

Introduction to Drinking Water Quality Monitoring

Interior Health Drinking Water Program

Small Water Systems Team

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January 21st, 2025

Land Acknowledgement

Interior Health would like to recognize and acknowledge the traditional, ancestral, and unceded territories of the Dǎkelh Dené, Ktunaxa, Nlaka'pamux, Secwépemc, St'át'imc, syilx, and T̓silhqot'in Nations where we live, learn, collaborate and work together.



Overview



The Importance of Safe Drinking Water



Why Water Systems need to be Monitored?



Legislative Requirement



Water Quality Monitoring Plan



Common Parameters to Monitor



Best Practices



The Importance of Safe Drinking Water

- In British Columbia, there are ~5000 permitted water systems.
- Interior Health Authority has ~2000 permitted water systems (include stand-alone, small water and large water systems).
 - About 1400 (70%) of the water systems are small water systems.
 - Small water systems are those serving up to 500 population during any 24 hour period.

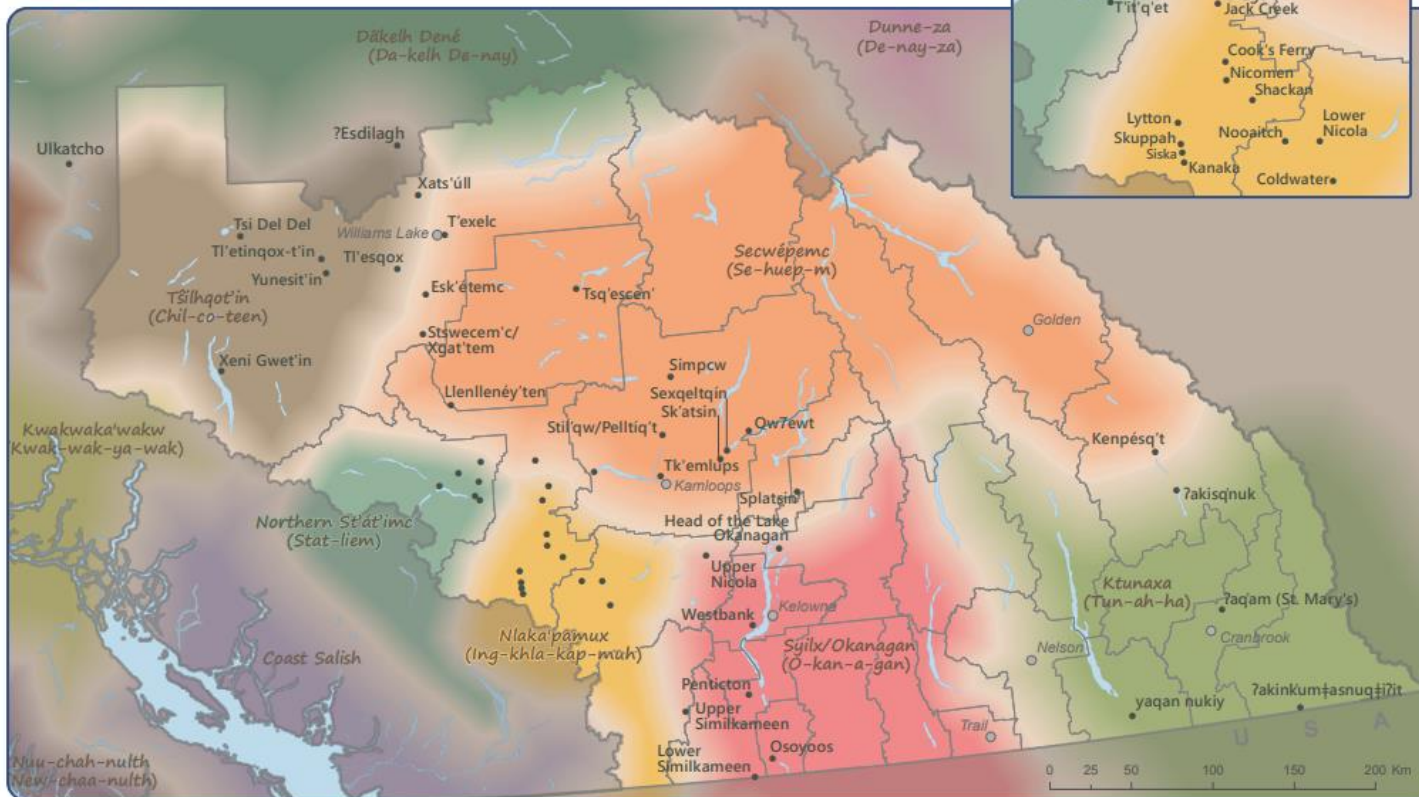




Interior Health

First Nations Communities

with Local Health Area boundaries

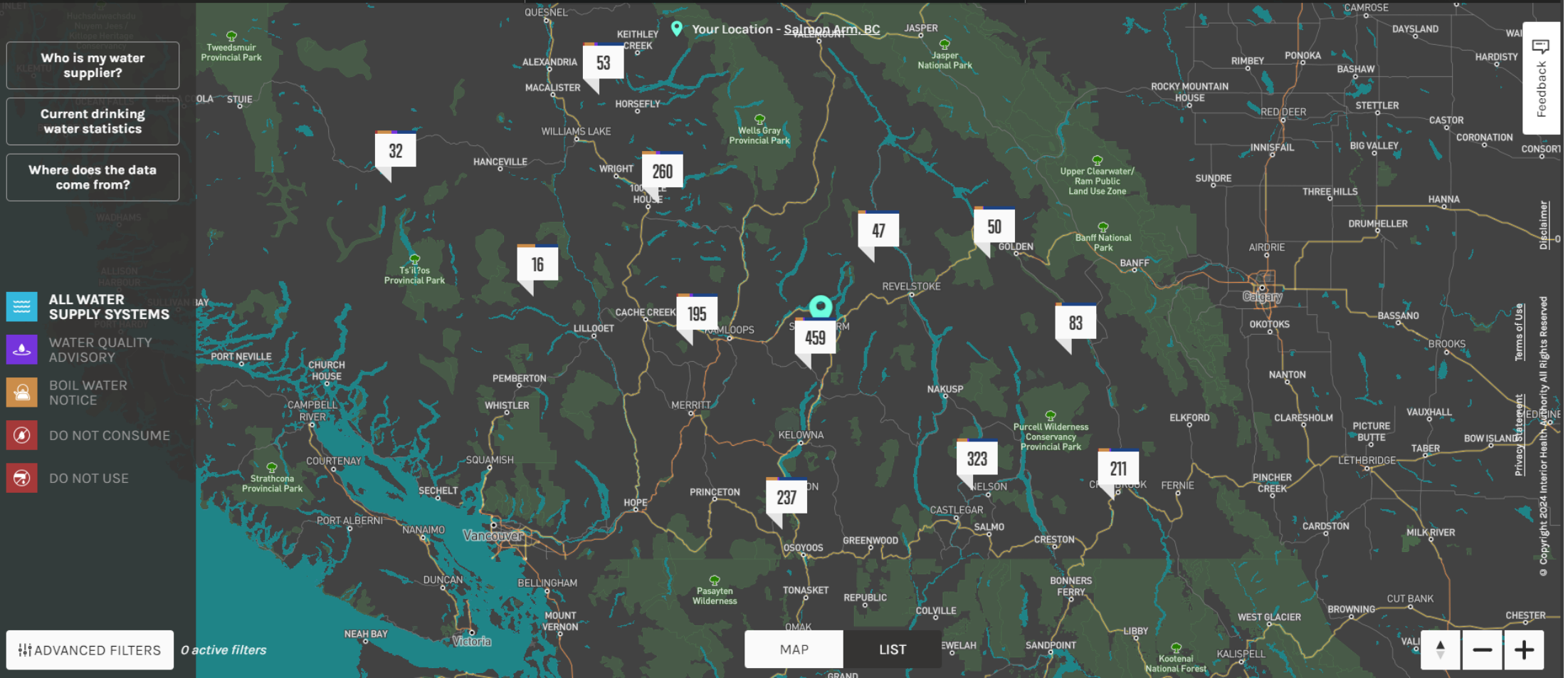


- Ex. People (Pronunciation) / Have Been Called Language Family
- First Nation Community
