Water, Water Everywhere

Drinking Water in Island Health

island health

Medical Health Officer's Report

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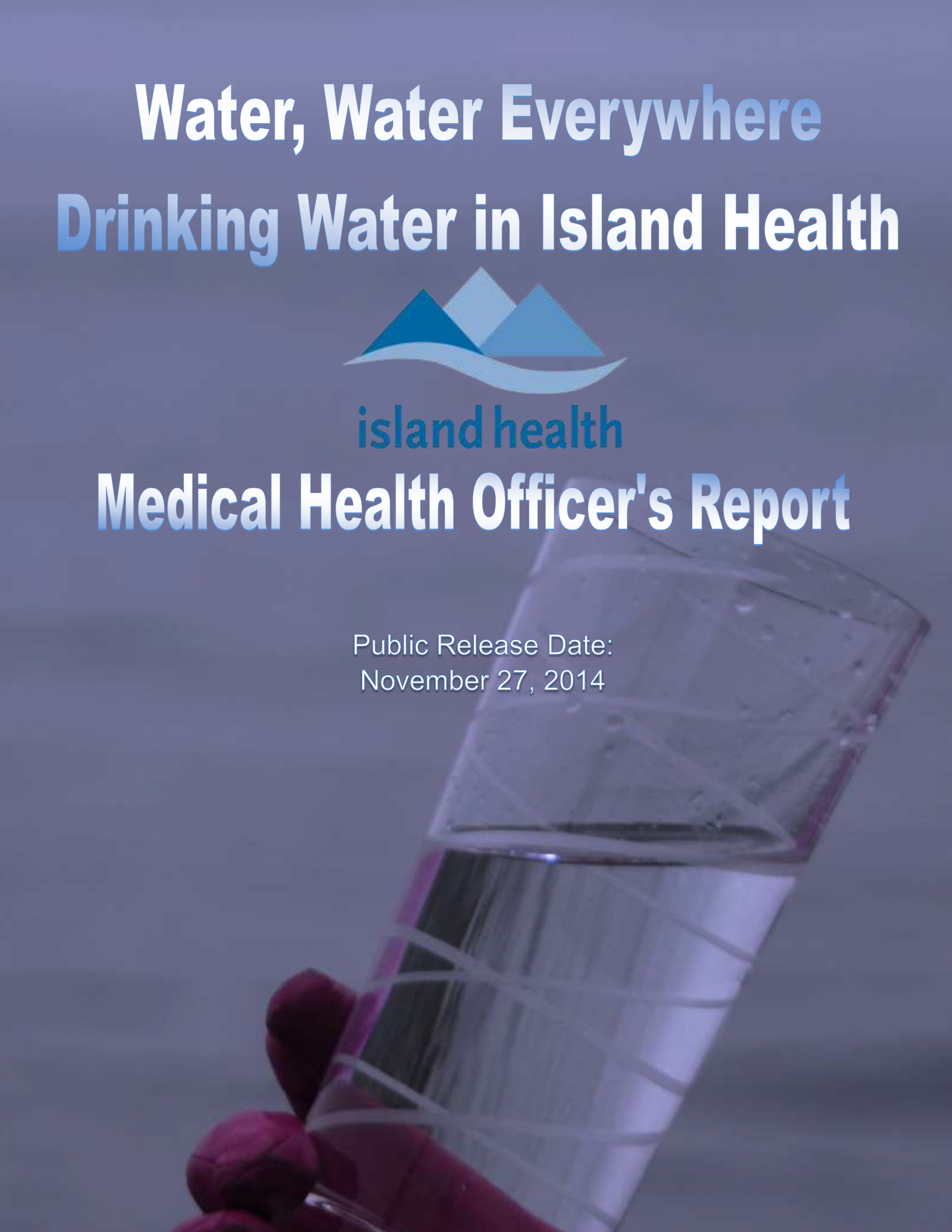

MESSAGE FROM THE CHIEF MEDICAL HEALTH OFFICER

I am pleased to provide a report on the progress that has been made in providing safe drinking water to all individuals who reside in or visit the areas served by Island Health. The achievements and challenges in this report can be contextualized by another document, a report from the United Nations Development Programme. Their Annual Human Development Report of 2006 underscores the importance of this issue with the disturbing statistic that globally thousands of children die every day of drinking dirty water, and over one billion people do not have access to safe water.[1]

Our public health team at Island Health aspires to the goal of the delivery of high quality, reliable, safe and sufficient quantity of drinking water to all residents. Through the efforts of public health staff and their diligent work with the operators of nearly 900 water systems the number of Vancouver Island systems on permanent boil water notices has been reduced to a few dozen. Coupled with these on the ground efforts have been significant improvements in reporting and transparency on the state of all water systems on the Islands. This enhancement not only meets the recommendation to Health Authorities from the Ombudsperson in her recent report on drinking water,[2] but also meets the expectations of the consumers of drinking water on Vancouver Island and surrounding Islands in having full knowledge of their water supplies.

The challenges facing water system operators in meeting microbial, chemical and physical requirements are acknowledged and detailed in this report. Documented as well are the significant challenges faced by the smaller systems on the island in fulfilling standards without having the same economies of scale as larger public systems.

Through education, cooperative engagement/mentoring and occasional enforcement, our team is fulfilling its legislative mandate for drinking water. It should be noted that, while employees of the Health Authority, the Island Health staff receive their powers from the *Drinking Water Protection Act* and the *Public Health Act*, and are acting as agents of the province in carrying out the duties of Drinking Water Officers.

In spite of the obvious importance of drinking water in our everyday lives, some communities have been reticent to accept that the health protecting standards set by the Guidelines for Canadian Drinking Water Quality[3] must be met by their water systems. Despite high-profile coverage of outbreaks associated with bad water in British Columbia and Canada, such as the notorious Walkerton outbreak, reluctance by water recipients to make the necessary investments to bring existing water systems up to British Columbia standards occurs from time to time.

[1] United Nations Development Programme. Annual Human Development Report 2006. Beyond scarcity: Power, poverty and the global water crisis. http://hdr.undp.org/en/content/human-development-report-2006 (Accessed July 29, 2014).
[2] Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia: Special Report No. 32. https://www.ombudsman.bc.ca/investigations/systemic-investigations/systemic-investigations-completed-in-2008-09/142-implementations-of-recommendations-in-special-report-no-32-fit-to-drink-challenges-in-providing-safe-drinking-water-in-british-columbia (Accessed July 29, 2014).
[3] Guidelines for Canadian Drinking Water Quality http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php (Accessed July 29, 2014).

It is ironic that Drinking Water Officers have had to resort to issuing orders for water systems to comply with these expectations at a time when some members of the public are willingly paying more for a litre of bottled water (which for all intents is no better than tap water) than for a litre of gasoline.

Island Health will continue to work with water system operators and the public to maintain and improve our drinking water in the Island Health region. We will strive to ensure water quality does not emerge as a metric of health inequity amongst communities beyond what already needs to be addressed in our region.

The success of our drinking water program relies on many public health staff, their expertise ranging from the Public Health Engineer to that of the field Environmental Health Officers who regularly assist in addressing local onsite water issues. The consequences of failing to ensure high quality drinking water are always on the minds of those whose role it is to protect this precious resource.

The preparation of this report involved many individuals and I would like to especially thank Dr. Paul Hasselback, Medical Health Officer for Central Island and Lynne Magee, Regional Drinking Water Coordinator for Island Health for their contributions to this report. Production coordination was led by Christal Lawson in the Central Island MHO office. Significant text and data contributions were also provided by Heather Florence with the drinking water team, and Melanie Rusch and Fiona Lawson with the Population and Community Engagement team. The Health Protection Leadership Council was invaluable in reviewing drafts with special thanks to Gary Anderson, Cole Diplock and Murray Sexton. Bruce Patterson and the Communications Department supported copy development. Thanks also to numerous colleagues in other Health Regions, the Ministry of Health, the Provincial Health Officer's office and to select water system operators who have reviewed the text. Most importantly, however, credit goes to the Health Protection and Environmental Services staff who daily work with drinking water system operators, undertake inspections, provide reports and permits, and the administrative support team who enter this information into the database that makes sharing this information widely now possible.

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EXECUTIVE SUMMARY

Under Section 73 of the *Public Health Act* Medical Health Officers are expected to advise and report on public health issues. The assurance of safe, reliable, affordable and accessible drinking water is a public health challenge. This report presents the current status and oversight of drinking water in the region served by Island Health.

This report makes recommendations for ensuring that all residents and visitors receiving drinking water from our water supply systems can be assured of a quality of water that is equal to or better than that enjoyed by other North American jurisdictions. Within the Island Health region, at least 898 water supply systems are known to be operating, demonstrating the magnitude of the challenge for public health. The report draws its structure from the chapters of Health Canada's document "From Source to Tap – The Multi-Barrier Approach to Safe Drinking Water."[4]

Island Health has 24 water supply systems serving greater than 5000 persons every day. These systems serve a total of 706,280 persons. About 150,000 people are supplied by 874 water supply systems serving less than 5000 persons per day. The total number of people served exceeds the 765,000 population figure for Island Health as some people move between systems and are double counted. As well, some tourist-based operating systems are dedicated to providing amenities for visitors to our region.

Island Health has developed tools for suppliers to ensure effective source protection by identifying issues and establishing a Source Protection Plan for their water supply. While source protection planning does vary widely across the Island, there are examples of excellent programming already completed by some operators.

Seventy per cent of water supply systems depend on ground water (wells) for their drinking water, 15% on surface water, 2.3% a combination of surface and well water and 12.6% are currently not captured in our records. Over two-thirds of the systems serve less than 15 connections, 22.3% serve 15 to 300 connections and the remaining 6.5% consist of systems with over 300 connections, which serve the majority of the population of Island Health. As the size of the population served grows, the proportion of water supply systems drawing on surface water tends to increase.

Ten water supply systems using surface water as their source, all of which serve greater than 500 people, comply with the BC Surface Water Treatment Objectives.[5] As of March 2012, 33 large systems using surface water were non-compliant with these provincial treatment objectives. These standards are not applicable to the 33 large systems reliant on ground water.

Bacteriological monitoring is performed at a frequency based on the size of the population served by the system. Only 29% of water supply systems met the objective of submitting 90% or more of their required bacteriological samples. 17,812 water samples were taken from 2011 to 2012, of which 0.3% were positive for *Escherichia coli*. The results of this testing program are publically available online at http://www.healthspace.ca/Clients/VIHA/VIHA_Website.nsf/Water-Samples-Frameset?OpenPage.

[4] http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/tap-source-robinet/index-eng.php
[5] www.health.gov.bc.ca/protect/pdf/surfacewater-treatment-objectives.pdf

Samples must reach the laboratory within 30 hours of collection. Since most Central and North Island samples currently are only analyzed in Vancouver, this can pose a serious quality challenge for remote and isolated locations. Chemical analysis is performed less frequently, with only 15% of water supply systems performing routine chemical sampling.

Water supply systems currently operate under more than a dozen different governance models. These oversight structures are regulated by various pieces of provincial legislation. Many of these governance bodies also deliver community services beyond drinking water and it is but one of a number of competing priorities for resourcing.

Operators of larger water supply systems (serving 500 persons or more, of which there are a total of 81 within Island Health) are required to receive training through the Environmental Operators Certification Program. The development of a course that would ensure appropriate training for operators of smaller water supply systems could serve to enhance water safety for even more consumers.

In 2008, the Ombudsman tasked Regional Health Authorities with reducing the number and duration of Boil Water Notices issued for BC water supply systems. In response, Island Health by March 2012 worked to remediate 36 of the 57 systems on Boil Water Notices, which historically had been in place for longer than 18 months. At the time of the release of this report, reflecting ongoing challenges, 40 water supply systems in our jurisdiction are on long-term Boil Water Notices.

Emergency Response Plans exist for half of the water supply systems, which is a marked improvement from previous years.

Operating permits for water supply systems are a requirement under Section 8 of the *Drinking Water Protection Act* and are issued by Drinking Water Officers. In 2012, our official statistics indicated that 53.5% of water supply systems had operating permits, 27.7% of which were granted with conditions. It is assumed that most systems have, in fact, been granted operating permits, but have not had their information entered into Island Health files.

A complaint process exists within Island Health where members of the public can express concerns. Sixty-eight complaints have been received over the past four years, arising mainly from those customers served by smaller water supply systems. Larger systems have their own complaint intakes and our number is likely an undercount.

Within the plethora of challenges faced by many water supply systems, there are locale-specific drinking water concerns including: saline intrusion, highly coloured water, blue-green algae, ammonia/iron/manganese and other quantity issues.

The *Drinking Water Protection Act* defines a water supply system as other than serving a single-family residence. The onus is on these property owners to provide safe water for themselves. While not within the purview of the *Act*, concern about potential health risks for water supplies serving these single-family residences is of importance to Island Health. Support exists through Island Health and other organizations for managing these private water sources safely.

The release of the provincial Living Water Smart Plan has generated new initiatives including rainwater harvesting, Aquifer Storage and Recovery and Point of Entry/Point of Use equipment. Island Health has responded to assess the safety of these innovations and provide sound oversight of their implementation.

This report includes 32 recommendations structured to move the drinking water industry, suppliers, users and regulators forward as the *Drinking Water Protection Act* enters its second decade.

Source: Island Health Staff Photo

LIST OF RECOMMENDATIONS[6]

I – 1 *Health Protection and Environmental Services ensure that water supply systems currently undefined regarding source type in Island Health records be appropriately classified by December 2014.*

III – 2 *Health Protection and Environmental Services document in Island Health records wellhead/watershed protection status for all water supply systems over 15 connections by December 2014.*

III – 3 *All water supply systems with greater than 300 connections have "completion of wellhead/watershed assessment" included as a condition on operating permits by March 2016.*

III – 4 *Further, that all assessments should be completed and documented before March 2018.*

III – 5 *The need for a Watershed Protection Plan should be included on the conditions of an operating permit for water supply systems with greater than 300 connections where significant threats to the watershed are identified, with such planning completed by March 2019.*

III – 6 *Island Health ensure that short form wellhead/watershed assessments should be documented and completed on water supply systems of 15 to 300 connections by March 2019. Determination of when to complete smaller water supply system assessments should be undertaken by March 2019.*

III – 7 *Health Space database be modified to be able to track conditions on an operating permit relative to source water protection, and identify status of wellhead/watershed assessments and Wellhead/Watershed Protection Plans.*

III – 8 *Island Health develop a course eligible for Continuing Education Units under Environmental Operators Certification Program on source water protection. The thematic offering will focus upon developing a plan specific to the water supply systems of the participating operators. The target audience will be small water supply system operators and suppliers.*

IV – 9 *Health Protection and Environmental Services, by December 2014, review and ensure that all water supply systems with greater than 150 connections that require treatment/system upgrades have, documented conditions on operating permits with time bound deadlines for completion.*

IV – 10 *Island Health, by April 2014, ensure that the processes required to ensure water supply systems of 15 to 150 connections meet treatment expectations by 2021 are developed by Health Protection and Environmental Services.*

[6] Roman numerals relate to the Section within the document.

IV – 11 *Island Health, by March 2016, ensure that processes for ensuring appropriate treatment is implemented in water supply systems of less than 15 connections be developed and communicated by Health Protection and Environmental Services.*

IV – 12 *Annually, Island Health report on progress towards compliance with Surface Water Treatment Objectives based on population served as well as by size of the water supply system for those systems dependant on surface water or combined sources. When Ground Water Treatment Objectives are available, this report should include ground water based systems.*

V – 13 *BC Ministry of Health be encouraged to develop planning and support materials for asset management and distribution system operation.*

V – 14 *Island Health ensure that asset management planning as well as distribution system operation and management, be incorporated into conditions on the operating permits for water supply systems greater than 300 connections by March 2016.*

VI – 15 *Island Health and water suppliers strive to increase the number of water supply systems that submit 90% or more of the required bacteriological samples.*

VI – 16 *Island Health reports annually on compliance with: annual chemical analysis for large water systems, three year chemical sampling for systems with 15 to 300 connections and five year chemical sampling for systems with less than 15 connections. Such chemical monitoring should be inclusive of disinfection by-products where chlorination or chloramination processes are used.*

VI – 17 *Island Health develop consistent policy on expectations for monitoring disinfection by-products based on type of treatment and size of the water supply system by March 2015.*

VI – 18 *Island Health develop a process for addressing disinfection by-products including monitoring and corrective actions as required by March 2015.*

VII – 19 *Island Health provide, to the best extent possible, support for small water supply system operators; in governance modelling, in the amalgamation of adjacent systems, in the shift to management of systems by regional or municipal government and in encouraging that pricing for water adequately reflects the lifecycle management requirements for individual systems.*

IX – 20 *Island Health ensure all water supply systems serving over 500 persons per day are classified by Environmental Operators Certification Program and have staff certified to the appropriate level. Continue to require some level of training for operators of small water supply systems. Until all larger water supply systems are classified, Island Health report annually on the classification of the larger water supply systems distribution and treatment.*

IX – 21 *Island Health is to develop and provide courses for the Environmental Operators Certification Program with a target audience of small water supply system operators/suppliers and to report on course attendance and evaluation by March 2015.*

IX – 22 *A long term education plan be developed that establishes a new training program every year over the next five years.*

X – 23 *Island Health to work with water supply systems to ensure their annual reports are prepared in a timely fashion and adequately communicated to their system users.*

X – 24 *Island Health implement a more consistent approach to addressing water supply systems on water advisories through recently developed policy tools. These tools include: guidance on issuing and removing Boil Water Notices, routinely updating progress reports to ensure deadlines are met; moving to the next step on the enforcement continuum for systems which are not progressing to upgrade their systems to remove long-term Boil Water Notices, or to meet treatment objectives to reduce periodic short-term Boil Water Notices.*

XI – 25 *Island Health continues to work with water suppliers to ensure they have adequate and up to date Emergency Response and Contingency Plans.*

XI – 26 *Island Health reports annually on compliance with emergency response planning and reports on incidents involving the activation of Emergency Response Plans by water suppliers.*

XI – 27 *Island Health continue to work with other stakeholders (Royal Canadian Mounted Police, British Columbia Centre for Disease Control, local laboratories and water suppliers), to ensure that the emergency response to potential acts of vandalism or terrorism is as rapid and effective as possible.*

XII – 28 *Island Health to review the status of all operating permits for water supply systems and update as required, with consideration given to attaching terms and condition by December 2014.*

XII – 29 *Island Health report annually on compliance, enforcement and complaint activity.*

XIII – 30 *The Health Space database include documentation, with retrieval capacity for common and unusual threats to water supply systems*.

XIV – 31 *Island Health continue to support regional and local governments in providing education and resources to private residential systems.*

XVI – 32 *The Provincial Health Officer be requested to revisit the current format of the annual drinking water report and to consider including province-wide reporting on more aspects associated with the Source to Tap oversight and actions under the Drinking Water Protection Act.*

INTRODUCTION

1 PURPOSE OF REPORT

Medical Health Officers (MHOs) are expected to advise and report on public health matters under Section 73 of the *Public Health Act.* The MHOs have a mandate under the BC *Drinking Water Protection Act* (*DWPA*) and the BC Drinking Water Protection Regulation (DWPR) to ensure that water supply systems provide potable water to their users.

The purposes of this report are:

- To report on the public health issue of the safety of drinking water in the areas served by Island Health;
- To report a baseline assessment of the Drinking Water Program of Island Health, Health Protection and Environmental Services, and its activities towards meeting expectations arising from legislation;
- To inform the public on safe drinking water activities and educate them on the complexity of this undertaking;
- To highlight some successes of the drinking water program;
- To identify areas for future improvement; and
- To provide recommendations to secure for all residents of the region access to safe, reliable drinking water and promote public confidence in our management of this resource.

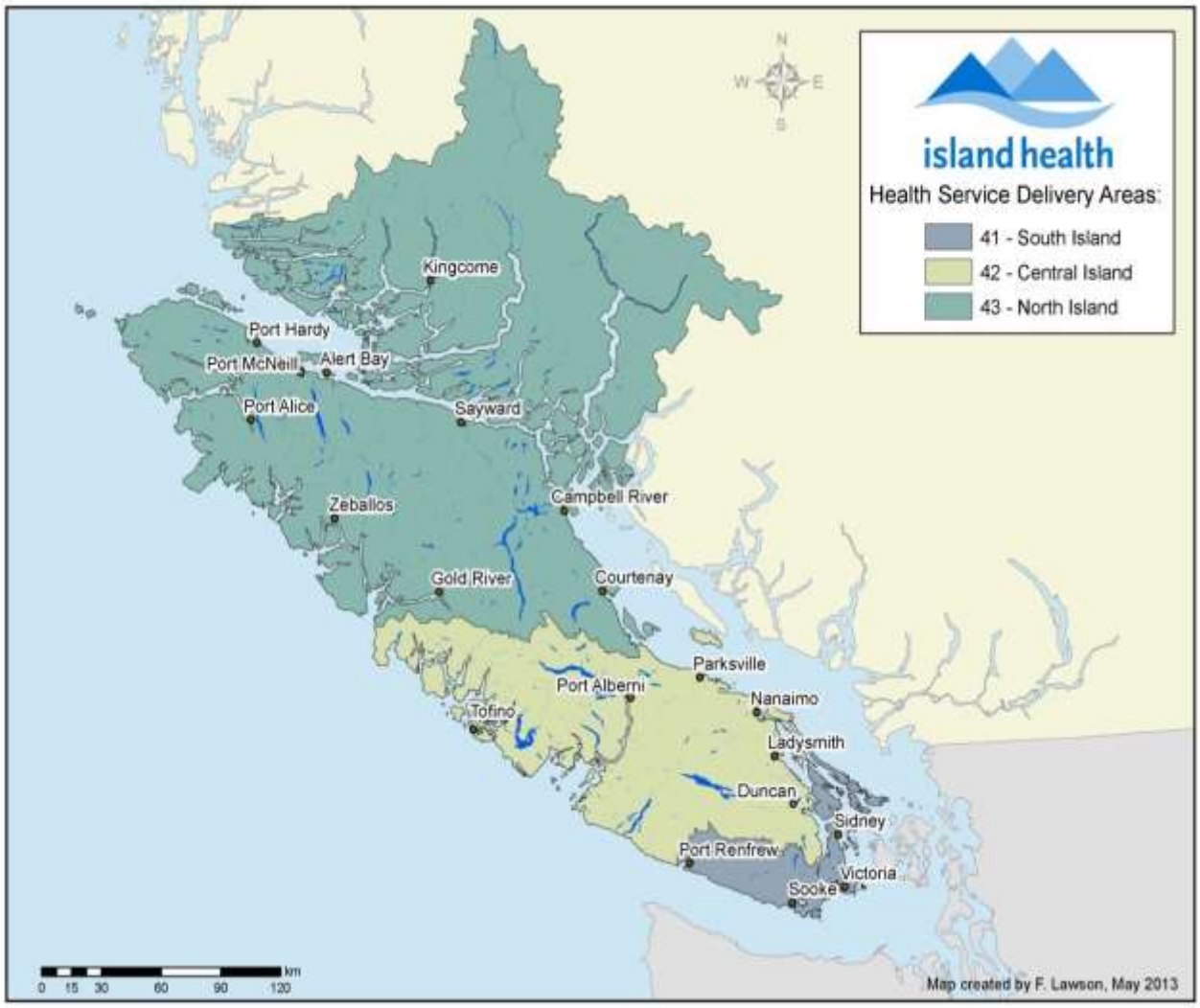
The intended audience of this report is drinking water system users, operators and regulators as well as Island Health and government decision makers and administrators. The content of the report is presented with the intent that the consumers of our drinking water may be made aware of the BC drinking water environment and begin to understand the current state of drinking water in the Island Health regions.

Source: Island Health Staff Photo

SECTION I – OVERVIEW OF THE DRINKING WATER PROGRAM

MHOs are responsible for administering the *DWPA* and DWPR throughout the regions served by Island Health. They do so in conjunction with Environmental Health Officers and a Public Health Engineer who are all delegated responsibility as Drinking Water Officers (DWO). The area served by Island Health is shown on Map 1. The area is divided into three Health Service Delivery areas; North, Central and South. Map 1 and the subsequent maps throughout the report are posted on the Island Health website, so they may be viewed in greater detail. The maps can be found at: http://www.viha.ca/mho/water/.

Map 1: Health Service Delivery Areas, Island Health



Water supply systems falling Under the *DWPA* are systems that supply water for domestic purposes to anything other than a single-family residence. A water supply system may include a shared well, surface water intake, storage or other infrastructure. Water supply system operators are required to provide potable water to their users that meet the requirements of the *DWPA* and DWPR. Achieving compliance includes monitoring their water, notifying users of threats and having permits to construct and operate their systems.

General oversight is provided by MHOs who have been delegated the authority of a DWO under the *Act*, and who may in turn delegate these functions to Environmental Health Officers and Public Health Engineers. Under the auspices of Island Health as the organization entrusted with public health services, the Health Protection and Environment Services program provides administrative support to DWOs, Public Health Engineer, drinking water specialists and other personnel who deliver the Drinking Water Program in the region. First Nations Inuit Health with Health Canada was responsible for oversight of safe water to First Nations. As of October 2013, partial responsibility has been transferred to the First Nations Health Authority.

