TAKING CARE OF OUR **SMALL WATER SYSTEMS**

REFERENCE GUIDE

BCWWA
BC WATER & WASTE ASSOCIATION

ACKNOWLEDGEMENTS

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Many sections of this guide have been adapted from the the BC Ministry of Health, Small Water System Guidebook (2013), the Ontario Ministry of Environment, Taking Care of Your Drinking Water and Wastewater: A Guide for Members of Municipal Councils (2011), and updated with information for 2016.

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FOREWORD

Welcome to the Building Sustainable Small Water Systems pilot program. This program is targeted at individuals such as yourself: small water systems owners in BC, including trustees and directors of a water user's community/society, and small water system operators. In most cases, you and your family, friends, and community also are users of the water provided by your small water system and your health and safety are directly impacted by the quality of this water.

A small water system is considered to be any system that serves more than a single family dwelling and up to 500 people. British Columbia has over 4,500 registered small water systems which supply drinking water to over 700,000 people or approximately 15% of BC's total population, mostly in non-urban areas. Many of these systems are not connected to any form of local government. They are privately owned and managed by the homeowners (i.e. stratas and water users communities (WUC)). Unfortunately, a large number of these small water systems do not meet current provincial standards for drinking water.

Small water systems commonly face a number of challenges in meeting BC's drinking water standards:

1. Insufficient funds
2. Scarcity of experienced staff (usually volunteers) to manage and operate the system
3. Water suppliers and users who may not understand the serious health risks posed by unprotected or untreated water
4. Limited expertise and experience in identifying what to focus on to improve a water system or where to begin to fix problems
5. Existing beliefs and concerns about the chemicals and costs associated with water treatment

The BC Water & Waste Association, in partnership with the BC Ministry of Health, is providing the Building Sustainable Small Water Systems pilot program to address many of the challenges faced by small water systems. Specifically, this program aims to build **financial and managerial capacity** among small water systems owners and operators so that:

- Water system owners and operators make informed decisions that advance financial sustainability, operational resilience, and public safety; and
- Health risks to small water systems users are reduced, and boil water advisories are lifted.

This reference guide provides a summary of the topics covered in the Taking Care of Your Small Water System full day workshop portion of the program. System owners and operators who do not attend the workshop are encouraged to refer to this reference guide as one of many resources that can be used to address the risks within their systems.

There is not one perfect formula for managing and operating a small water system. The knowledge, skills and tools to effectively provide potable water is dependent on a wide range of factors, some of which include the water source, quality of water, infrastructure, community needs, and finances. It is our intention to identify some critical questions for you to ask about the current status of your small water systems and provide some simple steps that can substantially simplify system management and improve the safety of your drinking water

LIST OF ACRONYMS

BWA	Boil Water Advisory
CEU	Continuing Education Credits
DNDA	Do Not Use / Do Not Drink Advisory
DWPA	Drinking Water Protection Act
EOCP	Environmental Operators Certification Program
FITFIR	First-in-Time, First-in-Rights
GARP	Groundwater at Risk of Containing Pathogens
GWUDI or GUDI	Groundwater Under Direct Influence (of Surface Water)
HDPE	High-Density Polyethylene
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MHO	Medical Health Officer
POE	Point of Entry
POU	Point of Use
PVC	Polyvinyl Chloride
STMBA	Source to Tap, Multi-Barrier Approach
SWS	Small Water System
WD	Water Distribution
WSA	Water Sustainability Act
WT	Water Treatment

INTRODUCTION

British Columbians assume that their water is of high quality and safe to drink. As a small water system owner or water supplier, you have an important role in ensuring your community's safety. In fact, you have a legal duty to do so.

Three things to remember as a water purveyor:

1. **It's Your Duty**
2. **Be Informed**
3. **Be Vigilant**

It's Your Duty. The BC *Drinking Water Protection Act* and its regulation include a legal duty for persons responsible for water systems to ensure water is safe from contaminants and that operations are in compliance with the *Act*. This duty to provide potable water to end users extends to elected or appointed officials such as trustees from improvement districts, directors of water societies, and managers for water user's communities. Read more about the *Act* in the Regulatory Landscape section of this guide.

Be Informed. Ask questions. Get answers. You don't have to be an expert in drinking water operations, but you do need to be informed. Your decisions have an impact on the health of people in your community and the health of our environment. Seek advice from those with expertise and act prudently on that advice. Check your knowledge in the Self-Assessment of Current Capacity section of this guide.

Be Vigilant. Complacency can pose a great risk to drinking water systems. It is critical that you never take water safety for granted or assume all is well with the drinking water system under your care and direction. The health of all of the people in your community, including the children, adults, and elderly using the drinking water from your community, depends on the diligent and prudent oversight of your community's water system. Don't assume that someone else is checking that all the regulations are met and that they system is running safely – keep asking questions until you are sure it is.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

WHY IT MATTERS—THE COST OF GETTING IT WRONG

- What could go wrong?
- How can you prevent an outbreak?
- What are health impacts to your community?
- What are the financial impacts to your community?
- Could this happen in your community?
- As a trustee/elected official, what questions should I be asking?
- Who is ultimately responsible?

WHY IT MATTERS—THE COST OF GETTING IT WRONG

CASE STUDIES

Water-borne disease outbreaks in North America are not common, but they do happen. While it is easy to be complacent about a water source if it does not have a known history of causing illness, a series of incidents over the last number of years has highlighted the fact that safe drinking water in the past does not guarantee the water will stay safe to drink in the future. Water suppliers must be constantly vigilant about testing water and taking action to make sure it is safe.

MILWAUKEE

In 1993, about 400,000 people were infected with Cryptosporidium when the municipal water in Milwaukee, Wisconsin became contaminated. An estimated 70 people died during this incident. This was caused by an ineffective filtration process at one of the two treatment plants (Corso, P., M. Kramer, K.Blair, D. Addiss, J.Davis, and A. Haddix. 2003. "Costs of Illness in the 1993 Waterborne Cryptosporidium Outbreak, Milwaukee, Wisconsin". Emerging Infectious Diseases, 9(4)).

WALKERTON

In 2000, a major event occurred in this small Ontario town of 4,800 people, when heavy rains washed cattle manure into the town's shallow well from a farmer's field nearby. The manure contained E. coli 0157:H7, a particularly dangerous strain, and Campylobacter. This in turn contaminated the town's drinking water. About 2,700 people became will, 65 were hospitalized, and 7 people died (O'Connor, D. 2002. "Part One: A Summary – Report of Walkerton Inquiry: The Events of May 2000 and Related Issues."). Many people suffered permanent organ damage and the economic impact to the community was $155 million.

NORTH BATTLEFORD

In 2001, nearly 6,000 residents of this Saskatchewan city of 13,000 fell victim to an outbreak of cryptosporidiosis, an illness caused by a parasite in human and animal waste, which entered the local drinking water supply. Symptoms included diarrhea, abdominal cramps, fever, nausea, and headaches.

The City of North Battleford subsequently faced class action lawsuits totaling millions of dollars. The first settlement was an out of court agreement awarding $3.2 million to some 700 claimants (CBC as per Ontario Ministry of the Environment and Climate Change. 2014. "Taking Care of Your Drinking Water".).

In an article on the subsequent Commission of Inquiry, the Canadian Environmental Law Association noted:

…what became clear was that the people of North Battleford were let down. Their municipality, carrying a bulging contingency fund, refused to spend money on upgrading their decrepit water treatment plant. Their provincial government, although aware the plant was in poor condition, hadn't inspected it in the ten years prior to the outbreak... plant employees, who had been working without a supervisor for over four months, were unable to heed the warning signs of a potential drinking water problem.

BRITISH COLUMBIA

Between 1980 and 2004, there were 29 confirmed water-borne outbreaks in British Columbia, affecting tens of thousands of people. The province has had one of the highest reported numbers of water-borne disease outbreaks in Canada. Its record for outbreaks is improving, with no reported outbreaks occurring between 2007 and 2009. However, many drinking water supply systems remain on boil water notices, and small water supply systems are over-represented in this group.

Key outbreaks related to drinking water in British Columbia 1995-2004

Year	Outbreaks
1995	**Victoria:** Toxoplasmosis (Toxoplasma gondii) – 110 infections confirmed, an estimated 3,000 infected.
1996	**Kelowna:** Cryptosporidiosis (Cryptosporidium) – 177 infections confirmed, an estimated 10,000 infected. **Cranbrook:** Cryptosporidiosis (Cryptosporidium) – 29 infections confirmed, an estimated 2097 households containing at least one resident with diarrhea.
1997	**Princeton:** Norwalk-flu-like virus (norovirus) – 88% of the service area affected.
1998	**Chilliwack:** Cryptosporidiosis (Cryptosporidium) – 19 infections confirmed. **Sunshine Coast:** Campylobacteriosis (Campylobacter) – 26 infections confirmed.
2002	**Langdale:** Suspected water-borne campylobacteriosis (Campylobacter).
2004	**Hagensborg:** campylobacteriosis (Campylobacter) – 5 infections confirmed.

Source: Adapted from BC Office of the Provincial Health Officer. 2007. "Progress on the Action Plan for Safe Drinking Water in British Columbia".

UNREPORTED ILLNESSES

Did you know that the majority of water-borne illnesses go unreported? There is evidence that for every one case of reported water-borne illness, there could be as many as 285 unreported cases. Many infected individuals will only get mild symptoms lasting a couple of days and assume they have a minor "stomach flu". Usually, they do not seek medical attention. This means they do not undergo laboratory tests to confirm a case of water-borne illness, so health agencies cannot track the actual number of cases of water-borne illnesses (Hrudey, S. and E. Hrudey. 2007. "Published Case Studies of Waterborne Disease Outbreaks – Evidence of a Recurrent Threat". Water Environment Research. 79(3), 233-245).

Even if cases are laboratory-confirmed, it is not always easy to determine the source of illnesses, as tracing it back to a specific source can be difficult for a variety of reasons, including:

- Food can also be a source of many of these same pathogens.
- It can often take several days after ingestion for symptoms to appear. By the time the investigation is underway, the pathogens in the source may be gone.

A lack of reported cases of water-borne illnesses is not evidence that the water you are producing is not making people sick.

SMALL WATER SYSTEMS

Detecting outbreaks in small communities can be even more challenging. Milwaukee had a population of about 1.6 million people in 1993 and an estimated 400,000 people got sick – that is one-quarter of the population. Only 12% of this group sought medical attention, but this was enough people (approximately 12,000) to trigger an investigation – the medical community knew this was not a coincidence.

Compare this to a community of 20 people. If drinking water was to cause illness in one-quarter of that population, it would amount to five people. Of these people, there is a strong possibility that only one (or none) of them would seek medical attention. If there are few or no reported cases, the outbreak might not be flagged for investigation and no one would know to check the drinking water for issues.

WHAT CAN YOU DO?

Your role as drinking water supplier to your neighbours and community is a serious responsibility. You deliver a critical service that maintains the health of all those that are served by your water system. This means that you must understand your role and carry it out effectively to prevent illness, long term disability, and death. The responsibility may seem overwhelming.

Ensuring that your water supply system is producing safe drinking water is challenging. You can address this challenge by gaining the knowledge and the tools to maintain your system, and practicing sound risk management. In each section of this guide, there are questions that you can ask to gather the information required to make good decisions on behalf of your water system.

Additionally, invite your community to work with you. The more your community understands the necessity of safe drinking water and everything needed to make it happen, the easier it will be for you to make decisions in the best interest of the system and your community. You may also find that many individuals in your community can offer skills that will be helpful to the effective management of your water system (i.e. financial and accounting skills, record keeping and documenting procedures, technical or mechanical skills). Seek out a diversity of people who can learn, contribute their expertise, and provide support.

HOW MANY HATS DO YOUR WEAR?

Each role requires knowledge, skills and personal commitment. Do your best by accessing training, becoming informed and building a strong support network.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

WHAT IS IN YOUR WATER

- What is in your water that requires treatment?
- What are water-borne pathogens?
- What other common water quality concerns are out there?
- Is your water source affected by turbidity?

WHAT IS IN YOUR WATER

DRINKING WATER CONTAMINATION

Drinking water is used for human consumption, food preparation and other household purposes (i.e. baths/showers). Safe drinking water, or "potable" water, is water that is safe to drink and fit for domestic purposes without further treatment. Water sources can become contaminated with feces and other substances that can cause human illnesses through natural and human activities. Some of these activities are easy to notice and others are virtually undetectable.

Most animals and birds make their homes around water sources, such as lakes, rivers and reservoirs. They may depend on this water for drinking, food, bathing, and cooling on hot summer days. Animals and birds urinate and defecate in and around water sources and many of them may also die in and around water sources. These natural animal processes, as well as other natural processes such as heavy rains and spring snow melt, can lead to water contamination.

Some human activity also contaminates water sources. Fertilizer and manure from farming and raising livestock can infect water sources, including improperly sealed wells. Runoff from forestry practices, mining and construction can lead to water contamination. So can human sewage from poorly designed or improperly functioning sewer or septic systems.

Contaminated drinking water poses a threat to human health because it can contain water-borne pathogens, metals, or chemicals that can cause illness. This is why it is important for water suppliers to be vigilant about the design, operation and maintenance of their water supply system. Suppliers must take reasonable steps to protect water from known sources of contamination and ensure appropriate treatment is in place.

WATER-BORNE PATHOGENS

Micro-organisms such as bacteria, protozoa and viruses – are everywhere in our environment. They are so small that most cannot be seen with the naked eye. In fact, a pristine-looking glass of water could contain millions of micro-organisms. You would not know it unless you looked at the water through a microscope or put it through laboratory testing. While some micro-organisms may are beneficial or do not cause harm, there are other micro-organisms, called "pathogens," that cause illness, permanent damage or even death.

Water-borne pathogens can live in the water we drink. Most of them cause infection and illness by growing in a person's digestive system. Symptoms of water-borne illness often include cramps, diarrhea, vomiting, muscle aches, weight loss, fever and chills. Severe cases can result in kidney failure, long-term illness and even death. Infants, children, the elderly and people with weakened immune systems are the most severely affected.

Water-borne pathogens are present in, and transmitted by, the fecal matter of infected people and animals. Any water source susceptible to animal or human activity is also susceptible to contamination with "infected" fecal matter.

PROTOZOA

Protozoa are also single-celled organisms, larger than bacteria and viruses at 3 – 12 microns. At this size, very few are needed to cause infection in a person. Just one could cause major illness.

The protozoa that are prevalent in BC water include:

- *Cryptosporidium*
- *Toxoplasma gondii*
- *Giardia lamblia* (also known as "beaver fever")

Cryptosporidium parvum and ***Giardia lamblia*** infect the intestinal tract, which offers ideal conditions for them to multiply. They attach to the intestinal wall and eventually line it, reducing the body's ability to absorb nutrients from food.

BACTERIA

Bacteria are smaller than protozoa (0.2-2 microns) and can easily multiply both inside and outside the body. They can colonize the intestines and, in the process, disrupt your digestive processes. Some can produce toxins, or move from the intestines to infect other tissues in the body, making an individual very sick.

