thrust blocks. Design calculations must be based on fitting type, water pressure and soil conditions.

.3 A bond break such as a poly sheet shall be provided between the concrete thrust block and fitting interface.

.4 Where soil conditions preclude the use of conventional thrust blocks, the Consulting Engineer shall specify joint restraints required to prevent movement of the main and separation of joints.

.5 Cast-in-place concrete thrust blocks shall be a minimum 20 MPa compressive strength at 28 days.

.1 For pipes equal to or less than 300 mm diameter the minimum thrust block dimension shall be as per CRD Standard Drawings; and

.2 Fire hydrants and associated tee on water main shall be thrusted and restrained.

.6 Thrust calculations shall be completed by the Consulting Engineer and details shall be shown on the design drawings in the following cases:

.1 For pipes larger than 300 mm diameter;

.2 Where water pressure exceeds 1,035 kPa (150 psi);

.3 Where allowable soil bearing is less than 96 kPa. (14 psi);

.4 Where vertical thrust blocking is required; and

.5 Where joint restraints are used.

14. RESTRAINTS

14.1 General Configuration and Type

.1 Where soil conditions preclude the use of conventional thrust blocks, the Consulting Engineer shall design and specify joint restraints required to prevent movement of the main and separation of joints.

.2 The Consulting Engineer shall confirm design for restraints and provide restraints at all fittings as required such as bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs.

.3 All restraint components shall be coated with an approved petrolatum corrosion protection system.

.4 All restrainers shall conform to the CRD Water Engineering Specification, *Appendix A – Approved Standard Materials.*

.5 Thrust calculations for joint restraints shall be undertaken in accordance with the manufacturer's specifications. The type of joint restraint and length of pipe to be restrained shall be clearly indicated on the design drawings.

.6 Joint restraints shall be provided, as a minimum, for the following locations:

- .1 Hydrants;
- .2 Road crossings;
- .3 Flush outs and blow-offs;
- .4 Temporary caps;
- .5 Fittings and all DI pipe 300 mm diameter and larger;
- .6 All pipe inserted in carrier pipe casing; and
- .7 Connections to valves outside Pressure Control Station (PCS) and other chambers.

.7 Reference – CRD Standard Drawings.

15. CATHODIC PROTECTION

.1 Where ductile iron water mains and fittings are placed in corrosive soil or where they run parallel to high tension hydro transmission lines, the Consulting Engineer shall evaluate and report on cathodic protection and specify on the plans for providing protection.

16. MECHANICAL METER ROOMS (AS APPROVED BY THE CRD)

16.1 General Configuration

.1 Mechanical rooms are special case only and generally not acceptable. Mechanical rooms shall be rejected or approved on a case by case basis by the CRD.

.2 Drawing submissions shall follow Drawing Standards and Guidelines outlined in Schedule A and show the plumbing fixture unit count for the building and any irrigation flow requirements for CRD to check the size of the domestic meter.

.3 No connections to the water service line or installation of valves may be made prior to the meter except for the fire service, which is not required to be metered, but does require appropriate backflow.

.4 Minimum Space Requirements:

.1 Meter shall be a minimum of 750 mm and a maximum of 1,500 mm above finished floor; and

.2 Vertical distance from the meter to the nearest permanent obstruction shall be no less than 1,200 mm.

.5 Piping Requirements

.1 No fittings including valves shall be within 5 pipe diameters upstream and 3 pipe diameters downstream of the meter.

17. PRESSURE CONTROL STATIONS (PCS)

17.1 GENERAL

.1 A PCS is required wherever a water main connects different pressure zones.

.2 PCS shall include a pressure reducing valve with a diameter equal to the pipe upstream of the PCS for fire flow demand and a separately piped pressure reducing valve for the peak hour demand. The sizing of the pressure control valve shall be subject to CRD approval.

.3 General considerations:

.1 Parallel pressure reducing valves sized for peak hour and maximum day plus fire flows;

.2 Basket strainers upstream of each control valve;

.3 Upstream and downstream pressure gauges;

.4 All pipe and tubing to be stainless steel;

.5 Forced air ventilation plus heat and light, subject to local authority review;

.6 Isolating valves;

.7 Air release valves;

.8 Bypass pipe complete with isolation valves around the PRV; and

.9 External kiosk, if electrical and electronic equipment is included.

.4 PCS shall be accompanied with a magnetic flow meter installed upstream of the PCS. Provide electrical power to the chamber complete with an approved kiosk to house an electrical disconnect and BC Hydro meter, and where required, SCADA equipment.

.5 Critical PCS, as determined by the CRD, shall require SCADA. The kiosk shall require a decal. The decal shall be affixed to the outside of the kiosk. Obtain all required permits for the work.

.1 PLC-controlled with connection to SCADA system, if applicable, including:

.1 discharge and suction pressure transmitters;

.2 flow transmitter;

.3 uninterruptible power supply (UPS); and

.4 operator interface panel.

.6 All PCS must have a civic address from municipality or other Local government. The Applicant shall obtain the address from the municipality or other Local government.

.7 Provide a plan view and section drawings for the PCS. Design Drawings shall be accompanied by a design brief and shall be Approved in Principle by the CRD prior to installation.

.8 The Consulting Engineer for the waterworks Design Drawings shall certify the design submission.

.9 All pressure reducing valves shall have speed controls and valve stem position indicator.

.10 Provide a minimum 50 mm flush valve on pressure reducing valves 150 mm diameter or larger.

.11 Provide a flow test port and gauge between downstream isolation valve and control valve.

.1 For a 50 – 100 mm pressure reducing valve (minimum 19 mm port) with gauge;

.2 For a 150 – 200 mm pressure reducing valve (minimum 50 mm port) with gauge; and

.3 Any connections for isolating valves or drain ports shall be at either the 3 o'clock or 9 o'clock positions.

.12 Where suitable all PCS chambers or structures shall be designed with stairs and suitably opening hatches to mitigate issues with confined spaces.

.1 All PCS chambers shall be designed to reduce or eliminate WorkSafe BC confined space entry requirements.

18. STORAGE RESERVOIRS

18.1 CRITERIA FOR DESIGN OF FACILITIES

.1 See Section 2.2 Water Demand.

