A Soft Path Strategy for Salt Spring Island, BC

A Soft Path for Water Case Study

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Executive Summary

Many Canadians believe that our fresh water resources are boundless. The truth is that only a small proportion of our water is renewable and located close to where most Canadians live. Continuing to take more and more water from nature while ignoring wasteful use at farms, factories and households will likely lead us to an arid future of our own making. The best way to secure the future for fresh water is to develop a plan that draws all "new" water from better use of existing supplies and to change habits and attitudes.

The "soft path" is a planning approach for fresh water that differs fundamentally from conventional, supply-focused water planning. The soft path approach allows us to unleash the full potential of demand management by changing water-use habits, technologies and practices. As a matter of principle, the soft path works within ecological limits and promotes local public participation to ensure sustainability of our water resources.

Salt Spring Island (popn: 9,640)[1] is the largest of the 13 main Gulf Islands in the Georgia Straight off the coast of the lower mainland of British Columbia. Summer population can approximately double. As with the lower mainland, Salt Spring has experienced considerable growth over the past twenty years. Permanent population is predicted to continue to grow with the current total build-out scenario under current zoning projected to be a little over 17,000. (OCP, 2008). Development pressures, high rates of seasonal tourism, high dependence on groundwater for drinking water and the presence of small community and private systems make Salt Spring a unique study for the application of water conservation planning.

This heavy growth and growing demand for water has increasingly strained the island's water supplies. For example, the North Salt Spring Island Water District (the largest publicly-managed centralized water system on the island) is projected to reach the limit of its license well before the build-out projection in the OCP is met. Elsewhere on the island, there are increasing constraints – regulatory, economic, hydrologic, environmental, legal and water quality – that may further stress water demands and stretch water supply. Salt Spring is faced with a choice to build costly infrastructure to tap into greater surface and groundwater supplies or to defer the need for new infrastructure by engaging in long-term conservation planning. This strategy seeks to provide direction to this second option.

A Sustainable Future for Salt Spring Island

A commitment to "preserve water for the next generation" – meaning that all new demands for water will be met through conservation and efficiency rather than expanding supply, would be a significant step toward water sustainability and sustainable water leadership on Salt Spring. Aiming for water neutrality on Salt Spring would mean mandating the highest level of water efficient fixtures and appliances in all new construction, use of alternative sources of water (e.g. rainwater capture and recycled water) for toilet flushing and landscape management, the use of off-site recycled water where available, conservation-based pricing for the residential and industrial, commercial and institutional (ICI) sectors drawing water from centralized systems, and a progressive programme that targets reductions in residential outdoor water use and in the agricultural sector.

Using the POLIS Water Smart Scenario Builder, we constructed a desired future condition as the simplified goal of preserving water supplies for future generations by meeting all new water

[1] 2006 Census

needs until 2026 through conservation and efficiency measures. A more ambitious target of reducing water demand in 2026 to 20% below current demand was also considered.These targets are based on the understanding that expanding current water takings and constructing the associated infrastructure may damage local aquatic ecosystem health and can be avoided through conservation and increased water productivity.

Based on population projections, three scenarios for future water use were calculated:

1) **Business as Usual**
2) **No New Water Until 2026**
3) **20% Reduction of 2006 Levels**

The **No New Water Until 2026** scenario targets average day reductions from **Business As Usual** of approximately 30% by 2026. The **No New Water Until 2026** scenario should be considered readily achievable provided funds and personnel are directed to the program.

The **20% Reduction of 2006 Levels** scenario explores a commitment to securing the water necessary for a thriving community through conservation efforts. A 41% reduction in annual average daily water use over 20 years would be required to meet this target while providing services for the increasing population.

For both of these scenarios, short-term strategies include expanding the prohibited uses of water, enforcing prohibited uses of water, extending outreach efforts, and encouraging regional conservation measures. Long-term strategies include increasing water conservation through reduction of outdoor water use and new technology, maximizing water recycling, and enhancing stormwater capture.

Choosing a New Path Forward

This analysis demonstrates that it is not difficult to envision a better water future for Salt Spring Island- one that is sustainable yet permits some development and agreeable lifestyles for residents and local business. However, conservation does not just happen. It will take concerted action and political leadership for Salt Spring Island to move to a sustainable use of fresh water. As this strategy illustrates, this action does not require immediate radical change, but it does require new thinking on getting an early start on implementing a step-by-step process that will, over the next 20 to 30 years, change the way water is managed and consumed on Salt Spring Island.

Section 1 – Introduction

1.1 Background

Fresh water is vital to Canada's long-term prosperity. Yet despite its critical importance, water in this country is undervalued and often perceived (and managed) as if it were a virtually limitless resource. In water-stressed areas such as British Columbia's Gulf Islands, this "myth of abundance" remains firmly entrenched even though the region's drinking water supplies are under stress, conflicts among water users and uses are increasingly common, aquatic ecosystem health and fisheries are in decline, and economic opportunities are threatened (Brandes and Kriwoken, 2006).

Located in the Strait of Georgia between Vancouver Island and the Mainland, Salt Spring Island is the largest and most populous of the Gulf Islands. At 26km long and an average of 9km wide, the island has a year-round population of approximately 10,000 which doubles during the summer with tourists and temporary residents. Salt Spring lies in the rain shadow of the Olympic Mountains and the Coastal Mountains on the BC mainland which lends to the island a cool Mediterranean climate characterised by mild winters and warm summers. Water supply and quality is an issue on some parts of Salt Spring, with some drinking water lakes being close to their capacity to meet current demand and future commitments for additional supply, and difficulties with private wells particularly on the north end of the island.

Box 1: A Continuum of Water Management

Supply Management

Asks: How can we meet projected water needs given current trends in water use and population growth?

Solution: Construction of dams, pipelines, canals, wells, desalination systems and interbasin transfers.

Demand Management

Asks: How can we reduce needs for water to conserve the resource, save money, and reduce environmental impacts?

Solution: Gain efficiency through technical fixes and consumer education.

Soft Path

Asks: How can we deliver services currently provided by water (sanitation and irrigation, for example) in ways that recognize the need for economic, social and ecological sustainability?

Solution: Reduce water use through innovation, conservation, water reallocation and changing patterns of use and re-use so that more water is left *in situ*.

Salt Spring is at a critical stage in its development. A number of recent studies, reports and investigations look toward the future of the island: the Energy Baseline and Future Strategy, the Area Farm Plan, various water supply analyses and projections, and a study examining future settlement patterns that lessen the generation of greenhouse gases from car travel. The island is halfway built-out in terms of dwelling units and population and the community recently updated its Official Community Plan (OCP) to plan for this growth.

The traditional, supply-oriented, approach to water management on Salt Spring and the surrounding southern Gulf Islands is strained by steady population growth (both in terms of seasonal tourists and permanent residents), polluted water sources, increasing demands by residents for sustainable approaches, and the uncertainty of a changing climate. Changes in the Gulf Islands' economic priorities are another significant factor. Emerging regional economic reliance on agriculture focuses attention on water security and emphasizes the need for a new approach to water management on Salt Spring and the Gulf Islands. During this period of rapid change, water supply on Salt Spring may not be able to meet future projected demands based on current supply capacity, particularly given the heavy reliance on groundwater which is currently unlicensed in British Columbia and largely unaccounted for.

Fortunately, a new paradigm of water management is emerging—an approach focused primarily on water conservation and efficiency, with the potential to ensure long-term sustainability and social and economic prosperity. It is called the "soft path" for water.

As demand management programmes become more comprehensive and longer term, these begin to approach a holistic way of thinking about water – the soft path. As with demand management, the soft path strives for efficiency in water use, but goes beyond efficiency by fundamentally challenging today's patterns of freshwater consumption. Demand management focuses on "how" – how to do the same with less water. The soft path, in contrast, focuses on "why" – why use water to do this in the first place? For example, why do we use half the potable water that is piped to a house in the summer for watering lawns and gardens – and sidewalks? Demand management would urge more efficient sprinklers with automatic shut-offs, maybe even watering restrictions. The soft path goes further: recycling water from bathtubs and washing machines or, better yet, drought-resistant greenery that requires little or no watering once it is established.

1.2 Strategy Purpose

This strategy is a "real world" application of the soft path concept for Salt Spring Island. This project is part of a national soft path pilot project programme led by the University of Victoria's POLIS Project on Ecological Governance that seeks to test and refine tools for water soft path planning and implementation in Canadian communities. Through a number of sites in British Columbia and Ontario, this initiative applies the soft path approach to water planning at multiple scales and contexts to explore its potential for applying a widespread and more sustainable approach to water management in Canada.

This project was initiated by the Water Sustainability Project at the University of Victoria's POLIS Project on Ecological Governance (www.poliswaterproject.org/) and the Salt Spring Island Water Council in Spring 2008 to assess the potential to improve water sustainability planning and implementation. As noted above, Salt Spring is experiencing growing demands for water and energy related to the significant population growth on the island as well as the seasonal influx of tourists and summer residents. Linked to this pattern of growth is a need for costly infrastructure expansion or improvement, shifting more Improvement Districts to become local service areas of the Capital Regional District, and putting more stress on small community well systems with limited resources. Improving the overall efficiency of water use on Salt Spring will have at least four significant impacts:

- Reduce or defer the need for capital expenditures related to infrastructure expansion
- Provide a blueprint for other Gulf Islands to follow Salt Spring's lead and help establish the Gulf Islands as one of Canada's most proactive regions regarding water efficiency and conservation
- Preserve precious groundwater sources
- Help reduce the region's environmental footprint

1.3 Strategy Overview

The report is divided into four sections. Following the introduction in Section I is an overview of the soft path approach in the context of various water management approaches. Section II provides an overview of the respective planning contexts of Salt Spring and points to some of the emerging issues and challenges on the island and in the Gulf Island region. This includes a discussion of the Salt Spring's geography and hydrology, water and the local economy, climate change impacts and some aspects of the framework for water management and governance. More specific details about water use, infrastructure and current water management efforts on Salt Spring are also provided in this section.

Section III begins a more detailed soft path discussion, outlining the potential of water conservation, and developing two different soft path scenarios for Salt Spring. Each of the scenarios—**Business as Usual**, **No New Water Until 2026**, and **20% Reduction of 2006 Levels** —are summarized in tables of water use and savings potential. The **Business as Usual** scenario describes future water use for Salt Spring under current management practices. The **No New Water Until 2026** scenario applies some common demand management techniques to the Business as Usual model to demonstrate potential water savings. The **20% Reduction of 2006 Levels** goes even further. This is the preferred scenario, which integrates efficiency and conservation measures, and illustrates what a commitment to "Preserving Water supplies for the Next Generation" would entail for Salt Spring Island.

The final section provides recommendations and a high-level implementation plan for Salt Spring to begin developing a sustainable approach to water management.

Section 2 – Salt Spring Island

2.1 Hydrology and Geography

2.1.1 Surface Water Quantity and Quality

Salt Spring Island contains a varied topography of rocky highlands and low, fertile agricultural valleys as well as a fairly substantial lake and stream network. The island is located in a rain shadow, which results in a hotter, drier climate than most of the surrounding region. Average annual rainfall is about half of that of Vancouver with a total of 959 mm, (Sprague: Nine Lakes Report, Nov.2009) but the minimum has been as low as 566 mm. Approximately 50 percent of the rainfall occurs between November and January and 80 percent occurs from October to April (Community Profile, 2006). Water demands are highest during the summer months due to the influx of tourists and the requirements of agricultural and residential landscapes, when rainfall is at its lowest.

Peak day demands and system or physical capacity was not available for all water supplies, however a review of available data for NSSWD suggests that both peak daily and average annual demands are already at 60-75% of licensed capacity. In addition, historical supply shortages experienced by some on the island suggest a disconnect between rated capacity and sustainable supply.

The capacity of the lakes and streams on the island to supply water is dependent on several factors, but the most limiting is the watershed yield (AQION, 2003). The collective drainage areas for the lakes represent only a small proportion of the total island land area, and the annual surface runoff, directly from the land into creeks is estimated to be 48% of the amount of rain and snow that falls. (Sprague,2009) . St. Mary's Lake, Maxwell Lake and Cusheon lake are the three major surface drinking water supply sources. The majority of the population in the northern part of the island is served by a centralised water system (the North Salt Spring Water District or NSSWD); an additional 12 percent have licenses for surface water extraction (typically directly from a lake or stream). The lakes are currently able to meet the demands at most times of the year, but during summer months water restrictions are occasionally necessary (AQION, 2003).

In the northern part of the island, surface water supplies are expected to be 100% allocated in the next 10 to 20 years, assuming current growth rates and adherence to the current land use plan. Permits are currently used to determine surface water allocation, unlike groundwater, which is not currently regulated by the Province. Recommendations have been made to explore options for water supply augmentation in order to ensure adequate clean water through the waterworks system Some residents harvest rainwater for household use, but most rainwater harvesting is devoted to landscape irrigation and non-potable uses because no treatment is needed.

Water quality in the island's reservoirs (natural lakes) and streams is a significant concern. We do not address water quality in this report but acknowledge that if the quality is so poor as to render water unsuitable for use, that is another factor affecting the available quantity to humans. Such a situation arose in Cusheon Lake for several weeks when the lake was posted as unsuitable for consumption, or even for bathing. Information on water quality, its causes, and remedies, can be seen in the watershed management plans for Cusheon Lake (2006) and St. Mary Lake (2008).

Cusheon Lake is one of the island's largest water sources, but pollution is currently compromising the safety of using it for drinking water. Algal blooms occur in the summer and several drinking water criteria have not been met (total phosphorus, chlorophyll, total organic carbon, dissolved oxygen, water temperature, total iron, and turbidity) (McPherson, 2004). In Cusheon Lake, little more than half of the key nutrient for enrichment (phosphorus) comes from land drainage, about one quarter from regeneration from bottom sediment, and another quarter from septic fields and other household influences around the lake. (Cusheon Lake Watershed Management Plan, 2006). In St. Mary Lake, regeneration from bottom sediments accounts for 63% of the phosphorus loading and domestic septic field runoff for 29%. (St. Mary Lake Watershed Management Plan, 2008).