Examples include:

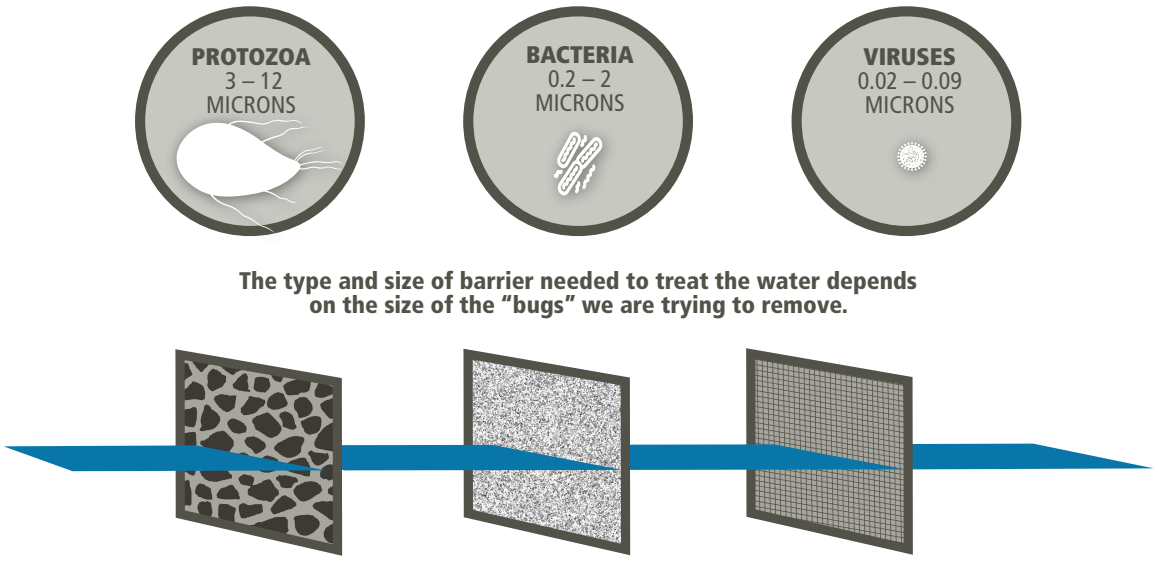
- *Escherichia coli (E. coli)*
- *Campylobacter*
- *Salmonella* (includes the bacteria responsible for typhoid fever and cholera)

VIRUSES

Viruses are the smallest water-borne pathogens at 0.02 – 0.09 microns. Once inside the body, viruses hijack the cells to reproduce, damaging the "host" cells.

Enteric viruses (those that affect the digestive system) include:

- rotavirus
- meningitis
- polio
- hepatitis A
- norovirus



The type and size of barrier needed to treat the water depends on the size of the "bugs" we are trying to remove.

IMMUNITY

The **immune system** is the body's defense mechanism against infection from pathogens. When a pathogen enters the body, the immune system forms a complex line of defense to attack and rid it from the body. It is during this process that some of the body's cells create "memories" of the pathogen. If this pathogen enters the body again, these memory cells create antibodies that quickly detect and destroy it before it can cause any problems.

People drinking untreated water may assume their water is safe as they have "never been sick," when in fact they may have been sick but did not associate the illness with the water supply. If this is the case, they may have acquired antibodies to keep them from getting sick again. This is called immunity.

People new to an untreated water supply system may not have developed immunity to any pathogens existing in the drinking water. There is also research demonstrating that people with immune deficiencies, and some children and older adults, may be more vulnerable because their immune systems do not function well (Strauss, B., W. King, A. Ley, and J. Hoey. 2001. "Outbreaks of infectious diseases associated with private drinking water supplies in England and Wales. 1970-2000." Epidemial. Infect. 130, 469-479.) Any of these people could get seriously ill after drinking contaminated drinking water.

Check Your Assumption:

How your immune system reacts to water contamination will be different from person to person. If one person seems "fine" drinking water that does not meet the required standards, it does not guarantee that it is safe for the rest of the community.

TURBIDITY AS AN INDICATOR OF MICROBIOLOGICAL RISKS

Turbidity refers to the "cloudiness" of water. It can be caused by suspended microscopic particles, such as clay, silt, finely divided organic and inorganic matter, bacteria, protozoa and other microscopic organisms. It is measured in nephelometric turbidity units (NTU). Water generally becomes visibly turbid above 5.0 NTU.

Turbidity, in and of itself, does not usually pose a threat to human health, but it can be an indicator of the potential presence of human pathogens. For example, levels of Giardia and Cryptosporidium tend to increase with turbidity levels. Other potential problems with turbid water include:

- Turbidity can cause filters to clog quickly, leading to frequent backwashing and/or replacement.
- Turbidity can shield bacteria and viruses from disinfection.
- Turbidity can reduce the effectiveness of ultraviolet (UV disinfection).

CHEMICAL HAZARDS

Water-borne pathogens are not the only risk related to drinking water. Water can pick up contaminants such as heavy metals (e.g., lead), arsenic, nitrates, pesticides, gasoline and radioactive materials. Some of these substances occur naturally in surface or groundwater sources. Others enter the water as a result of human activity or leach out of the piping materials used to distribute the water.

The effect of these substances on human health depends on the chemical properties of the substance and the dose. A water supplier should consult with the local Drinking Water Officer and refer to the Guidelines for Canadian Drinking Water Quality to determine testing and treatment needs related to chemical contaminants.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
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WATER TREATMENT 101

- Is your water supply taken from surface or groundwater?
- What is your current treatment process?
- What is the state of your equipment and pipes?
- How are you monitoring the quality of your water?
- Does your treatment match what is in your water?
- Is your water source reliable?
- Does your water systems provide water that meets the current drinking water standard?
- Once the water is treated, what is being done to make sure it is safe when it is delivered to the users?

WATER TREATMENT 101

The design of your water supply system will be highly dependent on the source:

- Secure Groundwater
- Groundwater at risk of containing pathogens (GARP), or;
- Surface water

Another consideration is the characteristics of the raw water:

1. What microbes does it contain?
2. What chemicals does it contain
3. Aesthetics such as colour, taste and odour
4. Turbidity – the cloudiness or haziness of the water caused by suspended solids

Generally, there are three main stages to delivering water:

1. Source water,
2. Treatment, and;
3. Storage and distribution.

SOURCE WATER

Secure Groundwater

Groundwater is defined as water that occurs beneath the surface of the earth and can be found in most parts of BC. It gathers in aquifers — the layers of sand, gravel, and rock through which water seeps from the surface.

Wells are used for the intake of groundwater. In some cases, if a well is drilled in the right location, the pressure will cause it to flow on its own. Alternatively, a pump connected to an energy source is used to extract groundwater and move it into the water system.

IS ALL GROUNDWATER SAFE?

An aquifer is the layers of sand, gravel and rock through which water seeps from it's surface. The safety of groundwater relates to whether is comes from an confined or unconfined aquifer.

Confined aquifers are those in which an impermeable dirt/rock layer exists that prevents water from seeping into the aquifer from the ground surface located directly above. Instead, water seeps into confined aquifers from farther away where the impermeable layer doesn't exist. The confining layer may offer some protection from surface contamination.

Unconfined aquifers are not "protected" by an impermeable layer. This is a risk factor because leaks or spills into the soil above the unconfined aquifer can seep into and contaminate the water.

Check Your Assumption:

Water from unconfined aquifers is generally at greater risk of microbiological contamination than confined aquifers. Raw water should always be tested, and in some cases, even groundwater will require treatment.

Groundwater at Risk of Containing Pathogens (GARP)

This is groundwater below the surface that is considered to be at risk of microbiological contamination, either through direct contact with surface water or a likely source of contamination. There is a "Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP)" (2015; http://bit.ly/GovEnviroAssessDoc) and it is intended to help water purveyors in assessing if the water from a groundwater source is at risk. It considers at least two types of risk:

- **GARP:** the water source is at obvious risk of pathogenic contamination. In this case, an aquifer supplied by GARP is viewed in the same category as surface water and has the same treatment and disinfection requirements.
- **GARP-viruses only:** the water source is only at risk of containing viruses. The water source requires disinfection for virus inactivation but does not have the filtration and dual-barrier treatment requirements of surface water.

Surface Water

Surface water is taken from rivers, lakes, or reservoirs, which are replenished by rain and snow. In BC, 90% of municipal drinking water comes from surface water sources. Surface water is more susceptible to contamination than groundwater for the following reasons:

- Rivers may flow through farmland, industrial areas, sewage discharge zones, and other districts that may cause harmful contamination and/or affect taste, odour, clarity, and colour. River water quality will vary throughout the year; and
- Lakes and reservoirs usually have better water quality than rivers as suspended contaminants will "settle-out" in lakes. However, lakes and reservoirs are subject to plant and algae growth, which can give lake water an unpleasant odour or taste. Human activities such as power boats, feed lots, etc., are also a threat. In addition, lakes are often fed by rivers that can carry contaminants.

Surface water intakes generally make use of screens and filters to keep large debris, animals, fish and vegetation out of the water supply system. Intakes are strategically located at an appropriate depth within the surface water source to maximize quality. Pumps provide the pressure needed to move the water from the intake into the system and beyond.

SUSPENDED SOLIDS

Suspended solids generally refer to small, solid particles that remain in suspension while in water. Suspended solids are typically 2 micrometer in size or larger.

Dissolved solids refer to small particles that are dissolved in water. These are typically inorganic salts such as calcium, sodium, and nitrate ions, or small organic matter. Dissolved solids are typically smaller than 2 micrometer in size.

For drinking water sources, surface water tends to contain more suspended solids than groundwater sources, while groundwater sources tend to contain greater concentrations of dissolved solids, leached from materials in the ground.

Check Your Assumption:

Solids can be present in your water in different forms and often impact the quality of your water. While suspended solids can impact the taste and clarity of water, they often interfere with disinfection as well.

What is in the Water?

Surface Water Characteristics	Groundwater Characteristics
Highly Variable	Consistent Quality
High Suspended Solids	High in dissolved solids
Microbiological Content	Low in organic content
Variable Temperature	Variable Temperature
Quality – subject to surface influences	Quality – less susceptible to surface influences
Treatment – usually more complex	Treatment – often relatively simple

MULTI-BARRIER APPROACH

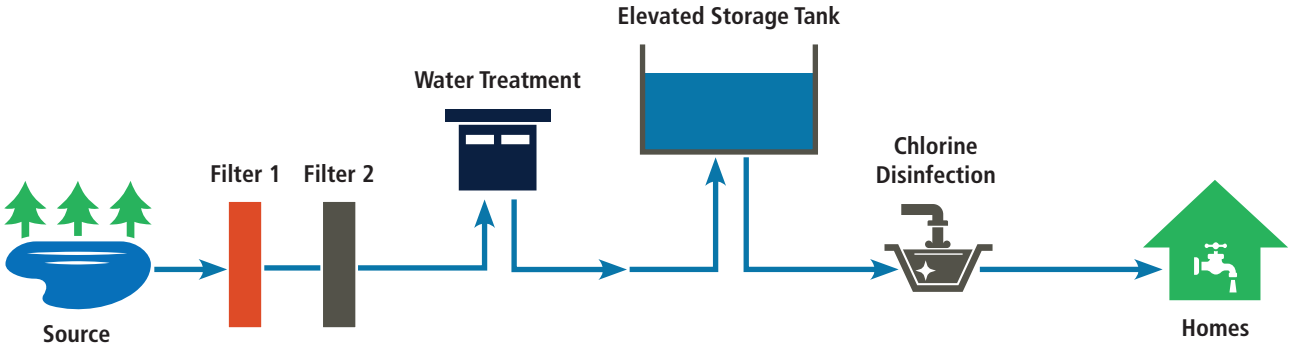
Even though no approach will guarantee 100% protection all of the time, it has been demonstrated that the most effective way to manage drinking water systems is to implement a multi-barrier approach. The multi-barrier approach is an integrated system that prevents or reduces the contamination of drinking water, from source to tap, in order to reduce risks to public health.

In his report on the Walkerton tragedy, Justice O'Connor discussed five major elements of the multi-barrier approach: (http://bit.ly/AttorneyGeneralAboutWalkertonTragedy):

1. Source water protection – Selecting and protecting the best supply source for your system;
2. Robust water treatment – Running a treatment system appropriate for your water, run by an operator trained in its use;
3. A secure water supply network – Maintaining clean storage and distribution infrastructure;
4. Monitoring programs – Confirming the quality of the water provided to the consumers;
5. Prepared responses to adverse conditions – Having an updated Emergency Response Plan.

The multi-barrier approach relies on overlapping safety practices that, should one element be compromised, the other practices can compensate to protect the water consumers.

The multi-barrier approach to safe and reliable drinking water starts with understanding the potential threats to your drinking water supply and implementing a series of barriers to prevent or reduce the impact of contamination. Tools to help you assess your drinking water system are detailed in the **Self-Assessment of Water Utility Performance** section of this guide.



RED FLAGS

The following is a list of potential signs of trouble you may encounter during routine monitoring or your regular, day-to-day operations. This should not be considered an exhaustive list, but something to get you thinking about what trouble might look like in your system:

- Customers are experiencing gastrointestinal illness.
- Water sampling indicates the presence of total coliforms, fecal coliforms or E. coli.
- Increased turbidity, particularly turbidity monitoring results beyond the parameters defined your operating permit.
- Customers complain about the colour, odour or taste of the water.
- Water pressure drops unexpectedly.
- Chlorine levels cannot be maintained in the distribution system.
- Equipment is cracked and/or leaking.
- There is a main break.
- There is evidence of recent animal activity near the intake.

If any of these issues come to your attention, you should contact your Drinking Water Officer immediately and check your emergency response and contingency plan.

TREATMENT

Water treatment is the process of improving water quality by removing unwanted and unsafe physical, chemical, or biological material. The type of water treatment needed depends on your water source (i.e. groundwater or surface water) and what is in your water (i.e. microbial quality and chemical contaminants) and aesthetics (i.e. turbidity, colour, taste, and odour). Because each water source has unique characteristics, treatment requirements will vary from source to source.

Two common types of water treatment for small water systems are:

Filtration removes matter from water by use of a physical barrier or chemical or biological process (i.e. sand and cartridge filters). Filters can be placed in a series, so that the water moves from one type of filter to another, to maximize removal of unwanted material.

In surface water sources, an intake screen is often used to prevent larger objects, such as tree branches and rocks, from entering the system. The filtration step is required to remove smaller sized particles from surface water or GARP sources. Sometimes a pre-treatment step, in the form of **coagulation** and **flocculation** is applied to help particles clump together and become larger in size for more effective filtration.

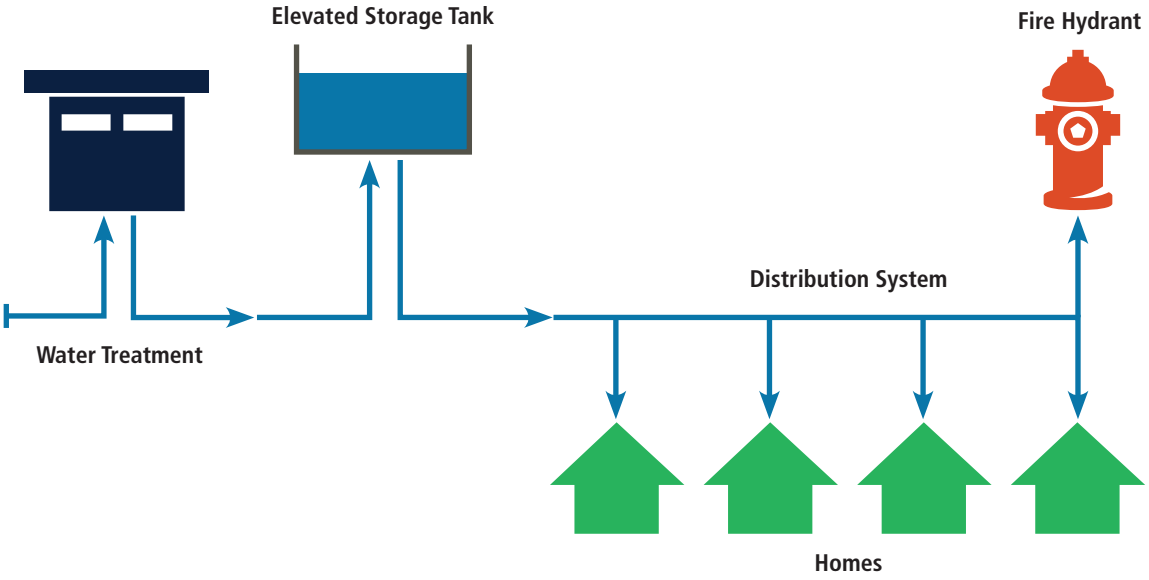
Disinfection kills or inactivates disease containing organisms such as bacteria and protozoa. Common disinfection methods are **chlorination** and **ultraviolet light**.

Chlorination is a relatively simple and effective chemical disinfection method as it has the ability to kill off many different types of pathogens. Chlorine requires a minimum amount of time to interact with the water to ensure that it has adequately disinfected the water. This interaction time, depends on the concentration of chlorine in the water as well as the amount of contact time that the chlorine has with the water before it reaches the first water user. Maintaining a chlorine level throughout all points of your water system is an important safeguard that will kill the pathogens and protect against re-contamination after treatment.