- Dákelh Dene (Da-kelh De-Nay) / Carrier Athapaskan
- Tsilhqot'in (Chil-co-teen) / Chilcotin Athapaskan
- Northern St'at'imc (Stat-liem) / Lillooet Interior Salish
- Ktunaxa (Tun-ah-ha) / Kootenay Ktunaxa
- Syilx/Okanagan (O-kan-a-gan) Interior Salish
- Secwépemc (Se-huep-m) / Shuswap Interior Salish
- Nlaka'pamux (Ing-khla-kap-muh) / Thompson / Coteau Interior Salish

For traditional and English names of First Nations communities visit: <http://insidenet.interiorhealth.ca/about/ProgServ/aboriginal/Documents/Interior%20First%20Nation%20Communities%20Nearest%20H%20Communities.pdf>

Notes: This map has been adapted from the First Nations Peoples of BC. It is intended to be used as a general reference that reflects the regional diversity of First Nations People served by Interior Health. It is not intended to delineate territorial boundaries.

Updated by Aboriginal Health & Wellness: May 2023



Drinking Water for Everyone: <https://drinkingwaterforeveryone.ca/>

The Importance of Safe Drinking Water (Cont.)

- Trends have suggested that small drinking water systems, maybe more vulnerable to water-borne disease outbreaks.
- Waterborne disease outbreaks in small water systems are often the result of a combination of water system failure.
- Majority of waterborne illnesses go unreported.



The Importance of Safe Drinking Water (Cont.)