These water quality issues are believed to be independent of climate change.

2.1.2 Groundwater Quantity and Quality

Groundwater on Salt Spring is stored in fractures in the sedimentary rocks of the island. This type of aquifer is particularly susceptible to contamination, compared with aquifers with porous rock formations. Currently aquifers are being completely recharged each year through the transfer of approximately 25 to 150mm of precipitation into the system per year (SSI Community Profile, 2006). Many residences rely on groundwater drawn from wells for their potable water supply, and a significant number of farmers use well water to irrigate (Korteling et al., 2007; SSI Community Profile, 2006). Population growth and unregulated well development and groundwater withdrawals[2] is a greater concern for groundwater supplies than the anticipated effects of climate change.

Several issues are currently understood to be threats to the groundwater supply, regardless of the impacts of climate change. These include 1) salt water intrusion into the aquifer as a result of over pumping of wells near the shoreline, 2) contamination of the aquifer from septic systems and non-point source pollution, and 3) overuse of groundwater resulting in the inability of the annual rainfall to fully recharge the aquifer, and 4) additional development and increasing impervious surfaces on the island reducing the amount of rainfall that infiltrates (OCP Potable Water Focus Group Report, 2007). Saltwater intrusion and water quality issues have already led to abandonment of some wells (Islands Trust).

2.2 Water Management and Governance

Salt Spring Island is one of the Gulf Islands in the Islands Trust which has a special provincial mandate "to preserve and protect" the Trust area environment. The island is locally governed by two bodies: the Capital Regional District (CRD) and the Islands Trust. The CRD provides services such as regional parks, a portion of the island's water distribution through Improvement Districts, sewer, building inspection, public transit and solid waste. The local trust committee of the Islands Trust has jurisdiction over land-use planning. It adopts objectives and policies in an Official Community Plan (OCP), including guidelines for designated development permit areas. It also adopts a Land Use Bylaw which establishes zoning, permitted uses, subdivision and servicing requirements, and is a referral agency on subdivision approvals.

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[2] In BC there is currently no legislated extraction limit and no permit for groundwater pumping is required, although this is slotted to change with the implementation of the Province's *Living Water Smart Strategy* (2008).

The OCP contains objectives and policies for potable water supply and quality. Section 5.5 of the Land Use Bylaw sets out the general regulatory requirements for potable water supply on the island including quantity and quality standards for new developments.

There are 14 water Improvement Districts on SSI, 6 of them currently operating under the Regional District and able to access provincial Infrastructure Grants through the BC Ministry of Community and Rural Development to upgrade their water systems.

Salt Spring is additionally characterized by a fairly robust level of community engagement and action on water and environmental issues, such as the Salt Spring Island Water Council, the Water Preservation Society, SSI Conservancy, and the Institute for Sustainability Education and Action. Many sustainability initiatives are driven by the community and resourced by the goodwill of individuals or funded by the Islands Trust, CRD, and provincial, federal and local government grants as well as foundations and other granting programs. The community is known for a high degree of volunteerism and activism, with a large number of different groups with frequently overlapping agendas.

It is estimated that up 45 percent of the population draws its drinking water supply from private wells with no link to any larger infrastructure. The remaining potable water is drawn from “Community Systems”, which include Water Districts and Improvement Districts managed by the CRD and community systems run by volunteer boards. Most Community Systems on groundwater are close to build out and may or may not experience shortages depending on factors such as consumption patterns and culture, demographics, water efficiency retrofits with real estate turnover, and changes in both rainfall and drought season durations (OCP Potable Water Focus Group, p.58). This means that growth in groundwater use would need to largely come from new private wells or the formation of new community systems. Total growth would still have to rely heavily on surface water (OCP Potable Water Focus Group, p.59). Residential and ICI customers drawing from the Community Systems are mostly metered, however the commercial and institutional components of NSSWD (including Ganges where the majority of commercial demands exist) cannot be disaggregated from the residential sector. The majority of private wells for residential and agricultural use are presumably not metered.

2.3 Population and Growth

The population on Salt Spring Island increases significantly in summer months. Although there are few data on the number of summer residents and visitors to the islands each month, local estimates indicate that the population may at least double in summer months. This seasonal population growth, combined with significantly lower rainfall, places considerable strain on the island’s water resources during the summer months. Seasonal water demand has been reported by each system operator to comprise between 7 percent and 70 percent of total annual demand. In using the POLIS ScenarioBuilder, the seasonal population was normalized over the entire year to account for the increased summer demand for water as a direct result of increased residents and visitors during summer months, For example, in NSSWD, the total population in the summer is estimated at 5,900 and total water use in 2007 at 2040 m^3/d. However, if we assume 32% of this population only resides on SSI for 4 months of the year, redistributing the maximum population over an entire year (to match the annual reported water use) provides an “equivalent” population of 4,720. The results of this population adjustment are presented in Table 2.1. Population projections were based on growth factors for each community system.

Table 2.1 Serviced Population Growth for Community Systems, Adjusted for Seasonal Population (excludes private wells)

	2006 Total Connected Population[3]	% of Total Connected Population that is Seasonal[4]	2006 Assumed Equivalent Annual Population[5]	2026 Projected Equivalent Annual Population
NSSWD	4862	32 % [6]	3831	5134
Other Surface Water Systems	1102	22%	936	1122
Groundwater Systems	436	41 % [7]	316	369
Design Population	**6400**		**5085**	**6626**

2.4 Water Use

2.4.1 Average Annual Demand

An analysis of average annual water demands is useful for understanding annual trends in operating cost and for benchmarking average per capita daily water use in each sector against other communities. However, average summer demands and peak daily demands provide a more accurate illustration of the potential for water shortages and system design needs. The complete water use analysis is presented in Appendix A.

Private Withdrawals

A detailed analysis of private water takings was beyond the scope of this study given that growth projection values and detailed water use information was unavailable. However, an estimate of maximum water use based on license information[8] is included below, and an estimate of the potential for water savings based on reductions achieved in other locales is included in Table 2.2. These estimates should be considered only a first order of magnitude estimate, and water audits would be required to determine actual water demand and the potential for savings.

Community Systems

Residents on community groundwater systems generally exhibit behaviour resulting in lower per capita demands in comparison to surface water systems. However, the calculated per capita demand in small groundwater systems is highly dependent on the assumed population which varies significantly both temporally and within each water service area. For example, an overestimation of the population by 10 persons in a community that has 20 to 30 people could impact the calculated annual per capita demand by as much as 50%.

Given the potential for significant error in per capita demand calculations resulting from of the small population, the scenarios developed for Salt Spring using the WaterSmart Scenario

[3] Connected population has been estimated as the number of service connections multiplied by 2 persons per household for consistency. The exception is NSSWD, which multiplied connections x 2 pph and then by 71% of connections assumed to be residential based on water use in AQION (2003)

[4] Percentage of total connected population that resides on SSI during summer time only estimated by each system manager. Summer residents have been assumed to reside on SSI for 4 months

[5] The seasonal population has been adjusted to an "equivalent" annual population by multiplying the seasonal population x 4/12, and then adding in the permanent population.

[6] Data not available, assumed average for all systems.

[7] Weighted average based on flow

[8] Note that licenses are only issues for surface water withdrawals in British Columbia.

Builder have combined all Community Systems to estimate the overall potential for savings. However, the WaterSmart Scenario Builder can be applied to individual community systems.

Nonetheless, the recommendations included herein are illustrative of trends, and opportunities for savings and are therefore anticipated to be universally applicable. Individual systems can, and should, refine the understanding of water demand in their respective areas by devising a universally understood standard for reporting data and population estimates, conducting indoor and outdoor water audits and/or population surveys. However, refining water demand estimates can take place over time and does not preclude proceeding with water conservation actions.

Total average annual daily water demand for the combined Community Systems was 2,586 m^3/d in 2006.

2.4.2 Future projections

Future average day and peak day water use projections are used to construct the **Business as Usual** scenario. Residential water use projections assumed the historical per capita demands of 274 Lcd and utilized the residential growth factors provided by each system provider (refer to Appendix G for growth factors assumed in each system).

Water demand projections for each non-residential sector were extracted from an AQION report (2003). The Commercial sector was projected to grow by a factor of 1.18 and the Industrial/Institutional sector by 1.27 in 10 years. The growth factors for each sector in NSSWD were multiplied by two to account for a 20-year planning horizon (2006 through 2026) and applied to the scenarios for each system in the absence of data for the other surface and groundwater systems. These sectoral growth factors were directly input into the WaterSmart Scenario Builder calculations.

Annual average daily water demands for the combined Community Systems are projected to reach 3,451 m^3/d in 2026 as reported in Table 2.5. Peak day demands of 6,599 m^3/d in 2026 were estimated by assuming that the peaking factors will remain constant for residential and commercial sectors, resulting in a slightly lower peaking factor resulting from the higher growth rate of institutional demands. Non-revenue water – water that is unaccounted for either through leaks or other losses - has been assumed to increase linearly, and to constitute 19% of total future demands.

Table 2.2 Community Systems Current and Projected BAU Demands

Sector	Current 2006 (m^3/d)	Growth Factor	BAU 2026 (m^3/d)
Peak/Max Daily Demand (MDD)	**5120**		**6599**
Average Daily Demand (ADD)	**2586**		**3451**
Residential	1598	1.31[9]	2099
ICI (Industrial, Commercial, Institutional)	489		686
Commercial	*352*[10]	*1.36*	*475*

[9] Residential growth projections based on growth factors provided for each system

[10] Commercial demands are assumed to be 72% of total ICI based on AQION (2003)

Industrial/Institutional	*137*	*1.54*	*211*
Non-Revenue	498	1.33[12]	665

2.4.3 Climate Change Impacts

Climate change models based on the global climate factors cannot be applied directly to regional and local scales. Impacts for the Gulf Islands are shown in recent climate change modeling conducted by the Ministry of Forests (Climate BC – http://www.for.gov.bc.ca/hre/pubs/pubs/1393.htm). Summer temperatures are expected to rise in the future, while summer precipitation is expected to fall substantially. The combination of these two factors could have significant potential impacts on water supply and agriculture. Particularly in the case of water resources, there are many uncertainties within different parts of the local water cycle that make it difficult to develop future scenarios.

While summer droughts may become longer, winter storms may increase in severity. With increased winter precipitation, a larger percentage of rainfall may be lost as runoff into the ocean because the amount of infiltration to groundwater and collection by reservoirs will remain the same. If summer droughts become longer and temperatures are higher, the result could be that irrigation is needed for a longer proportion of the year; irrigation requirements per land unit per day could increase if soil moisture levels decrease as a result of greater evapotranspiration and evaporation rates (Islands Trust Fund, 2007).

2.5 Existing Water Demand Management on Salt Spring

The OCP Potable Water Focus Group report contains a number of recommendations for water conservation and water management best practices including volume-based conservation pricing, universal metering, and leak detection and conservation programming measures including toilet rebates, and education programmes. To date, a small number of best management practices and conservation programming have been initiated on Salt Spring, as outlined in Table 2.3 below.

Table 2.3 Existing Water Conservation and Efficiency Measures on SSI

	Measure
Best Practices of Water	**Leak Detection and Reduction** • Mount Belcher and Scott Point Water Districts have implemented leak detection programmes
	Metering • NSSWD, Maracaibo Estates, Scott Point Water District and Mt Belcher use an increasing block rate structure
Water Conser	**Watering Restrictions** • Scott Point Water District cuts off extreme users after due warning

[11] Commercial, Industrial and Institutional growth factors based AQION (2003)

[12] calculated from overall growth factor of residential, commercial and industrial sectors

	Measure
	Public Education • Both NSSWD and Maracaibo Estates send education letters to high users; Maracaibo publishes a public lists of high users, and Mt Belcher issues a periodic newsletter
	Rebates • SSI Water Council recently launched a low flush toilet rebate program and City Green is helping to implement the program. Applications are on the website and at the CRD building inspection office, Mouats', Slegg Lumber and Windsor Plywood.
	Other • SSI local bylaw states that the Local Trust Committee must require proof of adequate potable water supply for each new lot created by subdivision • Salt Spring Island Water Council is active • The St. Mary and Cusheon Lake Watershed Management Plans have lots of stewardship and nutrient-loading recommendations, • The *Salt Spring Tourist Accommodation Water Conservation Project* (2006) indicates that some tourist accommodations have implemented a number of water conservation measures such as flow restrictors on showerheads and low-flow toilets. • Revisions to the *OCP* (October 2008) contain a number of policies that relate to water conservation, including ones that state all developments and public institutions located in waterworks districts and all users that rely on groundwater are encouraged to conserve water and avoid using potable water to maintain ornamental landscapes; encourage the use of rainwater catchment systems and recirculated water; and the creation of a groundwater conservation strategy. At a policy level, all of these have been “adopted,” but they have not yet been included in an amended land use bylaw.

Section 3 – Water Conservation and the Soft Path on Salt Spring Island

3.1 Uncertainty and Adaptive Management

A precautionary approach suggests that we prevent unnecessary damage to ecological health by first tapping the significant source of new water available through conservation. Adapting to climate change and reducing human impact on the environment is fundamental to a long-term comprehensive approach to water management. It will also be a condition of BC Provincial infrastructure funding (BC Living Water Smart Strategy, 2008). While it is difficult to predict exactly how communities will be affected by climate change, it is important to recognize that water conservation planning is an iterative process of testing and improving methods of analysis and management policies and practices, meaning that strategies should be robust and perform well under a range of potential but initially uncertain future developments.