Ultraviolet (UV) light is a non-chemical way to disinfect water. A special UV light bulb gives off a wavelength of light that can kill off some pathogens entirely and prevent others from later causing illness. UV is effective at inactivating *Giardia* and *Cryptospordium*, but significantly higher doses are required if using UV to disinfect for viruses.

STORAGE AND DISTRIBUTION

Once the water is treated, it is ready for distribution to service users via a series of pipes and pumps. Some systems make use of storage tanks that collect water during low-use times for release during high-use times. This contributes to consistency in water delivery and can be important for maintaining water pressure.



The distribution system must be large enough to meet needs of the size of your community and provide adequate flow for fire protection.

The most common types of material used for distribution pipes include:

- **Cast-iron:** Cast-iron pipes have a long history of use. While sturdy, they are also known to be prone to corrosion and breaks;
- **Ductile-iron:** Ductile-iron pipes are becoming widely used, and are considered a newer version of cast-iron piping. These are more flexible and less likely to corrode than their cast-iron counterpart;
- **Asbestos-cement:** Asbestos-cement pipes are not often used, but are appealing due to their low-cost and light weight; and
- **Plastic:** Polyvinyl chloride (PVC) or polyethylene (HDPE) pipes are widely used today and typically have a longer life than their counterparts.

The quality of your water can change as it moves through your distribution system. Over time, there can be some bacterial regrowth and minerals deposits, metals and biofilm will inevitably accumulate on the inner wall. Buildup in pipes occurs particularly in areas where there is little water movement and the water becomes stagnant. This buildup can fall off the pipe walls back into the water if there is a change in water quality or flow. These risks can be minimized by maintaining a consistent chlorine residual throughout your distribution system, minimizing dead-end zones in the pipe network, and regularly cleaning or flushing the distribution system.

ACTIONS YOU CAN TAKE TO BE BETTER INFORMED

- **Conduct a source-to-tap review** of your water system infrastructure. BC Ministry of Health provides a useful tool that you can access at **http://bit.ly/drinkingwaterqualityresourcesforoperators**
- **Meet with your operating team** to review the components and current condition of the infrastructure in your water system.
- **Gather outside expertise** to help assess or improve the water system infrastructure.

Key Message:

Get to know your water system. This will help you identify the challenges specific to your systems before they become bigger and more expensive issues.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

THE REGULATORY LANDSCAPE

- What are the drinking water regulations?
- Do you meet the current health regulations?
- Are there any terms or conditions placed on our operating permit?
- Does our water system have a license?
- What are your responsibilities under the regulations?
- Who do you talk to for support?
- Do you have a network of other small systems suppliers that you can use as a resource?

THE REGULATORY LANDSCAPE

KEY DRINKING WATER LEGISLATION

There are four provincial acts and regulations that apply to all small water systems in BC:

1. The *Water Sustainability Act*
2. The BC *Drinking Water Protection Act and Regulation*
3. The BC *Drinking Water Protection Regulation*
4. *Public Health Act*

You can find more information on these acts/regulations by visiting the BC Laws website at www.bclaws.ca

1. WATER SUSTAINABILITY ACT

The *Water Sustainability Act (WSA)* and the first phase of regulations were brought into force on February 29, 2016. The *Act* replaces the old *Water Act*, which was in place for more than 100 years.

The WSA states that no one can divert or use surface water or groundwater in British Columbia unless authorized by the Province, or permitted under the WSA. The WSA also sets out methods for conservation and protection of water in British Columbia and restricts work in and around streams.

Under the WSA, most drinking water supply system operators require a license – whether they source water from a stream or an aquifer. There is an exemption for groundwater for "domestic purpose", which means the use of water for household purposes by the occupants of one or more private dwellings located on a single parcel. Licenses with an earlier date of precedence take priority over licenses that follow (this principle is referred to as First in Time, First in Right). If two licenses have the same date, priority is based on use (domestic and waterworks rank higher than industrial uses).

When issued, the license will authorize the license holder to divert and beneficially use water, in accordance with the license. The license will specify the date from which the use may begin (the date of precedence), the maximum quantity of water that may be used, and the purposes for which the water may be used. The license may also contain the terms and conditions under which the right to use water is granted.

The use of groundwater was not licensed under the old Water Act. As such, the Province has put in place a transition period to license existing users. Existing groundwater users who apply by March 1, 2019 will be granted a license with a date of precedence based on the date they began using groundwater (which must be established as part of the application process). After March 1, 2019, everyone will be treated as a new applicant. As an incentive to apply early, the Province has agreed to waive application fees for existing groundwater users who apply by March 1, 2017. Water rental fees for using groundwater accrue as of February 29, 2016. For more on applying for licences and approvals contact FrontCounterBC at 1-877-855-3222 or visit www.frontcounterbc.gov.bc.ca

There are several regulations under the *Water Sustainability Act* that are relevant to small water system owners:

- **Water Sustainability Regulation** provides details on the submission of applications for a new water source license or for modifications to an existing license.
- **Water Sustainability Fees, Rentals and Charges Tariff Regulations** list the minimum annual rental fees and rental rates, typically priced per 1,000 m3. Minimum fees and fee rates are based on water use classification as listed on the water license.
- **Groundwater Protection Regulation** adds a new requirement that new water supply wells or permanent dewatering wells must be located at least 15 horizontal meters from an existing well (see section 18 of the Groundwater Protection Regulation). Wells must be drilled by a qualified well driller, except for excavated (dug) wells up to 15 metres (50 feet) deep. Pumps for water wells must be installed by or under the direct supervision of a qualified well pump installer. Registered well drillers and pump installers have identification cards issued by the Ministry of Environment. The Ministry maintains registries of qualified well drillers and qualified well pump installers, at http://bit.ly/GroundWaterProtectionRegulation

2. BC DRINKING WATER PROTECTION ACT

The *Drinking Water Protection Act (DWPA)* covers almost all water supply systems, except single-family dwellings. As a result, any residential water supply with two or more connections or any commercial, recreational or industrial water supply serving the general public or workers is considered a public water supply and requires a permit from the Health Authority to operate. The DWPA sets out requirements for drinking water operators and suppliers to ensure the provision of safe drinking water to their customers including minimum water treatment standards, monitoring/ testing, and water quality standards.

Bottled water and bulk-water dispensing machines are excluded from the requirements of the *Drinking Water Protection Act*.

3. BC DRINKING WATER PROTECTION REGULATION

The *BC Drinking Water Protection Regulation* sets out the detailed requirements for drinking water quality: construction, operation (including treatment), monitoring, reporting of water systems, and public notification in the event that water becomes undrinkable. It contains the following considerations that are important to small water systems:

- Water supplied from a clearly marked small system equipped with a Point of Entry / Point of Use treatment technology does not have to be potable, provided that the Point of Entry/Point of Use technology makes the water potable.
- Drinking Water Officers have discretionary authority to: determine certification requirements for small system operators; and waive requirement for construction permits. Application of this discretionary authority is guided by the Drinking Water Officers' Guide http://bit.ly/BCDrinkingWaterProtectionRegulation
- Water which is not intended for human consumption or food preparation does not have to be potable.
- Drinking water must be disinfected if it originates from surface water or from groundwater that is at risk of containing pathogens.
- If requested by a Drinking Water Officer, laboratories are required to report all water samples received and the results of testing to the Drinking Water Officer and/or the water supply system owner.

In order to protect the groundwater source from contamination, the *BC Groundwater Protection Regulation* stipulates the methods required to safely install a well, and later decommission it when it is no longer in use. This regulation will be replaced by supporting policies under development as part of the *BC Water Sustainability Act*.

4. PUBLIC HEALTH ACT

The *Public Health Act* provides the authority to public health officials to conduct inspections and take actions to prevent health hazards. It addresses reporting of diseases and hazards, as well as current and emerging public health and environmental health issues.

There are a number of regulations under the *Public Health Act*. The following are most relevant to small water systems:

1. **Sewerage System Regulation:** The Sewerage System Regulation prescribes setbacks for domestic sewage holding tanks and sewerage systems from domestic water system wells. A sewerage holding tank must be situated at least 15 metres from a well; a sewerage system must be situated at least 30 metres from a well.

2. **Health Hazards Regulations:** The Health Hazard Regulations prohibits landlords from renting units which are not connected to a water supply system, unless the landlord can provide the tenant with a supply of potable water for domestic purposes. The term "potable water" has the same meaning as in the *Drinking Water Protection Act*.

OTHER RELATED LEGISLATION

There are other pieces of legislations that may affect your small water systems, depending on your water source, organization and governance. For example:

- Water users' communities are incorporated and are governed by the *Water Users' Communities Act*.
- Strata corporations are incorporated and are governed by the *Strata Property Act*.
- Water utilities are established and are governed by the *Water Utility Act* and the *Utilities Commission Act*.

Applicable legislation depends on the organization and the governance structure of the water supplier. It would be prudent to seek professional advice about how to create a structure best suitable to the particular needs of your community.

WHAT ARE YOUR RESPONSIBILITIES?

The following outlines some of the key responsibilities for a drinking water purveyor, as stipulated in the *Drinking Water Protection Act and Regulation*.

POTABLE WATER

As a water supplier, you must supply water that is safe to drink and fit for domestic purposes, without further treatment, and that meets any requirements set out in the operating permit or regulations.

However, water supply systems are not required to meet potability requirements in the distribution system if they meet either of the following criteria:

- The system does not supply water intended for human consumption or food preparation (i.e. it supplies water for industrial processes, irrigation or other agricultural purposes), and is not connected to a water supply system that provides water for human consumption and food preparation purposes.
- Each recipient of the water from a small system has a point of entry (POE) or point of use (POU) treatment system that makes the water potable.

In each of these circumstances, the water supplier must ensure the location of nonpotable discharge and nonpotable water piping are identified by markings that are permanent, distinct and easily recognized.

POINT-OF-ENTRY (POE) AND POINT-OF-USE (POU) SYSTEMS

Point-of-Entry (POE) and Point-of-Use (POU) treatment systems are an alternative to centralized water supply systems. This equipment treats all the water entering the property/home (POE) or treats the water where needed, such as kitchen and bathroom taps (POU).

When POE or POU systems are employed, the community water distribution system may supply non-potable water to the POE or POU equipment installed in each home. The water is then treated by the POE or POU equipment before being consumed by the occupants.

The *Drinking Water Protection Regulation* gives small water supply systems the option of using POE and POU technology. There are only some situations in which this is financially and practically appropriate. Speak to your Drinking Water Officer if you are considering this as an option.

DISINFECTION

Drinking water must be disinfected if it is supplied by a source that uses surface water or groundwater that is at risk of containing pathogens (GARP).

CONSTRUCTION PERMITS

Every new drinking water supply system, or upgrade to an existing system, must have a construction permit from the local Health Authority before construction begins. Construction permits are issued by a Drinking Water Officer. The application is reviewed to make sure the proposed work follows provincial legislation and health policies. Contact your local Public Health Engineer or Drinking Water Officer for an application package.

Under certain circumstances, the requirement for a construction permit may be waived by the issuing official. Examples of circumstances in which issuing officials may choose to waive a construction permit include:

- The work is so minor that it does not need a permit.
- There is little health risk associated with the change.

Check with your local Health Authority before beginning any construction or upgrades to see if your system may be exempt. An application may be required even if the requirement for a construction permit is waived.

Information requested by local health authorities for a construction permit may vary throughout the province, as site conditions are different. You may be asked for detailed information such as:

- Owner/operator contact information
- Information on any existing operating permit
- Source data – groundwater (e.g., Is your well drilled, dug or driven? Is it an artesian well?)
- Source data – surface (e.g., Is your source a lake, stream, or spring?)
- Aquifer/source protection plan
- Length of operation (e.g., continuous, seasonal or limited)
- Purpose (e.g., subdivision, strata)
- Plans and specifications of equipment (e.g., water main lengths of each size, class and type)
- Source water data (chemical, physical and bacteriological) on raw untreated water
- Water quality concerns for all health-based and aesthetic parameters
- Treatment works: pre-treatment, filtration, disinfection, treatment and storage
- Design flow and population served
- Cross-connection prevention program
- Labeling of the location of nonpotable discharge and nonpotable water piping
- Manufacturers' specifications
- Well log
- Location map, site plan and schematic diagrams
- Engineered plans (or consultant plans, with permission from the Public Health Engineer)

Construction permit applications vary between health authorities. Please check with your local Health Authority to receive the correct application form.

Be sure to keep a copy of your construction permit. Once you have assembled the information necessary for your construction permit, keep a copy in a binder or folder in a safe location. You may need to refer to it when you write your annual reports and other communications.

OPERATING PERMITS

Every small water system, except those supplying a single-family residence, must have a current operating permit from the local Health Authority, which is issued by your Drinking Water Officer. The Drinking Water Officer usually asks for detailed information about your water supply system.

The Drinking Water Officer may put terms and conditions in your operating permit. These are system specific, as each system will have unique site conditions and characteristics. The Drinking Water Officer may discuss how to plan for addressing specific concerns before finalizing or amending the permit's conditions. As a water supplier, you are responsible for compliance. Some examples of terms and conditions that may be required on the operating permit:

- A minimum frequency for bacteriological sampling
- A minimum frequency for chemical sampling
- Specific sampling requirements, such as for fluoride, arsenic or nitrate
- Updating of an emergency response and contingency plan by a certain date
- A specific level of operator training
- A minimum chlorine content for water hauling

Application forms for an operating permit vary between health authorities. Please check with your local Health Authority to receive the correct application form.

EMERGENCY RESPONSE PLANS

All water suppliers must have written emergency response plans. Emergencies can occur when the main operator is unavailable. Therefore, your completed emergency response plan should be posted where it can be easily seen and acted upon if the regular operator is not available. Your water system website is a suitable location for posting the emergency response plan. It is a good idea to periodically talk through or even walk through your plan to practice it and confirm that it is effective. The Ministry of Health's Emergency Response Planning for Small Waterworks Systems is a great template with examples to use to build your own plan. The document can be found at the following link:
http://bit.ly/EmergencyResponsePlanningSmallWaterSystems

MONITORING

Bacteriological and chemical water sample monitoring is required under the *BC Drinking Water Protection Regulation*. The regulation requires systems serving less than 5,000 people to take at least four E. coli and total coliform samples per month. However, variations on this requirement may be specified by a Drinking Water Officer and may appear on the operating permit based on the history of the systems, or site conditions.

The monitoring frequency of chemical sampling is specified by the Drinking Water Officer. This frequency typically ranges between one and five years, depending on the nature of the source. In addition, specific parameters such as arsenic may require testing more frequently when they are a concern.

LABORATORY REPORTS

Laboratories must immediately report to water suppliers, the Drinking Water Officer and the Medical Health Officer (MHO) if water sample test results for E. coli and total coliform do not meet specified standards. Water suppliers must immediately advise the Drinking Water Officer that they have been notified by the lab in such cases. Laboratories may also advise Drinking Water Officers of other information on request.

OPERATORS

The *Drinking Water Protection Act* states that water systems with greater than 500 individuals must have an operator that is certified through the Environmental Operators Certification Program (EOCP). Certification requirements for smaller systems are determined on a case-by-case basis. While EOCP certification may not be required for all small water systems, it can help ensure that an operator has the appropriate training and knowledge.

Generally, Health Authorities consider the size and complexity of your small water system to determine what training is appropriate. The requirements may range from an introductory water safe course, to a small water systems course, and for a more complex system, training and EOCP certification matching the classification of the system may be required. Contact your regional Health Authority and see your operating permit to confirm requirements for your system.

NOTIFYING DRINKING WATER OFFICER OF THREATS

As an owner, trustee, director or operator of a small water systems, you are required to notify the Drinking Water Officer of any threats or potential threats (e.g., spills/releases of chemicals, manure, farm waste, garbage, road construction and forestry activities) to drinking water as soon as you become aware of them.

PUBLIC NOTICE OF THREATS

If there is reason to believe there is a threat to the water supplied by a drinking water supply system, the Drinking Water Officer may request or order a water supplier to give public notice to the users of the system. If the water supplier becomes aware of a threat to their system and the Drinking Water Officer cannot be reached right away, the water supplier must immediately notify users of the water supply system of the possible hazard. This process should be clearly laid out in emergency response and contingency plans.

