Water Conservation Guide

for British Columbia

December 2013

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Acknowledgments

The Water Conservation Guide was written and designed by Jacqueline Belzile of Blue Currents Consulting in collaboration with a steering committee, including Madelaine Martin, Liam Edwards and Glen Brown of the BC Ministry of Community, Sport and Cultural Development, Laura Brandes of the POLIS Project on Ecological Governance, and Dr. Anna Warwick Sears of the Okanagan Basin Water Board. This guidebook is the second edition of the Water Conservation Planning Guide, which was developed by University of Victoria's POLIS Project on Ecological Governance with the BC Ministry of Community Development in 2009.

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This guide is intended to evolve and expand with community and practitioner feedback, which will be incorporated in future editions. For suggestions about improving this guide, please contact the Local Government Infrastructure and Finance Division at the Ministry of Community, Sport, and Cultural Development.

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Water Conservation Guide for British Columbia

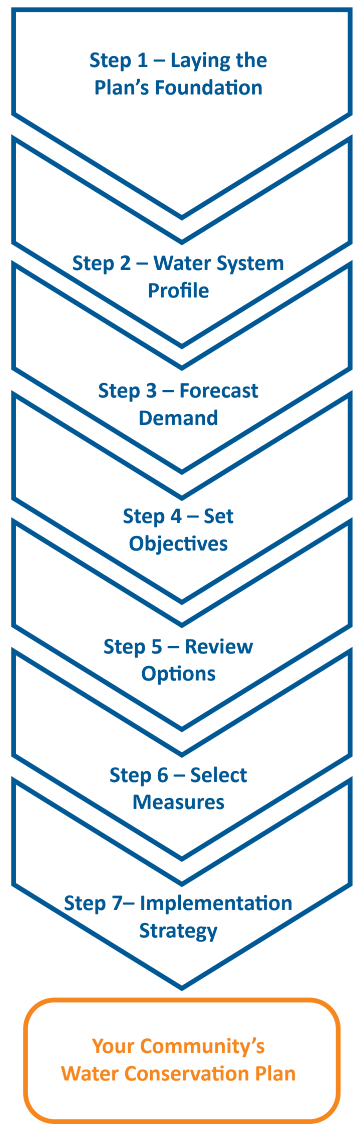
Executive Summary

Water conservation is a valuable source of 'new' water that brings benefits to communities of all sizes. It can lighten the load on your existing water sources and systems, increase the efficiency of local water use, and save your utility money on treatment and distribution costs while protecting the environment and keeping water services affordable.

Water conservation plans are an excellent means of coordinating conservation efforts to maximize the benefits to your community and keep the number of drops saved per dollar high. The potential savings can be great, allowing your utility to defer or reduce costly investments in upgrades or new water or wastewater infrastructure. As of 2013, over 40% of British Columbian communities have developed water conservation plans.

This guide provides a seven-step water conservation planning process to get your community on track for a healthy, water-wise future. It has been designed to help small to mid-size communities identify and realize their water conservation goals, though it contains information that larger BC communities may also find useful.

Each step shown in the diagram is outlined in a chapter, with step-by-step instructions for how to develop and run your planning process, an example case to demonstrate ideas, and a writing checklist to assist you in crafting a water conservation plan for your community.



Blue Currents Consulting

Table of Contents

Making the Most of Your Water

In the winter, as snowpack builds, streams flow high and reservoirs fill, it's hard to imagine that water conservation could be a priority in BC. Yet our supply of fresh water is not as plentiful as many would like to think: nearly a quarter of BC's surface water has reached or is near its capacity to reliably supply water withdrawals for human use[i] .

At the same time, those in charge of water systems are facing new challenges. The combination of aging infrastructure and shrinking budgets is placing financial pressure on water systems. Climate change is making weather more variable and stressing infrastructure in new ways. And, in some communities, population growth is increasing demand and development is expanding the reach of systems. One way to address these challenges is to make the most of our water through conservation.

BC Sees Water Conservation as a Smart and Responsible Solution

Luckily, there are many opportunities for BC communities to grow their local economies, protect their environments, and provide great quality of life for residents while using less water. Canadians are among the highest water users in the world – averaging 353 liters per capita per day for domestic use[ii]. In contrast, the average European uses a hundred liters less per day[iii]. British Columbians' use at 490 litres per day is higher than the national average[iv]. By engaging in smarter, more efficient and appropriate water use, 'new' water can be generated to support our communities, keeping them healthy and vibrant for years to come.

Recognizing the value of conservation as part of its water sustainability solution, the Province made it a central pillar of the *Living Water Smart* policy in 2008. *Box 1* (on page 2) lists some of its conservation-based targets.

To encourage communities to conserve, water conservation plans are now a requirement for local governments who receive capital grants from the Province for drinking water and wastewater infrastructure. Having a plan or actively conserving water is also considered in the evaluation of provincial grant applications. If you are preparing a plan to meet provincial requirements, be sure to use their requirement checklist along with this Guide.

Water Conservation Works for Communities Big and Small

Water conservation makes sense for BC communities of all sizes, from municipalities to small systems. The benefits of saving water include:

- Optimizing the use of existing infrastructure and deferring development of new infrastructure
- Increasing efficiency of water and energy use
- Reducing treatment costs, waste and pollution
- Maintaining affordability and accessibility of water services
- Creating environmental benefits – slowing degradation of water sources, improving air quality, mitigating climate change, and protecting biodiversity, fisheries and natural spaces[v]

Box 1. Water Conservation-Related Commitments in BC's 2008 Living Water Smart Plan

- By 2020, overall water use in British Columbia will be 33% more efficient.
- By 2020, 50% of new municipal water needs will be acquired through conservation.
- Adapting to climate change and reducing our impact on the environment will be a condition for receiving provincial infrastructure funding.
- Government will fund household evaluations of water, energy and transportation use.
- By 2012, water laws will improve the protection of ecological values, provide for more community involvement, and provide incentives to be water efficient.
- Government will require more efficient water use in the agriculture sector.
- In partnership with industry, government will develop a water efficiency labeling system for water consuming products.
- Government will look at new ways to help water conservation technology succeed.

Source: *Living Water Smart*, BC Ministry of Environment 2008

Every community has different resources and faces unique challenges – differences that are reflected in their water conservation plans. This planning guide is designed to assist smaller local governments and other small water providers in water conservation planning. Plans can range in size from just a few pages to a long and comprehensive document. You may or may not choose to use all of the ideas discussed in this Guide. It's up to you to create a planning process and plan that suits the needs of your community.

Remember, you are not alone in striving to make the most of your water resources. Communities across BC have been taking action on water conservation. To date, at least 42% (80 local governments out of 188) have completed water conservation plans[vi].

Integrated Plans Save Water and Money

One of the greatest benefits of developing a plan is that it lets you see your system in a new way. Instead of focusing on managing supply, you aim to manage demand. Conservation saves your community money and protects its environment because the less water you take, the less you treat and distribute, and the less wastewater you discharge. This reduces wear and tear on infrastructure and defers the need for infrastructure up-sizing to meet rising demand. Using the method outlined in this Guide, you can look at your system as a whole and evaluate where to get the greatest impact for your investment.

Plans Develop Over Time

Water sustainability takes time, work and commitment, and developing a locally feasible water conservation plan is an important first step for every community. To be effective, plans should develop comprehensive, long-term strategies that optimize the use of water and funds. Water infrastructure is more than pipes, pumps, and reservoirs. Consider including green infrastructure (for example, wetlands), conservation-oriented built components (low flow toilets), low impact development or water sensitive urban design (swales instead of curbs), and conservation programs that engage people in your plan.

Water conservation planning is an ongoing process. It's okay to start small and expand your plan as more information becomes available. Also, try to combine your efforts by seeing how the knowledge you gain about your water system through this process can inform other initiatives, like your Official Community Plan, Asset Management Plan, or Climate Change Adaptation Strategy.

What Makes for a Good Plan or a Great One?

To make the best of your water you can create a plan that respects the environment, supports the economy, and helps people to think and behave in ways that promote water stewardship and sustainability.

A ***good*** water conservation plan includes:

- at least a 20 to 50 year time frame
- information on why you want to conserve water
- an effective strategy for putting it into use
- an integrated approach to water conservation, with links to other plans such as those for wastewater, land use, asset management, climate change and others
- strategies that specifically address those major sources of demand that are under your organization's control, including water loss in the distribution system and irrigation

A ***great*** water conservation plan goes even further, to:

- place environmental health at its core
- consider watershed impacts and tailor the plan to a community's watershed
- blend legal tools (such as water restrictions and land use planning bylaws) with practical measures (such as rebate and metering programs)
- make managing demand a part of daily business
- include elements to better match water quality to water use, such as rainwater capture, wastewater reclamation, and water reuse or recycling
- engage and inspire citizens to permanently change their water use behavior through outreach and education programs that go beyond just giving out information
- account for economic values (for example, savings on treatment costs), environmental values (improving source water quality) and social values (protecting human health)

How to Use this Guide: 7 Steps to Success

Successful water conservation planning involves thinking about the future you want for your community, then figuring out how managing water demands can help you get there. This Guide outlines a seven step method for developing a water conservation plan, shown in *Figure 1* (on page 5). Each of the chapters that follow focuses on a step, with information on how to develop and run your planning process, and how to write up your plan. Depending on your process, you may skip some steps or leave out some items when writing your plan.

Many of the steps can be completed using the online Water Conservation Calculator tool. The Calculator is a ***free tool*** available online at: http://www.waterconservationcalculator.ca/. While using the Calculator isn't mandatory, it's a valuable complementary tool and tips for how to use it are provided in orange *Calculator Tool Boxes* marked with the calculator icon throughout this Guide.

Other features include:

- *Worksheets* to help you gather necessary information. All worksheets are available in Appendix A. You may find it useful to review these before getting started. You can download Microsoft Excel versions of these worksheets from the Guide website and use them to gather your data.
- *Example Sections* that illustrate how steps might be carried out for a fictitious community of 2,500 residents called 'Anytown, BC'.
- *A Glossary* with definitions of terms and concepts used in the Guide.
- *Writing Checklists* at the end of each chapter with an outline and questions to be answered when writing your plan. Checklist items include keywords, write-up focus questions and references to relevant sections in the Guide (i.e. 1.3 refers Section 1.3). Depending on your process, you may choose to add, omit, or reorganize items when writing your plan. You can download a workbook of these checklists from the Guide website.
- A *Resources List* at the end of the Guide that directs you to more in-depth resources on various concepts that have been presented.

Tips and Tricks

A good place to start is by scanning over the Guide, paying special attention to the *Process Overviews*, *Worksheets*, and *Writing Checklists* for each step.

You can then get into planning mode by making a 'To Do List' that includes:

- actions or steps that you want to include in your process
- resources that are available (like existing data, a water use study or an existing planning team)
- resources you foresee needing (like missing data, or technical assistance required)

Next, you can prioritize the actions you've decided to include in your process. If you decide to write a plan proposal, you may also want to identify the resources and time required to complete each step. A well thought out proposal can help generate support for the development of your water conservation plan.

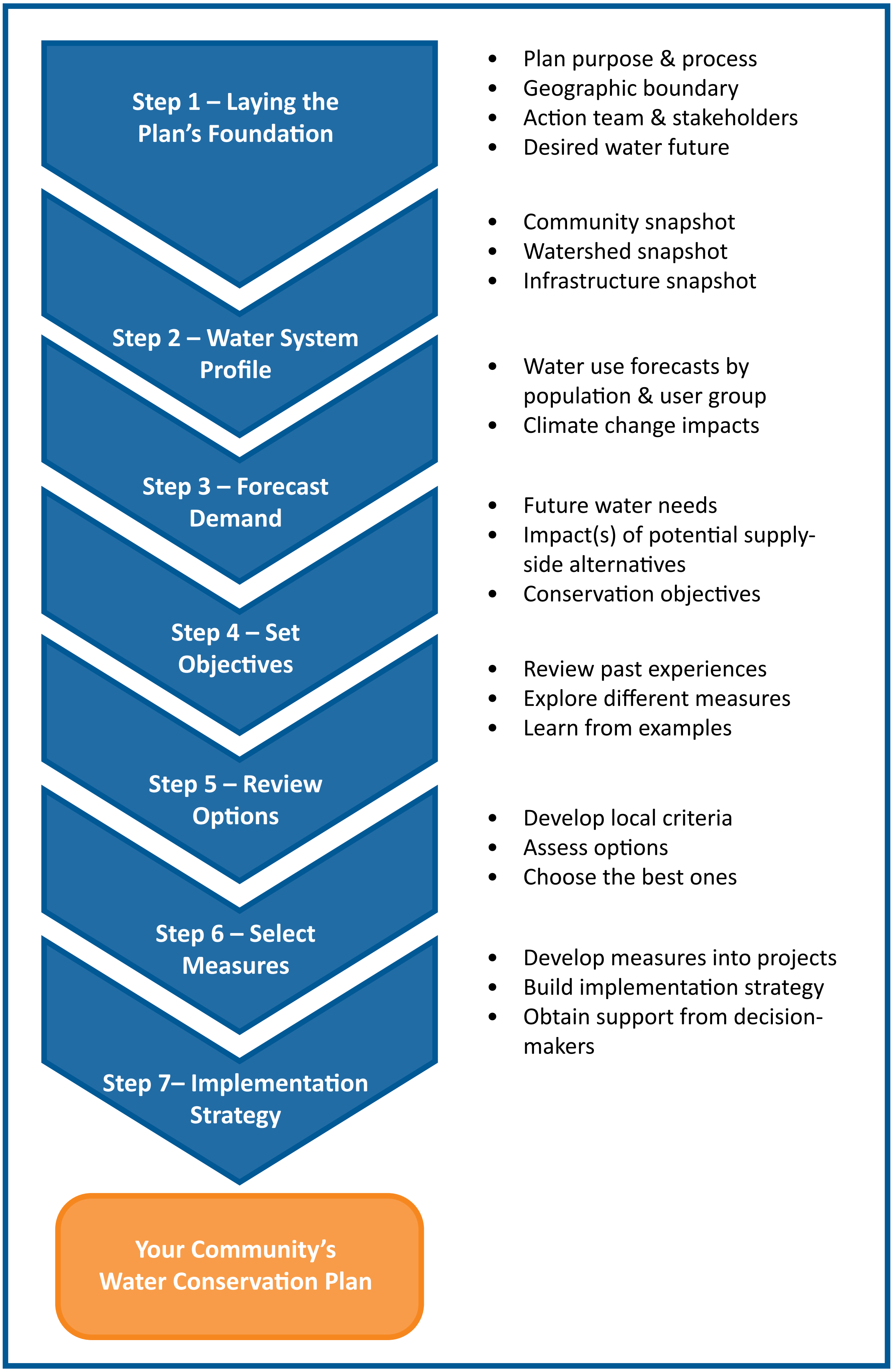


Figure 1. Overview of the Water Conservation Planning Process

Step 1

Laying Your Plan's Foundation

Laying your plan's foundation involves answering some basic questions: why, how, where, who, what and when. By the end of this chapter, you'll be prepared to start building a road map to your community's preferred water future.

Overview of Step 1 Planning Process

1. **Establish your plan's purpose**
2. **Develop your process**
3. **Set your geographic boundaries**
4. **Build your action team and engage people**
5. **Create scenarios for the future and define goals**
6. **Get buy-in for your plan**

1.1 Establish Your Plan's Purpose

The first step is to define the purpose behind your plan. What do you want to achieve through conservation? Are you hoping to defer investments in new infrastructure, to improve your odds of receiving grants, or to protect the environment? Some examples are:

- *To be fiscally responsible and accountable to future generations in our decision-making and water use.*
- *To delay the need to install a new well through water conservation efforts.*
- *To develop a strategy that addresses water quantity and quality issues to protect human and environmental health.*

1.2 Develop Your Process

This Guide offers one approach to water conservation planning. You can modify the seven steps to suit your community's unique needs, history and context. For example, if you have a water use profile you can skip that step. Or, if you want to focus on internal upgrades, you can investigate those first.

When selecting steps for your process and deciding how to include them, think about these questions:

- What assumptions are you making? Why are you choosing to keep or omit each step?
- How will you modify the process for your situation?
- What resources do you already have? What resources do you need?
- How will your plan fit into wider planning initiatives?

Ideally, your water conservation plan will describe your reasoning and will be integrated with other plans – like your Official Community Plan, regional growth strategies, land use and transportation plans, watershed management plans, asset management plans, and others. Such integration improves the likelihood of your plan's success.

1.3 Set Your Geographic Boundaries

What are the geographic boundaries for your plan? When setting these boundaries it's important to consider how your system fits into a bigger whole – your catchment, your environment, your political context. How will your conservation efforts affect upstream and downstream users, or the human and non-human residents of your ecosystem? To develop a strong plan, aim to cover your entire water system and to consider your water source(s) and your surrounding environment.

1.4 Build Your Action Team and Engage People

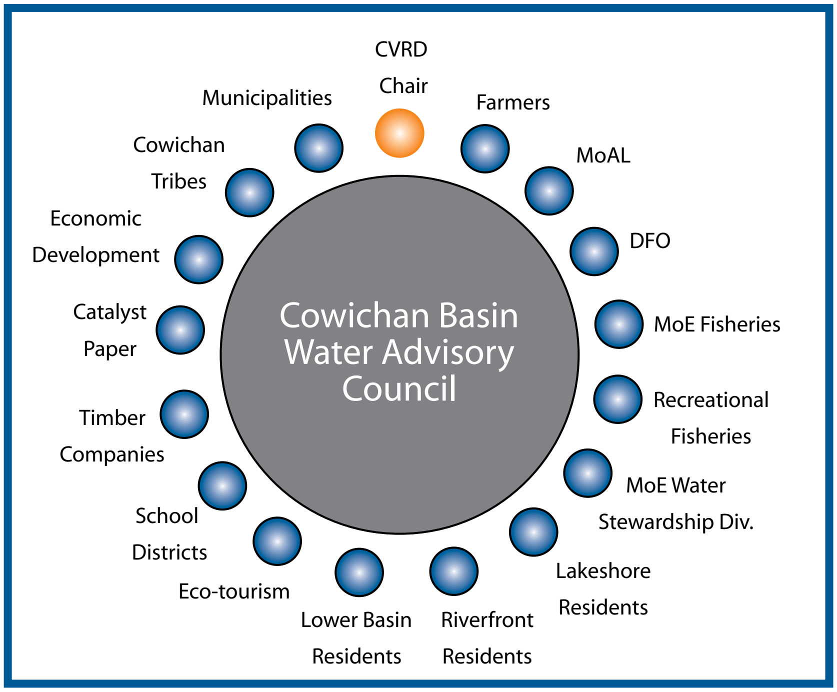


Figure 2. The diverse range of organizations involved in developing the CVRD's Water Management Plan (modified from CVRD 2007)

You can build an Action Team to inform and direct the planning process. Teams will range in size depending on the complexity of your system and what resources are available. If you have a small system, you may have just one or two members. Candidates for your team could include: municipal staff, planners, engineers, community and Aboriginal representatives, water system users (agriculture, ICI, residential), utility staff and others. If you can get people with experience in conservation planning, they can be a great resource.

With your Action Team in place, you can decide on how much public input you want to include in your process. The objective of stakeholder engagement is to gain a variety of perspectives to inform your plan. You might gather people from a wide range of organizations, like those shown in *Figure 2*. Or, if you're managing a small system, you may decide to have more informal discussions with a few key people.

You may also consider collaborating with neighboring communities in your watershed to share information and to address any regional conservation issues.

1.5 Create Scenarios for the Future and Define Goals

Once you have decided who to bring together, it's time to work with them on developing a target scenario for the future and specific goals for how to achieve this target. In Step 1.1, you defined the purpose driving your planning process. Now you can build on that purpose with the help of stakeholders to develop a shared vision for the future, either in a workshop or in a series of conversations. Although specific to water, this process is closely related to defining community values and forecasting growth for economic sectors in your community planning process.

In the workshop(s), you will be discussing possible scenarios for future water availability and water uses. Considering new ideas, possibilities, and choices can allow you to define scenarios and solutions that may have been overlooked without stakeholder involvement. The end goal is to define one or two realistic possible futures that meet your community's goals and are based within ecological limits.

In running a futures scenario exercise, you can start by establishing your community's water values. Ask participants questions like: 'Why are water and water conservation important to us?' and 'What are our top water priorities?' Moving on, you can look at the trends affecting your water system. How might population growth, industry expansion, or climate

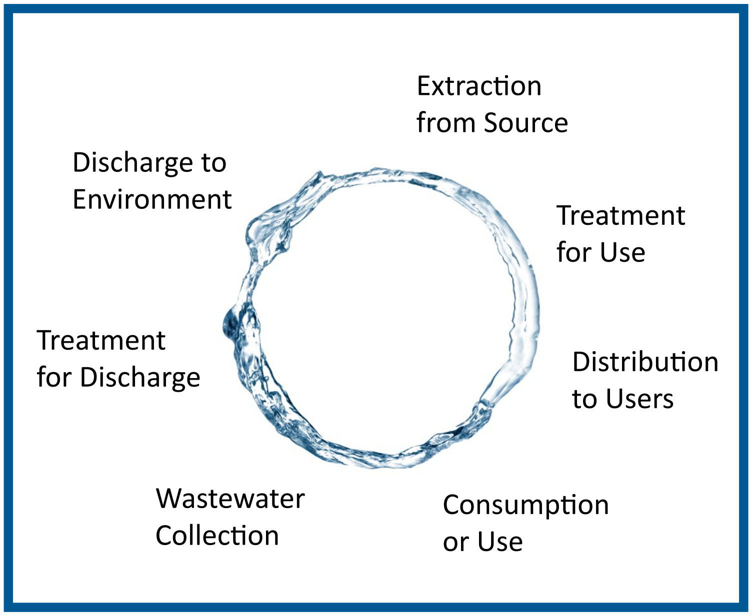


Figure 3. Exploring links in your system's water cycle

change impact your water resources and system? With a set of values and trends in mind, you can move on to ask participants: 'What do we want our community's water future look like in 20, 30 or 50 years?'

Once you've decided where you want to go, you can explore ways to get there and set goals. Think of the cycle that water goes through in your system (see *Figure 3)* and ask: 'How could water be saved or re-used in each stage?' and 'At what stages do we currently experience challenges?' Opportunities could include reducing leaks in the distribution stage. Challenges could include a lack of metering. Try discussing the different services water is providing, or how you might better align water quality to end use needs[1]. For example, you may not need to use potable water to flush toilets or irrigate gardens.

Remind participants that conservation is about more than quantity issues – conservation affects water quality, it reduces energy use, and it can change people's perceptions of water use. You will build on this vision later in Step 4 when you develop specific water conservation objectives.