Throughout the report, recommendations for the 'Health Protection and Environmental Services' program speak to the need to complete work that has already been identified previously. Where recommendations are directed to 'Island Health', it is in the organization's broad capacity as the body responsible for health of the population that such future work needs to be supported and attained.

Island Health employs the multi-barrier to underpin its approach to regulate water supply systems. Health Canada defines the multi-barrier approach as "an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health."[7]

2 Framework and Drinking Water in BC

In BC, drinking water is regulated under the *DWPA* and the DWPR. While not an exhaustive list, this legislation requires among other things that all water supply systems:

- Use only approved sources.
- Obtain a construction permit (or waiver) prior to construction.
- Hold a valid operating permit and meet all terms and conditions, where applicable.
- Consistently provide potable water to all water users.
- Retain an operator with an appropriate level of training.
- Undertake regular water quality testing and operational monitoring.
- Report to water users annually the status of their drinking water, including test results.
- Abide by all other aspects of the legislation, industry better practices and the direction of the DWO.

There is other provincial legislation beyond the *DWPA* affecting the ongoing sustainability of water for domestic supply, use by wildlife, and for recreational, agricultural and industrial purposes. DWOs work cooperatively with these other government agencies where authority and/or responsibility converge. An inter-agency Memorandum of Understanding exists to guide this process and is available at: http://www.healthservices.gov.bc.ca/protect/pdf/drinking_water_protection.pdf.

The DWPR defines water supply systems as small when they serve less than 500 individuals during a 24 hour period. Systems also are often alternatively classified by the number of known connections to the system rather than counts of customers. For consistency, throughout this document, when reference is made to size of systems, unless otherwise specified, it will be based on the number of connections rather than number of persons served.

[7] http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/tap-source-robinet/index-eng.php accessed July 2, 2013.

3 Regulatory Oversight

In Island Health, there are 39 Environmental Health Officers who have been delegated the authority of a DWO by the Health Authority's five MHOs. In addition to water supply systems, these Environmental Health Officers have regulatory responsibility for food facilities (such as restaurants, cafeterias, food stores, mobile vending units, commercial kitchens and food processing plants), recreational water facilities (such as public and commercial pools and hot tubs) and personal service establishments (such as tattoo parlours, piercing studios and tanning salons). DWO duties as well as other Environmental Health Officer duties are delivered by personnel assigned to a specific geographic area.

The Public Health Engineer is delegated as a DWO and is the issuing official for water supply system construction permits. The Public Health Engineer is also a resource to the DWOs for questions regarding water chemistry, water treatment and system design.

The allocation of time between drinking water facilities and other program area responsibilities varies considerably, as does the time required for each individual facility. In general, this is a function of the size of the system. Smaller water supply systems tend to need more assistance because they lack the operator expertise and resources that are available within larger, more professional municipal systems.

4 Water Supplier Responsibilities

Water suppliers are responsible for ensuring they provide potable water to their users, specifically that the water from the tap is safe to drink without need of further treatment. Depending on the bacterial and chemical quality of the water, this may mean the water has been required it to be treated, disinfected or a combination of both. Of note, some systems accessing a secure ground water source may not treat or disinfect the water prior to distribution. In order to meet evolving enhanced treatment standards, in response to deteriorating source quality or in reaction to a threat to source security, systems from time to time may be required to install treatment or disinfection equipment, or to upgrade existing treatment.

Some key responsibilities of water suppliers include: ensuring they provide potable water, have a permit to operate, monitor and conduct assessments of the system and have Emergency Response and Contingency Plans.

Water suppliers must have a permit to operate the water supply system. Also, any time they are constructing a new system, or upgrading an existing system, they must apply for and acquire a construction permit. Large systems as well as systems with advanced treatment requirements or having complex distribution designs must be designated a classification as to the level of complexity by the Environmental Operators Certification Program. Moreover, operating staff for these systems also must be trained to the appropriate level that matches the classification of complexity. Of note, the requirements under the *DWPA* and DWPR are different for small water supply systems, and in some cases, these smaller systems may even have relief from application of certain sections of the legislation.

Water suppliers are required to monitor their water supply systems. Expected activities include evaluation of water quality, water quantity and operational processes such as chlorine residuals or filtration efficiency. Annually, the system operator is required to provide an annual report to the respective users, summarizing the water quality over the previous year and any other information as required by their DWO. Suppliers are responsible to notify both Island Health and the system users of any threats to the water supply system or to water quality.

Water suppliers are required to have Emergency Response and Contingency Plans in place to deal with situations such as a loss of, or contamination of the water source, line breaks or other threat to the system. They are also responsible to do any prescribed assessments of their system, as determined by their DWO.

5 Number of Water Supply Systems

A water connection can be to a house, business, mall, school, trailer park or any other similar branch off a main distribution system. Based on the number of connections served, water supply systems are divided into large and small categories. The smallest systems are single connections serving the public such as a restaurant served by its own well or surface water intake. Systems serving two to 14 connections form the next grouping and can include, for example, subdivisions, strata developments, mobile home parks and serviced campgrounds. Water supply systems serving 15 to 300 connections could be a larger subdivision or a small community. These systems can be owned and operated privately or by a company, utility or local government (for more information on the types of ownership, see Section VII - Governance). Systems over 300 connections have further divisions in size, as shown in Table 1 below. Of significance, a property owner is responsible for their water quality 'beyond the curb' – once the line is on private property; for larger land parcels and/or with extensive distribution lines meeting this expectation can require ongoing maintenance and upkeep.

Those systems currently recorded as 'undefined' may have records that are not up to date, or have not been recently reviewed. Ensuring that all water supply systems are properly described in files should be a priority at all times. Table 1 below shows the number of water supply systems by number of connections, and by source in Island Health.

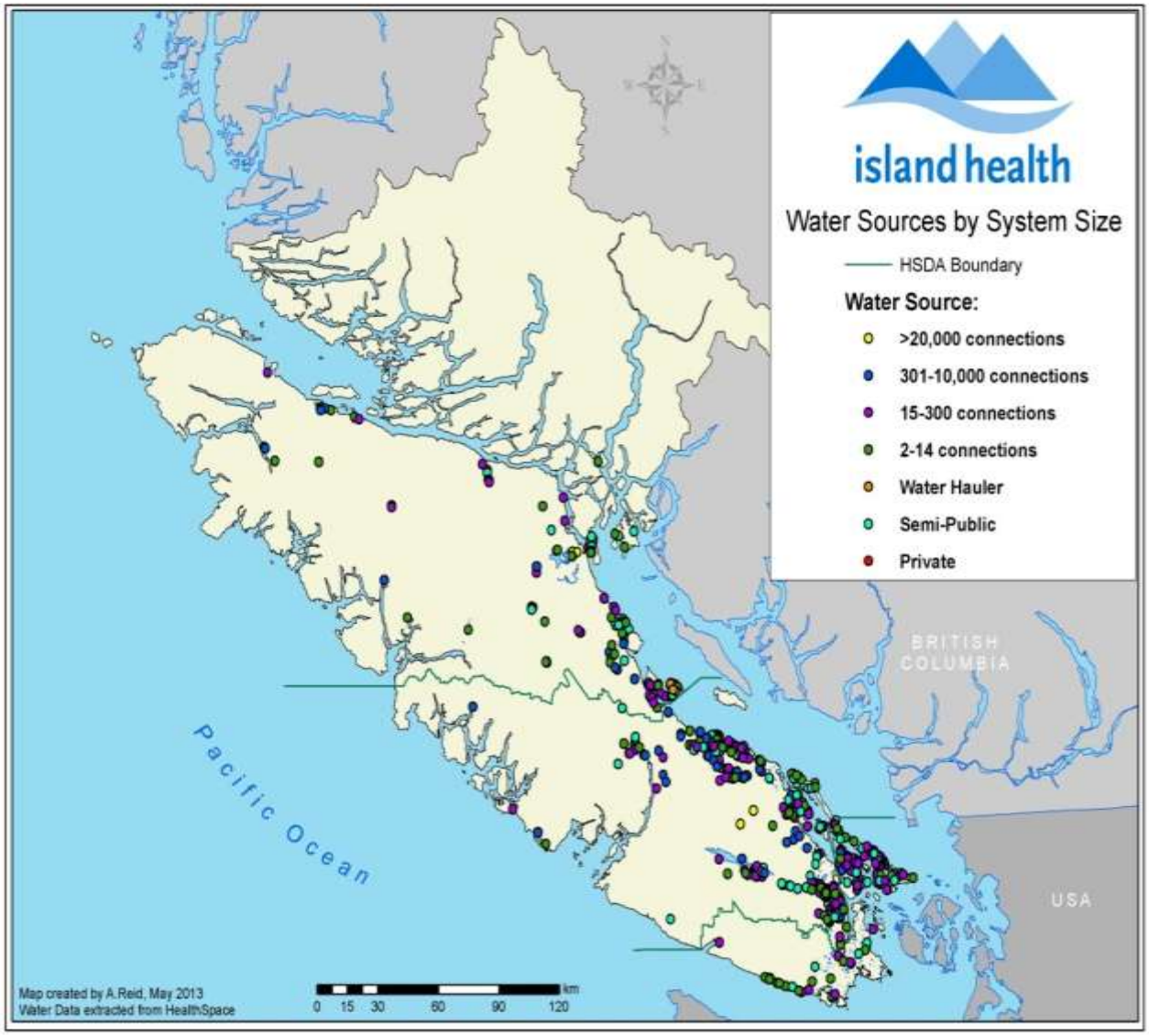
Table 1: Sources of Water by Water Supply System Size, Island Health

Number of Connections	Ground Water	Surface Water	Both Surface and Ground Water Sources	Currently Undefined in Island Health Records
1	217	17	3	15
2 – 14	249	50	6	76
15 – 300	155	42	5	3
301 – 10,000	21	26	7	1
10, 001 – 20, 000	0	1	0	0
>20,000	0	4	0	0
Number of Systems	642	140	21	95

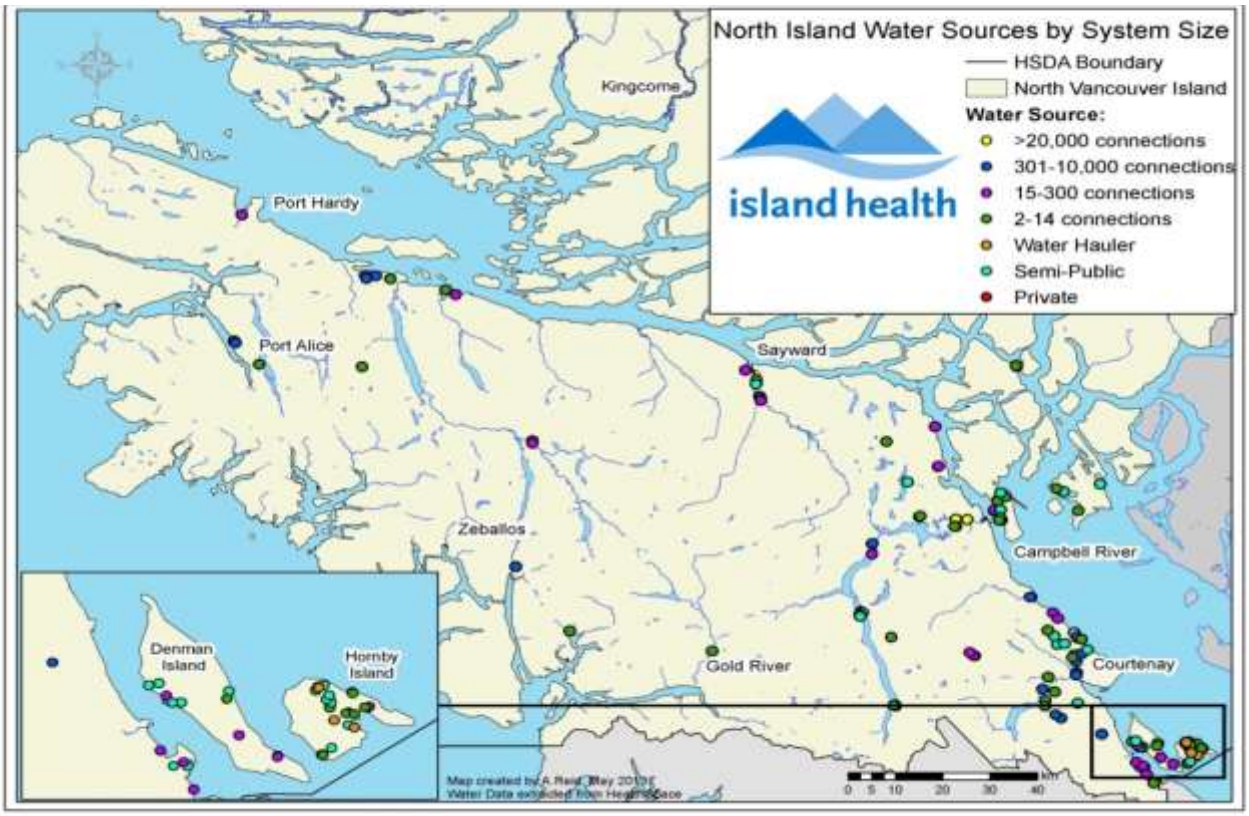
Note: Island Health data as presented in this report provides a snapshot from when the database was accessed. The information changes over time as more information becomes available, as water supply systems open, close or make upgrades. Some gaps and errors have been identified. This data helps to illustrate program achievements and identify focus areas. Island Health continues to verify and update information in the database as well as to obtain missing information.

Maps 2 to 5 provide a visual overview of the number of water supply systems of various sizes and their distribution within Island Health. In more densely populated areas, it follows that the systems may be larger and/or may be more numerous. These more urbanized systems have certain advantages, such as being closer to laboratory services, trades people and equipment suppliers as well as being more financially viable arising from having a larger number of users to fund the system. Maps 2 to 5 can be viewed in more detail on the Island Health website at: http://www.viha.ca/mho/water/.

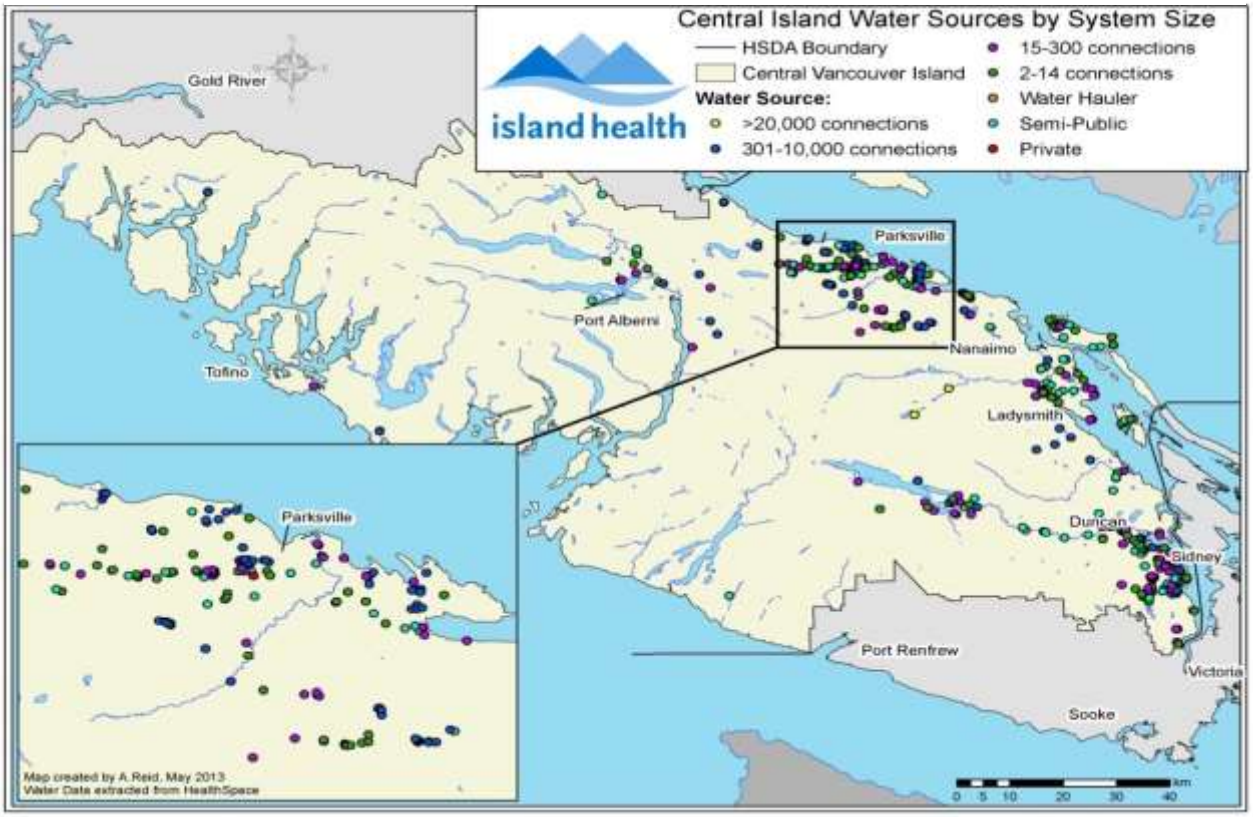
Map 2: Water Source Location by Water Supply System Size, Island Health



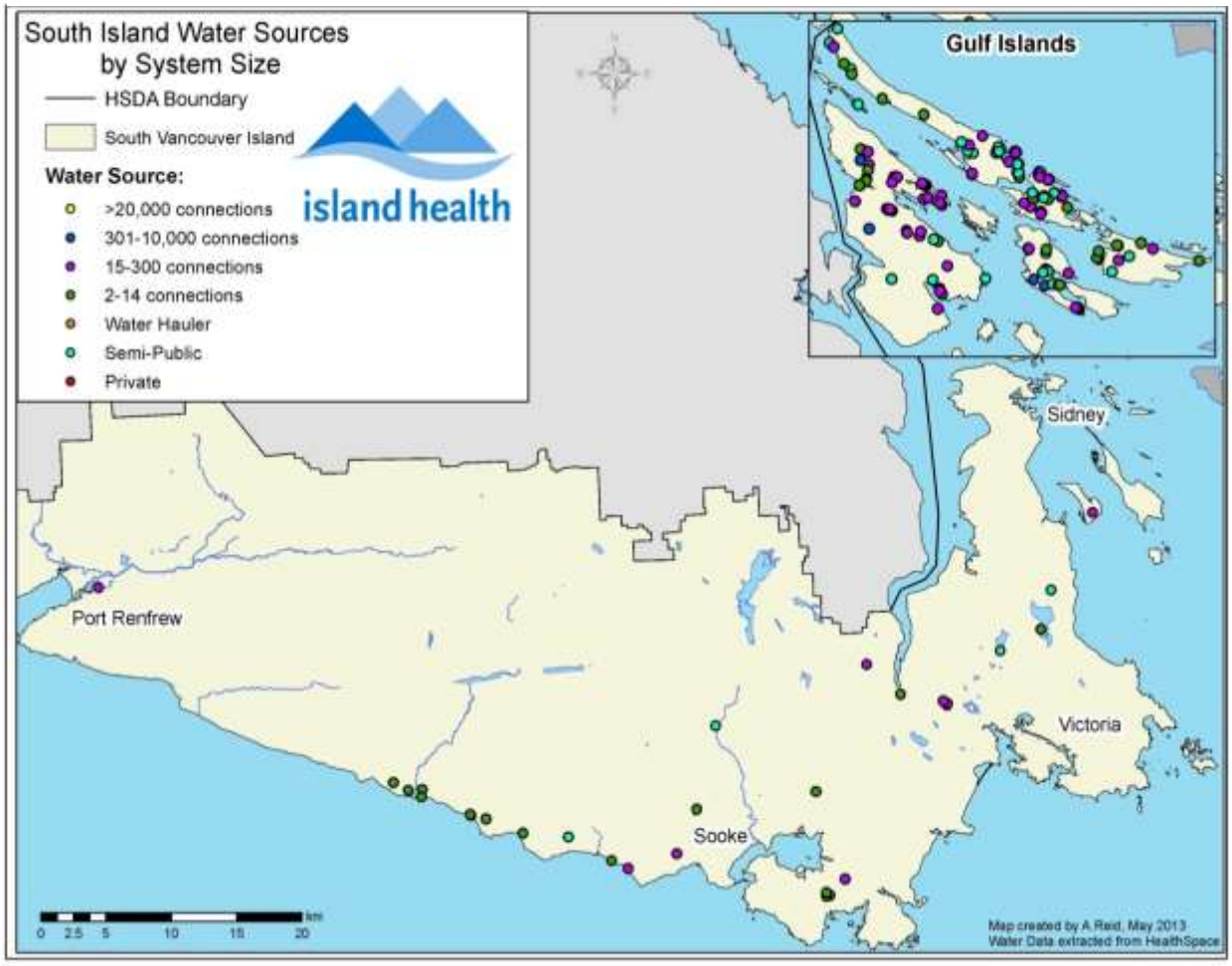
Map 3: Water Source Location by Water Supply System Size, North Island



Map 4: Water Source Location by Water Supply System Size, Central Island



Map 5: Water Source Location by Water Supply System Size, South Island



Recommendation:

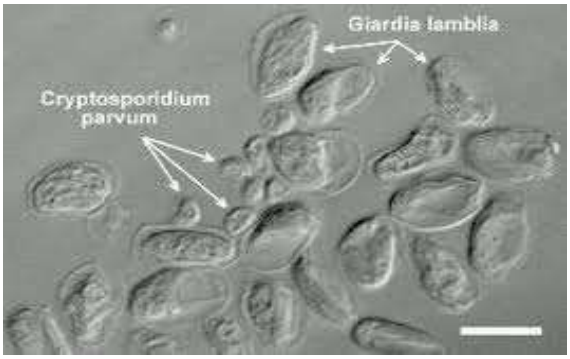
I – 1 *Health Protection and Environmental Services ensure that water supply systems currently undefined regarding source type in Island Health records be appropriately classified by December 2014.*

SECTION II – HEALTH IMPACTS ASSOCIATED WITH DRINKING WATER

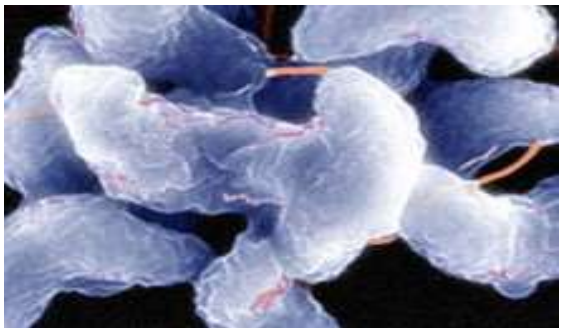
In the past, drinking water has been known to be responsible for major outbreaks of illnesses like cholera and typhoid fever. Over time and with the recognition of safe drinking water being essential to public health, the provision of quality drinking water has become a public expectation when turning on any tap. Yet, major waterborne outbreaks have continued to occur and receive wide media attention. In the Canadian context, the tragic Walkerton outbreak served to demonstrate the consequences of incompetent drinking water oversight. The associated morbidity and deaths prompted considerable attention and led to improvements in the supplying of drinking water nationally. Nevertheless, in the years between 1980 and 2000, there were at least 29 documented waterborne outbreaks in British Columbia, the largest of which affected over 10,000 people in Kelowna in 1996.[8]

Drinking water improvements are often measured by changes in infection rates by organisms that are more commonly associated with water supply outbreaks. However, these same organisms may also be associated with foodborne outbreaks, person to person spread in settings like day cares/schools or with travel exposures in foreign environments. Consequently, it is often difficult to attribute an infection to a specific source in the absence of a well-documented outbreak or evidence of a specific food or water source.

The most commonly associated organisms with waterborne illness are the parasites *Cryptosporidium* and *Giardia*. Of note, the parasite Toxoplasmosis was unexpectedly associated with a large waterborne outbreak of disease in the Capital Regional District (CRD) in 1995. More often associated with food than with water in causing disease, the bacteria *Campylobacter* is occasionally implicated in a water related case. The bacteria shigotoxigenic *Escherichia coli* (*E. coli*) and Salmonella may be associated with illness from drinking water, but are more likely to be associated with foodborne sources. The trends presented below reflect an improvement in addressing these organisms in both food and water as sources of infection. Not surprising, it is not possible to provide a finer partitioning of the respective source contributions.



Source: http://www.epa.gov/nerlcwww/graphics/cpt_gda.jpg



Campylobacter bacteria http://www.biocontrolsys.com/products/targets/pathogens/

Reports of enteric illnesses are known to be affected by differences in symptoms, low proportion of infected persons seeking health providers and differences in who receives medical tests. For example, people with milder illnesses tend not to seek the attention of a health care provider, children are more likely to be brought to a health care provider by care givers and people are more likely to seek care when blood is seen in feces. Estimated rates of persons seeking medical attention range from as few as 1 in 200 infections for some of the parasitic infections to 1 in 10 for more severe symptom producing bacterial infections.