3.2 Applying the soft path approach: Future water use scenarios

For the strategy, the desired future condition is the simplified goal of preserving water supplies for future generations by meeting all new water needs until 2026 through conservation measures. This target is based on the understanding that expanding current water takings and constructing the associated infrastructure will damage local aquatic ecosystem health — both of which can be avoided through conservation and increased water productivity.

How Much Does Water Really Cost?
Unlike other extractive activities that have an obvious direct impact on ecological health (toxics, forestry, dams), our demand for increasing volumes of water has a cumulative "death by a thousand cuts" impact on our freshwater ecosystems. The ecological impacts of removing too much water from the source include the following:

- Energy demands for pumping, treating and heating water contribute to new hydropower dams and/or greenhouse gas emissions.
- Production of the large quantities of concrete, steel and PVC used to expand hard infrastructure has known ecological impacts.
- Diversion of water across local watershed boundaries can cause significant alterations to the natural hydrology.
- Wastewater generates point source pollution to local streams and rivers.
- Chemicals added into the water for treatment - chlorine, alum, ferrous and polymers - are ultimately released to local water bodies.

Based on population projections, three scenarios for water use in 2026 were calculated:

1) **Business as Usual**
2) **No New Water Until 2026**
3) **20% Reduction of 2006 Levels**

For the *Business As Usual* scenario current water use patterns were extrapolated to 2026 using the analysis described in Section 2.3. No water conservation and demand management measures were incorporated into the business as usual projections. However, the revisions to the BC Building Code that mandate ultra low flow toilets (6 Litres per flush) in all new construction are anticipated to reduce the average per capita residential demands on Salt

Spring Island by 2026 given that the population, and presumably the number of homes, is projected to increase by 30%.

To develop alternative scenarios, different packages of water efficiency measures and practices were applied to the **Business As Usual** baseline scenario. Combined with the targeted shift in population uptake for each measure (called the penetration rate), we arrive at the community's total water use under these new hypothetical conditions.

Reducing discretionary (non-essential) water use, such as lawn watering, car washing, and pools, can significantly reduce peak day demands and delay infrastructure expansion. The **No New Water Until 2026** scenario was therefore developed with the intention to target peak day demands, while simultaneously offering programming that will reduce average day demand and thereby save operating costs and reduce pressures on local water resources. The **20% Reduction of 2006 Levels** scenario examined the goal of "Preserving Water for the Next Generation", essentially a commitment to finding the water needed for the community to grow through conservation.

A full description of the development of scenarios is included in Appendix D.

3.3 Scenario Results

The **No New Water Until 2026** scenario targets average day reductions from **Business As Usual** of approximately 25% by 2026 to offset population growth rates of approximately 30%. As a comparison, municipal Water Efficiency Plans in Canada have tended to target a 10 to 20 percent reduction in average daily water use over 10 years through cost-effective rebates, auditing, and capacity buyback programs alone (City of Guelph, 2009; Region of Peel, 2004; Region of Waterloo, 2006; CMHC, 2004). The **No New Water Until 2026** scenario is therefore anticipated to be achievable provided funds and personnel are directed to the program. Table 3.1 summarizes the results of the scenarios, including future water demand projections and targeted water demand reductions by sector.

The second scenario, 20% Reduction of 2006 Levels, explores a commitment to reducing the water demands of future communities 20% below water use levels in 2006. This goal would help to mitigate the risks of climate change which may impact the water resources available to the community. The results of both scenarios are summarized in Table 3.1.

Reduction of peak day demands offers significant system efficiencies; in many communities 50% of the system is constructed to serve a single day (or in some cases a single hour) of the year. The two scenarios illustrate the opportunity to significantly reduce peak day demands for system-supplied water by shifting to non-potable sources of supply such as greywater and rainwater for irrigation. All estimates have been based on available water demand information, meaning assumptions for indoor and outdoor water use, per capita demand, peaking factors, etc. may contain inaccuracies as a result of insufficiently detailed data. As monthly (or daily) meter readings are obtained, the data and estimated savings can be refined.

Table 3.1 Summary Table for Water Demand Targets in Community Systems

Parameter	Current 2006 (m³/d)	Scenario 1 BAU 2026 (m³/d)	Scenario 2 No New Water Until 2026 (m³/d)	Scenario 3: 20% Reduction of 2006 Levels (m³/d)
Equivalent Serviced Population	5,832	7,660	7,660	7,660
Peak Day Demand (PDD)	**5120**	**6599**	**4550**	**2193**
PDD Target Reduction[13]		***0%***	***31%***	***67%***
Annual Average Day Demand (AADD)	**2586**	**3451**	**2586**	**2018**
AADD Target Reduction		***0%***	***25%***	***41%***
Residential Demand	**1598**	**2099**	**1373**	**955**
Residential Demand Target Reduction		*0%*	*35%*	*55%*
ICI[14]	**489**	**687**	**613**	**516**
ICI Demand Target Reduction		*0%*	*10%*	*25%*
Non-Revenue	**499**	**665**	**601**	**546**
Non-Revenue Target Reduction		*0%*	*10%*	*18%*
Private Agricultural Demand				
Private Domestic Demand				
Non-Revenue Target Reduction		*0%*	*10%*	*18%*
Residential Per Capita Demands (LCD)	*274*	*274*	*179*	*125*

[13] % reduction in water demand from Business as Usual

[14] Industrial, Commercial, Institutional

Section 4 – Getting from Here to There: Action Items for Implementing a Soft Path Strategy

All too often, contemporary water efficiency efforts are viewed as ad hoc measures aimed at buying time until new supplies can be secured and developed. The soft path differs fundamentally from these efforts by directing planners to look beyond programs aimed at simply using water in more efficient ways. Instead the soft path tackles broad questions—asking not only how to use water more efficiently, but, in some cases, why use water at all? This shifts the objective of water management from expanding and maintaining water supply infrastructure to providing water-related services, such as new forms of sanitation, drought-resistant landscapes, rain-fed ways to grow certain crops, or even influencing what crops are grown in the first place.

This strategy is not a detailed analysis, nor does it provide a complete plan of action. Instead this is a coarse survey that illustrates what is possible by integrating various technological and policy measures. This should not be considered an endpoint. On the contrary, it is only the beginning of a dialogue about what kind of future makes sense for Salt Spring Island. A number of potential barriers slow or impede the implementation of water conservation measures. Perhaps most important among these is the general lack of public awareness on Salt Spring about the region's water resource limits and the associated impacts on economic development and ecosystem health. This lack of awareness limits community and political commitment to a long-term and comprehensive approach to demand management. With little sense of urgency, inertia maintains the status quo.

The following action items and associated recommendations represent the immediate (and likely most effective) opportunities to begin creating a more sustainable approach to water management for Salt Spring Island regardless of which scenario is adopted.

4.1 Screening Measures for Action Items

Although there are many ways to reduce water use, not all of them are applicable to Salt Spring Island. Potential water conservation and efficiency measures were subjected an informal screening process before being included in Salt Spring Soft Path Plan. Each recommendation was qualitatively evaluated based on the following criteria and only those measures meeting these criteria have been included as recommendations below:

Technical Feasibility
Measures must be based on proven technology and expertise and must reduce water demands as intended

Applicability
Measures must address inefficient water demand occurring in the region and be within Salt Spring's jurisdiction

Social Acceptability
Measures must satisfy the values and priorities of the Salt Spring Island community (participation rates may be greater for measures that are more socially acceptable)

Where possible, *cost-effectiveness* was also taken into consideration when reviewing potential measures. While some water efficiency planning works to gauge cost-effectiveness according to the degree to which a given measure costs less to implement than to meet the same water demand through infrastructure expansion, a soft path approach takes a more holistic look at costs, including the cost of removing water from the ecosystem (generally difficult to measure using conventional approaches to costing).

4.2 Action Items - All Sectors

A commitment to "preserve water for the next generation" – meaning that all new demands for water will be met through conservation and efficiency rather than expanding supply, would be a significant step toward water sustainability and sustainable water leadership on Salt Spring. Aiming for water neutrality on Salt Spring would mean mandating the highest level of water efficient fixtures and appliances in all new construction, use of alternative sources of water (e.g. rainwater capture and recycled water) for toilet flushing and landscape management, the use of off-site recycled water where available, conservation-based pricing for the residential and ICI sectors, and a progressive programme that targets reductions in residential outdoor water use and use in the agricultural sector.

4.2.1 Set an Overall Water Use Goal of "Preserving Water Supplies for the Next Generation"

Adopting a vision of "Preserving Water Supplies for the Next Generation" for Salt Spring inspires a paradigm shift towards water conservation without using an absolute or percentage reduction target that may be difficult to quantify. It means focusing on the abundant supply of "new water" that is being flushed down the drain in the interest of ensuring the long term sustainability of water supplies, minimizing damage to sensitive aquatic ecosystems from new infrastructure, and increasing overall community resilience by doing more with less. The financial benefits of committing to conservation now will reduce all future expenditures on water and wastewater. Water conservation planning is flexible and can be adapted over time with improvements in technology, changing social values and norms and the needs of the community stemming from increasing pressures on limited resources.

An overarching water conservation target sends a clear signal to islanders that water conservation and efficiency are essential to continued economic and ecological health. Naturally, there are challenges associated with setting overarching targets, particularly in the absence of solid baseline information on existing water use and the potential for water savings in each sector (residential, institutional, commercial and industrial and particularly agricultural). Yet in spite of these challenges, a target provides incentive for change and a benchmark with which to gauge progress.

Specific Actions:

- Adopt a public commitment to "Preserve Water Supplies for the Next Generation" for Salt Spring Island and embed in OCP and other planning documents

Who's Already Doing it?

- *Calgary, AB* – Calgary's "30-in-30 by 2030" target is aimed at accommodating Calgary's future population growth with the same amount of water removed from the Bow River in 2003. The City's Water Efficiency Plan takes into account residential, commercial, municipal and industrial water use.
- *Los Angeles, CA* – Released an aggressive water conservation plan in July 2008 that targets 100% of new demand for water to be met through water conservation and water

recycling by 2030, with 50% of all new demand being filled by recycled water by 2019 and the other 50% being met through additional conservation.

- *Guelph, ON* – Guelph is aiming for a 20% (10,600 m3/day) water reduction by 2025 with an explicit goal "to use less water per capita than any comparable Canadian City"
- *Okotoks, AB* – Okotoks is one of the first municipalities in the world to establish population growth limits linked to infrastructure development and the environmental carrying capacity of water source (Sheep River)
- *Dawson Creek, BC* has committed to a 50% reduction in water use by 2020
- *Great Lakes St. Lawrence Cities Initiative (GLSLCI)* has 62 member municipalities from the river's mouth to the innermost reaches of Lake Superior, and 33 local governments – not all of them GLSLCI members –working towards water consumption levels that would, by 2015, be 15 per cent below the volume used in 2000
- *Region of Peel, City of Waterloo, and City of Durham, ON* have all pledged to increase water efficiency by approximately 10% over 10 years.

4.2.2 Create a Water Demand Management Coordinator Position

Hiring a permanent staff person (either full-time or part-time) with technical skills and understanding in fields such as ecology, social marketing, economics, and education is a critical first step in developing and implementing any long-term water conservation strategy. A project coordinator that is shared among the Southern Gulf Islands, working toward the same goal and objectives and sharing information, resources and expertise will be able to exercise greater control over the implementation process, thereby increasing the likelihood of success. Responsibilities of the coordinator can include measuring, tracking and reporting on the performance of the water soft path strategy and establishing and implementing water conservation and efficiency measures.

Specific Actions

- Create a Water Demand Management Coordinator Position for Salt Spring Island. Eventually southern Gulf Islands should consider sharing a minimum of three FTE staff positions, including residential, agricultural and ICI and outreach positions and 4 PTE seasonal (summer) positions
- Create a webpage for the SSI Water Council (with links to the Islands' Trust and CRD websites) that displays information and resources for water conservation and acts as a public hub for water conservation initiatives on SSI
- Funding options: In Year 1 the SSI Water Council could consider acquiring non-profit status in order to access funding from foundations and other grant programmes. Alternatively, an MOU can be drafted between the SSI WC and another organisation that already has non-profit status (for example the Water Preservation Society) to fundraise for the position. SSI can also consider implementing an optional "water credit offset" programme for visitors to be administered through a local non-profit. A third option is to work with the CRD to have it create a permanent .5FTE Coordinator specifically for the Southern Gulf Islands. For all of these options, in future years water rates should be structured to extend to water conservation planning and programming (see 4.2.3).

Who's Already Doing It?

- *CRD* has a comprehensive Demand side management team with 5.5 FTE as of 2009 and 4 summer students plus 1 winter co-op student every year with an annual total operating budget in 2008 of $1.5 million
- The *City of Guelph, ON* has 3 FTE and 4 PTE (seasonal) staff with an annual budget for its

Water DSM programme of $825,000. Beginning in 2010 the staffing will increase to 6 FTE and 4 PTE (seasonal) with 1 PTE (ongoing co-op student) and an annual budget of $2-million

4.2.3 Implement Full-Cost and Volume-Based Pricing

In the majority of Canadian communities water rates fail to reflect environmental costs, and in many cases do not even reflect the full financial cost of providing water services. Canadians paying flat rates use 74% more water than those under volume-based structures. Full cost water rates should extend to protecting the source, replacing aging infrastructure at a reasonable rate, water conservation planning and programming, education, research, and treatment of wastewater as opposed to a narrow focus on water treatment infrastructure. Heavily increased progressive rate structure at levels that are likely to bring projected build-out demand and supply in balance

Specific Actions

- Require individual metering in all new residential and ICI developments connected to a community water system
- Implement separate volume-based pricing schemes for residences, businesses and agriculture to encourage water conservation
- Provide homeowners and businesses with water bills that clearly indicate their daily water use, which can then be compared to water use per person on the Water Council website
- Implement volumetric wastewater charges for non-residential customers to encourage water conservation
- Give a property-tax rebate or credit to well users who implement water catchment.
- A similar incentive to do rainwater harvesting could be achieved by graduated pricing of delivered water.
- Explore giving a property-tax credit to off-grid groundwater users who implement a water-catchment strategy thereby causing reduced impact on the aquifer.