Select a disease:

Giardiasis

Select a health region:

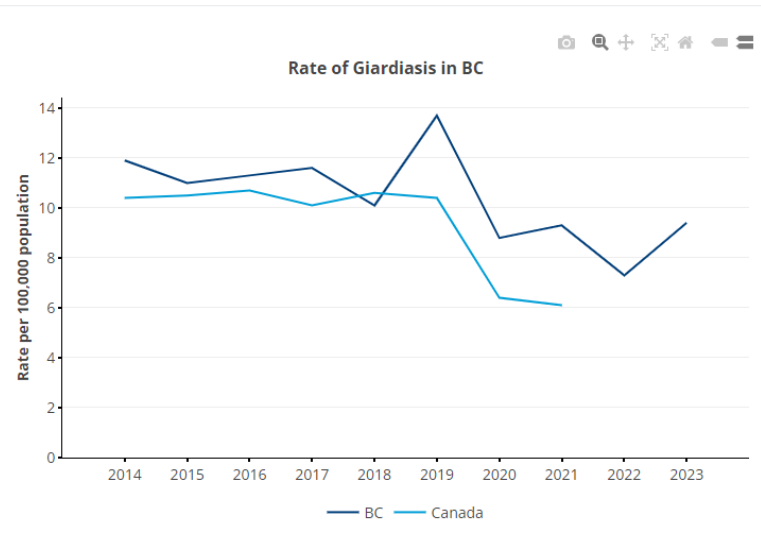
BC

How to Navigate This Report

Download App Data

Giardiasis

Trend



Select a disease:

Cryptosporidiosis

Select a health region:

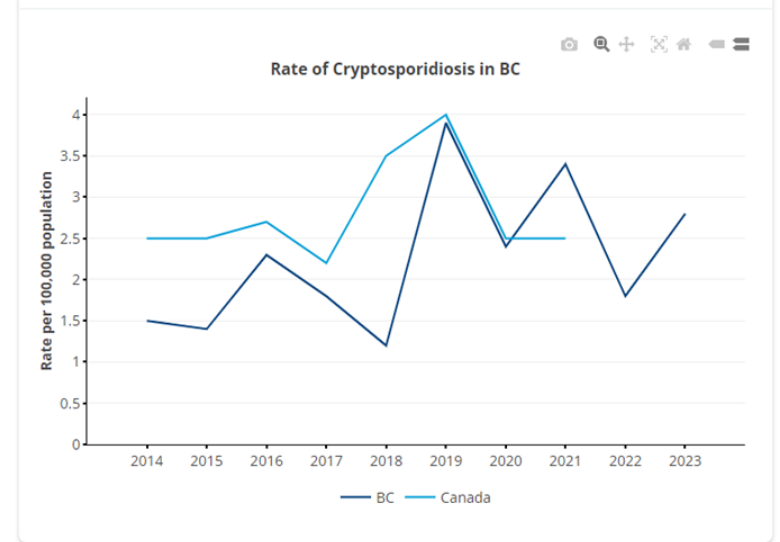
BC

How to Navigate This Report

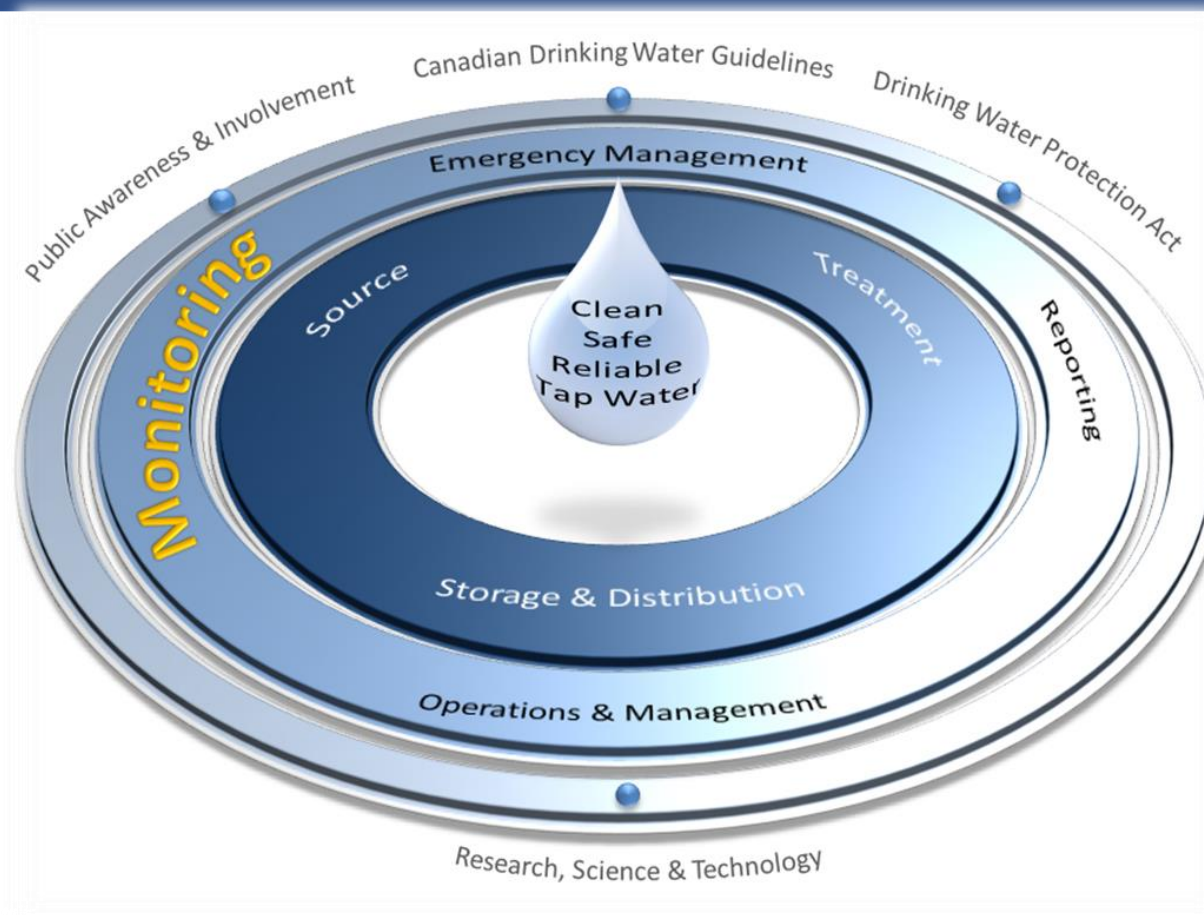
Download App Data

Cryptosporidiosis

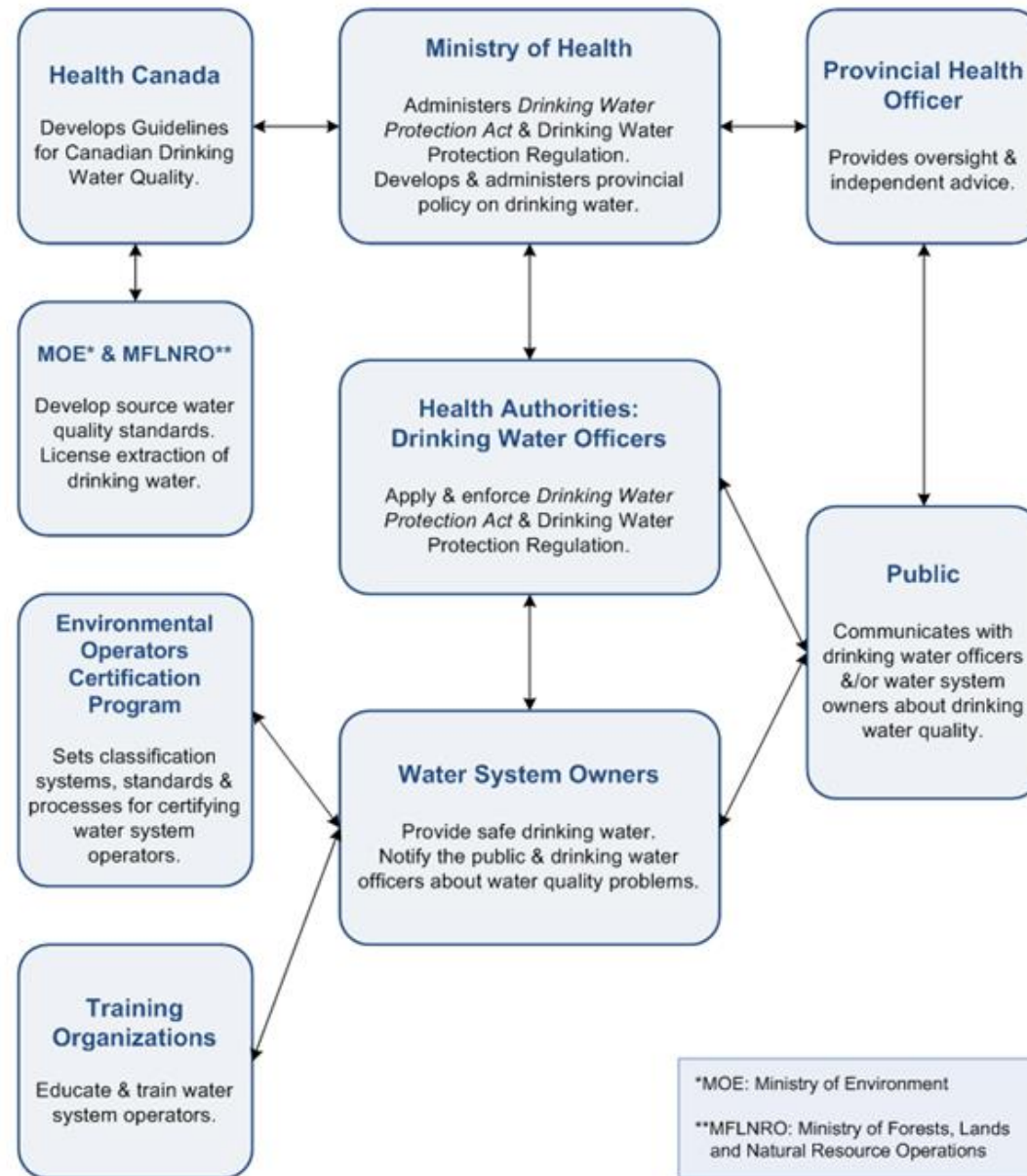
Trend



Multi-Barrier Approach



Roles & Responsibilities in Protecting BC Drinking Water



Reference from the Ministry of Health webpage: [Shared Roles & Responsibilities in Protecting B.C. Drinking Water - Province of British Columbia](#)



Goal: Safe, Reliable, Potable Water

Under the Drinking Water Protection Act, “potable water” is defined as water provided by a domestic water system that

- a) meets the standards prescribed by regulation, and
- b) is safe to drink and fit for domestic purposes without further treatment.



Why Water Systems need to be monitored? (Cont.)