1.6 Get Buy-in for Your Plan

Engaging people in the planning process does three things, it helps you to:

- Develop scenarios for the future and set goals
- Ensure that you deal with issues arising from different perspectives and values from the outset
- Gain support for your water conservation plan

Obtaining political support for your plan is important to help to secure the budget and resources necessary to develop and action your plan. It is highly recommended that your Council or Board (if applicable) be involved in the planning process early on. Having a directive or endorsement from local politicians shows their commitment and may be a requirement for senior government funding.

[1] For more on how to approach your water use from a services perspective see *Soft Path* in the Resources List on page 70.

Step 1 Example: Laying the Foundation for Anytown's* Water Conservation Plan

Anytown is an interior mountain community with a semi-arid climate and a population of 2,500. Its water is supplied by three main sources. Anyway Creek and Somewhere Creek are the two main drinking water sources and are located above the Town. Pine Well is a groundwater source that provides water to the west end of Town. There are also two reservoirs in the system: Holding Reservoir stores raw water downstream of the two creek intakes and High Road Reservoir stores treated water on the opposite side of Town. Coarse filtration and chlorination are used to treat water before it is distributed through approximately 50 km of water mains.

The community is semi-rural to rural, and a fifth of the population are summer residents. Economically, the Town has transformed over time from being primarily agricultural to having a mix of agriculture, tourism, and commercial businesses. Recreational fishing is a big tourist draw in the summer months.

1.1 Purpose

Anytown is facing several water system challenges. In recent years the Town's aging, leaking water distribution infrastructure has led to rising maintenance and treatment costs. Anyway Creek is susceptible to seasonal turbidity that causes water quality problems. And more extreme weather events, such as large storms and longer dry periods in summer, are raising concerns about water shortages.

Council wants to ensure that these issues are addressed and that there is adequate water of a good quality for years to come. As such, they have endorsed the following directive for their water conservation plan:

Anytown is committed to water sustainability and to finding solutions to meet our water quantity and quality demands at a reasonable price, while protecting the integrity of our local ecosystem and the health of our residents for generations to come.

1.2 Process

To create a comprehensive Water Conservation Plan, Anytown has chosen to adopt the Water Conservation Guide's seven step process. For each step of their process, they make choices to balance limited resources with the end results that are their top priorities. Using the online Water Conservation Calculator is helping them to assess supply problems, to compare the relative costs of infrastructure and conservation measures, and to speed up the planning process.

Recognizing that conservation planning is ongoing, those running the process are documenting their choices as they go and highlighting actions that, while unfeasible in the first round, can be undertaken later.

1.3 Geographic Boundaries

As a relatively isolated community, Anytown has the luxury of setting its conservation plan scope to cover the extent of its system and watershed. They have a longstanding agreement to cooperate on water issues with their aboriginal neighbors, the FN Band, who have a fishing resort on the water system and who will be consulted throughout the planning process. There is one community further downstream on Somewhere Creek called Farvale that needs to be considered as it may be impacted by the Plan.

1.4 Action Team & Community Engagement

Leading the water conservation Action Team is Anytown's planner, Sue Blue. She is supported by the water utility's engineer and the Town's receptionist. Anytown has a relatively small staff, so Sue has taken the initiative to drive water conservation planning forward.

1.5 Future Scenarios & Community Water Goals

To gain a broader sense of the water issues and values in their community, the team ran a Water Futures Workshop. They invited a wide range of people to participate: residents, local farmers, commercial and industry representatives, a local environmental stewardship group, and government representatives from the Department of Fisheries and Oceans, the BC Ministries of Environment and Health, and the FN Band. Together workshop participants identified:

- Water values:
  - Clean and safe drinking water
  - Healthy streams to support local fish populations and tourism
  - Adequate amounts of water for everyone to have a fair share
  - Water stewardship and user's responsibility for water use and community protection
  - Fair water rates that have a life line for the most vulnerable

**Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.*

- Trends affecting the water system:
  - Climate change
  - Old system leakage
  - Occasional Boil Water Advisories negatively impacting tourism
  - Moderately growing population since the Town has been 'discovered' by tourists
- Preferred Water Future:
  - As a community, we fix our leaks, establish a new water ethic, and save water wherever possible by upgrading our end devices and changing our behaviors. As a result, we build a community where fish are abundant, businesses can grow, and our children and grandchildren can lead healthy lives.
- Challenges:
  - Lack of awareness of water problems, especially among seasonal residents and tourists
  - No residential water metering
- Opportunities:
  - Reducing leakage
  - Water restrictions in summer for outdoor watering

1.6 Plan Buy-in

Aware that the Town has limited time to address water supply issues before there is a crisis, Sue has brought the issues to the attention of Council and found a fellow water enthusiast in Councilor Pat D'Leau. Together their leadership has helped to draw attention to Anytown's pending crisis and secure resources for the conservation plan.

Writing Checklist 1: Your Conservation Plan Introduction

☐ ***Conservation Plan Objectives*: State your plan's purpose and goals (1.1 & 1.5)**

- *Purpose* – Why is the conservation plan being developed?
- *Goals* – What goals are you aiming to achieve?

☐ ***Community Values*: Explain why conservation is important to your community (1.5)**

- *Values* – Why are water and water conservation important to your community? What can water conservation help you to achieve or avoid?
- *Vision* – Based on your futures exercise and stakeholder consultation, what would you like your community to look like in 20 years? And, in 50 years?
- *Realizing the Future* – What steps can be taken to help realize this vision?

☐ ***Plan Context and Scope*: Characterize your water planning context and plan boundaries (1.3, 1.4 & 1.5)**

- *Context* – What are the geographic and other boundaries (ex. political, social, etc.) that your plan is operating within?
- *Sectors & Stakeholders* – Who will be involved and what sectors will be included in the Plan?
- *Water System Cycle* – What opportunities or obstacles have you identified throughout your system's cycle?

☐ ***Planning Process*: Outline how you will develop your plan (1.2, 1.4, & 1.6)**

- *Planning Process* – How was your plan developed (i.e. method)? How will you implement your plan?
- *Assumptions* – What assumptions have you made in developing your plan?
- *Data sources* – What information sources have you used (e.g. reports, bylaws, etc.)?
    - » *Planning Framework* – How does this conservation plan fit into your wider planning framework? How does it relate to your community's: Official Community Plan, Growth Strategy and plans for asset management, liquid/solid waste, or watershed management?
- *Planning Efficiency* – Are there opportunities to use information gathered in this planning process to inform other activities?
- *Action Team* – Who will be on the team to implement your plan (ex. municipal staff, scientists, community and environmental groups, water system users)?
- *Resources* – What resources are available to ensure successful implementation?

☐ ***Endorsements and Supporters:* Document support for your plan (1.5 & 1.6)**

- *Political buy-in* – What Council and/or Board directive and support has been given? Has the final plan been endorsed? (If yes, include endorsement.)
- *Stakeholder support (from public & business sector)* – How have stakeholders been engaged so far? How do you plan to engage them in the implementation stage?

Step 2

Building Your Community's Water System Profile

The more information you have on your water system – the people who use it, where it is, and how it operates – the better positioned you are to design a water conservation plan that works for your community. In this step you gather data and build a water system profile that describes your water system in a series of snapshots. Together, the Community Snapshot, Watershed Snapshot and Infrastructure Snapshot give you a complete picture of your system's current situation.

For each snapshot, there are instructions on where to look for the data, how to do any necessary calculations, and what to use it for. Worksheets on *Water Demand*, *Water Sources*, and *Infrastructure* have been provided in Appendix A and in Excel spreadsheets on the Guide website to help you to collect your data. You may also choose to build a *Water System Map* (like those shown in *Figure 6* (on page 17) to better understand how your watershed and current water system fit together, and how they might change in years to come.

Use the best available data to build your plan. Data perfection is not required, though good quality data (i.e. gathered regularly from routinely calibrated meters or calculated based on performance assessed pump rates) will allow you to know more and do more about your water demand. To get started, at minimum you will need data on the total amount of water coming into your system each month and the total available supply – your monthly demand and source capacity.

Water Conservation Calculator

The Calculator is a free tool that has been designed to help you understand your organization's water conservation options and get a sense of how saving water can affect your community's future. In the coming chapters you will find instructions on how to use the Calculator to develop your plan in boxes like this one. Any data with an orange dot (•) next to it can be put into the Calculator to speed up your planning process. If the dot is shown in brackets, it means that the data is optional in the Calculator.

Refining your data collection may be an action item in your water conservation plan. For example, if a certain sector has high demand, you could meter those users. While you may not be able to gather all the data in the first round, you can always come back to this chapter for ideas on where to dig deeper for more information.

Overview of Step 2 Planning Process

1. **Develop your community snapshot**
2. **Describe your sources and map them in a watershed snapshot**
3. **Characterize and map your system in an infrastructure snapshot**

2.1 Develop a Community Snapshot

By the end of this step you'll have a *community snapshot* – an overview of the characteristics of the community that you service.

Knowing Your Customers

Knowing whom you serve water to is the first step in understanding how to drive water savings in your community. Survey your water users by searching through census data, water billing records and records on your local government or water utility usage (e.g. parks irrigation).

Begin by describing your community in general terms. Is it rural or urban? Is it a one-industry town, focused on forestry, agriculture or tourism? Or is it a central hub for a number of sectors?

Next, use the Service Characteristics table in the *Water Demand Worksheet* to compile a more detailed portrait of your water users by gathering information on your community's population:

- **Permanent Population** • – How many people live year-round in your community?
- **Seasonal Population** • – How many people live in your community on a seasonal basis?
- **Predicted Annual Population Growth Rate** • – How fast is your community predicted to grow?

Understanding Your Water Demands

Conservation involves managing water demand, and the more you know about your current demands, the better positioned you are to manage them with your plan. Gathering information about your water demands allows you to understand which sectors are high water users and target conservation measures to particular uses. Data on water use can be compiled into the tables on Water Demand and Detailed Consumption Data in the *Water Demand Worksheet* (see Appendix A on page 59). This data can be found in water utility and billing records, or by speaking to your utility's water operators or engineers.

Ideally, you want to use data from the last five years. If you have metered water connections, you will have plenty of demand information to work with. If you have bulk meters, you can use them to measure mass flows of water through various parts of your system, giving you a sense of how your water demand is distributed. When metered data is unavailable, you can estimate demand based on water production to get a rough picture. Look for patterns of high use or loss to figure out the best places to target your conservation efforts.

As demand is critical to conservation, we highly recommend gathering data on:

- **Total Annual Supply Capacity –** The volume of water (m^3) brought into your system, which is typically measured or estimated at the well head, water treatment plant or reservoir. The total annual water produced can be split into different categories to explore water uses, including: sector uses (residential, ICI, agricultural) and whether demand is unmetered or metered.
- **Breakdown of Annual Demand by Sector** • – using billing or meter data, estimate or determine exactly how much of your annual water demand is used by each sector.
  - ***Industrial, Commercial, and Institutional (ICI) Demand*** is unique to each community, and is best based on metering data. If metering data is unavailable, you can use the online Calculator to estimate ICI demand based on the number of facilities in each sector and the percentage of total demand they are estimated to be using.
  - ***Agricultural Demand*** is usually supplied independently of the main municipal supply, by private wells, retention ponds or irrigation districts. Only count the water used by agriculture from your system in your demand profile. If you are completing a water conservation plan for your whole catchment, the supply and demand for each independently serviced agricultural property can be included.

Table 1. Average Water Use by Sector for British Columbia in 2009[i]

	Residential Use	Commercial, Institutional, & Municipal Uses	Industrial & Agricultural Uses	Leaks or Unaccounted Water Use
BC Average Percentage of Total Use	62.5%	16.8%	9.3%	11.4%

- ▹ ***Residential Demand*** can be based on metering data, if available. If no metering data is available, you can use BC averages (see *Table 1* on page 13) to estimate demand, since residential use tends to be similar across communities. Residential demand can be further divided into single-family or multi-family dwellings, and indoor versus outdoor water use. Data on end-uses can be useful to target conservation initiatives. Since indoor water use tends to be fairly stable year round, the monthly demand data from winter months (when there is little outdoor water use) can be used to estimate the average indoor use for the whole year:

  average annual indoor water use = (average monthly winter residential water use) x 12 months

  % indoor residential use = (annual indoor water use) / (total residential water use)

  annual outdoor residential water use = (total residential water use) – (annual indoor water use)

  % outdoor residential water use = 100 – (% indoor residential use)

  Indoor uses can be further divided into cleaning, drinking and food preparation, laundry, toilet flushing, and bathing to help identify indoor conservation opportunities. Outdoor uses can also be separated to target initiatives, for example into irrigation or watering, cleaning and recreation (i.e. pools).

  Identifying per capita residential water use will give you a good idea of how much water each person is using – assuming that everyone is using the same amount of water! This is a useful value to compare with other communities and to set a residential water use goal that people will understand (ex. "we want to use only 100 m^3 per person per year" or "we want to use only 250L per person per day"):

  annual per capita residential water use = (total annual residential water use) / (# of people supplied water)

- **Break Down Demand by Revenue and Non-Revenue Demand:**

  - ▹ ***Revenue demand*** includes all water demand for which there is a charge. This usually includes all residential, industrial, commercial, institutional, and agricultural demand.

  - ▹ ***Non-revenue demand*** is the difference between how much water you supply and all billed water:

    non-revenue water demand = (total water supplied) – (total billed water volume)

    It often reflects water lost in your system through leaks, maintenance flushing and cleaning, fire hydrants, theft, measurement errors, or other unbilled uses. *Table 2* shows the breakdown of what is included in revenue vs. non-revenue water. Identifying and saving lost water can give you a 'new' source of supply[1].

Table 2. International Water Association Definition of Revenue vs. Non-revenue Water[ii]

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies	
		Real Losses	Leakage on Transmission & Distribution Mains	
			Leakage & Overflows at Reservoirs	
			Leakage on Service Connections up to Metering Point	

[1] To identify where your non-revenue water is going, consider doing an International Water Association (IWA) water balance. For more information see *Water Accounting and Water Loss Management* on page 71 in the Resources List.

- **Breakdown of Annual Metered Demand per Sector (estimates or exact data)** • – To compare annual metered demand to non-metered demand, gather data on their relative volumes.

- **Peak Demand Data by Sector** – For any year you can find peak demand by identifying the largest volume of water used in the time period of interest – one season, one day, or one hour.

  - ***Peak Season Demand*** – Peak season demand is the volume of water used by your community in the high water use season. For many communities this is reflected as higher summer use in June through August. If you compare data on peak season use to low season (winter for most water systems) use, you can see an increase in seasonal water use over time that may be more consistent year over year than Peak Day Demand. Different sectors may also have their own peak seasons.

  - ***Maximum Daily Demand (MDD)*** • – Also called peak day demand, MDD is the volume of water that was used by your community on the highest use day of the year. Often used to justify infrastructure expansion, use caution in analyzing MDD since it can reflect events like big fires or industry closures that do not reflect changes in water use behavior in the community.

  - ***Peak Hour Demand*** • – Peak hour demand is the volume of water that was used by your community in the highest use hour of the year.

To gain an even clearer picture of your demand – now or later – go further and collect data on:

- **Average Daily Demand (ADD)** – ADD is the average volume of water used in a day in a given year. If you are using the Calculator, ADD will be calculated for you. You can calculate it yourself by dividing total annual supply capacity by the number of days in the year:

  ADD = (total annual supply capacity) / 365

  Or, for unmetered water use, estimate ADD using your pump rate, run time and efficiency (which decreases as the pump gets older):

  ADD = (pump rate) x (run time) x (efficiency of pump)

  ADD can be used to calculate other measures of water use efficiency, like peaking factors (i.e. PDD/ADD = peaking factors) or gross (total) per capita demand (i.e. GPCD = ADD/residential population). Comparing the peaking factors for which your system was designed to the recorded peaking factors can show you how close your system is operating to its capacity.

Water Conservation Calculator

Along with the maximum day demand, peak hour demand can be entered into the Calculator, which will automatically calculate average daily demand, residential daily per capita consumption, daily per capita consumption for the entire system, and demand as a percentage of maximum daily supply capacity for you. It will also generate a monthly demand profile for you.

- **Detailed Consumption Data** – Detailed water use data can be used to identify water demand issues or time periods when water savings would make the most difference.

  - ***Monthly Demand Data*** • – Data on monthly water use can be used to build a monthly water demand profile, or a picture of your seasonal water demand over 12 months of the year, as shown in *Figures 4* and *5* (on page 16).

    Your community's monthly water demand profile can reveal issues, enabling you to start your conservation efforts even if you don't have detailed information from meters. For example, if your community's profile shows high seasonal use (as in *Figure* 4), you will know immediately that reducing peak outdoor demand is a priority. In this case, irrigation-

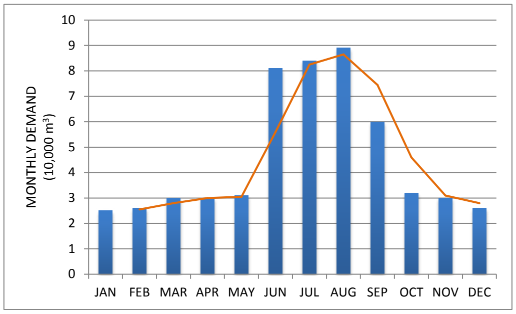


Figure 4. Monthly Water Demand Profile: High Seasonal Use

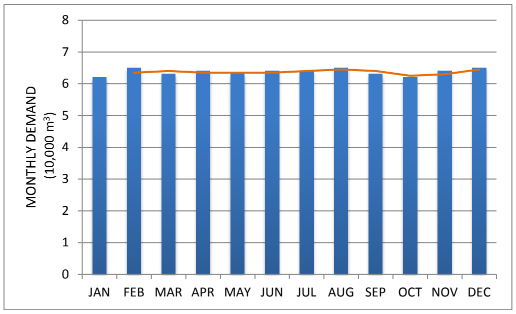


Figure 5. Monthly Water Demand Profile: Consistently High Annual Demand

focused strategies will provide a better return on investment than indoor strategies, such as toilet retrofits. A high peak in your profile could also show high seasonal use by a particular industry. If your community's demand profile is flat (as in *Figure* 5), this consistently high water use may indicate high water losses and point you towards developing a water loss management strategy.

▹ ***24 Hour Demand Data*** • – Hourly demand data is useful for identifying time periods of high use and can be used to target conservation programs. For example, you might use it to design a water restriction program that asks residents to water their lawns only on certain days or at certain times.

2.2 Describe Your Sources and Map a Watershed Snapshot

The next step is to build your Watershed Snapshot – a view into your water sources, the ecosystems and people who depend on them, and how impacts on your sources may affect your water supply.

Describing Where Your Water Comes From

Gathering data that connects your water system with its surrounding natural environment can give important insights into how conservation can help achieve your community's water sustainability objectives. In this step you will assess and describe your water sources, their capacity, and any factors affecting them. You can use the *Water Supply Worksheet* (see Appendix A) to collect your data. You can find the data in utility records, provincial and municipal planning documents, environmental assessments, or by talking to your utility's water operators or engineers.

Another useful way for you to capture and integrate data from all three snapshots into a complete picture is by building a map of all of the system components overlaying the geographic features of your watershed, like the examples shown in *Figure* 6 (on page 17). You can include your water sources, important land forms, and any areas of social or ecological significance (e.g. fishing spots, habitat, etc.). Later, you will have data on your system's components from your Infrastructure Snapshot (see Section 2.3) to complete the map.

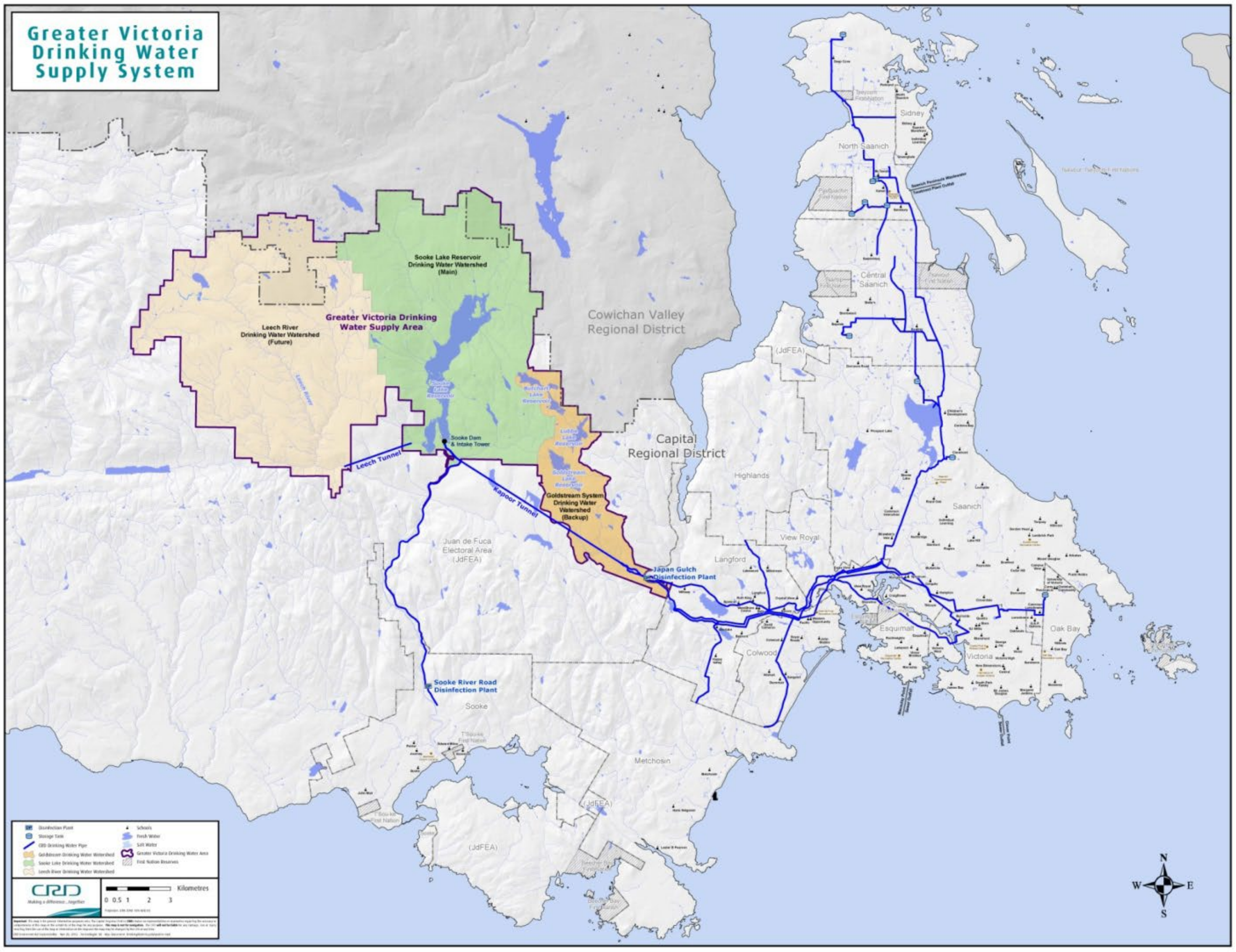
Governing Your Waters

Some key questions you can ask to help you to describe the management of your watershed include:

- Does your community have direct or exclusive control over its water supply?
- Are there multiple water sources?
- Do you purchase any bulk water from another purveyor, like a Regional District? Or do you sell water to other purveyors? If so, at what price?
- Who owns and controls your watershed?