Who's Already Doing It?

- The Capital Regional District has implemented full-cost pricing so that customers pay the entire cost of the water they use, including the capital costs and maintenance costs
- South East Kelowna Irrigation District reduced agricultural water use by 27% over a five-year period through an increasing-block pricing system
- City of Calgary provides a good model in terms of content and format for displaying water consumption and payment information on residential water bills
- Greater Melbourne, Australia began incorporating the costs of water conservation programmes into water pricing in 2008

4.2.4 Plan for Sustainability Through "Wet Growth"

Land use decisions determine water use and watershed health now and in the future, and many patterns of development are problematic. Standard subdivision design is a classic example of how "urban sprawl" inevitably leads to more and bigger water pipes. This type of land use decision – often divorced from water use considerations – has negative impacts that may not be evident until years later. SSI should explore implementing water and land use policies that require all new developments to either offset new water demands with conserved water or purchase water rights.

Specific Actions

- Assess opportunities for leak reduction in NSSWD??
- Require that all land use decisions be assessed for watershed impacts: assess the need for expanding community well capture zones.
- Approve all new construction in a manner that ensures avoiding negative impact on the supply and quality of potable water by requiring a permit and a development plan for all construction that states how potential problems related to water supply and quality will be handled
- Have developers include water efficiency packages for homeowners as part of their building permits
- Set reasonable irrigation limits on residential construction by establishing maximum lot sizes
- Where appropriate and applicable, offer incentives to developers to develop "closed loop" communities that supply their own "off the grid" wastewater systems and use rainwater harvesting for outdoor and toilet use

Who's Already Doing It?

- *Dockside Green in Victoria, BC* is a 1.3 million square foot development comprised of mixed residential, office, retail and industrial space in downtown Victoria. The development uses a "triple bottom line" approach to integrate a closed-loop water system featuring cutting-edge conservation technologies, alternative sources, drought-resistant landscaping, and water reuse and recycling to minimize municipal water demands and water impacts, including 100 percent onsite sewage treatment.
- *Cochrane, Alberta's* 2008-09 Water Conservation Strategy provides that, "Under the Land Use Bylaw, the minimum naturescaping requirement for residential areas is 25%" and "Commercial properties must be 100% naturescaped."

4.3 Residential Use

4.3.1 Efficient Indoor Residential Water Use

Municipalities spend millions of dollars per year on rebate programs that would no longer be necessary if water-wasting fixtures (such as 13L toilets, top-loading clothes washers, inefficient pre-rinse spray valves) were no longer available for purchase. Mandating best available efficient fixtures in all new construction that meet or exceed existing international standards through bylaws and by updating specifications regularly is much more cost effective than conducting retrofits later, and ensures all new demands for water are the most efficient possible.

Residential water consumption is influenced by both lifestyle (personal habits, showering frequency/duration, laundry frequency, irrigation practices etc.) and the technology used in the home (type of toilet, showerhead, clothes washer etc.). Typically about 75% of indoor water use is related to just three elements: toilet flushing (31%) laundry (25%) and showers (19%). [15] A recent study shows that up to half of the water savings achieved by retrofitting homes with efficient clothes washers, dish washers, toilets, showerheads, fridges and landscape packages appears to be from changes in participant lifestyle and habits vs. improvements in technology.[16]

[15] Aquacraft. Residential End Use Study.

[16] Veritec (2008)

This is significant in terms of recommendations because it means that the potential for water savings is far greater than can be explained simply by the installation of efficient appliances. In other words, municipal efficiency improvement programmes should promote both physical changes to fixtures, appliances, gardens etc. through rebate and give-away promotions, as well as habitual changes regarding how these fixtures, appliances, and gardens are achieved through education and outreach programmes.[17]

Table 4.1 Getting From Here to There, Salt Spring vs. Benchmarks, Indoor Residential

		Target		Benchmarks			
Benchmark	Salt Spring Current	Scen 2	Scen 3	Water Wasting Homes	New Homes today	Water Efficient Homes	Water Sensitive Homes[18]
Per Capita Demand (LCD)	200-275[19]	130 - 180	90 - 125	250-350	200 LCD	150 LCD	60 LCD
Assumptions	*Varies depending on population estimates and water source*	*To meet target, need to shift to between 50-100% of homes being water efficient or water sensitive homes by 2026*		*-Leaks -Top Loading washer -13-20 Lpf toilet -12 Lpm showerhead*	*-6 Lpf toilet -No leaks -9.5 Lpm showerhead*	*-4.8 Lpf toilet -Front loading clothes washer*	*Rainwater, greywater or composting toilet used for toilet, laundry and shower*

Note: Water use audits would need to be completed to assess the extent of water wasting practices and technologies

Specific Actions

- Work with CRD and federal programmes, local businesses and manufacturers to ramp up a comprehensive island-wide rebate programme that includes toilets, showerheads, washing machines and irrigation systems
- Investigate options to require the installation of water efficient fittings and fixtures in all existing homes upon resale, or mandating disclosure of water efficiency at point of sale
- Work with local businesses and retailers to extend standards beyond new construction to point of sale transactions (i.e. discourage the sale of water inefficient fixtures such as 13 L toilets)
- Require plumbing rough-ins that enable future water collection and use of alternative sources for toilet flushing and lawn watering (purple pipes) as will be mandated in BC according to Living WaterSmart by 2010
- Create an extensive high-efficiency fixture and appliance retrofit and installation programme for all residences that focuses on toilets, showerheads and clothes washer replacement

Who's Already Doing It?

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[17] The study also calculated that the payback period associated with upgrading the study homes is approximately 3.4 years - which is reasonable considering that the retrofitted fixtures and appliances installed will last much longer than 3.4 years. It was also projected that after the 3.4 year period the homeowner will start to save more than $200 per year in water and energy costs (Veritec 2008, p.22)

[18] this is the standard for new homes in many states in Australia

[19] per capita demand varies in each community system and data inaccuracies with seasonal population and an absence of monthly demands made an accurate assessment difficult.

- The *"Target 140" programme in Australia* saw residents of Southeast Queensland reduce their per capita water use from 295 lpd to 140 lpd through a series of restrictions, education programmes and water conservation-based rates. The programme attributes the largest reduction in residential water use to its "Home WaterWise Rebate Scheme", an extensive home visit programme that had project staff going to each home and replacing all fixtures with high efficiency fixtures as well as rainwater tanks plumbed into internal fixtures at a significantly subsidized cost to homeowners
- *The US Energy Policy Act* sets minimum water efficiency standards for both new construction and all point of sale transactions
- *District of Campbell River Engineering Services* has produced a good paper on conducting both residential and commercial indoor water audits for the purposes of identifying high water use devices that can then be replaced or retrofitted to save water
- *Sunshine Coast Regional District* saved approximately 3.2% of total annual municipal water use in 2007 alone through its rebate and installation programme

4.3.2 "Go Golden" Campaign to Reduce Outdoor Water Use

Outdoor water use is a primary factor contributing to peak demands in Canadian communities. For this reason, outdoor summer demands should be one of the primary targets of Salt Spring's water conservation programme. Although odd/even day watering restrictions are common in Canada, from a practical and mathematical perspective they tend to offer little in the way of savings. Instead, limiting water use to one day per week is becoming more common in the US and Ontario. "Go Golden" refers to letting lawns go golden in times of decreased precipitation and water shortages.

Table 4.2 Getting From Here to There, Salt Spring vs. Benchmarks, Outdoor Residential

		Target		Benchmarks[20]			
Benchmark	Salt Spring Current	Scen 2	Scen 3	Automatic Irrigation Systems (AI)	Tuned AI	Manual Sprinkling	Water Sensitive Homes
Per Capita Demand (LCD)	20-60[21]	18 - 36	0	> 50	> 20	10-20	0 – 10
Assumptions	*Varies depending on population estimates and water source*	*To meet target, need to shift to between 50-100% of homes being water efficient or water sensitive homes by 2026*		*-Watering more than 1" per week -Waters when unnecessary*	*-50-70% less than untuned AI -Tuned to water 1" per week or less only when necessary*	*--50% less than tuned AI -Water ¼ to 1/3"" per week*	*-25-100% less than manual -Rainwater, greywater, xeriscaping, drip irrigation*

Specific Actions

[20] Outdoor water use is highly variable and dependent on lot size, climatic conditions and frequency and duration of watering. These estimates are based on research in Ontario and best used to illustrate the reduction in water use from shifting to water efficient practices

[21] per capita demand varies in each community system and data inaccuracies with seasonal population and an absence of monthly demands made an accurate assessment difficult.

- Offer residential landscape water audits and home visits to residences drawing from private wells and community systems
- Implement a bylaw limiting outdoor residential watering to one day per week and use a tiered system of communication/outreach program and enforcement to enforce compliance
- Mandate water efficient landscapes in all new homes
- Set a target of reducing irrigation by 15% through a number of measures including a centralized irrigation system (the largest in North America) as well as irrigating "only when necessary" and banning irrigation on boulevards, medians, traffic; using drought-tolerant plants and xeriscaping; having developers submit irrigation master plans early
- Continued incentives and rebates programme for homeowners for rain barrels and rain gauges, hose timers and automatic irrigation systems
- Offer automatic irrigation system tuning and education local landscape irrigation professionals

Who's Already Doing It?

- *York, Guelph, Waterloo, ON* each implement bans during drought conditions and use a tiered system of communication/outreach program and enforcement to enforce compliance.
- *City of Kelowna* found that seasonal residential landscape water audits and home visits (mid-April to August 31st), where City staff visited homeowners and conducted irrigation system, landscape and soil assessments was key to reducing outdoor water use by 15% in the first year of the programme. WaterSmart staff is certified by the Irrigation Association of BC. Similar pilot programmes completed in Durham and Halton, Ontario have shown an average peak day savings of about 200 litres per single-family household. The pilot programmes involved distributing water efficiency items such as rain gauges and hose washers and information pamphlets to households.
- *Vernon, BC* limits lawn coverage to 30% of property
- *Cochrane, AB* requires that all landscaped areas have a naturescaping component, where **"naturescaping "** refers to the modification and enhancement of a lot or development area through the use of natural indigenous vegetation, in conjunction with permeable or pervious surfacing material, such as brick, stones, wood, and similar indigenous landscaping materials. **100%** on all non-residential developments are required to be naturescaped, **50%** of all multi-unit residential developments, and **25%** of all other residential developments
- *District of Campbell River Engineering Services* has produced a good paper on conducting residential landscape and irrigation water audits

4.4 ICI Sector

Increase efficiency and conservation across the ICI sector.

Table 4.3 Getting From Here to There, Salt Spring vs. Benchmarks, ICI

	Salt Spring Current	Scenario 2	Scenario 3	Benchmarks
Targeted Industrial /Institutional Savings	0% reductions,	15% reduction in industrial use	25% reduction in industrial use	15-50% potential reduction (Vickers, 2001; Cohen, 2004)

Targeted *Commercial Replacements*	Unknown	15 Toilets, 15 Pre-Rinse Spray Valves, 15 Efficient Clothes Washers	50 Toilets, 50 Pre-Rinse Spray Valves, 50 Efficient Clothes Washers	Region of Peel (2004) toilet replacement targeted 11,600 commercial toilets. City of Calgary had replaced 1300 pre-rinse spray valves by 2008.

Note: The ICI sector can't be usefully represented as a per capita demand benchmark because of the highly variable nature of water use in this sector. Water audits can help assess the potential for savings.

Specific Actions

- Pre-rinse spray valve, toilet, clothes washer rebates/education, water audits of top 10 users
- Designate part of the DSM Coordinator's time toward addressing water reductions in the ICI sector with responsibilities that include conducting comprehensive process-based audits of ICI
- Educate businesses about their water use and encourage them to implement water conservation programmes through an "Every Drop Counts" programme
- All businesses using more than a certain amount (for example, 10ML/year) must prepare, submit and comply with a Water Efficiency Management Plan (WEMP). Under the WEMP the business must achieve a 10-20% reduction in total water consumption or comply with best practice in an agreed upon timeframe
- Develop water efficiency guidelines to assist businesses in implementing WEMP as an ongoing priority
- If not using aggressive volume rate structures implement incentive-based capacity "buy back" programme
- Implement restaurant rebate & pre-rinse spray valve and accommodation industry bathroom audit and retrofit programmes

Who's Already Doing It?

- The *Capital Regional District* has an ICI efficiency staff member to conduct ICI audits as does the City of Toronto
- *Sydney, Australia* Water's "Every Drop Counts" programme is an interactive arrangement with businesses to diagnose, develop, implement and review improvement plans. An online plan selector programme allows nurseries, landscapers and gardeners to select water efficient plants for their area and soil type. Low cost and crisis accommodation are provided with audits and retrofits to facilitate their participation to help meet water use efficiency targets
- All businesses in *South East Queensland, Australia* using more than 10ML/year must prepare and comply with a WEMP
- *City of Calgary* launched a Pre-rinse Spray Valve programme in 2007 that targeted restaurants, institutional kitchens and other food prep facilities. A total of 1,200 high-flow pre-rinse spray valves were replaced with low-flow models. On average, participants saved 358 litres per day per spray valve installed, with estimated water and energy savings between $1,40o and $1,800 over the five-year life of a valve. Some participants even reported canceling the installation of second hot water tanks for their facility.

