GUIDELINES

FOR THE

APPROVAL OF WATERWORKS

Northern Health Authority
Public Health Protection
Public Health Engineering
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Current to June 2013

Table of Contents

Appendix:

1.0 Introduction

To improve public health protection in British Columbia, the ***Drinking Water Protection Act*** (the *Act*) and the ***Drinking Water Protection Regulation*** (the *Regulation*) require that a **Construction Permit** be obtained from a Public Health Engineer before construction, installation, alteration or extension of a water supply system is commenced. A Construction Permit is not required for normal repairs and maintenance, where the technical specifications for the equipment is not being changed in any way – that is, exchanging **"like for like"**.

New water systems and new sources of water require both a Construction Permit before construction of works and an **Operating Permit** before water can be provided to users. For Northern Health, Construction Permits are issued by the Regional Public Health Engineer (**PHE**) and Operating Permits are issued by a Drinking Water Officer (DWO) in the various Heath Units in Northern Health's service area. In this document, **EHO/DWO** is used to refer to Environmental Health Officers who have been delegated the power of Drinking Water Officer under the *Act*.

Submit Waterworks Construction Permit applications to:

Public Health Engineer
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4th Floor, 1600 3rd Avenue
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2.0 Waterworks Construction Permit Process

The table below outlines the usual steps in the construction of a **new water supply system**. For **existing water systems** with a valid **Operating Permit**, some of these steps will not apply. A **Construction Permit** from Northern Health is required prior to every structural or mechanical change to an existing water system that may occur over time, but not including routine maintenance. Construction, installation, alteration or extension of any part of a water supply system without a valid Construction Permit is an offence under section 45 of the *Act*.

Construction Permit (CP) *contact NH Public Health Engineer (PHE)*		**Operating Permit (OP)** *contact NH Drinking Water Officer (DWO)*
Steps		
1. IDEA – the owner identifies a need for water supply.		
2. SOURCE – the owner decides on a proposed source of water for the system – usually surface water from a lake or stream, or groundwater from a well.	⇦	Owner should contact the DWO to advise on required analyses, sampling protocols, etc.
3. SAMPLES – the owner collects a first sample of water from the source for a complete suite of physical-chemical and bacteriological analyses – this allows a treatment system to be designed.		At this time, the owner needs to complete a **WATER SYSTEM APPLICATION**
4. DESIGNER – the owner hires a professional engineering firm or water system design specialist.		The Operating Permit (OP) process for a new Water System can move forward in ***parallel*** with the Construction Permit process. The OP will not usually be issued until the CP process is completed. Key elements in the OP include: • OPERATOR TRAINING – consistent with the level of complexity of the water system • ROUTINE SAMPLING – locations, parameters and frequency • CONTINGENCY & EMERGENCY RESPONSE PLAN For existing water systems, changes arising due to the CP may or may not require any changes to the OP.
5. DRAWINGS – the designer prepares site plans and treatment schematics to explain the proposed water system design.		
6. **CONSTRUCTION PERMIT APPLICATION** – the designer applies to Northern Health PHE for a permit for construction of waterworks, together with all construction plans and equipment specifications, and a copy of the source water chemical analyses.		
7. **APPROVAL OF SOURCE** – the DWO reviews the source water chemistry and decides whether it is acceptable.	⇦	
8. CONSTRUCTION PERMIT REVIEW – PHE reviews the application against regulatory requirements and Northern Health policy. Allowing for design modifications, this step usually requires 60 days.		
CONSTRUCTION PERMIT ISSUED – PHE issues construction permit, with conditions.		
9. CONSTRUCTION * – installation of treatment, distribution, and storage facilities as per Construction Permit.	⇦	DWO may optionally inspect the works during construction
10. DISINFECTION – following construction, all new or altered works must be disinfected, lab results from confirmatory samples sent to DWO.	⇨	DWO receives confirmation that the equipment and distribution pipes are free of bacterial contamination
END OF CONSTRUCTION PERMIT PROCESS		**OPERATIING PERMIT ISSUED – DWO issues operating permit, with conditions.**

* Permits and approvals from other government agencies may be required before construction may begin.

3.0 Submission Requirements

Applications may be made by water system staff, owner, or a representative such as a consultant. If the application is submitted by someone other than the waterworks system owner, provide confirmation that the waterworks system owner has agreed to the proposed design and if applicable state the terms and conditions of the agreement.