Since your conservation plan will be aimed at changing peoples' behaviors, you may also want to consider these questions on the social and cultural life of your watershed:

- Do water consumption or shortages impact recreational uses, such as golfing, swimming, fishing or boating?
- Are there any social, cultural, or economic issues that may impact the integrity of your watershed? For example, do any First Nations in your community rely on water sources for cultural activities, such as wetland plant harvesting or fishing? Or are there any industries, like tourism, that require a certain level of water quality?
- What is your community's minimum required fire flow?



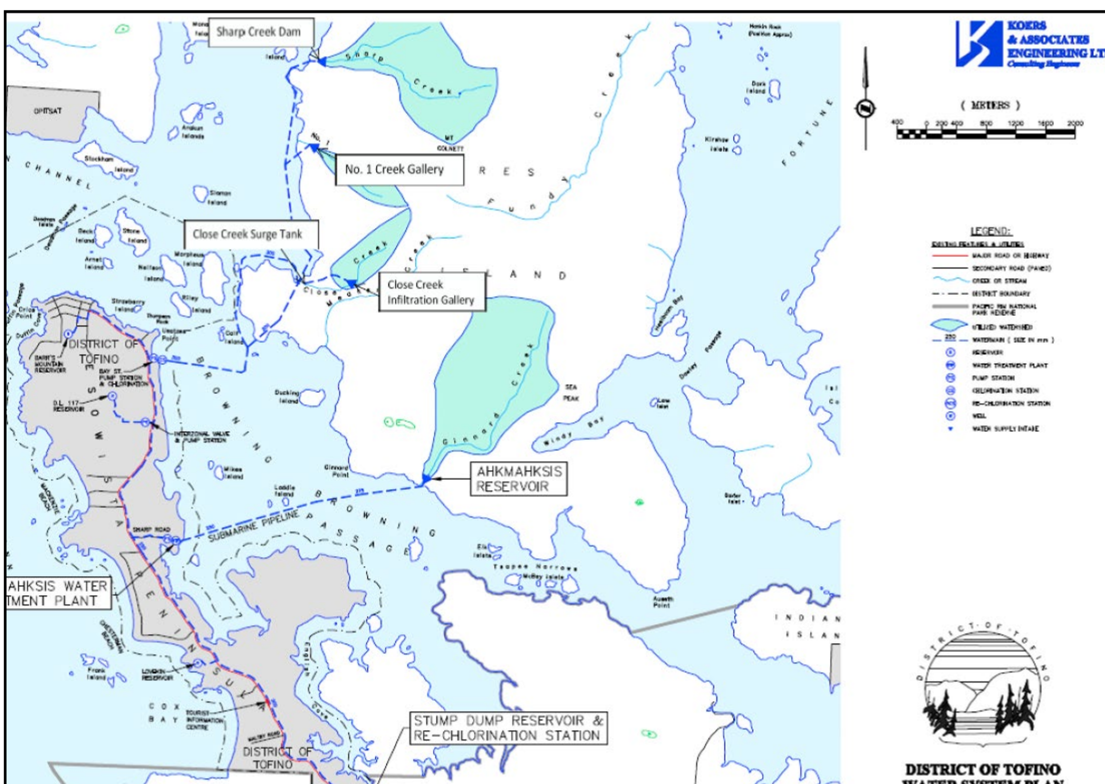


Figure 6. Sample Water System Maps

The Greater Victoria Map above shows the watersheds supplying the system and the water distribution mains. You can see how their plans to expand into the Leech watershed in beige would change the system.

The Tofino Map shows what a small system map might look like. Features are clearly labeled and you can see how the water sources connect to the distribution system.

- Are there community environmental groups active in your community? If yes, what type of activities are they conducting? Would they be interested in helping to do stream or lake assessments?

Your Water Sources

To assess and describe your water sources you can use the *Water Supply Worksheet* in Appendix A (on page 61). It is highly recommended that you gather data on:

- **Maximum Daily Supply Capacity** • – The maximum amount of water your system can supply to customers in a day. Ask your water utility engineer or operator for this information.
- **Peak Hour System Capacity** • – The maximum amount of water your system can supply to customers in an hour. It can be obtained from your water utility engineer or operator.
- **Annual Water Supply Capacity (by source)** • – For surface water sources, look for information on maximum and minimum flows, and capacity volume (m^3). For example, the highest and lowest lake levels per year, and the minimum and maximum river flow volumes (m^3). Source water supply capacity may be limited by environmental flow needs as well as by minimum and maximum flow volumes. For groundwater sources, look for data on well yield rates and water quality, or a groundwater capacity assessment.
- **Source and Water System Intake Locations** – Including the geographic location and service area for each one. These can be used to describe your system and/or chart your water system map.

Changes in Your Watershed

Now that you have described your water sources, you can move on to gather information on the factors affecting them. This data can be logged into the Surface and Groundwater Description tables in the *Water Supply Worksheet* (on page 61). To better understand how changes in your water management can affect your environment, and how changes in the environment can affect your water supply, gather data on:

- **Water Quantity** – Gather data on water flows (e.g. total annual flow, historical flow trends) and any multi-year droughts or extreme low flow periods to describe the kinds of water quantity challenges your system has faced in the past.
- **Water Quality** – Gather available information on water quality, which includes the physical, chemical, and biological characteristics of your water supply. This is assessed by testing your source water for contaminants such as bacteria, viruses, chemicals, salts, metals, and minerals as well as attributes such as temperature, pH (acidity), dissolved oxygen content, turbidity, and conductivity. You can put this information into the 'Factors Affecting Source' column in the source water description tables.

  Water quantity and quality are closely linked, and low water levels have a direct negative impact on water quality. For example, water with higher temperatures or that is stagnant is more susceptible to bacterial and algal growth than fast, cold water. Conservation can help maintain or improve water quality by keeping adequate flows in streams and lakes and by reducing the amount of wastewater generated and discharged.
- **Ecological Health** – See if there are any studies on the health of your water sources (e.g. environmental assessments, BC Ministry reports, or community feedback) and take note of any factors that stress your local fish, wildlife and plants.
- **Infrastructure Capacity** – Gather information on the limits of your existing infrastructure by inventorying your treatment plants, reservoir balances and storages, the diameter of trunk mains and condition of well screens. You can also use the Calculator to estimate how close you are to the limits of your existing capacity. Remember that building new reservoirs and wells will change how water moves in your watershed and may impact natural habitat or recreational areas.

- **Climate Change – Estimated Annual Percentage of Declining Storage Volumes (•)** – This data is used in the Calculator to estimate how much of an impact climate change is expected to have on your sources. Climate change is discussed more in the next chapter.

2.3 Characterize Your System in an Infrastructure Snapshot

The Infrastructure Snapshot completes your water system profile by bringing in data on your service connections, metering, distribution system, and costs. You can use the *Infrastructure Worksheet* in Appendix A (on page 62) to compile your data. Look for this data in water utility and billing records, or from water utility staff. If you have chosen to develop a water system map, this information can be used to draw your water system onto your watershed.

Where Your Water Goes

Gather data on service connections to better understand how many homes, businesses, and institutions use water from your system and how much water they are using.

- **Service Connections** – This data on your water users can be used to help target metering or conservation programs.
    - **Number of Connections by Sector •** – the number of service connections for each sector, or type of user, on your system (e.g. residential, ICI, agricultural).
    - **Percentage of Total Connections by Sector** – these percentages are used to gain a picture of how your water is used.

      % of total connections by sector = (# of connections in a sector) / (total # of connections)

    - **Annual Demand by Connection (m^3/yr)** – the volume of water used by each connection in a year. Can be obtained from meters or billing records.
- **Metering** – Metering combined with conservation pricing has been shown to reduce water use.
    - **Number of Metered Connections •**
    - **Number of Unmetered Connections**
    - **Percentage of Metered Connections per Sector** – calculated using the following equation:

      % metered connections = (# of metered connections in a sector) / (total # of connections in a sector)

- **Water and Wastewater Treatment** – Water treatment data can help you to work out the water quality and cost benefits of conservation for your system.
    - **Level of Treatment** – Level of contaminant removal, Interior Health's 4-3-2-1-0 drinking water objective[2] can help you to determine the optimal level of treatment for drinking water
    - **Type of Treatment** – Chlorine disinfection, UV, filtration type, etc.
    - **Percentage Treated** – The percentage of water and wastewater you treat

[2] A factsheet on Interior Health's 4-3-2-1-0 Drinking Water Objective is available online at: http://www.obwb.ca/fileadmin/docs/43210_Drinking_Water_Objective.pdf

How Your Water is Moved

Your distribution system is another good place to look for water savings. By finding and fixing leaks you can potentially save large amounts of water, which will also save you money on treatment and pumping costs. To describe your distribution system, gather data on:

- **Distribution and Piped Infrastructure**
    - **Water Lines** – Length (km), age, condition and maintenance/repair history for potable water lines and any twinned systems (for non-potable delivery or irrigation)
    - **Distribution Reservoirs** – The number, age, condition, and maintenance history of your distribution reservoirs
    - **Average and Peak Water System Pressures** – These variables are useful for pressure management. Lower pressures reduce water loss due to leakage
    - **Wastewater Lines** – Length (km) of wastewater lines in the system

What Water Service Costs

Gathering data on your water service costs can help you to determine what pricing structure will support service provision and water conservation.

- **System Energy Consumption** (Distribution System, Treatment System, Incidental System Use) (•)
- **Annual System Budget** (Expenditure, Revenue, Average Water Rate) •

When determining your water system expenditure, all of the costs associated with supplying water services should be considered, including associated operations, maintenance, and administrative costs, as well as capital costs to repair and replace infrastructure[3]. This full cost accounting helps to determine the total cost of providing water services to customers.

Comparing your full cost expenditure to your revenue shows you whether the cost of service provision is being fairly recouped through water rates and other revenues. Full cost accounting also enables you to see the benefits of water conservation in terms of money saved through reduced wear and tear on existing infrastructure and reduced or deferred needs for new supply infrastructure.

Appropriate pricing for water services is one proven way to promote water conservation. As a general rule, water service pricing should allow for the full cost of services to be covered. This allows customers to see the true cost of water provision. Using volume-based pricing with increasing block pricing (i.e. beyond a minimum usage level prices increase as more water is used (per m^3)) provides an economic incentive for users to conserve water.

What kind of rate structure are you using (e.g. fixed, inclining block, seasonal rates, etc.)? Is it currently designed to promote efficient water use? In the Step 5 chapter you will learn more about how to use economic measures such as conservation-oriented pricing to achieve your goals.

With the final piece of the picture in place, you are ready to move on to the next chapter where you will project future water demand for your community.

[3] For more information, see the BC Water and Waste Association's issue analysis paper on Water Service Rate Setting: http://www.bcwwa.org/resourcelibrary/RateSetting%20Position%20Statement%20rev%20%2024-06-2013_final.pdf

Step 2 Example: Anytown's* Water System Profile

Sue Blue, the planner leading Anytown's water conservation planning team, has been working her way through utility records, billing files, municipal and provincial planning documents, and environmental reports to gather the data necessary for her water system profile. Sue has downloaded the Excel worksheets from the Guide website and has been logging data as she finds it. Knowing she won't be able to find all of the data in this first planning round, Sue has been focusing on the fields necessary for the Water Conservation Calculator. She has signed up online and entered in the data for Module 1. Bringing together the Town's water system profile has given her team a clear picture of where there are problems that can be addressed through water savings and where there are values they want to protect.

2.1 Anytown's Community Snapshot

Anytown's current population is 2,500, made up of 2,000 permanent residents and 500 summer residents. The BC Stats website estimated annual population growth for the community at 1.2%, meaning that in fifty years the community will need water to support almost double its current population. Based on meter data, water demand is primarily single family residential (53%), followed by leaks (19%), non-revenue water (9%), commercial (8%), institutional (7%), agricultural (2%), and industrial (1%). Total water demand is 1,021,931 m^3. Given the high leakage rates in the system and a lack of awareness of water issues among residents, daily demand values leave room for improvement. Average daily demand is 2,799 m^3 or 2,799,810 L, residential per capita consumption is 594 L per day as compared to the provincial average of 353 L per day, and maximum daily demand is pushing the limits at 92% of Anytown's maximum daily supply capacity.

2.2 Anytown's Watershed Snapshot

The total annual supply capacity of Anytown's three sources is 1,054,700 m^3. Somewhere Creek is the biggest source, providing 410,300 m^3 annually. Anyway Creek is the other surface water source and provides 328,400 m^3 annually, and is more prone to seasonal turbidity issues. Pine Well is the only groundwater source in the system, and it provides 316,000 m^3 annually. Fishing is a major tourist draw in the summer and having enough water in the streams to keep the salmon healthy is a top priority.

2.3 Anytown's Water Infrastructure Snapshot

The total number of service connections in Town is 1,007, the majority being single family residential (81%), followed by commercial (11%), non-revenue water (4%), institutional (3%) and a few agricultural and industrial connections. Connections can be big or small and give a different perspective on water demand than consumption data. For example, 81% of connections are residential, though residential demand is only 53% of total. Municipal, ICI, and agricultural users are metered, but they are currently charged a declining rate the more water they use, so there is no financial incentive for them to conserve water. There is no residential metering at present. In terms of treatment, raw water from the two creeks is run through a coarse filter and chlorinated, and water from the well is chlorinated with sodium hyperchlorite after the pump discharge. In the future, Anytown plans to add UV treatment. The distribution system is older, and is made up of 85% asbestos cement pipe constructed prior to 1977, 5% ductile iron pipe built in the late '70s, and 10% polyvinyl chlorine pipe installed in the '80s. There have been several pipe breaks in recent years, and leakage is suspected to be high. The majority of the system is gravity fed, although a pump station serves the high elevation properties on High Road.

**Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.*

Writing Checklist 2: Your Community's Water System Profile

☐ ***Community Snapshot:*** **Describe your community, water users and water uses. (2.1)**

- *Population* – What is your community's current population? Can you break it down into permanent residents and seasonal residents, and/or by age groups?
- *Water User Sectors* – What are the different sectors using water in your community (i.e. residential, industrial, commercial, institutional, and agricultural)? Which sector(s) are the biggest water users (e.g. forestry, agriculture, tourism, residential or other)?
- *Annual Water Demand* – What is your annual water demand? How does it break down by sector?
- *Daily Water Demand* – What are your average daily demand (ADD), maximum daily demand (MDD) and peak hour demand (PHD)? What percentage of your maximum daily supply capacity do they represent?
- *Monthly Water Demand* – What is your demand by month? If possible, break this down by hour.

☐ ***Watershed Snapshot*****: Describe your watershed and environment. (2.2)**

- *Catchment Map* – What geographic features are in your area (i.e. land and water forms)? How does your water system (i.e. water system components) overlay them?
- *Governance Issues* – Do you share responsibility for your watershed or water system with other communities? Are you part of any regional water planning initiatives?
- *Social and Cultural Aspects* – Are there any social or cultural activities that affect your watershed? For example, are there any recreational activities (e.g. boating, tubing, fishing, etc.) that may impact your water supply? Or, do any First Nations in your community rely on a water source for cultural activities?
- *Water Sources* – What are your sources of supply (e.g. lakes, rivers, aquifers, reservoirs, intakes, wells, pumps)?
- *Precipitation* – What is your annual precipitation (average, high, low) including spring freshet (the high waters from combined snow melt and spring rains)?
    - » *Groundwater and Reservoir(s)* – What are recharge rates and time periods like for each?
    - » *Ecological Needs* – What important natural processes (e.g. breaking down and transporting nutrients, watering trees, etc.) or habitats are supported by the waters in your region? For example, how much in-stream flow is needed to support healthy fish populations?

☐ ***Infrastructure Snapshot:*** **Describe your water system infrastructure, including size, age and condition for each component. (2.3)**

- *Connections* – How many connections are there in your system?
- *Metering* – How much of your system is metered? Are you charging more for higher water use or less (i.e. inclining or declining block rates)?
- *Water Treatment* – How do you treat the water you supply ?
- *Distribution System* – What does your distribution system consist of? Does it include balancing storage reservoirs?
- *Sewer Collection System* – Do you have a sewer collection system? If yes, describe it.
- *Sewage Treatment* – Do you treat wastewater? If yes, how do you treat the wastewater you discharge? Where is your effluent discharged?
- *Stormwater System* – Is stormwater ever combined with sewage in your system?

Step

3

Forecasting Future Demand and Setting the Bar for Success

In the past, water demand forecasting has been used to decide when it was time to build new infrastructure. In conservation planning, demand forecasting serves a different purpose: it sets the bar for evaluating the success of your conservation plan. Forecasting shows you where your community is likely to end up if it stays on the same water consumption course, in many cases with less water than you would prefer, sooner than you think. Water conservation plans can help delay the need for new sources and supply infrastructure further into the future. The longer you can delay new supply side infrastructure is a measure of your program's success.

In Step 3 you establish a baseline scenario for the future in which you do nothing to improve your community's water consumption. In later steps you'll look at different options for how to beat this scenario and make your community's water future more sustainable through conservation.

Overview of Step 3 Planning Process

1. **Choose your forecasting method(s)**
2. **Project your water demand**
3. **Think about how a changing climate will impact your community's water future**

3.1 Choose Your Forecasting Method

Since your objective is simply to understand the relative effectiveness of conservation options, you can choose one of two basic methods to forecast demand: Per Capita Water Demand Forecasting or Water Demand Forecasting by User Group[1]. With either method (or both) you can aim to make a series of high, medium and low forecasts for the next 5, 10, 20, and 50 years. The *Water Demand Forecast Worksheet* in Appendix A (on page 63) has been provided to help you structure your results.

Per Capita Water Demand Forecasting

This method is best-suited for smaller communities that don't have detailed information on the end users in their system. It assumes a direct link between water conservation and population growth. While this link is common, you'll see in later chapters that conservation means water use does not always have to rise with population.

To calculate water demand projections using daily per capita water use information, use the following equation:

Future water use = (daily per capita water use) x (future population) x 365 days

Or, to calculate water demand projections using total annual per capita water use[2] information, use:

Future water use = (total annual per capita water use) x (future population)

[1] Note that other forecasting methods may be more appropriate for other utility planning purposes. For example, per capita demand forecasting works well if you only need to project average annual demand. When new infrastructure is needed, a demand forecast that analyses demand by service area and customer type may more useful for defining the capacity needed to service future water demands (AWWA 2007).

[2] 'Total per capita water use' is also known as 'gross per capita water use'.

Water Demand Forecasting by User Group

Forecasting water demand by user group is more accurate than per capita demand forecasting because it accounts for differences in growth between sectors, such as residential population, industry and commercial businesses. For example, if a large commercial user set up shop in town it could increase your water demands sooner than would be expected based on population growth alone. This method is well suited to communities that have reliable data on the water demands of their different user groups or sectors.

To calculate water demand projections by user group use the following equation:

Future water use = (annual water use by sector) x (sector growth)

Water Conservation Calculator

If you have entered your information into the Water Conservation Calculator it will generate a 50-year forecast for you (see Module 5: Results & Charting). Depending on how much detail you have entered, it will generate a series of forecasts for you on: annual demand, daily demand, hourly demand, 24-hour demand, and monthly demand.

3.2 Project Annual Water Demand

Once you have selected the forecasting method that works best for your system, you can use the data you gathered in the Step 2 to project your annual water demand for the forecast periods. You can use the Annual Demand and Daily Demand tables to compile your results in the *Water Demand Forecast Worksheet* (see Appendix A, page 63). If you are using the Calculator, the forecast will be done for you. Otherwise, start by calculating your future population for each time period (5, 10, 20, and 50 years) using your current population and the predicted annual population growth rate. Next use one of the methods above to project Annual Water Demand for each period. In forecasting your future annual supply capacity, describe any trends and possible impacts you foresee, and try to integrate them into your supply projections.

Water Conservation Calculator

If you are using the Water Conservation Calculator and have entered demand data for each sector, it will project future water use for you. The Calculator will also give you a Sector Summary after you have applied conservation measures in Module 2.

3.3 Think About How a Changing Climate Will Impact Your Community's Water Future

As our climate changes it becomes increasingly difficult to predict what water sources and supply will look like in the future. There are a number of trends and climate change impacts that have been documented in BC and that you may want to consider in estimating your future water supply:

- Increases in average temperatures in both winter (+2.1°C) and summer (+1.1°C) over the period of 1900 to 2012[i].
- Sea level rise as the ocean warms and expands, polar ice caps melt and glaciers retreat
- Snow pack losses, causing lower peak flows earlier in the year and lower low flows in summer
- More frequent and severe storm events, and more frequent floods and droughts.[ii]

Science around climate change is rapidly evolving; as such it's important to look for the latest available research when developing planning estimates of change for your community. See the *Resources* section at the end of the Guide for a list of organizations and resources that can help you with this investigation.

Step 3 Example: Anytown's* Forecasts for the Future

After entering her water use profile data into the Water Conservation Calculator and checking the Results and Charting page, Sue discovers that her suspicions that Anytown is heading for a water supply crisis in the near future are true.

Even with a relatively modest population growth rate of 1.2% per year, Anytown is heading for severe water shortages in the near future if they do not reduce their water consumption.

Figure 7 shows the 50-Year Forecast results from the Conservation Calculator. At just under 3,000 people the Town will have reached its maximum system capacity. The light gray shaded area under the black dotted line shows Anytown's existing water system capacity, which is predicted to decline in the future due to climate change impacts. The light blue line shows current and projected demand levels continuing to rise year by year, getting ever further away from the community's water supply reality.

Sue plans to use this graphic in her upcoming report to Council to demonstrate the need to increase water awareness in the community and to promote conservation as a way to better align water demands with available water supply.