18.2 STORAGE

TOTAL STORAGE REQUIRED = A plus B plus C*
A = Equalization storage capacity (25% of Maximum Day Demand)
B = Meet Fire Underwriters Survey(FUS), based on ultimate zoning
C = Emergency storage (25% of A + B)

* *Total Storage required shall be reviewed against design philosophy based on ultimate zoning and properties served. The CRD at their discretion may require an increase of the Total Storage required.*

.1 A reservoir shall have a minimum of two (2) cells. For larger reservoirs, three or more cells may be required to allow a cell or cells to be taken out of service during winter due to water quality concerns.

.2 Prior to design, submit for approval a design philosophy, which shall include cleaning of the reservoir.

.3 Design the reservoir using the philosophy of a drain then fill cycle. Water shall drain down to low water level; pumps shall start and pump until the reservoir reaches the top water level. Low water level shall be equal to the fire or emergency storage volume, whichever is greater.

.4 Reservoir mixing shall be considered and reviewed by CRD.

.5 The top operating water level (TWL) of the reservoir shall be approved by the CRD.

.6 A dedicated transmission water main shall be provided between the relevant pump station and the reservoir, separate from the outlet/distribution water main.

.7 Reservoirs shall have isolation valves located such that any one of a group of reservoir cells can be removed from service for cleaning and maintenance without removing the other cell(s) from service.

.8 Isolation valves shall be installed to permit the reservoir to be completely bypassed or taken offline.

18.3 MECHANICAL

.1 All piping under and inside the reservoir to 3 m outside the reservoir shall be 316L Stainless Steel, minimum Schedule 10S. Location of sample lines shall be approved by the CRD. Use corrosion resistant brackets/clamps to secure and support piping for sampling lines.

.2 Provide magnetic flow meters on the outlet piping and where required by the CRD, on the inlet piping to the reservoir.

.3 All valves shall be right hand opening with a 31 mm (1¼") square operating nut.

18.4 METAL

.1 All platforms shall be structural aluminum grating or fiberglass grating.

.2 All internal ladders shall be constructed of 316L Stainless Steel with serrated rungs.

.3 Use corrosion resistant brackets/fasteners to secure and support copper piping for sampling lines.

.4 All external ladders shall be aluminum with secured access.

.5 Where reservoir is buried the reservoir access hatch shall be manufactured for use on reservoirs and rated 300 PSF live load. Hatch shall be lockable, mounted on a curb, weather tight, internal trough/self-draining, and prevent entry of animals, insects, rainfall, runoff, dust, dirt and other potential sources of contamination. Reservoir hatch shall be acceptable to the CRD and IHA.

18.5 STRUCTURAL

.1 Reservoirs shall be of bolted steel or reinforced concrete construction, faced as necessary to blend with the surroundings. Access shall be provided to any check valve, isolation valve chambers, or other appurtenances. Secured access shall be provided to the top of the reservoir by means of stairway or ladder. A stainless-steel ladder with safety cage as applicable shall be provided inside the reservoir.

.2 Where possible, and if applicable, the reinforced concrete reservoir shall be buried and protected externally by an approved waterproof membrane.

.3 Reservoir and associated electrical/mechanical building shall be designed for post-disaster use i.e., the structure does not leak and shall be fully usable following a 2,475-year return period earthquake.

.4 Reservoir floors shall have a trowel finish and sloped floor to the floor drain in the middle of the reservoir with a minimum slope of 1%. Ponding of water shall not be accepted.

.5 A lighted and ventilated electrical/mechanical building enclosure shall be provided for valves, water quality sampling points and instrumentation/SCADA equipment.

18.6 SITE REQUIREMENTS

.1 The Applicant shall apply for and obtain a civic address for the property from the municipality, which shall be displayed on the outside of the building, signage to CRD approval.

.2 For reinforced concrete storage reservoir, a survey monument (supplied by the CRD) shall be set by the Applicant in a corner of the reservoir roof, a minimum of 1 m from the edge of the roof. Provide the Geodetic elevation (Geological Survey of Canada (GSC) datum) and horizontal NAD83 UTM coordinates with sub decimeter accuracy.

.3 Generally, reservoir sites including adequate working space shall be located on land transferred by the Applicant in fee simple lot to the CRD with access to a public road right-of-way. If access to a public road right-of-way is not available and provided the reservoir does not front on a public road right-of-way, access shall be provided by a statutory right-of-way registered in favour of the CRD as per the CRD's standard right-of-way agreement.

.4 A vehicle access road to the reservoir shall be provided with a minimum drivable surface width of 3.5 m, a maximum allowable grade of 12% and a minimum 6 m turning radius suitable for trucks and boom hoists. Provision shall be made on the site for delivery trucks and cars to turn around. Access roads and turning areas shall be paved. An asphalt paved parking area is required for vehicles during maintenance or repair operations.

.5 The access road to the reservoir and the reservoir parking shall be paved with a minimum of 50 mm asphalt or as recommended by a geotechnical engineer registered in the Province of BC. Sub-grade and sub-base shall be approved by geotechnical engineer. Sub-base material shall be a minimum of 300 mm of 75 mm minus crushed road base (as per CRD Standard Drawings) and base material of 150 mm of 25 mm minus crushed road base (as per CRD Standard Drawings).

.6 Where the reservoir is buried, a 3.5 m wide access road shall be provided to allow vehicle access to the top of the reservoir and shall be constructed to the specifications described in subsections .4 and .5 above.

18.7 LANDSCAPING, GRADING & DRAINAGE

.1 Aesthetically pleasing landscaping shall be provided, which blends in with the local surroundings and is preferably of low maintenance design and low water consumption to the approval of CRD IWS and the local municipality. Where grass is deemed acceptable by the CRD, a metered irrigation system with appropriate backflow prevention assembly shall be installed. Design shall be Approved in Principle by the CRD.

.2 Site grading shall allow for positive drainage away from the structure. The use of berms is recommended in areas sensitive to noise and visual impact.