- *City of Toronto and the City of Guelph* both have capacity buyback programmes to "buy back" water savings from ICI users in order to help defer proposed expansions to water supply networks. A one time capacity buy back incentive is offered to each facility, paid once the water savings have been confirmed by onsite metering data.

4.5 Agricultural Sector

4.5.1 Data Collection

In order to make informed decisions about water use, the SSI Water Council should make a concerted effort in close cooperation with farmers to gather more data about agricultural water use on Salt Spring. This information would not only enhance understanding of the timing of water demands, it can also help farmers plan for farm water use and measure the success of their conservation efforts.

Table 4.4 Getting From Here to There, Salt Spring vs. Benchmarks,

	Saltspring Current	Scenario 2	Scenario 3	Benchmark
Targeted Reductions	0%	10% reduction in demand	20% reduction in demand	10 – 40% reduction potential (Pacific Institute, 2009, Georgia's Water Conservation Implementation Plan, 2009)

Specific Actions

- All users of water for agricultural purposes (irrigation, food processing etc,) should be 100% metered, regardless of whether water is being pulled from private or centralized systems
- Farmers and growers should be provided with reports from annual meter readings for comparison of their water use with others farmers and growers across the Southern Gulf islands
- Audits of largest users to enable DSM coordinator to conduct research into efficient technologies and practices for specific agricultural and food processing (for example, cheese, tofu etc.) subsectors

4.5.2 Improve Water Efficiency for Irrigation

Irrigation represents the biggest opportunity for improving efficiency in agriculture. Three areas should be considered when looking to reduce water use in irrigation: reducing wasted water and runoff, improving efficiency of the irrigation system, and reusing irrigation water (the largest opportunity for water savings in greenhouses).

Reducing water use for agriculture also has the potential to reduce peak energy demand. For example, in Idaho an innovative program provides incentives for farmers to turn off their pumps and stop irrigating in the late afternoon, when evapotranspiration rates are at their highest. Not only does this strategy save water by encouraging farmers to irrigate during cooler, less evaporative periods of the day, it has also reduced energy demand on hot summer days by more than 5 percent. Instituting irrigation controls to improve water efficiency and reduce peak electricity demand is a win-win solution for farmers, energy providers and the ratepayers who would have to finance the costs of expanding electricity supplies.

Improved irrigation scheduling can also result in large water savings. A recent report by the Pacific Institute found that irrigation scheduling reduced water use by 20% while also reducing energy, fertilizer, and labor costs. The study found that the benefits of irrigation scheduling exceeded the costs, with a net return of nearly $13 per acre (in year 2007 dollars) (Buchleiter et al. 1996).

Specific Actions

- Implement rebate programmes to install more water efficient devices for use for irrigation
    - By 2012, all new, and by 2020, all existing devices for use in irrigation (drip or trickle and sub-irrigation systems such as ebb and flow, flood floors, troughs or capillary mats) as well as water recycling/recirculation systems and in food processing plants (high-pressure, low-volume nozzles on spray washers, fogging nozzles, in-line strainers for all spray headers) should have application efficiencies of 80% or greater.
- Produce education materials that remind growers of water efficient growing techniques such as irrigation scheduling and grouping plants with similar water needs together to improve efficiency and watering plants intermittently to increase absorption. Materials should also point to the potential of water recycling and rainwater harvesting through storage ponds, retention basins, and storage tanks as a means for reducing water use
- Conduct one-on-one onsite water audits to help growers use less water

4.6 Looking to the Future

4.6.1 Rainwater and Waste(d) Water as the Source

In some countries, rainwater collected from roofs or other impermeable surfaces is a viable source of water for outdoor irrigation, and for many indoor uses such as laundry washing or toilet flushing. Yet on Salt Spring Island, with average annual precipitation about 959 mm (the Canadian average is around 250mm) rainwater harvesting (RWH) is vastly underused, resulting in missed opportunities to save 40% to 50% of the water currently used around the home. Rainfall in summer months can be sporadic on Salt Spring suggesting that larger cisterns or tanks would be more appropriate than rainbarrels. Rainwater could be utilized for indoor toilet flushing and clothes washing during winter months when rainfall is abundant. With appropriate tank sizing, many island residents have found rainwater harvesting to be an effective way to meet their summer water needs.

In 2010 the BC Ministry of Housing and Social Development is looking to update the Building Code to include RWH in response to government's commitment to "mandate purple pipes in new construction for water collection and reuse by 2010" outlined in the Living Water Smart strategy. The Ministry is also considering enabling interested local governments to require RWH within their jurisdictions. These local governments would enter into an agreement with the Province that gives them the necessary authority, while specifying the Code provisions that would apply to rainwater harvesting systems. Communities would also be asked to collect and pass on data on costs, benefits and implementation, to help evaluate the potential for a province-wide Code requirement for RWH.

Getting From Here to There
The benefits of rainwater harvesting have been incorporated explicitly in the indoor and outdoor residential sector analyses, targets and benchmarks. However, rainwater harvesting can be an effective way to provide water from industrial, commercial and institutional needs, as well as reduce stormwater runoff and associated pollution.

Specific Actions

- Designers, builders and the CRD building inspector should work to make clients aware of the potential of designing for some degree of rainwater catchment
- Develop practical guidelines and specifications to assist homeowners in the proper installation of rainwater, greywater and black water collection systems and the installation of composting toilets
- Implement rebate and installation programmes to enable uptake of onsite rainwater catchment and greywater reuse for homeowners
- Provide information on groundwater recharges, precipitation runoff and evaporation rates to assist RWH projects

Who's Already Doing It?

- *Guelph, ON* is piloting rainwater harvesting cisterns and reuse
- *Nova Scotia* has a rainwater cisterns best practice guide (provincial) and Dalhousie University has modelling software to create custom RWH designs for residences.
- *Pimpama Coomera* housing development in Southeast Queensland (2500 homes, growing by 120 homes/month) has a Class A+ Recycled Water Treatment Plant that supplies toilets & outdoor water use. Each home also has mandatory rainwater tanks used for laundry cold water & outdoor use.
- *State Of Arizona* has a one-time tax credit of 25% of the cost of water conservation system (the maximum limit is $1,000) for its residents. The water conservation system is defined as any system, that can harvest residential grey water and/or rainwater. Even builders are eligible to get the tax credit up to $200 per residence unit constructed with a water conservation system.
- *New Mexico, Santa Fe County*- Residences with 2,500 sq ft or more area must install an active rainwater catchment system comprised of cisterns. All commercial developments are required to collect all roof drainage into cisterns to be reused for landscape irrigation.
- *Albuquerque and Bernalillo County*- Residences with 2,500 sq ft or more area must install an active rainwater catchment system comprised of cisterns. All commercial developments are required to collect all roof drainage into cisterns to be reused for landscape irrigation.
- *State of Texas* amended the Texas Tax Code to allow taxing units of government the option to exempt from taxation all or a part of the assessed value of the property on which water conservation modifications have been made.

4.7 Five Year Implementation Overview

1. Hire a co-ordinator, funded through NSSWD, the CRD, who will make use of existing resources in the CRD and adapt for use on SSI....

1a) Co-ordinate an improved data collection and reporting system amongst community systems to ensure reporting is standardized across systems.
1b) Co-ordinator will develop a detailed 5-year action plan, including anticpated annual water savings dependent on program initiatives.

2. Launch toilet rebate program and offer rebates ONLY for high efficiency/dual flush toilets that meet MaP testing specifications to maximize effectiveness

3. Co-ordinator to develop and deliver an educational campaign consisting of (at a minimum) water bill inserts, education for commercial facilities on the hot water cost benefits of pre-rinse spray valves,

4. Education/liase with hardware stores that sell water efficient fixtures to ensure they stock the best models, train employees and have signage to guide purchases

5. Co-ordinator to hold rainwater harvesting workshop including pitfalls to avoid, regulatory constraints and approvals, tank sizing and connections, etc.

6. Revisit targets, successes, failures and adapt and adjust strategy for next 5 years to meet targets.

A more detailed 20 year sample implementation plan is included in Appendix B.

4.8 Implement for Success

The observed rate of water savings will depend on the aggressiveness, available funding and effectiveness of the program; the residential, industrial, commercial and agricultural growth rates; and natural replacement frequencies of water use fixtures. For example, a toilet has a typical replacement period of 25 years, whereas a clothes washer will tend to be replaced on average every 7-10 years making the rate of substitution with an efficient model much more rapid. The persistence of inefficient technology for 10-20 years illuminates the importance of ensuring new development is as efficient as possible.

Methodologies for estimating these replacement rates and savings are available in a number of readily available references including water efficiency plans developed for other communities[22] and water efficiency planning manuals.[23] Specific programming calculations are, however, beyond the scope of a long-term soft path planning exercise and should be executed by in-house staff during the first year of program planning.

4.9 Cost Comparison

We have not calculated costs here. The case for the cost-effectiveness of water conservation programs has been made in many communities across Canada. For example, if the City of Barrie, Ontario had not proceeded with a programme to conserve water and reduce wastewater flows beginning in 1998, construction on its wastewater treatment plant would have cost approximately $41 million, compared to approximately $3.1 million for the conservation programme (Ontario MOE, Green Industry. August 2008). The Region of Peel's Water Efficiency Plan (2004) resulted in a cost-benefit ratio of 0.29, or about one-third the cost of expanding Peel's water and wastewater infrastructure.

Many of the cost-benefit analyses that have suggested water conservation can provide "new water" at a fraction of the cost of supply-side hard infrastructure rely heavily on rebates to achieve savings. Although this approach is both reliable and measurable, key considerations

[22] See for example Region of Peel (2004) and City of Guelph (2009)

[23] See for example OWWA (2006)

for many municipalities, rebates are by no means the least cost approach. Policies (bylaws) and education can achieve similar impacts at a fraction of the cost of rebate programs.

And the savings don't stop there. In addition to the direct one-time capital cost savings for upgrading supply, the following additional savings and environmental benefits could potentially be realized by 2031 (ranges represent the difference between the Enhanced Efficiency and Conservation Commitment scenarios):

- Operating and maintenance cost savings for potable water treatment
- Operating and maintenance costs for wastewater treatment and collection, and potable water distribution,
- Significant cost savings for future water treatment systems,
- Capital costs for wastewater pumping expansion
- Reduced storm water overflows and run-off by capturing rainwater and reducing base sewage flows, protecting local water bodies and aquifers,
- Reduced levels of chlorine will be discharged to the ecosystem,
- Reduced CO_2 emissions every year from reduced hot water use in the residential sector and reduced pumping from wells and surface water supplies.

A literature review of economic and environmental benefits of water conservation is provided in Appendix C.

Appendix A - Water Demand Analysis

Private Water Takings

Residential

Water use for private wells on Salt Spring was estimated using water license data. The maximum allowed limit for all existing water licenses for domestic use is 652 m^3/d.

Agricultural Demand

Water use for agriculture on Salt Spring was estimated using water license data. The maximum allowed limit for all existing water licenses for irrigation is 1482 m3/d and is more than half the current demand of the combined community Systems (note that licenses for conservation, land improvement, and works/fire/storage licenses are omitted from this figure). However, this estimate does not account for groundwater withdrawals or growers pulling from private systems such as wells and retention ponds.

Community Systems

Total average annual daily water demand for the Community Systems was 2,586 m^3/d in 2006. Table 2.2 further disaggregates water use in NSSWD, the other surface water systems and the groundwater community systems into residential, industrial commercial institutional (ICI) and non-revenue water demand for 2006. The majority of users connected to Salt Spring Island Community Systems are metered, however in some cases a breakdown of commercial vs. residential billings data was unavailable. So while some of the water use from each sector is based on actual measured volumes reported by the various systems, the remaining demand represents a first estimate and is considered much less accurate.

Table A.1 Community Systems Disaggregated Average Annual Day Demands (m^3/d)

	NSSWD[24] (m^3/d)	**Surface Water Systems**[25] (m^3/d)	**Groundwater Systems**[26] (m^3/d)
Residential	1284	464	78
ICI	405	11	0
Non-Revenue	351	153	4
Total	2040	464	82

The groundwater-based systems were assumed to have very little commercial or industrial demand for water. The other surface water systems were estimated to have only 2% of total water demands allocated for commercial use, with the bulk of commercial demands in Fulford. The NSSWD serves Ganges, the primary commercial hub on the island, and estimates for the breakdown of residential, ICI and non-revenue water demands were based on a combination of metering data and an assumed correlation of water demand with land-use service area data (AQION, 2003).

[24] Ratios of sector base demands in NSSWD were determined using data in AQION (2003) report.

[25] Includes Fernwood, Highland, Fulford and Beddis

[26] Cedar Lane, Cedars of Tuam, Maracaibo, Mount Belcher, Harbor View and Reginald Hill

Residential Demand

Residential water use constitutes approximately 60% of the total water demand in NSSWD and more than 65% in the other systems. An average daily residential (indoor and outdoor) water consumption of 334 litres per capita per day (Lcd) in 2006 was estimated for NSSWD by dividing the total metered residential water use by the equivalent annual serviced population. The other surface water systems have an estimated per capita demand of 320 Lcd and 246 Lcd in the smaller groundwater systems.

Environment Canada's Municipal Water and Wastewater Survey suggests that British Columbia's average per capita water demand is 420 Lcd, and the National Water and Wastewater Benchmarking Initiative (NWWBI) indicated average residential water use in BC is 440 Lcd (Environment Canada, 2007; AMWSC, 2009). The per capita demand analysis suggested that residential water demands on Salt Spring Island are lower than average demands in British Columbia.

The CRD estimates the percentage of outdoor water use as a total of residential use as ranging from 7% to 22% with a weighted average of 19%. In the absence of island-wide daily or monthly metering data, this estimate has been assumed to represent the average outdoor use for the entire island.