[8] http://www.health.gov.bc.ca/pho/pdf/phoannual2000.pdf

Figures 1 to 5 are Health Authority rates of infection per 100,000 population presented by geographic region (South, Central and North) for the five infections over the past two decades. The rates are evened out or 'smoothed' by applying the statistical technique of a three year rolling average for the data. Despite the data being presented for all organisms for the 20 year time period, testing and reporting for some of the infections were inconsistent in the early 1990s and the data interpreted accordingly.

Shigatoxigenic E. coli bacteria http://www.biocontrolsys.com/products/targets/pathogens/

Despite producing symptoms less likely than bacteria to prompt the seeking of care, *Campylobacter* and *Giardia* are the most commonly reported infections. Shigatoxigenic *E. coli* is reported at a lesser frequency. The organisms more commonly related to waterborne illness have trended downward for much of the observed timeframe. These trends mirror findings in other jurisdictions and may be indicative of the continuous improvements being achieved in drinking water quality through better infrastructure, better management and better evidence informed regulation of water supply systems. Rates of shigatoxigenic *E. coli* and Salmonella, which are more likely to be related to food sources, have remained relatively stable over time.

Salmonella bacteria http://www.biocontrolsys.com/products/targets/pathogens/

Figure 1: Campylobacteriosis Infection: 3 Year Moving Average Rate by HSDA, Island Health (1992-2012)

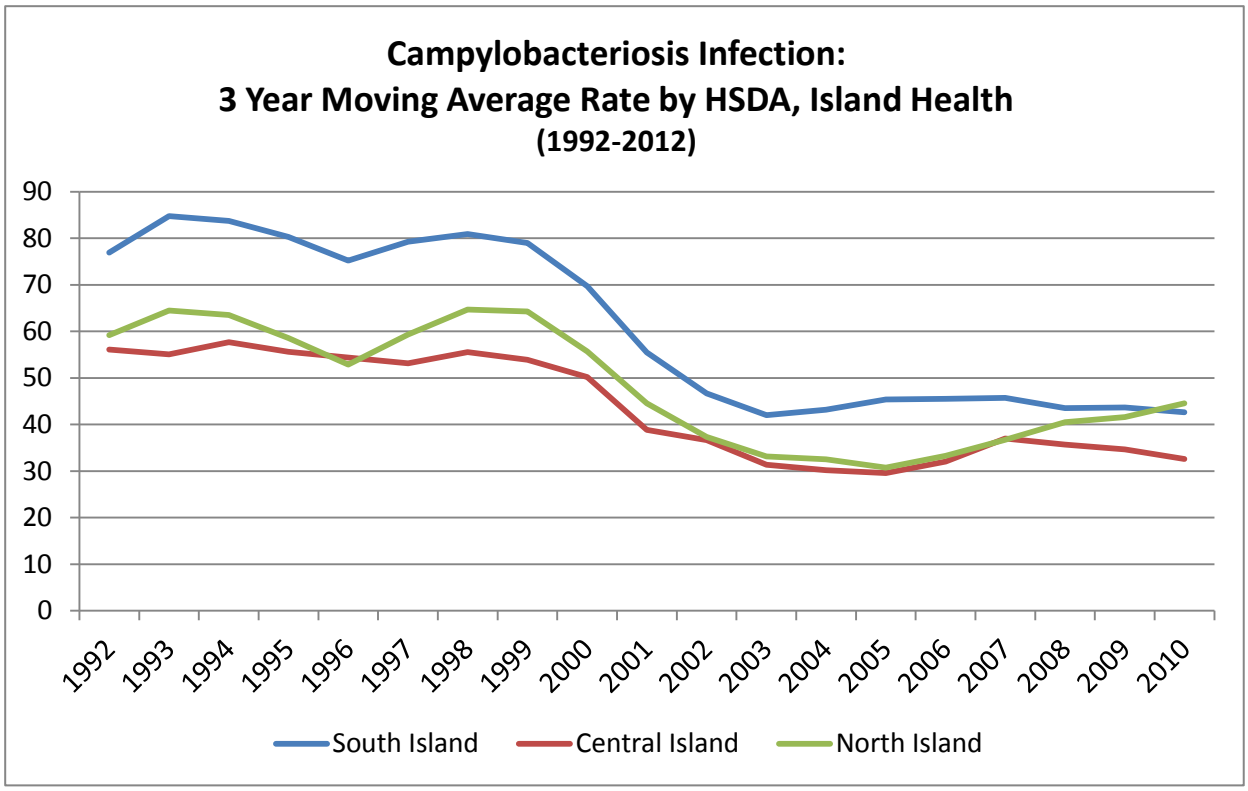


Figure 2: Giardiasis Infection: 3 Year Moving Average Rate by HSDA, Island Health (1992-2012)

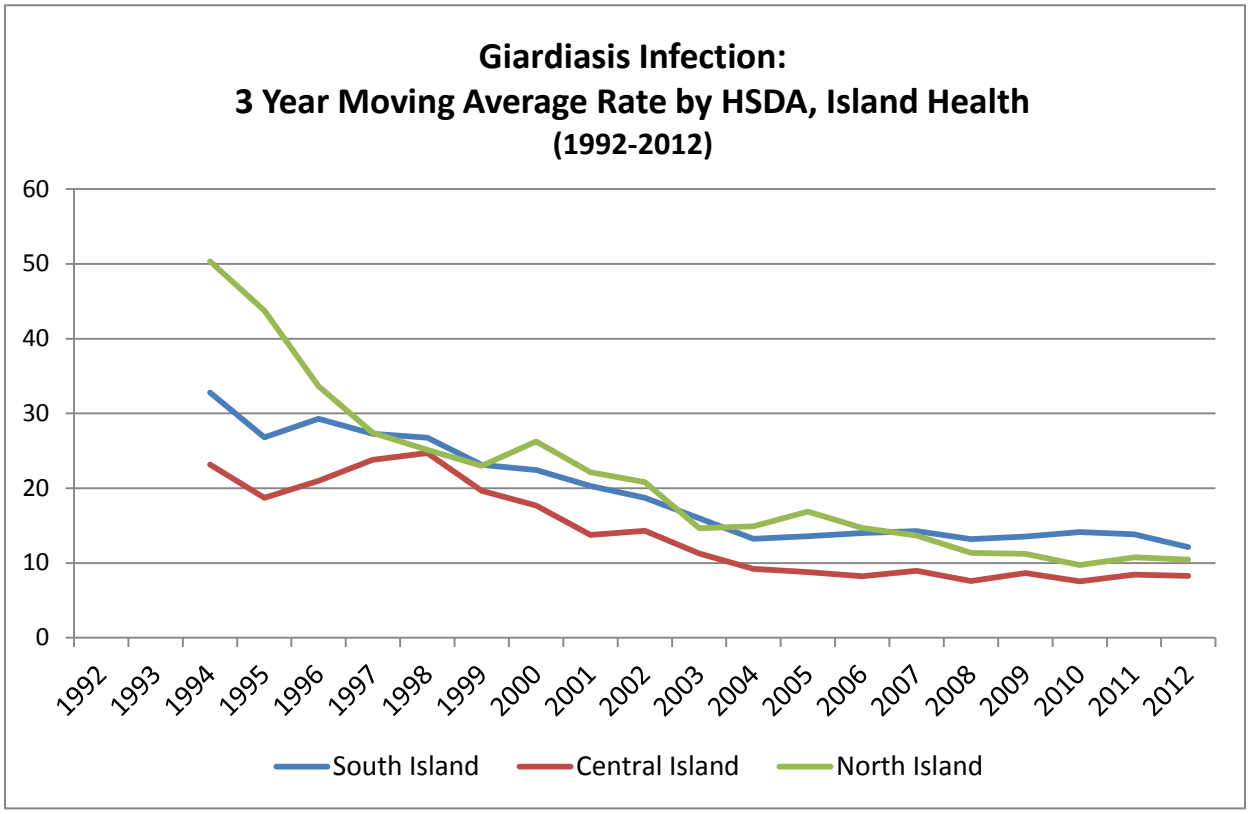


Figure 3: Salmonellosis Infection: 3 Year Moving Average Rate by HSDA, Island Health (1992-2012)

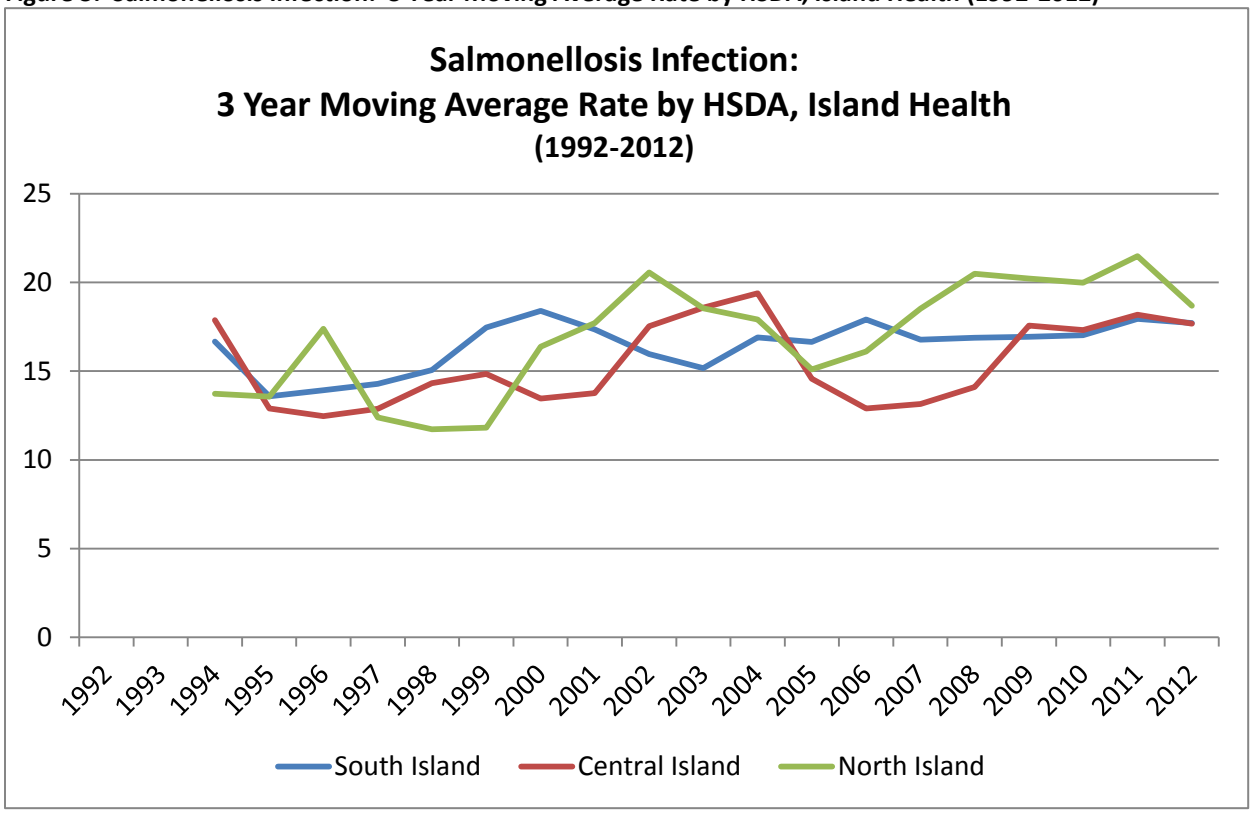


Figure 4: Shigatoxigenic *E. coli* Infection: 3 Year Moving Average Rate by HSDA, Island Health (1992-2012)

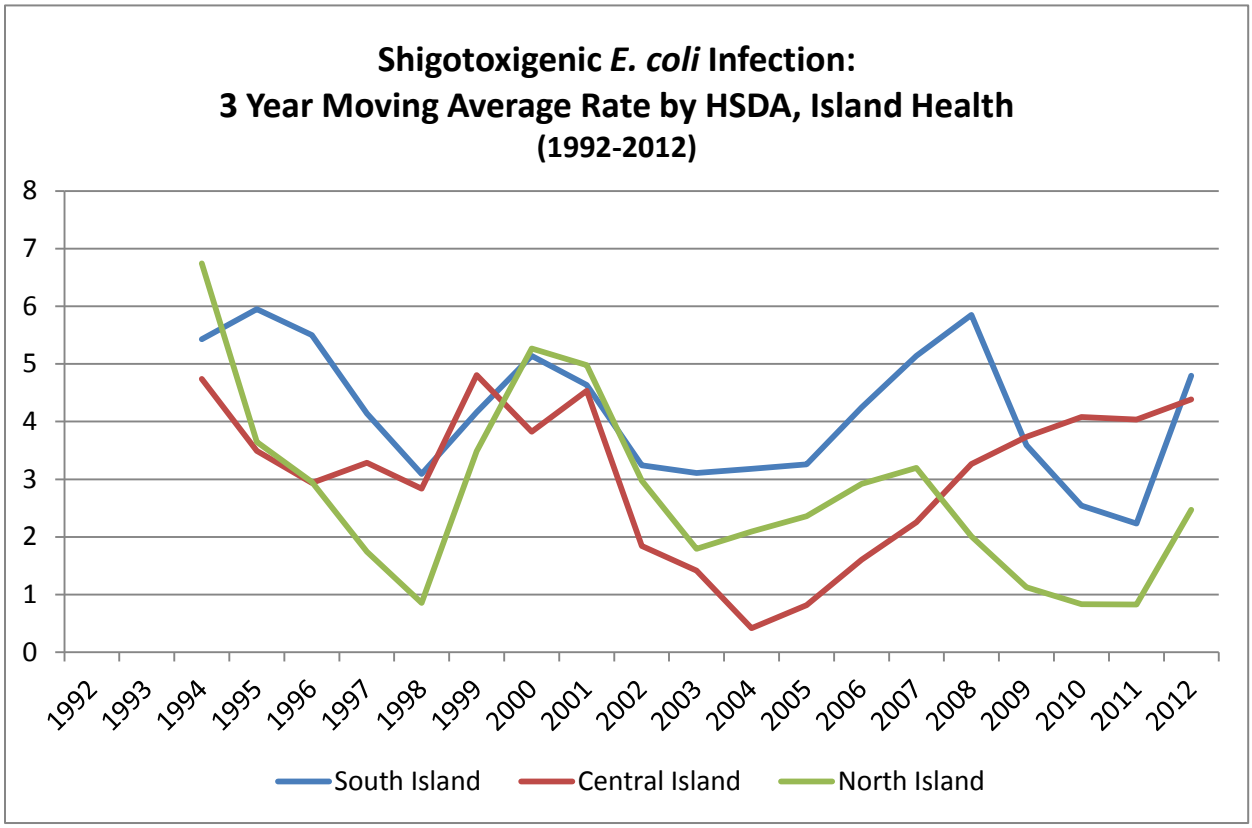
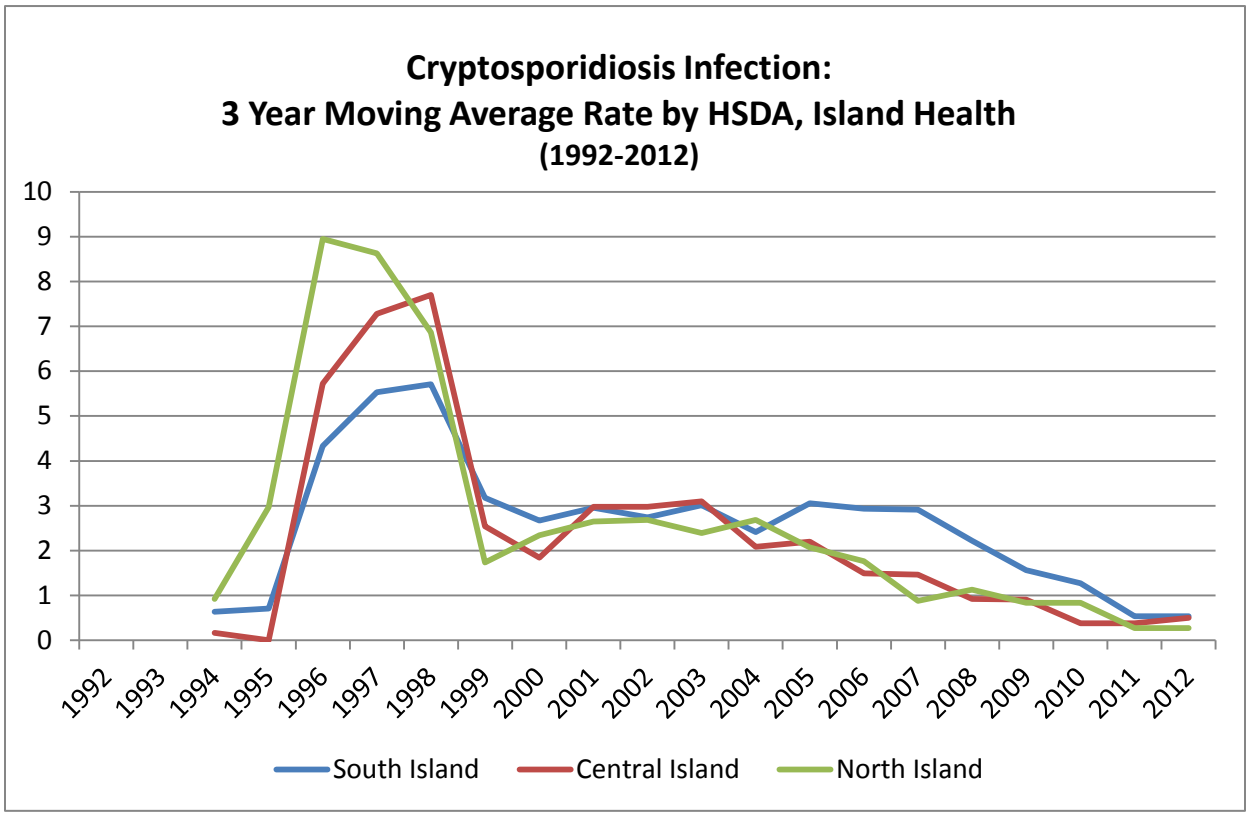


Figure 5: Cryptosporidiosis Infection: 3 Year Moving Average Rate by HSDA, Island Health (1992-2012)



SECTION III – SOURCE WATER PROTECTION

6 TYPES OF SOURCES

There are three types of sources for drinking water: surface water, ground water or combined.

Water used for drinking, cooking, hygiene, agriculture and other activities originates from surface and/or ground sources. Though all water is connected through the hydrologic cycle, it is useful to consider surface water and ground water separately when addressing issues relating to drinking water.

6.1 SURFACE WATER

Source: Island Health Staff Photo

Surface water is typically drawn from sources like lakes, streams, springs and rivers. Surface water sources are able to sustain higher water demands than ground water sources. In addition to providing drinking water, surface water and the adjacent land attracts wildlife, recreation seekers, industry and commercial and residential development; which in turn can result in the introduction of unwanted materials. The relative accessibility of these water sources makes surface bodies of water vulnerable to contamination. Surface water is subject to bacterial, viral and parasitic contamination and both organic and inorganic material becoming suspended in the water (turbidity). The same attributes that cause issues also result in surface waters lending themselves to be more easily monitored.

Surface water sources and surrounding lands are vulnerable to contamination from wildlife, recreation seekers, industry, and commercial and residential development.

In order to protect water users from exposure to hazardous pathogens present in surface water sources, our province has developed the "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in BC."[9] These objectives emphasize the importance of source protection in conjunction with appropriate treatment and disinfection (they are discussed in more detail in Section 9.1). Island Health has adopted these standards and is working with suppliers to meet surface water treatment objectives (SWTO).

6.1.1 Status of Surface Water Systems in Island Health

Within Island Health, there are 140 water supply systems that rely upon surface water sources. Of these, 43 systems serve populations greater than 500 persons per day and are therefore classified as large. All large water supply systems served by surface water within Island Health are either in compliance with SWTO or have been required to begin processes towards achieving compliance.

Currently, 10 large water supply systems are compliant with SWTO. Two of these systems have received a filtration deferral and six have installed filtration and disinfection to achieve treatment objectives. The remaining two systems purchase bulk water from a system that meets the SWTO. The remaining 33 large systems using surface water sources did not meet the SWTO as of March 2012. Of those that do not meet the SWTO, nine systems have conditions on their permits to begin the process and are on track to meet their deadlines. There are 16 systems that have work ongoing, but may not achieve

[9] http://www.health.gov.bc.ca/protect/dw_treatment-objectives.html

compliance by the dates specified on their operating permits. The remaining eight large water supply systems are not in compliance with the terms or conditions on their permits, or the SWTO. Common challenges cited to achieving compliance include securing the required financing and a lack of acceptance of upgrades by water users. Systems in non-compliance with their operating permits may be subject to progressive enforcement by Island Health.

The total number of water supply systems on the Island poses a workload challenge for DWOs. To address the capacity issues of the current size of workforce, DWOs have elected to place primary emphasis on larger water supply systems and only now are beginning to work with smaller water supply systems. Prioritization of which smaller systems to engage is based on the relative risk posed by the current disinfection or treatment technology used by the operator for that surface water source.

Source: Island Health Staff Photo

The photo above shows a typical dug ground well.

6.2 Ground Water

Ground water is found within water bearing geologic materials known as aquifers and accessed via wells. Precipitation that falls onto the well recharge zone percolates through the soil and collects in the pore spaces of the aquifer.

Aquifers are found in sand and gravel deposits, or fractured bedrock. Where the aquifer is made of loose materials such as sand and gravel, it is known as an 'unconsolidated' aquifer, while water captured within bedrock is called a 'consolidated' aquifer.

Aquifers can also be 'confined', where there are one or more overlying layers of low permeability material such as clay or compacted glacial till (known as an aquitard). The aquitard prevents or slows down the movement of water through the formation, providing protection from contamination. An 'unconfined' aquifer does not have the aquitard and the aquifer is at greater likelihood of being influenced by surface activities. Often 'unconfined' aquifers are also at shallow depths, further increasing their vulnerability to contamination from surface influences. This water is often 'newer' as the 'unconfined' aquifer is more readily recharged than with 'confined' aquifers where the water may have collected hundreds or thousands of years ago.

Ground water sources change over time and require ongoing microbiological, physical and chemical testing.

Each aquifer varies in its productivity and the degree to which it is protected against surface contamination. Included in the equation is the demand placed upon it as aquifers can be drawn down more quickly than they are recharged; overuse of an aquifer may result in a reduction of available drinking water supply. Other considerations include the amount of dissolved minerals in ground water sources to the point where aesthetic issues prompt an ongoing treatment regimen to mitigate matters. Ground water sources are dynamic and can change over time, underscoring the need for ongoing microbiological, physical and chemical testing in addition to effective resource management.

On Vancouver Island, there are 642 water supply systems served by ground water sources. Proper well construction is critical to ensure safe ground water supply. The BC Ground Water Protection Regulation outlines well requirements, which include: height (above flood level), use of proper sealant, secure and vermin-proof caps/covers, maintenance schedules and location/sighting of well. Drilled wells of greater depth (over 50 feet (15 meters)) tend to be more secure than dug or shallow drilled wells.

Shallow wells are those less than 15 meters (50 feet) in depth. Often they are dug rather than drilled, have a diameter of three feet or more and are located in sand and gravel aquifers. Deep wells are generally drilled, have a diameter of 4 to 20 inches and can be in excess of 300 meters (1000 feet) deep. A deep well does not determine the type of aquifer sourced, and depending on the geological materials present, the water quality may vary significantly.

6.3 Combined

Water supply systems can draw from multiple sources and be served by both ground and surface water supplies. Combined water systems have the flexibility of switching sources seasonally or in response to operational needs. On Vancouver Island, 20 or so systems rely upon a combination of ground and surface water.

The City of Parksville uses both ground water as well as surface water drawn from the Englishman River. The photo on the right shows the area of the surface intake.