The application should be of professional quality, and should normally be prepared by a Professional Engineer experienced in waterworks design and registered to practise in British Columbia. Applications should be made in writing at least **60 days (2 months) before approval is needed.** When approval is urgently needed, contact the PHE directly.

For complex municipal works, all plans must be sealed, signed and dated by a **Professional Engineer** experienced in waterworks design and registered to practice in British Columbia. This requirement may be waived for small systems (those serving fewer than 500 people) and in certain other situations, such as minor modifications to existing works. For small water systems, submissions by non-professionals may be accepted provided the submission package is complete and of reasonable quality, and the PHE is satisfied with the designer's competence to undertake the waterworks design.

A copy of the **Application for a Waterworks Construction Permit** form is contained in the **Appendix** to this document. The following information must be included in the application.

3.1 Plans and Specifications

For new water systems and works that include a new source of supply, and for complex works such as water storage tanks and reservoirs, pump houses, pumping stations, disinfection and other treatment works, submit **two complete sets of plans**. Plans may be submitted electronically in "portable document format" (pdf), for review purposes. A signed, sealed, and dated paper copy may still be required prior to issuance of the final permit.

For simple works at existing water systems, submit **one set of plans.** Include:

- A completed **Application for Waterworks Construction Permit**, along with completed Submission Package Checklist. The application form is attached in the **Appendix** to this document.
    - **Location plan**, which shows the regional location of the waterworks in relation to nearby communities or facilities.
    - **Site plan**, showing the location of the proposed works in relation to existing site features, including sewage facilities or other potential sources of contamination.
    - **Treatment schematic** (if applicable) showing the sequence of treatment and disinfection processes.
- A **cover letter** explaining the purpose of the proposed waterworks, providing a description including the design capacity of the major components, noting what design and construction standards are being used, and confirming who will be responsible for construction inspections and the post-construction certification of the waterworks.

- ***For watermains***, submit plan and profile drawings, detailed as normally needed for construction purposes, including the type, pressure class and diameter of watermain, depth of burial, and high and low points; the location of valves, air relief facilities, blow-offs, and fire hydrants; cross-connection and backflow protection; the **location of any sanitary and storm sewers** which are nearby or which are crossed by the proposed works; other underground utilities; connections to existing watermains; details showing safeguards proposed to protect the watermain where watermains are nearer than 3 m horizontally or have less than 0.45 m clear distance vertically (with watermain above) from any sanitary or storm sewer; typical details and construction standards; and disinfection procedures following construction.
- ***For other waterworks***, including water storage tanks and reservoirs, pump houses, pumping stations, valve chambers, disinfection and other treatment works, a complete sets of plans which include all details needed for construction purposes, and where needed for clarity, piping schematics and specifications.

3.2 Modifications to Existing Water Systems

Where an existing waterworks is being expanded or improved to include new service areas, confirm that both the water quality and the capacity of the waterworks will be adequate to accommodate existing, committed and proposed new service requirements.

Water systems on boil advisories will be required to improve water quality prior to approval of proposed expanded servicing.

3.3 New Water Sources

For all new sources of water, submit data on bacteriological and physical/chemical water quality to the PHE, with a copy to the local DWO. The core source quality parameters are listed in the **Appendix**. Provide confirmation that the water will not have offensive taste and odour, and comment on the expected seasonal variations in water quality and quantity (water level). New water sources require consensus approval from both the DWO and the PHE.

3.3.1 New Ground Water Sources

Include information pertaining to the well log, pumping test, hydrogeological report, screening checklist for ground water at risk of containing pathogens (see **Appendix**), mechanical and instrumentation/control facilities at wellhead, pump house or intake, and proposed treatment.

The hydrogeological report should include an assessment and recommendations on water quality protection including a description of confining layers, regional gradient, capture zone assessment, aquifer characterisation, maximum discharge rates, wellhead protection, and proposed quality and quantity monitoring program including parameters and frequency. The report should include information on existing uses of groundwater in the area and potential conflicts with other users.

