Regional District of Okanagan-Similkameen

Regional Water Conservation Strategy

14 November 2017

Prepared for

REGIONAL DISTRICT
RDOS
OKANAGAN·SIMILKAMEEN

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Glossary and Acronyms

Technical terms and acronyms used throughout the report are explained below.

Average Day Demand: Total bulk water produced for the year divided by 365 days.

AWWA: American Water and Wastewater Association

BCWWA: British Columbia Water and Waste Association

CWWA: Canadian Water and Wastewater Association

Conservation Measure: A tool used to generate water savings in the community. These tools can be categorized as economic, encouragement, education, enforcement, and engineering.

Farm-Use Property: Properties within a water service area and classified as 'farm' by the British Columbia Assessment Authority.

ICI: Industrial, Commercial, Institutional Customers that use water in their business operations, either as a production input or for domestic-like purposes.

LCD: Litres per capita per day. This unit is used to measure consumption on a per person basis. While overall demand may be increasing with population, the LCD can decrease as water efficiencies are gained.

m^3: Cubic metre (= 1000 litres = 220 imperial gallons).

ML: Megalitre (= 1000 cubic metres = 1,000,000 litres = 219,969 imperial gallons).

NRW: Non-Revenue Water. Water that has been treated and pumped to the distribution system, but is generally not metered, not billed, and therefore does not contribute to utility revenues. There are more than 20 sources of NRW, including consumptive uses such as distribution system leakage ("system loss") and hydrant water used by utility operations and fire departments for various maintenance and training purposes (AWWA, 2009).

Maximum Day Demand: Peak day water use divided by total serviced population, reported in litres per capita per day (LCD).

Peaking Factor: Compares water use on the day that it was highest with average daily consumption throughout the year.

RDOS: Regional District of Okanagan-Similkameen.

Executive Summary

The Regional District of Okanagan-Similkameen (RDOS) operates a growing number of small water systems for residents, businesses, and agricultural producers in the South Okanagan area. Like other water systems throughout the region, they are under a variety of pressures from a dry climate, agricultural water demand, historical high water use, and the anticipated impacts of climate change.

The RDOS recognizes that water is a valuable resource that should be used wisely. By working together to use water as efficiently as possible in regional district operations, private dwellings, agricultural operations, and commercial enterprises, the RDOS can lead the way in ensuring that supplies and its services are resilient in the face of these challenges and sustainable into the future.

Benefits of Conservation

Promoting water efficiency will bring a number of social, ecological, and economic benefits to RDOS and its water service customers. These include saving energy and money on treatment and distribution, deferring capital spending on infrastructure, reducing impacts on aquatic ecosystems, and advancing objectives in the 2015-18 Strategic Plan and the recently approved Regional Growth Strategy. Water conservation will not only improve our quality of life today, but will also contribute to a desirable place to live for future generations.

Water System Profiles

At the time of writing, the RDOS owned eight water systems and operated one additional system under other ownership (see Table 1). These systems serve mostly residential customers, a relatively small number of commercial accounts, and some commercial agricultural operations (defined by the RDOS as *Farm-Use Property*).

Quantitative analysis of total water use was conducted only for the Naramata, Faulder, West Bench, and Olalla systems due to limited data availability. With the exception of Olalla, the analysis confirmed that these water systems have experienced declines in average annual use over the last 8-10 years. Although this is consistent with trends in other North American communities attributed to reduced indoor water use from the gradual installation of more efficient appliances and fixtures, some reductions in per capita use in the Faulder system over this timeframe are likely also the result of significant supply shortages. These declines ranged from an average of 1.3% per year for the Naramata system between 2007 and 2015, to 4.2% per year between 2005 and 2015 for the Faulder system. Possible explanations for the anomalous results for Olalla include an increase in the size of the service population, erroneous bulk meter readings, or an increase in leaks or system loss.

