



Progress on the Action Plan for Safe Drinking Water in British Columbia 2015



Office of the
Provincial Health Officer

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Provincial Health Officer

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www.health.gov.bc.ca/pho

Ministry of Health
Victoria, BC

July 2015

The Honourable Terry Lake
Minister of Health

Dear Minister:

I have the honour of submitting the Provincial Health Officer's report, *Progress on the Action Plan for Safe Drinking Water in British Columbia*, for the years 2009/2010 to 2011/2012.

Sincerely,

A handwritten signature in black ink, appearing to read 'P.R.W. Kendall', with a horizontal line drawn underneath it.

P.R.W. Kendall,
OBC, MBBS, MHSc, FRCPC
Provincial Health Officer



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The Provincial Health Officer is grateful for the contributions to this report by the following people:

Evan Adams, MD

Chief Medical Health Officer
First Nations Health Authority

Lucy Beck

Regional Director of Health Protection (retired)
Northern Health Authority

Glen Brown

*Executive Director, Local Government,
Infrastructure and Finance*
BC Ministry of Community, Sport and Cultural
Development
(moved to Union of BC Municipalities)

Barb Callander

Manager, Projects and Strategic Initiatives
Population Health Surveillance, Engagement and
Operations
BC Ministry of Health

Vicki Carmichael

*Groundwater Hydrologist, Groundwater and Aquifer
Science (retired)*
BC Ministry of Environment

Eleni Galanis, MD

Epidemiological Services
BC Centre for Disease Control

Bruce Gaunt

Drinking Water Leader
Northern Health Authority

Bill Hyslop

Executive Director (retired)
Environmental Operators Certification Program

Judy Isaac-Renton, MD

Public Health Laboratory Director
Public Health Microbiology & Reference Laboratory
BC Centre for Disease Control

Lynn Kriwoken

Director, Water Protection and Sustainability
BC Ministry of Environment

Nadine Loewen, MD

Medical Health Officer (retired)
Fraser Health Authority

Acknowledgements

David Maloney

Forest Water Management Officer
BC Ministry of Forests, Lands and Natural Resource
Operations

Meggin Messenger

Director, Planning Programs
Intergovernmental Relations and Planning
BC Ministry of Community, Sport and Cultural
Development

Roger Parsonage

Regional Director, Health Protection
Interior Health Authority

Al Planiden

Manager, Roadside Development (retired)
BC Ministry of Transportation and Infrastructure

Sandy Reber

Graphic Design
Reber Creative Design & Communications

Talitha Soldera

Director, Local Government Finance
BC Ministry of Community, Sport and Cultural
Development

Sylvia K. Struck, PhD

Environmental Health Scientist
BC Centre for Disease Control and
National Collaborating Centre for
Environmental Health
(moved to First Nations Health Authority)

Richard Taki

Executive Director, Health Protection
Vancouver Health Authority

Ann Thomas

*Regional Manager, Health Protection
and Environmental Services*
Vancouver Island Health Authority

Adrienne Treloar

Manager, Project Research Reporting Initiatives
Office of the Provincial Health Officer
BC Ministry of Health

Ted van der Gulik

*Senior Engineer, Sustainable Agriculture
Management (retired)*
BC Ministry of Agriculture

Mike Wei

Section Head, Groundwater and Aquifer Science
BC Ministry of Environment

Marc Zubel

Manager, Drinking Water Program
Fraser Health Authority

REPORT LEADS

Eric Young, MD, FRCP(C)

Deputy Provincial Health Officer (retired)
Office of the Provincial Health Officer
BC Ministry of Health

Bonnie Henry, MD, MPH FRCP(C)

Deputy Provincial Health Officer
Office of the Provincial Health Officer
BC Ministry of Health

Heather Slater, PhD, PHI(c)

Environmental Engineer
Independent Contractor

Barry Boettger

Provincial Drinking Water Officer (retired)
Office of the Provincial Health Officer
BC Ministry of Health

Lynne Magee

Interim Provincial Drinking Water Officer
Office of the Provincial Health Officer
BC Ministry of Health
(formerly Regional Drinking Water Coordinator,
Vancouver Island Health Authority)

Highlights



This report continues to chart the progress made on the eight key principles under the *Action Plan for Safe Drinking Water in British Columbia* (Action Plan). It also fulfils the requirement under Section 4.1 of the *Drinking Water Protection Act* to report out on activities conducted under the Act.

The report covers the programs and initiatives from the 2009/2010, 2010/2011, and 2011/2012 fiscal years. The format is similar to the previous reports covering 2003/2004 to 2008/2009. These reports have background information not covered in this report, and can be found at www.health.gov.bc.ca/pho/reports/drinkingwater.html.

At the end of March 2012, there were 4,799 water systems in BC. Most of them serve very small numbers of people. The majority of the population receives drinking water from a few large systems. Large urban areas and some smaller centres have certified operators and professional engineers operating the water systems to provide the public with the highest water quality possible.

Some systems source high quality groundwater that does not require initial treatment, but may require

residual disinfection to maintain the water quality in the distribution system. Water from some wells and all surface sources must be treated. Treatment can include filtration and disinfection, or disinfection alone. Different methods of disinfection include chlorination, chloramination, ultraviolet irradiation, or ozonation.

British Columbians living in small or remote communities frequently face challenges with their drinking water supplies. The challenges for suppliers can include the following:

- Inadequate treatment.
- Difficulty attracting and retaining trained and certified operators.
- Difficulty accessing laboratory services within the 30-hour time limit for analysis of *E. coli* and total coliform bacteria in drinking water.
- Inadequate financial resources to make upgrades to water systems.

Although progress is being made to address these challenges, in some cases it occurs very slowly.

The eight principles outlined in the *Action Plan for Safe Drinking Water in British Columbia* are as follows:

1. The safety of drinking water is a public health issue.
2. Source water protection is a critical part of drinking water protection.
3. Providing safe drinking water requires an integrated approach across all ministries and agencies that have legislated authority for water protection from source to tap.
4. All water systems need to be thoroughly assessed to determine risks.
5. Proper treatment and water distribution system integrity are important to protect public health.
6. Tap water must meet acceptable safety standards and be monitored.
7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Each principle will have its own section in the report, and will include highlights on activities under the Action Plan for 2009 to 2012.

Laboratory audits continue to be conducted and reviewed through the Enhanced Water Quality Assurance Program. Over the reporting period, one new laboratory in the province was approved for microbiological water testing. Approved laboratories also participated in a project to develop novel tools to assess water quality.

During the reporting period, no outbreaks of waterborne disease were reported. The number of boil water notices remained stable, with 604 notices in effect April 1, 2009, and 599 in effect March 31, 2012. Most of the notices were on small systems serving small numbers of people. Some larger systems were put on advisories for short periods due to decreased source water quality, often weather related. Changes in the number over time may reflect increased assessment and reporting practices and not necessarily decreased water quality. All health authorities post current advisories on their public websites.

In 2009, the *Water Act* modernization process began, with a goal to have a new *Water Act* by 2014.^{a,1} This is a goal from *Living Water Smart – BC's Water Plan*. The new *Water Act* will improve protection for the quality and quantity of water, and will include licensing of groundwater. A greater emphasis will be placed on the value of water and conservation measures.

In 2010, the *Oil and Gas Activities Act* replaced and updated existing regulations and created new ones. The *Oil and Gas Activities Act* continued the authority of the Oil and Gas Commission under Section 8 of the *Water Act* to issue short-term water approvals, for a maximum of two years, for water use in the oil and gas industry. The Commission also has the ability to issue longer term water licences under a designation from the Ministry of Forests, Lands and Natural Resource Operations.

Mandatory reporting of the additives used for hydraulic fracturing is required in BC. BC was the first province in Canada to require public reporting of components used in fracturing fluids. Hydraulic fracturing fluid information is uploaded to the chemical registry (www.fracfocus.ca).

In 2006, a Water Availability Indicator (WAI) was developed to describe the availability of water in Canada. BC as a whole was rated as having a low WAI (less than 10 per cent of available water being used and low stress on water source quantity). Water availability in the Okanagan Valley, however, is a concern, and the local area has a WAI rated as high (more than 40 per cent of available water being used, indicating severe stress to water source quantity). The Ministry of Environment reported that over 175 surface sources have reached, or are nearing, their capacity to supply water. Groundwater levels are declining in some areas and one-third of aquifers are vulnerable to contamination.

In 2010, the Auditor General of British Columbia reviewed the Groundwater Program. The report, *An Audit of the Management of Groundwater Resources in British Columbia*,² concluded that the provincial government is not ensuring the sustainability of the province's groundwater resources.

^a Bill 18, the new *Water Sustainability Act*, received Royal Assent on May 29, 2014. The current *Water Act* will remain in force until the *Water Sustainability Act* is brought into effect in 2016.

The Assistant Deputy Ministers' (ADM) Committee on Water and the Directors' Inter-Agency Committee on Drinking Water are the facilitating bodies for the Action Plan. During the reporting period, the ADM Committee on Water was dissolved. The Directors' Inter-Agency Committee on Drinking Water reviewed the function of the regional drinking water teams and confirmed that they are the best option at this time to address coordination and accountability in drinking water source protection.

Information management continues to be an issue in BC. As stated in the previous drinking water report, access to information on water in BC could be improved by creating a single public portal that has links to all relevant websites that deal with drinking water, source protection, and land-use management.

Assessments of drinking water systems consider the water source, the infrastructure, and the system's ability to meet regulatory requirements and industry standards. During the reporting period, the Ministry of Community, Sport and Cultural Development provided 71 grants to communities under the Infrastructure Planning Grant Program. These grants were to help communities plan improvements to their water systems. The total value of the grants was \$660,990.

In the years 2009 to 2012, 7,899 water system inspections were conducted and hazard ratings given based on the system's compliance with the *Drinking Water Protection Act* and Drinking Water Protection Regulation. Systems were also assessed on their use of the multi-barrier approach to meet operational standards.

Source-to-tap assessments are another component of the multi-barrier approach. There are three tools available that range in complexity, time, and cost from simple to very comprehensive assessments.

First Nations water systems are inspected annually. The inspections include risk assessments to ensure systems operate effectively and meet health and safety guidelines. In 2011, the National Assessment of First Nations Water and Wastewater Systems³ was completed. In BC, 290 water systems, serving 188 First Nations communities, were assessed.

In BC, drinking water from surface water sources must be disinfected. In March 2012, a draft guidance document, *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia*, was posted on the Ministry of Health website for public comment.

If groundwater is at risk of containing pathogens, it also requires disinfection. Version 1 of the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Groundwater under Direct Influence of Surface Water (GWUDI)* guides drinking water officers in determining appropriate treatment requirements.

Water systems are required to have operating permits and some may have conditions on the permits. There was very little change in the number of systems that had permits over the reporting period, but permits with conditions increased by 75 per cent. The number of systems that have an emergency response and contingency plan has continued to increase over the reporting period.

Water systems must be monitored for water quality. Over 100,000 samples are tested for bacteria each year. Water system operators also test chemical and physical parameters such as metals, nitrates, fluoride, and disinfection by-products. If a sample submitted from the distribution system tests positive for *E. coli*, the reason for the contamination will be investigated. A boil water notice may be issued. Changes to process indicators such as turbidity, pH, or chlorine levels also indicate a change in water quality, requiring an investigation into the cause of the change. Ongoing issues with water quality may require changes to the system, such as upgrading the treatment system or obtaining a new water source.

Governance of water systems in BC can be complex due to the diversity of governance structures and the variety of legislation under many different branches of government. The type of system governance was found to predict which small water systems were most likely to be placed on long-term drinking water advisories. Cooperative governance structures not owned nor operated by a local government or utility are the most challenged. They often lack the financial resources and the ability to deal with administrative functions.

In the reporting period, some health authorities had some success in reducing the number of long-term water quality or boil water notices. The reduction in health regions varied, possibly due to the challenges that face small drinking water systems, especially those in remote areas.

The total number of water samples testing positive for *E. coli* decreased approximately 7 per cent over the reporting period; however, the absolute number of samples reported has increased since the last reporting period, since Interior Health Authority is now able to report on this indicator. Under the Drinking Water Protection Regulation's "immediate reporting requirement", if a sample tests positive for *E. coli*, the laboratory will notify the water supplier, the drinking water officer, and the medical health officer. Drinking water officers and water suppliers will investigate to find the probable cause of the contamination, fix the problem, and resample. A public advisory or notice may be issued.

The Drinking Water Protection Regulation defines a small water system as "a water supply system that serves up to 500 individuals during any 24-hour period." Health authorities collect data on system size based on the number of connections they serve. Most systems with 15 connections or less will generally have a population of 500 persons or less. There are almost 4,800 water systems in BC at this time, and the vast majority are small water systems.

Small water systems often fail to generate the revenue required to update aging systems or inadequate

treatment processes. The system users may be reluctant to pay more for water because they believe the water is safe as it is, or they are comfortable managing their risk by using bottled water or water from another source. This makes it difficult to make changes to improve water quality.

In response to these issues, in 2010 the Union of BC Municipalities (UBCM) formed a Small Water Systems Working Group. The purpose was to respond to local government concerns over the application of the *Drinking Water Protection Act* and water quality standards to small water systems. In 2011, the UBCM Working Group made recommendations for a new definition of small water systems and a new approach to treating surface water.

Several organizations developed tools or provided educational opportunities for small water systems during the reporting period. Examples of completed projects by the Sustainable Infrastructure Society included group liability insurance, asset management and rate setting, access to loans, and a guidebook on point-of-entry water treatment. In 2010, a small water system on Bowen Island had point-of-entry treatment devices installed on every home, at a reasonable cost.

As of 2009, local governments are required to undertake an inventory of all their assets, including drinking water infrastructure. By 2012, all but one local government were compliant and most were working to develop tangible asset management programs.

Introduction



This report charts progress made on each of the eight key principles in the *Action Plan for Safe Drinking Water in British Columbia*, developed in 2002 by the provincial government. It also reports on activities under the *Drinking Water Protection Act* in accordance with the reporting requirements of Section 4.1 of the Act. The report covers programs and initiatives during the 2009/2010, 2010/2011, and 2011/2012 fiscal years. It follows a similar format to the previous three reports: the 2007 report covering 2003/2004 and 2004/2005 fiscal years; the 2008 report covering 2005/2006 and 2006/2007 fiscal years; and the 2011 report covering 2007/2008 and 2008/2009 fiscal years. Previous drinking water reports can be found online at www.health.gov.bc.ca/pho/reports/drinkingwater.html.

The three previous drinking water reports provide a great deal of contextual information not repeated in the current report on the activities under the *Action Plan for Safe Drinking Water in British Columbia*. The original Provincial Health Officer's (PHO) annual report on drinking water, *Drinking Water Quality in BC: The Public Health Perspective*, which recommended development of a *Drinking Water Protection Act* and an action plan for drinking water protection in British Columbia, can be downloaded at www.health.gov.bc.ca/pho/reports/annual.html.

The *Action Plan for Safe Drinking Water in British Columbia* (2002) can be found online at www2.gov.bc.ca/gov/topic.page?id=6B78C6F1852C49BAAF26D6D3FF16508E.

DRINKING WATER IN BRITISH COLUMBIA

The *Drinking Water Protection Act* and regulation recognize that drinking water supplies are best protected using a multi-barrier approach, from source to tap. Protection is achieved through a multi-step process that gathers information about each water source and supply system through inspections, assessments, and water monitoring, and then puts barriers in place to stop potential contaminants from entering the drinking water supply.

During the reporting period, the provincial government reorganized, created, and renamed those BC ministries responsible for drinking water protection. Table A outlines the transfer of primary drinking water protection responsibilities during the reorganization of BC ministries that occurred during the reporting period (April 1, 2009 to March 31, 2012). It is not a complete list of the transferred responsibilities between existing and created ministries and does not include regulatory responsibilities created during this reporting period.

Table A Reorganization of BC Ministries and Transfer of Primary Drinking Water Protection Regulatory Responsibilities during the Reporting Period (April 1, 2009 to March 31, 2012)

June 2009	October 2010	March 2011
Ministry of Agriculture and Lands (MAL)	Ministry of Agriculture (AGRI)	
Ministry of Energy, Mines and Petroleum Resources (MEMPR)	Ministry of Energy	Ministry of Energy and Mines (MEM)
Ministry of Environment (MOE)		
Ministry of Forests and Range (MFR)	Ministry of Forests, Mines and Lands (MFML)	Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). Responsibilities from <ul style="list-style-type: none">• MFML• MNRO
	Ministry of Natural Resource Operations (MNRO). Responsibilities from <ul style="list-style-type: none">• MAL• MEMPR• MOE• MFR	
Ministry of Health Services (MHS)	Ministry of Health	
Ministry of Healthy Living and Sport (MHLS)		

Sources: Office of the Premier. (2010). *Premier Campbell Announces Cabinet Changes* [News Release].⁴ Office of the Premier. (2011). *Premier Christy Clark Announces Cabinet* [News Release].⁵

Drinking Water Source Protection

While the Ministry of Health remained the lead for the Provincial Drinking Water Program, the primary responsibilities for the protection of water sources now rest with the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO).^b The Ministry of Environment continues to be responsible for science and knowledge management, strategic framework, standards, policies, and legislation development. The Ministry of Forests, Lands and Natural Resource Operations is now responsible for the operation and delivery of natural resource services across the province (e.g., groundwater quality and quantity monitoring, licences, and approvals).

During the reporting period, the Ministry of Energy and Mines remained the primary ministry responsible for oil and gas development policies. Responsibility for oversight and implementation of the oil and gas regime lies with the Oil and Gas Commission (OGC).

In 2010, the *Oil and Gas Activities Act* (2008) and its regulations came into force, which continued the OGC's regulatory responsibilities for permitting/authorization as well as monitoring/enforcement of all oil and gas activities from exploration to waste disposal and site remediation. This regulatory responsibility comes from statutory authorities under the *Oil and Gas Activities Act* and other specified enactments that include the *Forest Act*, *Heritage Conservation Act*, *Land Act*, *Environmental Management Act*, and *Water Act*.

The Auditor General of British Columbia initiated a review of the Groundwater Program in 2010 that assessed program objectives, monitoring and research needs, data analyses and reporting, and groundwater information management strategies.² The report concluded that the provincial government is not effectively ensuring the sustainability of the province's groundwater resources and recommended key actions to ensure the continued protection of this valuable resource. At the time the audit report was prepared, the main agency responsible for the management of groundwater was the Ministry of Environment. However, organizational changes in the provincial

^b The drinking water source protection responsibilities of what is now called MFLNRO came from the Ministry of Forests, Mines and Lands and the Ministry of Natural Resource Operations.

government (see Table A) have split the responsibilities for groundwater protection between MOE and MFLNRO. Although the Auditor General's report refers to MOE, recommendations in the report are applicable to both MOE and MFLNRO. The MOE is the lead agency in addressing audit recommendations through the review of the Groundwater Program, the commitments in *Living Water Smart; BC's Water Plan*, the current work to modernize the *Water Act* (BC's primary law for managing water resources), and completion of Phase 2 of the Ground Water Protection Regulation.

Drinking Water Treatment

Some water suppliers serve high quality groundwater that requires no treatment to make it safe to drink. However, water from some wells and from any surface water source must be treated. Treatment may include filtration and then disinfection, or just disinfection using chlorine, chloramines, ultraviolet irradiation, or ozonation. Drinking water officers work with water suppliers to ensure drinking water is adequately treated or that plans are in place to improve water treatment, where necessary.

Figure A shows the breakdown of the 4,799 water systems^c in BC by health authority as of March 2012.

In addition, there were approximately 300 community drinking water systems serving First Nations communities on reserve as of January 2011. The total number of systems can change as new systems are created, existing unregulated systems are located by drinking water officers, and others are amalgamated or stop serving the public when the business they are associated with closes (such as a restaurant or a campground). Some data presented in this report were compiled at different times of the year and may therefore reflect differing numbers of systems.

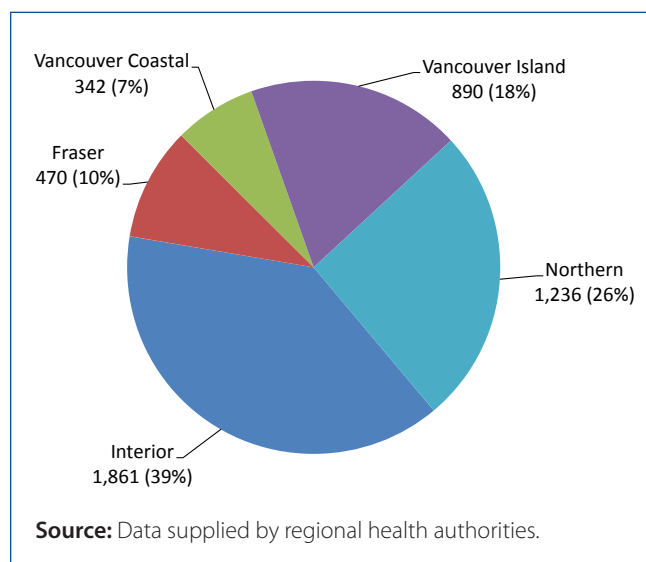
Of the 4,799 systems on record in March 2012, only 224 serve more than 300 connections,^d 1,010 serve

between 15 and 300 connections and 3,565 serve fewer than 15 connections.

In 2011, approximately 96 per cent of First Nations homes were on a drinking water distribution system; 4 per cent were served by individual wells; and less than 1 per cent had truck delivery or no water service.⁶ Of the approximately 300 community drinking water systems serving First Nations in 2011, 53 per cent had disinfection only, conventional filtration, or were served by a Municipal Type Agreement.⁶

The *Drinking Water Protection Act* applies to all water systems in the province with two or more connections. While the province is home to approximately 4,800 drinking water systems (see Figure 1), the vast majority of these systems are classified as "small water systems", defined as drinking water systems serving less than 500 people during a 24-hour period.

Figure A Number of Recorded Drinking Water Systems, by Health Authority, BC, as of March 31, 2012



British Columbians who live in small communities or in remote areas continue to be the ones who face the greatest challenges with their water supplies. For these suppliers, challenges can include the following:

- Lack of adequate treatment.
- Difficulty in attracting and retaining trained and certified operators.
- Difficulty in accessing laboratory services in a timely manner for testing water samples for *E. coli* and total coliform bacteria.

^c Given that data in this report were compiled at different times and that the number of water systems changes periodically, there may be slight variations in the numbers of water systems discussed in this report.

^d Service connections include any property served by a water supply system, such as private homes, apartments, public buildings, parks, etc.

- Lack of funding support for making improvements to infrastructure.

Progress in these areas has been slow, as will be discussed later in this report.

While the number of water systems on boil water notice or water quality advisory in BC appears high compared to other jurisdictions, a unique combination of geographical, reporting, and regulatory factors contribute to these high numbers. The primary contributory factors to the large number of drinking water systems reported to be on boil water notice or water quality advisory are the following:

1. There are a large number of drinking water systems due to geographic size, topography, and population in British Columbia. Most of these are categorized as small water systems, serving fewer than 500 people in a 24-hour period.
2. Many small water systems rely on surface water supplies, which require a greater level of treatment complexity. Small drinking water systems can face additional challenges in supplying potable water such as limited operational and financial capacity.
3. The reporting protocol in British Columbia captures a greater number and diversity of smaller water systems than most other jurisdictions. In jurisdictions that divide the oversight of drinking water between regulatory agencies (e.g., Ministries of Health and Environment), reporting methods may not capture all water system advisories/notices from both agencies. As a result of these regulatory and reporting differences, the number or type of systems being compared across jurisdictions is not the same, which limits the usefulness of cross-jurisdictional comparisons of advisory/notice numbers.
4. British Columbia is one of the few jurisdictions that regulates and licences drinking water systems with two or more connections and public facilities with one or more connection(s). Other jurisdictions that define and regulate small drinking water systems and/or public facilities differently may not capture as many water quality advisories or boil water notices in their drinking

water surveillance or reporting. Some jurisdictions, for example, do not regulate drinking water systems with less than 15 service connections; therefore, reporting of water quality advisories/boil water notices will also be limited to drinking water systems with 15 or more connections.

As stated in the previous drinking water report, most British Columbians live in urban centres and receive high quality drinking water from a few large drinking water suppliers.⁷ Water suppliers serving these larger urban areas, as well as some of the smaller centres, are staffed by professionals, including professional engineers and certified operators who are well qualified to provide the public with the highest quality water possible. When water quality concerns do arise, these suppliers have systems in place to notify their consumers and to correct any problems.

Provincial government ministries and agencies collect information about water in the province, relating to water systems, land use (urban development, forestry, agriculture, mining, or other industrial activities) or environmental monitoring. Ideally, the information in all of these databases would be shared for the benefit of all parties. Such sharing would also make it much easier to chart progress in achieving the objectives of the *Action Plan for Safe Drinking Water in British Columbia* and the *Drinking Water Protection Act* and Regulation. Initiatives to resolve data management challenges have not yet met with success. These data management initiatives are described in more detail in Section 3.

Accountability

The 2007 and 2011 reports on *Progress on the Action Plan for Safe Drinking Water in British Columbia* set out and followed an accountability framework that would allow the PHO to chart progress on drinking water issues in the province over many years. This framework was based on one developed by the Auditor General of British Columbia and is shown in Figure B.⁸ The current report continues with this basic framework.

For the purpose of consistent reporting on progress on the *Action Plan for Safe Drinking Water in British*

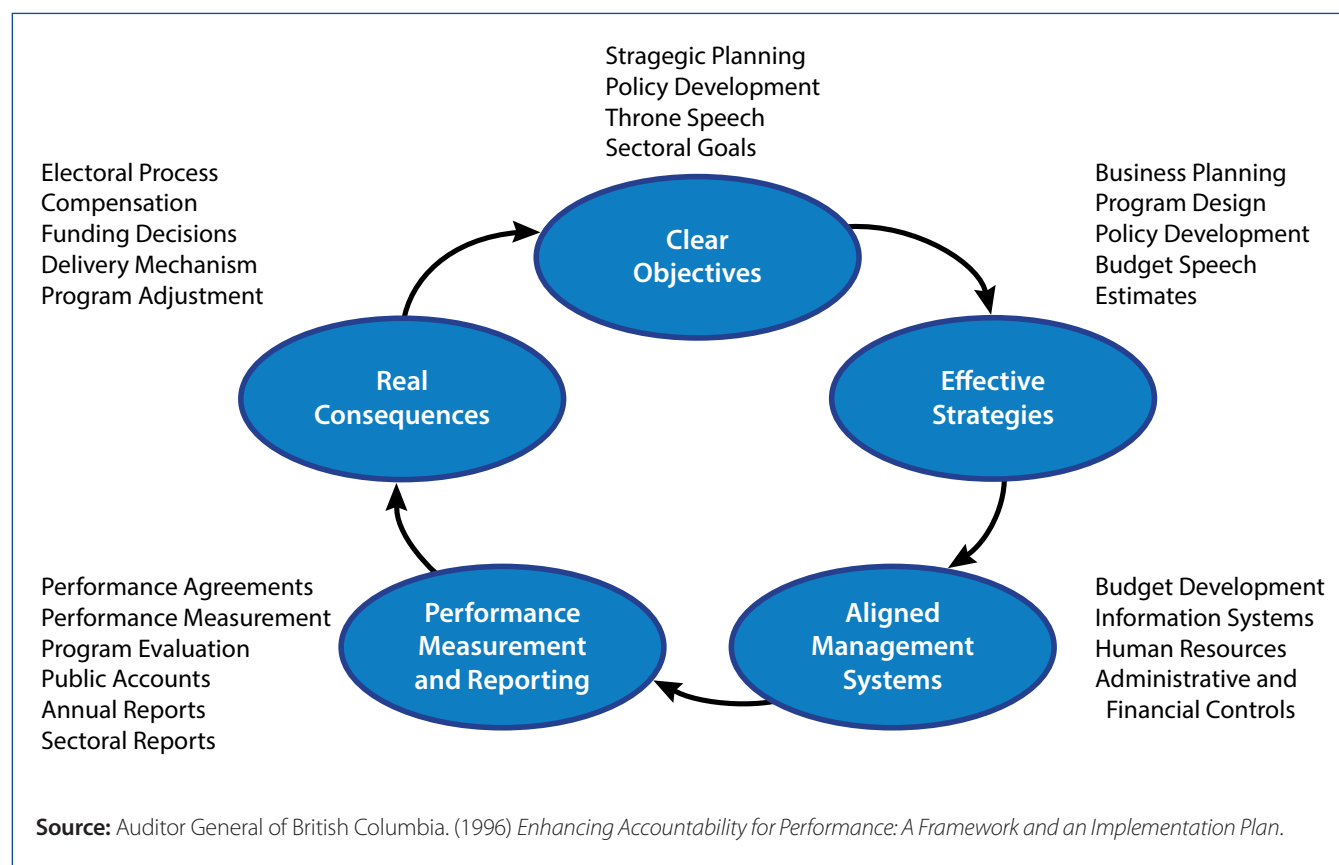
Columbia, the eight principles identified in the Action Plan serve as the objectives, as in previous reports:

1. The safety of drinking water is a public health issue.
2. Source water protection is a critical part of drinking water protection.
3. Providing safe drinking water requires an integrated approach across all the ministries and agencies that have legislated authority for water protection from source to tap.
4. All water systems need to be thoroughly assessed to determine risks.
5. Proper treatment and water distribution system integrity are important to protect public health.
6. Tap water must meet acceptable safety standards and be monitored.
7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Each of these eight principles is discussed in its own numbered section in this report. For each objective, progress is detailed under the headings of effective strategies, aligned management systems, and performance measurement and reporting. These categories cover the following types of topics:

- **Effective strategies:** Legislative and regulatory changes, policies, political priorities.
- **Aligned management systems:** Budgets, information systems, human resources, administration, and financial controls.
- **Performance measurement and reporting:** Performance measurement, program evaluation, public accounts, annual reports, reports from various sectors (government agencies, industry, non-profit organizations, etc.).

Figure B Accountability Framework



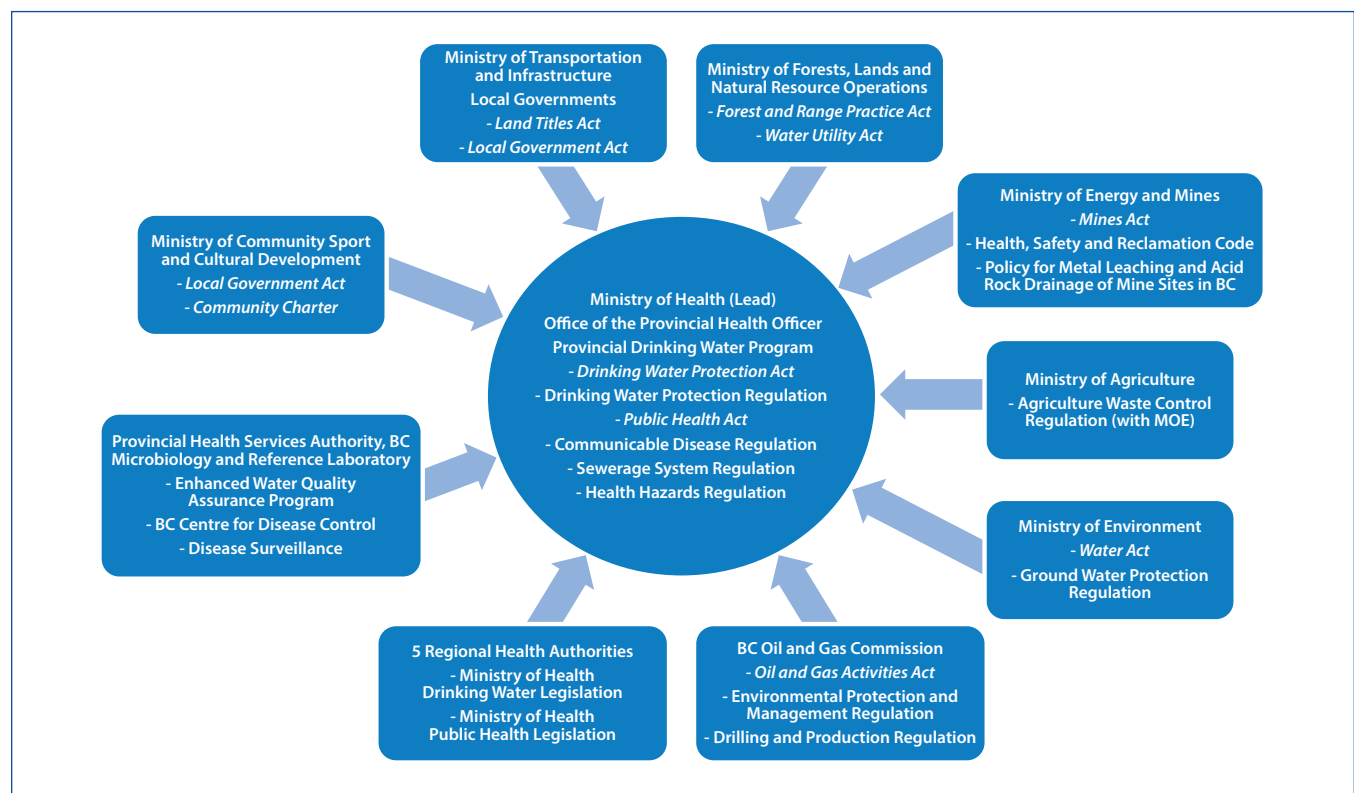
Section 1: Public Health Protection



Access to clean, safe, and reliable sources of drinking water remains a basic tenet of public health protection. In British Columbia, the Ministry of Health is the lead provincial ministry responsible for the Provincial Drinking Water Program. As the lead agency, the Ministry of Health works closely with

other government ministries, the health authorities, and water supply organizations to make sure public health is protected from threats to drinking water. Interagency cooperation for key legislation related to the *Action Plan for Safe Drinking Water in British Columbia* is illustrated in Figure 1.1.