3.3.2 New Surface Water Sources

Include information pertaining to the mechanical and instrumentation/control facilities at the intake, and proposed treatment. The intake must be properly screened and separated from both the surface and sediment bed. The design of the intake should reference the Fisheries and Oceans Canada publication: *Fresh Water Intake End of Pipe Fish Screen Guideline*. (ref. www.dfo-mpo.gc.ca/Library/223669.pdf). Seasonal variations in turbidity must be explicitly discussed. The report should include information on existing use of surface water in the area and potential conflicts with other users, including holders of Water Licences under the *Water Act*.

3.4 New Development

Where the proposed waterworks involve new lots or strata developments, provide information on the number of new building lots/units the waterworks system will service, the type of sewage system to be used, and whether or not sewage system approvals have been granted.

3.5 Existing Small Systems and Existing Rural Residential Community Systems

For small waterworks systems serving less than 50 people or with fewer than 15 connections, the procedures outlined above will generally apply. In cases where improvements are needed to resolve existing water problems, the submission may be modified at the discretion of the PHE. It should:

- Be of reasonable quality, with an explanatory letter and plans preferably prepared by a Professional Engineer.
- Include the name and address of the **water supplier** (purveyor) or person responsible for the water system operation and include documentation outlining the legal basis for operation - Municipality, Regional District, Improvement District, Water Utility under the *Water Utility Act*, Water Users Community under the Water Act, Strata Corporation, Privately Owned (mobile home parks, campsites), etc.
- Contain sufficient general information to assess the proposal.
- Include recent bacteriological and chemical analysis of the proposed source (see the **Appendix**) and contamination protection plans.
- Include draft operating and maintenance instructions, a draft **Emergency Response Plan** and a proposed sampling/water quality monitoring plan. These quality assurance/quality control plans need to take into account the nature and often remote location of these small/rural systems. The draft plans will be finalised in consultation with the local EHO/DWO.

Note that operators of existing waterworks for which water system approval (legalisation) is required must obtain an **Operating Permit** from the local DWO, following application for a **Construction Permit**.

4.0 Other Approvals

Where a **water utility** is involved (5 or more connections), confirm that the design incorporates the requirements of the Comptroller of Water Rights, Community Water Supply Section, Water Rights Branch of the Ministry of Environment (MoE) in Victoria. Any **changes in and about** a lake, river, spring, or stream require regional MoE approval from the Water Stewardship Division. Storage reservoirs and diversions may require a water licence under the *Water Act* and *Dam Safety Regulation*. Where waterworks are to be installed on road easements under the jurisdiction of the Ministry of

Transportation and Highways, confirm that an approval has been received for the specific proposal and state any conditions specified.

5.0 Design and Construction Considerations

5.1 Engineering Design Standards

Design, material and construction standards should meet current engineering standards such as those issued by the American Water Works Association (AWWA, www.awwa.org/Resources) and the Ten States Standards (2012, 10statesstandards.com/waterrev2012.pdf). Improvements to existing and proposed new small waterworks serving rural residential developments may be designed in accordance with the *Design Guidelines for Rural Residential Community Water Systems* (MoE, 2012, www.env.gov.bc.ca/wsd/water_rights/water_utilities/cabinet/design_guidelines_final_mar2012.pdf). Northern Health has also adopted a series of ***Public Health Engineering Guidelines*** to supplement these Guidelines for Approval of Waterworks. The PHE guidelines are under active development. A list of the current guidelines is contained in the **Appendix**.

Materials used in water supply systems should comply with **ANSI/NSF Standard 61** Drinking Water System Components - Health Effects. Where treatment for chemical contaminants is used, equipment is encouraged meet the applicable **ANSI/NSF** standards for Drinking Water Treatment Units: **Standard 42** - Aesthetic Effects and **Standard 53** - Health Effects. UV disinfection systems should meet **ANSI/NSF Standard 55 Class A**, or equivalent.

5.2 Water Quantity

The water supply must be sufficient for sanitary purposes and 700 L (150 Imperial gallons) per household per day may be adequate. Water for fire fighting, irrigation, or other purposes is additional to that required for sanitary purposes. The supply must be adequate to meet reasonable peak demands without development of low pressures that could result in health hazards. The Water Supplier is solely responsible for verifying that sufficient water is available to meet demands; a Northern Health Construction Permit does not imply any guarantee of water quantity. Totalizing flow meters are strongly recommended at all sources and water treatment plants.