ANNUAL REPORTS

Water users are often interested in learning about their water supply system. The annual report provides an opportunity for water suppliers to share important information about their water supply system, significant recent events and water topics in general (e.g., water conservation).

The report may also provide information about any local concerns, such as notice of any threats to the drinking water supply system, or levels of fluoride and/or sodium where they are significant. It may also list repairs completed or needed, major expenditures, vandalism, long term financial plans, and other general information about the water supply system. It may be convenient to post some or all of this information on your water system website

The *BC Drinking Water Protection Regulation* requires that an annual report be made available to all water supply system users within six months of the end of the calendar year (before July). The report must contain the results of monitoring required by the regulation, operating permit or Drinking Water Officer.

In addition, the *BC Drinking Water Protection Act* requires the following information be made public in accordance with the regulation, and any terms and conditions placed on the operating permit by the Drinking Water Officer:

- The water supplier's emergency response and contingency plan;
- Results of monitoring required by the regulation, operating permit or Drinking Water Officer, subject to any applicable time limits established by the regulation;
- If applicable, the most recent assessment of the water source and system;
- If applicable, the current assessment response plans; and
- Other information required to be made public by the regulation, operating permit or Drinking Water Officer.

SINGLE FAMILY RESIDENCES

A single-family residence on its own water supply system is exempt from most of the requirements of the BC *Drinking Water Protection Act*, such as construction and operating permits. However, property owners are still responsible for the safety of the water. Where a single-family residence on its own water supply system is a rental property, the BC *Public Health Act* requires landlords to supply tenants with potable water. Health authorities may be able to advise an owner on understanding and improving the safety of their single-family water supply system.

DEMONSTRATING DUE DILIGENCE

Owners/operators of small water systems should show compliance with their operating permit's conditions by using good record-keeping practices. This is part of demonstrating due diligence. Records are reviewed by Drinking Water Officers during routine inspections. On rare occasions, there could be a court challenge from someone who believes they have been harmed by the water supply system. Records will show the steps taken to avoid harm. Important factors to record include:

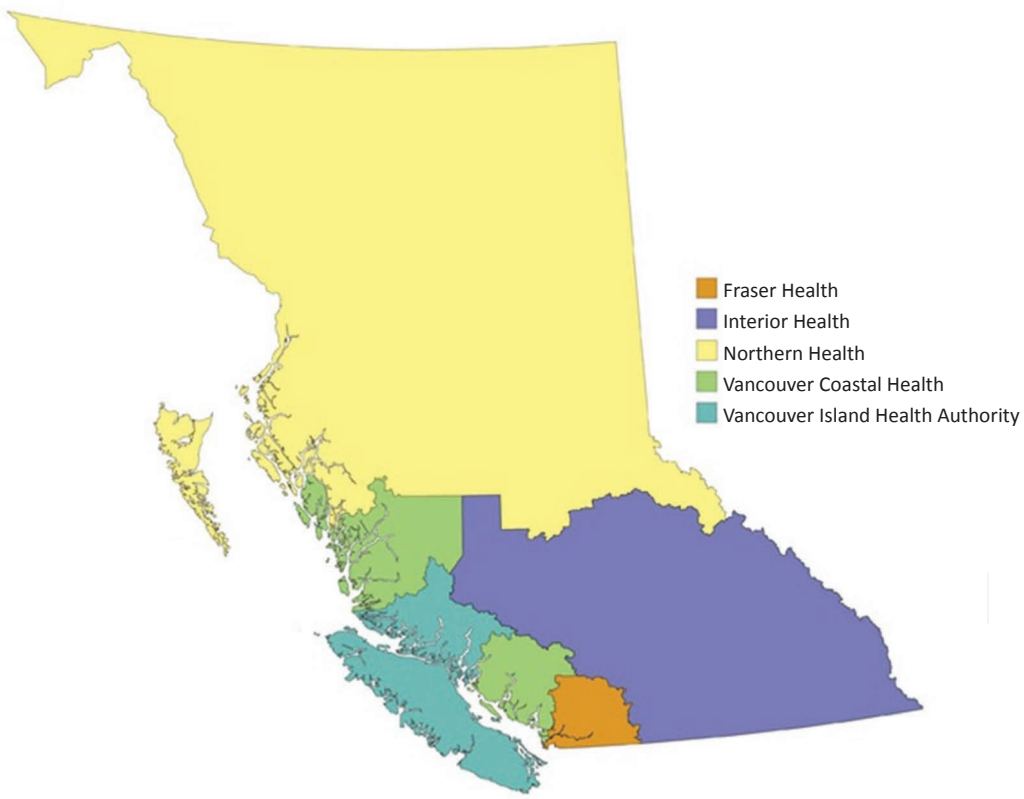
- Chlorine log
- Maintenance log (e.g., flushing, cleaning, reservoir maintenance, security, repairs, filter backwashing, checking filters, pumps, well casings, UV lamps and chemical feeders)
- Bacteriological sampling results (available online on Health Authority website)
- Chemical sampling results (available online on Health Authority website) and exceedances
- Emergency response and contingency plan
- Inspection reports and responses to deficiencies
- Record of user complaints and actions taken
- Annual report to users

THE KEY PLAYERS – WHO DOES WHAT?

Many people and organizations contribute to providing safe drinking water in British Columbia. Below is a brief description of the roles of the key organizations and roles that you talk to for support, information and direction.

HEALTH AUTHORITY

BC's five regional health authorities deliver local health services for the BC's Ministry of Health. The health authorities work with the Ministry of Health to set and implement province-wide policy for drinking water. Refer to the map below to see which Health Authority covers your area.



Source: BC Ministry of Health. "Regional Health Authorities".
http://bit.ly/BCRegionalHealthAuthorities

DRINKING WATER OFFICERS AND ENVIRONMENTAL HEALTH OFFICERS

Drinking Water Officers (DWO) administer and enforce drinking water legislation. They provide surveillance and monitoring of drinking water supply systems that may affect the public's health. As well, they review the design, construction, maintenance and operation of drinking water supply systems, with an emphasis on co-operation and leadership among interested parties. The DWO is typically the primary point of contact between the water owner and the regional Health Authority.

Health Authorities are responsible for:

- Implementing the *Drinking Water Protection Act* and *Drinking Water Protection Regulation*;
- Setting conditions for operating permits for small water systems;
- Approving and in some cases, waiving construction permits; and
- Determining training and certification requirements for small system operators.

As a water suppliers, you must:

- Provide water that is safe to drink without further treatment and meets the requirements in your operating permit and regulations (or via application of POE or POU where approved by your Drinking Water Officer);
- Analyze the water from your system for the presence of microbiological pathogens and other indicator organisms by a laboratory approved by the Provincial Health Officer; and
- Make the results of drinking water quality tests available in an annual report.

Contact your Health Authority for more information on available drinking water services including written resources, educational outreach, and training.

MEDICAL HEALTH OFFICER

Medical Health Officers (MHOs) are located in each Health Authority within BC. They are appointed by Cabinet, and have overall responsibility for the implementation of the *Public Health Act* and the *Drinking Water Protection Act* in their Health Authority. By default, Medical Health Officers are Drinking Water Officers.

PROVINCIAL HEALTH OFFICER

The Office of the Provincial Health Officer (PHO) has an oversight and accountability role under the *Drinking Water Protection Act*. The PHO can review decisions by DWOs. The PHO prepares an annual report on the status of drinking water.

BC MINISTRY OF HEALTH

The BC Ministry of Health (MoH) provides leadership and expertise to promote community environmental health. It develops policy, legislation, and guidelines for public health risk management in collaboration with government partners, stakeholders, local government and the public.

BC MINISTRY OF ENVIRONMENT

The BC Ministry of Environment (MoE) promotes environmental stewardship and sustainability by enhancing environmental protection, public health and safety as well as monitoring air and water quality. MoE's water-related responsibilities include developing policy, legislation and standards in the areas of:

- Ambient water quality standards, including monitoring and reporting; and
- Watershed and aquifer protection and sustainability.

Key pieces of ministry legislation related to drinking water include the *Water Sustainability Act* and the accompanying *Groundwater Protection Regulation*. They are administered by the Ministry of Forests, Lands and Natural Resource Operations. Under the *Environmental Management Act*, the Environmental Protection Division (MoE) works to prevent pollution, and promote and restore environmental quality. To learn more, see www.gov.bc.ca/env.

BC MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS

The BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) delivers integrated natural-resource-management services for British Columbians. It is the main agency responsible for establishing the policy and conditions for access to and use of BC's forest, land and natural resources, and for receiving water license applications for surface water and groundwater sources.

MFLNRO is charged with implementing various programs related to water source protection and sustainability. If you need more information or guidance related to water stewardship, you will generally work with this ministry as it administers water licenses and regulates water utilities and water users' communities. Key pieces of ministry legislation related to drinking water are *Forest and Range Practices Act* and *Water Utility Act*. It also has responsibilities under the *Water Sustainability Act* and the new *Water Users' Act*. See www.gov.bc.ca/for.

BC MINISTRY OF COMMUNITY, SPORT AND CULTURAL DEVELOPMENT

The Infrastructure and Finance Branch of the BC Ministry of Community, Sport and Cultural Development (MCSCD) oversees the local government financial system and supports local government infrastructure through the administration of several capital funding programs.

This branch supports the development of sustainable drinking water infrastructure by:

- Working with improvement districts, regional districts and municipalities to improve governance and financial stability of water supply systems under their jurisdictions; and
- Providing capital infrastructure and planning funding for local governments.

Some areas of support offered by the MCSCD are limited to water systems that are part of or are in partnership with a municipality or regional district. Other support, such as the New Building Canada Fund – Small Communities Fund, does not have this requirement. Information about funding programs available are available at: www.cscd.gov.bc.ca/Lgd/infra/infrastructure_grants/index.htm.

Key pieces of ministry legislation related to drinking water are the *Local Government Act* and the *Community Charter*. Further information is available at: www.gov.bc.ca.cscd.

ENVIRONMENTAL OPERATORS CERTIFICATION PROGRAM

The Environmental Operators Certification Program (EOCP) classifies water and waste water systems, and certifies trained operators. It offers certification that is recognized in the *Drinking Water Protection Regulation* for water supply systems and facility operators. For more information, see www.eocp.ca.

BC WATER & WASTE ASSOCIATION

The BC Water & Waste Association (BCWWA) is a non-profit association dedicated to safeguarding public health and the environment by sharing skills, knowledge and experience in the water and wastewater industries.

The BCWWA educates and trains water supply system operators. It provides networking and knowledge-sharing opportunities for water and wastewater industry professionals in BC and Yukon. In addition, the BCWWA is a voice for the water and waste community, providing its members with linkages with government and other organizations, and engaging in public outreach and advocacy. For more information, see www.bcwwa.org.

SMALL WATER USERS ASSOCIATION OF BC

This not-for-profit society of small system users and operators exchanges information about government, financial and other assistance programs and services, and advice on the application process. The association also offers information on group liability insurance. For more information, see www.smallwaterusers.com.

SUSTAINABLE INFRASTRUCTURE SOCIETY

The Sustainable Infrastructure Society is a not-for-profit organization offering a range of programs to help community water supply systems in BC access affordable resources. This society works with individual water suppliers, regional water associations, and government agencies delivering services. It provides access to affordable insurance designed for water suppliers; a service to help water suppliers create a website; a directory of products and services for the Canadian water industry; and links to financial best management practices covering asset management, water rate setting services, and other topics. For more information, see www.waterbc.ca.

WATER SUPPLY ASSOCIATION OF BC

The Water Supply Association of BC (WSABC) represents the interests of water suppliers throughout the Southern Interior of BC. For more information, see www.wsabc.ca.

RES'EAU-WATERNET

RES'EAU works with communities to develop innovative and affordable solutions for providing clean drinking water to small, rural, and First Nations communities. For more information, see www.reseauwaternet.ca.

BRITISH COLUMBIA GROUND WATER ASSOCIATION

The British Columbia Ground Water Association (BCGWA) provides professional and technical leadership for the advancement of the groundwater industry and in the protection, promotion, and responsible development and use of groundwater resources in British Columbia. For more information, see www.bcgwa.org.

COASTAL WATER SUPPLIERS ASSOCIATION

The Coastal Water Suppliers Association (CWSA) provides ongoing support, education and training to coastal water suppliers and their associates. It organizes an annual conference and trade show for coastal water suppliers, and occasional workshops on water-related topics. The conference features speakers covering a wide of topics of interest to community water suppliers of all sizes. For more information, see www.cwsa.net.

ACTIONS YOU CAN TAKE TO BE BETTER INFORMED

The following are some suggested actions you can take to be better informed about your drinking water oversight responsibilities.

- **Become further acquainted** with drinking water legislation and regulations. All BC legislation can be found at **www.bclaws.ca**. Search or browse current laws to find what you are looking for. To search, enter the title, or any part of the title, of the law you wish to find. If you don't know any part of the title of the law, enter a word or phrase that you think might be in the text of the law.
- **Learn about** water safety and its link to public health. Speak to the water system operators, regulators and public health staff to learn more.
- **Get to know** who your regional Health Authority representative is. They should be able to help you for any public health questions you may have.

Key Message:
Get to know your responsibilities. What you do or don't do impacts the health of your community.

THINGS TO REMEMBER

BC legislation stipulates that the water supplier is responsible for providing potable water to its consumers.

- Your regional Health Authority is an important resource for checking that you are meeting your regulatory requirements.
- Construction and operating permits are required to expand and run your drinking water infrastructure.
- For documentation, at minimum you should have an Emergency Response Plan and produce an annual report.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

THE ROLE OF OPERATORS

- Why do you need an operator?
- What are the roles and responsibilities of your operator?
- Does your operating permit require our operator(s) to be certified?
- What are the certification requirements?
- Are the operators trained appropriately?
- How often do you meet with your operators?
- Do we have Standard Operating Procedures for operators and volunteers to follow?
- Are there enough staff/volunteers?

THE ROLE OF OPERATORS

OPERATOR RESPONSIBILITIES

Operators play a vital role in providing safe water for your community. The responsibilities of an operator may include, but are not limited to:

- Checking, adjusting, and operating equipment such as pumps, meters, analyzers, and electrical systems, and having replacement parts on-site for critical repairs;
- Determining chemical dosages and keeping chemical feed equipment appropriately filled adjusted, and operating properly;
- Ordering and maintaining a stock of parts, chemicals, and supplies;
- Maintaining records and submitting reports to the system's operating team/owner and the regional Health Authority;
- Collecting and submitting water samples as required by regulation (this usually involves taking samples from a number of key locations and transporting them to a licensed laboratory); and
- Communicating and planning with the operating team/owner/council about maintenance issues, major repairs, replacements, or improvements that should be made to the system.

CERTIFICATION REQUIREMENTS

To qualify to write the certification exams, applicants must meet the minimum education, training, and experience requirements associated with each certification level. Once the requirements have been met and the exam passed, the applicant will receive their certificate from the Environmental Operators Certification Program (EOCP). To renew a certificate, an operator must complete twelve hours, or 1.2 continuing education credits (CEU), or post-secondary training every two years. Continuing education helps operators steadily improve their knowledge and skills throughout their careers.

Water operators may opt to first certify as an Operator-in-Training while gaining hands-on experience. The requirements to take the certification exam for these two roles are listed below:

Title	Training / Education Requirements	Minimum hands-on experience
Small Water System Certified Operator	1.2 CEU (12 hours) every 24 months	6 calendar months (50 hours)
Operator-in-Training	Prerequisite: High school diploma, GED, or equivalent	3 months hands experience or completion of approved basic operator-training course

For more information contact the EOCP at www.eocp.ca.

FACILITY CLASSIFICATION

The operational complexity of your water facility will determine what certification requirements your operators must have to operate the system. EOCP requires that the operation of a water facility be supervised by at least one person holding a certification matching the facility's classification level.

For larger systems, operator certification is classified under Water Distribution (WD) and Water Treatment (WT) on a scale from I to IV, with a higher number representing facilities of greater complexity. For systems serving fewer than 500 individuals, operators are generally certified along the following classifications:

- Small water system (SWS); and
- Bulk water delivery.

Some systems that serve less than 500 people with complex processes may be classified as Level I to IV. Contact your Health Authority if you are uncertain about the level of certification required for your operator.