ICI Demand

The geography of the community on Salt Spring is disparate with many large properties and several small villages spread across the island. The Ganges town centre located in the centre of the island is the largest village and the major retail and business service centre on the island. The ICI sector is 19% of Average Daily Demand with the majority of institutional and commercial uses situated in Ganges and reliant on water from the NSSWD system. The highest ICI demands identified in the AQION (2003) report were offices and retail stores, hospitals and care facilities, tourist accommodations and schools. ICI demands are projected to increase at a somewhat faster rate than residential sector growth, with a particularly steep increase in water demands for hospitals and care facilities. The projected sector growth rates, over the period 2006 to 2026, of 1.54 for institutional and 1.36 for commercial were incorporated into the POLIS Scenario Builder.

Non-Revenue

Non-revenue water includes both system leakage and leakage at the end-use, fire hydrant use, water system flushing, water meter inaccuracies, and other non-metered water uses. The non-revenue water demand of the Community Systems on SSI averaged was 19% of ADD in 2006. Non-revenue water was calculated by subtracting the total water accounted for by individual meter readings from the total volume measured by bulk water meters.. Typical non-revenue values in Canada range between 5 and 20%, however a percentage does not effectively represent the degree of water loss in a system as this is heavily dependent on the volume of water used in individual facilities (Environment Canada, 2007). The Infrastructure Leakage Index (ILI) is considered the appropriate benchmark for the degree of water loss in a community. The ILI requires a detailed IWA Water Balance and is recommended as a Best Practice to accurately assess the opportunity for leakage reduction.

Peak Water Demands

Peak water demands are of particular interest because they dictate water supply capacity. Water demands approximately double during the summer months and are heavily impacted by outdoor water use and the agriculture sector. Peak day demands are much more variable from year to year than base water demands[27] as a result of temperature, rainfall patterns, and the duration of drought periods and hot weather (OWWA, 2008).

A full analysis of the peak day demands (PDD) was not possible because daily meter readings are uncommon in the Community Systems. However, North Salt Spring Island Water District reported a peaking factor of 1.98 for the Maxwell and St.Mary system combined (NSSWD, 2007). Monthly peaking factors were reported for Fulford, Beddis and Cedars of Tuam ranging from 1.1 to 1.7. Fernwood and Highland surface water systems were reported to have peaking factors of 5.8 and 3.7 respectively, which suggests very high seasonal water demands. In the absence of validated peaking factors for each system, a peaking factor of 1.98 was assumed based on NSSWD data.

This increased demand during peak periods is attributed primarily to increased summer populations and outdoor water use in the residential sector and commercial sector. The peaking factors reported are higher than peaking factors noted in jurisdictions with conservation programming in place (OWWA, 2008; Maddaus, 2002). For example, the Capital Regional District reduced its peak day factor from between 1.8-2.0 to below 1.5 in 2001 by adopting Stage 3 water restrictions. However, this reduction may be partially due to the low contribution of commercial and industrial activities that may dampen overall peaking factors in other communities. The increase in summer population is anticipated to significantly contribute to maximum monthly demands in summer months.

[27] Base water demands are the demands that remain approximately constant year round, and can be estimated by examining winter water use patterns.

Appendix B - Sample Implementation Plan

	SHORT TERM			MEDIUM TERM	LONG TERM
	Year 1	**Year 2**	**Year 3**	**Year 10**	**Year 20**
Measures					
Technologies and practices – indoor	Plan and launch residential audit & retrofit programme	Continue residential audits & retrofits	Continue residential audits/retrofits	All existing devices for use in agriculture and in food processing plants should have application efficiencies of 80% or greater	All residences and ICI use waterless toilets
Technologies and practices – outdoor	Plan and launch outdoor water use audits on residential properties Establish retail discounts for moisture gauges, hose timers and tuning for automatic irrigation systems for residential sector	Begin audits for ICI and agricultural customers (large volume users)	Continue audits for ICI and agricultural customers Implement rebate programmes to install more water efficient devices for use in greenhouses and food processing	Complete ban on lawns and water inefficient landscapes except those designated for recreational use (parks, schools etc.)	All residences and ICI properties have onsite state-of-the-art rainwater harvesting and stormwater management systems
Water capture, reuse and recycling	Establish retail discounts for residential rain tanks and grey water systems	Explore industrial and large-scale irrigation applications of greywater reuse Requirements for new developments	Pilot large-scale irrigation application of greywater on public landscapes (e.g. parks and schoolgrounds)	Implement supply-side technologies for Integrated Resource Management in centralised systems (eg Water Districts)	Larger centralised systems (eg Water Districts) is fully plumbed with purple pipes
Instruments					

	SHORT TERM			**MEDIUM TERM**	**LONG TERM**
	Year 1	**Year 2**	**Year 3**	**Year 10**	**Year 20**
Information, education and promotion	Create DSM coordinator to be shared across all (or some, for example Mayne, Gabriola and SSI) southern Gulf Islands Create a website for the SSI Water Council Public launch of strategy Develop "Water Wise" info section on website, and include explanation of workings and cost of the water system Promote audit and retrofit programme (including free installs) Educate on indoor water use reductions (residential and ICI); Link to Go Golden and Every Drop Counts campaigns	Add residential water-use calculator to website Continue promotion of audit and retrofit services Educate about outdoor water use (residential and ICI), including promoting use of rainwater harvesting tanks and xeriscaping Produce outreach materials on reducing water use in greenhouses Conduct onsite water audits to help food processors use less water (for example, using a broom rather than a hose to push waste food scraps into grates).	Continue promotion of audit and retrofit services Develop demonstration (water-wise) gardens on public lands Educate about the safety of treated recycled water		
Regulations	Mandate low-flow fixtures in all new construction Study options	Ban the sale of water inefficient devices by working with local	Institute permanent regulations re: housing driveways/paths	Ensure all land use decisions are assessed for watershed impacts	All planning begins with assessing the expected impact on the watershed

	SHORT TERM			MEDIUM TERM	LONG TERM
	Year 1	**Year 2**	**Year 3**	**Year 10**	**Year 20**
	available for rainwater harvesting and large-scale greywater re-use in residential and ICI sectors Strengthen regulations for temporary restrictions on outdoor water use (ex. Introduce 50% xeriscaping requirement in all new developments)	businesses and retailers to extend standards to point-of-sale transactions Mandate plumbing rough-ins that enable future water collection and use of alternative sources for non-potable use (toilets, outdoor) Develop water efficiency guidelines to assist ICI in implementing WEMP as an ongoing priority Require all ICI using more than a certain amount to prepare, submit and comply with a water efficiency management plan	and moisture gauges on auto sprinkler systems Continue giveaways and subsidies with audit Design and implement agricultural policies that regulate stocking densities and manure management procedures		(watercentric planning)
Economic incentives	Cost analysis and options for full-cost accounting Launch low-flow fixture (toilet and showerhead) installation programme	Continue low-flow fixture (toilet and showerhead) installation programme (residential) Launch low-flow fixture (pre-rinse	Implement volumetric wastewater charges for ICI customers Offer incentives to developers to develop “closed loop” communities	Water prices reflect full ecological costs of removing water from source and treating all recycled water to drinking water quality	

	SHORT TERM			MEDIUM TERM	LONG TERM
	Year 1	**Year 2**	**Year 3**	**Year 10**	**Year 20**
	(residential)	spray valves and toilets) rebate programme (ICI) Offer incentives to developers to develop "closed loop" communities	Implement incentive-based capacity "buy back" programme		

Appendix C - Literature Review of Water Conservation Benefits

	New Infrastructure	Conservation
Capital Costs (one time costs) for Water and Wastewater	**Range $2-10 / (L/d)**[28]	**$0.6 – 2.8 / (L/d) cost of overall 10-20 year program**[29] • <<$0.3 / (L/d) bylaw for new construction, pricing & education[30] • $0.19 / (L/d) for leak reduction • $0.2-6 / (L/d) for rebates[31] • $1.35 / (L/d) for ICI capacity buyback
Potable Water Supply	$0.4 - 4 [32]/ (L/d)	See Above
Future Supplies	Status Quo	Save 20-50% of future expansion costs as a result of much lower per capita demands
Wastewater	$0.6 – 5.7[33] / (L/d)	Save on pump and transmission main size, and treatment processes that are flow dependent. Composting toilets and wastewater reuse also directly reduce future treatment plant size (load).
Operating & Maintenance	**$0.15-1.4/$m^3$**	**$0-0.02/$m^3$**
Potable Water Treatment **Distribution**	$0.05-0.9 [34]/$m^3$ $ 4 – 10 [35]/ 1000 km	$0-0.02 [36]/yr

[28] City of Guelph (2009); Region of Peel (2004); NWWBI (2007)

[29] Average Annual Day basis

[30] Region of Waterloo (2006) budget for water conservation education; bylaws and pricing instruments have costs approaching $0.

[31] Value of rebate dependent on technology offered

[32] CMHC (2005); City of Guelph (2006)

[33] CMHC (2005); City of Guelph (2009)

[34] NWWBI (2007); OMBI (2007); $0.075 in Montreal (Ferguson, 2009)

[35] OMBI (2007)

[36] City of Guelph (2009) included $0.02/yr for monitoring water efficiency programming

Wastewater Treatment (Secondary & BNR) **Wastewater Collection**	$0.1-0.45 [37]/ m^3 $1-10 [38]/ 1000 km $0.09[39]/$m^3$	$0 Save pumping energy costs and pump expansion capital and O&M costs. Save chemical costs. UV and ozone treatment in particular may benefit from cost savings resulting from reduced flows.
Other costs		
Stormwater Costs / I&I	$31.45/$m^3$ of storage capacity[40] Sewer & Urban Ditches $0.5-3.5[41] / 1000 km	Rainwater harvesting has potential to reduce storm-water management costs, particularly if rainwater is used for toilet flushing.
Carbon Costs	$20-75[42]/tonneCO2e	$0 Carbon savings could be significant if pumps are powered by natural gas.
Intrinsic Water Value	$0.05[43] / m^3	
Replacement Costs	Pumps have a typical life of 10-20 years; membranes are much less. These replacement costs are often excluded from cost-benefit comparisons of conservation vs. hard infrastructure.	A 40 year lifecycle highlights significant conservation savings. Efficient fixtures and technology will be replaced by the end-user at no cost to the municipality. Replacing leaky pipes can reduce damage caused to roads saving additional costs.
Cost over-runs	Capital cost over-runs are frequent.	Cost over-runs are unlikely as rebate programs are fixed price, salaries are straightforward to budget, and a firm budget can be allocated for marketing.
Source Protection	New sources have to be protected which typically incurs additional expenditures.	Source protection is embedded in the cost of conservation measures. Conservation serves to reduce the impact on local water resources.

[37] $0.11/m3 AMWSC (2006); $0.075/m3 CMHC (2004); NWWBI (2007)

[38] NWWBI (2007); OMBI (2007)

[39] Montreal (Ferguson, 2009)

[40] Montreal (Ferguson, 2009)

[41] NWWBI (2007)

[42] estimated based on purchasing offset credits (CarbonZero, 2009) and recommendations from *Tomorrow Today: How Canada Can Make a World of Difference.*

[43] Kerr Wood Leidl (2006)

		impact on local water resources.
Risk Management	Increasing pressure on upstream sources, climate change, pollution all present risks to water supply.	Conservation mitigates risk by reducing demands for limited supply.

Appendix D - Scenario Development

Given the potential for error in per capita demand calculations resulting from inaccuracies in population estimates, the scenarios developed for Salt Spring have combined the water use and population projections for NSSWD, and all other surface and groundwater water districts. The water conservation recommendations are anticipated to be universally applicable, and individual water districts can refine water demand and conservation estimates over time by conducting indoor and outdoor water audits and/or population surveys.

The water saving scenarios were developed with the **POLIS WaterSmart Scenario Builder,** a Microsoft Excel spreadsheet-based tool. The Scenario Builder requires a series of steps to evaluate the potential for water savings, and to eventually arrive at a total future water demand under a given scenario. At a minimum, the Scenario Builder requires quantitative information about current and projected population and per capita water demand. Based on these values, it calculates current and projected average annual demand.

Both current and projected demands are then disaggregated—first into sectors (i.e. residential, institution & commercial, industrial, agricultural); then into sub-sectors (i.e. residential is subdivided into indoor and outdoor uses). Suites of water conserving technologies and practices are then applied to the disaggregated elements of the projected demand. For example, the penetration rate of water conservation measures is adjusted by shifting a portion of the future population from current per capita water demands of an average home to "efficient" homes with reduced water demands.

The reduced demand values are then re-aggregated into sub-sectors, sectors and total demand for the community. These re-aggregated values can then be compared to **Business as Usual** conditions to determine potential water savings for each of the two water saving scenarios. Further details on the WaterSmart Scenario Builder are included in Appendix A.

As noted previously, the two water-saving scenarios integrate a number of measures into "packages": The **No New Water Until 2026** scenario was developed using a backcasting approach. It starts with the goal of preserving water supplies for future generations, which is achieved by offsetting increases in water demand (from growth) through water efficiency and conservation. In order to meet this goal, re-aggregated total demand in the future must be less than or equal to current total water demand. The scenario requires a diverse suite of demand management measures including reducing peak day demands through minimizing outdoor water use, by increasing the efficiency of homes for example by increasing the penetration rate of High Efficiency Toilets (HETs use 4.8 Litres per flush) and high efficiency clothes washers, and water loss reduction in the distribution system.

The **20% Reduction of 2006 Levels** scenario was also developed using a backcasting approach and recognizes that water resources are today stressed and may become more so in coming years as a result of climate change. This scenario applies many of the measures more aggressively than under the **No New Water Until 2026** scenario.