Figure 1.1 Interagency Co-operation and Key Legislation for the Action Plan for Safe Drinking Water in British Columbia



There are four statutes that set out most of the law concerning the conservation, management, and use of water in BC:

- *Water Act.*
- *Drinking Water Protection Act.*
- *Forest and Range Practices Act.*
- *Oil and Gas Activities Act.*

The *Water Act* is the primary legislation for managing public water resources. It governs the approval and regulation of water licences to use surface waters (water allocation) and divert streams.

The *Drinking Water Protection Act* (DWPA) is the primary legislation that directly protects the province's drinking water from health hazards and appoints drinking water officers in each of the five regional health authorities. The Act requires water suppliers to provide potable water; monitor water quality; and have written emergency response and contingency plans in place. In addition, the DWPA prohibits any person from carrying out activities that are likely to result in a drinking water health hazard.

The *Forest and Range Practices Act* and its associated regulations are the primary legislation used to protect drinking water sources from damage by forest practices on Crown land.

The *Oil and Gas Activities Act* (OGAA), the Environmental Protection and Management Regulation, and the Drilling and Production Regulation set forth environmental objectives for ground and surface water use that the Oil and Gas Commission (OGC) is required to consider when deciding whether to authorize an oil and gas activity. Under the OGAA, the OGC has the power to grant approvals for oil and gas activities under the *Environmental Management Act*, the *Forest Act*, the *Heritage Conservation Act*, the *Land Act*, and the *Water Act*.

This section discusses the progress on the *Action Plan for Safe Drinking Water in British Columbia* in terms of public health protection by discussing effective strategies, aligned management systems, and performance measurement and reporting.

1.1 EFFECTIVE STRATEGIES

The BC *Water Act* Section 98(1) was amended to extend the time limit to lay an information respecting an offence under the Act from 2 years to 3 years after knowledge of the facts on which the information arose.

Drinking water officers are empowered to issue violation tickets under the Violation Ticket Administration and Fines Regulation under the *Offence Act* for failure to comply with certain sections of the *Drinking Water Protection Act* and Regulation. The Provincial Fines Booklet^e includes the complete list of ticketable offences under both the *Drinking Water Protection Act* and the *Public Health Act*. The Insurance Corporation of British Columbia has administrative responsibilities for all tickets issued under the Violation Ticket Administration and Fines Regulation. However, since there is no mechanism in place to follow through on ensuring that tickets are paid, the deterrent value of ticketing is limited. Health authority data systems did not track information related to violation tickets during the reporting period.

Guidelines, Directives, and Special Committees

In 2010, the Ministry of Healthy Living and Sport updated the Comprehensive Drinking Water Source-to-Tap Assessment Guideline.^f Requirements for water suppliers to undertake assessments of their drinking water system are outlined in Part 3 of the BC *Drinking Water Protection Act*. This updated guideline for conducting comprehensive drinking water source-to-tap assessments in British Columbia provides a structured and consistent approach to evaluating risks to drinking water, and satisfying the assessment requirement under the Act.

The Ministry of Health, Ministry of Environment and health authorities responded to all of the recommendations in the 2008 Ombudsperson's Special Report No.32 – *Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia*⁹ and posted these responses in December 2009 at

^e The Provincial Fines Booklet can be found online at www.lib4shared.com/doc-file/provincial-fines-booklet-ministry-of-justice-province-of.

^f The Comprehensive Drinking Water Source-to-Tap Assessment Guideline can be found online at www2.gov.bc.ca/gov/topic.page?id=E7584F788B6C4522801D45CEA3675B2.

www.bcombudsperson.ca/sites/default/files/2009.12.07_Update_on_DW_recommendations.pdf.

An update was completed in 2010 and is available from BC's Office of the Ombudsperson. In 2009, the Ministry of Health developed a fact sheet, available in six languages, regarding drinking water and people with weakened immune systems. This fact sheet is available at www.healthlinkbc.ca/healthfiles/hfile56.stm.

Ministry of Health Human Health Risk Assessment

In late 2011, the Government of British Columbia, led by the Ministry of Health, launched a three-phase human health risk assessment project to ensure that health concerns associated with oil and gas activities are adequately identified, qualified, and managed. Concerns were raised by the public, Northern Health Authority, medical health officers, First Nations, local government, and non-government organizations in northeastern British Columbia.

Phase 1 of this human health risk assessment project, conducted by the Fraser Basin Council, involved public engagement to define the scope and terms of reference for this project and identify key concerns relating to oil and gas development. The Phase 1 document, *Identifying Health Concerns Relating to Oil & Gas Development in Northeastern BC*,¹⁰ and a compendium of submissions, was published on March 30, 2012. Human health concerns identified in Phase 1 through a survey of residents in northeastern BC included water and air quality, as well as the social impacts associated with the “boom town effect”, such as lack of accessibility to affordable, healthy food; inadequate housing and schools; and an increase in alcoholism and depression.

Phase 2 is a human health risk assessment based on findings from Phase 1 and a comprehensive scientific review of evidence. The Phase 2 report was released in the spring of 2015. The results will be discussed in the next Provincial Health Officer's Drinking Water Report. A fact sheet entitled *Phase 2: Human Health Risk Assessment of Oil and Gas Activities in Northeastern B.C.* details the Phase 2 assessment activities.¹⁰ Phase 3 will report on the Phase 2

findings and make recommendations, as appropriate, on improvements.⁸

1.2 ALIGNED MANAGEMENT SYSTEMS

The Health Protection Branch of the Ministry of Health developed and implemented an electronic system to track and record drinking water system complaints. This system can generate drinking water complaint reports and is currently in use by the drinking water program and by the Office of the Provincial Health Officer (PHO). Standardized drinking water complaint procedures with associated contact information are detailed on the Ministry of Health website at www2.gov.bc.ca/gov/topic.page?id=0C51B168772947728309A5CBF10F3C30.

Over the course of the reporting period, drinking water officers engaged in continuing education through conferences and workshops and courses available through universities. Detailed data on training attended by drinking water officers is not currently available.

The Ministry of Health initiated a program of ongoing education for drinking water officers and other health authority staff with an interest in drinking water regulation. Webinars are held on a regular basis presenting topical material by local experts, and these webinars are well attended by regional staff. Webinars generally occur on a monthly basis, last one to two hours, and provide roughly the same amount of education time as previously offered through dedicated conferences.

Drinking Water Officer Positions in the Regional Health Authorities

As described in previous reports, each regional health authority has appointed drinking water officers and/or has delegated drinking water officer responsibilities to various staff. The number of drinking water officers, delegates, and support staff varies between the health authorities, based on the number of water supply systems in the region, and on the organizational structure of the health authorities.

⁹ More information on this human health risk assessment project can be found at www2.gov.bc.ca/gov/topic.page?id=11C02593386744C9994642CE366E3BB0.

Table 1.1 Number of Full-time Equivalent (FTE) Staff Working as, or Supporting, Drinking Water Officers, as of March 31, 2012

Health Authority	FTEs by Type of Position						
	Medical Health Officers	Public Health Inspectors	Management	Technical*	Public Health Engineers	Clerical	Total
Interior	0.8	8.3	2.0	6.2	3.2	5.0	25.5
Fraser	0.4	6.0	1.2	2.5	1.0	1.4	12.5
Vancouver Coastal	0.2	3.7	0.3	0.8	0.5	0.5	6.0
Vancouver Island	0.5	5.0	1.0	2.9	1.0	2.3	12.7
Northern	0.2	2.0	0.1	0.8	0.9	1.0	5.0
Total	2.1	25.0	4.6	13.2	6.6	10.2	61.7

Notes: *Includes technical specialist and water samplers.

Source: Regional Health Authorities.

Most drinking water officer positions in the health authorities remained filled during the reporting period, with minor exceptions resulting from staff turnover. The responsibility for administering the *Drinking Water Protection Act* may be only one part of a drinking water officer's duties, with the rest defined by other provincial or federal legislation such as the *Public Health Act*, *Food Safety Act*, *Tobacco Control Act*, and *Tobacco Act*. Table 1.1 summarizes the number of full-time equivalent (FTE) staff positions dedicated to regional drinking water programs. The 61.7 total FTEs reported as of March 31, 2012, is a decrease of 3.9 FTEs from the number reported for March 31, 2009, in the last drinking water report. This could be due to changes in how the FTEs are reported, efficiencies achieved by program reorganization, or actual reductions in the number of positions related to drinking water.

Increased demand on the drinking water program and the overall Environmental Health Program is seen in Northern Health, because of the additional burden of managing industrial camps. Northern Health is responsible for implementing and enforcing environmental and public health regulations to over 1,800 identified industrial camps in the region.^h All industrial camps must apply to Northern Health's Environmental Health Officers for drinking water,

sewage, and food services permits. This burden is compounded by the challenge, common in the North, around recruiting and retaining qualified staff to fill FTE positions. Simply increasing the number of FTE positions does not address this challenge.

1.3 PERFORMANCE MEASUREMENT AND REPORTING

In May 2012, the PHO released the second report on progress on the *Action Plan for Safe Drinking Water in British Columbia*, covering fiscal years 2007/2008 and 2008/2009.⁷

Public Notification or Advisories Related to Water Quality

After the *Drinking Water Protection Act* was promulgated in May 2003, drinking water officers began re-evaluating programs that encourage public awareness of water quality problems. As public notification procedures have changed, the value of tracking the number of boil water notices and water quality advisories as a way of assessing the overall performance of drinking water programs has come under scrutiny. Increases in water quality advisories and boil water notices over time are not necessarily indicative of decreased water quality but may also be reflective of increased assessment and more detailed reporting practices.

^h The environmental and public health regulations are outlined in the Industrial Camps Regulation and the Sewerage System Regulation under the *Public Health Act*, and the *Drinking Water Protection Act* and Drinking Water Protection Regulation.

The total number of water supply systems on water quality advisory or boil water notice was 604 at the beginning of the reporting period (April 1, 2009) and 599 at the end of the reporting period (March 31, 2012). This number remained relatively stable over the reporting period and mostly affected systems serving small populations. Care needs to be taken to ensure that the focus on reducing the number of boil water advisories does not undermine the fundamental purpose of an advisory, which is to inform specific communities about concerns related to the quality of their drinking water. Reasons that the number of advisories and notices can increase over time include the discovery of unpermitted, and subsequent permitting of, existing water systems that provide inadequate treatment, and re-evaluation of systems with aging or inadequate infrastructure.

Health authorities now post current water quality advisories and boil water notices online using health region specific data management systems. Although there was no provincial information management system at the end of this reporting period, the Ministry of Health has provided online definitions of public notification levels for drinking water system water quality and links to the health authorities' current water quality advisories and boil water notices at www.health.gov.bc.ca/protect/dwadvisories.html.

Small drinking water systems in remote areas continued to present challenges. These include inadequate funding capacity to implement necessary infrastructure improvements; and concerns with

increased time, cost, and temperature for transportation of water quality samples to approved laboratories. In BC, there is no centralized access point for the collection of water quality data necessary to comprehensively oversee the provincial drinking water program. Health authorities continue to use different data management systems from one region to another, and those systems do not capture all of the data needed to report out on activities under the *Drinking Water Protection Act*. The data collection systems used by the health authorities do allow them to publicly report some data on their websites,ⁱ such as boil water notices, water quality advisories, water system inspections, and water quality monitoring results, but these systems lack a comprehensive tracking and reporting function.

Prosecution

One water supplier and the owner were taken to court for violations of the *Drinking Water Protection Act* during the reporting period. Section 45 of the *Drinking Water Protection Act* establishes penalties for a person who commits an offence under the Act. In addition to establishing the penalties, section 45(4) states that "If a corporation commits an offence under this Act, an employee, officer, director or agent of the corporation who authorizes, permits or acquiesces in the commission of the offence commits an offence." Penalties may include fines of not more than \$200,000 (per day for a continuing offence) or imprisonment for not longer than 12 months, or both.

ⁱ Websites for the regional health authorities are as follows: Northern Health Authority: www.healthspace.com/nha; Vancouver Island Health Authority: www.healthspace.com/viha; Fraser Health Authority: www.healthspace.com/fha; Vancouver Coastal Health Authority: www.vch.ca/your-environment/water-quality/drinking-water/drinking-water; Interior Health Authority: www.interiorhealth.ca/YourEnvironment/InspectionReports/Pages/WaterNotifications.aspx.

Violation of the *Drinking Water Protection Act*

Anglemont Utilities provides water to 385 connections. The supply relies on surface water and is, therefore, vulnerable to contamination. Since December 2002 the operating permit for the utility has included the condition to maintain a chlorine residual in the water supply system.

In September 2005, the drinking water officer increased the level of communication with the owner to ensure that regulatory compliance was achieved. Despite this added effort, there were repeated incidents when chlorine was not present in the water system or present at levels lower than the minimum specified in the operating permit. In some cases Anglemont Utilities did not advise the health authority of these violations of the *Drinking Water Protection Act* as required under the Act, nor was public notification undertaken. To ensure the utility improved its operation of the drinking water system, several conditions were attached to the operating permit and a number of orders were issued against the owner.

Three charges were brought against Anglemont Utilities and its owner for offences committed between September 15, 2006, and September 15, 2008. The offences included failure to provide potable water, failure to comply with the terms and conditions of their operating permit, and failure to immediately notify the drinking water officer of a threat that was likely to result in the water supplied not being potable. Both the owner and the utility pled guilty to the three charges. A final judgment was brought against Anglemont Utilities and its owner on May 4, 2010, with both the owner and the utility being fined \$15,000.¹¹

In his reasons for sentencing, the Honourable Mr. Justice Dley stated “Anglemont Utilities has failed miserably in its obligations to provide potable water, to comply with the terms and conditions of the operating permit and in appreciating that notification was required regarding the threat of water not being potable.”¹¹

Waterborne Disease

The Health Act Communicable Disease Regulation under the *Public Health Act* requires physicians and laboratories to report all known or suspected cases of waterborne illness to the regional medical

health officer. Health authority staff may follow up on individual cases through direct contact with the patient, in order to request information on what activities the patient had recently engaged in that may have resulted in the illness. Information collected relates to types of food and water consumed, contact with animals or other ill people, travel out of the country, etc. The medical health officer in turn reports information on all cases to the BC Centre for Disease Control (BCCDC), where they are entered into a data management system. The BCCDC reviews the data to identify any clusters of illness that may indicate the occurrence of an outbreak, and reports on trends in illness over time.

People with symptoms of enteric disease (e.g., diarrhea and/or vomiting) are under-represented in communicable disease statistics. It has been estimated that for every case of acute gastrointestinal illness (enteric disease) reported to BCCDC, an average of 347 community cases actually occurred in British Columbia.¹² Although acute enteric disease is vastly under-reported, the enteric disease data reported by BCCDC are representative of enteric disease trends in BC and play an essential role in identifying outbreaks.

No outbreaks of waterborne disease were identified and reported between April 2009 and March 2012. However, individual British Columbians were affected by enteric or gastrointestinal diseases from pathogens that can be acquired from food, water, or person-to-person contact, such as *Campylobacter*, *Giardia*, *Cryptosporidium*, shigatoxigenic *E. coli*, and *Salmonella*.

Details on the background of waterborne disease in British Columbia have been reported in previous reports on progress on the *Action Plan for Safe Drinking Water in British Columbia*. The data provided in this section are for all reported cases of selected enteric diseases during the calendar years of 2009 through 2012 and do not differentiate between cases acquired from drinking water and cases acquired through other routes of exposure. Table 1.2 shows the number of cases of selected enteric diseases reported in BC in 2009 to 2012.

Table 1.2 Number of Cases of Selected Enteric Diseases Reported, BC, 2009 to 2012

Enteric Disease	2009	2010	2011	2012
Campylobacteriosis	1,755	1,558	1,722	1,853
Giardiasis	614	623	617	613
Cryptosporidiosis	86	55	53	74
Shigatoxigenic <i>E. coli</i> Infection	160	109	112	136
Salmonellosis	952	1,078	1,104	930
Total	3,567	3,423	3,608	3,606

Source: BC Centre for Disease Control.

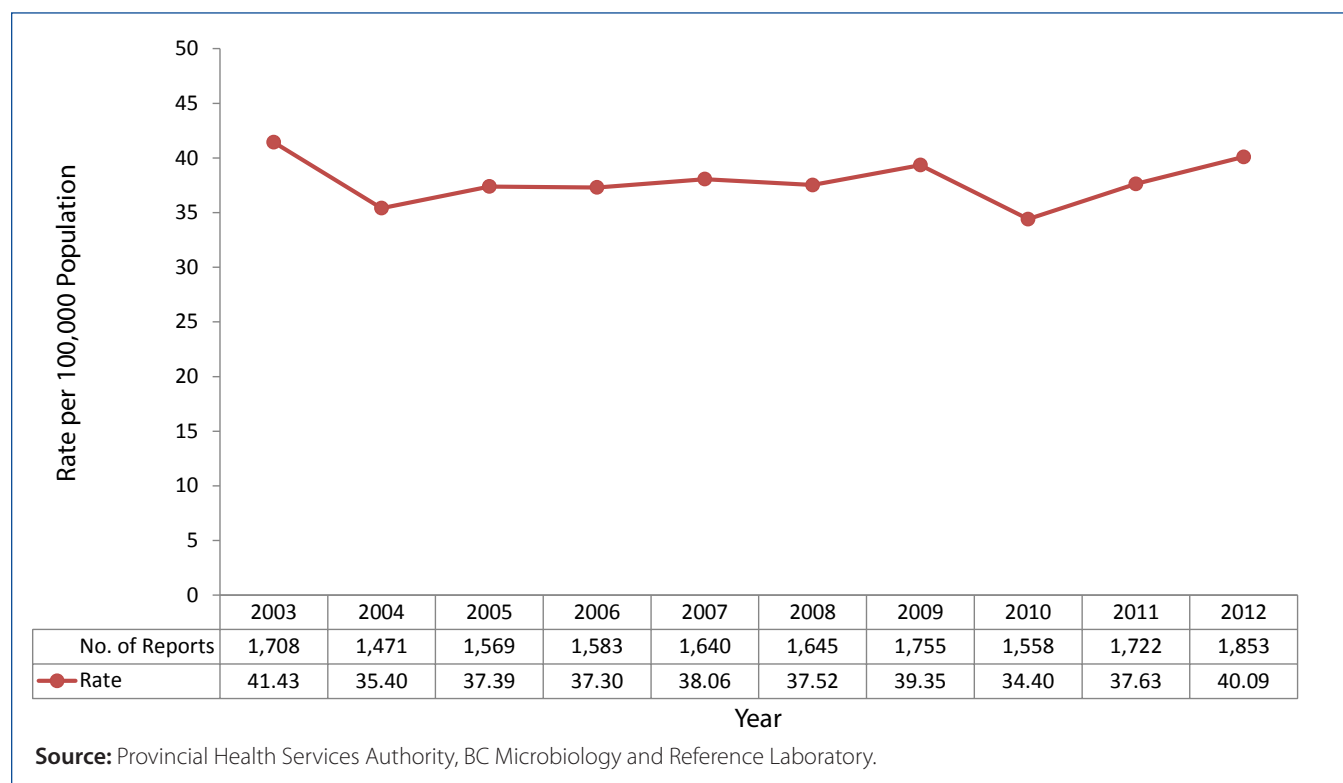
Figures 1.2 through 1.6 show the rates of these enteric diseases from 2003 to 2012, inclusive. Minor discrepancies in the number of enteric disease cases between this and previous reports are due to delayed reporting or updates that were included at a later time.

Campylobacteriosis

Research estimates that between 70 and 80 per cent of cases of Campylobacteriosis are foodborne. However, *Campylobacter* infection can be transmitted by drinking water if the water is contaminated with animal or human fecal material and not adequately treated.

Campylobacteriosis remains the most commonly reported enteric disease in BC. However, the average

number of Campylobacteriosis cases in the last reporting period, from 2007–2008 (1,637 per year), was similar to the average number of cases during this reporting period, from 2009–2011 (1,678 cases per year), with only a 3 per cent difference. In fact, the number of reported cases has remained stable over the past 10 years, from 2003 to 2012, inclusive (Figure 1.2).

Figure 1.2 Campylobacteriosis Rate, BC, 2003 to 2012

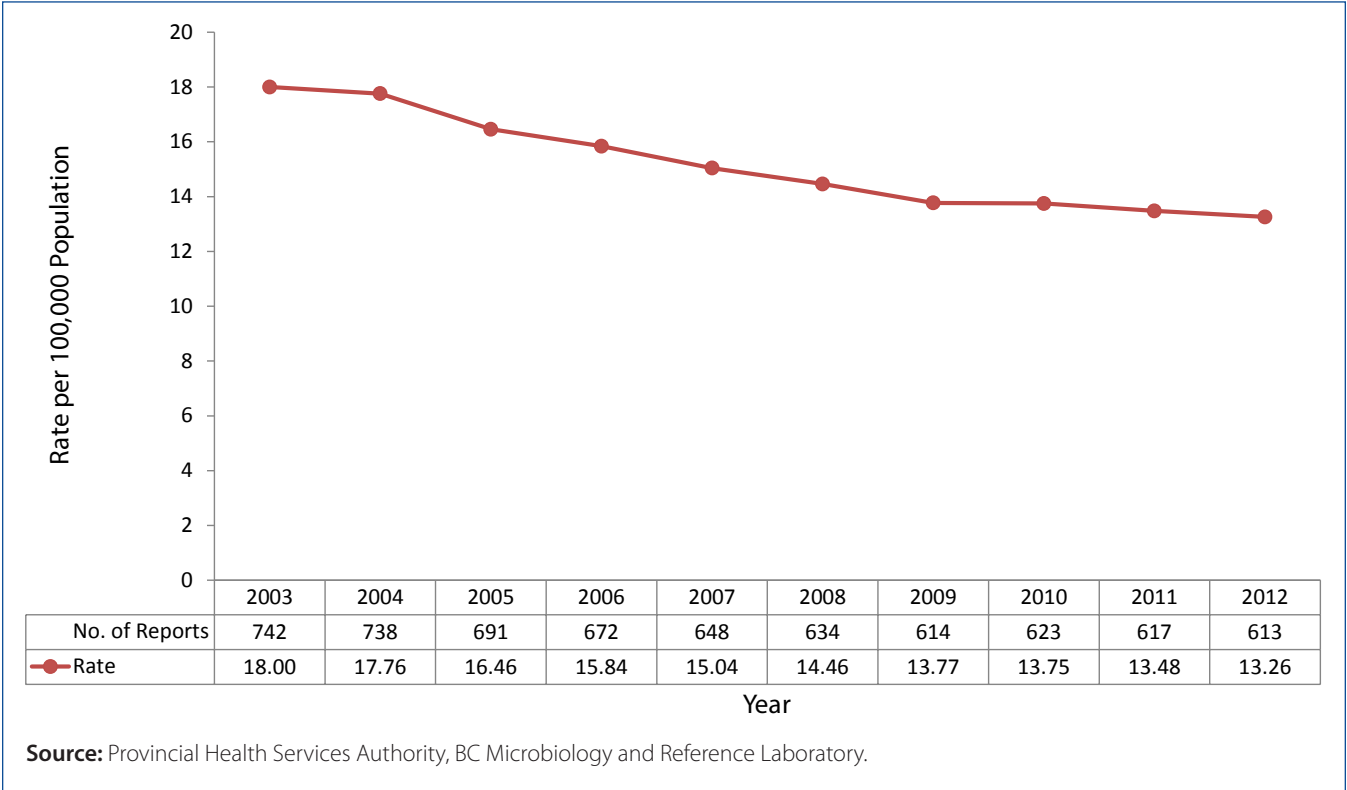
Giardiasis

Giardiasis can be transmitted from person-to-person and from animals to humans, but the majority of cases are believed to be due to ingestion of contaminated water, including by hikers in wilderness areas and travellers who drink water that has not been properly filtered, treated or boiled.¹³ Contaminated drinking water, recreational water and, to a lesser extent, food have

been associated with outbreaks, although no outbreaks were reported between 2009 and 2012 in BC.

Annual rates of giardiasis in BC have continued to decrease gradually over the last decade (Figure 1.3). The downward trend may be due to initiatives aimed at improving food safety, traveler safety, or drinking water safety in BC.

Figure 1.3 Giardiasis Rate, BC, 2003 to 2012



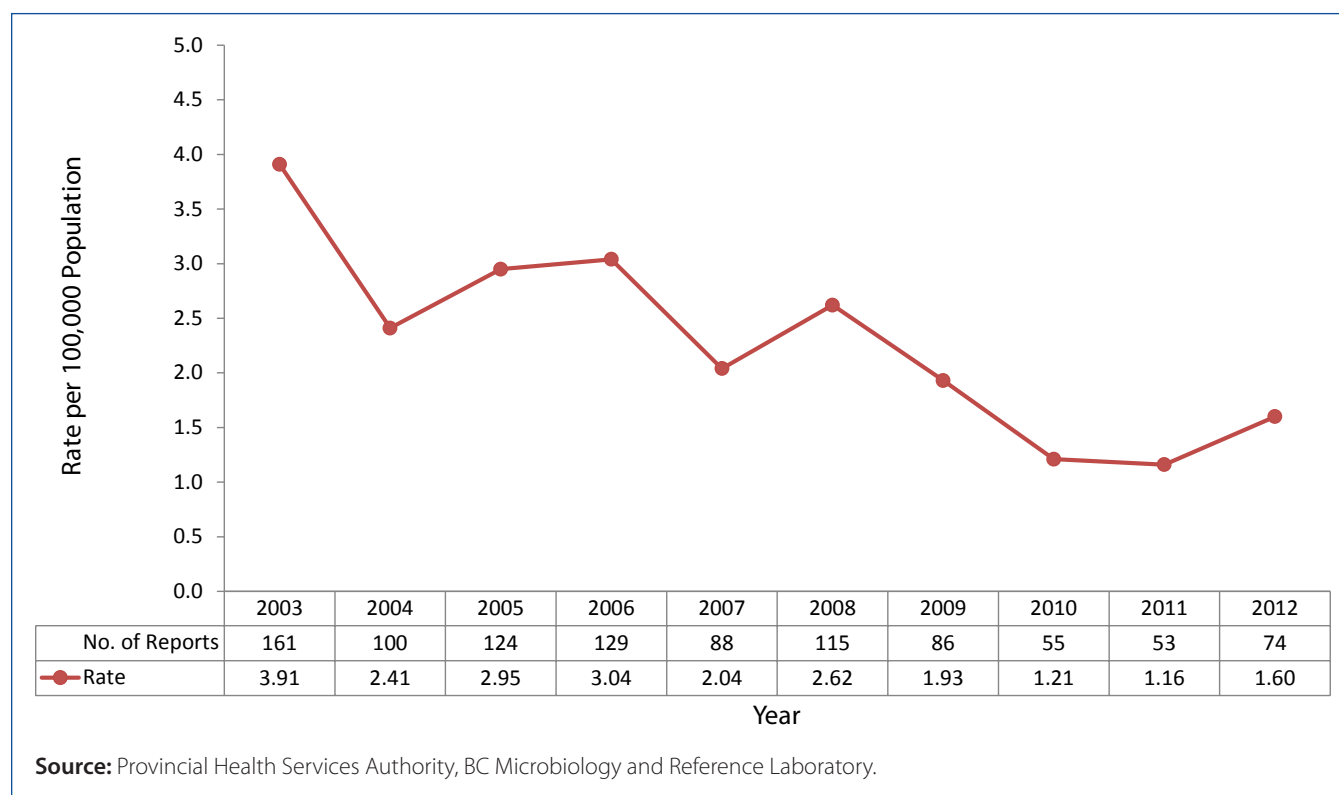
Cryptosporidiosis

Cryptosporidiosis has caused waterborne outbreaks throughout North America, including two recreational water outbreaks identified in BC in 2003. No drinking water outbreaks have been reported in BC in the 10 years from 2003 to 2012 inclusive. However, the majority of background (endemic)

cases of cryptosporidiosis are likely waterborne. Since *Cryptosporidium* is resistant to disinfection by chlorine alone, cases may be linked to water supplies that are not filtered or treated with ultraviolet irradiation.

The rate of cryptosporidiosis in BC has declined in the last decade, reaching an all-time low of 53 cases reported in 2011 (Figure 1.4).

Figure 1.4 Cryptosporidiosis Rate, BC, 2003 to 2012



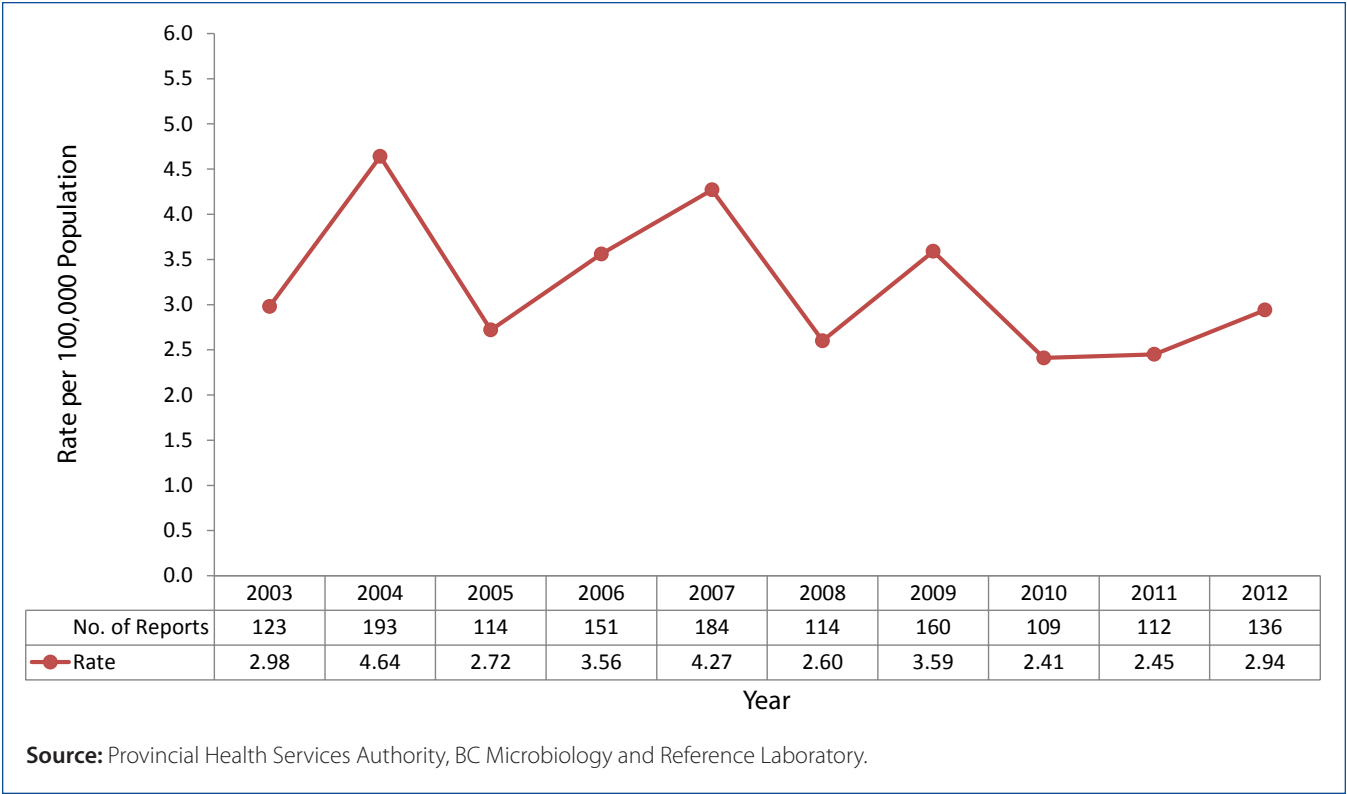
Shigatoxigenic E. coli

Research estimates that 70-80 per cent of shigatoxigenic *E. coli* infection cases are foodborne. The rest are spread through contact with infected humans or animals or by ingestion of contaminated water. The number of BC cases that could have been waterborne is unknown; there were no outbreaks of

waterborne *E. coli* infection reported in BC during the 10-year period from 2003 to 2012 inclusive.