COMMUNICATING WITH YOUR OPERATORS

Communication is an integral component for the successful operation of a small water system. Taking action to develop communication strategies between owners/trustees and operators, as well as your community users, ensures vigilance in maintaining safe, high quality water and protects the water supplier from liability.

It is important for owners/trustees to develop a procedure for communicating with the operators of your water system. The procedure for communicating with the operators may be as simple as indicating the status of the various monthly and annual reports and the implementation and effectiveness of the operations plan during scheduled meetings.

Communication procedures with the water users is highly recommended. This level of communication can be done through written communication (i.e. publicly accessible website or through handouts/ mailouts) or by developing a community engagement strategy that will allow members of your community to become aware and regularly informed about your water systems. By encouraging regular conversations related to water, your community can stay informed and aware of the system and their role in maintaining a safe and sustainable water systems.

ACTIONS YOU CAN TAKE TO BE BETTER PREPARED

As the facility's owner/trustee, you are responsible for being aware of the certified operator requirements for your facility and to ensure that the requirements are met. To meet this legal responsibility the following actions are recommended:

- **Review** your operating permit and ask if your water system meets the requirements.
- **Consult with** your Drinking Water Officer to ask questions about anything that is unclear or beyond your systems current capacity.
- **Confirm that** your operators both paid and volunteer have the right knowledge and skills to effectively and safely run your water system.
- **Develop or become familiar** with your water system's contingency plan to ensure that duties are completed in the case of planned absences, unplanned absences, or changes of roles or people. Identify other who can take on these duties if needed.
- **Proactively plan and budget** for your volunteers and operators to access training to meet the needs of your water system and if needed, continuing education requirements for operators who are certified.

Key Message:
Keeping your operations team trained and current in order to maintain a safe water system.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

KEY FACTORS IMPACTING SUCCESS

- Are you are meeting the regulatory requirement for drinking water?
- Are you using the right treatment system for your water?
- Do you have the right administrative procedures in place to manage your water system?
- Do you have operators in place to run and maintain the water system?
- Do you have sufficient funding to maintain your water system for the short and long term?
- Do you have a supportive public?

KEY FACTORS IMPACTING SUCCESS

Consider the following factors in assessing the current knowledge and capacity of the team of people managing and operating your small water systems;

- **Are you are meeting the regulatory requirements for drinking water?** Do you have open communication with your Drinking Water Officer? Are you aware of the conditions of your Operating Permit?

- **Are you using the right treatment system for your water?** The right treatment for your water system is not only one that meets the regulatory requirements, but is one your operators have the knowledge and skills to consistently operate, manage, and troubleshoot. The process should meet your treatment objectives at a reasonable cost.

- **Do you have the right administrative procedures in place to manage your water system**? Your operations team is important in overseeing management of the system, including keeping regular, clear, and accurate records of system performance and accounting; and written plans for the long term maintenance, growth and/or replacement of your system.

- **Do you have operators in place to run and maintain the water system?** An operator is responsible for active, daily on-site operation of the small water system. Operators must maintain knowledge of the water system from source to tap, perform regular monitoring, keep consistent regular records, and provide timely updates to the owners, managers, trustees.

- **Do you have sufficient funding to maintain your water system for the short and long term?** Revenue self-sufficiency is required to be able to finance the operation, upkeep, and improvement of your water system. Do you have an asset management plan in place that will ensure sufficient money is available to replace each physical asset as it reaches the end of its useful life?

- **Do you have a supportive public?** Regular, positive engagement with the community and other key stakeholders will reinforce the value of safe drinking water, build support for water system upgrades in your community, and improve the community's ability to respond to water system emergencies.

In later sections of this document, we examine these objectives in greater detail and provide recommendations on how to move towards meeting them.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

OVERVIEW OF KEY CAPACITY BUILDING AREAS FOR SUSTAINABLE SYSTEMS

- **How do you strengthen the safety and reliability of your water system?**
- **What areas should you focus on?**

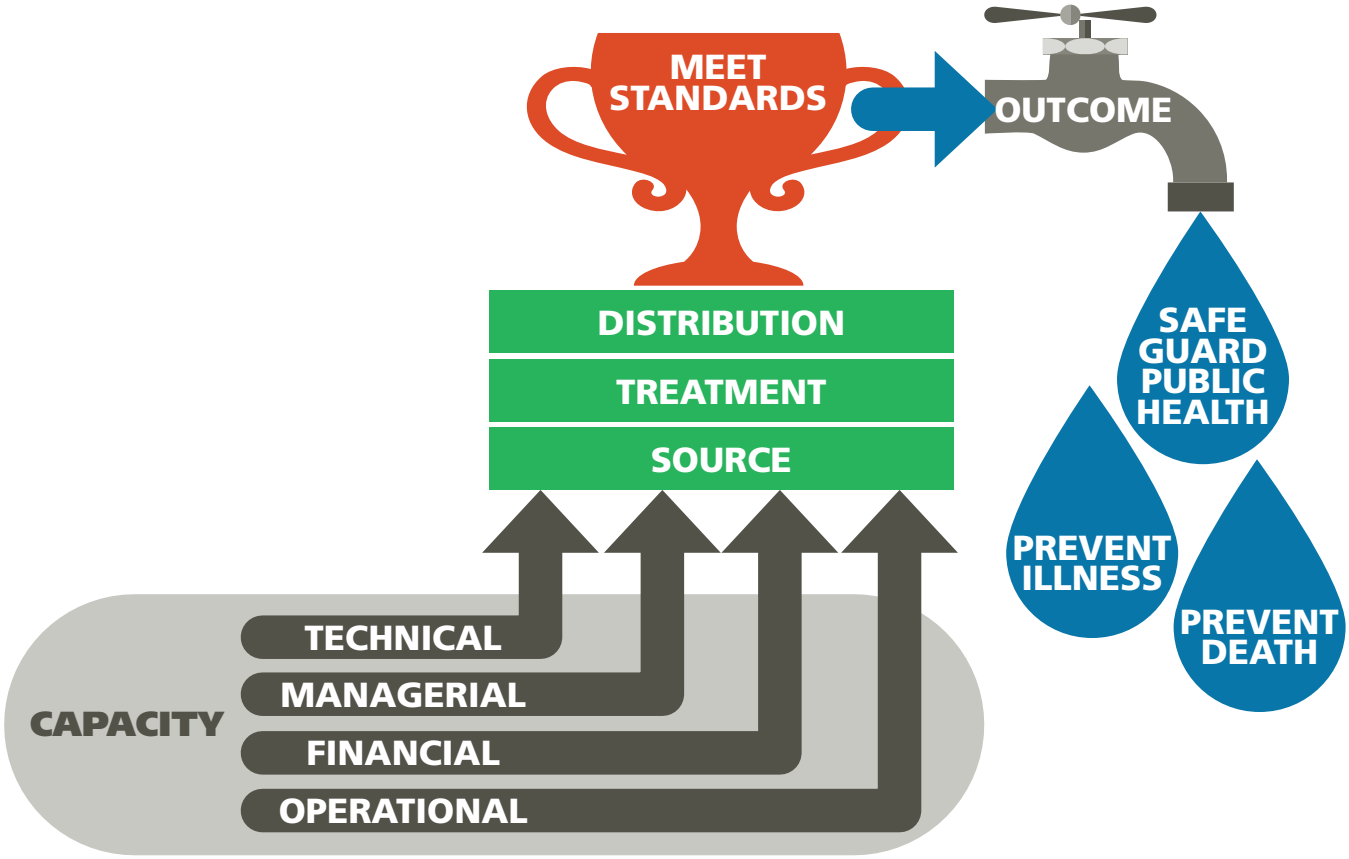
OVERVIEW OF KEY CAPACITY BUILDING AREAS FOR SUSTAINABLE SYSTEMS

WATER SYSTEM CAPACITY

Water system capacity can be defined as the ability to plan for, achieve, and maintain compliance with applicable drinking water standards so that systems can provide safe and affordable water to their customers (USEPA Drinking Water Academy. 2003. "Capacity Development: an Introduction"). For a successful water system, capacity is required in four key areas:

- Technical Capacity
- Managerial Capacity
- Financial Capacity
- Operational Capacity

A successful water system can be thought of as a table, with the four areas of capacity each representing a leg to this table. All four legs are essential to support the table, and each leg must be attended to equally or the table will eventually collapse.



TECHNICAL CAPACITY

Technical capacity refers to the physical infrastructure in place to reliably provide safe water from the source to the consumers and can be split into two main components:

- **Source Water Adequacy:** Source water adequacy is ensuring water supply sources are protected and provide sufficient capacity to meet your system's water demands. When considering potential supply sources, the water source should be of relatively good quality and easy to access when compared to alternative supply options.
- **Infrastructure Adequacy:** Infrastructure adequacy is ensuring the good working condition of the physical infrastructure that transports water from the source, through treatment and distribution, to the user safely. The infrastructure should be in good condition and not have exceeded its useful life, as aged infrastructure or infrastructure in poor condition can detrimentally impact the quality of the water and result in increasing maintenance costs. The development of a capital improvement plan, where the replacement of aging or failing infrastructure can be scheduled along a timeline, is recommended to help plan infrastructure improvements well in advance.

MANAGERIAL CAPACITY

Managerial capacity is the overseeing and administration of the water system and can be split into several components:

- **Ownership Accountability:** The specific owners/trustees or directors of a water system should be clearly identified and held accountable for their water systems (i.e. demonstrate good governance). Accountability is essential for the system to continually operate effectively. Clearly defining accountability for owners and their roles will minimize confusion, mistakes, and misunderstandings in the daily operation of the system, or during an emergency.
- **Staffing and Organization:** Defining roles and responsibilities should extend to the rest of the water system team, including managers and operators. The members of your team should have adequate training and expertise to manage their duties as well as understand the water system's regulatory requirements, including license and certification requirements. Staff training should be a continual process, as the drinking water regulatory landscape and water technologies constantly evolve.
- **Effective External Linkages:** Water system staff need to interact regularly with the system users and the Health Authorities. Building relationships with these external points of contact will increase a system's ability to solve problems as they occur, as well as build support to recognize the value of water and improve the water system overall. External linkages also include building relationships with external experts to assist you with technical problems and financial issues as needed.

FINANCIAL CAPACITY

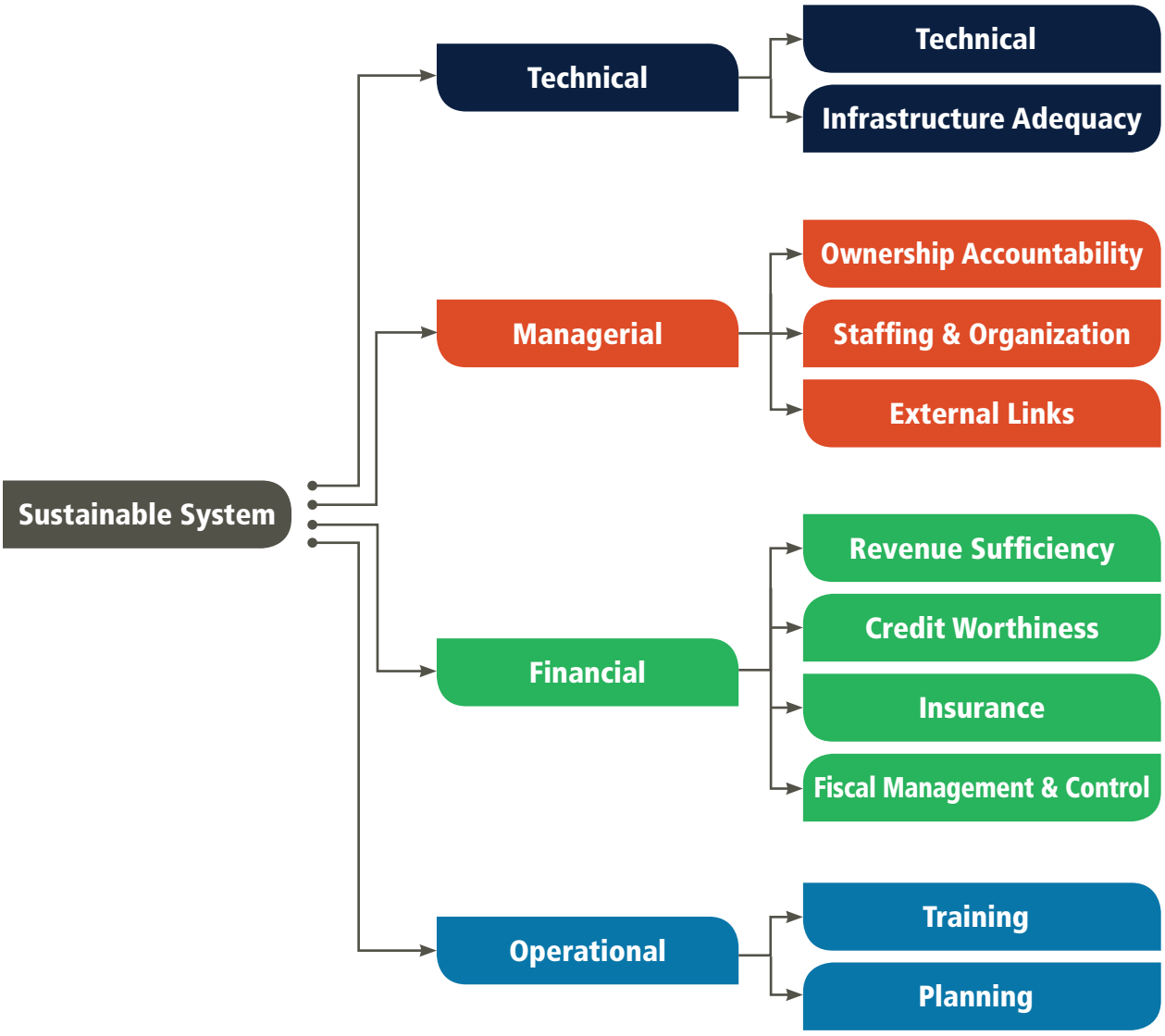
Financial capacity is ensuring that a water system is able to fund its operation, maintenance, and improvement work, and eventual replacement. There are four facets of financial capacity:

- **Revenue Sufficiency:** Having enough revenue is the cornerstone of a well-run system. If revenues from services rates do not cover system costs, the system will eventually be unable to make needed repairs. A water system should be charging rates that reflect the true cost of service, and able to accurately determine the cost of service by tracking all revenues and costs. For more information, please refer the section on financial management best practices.
- **Fiscal Management and Controls:** Sound financial management allows a system to maintain efficient and effective operations. This includes keeping adequate records, implementing appropriate accounting and financial planning tools, and managing incoming revenues effectively.
- **Credit Worthiness:** Establishing a good credit rating will allow the owners of a water system to borrow funds if an emergency or unexpected cost occurs, and when the community need to access financing to replace their water system. Financial institutions will look at the financial health of a system to determine whether the system is a good credit risk.
- **Insurance:** Some risks are managed in part, by purchasing appropriate insurance coverage. The kinds of insurance that are appropriate depend on risks faced by your water system. Reach out to insurance professionals to determine whether you are adequately insured for liability including death, injury or damage, breach of duty, errors, omissions, accidents, property damage, boiler, and machinery insurance. Be prepared to provide detailed information so that your needs for coverage are clear and you help minimize the possibility of overlaps and gaps.

OPERATIONAL CAPACITY

Operational capacity relates to the people responsible for the day-to-day running of your water system. There are two key components of operational capacity:

- **Training:** Regardless of whether or not your operators are required to be certified, they should receive sufficient training to be familiar with BC's drinking water standards, as well as understand the technical and operational characteristics of the equipment and components that make up the water system infrastructure. Continuing education is important as to regularly refresh existing knowledge and skills, boost technical expertise, and stay up to date on developments in the water industry.
- **Planning:** A regular maintenance and inspection routine helps operators spot unusual behaviour in the water system before a more serious problem develops. This routine is best formalized by developing an operating plan or standard operating procedures, which involve maintenance checklists and daily logs to fill out. Developing an Emergency Response Plan will also provide the operators a clear procedure to follow during an emergency.