Considerably more water is used in all four of these water systems in the summer months, which is consistent with anecdotal accounts of high outdoor use for watering large lawns and private gardens, as well as commercial irrigation activities in some systems. Peaking factors, which describe how many times more water was used on the day of the year use was highest compared to the average daily total water use throughout the year, ranged from a low of 2.05 in Olalla in 2015, to 4.67 in Faulder in 2013. Peaking factors provide an indication of the pressure on water systems from seasonal and discretionary water uses, and how much systems have to be 'built up' to accommodate fluctuating water use, relative to average use.

Crude per capita daily estimates of total water use were estimated for Naramata, Faulder, West Bench, and Olalla based on the available service population data. Per capita total water use in West Bench, Olalla, and Naramata in particular appears to be high relative to benchmarks for communities in BC (ranging from twice as high in Olalla and West Bench, to almost five times as high as the BC average in Naramata). While the high water use in Naramata can likely be attributed in part to commercial irrigation, the values for West Bench and Olalla are likely attributed to high outdoor residential water use and/or high system loss. In per capita terms, water use in the Faulder system is a noteworthy outlier that approximates the BC average. The considerably lower total water use in this system is attributed to historic and continued water supply limitations and attendant conservation awareness among water users. The water efficiency already achieved in the Faulder system serves as a useful benchmark of what can be achieved for the RDOS's conservation efforts in other water systems.

2018-2022 Conservation Program

The RDOS strives to continue to provide safe and reliable water services to all of its customers, while improving the efficiency of its water service operations, and minimizing impacts to aquatic ecosystems with shared reliance on limited water sources. To realize this goal, the RDOS will implement a water conservation program comprised of measures that have been proven to achieve results in jurisdictions throughout the province and across the country. These measures have been grouped into six themes:

- Theme #1: Implement a Long-term Metering Strategy;
- Theme #2: Enhance Non-revenue Water Management;
- Theme #3: Demonstrate Leadership in Water Efficiency;
- Theme #4: Manage Outdoor Residential Water Use;
- Theme #5: Ensure Efficient Agricultural Water Use; and,
- Theme #6: Enhance Water Conservation Education & Outreach.

Implementation will require commitment from staff across all departments at the RDOS, as well as from residents, businesses, and agricultural producers. The enclosed evaluation metrics and recommended program timeline will help ensure implementation proceeds smoothly, and that the strategy produces meaningful results. An appendix to this strategy provides recommendations to improve water use data collection, analysis, and reporting in order to a) evaluate the effectiveness of conservation measures, and b) address recommendations from the 2017 performance audit of three RDOS water systems carried out by the Auditor General for Local Government of British Columbia.

What is documented in this plan is the beginning, not the end, of the RDOS's journey to improved water efficiency. With a strong focus on outdoor water use, improving water use accounting through metering, and enhancing conservation incentives for all users, this strategy will help the RDOS realize short-term gains in efficiency, while also laying a foundation for more targeted measures to secure the sustainable operation of all the water systems it operates, well into the future.

1.0 Introduction

The Regional District of Okanagan-Similkameen (RDOS) owns and operates several small water systems for residents, businesses, and agricultural customers within its electoral boundaries in the South Okanagan and Simikameen areas. Like other systems in the Okanagan region, the RDOS's water systems face pressures from a dry climate, significant agricultural activity, high historical domestic water use, and the anticipated impacts of climate change.

Despite involvement in a range of water conservation initiatives in recent years, to ensure it can continue to provide safe and reliable water services for all customers well into the future, the RDOS has committed to further enhancing water-use efficiency across all systems. Consequently, in 2016, the Regional District contracted Econics, a Canadian leader in municipal sustainability planning, to assist with developing a Regional Water Conservation Strategy to guide its activities over the next five years, from 2018 to 2022.

To account for the unique characteristics of each water system, the RDOS's operational planning, has typically been undertaken on a system-by-system basis. This strategy is the first to lay a foundation for water conservation activities across all of the RDOS's water systems, including those under other ownership. In doing so, it contributes to more equitable services for all the RDOS water customers, and makes apparent opportunities to achieve economies of scale by coordinating conservation efforts across multiple systems. It also provides the RDOS with a basis for prioritizing conservation measures in systems where the resultant gains – in terms of water and financial savings, or quality of service for customers – will be maximized.