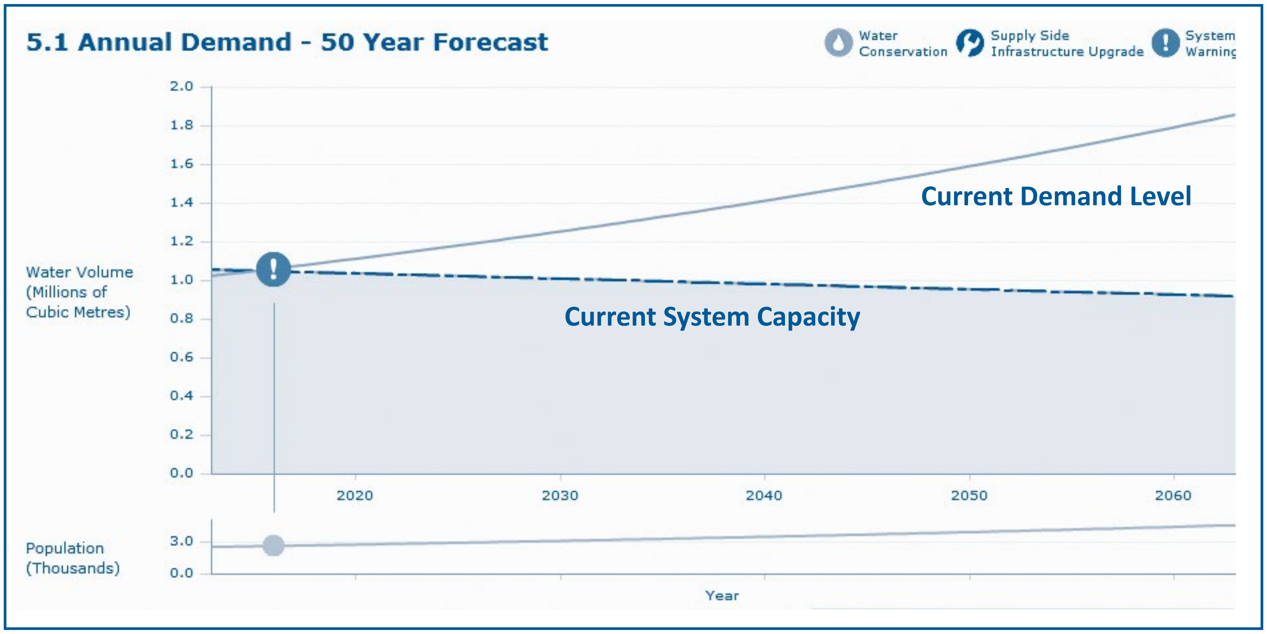


Figure 7. Anytown's Annual Demand 50 Year Forecast from the Water Conservation Calculator

Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.

Writing Checklist 3: Forecasting Your Future Demand

☐ ***Water Demand Forecasts:* Specify the method you used to forecast water demand and describe your projections for the next 5, 10, 20, and 50 years. (3.1 & 3.2)**

- *Method* – Which method(s) did you use to estimate future water demand (i.e. by population or by user group)? Did you use the Water Conservation Calculator?
- *Annual Water Demand Forecast* – What are your projections for population served, annual water demand, annual supply capacity, and the difference between annual supply and demand for the next 5, 10, 20, and 50 years?
- *Daily Water Demand Forecast* – What are your anticipated Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD in m^3/hour) for each period?

☐ ***Future Trends*: Describe how changes in population or other trends might affect your projections. (3.2)**

- *Demographic Changes* – How will an increase or decrease in your population affect your forecasts? How will changes in the age distribution of your population affect demand?
- *Supply Capacity* – Can your current water source(s) meet your community's projected future water needs?

☐ ***Climate Change Impacts*: Describe possible climate change impacts to your community's water resources and system. (3.3)**

- *Impacts on Local Hydrology* – How could changes in climate impact your watershed and your local hydrology (e.g. increasing frequency and severity of extreme weather events such as storms, floods and droughts)?
- *Impacts on Community* – How could these changes in hydrology affect your water system? How might these changes in your water system impact local residents, businesses, and ecosystems?
- *Growth* – Will your community have enough water to continue to grow if it stays on its current water management path and climate change impacts occur?

Step

4

Conservation Objectives and Aiming to Use Less

Now that you've gathered data on water use and forecasts for the future, you are ready to investigate your community's water issues and develop water conservation objectives.

Overview of Step 4 Planning Process

1. **Understand your future water needs**
2. **Determine the timing and cost of additional supply requirements**
3. **Develop water conservation objectives**

4.1 Understanding Your Future Water Needs

In Step 3, you compared your current and forecast water demand to your available water supply in the *Water Demand Forecast Worksheet*. By graphing demand and supply over time, you can see that there is a point in time where the forecast demand will exceed your available supply. This means there will not be enough water to meet future needs unless steps are taken to reduce use, or to build new supply infrastructure. As no water supply is infinite, reducing use is the most practical and cost effective solution to guarantee your community a sustainable water future.

Water Conservation Calculator

If you have been entering your data into the Calculator as you go, you can use it to generate a graph that compares your future demand forecast to your supply. Look under the Results and Charting tab for different forecast graphs.

Share this graph with your Action Team to help define the limits of your existing water supply. Work with your team to answer the following questions based on the information you gathered in Steps 2 and 3:

- Are you experiencing water shortages or do you anticipate any in the future? If so, when?
- Do you have water quality issues related to having too little water?
- Where is the most water being used? What are the sectors where water use could be most easily reduced?
- What are the main factors limiting supply? Is the amount of water available from existing water licenses and water sources too low to supply the current demand? Is there a lack of capacity to treat or deliver more water due to treatment or distribution system sizing?

4.2 How Conservation Can Save You Money in the Long Run

As your community grows, so to do its water needs. With various pressures on the local watershed, the most sustainable option for your community is to conserve and reduce waste. Implementing water conservation measures will have an associated cost; however it is important to look at this cost in context. When you are carrying out water conservation measures, you are avoiding the environmental and social costs of using additional water, as well as the cost of installing and maintaining new supply infrastructure.

Water Conservation Calculator

Entering the optional information into Module 4 on Infrastructure Upgrades can help you to compare the costs associated with planned supply upgrades to the cost of implementing water conservation measures, the annual water capacity gained and cost of capacity gained.

Determining the costs associated with new supply infrastructure and comparing these to the costs of conservation programs can help you to demonstrate the affordability of water conservation to your community. Assuming that there is additional water available, how much would it cost to build and maintain new supply infrastructure? The costs of building new infrastructure include both the upfront and ongoing monetary costs, and wider environmental, social, and cultural impacts of obtaining new water from your local environment.

4.3 Striving for Savings: How to Develop Water Conservation Objectives

Working with Your Community

With an understanding of your system's limits and the data gathered earlier, it is time to bring people together, share what you've learned so far, and work towards developing conservation objectives.

In Step 1 you worked with stakeholders from your community to develop a vision and preliminary conservation goals. At this stage you will benefit again from having a workshop or a series of conversations as you work on the question of how to collectively realize this vision. You may choose to bring the same group together, or seek out new participants to broaden the range of needs and values represented in your plan.

In this planning exercise, begin by reviewing the vision for your community's preferred water future and the findings of your investigations so far. The bigger question you are asking here is: Are we moving toward a sustainable water future? Think about the ideal outcomes from water savings. How much water does your community need to save to ensure that streams stay healthy, fish have adequate habitat, aquifers are not depleted, water is available for other economic growth areas, and costs of treatment remain affordable?

Developing Conservation Objectives

Ideally, your conservation objectives will capture the values which are important to your community. *Conservation objectives* are collaboratively developed tangible goals that set the direction for your conservation plan and provide benchmarks to evaluate your progress on water savings. The benefit of developing these objectives collaboratively is that the final list will represent the diversity of water needs and values in your community.

Conservation objectives should be measurable and descriptive. For example, you can create objectives that describe how much water should be saved by a particular date, such as:

Reduce Potable Water Use by 50% by 2030
We recognize that many water uses do not require potable water and we are committed to reducing the wasteful use of this resource. We will find other ways (like rainwater harvesting and water reuse) to meet these needs and support our community's wellbeing.

Kelowna's objective to 'Reduce Overall Water Consumption by a Further 15% by 2012'

You can also create objectives that aim to eliminate water supply growth or defer infrastructure replacement until a specific point in the future, such as:

No New Water Before 2050

We want our community to thrive economically, socially and environmentally. Through smarter water use we will find ways to thrive using the same water supply as we have in 2013.

Capital Regional District's Objective to 'Ensure Programs are in Place to Defer Source Water Expansion for 50 Years'

CRD will adopt necessary demand management initiatives to defer expansion of the water supply system for 50 years.

Campbell River's Objective to 'Reduce Peak Demand to Less than Twice the Average Winter Day Demand'

Another option is for you to create objectives that focus on the benefits you want to realize through water conservation, for example:

Keep Our Waters Clean and Safe for Aquatic Life and Recreation by Reducing Current Water Use by 10%

We will work to ensure that there is enough water of good quality to support healthy aquatic life and enable our children to swim in our lakes and rivers for the foreseeable future.

Developing Objectives for Different Sectors

The objectives above are examples of community-wide objectives; you can also create sector specific objectives for your plan. For example:

Prince George's objective to 'Use All Feasible Water Use Efficiency Tools to Reduce Residential Water Consumption by 20% in the next 10 years'

Involving stakeholders from each sector of the community at this stage gives them an understanding of local water issues and opportunities for positive change. They will have the best knowledge of how water is used in their business, and may be able to identify options for how water can be saved. Early involvement by different sectors in setting objectives can help create buy-in for water conservation.

Water Conservation Calculator

If you've entered sector usage data into the Calculator, you can use the Sector Demand pie chart under the Results & Charting tab to see the distribution of water use by sector. This is a good graphic to help you discuss options with stakeholders.

Working with representatives from different sectors, examine the information on current water uses and how each sector fits into the bigger picture of your community's water use. Ask participants to help develop sector specific (i.e. residential, industrial, commercial, institutional, and agricultural) water use objectives for the short, medium and long-term. To get the discussion rolling ask questions like: 'How will we manage water demands in the coming year, in ten to twenty years, and in fifty years?'

When you have come up with a preliminary list, go back and see if you can make each objective more specific, measurable, achievable, relevant, and timely. These sector objectives will help contribute to the overall water conservation objectives.

Step 4 Example: Anytown's* Water Conservation Objectives

Recognizing crisis is near, Anytown's Action Team has been working hard to build the case for water conservation before going back to the community for consultation. Their current supplies are limited, and soon they will need to either find a new water source and build new supply infrastructure or considerably reduce their current water use. Based on their research and the results from the Calculator, the team estimates that Anytown's water needs will outstrip their supply in the next five years. Two key issues that are apparent from compiling demand information are high leakage rates and high residential use (as shown in *Figure 8*). Given the large volumes of water used by relatively few industrial and institutional users, they have decided to speak with the businesses in these sectors to share current and upcoming water problems and to gather some initial ideas about the potential for water savings. The local schools also want to get involved, as they believe their field irrigation systems and older fixtures are losing water.

The Action Team estimates that the capital cost to construct new supply side infrastructure would be at least $691,000, and new annual costs would be in the order of $51,000. Using the Calculator they determine that new infrastructure would only be effective until 2036, when again they would need to look for additional water.

To develop their conservation objectives the team runs another workshop, inviting those from their original Water Futures Workshop to participate. Together this group works through a number of different options. After some debate the group reaches consensus and decides on the following outcome-based conservation objectives:

No new water supply infrastructure until 2030.

Water levels must be kept high enough to protect water quality for fish and people.

By having water quantity and quality objectives the Team hopes to address both sides of the emerging crisis. Next, they move on to selecting the best methods to achieve them.

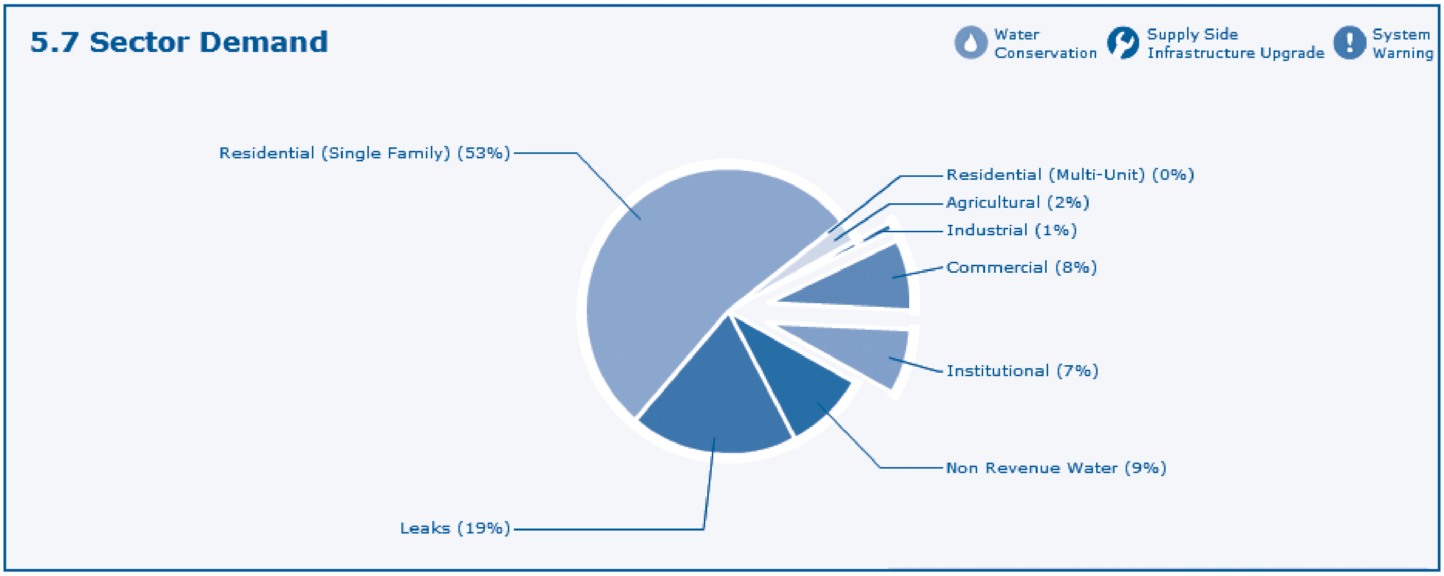


Figure 8. Anytown's Total Water Demand by Sector from the Water Conservation Calculator

**Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.*

Writing Checklist 4: Developing Your Conservation Objectives

☐ ***Future Water Needs:* Compare your supply and demand over time (4.1)**

- *Comparing Supply and Demand:* Do you anticipate any water shortages? If so, when?
- *Water Quality Issues:* Do you have any issues with water quality? How would water conservation assist you in addressing or preventing these issues?
- Water Uses: Where is the majority of your demand coming from or how is it distributed by sector? Where might you have issues with supply in the future?

☐ ***Supply Limits:* Describe any challenges or limitations with your current water supply. (4.1)**

- *Limiting Factors* – What factors limit your system's water supply now and in the future?

☐ ***Potential Cost of New Supply Infrastructure to Meet Future Demand:* Summarize any potential new supply options and the associated costs for you to develop them. (4.2)**

- *New Water Sources*: Do you have any potential new sources of supply to develop?
- *Costs to Develop New Supply:* What would it cost your community, financially and environmentally, to develop new water supplies? If developed, how much would it cost you in the future to maintain these supplies?

☐ ***Community Water Conservation Objectives:* Describe your community's water conservation objectives for the near, mid, and long term (i.e. from this year, up to fifty years from now). (4.3)**

- *Community-wide Objectives* – What water conservation goals are you trying to achieve as a community? And when are you aiming to achieve each of them?
- *Conservation Objectives by Sector* – What conservation objectives have you set for the following sectors?
  - Residential
  - Industrial
  - Commercial
  - Institutional
  - Agricultural

Step

5

Exploring Your Conservation Options

What are the options for how to *do* water conservation? In this step you will review your community's past experiences with water conservation, explore the measures available for saving water, and look to other communities for ideas on how to design and run programs.

Overview of Step 5 Planning Process

1. **Discuss and document your community's past experiences with water conservation**
2. **Investigate potential water conservation measures and create a shortlist of options**
3. **Learn from others through research and communication with other communities**

5.1 Starting With What You Know: Your Community's Past Experiences

A good place to start exploring you water conservation options is by analyzing your community's past experiences with water conservation. Depending on whether or not you have participated in past initiatives, you may rely on your own experiences or want to speak to others who were involved with their design and execution. You can also look to planning documents and water use records, or speak to people who participated in these programs to find more information. The following questions can help to guide your analysis:

- Does your community have any existing or past water conservation initiatives?
- Who was involved in the development and realization of these programs?
- In past experiences, what worked, what didn't work, and why?
- Did these programs take advantage of any opportunities or overcome any barriers? If so, how?
- Based on what you've discovered about past initiatives, what criteria do you want to keep in mind while exploring new conservation options?

Ideally, you want to maximize the water savings for your investment. As you explore options, think about how the different pieces – past and future – can be fit together into a comprehensive solution in your plan. Water conservation success largely depends on finding the right measures to suit the water use patterns, environment and water demand problems of your community, so the more you know about past conservation experiences the better prepared you are to build a plan that will succeed.

5.2 Water Conservation Measures: Researching Ways to Save

With knowledge of your community's water conservation history, you are ready to start researching water conservation options and developing a shortlist of those you wish to consider for your plan.

Conservation measures are tools, instruments, or programs designed to achieve water savings. They can be:

- Enforceable or voluntary
- Focused on technology or behavior change
- Simple or complex

There are four main types to choose from: legal measures, economic and financial measures, operations and management measures, and community engagement measures. To make it easier to compare the various options in each category, *Table 3* (on page 34) shows a summary of the measures described in this Guide, as well as their characteristics, and their relative water savings potential and cost. The water drops under *Water Savings* represent a measure's water savings potential as low, medium, or high. The dollar signs under *Costs* give a rough estimate of the typical costs associated with a measure, shown as low, medium, and high.

These ratings are solely intended to provide you with a sense of the relative effectiveness of different measures based on the experiences of other communities. The actual costs and savings will depend on your local situation, actual savings potential, and how you design and apply your measure. For example, you could choose to create a comprehensive education program and it might be more costly than a small-scale leak detection program. Or if there are several buildings with older wasteful water fixtures, a fixture replacement rebate program may be more effective than elsewhere. Or, you may design a rate based on recovering water service costs, then run into political problems and have to compromise on a reduced rate that does not promote the same level of water savings.

Not surprisingly, many of the measures that help achieve the highest savings require higher investment. When comparing costs of different options, keep in mind that water conservation initiatives can help you to defer the higher costs (both monetary and environmental) of developing a new supply. The most effective measures directly target specific objectives for the water utility, such as reducing peak, indoor or outdoor water demand.

Whatever conservation measures you choose to investigate, make sure that they are in line with your conservation objectives. Also, think about how these measures can support your other objectives, such as wastewater flow reduction, stormwater management, public engagement and others.

Legal Measures: Using Your Powers to Change

If you are a local government, or a utility working with a local government, one effective means of increasing your community's overall water efficiency is by using your legal powers to require residents to change their water use behavior or to adopt water saving technologies.

Mandatory Watering Restrictions

One of the most commonly used legal measures is *mandatory watering restrictions*, which limit the number of days and/or specify the timing of outdoor water use. These restrictions help to reduce peak day demand and prevent your system from reaching capacity on hot, dry summer days. If you choose to use this measure, it must be designed to include public education and fines for violations. Many BC communities have watering restrictions in force from May through September, with watering days alternating between buildings with even and odd numbered addresses. Some communities that have watering restrictions include Terrace, Northern Rockies, Ladysmith, Greenwood, Enderby, Gold River and Summerland, to name a few. Your fines may vary depending on how scarce water is in your region. For example, in Penticton violators face fines from $25 to $400, whereas in Calgary fines run up to $1,000.

Municipal Bylaws, Standards, Regulations, Building and Plumbing Codes

Municipal bylaws that promote water saving technologies or conservation are another common measure to reduce community water demands. To make these easier to enforce, consider tying them to permit approval processes. Building or plumbing bylaws can be modified to require low flow fixtures for new developments or renovations. Or, water offset conditions can be added to building permits, requiring developers to prove any additional water demands for new developments will be offset by conservation improvements in existing homes or businesses. You can also create landscaping bylaws that promote drought-tolerant landscaping or maintain a certain depth of top soil – both of which reduce the need for outdoor water use. For example, the City of Kelowna requires applicants to develop mandatory landscaping standards that show a reduction in water use for permit approval. Changing the rules can help you to literally build a water saving community.

Table 3. Overview of Measures, their Characteristics and their Relative Costs and Savings Potential

This table gives you a sense of how the different types of water conservation measures compare and their relative costs and effectiveness. Actual water savings and costs will vary depending on the unique situation of your community, conservation program design and roll-out.

Measure Type	Measures	Water Savings	Costs	Enforceable or Voluntary	Technology or Behavior Change Focused
Legal Measures	Mandatory water restrictions*	💧💧	$ - $$	Enforceable	Behavior change
	Municipal bylaws, standards, regulations, building and plumbing codes	💧 - 💧💧💧	$ - $$	Enforceable	Technology and/or behavior change
Economic and Financial Measures	Conservation-oriented pricing and rate structures	💧💧 - 💧💧💧	$ - $$	Enforceable	Behavior change
	Rebate programs or free retrofitting programs	💧💧 - 💧💧💧	$$ - $$$	Voluntary	Technology
Operations and Management Measures	Water loss management and leak repair*	💧 - 💧💧💧	$ - $$$	Enforceable or Voluntary	Technology
	Metering programs**	💧 - 💧💧💧	$$ - $$$	Enforceable or Voluntary	Technology and/or behavior change
	Water recovery, reclamation, reuse and recycle programs*	💧💧 - 💧💧💧	$$$	Enforceable or Voluntary	Technology and/or behavior change
	Rainwater harvesting programs	💧	$	Voluntary	Technology and/or behavior change
Community Engagement Measures	Voluntary restrictions	💧	$	Voluntary	Behavior change
	Education and outreach programs	💧 - 💧💧	$ - $$	Voluntary	Behavior change
	Partnerships and collaborative initiatives	💧 - 💧💧💧	$ - $$$	Voluntary	Behavior change

💧 = Order of magnitude range of water savings

$ = Order of magnitude range of costs

** Immediate water savings benefits can be expected once this measure is put in place.*

*** Metering can realize immediate water savings if it is tied to conservation-based water pricing.*

Economic and Financial Measures: Motivating with Money

You can use *economic and financial measures* to drive water savings through monetary rewards for conservation or penalties for overconsumption.

Conservation-Oriented Pricing and Rate Structures

Your water pricing and water rate structure are two of the most valuable measures for directly communicating with customers about water conservation. Canadians pay some of the lowest water rates among developed countries and are some of the highest water consumers[i] – a situation that leaves many customers unaware of the need to use water wisely.