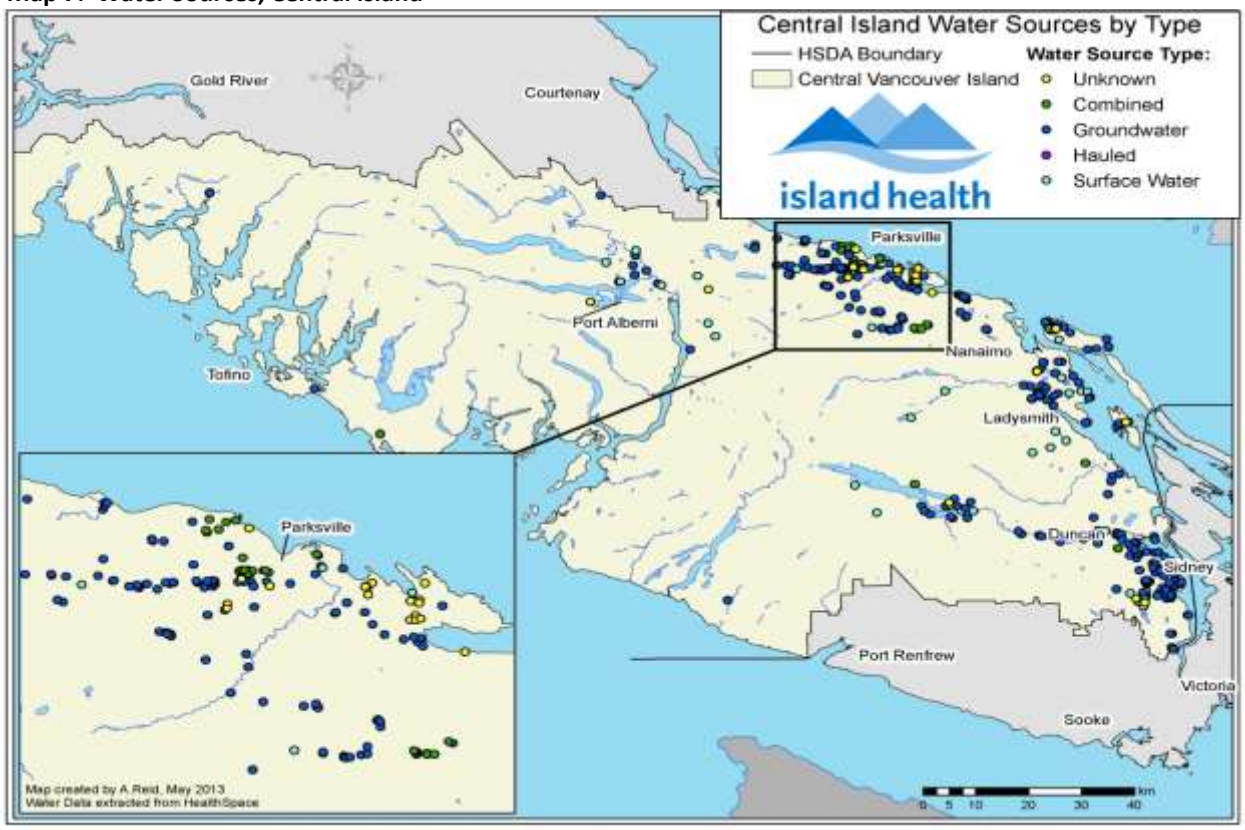
Source: Island Health Staff Photo

7 Maps

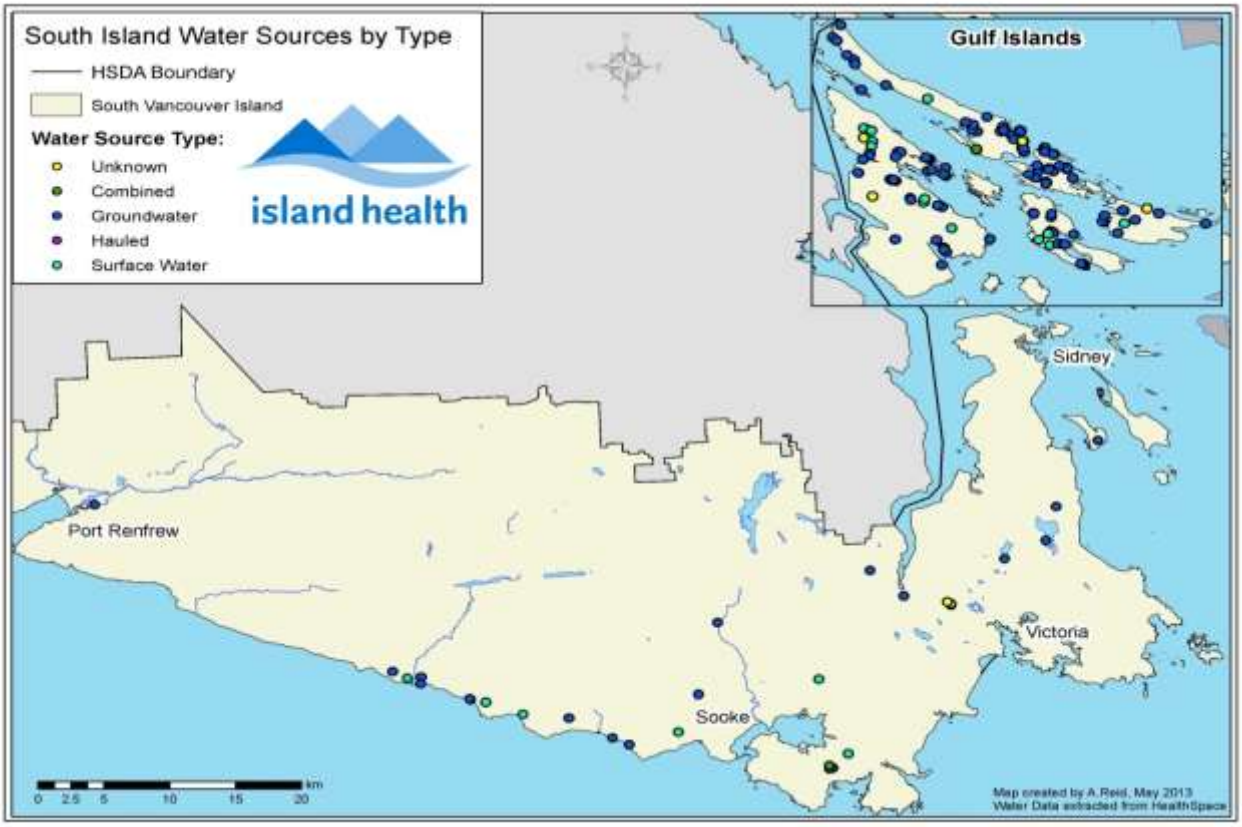
Maps 6 to 8 provide an overview of the types of water sources accessed within Island Health and their distribution. In general, there are a higher proportion of water supply systems relying upon surface water sources as size of population served increases. Small systems are more likely to be served by ground water sources. Maps 6 to 8 can be viewed in greater detail on the Island Health website at: http://www.viha.ca/mho/water/.

Map 6: Water Sources, North Island

Map 7: Water Sources, Central Island



Map 8: Water Sources, South Island



8 Source Protection Assessment and Plans

Effective source protection is the first barrier that can minimize risk of water contamination. The process includes identification of potential threats to the water source and the development of strategies to avoid and, where possible, mitigate problems. Once the assessment has been completed, a Source Protection Plan is prepared to address the issues of concern identified in the evaluation. To ensure protection of water sources, sustainable principles must be followed, integrated resource management practiced and the ongoing prioritization and updating of the Source Protection Assessment and Plans maintained. If necessary, DWOs can request or order water suppliers to prepare assessments for their water supply systems.

Source: Island Health Staff Photo

The photo above shows the view of upper Campbell Lake from an unauthorized campsite. No provisions were made for proper disposal of sewage, which posed a threat to the water source.

Island Health presently does not have the ability to track source assessments in the Health Space database. Work is ongoing to update the database to include a method to track source assessments and the number of operating permits that have terms and conditions relating to source assessments.

Source protection is a dynamic process that requires ongoing commitment to achieve desired results.

In 2012, Island Health had 61 water supply systems serving greater than 300 connections. Of those systems, at least 16 have completed some or all sections of a Comprehensive Source Assessment. During a pilot project with the Ministry of Health (MOH), "Drinking Water Inventory and Mapping Project" Source to Tap Screening Tools[10] were mailed to small system water operators. Island Health received 360 assessments back for systems serving less than 300 connections.

Presently 45 water supply systems have terms and conditions on their operating permits requiring either Wellhead or Source Protection Plans to be completed. Preparing the plans for these existing systems will require some level of assessment. When new water supply systems are established, the DWO performs a site assessment during the approval of the source stage. This consists of looking for existing and potential sources of contamination that might impact the future water source. Based on this survey, the DWO will then formally request an assessment of the intended operator and this ultimately should lead to a Source Protection Plan for the proposed system.

BC MOH and Ministry of Environment (MOE) have prepared a number of assessment tools that can be used to "identify, inventory and assess" what activities and conditions may affect the source water, the treatment(s) necessary for safe water and for appropriate operation of the system, the monitoring required to maintain quality and any potential threats to the system.

[10] http://www.health.gov.bc.ca/protect/dwpublications.html

These tools include:

- The "Source to Tap Screening Tool" – suitable for a quick scan of the constituents comprising the water supply system. This tool identifies the issues but does not discuss options to mitigate the issues.
- The "Water System Assessment" – designed to be conducted by a small system operator. This is a mid-range tool between the aforementioned screening tool and a comprehensive assessment. This process will allow operators to develop action plans to deal with identified issues.
- The "Comprehensive Drinking Water Source to Tap Assessment" – a very thorough process to identify issues and hazards and develop mitigation plans, suitable for large systems.
- The "Well Protection Toolkit" – consists of a series of booklets that help guide water suppliers on how to prepare, develop, implement, evaluate and update a Source Protection Plan. The logical stepwise process has helped many system operators in their protection programs.

All of these assessment tools can be accessed from the MOH website at: http://www.health.gov.bc.ca/protect/dwpublications.html.

The photo on the left shows an area around the Arrowsmith Dam on the Englishman River where logging has taken place immediately above the reservoir. Removal of vegetation and steep slopes can contribute to increased erosion and sedimentation of the reservoir, resulting in diminished water quality. The Englishman River provides water to Parksville, and during the summer months, the Nanoose Peninsula.

Source: Island Health Staff Photo

8.1 Wellhead/Watershed Protection – What Plans Might Look Like

8.1.1 Examples of Watershed Plans Already in Place

Source: Island Health Staff Photo

A Watershed Protection Plan is specific to a water source, nearby activities and the resources of the respective water supply system. The process aims to identify contaminants or activities that may impact the water source within a given time. Next, a plan is developed to mitigate the consequences and reduce the hazard to the users. While all systems using surface water sources would benefit from having a Watershed Protection Plan, it can be a very demanding and expensive process to formulate, especially for a minimally funded smaller water supply system with development pressures, related recreation seeking and industrial activity in the watershed.

Information on watershed basics can be found at: https://www.crd.bc.ca/education/in-your-community/watersheds/watershed-basics.

Below are three areas that use a surface water supply, which have Watershed Protection Plans in place.

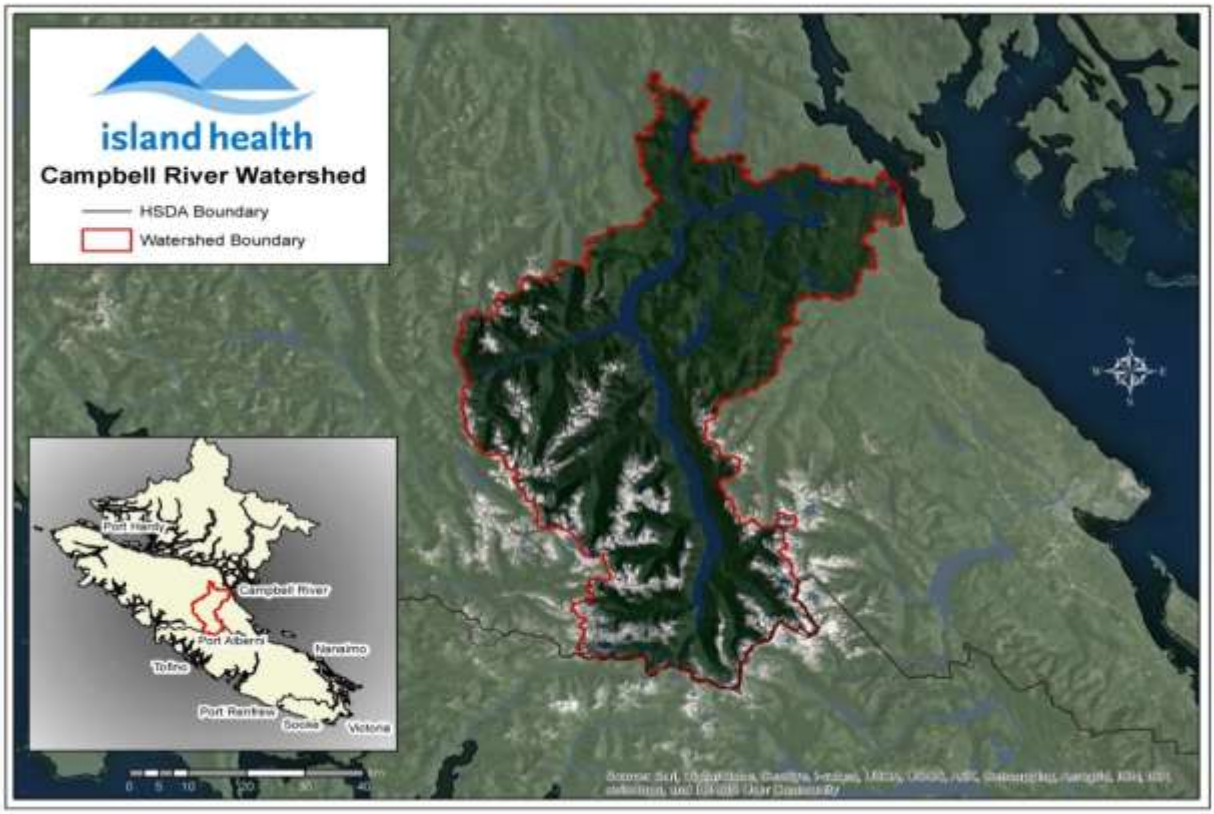
8.1.1.1 Campbell River

The Campbell River Watershed is 1755 km^2 in size, covering an area from the mountains in Strathcona Park to the outlet of the Campbell River. The fresh water intake for the City of Campbell River is located at the outlet of John Hart Lake, which is the end of the dammed portion of the Campbell River. Map 9 below shows the Campbell River Watershed and can be viewed on the Island Health website at: http://www.viha.ca/NR/rdonlyres/F8992131-B19C-4D83-8516-09B2CBE03B05/0/Map9_CRWatershed.pdf.

In 2001 the City of Campbell River created a Watershed Management Plan that quantified risk and identified remediation measures. As most of the watershed is beyond the boundaries of the city, they are unable to provide the same level of protection as watersheds that are completely controlled.

Campbell River's watershed is open to the public and used for fishing, hiking, boating and camping as well as hydroelectricity production. In 2004 a Technical Watershed Committee was formed to identify issues, develop best management practices for activities occurring in the watershed and make recommendations for protecting the watershed. One specific step was instituting voluntary procedures to address public access issues, such as packing out waste and not introducing detergents, fuels or other products into the watershed.

Map 9: Campbell River Watershed



More information on Campbell River Watershed Protection can be found at: http://www.campbellriver.ca/CityHall/Departments/Utilities/Water/Pages/WatershedProtection.aspx.

8.1.1.2 Capital Regional District (CRD)

Water for the City of Victoria and surrounding communities is supplied by the CRD. They have an "Integrated Watershed Management Program" that works with municipalities, the community, environmental groups and various levels of government through a collaborative approach to maintain healthy watersheds. Specific actions include watercourse quality, providing regulatory tools, restoring habitat, educating the public on water conservation and promoting voluntary best management practices by all partners in the system. All of these activities directly contribute to the overall health of the watershed and the quality of water in the water supply system for the CRD.

CRD purchased the lands in and around the watershed to ensure the ongoing protection of their drinking water source. The watershed has restricted public access to reduce potential human impact on the drinking water source. Victoria currently is in compliance with the SWTO by providing two methods of treatment and meeting the criteria for deferring the need for filtration. Future circumstances may warrant the addition of filtration.

More information on watershed protection in the CRD can be found at:
https://www.crd.bc.ca/service/drinking-water/watershed-protection.

8.1.1.3 Comox Lake

Comox Lake is the drinking water source for the Comox Valley. It also is used for recreation by boaters, swimmers and fishermen. The land surrounding the lake is used by hikers, campers, all-terrain vehicles and a multitude of other user groups. Timber is harvested in the watershed and the outlet is used for hydroelectricity generation. This has led to concerns about management of the watershed. User groups, Island Health and the water supplier have requested the lake be designated under the *DWPA* for development of a Drinking Water Protection Plan. Rather than obtaining such designation, Ministry of Health, the water supplier and community stakeholders have voluntarily engaged in work to ensure the watershed is better protected. The Comox Valley Regional District is in the process of complying with the SWTO with an expected completion date of December 31, 2017.

8.1.2 Examples of Wellhead Protection Plans

These photos are examples of the signage Gold River has posted to educate their residents and visitors about protecting their drinking water source. The wells supplying the district are located in a recreation area.

Source: Island Health Staff Photos

8.1.2.1 Municipality of North Cowichan and the City of Duncan

The Municipality of North Cowichan and the City of Duncan commissioned a Well Protection Plan for the Lower Cowichan River aquifer and the Chemainus River aquifer to investigate and recommend measures to protect the drinking water wells and industrial wells.[11] They followed the process outlined in the Well Protection Toolkit. Steps included identifying the area of concern, the sources of potential contamination, management options and contingency plans. The potential contaminants were identified and unforeseen event plans developed to mitigate risks to users should contamination occur.

8.1.2.2 Sample Plan Templates

Island Health has developed two source protection templates for use by water supply systems. The first is suitable for very small systems with limited resources. The second is suitable for medium-sized systems and is based on the Well Protection Tool Kit documents. For copies of these templates, please contact your local DWO or Island Health.

Recommendations:

III – 2 *Health Protection and Environmental Services document in Island Health records wellhead/watershed protection status for all water supply systems over 15 connections by December 2014.*

III – 3 *All water supply systems with greater than 300 connections have "completion of wellhead/watershed assessment" included as a condition on operating permits by March 2016.*

III – 4 *Further, that all assessments should be completed and documented before March 2018.*

III – 5 *The need for a Watershed Protection Plan should be included on the conditions of an operating permit for water supply systems with greater than 300 connections where significant threats to the watershed are identified, with such planning completed by March 2019.*

III – 6 *Island Health ensure that short form wellhead/watershed assessments should be documented and completed on water supply systems of 15 to 300 connections by March 2019. Determination of when to complete smaller water supply system assessments should be undertaken by March 2019.*

III – 7 *Health Space database be modified to be able to track conditions on an operating permit relative to source water protection, and identify status of wellhead/watershed assessments and Wellhead/Watershed Protection Plans.*

III – 8 *Island Health develop a course eligible for Continuing Education Units under Environmental Operators Certification Program on source water protection. The thematic offering will focus upon developing a plan specific to the water supply systems of the participating operators. The target audience will be small water supply system operators and suppliers.*

[11] http://www.northcowichan.ca/assets/Departments/Waste~Water~Management/docs/WellProtectionPlan.pdf

SECTION IV – TREATMENT

Based on inspection findings, water test results and evolving quality standards, water supply systems may need to install or upgrade disinfection and treatment methods to ensure ongoing water user protection.

The selection and installation of treatment technology requires:

1. A solid understanding of the benefits and limitations of available treatment technologies.
2. Chemical and bacteriological analysis to assess treatment needs, identify source water quality limitations and determine pre-treatment requirements.
3. Input from knowledgeable water treatment specialists.
4. Determination of initial and ongoing costs and maintenance requirements (and adequate financial planning to manage these costs).
5. Construction permit or waiver from the Public Health Engineer.

Source: Island Health Staff Photo

The photo above is an example of a typical Point of Entry treatment system for a small water supply system. It includes filtration and Ultraviolet disinfection.

Source: Island Health Staff Photo

Two common forms of disinfection and a brief overview of filtration are presented in Table 2. All treatment equipment on water supply systems must meet standards acceptable to the DWO. Point of Entry/Point of Use equipment may be acceptable under certain circumstances. Any water supplier considering Point of Entry/Point of Use equipment should consult with their DWO.

The photo on the left is of a large water supply system Ultraviolet disinfection reaction chamber. The City of Campbell River installed this as their second method of treatment in addition to the existing chlorination process.

Table 2: Basic Overview of Two Common Disinfection Technologies and Introduction to Filtration

	How it Works	Source Requirements	Limitations	Advantages
Ultraviolet (UV) Disinfection [1] *(Protozoa, bacteria and to a lesser degree viruses)*	UV radiation hits micro-organisms so that they are unable to reproduce.	• High UV Transmittance. • Low iron and manganese. • Low turbidity, colour, natural organic matter, suspended solids, calcium hardness, tannins, hydrogen sulphide.	• Water quality may deteriorate in distribution system.	• No disinfection by-products. • No chemicals are added to the water, alarms when source water unacceptable, lamp is fouled etc. • No contact time is required post-UV disinfection.
Chlorination [2] *(Viruses and bacteria)*	Chlorine kills micro-organisms through direct contact.	• Neutral to slightly basic pH. • Low turbidity, temperature, organics, ammonia, particulates, iron and manganese.	• Requires storage to achieve required contact time. • Taste and odour concerns may arise. • Some source waters may have by-product formation.	• Provides disinfectant residual for lasting protection. • Concentration can be monitored in the distribution system.
Filtration [3] (potentially for protozoa, bacteria, particulate matter, and natural organic matter – *depending on type of filtration)*	Combination of physical, chemical and biological processes to remove particles through straining and adhesion.	• Low turbidity and bacterial counts (*or effective pre-treatment).* • Seasonal consistency in source water quality *(or effective pre-treatment).*	Depending on type selected: • More Expensive initial capital cost. • May be higher operating requirements.	• Reliable and effective. • Chemicals added to the water are removed during processing.

[1] UV disinfection equipment must meet specific requirements.
[2] Different chemical species of chlorine are used in drinking water disinfection. Each has its own advantages and limitations.
[3] There are numerous types of filtration systems. The systems differ in ability to remove various physical, microbiological and chemical contaminants, limitations, pre-treatment requirements and operating needs.

9 TREATMENT OBJECTIVES

Treatment objectives outline the minimum expectations for treating water sources in BC to ensure safe drinking water. They are of value to a variety of groups including regulators, water suppliers, local government and the discerning water consuming public.

9.1 SURFACE WATER

For surface water sources, the MOH has developed the "Drinking Water Treatment Objectives (microbiological) for Surface Water Supplies in British Columbia." This document outlines and consolidates the approaches the Health Authorities have used over the years to ensure safe drinking water. Risk reduction is generally accomplished through use of the multi-barrier approach, which combines treatment and disinfection requirements with source water protection measures.

Source: Island Health Staff Photo

The photo above shows the view from above Buttle Lake, the furthest lake in the Campbell River Watershed. The lakes were formed by dams installed for hydroelectric power generation.

The objectives specify a four-log reduction of the protozoa *Giardia* and *Cryptosporidium* (microscopic parasites), a three-log reduction in viruses, two approved forms of treatment/disinfection, less than 1 Nephelometric Turbidity Unit (NTU) turbidity in finished water and no *E. coli* or fecal coliform bacteria in the water. Water systems that access pristine watersheds with high quality raw water, and provide ongoing monitoring and protection for their drinking water source may be permitted to use two approved forms of disinfection, generally UV disinfection and chlorination. Other water supply systems accessing surface water require filtration and then some form of disinfection.

The "Drinking Water Treatment Objectives (microbiological) for Surface Water Supplies in British Columbia" can be found at: http://www.health.gov.bc.ca/protect/dw_treatment-objectives.html.

9.2 SUCCESSES IN ADDRESSING THE SURFACE WATER TREATMENT OBJECTIVES

In some cases of water supply systems with unique challenges and for very small systems generally, it may be cost prohibitive to install and maintain treatment and disinfection that meet the SWTO. Aside from the initial costs, additional skills and expertise are likely to be required to oversee operation of the disinfection and treatment equipment of varying complexity. This usually means that additional staffing costs must be budgeted for these systems to achieve desired quality.

Sometimes, the development and approval of an alternate ground water source to augment or even replace the surface water supply may be an appropriate remedy. In the case of Shawnigan Lake School, the operator found it less expensive to access local ground water than upgrade existing disinfection of the surface water supply to achieve compliance with SWTO. The school now has a drilled well, which serves all of the school's potable water needs. Chlorination of the well water provides assurance of water safety and prevents degradation of water quality within the distribution system for the school.

9.3 Ground Water

Ground water is more secure against microbial contamination than surface water. Recent work suggests that there may be risk associated with the consumption of untreated ground water.

The Enteric Virus Technical document of the *Canadian Guidelines for Drinking Water Quality* shows that ground water may be contaminated with viruses, even though routine indicator organisms such as total coliforms and *E. coli* may not be present in water sampled directly from a well (source water).[12] The guidelines recommend using the multi-barrier approach to reduce enteric viruses, including identifying source water risks as well as employing effective treatment barriers.

Source: Island Health Staff Photo

The photo above shows a typical modern ground water well installation, with a secure cap.

The BC DWPR Section 5(2) requires "ground water that, in the opinion of a Drinking Water Officer is at risk of containing pathogens" to be disinfected. In April 2012, MOH released a document called *Guidance Document for Determining Ground Water at Risk of Containing Pathogens* (GARP) including *Ground Water under Direct Influence of Surface Water* (GWUDI).[13] The purpose of this document is to assist water suppliers and regulators in identifying sources that would be categorized as being at risk, and therefore would need to be disinfected.

Early in 2011 MOH, in conjunction with the BC Health Authorities, started a process to develop Ground Water Treatment Objectives, similar to those for surface water. During that process, the GARP/GWUDI document was revised to ensure consistency between the two documents. Stake holder review is underway and it is hoped the documents will be released some time in 2014.