Annual rates of shigatoxigenic *E. coli* infection in BC have remained relatively stable, with peaks in incidence often associated with foodborne outbreaks (Figure 1.5).

Figure 1.5 Shigatoxigenic E. coli Infection Rate, BC, 2003 to 2012

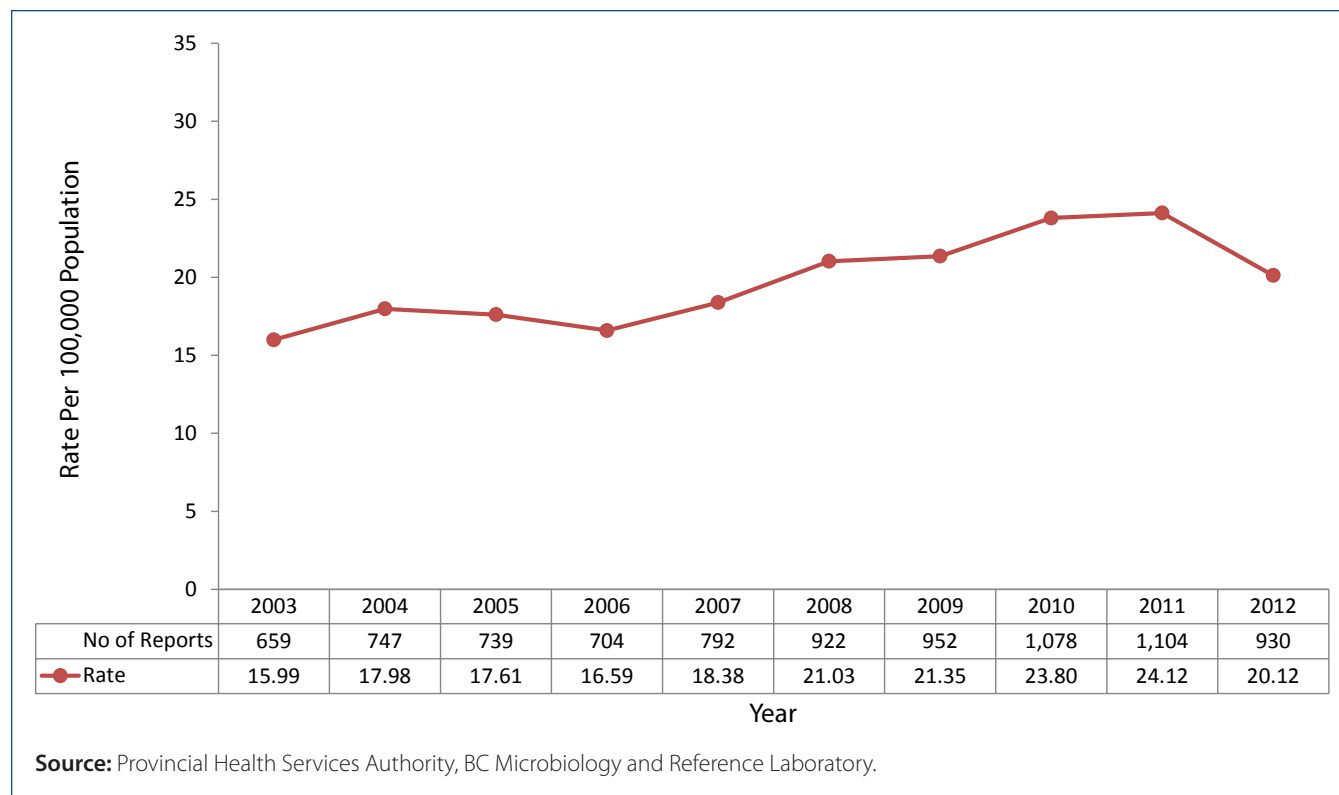


Salmonellosis

Approximately 80 to 90 per cent of salmonellosis cases are believed to be foodborne. Only a small proportion of endemic cases are waterborne.

The incidence of salmonellosis in BC rose between 2008 and 2011 (Figure 1.6) due to a *Salmonella Enteritidis* outbreak transmitted through contaminated eggs and poultry products. This outbreak was declared over in 2012.

Figure 1.6 Salmonellosis Rate, BC, 2003 to 2012



Laboratory Testing of Drinking Water Samples

Water samples collected for microbiological sampling are time-sensitive; laboratories must begin to analyze them within 30 hours of collection. In most areas of BC, water samples are tested well within this time limit. However, water suppliers in some remote areas (e.g., in the North, in some central coastal regions, and in some parts of the Kootenays) may face obstacles in getting samples to the closest laboratory in a timely manner.

There is at least one PHO-approved laboratory in each of the five regional health authorities in British Columbia. Two of these laboratories are located in Northern Health, with one servicing the Northwest in Prince Rupert and the other in the Northeast in

Fort St. John. Improvements made in previous years in efficient transport of drinking water samples to laboratories continued to be effective over the past two reporting periods, and the number of samples “wasted” because they were too long in transit remained under 1 per cent.

Laboratory Approval and Audits

The laboratories that test drinking water samples for microbiological water quality in BC are approved by the PHO. This process ensures that laboratories are using appropriate testing methods, results are reliable, and processes to immediately report positive *E. coli* results are in place. The Enhanced Water Quality Assurance Program (EWQA) reviews applications from laboratories and engages experienced laboratory personnel to undertake inspections of laboratories and

identify any concerns they observe about laboratory operations. A steering committee reviews inspection reports and may request a laboratory to make changes to their operations. When satisfied that a laboratory provides reliable service, the steering committee will recommend that the PHO approve the laboratory.

The EWQA continued to carry out its legislated mandate of supporting PHO approval of water microbiology laboratories for drinking water testing. The volunteer auditor teams carried out the peer review public health quality assurance work, led by the provincial coordinator, and supported by the steering committee and the Quality Assurance Advisory Group. Under this program, one new laboratory was approved for microbiological water testing during the reporting period, bringing the total number of PHO-approved laboratories to 17. These laboratories are located throughout BC and Alberta, with testing laboratories located in each of BC's five regional health authorities. Of the 16 laboratories that had been approved as of March 31, 2009, all underwent some level of review, either a full audit or a review of new test methodologies.

The PHO Approved Laboratory List is updated as required, when laboratories are newly accredited, choose to retire their certificate, or add new testing methods. The list indicates the current approved

environmental laboratories, along with the test targets (total coliforms, fecal coliforms, and *Escherichia coli*) the laboratory is approved for. A current list of the PHO laboratories is available online at <http://lmlabs.phsa.ca/NR/rdonlyres/33521F8F-576A-4570-BAB6-F9F6D4D377A6/0/831PHOApprovedLaboratoryList20140501.pdf>.

In addition to auditing and recommending laboratories for approval by the PHO, the EWQA was involved in a number of projects during the reporting period. In addition to training workshops for auditors, EWQA initiated a waterborne pathogen detection and typing project. In collaboration with several watershed managers, the environmental microbiology section of EWQA assessed parasite occurrence (*Giardia* and *Cryptosporidium*) to permit better watershed management and public health protection. Genomic sequencing of these protozoans allows public health risk assessment by differentiating between human-infective and human non-infective strains.

The EWQA has also partnered with Genome Canada and the Canadian Water Network to launch a project that aims to improve water quality in Canada and abroad by developing novel tools to assess water quality, such as a Water Health Profile tool to assess general water quality and a Microbial Pollution Profile tool to help identify the source of pollution.

Section 2:

Source Water Protection



During the reporting period, government maintained a high-level commitment to water quality, embodied in the goal to “Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none.” This goal was articulated in the provincial government’s *Strategic Plan 2010/11 – 2012/13*,¹⁴ and was incorporated in strategic plans of resource ministries.

Source water protection is an important component of the multi-barrier approach to ensuring safe drinking water. Protecting sources of drinking water is complex and relies on the work of many individuals and organizations. These include federal government departments, provincial government ministries and agencies, regional health authorities, local governments, First Nations, political leaders, non-government organizations, special interest groups, land users, and the general public. The source water protection initiatives of various agencies and ministries in BC are discussed in this section.

Several government ministries are involved in protecting source water. These include the Ministry of Health, Ministry of Environment and the Ministry of Forests,

Lands and Natural Resource Operations (MFLNRO). The Forest Practices Board and the BC Oil and Gas Commission (OGC) also have roles to play, directly or indirectly, in overseeing activities that can have an impact on drinking water sources and responding to complaints related to drinking water sources.

2.1 EFFECTIVE STRATEGIES

Organizational changes were made to the administration of source water protection oversight during the reporting period. Responsibility for a wide range of source protection issues was transferred from the Ministry of Health to the Ministry of Environment in 2010. These changes re-established responsibilities between the two ministries that had been in place prior to the 2008 reorganization, and only affected central office operations.

In 2011, the Ministry of Natural Resource Operations and the Ministry of Forests, Mines and Lands were amalgamated into MFLNRO. This new ministry took over responsibilities for drinking water source protection from these two organizations.

Regulatory Considerations

Agricultural Waste Control Regulation

During the reporting period, the Ministry of Environment, the Ministry of Agriculture, and the BC Agriculture Council reviewed the Agricultural Waste Control Regulation, under the *Environmental Management Act*, with the intent to move towards a code of practice under the *Environmental Management Act*, the *Public Health Act*, and the Waste Discharge Regulation. The code of practice will use best management practices to protect the environment and human health. Changes will not likely occur before spring of 2014.¹⁵

Water Act

The government of British Columbia embarked on a *Water Act* modernization process that initiated public engagement in 2009 and that aims to deliver a new *Water Act* by 2014. The *Water Act* is the principal law for managing the diversion and use of provincial water resources. Modernizing the *Water Act* is one of the actions and targets of the province's water protection plan, *Living Water Smart – BC's Water Plan*. In *Living Water Smart*, government committed to improving the protection of the quality and quantity of groundwater. The plan includes regulation of groundwater use in priority areas and high volume groundwater withdrawals. To that end, the Ministry of Environment and MFLNRO are developing policy options for groundwater licensing as part of the *Water Act* modernization process. The new legislation will place a greater emphasis on the value of water and conservation measures. Updated information on the *Water Act* modernization process can be found at: <http://engage.gov.bc.ca/watersustainabilityact/>.

Groundwater Protection Regulation

Although reorganization of the ministries and water source protection responsibilities has slowed progress, the Ministry of Environment continued to work on the Groundwater Protection Regulation (GWPR) under the *Water Act*. The GWPR will be completed in three phases. While Phase 1 was enacted in 2004, Phase 2 had not yet been completed by the end of the reporting period. Phase 2 is anticipated to include a

provision for the mandatory reporting of groundwater wells in the WELLS database and will focus on

- Additional standards for well construction, flowing wells, well pumps, flow testing, well operation, and well siting.
- Water analysis for new and altered wells.
- Well reports.
- The establishment of offences for which tickets may be issued.

Phase 3 of the GWPR will focus on

- Implementing water management plans in designated areas.
- Drilling authorizations (if necessary).
- Other measures for aquifer quality and quantity protection and use.

Oil and Gas Activities Act

In British Columbia, the Ministry of Energy and Mines remained the primary ministry responsible for oil and gas development policies during the reporting period. The OGC is responsible for oversight and implementation of the oil and gas regime. The BC OGC is an independent, single-window regulatory agency with responsibilities for overseeing oil and gas operations in BC, including exploration, development, pipeline transportation, and reclamation.

The OGC was created as a Crown Corporation through the enactment of the *Oil and Gas Commission Act*. In October 2010, the OGC transitioned from the *Oil and Gas Commission Act* to the new *Oil and Gas Activities Act*.

During the reporting period, legislation and regulations that have an impact on source waters through the *Oil and Gas Activities Act* were changed.

The Drilling and Production Regulation (BC Reg 362/98) was repealed and replaced with the Drilling and Production Regulation (BC Reg 282/2010). Key changes to protect water include the following:

- Section 5, the position of the wells in relation to water bodies.
- Section 21, hydraulic fracturing at depths less than 600 metres below ground level.

- Section, 37, the composition of fracturing fluids must be recorded and submitted to the Oil and Gas Commission within 30 days of completion of the well.

The BC Environmental Protection and Management Regulation was enacted to recognize environmental values and watershed protection in connection with oil and gas development. Wildlife and habitat values are also protected.

Section 35 allows the Minister responsible for administering the *Water Act* to designate a watershed or portion, including a community watershed, as a designated watershed if it requires special management to protect quality or quantity of water, or timing of flows. On August 18, 2011, an order was written to protect all of the existing community watersheds recorded in the Ministry of Forests database as of that time.¹⁶

The OGC has authority to issue approvals for short-term water use under Section 8 of the *Oil and Gas Activities Act*.

In January 2012 it became mandatory for companies operating in BC to publicly disclose the additives used in hydraulic fracturing operations under Section 37 of the Drilling and Production Regulation. A list of hydraulic fracturing fluid ingredients and other information (e.g., purpose of ingredient, concentration, supplier, volume of water) must be submitted to the OGC within 30 days of completion of the well (the point in time when a well is able to produce gas). Hydraulic fracturing fluid information is uploaded to the chemical registry, available at www.fracfocus.ca.

Improvements are required to baseline water quality and quantity monitoring, data collection, and reporting around hydraulic fracturing operations, to further knowledge and understanding of the potential health and environmental risks associated with this emerging industry.

Shale Gas Exploration

Exploration and extraction of shale gas in northeastern BC increased during the reporting period. For example, the Montney Play Region, one of the most active plays in North America, had 426 wells completed by 35 operators in 2011. Shale gas

extraction on a large scale is a relatively new activity within the oil and gas industry but has important potential in northeastern BC.

Unlike more conventional oil and gas deposits, which can be accessed directly through a vertical bore hole, shale gas is tightly bound within shale deposits, which must be fractured to release the gas. The fracturing process involves drilling lateral bore holes through the shale formation and injecting large volumes of water containing a mixture of sand or other particulates and various chemicals into the formation under very high pressures. This has the effect of forcing fine cracks throughout the shale; when the fluid is removed, sand and/or other proppants (materials used to hold open the created fractures) are left behind to maintain the cracks and allow gas to flow out of the formation.

The volume of water returned to the surface (flowback water) can vary from less than 30 per cent to almost 70 per cent for shale gas wells in BC. Return water is considered contaminated waste water and could pose a risk of contaminating water sources during storage, transportation, and/or disposal. BC has strict laws related to the storage, transportation, and disposal of flowback water. In BC, return water is either used for further hydraulic fracturing (recycled), or is disposed of by injection, into deep subsurface formations, through a water disposal (deep injection) well.

While direct surface discharge of produced water (a by-product withdrawn with oil and gas) and return water is not allowed in BC, it can be stored on the surface prior to being recycled or injected. Fluids can only be stored in above-ground tanks with secondary containment, or in engineered pits with dual synthetic liners and leak detection mechanisms, in order to address any potential failures. The OGC inspects these containment areas frequently.

Concerns have been raised about the potential for shale gas operations to have adverse effects on the environment, including depletion or contamination of both surface water and groundwater. In other jurisdictions there have been concerns that drinking water aquifers have been contaminated, either through leaks in well casings or from upward migration of contaminants following the fracturing process.

A risk of seismic activity is associated with hydraulic fracturing, during well stimulation (fracturing) and

wastewater injection. Minor earthquakes have been stimulated by shale gas activities in several locations, including BC. The OGC has conducted two major studies on this, with the results available on their website (www.bcogc.ca/publications/reports).

Large volumes of water are required for hydraulic fracturing, dust control, industrial camps, and other activities related to shale gas operations. A study of shale gas wells in seven geological formations in northeast British Columbia found the average water consumption ranged from 0.4–34.9 million litres per well. Withdrawal of large volumes of water, particularly within a short period of time, may affect the hydraulic flow patterns and potentially lead to contaminant migration to domestic and agricultural wells. The OGC has developed approaches to assessing and addressing water allocation to address this potential problem. Recycling return water and using non-potable water sources (e.g., deep saline aquifers, wastewater lagoons) may also help reduce the need for fresh water.

The extraction of ground and surface water requires careful consideration of the possible effects on existing water wells, stream flow, lakes, and wetlands. One of the most important environmental concerns is the potential to deplete and/or reduce the capacity of ground and surface water sources (e.g., through soil compression, undesired drawdown, excessive withdrawals, and inadequate recharge rates).

On August 10, 2010, the Ministry of Environment issued an information bulletin advising that rivers in the north half of BC were “at or near record low water levels.”¹⁷ On August 11, 2010, the OGC issued Directive 2010-05, *Suspension of Surface Water Withdrawals*, suspending water withdrawal in four basins within the Peace River watershed. Significant rainfall in September and early October allowed the suspensions to be lifted on October 6, 2010. These directives are available at www.bcogc.ca/publications/directives/2010.

In Canada, hydraulic fracturing is active in the provinces of British Columbia, Alberta, Saskatchewan, Manitoba, and New Brunswick. Several jurisdictions currently do not allow the process. The technologies used by the shale gas industry have developed incrementally over several decades resulting in significant gaps in scientific knowledge. Scientific

knowledge and public acceptance will continue to advance through transparent and credible monitoring programs with relevant data collection and open information sharing. To date in BC, no significant environmental damage has been documented from hydraulic fracturing, beyond the ground disturbances associated with land-based activities.

Directives and Special Committees

Auditor General Groundwater Protection Review

In 2010, the Auditor General of British Columbia completed an *Audit of the Management of Groundwater Resources in British Columbia*.² This review of the Groundwater Program in BC was initiated to determine whether the provincial government was ensuring the sustainability of groundwater resources in British Columbia. The Auditor General asked the following questions:

- Is the Ministry of Environment’s information about groundwater sufficient to ensure the sustainability of the resource?
- Is groundwater being protected from depletion and contamination and to ensure the viability of the ecosystems it supports?
- Is groundwater access being controlled and do key organizations have the authority needed to take appropriate local responsibility?

The audit assessed the Groundwater Program objectives, monitoring and research needs, data analysis and reporting, and groundwater information management strategies and development. The report concluded that the provincial government is not effectively ensuring the sustainability of the province’s groundwater resources. The report findings and recommendations are discussed in more detail in Section 2.3.

Council of Canadian Academies Environmental Impact Review

At the request of Environment Canada, the Council of Canadian Academies assembled an Expert Panel on Harnessing Science and Technology and initiated an evidence-based and authoritative expert assessment on the state of knowledge of potential environmental impacts from the exploration, extraction, and

development of Canada's shale gas resources. The assessment will review approaches to associated monitoring and mitigation activities. Environmental aspects to be examined include potential impacts to ground and surface waters, land, humans, communities, air quality, and greenhouse gas emissions. This assessment of potential environmental impacts of shale gas activity is expected to be completed in fiscal year 2013/2014. Updated information on this review can be found at www.scienceadvice.ca/en/assessments/completed/shale-gas.aspx.

Water Quality Guidelines

The Ministry of Environment has established Water Quality Guidelines for 43 parameters in BC and continued to develop ambient water quality guidelines during much of the reporting period. Following the reallocation of responsibilities from the Ministry of Environment to the Ministry of Health in 2008, the Ministry of Environment discontinued developing guidelines specifically for drinking water source use; however, they resumed that role following a reversal of the decision in 2010. The Minister of Environment was delegated responsibility to establish water quality objectives in community watersheds by Order-in-Council on March 14, 2011 (OIC # 62_2011).

In 2010, the Ministry of Environment released a new guideline for the pharmaceutically active compound 17 α -ethinylestradiol (EE2). During the reporting period, the Ministry of Environment updated water quality guidelines for nitrogen, and continued to develop water quality objectives to protect the most sensitive designated water use at a specific location. A designated water use is one that is protected in a given location and is one of the following:

- Raw drinking water, public water supply, and food processing.
- Aquatic life and wildlife.
- Agriculture (livestock watering and irrigation).
- Recreation and aesthetics.
- Industrial water supplies.

Each objective for a location may be based on the protection of a different water use, depending on the uses that are most sensitive to the physical, chemical, or biological characteristics affecting that water

body. For example, water quality objectives for EE2 would likely be set at a lower concentration for a fish spawning stream than for a raw drinking water source, since fish are more sensitive to this chemical than humans. Ambient water quality guidelines for sulphate and selenium were being updated as of March 31, 2012. Water quality guidelines are available at www.env.gov.bc.ca/wat/wq/wq_guidelines.html.

As a strategy for monitoring potential changes to water quality due to human impacts, the Ministry of Environment also establishes water quality objectives based on monitoring results and watershed assessments for a range of water quality parameters. During 2009–2012, water quality objectives were developed for China Creek, Comox Lake, Cowichan Lake, Cowichan and Koksilah Rivers, Englishman River, John Hart Lake Community Watershed, Newcastle Creek, Tsolum River, and McIlvor Lake. Approved Water Quality Objectives and reports for specific water bodies are available at www.env.gov.bc.ca/wat/wq/wq_objectives.html.

Community Planning

Relatively few communities draw their water supplies from locations that can be affected by the actual community. Those that do need to be especially conscious of development activities within the community to ensure that water sources are protected.

In March 2012, a guidance document for community planning was published that includes information on how communities can incorporate water resource values into their development strategies. Entitled *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia*,^j the document includes advice on

- Managing rainwater.
- Protecting both surface water and groundwater from contamination.
- Preventing erosion and sediment deposition.
- Managing potential sources of contaminants such as liquid and solid wastes.

^j This guidance document was updated in 2014 is available at www.env.gov.bc.ca/wld/documents/bmp/devwithcare/index.html.

2.2 ALIGNED MANAGEMENT SYSTEMS

Ministry of Environment

Over the reporting period, approximately 30 to 35 full-time equivalent positions with the Ministry of Environment worked directly or indirectly on water issues involving drinking water. These staff included surface and groundwater technical specialists, source water protection specialists, policy analysts, monitoring and reporting staff, water technicians, impact assessment biologists, and management. This summary of staff does not include compliance officers or toxic management and emergency response staff who are called out on an as-needed basis, providing additional resources in the protection of drinking water sources. It remains difficult to determine the total resources directed toward source water protection because many staff are engaged in relevant work supporting other resource management programs, such as fish habitat and wildlife protection.

The Ministry of Environment continued to help smaller local governments develop and refine their drought management plans and water restriction bylaws. It also provided broader support for considering drought when developing regional growth strategies.

Ministry of Health

In 2010, government restructured water and air monitoring and reporting. This change involved the transfer of both FTEs and responsibilities from the Ministry of Health to the Ministry of Environment. The Ministry of Health restructured its drinking water program, with approximately three FTEs continuing to be engaged in supporting the Ministry's drinking water responsibilities.

Health Authorities

Within health authorities, approximately 60 FTEs support the drinking water program. They contribute significantly to source water protection activities, and work with resource management agencies and water suppliers to provide advice, identify hazards, investigate complaints, and promote improved source water management. For example, Interior Health has contributed to Better Management Practices for land

use related to range management, aggregate mining and motorized recreation.

Ministry of Forests, Lands and Natural Resource Operations

In 2011, the government reorganized and created MFLNRO. With a few exceptions, MFLNRO amalgamated responsibilities from the Ministry of Forests, Mines and Lands (formulated in 2010 mostly with responsibilities from the Ministry of Forests and Range) and the Ministry of Natural Resource Operations. While the increased mandate meant more activities to inspect, MFLNRO had fewer natural resource officers and carried out fewer on-the-ground inspections. During the reporting period, the number of forest and range inspections dropped from 14,772 (2009/2010) to 4,993 (2011/2012) inspections annually. While the decrease to one-third of the previous inspection rate may be explained in part by greater efficiencies achieved through resource management coordination and the creation of MFLNRO, it also may be a result of inadequate resources. In 2012, MFLRO reported it had 169 officers, of which 156 were dedicated to carrying out inspections and investigations. In contrast, in 2009, the Ministry of Forests and Range reported it had 292 officers inspecting forest and range licensees' activities.

In a review of the May 2010 discussion paper on range management and water¹⁸ prepared by Range Branch from the Ministry of Forests and Range, the Forest Practices Board expressed concern that the reallocation of limited enforcement resources would reduce the monitoring of range practices.¹⁹ The Board stated at the time of the review that there was little to no monitoring of the efficacy of the *Forest and Range Practices Act*, and of how effective current practices were in protecting drinking water from potential impacts of range activities.¹⁹

During the reporting period, the Forest and Range Evaluation Program (FREP) held several annual community watershed field days—attended by staff, producers, and water purveyors—where they discussed water quality and range management. Throughout the reporting period, FREP undertook field assessments and training of regional staff. In each of the three years, two-day training sessions for fish habitat,

riparian and water quality assessments, as well as one-day refresher courses, were provided for program staff.

Information Sharing

Partnership for Water Sustainability

The Partnership for Water Sustainability in BC (www.waterbucket.ca) continues to be supported by the provincial government. It promotes projects and case studies related to water sustainability and conservation in BC. During the reporting period, aids to water suppliers developed by government and industry groups were added to the website. The site profiles activities related to *Living Water Smart – BC's Water Plan*, such as water-related initiatives in the Green Communities Initiative, the BC Climate Action Toolkit, Water Balance Monitoring, and Integrated Rainwater Management.

Ministry of Environment

A number of Ministry of Environment programs monitor, assess, and report on water quality. These programs take into account many considerations, including drinking water source assessments and protection. Information on these programs is available on the Water Stewardship Division website at www.env.gov.bc.ca/wsd/plan_protect_sustain/.

EcoCat is an ecological reports catalogue maintained by the Ministry of Environment (www.env.gov.bc.ca/ecocat/). It provides access to digital reports and publications, and their associated files such as maps, datasets, and published inventory information. In addition to government reports, the site is a common repository for reports published by local governments and consultants. Reports include well protection plans, watershed assessments, source-to-tap assessments, and other reports produced to satisfy requirements under the *Drinking Water Protection Act*.

During the reporting period, the Ministry of Environment completed an inventory of groundwater quality data collected by other agencies. A pilot project was initiated to assess the feasibility of consolidating water quality data collected by public water systems into the Ministry of Environment's Environmental Management System database.

The River Forecast Centre, under the MFLNRO, works with the Water Survey of Canada and the Ministry of Environment to take a lead role for the province in the interpretation and analysis of hydrometric data, including seasonal river runoff forecasts, drought monitoring, and flood advisories. The Centre continued to publish monthly information bulletins during this reporting period. Flood advisories and warnings are available at <http://bcrfc.env.gov.bc.ca/warnings/index.htm> and water supply and drought advisories are found at <http://bcrfc.env.gov.bc.ca/lowflow/index.htm>.

When drier than normal conditions materialize, the Ministry of Environment issues advisories in newsletter format to provide information on related subjects including how low flows can impact drinking water. These advisories help water suppliers implement their water conservation programs in a timely and effective manner. These advisories, along with snow survey bulletins and information about groundwater supplies, are posted on the Ministry of Environment's website at www.env.gov.bc.ca/rfc.

Ministry of Forest, Lands and Natural Resource Operations

The Water Quality Monitoring Network monitors raw water quality for drinking water and aquatic ecosystems. The program was delivered by the Ministry of Environment earlier in the reporting period, but is now delivered by regional staff from MFLNRO. Publication of information collected from the monitoring network was not completed during the reporting period, although some water quality reports are available on the Ministry of Environment's water quality monitoring website (www.env.gov.bc.ca/wat/wq/wq_sediment.html) and on EcoCat (www.env.gov.bc.ca/ecocat/).

Ministry of Agriculture

The Ministry of Agriculture provides water-related information to the public and agriculture sectors through their Agriculture Water website (www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/agriculture-water). During the reporting period, the Ministry of Agriculture continued to support the Environmental Farm Plan Program. The Ministry of Agriculture was

involved in a number of programs and initiatives related to source water protection and conservation.

One initiative in this reporting period resulted in issuing advisories to farmers in the south coast region as to when it was appropriate to apply manure to their fields. This enables farmers to apply manure in a manner that fertilizes crops but protects water quality by avoiding application at times when run-off is more likely to occur. Other initiatives include providing incentive funds to farmers and ranchers to improve manure storage and handling, and the storage of farm input products such as fuel, pesticides, and fertilizer to protect water resources.

Ministry of Energy and Mines

A fluid disclosure registry came on line in 2012 for the mandatory reporting by natural gas producers of hydraulic fracturing fluids used in BC. Information on oil and gas activities in Canada and a listing of hydraulic fracturing fluids used by industry in British Columbia can be found at www.fracfocus.ca.

Oil and Gas Commission

The Public Zone main page on the OGC's website at www.bccogc.ca/public-zone has general information, fact sheets, reports and incidents, about various topics such as air and water quality.

The OGC's website with information on water can be found at www.bccogc.ca/public-zone/water-information. Information is available on OGC's authority for water management, public reporting of water allocation and use, and map based tools to identify water availability and source characteristics, including water quality.

2.3 PERFORMANCE MEASUREMENT AND REPORTING

Forest Practices Board

The Forest Practices Board conducts audits and investigations and issues public reports on how well industry and government are meeting the intent of British Columbia's forest practices legislation. A summary of the Board's experience with forestry and water users in the context of modernization of

the *Water Act* can be found at www.bcfpb.ca/reports-publications/reports/forest-practices-board-experience-forestry-and-water-users.

A review of over 200 range plans prepared under the *Forest and Range Practices Act* was completed by the Forest Practices Board in 2009. They found range use plans were not clear about how water quality would be protected and there was limited monitoring or enforcement of legislative requirements by government. Concerns were raised that there was no requirement to identify water intakes in a range plan or on the associated map, and that range users may not be aware of the location of licensed waterworks.

During the reporting period, the Board published reports on six investigations of water-related complaints.^k The board recognized that some complaints were valid with respect to practices of concern. They worked with licensees and complainants to address issues such as contamination of surface drinking water sources and managing impacts to community watersheds.

In 2009, one of the Board's complaint investigation reports²⁰ highlighted how the *Forest and Range Practices Act* does not directly address the potential impacts of forestry operations on domestic water. The Board stated that the *Forest and Range Practices Act* objectives for drinking water apply only in "community watersheds", not in "domestic watersheds" or consumptive use streams. The Board concluded that "sound forest practices require consideration of the potential impacts of forest development on drinking water."

Forest and Range Evaluation Program

The FREP is designed to assess the effectiveness of the *Forest and Range Practices Act* in meeting the provincial government's objectives for each of the forest and range values under the Act. Water is one of 11 resource values.

To determine whether licensees are meeting government's objectives, FREP has developed "effectiveness evaluations", which look at selected indicators or attributes of a particular resource

^k Forest Practices Board investigation reports are available at www.fpb.gov.bc.ca/reportsearch.aspx.

value to determine the effects of forest management on the value. The evaluation also provides a benchmark to determine how forest companies are performing with respect to protecting water resources. Checklists and field forms have been prepared to standardize the evaluation process.¹ The effectiveness evaluation for water examines parameters such as stream bank erosion, sediment loading, landslides, and livestock concerns.

During the reporting period, FREP continued to determine whether licensees are meeting government objectives. In the area of water quality, these objectives deal with stream bank erosion, landslides, and livestock concerns. Branches and districts continued to carry out upland and riparian assessments in community watersheds in addition to the annual monitoring carried out by district staff and range tenure holders. From 2009–2012, 27 remedial measures (range and water infrastructure) projects were completed in community watersheds. These included debris placement, exclusion fencing, distribution fencing, and off-stream watering.

In addition to objectives related to water quality, FREP also evaluates objectives related to fish habitat and riparian protection.^m While fish habitat values do not directly correlate with protection of drinking water sources, practices that protect fish habitat will also protect drinking water sources.