Following this introduction, this document has eight main sections and two appendices:

- Section 2 provides an overview of water use trends;
- Section 3 identifies linkages to the RDOS's governance framework and priorities;
- Section 4 outlines the case for water conservation in Okanagan-Similkameen;
- Section 5 summarizes current water conservation efforts;
- Section 6 sets out the water conservation strategy for 2018 to 2022;
- Section 7 provides an implementation schedule;
- Section 8 provides a brief conclusion;
- Section 9 contains the bibliography;
- Appendix I has highlights and links to web-based conservation resources; and,
- Appendix II has actions to improve water use data collection, analysis, and reporting.

1.1 Strategy Scope

This Regional Water Conservation Strategy applies to all water systems under the ownership or operation of the RDOS during the time when the Strategy remains in effect. The water systems it applied to at the time of writing are identified in Table 1.

Table 1: Water Systems Owned and Operated by the Regional District

Water Systems Owned and Operated by the Regional District			Water Systems Operated by the Regional District and Under Other Ownership
Naramata Faulder West Bench	Willowbrook Loose Bay Olalla	Sun Valley Gallagher Lake	Sage Mesa

2.0 Water Use in the Regional District of Okanagan-Similkameen

As of September 2017, the Regional District owned and managed eight water systems and operated one under separate ownership (see Table 1). Qualitative information about each of these systems is presented below. Total water use data, which represents the volume of water removed from the water source as measured by a bulk meter, was only available for some systems. Where it was available, basic usage analysis was conducted to illustrate water-use trends over time. The data presented should not be interpreted as water *use* or *consumption* since it includes non-revenue[1] water.

2.1 Water Systems Owned and Operated by the RDOS

2.1.1 Naramata Water System

The Naramata water system serves a combination of domestic customers, agricultural producers, and a small tourism-oriented commercial sector consisting primarily of accommodation providers in Electoral Area 'E'. A 2010 Conservation Strategy developed by the RDOS estimated that there were 800 domestic water connections and approximately 180 irrigation connections serviced by the Naramata system. The estimated service population is about 2,000. Okanagan Lake is the water source, and the RDOS also retains rights to water from Naramata and Robinson Creeks for emergency purposes.

A cursory estimate of water use in the Naramata system conducted in 2010 suggested that 61% of total water use and 70% of peak day use is for agricultural purposes. Despite an increase in water use for the Naramata system in 2015, annual use declined by an average of 1.3% from 2007-2015 (Figure 1). Figure 2 illustrates that total water use varies significantly across seasons, with peak use occurring during the summer months, likely to meet crop irrigation needs. In both absolute and per capita terms, the Naramata system produces the most water of all the RDOS-owned systems for which data was available (see Table 2 in Section 2.1.6 for per capita figures).

[1] *Non-revenue water (NRW)* is water that has been treated and pumped through the distribution system, but is generally not billed and therefore does not contribute to utility revenues. It can include "real losses" such as leaks, overflows, flow tests and fire hydrant testing, or "apparent losses" from errors in meter reading and data handling or other factors.