18.8 SECURITY

.1 Reservoirs shall be fenced with a chain link security fence at least 2.4 m high with 3 strands of barbed wire on top. The fencing shall be designed to allow service vehicles to be off the roadway/sidewalk prior to opening the gate, i.e., off the road. A 4.3 m gate for vehicular access and a separate man gate shall be provided. Local zoning by-laws may dictate type and height of fence. Specifications for fencing material are subject to approval by the CRD.

.2 All hatches shall be protected against vandalism with a double hatch as per CRD Standard Drawings.

.3 All vents shall be protected as per CRD Standard Drawings.

.4 Doors shall be reinforced steel, with a steel frame cast into the walls subject to CRD approval. Supply doors complete with Mul-T-Lock dead bolt locks to comply with the CRD security system.

.5 All openings or penetrations of the reservoir walls or roof shall be secured against vandalism, subject to the approval of the CRD.

18.9 ELECTRICAL/SCADA

.1 The Applicant shall provide details of the BC Hydro Account that was set up during construction. The Applicant shall be required to have this account paid in full prior to transfer/acceptance of the reservoir to the CRD.

.2 In general, refer to the CRD Pump Station Design Guidelines for electrical and SCADA requirements, and CRD Scada Standard – Touch Screen for touch screen requirements.

.3 All electrical materials and equipment shall be CSA approved.

.4 For the operator interface, or HMI, provide a Beijer Electronics X2 Pro. Provide unit with a 4GB Lexar Professional memory card. Standard RTU is Motorola ACE3600 communicate with touch screen through Ethernet cable.

.5 The HMI shall provide the operator with detailed information on the reservoir, such as, alarms and status points, set points for low water level (LWL), top water level (TWL), Overflow Level, flow rates for inflow and outflow, 24-hour totalized inflow/outflow and present conditions in the reservoir.

.6 Each cell shall be provided with Siemens Multiranger 200 Ultrasonic level transmitter. Float switches shall provide backup for the Ultrasonic level transmitters and shall be connected directly to local tank RTU.

.7 Provide connection/communication to the CRD SCADA system including the instrumentation and controls necessary to transmit/receive the data considered relevant by the CRD. Generally, communications shall be by radio, and, if required, a radio path survey shall be carried out at the Applicant's expense.

.8 Lighting levels shall be calculated using the lumen method for lighting calculation set forth by the Illuminating Engineering Society (IES) of North America Handbook. Provide a lighting level of 800 Lux.

.9 All lighting shall be easily accessible for maintenance purposes. LED lighting shall be provided in all stations and shall be located within 2.5 m of the floor to facilitate replacement of the fixture and/or tubes. LED lights shall be vapor proof. If fixture is hung from ceiling use field installable wet location fittings to stem hang fixture on 12.5 mm conduit – specify option WLF.

.10 At least one, outside, vandal-proof weatherproof light fixture shall be provided adjacent to or over the access door to the reservoir entrance. This fixture shall be activated by a motion detector and night sky compliant. Approved product is a Harmony Eye-Lite by Fail-Safe. Minimum lighting at entrance and service areas shall be 50 lux.

.11 Provide industrial grade waterproof PVC boxes for all switches and receptacles, industrial grade. Provide waterproof cover plates of same material.

.12 Tank hatches to be monitored with a hatch limit switch wired directly back to the security panel and setup as an independent zone. No security monitoring of the tank caged ladder entry is needed.

.13 If possible, the communications conduit should be installed while trenching from the PS to the RES for the filling pipe. This would provide an option for alternate comms for RES fill control other than having to use radio in all cases.

.14 All receptacles shall be GFCI receptacles.

.15 All indoor equipment located in the electrical/mechanical room shall be installed in splash resistant and dust-tight enclosures.

18.10 WATER QUALITY

.1 Each cell of the reservoir shall be provided with a sampling port as detailed in the CRD Standard Drawings. Where sampling points are in the electrical/mechanical building, the enclosure shown in the CRD Standard Drawings is not required. Provide a drip tray connected to the drain for the sampling port.

.2 Design each cell of the reservoir with a chlorine injection port in accordance with the CRD Standard Drawings. Vehicle access is required to the chlorine injection port.

.3 The CRD will determine the locations of sampling lines inside the reservoir and the sampling port locations.

.4 Sampling ports, chlorine injection, electrical and control valves shall generally be housed in a building meeting CRD approval.

END OF SCHEDULE A1 – DESIGN CRITERIA

Contents

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 This section provides a general list of submittals and checklist guide to assist the Applicant prior to construction of water Infrastructure within the water distribution system owned and operated by the CRD. No water Infrastructure works shall be constructed until:

.1 all submittals to other affected/interested Agencies, Regulatory, Government bodies have been reviewed and approved;

.2 all utility conflicts, independent utility conflicts, property acquisitions have been resolved;

.3 IHA has issued a "Waterworks Construction Permit"; and

.4 the CRD has received and reviewed final design drawings and have returned the design drawings back to the Applicant's Consulting Engineer marked as "Reviewed" and thereby Approved in Principle.

2. PRE-CONSTRUCTION REQUIREMENTS

2.1 CHECKLIST GUIDE

- ☐ Review entire CRD Water Engineering Specification.
- ☐ CRD Waterworks Extension Agreement complete and returned to the CRD.
- ☐ Engineer – Client Agreement complete and returned to the CRD.
- ☐ Preliminary design meeting, if required by the CRD.
- ☐ Conceptual design complete, if required by the CRD.
- ☐ Design survey complete.
- ☐ Existing record information reviewed and incorporated.
- ☐ All utilities identified with required works and conflict resolutions incorporated.
- ☐ Sealed pre-design reports complete and approved, if required by the CRD.
- ☐ As required, public open houses complete.
- ☐ Sealed interim designs complete and submitted.
- ☐ Sealed FUS calculations and analysis of the water system complete and submitted to the CRD and Approval Authority.
- ☐ Sealed final designs complete and submitted to the CRD.
- ☐ Rights-Of-Way and Easements have been acquired or letter of undertaking provided, both in favour of the CRD.
- ☐ Rights-Of-Way and Easements will be amended as required for legal use in favour of the CRD.
- ☐ Authorization, approval and/or permits required from municipalities, senior governments and other authorities having jurisdiction, have been obtained.
- ☐ As required, notification to and reply from all other affected parties (adjacent properties, postal, school board, public transit, garbage/recycling services, emergency services, first nations, etc.) complete.
- ☐ IHA has issued a "Waterworks Construction Permit".