ACTIONS YOU CAN TAKE TO BE BETTER PREPARED

Looking at how your water system provides capacity in the four areas described can give you a new way to identify the strengths and vulnerabilities of your system. This type of review can also raise questions where the answers are currently unknown. As a starting point, the following actions are recommended:

- **Gauge** the technical capacity of your system by conducting a source-to-tap assessment of your infrastructure, as detailed in the next section of this document.
- **Identify** the staff of your water system and governance structure, define each person's role and review their qualifications.
- **Review your financial records** to determine system revenues and costs. Identify methods or tools that would improve tracking of your financial records.
- **Locate and review** your standard operating procedures and Emergency Response Plan. Identify the current level of training your operators have received.
- **Proactively plan and budget** for your volunteers and operators to access training to meet the needs of your water system and if needed, continuing education requirements for operators who are certified.

Key Message:
Keep building knowledge in all four areas of capacity to achieve a safe, reliable and affordable water system.

THINGS TO REMEMBER

Building capacity takes time and is a continuous process. When reviewing the capacity of your water system, it is important to keep in mind:

- Equal attention to all four areas of capacity is required for a successful water system. Neglect in one area of capacity will compromise the strength of your water system, no matter how strong the other areas of capacity may be.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

SELF-ASSESSMENT OF WATER UTILITY PERFORMANCE

- Do you have an inventory of your assets?
- What is the current condition of your assets?
- Do you need additional equipment to meet the health regulations?
- Do you have a plan for renewal and replacement?
- How do you assess your water system infrastructure?

SELF-ASSESSMENT OF WATER UTILITY PERFORMANCE

CAPITAL PLAN

Capital Plans (also known as capital budgets or long term financial plans), are often made for longer terms, such as twenty years, to reflect the longer lives of the physical assets such as well pumps. Water supply systems require significant investment in capital assets such as collection, treatment and distribution structures. To manage this system, owners/trustees who hold financial responsibilities and operations staff should work together to determine the following:

- An inventory of the current infrastructure including the estimated remaining life of its components;
- A measure of the expected growth in the system – the infrastructure required to service new development and when that infrastructure will need to be constructed;
- Upgrades or additional equipment required to support processes to meet health regulations; and
- The total cost of renewing and replacing existing infrastructure and providing new infrastructure.

With this information, financial staff and decision makers can plan to steadily raise the funds to renew, replace and grow the water supply system and ensure long-term sustainability.

SOURCE-TO-TAP SCREENING AND ASSESSMENT

One way to determine the vulnerabilities of your system is to conduct a source-to-tap screening or assessment. This is an onsite review of the water source, treatment facilities, pumps, pipes, storage, and distribution up to the property line of the consumer. It can be completed voluntarily or by order of the local Drinking Water Officer. The purpose is to carry out a comprehensive inspection of the drinking water supply system and determine if the system is producing safe drinking water consistently and reliably. The following questions should be answered upon completing this process:

- Is the water supply system in compliance with regulations?
- Is the source protected and physical components in good condition?
- Is treatment appropriate for the water characteristics?
- Is water storage constructed and maintained to keep water safe?
- Is the distribution system adequate to deliver water quality/quantity needed?
- Are monitoring, reporting and data current and confirmed?

This chapter provides a basic overview of source-to tap-screening and assessment. The Ministry of Health has produced three tools with different levels of detail and complexity to aid in the screening/assessment process:

- *Drinking Water Source-to-Tap Screening Tool*
- *Water System Assessment User's Guide*
- *Comprehensive Drinking Water Source-to-Tap Assessment Guideline*

DRINKING WATER SOURCE-TO-TAP SCREENING TOOL

In 2004, the Province developed the Drinking Water Source-to-Tap Screening Tool as a method for assessing risk in drinking water supply systems. See http://bit.ly/DrinkingWaterScreeningTool.

It is a simple self-screening tool, produced by the Ministry of Health, which consists of 97 questions in the following categories:

- administration, management, operation and water system description
- water source
- water treatment
- water storage
- distribution
- tap water quality

WATER SUPPLY SYSTEM ASSESSMENT

The Water System Assessment User's Guide, and associated assessment forms, is a source-to-tap assessment designed to be completed by the water supply operator or the Drinking Water Officer. It was developed to provide a middle ground in complexity between the simpler Drinking Water Source-to-Tap Screening Tool, and the more complex Comprehensive Drinking Water Source-to-Tap Assessment. You can find the Water System Assessment User's Guide at http://bit.ly/GovEnviroResourcesForWaterSystemOperators.

This assessment tool uses Microsoft Excel forms with more and greater detailed questions than the Screening Tool. The Excel forms transfer information forward to the next form and automatically complete numerical calculations that are part of this tool.

COMPREHENSIVE DRINKING WATER SOURCE-TO-TAP ASSESSMENT

The Comprehensive Drinking Water Source-to-Tap Assessment is a tool to help water suppliers develop a more comprehensive understanding of the risks to drinking water safety and availability of their system. This is the most comprehensive and time-consuming assessment tool produced by the Ministry of Health and should only be completed with the assistance of a qualified professional.

This assessment tool includes an introduction, which should be reviewed in detail for information on the assessment process prior to commencing and eight modules. The complete document can be accessed at http://bit.ly/DrinkingWaterScreeningTool.

The introduction and individual modules are all available at http://bit.ly/GovEnviroResourcesForWaterSystemOperators.

There are eight individual modules available with the topics for each module listed below:

- **Introduction:** *Understand and Prepare for the Assessment Process*
- **Module 1:** *Delineate and Characterize Drinking Water Source(s)*
- **Module 2:** *Conduct Contaminant Source Inventory*
- **Module 3:** *Assess Water System Elements*
- **Module 4:** *Evaluate Water System Management, Operation and Maintenance Practices*
- **Module 5:** *Audit Water Quality and Availability*
- **Module 6:** *Review Financial Capacity and Governance of Water Service Agency*
- **Module 7:** *Characterize Risks from Source to Tap*
- **Module 8:** *Recommend Actions to Improve Drinking Water Protection*

THINGS TO REMEMBER

As an owner/trustee of a small water system, there is value in understanding what infrastructure you have and planning for the replacement or upgrading of used equipment over time.

- Conducting a source-to-tap assessment of your water system will allow you make an inventory of your infrastructure.
- There are three main assessment tools available from the Ministry of Health. They range in complexity and in the amount of information they provide. Use the tool appropriate for you:
  - Drinking Water Source-to-Tap Screening Tool
  - Water Supply System Assessment
  - Comprehensive Drinking Water Source-to-Tap Assessment
- An asset management plan is recommended to schedule the replacement of aging equipment so that replacement costs can be adequately planned for in advance.

ACTIONS YOU CAN TAKE TO BE BETTER PREPARED

- **Conduct** a source-to-tap assessment of your infrastructure.
- **Review** the inventory identified in your assessment. Anticipate the remaining life of key equipment and infrastructure based on its current condition, date of installation and expected life.
- **Consult** with your operator for a more accurate estimate of equipment condition and remaining lifespan.
- **Develop** an asset management plan including a replacement schedule for your equipment and infrastructure, based on the anticipated date that various equipment will reach its end-of-service life.
- **Use** the Financial Best Management Practices to create a long term financial plan so you can project your expenses and estimate rate for 5, 10 and 20 years.

Key Message:
Building a sustainable water system can be intimidating. Take it one step at a time and form a team to work on it together.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

OVERVIEW OF FINANCIAL CAPACITY

- **Do your rates cover the full cost of operations and maintenance?**
  - **What are your costs?**
  - **What are your rates?**
  - **Do you have a plan for upgrading/replacing your water system?**
- **How does communication factor into financial management?**

OVERVIEW OF FINANCIAL CAPACITY

BC WATER RATES

British Columbians are fortunate that fresh water is generally abundant and readily available throughout most of the province. Unfortunately, this has contributed to the assumption that the water coming from the tap should be cheap, if not free. However, the infrastructure, operator training, materials and supplies, regular maintenance, water testing and loan payments required to deliver the service all cost money. As with any other product or service, funds need to be supplied by the people that use the service. We need to think of safe drinking water as a valuable product that requires financial investment.

Sound financial management helps reduce financial surprises for customers and ensures that the funds entrusted to the system managers are used effectively and efficiently. It also helps to:

- Ensure there are enough funds for day-to-day expenses;
- Set water rates that reflect the true cost of service;
- Budget for infrastructure (capital) upgrades;
- Demonstrate due diligence to regulators and lenders;
- Reduce the possibility of omitting important activities; and
- Maintain long-term system sustainability.

Financial management provides decision makers with some of the information they need to make decisions and predict costs for property owners. It helps create and maintain a robust, sustainable system for providing clean water.

BC HAS ONE OF THE HIGHEST RATES OF WATER USAGE IN CANADA

We use more water per person per day than the average Canadian. Low, fixed water rates are partially responsible for this phenomenon; when individuals pay higher rates per cubic meter, they tend to use less water.

COMPONENTS OF FINANCIAL MANAGEMENT

Sound financial management extends beyond good record keeping. The following topics introduce the basics of some more advanced concepts of financial management and control.

FINANCIAL CONTROLS

Controls are policies and procedures that guide the day to day management of finances. Controls ensure that money is used in the way it is supposed to be used – as directed by the decision makers. There are a variety of controls that may be put in place. Some common controls are:

- A financial officer who is responsible for reporting to decision makers.
- Regular review of financial transactions by decision makers.
- Authorization structures for purchases of a certain size or type.
- Multiple signatures on cheques.
- Lockdown procedures for cash and cheques.

A specialist with experience in business management can help create controls that suit your organization.

FINANCIAL STATEMENTS

Financial statements look back over a specific period of time to illustrate the flow of funds through the organization (i.e. where the money was spent, during that period) and provide a picture of its current financial position. They also help decision makers to plan for the short and long term operation of the system. They can be used to help generate operating budgets, manage cash, develop capital (long term financial) plans, set aside reserve funds, and apply for loans.

Financial statements should be relevant – they should provide useful information to the decision makers in a timely manner. The statements should also be reliable – they should reasonably and accurately represent the operations and position of the organization.

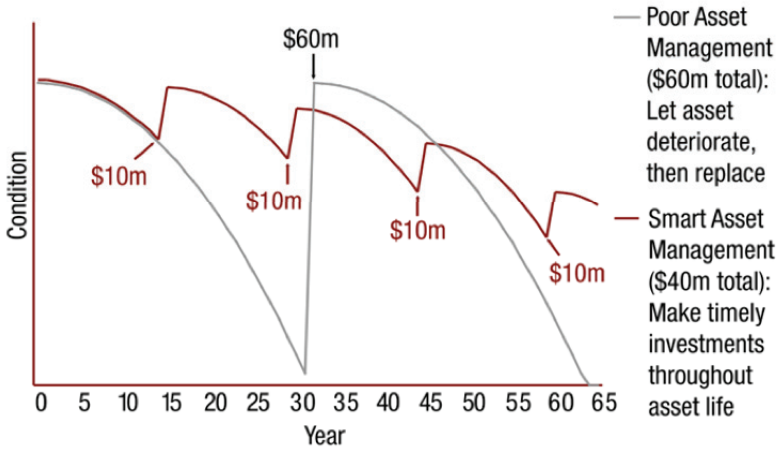
A water supply system may be required or may wish to have a third party analyze and attest to the relevance and reliability of the statements. The highest level of assurance that may be provided is an audit opinion by a qualified auditor. However, there are other levels of assurance that may be adequate for the needs of the organization.

BUDGET

A budget lays out the sources and uses of funds for a future time period. A financial plan, or operating budget, helps decision makers and financial staff to work together to plan cash flow in the near term. A budget is a living document and may be amended as circumstances change.

An asset management plan, as described in the previous section, will allow you to anticipate future costs related to replacing or upgrading major infrastructure. Planning for these expenses well in advance will reduce the need for rate hikes or levies when the equipment is replaced.

Timely Renewal Investments Save Money



Source: Ontario Ministry of Environment and Climate Change, 2014. Taking Care of Your Drinking Water.
Adapted from: Ontario Ministry of Infrastructure, 2012. Building Together: Guide for Municipal Asset Management Planning

RESERVE FUNDS

Capital assets are expensive, occasional purchases. A portion of funds that are being collected each year should fund large future purchases. Some of the funds should also be set aside, typically annually, and used only for the purpose of replacing capital assets. An Operating Reserve and an Emergency Reserve should also be established.

DEBT

If the water supply system is eligible, it may be able to borrow money to finance capital asset purchases. The need for debt should be anticipated in the capital (long-term financial) plan and the expected debt servicing cost incorporated into the plan.

REVENUE AND RATES

REVENUE

Developers generally install the initial infrastructure for a water supply system – including extensions to serve a new development – to the water utility with no expectation of a return on investment. However, once the system is operating, the main revenue sources for small water systems are generated by user fees, taxes or further investment by the system owners. When more funds are needed, options tend to be limited to raising rates, seeking investment in the system or seeking loans from financial institutions. Receiving funding or grants from government is generally not an option, and small systems should plan to be financially self-sufficient.

Small systems can reduce expenses and develop efficiencies by pooling resources or amalgamating some or all of their operations with neighbouring systems or local government.

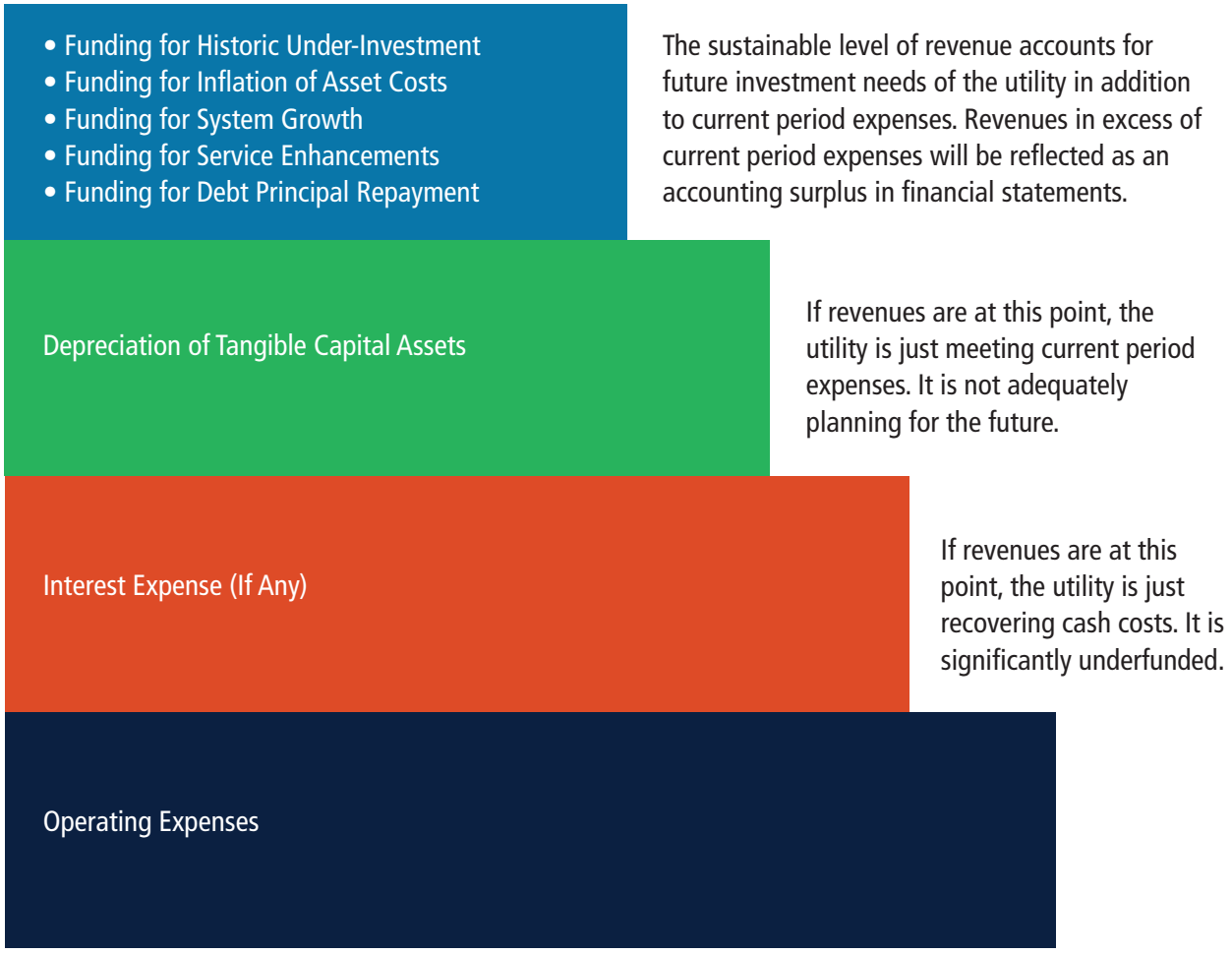
SETTING RATES

The infrastructure and human resources needed to move the water from source to tap are not free—regular maintenance and operator training cost money. Therefore, it is important to set realistic rates for your consumers to cover the full cost of production and delivery. This means setting rates for both regular operating costs and reasonably foreseeable expenses such as asset renewal, and future capital purchases.