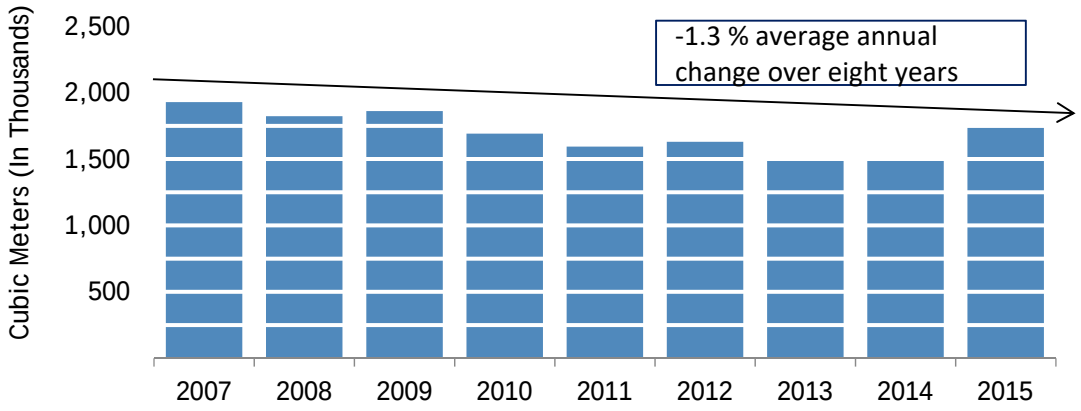

Figure 1: Historic Naramata Total Water Use (2007-2015)

More detailed analysis of the seasonal total water use data in Figure 2 revealed that use during the winter months (November – February) declined by an average of 6.3% annually over the 2007-2015 timeframe. In contrast, shoulder season (March/April and September/October) and summer water use (May – August) declined relatively little (an average of 1.5% annually and 0.9% annually, respectively). The significant reduction in winter water use can likely be attributed to indoor uses. This could be caused by a reduction in the size of the service population, but more likely reflects residents' gradual adoption of more water-efficient indoor appliances and fixtures. This has accounted for similar observed declines in water consumption in most North American communities over the last decade (see WRF, 2016, for example).

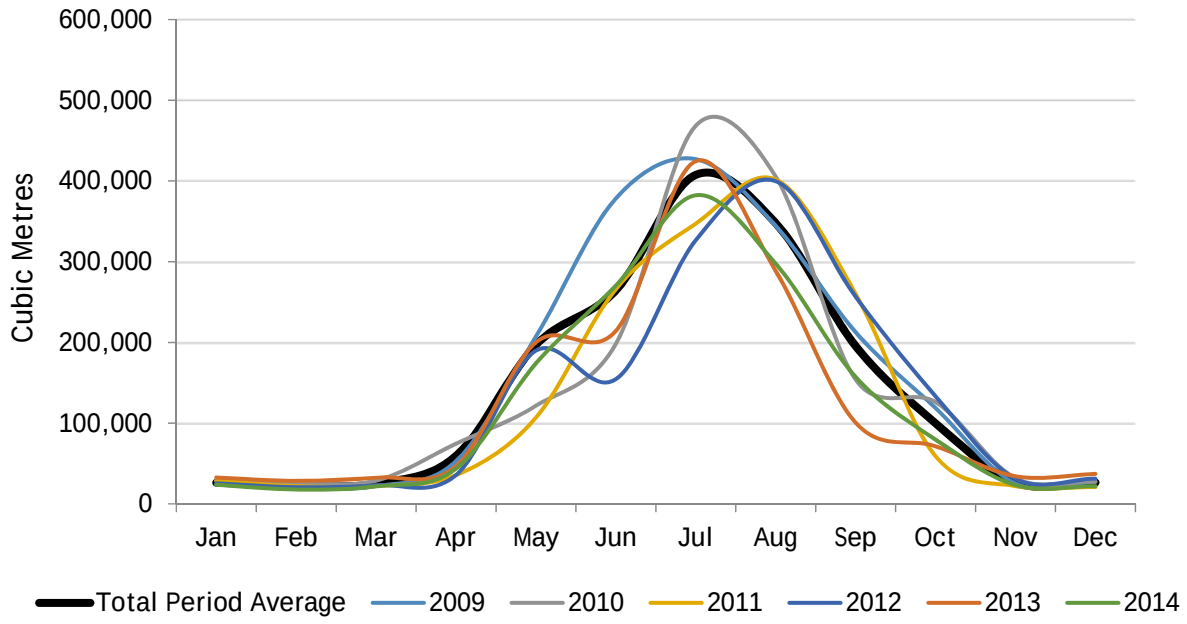

Figure 2: Average Total Monthly Water Use for the Naramata System (2009-2014)

The extent to which water use increases during the summer is often measured by the peaking factor, which compares use on the day that it was highest with average daily consumption throughout the year. Since water systems have to be constructed with enough capacity to meet peak water demand, high peaking factors are an indication of pressure on the water supply system, and they can also present a challenge for drought resiliency. Figure 3 shows maximum and average day demand for the Naramata water system in cubic metres per day. Between 2009 and 2015, the peaking factor (in red font) ranged from a high of 4.36 (2013) to a low of 3.51 (2015), and averaged 3.9.