Flat rates[1] are a common pricing method, used in roughly 40% of Canadian communities, and are considered to be the least effective pricing structure for reducing water demand[ii]. In contrast, c*onservation-oriented pricing and rate structures* encourage conservation by giving feedback to consumers about the true costs of their water services – including the costs of operating, maintaining, administrating, upgrading, expanding and managing their water systems. Since they are based on a pay-for-what-you-use principle, conservation rates require customer metering to attribute water use volumes to individual consumers.

You can promote conservation through different rate structures, including:

- *Volumetric rate* – users are charged for each unit of water. Going from a flat rate to a uniform volumetric rate for your water services (where you charge the same amount for each unit used) can help you to reduce your average water demand.
- *Increasing or inclining block rate* – a volumetric rate where you charge more as people use more, giving them a financial incentive to reduce wasteful water use. Charging an increasing block rate can help you to reduce your average and peak demand.
- *Seasonal rate* – a volumetric rate where water prices are higher during peak periods, like summer. A seasonal rate can help you communicate the need for water savings in a peak demand or low water period, and help you to reduce water use in these times.

A rate structure must be determined carefully to promote changes in water use behavior. To encourage conservation, the first pricing block should end at the volume of water required for basic water needs. Successive rating blocks should set a price per m^3 that discourages wasteful water use.

Switching to volumetric rates can significantly reduce system demands, as Canadians paying flat rates have been shown to use 70-80% more water than those on volume-based rate structures[iii]. One example of successful rate setting is the South East Kelowna Irrigation District project in the Okanagan that reduced agricultural water allotments by 27% over five years by implementing an increasing block rate[iv]. Another example is Tofino's increasing rate structure, which charges higher water prices in summer to manage seasonal use. Their summer rates for all sectors are roughly double the winter rates. For residential users, the first rate block ends at $25m^3$, which is lower than the provincial average per capita use[v].

If you choose to use a conservation-oriented rate structure and prices, be sure to combine them with an education program and appropriate billing system to ensure that customers are aware of the reasons behind the rates and how saving water and money benefits the community. Also, think about how you will foster the political support necessary to bring in conservation-oriented rates.

Rebate Programs or Give Away Programs

Today, there are many water saving technologies available, such as low-flow toilets, shower heads, sprinklers and appliances that use less water without impacting peoples' standard of living.

[1] *Flat* or *set rates* charge users a fixed fee for water services, typically on a yearly, bi-yearly or quarterly basis. They do not provide any feedback to consumers about their water use behavior and often fail to support the full costs of water service provision.

You can increase the uptake of these technologies through rebate or give away programs. In a *rebate program*, you give consumers money towards the purchase and/or installation of water saving technologies. In some cases, if the savings benefits are great enough, you may choose to run a *give away program* – one in which you distribute free water saving technologies to reduce water demand.

Providing installation services (professional or volunteer depending on the technology) are important to ensuring hardware is put to use.

You can target rebate or give away programs to particular water users, such as irrigators, commercial users or residents.

For example, the Capital Regional District successfully operated a water efficient rebate program for residents for 15 years and continues to operate a rebate program for industrial, commercial and institutional users aimed at eliminating the wasteful practice of once-through cooling[vi].

The City of Guelph has initiated a rebate program for new homes with a number of water saving installations called Blue Built Home, where residents receive a rebate depending upon the certification achieved by their home[vii]. Because these programs tend to be costly, we suggest you research the benefits, costs and design options before launching your own.

Operations and Management Measures: Using Technology to Save

There are many opportunities to find water savings in your system itself. *Operations and management measures* use technology and management approaches to reduce water losses throughout your system, to improve the efficiency of water use, and to develop alternative water sources, such as non-potable water, recycled water and rainwater.

Water Loss Management, Water System Audits, Leak Detection and Repair

Water loss management identifies and reduces non-revenue water. In many cases water saved through water loss management can be the cheapest available water source for a water utility. Water loss management involves many tools, including: water loss identification, system monitoring, minimum night flow monitoring, pressure management and leakage management.

Locating points of water loss and fixing water system leaks has the potential to save vast amounts of water now and into the future. As infrastructure ages and wears it becomes leakier. Depending on the management and condition of the system, the amount of water that is unaccounted for can vary dramatically, from less than 10% in new, well-managed systems to more than 50% in older systems suffering from poor maintenance[viii]. You can reclaim this lost water through a water loss management program involving water system audits[2], leak detection and repair.

You may also choose to work with customers on identifying leaks on the user end of the system. For example in 1997, after determining that its own outdoor water use contributed significantly to total water use, the Capital Regional District made outdoor water use audits available to priority customers.

If you don't have them already, you may want to install meters on supply sources to track water extraction and see how much water is lost. The City of Chilliwack installed source meters and began reading them every two months, and has found their yearly unaccounted for water to be roughly 10% of the water they produce. To be able to tell where water losses may be occurring in your system and identify high water users, it is helpful to have customer metering as well as source metering. If you do not intend to install customer metering and have a larger distribution system, you may wish to consider installing bulk or zone metering to help identify areas of your system where losses may be occurring.

Pressure management within your water reticulation system is another strategy to consider, which will prolong the life of your infrastructure and reduce leakage from small leaks and weeping joints that are difficult to find.

[2] The American Water Works Association (AWWA) offers free water audit software at: http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx. Note registration is required to access the tool.

Water Metering

Water meters allow you to measure water at different points in the system, from source to treatment facility to tap. Metering is an essential water conservation measure for understanding how water flows through the system and is used by consumers. It's necessary to install meters on the user end if you want to use conservation-oriented pricing and rate structures, because you need to know the volume used by each consumer to charge them according to their use. Meter data can also help you to identify high users, leaks, seasonal trends, water theft and more. You can do a water metering assessment to inform development of a locally appropriate and cost-effective metering program.

You may find that water metering alone can reduce water use, as some analysts have reported water use reductions of 10-40% when meters have been installed without a pricing change[ix]. This initial shift may be short lived, as water use often rebounds over time if no associated pricing changes are made to encourage conservation. The biggest reduction in use usually occurs in the first year, so you may consider bringing in new pricing structures at this point to maintain or improve savings.

Water Recovery, Reclamation, Reuse and Recycle Programs

Since more than two thirds of municipal water uses do not require drinking water quality water, wastewater is a potentially valuable resource in your efforts to conserve. You can recover water from a variety of uses and put it to work in buildings, industrial processes or the environment.

Water reclamation involves treating wastewater so that it can be safely used to replenish source waters, such as rivers or aquifers. This is a good choice if you are trying to maintain surface flows for fish or recreation.

Water reuse or recycling uses treated wastewater for non-potable uses. For example, *greywater* – wastewater from domestic uses like dish washing, laundering or bathing – can be used onsite for non-potable uses like toilet flushing and irrigation, resulting in water savings of up to 50%. One way to advance the use of home or office water recycling systems is by amending your building code to allow for greywater reuse. Dockside Green, a community development in Victoria which incorporates greywater recycling as well as other green building standards, was enabled through a planning process whereby bids from developers were assessed based on social, environmental, and economic benefits as well as the bid price[x]. At the system-wide level there are options to create even bigger changes when you consider your wastewater as a resource. For example, industrial users can reuse cooling water, or treated wastewater can be used to irrigate golf courses, agricultural and forestry land – a practice used in the communities of Vernon, Osoyoos, Oliver, Armstrong, Penticton, Cranbrook and Kamloops[xi].

Rainwater Harvesting Programs

Rainwater harvesting, or collecting rainwater, is another way to reduce the demand for potable water in your community. Your decision on whether or not this measure is right for you will largely depend on your local precipitation, what standards you set for rainwater use, and any regulations you need to follow. A rain barrel rebate program is an effective way to reduce demand for outdoor water use. For example, Delta's program is estimated to save 900,000 litres of water every year. Compared to their other measures, the water savings from this program are relatively low. However, rain barrels serve as a social marketing tool and provide other benefits such as reducing stormwater run-off.

Community Engagement Measures: Motivating People to Change

Community engagement aims to actively engage people who are not using water efficiently and create a culture of water stewardship. Identifying and targeting your campaigns at 'water wasters' and designing them to actively involve these individuals will provide the best return on investment in this area. Many community members already value water conservation, so it makes sense to target those who are still using water inefficiently.

Voluntary Restrictions

A *voluntary water restriction* is any local measure that asks residents to voluntarily restrict their water use during a dry spell or for any other reason. Voluntary restrictions can help you to reduce outdoor water consumption in the summer months. However, if you are facing serious shortages or want to significantly reduce summer watering then you may want to consider mandatory watering restrictions. Voluntary restrictions are cheaper because they don't require a bylaw or enforcement, but they are less effective than mandatory restrictions.

Education and Outreach Programs

Whichever conservation measures you choose, we highly recommend that you develop an *education and outreach program* to explain to your community:

- how each measure will promote water savings
- what individuals need to do to participate
- what are the specific benefits of these measures
- why water conservation is important

Communication and outreach measures allow you to share the water problems you are facing with residents and to inspire them to help address these challenges through new water habits, acceptance of the need for new water measures (like metering, prices and bylaws), and water stewardship.

Education and outreach programs should be active and engaging, and target specific water utility objectives. Active programs may involve volunteers, face to face outreach, or service provision elements, such as free installation services or water audits. It's important to note that a passive education program (with brochures, newsletters, billboards, etc.) is not by itself an effective water conservation strategy. You can increase the success of your outreach by tailoring communication to local needs and involving specific groups, like landscapers, builders, realtors, and plumbers. For example, you can promote water savings technologies by running workshops or organizing tours of demonstration sites.

Partnership and Collaboration Initiatives

As you've experienced in earlier steps of this process, water conservation is a collaborative effort between yourself and other stakeholders in your community. Think about what more you would like to know about water conservation and who might be able to provide that information. Get in touch with people and build relationships to support your conservation plan.

A great example of collaborative problem-solving is the Sunshine Coast Regional District's low-flow toilet replacement program, which allowed them to save more water faster and with less money than building new supply infrastructure. The main barrier to program success was liability for property damage when fixtures were installed in peoples' homes. SCRD solved this problem by partnering with Sustainable Solutions International, a distributor of low flow toilets, who were able to contract out the installation work under their liability insurance[xii]. This example shows how innovative relationships to help you reach your conservation objective.

5.3 Learning from Others: Turning Research into Inspiration for Your Plan

As populations grow and Earth's climate changes, more and more communities are looking to find ways to better use their water resources. You can look to these communities for inspiration. One way you can learn more is by looking through the sources under each option in the *Resources List* at the end of this Guide. Doing a web search of the measure name may also lead you to new examples. You can also speak neighbouring communities about their experiences. Aim to research communities with similar climate, geography and distribution systems. Be selective in emulating the projects of others, as you want to ensure they fit the needs of your community.

The flowchart in *Figure 9* (on page 39) illustrates some common water demand issues and measures for addressing them, which you can use as a starting point for your research or discussions.

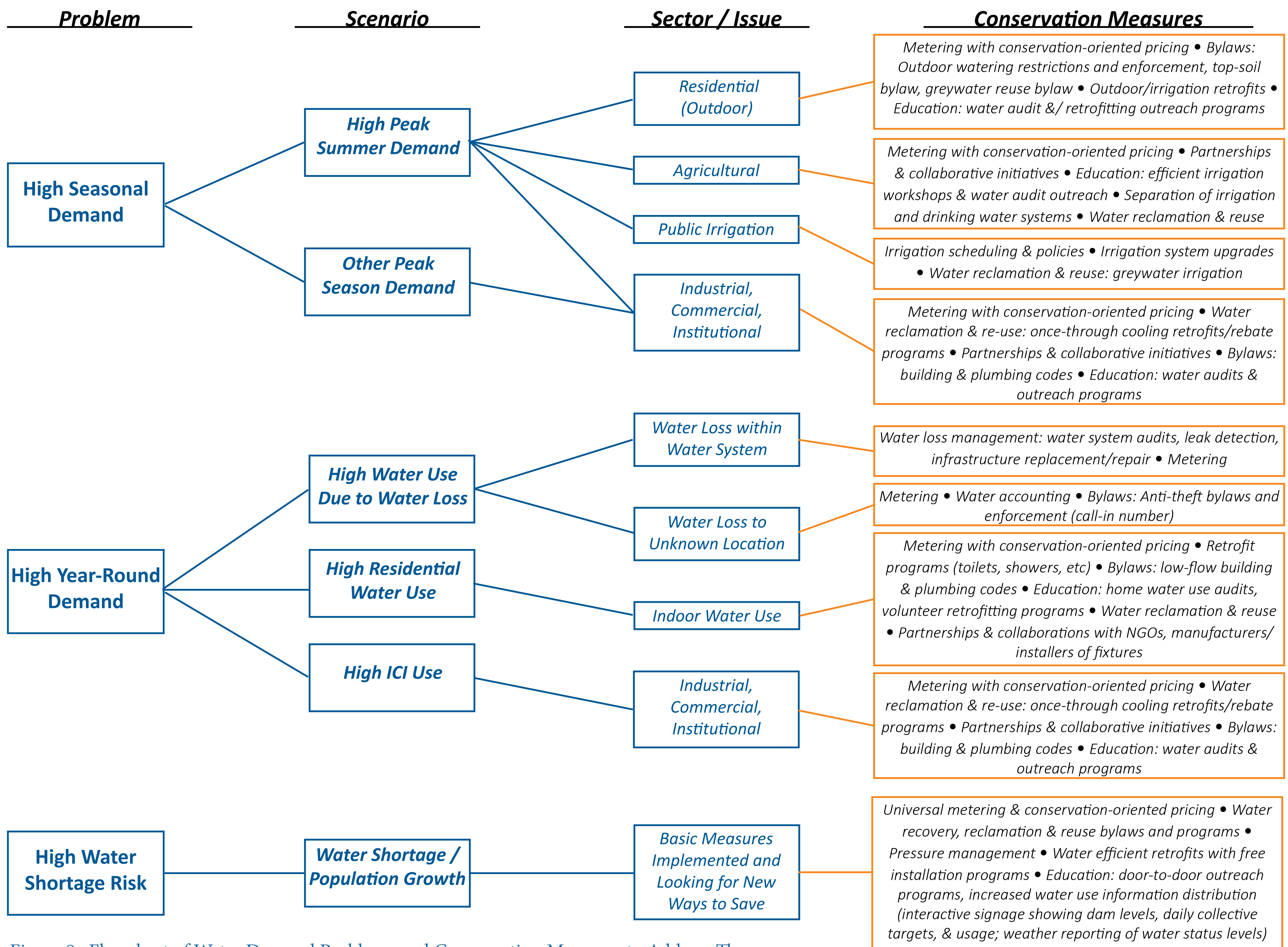


Figure 9. Flowchart of Water Demand Problems and Conservation Measures to Address Them

Step 5 Example: Exploring Anytown's* Conservation Options

With a sense of direction and a mandate from the community to focus on conservation solutions and water quality protection, Sue and her team embark on a quest to seek out the conservation options most suited to their needs.

5.1 Review of Anytown's Past Experiences

This is not the first time Anytown has tried to improve their water efficiency, and the team begins their search by reviewing what they know of past water initiatives. Sue has been a planner in Anytown for many years and shares her experiences with her colleagues.

Several years back, in hopes of gaining a better understanding of water use patterns and future system needs, the town decided to begin metering their industrial, commercial, institutional (ICI) and agricultural users. They experienced some initial push back from these customer groups who believed that metering was just a way to raise water prices. Since conservation was not the prime objective at that time, the town reached an agreement with these users that while they would be switching from a flat to volumetric rate under the new metering system, the rate would be a declining rate structure, meaning the cost of water would go down as more water was used.

Through discussing this experience, the team developed some key lessons to guide their future conservation endeavors:

> ***Given the looming crisis, we need to share our water problem with the community, so that we can develop solutions together while recognizing that our past approaches will not work in the future. Public outreach, education and early engagement are essential to our program's success.***
>
> ***Metering for ICI customers did not address leakage on the user end because the declining block rate provided no incentive for them to fix leaks. If we hope to conserve water to meet our future needs, water prices will need to reflect actual usage and increase as more water is used.***
>
> ***We will need to develop complementary programs and stage their roll out in phases, ensuring that we provide support to users throughout each step. Perhaps a rebate program could support ICI water efficiency improvements to soften the impact of any changes to a conservation rate structure.***
>
> ***With our high leakage rates and non-revenue water, we need to find ways to conserve water in our system and facilities, so that community members see we are all in this together.***

5.2 Conservation Measures that Anytown is Considering

Having gone over the wide range of conservation measures available, the team has developed a list of options to research further, including:

- Water loss management programs, including water audits, leak detection and repair
- Residential metering
- Volumetric water pricing for all water users, with an inclining block or seasonal rate
- Watering restrictions in summer months, either mandatory or voluntary
- Grey-water use for outdoor irrigation on town lands
- Rebate program or funding to support conversion of ICI users to more water efficient technologies
- Rebate or funding program to support fixture retrofits or irrigation improvements for schools and medical centres

The team has been researching to find examples of each of these options to see which ones best align with their needs and how different designs can address the issues they have identified in earlier steps.

5.3 Lessons Learned from Others

As leader of the team, Sue has also been reaching out to her contacts in neighboring communities to see what their experiences with conservation programs have taught them. In particular, she has been curious about their metering programs and what recommendations they have for bringing community members on board. Cliff Ville, a community to the West, has recently brought in residential metering and their utility engineer, Jackson Heights, has given Sue the following advice:

> "Focus a lot of your efforts on upfront communication and, when you do implement your metering program, make sure it's universal. We tried to start with voluntary residential metering and found that those who chose to participate were already people who are water conscious and conserve, so we didn't see any real impact in terms of water savings. We also waited a year after installing meters to bring in the new pricing structure, which was good because it allowed us to work out the kinks in the system and have some real

**Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.*

information to develop the rate with. It also let people in the community get used to the idea."

With his advice in mind, Sue has been researching innovative ways to reach customers. She has found a lot of inspiration in Australian examples of drought communications – things like advertising campaigns, water level updates in weather reports, and road signs that show a community's water use target for the day and how they did yesterday[xiii]. The idea of keeping people in better touch with their water resources and showing them how they have progressed really appeals to her, and she is thinking about how these linkages might be included in her plan.

Sue is also starting to collaborate with Allan Longview in Farvale, the community downstream of Anytown on Somewhere Creek. They are talking about ways they might collaborate to reduce water use during times of high water stress. One idea they have is to develop a regional drought plan that involves ramping up conservation efforts in both communities by bringing in emergency measures when needed, such as stricter mandatory watering restrictions that include no lawn watering, pool filling, or car washing in times of severe shortages.

With all of these options on the table, Sue and her team are feeling confident that they can find a way to avoid water crisis while continuing to maintain a high standard of life in Anytown. The next big question is which program designs will work best to convince the community to get on board with water conservation?

Writing Checklist 5: Conservation Options for Your Community

☐ ***Lessons from Your Community's Experiences with Water Conservation:* Describe any past or current experiences your community has had with water conservation and any lessons you have learned. (5.1)**

- *Factors for Success* – What factors or features of your past conservation programs have contributed to their success? How did they contribute to your programs' success?
- *Things to Avoid with Future Programs* – What things, if any, did not work in your community's past experiences with water conservation? Why did they not work?
- *Local Criteria for Selecting Measures* – Based on your community's past experiences, are there any criteria that may help you to select measures for your conservation plan? (You will learn how to define and use local criteria further in Step 6.)

☐ ***Options for Consideration*: Summarize your research on the conservation options you are considering for your conservation plan. (5.2)**

- *Shortlist of top picks* – Of the options you have researched, which are the most relevant to your community? What information have you learned that could help you to evaluate or design similar measures? Why do you think these options are the best fit for your community's needs and values?
- *Other possibilities* – Are there other options you may consider if issues you are uncertain about could be resolved in the design of your conservation program? What barriers would you need to overcome to be able to use these options?

☐ ***Examples and Lessons from Elsewhere*: Describe examples from similar communities (i.e. similar in size, population, geography or climate, etc.) and any lessons you have learned from researching their experiences. (5.3)**

- *Lessons from Others* – In your research, what lessons have you learned about conservation program design and use from other communities? Are there any particular design features you would like to include or avoid? Are there any lessons you wish to incorporate into your process on how to take advantage of opportunities or overcome barriers with particular options?
- *Opportunities to Collaborate* – Are there any communities who you wish to collaborate with and/or share experiences on water conservation with? Do they have a conservation plan or program in place that you want to learn about?

Step

6

Choosing Your Conservation Measures

You are now ready to select the most effective conservation measures to meet your community's goals.

Overview of Step 6 Planning Process

1. **Define decision-making priorities and develop local criteria to evaluate your conservation options**
2. **Assess how each measure performs on your community's criteria**
3. **Choose the best measures to meet your objectives within your means**

6.1 Deciding What's Important and Developing Your Local Criteria

What are the most effective measures to meet your water conservation goals and objectives? The answer will depend on a variety of factors, including:

- your community's water use profile and highest water users
- the nature of your water supply
- the state of your water infrastructure
- any existing water problems (e.g. shortages in supply or environmental issues)
- the resources and capacity available to implement your plan.

Which factors are critical to your choice of measures? Talking with your action team and local water experts, such as utility managers, operators or environmental consultants, can help you to establish decision-making priorities.

Next, you want to turn these priorities into selection criteria. Since every community is different, some measures will work better in some places than others. *Local criteria* are metrics or criteria you develop based on your priorities to assess how well a conservation measure will meet your community's unique needs and objectives. Ideally, your criteria should be: distinctive, measurable, understandable, concise and mutually exclusive (i.e. they do not overlap with each other). They should help you identify measures that will address your water challenges, leverage opportunities within your watershed, and reflect your community's water values[1].

Water Conservation Calculator

The Water Conservation Calculator is a valuable resource for completing this step as it can help you to compare options, play with project designs, and estimate the costs and water savings associated with different measures.

Entering the optional information into Module 2 on Conservation Savings, will generate estimates for: total annual water savings, reduction in total annual demand, and cost to implement for residential actions (education, metering, indoor retrofits, and outdoor enhancements) and ICI actions (plumbing fixture retrofits or once through cooling retrofits).

Entering the optional information into Module 3 on Conservation Savings Finances, will generate estimates for: total cost to implement, total annual costs during and after debt financing term, total weighted annual costs, cost of capacity gained, and a summary of total water savings and systems costs for all measures entered.

[1] The community water values you identified through stakeholder engagement workshops or discussions in Step 1.

To get you started, consider the following common criteria and the sample questions you could ask to evaluate a measure's performance on each:

- Cost-effectiveness – Does this measure achieve good water saving value for money?
  How much water a measure saves relative to how much it costs may be an important criterion to your community. When assessing the value a measure provides think about: the amount of water savings anticipated per dollar invested, as well as the social and environmental benefits it creates, and the costs of any water supply developments it defers. Remember that cost-effectiveness is only one of the factors you are considering. It may be easier in your assessment to compare water savings with other criterion, and then look at total benefits versus costs at the end. For example, you might choose a measure like education that does not perform as well on water savings per dollar, but improves public awareness of water issues – a social value that will make other water saving initiatives more effective.