Source: Island Health Staff Photo

9.4 Disinfection of a Ground Water Source Considered at Risk of Containing Pathogens – North Cowichan's Addition of Ultra Violet Treatment

The Municipality of North Cowichan has recently installed UV disinfection. Previously the system was not continuously disinfected. The Municipality does have the ability to chlorinate in case of emergencies or for routine maintenance tasks. The water is drawn from a number of wells in the Upper Cowichan aquifer, in proximity to sewerage infrastructure and may possibly be subject to influence from the Cowichan River. Addition of UV disinfection will reduce or inactivate any *Giardia* or *Cryptosporidium* cysts that may be present in this water supply.

The photo above shows the Municipality of North Cowichan's addition of primary treatment through UV disinfection to their ground water source.

[12] http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/enteric-enterovirus/enteric-enterovirus-eng.pdf accessed June 11, 2013.
[13] http://www.health.gov.bc.ca/protect/pdf/garp-gwudi-guidance.pdf accessed June 11, 2013.

9.5 Treatment Objectives Implementation

In the light of completion of both the BC SWTO and the expected BC Ground Water Treatment Objectives, the onus will rest with the Island Health Drinking Water Program for ensuring that there is consistent application of these documents, and for establishing clear time lines for engaging water supply systems in meeting the treatment objectives. It is incumbent upon Island Health to re-evaluate current program activities and realign priorities, if necessary, to achieve a timely application of the guidelines to all water supply systems.

Source: Island Health Staff Photo

The bank of membrane filtration units pictured here filters both particulate matter and microbial particles from the source water.

Recommendations:

IV – 9 *Health Protection and Environmental Services, by December 2014, review and ensure that all water supply systems with greater than 150 connections that require treatment/system upgrades have, documented conditions on operating permits with time bound deadlines for completion.*

IV – 10 *Island Health, by April 2014, ensure that the processes required to ensure water supply systems of 15 to 150 connections meet treatment expectations by 2021 are developed by Health Protection and Environmental Services.*

IV – 11 *Island Health, by March 2016, ensure that processes for ensuring appropriate treatment is implemented in water supply systems of less than 15 connections be developed and communicated by Health Protection and Environmental Services.*

IV – 12 *Annually, Island Health report on progress towards compliance with Surface Water Treatment Objectives based on population served as well as by size of the water supply system for those systems dependant on surface water or combined sources. When Ground Water Treatment Objectives are available, this report should include ground water based systems.*

SECTION V – STORAGE AND DISTRIBUTION

In order to maintain water quality, water should be stored in a fully enclosed storage vessel, with proper locking hatches to prevent unauthorized access and be circulated with a reasonable turnover rate. Stored water generally requires disinfection prior to use.

10 STORAGE

Storage of drinking water serves a number of purposes:

- Provides longer retention time for more effective chemical disinfection.
- Creates a reserve volume of water for fire protection and other emergency use.
- Smooth over fluctuations in demand using stored supply.
- Provides uniform water pressure within the system.
- Enables the well(s) (where applicable) time to recharge between pumping sessions.
- Allows for water from two or more sources to be blended. This could, for example, through mixing decrease iron levels at the tap arising from one of the sources.
- May allow for a reduction in size of distribution mains pipes.

Source: Island Health Staff Photos

The photo on the left is an example of a properly sealed and ventilated underground concrete reservoir, while the photo on the right is an example of a properly sealed and ventilated above ground reservoir.

10.1 SANITATION

Storage vessels for finished water must be fully enclosed to protect water quality. All tanks must be constructed of appropriate materials that will not impart any noxious tastes, odours or trace chemicals to the drinking water. They must be smooth and non-porous to facilitate cleaning and disinfection. Access hatches must be sealed against the entry of surface water, pests and other contaminants. Vents must be screened and downward facing. Overhanging vegetation is to be removed to reduce plant debris falling onto the tanks.

10.2 Circulation

In order to maintain water quality, it is critical that water within a storage vessel is circulated and that there is a reasonable turnover rate. Central to good operation, all water in storage should be used within a certain amount of time and replaced with fresh water. At no time should there be some water remaining in the tank indefinitely. Vessels are required to have dedicated entry and exit ports, and to improve circulation of the water, are strategically spaced separately within the storage vessel.

10.3 Safety Issues

Water supply system employees must not enter the confined space of a storage vessel without proper training and protection equipment. Unauthorized access must be averted through the use of locking hatches. Regular site visits by water supply system operators are required so that the operator can look for signs of tampering or attempts to access the vessel, and the necessary steps can be taken to mitigate the issue. Better preventive management practices include fenced and lighted vessel enclosures.

During inspections the DWO will discuss all of the above with operators and require changes as deemed necessary. DWOs generally require operators to record maintenance of storage vessels as part of their operating records; these records are then reviewed on an ongoing basis during subsequent inspections.

11 Distribution

The distribution system consists of the infrastructure that takes the water from the source or treatment plant to the consumer. This includes reservoirs where treated water is stored, and the piping, valves, fire hydrants and pumps to keep the water moving within the system. A key part of distribution system safety is an active cross-connection control program wherein sewer and water lines are NEVER linked.

Source: Island Health Staff Photo

The photo above shows a pump station and sections of the distribution system.

All design and construction of a distribution system must be done in compliance with legislation, best management practices and the terms and conditions of the construction permit. Design features incorporated in constructing a safe distribution system include preventing access by unauthorized people and wildlife, ensuring adequate capacity, providing adequate contact time for disinfection and looping of the lines to minimize or eliminate dead ends of piping, which could generate stagnant, bad tasting water.[14]

In the home, lead from water distribution lines or fixtures MAY be present in drinking water. It is a health concern especially for children. Water with a low pH and alkalinity in older homes is more at risk of containing elevated lead levels. Running the water until cold first thing in the morning will reduce lead levels significantly.

Pipe can be made of polyvinyl chloride, polyethylene, steel or ductile iron. Older systems may have asbestos concrete piping, but due to potential health concerns their use has been discontinued. Within the consumer structures supplied by the water supply system, pipes are generally either made of polyvinyl chloride or copper.

[14] http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/water-eau/tap-source-robinet/tap-source-robinet-eng.pdf pages 10 – 11 accessed July 2, 2013.

Prior to 1950 lead pipes may have been employed, and until 1990 lead solder was used to join copper pipes. Lead can enter the water in such applications; especially where there are very low water flows or the water is either warm or acidic. Lead can have health effects in people of all ages; children are especially cognitively vulnerable to the negative effects of lead ingestion.[15]

Ongoing repairs and maintenance are necessary to keep the water distribution system operating in an optimal fashion. The lines need to be flushed on a routine basis to reduce biofilm accumulation that could contribute to taste and odour issues, provide habitat for bacteria or result in sloughing of materials from pipe walls into distributed water. Reservoirs need to be cleaned routinely to remove sediments that might interfere with the ability of chlorine to disinfect the water, or that reduce the capacity of water storage. Water lines need to be repaired as they break, and if the pipes are very old, should be replaced as part of an ongoing capital upgrade program.[16]

Currently BC lacks guidance documents for water supply systems on managing storage and distribution systems. In light of water contamination arising from problems in storage and distribution in the White Rock and Chilliwack systems, planning has been proposed provincially to review the need for distribution system residual disinfection to prevent bacterial contamination. This effort will address only a portion of the issues associated with ensuring water storage and distribution system components are not the cause of human illness.

On Vancouver Island, the threat of earthquakes is very real. From global experience, earthquakes have their greatest effect on drinking water by disrupting the distribution infrastructure. All new construction in BC is required to meet moderate seismic requirements; however, most water supply systems are comprised of a variety of construction materials of varying age. With outdated infrastructure using older, less resilient construction methods, an earthquake of a magnitude bordering on severe could cause extensive damage to our water distribution systems, resulting in the loss of water to consumers, possibly for a protracted period of time. Loss of water supply system viability would present a major challenge, and potentially, bring great hardship to affected communities. The importance of personal planning for such events needs to be stressed. At a minimum, households should be proactive in storing bottled water as well as in maintaining a supply of plain unscented bleach for the emergency disinfection of drinking water. Island Health has published a guide on emergency disinfection of drinking water, which can be found at: http://www.IslandHealth.ca/mho/water/boil_water/What+to+do+During+a+Boil+Water+Notice.htm.

Such guidance also should consider the effect to infrastructure from a significant seismic event, especially where the repair of the distribution system has been identified as an impediment to community recovery. Some communities in earthquake prone areas are using flexible components for their distribution piping to mitigate damage caused by earthquakes and minimize disruption of supply.

Recommendations:

V – 13 *BC Ministry of Health be encouraged to develop planning and support materials for asset management and distribution system operation.*

V – 14 *Island Health ensure that asset management planning as well as distribution system operation and management, be incorporated into conditions on the operating permits for water supply systems greater than 300 connections by March 2016.*

[15] Health Canada, Lead and Human Health, http://www.hc-sc.gc.ca/ewh-semt/contaminants/lead-plomb/asked_questions-questions_posees-eng.php accessed July 17, 2013.
[16] https://awwoa.ab.ca/home/pdfs/SWSO_Manual.pdf accessed July 2, 2013.

SECTION VI – MONITORING

12 FREQUENCY/LOCATIONS/RESULTS

Source: BCCDC Publication

The photo on the left shows how a bacteriological sample is taken. The aerator has been removed from the faucet, and the cold water has been left to run for two minutes prior to collection of the water sample.

12.1 BACTERIOLOGICAL

Monitoring is an important component of assessing the effectiveness of the multi-barrier approach to safe drinking water. Water suppliers are required to regularly monitor for total coliform bacteria and *E. coli*. The number of samples required under the DWPR Schedule B is based on the size of the population served by the water supply system, and is shown in Table 3.[17]

Table 3: Number of Monthly Water Samples Required by Population Served

Population Served by Water Supply System	Number of Samples per Month
Less than 5000	4
5000 to 90,000	1 per 1000 of population
More than 90,000	90 plus 1 per 10,000 of population in excess of 90,000

Water test results for Island Health systems are available online at: http://www.Island Health.ca/mho/water/water_sampling_results.htm.

Test results also should be available through the water supplier and included in the water supply system's annual report.

A Public Notice may be issued if water sample tests identify a risk to consumers.

- The presence of *E. coli* in a water sample indicates that bacteria capable of causing illness may be present in the water supply system.
- The presence of total coliform bacteria may indicate a breakdown in the treatment process, the presence of surface water in a water supply system using ground water as a source or microbial growth within the distribution system.

If a risk to water users is identified, the water supplier will issue a Public Notice indicating that water should be boiled prior to use for personal purposes, such as for drinking or washing of food. Table 4 shows the number of samples positive for *E. coli* in each fiscal year out of the total number of samples taken. Samples that are positive for *E. coli* may indicate contamination of the drinking water supply system.

[17] http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/200_2003#ScheduleB

Also shown are the number of systems that submit 90% or more of their required samples in a given year. Most water samples on Vancouver Island are shipped to labs either in Victoria or Vancouver for analysis. Due to inclement weather, road conditions and ferry schedules, it may not always be possible to meet 100% of the sampling frequency within the required time frame between collection and analysis. To be a valid test, samples must be analysed at the British Columbia Centre for Disease Control lab within 30 hours of having been obtained. The CRD has its own water lab and all of the samples taken on the water supply systems operated by them are tested at their own lab.

Table 4: Water Samples Positive for *E. coli* and Number of Systems that Meet 90% of their Sampling Frequency, Island Health

Fiscal Year April to March	Samples Positive for *E. coli*/Total Number Taken	Systems Meeting 90% of Bacteriological Sampling Frequency
2009 to 2010	69/14,947 (0.46%)	192 (23%)
2010 to 2011	70/16,702 (0.42%)	222 (26.5%)
2011 to 2012	55/17,812 (0.31%)	267 (32%)

Source: Island Health Staff Photo

The photo above shows the water sample courier service to the British Columbia Centre for Disease Control.

The spring of 2012 was particularly difficult for wasted samples with 161/359 (45%) samples from the North Island not reaching the lab on time. Reasons for delay that year included extreme weather events, road closures, ferry cancellations or samples arriving at the courier warehouse late in the day after the final package handling had already been completed. Island Health and the British Columbia Centre for Disease Control have since made improvements to ensure samples are delivered to the lab within the required 30 hour time period. Arrangements have been made with the courier company so that water samples are to be given high priority. Alternate shipping may be used where the regular courier may not be able to meet this time sensitive requirement for quality testing.

12.2 Chemical

A chemical analysis is required of larger water supply systems on a regular basis. Lists of parameters that are sampled are available on request from Island Health, Health Protection and Environmental Services. Results are compared to the Maximum Acceptable Concentrations for health parameters under the *Guidelines for Canadian Drinking Water Quality*.

Frequency of water sampling depends on the size of the water supply system and/or the source. Large systems using surface water sources, such as Greater Victoria (CRD), City of Nanaimo, City of Campbell River and City of Courtenay will sample more frequently. For example, in 2011 the CRD did 11 routine chemical analyses, while the City of Campbell River did quarterly sampling. Testing may be expected for monitoring specific known water supply system concerns such as fluoride or arsenic. For smaller systems, routine chemical samples are generally done every three to five years depending on the source, the history of chemical contamination and other identified concerns.

Table 5: Number of Systems doing Routine Chemical Sampling and Number of Specific Chemical Sampling per Year, Island Health

Fiscal Year April to March	Systems doing Routine Chemical Sampling	Systems doing Routine Chemical Sampling for Specific Chemicals of Concern
2009 to 2010	120	21
2010 to 2011	139	24
2011 to 2012	139	24

12.3 Disinfection By-Products (where applicable)

The use of chlorine as a disinfectant for drinking water has been monumental in controlling waterborne diseases and improving public health by reducing the incidence of illness within the population. Chlorine may react with naturally occurring organics in the source water to form disinfection by-products, some of which have been identified as potentially harmful to human health. Water disinfection processes should be monitored regularly and should minimize the formation of disinfection by-products without compromising disinfection. Monitoring for disinfection by-products is not presently done by all water supply systems using chlorine compounds for disinfection. Island Health is working with operators to increase the number of systems that routinely sample for disinfection by-products.

The use of chlorine products as a disinfectant has been successful in controlling waterborne diseases, but it may react with naturally occurring organics in the water to form disinfection by-products. Island Health is working with operators to increase routine sampling for disinfection by-products and to take appropriate steps to reduce levels above the Health Canada Guidelines.

12.4 Processes (Residual Chlorine, Ultraviolet Transmittance, pH, Conductance, Turbidity)

Should circumstances arise, the water supplier can be required by the DWO to develop operational procedures that outline any monitoring deemed necessary. Compliance with the operational procedures is typically attached as a condition to the water supply system's operating permit.

Recommendations:

VI – 15 *Island Health and water suppliers strive to increase the number of water supply systems that submit 90% or more of the required bacteriological samples.*

VI – 16 *Island Health reports annually on compliance with: annual chemical analysis for large water systems, three year chemical sampling for systems with 15 to 300 connections and five year chemical sampling for systems with less than 15 connections. Such chemical monitoring should be inclusive of disinfection by-products where chlorination or chloramination processes are used.*

VI – 17 *Island Health develop consistent policy on expectations for monitoring disinfection by-products based on type of treatment and size of the water supply system by March 2015.*

VI – 18 *Island Health develop a process for addressing disinfection by-products including monitoring and corrective actions as required by March 2015.*

SECTION VII – GOVERNANCE

Source: Island Health Staff Photo

The photo on the left shows Hawes Bay, Cowichan Lake, which is an area consisting of large acreage, seemingly sold to private individuals by a private forest company. The private owners have sold shares to others, resulting in up to 10 separate dwellings on each lot. The current zoning in this area of the Cowichan Valley Regional District is F1 (minimum lot size of 80 hectares), which only allows for one single-family residence on the acreage. Informal development such as this occurs without proper land use planning, and likely is contrary to various levels of legislation from diverse agencies such as the Department of Fisheries and Oceans, Ministry of Environment, Cowichan Valley Regional District and Island Health. All regulatory bodies have a mandated role in ensuring that this development/use is in compliance and protecting the environmental, social and economic resources of the body of water. Similar issues are occurring on other local lakes including Great Central Lake, Upper Campbell Lake and Lower Campbell Lake. This issue has been raised at the Vancouver Island Watershed Protection Steering Committee, (aka Regional Drinking Water Team) on September 22, 2010 and the Cowichan Water Board Technical Advisory Committee on September 16, 2010. Through the Vancouver Island Watershed Protection Steering Committee the issue has been raised to the provincial inter-ministerial committee on drinking water to develop a provincial response to this issue; however, to date this has not been accomplished.

13 DIFFERENT TYPES OF GOVERNANCE MODELS AND IMPLICATIONS OF EACH

The 'governance', ' business model' or 'ownership structure' of a water supply system are all terms that refer to the leadership, decision making and planning to support ongoing system sustainability and user satisfaction. The term 'governance' is used in this report, but in future documents may be referenced as 'business model'.

The University of British Columbia's Program on Drinking Water Governance provides the following definition:

> ***Governance:*** *the process through which decision-makers are chosen, stakeholders (including citizens and interest groups) articulate their interests, decisions are made and decision-makers are held accountable. Governance is distinct from management.*[18]

[18] Delegating Water Governance: Issues and Challenges in the BC Context. Report for BC Water Governance Project prepared by UBC Program on Water Governance, Nov. 2007, http://www.tonydorcey.ca/597/Posts/FBCwatergovernancefinal2.pdf.

In spring of 2012, the provincial Drinking Water Leadership Council created a sub-committee to identify and enumerate various governance structures. The committee was tasked with examining and reporting on challenges relating to water supply system governance faced by each of the five regional Health Authorities. Ten different types of community water supply system governance structures were identified along with three other types of governance structures specific to commercial operations serving transient populations, such as tourists and seasonal workers.

For Island Health, the number of systems in each category and the approximate population served by each is reported in Table 6 below.

The different governance structures fall under various pieces of provincial legislation, which dictates certain processes such as the adjustment of water rates and general water supply system finances, as well as impacting the administration of enforcement activity. Often, water supply systems with private governance (strata, private, society, co-op, water user community and 'good neighbour') are not well equipped to manage all aspects of system operation and this is reflected, at times, in a lack of long-term system sustainability and limited success.

Table 6: Island Health findings for Enumeration of Systems within each Governance Category and the Approximate Population Served by Systems within each Category

Governance Structure	Number of Systems	Population
Municipality	38	567123
Regional District	54	176602
Improvement District	53	35647
Residential/large (private ownership)	123	23205
Business/small (private ownership)	415	21997
Provincial and Federal Government	43	7396
Water User Community	15	5847
Strata	35	5113
Utility	11	4673
Water Society	32	3297
School District	21	3050
Good Neighbour	8	388
Co-op	2	100
TOTALS	**850**	**854438**

Note: Many water supply systems serve more populations than just residents, such as visitors and seasonal workers. As such, the population served will exceed the population of Island Health regions. Some systems might be classified into more than one category but are only counted once for this enumeration.

14 Importance of Knowing your Water Supplier

Water suppliers are responsible for providing their users with safe drinking water. Nevertheless, all users should be aware of where their drinking water comes from, how it is treated and who supplies it.

Water suppliers are charged with providing safe water for each of their users on an ongoing basis, without disruption. The vital role they play in the health and safety of the communities they serve may be underappreciated. For very small water supply systems, duties relating to the provision of safe drinking water are only a portion of all assigned responsibilities, and in some cases many duties necessary to achieve expectations are performed by volunteers or board members.

On principle, everyone should know where his or her drinking water comes from, how it is treated and how to contact the water supplier. By doing so, a well-informed consumer can report issues with the water quality such as unusual taste, odours or other water supply issues. Water users should also notify the supplier of any concerns or threats that may arise in the vicinity of the water source.

15 Importance of Full Cost Accounting

As with any vital service, the provision of safe drinking water has associated costs. Aside from the immediate expenses related to daily water delivery, the water supply system must fund source protection efforts, operator training, equipment replacements and upgrades, emergency repairs, sampling, reports, insurance and other eventualities. A number of these expenditures may be unanticipated; therefore, every water supply system should have a contingency fund to cover such unforeseen circumstances. Water rates should reflect the true cost of the service being provided including future needs, and ensure that full cost accounting is achieved.

Recommendation:

VII – 19 *Island Health provide, to the best extent possible, support for small water supply system operators; in governance modelling, in the amalgamation of adjacent systems, in the shift to management of systems by regional or municipal government and in encouraging that pricing for water adequately reflects the lifecycle management requirements for individual systems.*

Source: Island Health Staff Photo

SECTION VIII – DRINKING WATER FOR FIRST NATIONS

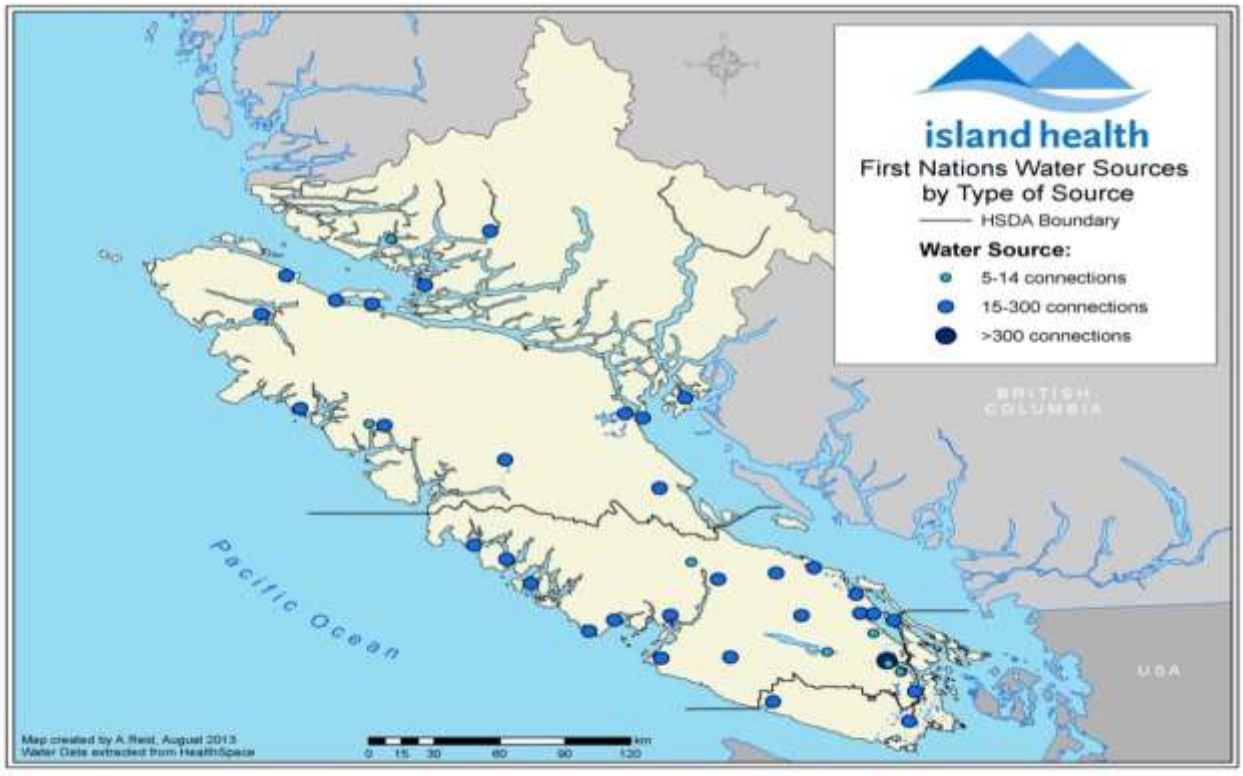
Water systems on Federal Land and First Nations reserves routinely are inspected by Environmental Health Officers employed by Health Canada, First Nations Inuit Health Branch.[19] Support for operator training and infrastructure assistance is provided by Aboriginal Affairs and Northern Development. On Vancouver Island there are four Health Canada Environmental Health Officers (HC EHO's) who are responsible for 57 water supply systems, serving approximately 13,000 people. In addition to routine inspections, the systems undergo comprehensive assessments on a five year rotating cycle.

The breakdown by water source includes one combined source, four surface water, 24 ground water and 28 systems receiving bulk water from municipal water supply systems such as CRD or the City of Campbell River. The water is routinely tested by the bands in their onsite labs and audited on a regular basis by the HC EHO's. The HC EHO's provide training in proper sampling and monitoring techniques. Currently two of the 57 water supply systems on First Nations Lands are on long-term Boil Water Notice (BWN).

Information on the Environmental Public Health program for First Nations can be found at: http://www.hc-sc.gc.ca/fniah-spnia/promotion/public-publique/index-eng.php.

Map 10 below shows the location and size of the First Nations water supply systems in Island Health and can viewed on the Island Health website at: http://www.viha.ca/NR/rdonlyres/54E81A28-E68D-4E91-B535-11DB9DAC8C49/0/Map10_FN_SourcebySize_VI.pdf.

Map 10: First Nations Water Sources by Type of Source, Island Health



[19] As of October 1, 2013 Environmental Health Officer services are provided by the First Nations Health Authority. Reference is made to Health Canada, who provided this service at the dating of this report from March 2012.

SECTION IX – TRAINING

16 ENVIRONMENTAL OPERATORS CERTIFICATION PROGRAM

Section 9 of the DWPR requires a qualified person to operate, maintain or repair a water supply system. Operators are considered qualified if they are approved by the Environmental Operators Certification Program to administer the complexity of the water supply system currently under the operator's oversight.