5.3 Water Quality

Water supplies for drinking, culinary, and other domestic uses should be free of pathogenic organisms and their indicators and deleterious chemical substances including radioactive materials. The *Act*, the *Regulation* and the current edition of the *Guidelines for Canadian Drinking Water Quality* (*Canadian Guidelines*) should be used as a reference for evaluation of water sources.

Guidelines for parameters to be analysed are attached (**Appendix**). The parameter list depends on the type of source, source location and available historical data. Initial samples from ground water sources should be taken near the end of the pumping test, when the water appears visually clear of sediment.

The water supplier should conduct routine monitoring of the source water quality. The monitoring program should attempt to recognise all potential sources of contamination and assess their present

and future importance. The monitoring program and any remedial action should be planned in consultation with the local DWO.

5.4 Water Source

The water supply should be obtained from a source that is most likely to produce drinking water of a quality meeting the *Act*, the *Regulation* and the current *Canadian Guidelines*. The source chosen should be one which is least subject to municipal and industrial contamination, and other types of contamination resulting from human activities within the watershed. Every effort should be made to prevent contamination of the source. The waterworks should be protected against access by unauthorised persons.

5.4.1 Wells

Wells should, in general, follow the *AWWA Standard for Deep Wells* (A100-66) to ensure contamination does not enter the well. Wells must be constructed to meet or exceed the standards in the *Groundwater Protection Regulation* (www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater). The well location should be chosen to minimise the risk of contamination or flooding, away from possible sources of contamination such as a septic field, livestock, underground tank, landfill, cemetery, effluent discharge, drainage ditch, surface water, chemical storage, etc. Wells in pits are strongly discouraged. Contact the local EHO/DWO for information on potential sources of contamination, well location and well protection.

5.4.2 Surface Water

Acceptable surface water sources include lakes, rivers, springs, rainwater capture, etc. Dugout ponds that capture surface runoff from snowmelt and storm runoff are strongly discouraged. The design of the intake should reference the Fisheries and Oceans Canada publication: *Fresh Water Intake End of Pipe Fish Screen Guideline*. (www.dfo-mpo.gc.ca/Library/223669.pdf).

5.4.3 Impounding Reservoirs

Any earth storage facility for domestic water before treatment or distribution should be designed to minimise contact between the water and organic materials such as grass, peat, trees, etc. Approval from MoE may be required under the *Water Act*.

5.5 Disinfection and Treatment Requirements

Some natural purification occurs in surface waters as a result of dilution, storage, sunlight and associated physical and biological processes. With groundwater, natural purification may occur by infiltration of the water through soil and percolation through underlying material. However, effective treatment should be provided whenever necessary to ensure safety and consistency in the quality of all finished waters.

Water sources for new waterworks systems or new sources for existing systems using surface water or **groundwater at risk of containing pathogens (GUDI/GARP)** need to be disinfected by law. In order to

meet the current *Canadian Guidelines*, treatment such as coagulation-flocculation, adsorption, sedimentation and filtration may also be necessary.

Treatment for new waterworks systems needs to consider current US EPA requirements intended to improve control of microbial pathogens, including *Cryptosporidium*, while minimizing public health risks of disinfectants and disinfection by-products. See the Office of Ground Water & Drinking Water website for more information at water.epa.gov/lawsregs/rulesregs/sdwa/mdbp.

5.5.1 4-3-2-1-0 Treatment Objectives

Northern Heath treatment objectives address the following microbiological parameters: enteric viruses, pathogenic bacteria, *Giardia* and *Cryptosporidium* cysts. The generic requirements are:

4 log (99.99%) reduction or inactivation of viruses
3 log (99.9%) reduction or inactivation of protozoan cysts
2 treatment processes for surface water or GUDI/GARP sources
1 NTU turbidity maximum
0 *E. Coli* and Total Coliforms.

These requirements may be increased by the DWO in situations where source water is known or suspected to be subject to unusual contamination. Existing water systems using surface water or GUDI/GARP sources also need to meet current Northern Health requirements. Where necessary because of costs, the DWO may consider allowing staging of improvements. Secure groundwater sources must be disinfected if deemed necessary by the DWO for reasons of either bacteriological quality or nuisance biological growths, and may also require other treatment to meet the *Canadian Guidelines* for chemical and physical constituents. Exceptions to the disinfection and/or other treatment requirements may be considered by the DWO upon receipt of an application from the water supplier.