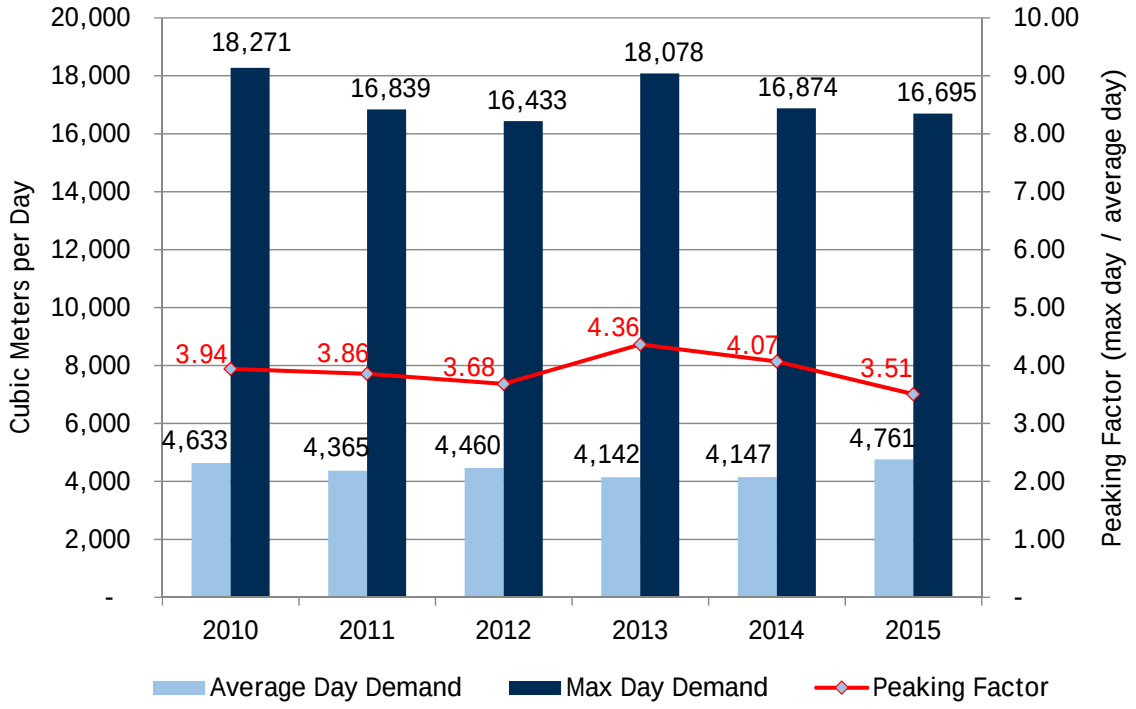

Figure 3: Average and Maximum Day Demand for the Naramata System (2010-2015)

2.1.2 Faulder Water System

The Faulder water system is located in the RDOS's Electoral Area 'F' and serves only domestic water users who are housed primarily on rural and semi-rural acreages. The estimated service population of 215 is expected to remain stable in the future due to limitations in water supply. Water levels in Meadow Valley Aquifer, which supplies the system, have fluctuated in recent years. This has highlighted the need to further enhance conservation efforts among Faulder water users, and resulted in an additional well being drilled in 2016.

Including several consecutive years of low total water use beginning in 2008 due to supply limitations, total use in the Faulder system declined by an average of 4.2% per year over the 2005 to 2015 period (Figure 4). Figure 5 illustrates that significantly more water is used during the summer months, presumably for outdoor uses such as lawn and garden watering. Nonetheless, total water used in the Faulder System (474 litres/day) is considerably lower in per capita terms than the other three water systems for which data is available (see Table 2) and approximates the BC average of 500 litres per capita per day (Honey-Rosés et al., 2016).