Environmental Farm Plan Program

The Environmental Farm Plan Program is a voluntary program, funded by the federal and provincial governments.ⁿ It provides financial incentives to agricultural producers who enhance the environmental performance of their farms, including protection of drinking water sources. Changes to the data management system have improved reporting on activities to protect water supplies.

A key component of environmental farm plans is the development of beneficial management practices (BMPs). BMPs that may be part of an environmental farm plan and include drinking water source protection are

- Farmyard Runoff Control.
- Relocation of Livestock.
- Water Well Management.
- Riparian Area Management.
- Nutrient Management Planning.

Participants in the Environmental Farm Plan Program may apply for incentive funding to implement BMPs. Over the reporting period, 865 water quality-related BMPs were implemented and cost-shared through the program. In 2009/2010, a total of \$5,199,839 was invested in 198 water-related BMPs, with a combined federal/provincial government contribution of \$1,368,648. In 2010/2011, a total of \$4,884,933 was invested in 279 water-related BMPs, with a combined federal/provincial government contribution of \$1,390,561. In 2011/2012, 388 water-related BMPs were completed at a total cost of \$5,260,555, with a combined federal/provincial government contribution of \$1,651,875. Funding for this program has been committed beyond the reporting period.

Agricultural Water Demand

In British Columbia, surface water and groundwater provide water for agricultural, domestic, recreational, fisheries, and a number of other uses. Under the *Water Sustainability Act*, domestic use is ranked highest in precedence of rights for water use, and irrigation is ranked third highest. Society requires water to function and our economy is affected by shortages. Improved water management in all sectors is important to ensure priority users have sufficient water for their respective uses.

In 2006, the Ministry of Agriculture developed the Agriculture Water Demand Model (AWDM) for the Okanagan Valley. The AWDM calculates current and future agricultural use of surface water, groundwater, and reclaimed water. The AWDM is a tool to help improve water use and efficiencies in agriculture. Since 2006, the AWDM has been expanded to cover an additional 15 regions in BC.

¹ Information on the evaluation program can be found at www.for.gov.bc.ca/hfp/frep/values/water.htm.

^m Riparian protection relates to protecting areas immediately adjacent to a stream from activities that could have a detrimental effect on the natural function of the stream.

ⁿ More information on the Environmental Farm Plan Program can be found at www.bcac.bc.ca/ardcorp/program/environmental-farm-plan-program.

Reports are available at www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/agriculture-water/water-management/agriculture-water-demand-model. The AWDM results provide a baseline for developing Water Sustainability Plans for watersheds. As of 2015, Bonsall Creek and Similkameen Valley have pilot Water Sustainability Plans underway to implement recommendations to ensure water access and use are fair and equitable across all sectors.

An Irrigation Scheduling Calculator was developed by the Ministry of Agriculture to assist agricultural producers to manage water use more effectively, and to improve water use efficiencies. The calculator can be accessed at: <http://ag-calc.irrigationbc.com/>.

Oil and Gas Commission

The OGC issues short-term water approvals under Section 8 of the *Water Act*, as well as longer term water licenses, to use or divert surface water from a specified source (rivers, lakes, or dugouts) for oil and gas activities. Section 8 approvals are for a maximum period of two years. Reporting the amount of water used is required.

In their annual report on short-term water approvals for 2011,²¹ the OGC reported that there were 294 short-term approvals, held by 51 companies. The volume of water approved for use was 31.6 million cubic metres. The actual water use reported was 3.7 million cubic metres.

These figures do not include the 20 approvals—held by 10 companies—that did not report their water use. The potential volume of the missing data was not provided. These companies were referred to the Commission's Compliance and Enforcement Branch for investigation and follow-up, and all data was received.

Commission enforcement officers are designated as Special Conservation Officers under the *Environmental Management Act*. This designation provides the authority to enforce both the *Environmental Management Act* and the *Water Act*. Enforcement actions may range from administrative penalties, to imposing a deadline for remediating a problem, to prosecution or shut-in by way of a ticket, order, or laying of information. The last *Compliance and Enforcement Activity Report* was published by the OGC

for the 2010/2011 fiscal year.²² Enforcement officers performed 6,474 inspections under the *Oil and Gas Activities Act* and reported a total of 361 non-compliant sites. In addition, commission enforcement officers were notified of 101 occurrences that resulted in 181 enforcement actions. Water use was the most frequently investigated occurrence in 2010/2011, due to rising water demand resulting from shale gas development technologies and subsequent increased monitoring of industry water use by the OGC.²²

Identification of groundwater resources in the northeast of the province was undertaken during the reporting period in response to concerns about the potential for groundwater impacts from oil and gas activities. This work was initiated jointly by the Ministry of Energy and Mines, the OGC and Geoscience BC, and will assist the oil and gas industry as well as the OGC to ensure that operations undertaken in the area comply with measures intended to protect known aquifers. The report was designed to provide a comprehensive inventory of water sources and potential for deep geological disposal sites by creating a comprehensive database of surface water, groundwater, and deep saline aquifers in the Montney area. The report, *Montney Water Project*, was completed in 2012 and can be found at www.geosciencebc.com/s/Montney.asp.

Canadian Ground Water Association

The Ground Water Protection Regulation establishes standards for constructing wells and sets qualification requirements for drillers and pump installers. Following a March 2009 amendment to the regulation to recognize equivalent certification from other Canadian jurisdictions, including continuing education requirements under the Canadian Ground Water Association, the Ministry of Environment notified qualified well drillers and pump installers of the new requirements. In response, 12 well drillers and 29 pump installers were found to have not kept up their minimum continuing education credits. The Canadian Ground Water Association offered a two-day course in March 2010 to enable drillers and pump installers to gain adequate continuing education credits to maintain their certification. All wells drillers and pump installers who were actively working in British Columbia met their education requirements and remain on the registry of qualified professionals.

Provincial Government Performance

Ministry of Environment

The Ministry of Environment, in collaboration with Agriculture and Agri-Food Canada, has completed a drought response plan for BC.²³ This plan builds on existing tools and outlines the actions to be taken proceeding, during, and immediately following a drought to reduce its impacts. It includes communication steps required to ensure timely and appropriate action.

In 2010, the Auditor General of British Columbia published an *Audit of the Management of Groundwater Resources in British Columbia*.² The report findings and recommendations are discussed in the sub-section on “Groundwater Resources”. Although the report refers to the Ministry of Environment, recommendations in the report are applicable to both the Ministry of Environment and MFLNRO.

The Ministry of Environment is addressing the Auditor General’s audit recommendations through the review of the Groundwater Program; the commitments in *Living Water Smart – BC’s Water Plan*; the update of the WELLS database; the work to map, classify, and characterize aquifers; and the work on Phase 2 of the Ground Water Protection Regulation (GWPR). These and other key actions carried out by the Ministry of Environment during the reporting period are described below.

During the reporting period, the Ministry of Environment developed a list of 20 priority areas for more in-depth characterization of groundwater sources. In 2011/2012, the Ministry of Environment and MFLNRO initiated aquifer characterization studies in three areas of BC: Parksville-Qualicum Beach, the Peace River region, and the southern interior. Groundwater availability is an issue or concern in each of the three areas. Mapping and classification of about 20 per cent of the province’s developed aquifers was undertaken to delineate and classify unrecorded aquifers and modify existing classified aquifers.

To help with watershed planning, the Ministry of Environment and Northern Health Authority delineated capture zones for over 100 water supply system wells in the Peace River area. Once delineated,

these source areas (or capture zones) will have legal protection from surface-based oil and gas activities under the *Oil and Gas Activities Act*. Capture zone data are stored online in the provincial data warehouse at www.data.gov.bc.ca/.

The Ministry of Environment, Ministry of Energy and Mines, and Simon Fraser University completed the first phase of the Montney hydrogeological study in 2011. The study objective is to characterize the aquifers in the Dawson Creek to Groundbirch area. Phase one included a survey of private wells and establishment of seven new observation wells.

In 2007, the Water Stewardship Division of the Ministry of Environment developed an inspection approach and field procedures to determine the level of compliance with the GWPR. Data on inspection and enforcement activity is available for the 2009/2010 and 2010/2011 fiscal years, but not for 2011/2012. The primary objective of the field inspections was to determine compliance with GWPR requirements by assessing the following:

- Qualifications of the well driller at the time of drilling.
- Compliance with the GWPR for sealing, capping, well identification, and wellhead completion practices.
- The overall level of compliance.

In 2009/2010, 119 wells were inspected, and 54 wells were inspected in 2010/2011. The decline in inspections occurred across all regions and reflected a combination of resource limitations and the need to place greater priority on other activities by staff undertaking GWPR compliance inspections.

Inspections were conducted at random and on a complaint basis. Complaints were received from contractors, qualified pump installers, drinking water officers, the Provincial Emergency Program, and residents. In one case in 2009/2010, a complaint lead to the inspection of 45 wells in a new residential subdivision on Salt Spring Island related to inadequate capping of the wells.

Violations discovered during these inspections included the following:

- Improperly capped wells (allowing access to vermin or contaminants).

- Improperly completed well heads (again allowing for potential contamination).
- Poor surface seals (allowing contaminated surface water to flow down the sides of wells to reach the groundwater below).
- Uncontrolled artesian flow (potentially decreasing the water in an aquifer).
- Inadequate flood-proofing or physical damage to the wellhead from debris flow that could result in direct contamination.
- “Junk” in wells (in one case a well had been used as a fire pit).
- Improperly deactivated wells (a potential source of contamination or, in the event of a dug well, presenting a risk of a person or animal falling into the well).
- Lack of an identification plate.

Most violations of the GWPR occurred when wells were investigated because of complaints. Randomly inspected wells tended to be in compliance; however, random inspections generally occurred as a result of a well driller voluntarily submitting a well log for a new well.

Inspections also identified inappropriate construction practices, with one well using thermoplastic pipe for production casing. The vertical stick up for these wells is vulnerable to damage, and the driller was advised that the casing at the ground surface must be protected from damage.

In one unusual case in the Prince George area, a resident complained that a neighbour had drilled a well on his property. To resolve the issue, the well driller used a tractor to bend the upper well casing until it surfaced on the adjacent property.

Of the 119 wells inspected in 2009/2010,

- 44 had improper wellhead completion or lacked a proper well cap.
- 1 did not have an adequate surface seal.
- 5 had uncontrolled artesian flow.
- 2 contained “junk”.
- 10 were improperly deactivated.
- 9 lacked a well identification plate.

Of the 54 inspections undertaken in 2010/2011,

- 10 had uncontrolled artesian flow.
- 3 lacked an adequate surface seal.
- 21 required protection of the wellhead.
- 1 lacked flood-proofing.

Enforcement staff used a progressive enforcement approach towards compliance. Most deficiencies were voluntarily corrected by the well owner or the driller. Orders were required to resolve four violations in 2009/2010, and one in 2010/2011.

Ministry of Forest, Lands and Natural Resource Operations

The Ministry of Environment and MFLNRO established 21 observation wells in 2011/2012 to monitor groundwater conditions in Langley (2); Okanagan Basin (8); Peace River (6); Nanaimo (4); and Savary Island (1). Long-term trends of observation wells indicate that groundwater levels are declining in some areas of the province and over one-third of our aquifers are vulnerable to contamination.²⁴ While the water supply situation is not a serious problem for many communities, these figures show that the availability of a healthy, sustainable, and plentiful water resource can no longer be presumed.

Since the 2010 reorganization, the Deputy Minister of MFLNRO is responsible for the designation of community watersheds. Community watersheds are designated to protect water sources from activities such as logging, oil and gas activities, road building, recreation, and agriculture. In August 2011, MFLNRO designated over 465 community watersheds or portions of watersheds for the purposes of the Environmental Protection and Management Regulation under the *Oil and Gas Activities Act*. This would allow the minister responsible for the *Water Act* to protect the quality or quantity of water, or timing of the flow. Community watersheds hold the water supply for a licensed waterworks or domestic water users' communities. There are no designated community watersheds in the northeast region of British Columbia. A list of the designated watersheds is contained in the community watershed spatial layer stored at www.for.gov.bc.ca/tasb/legsregs/ogaa/community.htm.

Water Availability Indicator

To ensure continued sustainability of fresh water for human use and ecosystem support, it is important to track the status of water availability. Following a recommendation of the National Round Table on the Environment and the Economy, a federal interdepartmental working group was established in 2006 to develop the Water Availability Indicator (WAI) to describe the availability of water across Canada. The WAI is derived by calculating the ratio of water demand (the amount of water being used) to water availability (the volume of water in rivers), at the sub-drainage-area scale, on an annual basis.

The second nationwide results of the WAI initiative describe Canada-wide progress to March 31, 2012, and were produced using 2009 survey data. The Water Availability Indicator consists of four categories based on the Organisation for Economic Co-operation and Development classification scheme.

HIGH	More than 40 per cent of available water is used; severe water stress.
MEDIUM	Between 20 and 40 per cent of available water is used; both water supply and water demand need to be managed; conflicts among competing uses will need to be resolved.
MODERATE	Between 10 and 20 per cent of available water is used; water availability becomes a constraint on development; significant investment is needed to provide for adequate water supply.
LOW	Less than 10 per cent of available water is used; low water stress.

British Columbia, as a whole, was rated as having a low WAI ratio, with less than 10 per cent of available water being used and low stress on water source quantity. The BC Ministry of Environment's Water Stewardship Division reports that despite the apparent abundance of water in BC, over 17 per cent of our surface water sources have reached, or are nearing, their capacity to reliably supply water for extractive uses in BC.²⁵

Since water availability is a concern in the Okanagan Valley, it was evaluated at the sub-sub-drainage-area scale. The area was rated as having a high WAI ratio, with more than 40 per cent of available water being used, indicating severe stress to water source quantity.²⁶

To ensure a long-term sustainable water supply, and to support member jurisdictions to meet their water management goals, the Okanagan Basin Water Board has a number of strategic projects and programs. These include managing funding from senior government agencies for grants²⁷ for local water quality and conservation projects, coordinating conferences and workshops²⁸ to share best water management practices, governance ideas, and water science findings.

Through a partnership with the province of BC and Environment Canada, the Board has an online water management and reporting system. The BC Water Use Reporting Centre²⁹ allows water users to record how much water they have used. Frequent reporting will ensure data is accurate, which will allow a more coordinated response to shortages.

Groundwater Resources

Groundwater provides 23 per cent of BC's population with drinking water and comprises 9 per cent of total water consumption in BC.³⁰ In 2010, the Auditor General of British Columbia completed an *Audit of the Management of Groundwater Resources in British Columbia*.² As discussed earlier in this section, the report concluded that the provincial government is not effectively ensuring the sustainability of the province's groundwater resources. Specifically, they found that

- Ministry of Environment information about groundwater was insufficient to enable it to ensure the sustainability of the resource.
- Groundwater was not being protected from depletion and contamination or to ensure the viability of the ecosystems it supports.
- Control over access to groundwater was insufficient to sustain the resource, and key organizations lack adequate authority to take appropriate local responsibility.²

The report recommended^o key actions to ensure the continued protection of this valuable resource in British Columbia that included the following:²

1. Ensure that classification of the province's aquifers is completed for all priority areas and that the WELLS database is kept up to date. The ministry should also ensure that aquifers are characterized, starting with those classified as having the highest priority.
2. Expand the Provincial Observation Wells Network and review the Provincial Ambient Groundwater Quality Monitoring Network to ensure there is sufficient monitoring of groundwater levels and quality across the province.
3. Take the lead on coordinating the consolidation of all of the groundwater monitoring information collected by provincial ministries and other agencies to reduce duplication of effort and to ensure the best use of limited resources.
4. Develop a groundwater information management strategy that takes into account detailed scientific information and identified trends, and ensure that the information required to support this strategy is collected, analyzed, and available through one location.
5. Develop and deploy systems to protect groundwater from depletion and contamination and to ensure the viability of the ecosystems it supports.
6. Develop a framework that clearly outlines the roles and responsibilities for managing groundwater provincially and locally, and ensure that agencies are able to take responsibility for groundwater in their area.
7. Ensure that integrated watershed management plans are developed for all priority watersheds.

Actions to address the Auditor General's recommendations are discussed in Section 2.3, under the heading "Provincial Government Performance: Ministry of Environment".

Surface Water Resources

The Water Survey of Canada is responsible for the collection, interpretation and dissemination of standardized water resource data and information. There are 2,300 active hydrometric gauges across Canada, with 452 located in British Columbia.^p In 2011/2012 in BC, four hydrometric stations were added to the network while five gauging stations were removed. This program is coordinated in partnership with the BC Ministry of Environment. This water resource data and information can be found at www.ec.gc.ca/rhc-wsc/.

The Canada-British Columbia Water Quality Monitoring Agreement, signed in 1985,³¹ monitored for water quality trends in 31 provincially significant rivers and streams. By measuring the concentrations of variables such as metals, nutrients, pH, temperature, and dissolved oxygen, the Ministry of Environment was able to identify trends in overall surface water quality. The performance measurement is the percentage of water bodies monitored under this agreement with stable or improving water quality trends. Throughout the reporting period, the target goal was achieved annually, with 96 per cent of the monitored water bodies in BC demonstrating stable or improving water quality trends.^{32[p.18]}

^o Although the report refers to the Ministry of Environment, recommendations in the report are applicable to the Ministry of Environment and the Ministry of Forests, Lands and Natural Resource Operations.

^p The locations of the stations in BC are available at www.wateroffice.ec.gc.ca/google_map/google_map_e.html?searchby=p&province=BC.

Section 3: Integration



Living Water Smart – BC’s *Water Plan* is the provincial plan that sets the direction for changes to water management and consumption. These changes are crucial measures for adapting to climate change impacts and the pressures placed on water resources from a growing population and economy. While delivery of the plan involved 11 ministries and a range of stakeholders, the Ministry of Environment is responsible for overall coordination and reporting on *Living Water Smart*, as well as leading action on a number of specific commitments in the plan. Local and federal governments, regional health authorities, industry groups, First Nations, non-government organizations (NGOs), communities, and citizens all have important roles to play in water stewardship and achieving the *Living Water Smart* vision and goals.

In British Columbia, the drinking water protection programs are led by the Ministry of Health and are delivered through a cooperative partnership with water suppliers, local governments, health authorities, federal and provincial government ministries and agencies, First Nations, NGOs, and the general public. Direct service delivery of drinking water programs is administered locally by drinking water officers, public health engineers, and medical health officers in BC’s health authorities. Drinking water officers provide surveillance and monitoring of drinking water systems that may affect the public’s health. They also

administer and enforce the *Drinking Water Protection Act*, the Drinking Water Protection Regulation and the *Public Health Act*, to provide interventions to minimize health and safety hazards.

Section 3 provides greater detail on the above groups and initiatives and how they are integrating programs, policies, and information across ministries and with other organizations.

3.1 EFFECTIVE STRATEGIES

In July 2010, the Steering Committee for the Collaborative Watershed Governance Initiative proposed the development of an accord or charter, where all levels of government, First Nations, and resource user organizations would agree to work collaboratively in watersheds based on a set of common principles. The accord was designed to be a high-level agreement that outlines the principles of effective governance and management of watersheds. The agreement was intended to raise awareness around the need for effective watershed governance among stakeholders that have responsibilities, interests, and/or activities in BC’s watersheds. As such, the provisions focus on facilitating effective dialogue and decision-making among competing interests. A copy of the draft accord (April 2012) can be found at [www.fraserbasin.bc.ca/ Library/Water/water_cwg_accord_draft.pdf](http://www.fraserbasin.bc.ca/Library/Water/water_cwg_accord_draft.pdf).

Assistant Deputy Ministers' Committee on Water

In 2002, the Government of British Columbia released the *Action Plan for Safe Drinking Water in British Columbia*, in recognition that providing safe drinking water requires an integrated approach across all the ministries and agencies with legislated authority for water protection from source to tap. The Assistant Deputy Ministers' (ADM) Committee on Water (co-chaired by the Ministry of Health and the Ministry of Environment) and the Directors' Inter-Agency Committee on Drinking Water (DIACDW) were created as facilitating bodies for the Action Plan. During this reporting period, the ADM Committee on Water was dissolved. This left the DIACDW as the only facilitating body for the Action Plan.

Directors' Inter-Agency Committee on Drinking Water

The DIACDW is co-chaired by the Ministry of Health (Health Protection Branch) and the Ministry of Environment (Water Management Branch). Under the *Memorandum of Understanding on Inter-Agency Accountability and Coordination on Drinking Water Protection* (2006), the DIACDW were to review the regional drinking water teams' annual reports and provide an annual overview report to the ADM Committee on Water. However, during the reporting period, the ADM Committee was dissolved and the submission of regional drinking water team annual reports became infrequent. Under the ratified terms of reference, the DIACDW was to meet six times per year and provide periodic status reports on the work of the committee to the Provincial Health Officer (PHO), drinking water team coordinators, the ADM Committee on Water, and each agency represented on the committee. However, the committee met less than six times per year and status reports were not distributed as described during the reporting period. An updated terms of reference was drafted for the DIACDW but not completed nor ratified by the end of the 2011/2012 fiscal year.

Memorandum of Understanding on Inter-Agency Accountability and Coordination on Drinking Water Protection

In 2006, a *Memorandum of Understanding on Inter-Agency Accountability and Coordination on Drinking Water Protection* (MOU) was created to provide an understanding of each agency's accountability concerning drinking water protection. Signatories to the MOU were the Ministry of Agriculture and Lands; Ministry of Energy, Mines and Petroleum Resources; Ministry of Environment; Ministry of Community Services; Ministry of Health; Ministry of Forests, Range and Housing; Ministry of Transportation; Office of the PHO; and the five regional health authorities. The 2006 MOU established a regional drinking water team in each of the five regional health authorities.

Since the MOU was signed, most of the signatory ministries have been reorganized and responsibilities for drinking water and source protection have changed (Table A in the introduction outlines changes during this reporting period). In particular, many of the provincial and regional land-use authorizations are now concentrated in one ministry: the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). The reorganization of the ministries and water source protection responsibilities affected the composition of the regional drinking water teams.

Regional Drinking Water Teams

Development of a reporting protocol for issues and concerns of the regional drinking water teams (RDWT) was challenged by the reporting structure within British Columbia's drinking water and source protection programs. The ADM Committee on Water was dissolved during this reporting period and major changes were made to drinking water source protection responsibilities within the ministries.

In the fall of 2011, members of the RDWTs requested a review of the MOU to assess support for continued operations of the RDWTs and to determine their effectiveness in meeting the MOU's original objectives. The review was completed April 27, 2012, and explored the strengths and challenges of the MOU, implementation by the RDWTs and DIACDW, and whether the MOU was ensuring

proactive coordination and accountability in source area drinking water protection.

There was consensus that RDWTs were valuable as the only inter-agency group with a primary focus on drinking water, but that they lacked a well-defined mandate. Some review participants expressed frustration at the mandate being limited to information sharing as opposed to planning or land-use decision-making. However, there are pre-existing established processes, many of a bilateral or trilateral nature, to resolve drinking water issues external to RDWT meetings. The review recommendations included expanding RDWT participation to include local governments, First Nations, and academia.

Ministry of Forests, Lands and Natural Resource Operations and Ministry of Environment

In March 2012, MFLNRO and the Ministry of Environment published a guidance document called *Develop with Care 2012: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. It describes the program priorities of MFLNRO, the Ministry of Environment, and other provincial and federal agencies and features information on sustainable urban and rural land development, riparian protection, watershed protection, and climate change. Section 2 of the document provides guidance for rainwater management and drinking water source protection. It is one in a series of environmental guideline documents prepared by the provincial government. The document was updated in 2014 and is available at www.env.gov.bc.ca/wld/documents/bmp/devwithcare/.

Drinking Water Leadership Council

The Drinking Water Leadership Council was established to coordinate discussions and foster cooperation among all agencies involved in the administration of the *Drinking Water Protection Act*, including the regional health authorities, the Ministry of Environment, the Ministry of Health, and the Office of the PHO. In the spring of 2012, the Council established a sub-committee to explore governance issues faced by the five regional health authorities. The sub-committee was tasked with identifying specific and systemic governance issues affecting compliance with the *Drinking Water Protection Act*.

For the purposes of this work, the sub-committee defined water system governance as the structure and administrative processes that direct and control operations, decision-making, and finances. Objectives of the sub-committee were to

1. Provide a functional breakdown of the various governance structure types in BC water systems.
2. Identify key stakeholders and legislation providing oversight for each governance structure type.
3. Identify and prioritize key governance issues and make recommendations.
4. Identify data collection and management gaps and make recommendations.

3.2 ALIGNED MANAGEMENT SYSTEMS

Water information in BC is highly distributed. Many agencies collect and generate scale dependent data and information with interplay between variables (e.g., climate, land-use decisions) linking small watersheds to the larger watersheds they are within. Given the diversity of water and watershed activities, no one individual or organization holds all the water-related information in BC. This poses a challenge to sustainable water management where the efficient sharing of data, information, and expertise across watersheds and organizations is essential. During the reporting period, the Ministry of Environment compiled a list of websites relevant to water science practitioners in British Columbia. This list is available at www.livingwatersmart.ca/watersciencestrategy/docs/Appendix-WaterInformationResources.pdf.

Information management and reporting continues to be a major ongoing challenge province-wide. Water suppliers collect data about their water supplies through their monitoring and testing programs, and share this information with drinking water officers from the regional health authority. Each health authority has databases where water quality information and other data is stored. However, not all data provided by water suppliers may be entered into health authority databases.

Provincial government ministries and agencies also collect information about water in the province, whether it relates to land use (urban development, forestry, agriculture, mining, or other industrial activities) or environmental monitoring. Water

quality and quantity data collection protocols are often inconsistent with other agencies in the provincial drinking water program, and data are stored in a variety of databases, often in formats that are incompatible with those used by other agencies. Ideally, the information in all of these databases would be shared for the benefit of all parties. Sharing would make it easier to chart progress in achieving the objectives of the *Action Plan for Safe Drinking Water in British Columbia* and the *Drinking Water Protection Act* and Regulation. Initiatives to resolve data management challenges have not yet been successful.

Regional Drinking Water Teams

Agencies responsible for land development, water consumption, and watershed protection legislation can issue permits/approvals/licences for land and water use and/or diversion independent of other agencies. During the reporting period, the Vancouver Island RDWT worked on a referral process to ensure appropriate health officials within the Ministry of Health or the health authorities receive interagency referrals that may have an impact on the safety of drinking water.

Other RDWTs may also benefit from an enhanced interagency referral process. For example, Northern Health reviewed environmental assessments (drinking water source quality) referred by the Ministry of Environment during the reporting period. However, neither Northern Health nor the Northern RDWT were able to obtain results from source water quality and related environmental monitoring by oil and gas industries. Interagency sharing of monitoring data for source water protection by the oil and gas industries would enhance the scientific understanding of risks associated with oil and gas activities and enhance source protection through coordination of interagency regulatory and monitoring activities.

Regional drinking water teams were designed to be action-based committees to address concerns of land development on drinking water treatment, delivery, and source protection. Participation, however, has been inconsistent and influenced by limited resources (time and budgets) and geographic distances. For many reasons, including fewer regional action items to address, government reorganization in 2010, and the uncertainty regarding the continuing status of the RDWTs, meetings were more infrequent during

this reporting period than the last reporting period, with the exception of Northern Health. All of the teams met at least once annually as required under the MOU. At the end of the reporting period, Fraser and Vancouver Coastal RDWTs had combined their teams to meet quarterly; Vancouver Island RDWT met quarterly; and Southern-Interior RDWT had ceased their biannual meetings in anticipation of the MOU review results. Northern Health RDWT continued to be fully functional, with ongoing action items and participation of all signatories of the MOU. The Ministry of Energy and Mines did not participate on RDWTs in other areas of the province, citing lack of capacity and resources.

Ministry of Environment

In March 2012, the Ministry of Environment facilitated conversations with the water science community about how to increase access to a wide variety of water data and information that support sustainable water use and management in BC. This qualitative research clarified preferences for existing water information-sharing tools, water science community needs, and information-sharing barriers. At the end of the reporting period, the Ministry of Environment was considering options for collaborative water information sharing with the water science community.

Small Water Systems Committees

The Inter-Ministry Small Water Systems Committee met regularly in 2011 and was led by the Ministry of Health with representation from MFLNRO; the Ministry of Community, Sport and Cultural Development; the Ministry of Transportation and Infrastructure; and the Office of the PHO. This committee reviewed a report commissioned by the Ministry of Health to characterize challenges facing small water systems, developed a paper that defined the problem, and sought support to move forward to address the challenges.

In September 2010, the Union of BC Municipalities (UBCM) Small Water Systems Working Group was established in response to ongoing local government concerns over the application of the *Drinking Water Protection Act* and associated regulatory water quality standards to small water systems. It had representation from local governments, Northern Health Authority,

and most of the provincial agencies represented on the Inter-Ministry Small Water Systems Committee. Throughout 2011, the working group developed terms of reference and an issues paper that identified a series of interpretation, application, financial, operational, governance, and liability issues with small water systems in BC. At the 2011 UBCM Convention, the working group made recommendations with respect to a new definition for small water systems as well as a new approach for the treatment of surface water.

Federal-Provincial-Territorial Coordinating Bodies

During the reporting period, the Ministry of Health participated on several national committees that coordinate drinking water activities across Canada and facilitate the exchange of information and science internationally. These committees included the Federal-Provincial-Territorial Committee on Health and the Environment (CHE) and the Federal-Provincial-Territorial Committee on Drinking Water (CDW). The CDW^q is a well-established national committee that has been active for more than 20 years and establishes the *Guidelines for Canadian Drinking Water Quality*.^r Health Canada provides scientific and technical expertise to the committee and coordinates its activities. The CDW reports to the CHE. The CHE, in turn, reports on health issues to the Advisory Committee on Population Health and Health Security and on environmental issues to the Canadian Council of Ministers of the Environment.

In 2012, the CDW updated the summary table of the *Guidelines for Canadian Drinking Water Quality*, published by Health Canada.³³ Public involvement is encouraged when drinking water quality guidelines are developed, and in 2011, the CDW sought public consultation on the following proposed guidance documents:

- *Escherichia coli* in Drinking Water.
- Total Coliforms in Drinking Water.
- Guidance on the use of Heterotrophic Plate Counts in Canadian Drinking Water Supplies.

^q For more information about this committee and its work, see the Health Canada website at www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/fpt/index-eng.php.

^r The *Guidelines for Canadian Drinking Water Quality* are available from Health Canada online at www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#guidelines.

- Enteric Protozoa: *Giardia* and *Cryptosporidium*.
- Turbidity in Drinking Water.

During the reporting period, the CDW approved new or revised drinking water guidelines for enteric viruses (2011); dichloromethane (2011); carbon tetrachloride (2010); fluoride (2010); 2-Methyl-4-chlorophenoxyacetic acid (MCPA) (2010); *N*-Nitrosodimethylamine (NDMA) (2010); benzene (2009); and chlorine (2009). In addition, in 2009, guidelines were created for seven radiological parameters that focus on “...routine operational conditions of existing or new water supplies, but...do not apply in the event of contamination during an emergency involving a large release of radionuclides into the environment.”³⁴

In 2009, the CDW created the following documents for drinking water authorities to provide guidance relating to contaminants, drinking water management issues, or emergency situations:

- Issuing and rescinding boil water advisories.
- Controlling corrosion in drinking water distribution systems.
- Issuing and rescinding drinking water avoidance advisories in emergency situations.

During the reporting period, the CDW sponsored the biennial Canadian National Drinking Water Conference, which was organized by the Canadian Water and Wastewater Association to bring together experts to share the latest research and activities related to drinking water quality and management.

First Nations

The Drinking Water Safety Program, a community-based program that works with First Nations communities to monitor and ensure the safety of drinking water, was part of the Environmental Public Health Program, First Nations and Inuit Health, Health Canada. Through the program, First Nations were actively involved in monitoring and analyzing their public water supplies and raising awareness of water issues in their communities.

During the reporting period, preparations were undertaken to transfer many environmental health programs, including drinking water, to the BC First Nations Health Authority. The BC First Nations

Health Authority (FNHA) is the first province-wide health authority of its kind in Canada. The transfer of programs, services, and responsibilities from Health Canada's First Nations and Inuit Health Branch—Pacific Region to the FNHA was completed in 2013. The FNHA is tasked with planning, designing, managing, and funding the delivery of First Nations health programs and services in BC. Its mandate is to collaborate, coordinate, and integrate their respective health programs and services with the Ministry of Health and regional health authorities to achieve better health outcomes for BC First Nations.