5.5.2 Chlorination

Chlorine and its compounds are the most commonly used disinfection chemicals. Alternative disinfecting agents or technologies may be appropriate for certain water sources. Contact the PHE if further information is needed on disinfection options. Note that chlorination does not provide effective control of protozoan cysts (*Giardia* and *Crypto*).

Free chlorination using hypochlorite is the method of disinfection most commonly practised. A minimum of 20 minutes contact time is required and the free residual after that time should be not less than 0.5 mg/L. The contact time calculation needs to take account of short-circuiting (T_{10}). The chlorine dosage and contact time should produce a C·T value of at least 12 min·mg/L to inactivate bacteria and enteric viruses. Higher chlorine dosages may result in elevated disinfection by-products, which are of health concern, especially if precursors such as organic carbon, organic nitrogen, and bromide are present in the source water. Consideration needs to be given to pH, ammonia, taste- and odour-producing substances, temperature, bacteriological quality, and other pertinent factors.

The chlorination equipment needs to maintain adequate residual when maximum flow rates coincide with anticipated maximum chlorine demands. It needs to operate accurately over the entire anticipated

flow range, including low chlorine demand and low flows. The free chlorine residual entering the distribution system should be between 0.2 mg/L and about 1.0 mg/L (maximum 4.0 mg/L).

If chlorine gas is used, the design needs to meet the objective of chlorine gas leak containment and release only under controlled conditions. The design must meet WorkSafe BC requirements. Additional details are listed in the current *Chlorine Gas Facilities – Safety Guidelines for Aquatic Centres, Swimming Pools and Waterworks,* available from the PHE.

A chlorine test kit (DPD), accurate to at least 5% and suitable for measuring both free and total chlorine residual over a range of 0 to 2.0 mg/L, should be provided when chlorine is used. Test kits with either a scale or digital readout are preferable to those that rely on visual colour comparison, particularly for measurements below 0.5 mg/L. Additional facilities such as standby power, standby chlorinator, flow pacing, chlorine residual monitoring/recording/controlling/alarm equipment should be considered.

5.5.3 UV Disinfection

Disinfection using ultraviolet light can be an effective technique for controlling pathogenic bacteria, viruses, and protozoa. Systems should include safeguards including a guaranteed minimum dose, intensity monitor, flow restrictor, audible and visual alarms, and solenoid shut-off. Third-party verification per **ANSI/NSF Standard 55**, UV Design Guidance Manual (USEPA, 2006), or equivalent is required. Pre-treatment to remove turbidity, hardness, iron, colour, tannins, organics, or other parameters that reduce UV transmittance are often required.

5.5.4 Membrane Filtration

Filters with an absolute rating below 1 micron may be eligible for pathogen log-reduction credits where supported by third-party challenge testing and incorporating direct integrity testing and/or continuous indirect integrity testing. Testing protocols should follow the *Membrane Filtration Guidance Manual* (USEPA, 2005), **ANSI/NSF Standard 53**, or equivalent. Where integrity testing is incomplete, the DWO may consider reduced treatment credits. Filters rated with a nominal pore size or above 1 micron absolute will not generally be eligible for pathogen reduction credits.

5.5.5 Other Disinfection Credits

Other water safety operations such as source water protection, subsurface filtration, conventional and direct filtration, slow sand filtration, ozonation, etc. are eligible for pathogen log-reduction credits per the ***Canadian Guidelines*** and/or the *LT2 Toolbox Guidance Manual* (USEPA, 2010). Proposed credits must be supported by clear documentation, such as engineering design calculations, manufacturer's specifications, third-party testing, etc.

5.5.6 Fluoridation

If water is to be fluoridated to reduce tooth decay, the target concentration should be 0.7 mg/L (per Health Canada, Fluoride Expert Panel, 2008). Fluoride concentrations below 0.6 mg/l are not effective in preventing dental caries, but fluoride should not routinely exceed 1.2 mg/L. Where flow is variable, automatic proportioning equipment needs to be provided. Facilities for operator safety (ventilation,

chemical storage, emergency eye wash, spill containment, protective clothing, etc.) and operational monitoring (test kit, log, alarm, etc.) need to be provided.