Reasons for monitoring:

- Provides information about your water source.
 - Factors influencing source water quality
 - Natural Factors (climate, watershed characteristics, geology, fire etc)
 - Human Factors (Wastewater/Industrial discharge, mine drainage, spills and releases, livestock, recreational activities etc)



Why Water Systems need to be monitored? (Cont.)

Reasons for monitoring (cont.):

- Provides information about your treated water.
- Ensures your treatment system is working properly and performing as designed.
- Helps identify problems and emergencies.
- Required under the Provincial legislation.



Legislative Requirement

Drinking Water Protection Act

Section 11

“The water supplier must monitor its drinking water source, the water in its system, and the water it provides, for the parameters, and at the frequency established by the regulations and its operating permit.”

“Have the sampling required for that monitoring carried out in accordance with the regulations and the directions of the drinking water officer.”



Legislative Requirement (Cont.)

Drinking Water Protection Regulation

Section 8

"A water supplier must transport water samples to a laboratory in accordance with the procedures established by a drinking water officer."

"A water supplier must monitor for total coliform bacteria and E. coli at the frequencies set out in Schedule B of this regulation."

"A drinking water officer may establish different sampling frequencies for a water supplier."



Legislative Requirement (Cont.)

Schedule B

Frequency of Monitoring Samples for Prescribed Water Supply Systems

(section 8)

**Population Served by the Prescribed
Water Supply System:**

Number of Samples Per Month:

| | |
|------------------|--------------------------------------------------------|
| less than 5 000 | 4 |
| 5 000 to 90 000 | 1 per 1 000 of population |
| more than 90 000 | 90 plus 1 per 10 000 of population in excess of 90 000 |



Conditions on Permit

Drinking Water Protection Act

Section 8

- An Environmental Health Officer can issue “Conditions” on the Operating Permit of a water supply system.
- Examples of the conditions on permit:
 - Monitor a parameter(s) of concern (turbidity, uranium, arsenic, manganese, fluoride, nitrate, etc)
 - Install continuous on-line monitoring of the disinfection chemical concentrations
 - Create and follow a Water Quality Monitoring Plan (WQMP)



What is a Water Quality Monitoring Plan (WQMP)?

A WQMP is

- a detailed written plan tailored to each individual water system “from source to tap”.
- aligned with the *Drinking Water Protection Act & Regulation*.

A WQMP

- identifies key chemical, physical and bacterial parameters to monitor.
- Outlines location, frequency and how-to instructions for monitoring and sampling.



What is a Water Quality Monitoring Plan (WQMP)? (Cont.)

- ❑ Depends on
 - Type of water source (surface water vs. groundwater)
 - Treatment components
 - Infrastructure age and type
- ❑ Includes record keeping
 - Operations & Maintenance
 - Treatment documentation
- ❑ Reporting to water users
 - Monthly
 - Annual



What is a Water Quality Monitoring Plan (WQMP)? (Cont.)

The Goal of a WQMP:

“The key to ensuring clean, safe and reliable drinking water is to understand the drinking water supply from the source all the way to the consumer’s tap.” – Health Canada, The Multi-Barrier Approach to Safe Drinking Water



EHO examples

SWS Water Quality Monitoring Plan Example Template

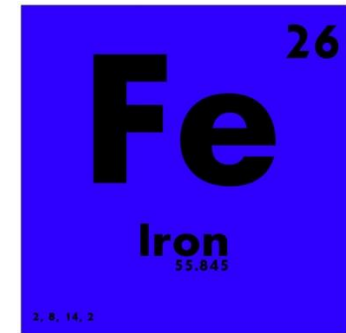


| Type of Monitoring | Parameters | Frequency | Points to Consider |
|-------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Microbiological | Total Coliform E. Coli Background growth | 4 x month (generally once per week) or at discretion of EHO | <ul style="list-style-type: none"> Where are your sampling locations? Raw water, dead ends, low pressure zones? Is your sampler trained? Are you using a lab approved by the BC Provincial Health Officer (PHO)? |
| Chemical | Routine Chemical Testing as per the Guidelines for Canadian Drinking Water Quality | Every 5 years (unless there is a parameter of concern) or at discretion of EHO | <ul style="list-style-type: none"> Where are your sampling locations? Raw water, post-treatment? Are you using a laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA)? |
| Disinfection/Treatment | | | |
| 1. Chlorine | Primary disinfection Residual (secondary) disinfection Injector function Visual inspections | Daily | <ul style="list-style-type: none"> Where in the system are you testing chlorine residuals? Are you testing for combined chlorine or free chlorine? Do you calibrate your chlorine test kit and chlorinator? |
| 2. UV | UV Dose and/or UVT Visual inspections Alarms | Daily | <ul style="list-style-type: none"> Is it a certified unit with low UV dose alarms? Is there an automated solenoid shut-off if low UV dose detected? |
| 3. Filtration | Visual inspections Pressure differentials | Daily | <ul style="list-style-type: none"> Do the filters need replacement? Are pressure gauges available for all filters? |



Common Parameters to Monitor

- ❖ Biological/Microbiological
- ❖ Chemical



Common Parameters to Monitor - Biological

➤ Biological parameters

- Bacteria, Protozoa and Viruses
- Pathogens are disease-causing microorganisms and primarily spread through feces.
- Pathogens can be naturally occurring in wildlife. They can get into the water via nearby septic systems and agriculture runoff.
- Routine microbiological samples are required under the Provincial legislation.