When setting rates for water usage you should consider the costs associated with:

- regular maintenance
- operating costs
- planned replacements
- contribution to reserve funds
- debt repayment and interest expenses
- inflation
- upgrading to meet standards
- operator training
- insurance covering liability, property, directors and officers, and mechanical breakdown
- wages
- rent

Any system that does not charge enough to cover these costs is at risk of becoming unsustainable. Please note that utilities need to request approval from the Comptroller to raise water rates and mobile home parks also have restrictions on raising fee pad rates.



Source: Ontario Ministry of Environment, 2007. Toward Financially Sustainable Drinking Water and Wastewater Systems

THINGS TO REMEMBER

- A water system should set their rates to be financially self-sustainable.
- Water revenues should not only cover day-to-day operating expenses, but to repay debt and build fund reserves to finance major expenses anticipated in the future.

INSURANCE

An often overlooked aspect of financial management of a water system is to ensure that the system and its staff are properly insured, to cover for accidents and the unexpected. At minimum, the following forms of insurance are recommended:

- **Liability Insurance:** Provides coverage to systems that are responsible for the operation and maintenance services for a water system.
- **Directors and Officers Insurance:** Provides coverage for your directors and officers for claims arising from their acts, omissions or decisions that may detrimentally impact the technical, operation, managerial and financial capacity of your water system.
- **Property Insurance:** Provides coverage for physical loss or damage to your water system infrastructure, including related equipment, tools, and buried mains.
- **Boiler and Machinery Insurance:** Provides coverage for physical infrastructure not covered under Property Insurance, such as failure of hot water heaters and pressure vessels, and arc damage caused to electrical equipment.

COMMUNICATION

Communicating the systems' financial position to users and health authorities and other stakeholders is critical to ensuring support for the system. This can explain why fees are reasonable (or need to be changed), and help negotiate reasonable timelines for implementing changes. As discussed in the Regulatory Landscape section of this guide, annual reports are an effective communications tool.

PUTTING THEORY INTO PRACTICE: FINANCIAL BEST MANAGEMENT PRACTICES

The Union of BC Municipalities and the Province worked with the Sustainable Infrastructure Society (SIS) to develop six financial best management practices (BMPs) for small water systems in BC. The BMPs are tools and worksheets to help system operators develop a financial plan by following practical and proven methods used by successful water supply systems to operate sustainably:

BMP A: Create a basic asset inventory.

BMP B: Build an asset management plan.

BMP C: Create a five-year operating plan.

BMP D: Establish a long-term financial (capital) plan.

BMP E: Determine sustainable water rates and charges.

BMP F: Develop a communications plan.

These tools build on each other and should be used in sequence, but several can also be used independently. You may choose to apply one or two to start, and implement other BMPs when you have the resources in the future. They are available through the WaterBC website at www.waterbc.ca.

ACTIONS YOU CAN TAKE TO BE BETTER INFORMED

- **Work** with your staff to develop a Capital Plan and a schedule of anticipated major replacement costs.
- **Review** annual reoccurring expenses related to labour, operation, minor parts replacement, power and consumables.
- **Identify** any outstanding debt and your debt repayment plan.
- **Calculate** annual revenues collected for managing the water system.

Key Message:
Creating a financial plan is an on-going process. Keep asking questions!

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
GET ANSWERS. **IT'S YOUR DUTY!**

IMPROVING OUTCOMES

Based on the information provided in this guide, you may have identified a number or elements from you water system that you would like to improve. The next step is to formulate an action plan to implement some of those improvements.

When putting together your action plan, the following steps are recommended:

Assess your system with the tools provided: If you are unsure of where to begin, it may help to assess your system with the tools provided in this document. The source-to-tap assessment tools listed in the **Self-Assessment of Water Utility Performance** section of this guide can help you review your infrastructure from a new perspective. It may also be helpful to think of your water system in terms of the four areas of capacity discussed in the **Overview of Key Capacity Building Areas for Sustainable Systems** section: Technical Capacity, Managerial Capacity, Financial Capacity, and Operational Capacity.

Identify your areas of priority: You may find that your water system is stronger in some areas of capacity than others. However, it is important to identify the areas of improvement that are the greatest priority for you. For example, if you expect substantial population growth in your community, water supply capacity maybe be one of your key priorities.

Start small: A key component of a successful action plan is breaking the desired outcome into small, simple tasks. If improving the financial stability of your water system is your desired outcome, you may want to break this down into first identifying what are your current levels of water use, water-related expenses, and water-related revenues. It is also recommended that your first action plan focus on no more than three desired improvements. Other improvements can be added in revisions to your action plan as you move forward.

To help you in preparing your first draft of an action plan, an action plan "Think Pad" is provided in the appendices. The Think Pad can be used for you to identify your key desired outcomes, identify the challenges that may interfere with this outcome, and the simple steps you can take to address these challenges.

BE INFORMED.
STAY VIGILANT. ASK QUESTIONS.
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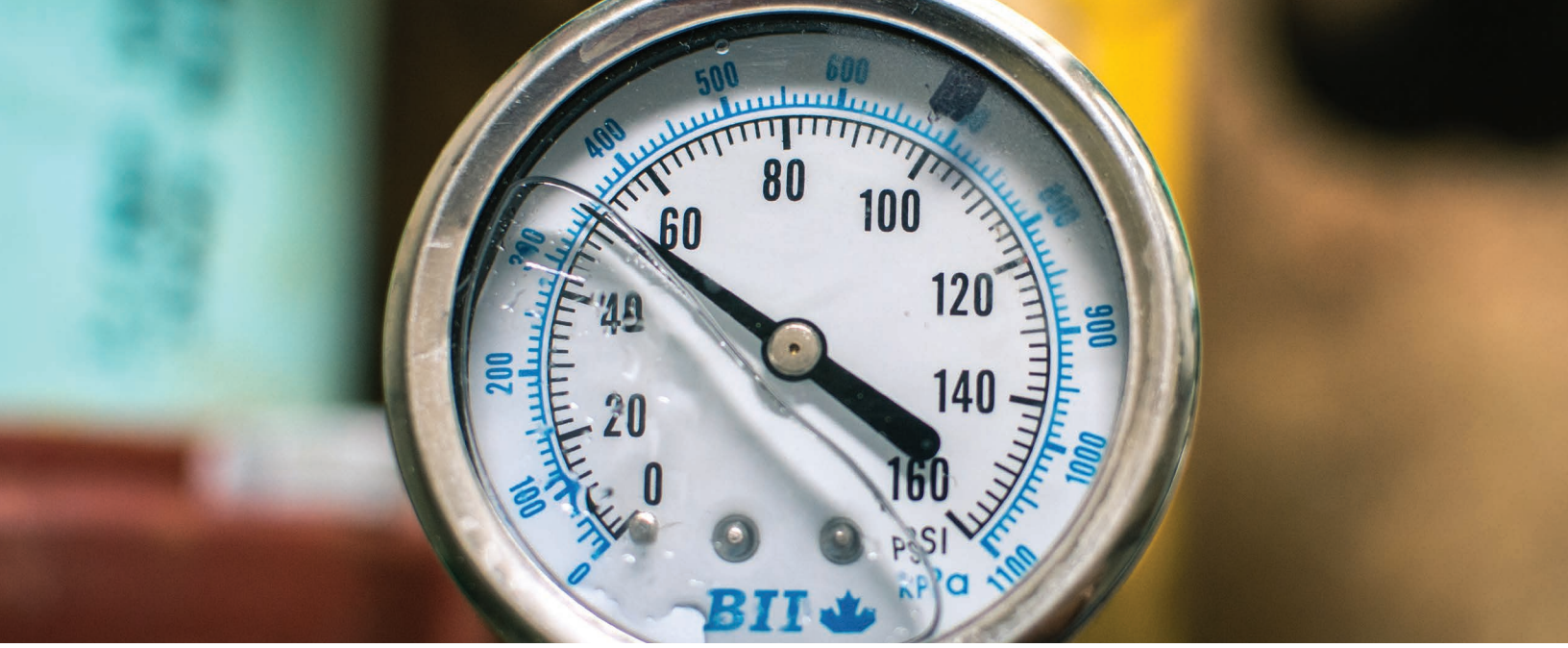

APPENDIX A LIST OF RESOURCES

Title	Publisher	Address	Description
General Education			
Small Water System Guidebook	Ministry of Health	http://www2.gov.bc.ca/assets/gov/environment/air-land-water/small-water-systemguidebook.pdf	An alternative guide that overviews all concepts of developing, owning, and operating a water system, including sources, treatment, permits, governance, self-assessment, financial sustainability, and communication.
Small Drinking Water Systems: Who Does What in British Columbia?	National Collaboration Centre for Envrionmental Health	http://www.ncceh.ca/sites/default/files/SDWS_Who_What_BC.pdf	Details what agency or Ministry to talk to in relation to new water sources, water quality, source protection, wastewater system development, and grant applications..
The Value of Water	BCWWA	http://www.valueofwater.ca	Provides educational material promoting the need to protect and conserve our drinking water resources..
Emergency Response Planning			
Emergency Response Planning for Small Waterworks Systems	Ministry of Health	http://www.health.gov.bc.ca/library/publications/year/2000/PHI061.PDF	A detailed guide of the precise elements to consider and include in your emergency response plan.
Best Management Practices: Emergency Response Planning	BCWWA	https://www.bcwwa.org/resourcelibrary/1296450923-EmergencyResponsePlanningBMP.pdf	Provides overview of the ERP process, with links for more detailed information and contact information for questions or support.
Water System Self-Assessment Tools			
Drinking Water Source-to-Tap Screening Tool	Ministry of Health	http://www2.gov.bc.ca/assets/gov/environment/air-landwater/water/documents/bc_drinking_water_screening_tool.pdf	A self-assessment tool. The simplest self-assessment but also providing less detail than the alternative tools prepared by the Ministry of Health.
Water System Assessment User's Guide	Ministry of Health	http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/waterquality/drinking-water-quality/resources-for-water-system-operators	A self-assessment tool focusing on hazard prioritization and the starting your action plan. Complexity of this tool falls between the Source-to-Tap Screening Tool and the Comprehensive Drinking Water Source-to-Tap Assessment.
Comprehensive Drinking Water Source-to-Tap Assessment	Ministry of Health	http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/waterquality/drinking-water-quality/resources-for-water-system-operators	A self-assessment tool focusing on hazard prioritization and the starting your action plan. This is the most complex of the selfassessment tools offerred by the Ministry of Health but also produces the most information.

Title	Publisher	Address	Description
Chlorination Guide			
Best Management Practices: Chlorine Disinfection and Monitoring	BCWWA	https://www.bcwwa.org/resourceli-brary/1296450792-Chlorine BMP.pdf	Identifies steps for developing a BMP for installing, operating, and monitoring a chlorination system, with links to more detailed information and contacts for questions or support.
Legislation			
Drinking Water Protection Act		http://bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_01009_01	
Drinking Water Protection Regulation		http://www.bclaws.ca/civix/document/id/complete/statreg/200_2003	
Groundwater Protection Regulation		http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/lawsrules/2016_groundwater_protection_regulation.pdf	
Water Sustainability Act		http://engage.gov.bc.ca/watersustainabilityact	
General Support			
BC Water and Waste Association		https://www.bcwwa.org	Offers general support and guidance for BC's drinking water community.
Environmental Operators Certification Program		http://eocp.ca	Offers training courses and certification for operators.
Regional Health Authorities			
Fraser Health		http://www.fraserhealth.ca/your-environment/drinking-water	
Interior Health		https://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Pages/default.aspx	
Vancouver Island Health		http://www.viha.ca/mho/water	

Title	Publisher	Address	Description
Regional Health Authorities, continued			
Northern Health		https://northernhealth.ca/YourHealth/Environmental-Health/DrinkingWaterSafety.aspx	
Vancouver Coastal Health		http://www.vch.ca/locations-and-services/find-health-services/?program_id=1245	
Regional Health-Specific Support Documents			
Responsibilities of a Water System Owner/Operator	FH	http://www.fraserhealth.ca/media/Responsi-bilities%20of%20a%20Water%20System%20Owner%20Operator_Aug2010.pdf	Identifies requirements for developping and operating a water system.
Guidelines for the Construction of Waterworks	IH	https://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Documents/construction%20of%20waterworks%20guidelines.pdf	Details the requirements for applying for a construction permit for new/upgraded water systems
Drinking Water Quality Improvement Program: Conditions on Operating Permit Handout	IH	https://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Documents/Conditionson-Permit.pdf	While it applies to systems with 500 + consumers, this handout identifies the precise documents and considerations desired by Interior Health before granting an opeating permit for a new/upgraded water system
Steps for a Small Water System Operator Handout	IH	Contact IH branch	Steps for implementing treatment upgrades to a water system. Includes recommendations on chemicals to monitor and details the 43210 rule.
Self Assessment Checklist for Small Water Systems Handout	IH	Contact IH branch	A self-assessment tool of low complexity.
Guidelines for the Approval of Water Supply Systems	VIHA	http://www.viha.ca/NR/rdonlyres/71A5047A-4E40-43A3-A6ED-32C60041FCCC/0/GUIDELINESFORTHEAPPROVALOFWATERWORKS.pdf	Identifies the requirements for applying for a Construction Permit and Operating Permit, as well as overviews some treatmentconcepts.
Drought Response Preparedeness: Are YOU Prepared?	VIHA	http://www.viha.ca/NR/rdonlyres/8530C3FF-A072-49E2-9B9FC868A1B3EB3D/0/June292015HPESDroughtResponsePreparednesscm_nc_ce_docx.pdf	Guide for developping a Drought Management Plant.
Water Supply System Construction Permit Guidelines and Application Form	VCH	http://www.vch.ca/media/VCH-CP-Guidelines-and-Form%20-July-2014.pdf	Identifies the requirements for applying for a Construction Permit.