- All authorizations, approvals and/or permits have been submitted to the CRD and are in a logical format acceptable to the CRD.
- Sealed final designs returned to the Consulting Engineer marked “Reviewed” by the CRD.
- Contact CRD to arrange a pre-construction site meeting.
- Once construction contractor has been selected provide Contractor’s insurance naming CRD as additional insured.
- As required, provide updated contact information for Applicant, Contractor, Developer/Owner and Consulting Engineer.

2.2 CONSTRUCTION COMMENCING PRIOR TO APPROVALS AND/OR PERMITS

.1 The Applicant is responsible to obtain all required authorizations, approvals and/or permits. Failure to obtain these documents may result in works and materials installed being rejected and not approved by the CRD.

.2 CRD Approved in Principle Drawings returned to the Applicant may be, at the sole discretion of the CRD, immediately withdrawn by the CRD and no longer Approved in Principle.

.1 Withdrawal of Approved in Principle Drawings shall immediately render those drawings invalid and not suitable for works. All works shall cease;

.2 Withdrawal of the Approved in Principle Drawings may result in a delay of any further work for a period of not less than 60 calendar days subject to review by the General Manager;

.3 The Applicant shall be responsible to re-apply and provide a complete revised set of drawings and design details to the CRD should the Applicant wish to continue; and

.4 The CRD shall not be libel for any loss or damages suffered by the Applicant due to the CRD withdrawing Approved in Principle Drawings.

2.3 CRD REVIEW PRIOR TO CONSTRUCTION

.1 The Applicant shall inform the CRD a minimum of one week prior to starting construction requesting a representative from the CRD attend the site to undertake a review.

.1 At the CRD’s discretion a CRD representative may or may not attend the site. The CRD will inform the Applicant if attendance is necessary; and

.2 Preferably attendance corresponds with a pre-construction meeting of all the parties.

END OF SCHEDULE B – PRE-CONSTRUCTION SUBMITTALS

Contents

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 This section shall provide the construction standards for water Infrastructure within the water distribution system owned by the CRD and operated by the CRD.

.1 CRD Water Engineering Specifications shall be used for all design and construction. MMCD supplementary specifications and supplementary detail drawings may be used if and when applicable but should be confirmed with the CRD IWS.

.2 Water distribution system and water Infrastructure construction shall be under the direction of a Consulting Engineer who has the appropriate knowledge, skill and experience.

.1 The Consulting Engineer shall exercise professional judgment and follow best practices on construction matters in the best interests of the CRD, Regulatory Agencies and the Public; and

.2 The Consulting Engineer shall liaise, consult and discuss construction matters with the CRD.

2. ENGINEERING SUPERVISION

2.1 RESPONSIBILITY

.1 The Applicant's Consulting Engineer shall be responsible for:

.1 Development of construction documents and specifications;

.2 Survey control for design layout;

.3 Field review and approval of all construction works;

.4 Pick up survey for record information;

.5 Signoff of Infrastructure installed;

.6 Coordinating all other design professionals;

.7 Record Drawings and Operations and Maintenance Manuals;

.8 Schedule and conduct a deficiency review with the CRD upon completion of all works;

.9 Confirm completion of all deficiencies; and

.10 Seal, certify and submit records and documentation for the CRD, regulatory agencies and authorities.

2.2 DEVELOPMENT OF CONSTRUCTION DOCUMENTS AND SPECIFICATIONS

.1 The Consulting Engineer shall develop construction documents and specifications in the best interests of the CRD, regulatory agencies and the public.

.1 Shall be in conformance with the Approved in Principle Design Drawings;

.2 Shall be in accordance with the latest edition of the MMCD unless otherwise specified and approved by the CRD; and

.3 The CRD requirements contained within the CRD Water Engineering Specification, CRD Approved Materials, CRD Forms and CRD Drawings shall take precedence over other construction documents and specifications.

2.3 SURVEY CONTROL FOR DESIGN LAYOUT

.1 Based on the details contained in the Approved in Principle Design Drawings the Consulting Engineer shall provide all required control and layout for construction purposes.

.1 Design layout may be undertaken by the Consulting Engineer or another designated party under direct supervision by the Consulting Engineer; and

.2 Should another party provide layout the Consulting Engineer shall check and confirm correctness of the layout and shall be responsible for the layout.

2.4 FIELD REVIEW AND APPROVAL OF INFRASTRUCTURE CONSTRUCTION WORKS

.1 Field review and approval of all works and services undertaken during construction by the Consulting Engineer shall be for the benefit of the CRD and shall provide certification that the work was constructed in accordance with the Approved in Principle Design Drawings, the CRD Water Engineering Specifications and IHA construction permit.

.1 Field review shall be carried out by a Professional Engineer (P.Eng.), or someone suitably qualified under the direct supervision of a Professional Engineer;

.2 The Consulting Engineer shall provide the necessary level of field review to ensure the works meets design standards. Field review hours will be subject to the complexity of the work;

.3 The Consulting Engineer shall provide sealed field review reports complete with pictures and details to justify approval and record information. The Consulting Engineer shall submit copies of these sealed field review reports to the CRD on a weekly basis; and

.4 As a minimum, field review reports shall describe and contain:

.1 Project name including client, contractor and contract number;

.2 date and weather;

.3 name of person conducting review;

.4 equipment and workforce on site;

.5 construction progress detailing location, materials, testing;

.6 reviewer's observations;

.7 discussions with contractor;

.8 discussions with others;

.9 action required; and

.10 photographs.

.2 The CRD shall be granted unencumbered access to the works and may undertake periodic review of construction and if necessary, immediately notify, in writing, the Applicant and/or the Consulting Engineer of any unacceptable materials or practices.

.1 If remedial action is not taken to the satisfaction of the CRD, the Waterworks shall not be accepted by the CRD; and

.2 Periodic review by the CRD does not infer or grant acceptance of materials or practices. Should unacceptable materials or practices be discovered at a later date the Applicant shall remedy the unacceptable materials and practices to the satisfaction of the CRD.