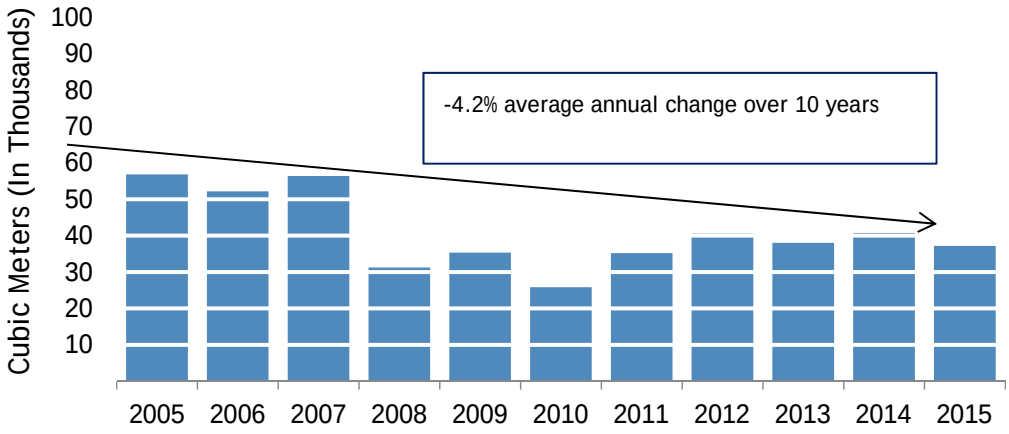

Figure 4: Historic Total Water Use for the Faulder System (2005-2015)

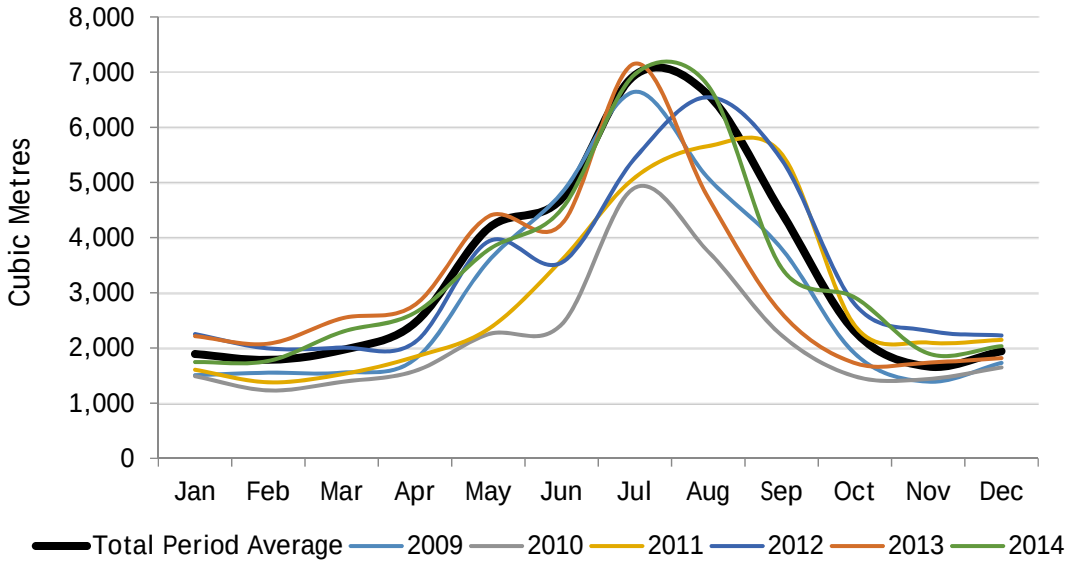

Figure 5: Average Total Monthly Water Use for the Faulder System (2009-2014)

Since daily total water use data for the Faulder System is only available for 2010-2015, *average day demand, maximum day demand*, and *peaking factors* are not available for prior years. The peaking factor between 2010-2015 ranged from a low of 2.42 to 4.67 in 2013 (see the red font in Figure 6). Aside from this anomalous high peaking factor in 2013, the peaking factors are within the range of what would be expected for water systems with few commercial agricultural water users.