The Environmental Operators Certification Program classifies water supply systems based on the size of the system, climatic conditions, the complexity of the disinfection process, the treatment and distribution components within the system, the source of the water and the type of instrumentation employed on the system.[20] The more complex the system, the higher the classification level and qualifications required for operators. Operator qualification assessments are based upon the operator's knowledge, skills and training. Small water supply systems serving less than 500 persons per day are currently exempt from the need for a certified operator. Nevertheless, the DWO has the discretion to require a trained operator for a small water supply system.

Issues of concern for water supply system operators are the cost of training and certification as well as the lack of applicability and relevancy of available courses to their operation. Island Health is working with the Environmental Operators Certification Program to develop short courses on germane topics to deliver to system operators inclusive of small system challenges. Course subject material includes source protection, water monitoring and emergency response planning.

Island Health has 81 large water supply systems which are subject to classification by the Environmental Operators Certification Program, and corresponding operators are certified to the classification of these systems. Table 7 below shows the breakdown of how current systems are classified, extracted from our database. At this time there are gaps in the consistency and accuracy of information entered into the database, but improvements are being made to ensure improved data integrity.

Table 7: Number of Water Supply Systems and Environmental Operators Certification Program Classifications

EOCP Classification	Distribution System	Treatment Plant
Level I	10	13
Level II	21	25
Level III	5	5
Level IV	3	4
Not Classified	42	34

[20] http://www.eocp.ca/facilities/facility-classification/

16.1 Regional District of Nanaimo Water Purveyor Working Group

The Regional District of Nanaimo (RDN) has facilitated the development of a Water Purveyor Working Group to assist small water purveyors in the RDN to meet other small water supply system owners and operators to network and engage in educational opportunities. Workshops have included a water supply system tour followed by a discussion of how to undertake upgrades of the system, financing, treatment options and developing and implementing Water Conservation Plans. Health Protection and Environmental Services staff has attended these workshops and have provided general advice and information to participants on the legislative role of EHO's.

More information on the Water Purveyor Working Group workshops can be found at: http://www.rdn.bc.ca/cms.asp?wpID=2323.

Source: Island Health Staff Photo

Recommendations:

IX – 20 *Island Health ensure all water supply systems serving over 500 persons per day are classified by Environmental Operators Certification Program and have staff certified to the appropriate level. Continue to require some level of training for operators of small water supply systems. Until all larger water supply systems are classified, Island Health report annually on the classification of the larger water supply systems distribution and treatment.*

IX – 21 *Island Health is to develop and provide courses for the Environmental Operators Certification Program with a target audience of small water supply system operators/suppliers and to report on course attendance and evaluation by March 2015.*

IX – 22 *A long term education plan be developed that establishes a new training program every year over the next five years.*

SECTION X – REPORTING AND NOTIFICATION

17 ANNUAL REPORTS

17.1 BASIS OF AUTHORITY AND LEGISLATED CONTENTS

Water suppliers are required by the *DWPA* to prepare and make public, within six months of the end of the calendar year, an annual report outlining the monitoring results and information specified on the water supply system's operating permit or as required by the DWO.

Additional information required by the DWO for the annual report may include:

- Summary of improvements or major maintenance initiatives since the last annual report.
- Operator training status/update on search for certified operator.
- Information on contract operator (where applicable).
- Anticipated future expenditures.
- Proposed rate increases and justification for proposed rate.

Delivery of the annual report to the system's consumers is often a function of the size of the water supply system and the needs of the user population. Larger systems generally have the report available on their website and a summary included with the water bill in some cases. Smaller systems may include the report as a bill insert. Systems serving transient or seasonal populations, such as campsites, generally post a copy of the report onsite with contact information for the water supplier in case further information is required.

At this time, Island Health does not have the capability to track the number of water supply systems that are compliant with issuing their annual reports; however, compliance has been low to date. Island Health needs to work with water suppliers to ensure that they are properly informing water users regarding the status of their drinking water (Recommendation X-23).

18 PUBLIC NOTICES

There are three types of Public Notices:

1. Do Not Use Notice: Threat is associated with chemical or physical parameters, or is of an unknown nature (i.e. evidence of vandalism/terrorism).
2. Boil Water Notice (BWN): Microbiological threat, boiling will render the water safe for consumption.
3. Water Quality Advisory: Threat may be minimal for the average user, but increased for certain populations such as the immunocompromised. Aesthetics of the water may be impacted without an associated health hazard.

In response to unacceptable water quality, the Drinking Water Officer may request or order the water supplier to issue one of three Public Notices. They are: Water Quality Advisory, Boil Water Notice and Do Not Use Notice. The Boil Water Notice is the most commonly issued notice.

A Public Notice will be considered under the following conditions:

1. There is immediate risk to water users that can be minimized through boiling the water, avoiding consumption or other specified use of the water.
2. There is a chronic condition that may impact the health of water users in the long-term. In this case, a Public Notice will cover only the interim period while a long-term solution is designed and implemented.

Source: Island Health Staff Photo

18.1 Boil Water Notices

The most common Public Notice is the BWN, which may be issued due to:

- Significant deterioration in source water quality.
- Equipment malfunctions during treatment or distribution.
- No disinfection, inadequate amount of disinfection agent or disinfection agent residuals in the system.
- Unacceptable microbiological quality.
- Unacceptable turbidity.
- Operation of water supply system could compromise public health.
- Evidence implicates drinking water in a disease outbreak.
- Unapproved water source.

Source: Island Health Staff Photo

18.1.1 Long-Term Boil Water Notices

Long-term BWNs are defined as public advisories that are in effect for longer than 18 months. Common causes may include a lack of effective treatment or disinfection, lack of operator vigilance during the application process and construction period, or no clear governance structure to ensure proper operation, maintenance and funding for the water supply system. A long-term BWN may be issued when a water supply system fails to maintain operating compliance or to monitor progress and water quality results.

Of note, errors in the Island Health database, if not identified and corrected, can precipitate a BWN or lead to a delay lifting a BWN.

The Ombudsman's 2008 report, *Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia*, tasked the regional Health Authorities with reducing the number of BWNs in each Health Authority.[21] On June 30, 2008 Island Health had 57 water supply systems on a BWN. Of those, 33 had already been on a BWN for more than 18 months. Through the development of a consistent process to initiate and remove a BWN, including remediation plans and regular reviews, Island Health has been able to reduce the numbers of systems on a long-term BWN as of June 2008. However, other systems have since been placed on the long-term BWN list, and consequently the total number of systems on BWN has reduced only slightly from the June 2008 figure.

As of March 31, 2012 there are still 21 of these original 57 water supply systems on a long-term BWN cited in the Ombudsman's 2008 report. Island Health initially focused on reducing BWNs for large water supply systems (greater than 500 persons per day) so the greatest number of people would benefit. Since 2008, the number of persons benefitting by the removal of BWNs is 82,658.

[21] http://www.ombudsman.bc.ca/resources-and-publications/investigative-reports/special-reports

Challenges remain with the 21 water supply systems still under a long-term BWN. Some of the matters influencing the removal of these BWNs include:

- Most are issued on small systems with strained finances, governances and resources.
- Systems owned by agencies, companies or individuals, that is, other than by local governments are generally unable to access public infrastructure funding.
- Consumers and water suppliers are not currently paying or charging the true cost of water and/or upgrades to systems.
- Small systems may have to rely upon poorer source water quality, requiring more expensive solutions to ensure quality.
- In the case of small remote commercial systems that operate seasonally for a short period of time, the operators are generally off site for much of the year and unable or unwilling to return to take necessary actions. Moreover, these systems are often difficult to inspect on a routine basis and follow-up on issues is difficult due to demands on staff time required and travel costs.

Adding terms and conditions to operating permits or formally requesting, requiring or ordering changes be made to the water supply system by a deadline are appropriate ways to deal with this situation; however, this requires ongoing oversight. When deadlines are missed, Island Health will generally apply graduated compliance and progressive enforcement methods as required to keep the process moving forward. There are presently nine systems working toward compliance, with completion dates ranging from 2013 to 2018. Working collaboratively with operators is usually effective and the preferred way of achieving compliance with regulatory expectations. By March 2012 only one file has needed legal review to determine what further action is required. The number of water supply systems, on which legal action is taken, is expected to increase over time as graduated enforcement actions are undertaken for non-compliant systems.

Table 8 below shows the number of BWNs issued by area in each fiscal year, as well as the time taken to resolve them. The chart shows that most BWNs are resolved quickly.

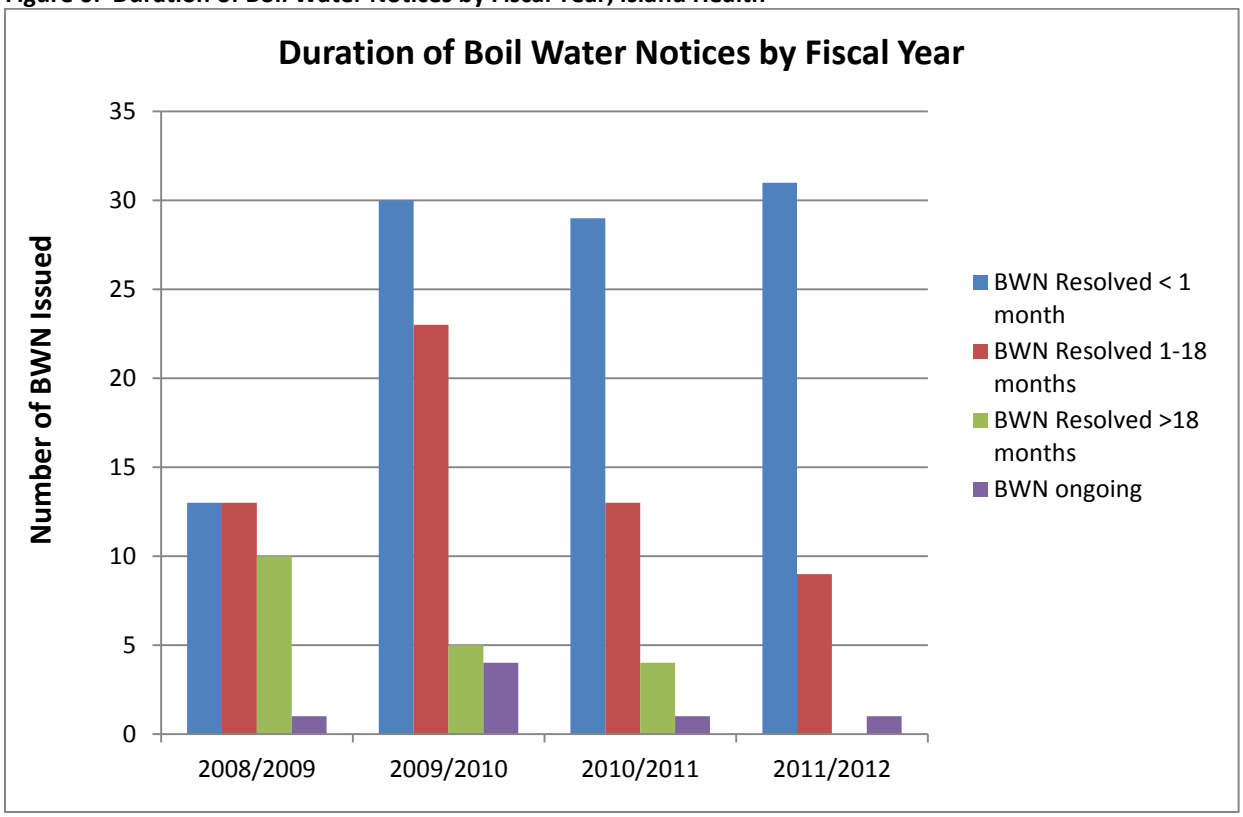
Table 8: Number and Type of Boil Water Notices Issued by Service Delivery Area by Fiscal Year, Island Health[22]

Service Delivery Area	Fiscal Year	Total Issued	Resolved <1 month	Resolved <18 Months	Resolved >18 months	Ongoing
North Island	2008/2009	17	3	5	8	1
	2009/2010	22	9	9	1	3
	2010/2011	19	10	6	2	1
	2011/2012	18	17	0	0	1
Central Island	2008/2009	11	5	5	1	0
	2009/2010	18	12	4	2	0
	2010/2011	11	9	1	1	0
	2011/2012	19	13	6	0	0
South Island	2008/2009	9	5	3	1	0
	2009/2010	24	11	10	2	1
	2010/2011	17	10	6	1	0
	2011/2012	4	1	3	0	0

[22] 21 of the 57 water supply systems on Public Notice prior to 2008 remain on Boil Water Notices.

Figure 6 below shows the duration of newly issued BWNs in each of the last four fiscal years, and reflects the ongoing effort being made to resolve BWNs prior to reaching 18 months in duration. The chart does not include the 21 systems on BWN prior to 2008 that remain on advisory.

Figure 6: Duration of Boil Water Notices by Fiscal Year, Island Health



18.1.2 Short-Term Boil Water Notices

Short-term BWNs are often issued due to operational issues such as equipment failure and loss of disinfection, diminished water quality or increased turbidity due to events in surface water supplies such as flooding, clear cut runoff or landslides.

Surface water sources that are unfiltered are at a higher probability of being placed on a short-term boil water notice, due to increased risk of high turbidity levels during storms.

Many of these high turbidity events are of a short duration, with the potential for numerous occurrences during a single storm season. Terms and conditions are usually placed on the operating permit of these water supply systems in order to guide the system towards compliance with the SWTO by a specific date.

Since the Ombudsman's 2008 report, Island Health has implemented a number of measures to reduce the time any water supply system is on a BWN, including:

- Policy guide for DWOs on issuing and removing BWNs;
- Procedure to track progress on BWNs to ensure deadlines are met and systems move forward with required actions; and
- Policy guide for graduated compliance and progressive enforcement methods for systems that continue to be non-compliant.

The Province of BC has recently released treatment objectives for water supply systems using surface water sources and is in the process of developing similar objectives for ground water sources (see Section IV 9). By providing appropriate treatment, the numbers of systems on BWN should be less and/or the length of time on BWN should be reduced as systems add protective barriers.

The impact of advisories is a function of both the duration of the advisory and the number of people affected. For example, a water supply system with a small population on a long-term BWN can have a similar impact to that of a large water supply system on a short-term BWN when both are measured in terms of people days at risk. Table 9 below provides examples of both small systems with long-term BWNs and large systems with short-term advisories.

Table 9: Comparison of Long and Short-Term Boil Water Notices on Populations

System Name	Time Frame	Number of People Affected	Total Person Days on Advisory
City of Nanaimo	December 4, 2007 to December 7, 2007	80,000	320,000
Pete's Lake	April 21, 1994 to March 31, 2012 (ongoing – 16.5 years)	150	770,850
Puntledge Townsite Water Users Community	August 23, 1996 to March 31, 2012 (ongoing – 14 years)	30	180,690
Royal Canadian Legion #154	August 23, 2005 to March 31, 2012 (ongoing – 7.5 years)	50	136,750
Powell Brook (Paddler's Inn)	August 1, 2007 to March 31, 2012 (ongoing – 5.5 years)	12	24,336

Recommendations:

X – 23 *Island Health to work with water supply systems to ensure their annual reports are prepared in a timely fashion and adequately communicated to their system users.*

X – 24 *Island Health implement a more consistent approach to addressing water supply systems on water advisories through recently developed policy tools. These tools include: guidance on issuing and removing Boil Water Notices, routinely updating progress reports to ensure deadlines are met; moving to the next step on the enforcement continuum for systems which are not progressing to upgrade their systems to remove long-term Boil Water Notices, or to meet treatment objectives to reduce periodic short-term Boil Water Notices.*

SECTION XI – EMERGENCY RESPONSE PLANNING

Water suppliers are to be prepared to respond to situations where the health and safety of water users is at risk. An Emergency Response Plan (ERP), which provides guidance on the steps to be taken during emergencies, must be created by all water supply systems. Common emergencies are flooding of source water, *E. coli* results in finished water, elevated turbidity, loss of pressure in the distribution system and contamination from an outside source.

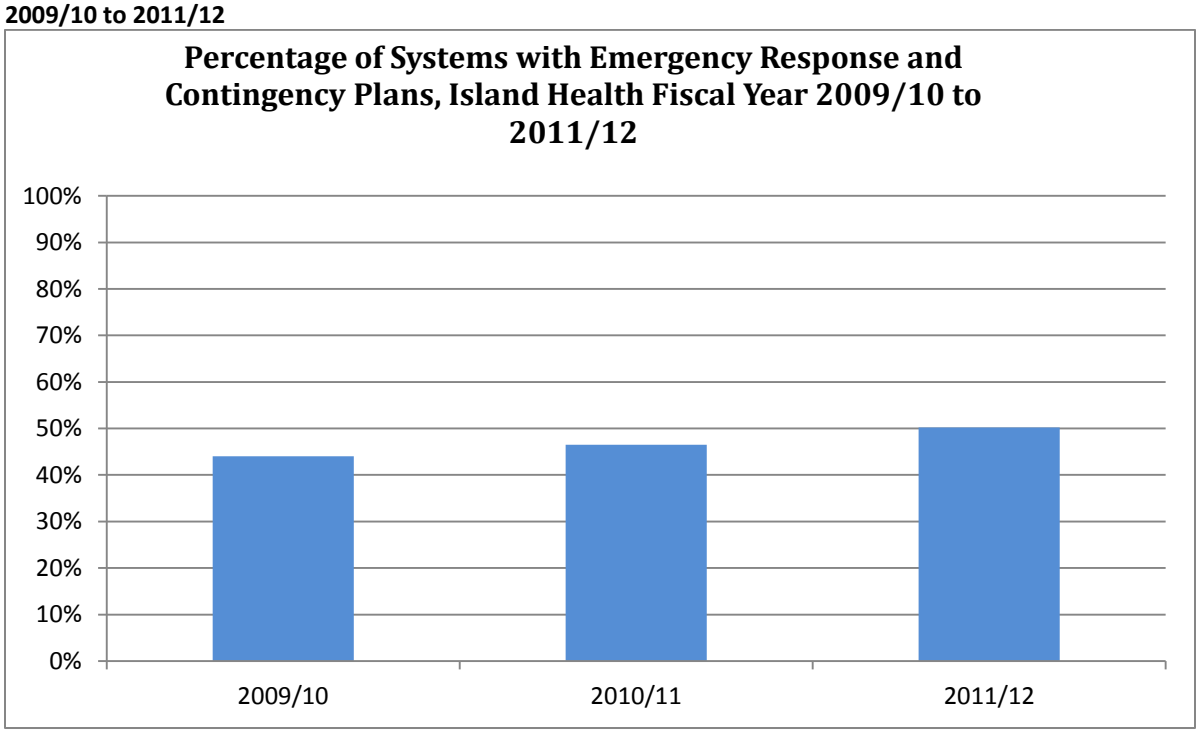
The ERP must be reviewed and updated annually, ensuring the information stays current. During an emergency it is the water supplier's responsibility to make prompt corrective actions and to notify the DWO. The water supplier should consult with the DWO, but corrective actions should not be unreasonably delayed.

Source: http://rickpaulettervjournal.blogspot.ca/2009/11/cowichan-river-floods-nearby-duncan-bc.html

The photo above shows the Cowichan River following heavy rains, November 22, 2009.

For further information, refer to Emergency Response Planning for Small Waterworks Systems, located at: http://www.health.gov.bc.ca/library/publications/year/2000/PHI061.PDF.

Figure 7: Percentage of Systems with Emergency Response and Contingency Plans, Island Health Fiscal Year 2009/10 to 2011/12



19 Stories/Scenarios where Emergency Response Plans have been Applied

19.1 Water System Vandalism

In 2010, the operator of a water supply system that serves about 1800 people using ground water (four wells) during the daily security check found on two of the well houses (metal cover on a concrete base) that the padlocks were missing. Both of the wells are in a forested area, about 100m from the nearest residences. One of the adjacent power kiosks was open as well.

The water supplier notified Island Health and the Royal Canadian Mounted Police as outlined in their ERP. Island Health conducted an inspection in the company of the water supplier. During the inspection, it appeared that the well heads had not been tampered with, and there were no noticeable odours of gas, pesticides or other noxious agent. The wells were taken offline pending testing of the water.

In the system's ERP the appropriate action in response to an act of vandalism was to notify Island Health, with no further details about other actions to be taken by the operator to implement for the water supply system. These events uncovered some gaps in the water supplier's emergency response as there was no established list of parameters for testing to detect a foreign substance. Evidently, there also was no laboratory able to immediately conduct the required testing due to a lack of equipment availability and staff shortages.

Island health has since prepared a list of potential contaminants to be tested for should a similar event occur.

19.2 Loss of Power

During a winter storm, a small mobile home park lost power for a period of time that exceeded 24 hours. This water supply system pumps ground water into a reservoir and also uses pumps to maintain water pressure throughout the system. With the power off, the amount of available water was reduced as was the pressure in the system. After power restored and pumps resumed functioning, Island Health received a complaint about the lack of water arising from the power outage.

The DWO reviewed the ERP for the water supply system and suggested that an alternate source of power be available to ensure that during future power outages water service and pressure would be maintained. The system owner installed a backup generator system, which starts up immediately upon loss of power from the electrical grid.

Recommendations:

XI – 25 *Island Health continues to work with water suppliers to ensure they have adequate and up to date Emergency Response and Contingency Plans.*

XI – 26 *Island Health reports annually on compliance with emergency response planning and reports on incidents involving the activation of Emergency Response Plans by water suppliers.*

XI – 27 *Island Health continue to work with other stakeholders (Royal Canadian Mounted Police, British Columbia Centre for Disease Control, local laboratories and water suppliers), to ensure that the emergency response to potential acts of vandalism or terrorism is as rapid and effective as possible.*

SECTION XII – COMPLIANCE AND ENFORCEMENT

20 INSPECTIONS

Water supply systems are routinely inspected by Island Health Drinking Water Officers.

When a new water supply system is proposed, the owner will provide adequate information about the water quality and proposed treatment methods to ensure the water will be safe for consumers to drink. Island Health will review the water quality information and as appropriate, grant source approval, with or without conditions. Conditions may include providing disinfection, meeting treatment objectives or preparing a Source Protection Plan.

The owner will then prepare a plan of the water supply system including all components of the system and apply for a construction permit or a construction permit waiver. The design elements will be specific to the proposed system. The system will then be constructed in accordance with industry 'better practices' and any specific system requirements laid out by the Public Health Engineer via the construction permit or waiver.

Once the water supply system has been completed, the DWO will conduct an initial inspection. This includes inspection of the entire water supply system from source to tap, generally in the company of the applicant. The DWO ensures that the operator has prepared all supporting documentation such as an ERP, Standard Operating and Maintenance Procedures, Water Monitoring Plan and has the appropriate operator training.

Based on the inspection, the DWO issues an operating permit when the water supply system is in compliance with legislation. The system may then begin distributing drinking water. While not all systems will require terms and conditions on their operating permits, often operating permits are issued with terms and conditions requiring upgrades to the system, setting out water monitoring requirements or specifying operator training levels.

Table 10 below shows the number of water supply systems with operating permits and those with terms and conditions. The table also shows the number of systems without operating permits. Not all systems have operating permits because:

- the required information may not have been entered into the Island Health database, or
- the water supply system may be pending so a permit has not yet been issued, or
- though the water supply system has been approved and is in compliance with the legislation, the paper permit was not printed and sent to the system.

Table 10: Number of Water Supply Systems with Operating Permits and Conditions, and Number of Water Supply Systems without Operating Permits, Island Health Fiscal Year 2009/10 to 2011/12

Fiscal Year April to March	Systems with Conditions on Operating Permits/Total with Permits	Systems Without Operating Permits Recorded in Database
2009 to 2010	70/316 (22%)	506
2010 to 2011	104/404 (26%)	506
2011 to 2012	132/477 (28%)	415

The first routine inspection will generally be conducted within six months of the operating permit being issued. Routine inspections focus on the management and operation of the water supply system with reviews of various records such as disinfectant residual, UV system upkeep and general maintenance. The frequency of subsequent inspections is based on a verity of risk factors such as the water source, treatment and/or disinfection methods, compliance and sampling history, the population served and operator's skills and abilities. Inspection frequencies range from once every six months to once every two years.

During inspections, the DWO will apply a hazard rating to the water supply system based on compliance and factors specific to the system including the use of the multi-barrier approach to reduce risk or prevent contamination of the system. These hazard ratings provide a snapshot of how the water supply system is functioning at the time of inspection. This assessment may differ from the inspection priority ratings, which tend to remain unchanged unless considerable changes are made to either the system infrastructure or management. Table 11 shows the number of water supply system inspections conducted by fiscal year, and indicates the number of low, moderate and high hazard ratings assigned.

Table 11: Number of Drinking Water System Inspections Showing Inspection Hazard Rating by Fiscal Year, Island Health

Inspection Hazard Rating	2009/10	2010/11	2011/12
Low	497	562	505
Moderate	48	59	71
High	15	17	15
Total	**560**	**638**	**591**

Source: Island Health Staff Photo

The photo above shows DWO's inspecting the water extraction point for the City of Nanaimo.