.3 Upon completion of the Work the Applicant shall schedule and undertake a final site review with the CRD.

2.5 PICK-UP SURVEY FOR RECORD INFORMATION

.1 Pick up survey shall be for all buried portions of the Work and shall include but not limited to:

- .1 50 m intervals along the water main;
- .2 at all critical utility crossings;
- .3 bends, valves, fittings, tubing; and
- .4 thrust blocks and all new/existing buried structures.

.2 Pick up survey shall be for all exposed portions of the Work and shall include but not limited to:

- .1 valve boxes, pigtails, service markers, roads, curb and gutter;
- .2 finish grade;
- .3 all new water Infrastructure installed; and
- .4 all other exposed structures as detailed on the Approved in Principle Design Drawings.

.3 Failure to pick up all buried and exposed Infrastructure shall render Record Drawings invalid and unacceptable.

2.6 TESTING – PUBLIC HEALTH TESTING AND INFRASTRUCTURE TESTING

.1 All water mains, water services and appurtenances shall remain isolated by an air gap from the public water supply. No testing shall be undertaken against a valve in a public water supply system.

.2 The CRD shall undertake water sampling and bacterial testing of the water system at the Applicant's cost.

.3 The Consulting Engineer shall be responsible for the following meeting AWWA standards:

- .1 First Flush – flush with potable water at a velocity of no less than 0.9 m/s to remove debris from the water system. Appropriate disposal of chlorinated water (potable water) meeting environmental guidelines;
- .2 Pressure Testing – Contractor shall conduct a pressure test in accordance with CRD Water Engineering Specifications to AWWA standards and in the presence of CRD personnel;
- .3 Disinfection – chlorination by continuous feed method providing disinfection of all surfaces in contact with water including hydrants, services and all appurtenances:
  - .1 Chlorine concentration greater than 100 mg/l shall be rejected by the Consulting Engineer and the disinfection shall be re-done.
- .4 Second flush – remove and dispose of heavily chlorinated water appropriate – disposal of heavily chlorinated water meeting environmental guidelines; and
- .5 Fill and securely seal the system – fill system with potable water in preparation for water sampling and bacterial testing by the CRD.
  - .1 Once the system is filled the chlorine concentration in the system being tested shall be equal to the chlorine concentration in the potable water supply; and
  - .2 If chlorine concentration in the system is still greater than the potable water supply, the Consulting Engineer shall reject the fill and a second flush and fill will need to be undertaken.

.4 Testing and approval of all water Infrastructure installed shall be undertaken by the Consulting Engineer and shall be for the benefit of the CRD. The Consulting Engineer shall have chlorine testing equipment capable of accurately measuring chlorine concentration of 0 to 3.5 mg/l and 10 to 200 mg/l. Test strips are specifically prohibited.

.5 The Consulting Engineer shall document all tests on field review reports. By way of seal and signature the Consulting Engineer shall confirm that the Work has been successfully tested (other than bacterial) to meet service requirements and regulatory agency/authority requirements.

2.7 RECORD DRAWINGS, OPERATIONS AND MAINTENANCE MANUALS

.1 Record Drawings and Operations and Maintenance manuals shall be produced and submitted to the CRD by the Consulting Engineer upon completion of the Work. See section 3 in Schedule D – Post Construction Submittals for details.

3. CHANGES

3.1 CHANGE OF APPROVED IN PRINCIPLE DESIGN DRAWINGS PRIOR TO CONSTRUCTION

.1 If the Consulting Engineer wishes to make any changes to the Approved in Principle Design Drawings before the execution of the Work, he/she shall submit a copy of the proposed revisions to the CRD and IHA.

.1 If Approval in Principle is granted for the revision:

.1 The original entire Approved in Principle Drawings set shall be immediately revised by the Consulting Engineer and title blocks updated;

.2 One full-size paper copy and a DWF file or unlocked PDF file containing the complete set of updated drawings shall be submitted to the CRD with additional submittal to IHA;

.3 When the CRD and IHA are satisfied that all design requirements are complete, and drawings are fully updated, one full set of drawings in DWF format or unlocked PDF file will be returned to the Consulting Engineer signed, dated and marked “Reviewed” and thereby Approved in Principle by the CRD; and

.4 Approved in Principle Drawings returned to the Consulting Engineer by the CRD does not in any way infer or grant approval for construction.

3.2 CHANGE OF DESIGN DURING CONSTRUCTION

.1 During construction, the Consulting Engineer may produce a revised drawing or figure drawing specific to a design change. He/she shall first submit a copy of the revision to the CRD and IHA for review.

.2 Minor changes such as “move an air valve’ a few feet or “relocate a water service” due to a conflict generally do not require issuance of a revised drawing set or figure drawing to the CRD for review. “Material” changes such as alignment, location change and pipe diameter change will require submissions and review by the CRD.

.3 If an Approval in Principle is granted for the revision:

.1 The revision shall immediately be included into the most recent Approved in Principle Drawing set;

.2 One full-size paper copy and a DWF file or unlocked PDF file containing the complete set of drawings complete with revision shall be submitted to the CRD with additional submittal to IHA; and

.3 When the CRD and IHA are satisfied that all drawings are fully updated, one full set of drawings in DWF format or unlocked PDF format will be returned to the Consulting Engineer signed, dated and marked “Reviewed” and thereby Approved in Principle by the CRD.

3.3 UNABLE TO MEET MINIMUM UTILITY CLEARANCE DURING CONSTRUCTION

.1 Approved in Principle Design Drawings shall detail minimum clearance and mitigative measures acceptable to the CRD and IHA. During construction existing conditions may provide less than the minimum clearance from other utilities. The Consulting Engineer shall identify when minimum clearances cannot be attained and obtain approval from the CRD and IHA for a variance.

.2 For storm mains/services and sanitary mains/services crossings the following mitigative measures are acceptable, subject to CRD approval:

.1 Where a water main crosses over a sewer or sewer service with less than 0.45 m but greater than 0.15 m clear vertical separation between the water main and the sewer, provide Ductile Iron AWWA C151 Pressure Class 350 pipe for the water main. All joints within 3.0 m of the sewer shall be wrapped with a petrolatum tape/paste system to AWWA C217 approved for potable water systems.