Common Parameters to Monitor (Cont.)

- Biological

➤ Biological parameters

- Monitored through Indicator Organisms
 - E. Coli and Total Coliform
- Use Indicator Organisms, because:
 - There are thousands of different pathogens
 - Lab tests are not available or are complicated for some pathogens
 - Most cost effective to test for “indicators” of fecal and environmental contamination



Indicator Organism

Total Coliform

- Bacterium naturally present in the environment (surface water, soils, vegetation, decaying animals etc)
- Indicates the need for further investigation of source of contamination
- Can occur because of:
 - Improper bacterial sample collection
 - Inadequate/malfunctioning treatment equipment
 - Cross-connections
 - Inadequate maintenance (biofilm growth in pipes)
- Public notification may or may not be required



Indicator Organism

E. Coli

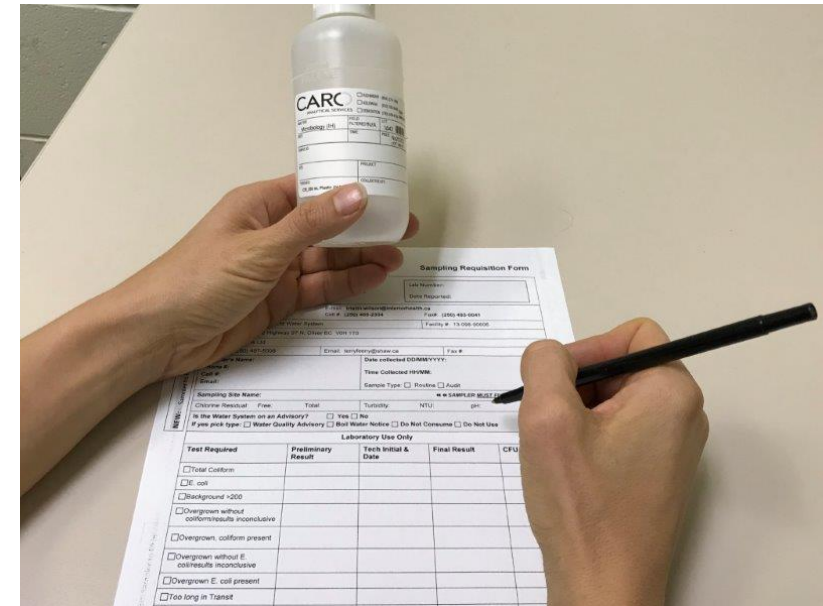
- Bacterium found in the intestines of humans and warm-blooded animals. Not usually found naturally in the environment.
- Indicates recent fecal contamination
- Significant public health threat
- Boil Water Notice must be issued



Collecting Bacteriological Samples

Steps and tips to collect a bacteriological sample

1. Label the sample bottle and complete the requisition form provided by EHO.
2. Collect and submit the water sample.
 - Samples received by the lab more than 30 hours after collection will be discarded/not tested
3. Reporting of water sample results.
 - Samples results are posted on Interior Health's public website.
 - Only will be contacted if sample results are unacceptable.



Bacteriological Sample Results Interpretation

Drinking Water Protection Regulation

Schedule A

[am. B.C. Reg. 47/2024, s. 2.]

Water Quality Standards for Potable Water

(sections 2 and 9)

| Parameter: | Standard: |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Escherichia coli</i> | No detectable <i>Escherichia coli</i> per 100 ml |
| Total coliform bacteria (a) 1 sample in a 30 day period (b) more than 1 sample in a 30 day period | No detectable total coliform bacteria per 100 ml At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml |



Water Sample Results

The screenshot shows the Interior Health website's 'Drinking Water' page. The top navigation bar includes links for 'About IH', 'Careers', 'HealthLink BC', 'Stories@IH', 'MyHealthPortal', 'Pay Online', 'Book a Lab Appointment', and 'Contact'. Below this is a secondary navigation bar with 'COVID-19', 'Toxic Drug Crisis', 'Health & Wellness', 'Information For', and 'Get Involved'. On the right, there are 'Find a SERVICE' and 'Find a LOCATION' buttons. The main content area features a large image of a young girl drinking from a bamboo water bottle. To the left of the image, the text reads: 'Home / Health & Wellness / Environmental Health & Hazards', 'Drinking Water', 'Learn how to stay up-to-date on the safety of drinking water in the Interior Region, and what process to follow if you have concerns about your drinking water.', and a yellow button labeled 'View Drinking Water Samples'. Below the image, the Interior Health logo is visible.

Interior Health webpage:
[Drinking Water Providers & Operators | Businesses | IH](#)

Water Samples

The list contains water quality samples taken over the last 120 days.

To find the results of water samples taken for a water supply system or a beach, enter the first three letters of a facility, city, town or beach name in the search textbox. Alternatively, select one of three geographical regions in the Region dropdown to see all of the samples within an entire region.