5.5.7 Chemical Contaminants

Various physical or chemical parameters, naturally occurring or man-made, may affect the safety of drinking water as well as its suitability for domestic purposes. Northern Health will generally require treatment where individual parameters exceed the *Canadian Guidelines* health-related Maximum Acceptable Concentration (MAC). Exceedance of aesthetic objectives will be noted, but treatment will be suggested rather than required. However, if the exceedance of aesthetic objectives is excessive, the DWO may decide that the water is not fit for domestic purposes without further treatment.

5.6 Pumping Stations

Pumping facilities need to be designed to maintain the sanitary quality of the pumped water. Subsurface pits or pump rooms and inaccessible installations should be avoided. Pumping stations should not be subject to flooding. A standby pump should normally be provided. Standby power should be provided in situations where a power failure could produce loss of positive watermain pressure in high areas of the distribution system.

5.7 Finished Water Storage

Storage is normally needed for pressure regulation, balancing, and emergencies. Additional storage is needed at water systems that provide fire protection. Storage for small waterworks serving residential developments may be designed in accordance with the *Design Guidelines for Rural Residential Community Water Systems,* (Ministry of Environment, 2012). Storage at water systems serving 500 or more people should be designed to AWWA guidelines.

Finished water storage needs to be adequately protected from contamination. Storage structures need a cover which is watertight and vermin-proof. Drains or overflows can not have a direct connection to a sewer or storm drain. Venting of these structures needs to be by special vent structures which will exclude birds, vermin, and dust. Entrances to these structures need to be framed at least 100 mm (4 inches) above the surface of the roof at the opening. Storage needs to needs to be designed to ensure adequate turnover (< 3-5 days). Inlet/outlet piping and baffling need to be designed to ensure good mixing and prevent summer thermal stratification.

Storage structures should comply with AWWA standards for steel tanks, standpipes, reservoirs and elevated tanks for water storage. Hydropneumatic tanks must comply with the *BC Boiler and Pressure Vessels Code*. Painting and coating of all steel tanks should comply with the current applicable AWWA standard and **ANSI/NSF Standard 61**.

5.8 Distribution

Special consideration should be given to transmission and distribution main sizing, providing for design of multidirectional flow, adequate valving for distribution system control, and provisions for adequate flushing. Systems should be designed to maximize turnover and to minimize residence times. Care

should be taken during design to minimise the risk of freezing of watermains and services. The system must be pressure tested before use.

5.8.1 Pipes and Appurtenances

Watermains in larger community water systems which include fire protection should normally be 150 mm (6 inches) in diameter or greater and be looped wherever economically feasible to minimise contamination risks and service disruption during repair of breaks or watermain flushing. For small water systems without fire protection, smaller diameter pipes are preferred to reduce retention time in the distribution system. Suggested materials include PVC, HDPE, and ductile iron, all conforming to AWWA standards. The pressure class of the pipe must be sufficient to cover the full range of operating conditions, including pump startup, etc.

Valves should be located at all intersections to facilitate repairs, flushing, maintenance, and testing.

Blow-offs (flushouts) or **hydrants** should be provided for flushing purposes on dead-ends and low points. The flushing facilities should be designed to allow water to flow at a velocity of at least 0.8 m/s (2.5 feet per second) in the watermain being flushed without causing very low pressure or potential backflow in high areas of the distribution system. Consideration should be given to using non-freeze/self-draining hydrants to reduce the risk of frost damage.

Air relief valves, hydrants or services designed to provide air relief should be provided at the high points of the system. Valves should be provided to isolate reasonably sized sections of the distribution system for repair or maintenance. The valves should be placed on property line projections if possible, to make them easier to locate.

5.8.2 Cross-Connection Control

Appropriate **backflow prevention devices** or other arrangements are needed to ensure that there are no cross connections with any sanitary or storm sewer or other source of non-potable water. Backflow preventers should be installed in accordance with the latest edition of the *Manual for the Selection, Installation, Maintenance and Field Testing of Backflow Prevention Devices* [CAN/CSA-B64.10-94] or the *Recommended Practice for Backflow Prevention and Cross-Connection Control Manual* (AWWA, 2004). Special attention to cross-connections is needed where a separate non-potable water distribution piping is present for any purpose, such as fire protection, irrigation, or toilets.