On February 29, 2012, Bill S-8, *Safe Drinking Water for First Nations Act*, was introduced in the Senate.⁵ This legislation will allow the federal government to develop, in partnership with First Nations, enforceable federal regulations to ensure access to safe, clean, and reliable drinking water and the protection of sources of water on First Nation lands. It is anticipated that the FNHA, along with Aboriginal Affairs and Northern Development Canada, will take the lead in coordinating and administering this and other drinking water legislation with respect to First Nations lands in BC.

Source Water Protection Activities

Source water protection requires considerable integration and coordination between provincial, federal, and local governments, as well as industry and recreation groups and other stakeholders. Source water protection activities are detailed in Section 2 of this report.

3.3 PERFORMANCE MEASUREMENT AND REPORTING

Each government ministry, including those with a mandate to protect water, publishes an annual service plan report, which details progress on its goals, objectives, strategies and performance results. The reports also provide information on resources spent in each program area and the number of full-time equivalent employees, as well as capital expenditures in the ministry. The reports are posted on each ministry's website.

Websites

Government websites play an important role in reporting actions and providing information on source water protection and drinking water quality and quantity in British Columbia. Many of these websites are discussed and links presented throughout this report are listed in Appendix A. Key websites with extensive information on water in British Columbia include the following:

- Waterbucket: <http://waterbucket.ca/>.
- Sustainable Infrastructure Society: www.waterbc.ca/.
- Science and Information (Ministry of Environment): www.env.gov.bc.ca/wsd/data_searches/index.html.
- Water Rights and Legislation (MFLNRO): www.env.gov.bc.ca/wsd/water_rights/index.html.
- Planning, Protection and Sustainability (Ministry of Environment): www.env.gov.bc.ca/wsd/plan_protect_sustain/index.html.
- Water Quality (Ministry of Health): www2.gov.bc.ca/gov/topic.page?id=2890C295ACC74344A677CC5EC97B7DE5.
- Regional health authorities: www.health.gov.bc.ca/protect/dw_ha_contacts.html.
- Oil and Gas Commission: www.bcogc.ca/public-zone.

As stated in the previous drinking water report, access to information on water in BC could be improved with the creation of a single public portal, with links to all websites of relevance to drinking water in BC, including source water protection and land-use management.

Regional Drinking Water Teams

Under the MOU, each RDWT is to provide a record of their progress in the form of an annual report to the DIACDW. The DIACDW is responsible for addressing any concerns or issues that have arisen in these reports, settling conflicts the teams are unable to resolve, and facilitating information sharing. While all RDWTs submitted reports in 2010, Southern Interior and Vancouver Island were the only RDWTs to submit an annual report in 2011.

⁵ The Bill came into force in November 2013.

Ministry of Environment

A significant amount of source water quality data is collected by water supply systems regulated under the *Drinking Water Protection Act*. During the reporting period, the Ministry of Environment initiated a pilot project with Fraser Health, four water supply systems in the Fraser Valley, the Ministry of Health, and MFLNRO to assess the feasibility of consolidating water quality data collected by public water supply systems into the Ministry of Environment's Environmental Management System database.

One possibility for improving the sharing of information across BC's many watersheds is to utilize online tools. The Ministry of Environment conducted a survey³⁵ that investigated the current range of BC online information resources for water science practitioners to help facilitate a conversation about the types of online tools that could improve the sharing of data (raw, unorganized observations), information, and expertise among BC's water science practitioners. This investigation

- Identified existing online tools for sharing of data, information, and expertise among water science practitioners.
- Characterized BC websites relevant to water science practitioners.
- Identified websites from other jurisdictions that could be models for online sharing of BC water science resources.

There were 92 websites inventoried.^t Fifty-five were from BC, and were catalogued representing stewardship groups and NGOs (15 sites); professional associations (5 sites); academic centres (6 sites); partnerships (10 sites); and federal (1 site), provincial (14 sites) and regional (4 sites) governments that provide data and/or information relevant to water science practitioners.³⁵ The survey found that data collected by stewardship groups, university researchers, and industry were not accessible online. Other findings and an evaluation of the online resource strengths and weaknesses in terms of data sharing can be found at www.livingwatersmart.ca/watersciencestrategy/.

^t The list of inventoried websites can be found at www.livingwatersmart.ca/watersciencestrategy/docs/Appendix-WaterInformationResources.pdf.

Observation Well Network

The Observation Well Network (established in 1961) monitors groundwater levels and baseline chemistry.^u In May 2009, the Expert Panel on Groundwater reported that

Groundwater monitoring (both water level and ambient quality) needs to be significantly enhanced in the province. There are 160 active observation wells in the network, monitoring less than 100 aquifers (just greater than 10% of the >900 aquifers identified and classified in BC). Ambient groundwater quality monitoring is being conducted in about 20 aquifers (<1% of the identified and classified aquifers in BC).³⁶

They concluded

In BC, a major challenge currently is the lack of a legal framework for regulating the extraction of groundwater...Lack of knowledge of actual quantities is a major gap in determining water balances and sustainable yield of aquifers. Legal requirements (and corresponding capacity) for regulating, monitoring and reporting groundwater extraction need to be developed or updated.³⁶

Following the recommendations of the 2009 Observation Well Network review, the Ministry of Environment and MFLNRO established 21 observation wells in 2011/2012 to monitor groundwater conditions in developed aquifers. Approximately one-half of these wells have been equipped with data loggers and are operational. The remaining wells will be equipped with data loggers and operationalized in 2012/2013. In addition, close to one-half of the current observation wells have been equipped with satellite telemetry that allows real-time measurement and reporting of well levels. It was projected that the majority of the Observation Well Network will be updated with telemetry over the next three years.

^u The Observation Well Network can be found at www.env.gov.bc.ca/wsd/data_searches/obswell/index.html.

Ambient Groundwater Quality Monitoring

An ambient groundwater quality monitoring program was initiated in 1986 to examine groundwater quality concerns and monitor trends over time. The studies concentrate on aquifers classified as 1A, which are highly developed and highly vulnerable aquifers. Water quality is monitored in observation wells, community water system wells, and private wells in the aquifer for a period of five years or more. If there is a change in quality, the study may continue for a longer period of time. Aquifers have been studied in the Langley-Abbotsford area, Osoyoos, Grand Forks, and most recently the Cowichan Estuary.^v

During the reporting period, a review of this program was initiated to help assess groundwater quality in priority areas, but was not finalized due to a greater focus on work related to aquifer mapping, classification, and characterization; the Observation Well Network; and *Water Act* modernization. Completion of this review is planned for fiscal year 2012/2013.

Drinking Water Information Management

Drinking water information management has been the topic of recommendations of several public reports, including the last three Provincial Health Officer reports on the *Progress on the Action Plan for Safe Drinking Water in British Columbia*. Drinking water officers and the PHO require access to data needed to administer and report on activities under the *Drinking Water Protection Act* and Regulation. Drinking water system and drinking water program data are needed to hold water suppliers, drinking water officers, and the government accountable through public reporting. For many years there have been ongoing discussions about the inability of government, health authorities, and water suppliers to readily access data on water supplies that could improve land-use decisions and help manage risk to source water.

Although the first drinking water information management project was initiated by the Ministry of Health in 2003, the situation of inadequate information infrastructure persists. The health authorities continued to use several versions of two information systems during this reporting period. Many of the same deficits identified in earlier reports have remained unchanged, particularly the inability to report on many key indicators and align with other water-related data management systems. At the end of the reporting period, the PHO, the Provincial Drinking Water Officer, and Health Protection Branch staff from the Ministry of Health did not have access to an application that would supply the data needed to improve administration and reporting activities under the *Drinking Water Protection Act*.

This drinking water report echoes the recommendations in previous reports that an environmental health/health protection application would improve the ability of government staff, health authority staff, water suppliers, and the public to access data relevant to drinking water systems or drinking water protection, which is not subject to protection of privacy requirements.

The British Columbia Ground Water Association has stated “We can’t manage what we aren’t measuring, and we can’t control what we aren’t willing to enforce” and concluded to a 2009 Expert Panel on Groundwater “We need national and provincial standards for data collection, compatible archiving and retrieval frameworks, reasonable extraction limits and legislated protection with enforcement for vulnerable and threatened aquifers.”³⁶

^v Details on the Lower Mainland project can be found at www.env.gov.bc.ca/epd/regions/lower_mainland/water_quality/ground_water/. Other reports can be found through the Ecological Reports Catalogue (EcoCat) at www.env.gov.bc.ca/ecocat/.

Section 4: Water System Assessments



Drinking water system assessments are critical to gaining an understanding of the state of BC's drinking water supplies and required improvements. A water system assessment considers

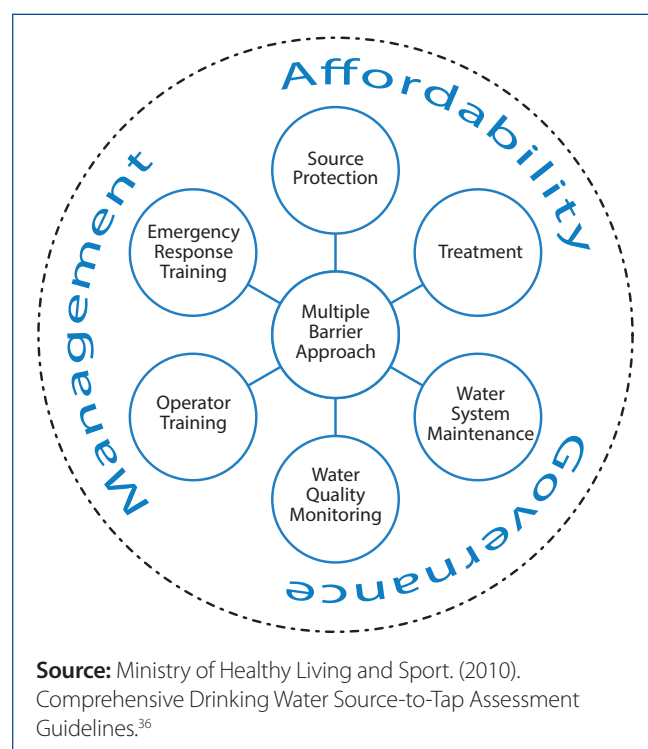
- The water source.
- The infrastructure (water supply, treatment, storage, and distribution equipment).
- The system's ability to meet regulatory requirements and industry best standards.

This assessment will guide water suppliers in planning and implementing changes to improve the safety and reliability of their water systems.

Systems that have been assessed with high hazard ratings can be assigned a higher priority for infrastructure upgrades or other improvements. During the reporting period, the Ministry of Community, Sport and Cultural Development (previously Ministry of Community and Rural Development)^w awarded 71 grants to communities to help them plan for improvements to their drinking water systems under the Infrastructure Planning Grant Program.

Approximately 7,900 water system inspections were conducted during the reporting period, and 4,234 of the province's 4,799 water supply systems had been assigned hazard ratings by March 31, 2012. Despite

Figure 4.1 Comprehensive Drinking Water Source-to-Tap Assessment



^w The Ministry of Community and Rural Development became the Ministry of Community, Sport and Cultural Development in October 2010.

an increase of 249 recorded water supply systems, by the end of the reporting period there were only 565 systems without a hazard rating. This represents a 25 per cent decrease in water systems without a drinking water system assessment since the beginning of the reporting period.

Water suppliers may be required to conduct source-to-tap assessments to identify source contamination risks and plan system improvements. A comprehensive drinking water source-to-tap assessment examines the physical hazards of the water source, system infrastructure, governance and financial systems, and the management and operation of the water supply system as illustrated in Figure 4.1.³⁷

The Comprehensive Drinking Water Source-to-Tap Assessment Guideline for assessing drinking water systems was completed in 2010. It is a tool to help water system operators develop a comprehensive understanding of the risks to drinking water safety and availability. In May 2012, the comprehensive drinking water assessment was simplified to allow small drinking water system operators to complete the assessment in a short timeframe. This document, the Water System Assessment Tool, is posted on the Ministry of Health website.³⁸

4.1 EFFECTIVE STRATEGIES

During the reporting period, the Ministry of Community, Sport and Cultural Development (formerly the Ministry of Community and Rural Development) maintained responsibility for community infrastructure grant programs available to drinking water systems.

A draft consolidation of the *Drinking Water Officers' Guide* was presented to the Drinking Water Leadership Council for comments in December 2011. The document is expected to be completed in 2012. This consolidation incorporates updates and revisions such as turbidity guidelines, complaints processes, messaging for those with compromised immune systems, and technical appendices with water quality parameters.

Water System Assessment Tools

In April 2012, the Health Protection Branch, Population and Public Health Division, Ministry of Health, developed and released Version 1 of the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Ground Water Under Direct Influence of Surface Water (GWUDI)*.³⁹ This guidance document will assist water suppliers and regulatory authorities in assessing the level of potential microbial health hazard and risk associated with a groundwater source.

The procedures outlined in this document follow a staged approach from initial screening of a groundwater source to preliminary and more advanced hydrogeological investigations. This will assist drinking water officers in determining, where necessary, appropriate microbial treatment requirements for groundwater sources. The guidance document's investigative process consists of four stages:

- Stage 1: Screening Tool
- Stage 2: Preliminary Hydrogeological Investigation
- Stage 3: Advanced Hydrogeological Investigation
- Stage 4: Long-term Water Quality Monitoring

If significant risks to a water system are identified, a drinking water officer can order an assessment of the water system under Part 3, Section 18 of the *Drinking Water Protection Act*. There are three assessment processes available to assess water systems, which vary in complexity.

The Drinking Water Source-to-Tap Screening Tool is a simple questionnaire that can be completed by the water supplier. It will determine risks to the water source; the water treatment and distribution system; operation of the system; the monitoring program; and system management.

In 2010, the Comprehensive Drinking Water Source-to-Tap Assessment Guideline was released for professionals, drinking water officers, and water suppliers to conduct detailed assessments of drinking water systems. It serves as a tool to help water system operators develop a comprehensive understanding of the risks to drinking water safety and availability and how to mitigate those risks. It provides a structured and consistent approach to evaluating risks.

The guideline consists of an introduction and eight modules, each of which addresses a different aspect of the drinking water system from source to tap. The drinking water officer may specify that the Comprehensive Drinking Water Source-to-Tap Assessment Guideline be used to complete an assessment ordered under the *Drinking Water Protection Act*. All of the modules can be used, or there can be a more targeted approach, which uses only those modules that will address the risks identified through the screening tool.

In order to simplify the assessment process for small water systems, a Water System Assessment Tool was created. This tool allows drinking water system operators to complete the assessment in a short timeframe, and facilitates communication with drinking water officers. It also fills a gap between the Drinking Water Source-to-Tap Screening Tool and the Comprehensive Drinking Water Source-to-Tap Assessment Guideline.

The intention of the tool was to offer an alternative that would allow for the development of an action plan to reduce risks to and in a water system, without the added cost and time commitment of a comprehensive assessment. In 2012, a trial version of a *Water System Assessment User's Guide* was posted on the Ministry of Health website. Water system operators were encouraged to provide feedback on this simplified source-to-tap assessment. The completed version can be found at www2.gov.bc.ca/gov/topic.page?id=E7584F788B6C4522801D45ECEA3675B2.

4.2 ALIGNED MANAGEMENT SYSTEMS

Planning Grants

During the reporting period, the Ministry of Community, Sport and Cultural Development administered the Infrastructure Planning Grant Program, and provided grants to communities to help them plan for infrastructure upgrades and projects related to the development of sustainable community infrastructure. Infrastructure planning grants have been used for assessing water system needs, including engineering studies, infrastructure assessments, water metering pilot projects, water treatment plans, and well protection plans. During the reporting period, 71 infrastructure planning grants totalling \$660,990 were

provided to help communities plan for improvements to their drinking water systems during 2009/2010 and 2010/2011. There were no infrastructure planning grants awarded in 2011/2012.

First Nations

First Nations hold more than 700 active provincial water licences for a wide range of purposes associated with their lands.⁴⁰ These licences are held by the First Nation or jointly by the First Nation and Aboriginal Affairs and Northern Development Canada (AANDC).⁴⁰ Financial assistance for water facilities on First Nations lands is provided by AANDC. Health Canada's responsibilities include working with communities to ensure water quality monitoring programs are in place, and providing community-based education on water issues.

The First Nations Infrastructure Investment Plan, developed annually by AANDC in partnership with First Nations, strategically plans investments over the short and long term. It supports an infrastructure base that protects health and safety and allows engagement in the economy.⁴¹ The National Ranking Priority Framework provides a consistent and transparent ranking system to address issues in First Nations communities.⁴¹

4.3 PERFORMANCE MEASUREMENT AND REPORTING

The risk level of a drinking water system represents the risk inherent in or arising from the overall infrastructure and management of that system. It does not necessarily reflect the water quality; unsafe drinking water is addressed through water quality advisories (WQA) and boil water notices (BWN). Water quality advisories and BWNs can be issued for reasons such as routine repairs or seasonal conditions such as high spring runoff, in addition to failures of the drinking water system. A high-risk system is more likely to be unable to cope with problems and thus be more likely to be challenged with frequent or long-term WQA or BWN. These challenges can occur in low-risk systems, but better overall risk management allows these systems to address the problem in the short term. This results in the rapid remedying of problems and lifting of WQA or

BWN. Overall, risk management through drinking water system assessments provide a better long-term strategic approach to water management compared to other indicators.

Drinking Water Systems Inspections and Hazard Ratings

In 2009/2010, 2,628 drinking water systems inspections were conducted. This number remained fairly stable, with 2,775 inspections conducted in 2010/2011 and 2,496 inspections completed in 2011/2012. The total number of recorded drinking water inspections conducted over the reporting period was 7,899. Figure 4.2 shows the numbers of inspections by health authority over the reporting period.

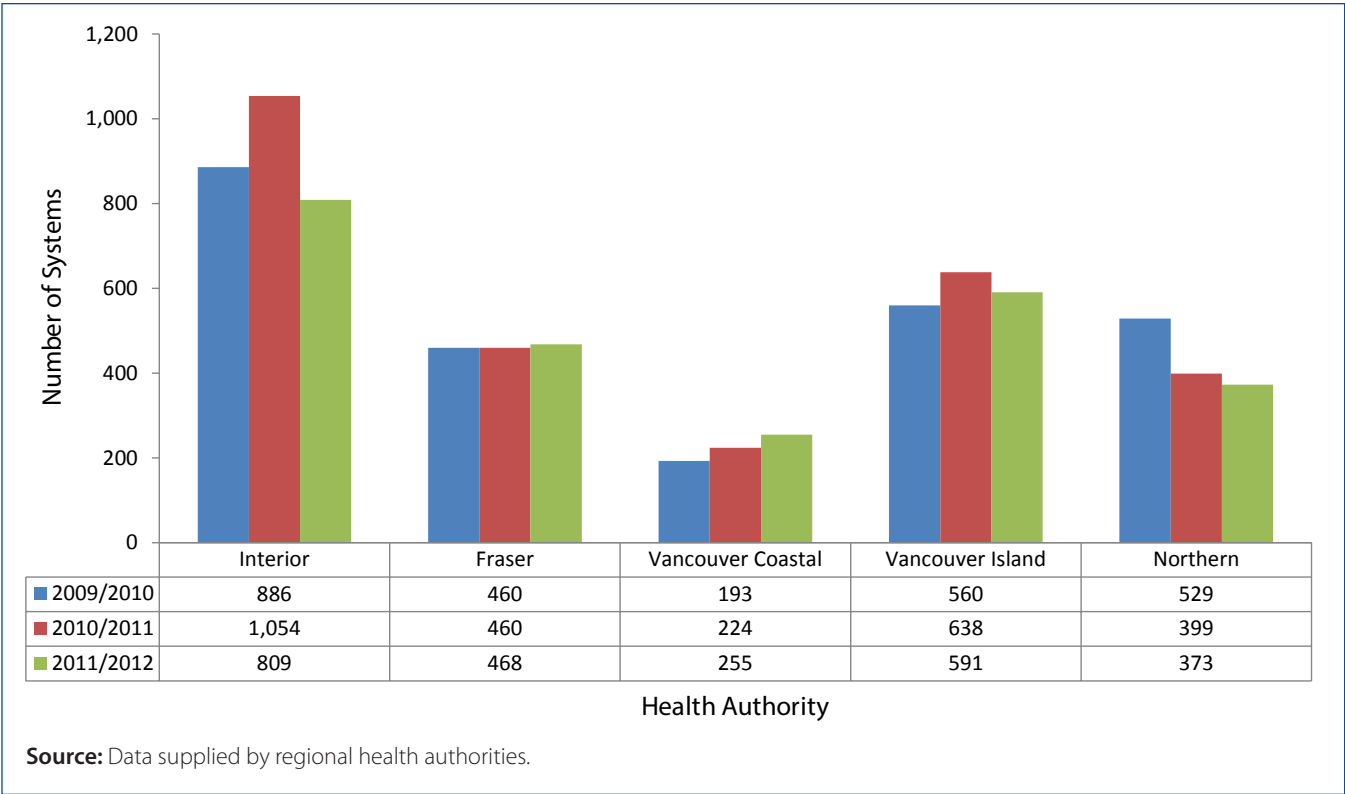
By March 31, 2012, 88 per cent of drinking water systems in BC had a hazard rating. This is consistent with the end of the last reporting period, where 90 per cent of the drinking water systems had a hazard rating as of March 31, 2009. The assigned hazard rating is used to prioritize activities by drinking water officers and water suppliers to make improvements

to water supply systems. Water systems with a higher hazard rating are asked or directed to place a higher priority on addressing the issues that contribute to the higher hazard rating. The number of low, medium, and high hazard ratings for water system inspections in each health authority is given in Figure 4.3. The hazard ratings shown are based on the results of the most recent inspection.

System hazard ratings can also be set based on known, inherent risks associated with the system, determined by using an assessment tool. Available tools include the Comprehensive Drinking Water Source-to-Tap Assessment Guideline, the Water System Assessment Tool, the Drinking Water Source-to-Tap Screening Tool, the Wellhead Protection Tool Kit, or other specific assessment tools developed by each health authority. Factors contributing to lower hazard ratings are also addressed in the drinking water system assessments, and the importance of maintaining these existing strengths are recognized.

Health authorities report that 49 systems have used, or are in the process of using, the Comprehensive Drinking Water Source-to Tap Assessment Guideline

Figure 4.2 Number of Drinking Water Systems Inspected, by Health Authority, BC, 2009/2010 to 2011/2012



to assess their water systems. Most of the water systems in the province have received some type of assessment to identify hazards to the water system and develop mitigation strategies. System assessments are an iterative process for water supply systems, with ongoing adaptation to changing issues and circumstances.

First Nations

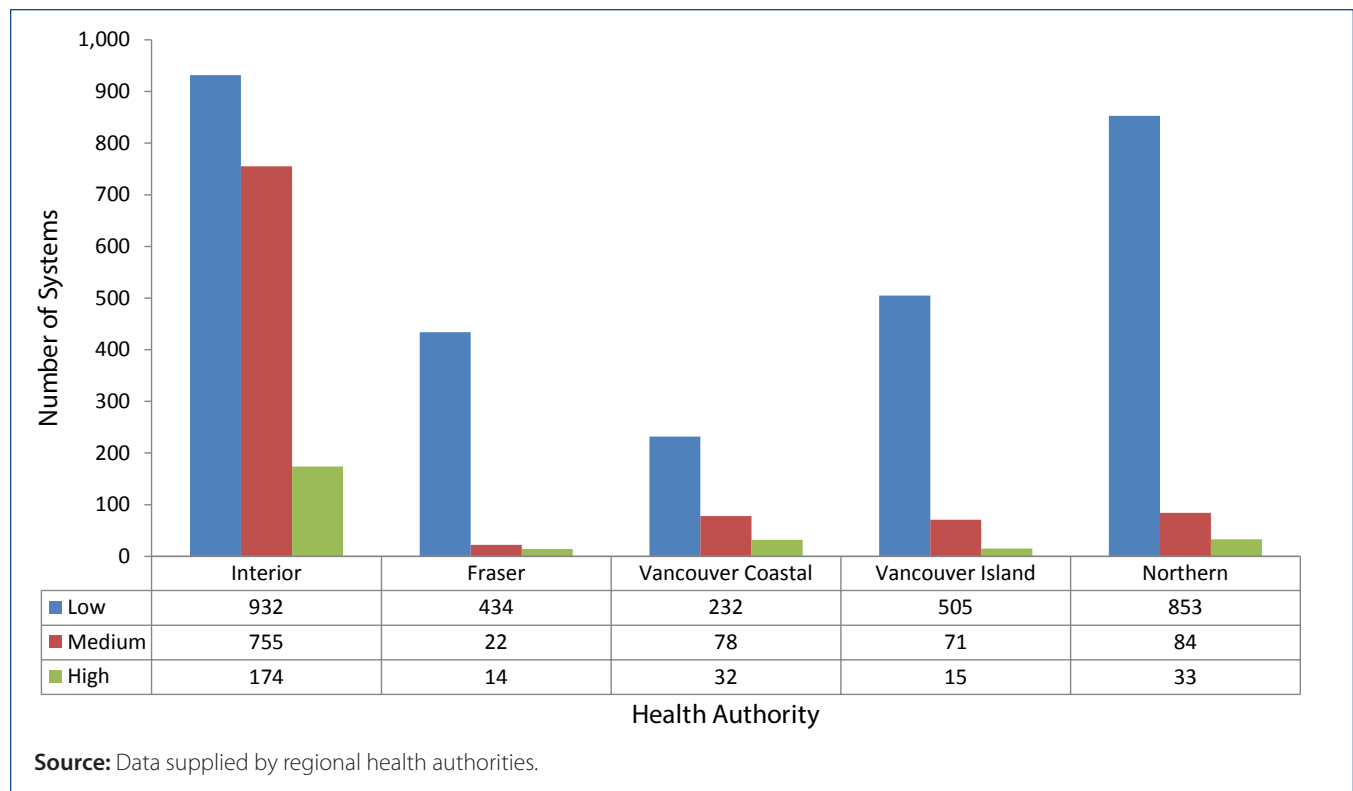
AANDC provides funding to First Nations for design, construction, upgrading, operations, and maintenance of drinking water systems and drinking water treatment facilities in First Nations communities, and for the training and certification of operators. Chiefs and Councils are responsible for the day-to-day maintenance of drinking water systems, including sampling and testing of drinking water quality.

During the reporting period, AANDC scheduled infrastructure inspections of water systems every three years and system performance inspections on an annual basis. Inspections of water systems have been required annually since the *Protocol for Centralised Drinking Water Systems in First Nations Communities* was introduced in 2006.⁴²

Risk assessments, conducted according to AANDC's Risk Level Evaluation Guidelines, are part of these inspections. Risk assessments are performed on water systems in First Nations communities to help ensure that the systems operate effectively and that health and safety guidelines are met. The results of these inspections help AANDC to assess risk level scores for water systems that can serve as a proxy to compliance.⁴³

The National Assessment of First Nations Water and Wastewater Systems 2009-2011 surveyed 290 water systems serving 188 First Nations in British Columbia using AANDC's Risk Level Evaluation Guidelines.⁴⁴ The survey categorized 154 systems as high risk, 52 as medium risk, and 84 as low risk. Forty-two percent of the First Nations water systems in BC were classified as small systems, and the majority of high-risk systems served small populations. In fact, water systems in remote communities were 2.5 times more likely to be high risk than low risk.⁴⁴ In 2011-2012, AANDC planned to invest in five water systems in BC that had a high design risk and a high overall risk rating, as determined by the national assessment.⁴⁴

Figure 4.3 Inspection Hazard Ratings for Drinking Water Systems, by Health Authority, BC, as of March 31, 2012



During the reporting period, environmental health officers with First Nations and Inuit Health's Environmental Public Health Program also carried out water system inspections and collected water samples to ensure the water met the *Guidelines for Canadian Drinking Water Quality* for bacteriological,

chemical, and radiological parameters. They also provided education on safe drinking water and investigation of waterborne illnesses.⁴⁵ Water samples collected by community-based water monitors are also tested in the community or through provincially approved laboratories.⁴⁶

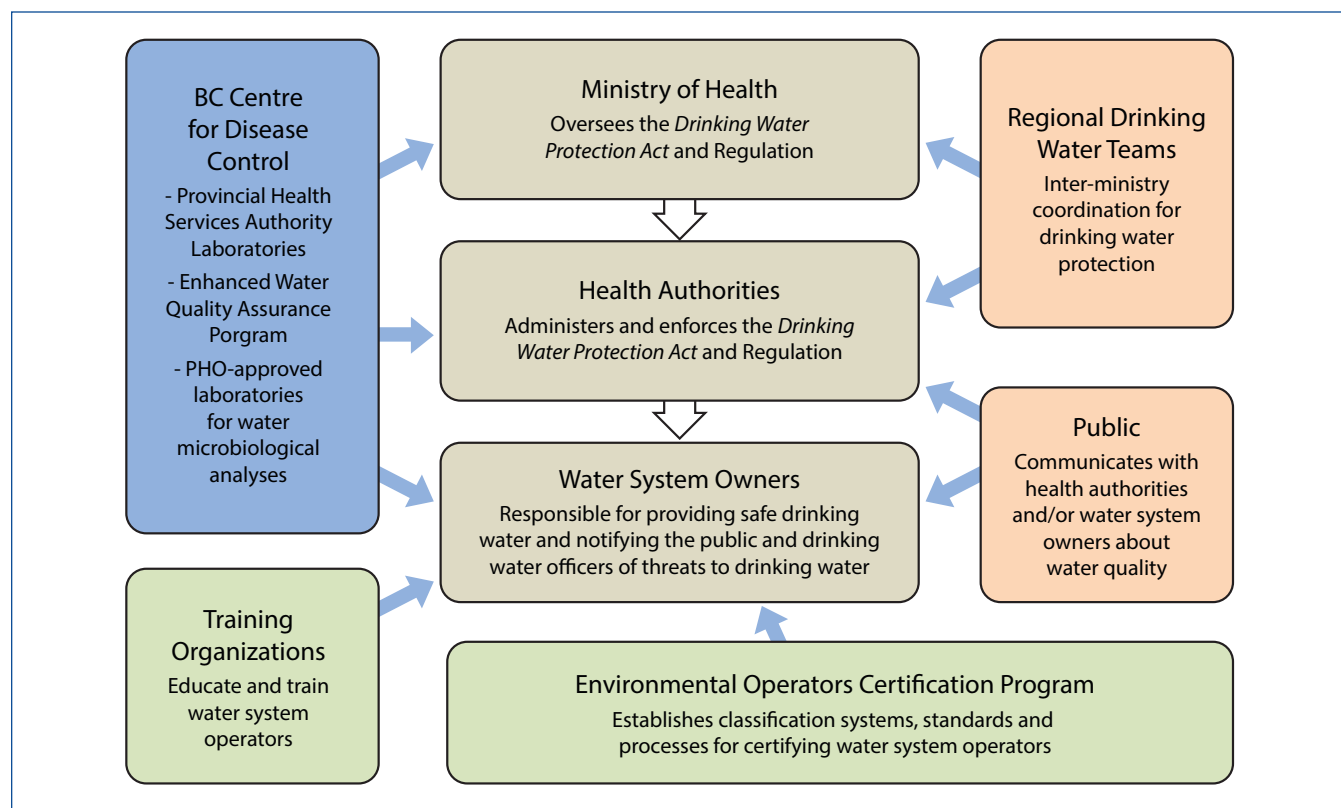
Section 5: Water Treatment and Distribution



Water treatment and distribution are at the heart of providing clean, safe, and reliable drinking water to consumers. Without proper treatment and distribution system operation, public health is

at risk. Inter-agency cooperation is essential to drinking water system operation and relies heavily on the skills, training, and dedication of drinking water owners and operators (Figure 5.1).

Figure 5.1 Inter-agency Cooperation within the Drinking Water Program for Water Treatment and Distribution in BC



In BC, all public drinking water supplies collected from surface water sources such as lakes and rivers must be disinfected. Many sources, particularly surface water sources, may also require filtration before water is safe to drink. In March 2012, a draft of the guidance document *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia* was posted on the Ministry of Health website for public comment. Where a drinking water officer believes a groundwater source is at risk of containing pathogens, often due to influence from surface water, the water supplier must provide disinfection. In April 2012, Version 1 of the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Ground Water under Direct Influence of Surface Water (GWUDI)*³⁹ was created to assist drinking water officers in determining, where necessary, appropriate treatment requirements for groundwater sources.