Follow-up inspections are scheduled by the DWO to ensure compliance is maintained, and that required changes are made according to an agreed upon timeline. The DWO may recommend or require additional training for the operator if their level of knowledge or ability is not appropriate to safely operate the water supply system. The frequency of subsequent inspections is based on an assessment that includes operator submissions, system specifics, inspection findings and DWO impressions. The DWO may collect/audit water samples, discuss operator training or address possible changes to terms and conditions of the operating permit in-between inspections.

DWOs will be in contact with water suppliers for a variety of other reasons such as to discuss sample results, annual report contents or other system specific topics. Water suppliers are encouraged to contact their DWO with questions or concerns regarding the operation of the water supply system, to find out about training opportunities and changes in water regulations.

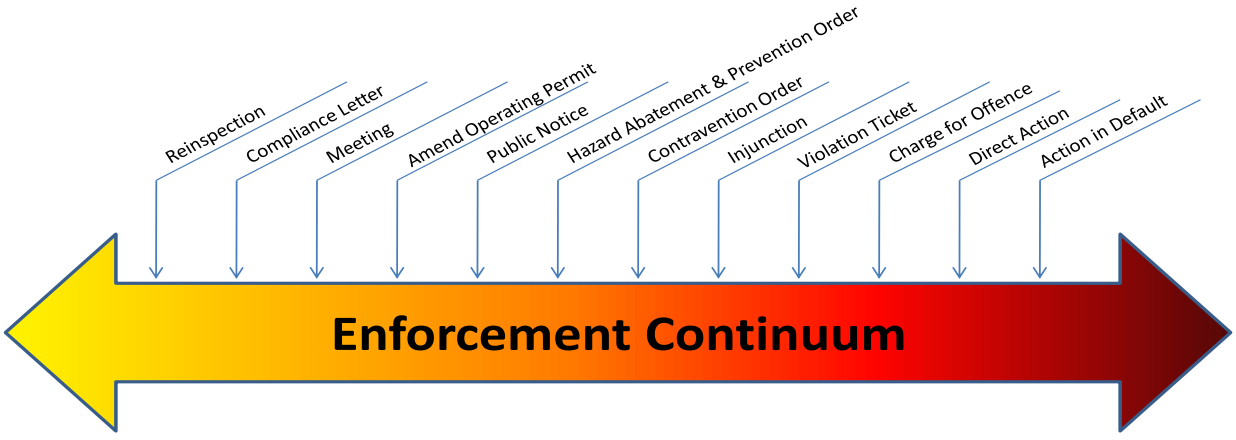
Information about water supply systems can be found at: http://www.Island Health.ca/mho/water/. There are sections for information on BWN, water inspections, sampling results, turbidity, monitoring and the process for complaints.

21 PROGRESSIVE COMPLIANCE

Provincial legislation establishes the minimum regulatory requirements for water supply systems. Ongoing compliance is expected of water supply system operators. When compliance is not maintained, the DWO follows a series of actions to restore compliance with the legislative and policy provisions that are in place so that the health and safety of the public are protected.

There are a range of options that can be used to manage risk. Figure 8 includes the *general* compliance and enforcement options available in provincial public health legislation

Figure 8: Enforcement Continuum



Enforcement options specific to the *DWPA* and DWPR include:

Orders: *Formal stipulation of actions to be taken, where failure to take the specified action will lead to escalating enforcement.*

- **Hazard Abatement and Prevention Orders:** may be issued to any person causing or contributing to an imminent health hazard (not necessarily a water supplier).
- **Contravention Orders:** may be issued to any person in contravention of the legislation (typically a water supplier).

Operating Permit Terms and Conditions*: Guidance that provides further clarification of the legislation; outlines system specific requirements that may be more stringent than the legislation or guides the system towards meeting a long term goal through incremental achievements. (Non-compliance with an operating permit may facilitate other enforcement options in the future).*

- **Amendments:** may be made only after consultation with the operator has occurred and any comments provided by the operator have been given fair consideration.

Charge for Offense: may be made following contraventions of the *DWPA*, DWPR, permits, orders and directions of the DWO, or where the DWO had been hindered, impeded or otherwise interfered with in the exercise of his or her duties.

Action in Default: may be taken to correct a health hazard when a person does not comply with a hazard abatement and prevention order requiring such action to be taken, but only after the person has been notified.

Direct Action: may be taken to correct a health hazard where an existing or potential health hazard has been identified, but there is no legal owner or other individual against whom an order can be issued. Where an owner or responsible party is later identified, an order can be issued to aid in cost recovery.

The type of enforcement is based on assessment of risk as well as an assessment of the likely consequences of implementing the selected option(s). The DWO will apply discretion on a case by case basis to develop a 'graduated enforcement strategy' to achieve compliance. While Figure 8 is linear, the development and execution of a graduated enforcement strategy often requires that the DWO revisit or avoid certain options as appropriate. There is no expectation that the DWO proceed in a linear fashion where a deviation from this approach may be more effective, only that the DWO be transparent and objective in his or her decision-making.

Since 2008 there have been 16 contraventions of the *DWPA* resulting in orders issued under Section 26. This Section is used when the DWO has reason to believe that the person is in contravention of the *Act* or Regulations. Of the 16 orders issued, three were in the North Island area, 12 in the Central Island area and one in the South Island area.

In three instances where the orders were not complied with, further action was taken. In North Island, the next step towards compliance included a court-ordered injunction to comply with the original order. This approach was also used with a Central Island water supply system. In the last instance, a violation ticket was issued in Central Island as a consequence of non-compliance with an order.

22 COMPLAINTS

Information regarding the number of complaints received by water supply systems serving populations less than and greater than 5000 persons per day is shown in Table 12. In general, smaller systems are more likely to experience challenges with water quality and compliance with provincial legislation. These matters are more likely to generate complaints. Larger systems have their own complaint intakes and our number is likely an undercount.

Members of the public are able to make complaints regarding drinking water by calling or visiting their local Health Protection and Environmental Services Office or by submitting a completed complaint form.

The form is available online at: http://www.IslandHealth.ca/nr/rdonlyres/b8f525a3-85a1-44f0-a4da-f3b60eacc3c8/0/drinkingwatercomplaintintakeform.pdf and may be submitted by mail, fax or in person.

Of the 68 complaints received over four years, 63% (n=43) were related to tap water quality. The remaining complaints (n=25) were regarding human impacts on water supply or potential contamination of water, well setback distances, lack of information from water supplier, information about local Public Notices and a lack of quantity of water.

Table 12: Number of Complaints Between April 2008 and March 2012 Relating to Water Supply Systems Serving up to and Greater than 5000 Persons per Day and the Expected Number of Complaints Based on Total Population.

Population Served per System	Number of Systems	Total Population Served	Total Number of Complaints Generated (%)
<5000 persons per day	827	148, 158	59 (87%)
>5000 persons per day	24	706,280	9 (13%)

Often, the provision of information to involved parties can result in a complaint being resolved. Health Protection and Environmental Services staff will be updating the Island Health drinking water website in the near future to provide further information on topics of interest to residents. This information will include general information for private water users and water supply systems, forms, templates and links to appropriate materials on other agency websites. Also included will be an annual Island Health report on compliance, enforcement and complaint activity.

Recommendations:

XII – 28 *Island Health to review the status of all operating permits for water supply systems and update as required, with consideration given to attaching terms and condition by December 2014.*

XII – 29 *Island Health report annually on compliance, enforcement and complaint activity.*

SECTION XIII – REGIONAL AND SPECIFIC ISSUES

23 A UNIQUE CHALLENGE – PROVIDING SERVICE TO REMOTE FACILITIES

While most of Island Health is easily accessible by road, some remote areas and isolated islands off the coast of Vancouver Island provide Island Health with a unique challenge. These areas may have resorts, industrial camps and other establishments with water supply systems falling under provincial legislation; Island Health must ensure the health of all consumers, regardless of location, is protected. Accessing these isolated systems is a challenge for DWOs due to inclement weather, tight timelines due to some having short operating seasons and the need to travel either by float plane or chartered boat; making regular inspections difficult, with follow-up inspections challenging for the same reasons as the initial visit. Generally, follow-up on issues when needed are done through a progressive series of actions – phone confirmation of compliance with issues, letters, registered letters and ultimately orders.

Source: Island Health Staff Photo

The photo above shows Environmental Health Officers heading off for remote resort inspections in the North Island area, July 2010. Often inspectors spot new or existing unapproved water supply systems while flying into these areas, exacerbating issues of workload in remote/inaccessible settings.

Common non-compliance issues include:

- Changes to ownership and/or operation without notifying Island Health.
- ERP/procedure manuals not current for the present staff/operator.
- Installation and/or upgrading of equipment without approvals from Island Health.
- Not meeting water sampling frequency to ensure the safety of the water.

24 REGIONAL ISSUES AND IMPLICATIONS

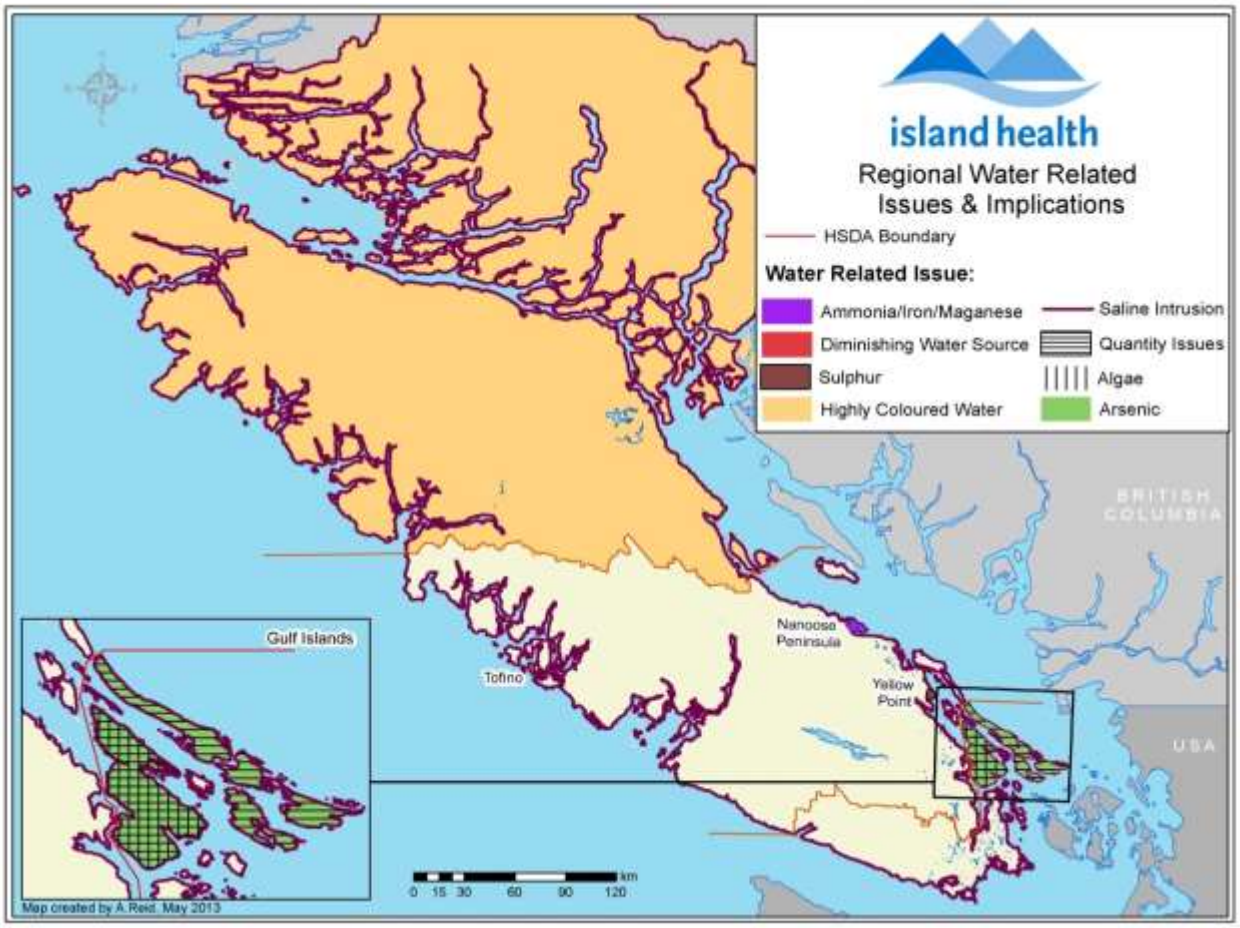
Precipitation is generally responsible for recharging both surface and ground water sources. It can contribute to increased runoff, and landslides leading to sedimentation entering into surface water bodies, causing issues with turbidity or microbiological quality.

Local water quality issues often develop as a result of regional geography and characteristics:

- The West Coast of Vancouver Island receives the highest amounts of rainfall and yet as described below in Section 24.6, the District of Tofino had a critical water shortage in 2006.
- A lack of recharge to coastal wells combined with overpumping can result in saline intrusion, and the water no longer being suitable for consumption.
- Temperatures and nutrient rich runoff entering a lake can contribute to the growth of blue-green algae. Some species have the ability to form toxins, which can be harmful to human and animal health.
- Water travelling through organic materials on the surface of the land can cause taste, odour and colour issues in surface water supplies. If water supply systems with a substantial organic load are chlorinated, it is possible to create disinfection by-products, which can be harmful to human health.

Map 11 below highlights some of the regional water quality or quantity issues; further discussion is provided below. Map 11 can be viewed on the Island Health website at: http://www.viha.ca/NR/rdonlyres/76253D1D-014F-40C7-9B17-8C57E2F9BACA/0/Map11_WaterIssues_VI.pdf.

Map 11: Regional Water Related Issues and Implications, Island Health



24.1 Turbidity

Some surface water sources, especially flowing sources such as rivers, may be subject to sudden increases of turbidity resulting in muddy coloured or cloudy water. Turbidity can be caused by suspended organic or colloidal materials such as clay, silt, organic matter, and contain bacteria, protozoa and other microorganisms. Landslides and surface runoff, especially after heavy rainfall events, are common causes of increased turbidity.

Turbidity itself does not cause health problems; however, it can be an indicator of the presence of pathogenic organisms. It can also interfere with disinfection processes so that the pathogens are not inactivated.

The MOH has created a "Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water" to help determine the health risk of the turbidity event, and whether or not a BWN must be issued. It can also be used to develop Emergency Response and Contingency Plans to allow a quick response to an unexpected turbidity event.[23]

[23] http://www.health.gov.bc.ca/protect/pdf/turbidity-decision-tree.pdf

Source: Island Health Staff Photo

The picture on the left is of the Southforks dam, which is used by the City of Nanaimo as a drinking water source. During heavy rains the volume of water flowing over the dam may increase in height from one foot up to as much as eight feet within a 24 hour period. This leads to turbidity levels in the river up to 70 Nephelometric Turbidity Unit.

24.2 Saline Intrusion

For wells on islands and near the coast, ground water is often a reservoir of fresh water on top of more dense saline water. When the aquifer is recharged by precipitation, this serves to drive the existing ground water deeper into the soil and fosters movement towards draining in the sea. The level of the water table will change over the year, depending on use and recharge. On the islands, the population may increase dramatically during the summer months, coupled with amount of water use typically higher in the summer months as well. Consequently, as the volume of fresh water decreases through increased draw the forces associated replenishing are reversed, and the saline water interface can rise. Thus, as the water level changes, the fresh water/saline water interface also changes. If a well is pumped at too high a rate, the fresh water zone could become depleted and saline water be drawn into the aquifer. The intrusion of saline water in ground water can result in the water no longer being suitable for use for drinking water or irrigation.

The Ministry of Environment has a report available online on saline intrusion on Saturna Island at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/aquifers/saturna_final_report2010.pdf.

Island Health works closely with MOE staff to review water test results from wells in areas subject to potential saline intrusion. The DWO will forward information on any wells of concern so that the MOE can take action under their mandate. Under the *Water Act*, the operation of a well must not cause saline intrusion in the aquifer from which that well, or any other well draws. The MOE encourages voluntary de-activation of wells that are pumping saline ground water in order to protect the water resource. The Ground Water Protection Regulation (Section 9(4))[24] allows an engineer to require well alterations or well closure if there is a contaminant entering the ground water because of well activities. DWOs consider the potential for saline intrusion issues when providing comments on proposed subdivisions in areas prone to this problem.

[24] A professional Engineer employed by the government or a government corporation and designated in writing by the comptroller as an Engineer and includes a Regional Water Manager (*Water Act*, Section 1).

Island Health is participating in an interdisciplinary working group to develop a guidance document to address issues and complaints related to saline water intrusion caused by over-pumping. This document will include well operation "best practices" for coastal areas at risk of saline intrusion. It will be distributed to water supply systems and private well owners.

24.3 Highly Coloured Water on the North Island

Source: Island Health Staff Photo

The photo above shows an example of a typical stream with highly coloured water.

Coloured water or "cedar water" is an issue in some areas, especially in the North Vancouver Island. The surface water supplies have a high organic content, which causes the water to have a highly coloured appearance. When relying on treating highly coloured water with chlorine, there is a concern that all the chlorine is 'consumed' by the colour and the water may not be properly disinfected. The chlorine can also combine with the organics to produce disinfection by-products such as trihalomethanes and haloacetic acid, both of which are potential human carcinogens. The colour also can interfere with the ability of UV light to effectively kill or inactivate microorganisms in the water. It is challenging to find cost-effective methods to remove the organics prior to disinfection, especially for small remote resorts that are reliant on generating their own electricity as well.

The photo below shows the contrast between incoming source water from the Tsulquate River, Port Hardy (right) and water that has been treated and disinfected for distribution as drinking water (left).

Source: http://www.watertechnology.net/projects/porthardy/porthardy15.html

Port Hardy takes source water from the Tsulquate River. The Tsulquate River has high colour, turbidity and organic content, which present a challenge to achieve and maintain required treatment objectives that will consistently result in the production of potable water. "From tea to clear" is how the difference in water colour is described in Port Hardy after installation of the water treatment plant that began operation in 2000. The process includes coagulation with chemical addition, flocculation tanks, dissolved air flotation tanks, gravity filtration through coal on top of fine sand, chlorine disinfection and lime and carbon dioxide addition for corrosion control. The plant is also proving to be very effective in preventing disinfection by-product formation.

The 2012 Annual Water Report for the Port Hardy water supply system can be found at: http://www.porthardy.ca/sites/default/files/reports_and_bylaws/epcor_ph_wtp_annual_report_2012.pdf.

There are other small water supply systems on Northern Vancouver Island, such as resorts, which face similar challenges with their source water quality. For some of these systems, the local DWO may already have initiated dialogue regarding how they plan to appropriately treat and disinfect the water to meet SWTO, with accompanying development of a time bound compliance strategy to guide their process. Small systems have an additional challenge in that they do not have the benefit of economy of scale in treatment installation, so the cost per litre produced can be substantially higher. Where the local DWO has not yet approached a system regarding long-term compliance, or during the interim period before required treatment is operational, risk to water user health may be temporarily managed by using Public Notices to boil water or by accessing another approved drinking water source.

24.4 Blue-Green Algae on Salt Spring Island

The photo on the right shows blue-green algae blooms on the surface of Cusheon Lake, Salt Spring Island, November 26, 2002.

Source: http://www.env.gov.bc.ca/wat/wq/trendsWQS/cusheon.pdf

Some Gulf Island lakes, such as Cusheon Lake on Salt Spring Island, are subject to blue-green algae blooms which can be toxic to people and animals. Cusheon Lake is a small surface water impoundment that lies within an uncontrolled watershed. While Cusheon Lake is used for recreational purposes, only electric boat motors are allowed. The lakeshore has been partially developed with residences.[25] In 2007 a Cusheon Watershed Management Plan was prepared through stewardship groups, volunteers and government agencies.[26] The goal was to restore and protect the watershed for drinking water purposes, as a fish and wildlife habitat and to reduce algal blooms; efforts are ongoing.

St. Mary Lake has issues with algal blooms, and is the source for three water districts: North Salt Spring, Highland and Fernwood. A new treatment plant for drinking water originating from St. Mary Lake has been built to service the Fernwood and Highland areas.

Cusheon Lake is the source for what was formerly the Beddis Waterworks District until it joined the CRD in 2005. The Beddis water supply system provides water to 130 lots in the Beddis subdivision on the east side of Salt Spring Island. Due to the presence of blue-green algae, the Beddis water supply system was required by the MHO to install a water treatment plant, which went on-line in July of 2013. The plant consists of coagulation, flocculation, dissolved air flotation tanks and gravity filtration through coal on top of fine sand, with chlorine and UV disinfection.

[25] www.crd.bc.ca
[26] http://www.islandstrust.bc.ca/ltc/ss/pdf/sscusheonlkwatershedplan.pdf

24.5 Quantity/Quality Issues – Yellow Point, Gulf Islands

South of Nanaimo is an area known as Yellow Point. This area is underlain by the Yellow Point aquifer. Wells in this area are bedrock wells into the Nanaimo Group formations of compacted mud and sandstone layers. Bedrock wells are considered less vulnerable to contamination; however, they also can be less productive in the amount of water available for use and there may be issues with the quality of water.[27]

In 2011, the Regional District of Nanaimo (RDN) created a Development Permit Area in Yellow Point to protect the aquifer. Within the Development Permit Area there are guidelines requiring a hydrogeological assessment to ensure there will be sufficient water for the development and to ensure the development will not impact other wells in the area. Guidelines for residential construction require rainwater harvesting infrastructure to facilitate water conservation and augment supply for non-consumption purposes. The rainwater is used only for irrigation and other non-potable uses.[28]

For some well users in the Yellow Point area, the strong smell and taste of hydrogen sulphide in their water is a major inconvenience. Hydrogen sulphide concentrations can vary widely, even between wells only a short distance apart. The characteristic 'rotten egg' odour makes the water generally unpleasant. Hydrogen sulphide can tarnish silverware and discolour other metals, as well as impart yellow or black stains in sinks, toilets and bathtubs as well as be unpalatable.

There is generally no health concern associated with hydrogen sulphide in drinking water, although standard recommendations for wells apply, including regular and ongoing water testing and well head protection.

Many residents impacted by hydrogen sulphide in their drinking water choose to purchase drinking water, while others purchase treatment equipment they hope will improve the aesthetics of the water. Before purchasing any treatment equipment, homeowners should consult a trained professional who will make recommendations on equipment that is suited for the well water chemistry.

24.6 Diminishing Source – District of Tofino

To serve the District of Tofino, water is gathered from four streams on Meares Island. The streams differ widely in terms of quality, with the one source having such high colour that it is often said to resemble tea. All surface water is required to meet SWTO in accordance with the water supply system's time bound compliance strategy. Presently the level of treatment for each source varies and is predicated on SWTO requirements. Details of these four water sources and how they are managed is available on the District's public website, as part of the Tofino Water Shortage Plan.[29]

The District of Tofino's water situation is amplified from the influx of tourists during the summer months.

In 2006, the community experienced the longest drought since records were kept. The water supply system relies on precipitation year round because the streams have a steep grade, meaning that there is little raw water storage. As a consequence of the dry spell, the District of Tofino suffered a critical water shortage that necessitated closure of many commercial accommodations, and resulted in many town faucets running dry.

[27] Nanaimo Regional District, Watershed 6: Nanaimo River and South Area A, http://www.rdn.bc.ca/cms.asp?wpID=2413 accessed June 28, 2013.
[28] Regional District of Nanaimo, Drinking Water/Watershed Protection, Program Actions, http://www.rdn.bc.ca/cms/wpattachments/wpID2245atID4644.pdf accessed June 28, 2013.
[29] http://www.tofino.ca/

Source: Island Health Staff Photo

The photo above shows the solar powered monitoring equipment that the District of Tofino has in place at the dams and reservoirs.

Since then, the town has had continued water shortage arising from their ongoing dependence on these water sources and not investing in a more stable supply. Nevertheless, since the 2006 event, the District of Tofino has added a 5000 ML finished water reservoir and built a water treatment plant consisting of coagulation, flocculation, dissolved air floatation, membrane filtration and chlorination. This plant treats the Ginnard Creek source only.

There are cameras positioned over the dams and reservoirs, enabling District staff to remotely observe the systems and monitor the amount of water flowing over the weirs. Site inspections are regularly performed to confirm these observations.[30] The District of Tofino has a water use bylaw in place that specifies fines for those not following water restrictions. The District has been proactive in encouraging residents to take additional voluntary steps to reduce their water consumption and to prepare at the household level for the possibility of a future water emergency that could see tap water temporarily unavailable.

Access to the water sources for inspection purposes is time consuming and can be limited by both the weather and the tide, creating a reliance on automated flow monitoring. Should it be non-functional, direct monitoring of the sources poses a challenge.

24.7 Ammonia/Iron/Manganese in Nanoose Peninsula

The Nanoose Peninsula water supply system is operated by the RDN and uses both ground water and treated surface water from the City of Parksville as water sources. This system provides water to over 2000 customers. A number of the ground water wells contain elevated levels of iron, manganese and ammonia. These wells are all chlorinated prior to entering the distribution.