5.8.3 Watermain - Sewer Conflicts

The water supplier needs to ensure that watermains under construction or repair do not become contaminated by seepage or effluent from nearby sanitary or storm sewers. Public Health Engineering guidelines are:

> The Water Supplier shall ensure that no sanitary sewer or storm sewer is constructed within 3.0 metres (10 feet), measured horizontally, or 450 mm (18 inches), measured vertically, of the watermain without the approval of the Northern Health Public Health Engineer.

Parallel Installation: Watermains should be laid at least 3 m (10 ft) horizontally from any sanitary or storm sewer.

Crossings: Where a watermain crosses a sanitary or storm sewer, the watermain should be laid a minimum 450 mm (18 inches) ***above*** the sewer with the nominal centre of the pipe lengths located at the crossing to maximize the separation distance between joints.

If the design engineer can show that there is adequate structural support for the pipes at the crossing, we will permit pipes to cross with a minimum of 150 mm (6 inches) of vertical separation. At any crossing where the watermain crosses ***below*** a sewer, some form of hydraulic barrier is required to isolate the watermain from future leaks. Additional information is available in the **PHE guideline** on sewer-watermain conflicts.

5.8.4 Secondary (Residual) Disinfection

The water supplier has a legal responsibility to ensure that water in all parts of the distribution and storage system remains potable. The risk of secondary contamination in the distribution system increases with more connections, older infrastructure, inadequate structural protection of watermains, longer flow distances, and longer residence times. **Distribution disinfection** and **residual disinfectant monitoring** may be required if the distribution system has:

a. Any open reservoir
b. Number of connections > **50**
c. Flow distance from the treatment plant or source > **5 km**
d. Flow (residence) time during lowest water usage > **7 days**, or
e. other criteria that, in the opinion of the PHE, present an unacceptable public health risk[1]

The minimum free chlorine residual acceptable throughout the water distribution system is 0.2 mg/L, which is considered reliably detectable.

5.9 Post-Construction Disinfection

Following completion of construction or repair, all new and repaired wells, treatment works, watermains, tanks, etc., need to be adequately disinfected in accordance with the appropriate AWWA standard or an equivalent provided for such disinfection. Note that post-construction disinfection is separate from any on-going disinfection of the actual water supply. It relates only to removal of pathogens that may have been accidentally introduced to the water system during construction. It complements, but does not substitute for, proper construction hygiene to minimise the introduction of contaminants. The current list of AWWA construction disinfection standards include:

- ANSI/AWWA C654: Disinfection of Wells

[1] Examples of situations where residual disinfection would be indicated could include:
- a history of poor construction practices
- incomplete documentation of underground services
- lack of cross-connection control program
- history of secondary growth in the distribution system
- known or suspected major contaminant sources in proximity with the distribution system.

- ANSI/AWWA C652: Disinfection of Water-Storage Facilities
- ANSI/AWWA C653: Disinfection of Water Treatment Plants
- ANSI/AWWA C651: Disinfecting Water Mains
- MMCD Section 02666

Northern Health publishes **PHE guidelines** covering recommended disinfection protocols, which may be used in place of the more detailed AWWA disinfection protocols for common situations. After disinfection, the water needs to be tested for bacteriological quality and satisfactory results obtained before the works are placed in service. A copy of the final test results must be sent to the local EHO/DWO.

6.0 Grounds for Refusal

Generally, deficiencies in proposed designs are discussed with the water supplier or their representative to see if adjustments acceptable to Northern Health are feasible. There may be some situations which preclude the issuance of a Construction Permit, such as:

- The existing/proposed treatment does not provide assurance of safe water quality.
- The existing water source is subject to pollution for which, in the opinion of the EHO/DWO adequate protection is not provided.
- Inadequate details of the proposed project are provided for evaluation.
- The design is not based on appropriate design guidelines or standards.

7.0 Operating Permit

The *Act* requires the water supplier to obtain a valid **Operating Permit** to operate a water system, issued by the EHO/DWO.

With new sources of water supply, the EHO/DWO may require additional operation of disinfection or treatment facilities to waste and additional analysis to confirm that the water quality is satisfactory before allowing the system to be placed in operation. Contact the local EHO/DWO for further information.

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