Search By:



Common parameters to monitor - chemical

➤ Chemical parameters

CHEMICAL AND PHYSICAL:

Alkalinity

Aluminum

Ammonia

Antimony

Arsenic

Barium

Boron

Cadmium

Calcium

Chlorides

Chromium

Colour

Conductivity

(Conductance/Specific

Conductance)

Copper

Corrosivity (Calcium

Carbonate

saturation/Langelier's index)

Cyanide

Fluoride

Hardness

Iron

Lead

Magnesium

Manganese

Molybdenum

Mercury

Nitrates

Organic Nitrogen

pH

Phosphorous

Potassium

Selenium

Sodium

Sulphate

Temperature

Total Dissolved Solids

Total Organic Carbon

Turbidity

Strontium

Uranium

UV transmittance

(unfiltered)

Zinc



Common parameters to monitor (Cont.)- chemical

Examples of accredited labs in or near the IH region:

- ALS Environmental (Calgary, Kamloops, Vancouver)
- CARO Analytical Services (Kelowna, Richmond)

Full list: [PHO-Approved-Laboratory-List.pdf](#)



Common parameters to monitor (Cont.) - chemical

Guidelines for Canadian Drinking Water Quality

MAC – Maximum Acceptable Concentration – health based

AO – Aesthetic Objective – based on aesthetics

OG – Operational Guideline Value – based on operational considerations



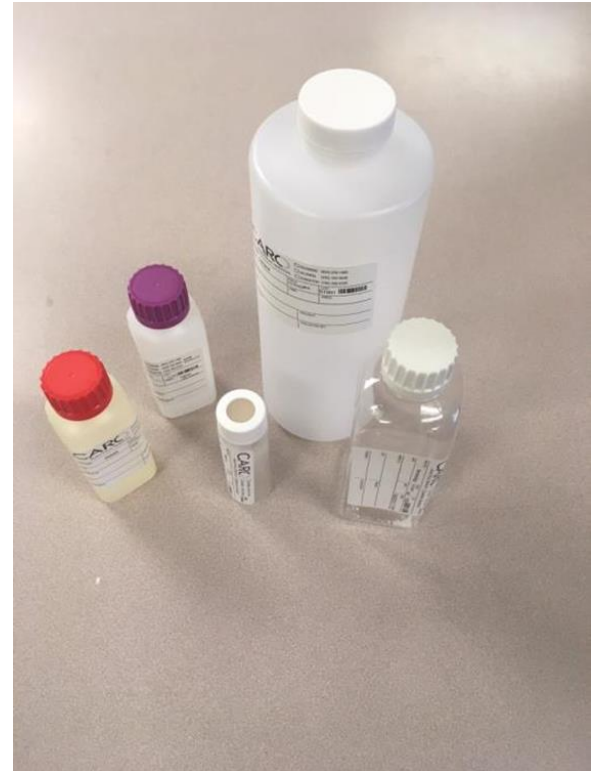
Chemical Parameters of Concern – in Interior BC

| PARAMETER | HEALTH EFFECTS |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manganese | Excessive levels may harm brain development in infants and young children. Manganese is most easily absorbed in the body through drinking water. |
| Nitrates | Blue baby syndrome (reduces the amount of oxygen in the blood), reduced thyroid gland function in school-age children and a possible carcinogen. |
| Uranium | Damages kidneys and bones due to direct toxic effect of uranium metal, not radiation. May indicate that Radon gas is also present. |
| Arsenic | Classified as a carcinogen (lung, bladder, liver, skin). High levels cause abdominal pain, vomiting, diarrhea, pain & numbness to the extremities and muscles, and weakness. Can cause warts on palms of hands or feet. |
| Fluoride | At high concentrations causes dental fluorosis in children (white, black, brown spots or streaks on the teeth). |
| Selenium | At high concentration causes selenosis (hair loss, tooth decay, muscle weakness, nail and skin anomalies and neurological problems). Causes garlic odour breath. |



Collecting Chemical Samples

- Use bottles supplied by accredited labs.
- There are specific bottles for each parameter type (some with preservatives).
- Similar to bacteriological sampling.
- Pack and ship as directed by the lab.



Chemical Sample Results Interpretation

- Compare sample results to the MAC, AO, OG listed in the Guidelines for Canadian Drinking Water Quality.

Guidelines for Canadian Drinking Water Quality

Summary Tables

October 2024



Canada



Health and well-being for all
Quality | Integrity | Compassion | Safety

Best Practices

- Other parameters to monitor in Small Water Systems:
 - ❖ Turbidity
 - ❖ pH
 - ❖ Temperature
 - ❖ Pressure differential
 - ❖ Disinfectant Residual
 - ❖ Disinfection By-Product (THMs, HAAs)
 - ❖ UV



Best Practices (Cont.) – Pilot Study Monitoring Program

- Pilot study monitoring programs should be developed to collect representative data to demonstrate the operating conditions and treatment process performance under normal and worse-case operating conditions, include:
 - ❑ Complete raw water characterization;
 - ❑ Climate conditions during piloting;
 - ❑ Water Quality parameters and the associated sampling location(s) for each unit process being tested;
 - ❑ Monitoring frequency for each parameter and sampling locations; and
 - ❑ Monitoring equipment and calibration standards.