Many sources, particularly surface water sources, may also require filtration before water is considered safe to drink. While filtration may be the only practical treatment for some water suppliers, other unfiltered supplies may be adequately treated with a combination of chlorine and ultraviolet disinfection. During the reporting period, a review of ultraviolet disinfection of viruses in point-of-use treatment systems was being conducted to provide additional drinking water treatment options to smaller systems.

Systems serving more than 500 people must have operators certified by the Environmental Operators Certification Program (EOCP), and may have other qualified professionals, such as engineers, managers, and technicians. The level of operator certification required is dependent on the complexity of the treatment and size of population served. Systems serving fewer than 500 people in a 24-hour period do not have legislated certification requirements, but may have conditions placed on their operating permit requiring specific qualifications of operators, including certification.

Operator certification is dependent on the classification of the drinking water system. As of March 15, 2012, the number of drinking water systems classified by the EOCP had increased by 14 per cent over the 1,157 classified facilities reported as of April 15, 2009. During the reporting period, the numbers of certified operators increased by 47 per cent.

The number of permitted and unpermitted water systems remained relatively stable over the reporting period, with less than 5 per cent change overall in permitting status. However, the percentage of systems with conditions on the operating permit increased by 43 per cent. Water systems with an emergency response plan increased by 13 per cent over the reporting period, from 2,545 (March 31, 2009) to 2,883 (March 31, 2012).

Drinking water infrastructure in British Columbia is aging and much of it needs to be upgraded or replaced. Infrastructure funding programs are working to improve this situation. Over the reporting period, the combined Canada/BC Towns for Tomorrow, Infrastructure Stimulus Fund, and Building Canada Fund committed over \$60.3 million towards approximately \$93.7 million worth of drinking water-related infrastructure improvements. In addition, the Infrastructure Planning Grant Program managed by the Ministry of Community and Rural Development (later the Ministry of Sport and Cultural Development) committed approximately \$660,990 toward planning for drinking water system improvements.

During the reporting period, the number of construction permits issued for drinking water system infrastructure projects across the province remained stable, with 570–604 permits issued annually. This was a significant decrease from the 883 permits issued in 2006/2007 and 1,008 in 2008/2009. These construction permits were issued for improvements and extensions to existing drinking water systems, and for new systems or treatment facilities for new water sources. The number of construction permits issued for drinking water system infrastructure projects may correlate to the infrastructure funding program allocation and timelines for project completion.

The sections that follow describe these programs and issues in greater detail.

5.1 EFFECTIVE STRATEGIES

Living Water Smart – BC's Water Plan outlines two important targets for water efficiency by 2020: (1) water use in BC will be 33 per cent more efficient; and (2) 50 per cent of new municipal demand will be met by conservation.⁴⁷ Actions taken

during this reporting period to achieve these targets included the following:

- In October 2011, the BC Ministry of Environment became a Promotional Partner of the US Environmental Protection Agency (EPA) WaterSense Program.^x Similar to the Energy Star labelling program for energy consumption, WaterSense labels can be placed on products that have been independently certified as meeting EPA water efficiency and performance criteria.
- Effective October 3, 2011, the BC Building Code regulation requires the installation of high-efficiency toilets and urinals in all new residential buildings and renovation projects involving toilet replacements in BC.⁴⁸
- The 2012 BC Building Code includes new provisions to enable non-potable water use for certain plumbing fixtures and underground irrigation systems.⁴⁹

Amendments were made to Section 3.1 of the Drinking Water Protection Regulation to ensure smaller sub-systems within municipal systems, which simply redistribute treated water, were not considered separate water systems. This will avoid the unnecessary creation of many small systems and the associated regulatory burden.

Ministry of Health

During the reporting period, three documents were created to provide guidance for water suppliers and regulatory authorities to assess the level of risk associated with water sources and evaluate appropriate treatments to optimize water quality:

- The *Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Ground Water under Direct Influence of Surface Water (GWUDI)* was made available.³⁹ This document recommends a staged approach in determining groundwater quality and associated risks to assist drinking water officers in determining, where necessary, appropriate treatment requirements for groundwater sources (see also Section 4.1 Effective Strategies).

- A draft version of the guidance document *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia* was posted on the Ministry of Health website for public comment March 2012. It sets the minimum microbiological treatment objectives, including pathogen reduction goals for drinking water supply systems using surface water sources in BC. The document follows the microbial objectives in the *Guidelines for Canadian Drinking Water Quality* as well as those adopted in the United States, United Kingdom, New Zealand, and other countries, but introduces treatment flexibility for virus reduction, where applicable, in drinking water systems with good source water. It summarizes microbial drinking water quality objectives most applicable to treatment of surface water sources and briefly describes common technologies to achieve these objectives. It does not address the treatment of groundwater or disinfection of distribution systems. Updated information on this guidance document can be found at: www.health.gov.bc.ca/protect/dw_treatment-objectives.html.
- In 2008, a draft turbidity decision tree was developed in response to a recommendation by the Ombudsperson regarding addressing inconsistencies in how regional health authorities issue public notices due to increased turbidity in drinking water. In 2009, the decision tree was tested by the health authorities to identify issues with the process. The turbidity decision process was evaluated over three spring freshet seasons (the time of year at which turbidity events usually take place), and a formal review of the draft policy for turbidity events was completed. Updates to the decision tree were drafted based on feedback from health authorities and water system operators and will be incorporated into the *Drinking Water Officers' Guide*. During the reporting period, development of the *Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water*⁵⁰ continued and completion of this guidance document was projected for 2013.

POLIS Project on Ecological Governance

The POLIS Project on Ecological Governance is a transdisciplinary centre for research and action established in 2000 by the Eco-Research Chair at

^x More information on the WaterSense Program can be found at www.epa.gov/watersense/.

the University of Victoria. The Water Sustainability Project at POLIS was “focused on reorienting Canadian water management from a supply development approach toward stewardship and managing demand as priorities for communities and decision makers.”⁵¹ The Water Sustainability Project created a guidance document, the *Water Conservation Planning Guide for British Columbia’s Communities*,⁵¹ which can help communities develop and implement comprehensive integrated water conservation plans. Following the guide’s step-by-step approach could assist communities in meeting the required conservation criteria of the Ministry of Community and Rural Development’s Infrastructure Planning Grant Program.⁵¹

Environmental Operators Certification Program

An independent certification body, the EOCP certifies drinking water and wastewater system operators. Certification is based on the level of complexity of the water system and involves meeting minimum educational and work experience requirements; passing certification exams; and maintaining ongoing educational credits. During the reporting period, BC had a shortage of qualified water and wastewater operators, and municipalities had difficulty recruiting qualified operators. Over time the shortage of qualified operators was not expected to improve and four related issues were identified:

1. Only one senior operator is required under the regulations; thus, the mentoring and training of all operators was not supported.
2. The EOCP’s requirement for obtaining “direct responsible charge” experience could present a bottleneck to certification, especially at water systems with limited positions for certified operators. Interest and capacity of utilities to meet their operator’s educational needs varied and could be a significant barrier to developing certified operators in province. To address these concerns, EOCP developed a “training registry” in an attempt to facilitate in-house training of operators to address educational barriers.
3. The classification protocol for water systems does not adequately reflect operator responsibilities, and its differentiation of treatment facilities

versus distribution systems results in non-uniform reporting by communities when describing their water systems.

4. The role of management staff, in particular engineers and technicians, in addressing public health and environmental risk management issues had not been recognized.

Once these issues were identified, the EOCP, the Ministry of Health, and the Ministry of Environment initiated a joint review of EOCP policy and practices in 2012. In consultation with local governments, health authorities, and other stakeholders, the project team will make recommendations for policy and/or regulatory changes to government and the EOCP Board. The review was expected to be completed in 2014.

5.2 ALIGNED MANAGEMENT SYSTEMS

With respect to the distribution of water from “source to tap,” either the federal or provincial government set standards for legal entities with authority/responsibility to distribute and sell water. In BC’s rural areas, management and delivery of water is provided by local improvement districts, regional districts, and/or municipalities in accordance with provincial legislation. In addition, the *Local Government Act* and the *BC Community Charter* provide powers and responsibilities to local government with respect to water management. Many First Nations in BC receive domestic water through agreements with local government entities. Water provided this way meets the provincial drinking water guidelines, and the facilities that produce and distribute water are subject to inspection and regulation by the province.

Governance structure of a water service agency has inherent implications with regard to management, fee systems, and eligibility for government funding. Common governance structures are local government systems, water users’ communities, private water utilities and, in the case of many small water systems, informal governance structures. Water system owners and operators often struggle to maintain infrastructure and install adequate treatment systems in the face of inadequate financial, managerial, and operational resources. This is particularly true of small drinking water systems. Although the type of water system

governance is inherently linked to system size, the type of governance is a better predictor of water quality advisory status than water system size.⁵²

Drinking water systems require construction permits and operating permits. Drinking water officers and public health engineers must be contacted prior to the creation or alteration of drinking water systems. This is to ensure that they are created and maintained to safeguard the drinking water supplied to customers. New water systems must also obtain the proper certificates and approvals from other government ministries. In addition, water suppliers are required to have the water from their systems analyzed for the presence of microbiological pathogens and other indicator organisms by a laboratory approved by the Provincial Health Officer.

Construction Permits

Health authorities issued substantially fewer construction permits annually over the reporting period than the 1,008 permits issued in 2008/2009. During the reporting period, the following number of permits were issued for each fiscal year: 583 (2009/2010); 570 (2010/2011); and 604 (2011/2012). Table 5.1 shows the breakdown of permits issued by health authority. The number of permits issued across all health authorities has significantly decreased from numbers reported in 2007/2008 and 2008/2009, especially in Northern

and Interior Health Authorities. The number of construction permits issued per fiscal year may correlate with the allocation of funding for drinking water infrastructure improvement and planning projects and the timelines for completion of funded projects. For example, the Building Canada Fund (2007–2014) allocated all funding for drinking water infrastructure projects in BC by the 2009/2010 fiscal year.

Conditions may be attached to construction permits. In some cases, a phased approach to construction may be agreed upon by the drinking water officer and the water supplier. When construction permits are issued for the significant expansion of drinking water systems that do not meet the current drinking water treatment objectives, conditions are included on the permit requiring system improvements to be made according to timetables agreed upon by water suppliers and the drinking water officer.

When reviewing construction permit applications, issuing officials (public health engineers) may find deficiencies in the application, such as incomplete specifications, cross-connections between treated and non-treated water, and inadequate levels of treatment. The process for responding to these deficiencies varies between issuing officials and specific applications. In some cases, the application is formally rejected, while in others the application is returned with requests for changes or additional information.

Table 5.1 Number of Construction Permits Issued by Health Authority, BC, 2009/2010 to 2011/2012

Health Authority	Improvements			Extensions			New Systems		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Interior	-	30	131	154	107	21	-	-	2
Fraser	12	9	15	57	48	67	0	2	2
Vancouver Coastal	19	29	50	25	25	24	9	6	13
Vancouver Island	250	250	168	12	14	37	0	14	10
Northern	18	12	12	23	13	25	4	11	2
Total permits	299	330	376	271	207	174	13	33	29

Note: Data for Interior Health Authority are incomplete.

Source: Data supplied by regional health authorities.

Facility Classifications

As of March 15, 2012, the EOCP had classified a total of 1,351 drinking water facilities in BC.^y This number represented a 16.8 per cent increase from the 1,157 facilities classified as of April 15, 2009. Since the previous reporting period, the number of classified small water systems had increased by 112.

Even though water treatment facilities are classified separately from water distribution systems, they are almost always associated with a distribution system. Consequently, the total number of water supply systems that have been classified is 1,225, with an additional 126 systems having both their treatment facility and distribution system classified.

Classifications are broken down by complexity of water system, from I (least complex) to IV (most complex). A small water systems designation is used for facilities serving up to 500 people per 24-hour period. Table 5.2 shows the breakdown of facility classification, by level.

Table 5.2 Facility Classifications, by Complexity Level, as of March 15, 2012

Classification Level	Type of Water System		Total
	Water Distribution	Water Treatment	
IV	32	15	47
III	49	32	81
II	160	67	227
I	167	12	179
Small Water System	817	N/A	817
Total	1,225	126	1,351

Source: BC Environmental Operators Certification Program.

The number of classified facilities has progressively increased since 2004, when classification and operator certification was required under the *Drinking Water Protection Act*. The number of classified water treatment facilities has risen from 56 in 2004, to

126 in 2012, with increases noted at each level. Since 2009, the number of classified distribution systems, including small water systems, has increased from 1,061 to 1,225 (March 15, 2012).

Given that there are approximately 4,800 drinking water systems in the province, the majority of water systems, especially small water systems, remain unclassified. However, drinking water officers recognize that systems serving fewer than 500 people that do not have filtration or other higher level treatment, meet the small water system criteria of the EOCP, and they are treated accordingly. Most of the BC population is served by classified water systems that have appropriately certified operators and professional staff.

Operating Permits

Operating permits are issued to drinking water system owners by drinking water officers. The numbers of systems operating with and without operating permits are listed in Table 5.3, along with the number of systems operating with conditions on their permits. The reported numbers of permitted and unpermitted systems vary from those in the previous report primarily due to differences in data tracking and recording. Vancouver Island Health Authority showed the greatest discrepancy from the previous report for numbers of permitted and unpermitted systems. However, the data in Table 5.3 as reported over the three fiscal years of the reporting period (2009/2010, 2010/2011, and 2011/2012) were representative of trends in water system permitting during the reporting period. The number of permitted and unpermitted water systems remained relatively stable over the reporting period with less than 5 per cent change overall in permitting status. However, the percentage of systems with conditions on the drinking water system permit increased by 75 per cent across the province, with the greatest increase in Northern Health. The observed increase in reported water systems with conditions on their permit may be a result of an increased implementation of risk management protocols.

^y For more information on the classification process for facilities, see the EOCP website at www.eocp.org.

Table 5.3 Number of Water Systems with Operating Permits, without Operating Permits, and with Conditions on Their Permits, by Health Authority, BC, 2009/2010 to 2011/2012

Health Authority	Number of Systems with Operating Permits			Number of Systems without Operating Permits			Number of Systems with Conditions on Their Operating Permit		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Interior	1,828	1,849	1,861	42	46	57	134	155	212
Fraser	467	469	470	0	0	0	120	135	140
Vancouver Coastal	300	291	293	19	10	49	254	243	245
Vancouver Island	316	404	477	506	488	415	70	104	132
Northern	1,128	1,121	1,126	100	100	113	378	411	941
Total permits	4,039	4,134	4,227	667	644	634	956	1,048	1,670

Source: Data supplied by regional health authorities.

The total number of systems with operating permits is dominated by over 3,500 small systems, with only an estimated 1,234 systems serving more than 15 connections. The data on the smaller systems are often inaccurate, with out-of-date information still listed in the databases. Furthermore, it is generally recognized that there are many small systems that meet the regulatory definition of a water supply system, but remain unknown to drinking water officers and therefore operate with no regulatory oversight.

Much of the difference between the number of systems with and without operating permits between the three years in this reporting period, particularly where the number has decreased, reflects corrections in data tracking (e.g., in Vancouver Island Health Authority). For example, systems had been entered into a data system more than once if they were associated with a business that changed ownership or name.

Emergency Response Plans

The *Drinking Water Protection Act* requires all water suppliers to have a written emergency response and contingency plan (ERCP), and drinking water officers may order the plan to be reviewed or updated. The ERCP is a plan for responding to emergencies, disasters, or unusual operational conditions, in order to minimize disruption of services and protect public health and safety. During the current reporting period, the number of drinking water systems with a current ERCP increased by 19 per cent. The number of water systems without an ERCP decreased by 11 per cent during the same time period (Table 5.4). Since the last reporting period (2008/2009), the number of systems with an ERCP increased by a similar percentage (12 per cent).

Table 5.4 Number of Systems with and without Emergency Response and Contingency Plans, by Health Authority, BC, 2009/2010 to 2011/2012

Health Authority	Number of Systems with Current Emergency and Contingency Plan			Number of Systems with No Emergency and Contingency Plan		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Interior	1,055	1,186	1,231	773	663	630
Fraser	461	469	470	6	0	0
Vancouver Coastal	155	240	246	39	61	96
Vancouver Island	430	437	447	557	502	443
Northern	305	485	489	826	782	792
Total	2,406	2,817	2,883	2,201	2,008	1,961

Source: Data supplied by regional health authorities.

From March 31, 2009 (the end of the previous report), to March 31, 2012, the number of systems with a current ERCP increased by 13 per cent and those without an ERCP increased by 10 per cent. The increase in the number of systems without a current ERCP may have been due to a 7 per cent increase in the number of water systems, and changes in data collection and recording, coinciding with an emphasis on the need for drinking water system data, including permits, treatment, source, distribution, assessments, operator certification, and ERCPs.

Operator Training Organizations

Many institutions and organizations provide training for drinking water operators. In BC, the list includes the BC Water & Waste Association, the Water Supply Association of BC, the Small Water Users Association of BC, the Regional District of Nanaimo Water Purveyor Working Group, the British Columbia Institute of Technology, Thompson Rivers University, Simon Fraser University, the University of British Columbia, and correspondence courses through American institutions such as California State University at Sacramento.

A wide range of private-sector companies, such as equipment suppliers, also offer training that is recognized for the purposes of certification. Water suppliers can also conduct in-house training that counts toward certification if the EOCP assigns education credits to the training program. A list of training courses that the EOCP has accepted is available at www.trainingregistry.eocp.ca/. The EOCP maintains

an online form for trainers to submit their course information to have education credits assigned to it.

BC Water & Waste Association

The BC Water & Waste Association (BCWWA) is the largest provider of water operation courses in the province. It is a non-profit association of water and wastewater system professionals with a mandate to provide training opportunities for people working in these industries.

The BCWWA holds one- to five-day training courses on a wide variety of water and wastewater system issues. Courses include water treatment (Levels I and II), water distribution (Levels I, II, and III), wastewater collection (Levels I, II, and III), wastewater treatment (Levels I, II, and III/IV), chlorine handling, water sampling, water quality for distribution operators, dam inspection and maintenance, leak detection, confined space awareness, shoring and utilities location awareness, unidirectional flushing, and small water and wastewater systems. For more information on BCWWA's course offerings, see www.bcwwa.org.

The BCWWA offered 110 courses and trained 1,448 operators during the reporting period. In 2009/2010, they held 42 courses attended by a total of 590 operators. In 2010/2011, 36 courses attracted 444 operators. In 2011/2012, 414 operators attended 32 courses.^z The number of courses offered and

^z Some operators were counted multiple times if they took more than one course during the year.

operators trained annually by BCWWA was less than half that reported annually in the previous drinking water report.⁷

Water Supply Association of BC

In the spring and fall, the Water Supply Association of BC holds workshops for waterworks managers, administrative staff, and waterworks operators. The association liaises with the EOCP to assess and meet training, certification, and classification needs in the province. It also works with the BCWWA and the Small Water Users Association of BC.

Operator Certification

The number of certified operators in British Columbia during the reporting period is broken

down by certification level in Table 5.5. Certification levels are designed to match the complexity of the water system. The number of certified drinking water distribution operators in the province declined by 40 per cent between April 2009 and April 2010, then increased by 81 per cent as of March 2012. Similarly, the number of certified water treatment operators initially declined by 24 per cent, then increased by 132 per cent as of March 15, 2012. By March 2012, 3,529 operators were certified in BC, with 2,960 certified for water distribution and 568 certified water treatment operators. However, only 592 operators were certified for small systems in March 2012, a decline of 46 per cent since April 2009.

Table 5.5 Number of Certified Operators in BC, by Certification Level, 2010 to 2012

Certification Level	2010		2011		2012	
	Type of System					
	Water Distribution	Water Treatment	Water Distribution	Water Treatment	Water Distribution	Water Treatment
IV	22	12	19	10	34	21
III	95	18	103	28	161	54
II	512	91	554	111	778	178
I	531	124	1,033	206	1,395	315
Small System	478	0	395	0	592	0
Total	1,638	245	2,104	355	2,960	568

Notes: 2010 certification is as of April 2010; 2011 certification is as of March 8, 2011; 2012 certification is as of March 15, 2012.

Source: Environmental Operators Certification Program.

As mentioned in previous reports, managers of some larger water distribution systems, classified as Class III or IV systems, have questioned the need to have their operations overseen by a Level III or IV operator. These systems generally have extensive expertise available within their water department from professional staff such as engineers, technicians, and technologists. These people do not qualify for operator certification, but may be able to oversee distribution system operation and administration.

First Nations

In some cases where the cost of building a water system may be too prohibitive, water may be provided through a local service agreement with an adjacent water distributor (e.g., an improvement/ water district or an adjacent local government). The decision as to whether a First Nation receives water via a neighbour will factor in reduced costs and complexity and a desire to build working community relationships. Where access to water services is required to support economic development, such arrangements may be beneficial to both the First Nation and the adjacent jurisdiction. A number of BC First Nations receive their water services under such local service agreements with a local government, which operate under a provincially regulated system. The terms of these service agreements can vary depending on the relationship between the parties and whether the First Nations land is treated simply as another “private” water user or as a government. An overview of AANDC protocols for centralized and decentralized drinking water systems on First Nation lands can be found at: www.aadnc-aandc.gc.ca/eng/1313685676730/1313685729731.

5.3 PERFORMANCE MEASUREMENT AND REPORTING

Drinking water from surface water sources or groundwater at risk of containing pathogens must be disinfected. If the source water is turbid, then filtration may also be required to remove pathogens, ensure effective disinfection and reduce the formation of disinfection by-products.

Infrastructure funding programs are in place to help upgrade and replace aging drinking water

infrastructure in British Columbia. Over the reporting period, the combined Towns for Tomorrow and Building Canada Fund committed \$34.4 million toward 30 drinking water-related infrastructure improvement projects, with a total capital cost of \$54.9 million. In addition, the Infrastructure Stimulus Fund awarded \$25.9 million toward 13 drinking water projects in BC, and \$660,990 infrastructure planning grants were awarded for 71 projects by the Infrastructure Planning Grant Program.

Treatment of Drinking Water Supplies

In the previous drinking water report,⁷ the health authorities reported on the number of systems with various combinations of disinfection and treatment. It was noted that 75 per cent of the population had access to drinking water that had some method of treatment. A gap in that data was that it did not clearly identify groundwater that does not require treatment.

Due to differences in how health authorities collect information and produce reports from their databases, it was not possible to report comparable information for this reporting period. Health authorities continue to work with water supply systems to improve their levels of treatment, with the goal of meeting provincial treatment objectives.

Ministry of Forests, Lands, and Natural Resource Operations

Under the Ground Water Protection Regulation, the Ministry of Environment and, subsequently in 2010, the Ministry of Forests, Lands and Natural Resource Operations, have been promoting compliance by registering well drillers and well pump installers and performing compliance audits. A list of registered well drillers and well pump installers can be found at www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells.html#reg.

First Nations

A National Assessment of First Nations Water and Wastewater Systems was launched in 2009 and was completed in 2011. This assessment found that First Nation communities receive their water through a variety of methods, with national figures showing

72 per cent of all homes being piped, 13.5 per cent receiving truck delivery, 13 per cent serviced by individual wells, and 1.5 per cent having no water service.⁵³ There were a total of 807 water systems serving 560 of the 571 First Nations across Canada. The remaining 11 First Nations were serviced solely by individual water supplies.⁵³

There are more First Nations and systems in BC than in other provinces. British Columbia has 198 First Nations and 188 of these communities participated in the national assessment (seven communities had no members and no assets and three chose not to participate). A total of 290 drinking water systems servicing these 188 communities were reviewed for this national assessment.⁴⁴

The national assessment identified the financial cost to meet AANDC's departmental protocols for safe water and wastewater based on the risk level of each system. In 2011, they estimated the total cost for BC First Nations water and wastewater systems was \$324 million, which included, among other factors, the development of new infrastructure when required.⁴⁴ The projected cost of new servicing,

over 10 years, to accommodate growth within First Nation communities was \$710 million (including the \$324 million to meet AANDC's protocols in 2011).⁴⁴ Between April 1, 2006, and March 31, 2010, AANDC invested approximately \$174.4 million in water and wastewater infrastructure for First Nations in BC.⁴⁴ A substantial increase in the financial assistance provided by AANDC for water facilities on First Nations lands in BC would be required to meet the costs projected by the national assessment.

Infrastructure Improvement and Planning Grant Programs

During the reporting period, the Ministry of Community and Rural Development (later the Ministry of Community, Sport and Cultural Development) delivered four programs to help water suppliers fund improvements to their water supply systems. These programs are available to local governments, including municipalities and regional districts. The programs are funded by both the provincial and federal governments. Table 5.6 shows the number of projects and the funding supplied.

Table 5.6 Drinking Water Projects 2009/2010 to 2011/2012

Program	Number of Projects	Estimated Capital Cost	Contribution Amount	Fiscal Year
Building Canada Fund	15	\$43,245,160	\$28,662,100	2009/2010
Infrastructure Stimulus Fund	13	\$38,790,524	\$25,860,335	2009/2010
Infrastructure Planning Grant	38	\$361,200	\$361,200	2009/2010
Towns for Tomorrow	15	\$11,653,612	\$5,778,959	2010/2011
Infrastructure Planning Grant	33	\$293,905	\$299,790	2010/2011

Source: Information provided by Ministry of Community, Sport and Cultural Development.

Federal Programs

Infrastructure Stimulus Fund

The 2009 federal budget established an Infrastructure Stimulus Fund, which provided funding toward the rehabilitation or construction of provincial, municipal, and community infrastructure projects, including drinking water system infrastructure. Through this fund, Infrastructure Canada focused on improving, renewing, and rehabilitating existing infrastructure and on new infrastructure projects that could be completed by March 31, 2011.⁵⁴ The program provided \$25.86 million in 2009/2010 for 13 drinking water system projects in BC with a capital cost of \$38.79 million.

Building Canada Fund

The Building Canada Fund was established under the 2007 Building Canada plan to fund projects from 2007 to 2014.⁵⁵ Under the Building Canada Fund, local governments are eligible for as much as two-thirds of the total cost of an infrastructure project. The Communities Component of the Building Canada Fund targets projects in communities with populations of less than 100,000.⁵⁵

The Fund recognizes the unique infrastructure needs of Canada's smaller communities and focuses on projects that meet environmental, economic, and quality of life objectives.⁵⁵ In order for projects to be completed by 2014, the Building Canada funds were awarded up to and including the 2009/2010 fiscal year. During the reporting period, the Building Canada Fund awarded \$28.66 million toward 15 projects with a capital cost of \$43.24 million.

The New Building Canada Fund is to be initiated in 2014 and will contain a small communities funding component similar to the communities component of the 2007 Building Canada Fund. Starting in 2014, the Small Communities Fund is to provide dedicated funding for small communities, with populations less than 100,000, as determined by the final 2011 census.⁵⁶

Municipal Rural Infrastructure Fund

The Municipal Rural Infrastructure Fund provided funding for smaller-scale municipal infrastructure projects such as water and wastewater treatment, and cultural and recreation projects, mainly for smaller and First Nations communities. Each province and territory received a base allocation of \$15 million to address pressing public infrastructure needs, with the remaining funds allocated on a per capita basis.⁵⁷ Under the 2010 Strategic Review process, \$23 million in unallocated funds from the Municipal Rural Infrastructure Fund is being removed from departmental reference levels and made available for other federal government priorities.⁵⁷ No drinking water infrastructure projects were awarded funding from the Municipal Rural Infrastructure Fund during the reporting period.

Infrastructure Canada Program

From 2000/2001 to 2010/2011, the Infrastructure Canada Program provided funding for urban and rural municipal infrastructure projects that protect the environment and support long-term community and economic growth.⁵⁸ Local governments identified proposed projects for funding according to their priorities. To help meet local needs, funding was allocated to each province and territory based on each jurisdiction's population and unemployment rate. In most cases, the federal government provided up to one-third of the cost of each municipal infrastructure project.⁵⁸ No drinking water infrastructure projects were awarded funding from the Infrastructure Canada Program during the reporting period.

Provincial Programs

Towns for Tomorrow

Towns for Tomorrow provided provincial funding for infrastructure projects that address climate change and contribute to the overall health, sustainability, and livability of communities. Unlike traditional government infrastructure programs that provided matching provincial funding up to one-third of the

total project cost, Towns for Tomorrow provided up to 80 percent of the funding for municipalities and regional districts for approved projects.⁵⁹ Towns for Tomorrow was launched in December 2006 as part of the provincial government's efforts to address the unique challenges faced by smaller communities in British Columbia, particularly with respect to sustainability and meeting infrastructure needs.⁵⁹ Towns for Tomorrow contributed \$5.78 million for 15 drinking water projects with a total capital cost of \$11.65 million in the 2010/2011 fiscal year.

Infrastructure Planning Grants

The provincial government also provides grants of up to \$10,000 to local governments to engage in planning projects related to a variety of water system needs, including infrastructure improvement, governance, well protection, water conservation, and risk assessment. Over the reporting period, \$660,990 was contributed toward drinking water planning projects in BC (\$361,200 awarded in 2009/2010 to 38 water-related projects, and \$299,790 awarded in 2010/2011 to 33 projects).

Section 6: Drinking Water Quality



Drinking water quality is measured through programs that monitor treatment effectiveness and treated water quality. Water suppliers are required to monitor bacteriological and chemical water quality on a regular basis. Water is tested onsite, or sent to a laboratory for analysis. In excess of 100,000 microbiological tests are conducted on BC water supplies each year, and during the reporting period, at least 1,315 samples were tested for a range of chemicals such as metals, nitrates, fluoride, and disinfection by-products such as trihalomethanes. The *Guidelines for Canadian Drinking Water Quality* (GCDWQ) are established by the Federal-Provincial-Territorial Committee on Drinking Water and published by Health Canada. They list the microbiological, chemical, and radiological standards water suppliers must meet.⁶⁰

Water suppliers monitor water in the distribution system (at the tap) for *E. coli*, to indicate the presence of microbiological pathogens that may cause illness. If the water is positive for *E. coli*, the reason for the contamination will be investigated and a boil water notice may be issued. For chemical parameters that exceed the Maximum Acceptable Concentration (MAC) under the GCDWQ, some method of treatment is generally required.

Water suppliers may also monitor their water quality using process indicators such as turbidity, pH, or

chlorine levels. A change in the indicator indicates a change in water quality, either at the source or in the system. This would trigger an investigation to ensure the water quality can be maintained, or if not, a public notice should be issued. If there are ongoing issues with water quality, drinking water officers may also require installation, or upgrading of treatment systems, or upgrading or obtaining a new water source.

6.1 EFFECTIVE STRATEGIES

No amendments related to water quality monitoring were made to the Drinking Water Protection Regulation during the reporting period. The regulation continues to require water suppliers to monitor their drinking water for *E. coli* and total coliform bacteria and provides the opportunity for drinking water officers to establish chemical monitoring programs through conditions on operating permits.

After the *Drinking Water Protection Act* was promulgated in May 2003, drinking water officers began re-evaluating programs that encourage public awareness of water quality problems. As public notification procedures have changed, the value of tracking the number of boil water notices and water quality advisories as a way of assessing the overall performance of drinking water programs has become questionable. In particular, the increase in water quality advisories and boil water notices over time

may be more of a reflection of increased infrastructure assessments and more vigilant reporting practices than simply decreased water quality. For example, the number of water systems on boil water notice or water quality advisory in BC appears high compared to other jurisdictions. However, the reporting protocol used in British Columbia captures more drinking water systems, and the boil water notices and water quality advisories associated with them, than most other jurisdictions.

British Columbia is one of the few jurisdictions that regulates and licences drinking water systems with two or more connections and public facilities with one or more connection(s). Some jurisdictions do not regulate residential drinking water systems with less than five service connections (e.g., Ontario, Northwest Territories, and Prince Edward Island), and other jurisdictions do not regulate residential systems with less than 15 connections (e.g., Alberta, Yukon, Nova Scotia, and New Brunswick). Newfoundland and Labrador does not regulate any private independent small water systems. Therefore, reporting of water quality advisories/boil water notices would be limited to residential drinking water systems that meet or exceed the minimum number of connections required to be regulated. If the reporting in British Columbia was changed to include only drinking water systems with 15 or more connections, the 4,799 drinking water systems currently regulated would be reduced to 1,234—approximately one-quarter of the reported number of drinking water systems in BC for this reporting period.

6.2 ALIGNED MANAGEMENT SYSTEMS

In British Columbia, water system governance can be complex due in part to the diversity of governance structures and the variety of legislation under multiple branches of government. Many barriers to water system improvements and challenges in providing regulatory oversight and enforcement stem from water system governance issues. The type of water system governance was found to be the primary characteristic that predicted which small water systems were most likely to be placed and remain on a long-term drinking water advisory.⁵² Cooperative governance structures not owned and operated by a local government or utility were especially challenged. These systems often lacked financial resources and the ability to conduct administrative functions.