- Targets High Use – Does this measure target high water use and users?
  Choosing conservation measures that target your highest water uses and users will have the greatest impact on reducing your water demand. For example, it wouldn't make sense to use measures that focus on reducing indoor water use in a community where outdoor watering is the biggest use and peak season demand needs to be reduced. Think about your objectives and the aspect of your demand a measure would affect. Will it affect average day demand or peak day demand? Do you want to reduce one more than the other to meet your objectives or deal with a problem?

- Technology Availability – Is the technology needed to apply this measure readily available?
  Cutting edge technology may seem to be the best option for addressing a water problem; however, you need to consider whether this technology is readily available and whether it can be supported by local businesses once it is installed. For example, new irrigation systems that shut off automatically when it's raining may be a prohibitively expensive option if there is no one local who can install and maintain them.

- Social and Political Acceptability – Is this measure socially and politically viable in your community?
  To be effective a measure needs to be politically acceptable to be approved and socially acceptable to be adopted by members of your community. A measure's acceptability is often based on its: convenience, cost, perceived fairness, equity[2], cultural appropriateness, aesthetics and environmental impacts. For instance, promoting bathing less often might save water, but would be socially unacceptable and politically unpopular. Consider affecting a measure's performance on this criterion by including a public education element. Any measure is more likely to be accepted when accompanied by education explaining why it is needed.

- Water Savings Reliability – How reliably will this measure generate water savings?
  Different types of measures can produce more or less consistent water savings, and this criterion reflects your confidence in a measure's potential to systematically reduce water use. Generally, projects which target peoples' behaviors are less reliable than those that use technology to reduce water demand. For instance, low-flow toilets and appliances will always use less water than their high flow counterparts, whereas watering restrictions may influence some people to reduce their water use and not others.

How many criteria you choose to develop is up to you, though it is recommended that you keep the list short and focused on your main priorities. The simplest selection process might use just one criterion (such as cost-effectiveness) to compare options, whereas a complex one could include many more.

Once you have developed a list of criteria that reflects your community's needs and objectives, you are ready to evaluate the conservation options you shortlisted for consideration in Step 5.

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[2] To be equitable a conservation measure should be paid for by those water users who receive the benefits of water savings, not subsidized by another class of water user. This does not apply in cases where you are discouraging unsustainable water use behavior through higher water pricing.

6.2 Scoring for Water Savings: How to Assess Your Options

You can use the scoring method outlined in this section to compare how different conservation measures perform on your local criteria. The method involves scoring each measure on a scale of 1 to 5 (from worst to best) for each criterion, then weighting the results to reflect your planning priorities. The next section covers how to compare the final scores for each measure with their costs and how to identify the most effective ways to save water in your community.

Your community may also use other evaluation processes to choose its measures. Another option is to hold a public meeting to further refine ideas once you have identified some options and gain community feedback.

Step-by-Step Scoring Method

1. Define scales for each of your criteria

Start with establishing scales for your criteria, by defining what scores of 1 to 5 mean for each criterion. Clearly defining what scores mean ensures consistent scoring by different people. For example, scales for expected water savings and technology availability could look like this:

Expected Water Savings Scale:

Rating	Definition
1	Little to no water savings
2	Less than 5% water savings
3	5% to 10% water savings
4	10% to 20% water savings
5	More than 20% water savings

Technology Availability Scale:

Rating	Definition
1	Technology is untested and little or no local expertise is available
2	Technology is new to the region and limited local expertise is available
3	Technology is somewhat familiar and there is limited local expertise available
4	Technology has been used nearby and some local expertise is available
5	Technology and local expertise are readily available

2. Score each measure on each criterion

Next, score each measure on your criteria using the scales you just defined. Scoring is not an exact science. You can use the knowledge you've gained from researching different conservation measures and common sense to arrive at scores. If you don't have enough information to assess a measure on a criterion, you may want to do more research or speak to a supplier. You can organize your results into a table like this one:

Conservation Measure	*Local Criteria*					
	Water Savings	Targets High Use	Savings Reliability	Technology Availability	Political/ Social Acceptability	Internal Capacity
Toilet Replacement	3	4	5	5	4	5
Conventional Education	4	2	1	4	5	4
Social Marketing	2	3	3	4	4	3

3. Weight your criteria to reflect your decision-making priorities

You now have preliminary scores for each measure. But how can you account for the relative importance of different criteria in your assessment? For instance, water savings may be more valuable to you than technology availability.

You can solve this problem by weighting your criteria on a scale of 100. Similar to grading in school, these weights are percentages that demonstrate how important a criterion is to your decision-making and the final mark you assign a conservation measure. To simplify calculations, make your weights at intervals of 5 (i.e. 5%, 10%, etc.). The weights of all of your criteria should add up to 100. For example, the criteria in the example above could be weighted as shown in this table:

	Local Criteria					
	Water Savings	**Targets High Use**	**Savings Reliability**	**Technology Availability**	**Political/Social Acceptability**	**Internal Capacity**
Weight (%)	40	20	5	10	15	10

4. Apply weights to your initial scores

The easiest way to weight your scores is to calculate a multiplier for each criterion, or number you can multiply the original scores by to arrive at the weighted scores. Simply divide each criterion's weight by five to arrive at its multiplier, as in this equation:

Multiplier = Weight / 5

The multipliers for the example are shown in the table below:

	Local Criteria					
	Water Savings	**Targets High Use**	**Savings Reliability**	**Technology Availability**	**Political/Social Acceptability**	**Internal Capacity**
Weight (%)	40	20	5	10	15	10
Multiplier	8	4	1	2	3	2

Once you have calculated multipliers for each criterion, you can multiply each score by the appropriate multiplier to arrive at its weighted score, as in the equation below:

Weighted Score = (Original Score) x Multiplier

The following table shows the multipliers, a sample calculation, and the weighted scores:

	Local Criteria					
Conservation Measure	**Water Savings**	**Targets High Use**	**Savings Reliability**	**Technology Availability**	**Political/ Social Acceptability**	**Internal Capacity**
Multiplier	***8***	***4***	***1***	***2***	***3***	***2***
Toilet Replacement	3 x 8 = 24	16	5	10	12	10
Conventional Education	32	8	1	8	15	8
Social Marketing	16	12	3	8	12	6

5. Add weighted scores to arrive at a final score for each measure

Now add together the weighted scores for each measure to arrive at its final score – an indication of how well it performs on your community's decision-making criteria. For example, the final score for toilet replacement is 77, which was calculated by adding all of the scores in its row, as shown below:

Conservation Measure		*Local Criteria*					
	Final Score	**Water Savings**	**Targets High Use**	**Savings Reliability**	**Technology Availability**	**Political/Social Acceptability**	**Internal Capacity**
Toilet Replacement	**77**	24	16	5	10	12	10
Conventional Education	**72**	32	8	1	8	15	8
Social Marketing	**57**	16	12	3	8	12	6

6. Rank your conservation options from best to worst

Finally, you can rank your conservation measures from best (highest) to worst (lowest) based on how well they have performed. The benefits of weighting your scores, as opposed to simply adding up the original scores, are shown in the example below. There are two clear winners with the weighted scores, whereas in the pre-weighted totals there is little difference between the second and third place options.

Rank	Conservation Measure	Final Weighted Score	Pre-weighted Total
1	Toilet Replacement	77	26
2	Conventional Education	72	20
3	Social Marketing	57	19

6.3 Choosing the Most Effective Measures for Your Community

With a better understanding of how the different measures compare on your local criteria, it's time to think about costs. For each measure you want to estimate both initial costs, such as start-up and implementation costs, and ongoing costs, such as maintenance, operations, or program costs. In the example case, cost estimates might look like this:

Conservation Measure	Initial Costs	Ongoing Costs
Toilet Replacement	$15,000	$0
Conventional Education	$2,000	$10,000
Social Marketing	$2,000	$5,000

You can contact suppliers or speak to others who have run similar programs to estimate costs.

By looking at the final scores and comparing these to the costs, you can see which measures are likely to be most effective at saving your community water. Choose measures based on how well they achieve each of your conservation objectives and how they perform on your local criteria.

Box 2. Conservation Measures that Work Better Together

- **water metering + conservation-oriented pricing**
- **water metering + water loss management**
- **mandatory watering restrictions + irrigation retrofits**
- **conservation-oriented pricing + low-flow fixture rebates + give-away installations**
- **education + any measure**

You also want to think about how one measure may work well as a stepping stone or complement to another. Even if one receives a lower score, it may be worth using if it is one of the ideal pairings of conservation measures shown in *Box 2*. Some measures can only be used in concert with others. For instance, you cannot put in conservation-oriented water pricing until you have meters to track customers' water usage. You may also have measures that get triggered in times of water stress, like upgrading voluntary water restrictions to mandatory restrictions during a drought.

Once you have chosen your measures, it's a good idea to ask: Will they provide enough water savings to meet your water conservation objectives? If not, this is a good opportunity to consider some additional measures.

Step 6 Example: Anytown* Chooses its Conservation Measures

6.1 Anytown's Evaluation Criteria and Assessment

The Anytown Action Team knows they need to achieve the maximum water savings for their budget, so they have developed the following table showing: their evaluation criteria on the top row, the weight and multiplier assigned to each one, their original scores, and the final ranking and weighted score for each measure. The team has decided to include education as a component of each measure and therefore have not included it separately.

Anytown's Conservation Measure Evaluation Table

Measure	Rank	Overall Score	Water Savings	Targets High Use	Reliability	Technology or Measure Availability	Political &/ or Social Acceptability	Internal Capacity	Initial Cost ($)	Ongoing Costs ($)
Weight (%)	-	100	30	20	10	15	15	10	-	-
Multiplier	-	-	x6	x4	x2	x3	x3	x2	-	-
Water Loss Management	1	91	4	5	5	4	5	5	20,000	2,000
Residential metering	3	87	5	5	3	5	2	5	450,000	1,600
Universal volumetric pricing	2	89	5	5	5	5	2	4	5,000	1,200
Voluntary water restrictions	6	65	3	2	1	5	4	5	100	100
Mandatory water restrictions	4	76	4	4	2	5	3	4	100	400
Greywater irrigation for town	7	57	3	1	4	4	3	3	200,000	5,000
Water audit program for ICI users	5	73	3	3	4	5	4	4	3,000	1,000
Plumbing fixture retrofits for schools and medical facilities	8	55	2	1	4	4	5	2	30,000	0

Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.

6.2 Anytown's Measure Selection

This assessment has shown Sue and her team that they need to focus their efforts on areas of high use. They have decided to develop their top five measures into projects: 1) water loss management, 2) universal volumetric pricing, 3) residential metering, 4) mandatory watering restrictions, and 5) a water audit program for ICI users.

Sue checks what impacts these measures will have on future water demand using the Water Conservation Calculator (see *Figure 10*). The Calculator costs are higher than their initial estimates, partially due to debt financing and education programming costs. The Calculator has proven to be a good way to estimate debt financing costs and the team has revised their budget accordingly.

Anytown's planned water conservation measures will reduce demand by over 300,000 m³ per year. This will help to ensure that the community has water available to meet its needs until 2034 without needing to build new supply infrastructure. An added benefit for the Town is that carrying out water conservation activities is less expensive than the avoided supply upgrades.

These actions will meet the objectives developed with their community stakeholders that "no new supply infrastructure will be needed until 2030" and that "water levels must be kept high enough to protect water quality for fish and people". The Action Team is confident that they have found a solution that improves the sustainability of their water supply, maximizes the benefits for local recreational fishing and tourism industries, and helps protect the environment.

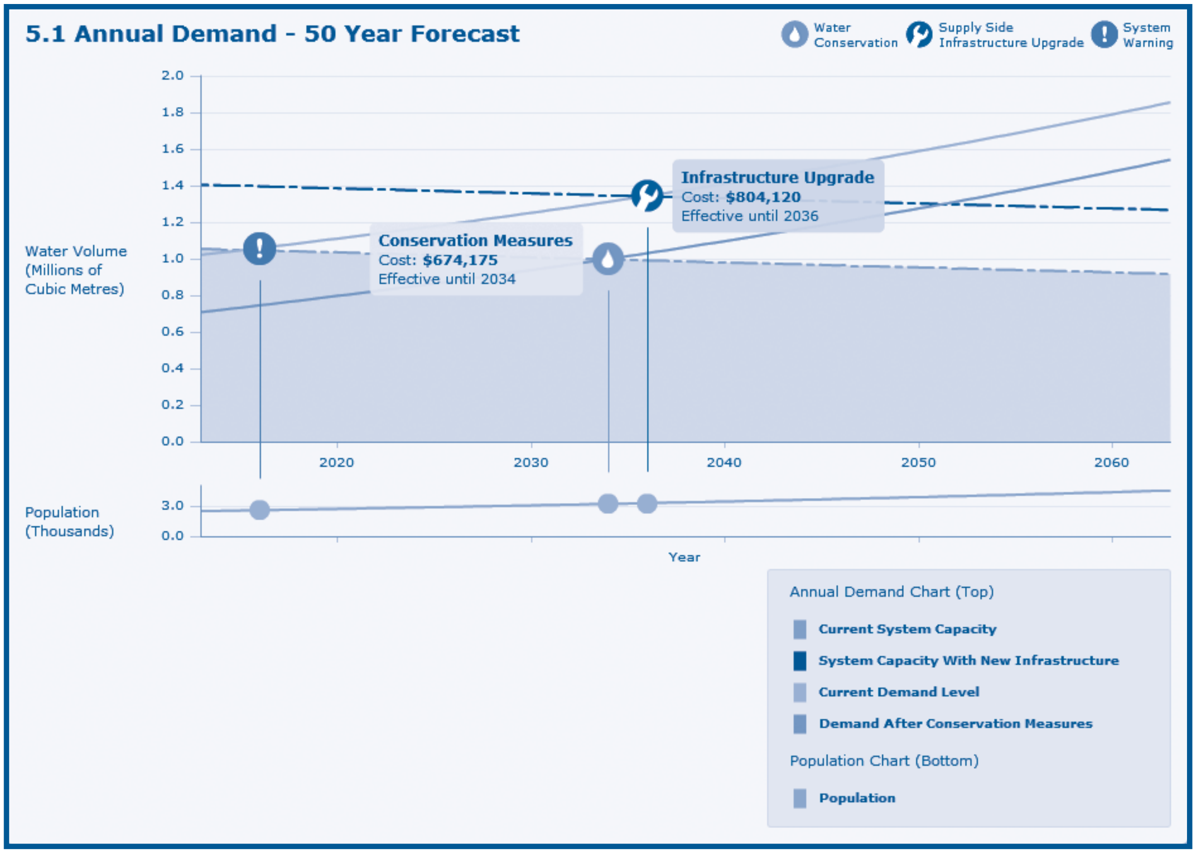

Figure 10. Annual Demand 50 Year Forecast Results from Anytown's Water Conservation Calculator Scenario

Writing Checklist 6: Choosing Your Conservation Measures

☐ ***Local Evaluation Criteria:* Describe how you developed your local evaluation criteria (6.1 & 6.2)**

- *Local Evaluation Criteria* – What criteria have you developed to evaluate your conservation measure options? What process have you used to create them and who was involved? When writing up criteria, aim to include the following information for each:
  - » a descriptive title
  - » what it is supposed to measure
  - » the scoring scale developed to assess measures on this criteria
  - » details on what information was used to rate a measure's performance and how it has been analyzed
- *Local Priorities* – Which criteria are the most important for your decision-making (i.e. have the highest weight)? Do they address particular problem areas or reflect lessons from past experiences? Or, are they essential to achieving your conservation objectives?
- *Evaluation Table* – Did you build a scoring framework and evaluation table to assess the different options based on your criteria? If yes, you may want to include them in an appendix in your conservation plan.

☐ ***Selected Measures*: List the measures you have selected and the rationale behind your choices. (6.3)**

- *Top Ranked Options* – Which conservation measures have you identified as being best suited to meeting your community's needs and objectives? Which of these have you decided to develop into projects? Why did you select these ones?
- *Complementary Measures* – Do any of the measures you have selected rely on or work better in concert with other measures? If so, is there a particular order they should be applied in?

Step

7

Putting Your Plan into Action

The final step in your conservation planning process is to design your conservation initiatives and define how you will successfully roll-out your water conservation plan. A good implementation strategy will help your community reap the benefits of your plan by ensuring that:

- the timing is right to prevent further environmental damage and promote community awareness of water issues,
- the necessary financial and human resources are available, and
- the plan is revised over time as needed.

Once your strategy is in place, it is time to take action and get your community on the path to water savings.

Overview of Step 7

1. **Turn your selected measures into conservation projects**
2. **Build your implementation strategy**
3. **Obtain support for your plan from decision-makers**

Water Conservation Calculator

The Water Conservation Calculator offers an easy way to play with designs, since you can change some design elements (such as the population targeted) and it will generate water savings and cost estimates for you.

7.1 Designing Your Conservation Projects

With your measures selected, you can now turn them into water conservation projects. The depth of detail in each of your project plans will depend on whether you want to launch a project right away or if it's a longer-term action. Each of your conservation project designs should include the following elements:

- ***Conservation objective(s)*** – The conservation objective(s) the project is designed to address and how it will help to achieve them.
- ***Project scope and target population*** – The portion of the system or percentage of population the project is targeted at.
- ***Estimated water savings and conservation targets*** – The estimated total annual water savings based on the results from the Water Conservation Calculator or your research on the average savings associated with a measure. You can also set specific *water conservation targets* – water savings goals for a project that include time estimates for when in the future the savings will be achieved.
- ***Project costs*** – The estimated start-up and ongoing costs associated with a project, based on results from further research or supplier quotes.
- ***Existing capacity*** – A description of the knowledge and resources you already have in-house for completing the project, and any resources or expertise that you anticipate needing.
- ***Risk Management*** – Any anticipated project risks and strategies for mitigating them.

For inspiration, look at how conservation projects in other communities have been designed. The City of Kamloops' water metering program is one example of effective project design. By focusing on communication and installing meters in phases, they have achieved a 95% satisfaction rate with their installation program[i]. To keep customers informed they sent out: a booklet explaining the meter installation process and why metering is important to conservation, information on meters a few weeks before installation, and sample bills comparing the old and new pricing structures prior to changing rates. They phased in metering geographically and by customer-type, starting with businesses and multi-family dwellings before moving to single-family residences.

Playing with Designs to Optimize Effectiveness

It's a good idea to play with different aspects of your project designs to optimize their expected outcomes. Aim to design projects that maximize water savings or other benefits and minimize costs. You may want to design projects that influence each other at the same time, such as water metering and volumetric pricing or leak detection.

7.2 Building Your Implementation Strategy

Your *implementation strategy* is the long-term road map for how you will roll-out the various conservation projects in your water conservation plan and how they will help you to achieve your water conservation objectives and higher level goals. Your strategy should include:

- details on project designs, including how each will contribute to achieving your conservation objectives
- a timeline that outlines the order of projects
- a budget
- specifics on who is responsible for completing actions
- expected impacts on water demand and stakeholders
- any barriers you can foresee and solutions for addressing these
- a monitoring schedule and triggers for plan re-evaluation.

The What, Where and When: Define Your Timeline for Action

Timing is everything when it comes to gaining acceptance for your plan and achieving your water conservation objectives. To get the timing right, you can bring together those who will be involved in your projects to discuss the merits and trade-offs of different schedules. The following questions can help you to determine your timeline:

- Do any measures need to be rolled out in a specific order?
- Are there any existing problems or time-sensitive water savings goals that need to be prioritized?
- Are the project resources (human and financial) available now? If not, where will they come from and when will they be available?
- Are there any permits or approvals that need to be obtained from regulators? If yes, from whom and how long will they take?
- How will project materials be obtained? What is the lag-time between ordering and delivery?
- Do you need additional staff or training to run your projects? How long will it take to meet these needs?

You can begin with a high-level timeline, then add more timing details into your implementation strategy as they are established. A *high-level timeline* includes basic information on your projects and when they will occur, as shown in *Table 4* (on page 54). An *implementation strategy* includes all the details for your projects. An example of the project details to include in your implementation strategy is included in *Table 5* (on page 55). You may also wish to set deadlines for each task to keep the projects on track. The level of detail you include will depend on how soon you intend to start each project. Having the big picture on paper is a valuable asset as it can help you to explain your strategy to others.

Consider building in pilot phases to work out any issues prior to launching your projects. And expect a delay in water savings, as it typically takes three to four years for conservation projects to become fully operational and up to ten years for their full savings to be realized[ii].

Table 4. Example of a High-Level Implementation Timeline

Measure Type	Measure	Water Use	Water Savings Target	Staffing	Cost	Timing	2013	2014	2015
Metering	Residential metering program	Indoor and Outdoor	20%	Contractors and staff	$450,000	2013, ongoing	X	X	X
Education	Home audits, xeriscaping workshop	Indoor and Outdoor	5%	2 staff, graphic designer (2 week contract), and 2 students	$10,000	2014, ongoing		X	X
Rebate Program	Efficient toilets and fixtures	Indoor	20% indoor demand	1 staff	$200,000	2015, ongoing			X

Building Your Budget and Finding Funds

You can fund your water conservation projects through a variety of sources, including:

- **Taxes and levies**
  Since water conservation is an effective way to reduce the pressure on your water system and supply, it can reduce costs in municipal operating budgets. For example, the Capital Regional District's (CRD) budget for water conservation was $1.5 million in 2008, yet these costs were significantly cheaper than the costs of higher water use. To run their program CRD employs five full time staff and hires four summer students and one winter co-op student. Their salaries are paid for through by the revenues generated from wholesale water provision to surrounding municipalities[iii].

- **Savings on infrastructure costs**
  Another option is to fund your plan with the money saved on infrastructure costs through water conservation. By implementing their water conservation plan, the City of Toronto estimated it would save $146 million in infrastructure and operating costs – savings which could be used to pay for the city's $75 million water efficiency plan[iv].

- **Conservation-based water rates**
  One interesting option is to fund your conservation plan through a conservation-based water rate that charges a premium to penalize wasteful water use. The section in this guide on Conservation-Oriented Pricing and Rate Structures in Step 5 has additional details on this option. In Pleasanton, California they added a $0.05/ccf surcharge on irrigators' bills to fund a rebate program for water-efficient irrigation technology[v].

- **External funding sources such as grants and partnerships**
  You may be able to find government or foundation grants, or private partnerships to support your conservation efforts.