Water containing iron and manganese can cause discolouration of the water and build up in distribution lines and household plumbing such as toilet reservoirs. Resident concerns about the quality of the water resulted in a commitment to install treatment to remove the iron and manganese.

Source: Island Health Staff Photo

The photo above shows the discolouration of Nanoose Peninsula's water, prior to the installation of the new treatment plant.

[30] http://www.tofino.ca/content/tofinos-water-supply

A new treatment plant to remove iron and manganese was installed. It began operating in late 2012 and is showing excellent results in reducing the iron, manganese and ammonia. The ammonia present in the raw water in the Nanoose water supply system may interfere with the effectiveness of the chlorination disinfection process.

Information on the Nanoose Peninsula water supply system can be found online at: http://www.rdn.bc.ca/cms.asp?wpID=1175.

24.8 KARST FORMATIONS

Source: Island Health Staff Photo

The photo above shows Little Husan River near Zeballos, which is an example of a river flowing through karst formations.

Karst landscape is formed by the water dissolving carbonate bedrock such as limestone, dolomite or marble. After thousands of years this process forms unique surface and subsurface features that include sinkholes, vertical shafts, disappearing streams and springs which can lead to caves and complex underground drainage systems. Although karst is found in many locations in BC, Vancouver Island has a high concentration of karst features.

Karst is a highly valuable and non-renewable resource that is very vulnerable to disturbances such as rock quarrying, forestry and recreational activities. These practices, if not properly managed or even curtailed, can result in excessive soil erosion, surface and subsurface karst feature destruction, changes to ground water flow and contamination and sedimentation of underground and surface streams.

Some areas on Vancouver Island that are well known for their karst formations include the Horne Lake Caves Provincial Park near Qualicum Beach, Upana Caves Recreation Site near Gold River, Little Husan Caves Regional Park at the south end of Nimpkish Lake and the Karst Creek Trail in Strathcona Provincial Park.[31]

In provincial forests, karst resources are managed by the Ministry of Forests, requiring sensitive areas to be protected or the resource value conserved. In 2003 the ministry produced the "Karst Management Handbook for British Columbia" to address road construction and maintenance, timber harvesting and reforestation as well as site and trail selection and access for recreational purposes.[32]

Recommendation:

XIII – 30 The Health Space database include documentation, with retrieval capacity for common and unusual threats to water supply systems.

[31] http://www.for.gov.bc.ca/hfp/publications/00192/Text.htm
[32] http://www.for.gov.bc.ca/hfp/publications/00189/Karst-Mgmt-Handbook-web.pdf

SECTION XIV – WATER SYSTEMS FOR SINGLE-FAMILY HOMES

25 WHAT HOMEOWNERS SHOULD KNOW ABOUT THEIR SYSTEMS

Many single-family residences have individual wells or individual surface water intakes. In these cases, the individual property owners are wholly responsible for the delivery of safe water and the ongoing protection of their drinking water resource.

Though there are minimum submission requirements (Schedule 2 of the Ground Water Protection Regulation) for wells serving water supply systems, well drillers are not legally obligated to submit information for wells serving individual homes.

Source: State Department of Environment. Health, DOH PUB. #331 – 243

The photo above shows animals very near a single-family home's well head.

Homeowners responsible for their own drinking water source should evaluate and protect the safety of their drinking water source through frequent inspections, regular testing and ongoing maintenance and upkeep. Records should be kept to monitor any changes seasonally and over time. Through the BC Water Atlas at: http://www.env.gov.bc.ca/wsd/data_searches/wrbc/, homeowners can find helpful information on well locations, well logs, aquifer characteristics and water licenses.

Consequently, it is very difficult to estimate the number of wells serving individual properties on Vancouver Island. There are tracts of densely populated land not served by regulated water supply systems (i.e. outlying areas of many Regional Districts, many of the Gulf Islands and other rural areas), thus the total population served by private wells is likely considerable. Map 1 in Section 1 shows the areas where water supply systems are located. People living outside these areas would be obliged to provide their own water source. Also not captured are properties where the home owners have opted out of the public water supply systems and have developed their own private wells.

While the extraction of surface water for domestic use requires a water licence, there are households and seasonal homes accessing surface water without having acquired a water licence. This is in contravention of the *Water Act*, but oversight/enforcement of these systems by the MOE, for a variety of reasons including resource issues, is not achieved.

The provision of safe drinking water is a serious undertaking for these homeowners because bacterial, viral or parasitic illness may result from the consumption of improperly or untreated water. There also may be health effects associated with the consumption of water with unsuitable chemistry or that has been subject to contamination. It is strongly recommended that surface water never be consumed without appropriate chemical testing, disinfection and treatment. Health Protection and Environmental Services staff works to communicate these recommendations routinely during any interaction with water users.

While Provincial drinking water legislation does not address individual homeowner systems, the local DWO is able to assist homeowners in the following ways:

- Provide Island Health materials to assist homeowners in managing their drinking water source.
- Provide a list of recommended parameters for monitoring.
- Assist with the interpretation of laboratory results.
- Direct homeowners to other applicable resources (BC health files, MOE documents, etc.).
- Advise on a suitable course of action where a homeowner has concerns about his or her drinking water.

A DWO does not typically perform site visits for homeowner water supply systems. Where the homeowner feels that there may be a threat to his or her drinking water, the homeowner may request an investigation under the *DWPA* (Section 29), and where warranted, the DWO may conduct a site inspection as part of an investigation. To review what is entailed in an investigation and how to request one, please refer to the provincial guidelines and attached submission form at: http://www.health.gov.bc.ca/protect/pdf/Omb_Rec_2__S_29_Review_DWOG.pdf.

26 Support for Well Owners

Many local governments recognize the importance of good stewardship of private wells for the protection of human health and the local environment. Island Health often partners with local governments and industry professionals in offering local seminars to engage and educate private well owners. There are also many online educational opportunities providing similar content.

26.1 Well Smart

Well Smart is a workshop created by the RDN in partnership with Island Health and the Ministry of Forest, Lands and Natural Resource Operations for private well owners. It covers well construction and maintenance requirements, the importance of regular well inspections, the value of regular testing and treatment and disinfection options for well water. This workshop has been offered 10 times in the last three years at various locations within the RDN. Information on the workshop can be found at: http://www.cvrd.bc.ca/index.aspx?nid=1580. PowerPoint slides from workshop presentation can be accessed at: http://www.rdn.bc.ca/cms/wpattachments/wpID2284atID3818.pdf.

26.2 Well Owners Workshop

The Well Owners Workshop is similar in content to Well Smart and was created in partnership with government ministries and the BC Ground Water Association in 2012. Island Health assisted with the development of the content as well as the delivery of a portion of the presentation. The Cowichan Valley Regional District has hosted two Well Owners Workshops in the past year. Information on Well Owners Workshops can be acquired at: http://www.cowichanvalleyvoice.com/uploads/Well%20Owners%20Workshop%20announcement.pdf. PowerPoint slides from the workshop presentations can be found at: http://www.cvrd.bc.ca/DocumentView.aspx?DID=9071.

Recommendation:

XIV – 31 Island Health continue to support regional and local governments in providing education and resources to private residential systems.

SECTION XV – SUCCESS STORIES

27 AMALGAMATION OF SYSTEMS AND LOCAL GOVERNMENT MANAGEMENT

27.1 BENEFITS/BARRIERS

Small water supply systems may consider amalgamation with adjacent systems or local government management in order to achieve efficiencies and cost effectiveness. This type of restructuring can improve technical, managerial and financial capacity through facilitating access to higher quality water sources, gaining the expertise of certified operators or sharing the costs for the development of improved treatment facilities and other infrastructure upgrades. In her 2008 report, the Ombudsman describes the benefits of amalgamating as follows:

- "Larger systems have greater resources (both financial and technical) at their disposal.
- Systems run by municipalities and RDs are eligible for federal and provincial government grants.
- Small systems would no longer have to deal with liability issues."[33]

Amalgamation or local government management can be concerning to some. The Ombudsman acknowledges that operators foresee potential disadvantages to amalgamation, such as:

- "Higher wage rates.
- Loss of autonomy and lower level of customer service.
- Initial costs associated with amalgamation including the costs of upgrades to the system and fees for an engineering inspection."[34]

Island Health has recently supported three adjacent small strata water supply systems amalgamating as they were unable to meet legislative requirements individually. Island Health has also fostered local governments incorporating small systems. Amalgamation, or a change to local government management, often occurs at a point where upgrades to the water supply system are being required and the system is unable to underwrite the cost. The increased costs associated with the transition may be perceived as related to the amalgamation or change in management structure, when in fact the costs are both inevitable and ultimately are considerably lower than if they were undertaken without such restructuring. Financing opportunities and terms are often improved through amalgamation or a change to local government management. Of special significance is that with local government managing the water supply system, access is often gained to senior government supports and other financing options that are not available to systems with other types of governance and oversight.

Source: Island Health Staff Photo

[33] Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia, Special Report No. 32, June 2008, page 94.

[34] Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia, Special Report No. 32, June 2008, page 94.

27.1.1 Whiskey Creek

In 2010 the RDN commenced the process of assuming responsibility for the Whiskey Creek water supply system. This process included a study of the system to determine its overall condition and what would be required of the users for the RDN to complete the acquisition. The information was presented to the users, and ownership and operation were transferred to the RDN in 2011. Improvements made by the RDN included:

- Physical works such as replacing and upgrading water meters and the addition of alarms and controls on the system.
- Plans to not only maintain but also improve water quality.
- Addressing governance issues such as adopting water use regulations and cross connection control bylaws, updating ERPs and standard operating procedures, water conservation and other educational programs.

Source: http://www.rdn.bc.ca/cms.asp?wpID=2360

27.1.2 Beaver Creek

In June 2012, the Beaver Creek Improvement District joined the Alberni Clayoquot Regional District (ACRD) as a local service area. This enabled the ACRD to assume operation of the Beaver Creek water supply system. The surface water (creek) source is subject to increased turbidity during heavy rainfall events, resulting in the system being put on BWN frequently throughout the winter months. The ACRD and Beaver Creek are actively working on a solution to comply with the SWTO.[35] Infrastructure upgrades such as installation of a new water reservoir and a connection to the City of Port Alberni water supply for times of high turbidity are underway to improve water supply quality and to reduce the number of BWNs over the winter season.

27.1.3 Capital Regional District Systems in South Island

The CRD through its Integrated Water Service provides water to 340,000 people in the Greater Victoria Drinking Water System, the Westshore Communities and Sooke. It also operates six systems on Salt Spring Island, five systems on the other Southern Gulf Islands and three systems in the Juan de Fuca Electoral Area. They are responsible for water supply, treatment and delivery to these service areas.

The advantages of having the CRD operate these water supply systems are what were described by the Ombudsman in Section 27.1 above – greater financial and technical resources availability, access to senior government funding for upgrades and mitigating liability issues for the small system governing bodies.

[35] Alberni Clayoquot Regional District, http://www.acrd.bc.ca/cms.asp?wpID=277.

28 Long-Term Boil Water Notice Solutions

As mentioned in Section 18.1.1 on long-term BWN, a variety of challenges to small water supply systems for addressing a BWN include short operating seasons, a lack of financial resources, lack of knowledge about what type of treatment is required and a willingness to follow the mandated processes for systems including securing the appropriate permits and approvals for changes to systems prior to making them. Working with the DWO and establishing a compliance plan with deadlines is often an important step in the process of realizing the removal of a BWN. Sections 28.1 and 28.2 below are some success stories in getting long-term BWNs removed.

28.1 Enhanced Treatment – Point of Entry in a Small Resort Community

A small resort community in the Central Island has been on a BWN since 1994 arising from poor bacteriological water quality from the untreated surface water source. In 2011 the water supply system was ordered to disinfect the water by September 2013. The community decided the best solution would be to install Point of Entry devices at every home rather than install a centralized treatment system.

The DWO developed a pilot project to evaluate the Point of Entry units. This involved installing three Point of Entry devices (UV units and filters as necessary) and monitoring water quality for bacteriological quality for a period of three months. The pilot was successful in providing potable water to the users and the community is moving ahead on providing Point of Entry devices to all of the homes.

Although this system is still a work-in-progress, once all of the homes have their Point of Entry units in place, the BWN will be removed.

28.2 Amalgamation

Many small water supply systems will consider amalgamation with a larger water supply system as a mechanism to get off the long-term BWN. Examples include:

28.2.1 Olympic Springs Water Supply System

This water supply system had 13 connections and served 39 people. It had been on a BWN since 1994 due to water contamination from drawing upon an unprotected source, and with no treatment on the system. In 2008 the Qualicum Bay Horne Lake water supply system ran a new distribution main from their system to the homes on the Olympic Springs water supply system and provided them with high quality potable water.

28.2.2 Remote Water Supply System in North Island

In 2002 a small water supply system was found to have contaminated water and an order was issued to boil water prior to consumption, develop an ERP and complete an assessment of the system to determine what upgrades would be required to meet water quality parameters. The system users attended a community meeting to discuss ownership of the system, flushing the system and sampling the water on an ongoing basis, preparing an ERP and Annual Reports and having a trained operator for the system.

All actions required were completed in 2010 and water results to date have remained good. A nearby small private system was able to join into this system, allowing the BWN on that system to be removed as well.

SECTION XVI – MOVING FORWARD

Communities and individuals within Island Health are turning to alternate sources of water such as rainwater harvesting, Aquifer Storage and Recovery and Point of Entry systems in order to protect and reduce the demand on traditional water resources.

In 2008 the BC Government released its Living Water Smart, British Columbia's Water Plan "as its recognition of the value of sufficient water for health, economic growth, energy and the environment" and made a "commitment to ensure our water stays healthy and secure."[36] Key items of this Plan include:

- Protecting ecological values of the water source.
- Providing incentives for water efficiency.
- Regulating ground water use.
- Making changes to water management to address impacts from climate change.
- Providing measures to mitigate flood damage on developments in the flood plain.
- Providing incentives for restoration of streams or wetlands.
- Improving the quality and protection of drinking water sources.
- By 2020 50% of new municipal water needs must be acquired through conservation.
- By 2010 purple pipes for water collection and reuse will be required in new construction.
- Updating the Green Building Code to require water conserving plumbing fixtures.

Many Communities and individuals are working to protect local water resources and reduce water demand through accessing alternate sources such as rainwater harvesting or water reuse. The RDN has taken a lead role in producing a guidebook for using rainwater harvesting for personal use. The City of Parksville is exploring Aquifer Storage and Recovery, which transfers water from the Englishman River to injection wells during the winter when there is high volumes and flows, and removes the water during the low flow times in the summer, ensuring adequate water for both the people and the fisheries resource. Some small water supply systems are finding that it is more economical to use an appropriately designed Point of Entry system at each home to provide potable water rather than using central treatment. More details on each of these initiatives are below.

The Provincial Health Officer for BC has issued regular reports on drinking water[37] since the initial release of the Action Plan for Safe Drinking Water in British Columbia.[38] These valuable resources have tracked progress against the initial set of eight principles and have been an instrumental aid in reducing waterborne risk for the province. This MHO report documents in greater detail progress on these principles as well as identifying new indicators and new issues that should be incorporated into future reports. Modernization of the Action Plan or incorporation of new indicators into regular Provincial Health Officer drinking water reports will be beneficial to users, operators and regulators in the province in understanding and applying the ongoing development of quality guidance documents such as the surface and ground water treatment objectives.

[36] Living Water Smart - British Columbia's Water Plan 2008, http://livingwatersmart.ca/book/.
[37] http://www.health.gov.bc.ca/pho/reports/drinkingwater.html
[38] http://www.health.gov.bc.ca/cpa/publications/safe_drinking_printcopy.pdf

29 RAINWATER HARVESTING

Rainwater harvesting refers to the collection of rainwater from specific roof top surfaces for a variety of uses ranging from toilet flushing to irrigation. Although rainwater is generally high quality as it falls, it frequently becomes contaminated as it comes in contact with a variety of surfaces. The act of collecting and storing this water can introduce varying amounts of chemical, physical and biological contaminants that must be appropriately treated or removed before it is fit to be consumed as potable water.

The source quality of harvested rainwater should be preserved in a number of ways, such as:

- Use of roof top and gutter materials that will not leach materials into the water and will not provide a media for the growth of biological contaminants.
- Use of a first flush diverter to prevent the water with the highest potential to pick up contaminants off the roof from entering the storage tank.
- Use of an appropriately screened and protected holding tank.
- Use of treatment and disinfection appropriate to the intended water use.
- Strict operating and maintenance practices to ensure all system components are clean and in good repair.

The Regional District of Nanaimo has developed a publication to provide the public with a detailed overview of rainwater harvesting systems for single-family dwellings. Of note, these residences are not subject to provincial drinking water legislation. This resource is available at: http://www.rdn.bc.ca/cms/wpattachments/wpID2430atID5059.pdf.

Currently, Island Health has one water supply system with an approved rainwater harvesting system. This water supply system uses harvested rainwater in combination with a ground water source. Island Health will assess applications received for the use of rooftop harvested rainwater, and is in the process of creating guidelines to provide assistance to applicants. Island Health also is working with the MOH and the other provincial Health Authorities to produce treatment objectives for rainwater harvested systems.

30 AQUIFER STORAGE AND RECOVERY

Arrowsmith Water Services was formed in 1996 between the RDN, the City of Parksville and the Town of Qualicum Beach. The purpose was to share resources amongst the partners in a bulk water supply system. Presently the RDN purchases bulk water from the City of Parksville water supply system for the Nanoose Peninsula area, to meet this area's summer demands. The Town of Qualicum Beach presently has enough water to meet their needs, but has negotiated the option to obtain bulk water from the City of Parksville as future needs increase.

The first project of this consortium was the construction of the Arrowsmith Dam to create storage for 9 million cubic metres of water for use in low flow months. The work was completed in 2000. Another component of the capital plan for the group was to relocate the existing water intake. After weighing economic, environmental and social factors the best intake location was determined to be upstream of the Island Highway Bridge near the estuary of the Englishman River, upstream of the confluence of the Englishman and South Englishman River. This sighting is above sources of contamination such as agricultural and industrial practices and residential developments, as well as pollutants from the Island Highway. A water treatment plant is planned in conjunction with the new intake.

Source: Island Health Staff Photo

The City of Parksville has two sources for its water supply – the Englishman River and a number of wells. During times of heavy rain, including most of the winter, the turbidity in the river increases to unacceptable levels. The present system of just chlorinating the water does not provide the level of safety required in BC and by Island Health under the SWTO. Additional treatment in the form of filtration would be required to use this surface source all year.

Arrowsmith Water Services has proposed a plan for Aquifer Storage and Recovery to help reduce costs of treating the water and storing it for high demand times. This entails taking the water from the Englishman River during the winter, when turbidity is low, and treating it to meet drinking water standards and then pumping it into a suitable aquifer. During high demand times in the summer, this water can be recovered from the aquifer and pumped into the distribution system for use by residents of the City of Parksville and the RDN. This strategy will result in cost avoidance for the construction and operational expenditures in deploying conventional water treatment and storage facilities. This approach enhances fisheries benefits both now and into the future.

More information on Arrowsmith Water Services and Aquifer Storage and Recovery can be found at: http://www.englishmanriverwaterservice.ca/index.asp.

31 Point of Entry/Point of Use

Small water supply systems may struggle with the cost of centralized treatment due to having comparatively few connections and not having the economic benefits of larger systems. The DWPR allows small water supply systems to provide each connection with an approved Point of Entry/Point of Use device that makes the water potable.

The photo to the right shows a Point of Entry system which includes a filter unit prior to an Ultraviolet disinfection unit.

Source: Island Health Staff Photo

Within Island Health, there are a number of water supply systems with approved Point of Entry/Point of Use equipment, such as:

- Use of a UV disinfection system on restaurant kitchens. This could allow a business to save on costs to treat all water, which may be particularly important if the system is used for some other high water demand.
- Use of Point of Use treatment devices to remove excess levels of naturally occurring fluoride in a system. Units are installed in each dwelling. Access for maintenance and testing to each device is assured through oversight by the operator of the system.

In order to protect the health of water users, the following limitations are generally imposed on the use of Point of Entry/Point of Use equipment for prescribed water supply systems:

- Point of Use will generally not be considered for microbial hazards, acute toxins or contaminants with inhalation or dermal exposure hazards. Point of Entry may be considered for these applications.
- Drinking water from any surface source requires treatment in accordance with SWTO. New water supply systems must propose a system that meets the SWTO prior to the issuance of a construction permit. The new systems must demonstrate effective operation prior to issuance of an operating permit. Existing systems must develop, implement and adhere to a time bound compliance strategy acceptable to the DWO. (Pre-existing unapproved systems are treated as 'New').
- Prior to committing to Point of Entry/Point of Use treatment, the water supplier should have arrangements regarding unit access, ongoing liabilities, the proposed maintenance contract and potential incurred and ongoing costs, such as sampling for monitoring purposes.
- Point of Entry/Point of Use equipment must offer benefit(s) to water users over centralized treatment, connection to an adjacent water supply system or development of an alternate source.

32 Cowichan Water Board

Completed in 2007, the Cowichan Basin Water Management Plan (the Plan) provides a framework to:

- Identify issues in the basin system (the entire watershed from above Cowichan Lake to the estuary).
- Protect ecological functions.
- Balance water supply and use.
- Engage the public to understand and support the Plan.

Partners in preparing the Plan included the Cowichan Valley Regional District, Cowichan Tribes, MOE, Fisheries and Oceans Canada, Catalyst Paper and the Pacific Salmon Commission. It was recognized that water management in the basin needed a formal and proactive approach to deal with population growth, climate change and impacts of previous decisions made without taking into consideration the interests of all parties. A key recommendation was to establish an advisory board to guide plan implementation and improve water management decisions and outcomes within the basin. The existing method of decision making by various federal, provincial, local governments and agencies through their jurisdiction often resulted in jurisdictional conflicts with uses and values for the area being at odds. The Cowichan Watershed Board was formed as the advisory board. A Technical Advisory Committee was struck to support the Board.

In the Plan, Goal 6 identifies the need to improve the governance of the basin and how decisions are made about water, and holding accountable the persons making those decisions. The Cowichan Watershed Board governance model will support collaborative, local decision making for the regional/watershed scale within the existing legal and institutional framework with the express purpose of encouraging management decisions based on the Cowichan Watershed Board's recommendations and the Plan.

This regional watershed approach is similar to Alberta's "Water for Life" – an action plan to ensure a healthy, secure and sustainable water supply for the province's communities, environment, and economy through knowledge and research, water conservation and partnerships.[39] These key values and updated governance models are reflected in the proposed "Water Act Modernization" process that is currently underway with the government of BC.[40] Watershed management through a process like the Cowichan Water Board is well on its way to being accepted as a better practice.

Source: Island Health Staff Photo

Recommendation:

XVI – 32 The Provincial Health Officer be requested to revisit the current format of the annual drinking water report and to consider including province-wide reporting on more aspects associated with the Source to Tap oversight and actions under the Drinking Water Protection Act.

[39] http://www.waterforlife.alberta.ca/
[40] http://www.livingwatersmart.ca/water-act/

CONCLUSION

The provision of safe, reliable, affordable and accessible drinking water is a foundation of a healthy Island population. The Provincial Health Officer's reports on drinking water, the Safe Drinking Water Plan for BC, the BC *DWPA* and associated Regulations, the Drinking Water Officer's Guide and several key provincial guidance documents have laid a solid foundation for BC and Island Health communities to have the quality of water expected by the public we serve. Each time a resident or visitor turns on a tap, the quality is a given.

In 2002, the MOH set an Action Plan for Safe Drinking Water in British Columbia. Eight principles were set out through this Action Plan:

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 supply 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 water supply systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Over the past decade considerable progress has been made in achieving the objectives for safe drinking water. This report reflects a snap shot on progress to date and captures the ongoing efforts to ensure quality water throughout Island Health. Data systems are now able to provide information on a variety of parameters that are critical to proper monitoring of measures of water quality, and this report establishes a current baseline against which improvements can be assessed. The report does not reflect all of the significant improvements attained over the last decade.

The recommendations are those of the MHOs responsible for both oversight under the *DWPA* and for reporting on public health issues under the *Public Health Act*. In these respects the duty of the MHOs are to the communities, residents and guests of the region and are acting without influence from the operational and administrative contingents of Island Health.

The staff of Island Health and the Health Protection and Environmental Services program are requested to respond to the recommendations, and these responses will be a companion document to this report.

Source: Island Health Staff Photo

List of Acronyms

ACRD:	Alberni Clayoquot Regional District
BWN:	Boil Water Notice
CRD:	Capital Regional District
DWO:	Drinking Water Officer
DWPA:	*Drinking Water Protection Act*
DWPR:	Drinking Water Protection Regulation
E. coli:	Escherichia coli
ERP:	Emergency Response Plan
GARP:	Guidance Document for Determining Ground Water at Risk of Containing Pathogens
GWUDI:	Ground Water under Direct Influence of Surface Water
HC EHO:	Health Canada Environmental Health Officers
MHO:	Medical Health Officer
MOE:	Ministry of Environment
MOH:	Ministry of Health
RDN:	Regional District of Nanaimo
SWTO:	Surface Water Treatment Objectives
UV:	Ultraviolet