APPENDIX B SELF-ASSESSMENT OF CURRENT CAPACITY

Self Assessment of Current Capacity

COMPONENT	DESIRED OUTCOME	ADEQUACY ASSESSMENT RATING						VALUE	PRIORITY
TECHNICAL CAPACITY	**Technical Capacity:** Physical ability of a water system to meet regulatory requirements and customer satisfaction, including the adequacy of physical infrastructure (e.g., treatment, distribution, and facilities), and the adequacy of the source water.	0 Don't Know	1 Very Poor	2 Poor	3 Fair	4 Good	5 Very Good	Input Number	Rating (A, B, C, D)
(A) **Source Protection**	Source is adequately protected from contamination	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(B) **Source Quantity**	Have sufficient quantity to meet current & future demands *(Average day, Peak day, Fire flow)*	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(C) **Source Quality**	Best available water quality source being used – one with limited treatment challenges. *(VG = source with no health related parameters of concern; VP = source with many health related parameters of concern)*	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(D) **Treatment Infrastructure**	**Treatment** in place that removes and/or neutralize hazards, that is in good condition & has not exceeded itsuseful life. *(Need in place chemical conditioning, filtration & disinfection barriers are appropriate for bothhealth & non-health related parameters).*	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(E) **Distribution Infrastructure**	**Distribution system** (*piping, pumping & storage)* that is: (1) in good condition, (2) has not exceeded its useful life, (3) prevents recontamination & water quality degradation after treatment, and (4) delivers sufficient water quantity and pressure. *(i.e. Desire: stable water quality & pressure; backflow & cross contamination preventionmeans & safeguards; minimal water loss)*	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(F) **Alarming & Security Devices**	Real time pressure, level & water quality monitoring & illegal entry alarming	( )	( )	( )	( )	( )	( )	[ ]	[ ]
		(G) Point Total *(out of 30 maximum possible)*							
		(H) Percentage Tally = (Point Total / 30) X 100%							

Self Assessment of Current Capacity

COMPONENT	DESIRED OUTCOME	ADEQUACY ASSESSMENT RATING						VALUE	PRIORITY
OPERATIONAL CAPACITY	**Operational Capacity:** Operational and maintenance management ability of a water system to meet regulatory requirements including knowledge and capability of personnel, routine aspects of system operation (e.g., testing, monitoring, and routine maintenance adequacy), and procedures in place to allow consistent and safe operation of the system and ability to handle non-routine situations.	0 Don't Know	1 Very Poor	2 Poor	3 Fair	4 Good	5 Very Good	Input Number	Rating (A, B, C, D)
(A) **Operating Staff**	Have operators with appropriate knowledge, skills & training to operate the system. (1= Volunteer with No training; 2= Volunteer with some Training 3= Trained volunteer with DRC oversight by Certified Operator, 4= Have DRC certified operator – part time availability, 5= Have DRC certified operator – full time availability	( )	( )	( )	( )	( )	( )	[ ]	[ ]
		( )	( )	( )	( )	( )	( )	[ ]	[ ]
(B) **Water testing & Monitoring**	Water quality testing & monitoring in accordance with regulatory requirements & best practices	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(C) **Data Recording and Logging**	Detailed monitoring & recording of operating conditions (water quality, daily production, repairs or maintenance undertaken, chemical usage, storage tank levels, water pressure, pump run hours, instrumentation readings, customer complaints)	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(D) **Routine checks, adjustments, maintenance & calibration**	Thorough checks to assess condition & ensure system is operating properly. Make operational adjustments as needed to ensure effective operation. Maintain inventories (treatment chemicals, testing equipment supplies etc.). Inspect clean, maintain, calibrate and adjust chemical feed equipment and instrumentation as needed.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(E) **Facility Maintenance**	Facilities & grounds kept clean and equipment accessibility maintained at all times								
(F) **On-going Training**	Receive ongoing up-to-date training to stay current on regulations, standards and best practices								
		(G) Point Total *(out of 30 maximum possible)*							
		(H) Percentage Tally = (Point Total / 30) X 100%							

COMPONENT	DESIRED OUTCOME	ADEQUACY ASSESSMENT RATING						VALUE	PRIORITY
MANAGERIAL CAPACITY	**Managerial Capacity:** Can be thought of as the structured organization in place and the ability of a water system to conduct its affairs (e.g., decision making, planning, and interactions with customers, regulators, and other entities) in a manner enabling the system to achieve and maintain compliance with regulatory requirements, and administrative capabilities.	0 Don't Know	1 Very Poor	2 Poor	3 Fair	4 Good	5 Very Good	Input Number	Rating (A, B, C, D)
(A) **Accountability, Staffing, Organization**	We have clear plan of organization, control and duties among the people responsible for management and operation of the system.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(B) **Management Programs & Procedures**	Have adequate plans that are actively used to operate and manage the water system: (1) Operation & Maintenance SOP's, (2) Asset Inventory & Condition Assessment (includes up to date distribution map); (3) Emergency Response Plan, (4) Source-to-tap Assessment; (5) Regulatory Compliance Program (e.g. records, procedures, actions); (6) 5 Yr Operating Plan	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(C) **Effective External Linkages & Communication**	We have an active communication & education outreach program to help our customer and stakeholders understand issues and promote the value of clean & safe water. Have built effective relationships with customers, technical assistance providers & regulatory agencies to help solve problems and address planning needs.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(D) **Staff Knowledge & Training**	Basic water system literacy. Have knowledge and training to manage operations and understand regulatory requirements. Commitment to on-going training for management & operations staff to stay current on new regulatory requirements and best practices	( )	( )	( )	( )	( )	( )	[ ]	[ ]
		(E) Point Total *(out of 20 maximum possible)*							
		(F) Percentage Tally = (Point Total / 20) X 100%							

COMPONENT	DESIRED OUTCOME	ADEQUACY ASSESSMENT RATING						VALUE	PRIORITY
FINANCIAL CAPACITY	**Financial Capacity:** Can be thought of as the ability of a water system to acquire and manage sufficient financial resources (i.e., revenue sufficiency) to allow the system to achieve and maintain regulatory compliance, customer satisfaction requirements and be sustainable.	0 Don't Know	1 Very Poor	2 Poor	3 Fair	4 Good	5 Very Good	Input Number	Rating (A, B, C, D)
(A) **Annual Budget**	Preparation of annual budget which includes: Operating expenses , Operating Cash Reserve, Emergency Reserve, Short-Live Asset Replacement Reserve, Capital Improvements Reserve.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(B) **Asset Management Plan**	Have a basic asset inventory, a priority list for repair or replacement of assets, an annual budget, including estimates for replacement reserves, and a schedule for implementation.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(C) **Financial Plan**	Have plan that forecasts revenue & expenses over 10 years into the future including asset replacement & renewal, regulatory driven changes / costs, proposed financing & projected reserves. Includes planning ahead for reasonable, gradual rate increases when necessary.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(D) **Water Rate Structure**	Rates and other system charges cover the full cost of providing service. Water Rates and fees set to adequately cover all costs to pay bills, put some funds away for the future, and maintain, repair and replace equipment and infrastructure as needed.	( )	( )	( )	( )	( )	( )	[ ]	[ ]
(E) **Fiscal Management**	System personnel know and can measure all costs and revenues. System personnel keep adequate books, records , use appropriate budgeting, accounting and financial planning methods and manage revenues effectively.								
(F) **Insurance**	We are adequately insured to cover claims against injury or damage caused by errors, omissions and accidents, typically including Liability Insurance, Directors and Officers Insurance, Property Insurance, and Boiler and Machinery Insurance.								
		(E) Point Total *(out of 30 maximum possible)*							
		(F) Percentage Tally = (Point Total / 30) X 100%							

APPENDIX C SAMPLE EMERGENCY RESPONSE PLAN

PUBLIC • HEALTH • PROTECTION

Emergency Response Planning for Small Waterworks Systems

Ministry of Health and
Ministry Responsible for Seniors

EMERGENCY RESPONSE PLAN • CONTACT LIST

Personnel Contact • Phone/Fax Numbers

	Phone	*Fax*
Operator's Name		
Staff Name		
Staff Name		
Staff Name		
Staff Name		

Emergency Contact Numbers

	Name	*Phone*	*Fax*
Medical Health Officer			
Environmental Health Officer			
Public Health Engineer			
Provincial Emerg. Preparedness Program			
Police			
Ministry of Environment			
Department of Fisheries			
Hospital			
Fire Department			
Radio Station			
B.C. Hydro			
Municipal Engineer			
Environmental Protection Service			
Pump Manufacturer			
Chlorinator Manufacturer			
Excavation Services			
Plumbing Services			
Newspaper			
T.V. Station			
Bulk Water Hauler			
Bottled Water Supplier			
Ministry of Municipal Affairs			

EMERGENCY RESPONSE PLAN • ACTION LIST

Type of Emergency: _____

Actions: _____

_____

_____

_____

_____

_____

Contacts: _____

_____

_____

Type of Emergency: _____

Actions: _____

_____

_____

_____

_____

_____

Contacts: _____

_____

_____

Type of Emergency: _____

Actions: _____

_____

_____

_____

_____

_____

Contacts: _____

_____

_____

CHECKLIST FOR EMERGENCY RESPONSE PLAN PREPARATION

1. EMERGENCY PHONE CONTACT LIST INCLUDING

- Personnel ☐
- Government agencies ☐
- Repair services ☐

2. EMERGENCY PROCEDURES

- Possible emergency situations: ☐
- Contamination of source ☐
- Loss of Source ☐
- Flood conditions ☐
- Chlorinator Failure ☐
- Broken water main ☐
- Pump failure ☐
- Power failure ☐
- Backflow or Back Siphonage ☐
- Chlorine gas leaks ☐
- Spills of disinfected water into fish bearing streams ☐
- Earthquake ☐
- Fire ☐
- Response plan (for each emergency) ☐
- Personnel assignments and responsibilities ☐

3. MAP OF SYSTEM SHOWING

- Mains ☐
- Critical Control Points ☐
- Intake(s) ☐
- Shut-off valves ☐
- Access Routes to Critical Control Points ☐
- Pump house ☐
- Location of emergency contact list, tools and maintenance equipment ☐
- High Risk Facilities ☐
- Schools ☐
- Day Care Centres ☐
- Hospitals ☐
- Long Term Care Facilities ☐
- High Water Use Industries ☐

4. ELECTRICAL SCHEMATICS

- Generators ☐
- Disinfection equipment, and room ☐

5. GENERAL PROCEDURES

- Generator start-up ☐
- Power source change over ☐
- Disinfection operation ☐
- Disinfection procedures for wells and distribution system ☐

EXAMPLES OF POTENTIAL EMERGENCY SITUATIONS AND POSSIBLE RESPONSES

(Contact phone number list must be kept with this list)

NOTE: These examples may not be appropriate for your particular water system. The type of response, the contact list and the order of response will all vary with the size of your system, the type of source you use, and other factors.

CONTAMINATION OF SOURCE – SPILLS, VEHICLE ACCIDENT

Actions:
- Shut down pump.
- Notify Health Unit.
- Notify all users.
- Contact government agencies (see below) for advice and assistance.
- Contact local media for public service announcement (where all customers can not be notified by phone).
- Arrange alternate source if necessary—i.e., bottled water, bulk hauler, storage tank

Contacts:
- Local Health Unit (Environmental Health Department), Provincial Emergency Preparedness, Police, Ministry of Environment, Department of Fisheries, and others as necessary, depending on severity.

LOSS OF SOURCE—(ie. intake damaged, creek dried up)

Actions:
- Ensure pump is shut off (to protect pump).
- Notify all users.
- Contact government agencies (see below) for advice and assistance.
- Arrange alternate source—i.e., bottled water, bulk hauler, storage tank.

Contacts:
- Local Health Unit (Environmental Health Department) and Ministry of Environment.

FLOOD CONDITIONS

Actions:
- Notify all users regarding the potential for water contamination, loss of pump, power, etc. Users should be advised to store some drinking water in advance, and to boil any suspect water for two minutes or disinfect with chlorine when flood conditions exist.
- Phone government contacts (see below).
- Contact local media fdor public serv ice announcement (where all customers can not be notified by phone).
- Arrange alternate source if possible – i.e., bottled water, bulk hauler, storage tank.

Contacts:
- Local Health Unit (Environmental Health Department), Provincial Emergency Preparedness, and Ministry of Environment.

BROKEN WATER MAIN

Actions:
- Reduce pressure (but maintain enough pressure to prevent backflow).
- Call for repairs (ie. plumber, excavator).
- Notify all users of interruption of service.
- Advise local Public Health office.
- Arrange alternate source if necessary—ie. bottled water, bulk hauler, etc.

Contact:
- Local Health Unit (Environmental Health Department).

CHLORINATOR FAILURE

Actions:
- Advise local Public Health Office.
- Notify all users to boil water for two minutes or take other disinfection procedures in accordance with recommendation of local health officials.
- Arrange chlorinator repairs.

Contacts:
- Local Health Unit (Environmental Health Department), Chlorinator manufacturer.

PUMP FAILURE

Actions:
- Notify all users of interruption of service.
- Call for repairs: pump manufacturer.
- Advise local Public Health office (if interruption not short-term).
- Arrange alternate source if necessary—ie. bottled water, bulk hauler, etc.

Contact:
- Local Health Unit (Environmental Health Department)

POWER FAILURE

Actions:
- Call B.C. Hydro.
- Start back-up generator.
- Notify all users about interruption of service if back up not capable of maintaining supply.
- Advise local Public Health office.
- Arrange alternate source if necessary—ie. bottled water, bulk hauler, etc.

Contact:
- Local Health Unit (Environmental Health Department).

BACKFLOW OR BACK SIPHONAGE

Actions:
- Advise Medical Health Officer at local Health Unit.
- Notify users to boil water for two minutes or take other disinfection procedures in accordance with recommendation of local health officials.
- Purge and disinfect lines as directed, after corrections have been made.

Contact:
- Local Health Unit (Environmental Health Department).

Warning signs are available at your local health unit.

APPENDIX D ACTION PLAN THINK PAD TEMPLATE

Improvement Area *"Think Pad"*

#1 AREA FOR IMPROVEMENT
Situation Appraisal
Why was this area ranked "low"? What are the possible causes?
Objective
Whats the desired outcome? Why is this important to our community?
Potential Obstacles
Biggest challenge to improving in this area? Is any resistance anticipated? What sort?
Resource Requirements
Who will need to be involved? Whose help (externally) will we need? What other resources will we require?

#2 AREA FOR IMPROVEMENT
Situation Appraisal
Why was this area ranked "low"? What are the possible causes?
Objective
Whats the desired outcome? Why is this important to our community?
Potential Obstacles
Biggest challenge to improving in this area? Is any resistance anticipated? What sort?
Resource Requirements
Who will need to be involved? Whose help (externally) will we need? What other resources will we require?

#3 AREA FOR IMPROVEMENT
Situation Appraisal
Why was this area ranked "low"? What are the possible causes?
Objective
Whats the desired outcome? Why is this important to our community?
Potential Obstacles
Biggest challenge to improving in this area? Is any resistance anticipated? What sort?
Resource Requirements
Who will need to be involved? Whose help (externally) will we need? What other resources will we require?

Implementation Action Plan

Date Prepared: _____

Area for Improvement	Proposed Actions to be Undertaken [1]	Proposed [2] Start/End Date	Anticipated Challenges [3]	Ideas to address challenges [4]
Source protection	Assess what we have	Feb 29	Could take a long time. Don't know where to get missing information. How to know what's important?	Use simplest assessment: sourceto-tap checklist. Look for old drawings (in files, ask old suppliers, designers, or installers). Talk to operators, long-time residents.
	Fill in information gaps	Mar 2 - 25		
	Pick top vulnerabilities to address	Mar 28 - Apr 6		
Asset Management	Make inventory of assets	Mar 2 - Apr 25	What to cover? Too many assets to list. How to guess the remaining life of an asset?	Use source-to-tap assessment to get scope of what to look at. Make list of big assets only. Don't count all the little things. Talk to suppliers, engineers, installers, operators, and neighbours for idea of asset life.
	Make table of expected life of assets	Apr25 - Apr 29		
	Make a schedule of when assets are expected to break down	May 2 - May 13		
Water Rate Structure	How much revenue comes in for water (annually)?	May 2 - May 13	How to get costs? This approach only covers average year expenses, and doesn't account for future needs or debt repayment.	Talk to operators and look at water-related expenses claimed throughout the year. This approach is a STARTING POINT for getting fully financially self-sufficient. Can refine later as we get more comfortable with costs.
	Estimate annual cost of running water system	May 15 - May 27		
	Compare lists for minimum	Apr 6 - Apr 15		

NOTES:

1. Describe the steps that are required for implementation of each option. This might include key meetings, financing approvals, new upgrade work.
2. Enter the date which you hope to start & finish the required action. If there is no specific date set, enter a month or day by which your would like to have this plan set in motion.
3. Summarize potential problems related to each required action. think about these before you begin and make any changes or updates as the work progresses.
4. Enter any ideas for overcoming potetnial problems or any challenges already encountered. As your options are implemented and new or different challenges arise, edit your plans accordingly.

Prepared By: **Keith Kohut**

Implementation Action Plan

Date Prepared: _____

Area for Improvement	Proposed Actions to be Undertaken [1]	Proposed [2] Start/End Date	Anticipated Challenges [3]	Ideas to address challenges [4]

NOTES:

1. Describe the steps that are required for implementation of each option. This might include key meetings, financing approvals, new upgrade work.
2. Enter the date which you hope to start & finish the required action. If there is no specific date set, enter a month or day by which your would like to have this plan set in motion.
3. Summarize potential problems related to each required action. think about these before you begin and make any changes or updates as the work progresses.
4. Enter any ideas for overcoming potetnial problems or any challenges already encountered. As your options are implemented and new or different challenges arise, edit your plans accordingly.

Prepared By: _____

BCWWA

BC WATER & WASTE ASSOCIATION