.1 Where existing conditions do not allow for the minimum vertical separation of 0.15 m, measures to mitigate the problem shall be proposed by the Consulting Engineer subject to review and approval by both the CRD and IHA on a case by case basis.

.3 Where a water main is found to run parallel to a storm/sanitary main/service with less than 3.0 m clear horizontal separation the Consulting Engineer shall:

.1 Discuss design with the CRD and IHA and be subject to a design review and determination by the CRD and IHA; and

.2 The CRD may request:

.1 A redesign and subsequent construction of the water main to achieve 3.0 m clearance;

.2 Subject to approval of the municipality or government of jurisdiction replace the storm/sanitary main/service with pressure rated pipe equal to or greater than the pressure rating of the water main with fused joints and hydrostatically pressure tested to 150 psi;

.3 Wrap all water main joints; and

.4 Any other requirements set forth by the CRD and IHA.

4. MATERIALS

4.1 GENERAL

.1 All materials shall be new/unused and approved by the CRD before being incorporated into the Work. A list of approved construction materials is included in *Appendix A - Approved Standard Materials.*

.1 Any material not approved by the CRD shall be rejected and shall be replaced with approved materials at the Applicant's cost.

4.2 MATERIAL FURNISHED BY APPLICANT OR CONTRACTOR

.1 Material supplied shall be stored and installed as recommended by the manufacturer.

.1 Material found to be not approved, used, defective, soiled and/or damaged shall be rejected and replaced at the Applicant's cost.

4.3 MATERIAL FURNISHED BY THE CRD

.1 At time of delivery to the Applicant, the Applicant becomes responsible for the care custody and control of the material. Material already on the site shall become the Applicant's responsibility on the day work commences.

.1 Any material lost, stolen or damaged shall be replaced by the Applicant from the same supplier/manufacturer at the Applicant's cost.

5. WATER SERVICES/METERS

5.1 GENERAL

.1 Installation of water services/meters shall be as per CRD specifications and standard drawings.

6. WATER MAINS

6.1 GENERAL

.1 Installation of water mains shall be as per MMCD standards.

.2 Ductile iron pipe shall be installed without joint conductance unless specifically required for corrosion protection.

.3 All pipes shall be delivered to site and stored with end caps secure and in place.

.4 When the water main is under construction in a trench, water and debris shall be prevented from entering openings in the water main by keeping the excavation sufficiently dewatered and by capping or plugging such openings with watertight fittings. Pipe and fittings shall be protected from contamination during construction. At the end of each working day, all pipes shall be securely capped.

.5 Existing valves shall not be operated except by CRD personnel.

.6 Service connections to existing water mains shall be made only by the CRD at the Applicant's expense.

.7 Tie-in of completed water mains to the public water supply shall only be undertaken by CRD personnel at the Applicant's expense.

.8 The pipe shall not be backfilled until the installation has been inspected and approved by the Consulting Engineer or their representative.

.9 The pipe shall not be backfilled until the horizontal and vertical alignment has been recorded by the Consulting Engineer or their representative.

.10 Marking tape required for all new water mains.

6.2 ASBESTOS CEMENT (AC) PIPE CONSIDERATIONS

.1 All work shall meet the requirements of WorkSafe BC for handling and disposal of Asbestos Cement Pipe.

.2 Where installation of water Infrastructure, other services and utilities cross under existing live AC water mains the following shall apply:

.1 AC 150 mm diameter or less:

.1 A section of the AC pipe shall be replaced with same inside diameter Ductile Iron (DI) pipe. This work shall be done by the CRD at the Applicant's expense;

.2 The AC pipe shall be replaced with DI pipe 1.50 m beyond each side of the undisturbed trench wall. The trench shall be backfilled with Controlled Density Fill (CDF) from bottom of trench to spring line of the existing AC main (drop-in DI section) that is being crossed; and

.3 Trench section to be filled with CDF shall be contained at either end of the trench section by bulkhead or earth fill. When used to support existing AC pipe (drop-in DI section), the CDF shall be brought up uniformly to the spring line of the drop-in DI pipe, as shown on CRD Standard Drawings.

.2 AC greater than 200 mm diameter:

.1 Contact the CRD and ensure CRD personnel are present during the excavation. If the excavation of the AC pipe does not impact the integrity of the pipe, the AC pipe may be allowed to remain in place. However, Controlled Density Fill (CDF) must be placed full depth from the spring line of the other service/utility to the spring line of the AC pipe in accordance with CRD Standard Drawings.

.2 If the AC must be replaced by the CRD then it shall be done at the Applicant's expense.

7. EXCAVATION

7.1 GENERAL

.1 For work on existing roadways, excavated and import materials shall not be stockpiled on the roadway.

.2 If the material at the bottom of the excavation is organic or other unsuitable material, it shall be over-excavated to firm ground and backfilled with suitable compacted material, unless otherwise specified by the Consulting Engineer.

.3 Excavations shall be dewatered where necessary. Provide sedimentation and erosion control as required.

.4 All solid rock boulders and large stones shall be removed to provide a minimum clearance of 150 mm under and beside the pipe.

.5 Where any existing buried or surface structures may be affected by the Work, appropriate mitigating measures shall be implemented.

8. BACKFILL

8.1 GENERAL

.1 All backfill shall be completed in accordance with the CRD Standard Drawings.

.2 CDF, where required, shall be used in lieu of compacted gravel backfill. CDF shall be manufactured and placed in accordance with CAN/CSA A23.1 & 2. CDF shall be excavatable in the future and have a maximum unconfined compressive strength of 0.5 MPa at 28 days and maximum cement content of 25 kg per m3. A copy of concrete test results shall be provided to the CRD. Record Drawings shall show the location and extent of CDF.

8.2 BEDDING

.1 Bedding for water main and services shall be in accordance with the CRD Standard Drawings.