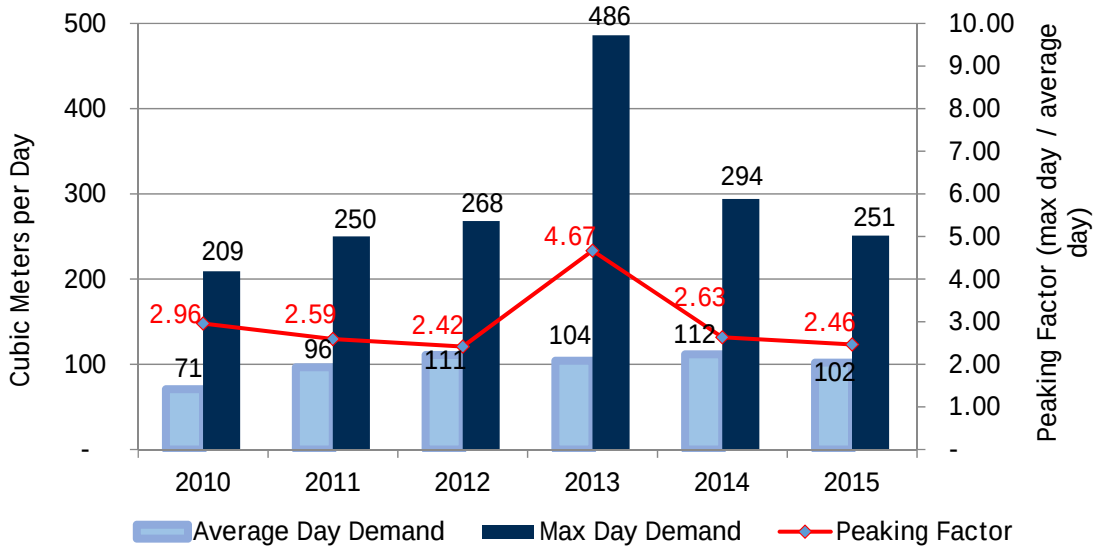

Figure 6: Average and Maximum Day Demand for the Faulder System (2010-2015)

2.1.3 West Bench Water System

The West Bench service area is comprised mainly of large, semi-rural properties within the Regional District's Electoral Area 'F'. Ninety-five percent of the total 357 water connections are rural residential, many of which include hobby farms. The remainder of service connections consist of large acreages with and without commercial agricultural activities (18), irrigated parks (2), a school, and a few small home-based businesses. The RDOS has previously estimated that 65% of total annual water demand in the West Bench system is used for irrigation and agricultural purposes, based on industry benchmarks for basic domestic indoor use. A rudimentary estimate of leakage in the West Bench system based on a limited 2014 night flow data set suggested it is approximately 11% of total demand. (WSP Canada, 2016)

The treated water supplied to West Bench system customers is sourced from the City of Penticton through a bulk water purchase agreement. The West Bench water system serves a population of approximately 1,050, which declines by an estimated 20% in the winter months, when 'snowbirds' temporarily vacate the community. The size of the service population is expected to remain stable in future years due to limitations in land availability and sewage disposal options. (WSP Canada, 2016)

Considerable reductions in water use have been achieved in the West Bench system through a variety of strategies: a pipe replacement program, education and outreach, water-use restrictions, and universal metering. Over the 2006-2015 period, total water use declined by an average of 2.4% annually (Figure 7).