In the absence of a provincial information management system, health authority-specific water quality information systems were developed and implemented for online public notification of current water quality advisories and boil water notices throughout British Columbia. The Ministry of Health website defines the public notification levels for drinking water quality and provides links to individual health authority websites with current water quality advisories and boil water notices at www.health.gov.bc.ca/protect/dwadvisories.html.

The provincial government and First Nations share a goal to support First Nations communities to provide safe, clean, and reliable drinking water.⁶¹ Band Councils are responsible for ensuring that drinking water systems are run in accordance with the Protocol for Safe Drinking Water in First Nations Communities and for implementing drinking water monitoring programs on First Nation lands.⁶² At the end of this reporting period, all First Nations on reserves south of 60° had access to trained personnel (either First Nation or Health Canada staff) to sample and test drinking water quality at the tap.⁶³

6.3 PERFORMANCE MEASUREMENT AND REPORTING

During the reporting period, the five regional health authorities reported some success in implementing measures to improve water quality and reduce the number of water systems on long-term water quality advisory or boil water notice. From 2007 to 2012, Fraser Health Authority reported a reduction of more than 10 per cent per year and an overall reduction of 46 per cent of drinking water systems on long-term water quality advisory or boil water notice. However, the reduction in systems with long-term water quality advisories and boil water notices varied for each health region during this reporting period, and this variation was likely a reflection of the challenges faced by small drinking water systems, especially those in isolated areas. Larger water systems with the financial capacity to support operational and maintenance costs can more easily accommodate adjacent populations served by smaller systems that may be challenged by inadequate infrastructure. Therefore, health authorities with higher density populations and water systems with adequate financial capacity may experience a

greater reduction in long-term water quality advisories and boil water notices than those with many isolated, small drinking water systems.

Water suppliers are responsible for water quality sampling and notifying the public about water quality concerns. The BC Water & Waste Association offered courses on water sampling during the reporting period. Additionally, all laboratories offering testing services will provide guidance to people who are collecting samples. An example of information provided by laboratories is available from the BC Centre for Disease Control (BCCDC) at www.bccdc.ca/NR/rdonlyres/0DDDE1063-FC56-4109-8D2D-1C9C9CA2DCFA/0/Watersamplingwithborder050930.pdf.

Water suppliers must arrange for bacteriological sampling and analyses with a laboratory approved by the Provincial Health Officer for microbial drinking water analyses. As discussed in Section 1.3, the Provincial Health Officer approves laboratories to carry out testing under the *Drinking Water Protection*

Act. During the reporting period, the number of water systems reported to have met 90 per cent of the bacteriological sampling frequency requirements set out in the Drinking Water Protection Regulation or on their operating permit were 1,249 (2009/2010), 1,326 (2010/2011), and 1,491 (2011/2012). This represents an increase of 19 per cent over the reporting period. Table 6.1 shows the number of drinking water systems meeting 90 per cent of the bacteriological sampling frequency requirements and those undertaking chemical sampling, by health authority.

As shown in Table 6.1, water system sampling data was not available from Interior Health Authority. This is due to the way it manages microbiological and chemical sampling data. The *Drinking Water Protection Act* requires water suppliers to undertake their own monitoring, but only requires that positive results for *E. coli* or fecal coliforms be reported to the drinking water officer. Drinking water officers can require laboratories or water suppliers to provide them with all data. Interior Health Authority does

Table 6.1 Number of Water Systems Meeting 90 per cent of Bacteriological Sampling Frequency, and Undertaking Sampling for General Chemical and Specific Chemical Parameters, 2009/2010 to 2011/2012

Health Authority	Number of Systems Meeting 90% of Bacteriological Sampling Frequency*			Number of Systems Undertaking General Chemical Sampling**			Number of Systems Undertaking Routine Sampling for Specific Chemicals***		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Interior****	-	-	-	-	-	-	-	-	-
Fraser	402	398	415	101	78	115	27	27	33
Vancouver Coastal	123	167	182	85	61	75	13	24	22
Vancouver Island****	192	222	267	-	-	-	-	-	-
Northern	532	539	627	87	66	65	3	3	4
Total permits	1,249	1,326	1,491	273	205	255	43	54	59

Notes:

* Count of systems that, over the year, have collected at least 90 per cent of the samples required by regulation or by their operating permits.

** Count of systems that have had chemical analysis for a suite of parameters such as metals, anions, pH, etc., at least once throughout the year.

*** Count of systems that undertake regular sampling over the year for chemical parameters such as fluoride, nitrate, arsenic, etc. (not chlorine).

**** Information not available.

Source: Data supplied by regional health authorities.

not require the larger water suppliers to provide all of their microbiological data; as a result, the health authority cannot definitively provide a summary of systems meeting sampling frequency requirements. In the other four regional health authorities, 1,447 water supply systems did not meet 90 per cent of the bacteriological sampling frequency requirements at the end of the reporting period (March 31, 2012).

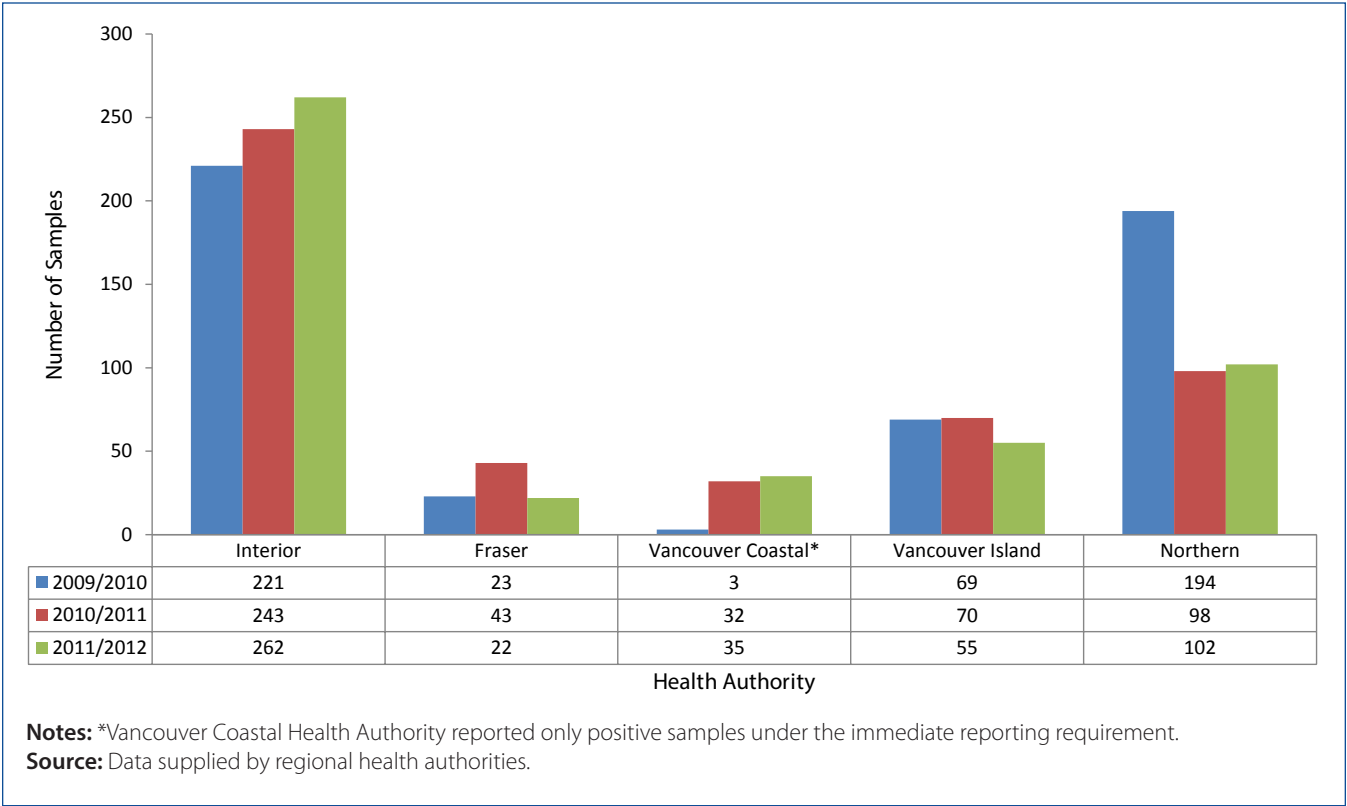
The reasons for not meeting the sampling frequency requirements vary. For example, in Northern Health Authority, getting samples to a laboratory from isolated sampling sites can take a long time, and if a sample arrives at a laboratory more than 30 hours after collection, the quality of the sample cannot be assured so it will not be analyzed. Ensuring timely transportation can be difficult and may be affected by adverse weather conditions; for example, in extreme cold weather, samples may freeze in transit, resulting in a supplier not meeting their testing frequency requirement (even though they may have collected the appropriate number of samples).

In 2009/2010, the five regional health authorities reported that a combined 510 samples were contaminated with *E. coli* bacteria (see Figure 6.1). For drinking water samples taken from various points along the distribution system, 0.2 per cent of the samples were positive for *E. coli* in 2009 and 2010; and only 0.1 per cent were positive for *E. coli* in 2011 and 2012 (1 per every 1,000 samples).

The number of samples contaminated with *E. coli* decreased to 486 in 2010/2011, and to 476 in 2011/2012 (see Figure 6.1), representing an overall decrease of approximately 7 per cent over the reporting period. There was a 30 per cent decrease in positive samples recorded from the previous reporting period, based on four health authorities reporting: from 304 positive samples recorded for 2008/2009, to 214 positive samples in 2011/2012 for the same four health authorities.^{aa}

^{aa} Data for the number of samples that tested positive for *E. coli* were not available from Interior Health Authority for the previous reporting period (2007/2008 and 2008/2009).

Figure 6.1 Number of Samples that Tested Positive for *E. coli*, by Health Authority, BC, 2009/2010 to 2011/2012



The number of positive samples can vary significantly by year, and within the individual health regions. Changes may be due to increased efforts to sample smaller systems, the number of new systems which are identified, and the number of systems that install or upgrade their disinfection systems. The reporting of positive samples was done under the Drinking Water Protection Regulation's "immediate reporting requirement", which allows rapid follow-up by water suppliers and drinking water officers. Follow-up by drinking water officers and water suppliers includes resampling, checking other water quality monitoring and treatment performance results, issuing public advisories or notices, and fixing any identified problems.

During the reporting period, the Provincial Health Services Authority's Public Health Microbiology Reference Laboratory, located at the BCCDC, tested 5,000 to 7,000 samples per month, for a total of 67,000 to 76,000 drinking water samples annually. In the three years of the reporting period, laboratories under contract to the BCCDC tested an additional 12,000 to 15,000 samples per year. The total number of samples tested at other approved laboratories not affiliated with the BCCDC is unknown. Metro Vancouver and the Capital Regional District operate their own laboratories, with the Metro Vancouver laboratory testing over 20,000 drinking water samples per year during the reporting period.^{ab}

In addition to bacteriological sampling, 273 water systems in BC reported sampling their water supplies for chemical and/or physical parameters in 2009/2010 (see Table 6.1). This type of broad spectrum sampling generally looks for a range of naturally occurring

metals, anions, and pH. The number of water systems undertaking chemical sampling decreased to 205 in 2010/2011, and then bounced back to 255 water systems in 2011/2012. Overall, the reporting protocols for Northern Health, Vancouver Coastal Health and Fraser Health Authorities that reported this type of sampling appear consistent for the reporting period, and the difference in their reported numbers may be due to sampling protocols rather than data collection and reporting.^{ac}

An additional 43 systems conducted regular testing for specific chemicals of concern within the distribution system in 2009/2010 (see Table 6.1). The reported number of systems monitoring for specific chemicals increased to 54 in 2010/2011 and 59 in 2011/2012. This type of monitoring is undertaken in response to concerns identified in the broad spectrum monitoring programs or because of treatment considerations. The chemicals most commonly tested for include arsenic, uranium (both of which are naturally occurring in source waters), nitrates (associated with fertilizers, agricultural waste, and sewage contamination), fluoride (naturally occurring and an additive to protect against dental cavities), and trihalomethanes (a by-product of chlorine disinfection).

Water chemistry data have not been readily available from health authority databases, making it difficult to report whether sampling has been undertaken, for which parameters, and what the results were. Information about water chemistry can be obtained directly from a water supplier upon request, or from the supplier's annual report or website, where applicable. Improvements in tracking water chemistry data are needed, as mentioned in previous reports.

^{ab} Microbiological drinking water sampling results from Metro Vancouver are reported on a calendar year basis.

^{ac} Vancouver Island and Interior Health Authorities were unable to report on the number of water systems that undertook sampling for chemical analyses.

Section 7: Small Systems



Ensuring people served by small drinking water systems have access to high quality drinking water has long been a challenge in BC. Since December 2005, small systems have been defined in the Drinking Water Protection Regulation as those serving fewer than 500 people per day. Most small systems serve far fewer than 500 people on a regular basis.

Health authorities collect data on system size based on the number of connections^{ad} they serve. This reflects the fact that water systems that serve more than 14 connections are required to pay an annual fee for their operating permit under the Drinking Water Protection Regulation, and data systems were designed to accommodate a billing function. While there is no absolute correlation between the number of connections and the population served, it is clear that most systems serving fewer than 15 connections will serve fewer than 500 people per day. Exceptions to this generality will occur where large multi-family dwellings, public facilities, or even municipalities^{ae} are served by the system. Table 7.1 provides a breakdown of these three categories over the reporting period.

^{ad} Service connections include any property served by a water supply system, such as private homes, apartments, public buildings, parks, etc.

^{ae} As an example, the Metro Vancouver water system services relatively few connections, but all of them are municipalities.

Table 7.1 Number of Water Systems, by Number of Connections Served, BC, 2010 to 2012

Number of Connections	2010	2011	2012
More than 300	228	225	224
15–300	1,024	1,014	1,010
1–14	3,577	3,540	3,565
Total	4,829	4,779	4,799

Source: Data supplied by regional health authorities.

While the Drinking Water Protection Regulation defines small systems on the basis of population served, many systems serving more than 500 people per day face similar challenges as smaller systems. The regulatory definition was chosen because of an amendment that allowed a point-of-entry or point-of-use approach to water treatment and exempted small water systems from the requirement to have an operator certified by the Environmental Operators Certification Program (EOCP).

There is no universal agreement on what constitutes a small drinking water system. Countries, municipalities, and organizations have defined small systems by number of individuals served; number of connections; amount of time per year that the system is in use; complexity of the system; and/or amount of water distributed (flow rate). In Canada, small water

systems are generally defined as serving less than 5,000 people,⁶⁴ and very small systems as serving less than 500 people.⁶⁵ Table 7.1 shows that the majority of water supply systems in the province are small, with only 224 systems serving more than 300 connections as of March 31, 2012.

In September 2010, the Small Water Systems Working Group was established by the Union of BC Municipalities (UBCM) in response to ongoing local government concerns over the application of the *Drinking Water Protection Act* and associated regulatory water quality standards to small water systems. At the 2011 UBCM Convention, the Small Water Systems Working Group made recommendations on a new definition for small water systems as well as a new approach for the treatment of surface water.

Small water supply systems often fail to generate adequate revenue to be self-sustaining. In some cases, rates need to be several thousand dollars per household per year to address infrastructure deficiencies, or several thousand dollars in upfront infrastructure costs. In other cases, the population served by the system is reluctant to accept any rate increase that would fully finance necessary infrastructure upgrades and proper operation. This is because they believe the water is safe for use as is, or because they are comfortable managing their risks through the use of bottled water, which is perceived to be inexpensive compared to the cost of upgrading infrastructure. Water supply systems not owned by local governments have to finance operations and improvements entirely through their water rates, unless they are able and willing to access resources through local governments. This option may require a transfer of ownership of the water system to the local government.

Over the reporting period, the provincial government, health authorities, water supply associations, and others have put considerable effort into understanding the challenges facing small systems and developing new support mechanisms. These mechanisms include programs for small community water systems that deal with networked monitoring solutions, group loans, and access to insurance; publications related to capacity building, sustainable operations, and pricing; studies and surveys of the management of small water systems and the use of point-of-use and point-of-entry water treatment devices; and courses and training opportunities for operators of small water systems.

7.1 EFFECTIVE STRATEGIES

Amendments to the Drinking Water Protection Regulation

The provincial government amended the Drinking Water Protection Regulation on May 19, 2011, to repeal the exclusion of strata corporation systems from the definition of a domestic water system. It was replaced with a similar exemption for drinking water “systems within systems” that redistribute water from another water supplier. These systems must not, in the opinion of a drinking water officer, require further treatment processes, additional infrastructure, or ongoing maintenance to prevent a drinking water health hazard.

The rationale behind the amendment was to ensure that large and complex strata corporation systems could be regulated as water supply systems where appropriate.^{af} This reduces the regulatory burden on some small systems (e.g., mobile home parks) that are not strata corporations but where there is little risk from the limited distribution system to the people served by those systems. In addition to reducing the regulatory burden on very small, low-risk systems, the amendment removes the need for drinking water officers to dedicate their efforts to systems that present little risk to the people they serve.

7.2 ALIGNED MANAGEMENT SYSTEMS

A key element that successfully contributed to addressing small water supply system challenges over the reporting period involved the investment in small system solutions by non-profit organizations. Organizations such as the Sustainable Infrastructure Society, Coastal Water Suppliers Association, Small Water Users Association of BC, Water Supply Association of BC, and the BC Water & Waste Association are contributors to improved tools and educational opportunities for small system owners and operators. These groups coordinate activities through an ad hoc Cooperative Committee of Water Organizations, which meets twice a year to discuss common issues and activities. All of

^{af} Strata corporations can range from simple duplexes to more complicated developments serving hundreds of properties within a Bare Lot Strata development.

these organizations work with various government ministries, often have government staff actively involved in the organization, and periodically receive financial or in-kind support for particular projects.

Transfer of Ownership to Local Government

Several regional districts have expressed a willingness to provide assistance to small water supply systems within their boundaries or to take ownership of systems and operate them. Transfer of ownership programs and the challenges faced when implementing them were discussed in the previous Provincial Health Officer's drinking water report.⁷ Details on the transfers of small systems to local governments are not tracked in any single data system and cannot be summarized here.

Group Liability Insurance

A Group Liability Insurance Program for small community water suppliers, developed by the Sustainable Infrastructure Society in collaboration with industry partners and the Ministry of Health, continued to provide affordable insurance to small water system owners.^{ag} During the reporting period, the program expanded to include contractor liability insurance. Small system owners continue to realize annual insurance cost savings of \$2,000 to in excess of \$10,000. Use of the insurance program increased during the reporting period, with over 100 small water suppliers now obtaining their insurance through it, and the society estimates that they are collectively realizing a savings of approximately \$300,000 annually. This money is now available for other operational or capital needs.

Guidebook for Community Water Supplies

In 2010/2011, a project to develop a series of guidebooks covering aspects of small water system governance, management, and operation was restarted. The project had been initiated in 2005 by the Sustainable Infrastructure Society, but was postponed due to conflicting priorities. An early draft of a guidebook, entitled *Small Water Systems in BC: An Introduction to the Provision of Safe and Reliable*

Supplies Part 1: Organization, was used as the basis for continued work. The guidebook focuses on regional cooperation and restructuring to reflect identified gaps in available support for small water supply systems and experience gained since the concept was first considered. This work is ongoing into 2012/2013 and includes examination of experiences in other jurisdictions that have undertaken successful restructuring of water supplies.

Asset Management and Rate Setting

One of the prime challenges facing small water systems is the deterioration of system infrastructure. All components of a water supply system have a natural lifespan that ranges from months to decades. Filters may need to be replaced within several months, ultraviolet irradiation tubes need to be replaced annually, and pipes, storage reservoirs, and pumps will last for decades, but all will need maintenance, replacement, or significant repairs at some point. An asset management plan allows system owners to systematically manage assets and schedule replacement or rehabilitation before it becomes a problem. In turn, the plan enables owners to predict financing needs well into the future, and set water rates accordingly. Working with industry partners, the Sustainable Infrastructure Society developed a program to assist small system owners to develop asset management plans and establish appropriate water rates. During the reporting period, the Sustainable Infrastructure Society was preparing a Financial Best Management Practices Guide for drinking water systems. The guide is expected to be completed in 2013.

Water System Mapping

In support of the asset management program, the Sustainable Infrastructure Society investigated the potential to develop a water system mapping capability during the reporting period. The intent of the project was to develop an Internet-based platform that would allow water suppliers to develop a map of their service area, showing the position of pipes, reservoirs, and other components of the water system, and would assist them to develop their asset management program. Mapping systems can be expensive and the society worked with suppliers to evaluate options to develop affordable scale plans of

^{ag} Information about the Sustainable Infrastructure Society, and access to its programs and support, are available through its website at www.WaterBC.ca.

their systems using existing off-the-shelf products. The business analysis undertaken ultimately concluded that current costs would be prohibitive for small suppliers, given competing interests for their financial resources. Future technological improvements to the mapping system components and input requirements, including computer and mapping tools and GIS technology, may provide a cost-effective opportunity for water suppliers to make full use of the knowledge they have of their water system.

Point-of-Entry Water Treatment

Point-of-entry water treatment devices may be the most cost-effective approach for some small water supply systems to meet their treatment needs. Considerable effort has been taken to provide small system owners with guidance on developing a point-of-entry treatment approach, and several have managed to achieve an acceptable approach over the reporting period. Information to assist suppliers to develop a point-of-entry treatment approach is available from the Sustainable Infrastructure Society at www.WaterBC.ca.

Access to Loans

The Sustainable Infrastructure Society has also been working with credit unions to arrange an Access to Loans program for community water suppliers. Historically, lending institutions have been reluctant to finance private water systems, since there is no tangible asset against which to secure the loan (the water systems have little “value”, except when operated for profit). Since suppliers often lack sufficient reserve funds, it is necessary to raise rates prior to commencing any system upgrades, which can be a concern for rate payers. In 2010/2011, the society established a partnership with Vancity Credit Union, where the credit union provided the society with a grant to cover initial work to develop an Access to Financing program. Vancity agreed to provide grants for subsequent stages of the program subject to successful completion of previous stages. During the reporting period, the program was in the pilot stage and involved several water supply systems in BC.

A Point-of-Entry Solution on Bowen Island

In 2009, drinking water officers with the Vancouver Coastal Health Authority directed a small water users’ community to install centralized water treatment for their surface water source. Several of the homes served by the system had already invested in point-of-entry treatment and challenged the need for centralized treatment since the regulation allowed for point-of-entry treatment.

The initial conflict between the supplier and the health authority was quickly resolved as both parties recognized the common objectives of achieving affordable, safe water, regulatory compliance, and liability management. Discussions ensued on how the supplier could develop a point-of-entry solution that would meet their needs and satisfy the drinking water officer. A long-term solution needed to include the checks and balances to ensure that all homes had potable water at all times and that the homeowner could not simply opt out without notification, leaving the water supplier in non-compliance with the Drinking Water Protection Regulation and leaving the drinking water officer unaware of the non-compliance.

Through discussions between drinking water officers, the regional public health engineer, and the water supplier, it was decided that a point-of-entry solution would require filtration and ultraviolet treatment with devices that are certified to NSF standards, and that possess alarms to advise homeowners when they are not functioning properly.^{ah} Other requirements included long-term service agreements for each unit so that homeowners who chose to cancel or not renew the service agreement would be given notice of disconnection by the water users’ community.

By the end of 2010, the water users’ community had installed appropriately approved devices, service contracts for maintenance and repair were in place, and the supplier was operating under permit, with regular monitoring of each home demonstrating that the devices were functioning. The cost to install the devices was approximately \$3,000 if the homeowner purchased them or \$92 per month to lease them. There will be additional, ongoing costs to replace filters and ultraviolet bulbs.

^{ah} Information on certification of water treatment devices is available on the NSF International site at www.nsf.org/services/by-industry/water-wastewater/residential-water-treatment.

The pilot program involves working with water suppliers to develop a long-term financial management plan, including establishing appropriate pricing of their water, and access to loans for infrastructure improvements.

Networked Monitoring

Large suppliers frequently invest in monitoring technology, which enables them to monitor water quality and treatment processes, and adjust treatment or other operations from a remote location. This type of system (known as Supervisory Control and Data Acquisition, or SCADA) is generally too expensive for small water supply owners. The Sustainable Infrastructure Society undertook the development of a networked monitoring service.^{ai} This service is intended to keep track of water system parameters (such as turbidity, water levels in wells, reservoir levels, temperature and pH, pump runtimes, water flow rate and pressure at different points in the system, chlorine dosage rate, chlorine concentration, consumption of chemical additives, UV transmittance, and the status of any pending alarms). These data can be collected at regular intervals and archived for later use.

The operator can review data at any time using an Internet browser to identify patterns, analyze trends in the system, and detect symptoms of problems at an early stage. Reports are automatically generated, converting operational data into useful information. This information is subsequently sent by email to designated individuals. This helps improve communication with customers, owners, and regulators. Overall, the service should help maximize the effectiveness of management and operations and is much more affordable than a full SCADA system. To develop the program, the society entered into an arrangement with a private sector service provider to establish a secure online service that is available to water suppliers for a monthly fee, rather than the initial large start-up costs of a conventional SCADA system.

Researchers at a national level have also been discussing the potential for “leapfrog” technologies where the intent would be to develop applications for “off-the-shelf” technologies (e.g., iPads, cell phones)

^{ai} For more information on the networked monitoring system, contact the Sustainable Infrastructure Society at www.WaterBC.ca.

that can be applied to water system monitoring or control. Sensors within the water supply system could then communicate directly with an operator’s handheld device or laptop computer. For several years, experts have discussed this concept, but little concrete progress has been made to develop a systematic approach. Initiative has been taken by at least one small supplier, where a trustee who had a background in electronics developed some capacity for internal monitoring and data communication with his personal computer, demonstrating the real potential for this approach. The greatest challenge to this concept is the cost of obtaining and maintaining sensors capable of providing real-time data, and most small water suppliers will likely continue to use grab samples for water quality monitoring.

Small Community Infrastructure Web Pages

The Smaller Community Infrastructure Working Group, under the National Round Table on Sustainable Infrastructure, was created to address issues faced by small communities. This group developed a web page dedicated to small community infrastructure. The page addressed drinking water, wastewater, storm water, and rainwater management, as well as related subject areas such as groundwater, energy efficiency, and First Nations issues, and was available as a Community of Interest (COI) at Waterbucket.ca (<http://waterbucket.ca/>).⁶⁶

In 2009, the COI administrator left provincial employment and no new content was developed. During the three year period it was available (2008–2011), there were 4,000 users and 10,000 page views. In 2012, the Waterbucket.ca website was rebuilt and a decision was made to discontinue this particular COI.⁶⁷ The lesson learned was that the Waterbucket format did not meet the needs of small communities; however, there are still many other opportunities and initiatives available to support small community infrastructure.⁶⁸

The Local Government Department section of the Ministry of Community, Sport and Cultural Development website has information available on drinking water, wastewater, storm water, rainwater management, and energy efficiency. The website can be found at www.cscd.gov.bc.ca/lgd/pathfinder-environment.htm.

Training and Information Sessions

There are a considerable number of educational initiatives for owners and operators of small water systems. Some examples of those initiatives are described in the sub-sections that follow.

Thompson Rivers University

Thompson Rivers University's WaterSafe course has been in place since 2005/2006. WaterSafe is a basic course for owners and operators of small water systems. It provides critical information about water sources, monitoring, treatment, storage, and distribution, and information about the responsibilities of small water system owners and operators. Successful completion of the course includes WaterSafe certification and EOCP education credits. Information about this course is available at www.tru.ca/trades/programs/water/watersafe.html.

Small Water Users Association of British Columbia

The Small Water Users Association (SWUA) of British Columbia supports small water suppliers in the province through educational workshops and newsletters. It has also developed a guide to online resources for small water systems that is periodically updated.⁶⁹ It works closely with the BC Water & Waste Association, the Water Supply Association of BC, the Coastal Water Suppliers Association, and the BC Ground Water Association to exchange information and coordinate scheduling for events. The SWUA participated in organizing small systems symposiums at the BC Water & Waste Association conferences in 2009, 2010, and 2011. In October 2009, the SWUA worked with partners to run workshops for small system owners in Kamloops, Salmon Arm, and Nelson. The theme of each workshop was "how to get off a boil order." A total of 200 people registered for the three workshops. In 2009, the SWUA presented seminar sessions at the Water Supply Association of BC's conference and Indian and Northern Affairs Canada's^{aj} First Nations Operators Conference. In 2011, the SWUA also hosted workshops for small water system operators

in Penticton, Salmon Arm, Nelson, and Cranbrook. Many agencies participated as speakers.

Mayne Island Integrated Water Systems Society

The Mayne Island Integrated Water Systems Society^{ak} is a non-profit organization that provides support to water suppliers and private well owners on the Gulf Islands. The Society hosts annual workshops and seminars and provides general information to its members. The workshops are organized to be particularly relevant to situations encountered on the Gulf Islands. Continuing education credits for certification by EOCP are arranged where possible to assist operators to maintain certification at relatively low cost.

BC Water & Waste Association

The BC Water & Waste Association regularly offered a "Managing Small Water Systems" course during the reporting period. This is a two-day course eligible for certification credits by the EOCP. The course is suitable for managers, operations staff, trustees, councillors, and anyone involved directly or indirectly with water systems. The course focuses on the basic fundamentals of managing and operating a well-run water system, including the following:

- Establishing best practices for managing assets and maintaining a system.
- Developing effective communication.
- Exploring key planning tools and sustainable operations.
- Establishing effective governance and management functions.
- Hiring the right staff and consulting with the public.
- Identifying the basics of project delivery.
- Establishing proper budgeting.
- Understanding legal requirements.

The course is participatory and involves several group exercises.

^{aj} Indian and Northern Affairs Canada is now called Aboriginal Affairs and Northern Development Canada.

^{ak} Information about the Mayne Island Integrated Water Systems Society's activities is available at www.miiwss.com/default.html.

Well Owners Workshops (WOW)

The Ministry of Environment and the BC Ground Water Association organized workshops for private well owners during the reporting period that were hosted by local municipalities. The first round of workshops were held in the interior in 2011 (Cawston, Kelowna, and Vernon). Many agencies and individuals participated, including Agriculture Canada, the Ministry of Forests, Lands and Natural Resource Operations, Interior Health Authority, Caro Analytical Services, hydrogeologist contractors, well pump installers, etc.

7.3 PERFORMANCE MEASUREMENT AND REPORTING

Ombudsperson's Report

In the Ombudsperson's 2008 special report *Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia*,⁹ the Ombudsperson made many observations about the challenges faced by small water supply systems and the people who rely upon them. Recommendations related to small systems were directed to health authorities as well as to the provincial government.

Most of the recommendations apply equally to large and small systems; however, small systems were specifically addressed. Recommendations included improved efforts to identify small systems and the development of a strategy to address small water system challenges. The Ombudsperson further recommended improvements to the oversight and accountability of those small water systems regulated by the Ministry of Forests, Lands and Natural Resource Operations.^{al}

Updates on implementation of the report recommendations were provided by regional health authorities in 2009 and 2010. These updates are available from BC's Office of the Ombudsperson. In response to the Ombudsperson's recommendations, the health authorities and the Ministry of Health improved protocols for requesting investigations and

making complaints, and posted this information on their websites. Responses specific to small water supply systems included the following:

- An increased focus on improving water quality and trying to reduce the number of systems on notification.
- Increasing efforts to identify small water systems that were not being regulated.
- Ensuring that when small water systems are created there are better referral mechanisms to ensure all regulatory requirements are met at that time.

Some health authorities have been successful at reducing the number of boil water notifications in their regions. For example, Interior Health Authority has developed the Boil Water Remediation Program, which is a stepwise compliance framework to help move high-risk water systems on an advisory to a lower risk status.

Small Water Systems and Drinking Water Advisory Status

An analysis of administrative data available from Interior Health Authority as of March 3, 2011, demonstrated that system ownership and the associated governance structure were correlated with the likelihood of a water supply system being on a water quality advisory, as was the population served, the quality of source water, and the existence of water treatment.⁵² The study recognized that water quality advisory status does not constitute an adverse public health outcome, but can be an indication of poor risk management. The analysis considered data for 1,847 systems, 411 of which were on water quality advisories. In general, systems owned by local government or utilities were less likely to be on an advisory than systems owned by cooperative governance structures such as water users' communities, partnerships, or "good neighbour systems", which have no significant oversight of governance and fiscal accountability under legislation.