Best Practices (Cont.) - Equipment

- Routine (daily, weekly or monthly) checks of all equipment and treatment components.
- Water system should have equipment to perform the routine performance monitoring necessary to ensure proper operation of the system.
- Monitoring equipment should be based on the characteristics of the raw water source and the complexity of the treatment processes.
- Testing and monitoring should be conducted by appropriately trained individuals.



Best Practices (Cont.) - Equipment

Some monitoring equipment include:

- Handheld turbidimeters
- Pressure gauges
- DPD method chlorine test equipment
- pH meter



Best Practices (Cont.) – Location of Monitoring

- Bacteriological samples (testing for Total Coliform and E. Coli) – typically sampling sites include at the source, mid-point and far end of the distribution system.
- Chemical(s) of concern – pre-treatment and post-treatment (if treatment available).
- Other parameters – in consultation with DWO.



Best Practices (Cont.) – Frequency of Monitoring

| Parameter | Frequency |
|-------------------------------|---------------------------------------------------------------------------------|
| Chlorine Residuals | Daily |
| Real-Time turbidity | Daily |
| Visual inspections | Daily |
| Routine Chemical Testing | Every 3-5 years |
| Chemical Parameter of Concern | Could be monthly, quarterly, or annually. May depend on treatment equipment. |



Best Practices (Cont.) - Record Keeping & Recording

Importance of record keeping:

- Creates a permanent record of operations
- Demonstrates due diligence and professionalism
- Improves reporting to water users
- Allows for continuity between operator hand-overs



Example of Monitoring Plan

Chlorine Readings in Distribution System:

| Date | Time | Location | Combined Residual (mg/L) | Free Residual (mg/L) | Initials |
|------|------|----------|--------------------------|----------------------|----------|
| | | | | | |
| | | | | | |
| | | | | | |

Maintenance Log:

| Date | Component | Comments |
|------|-----------|----------|
| | | |
| | | |
| | | |

Complaints Log:

| Date | Name | Comments |
|------|------|----------|
| | | |
| | | |
| | | |



Example of Report

Annual report:

- Must contain results of all monitoring required by the legislation, operating permit or DWO;
- Can also contain:
 - Brief summary of the water system
 - History of the water system
 - Notice of any threats to the water system
 - Drinking water health hazards
 - Emergency Response and Contingency Plan
 - Treatment goals and plans



BC Online Help Center for Small Water Systems

Water Quality Monitoring of your Small Water System course at: [Courses | BC Small Water Systems Online Help Center](#)

SAFE WATER FROM SOURCE TO TAP

Welcome to the BC Small Water Systems Online Help Centre. We understand that small water systems face many challenges, this website helps address many of those challenges by providing technical resources, templates, and free webinars and courses to support you to deliver safe tap water.

We encourage all small water operators, owners, and Indigenous small water system operators to explore this site. We have developed tools to help you in planning, construction, maintenance and troubleshooting of your small water system.

This website is developed and maintained by Thompson Rivers University. The Online Help Centre is designed to help you operate a water system that delivers safe drinking water that meets BC legislative requirements.

We are excited to provide this much needed service.

Introducing our Marketplace!

The Marketplace is an online service specifically for small water operators within British Columbia to save you time and help you source what you need, where you need it. These pages can help connect you to services in your area, or help you easily sell products you no longer need.

[VISIT THE MARKETPLACE](#) [LEARN MORE](#)

NEXT WEBINAR

Introduction to Water Quality Monitoring
Tue Jan 21, 2025
11:00 - 12:30 (PST)

[REGISTER FOR THIS WEBINAR](#)

NEXT COURSE

Emergency Response & Contingency Planning
Wed Dec 18, 2024
9:00 - 12:00 (PST)

[REGISTER FOR THIS COURSE](#)

Water Quality Monitoring of your Small Water System

This introductory level course will provide information to small water system operators on how to create a basic “water quality monitoring plan”. Attendees will learn about monitoring drinking water infrastructure, chemical and bacterial parameters to help keep the water system in good working order and quickly identify and correct problems when they arise. We will also discuss best practices and legislative requirements for operations and management of a small water system.

There are no prerequisite courses or education required for attendance.

| DATE & TIME | REGISTRATION CONTACT | DELIVERY METHOD |
|------------------------------|----------------------------------------------------------------------------------------------|-----------------|
| Wed, Mar 12 2025, 9am - 12pm | jennifer.marcotte@interiorhealth.ca | Online |
| Wed, Apr 23 2025, 9am - 12pm | paula.gray@interiorhealth.ca | Online |
| Wed, Sep 17 2025, 9am - 12pm | mansi.godhania@interiorhealth.ca | Online |
| Thu, Oct 30 2025, 9am - 12pm | keyana.bjornson@interiorhealth.ca | Online |
| Thu, Nov 20 2025, 9am - 12pm | christine.sweezey@interiorhealth.ca | Online |



Guidance Documents

- **Provincial Guidelines**
 - Small Water Systems Guidebook
 - Maintaining Water Quality in Distribution Systems
 - Drinking Water Source to Tap Screening Tool
 - Water System Assessment Users Guide
- **Provincial *Drinking Water Officers Guide***
 - Drinking Water Chemical and Physical Monitoring Guidelines
- ***Guidelines for Canadian Drinking Water Quality***
- **Interior Health Website**
- **BC Water and Waste Association (BCWWA) & AWWA**
 - Best practices





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