Appendix B outlines the packages of water conservation measures used to develop the two water saving scenarios, along with typical values for many of the parameters used in Scenario Building. Table 3.1 illustrates the output of the WaterSmart Scenario Builder for community systems under all three scenarios.

Appendix E - Understanding the WaterSmart Scenario Builder

This appendix explains the POLIS WaterSmart Scenario Builder, a Microsoft Excel spreadsheet developed to facilitate the development of the various scenarios presented here. It elaborates on the brief discussion of the tool presented in Section 2 and where possible/applicable provides the rationale for assumptions and judgments by analysts.

The POLIS WaterSmart Scenario Builder: A Soft Path Analysis Tool, is a tool designed for a specific purpose, from a particular perspective. Other tools exist to support activities such as water supply planning, water footprinting, and water efficiency planning. Each is intended to answer a particular question. How much water do we need (water supply planning)? How much water are we using (water footprinting)? Or how can we affordably use less water (water efficiency planning)?

Each of these tools is also set within a particular view of the world. Most neglect ecological limits to human water use. Most are based on the assumption that past political, economic and social trends will determine future conditions. And most rely on a cost-benefit framework to determine what is feasible in terms of developing new supply, or what water efficiency measures are economically efficient under existing conditions.

The WaterSmart Scenario Builder fits with and complements (rather than replaces) many, if not all, of these tools. It helps take an important first step toward developing detailed conservation audits or water efficiency plans by engaging communities in 'what if?' discussions about possible futures for water use – before asking what is economical. As such, it sets aside analysis of the economic costs and benefits associated with implementing the measures, or the capital cost savings associated with the reduced water use.

Input data

The scenario builder is designed to work with minimal inputs. While data collection for urban water use is improving in Canada, data remain incomplete for the detailed requirements of this analysis (i.e. breakdown of water use to the level of sub-sectors and indoor/outdoor use). At a minimum, the required data inputs include current population and current water demands—either on a per capita basis (i.e. litres per capita-day – L/c-d) or on a community-wide basis (i.e. cubic metres per year – m3/yr). In some cases, local data on the sectoral breakdown of water demands are available and lead to a more robust or contextualized analysis. In the absence of such data, general values for the region, province or the country as a whole must be used as a first estimate.

Process

The WaterSmart Scenario Builder facilitates a systematic approach to determining the potential for water savings through application of efficiency and conservation measures. The tool works on the basis of integration – on determining the macro impact of integrating different packages of micro measures (i.e., policies, programs and technologies) on total water use. It accomplishes this by:

- disaggregating total water demand of an urban or watershed community into its component elements (uses)
- treating each of those elements with water efficiency and conservation measures using four water Sectors: Residential, ICI (Industrial, Commercial and Institutional), Agricultural and

Non-Revenue; and

- re-aggregating to determine the macro impact of the various micro measures on total water use

By iterating through this process, the analyst (or planning team) can refine the micro measures to arrive at a package showing total water use that reflects desired future conditions. Sounds simple, but as with most complex socio-ecological problems, the devil is in the details – those details, and the devils within, are described below.

Desired Future State

The first step in the backcasting process – and in developing the resulting scenarios – is to define a desired future state for water use. This begins by deciding how far into the future to look; or in the parlance of the WaterSmart Scenario Builder, selecting a design year. Variables such as current and future population, changes in living patterns, and estimated growth in the various water sectors, are used to define the context of the design year.

The selected design year must be 20 to 50 years in the future. This long view is critical for a number of reasons. First, philosophically, any effort aimed at developing a sustainable society requires thinking in terms of intergenerational equity – to meet the needs and aspirations of present generations without compromising the opportunities for future generations to do the same. Second, and more pragmatically, the design year should be set far enough into the future to allow sufficient time to observe the full impact of proposed technological, social and policy shifts associated with scenarios. Transformational change of the type envisioned by the soft path approach can take decades to be fully realized. Third, no magic wand exists to change instantly all inefficient toilets into low-flow ones; even with incentives, rates of replacement of existing stock can be slow. Finally, taking a short view – looking only 5 to 10 years into the future – is also likely to direct attention away from non-technological measures, such as education, social marketing and policy changes, that often take significant time to stimulate behavioral change and to result in water use reduction. Indeed, taking a short view may prematurely write-off the soft path approach or a particular scenario before the full impact can be realized.

The future that is put forward should be one that is desired broadly by the urban or watershed community that will influence, and be influenced by, actions taken to realize it. Ideally, it will have been developed in consultation with the community. A future vision is more likely to have influence if it is a shared vision. Therefore, visioning processes strive for participation by a broad range of community interests and actors. That said, the process of establishing this future state should not be viewed as a bargaining process to arrive at consensus around a lowest common denominator. It must be imaginative rather than simply a projection of the status quo. And it must incorporate the best available science on local hydrological carrying capacity, with allowance for unpredicted changes in that carrying capacity (as with those stemming from climate change).

For some communities or individuals, this visioning step may prove to be the most difficult part of the soft path approach. In some cases, dense or jargon-laden scientific and engineering studies may challenge non-technical participants to engage effectively in decision-making. More often, an absence of studies and other information will challenge all participants. This difficulty in defining a reasonable target future for water use should not prevent or dissuade practitioners from pursuing a soft path for water. Rather, an adaptive approach should be adopted – working from an initial desired future that can be refined over time (using the

Scenario Builder) as new information on water demand, local hydrological conditions, and climate change impacts becomes available.

To get started, a goal of maintaining, at a minimum, current watershed health is likely a reasonable desired future state. This goal – often referred to as no new water – has been used in several soft path studies to date. Essentially, no new water means capping water takings at existing volumes and rates so as to exert no additional pressure on the watershed ecosystem from higher rates of water use.

Disaggregating demand

By disaggregating water demand into its component elements, the WSP Scenario Builder digs deep into the details of a community's water use. It exposes the intricacies of who uses water, how much, and for what purposes. Reviewing these intricacies exposes a wealth of opportunities to apply water efficiency and conservation measures.

The Scenario Builder takes a step-wise approach to disaggregating water demand – first into sectors, onward into sub-sectors, and finally, where possible, to end-uses. Using an urban centre as an example, sectors would include residential, ICI, agricultural and non-revenue water. Sub-sectors under the residential sector would include single and multi-family and indoor and outdoor water use.

Whenever possible this disaggregation should be based on current information. However, given the paucity of empirical data on water use, particularly at the scale of end use, it is often necessary to adopt benchmarks from other sources. Sources may include case studies or water management plans, conversations with water management practitioners, or nationally or regionally averaged compilations, such as that provided by Environment Canada (2008) or the American Water Works Association (Mayer et al., 1999). For simplicity, the scenario builder has adopted two standard benchmarks for indoor water use. "Efficient Homes" are assumed to have a typical demand of 200 Lcd and are characteristic of new homes with requirements for ultra low flow toilets (6L), energy efficient front loading washing machines, 9.5 Lpm showerheads and 8.35 Lpm faucets. "High Efficiency Homes" have front loading washers, and high efficiency 4.8 Lpf toilets and a typical water demand of 145 Lcd. These technologies are all available "off-the-shelf" and benchmarks have been validated by water efficiency experts.

Model Calibration to Business As Usual

The goal of any water conservation plan or soft path strategy is to increase the uptake (penetration rate) of water conserving practices (measures) and decrease the prevalence of water-intensive practices. To understand the behavioural, technological and policy changes required to realize a desired future state, a reasonable depiction of existing water use patterns must first be established. This depiction – often referred to in scenario-based planning as the 'business as usual' (BAU) case –is, quite simply, a forward extrapolation of current water use patterns based on population and economic growth projections.

The BAU scenario provides a benchmark against which to compare all additional scenarios, but it is more than that. For modelers it represents an opportunity to 'calibrate' – a critical though often overlooked step in developing an understanding of current community water use. Calibration provides an opportunity to question, challenge and better understand assumptions of penetration rates for the BAU scenario, and to refine those assumptions to arrive at values that represent, as closely as possible, the actual prevalence or absence of water conserving practices in today's society.

For example, a community's current residential per capita water use is compared against the standards for efficient homes described above, and against the range of typical per capita residential demands. This is a simple but effective gauge of the accuracy of water use estimates and assumptions. Benchmarks and typical values are also provided for many other parameters including residential vs. ICI, non-revenue water, and percentage of outdoor water use.

Through a process of calibration and recalibration, assumptions of water use are replaced with empirical data, which essentially means that the BAU becomes less speculation and more reality. In this way, the BAU resolves uncertainties related to input assumptions and the WaterSmart Scenario Builder evolves toward a working model that more accurately represents a society's water use.

Soft path scenarios

With a desired future state established and BAU conditions determined, the work of building alternative scenarios begins. At this point the disaggregated water demand – the intricate details of water use – is subjected to 'treatments.' These treatments come in the form of a combination of water efficiency and conservation measures and penetration rates. The Scenario Builder lays out the required community uptake of various measures necessary to realize its desired future. The scenario builder enables the user to specify the population that will uptake a change in technology or behaviour, in essence the penetration rate of new practices. Water savings are then calculated as the difference between the current water use and the potential for efficient water use, based on the population assigned to shift to efficient water use practices.

The many measures available have the potential to reduce or even eliminate water use across the full range of end uses. Penetration rates, in this case population, are quantitative measures of the uptake of a given measure into use by society over some period of time. They are strongly influenced by policies and programs such as water pricing, rebates, education and social marketing, and bylaws and regulations. The policy context must be considered as alternative scenarios are developed because it directly affects the penetration of behavioural change and technology into use.

For example, an aggressive toilet rebate program or an increase in water prices will result in a high degree of efficient technology penetration, such as low flow toilets and front loading clothes washers. Figure 1 illustrates two alternative scenarios in addition to business as usual. Looking closely at the population, one can see in numbers the shift toward water saving fixtures and alternative sources of water (i.e. in scenarios 1 and 2, a shift toward higher population residing in efficient homes, and lower populations residing in homes with the current per capita usage).

	Today's Average	Efficient Homes	High Efficiency Homes
SINGLE FAMILY			
PER CAPITA WATER (LCD)	**242**	**195**	**142**
INDIRECT ENERGY (KWH/C/D)	**0.18**	**0.14**	**0.10**
CURRENT POPULATION DISTRIBUTION	**132,391**	**-**	**-**
2007 CURRENT MUNICIPAL WATER USE (M3/D)	32,009	-	-
BAU POPULATION DISTRIBUTION	254,186	-	-
2031 BAU MUNICIPAL WATER USE (M3/D)	61,456	-	-
SCEN 1 POPULATION DISTRIBUTION	132,391	-	121,795
2031 SCEN 1 MUNICIPAL WATER USE (M3/D)	32,009	-	17,350
SCEN 2 POPULATION DISTRIBUTION	-	-	254,186
2031 SCEN 2 MUNICIPAL WATER USE (M3/D)	-	-	25,942

Figure E.1 Scenario Building in the Residential Indoor Sector

The WaterSmart Scenario Builder's strength lies in its capacity to explore a multitude of 'what if' scenarios by experimenting with various combinations of measures and penetration rates to determine the impact of particular packages of technologies or practices on future water use. For example, one community may choose to focus on residential and ICI rebate programs as its primary mechanism for water conservation. Another community might choose to implement policies that encourage rainwater harvesting, grey-water reuse and xeriscaping to reduce future water use. Both scenarios could ultimately lead to the same end but through different means.

If, after selecting a suite of measures and penetration rates, the resulting future water use exceeds the threshold identified in the community visioning process, efficiency and conservation measures must be re-visited, increasing the application and penetration of waters saving measures in an iterative manner until the desired future state is reached. As the community begins to understand in more explicit terms the extent to which water efficiency and conservation must be employed, it may decide that the desired future water state itself should be adjusted. This is the essence of the iterative visioning and backcasting process using the WaterSmart Scenario Builder as a tool to support decision-making.

Re-aggregating for comparison

The resulting calculations are re-aggregated to the level of sub-sectors and sectors. Comparing these re-aggregated values of projected demands to the business as usual case illustrates the water saving potential for the scenario. The results for a number of parameters including annual average municipal water demands, peak day demands, and energy and GHG savings are reported on a summary sheet.

Scenario Details

While the calculations performed by the WaterSmart Scenario Builder are fairly straightforward, it is important to note that the scenarios are based largely on assumptions and judgments of the analysts. This is in large part due to the nature of studying the future: we must rely on informed judgment to speculate about behavioural changes, technology uptake and technological innovation. This informed judgment approach was used to determine the shift in population distribution from inefficient to efficient practices in this analysis, the potential for savings in the industrial and agricultural sector and the reduction in peaking factor achievable through education and pricing.

Such contextual refinement can only be achieved by opening the planning process to community scrutiny and detailed community engagement. That said, we believe our analysis can provide sufficient specifics about the potential of a comprehensive approach to water conservation to inform a wider community dialogue. We acknowledge that our analysis is only the start and not the final prescription.

The conservation and efficiency measures considered in the scenario analysis have been validated by water efficiency experts as measurable best practices and should be considered conservative estimates. The targets are really a function of the uptake of each measure. Rebates will result in different participation rates than bylaws or market shifts, for example. At this time, the scenarios explored focused on measures that have been validated extensively in other communities. However, there is a significant potential for future savings by adopting more progressive technologies and practices such as composting toilets, 100% xeriscaped lawns or no lawns, rainwater for showers, etc. These practices, initiated over the course of 20 years, could offer significant *additional* water savings as values and provincial policies change.