Keep in mind that if you charge by volume, water conservation will change your water system revenues (based on reduction in use) unless you alter your rate structures. To deal with any changes, consider how your water system will meet its revenue requirements in the short run. In the longer term water conservation will save your utility and customers money through reduced system costs.

Table 5. An Example of the Project Details Included in an Implementation Strategy

<table>
<tr><th>Conservation Objective</th><td colspan="2">Reduce residential water use by 30% of 2013 usage</td></tr>
<tr><th>Water Savings Target</th><td colspan="2">20% of total 2013 water demand</td></tr>
<tr><th>Target Population</th><td colspan="2">100% of residential water customers</td></tr>
<tr><th>Project Budget</th><td colspan="2">$450,000</td></tr>
<tr><th rowspan="3">Risk Management</th><th>Project Risk</th><th>Mitigation Strategy</th></tr>
<tr><td>Lack of social acceptance</td><td>Education</td></tr>
<tr><td>Faulty meters or installation</td><td>Wording of Request for Proposals and installation contract to guarantee quality meters and workmanship</td></tr>
</table>

Project Phase	Task	Staffing	Time Allocated
Pilot	1. Install a small number of meters	Contract Installer	1 month
	2. Gather and assess data from meters	Water Tech and Engineering Staff	6 months
	3. Train staff in new metering process	Project Manager	1-day workshop
	4. Design roll-out strategy for full program, including billing and new conservation-oriented pricing	Project Manager and Planning Staff	5 months
Phase 1	1. Pre-installation education for residents	Planning Staff	6 months
	2. Request for Proposals and selection of contractor for meter installation	Project Manager	1 month
Phase 2	1. Ongoing communication with residents during installation	Planning and Engineering Staff	1 year
	2. Install meters in area 1	Contract Installer	6 months
	3. Integrate meter data from area 1	Engineering Staff	1 month
	4. Provide sample billing to area 1 residents	Financial Officer	1 month
Phase 3	1. Install meters in area 2	Contract Installer	6 months
	2. Integrate meter data from area 2	Engineering Staff	1 month
	3. Provide sample billing to area 2 residents	Financial Officer	1 month
Phase 4	1. Start consumption-based billing for area 1 residents	Financial Officer	1 month
	2. Start consumption-based billing for area 2 residents	Financial Officer	1 month
	3. Monitor water use and revenues collected from metering and consumption based billing	Project Manager	Ongoing

The Who and How: Assigning Roles and Responsibilities

For your plan to work effectively you'll need to establish roles and define who is responsible for each of your conservation projects. Many larger communities now have full-time Water Conservation Coordinators to run their programs, whereas in smaller communities the water utility manager or operator may be in charge. Whoever is assigned to these projects, it's a good idea to ensure that water conservation duties are part of their job description so that they can devote adequate time to them. Being clear about their roles and responsibilities will help your plan to succeed.

Timing and Triggers: Monitoring and Evaluating Your Plan

Monitoring your progress with water conservation is important to determine if your plan is working. One approach is to develop a list of indicators to monitor the performance of your projects; this allows you to periodically check-in and make sure they are on course for success. If they aren't, you can modify their designs to get them back on track.

To monitor progress you may want to collect new kinds of data. For example, you could monitor volumes of peak day and peak hour flows, then analyze this data to see if a water conservation bylaw is working. Or you could do a survey of program participants and non-participants, tracking their water use and comparing it to see what effect your project is having on their behavior. Consider the data, staff, and resources required for monitoring as part of your implementation strategy.

Set target dates and/or triggers to review and revise your plan to ensure that it is still effective and relevant. You may want to develop triggers for re-evaluation based on the data you collect in case unexpected changes in circumstances (e.g. unforeseen increases in population or variations in climate, failures or successes) call for revisions to a project or your overall plan. Ongoing data collection and analysis is important for water conservation plan success. For example, redoing your water demand profile on an annual basis will show changes in consumption.

7.3 Making Your Case: Obtaining Support for Your Conservation Plan from Decision-Makers

Keeping your decision-makers (often your local governing body such as a Council or Board) informed is essential because you will need buy-in from them to put your plan into action. When presenting your final plan, you can describe:

- the relative costs and water savings associated with each project and their timing
- the benefits and challenges of the proposed implementation strategy
- how the strategy has been designed to address problem areas and meet water conservation objectives.

You want to be clear about how and why the particular conservation measures were selected, the financial and human resources needed, and the time constraints based on your forecasted water demands and existing supplies.

Be sure to remind decision-makers of the issues that the plan was developed to address. You can also contextualize your argument by describing the supply development costs of generating the same amount of water. Highlight the benefits of gaining 'new' water through increased efficiency and behavior change to your community, economy and environment.

7.4 Saving for the Future

Ultimately, your water conservation plan is the path to realizing your community's preferred water future. By working through this Guide to develop your plan, you have laid the foundation to successfully action a long-term strategy for managing your community's water demands and to achieve your shared vision.

Step 7 Example: Anytown's* Implementation Strategy

7.1 Conservation Project Designs

To design their projects, Sue has been using the Water Conservation Calculator to test out different scenarios. On the residential side, she expects to reduce total annual demand by 21% through an education program targeting half the population and a universal residential metering program. On the ICI side she aims to develop a free water audit program to identify areas of high water use in local businesses and institutions. While water audit savings are uncertain, Sue is hoping that offering this service will soften the blow when they change to universal conservation-oriented pricing. Water loss management is another priority project, but the team wants to bring in some outside expertise to design it. By finding and fixing leaks, they estimate that they can reduce total annual demand by 9%. Mandatory watering restrictions are planned for all users to help reduce peak demand in summer and raise awareness of the community's water issues.

7.2 Implementation Strategy for Meeting Future Water Needs

Because of the severity of their water issues, Anytown needs to act fast to maintain its community values. The strategy they have developed involves launching residential metering and water loss management projects in the first year. By year two they aim to begin mandatory water restrictions and introduce a rebate program for ICI users. By year five they want to bring in conservation-oriented pricing for all users. Understanding that this is an extremely aggressive strategy, Sue has decided they need to invest in a widespread community education program concerning their existing supply and infrastructure problems and how they plan to address them.

To launch the plan, Sue has suggested the water loss management, education, watering restrictions, and ICI water audit programs be funded by the municipal operating budget. Residential meter installation will be funded in part from capital reserve funds and through borrowing, supplemented by any grant money that the Action Team is able to win. Once the conservation-oriented pricing kicks in by year five, the program will be converted to a self-funding model.

The town receptionist Cindy Snow, who has been working on the Action Team, has expressed an interest in taking on a part-time conservation coordinator role to deal with the day-to-day running of the various conservation projects. This is an ideal situation as she is familiar with the Plan and can field any inquiries. Sue is suggesting they hire a part-time receptionist to make up for the time Cindy will be devoting to these projects.

Sue will be managing the plan and monitoring the project results. She has developed a list of indicators for each one and, due to the severity of their current water issues, plans to do an analysis at least once a year. The Anytown Action Team will also revisit the Conservation Plan in five years to do any necessary updating.

7.3 Building Support for Water Conservation in Anytown

Knowing that the plan needs support from Council before resources can be allocated to it, Sue has been speaking to individual councilors about the impending water crisis and the consequences and costs of not taking action. She has been using the Water Conservation Calculator graphics that show how supply will outstrip demand to support her case; as well as a timeline that maps out all of her short and long term conservation projects and their anticipated impacts. Having worked with councilor Pat D'Leau to keep Council apprised of the situation from the outset is working in Sue's favour. Town Councilors have been involved in various stages of plan development and have had time to come on board to the ideas she is presenting.

**Anytown, BC does not exist. It has been created as an example to illustrate steps in the planning process.*

Writing Checklist 7: Your Strategy for Success

☐ ***Project Designs*: Outline the details for each of your planned conservation projects. (7.1)**

- *Conservation Objective(s)* – Which of your conservation objectives is the project designed to address? How will it help achieve these objectives?
- *Project Scope & Target Population* – What percentage of the population or part of the water system is this project targeted at? Are you planning to start with a pilot project? Do you plan for the target population to change over time or in different project stages?
- *Estimated Water Savings & Targets* – How much water do you anticipate each project will save? Have you set any water savings targets?
- *Project Budget & Costs* – What do you estimate the initial and ongoing costs will be for each project? Over what term or length of time would you like to finance each one?
- *Capacity* – What resources do you have in-house and what resources or skills would you need to acquire or develop to be able to implement each project?

☐ ***Implementation Strategy*: Describe how your water conservation plan will be carried out. (7.2)**

- *Timeline* – What is the timeline for your plan? How do your various projects build on each other to achieve your objectives?
- *Budget* – What are the upfront and ongoing costs you anticipate for your plan? How are these costs distributed over time? How will your projects be funded?
- *Roles and Responsibilities* – Who will be leading and participating in each of your conservation projects? How will you redesign roles to ensure that conservation is part of their expected workload?
- *Monitoring and Evaluation* – How do you plan to monitor progress on your conservation initiatives? What indicators or evaluation criteria are you planning to track? When do you plan to revisit your Conservation Plan (e.g. 3 to 5 years)? Have you set any triggers for re-evaluation based on peak day or peak hour water use data?

☐ ***Conservation Plan Presentation*: Outline the key points you will use in explaining your conservation plan to decision-makers. (7.3)**

- *Costs and Savings* – What are the relative costs and water savings associated with each project in your plan?
- *Benefits and Challenges* – What are the benefits and challenges you foresee with your implementation strategy? Do you have any plans to manage them?
- *Strategic Design* – How have your water conservation plan and implementation strategy been designed to address local water problems and meet your water conservation objectives?

Appendix A: Worksheets

To make your data collection easier, Microsoft Excel versions of these worksheets have been provided on the Water Conservation Guide website.

Any field marked with an orange dot (•) can be entered into the Water Conservation Calculator. If the dot appears in brackets, it is an optional data field. To access the Calculator go to:

www.waterconservationcalculator.ca

Water Demand Worksheet

Service Characteristics

	Total	Permanent Population •	Seasonal Population •	Projected Annual Pop Growth Rate •
Current Service Population				%

	5 years	10 years	20 years	50 years
Forecast Service Population				

Water Demand

Annual Demand •		ANNUAL WATER DEMAND (m³) •				PEAK DEMAND		
		Annual Demand •	Metered Volume •	Non-metered Volume	% of Total	Peak Season	Peak Day	Peak Hour (•)
Residential (single-family)•	**Indoor**							
	Outdoor							
Residential (multi-family)•								
Agricultural•								
Industrial•								
Commercial•								
Institutional•								
Non-revenue Water•								
Total Demand					100%			

Daily Water Demands	Volume (m^3/day)	% of maximum daily supply capacity
Maximum Daily Demand (MDD) (•)		
Peak Hour Demand (•)	*m^3/hour*	
Average Daily Demand		

Detailed Consumption Data

Monthly Demand Data (•)		24 Hour Demand Data (day with greatest peak hour) (•)			
Month	***Demand (m^3)***	***Hour***	***Demand (m^3)***	***Hour***	***Demand (m^3)***
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Average					

Water Supply Worksheet

Water Supply

	Volume in m³
Maximum Daily Supply Capacity •	
Peak Hour System Capacity •	
Total Annual Water Supply Capacity	

Surface Water Source Descriptions

This information can be used to build your Water System Map

Water Source	Location	Location of Intakes	Service Area	Water License (Max. Yield)	Annual Water Supply Capacity • (Available Yield)	Factors Affecting Source

Groundwater Source Descriptions

This information can be used to build your Water System Map

Water Source	Location	Service Area	Rated Capacity or Well Yield Rate (Max. Yield)	Annual Water Supply Capacity • (Available Yield)	Factors Affecting Source

Alternative Sources

	Average Annual	Average Summer
Precipitation		

Potential Sources	Target Water Uses
Non-Potable	
Water Reuse	

Infrastructure Worksheet

Service Connections

Service Connections	CONNECTIONS			METERING		
	# of Connections (•)	% of All Connections	Annual Demand Per Connection (m^3/year)	# of Metered Connections (•)	# of Unmetered Connections	% of Metered Connections Per Sector
Residential - Single Family						
Residential - Multi-family						
Industrial						
Commercial						
Institutional						
Agricultural						
Non-revenue Water						
Total		100%				100%

Distribution Infrastructure Data

	Total Water Lines	Potable Water Lines	Wastewater Lines	Twinned Systems (for non-potable uses)
Pipe Length (km)				

Treatment Infrastructure Data

	Level of Treatment	Type of Treatment	% of Total Production Treated
Drinking Water			
Wastewater			

Water Demand Forecast Worksheet

Annual Demand Forecast

Total Annual System Demand (m^3)	Current Year	5 Years	10 Years	20 Years	50 Years
Population Served					
Annual Water Demand					
Annual Supply Capacity					
Difference Between Annual Supply Capacity & Annual Water Demand*					

** Equals Annual Supply Capacity minus Annual Water Demand. If the difference is negative, water shortages are predicted in the future due to a lack of supply. If the difference is positive, a water surplus is anticipated.*

Daily Demand Forecast

Daily Water Demand (m^3)	Current Year	5 Years	10 Years	20 Years	50 Years
Average Day Demand (ADD)					
Maximum Day Demand (MDD)					
Peak Hour Demand (m^3/hour)					

Appendix B: Additional Resources

- Glossary
- Resources List
- Endnotes & References

Glossary

Action Team – Team of individuals who will direct the water conservation planning process.

Annual Demand by Connection – The volume of water used by each service connection in a year. Can be obtained from meters or billing records.

Annual Percentage of Declining Storage Volumes – This is the estimated percentage decrease in water storage volumes in water sources each year caused by climate change.

Annual System Budget – All cash flows associated with running a water system, including a comparison of expenditure and revenue against the average water rate and real per unit cost of water to the user.

(Annual) Water Demand – Water requirements (for one year) for a particular purpose, such as for residential, agricultural, or industrial use. For the purposes of this Guide, total water demand includes water requirements for all sectors and *non-revenue demand*.

Annual Water Supply Capacity – The volume of water (m^3) brought into the water system each year. This is typically measured or estimated at the well head, water treatment plant, or reservoir.

Average Daily Demand (ADD) – The average volume of water used in a day in a given year. It is determined by dividing total annual water demand by the number of days in the year (365). For unmetered water use, ADD can be estimated by multiplying pump rate, run time, and the pump efficiency.

Bulk Meters – Meters which measure mass flows of water through various parts of the system. Bulk meters are generally placed on supply pipes and larger distribution pipes. Sometimes called zone meters when used to determine flows to various reticulation or pressure zones.

Community-wide Conservation Objectives – See *Conservation Objectives.*

Community Engagement Measures – C*onservation measure*s that motivate people to change their water consumption behavior by engaging them on water issues and communicating to them the importance of water-conscious behavior in realizing a sustainable water future. Examples include: *voluntary restrictions*, *education and outreach programs*, and *partnership or collaborative initiatives*.

Community Snapshot – An overview or summary which describes the characteristics of the community that the water system services, including the community population and water use characteristics.

Conservation-Oriented Built Components – Infrastructure or fixtures that are designed to save water, such as low-flow toilets or dual-flush toilets, faucet aerators, or water recycling systems.

Conservation Goals – Developed in Step 1 of this planning process, these high level goals articulate what a community would like to achieve through water conservation in their preferred water *future scenario*.

Conservation Measures – Measures, instruments or programs designed to achieve water savings. They can be enforceable or voluntary, focused on technology or behavior change, and simple or complex. Most measures fall into four main categories: *legal measures*, *economic and financial measures*, *operations and management measures*, and c*ommunity engagement measures*. Conservation measures are described in-depth in the Step 5 chapter of this Guide.

Conservation Objectives – Developed in Step 4 of this process, these are collaboratively developed goals that set the direction for a conservation plan and provide benchmarks to evaluate progress on water savings. These objectives can be community-wide or sector-specific, and should be measureable and descriptive. Different objectives can be created to address the short-, medium-, and long-term. *Community-wide conservation objectives* focus on the benefits a community wants to realize from its collective water conservation efforts. *Sector-specific water conservation objectives* are water saving objectives specific to a particular category of water users (i.e. residential, industrial, commercial, institutional, or agricultural).

Conservation-Oriented Pricing and Rate Structures – Water service rates based on a consumer's metered water usage, which promote efficient water use by charging higher prices for wasteful consumption. These *volumetric rates* encourage conservation by giving feedback to consumers about the true costs of their water use – including the costs of operating, maintaining, administering, upgrading, expanding, and managing their water systems. Examples include: *increasing or inclining block rates* or *seasonal rates*.

Conservation Targets – Developed in Step 7 of this process, conservation targets are goals for specific conservation measures within a community's conservation plan.

Detailed Consumption Data – In-depth data on volumes of water use over different months of the year or during a typical day.

Domestic Use – Water use by residential customers, includes all water used in household activities (i.e. bathing, cleaning, drinking and food preparation, laundry, and toilet flushing).

Ecological Health – The health of an ecosystem is measured by the biodiversity (number of species), quality of habitat, and health of plants, animals, and other organisms in a local environment.

Economic and Financial Measures – *Conservation measures* that drive water savings through monetary rewards for conservation or penalties for overconsumption. Examples include: *conservation-oriented pricing or rate structures*, as well as *rebate programs* and *give-away programs* for water savings technologies.

Education and Outreach Programs – A *community engagement measure* that plays a vital role in any conservation plan by communicating how each measure will promote water savings, what individuals need to do to participate, the benefits of the measure and water conservation to the community and residents. Effective education and outreach actively engages people and targets specific water conservation objectives. These measures help to foster new water habits, an acceptance of the need for conservation measures, water policy awareness, and an ethic of water stewardship.

Efficiency of Pump – An indicator of pump performance, pump efficiency is a measure of how much work or power a pump is putting out in relation to how much work or power is being used to operate it, expressed as a percentage. A pump's efficiency declines over time as its parts wear.

Flat or Set Rate – Water pricing structure that chargers users a fixed fee for water services, typically on a yearly, bi-yearly, or quarterly basis. Flat rates do not provide any feedback to consumers about their water use behavior and often fail to support the full costs of water service provision.

Future Scenarios or **Futures Planning** – A planning process whereby different scenarios for the future are imagined to explore alternative cases for water availability and use. Trends that may affect water availability (like climate change) and water use (like population growth) are considered in creating a baseline scenario that illustrates a possible water future if the community stays on the same course. Then one or two realistic possible futures are developed to meet a community's goals while staying within ecological limits. Once scenarios are developed, users can then 'backcast' (or work backwards from their end goals to where they are now) and start developing different strategies to move forward and create their desired future. See *Water Soft Path* in the Resource Lists for more information on future scenario planning.

Geographic Boundaries – The geographic boundaries of the area to which a conservation plan will be applied. Ideally, to create a comprehensive plan, this area should include the entire water system, and possibly water sources and other parts of the surrounding environment. Catchment or watershed boundaries, ecosystem boundaries, and political boundaries can all be taken into account in setting a plan's geographic limits.

Give-away Programs – An *economic conservation measure* used by municipalities or utilities to reduce water consumption by distributing water saving technologies to water users free of charge. Provision of free installation greatly increases likelihood of technology use.

Green Infrastructure – In water resources management, *green infrastructure* typically refers to stormwater infrastructure built to manage and treat runoff from development through natural means (such as infiltration) or engineered systems that mimic natural systems (such as urban wetlands).

Greywater – Wastewater from *domestic uses* like dishwashing, laundering or bathing. This water can be *recycled* or *reused* onsite for non-potable uses, such as toilet flushing or irrigation.

High-level Timeline – A component of the *implementation strategy* that includes basic information for all of the projects in a plan and their timing. It is less comprehensive than the detailed *implementation strategy*.

ICI Demand – *Water Demand* for industrial, commercial, and institutional users.

Implementation Strategy – is the long-term roadmap for how to roll-out the various conservation projects in a water conservation plan and how each project helps to achieve the plan's water conservation objectives. It includes: details on individual project designs, an overall timeline and budget, assignments of roles and responsibilities, expected impacts, any barriers to implementation and possible solutions, a monitoring schedule and triggers for plan re-evaluation.

Increasing or Inclining Block Pricing – A rate structure where increasing costs are charged for each 'block' of water used, meaning there are set volume thresholds over which water becomes more expensive. By charging higher prices for higher consumption, increasing block pricing is intended to discourage wasteful water use.

Infrastructure Capacity – Refers to the maximum amount of water that can be supplied by a water treatment and distribution system. A system's capacity may be limited by constraints such as storage volumes, small pipe sizes, treatment plant size, or the condition of well screens.

Infrastructure Snapshot – An overview or summary in the *water system profile* that describes the current water infrastructure or water system, including data on service connections, metering, distribution and costs.

Legal Measures – *Conservation measures* that use a government's legal powers to require citizens or residents to change their water use behavior or adopt water saving technologies. These include: *mandatory watering restrictions*, *municipal bylaws*, standards, regulations, building and plumbing codes.

Local Evaluation Criteria – Criteria developed to assess how appropriate and potentially effective a measure is for meeting a community's unique needs and objectives. These criteria should be: distinctive, measurable, mutually exclusive, understandable and concise. They should address local water challenges, leverage opportunities within the watershed, and reflect a community's water values.

Mandatory Watering Restrictions – Enforceable restrictions by a local government that limit the number of days and/or specify the timing of outdoor water use.

Maximum Daily Demand (MDD) – The volume of water that was used by a community on the highest use day. Also known as Peak Day Demand.

Maximum Daily Supply Capacity – The maximum amount of water a system can supply to customers in a day.

Metered Volume – The volume of water distributed in a year that is metered – a portion of *Annual Water Demand*.

Municipal Bylaws for Water Conservation – Local governments can use municipal bylaws to promote water saving technologies or water conservation through required standards, regulations, building or plumbing codes. These can be enforced using existing permitting processes in place for new construction or renovations. Examples of water conservation bylaws include: top soil bylaws that require a certain depth of soil (to promote infiltration), building code requirements for low-flow fixtures, and water offset requirements for new developments.

Non-Metered Volume – The volume of water distributed in a year that is unmetered – a portion of *Annual Water Demand*.

Non-Potable – Not suitable for drinking. Non-potable water can have other uses, such as toilet-flushing or irrigation.

Non-Revenue Demand – The amount of water demand for which no charge is collected, such as water for firefighting, system flushing, or lost to leaks. If non-revenue demand is un-metered, the amount of non-revenue demand can be calculated by subtracting revenue demand from the total water demand.

Operations and Management Measures – *Conservation measures* that use technology and management approaches to reduce water losses throughout a water system, to improve the efficiency of water use, or to develop alternative water sources (like non-potable water, recycled water and rainwater). Examples include: *water system audits*, leak detection and repair, *water metering*, *water reclamation, reuse* and *recycling programs*.