9. COMPACTION AND MATERIALS TESTING

9.1 GENERAL

.1 Regular compaction testing is required for all phases of the water Infrastructure work. The Consulting Engineer shall arrange for compaction testing at the Applicant's expense.

.2 A copy of test reports shall be included with field review reports.

.3 Testing shall be undertaken by an accredited material testing company customarily undertaking such work. Testing will be overseen by a P.Eng. registered in BC and shall be an employee of the materials testing company.

.4 Testing shall be to the standards set out by the municipality or government having jurisdiction. In the event standards are not set out, the following sections 9.2 – 9.3 shall apply.

9.2 CONFIRM GRAVEL SOURCE AND GRADATION

.1 Prior to delivery of gravels to the work site the Applicant shall select a pit/gravel source and provide the CRD with a current copy (no older than 2 days) of the sieve results detailing pit name/location/ownership and materials selected for use.

.2 Provide ongoing sieve analysis of materials as delivered to the work site.

9.3 PIPE/TRENCH ZONE & SUB-GRADE CONSTRUCTION

.1 Moisture-density relationship (Standard Proctor) – ASTM D698; one test for each class of material.

.2 Pipe zone and trench backfill – one test per lift per 50 linear meters of water main, one test per lift of each water service and one test per lift around vaults, chambers, manholes, etc.

10. RESTORATION AND CLEAN-UP

10.1 GENERAL

.1 Generally, restoration and cleanup shall be to the standards set out by the municipality or government having jurisdiction.

.2 When the Work is completed, it is a minimum expectation that the site is left in equal or better condition than compared to conditions prior to construction.

.1 Upon completion of the Work, remove waste materials and debris, trim slopes and correct defects. Dispose of excess materials at an approved disposal site; and

.2 Reinstate pavement, sidewalks and lawns to the elevation, which existed before the excavation, or as shown on the drawings to the satisfaction of the CRD or the municipality or government having jurisdiction.

10.2 SEEDING AND TOPSOIL

.1 Shall be to the standards set out by the municipality or government having jurisdiction. In the event standards are not set out, the following shall apply:

.1 Where seeding is required, use a premium quality grass seed at the rate of 50 grams of seed per square metre; and

.2 Where replacement of topsoil is required, provide a minimum of 200 mm approved topsoil, mounded on top to allow for settlement and sown with a good quality grass seed. If the

installation is under a developed lawn, the soil shall be rolled, fine raked during the appropriate season and sown with a good quality grass seed at a rate of 50 grams seed per square metre.

10.3 PAVING

.1 Shall be to the standards set out by the municipality or government having jurisdiction. In the event standards are not set out, the following shall apply:

.1 If final paving cannot be completed immediately, gravel filled trenches shall be maintained to within 25 mm of the original surface prior to final paving, or cold mix asphalt applied;

.2 Patch all cuts in existing pavement;

.3 Cuts shall be hot mix paved within 3 days of backfilling and to the same thickness as the adjacent pavement with a minimum of 50 mm, weather permitting;

.4 If weather conditions do not permit hot-mix asphalt, cuts shall be paved within 3 days of backfilling using cold-mix asphalt and replaced as weather permits;

.5 Where the excavation is on the shoulder or under the travelled portion of the street, the surface material shall be cut in neat straight lines at the edges of the trench by means of an asphalt cutting wheel, milling machine or pneumatic pavement breaker. Where the edges of any area requiring repaving extend outside the straight lines cut, further cuts shall be made so that the final patch will have a neat appearance;

.6 Any area of pavement adjacent to the excavation which has become undermined or deformed due to excavation practices shall be removed and repaved as above; and

.7 For pavement cuts, which have settled, remove asphalt, excavate and re-compact the trench, then repave.

END OF SCHEDULE C – CONSTRUCTION STANDARDS

Contents

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 This section provides a general list of submittals and checklist guide to assist the Applicant post construction of waterworks Infrastructure within the water distribution system owned and operated by the CRD.

.1 All post construction submittals are subject to review and acceptance by the CRD.

.2 Submittals shall be prepared under the direction of a Consulting Engineer who has the appropriate knowledge, skill and experience.

.1 The Consulting Engineer shall exercise professional judgment on technical matters in the best interests of the CRD, Regulatory Agencies and the Public; and

.2 The Consulting Engineer shall be the Engineer of Record.

1.2 CHECKLIST GUIDE

.1 The following checklist is a guide to assist the Applicant with the post construction submittals.

- ☐ Prepare and submit Record Drawings for review by the CRD.
- ☐ Prepare and submit hydrant and specified valve information.
- ☐ Revise Record Drawings as required.
- ☐ Conduct deficiency review with the CRD upon completion of Work.
- ☐ Prepare and submit Final Record Drawings.
- ☐ Prepare and submit digital record information.
- ☐ Prepare and submit a consolidated project summary of all approvals, inspections, tests and commissioning undertaken during construction.
- ☐ Prepare and submit all necessary Operations and Maintenance Manuals, if required.
- ☐ Prepare and submit Statutory Declaration – *Appendix B – Standard Forms*.
- ☐ Prepare and submit Construction Completion Certificate (See Part 2 Section 2.8 for additional information) – *Appendix B – Standard Forms*.
- ☐ Prepare and submit a summary of waterworks construction costs.
- ☐ Submit Warranty Bond.

2. RECORD DRAWING SUBMITTALS

2.1 GENERAL REQUIREMENTS

.1 The Applicant's Consulting Engineer is the Coordinating Professional and shall compile and provide record information from all other consultants.

.2 The Record Drawings shall clearly show the location of all services, fittings, valves, all buried/surface water Infrastructure existing and installed using offsets from iron pins and/or property lines. It is intended that record information is fully described and indicated on all the drawings and submissions.

.1 Record Drawings shall conform to the standards of the Approved in Principle Design Drawings; and

.2 The complete set of Record Drawings must be submitted. Partial submissions will not be accepted.

.3 Bends, reducers, fittings, pipe ends, controlled density fill locations and appurtenances fully buried with no identifiable surface feature shall be referenced to the same NAD/UTM zone and elevation standard as design survey coordinates and pickup.

.4 Fire Hydrant locations and invert elevation of the tee at watermain to be recorded and displayed on Record Drawings.