Appendix F - Participation Rate Analysis

Table F.1 summarizes target average day savings in each sector and scenario, along with a description of the shift in practices required to realize savings, relevant policies, measures and actions to enable change, and examples of municipalities who have implemented similar measures. The participation rates presented in Table F.1 should be considered one example of how the suggested targets might be realized. For example, the savings generated by 50% of homes shifting to partially (50%) xeriscaped landscapes could also be achieved by 25% of homes shifting to 100% xeriscaped landscapes. Another example is composting toilets, which are gaining in popularity. Adoption of this technology would achieve the equivalent of using a non-potable water source for flushing toilets, but with the added benefit of reducing the release of nutrients such as phosphorus that are leading to water quality problems on Salt Spring. The participation rates noted are intended to serve as examples of what the future *could* look like, but should not be considered prescriptive.

The targeted water savings presented may differ from conservation targets in other communities where targets are addressed primarily through rebates issued by the municipality. A comprehensive soft path strategy also accounts for savings achieved by the homeowner as a result of the many influences that may effect *behavioural* change including education, market trends, bylaws, pricing, etc.

The projected savings in Table F.1 should be considered a first estimate. Despite the uncertainty in future estimates, while being cognizant that uncertainty exists in conventional water demand and population projections, the results illustrate the potential reduction in water demand based on the success of programs elsewhere.

Where are the Savings?

Indoor residential water use has an enormous potential for water savings, largely because of the large volume of water typically used for toilet flushing, clothes washing and in some cases leaks. Ensuring all new development incorporates the most efficient fixtures and technology possible would significantly reduce future water use. While many Canadian references and websites identify indoor per capita demand of 250 Lcd or greater, Veritec (2008) has shown that demands of as low as 150 Lcd can readily be achieved with off the shelf technology in Canada. A residential per capita demand of 150 Lcd approaches that of many European countries and communities in Australia.

Incorporating further efficiencies into new homes such as composting toilets, hot water recirculation systems, rainwater harvesting systems, grey water harvesting systems etc. could further reduce this demand. Use of composting toilets would not only ensure reduced water and energy use, but would also reduce nutrient loadings to local water bodies some of which are already experiencing the harmful effects of eutrophication. An inefficient fixture installed today may persist for 10 to 20 years. "Future proofing" new homes with efficient technology is critical to ensuring the long-term sustainability of the water system. Rainwater harvesting offers particular value on Salt Spring as it would reduce the volume of rainwater lost to run-off on the island, essentially increasing the storage capacity.

Reducing outdoor water use in the residential sector is the second largest potential, and the scenarios have considered the benefits of widely acknowledged best practices including tuning automatic irrigation systems and shifting landscape design to xeriscaped (a minimum 50% of landscape) and drip irrigation. Scenario 2 suggests that shifting to a point in time where no potable water is delivered to landscapes would mean a greater reliance on rainwater harvesting, greywater, xeriscaping and simply a larger cultural acceptance of "Going Golden".

Future proofing outdoor water use is also well suited to new development. Outdoor water audits and education for existing homes, and working with landscape and irrigation professionals can assist in minimizing outdoor water use in new homes.

Table F.1 Targeted Average Daily Water Savings by 2026, and Participation Rates, by Sector for Community Systems

Measures	**Targeted Average Day Water Saved**		**Examples in Practice**
	Scenario 2	**Scenario 3**	
Total Average Day Demand Reduction	**Target Reduction** **= 857 m^3/d** No New Water Until 2026	**Target Reduction** **= 1423 m^3/d** 20% Reduction from 2006 Levels	10% reduction in water use over 10 years (City of Guelph, 2009; Region of Peel, 2004; Region of Waterloo, 2006)
Reduced Use or Shifted Demand	As a conservative assumption, water savings from behavioural changes (fewer loads of laundry, less outdoor watering, etc.) stemming from education, pricing and metering have been excluded. These savings would be bonus!		Kelowna – metering and education = 20% reduction despite 25% increase in population (Klassen, 2007). Abbotsford's residential sector uses 40% less water than Mission – presumably from metering alone.
Residential Indoor: efficient toilets, clothes washers, faucets, showerheads.	**583 m^3/d** *67% All Homes High Efficiency* OR *100% New Homes / 50% Retrofits* *30% Homes using non-potable or composting toilets, and rainwater for clotheswashers*	**785 m^3/d** *100% New Homes High Efficiency* *100% Existing Homes Retrofit to High Efficiency* *30% Homes using non-potable water for toilets or composting models and rainwater for clotheswashers*	Edmonton's bylaw for water efficient fixtures (Edmonton, 2008) Ontario Building Code ensured all new homes since 1996 were Efficient[44]
Outdoor water conservation. Efficient homes are:	**143 m^3/d [45] Residential** *50% Homes Efficient*	**359 m^3/d Residential** *No Municipal/Potable Water Applied to Landscapes*	Cochrane, Kelowna, Vernon have outdoor landscape bylaws that would ensure all new

[44] required 6 Lpf toilets and 9.5 LPM showerheads in all new homes since 1996 and has an average residential per capita use of 260 LCD – compare to BC's per capita of > 400 LCD.

[45] Assumes 10% of future population has automatic irrigation systems

Measures	Targeted Average Day Water Saved		Examples in Practice
• 50% of landscape xeriscaped • drip/micro irrigation • tuned-auto irrigation	*50% of all homes use non-potable sources for outdoor use.* **32 m³/d Commercial Institutional** *50% Landscapes Efficient* *50% of all homes use non-potable sources for outdoor use.*	*Landscapes* **77 m³/d Commercial Institutional** *No Municipal/Potable Water Applied to Landscapes*	homes are efficient or better. City of Tucson (2008) mandates all commercial development plans have a rainwater harvesting plan. Southeast Queensland (2008) has mandated rainwater harvesting in all new homes.
Institutional Water Use Audits and/or Capacity Buyback, Once through Cooling	**32 m³/d** *15% increase in efficiency*	**53 m³/d** *25% increase in efficiency*	15-50% potential reduction (Vickers, 2001; Cohen, 2004)
Commercial Rebates: Toilets, Urinals and Pre-Rinse Spray Valves	**12 m³/d**	**41 m³/d**	15-50% potential reduction (Vickers, 2001; Cohen, 2004) Region of Peel (2004) toilet replacement targeted 11,600 commercial toilets. City of Calgary had replaced 1300 pre-rinse spray valves by 2008.
Non-Revenue	**55** *10% reduction*	**109** *20% reduction*	10-35% reduction potential (Environment Canada)
Sector	**Scenario 2**[46]	**Scenario 3**	**Examples**
Private Wells	*35% reduction in ADD* **230 m³/d**	*55% reduction in ADD* **360 m³/d**	(refer to Table 3.1, Residential Sector)

[46] Note that all water savings reported are based on current licensed annual volumes, as projected future demand was not available

Appendix G - Typical Values for Parameters

PARAMETER	TYPICAL/ DEFAULT	RANGE	NOTES	REFERENCE
COMMUNITY WATER USE				
Number of Summer Months	4 (mid-May to mid-Sept)	2-8	Dependent on climate and type of irrigators	
CURRENT WATER USE				
Disaggregation of Water Use - % of Municipal Total Annual Daily Demand				
%Residential	52%[47] in Canada	52% (290 LCD) for pop. > 500,000 & 72% (450 LCD) for pop. < 1,000	**Community specific.** Small or bedroom communities will have a higher percentage of residential water use.	Environment Canada (2009)
Indoor Per Capita Water Use	230 LCD in Ontario	150-300 LCD	New homes should have an indoor water use < 200 LCD Homes with significant leakage could have water use as high as 350 LCD	Environment Canada (2007); Veritec (2008)
%Indoor Single Family Residential Water Use	93% of annual average typical in Ontario	80-98% of annual average in Canada		Calculations from Ontario Municipalities
Outdoor Per Capita Water Use	30 LCD typical in Ontario	20-40 LCD	Dependent on rainfall and irrigated area	Calculation based on 10% outdoor use & MUD Database
%Outdoor Single Family Lawn & Garden	> 90% of total outdoor water use			Estimate
%Commercial Institutional (CI)	19% in Canada		Highly variable depending on the community	Environment Canada (2009)
% Indoor CI	75%	60-95% for all ICI	Highly variable depending on the types of institution	Estimate
% Outdoor CI	25%			Estimate
% Industrial	16% in Canada	N/A	**Community specific.**	Environment Canada (2009)
%Agricultural	0%	Urban 0%	Community specific. Dependent on proximity of agriculture to municipal supply	
%Non-Revenue	13% in Canada[48]	5-20% across	Community specific.	Environment

[47] All sector percentages are percentages of municipally supplied water

[48] Note: The percentage of Non-Revenue water is strongly influenced by the total volume of water used in a community, and

		Canada	Dependent on age and size of distribution mains, leak reduction programs, etc.	Canada (2009)
%Unbilled Authorized	1.25% of System Input Volume		Main flushing, fire fighting, etc.	Estimate
%Apparent Losses	10%	5-15%	Meter Inaccuracies; 5% on end-use meter + 5% on water supply meters	Estimate
%Real Losses	70%		Note that 50% of these losses may be background losses	Estimate
Peak Day Factors				
Peak Day/Total ADD	1.4	1.2-1.6	Historical (actual, not design) peaking factor with respect to average day demand. Note that smaller municipalities (with lower industrial use) may experience higher peaking factors	OWWA (2008) for medium – large Ontario municipalities
Peak Day/Non-Revenue	1.0	N/A	Non-revenue is not assumed to be impacted by peak day demands.	Assumption
Growth Factors				
Commercial Institutional	Equivalent to the population growth	N/A	Typically identical to the population growth	
Industrial	1.0	1.0 – Population Growth Factor	Difficult to predict, and the water use is sometimes not predicted to change from the current status in urban communities	
Residential	Equivalent to the population growth	N/A	Specific to single family and multi-family population growth	
Agricultural	1.0	N/A		
Non-Revenue	Equivalent to the population growth	N/A	Equivalent to the population growth	
INDOOR RESIDENTIAL WATER USE				

can be skewed by high volume water users, for example. Non-Revenue and Real Losses cannot effectively be compared to best practices using a percentage. An IWA Water Balance should be conducted and an ILI value calculated. Percentages are used within the WaterSmart Scenario Builder for simplicity - but a high or low percentage must be evaluated on an individual basis.

Efficient Homes	Approx. 200 LCD	Ontario, and British Columbia, have required 6 L toilets in all new construction since 1996 and 2008 respectively.		Based on Veritec (2008); Mayer & deOreo (1999)
High Efficiency Homes	130-150 LCD	Clothes Washers are replaced approximately every 10-14 years and sales are moving toward horizontal axis, water efficient, models. It is estimated that 40% of sales in 2005 were front loading clothes washers (NRCan, 2007; Figure 2-4). High efficiency toilets are becoming more widely available and are will be mandated in California by 2014.		Based on Veritec (2008); Mayer & deOreo (1999)
OUTDOOR WATER USE				
Un-tuned Automatic Irrigation Systems	Water Use Factor of 1.0	An estimated 10% of homes, in urban communities, are equipped with automatic irrigation systems, using an estimated 60% total residential water for irrigation. New homes are increasingly being equipped with automatic irrigations systems. Assumes 3 - 3.75" of water delivered.		OWWA (2008) pg 35
Tuned Automatic Irrigation Systems	Water Use Factor of 0.3	It is assumed that very few homes are today optimally tuned for water savings. Assumes 1" of water delivered. 70% less water use than un-tuned		OWWA (2008)
Manual, overhead sprinklers	Water Use Factor of 0.15	Used in 90% of homes & businesses Assumes delivery of ¼ to 1/5" per week. 80% less water use than Un-tuned Automatic Irrigation Systems		OWWA (2008)
Drip Irrigation & Efficient Landscaping	Water Use Factor of 0.07	Efficient Landscaping 20-80% less Drip irrigation 25-75% less than manual	It is assumed that very few homes today adopt best practices for outdoor use.	Gleick et al. (2003); pg 73 AWE (2009)
Alternative Sources	Reduce 100% of potable water irrigation demands		Rainwater and greywater could potentially supply 100% of outdoor water use needs, assuming water was ½" per week	OWWA (2008) page 31
COMMERCIAL INSTITUTIONAL				
Targeted CI Water Savings	5% reduction of total future demand typical of programs today	5-10% readily achievable 15-35% typical potential	Greatest opportunity exists for toilets, urinals, showerheads and faucets. If individual users known, 50% of potential could be achieved.	Vickers (2001); pg 239 Cohen (2004)
INDUSTRIAL				

Targeted Industrial Water Savings	10% reduction of total future demand	5-10% readily achievable 33-50% typical potential	VERY municipality specific. Greatest opportunity exists for adjusting blow-down cycles in cooling equipment and recycling process water. If individual users known, 50% of potential could be achieved.	Vickers (2001); pg 239 Cohen (2004)
NON-REVENUE				
Water Loss Reduction	20% of Real Losses Typical of Municipal Savings Today	10-40%		Estimate
IMPLEMENTATION				
Overall Targeted Reduction in Water Use	10% of BAU in 10 Years targeted through Ontario municipal programs today	10-40% of BAU in 10 years (dependent on baseline water use)	Reduction in water use is a percentage of BAU projected water use achieved by Municipally supplied rebates	Review of Water Efficiency Plans from the Region of Peel, Durham Region, York Region, Region of Waterloo, City of Guelph, City of Calgary and Southeast Queensland, Australia

Appendix H - Conversion Factors

Feet to metres:	feet x 0.30480	=	metres (m)
Acres to hectares:	acres x 0.40469	=	hectares (ha)
	10,000 m2	=	1 hectare (100 m x 100 m)
	100 hectares	=	1 square kilometre (km2)
Acre-feet to cubic metres:	acre-feet x 1233.5	=	m3
Cubic feet per second to m3: (m3/min)	c.f.s. x 1.699	=	cubic metres per minute
Imperial gallons to litres:	gallons x 4.5461	=	litres (L)
or cubic metres:	1 ,000 litres	=	1 cubic metre (m3)
Million gallons/day to m3:	MGD x 4546	=	cubic metres per day (m3/d)

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