Partnership and Collaboration Initiatives – *Conservation measures* that involve leveraging relationships with others to achieve water conservation goals or objectives. These initiatives are often context specific and can be developed to address specific challenges or to learn from the conservation experiences of others.

Peak Day Demand – See *Maximum Daily Demand*.

Peak Demand Data – Data on the largest volume of water used in the time period of interest – one season, one day, or one hour.

Peak Hour Demand – The volume of water that was used by a community in the highest use hour of the year.

Peak Hour System Capacity – The maximum amount of water a system can supply to customers in an hour.

Peak Season Demand – The volume of water used by a community in the high water use season (e.g. there may be higher water use through the summer).

Peak Water Demand – Describes a period of highest water demand, where water is expected to be provided for a sustained period at a higher than average supply level (i.e. the highest monthly or daily water use in one year – see *Maximum Daily Demand*, *Peak Day Demand*, and *Peak Season Demand*).

Per Capita Water Demand Forecasting – A simplified method of forecasting future water consumption by a community that assumes a direct link between water conservation and population growth. Future water use is determined by multiplying current annual per capita water use by the future population, or by multiplying current daily per capita water use by the future population by 365 days. This method is suitable when little information is available on water users and the potential for sector growth.

Permanent Population – The total number of people who live in a community year round.

Predicted Annual Population Growth Rate – The average percentage increase or decrease in residents expected each year.

Pump Rate – The rate at which water is supplied by a well pump or primary supply pump. This is expressed as volume of water supplied per time period (e.g. litres per second) and may be determined by a water yield test.

Rainwater Harvesting – A *conservation measure*, rainwater harvesting involves collecting rainwater via rain barrels or cisterns to be used for non-potable purposes, such as irrigation or toilet flushing.

Rebate Program – An *economic conservation measure* in which municipalities or utilities give consumers rebates towards the purchase and/or installation of water saving technologies to encourage water conservation. These programs are an effective means to encourage conservation at the point of use as they provide consistent water savings and, beyond choosing to participate, do not require users to change their behaviors.

Revenue Demand – The amount of water demand for which there is a charge collected. Sometimes called billed water demand.

Seasonal Population – The number of people who live in a community only during certain times of the year.

Seasonal Rate – A volumetric water rate that charges higher prices in peak periods, such as summer. A seasonal rate can help to communicate the need for water savings in a peak demand or low water period, and encourage water use reductions in these times.

Sector – A group or category of water users in which consumers share similar characteristics in water use such as residential, agricultural, industrial, commercial, or institutional.

Sector Growth – The percentage increase in outputs and resource consumption expected in a sector over a specified time period. This could include the addition of new businesses or expansion of existing businesses or industry.

Sector-specific Water Conservation Objectives – See *Conservation Objectives.*

Service Characteristics – Characteristics that describe whom a water system serves, including variables such as *Permanent* and *Seasonal Populations*, and *Annual Population Growth Rate*.

Stakeholder Engagement – Involving people from different backgrounds or organizations in activities to gain feedback on a particular issue. In water conservation planning, this may involve running workshops or an open online forum to collaboratively develop and or evaluate different conservation objectives or programs. Stakeholder engagement throughout the planning process can help to ensure that the range of values and issues represented in a plan reflect those of the wider community. It can also help to create buy-in for a plan and foster awareness of water issues.

Sustainability – a concept that has evolved from the United Nations' Bruntland Commission definition of *sustainable development*: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Planning for sustainability involves accounting for and reconciling environmental, social equity, and economic factors to achieve balanced outcomes that will endure over the long-term. *Water sustainability* involves planning, management and use of water resources in ways that protect human and ecological health for present and future generations. To be sustainable over the long-term a system's freshwater withdrawal rate should not exceed the water source's natural replacement rate.

System Energy Consumption – The total energy use or amount of energy used to deliver water by the system. Consider energy consumption in the distribution system, treatment system, and incidental system electrical uses such as heating and lighting.

Volumetric Rate or Volume-Based Pricing – Water pricing structure where costs are charged based on the amount used, generally by charging a per unit rate. Volumetric pricing requires metering to establish how much water each customer is using.

Voluntary Restrictions – A *community engagement measure* that asks residents to voluntarily restrict their water use during a dry period or for any other reason. One example is voluntary outdoor watering restrictions, which can help to reduce water use in dry summer months. If there are severe water shortages, *mandatory restrictions* are recommended as they produce higher water savings than voluntary restrictions.

Wastewater Reclamation – Treating wastewater and then using it to safely replenish source waters, such as rivers or aquifers. A good measure for maintaining surface flows for fish or recreation.

Wastewater Reuse or Recycling – Treating wastewater and using it for non-potable uses. For example, *greywater* recycling systems can be used to get up to 50% more use out of the same amount of water by reusing it for toilet flushing or irrigation onsite.

Water Conservation Calculator – A free online decision-support tool designed to help communities with conservation planning. Available online at: http://www.waterconservationcalculator.ca/

Water Conservation Plan – A local government or water utility's plan to save water within their systems using a variety of measures to reduce water demands and increase efficiency of water use. Water conservation plans evolve over time and are revised regularly to meet the changing needs of a community. They are often integrated with other plans, such as a Community Growth Strategy, Liquid Waste Management Plan, Climate Change Adaptation Strategy or Asset Management Plan.

Water Demand Forecasting by User Group – A method for forecasting a community's water consumption based on the distribution of water use across different sectors. To calculate future water use, annual water use by sector is multiplied by sector growth. This method is well suited to communities that have reliable data on the water demands of their different user groups or sectors.

Water Distribution System – The water infrastructure that transports water from where it is sourced or treated to where it supplies homes and businesses (e.g. pipes, valves).

Water Infrastructure – The physical components of a system which enable water to be provided to households and businesses. Infrastructure includes pipes, treatment facilities, wells, pumps, valves, etc.

Water Quality Data – Data on the physical, chemical, and biological characteristics of a water supply. This data is gathered through water source testing for contaminants (bacteria, viruses, chemicals, salts, metals and minerals) and for other attributes, such as temperature, pH (acidity), dissolved oxygen content, turbidity, and conductivity.

Water Quantity Data – Data on water flows from water sources. This may include data on total annual flows, historical flows, and maximum and minimum flows for surface water sources, or well yield rates and groundwater assessments for groundwater sources.

Water Metering – Water meters are devices used to measure water at different points in a water system. Water metering is an essential water *conservation measure* for understanding how water flows through the system and is used by consumers. End-user metering is required to implement *volumetric pricing*.

Water Sensitive Urban Design (WSUD) – Also known as *low-impact development* or *sustainable urban drainage systems*, it is an approach to urban development that accounts for and aims to minimize impacts of land use on a watershed. It promotes the use of *green infrastructure* and climate appropriate landscaping. Increased topsoil and drought-tolerant landscaping are examples of how WSUD can help conserve water through reducing outdoor irrigation demand.

Watershed Snapshot – A component of the *water system profile*, which provides an overview or summary of the characteristics of the watershed(s) that supplies the community, including: a description of the natural environment which makes up the watershed, other water users (both human and non-human), existing water quantity and quality, watershed health, future capacity to supply water, land ownership, and susceptibility to climate change.

Water Sources – Bodies or volumes of water from which water can be obtained for a community or region. Examples of water sources include aquifers, rivers, lakes, recycled water, or rainwater tanks.

Water Stewardship – Practicing behaviors to protect and care for one's water resources, such as conserving water wherever possible, reducing the use of harmful chemicals and pollutants that would otherwise enter water bodies, and building infrastructure in ways that minimize the negative effects of development on a watershed.

Water Sustainability – See *Sustainability*.

Water System Audit – An assessment of how much water is moving through a water system and where water losses may be occurring. A water audit if often the first step in a water loss management program.

Water System Profile – A description of the current state of the water system that the conservation plan is being developed for that includes a *Community Snapshot*, *Watershed Snapshot*, and *Infrastructure Snapshot*.

Water System Map – For the purposes of this Guide, a map which shows the geographic locations of water sources and intakes, service areas for each supply, and water system infrastructure. Ideally, a water system map shows infrastructure and supply areas in the context of topography and other natural characteristics of the watershed (i.e. aquifers, rivers, contours).

Resources List

Water Conservation Planning and the Water Soft Path

Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money – POLIS Water Sustainability Project
http://poliswaterproject.org/publication/22

Water Conservation *Case Studies* – POLIS Water Sustainability Project
http://www.poliswaterproject.org/publications/studies

Making the Most of the Water We Have: The Soft Path Approach to Water Management – POLIS Water Sustainability Project
http://poliswaterproject.org/publication/284

The Soft Path for Water in a Nutshell – POLIS Water Sustainability Project
http://poliswaterproject.org/publication/23

BC Specific Guides, Programs, Training, Funding, Success Stories – BC Climate Action
www.toolkit.bc.ca/tool/water-conservation

Water Conservation Plan Guidelines - US Environmental Protection Agency
http://www.epa.gov/WaterSense/pubs/guide.html

Publications on Water Conservation – POLIS Water Sustainability Project
http://www.polisproject.org/projects/watersustainability

Water Conservation Research – POLIS Water Sustainability Project
http://poliswaterproject.org/conservation

Water Conservation Ideas, Water Balance Model, Water Conservation News – Partnership for Water Sustainability in BC
http://waterbucket.ca/

Information about water-efficient products, practices, and programs – Alliance for Water Efficiency
http://www.allianceforwaterefficiency.org/resource-library/default.aspx

Examples of Conservation Programs and Strategies

Okanagan Waterwise – Okanagan Basin Water Board
http://www.okwaterwise.ca/

Columbia Basin Water Smart – Columbia Basin Trust (examples from 23 communities)
http://www.cbt.org/watersmart/index.asp

Conservation Programs – City of Richmond
http://www.richmond.ca/services/rdws/water/savewater.htm

Water Conservation Strategy 2010-2015 – Sydney Water (Australia)
http://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq1/~edisp/dd_045260.pdf

Water Conservation Measures

Legal Measures

Municipal Bylaws, Standards, Regulations, Building and Plumbing Codes

Green Bylaws Toolkit – Okanagan Basin Water Board
http://www.greenbylaws.ca/

Topsoil Bylaws Toolkit – Okanagan Basin Water Board
http://www.obwb.ca/library/topsoil-bylaws-toolkit/

Groundwater Bylaws Toolkit – Okanagan Basin Water Board
http://www.obwb.ca/library/groundwater-bylaws-toolkit/

Economic and Financial Measures

Conservation-Oriented Water Pricing and Rate Structures

Worth Every Penny: A Primer on Conservation-Oriented Water Pricing – POLIS Water Sustainability Project
http://poliswaterproject.org/publication/344

Water Service Rate Setting – BC Water and Wastewater Association
https://www.bcwwa.org/resourcelibrary/RateSetting%20Position%20Statement%20rev%20%2024-06-2013_final.pdf

Financial Best Management Practices for Small Community Water Systems in British Columbia – Union of British Columbia Municipalities
http://www.waterbc.ca/resources/best-management-practices/

Example of Volumetric Rate Structure – City of Kamloops
http://www.kamloops.ca/waterwise/watermeterrates.shtml

Rebate, Retrofitting and Give-Away Programs

Toilet Fixture Performance Information – Canadian Water and Wastewater Association
http://cwwa.ca/freepub_e.asp

Example of a *Toilet Program* – Sunshine Coast Regional District
http://www.scrd.ca/Toilet-Program

Once-Through Cooling Systems Rebates – Capital Regional District
https://www.crd.bc.ca/education/at-work/water-conservation/cooling-systems-rebates

Operations and Management Measures

Water Accounting and Water Loss Management: Water System Audits, Leak Detection and Repair

Water Audit Software (free) – American Water Works Association
http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx

Water Use and Loss in Water Distribution Systems: A Best Practice National Guide to Sustainable Municipal Infrastructure – Federation of Canadian Municipalities and National Research Council
http://www.fcm.ca/Documents/reports/Infraguide/Water_Use_and_Loss_in_the_Water_Distribution_System_EN.pdf

Leakage Management and Control: A Best Practice Training Manual – World Health Organization
http://www.who.int/water_sanitation_health/hygiene/om/leakage/en/

Water Metering Programs

Water Metering – BC Water and Waste Association
https://www.bcwwa.org/resourcelibrary/2012%20June%2026%20Water%20Metering_final%20rev%20%2006-01-2013.pdf

Example of a Mandatory Water Metering Program with Conservation-Oriented Pricing – Comox Valley Regional District
http://www.comoxvalleyrd.ca/EN/main/departments/water-services/water-metering.html

Water Recovery, Reclamation, Reuse and Recycling Programs

Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing – Health Canada
http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/reclaimed_water-eaux_recyclees/index-eng.php

Information on *Water Reuse* – Canadian Mortgage and Housing Corporation
http://www.cmhc-schl.gc.ca/en/inpr/su/waho/waho_001.cfm

Regulatory Barriers to On-Site Water Reuse – Canadian Mortgage and Housing Corporation
http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/98101.htm

Canadian Examples of Water Reuse – Sustain Water
http://www.sustainwater.ca/index.php?option=com_feedbackfactory&task=categoryfeedbacks&category_id=15Itemid=237

Research on Water Recycling Issues – Australian Water Recycling Centre of Excellence
http://www.australianwaterrecycling.com.au/research-publications.html

Rainwater Harvesting

Peeling Back the Pavement: Reinventing Rainwater Management in Canada's Communities – POLIS Water Sustainability Project
http://poliswaterproject.org/publication/426

Residential Rainwater Harvesting Design and Installation Best Practices Manual – City of Guelph
http://guelph.ca/wp-content/uploads/RainwaterHarvestingDesignInstallationBestPractices.pdf

Community Engagement Measures

Voluntary Restrictions

Water Use Efficiency Catalogue for British Columbia: Voluntary Restrictions – BC Ministry of Environment
http://www.env.gov.bc.ca/wsd/plan_protect_sustain/water_conservation/wtr_use_eff_cat_bc/vol_restrict.html

Education and Outreach Programs

Community-Based Social Marketing – Dr. Doug McKenzie-Mohr
http://www.cbsm.com/public/world.lasso

Educational Resources – Capital Regional District
https://www.crd.bc.ca/education/at-home/water-conservation/water-conservation-facts

(Xeriscaping) *Waterwise Gardening for Home and Small Acreage Owners of the Oliver Area* – Town of Oliver
https://oliver.civicweb.net/Documents/DocumentDisplay.aspx?Id=28370

Partnerships and Collaborative Initiatives

Saving Water Partnership – Seattle and Participating Local Water Utilities
http://www.savingwater.org/Businesses/index.htm

Provincial Water Conservation Strategy

British Columbia Water Conservation Strategy: Executive Summary – BC Ministry of Environment
http://www.env.gov.bc.ca/wsd/plan_protect_sustain/water_conservation/wtr_cons_strategy/wce.html

Living Water Smart: BC'S Water Plan – BC Ministry of Environment
http://www.livingwatersmart.ca/

Climate Change

Climate Data and Analysis

Tools and Data – Pacific Climate Impacts Consortium
http://www.pacificclimate.org/tools-and-data

Introduction to Climate Modeling – Pacific Institute for Climate Solutions
http://pics.uvic.ca/insights/lesson4/player.html

Climate Change Impacts in BC

Climate Change Impacts – Ministry of Environment Climate Action Secretariat
http://www.env.gov.bc.ca/cas/impacts/index.html

***Plan2Adapt* Tool for Regional Climate Modeling** – Pacific Climate Impacts Consortium
http://www.pacificclimate.org/tools-and-data/plan2adapt

Climate Change Context Statement – BC Water and Waste Association
https://bcwwa.org/resourcelibrary/BCWWA%20Climate%20Change%20Context%20Statement.pdf

Climate Change Mitigation and Adaptation

Webinar: Adapting to a Changing Climate: The Perspective of an Insurer on Water and Risk Governance – POLIS Water Sustainability Project
http://poliswaterproject.org/webinar/504

Adapting to Climate Change: An Introduction for Canadian Municipalities – Government of Canada
http://www.nrcan.gc.ca/earth-sciences/climate-change/community-adaptation/municipalities/373

Adapting Infrastructure for a Changing Climate – BC Water and Waste Association
http://bcwwa.org/resourcelibrary/Adapting%20Infrastructure%20for%20a%20Changing%20Climate%20IAP_final.pdf

Assessing Vulnerability and Adapting Infrastructure to Climate Change – Engineers Canada
http://www.pievc.ca/e/doc_home_.cfm

Mitigation and Adaptation – BC Climate Action Toolkit
http://www.toolkit.bc.ca/

Adaptation to Climate Change Team at Simon Fraser University
http://act-adapt.org/

Preparing for Climate Change* – *An Implementation Guide for Local Governments in British Columbia – West Coast Environmental Law
http://www.toolkit.bc.ca/Resource/Preparing-Climate-Change-Implementation-Guide-Local-Governments-British-Columbia

Making the Most of Your Water

[i] BC Ministry of Environment. 1999. *Water Conservation Strategy*. www.env.gov.bc.ca/wsd/plan_protect_sustain/water_conservation/wtr_cons_strategy/strategy.html#11. (accessed 28 July 2013)

[ii] Environment Canada. 2011a. *2011 Municipal Water Use Report - Municipal Water Use 2009 Statistics*. http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=B77CE4D0-80D4-4FEB-AFFA-0201BE6FB37B (accessed 28 July 2013)

[iii] Environment Canada. 2011b. *Wise Water Use*. http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=F25C70EC-1 (accessed 28 July 2013)

[iv] BC Ministry of Environment. 2013. *Did You Know...* http://www.livingwatersmart.ca/didyouknow.html (accessed 28 July 2013)

[v] Federation of Canadian Municipalities. 2007. *InfraGuide*. www.sustainablecommunities.fcm.ca/Infraguide/. (accessed on 12 September 2008)

[vi] BC Ministry of Community, Sport & Cultural Development. 2013. Personal communication from Madelaine Martin, Local Government Infrastructure and Finance Division.

Step 2 - Building Your Community's Water Profile

[i] Environment Canada. 2009. *Municipal Water Use 2009 Summary Tables - Municipal Water and Wastewater Survey*. http://data.gc.ca/data/en/dataset/902fd3f7-7d9a-4a9c-b4b6-3ea9d1a0b885 (accessed 5 December 2013)

[ii] International Water Association (IWA). 2003. *Assessing Non-Revenue Water and its Components: A Practical Approach*. http://www.iwapublishing.com/pdf/WaterLoss-Aug.pdf (accessed 5 December 2013)

Step 3 - Forecasting Future Demand and Setting the Bar for Success

[i] Pacific Climate Impacts Consortium & Pacific Institute of Climate Solutions. 2013. *British Columbia Climate Facts.* University of Victoria.

[ii] BC Water and Waste Association. 2012. *BCWWA Climate Change Context Statement*. https://www.bcwwa.org/resourcelibrary/BCWWA%20Climate%20Change%20Context%20Statement.pdf (accessed 5 December 2013)

Step 5 - Exploring Your Conservation Options

[i] Brandes, OM, Maas, T, & E Reynolds. 2006. *Thinking Beyond the Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*. Victoria: POLIS Project on Ecological Governance. http://poliswaterproject.org/sites/default/files/ThinkingBeyond_eng_highres.pdf (accessed 5 December 2013)

[ii] Reynaud A., & Renzetti, S. 2004. *Micro-Economic Analysis of the Impact of Pricing Structure on Residential Water Demand in Canada*. Ottawa: Report for Environment Canada.

[iii] Environment Canada. 2008. *Municipal Water Pricing Report*. http://www.ec.gc.ca/Water/en/manage/data/e_MUP2008.pdf. (accessed on 24 July 2008)

[iv] Pike, T. 2005. *Agricultural Water Conservation Program Review*. Proceedings of Water - Our Limiting Resource: Towards Sustainable Water Management in the Okanagan. CWRA-BC Branch: Kelowna, BC.

[v] District of Tofino. 1992. *District of Tofino Water Utility Rates, Terms and Conditions By-law No. 574, 1992*. https://

tofino.civicweb.net/Documents/DocumentList.aspx?ID=707 (accessed 28 July 2013)

[vi] Capital Regional District. 2013. *Water Efficient Rebate Programs*. http://www.crd.bc.ca/water/conservation/rebates/index.htm (accessed 31 April 2013)

[vii] City of Guelph. 2012. *Blue Built Home - Terms and Conditions*. http://guelph.ca/wp-content/uploads/BlueBuiltHomeTermsConditions.pdf (accessed 28 July 2013)

[viii] Federation of Canadian Municipalities. 2007. *InfraGuide*. www.sustainablecommunities.fcm.ca/Infraguide/ (accessed on 12 September 2008)

[ix] Shrubsole, D. & D Tate (eds). 1994. E*very Drop Counts*. Canadian Water Resources Association: Cambridge, Ontario.

[x] Ling, C, Thomas, K, & J. Hamilton. 2007. *Triple Bottom Line in Practice: From Dockside to Dockside Green*. http://crcresearch.org/case-studies/case-studies-sustainable-infrastructure/land-use-planning/triple-bottom-line-practice-f (accessed 5 December 2013)

[xi] Capital Regional District. 2003. *Recycling Water: A Conservation Strategy for the 21st Century*. http://www.crd.bc.ca/reports/water_/2003_/recycle1130/recycle1130.pdf (accessed 28 July 2013)

[xii] Sunshine Coast Regional District. 2008. Interview with Dion Whyte, Manager of Sustainable Services.

[xiii] Belzile, J. 2011. *Lessons from Oz to the Okanagan: Water Policy and Structural Reform in a Changing Climate*. University of British Columbia Masters Thesis. https://circle.ubc.ca/bitstream/handle/2429/36939/ubc_2011_fall_belzile_jacqueline.pdf?sequence=1 (accessed 28 July 2013)

Step 7 - Putting Your Plan into Action

[i] City of Kamloops. 2013. *Water Meter Installation Program*. http://www.city.kamloops.bc.ca/waterwise/index.shtml (accessed 28 July 2013)

[ii] American Water and Waste Association. 2006. *M52: Water Conservation Programs—A Planning Manual*. Denver: AWWA.

[iii] Capital Regional District. 2008. Personal Communications with Deborah Walker, Demand Management Coordinator.

[iv] City of Toronto. 2002. *Water Efficiency Plan*. www.toronto.ca/watereff/plan.htm. (accessed on 24 July 2008)

[v] American Water and Waste Association. 2006. *M52: Water Conservation Programs—A Planning Manual*. Denver: AWWA.

What does a water wise
community look like?

Is your community on the path
to a healthy water future?

How can water conservation save money
and protect local water resources?

Which measures will work
best for your community?

To answer these questions and get your community on
track for a sustainable water future, use the seven
step process in this Guide to build a
Water Conservation Plan.

Blue Currents Consulting

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University of Victoria

Okanagan Basin Water Board