The study was limited by constraints associated with the administrative nature and quality of the data, but was robust enough to clearly highlight that smaller systems serving residential consumers have a higher risk of being on an advisory than larger systems. While the study linked governance with the type

^{al} The original recommendations were directed to the Ministry of Environment; however, those responsibilities were transferred to the Ministry of Forests, Lands and Natural Resource Operations in 2010.

of ownership and business model, it is important to recognize that governance extends beyond ownership to accounting principles, asset management strategies, rate structures, etc. Local governments are required to consider all of these factors, as are improvement districts and utilities. Less oversight is applied to water users' communities and no oversight is applied to cooperative governance structures. It is possible for these system types to adopt rigorous governance structures, but they generally function on an ad hoc basis as needs arise.

The study also differentiated commercial systems from residential systems, considering water systems that supplied facilities such as food establishments, tourist sites, recreational operations, parks, and resorts as commercial. For commercial water systems, the likelihood of being on a water quality advisory increased with the number of connections served.

Underlying the system size and ownership criteria, the study also considered source water quality and treatment. Because of limitations in the data system with respect to recording information on source protection and details of treatment, the study's conclusions are broad, but clearly establish that surface water systems with no treatment were more common on advisories than systems on treated surface water or groundwater.

While governance is correlated with the probability of a system being on an advisory, it is equally clear that the ultimate solution to water quality problems of small systems is to either ensure adequate treatment of surface water or groundwater under the influence of surface water, or use secure groundwater sources.

Section 8: Full-Cost Accounting



The *Action Plan for Safe Drinking Water in British Columbia* states that “water should be affordable with users paying appropriate costs.”⁷⁰ Full-cost accounting is a process that ensures water suppliers are funding all water system costs through their basic water rates, neither subsidizing water supply system costs through other revenue streams (general tax base), nor deferring costs of future infrastructure or operational needs.

8.1 EFFECTIVE STRATEGIES

Throughout the reporting period, the provincial government, through the Ministry of Community, Sport and Cultural Development, committed to supporting local governments in their efforts to ensure that drinking water infrastructure was adequately funded. For example, the ministry’s *2011/2012 Annual Service Plan Report*⁷¹ included the following objectives and strategies:

- Supporting the development of sustainable infrastructures and amenities.
- Providing targeted funding to local governments to help them achieve provincial drinking water objectives.
- Providing tools and resources to local governments to assist them in conserving and protecting our water resources.

- Working with the Ministry of Health to ensure the application of drinking water quality standards supports the use of best, lowest life-cycle cost approaches to the provision of safe drinking water.⁷¹

As of January 2009, local governments are required to undertake an inventory of all of their assets, including their drinking water infrastructure (when it was installed, its useful life, and original cost). This requirement is intended to result in improved assessments of treatment and distribution works and will facilitate planning for future maintenance and replacement schedules. All but one local government achieved compliance during the reporting period. It is anticipated that all local governments will comply and will continue to improve their inventories over time.

8.2 ALIGNED MANAGEMENT SYSTEMS

In order to appropriately manage a water supply system’s finances, it is necessary to have a full understanding of the financial needs of the system. Assessments conducted by water suppliers, combined with information from drinking water officer inspections, will help water suppliers identify and prioritize their infrastructure and operational needs, develop budgets, and set appropriate rates. Data systems do not currently allow detailed analysis or reporting

of progress made by water suppliers to identify and prioritize their financial needs and develop full-cost accounting programs. General progress by local governments with respect to tangible asset management can be reported on at a national level,^{am} and individual local governments can provide information on their progress to date. The majority of the BC population is served by water supplies owned by local governments, which are required to be fiscally responsible. Water utilities and improvement districts are also required to have financial plans and reserve financial assets to maintain their infrastructure and maintain overall fiscal accountability, but other non-local government water suppliers (e.g., water users' communities, partnerships, etc.) have no financial accountability to the Province. They are generally accountable only to the users, who may not be able to recognize or manage the assets of the systems or who choose to respond to infrastructure failures as they occur.

Tangible Asset Management

As discussed in previous drinking water reports, a significant infrastructure deficit^{an} exists across the country. In general, most municipal infrastructure is in good condition; however, the relatively small percentage that is in poor or very poor condition and in need of replacement represents a large fiscal challenge to government. Of 123 municipalities surveyed across Canada in 2009–2010, 2 per cent of the assets were reported as being in poor or very poor condition, with an estimated replacement cost of \$3.4 billion.⁷² This infrastructure deficit is not related entirely to drinking water systems; it also includes wastewater, roads and bridges, and other public amenities. The fact that the infrastructure deficit is so broad makes it more difficult for local government to develop revenue streams to address drinking water system needs.

Accounting rules changed in 2009 to require local governments to undertake an inventory of all of their

assets, including their drinking water infrastructure (when it was installed, its useful life, and original cost). This does not mean that local governments are required to develop an asset management plan; however, it clearly positions them to do so.

Asset Management BC assists local governments to develop proactive approaches to dealing with their current infrastructure deficits and to develop tangible asset management plans. The presence of an asset management plan helps the Ministry of Community, Sport and Cultural Development in allocating funding through existing infrastructure funding programs. Asset Management BC arose, in part, through a National Asset Management Working Group. It continues to liaise with similar agencies across the country, benefiting from experience in other jurisdictions as well as providing leadership to other jurisdictions.

Ultimately the responsibility to ensure that tangible asset management is undertaken rests with local governments. Details on the progress of local governments in BC towards this objective are not currently available.

Small Water System Assistance

As discussed in Section 7.2, a number of projects were underway during the reporting period to assist small water systems. Many of these projects intend to address the challenges small systems face with respect to their basic capacity to comply with regulatory requirements; i.e., when they attempt to improve their system management in order to achieve long-term sustainability of their supply.

Small Systems Review

Over the reporting period, two coordinated efforts were underway to consider and recommend improvements to the manner in which small water systems are regulated. These efforts may result in more cost-effective management of small systems, by improving the flexibility that systems have in managing their operations. One process has been underway internally within the provincial government, while the other has been a joint process led by the Union of BC Municipalities (UBCM) with the involvement of provincial government representatives.

^{am} The Canadian Infrastructure Report Card – Volume 1: 2012 Municipal Roads and Water Systems reports on a voluntary survey of municipalities conducted for the 2009–2010 reporting period. It is available at www.canadainfrastructure.ca/en/index.html.

^{an} An infrastructure deficit exists when aging infrastructure requires replacement, maintenance, or upgrade beyond existing budget capacity.

The work undertaken has reaffirmed previous summaries of challenges faced by small water systems, and it is clear that efforts taken over the last decade to resolve water quality problems with small water systems have not been as successful as anticipated.

One analysis of data available from Interior Health Authority as of March 2011 clearly identified that water quality issues, as indicated by water quality advisories, were related to system ownership and associated governance models and how this influenced the financial models in place by owners.⁵² Systems owned by local government or utilities were the least likely to have a water quality advisory, while systems owned by water users' communities or other cooperative governance structures with less well-developed financing and asset management plans were more likely to be on advisory.

New approaches to working with small systems are needed and may include increased efforts to transfer ownership to local governments, redefining the water quality expectations of small systems with greater reliance on individuals to understand and manage their residual risk, new funding assistance models, and increased reliance on point-of-entry treatment systems.

Financial Best Management Practices for Small Water Systems

Work on financial best management practices began during the reporting period. The Sustainable Infrastructure Society's Small Water Systems Working Group planned to address areas in the report such

as basic asset inventory, asset management plans, five-year operating plans, long-term financial plans, sustainable rates and charges, and communication plans. The report was scheduled for release by UBCM in 2013.

8.3 PERFORMANCE MEASUREMENT AND REPORTING

Tangible Asset Management

Over the reporting period, significant progress was made in achieving the objectives of tangible asset management in British Columbia, although significant challenges for local governments remain. By 2012, all but one local government in British Columbia were compliant with the requirement to capitalize and amortize their infrastructure, and most were moving toward tangible asset management programs.

Small Water System Assistance

Efforts to support small water supply systems include progress on asset management planning (separate to the processes mentioned earlier, but outlined in previous Provincial Health Officer drinking water reports), access to loans and improvements, and availability of affordable training through the BC Environmental Operators Certification Program (EOCP) training registry. Information on asset management planning and access to loans is available at www.WaterBC.ca, while the EOCP training registry can be accessed through www.trainingregistry.eocp.ca/.

Section 9: Recommendations



PROGRESS AND GAPS

Many of the gaps identified in previous reports on progress on the *Action Plan for Safe Drinking Water in British Columbia*^{ao} persist: there is still work to be done. This section will comment on the progress on the recommendations made in the 2011 report, for the fiscal years of 2007/2008 and 2008/2009. It will also establish a current context for the recommendation, and provide updated recommendations for 2015.

Lead roles have been assigned for responding to the recommendations. It is understood that the lead agency may not necessarily be able to address all elements of the recommendation, but will lead joint actions across ministries and agencies.

Environmental Farm Planning

Recommendation 1

2011: The federal and provincial governments should continue to fund the Environmental Farm Plan Program. (Leads: Ministry of Agriculture, Agriculture and Agri-food Canada)

The Environmental Farm Plan Program will continue to be funded under a new federal/ provincial/ territorial policy framework: “Growing Forward 2”. An estimated \$426.9 million will be invested in BC from 2013–2018. This initiative will also fund other innovative practices, including climate change adaptation.

2015: Continue to increase the number of farms participating in programs to protect source water. (Leads: Ministry of Agriculture, Agriculture and Agri-food Canada)

^{ao} These reports cover the period of May 2003 to March 31, 2009, and are available at www2.gov.bc.ca/gov/topic.page?id=58FC033FD96A416CB03069BC77CE9878.

Source Water Protection

Recommendation 2

2011: Government should clarify the respective source protection roles of the Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission and Ministry of Forests, Lands and Natural Resource Operations, and should continue to identify priorities for source water protection initiatives, ensuring action is coordinated across government agencies and health authorities. (Leads: Ministry of Health, Ministry of Environment, Ministry of Forests, Lands and Natural Resource Operations, Ministry of Energy and Mines, Oil and Gas Commission)

The Ministry of Energy and Mines has led a working group looking at hydraulic fracturing associated with shale gas resource development in northeastern BC, to develop best practices for water conservation and responsible use. This interministry group has clarified the roles of the Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, BC Oil and Gas Commission, and Ministry of Forests, Lands and Natural Resource Operations. Through the work of an interprovincial committee, an online fluid disclosure registry was introduced (www.fracfocus.ca).

2015: The Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission and Ministry of Forests, Lands and Natural Resource Operations should continue to identify priorities for source water protection initiatives, ensuring action is coordinated across government agencies and health authorities. (Leads: Ministry of Health, Ministry of Environment, Ministry of Forests, Lands and Natural Resource Operations, Ministry of Energy and Mines, Oil and Gas Commission)

Groundwater Management

Recommendation 3

2011: Where groundwater use, including use for geothermal energy or oil and gas exploration or production, threatens to contaminate or significantly deplete water supply sources, including drinking water sources, government should

- a) continue to identify and characterize water resources and ensure they are documented in the Integrated Land and Resource Registry or in the Land and Resource Data Warehouse;*
- b) initiate water protection planning processes; and*
- c) require groundwater licensing where appropriate.*

(Leads: Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission)

The Ministry of Energy and Mines contributed to the Montney Water Project to create a comprehensive database of surface water, groundwater, and deep saline aquifers in the Montney Gas Play in northeastern British Columbia. The Ministry of Energy and Mines coordinated with the Ministry of Forest, Lands and Natural Resource Operations and the Oil and Gas Commission to manage water licensing issues and backlogs. The Ministry of Forests, Lands and Natural Resource Operations and the Ministry of Environment collaborated on the establishment of six monitoring wells in the Montney region, and consultation occurred to identify the best locations for monitoring wells in the Horn River Basin.

Improvements are required to water quality and quantity monitoring, data collection, and reporting, especially in light of the very limited knowledge and understanding of the potential health and environmental risks associated with the emerging oil and gas industry.

In 2009, the Ministry of Environment started the process to modernize the *Water Act*, including public engagement and policy development. The *Water Sustainability Act*, which will replace the *Water Act*, received Royal Assent in May 2014. The *Water Sustainability Act* will come into effect in 2016 and will require groundwater licensing.⁷³ It will also establish limits on both surface and groundwater use in times of drought.

In 2010, the Auditor General of British Columbia completed an *Audit of the Management of Groundwater Resources in British Columbia*.² This report concluded that BC is not effectively ensuring the sustainability of the province's groundwater resources. The report made recommendations including the following:

- Ensure that classification of the province's aquifers is completed for all priority areas and that the WELLS database is kept up to date. The ministry should also ensure that aquifers are characterized, starting with those classified as having the highest priority.
- Develop a groundwater information management strategy that takes into account detailed scientific information and identified trends, and ensure that the information required to support this strategy is collected, analyzed and available through one location.
- Develop a framework that clearly outlines the roles and responsibilities for managing groundwater provincially and locally, and ensure that agencies are able to take responsibility for groundwater in their area.

The Ministry of Environment and the Ministry of Forests, Lands and Natural Resource Operations provided an update report in March 2012⁷⁴ that showed the progress made on the Auditor General's recommendations. All of the recommendations have been partially implemented, while the recommendation around aquifer classification and keeping the WELLS database up to date has been substantially implemented.

2015: Where groundwater use, including use for geothermal energy or oil and gas exploration or production, threatens to contaminate or significantly deplete water supply sources, including drinking water sources, government should

- a) Continue to identify and characterize water resources and ensure they are documented in the Integrated Land and Resource Registry or in the Land and Resource Data Warehouse.
- b) Initiate water protection planning processes.

(Leads: Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission)

Monitoring Effects of Resource Activity

Recommendation 4

2011: Government should continue to improve monitoring for potential impacts of resource activities on drinking water. Monitoring should either be undertaken by the parties conducting the resource activity or by government, and should focus on parameters specifically associated with each resource activity such as sediment loading from soil. (Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Health, Ministry of Environment)

In 2010, key operational resource management components of several ministries were merged and became the Ministry of Forests, Lands and Natural Resource Operations. The purpose was to have a "one land manager" approach to natural resource management, better coordination of approval processes, and devolution of decision-making to regional and district offices that had local knowledge to enable better source water protection decisions.

The Forest and Range Evaluation Program conducted 2,176 assessments of forestry operations on water sources over the previous three fiscal years.

In 2011, the Ministry of Environment partnered with the Regional District of Nanaimo and the Geological Survey of Canada to begin expanding the Observation Well Network on the east coast of Vancouver Island.

2015: Government should continue to improve monitoring for potential impacts of resource activities on drinking water. Monitoring should either be undertaken by the parties conducting the resource activity or by government, and should focus on parameters specifically associated with each resource activity, such as sediment loading from soil. (Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Health, Ministry of Environment)

Evaluating Land-use Management Practices

Recommendation 5

2011: Government should continue to evaluate the potential impacts of activities on source water quality, including the benefits and weaknesses of different land-use management practices, and should promote those practices that minimize water quality impacts. (Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Agriculture, Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission and research and granting agencies)

The Ministry of Agriculture has collected detailed land-use information to evaluate practices, emergency management and bylaw development, and to support the agriculture water demand model. While there is currently no specific project to evaluate land-use management, the data collected will allow the ministry to do so in watersheds where data has been collected. Efforts are ongoing to manage direct access of cattle to streams for drinking water. The Agricultural Waste Control Regulation is under review and the process will help in the evaluation of land-use management practices pertaining to agriculture in watersheds with drinking water sources.

The Ministry of Energy and Mines supported and encouraged industry to adopt guiding principles and practices for water management.

The Ministry of Forests, Lands and Natural Resource Operations and Ministry of Environment established 21 new observation wells in 2011/2012 to monitor groundwater conditions in the province.

2015: Government should continue to evaluate the potential impacts of activities on source water quality, including the benefits and weaknesses of different land-use management practices, and should promote those practices that minimize water quality impacts. (Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Agriculture, Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission, and research and granting agencies)

Water Protection Planning

Recommendation 6

2011: To ensure that any planning efforts undertaken by a water supplier, including planning undertaken outside the scope of the Drinking Water Protection Act, can be implemented under the Drinking Water Protection Act, government should consider amending the Act to clearly enable elements of water suppliers' plans to be implemented through provincial regulation made pursuant to the Drinking Water Protection Act. (Lead: Ministry of Health)

The drinking water protection planning processes established under the *Drinking Water Protection Act* are intended to be initiated only under unusual circumstances where all other means of addressing drinking water health hazards have failed. This part of the Act is not intended as a mechanism for routine planning by all water supply systems. The *Drinking Water Protection Act* enables implementation of planning undertaken by direction of a ministerial order through regulations made under the Act, but does not clearly contemplate implementing plans that were developed in the absence of such a ministerial order.

During this time period, the *Water Act* modernization process was underway. The new act will contain planning provisions.

2015: To ensure that any planning efforts undertaken by a water supplier, including planning undertaken outside the scope of the *Drinking Water Protection Act*, can be implemented under the *Drinking Water Protection Act*, government should consider amending the Act to clearly enable elements of water suppliers' plans to be implemented through provincial regulation made pursuant to the *Drinking Water Protection Act*. (Lead: Ministry of Health)

Information Management

Recommendation 7

2011: In the absence of a province-wide drinking water information management system, regional applications should be improved to allow standardized reporting across the province. At a provincial level, applications should be enhanced to allow government staff, health authority staff, water suppliers and their agents, and the general public to access all provincial government and health authority data relevant to drinking water systems or drinking water protection, where that data is not subject to protection of privacy requirements. (Lead: Ministry of Health, Ministry of Labour, Citizens' Services and Open Government, health authorities)

Although all of the regional health authorities have individual drinking water information management systems, they are able to provide information to the public regarding water system quality, including systems on public notice, and system inspection reports. One of the biggest reported challenges is the lack of capacity to acquire electronic transmission of chemical and physical water quality parameters.

All health authorities are continuously improving the amount of information and resource materials available to the public.

2015: In the absence of a province-wide drinking water information management system, regional applications should be improved to allow standardized reporting across the province. At a provincial level applications should be enhanced to allow government staff, health authority staff, water suppliers and their agents, and the general public to access all provincial government and health authority data relevant to drinking water systems or drinking water protection, where that data is not subject to protection of privacy requirements. (Leads: Ministry of Health, Ministry of Jobs, Tourism and Skills Training, health authorities)

Cross-Government Referral Protocols

Recommendation 8

2011: Regional drinking water teams established under the Memorandum of Understanding for Inter-Agency Accountability and Coordination on Drinking Water Protection should continue to evaluate and improve protocols to ensure decisions that affect the safety of drinking water involve the appropriate health officials, either within the Ministry of Health or within the regional health authority. (Leads: Regional drinking water teams, Directors' Inter-Agency Committee on Drinking Water)

The Directors' Inter-Agency Committee on Drinking Water conducted a review of the regional drinking water teams to assess support for their continued operation and effectiveness in meeting the objectives of the Memorandum of Understanding and to ensure decisions that affect the safety of drinking water involves the appropriate health officials. The review confirmed that the regional drinking water teams are the best solution at this time to address coordination and accountability in drinking water source protection.

2015: Regional drinking water teams established under the *Memorandum of Understanding for Inter-Agency Accountability and Coordination on Drinking Water Protection* should continue to evaluate and improve protocols to ensure decisions that affect the safety of drinking water involve the appropriate health officials, either within the Ministry of Health or within the regional health authority. The Ministers previously involved in the Directors Inter-Agency Committee on Drinking Water need to ensure they commit to having the appropriate staff available to support the regional drinking water teams. The format for meetings may need to be updated to provide effective consultation and action. (Leads: Regional drinking water teams)

Recommendation 9

2011: The Directors' Inter-Agency Committee on Drinking Water should take steps to ensure that regional decision makers with all resource ministries are aware of the cabinet-approved Action Plan for Safe Drinking Water in British Columbia commitment to an integrated approach to providing safe drinking water. (Lead: Ministry of Health)

Through the Directors' Inter-Agency Committee on Drinking Water review of regional drinking water teams mentioned in Recommendation #8, the Action Plan's commitment to an integrated approach to providing safe drinking water was reaffirmed.

2015: The directors involved in the Directors' Inter-Agency Committee on Drinking Water should monitor regional decision makers with all resource ministries to ensure an integrated approach to providing safe drinking water is being used, outlined in the Action Plan for Safe Drinking Water in British Columbia. (Lead: Ministry of Health)

Consistent Policy across Government

Recommendation 10

2011: Government needs to ensure that mechanisms are in place to ensure that policy direction across government is consistent with government's eight principles outlined in the Action Plan for Safe Drinking Water in British Columbia. (Lead: Ministry of Health)

Although the Assistant Deputy Minister's Committee on Water has been disbanded, the Directors Inter-Agency Committee on Drinking Water continues to deal with protection of water through regular resource and land-use decision making. Each ministry is organized around projects and activities, and if gaps exist, they need to be addressed within each sector.

2015: Government needs to ensure that mechanisms are in place to ensure that policy direction across government is consistent with government's eight principles outlined in the Action Plan for Safe Drinking Water in British Columbia. (Lead: Ministry of Health)

Water System Assessments

Recommendation 11

2011: All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans, health authorities should require water suppliers relying on surface water sources to plan for treatment capable of achieving 99.99 per cent reduction in virus levels, 99.9 per cent reduction in protozoa levels, and turbidity levels below 1 NTU, through treatment processes involving at least two barriers, unless there is good justification, acceptable to the drinking water officer, for not achieving those levels. Health authorities should also ensure that all small water supply systems understand the sampling frequency requirements. Where appropriate, sampling frequencies should be included on operating permits. Efforts should be made by stakeholders to reduce the number of systems on long-term boil water advisories, while ensuring the health of the community through improvements in water quality delivered to citizens. (Leads: Health authorities, drinking water suppliers, local authorities)

All regional health authorities are working actively with water suppliers to move beyond basic treatment and monitoring expectations, and to meet provincial surface water treatment objectives. Requirements for system assessments and assessment response plans are part of the ongoing source-to-tap assessments done by drinking water officers in each health region.

In all health regions, significant progress has been made on reducing the number of long-term boil water notices, and health authorities will continue to require plans to provide treatment upgrades and monitor progress with the plans.

2015: All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans, health authorities should require water suppliers to meet all applicable provincial treatment objectives. Where appropriate, sampling frequencies should be included on operating permits. Efforts should be made by

stakeholders to reduce the number of systems on long-term boil water advisories, while ensuring the health of the community through improvements in water quality delivered to citizens. (Leads: Health authorities, drinking water suppliers, local authorities)

Small Water System Financing

Recommendation 12

2011: Government should work with small water supply system owners to access financial resources through methods such as transfer of ownership to local government, and should consider the development of loan or grant programs for small systems with an associated fiscal accountability framework. (Lead: Ministry of Community, Sport and Cultural Development, Ministry of Health)

The Sustainable Infrastructure Society, a non-profit society, has developed a number of programs to assist small water systems. These include liability insurance for water systems and operators and access to loans and funding. In partnership with the Ministry of Health, Financial Best Management Practices have been developed to enable small systems to document their water system assets and finances, in order to assist in planning for system upgrades and rate setting.

Infrastructure funding is not available to privately operated systems including improvement districts and strata corporations. The Ministry of Community, Sport and Cultural Development provides planning grants to municipal governments and regional districts to facilitate conversion of privately operated water systems to the local government.

As small systems work towards upgrading their water treatment systems to meet provincial treatment objectives, a lack of funding will continue to be a significant barrier to making changes.

2015: Government should continue to work with small water supply system owners to access financial resources through transfer of ownership to local government, and should consider the development of loan or grant programs for small systems with an associated fiscal accountability framework. (Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)

Water System Performance Monitoring

Recommendation 13

2011: Based on the needs identified by assessments and the requirements stipulated on operating permits, most water suppliers should implement or expand treatment performance monitoring to include variables such as CT, filtration performance, turbidity, UV performance, pH, and pressure regimes as appropriate. (Leads: Water suppliers, drinking water officers)

All health authorities support performance monitoring as a best practice, and may require it through terms and conditions on operating permits. As more systems update their treatment systems to meet provincial treatment objectives, performance monitoring will become a more common practice to confirm that the objectives are being met.

2015: Based on the needs identified by assessments and the requirements stipulated on operating permits, most water suppliers should implement or expand treatment performance monitoring to include variables such as CT, filtration performance, turbidity, UV performance, pH, and pressure regimes as appropriate. (Leads: Water suppliers, drinking water officers)

Water Testing

Recommendation 14

2011: To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged. The use of on-site test kits as a quality assurance tool to augment testing at approved laboratories should be promoted. (Leads: BC Centre for Disease Control, Ministry of Health, health authorities)

In addition to services provided by the BC Centre for Disease Control, Vancouver Coastal and Fraser Health Authorities maintain Colilert testing equipment at some of their offices. Metro Vancouver and the Capital Regional District have Provincial Health Officer-approved water laboratories to test water within their systems. A small number of individual systems use Colilert testing in-house to augment the samples sent to an approved laboratory.

There are privately operated laboratories located in the geographical boundaries of each health authority.

2015: To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged. The use of on-site test kits by water suppliers as a quality assurance tool to augment testing at approved laboratories should be promoted. (Leads: BC Centre for Disease Control, Ministry of Health, health authorities)

Inventory and Assessment of Small Water Systems

Recommendation 15

2011: Health authorities and the provincial government should continue to develop an accurate inventory of BC's small water supply systems and obtain all of the data that was identified as part of the drinking water information management project core data set. (Leads: Health authorities, Ministry of Health)

All health authorities are continually updating their inventory of small water systems, including core data information. Existing systems are often found through complaints, a change to include a commercial use of the property, or through new permit applications.

2015: Health authorities and the provincial government should continue to develop an accurate inventory of BC's small water supply systems and obtain all of the data that was identified as part of the drinking water information management project core data set. (Leads: Health authorities, Ministry of Health)

Small Water System Amalgamation

Recommendation 16

2011: Government should pursue legislative change to allow decision makers with the Ministry of Transportation and Infrastructure, Ministry of Forests, Lands and Natural Resource Operations, health authorities, and local governments to

- a) *Prohibit the creation of multiple small water supply systems where one larger system could be developed.*

- b) *Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.*
- c) *Provide authority to require developers to connect new properties with existing adjacent water supply systems.*

All local governments should be required to address the issues of non-viable small water supply systems in growth management strategies. (Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)

All regional health authorities support this recommendation.

There is an Inter-Ministry Small Water Systems Committee addressing regulatory, financial, subdivision and amalgamation issues to promote amalgamation of existing small systems, and the creation of sustainable, new small systems.

2015: Government should pursue legislative change to allow decision makers with the Ministry of Transportation and Infrastructure, Ministry of Forests, Lands and Natural Resource Operations, health authorities, and local governments to

- a) **Prohibit the creation of multiple small water supply systems where one larger system could be developed.**
- b) **Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.**
- c) **Provide authority to require developers to connect new properties with existing adjacent water supply systems.**

All local governments should be required to address the issue of non-viable small water supply systems in growth management strategies. (Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)

Full Cost Accounting

Recommendation 17

2011: Government should continue to develop assistance for small water supply systems to help them plan for ongoing maintenance and system upgrades. Suppliers should be required to proceed with upgrades through conditions on their operating permits. (Leads: Ministry of Health, Ministry of Community, Sport and Cultural Development, health authorities)

Regional health authorities use terms and conditions on permits to facilitate upgrades; however, many of the necessary remedies are provincial in nature and require action at that level.

The Ministry of Health has developed, or worked with partners, to create tools to assist small water systems. These include a Water System Assessment Tool, a Small Water Systems Guidebook, and Financial Best Management Practices.

The Sustainable Infrastructure Society, a non-profit society, has developed a number of programs to assist small water systems, such as liability insurance for water systems and operators, access to funding, and best management practices.

2015: Government should continue to develop assistance for small water supply systems to help them plan for ongoing maintenance and system upgrades. Suppliers should be required to proceed with upgrades through conditions on their operating permits. (Leads: Ministry of Health, Ministry of Community, Sport and Cultural Development, health authorities)

Water Rates

Recommendation 18

2011: Rates for drinking water should reflect the true, long-term costs of water treatment, distribution and water system operation, maintenance, and monitoring. Revenue generated from charges for water should be re-invested in programs that promote awareness of water quality and quantity, protect water quality, improve public health, and encourage sustainable water use to promote healthy communities. (Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)

No substantial progress has been made by government to ensure that water supplies not owned by local government are moving toward sustainable funding of their operations and infrastructure requirements.

The Ministry of Health has developed a number of tools to assist small, private water systems in assessing various aspects of their systems. In a partnership between the Sustainable Infrastructure Society, the Union of BC Municipalities, the Ministry of Health and the Ministry of Community, Sport and Cultural Development, a Financial Best Management Practices guidebook was developed to assist water system operators to operate their systems sustainably.

2015: Rates for drinking water should reflect the true, long-term costs of water treatment, distribution and water system operation, maintenance, and monitoring. Revenue generated from charges for water should be reinvested in programs that promote awareness of water quality and quantity, protect water quality, improve public health, and encourage sustainable water use to promote healthy communities. (Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)

Appendix A: Websites



Agency	Website	Information
Auditor General of British Columbia	www.bcauditor.com/pubs/2010/report8/audit-management-groundwater-resources-british-columbia	<i>Audit of the Management of Groundwater Resources in British Columbia</i>
BC Oil and Gas Commission	www.bcogc.ca	FracFocus chemical disclosure registry
Collaborative Watershed Initiative's Steering Committee	www.fraserbasin.bc.ca/Library/Water/water_cwg_accord_draft.pdf	Draft Collaborative Watershed Governance Accord for BC
Council of Canadian Academies	www.scienceadvice.ca/en/assessments/completed/shale-gas.aspx	Environmental Impacts of Shale Gas Extraction in Canada
EcoCat	www.env.gov.bc.ca/ecocat/	Ecological reports catalogue
Fraser Health Authority	www.healthspace.ca/Clients/FHA/FHA_Website.nsf/Env-Frameset	Environmental Health Services, including drinking water
Forest Practices Board	www.bcfpb.ca/reports-publications/	Audits, investigations, complaints and other public reports
Geoscience BC	www.geosciencebc.com/s/Montney.asp	<i>Montney Water Project</i>
Interior Health Authority	www.interiorhealth.ca/YourEnvironment/DrinkingWater/Pages/default.aspx	Drinking Water main page
Health Canada	www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/fpt/index-eng.php	Federal-Provincial-Territorial Committee on Drinking Water
Health Canada	www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#guidelines	<i>Guidelines for Canadian Drinking Water Quality</i>

Agency	Website	Information
Ministry of Agriculture	www2.gov.bc.ca/gov/topic.page?id=7C5E84D316B14AD39447A1FB313882DC	Agriculture water information
Ministry of Agriculture	www.bcac.bc.ca/ardcorp/program/environmental-farm-plan-program	Environmental Farm Plan Program
Ministry of Environment	www2.gov.bc.ca/gov/topic.page?id=044DD64C7E24415D83D07430964113C9	Water quality guidelines
Ministry of Environment	www.env.gov.bc.ca/wld/documents/bmp/devwithcare/	<i>Develop with Care</i> Environmental Guidelines for Urban and Rural Development
Ministry of Environment (Water Stewardship)	www.env.gov.bc.ca/wsd/plan_protect_sustain/	Water quality assessments and protection programs



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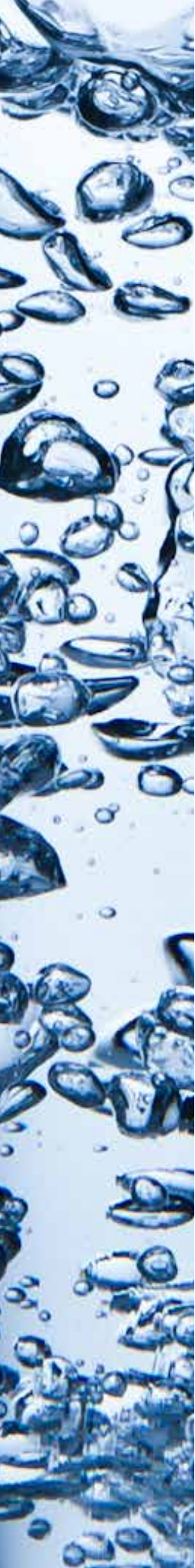
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