.5 All dimensions, elevations, locations, callouts and notes shall be updated to reflect the record information. Typical offsets and locations are not acceptable.

.6 The Consulting Engineer shall record the manufacturer of all pipe/tubing, type and specification, and the date code, on the Record Drawings.

.7 The drawings shall include the following written statement signed, sealed and dated by the Consulting Engineer certifying:

.1 *"The Waterworks were constructed in accordance with the Approved in Principle Design Drawings, the Capital Regional District Water Engineering Specifications, the Capital Regional District Standard Drawings, and Island Health Authority Waterworks Construction Permit".*

2.2 INITIAL SUBMISSION

.1 Within 30 days of completion of the waterworks installed by the Applicant, the Consulting Engineer shall deliver Record Drawings to CRD IWS as follows:

.1 Submit one full size hardcopy sealed paper copies and a DWF file or unlocked PDF file containing the complete set of Record Drawings; and

.2 All drawings submitted shall be identified as "Initial Submission".

.2 The CRD shall review the Record Drawings and will:

.1 Mark-up the digital copy and return the marked digital drawings back to the Applicant for revision and re-submission; and

.2 If Record Drawing submissions are acceptable, the CRD will not request further revisions and notify the Applicant.

2.3 FINAL SUBMISSION

.1 Once the CRD is satisfied the "Initial Submission" Record Drawings are complete and satisfactory to the CRD, the Consulting Engineer shall provide:

.1 One complete full size sealed hard copy drawing set;

.2 PDF and DWF, and

.3 Provide to the satisfaction of the CRD:

.1 Base drawings in a .dwg format; and

.2 Land XML file.

2.4 FIRE HYDRANTS AND SPECIFIED VALVES

.1 Within 30 days of completion of the Work installed by the Applicant, provide fire hydrant and valve information in CRD standard format (refer to *Appendix B*).

.1 Valve information is required for air valves, check valves and control valves only;

.2 Hydrant and valve information shall be submitted with the initial Record Drawing submission; and

.3 Submit one hardcopy and PDF.

2.5 CONSOLIDATED PROJECT SUMMARY (IF REQUESTED BY THE CRD)

.1 Subject to a request by the CRD the Applicant shall within 10 days of completion of the Work, provide a consolidated project summary of Approval, Inspections, Tests and Commissioning undertaken during construction.

.1 Provide 2 hard copies in a bound binder titled Consolidated Project Summary with the name of the facility and project on the cover and spine. Manuals shall contain a table of contents with robust labelled tab dividers. Also provide a complete digital (PDF) set; and

.2 Consolidated summary shall include:

.1 Request, Approvals, Permits:
- Copy of IHA Waterworks Construction Permit.

.2 Site inspection reports:
- Copy of all site inspections; and
- Include USB flash drives or access to electronic copies (at the discretion of the CRD) with all project photos.

.3 Water Testing results:
- Flushing reports and calculations;
- Pressure Testing reports and calculations; and
- Disinfection reports and calculations.

.4 Hydrant flow tests including theoretical calculations.

.5 Material Testing results including name of supplier:
- Granular sieve and compaction;
- Asphalt; and
- Concrete.

.6 Other Testing:
- Hydrostatic;
- Motor vibration;
- Electrical; and
- Any other tests required by the CRD.

.7 Commissioning Reports:
- Supplier;
- Installer;
- Engineer; and
- Any other commissioning reports required by the CRD.

3. OPERATIONS AND MAINTENANCE MANUALS

3.1 REQUIREMENTS AND SUBMISSION

.1 Within 30 days of completion of the works, Operation and Maintenance (O&M) manuals shall be provided for all pump stations, pressure control stations, reservoirs, water intakes, disinfection facilities, water treatment plants, and any other water Infrastructure works requested by the CRD.

.2 Operations and Maintenance Manuals shall be submitted as follows:

.1 Two complete sets of O&M Manuals (to CRD standard format), using Contractor's data. Manuals will be in heavy duty catalogue style binders with full length metal hinges, complete with debossed cover and spine. Manuals shall contain a table of contents with robust labelled tab dividers; and

.2 MS Word file. Manufacturer information may be scanned and provided in high quality PDF format to compliment the MS Word file.

.3 Operation and Maintenance Manual shall contain:

.1 Design brief;

.2 description of facility and major mechanical, ventilation, electrical and monitoring systems;

.3 status and location of facility within overall utility system or service;

.4 geographic location and photographs;

.5 design criteria including flows and pressures;

.6 Record Drawings and shop drawings;

.7 test reports;

.8 equipment layout drawings;

.9 equipment manufacturers data and service manuals;

.10 electric power distribution single line diagram and service details;

.11 electrical, control and alarm wiring diagrams (laminated);

.12 PLC ladder diagram (laminated);

.13 control telemetry details with inputs and outputs identified;

.14 additional instrumentation;

.15 operating instructions for all equipment;

.16 routine and preventative maintenance schedule;

.17 routine and preventative maintenance diary;

.18 equipment data sheets;

.19 spare circuit cards for critical components;

.20 certified head/capacity curves for pumps;

.21 equipment part lists and list of suppliers;

.22 emergency operating procedures; and

.23 Commissioning summary covering all testing.

4. THIRD PARTY – APPLICANT/CONTRACTOR DOCUMENTATION

4.1 REQUIREMENTS AND SUBMISSION (IF REQUESTED BY THE CRD)

.1 Third party documentation shall be provided at the request of the CRD.

.2 Once construction works have been completed the following documents may be required to be provided to the CRD by the Applicant. These documents are for reference only by the CRD to confirm the contractual status and completion between the Applicant and Contractor.

.1 BC Builders Lien Certification of Completion;

.2 Construction Contract Certificate of Substantial Performance; and

.3 Construction Contract Certificate of Total Performance.

.3 These documents shall not bind the CRD in any way and shall be independent and separate of any agreement between the CRD and Applicant.

5. WARRANTY PERIOD

5.1 WARRANTY PERIOD

.1 The warranty period between the CRD and the Applicant shall be as per the Waterworks Extension Agreement.

END OF SCHEDULE D – POST CONSTRUCTION SUBMITTALS