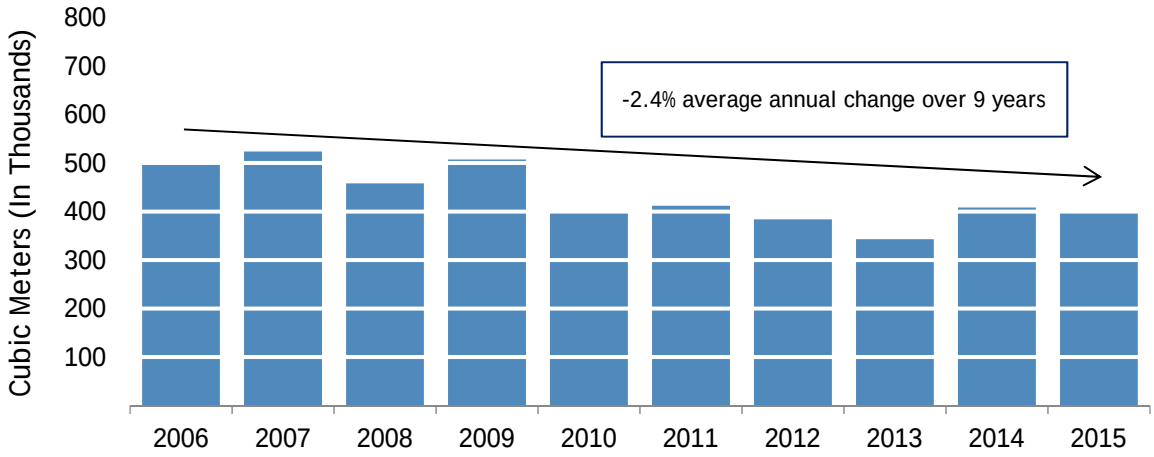

Figure 7: Historic Total Water Use for the West Bench System (2006-2015)

Seasonal water-use trends in the West Bench System did not change significantly over the five-year timeframe from 2009-2014. Summer total water use continues to be significantly higher than during the winter months and to a lesser extent, the shoulder seasons (Figure 8). The availability of daily total water use data for 2014-15 facilitated peak factor calculations (Figure 9). The West Bench peaking factors of 3.67 in 2014 and 3.55 in 2015 may be higher than those observed in the Faulder system due to a reduction in the size of the service population in winter, or more outdoor water use.

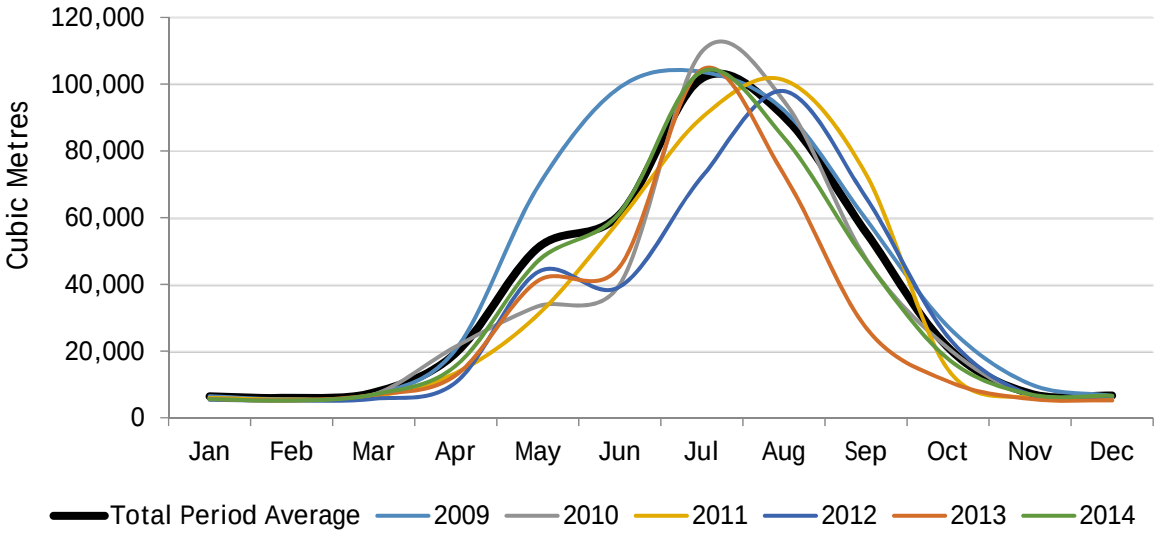

Figure 8: Average Total Monthly Water Use for the West Bench System (2009-2014)

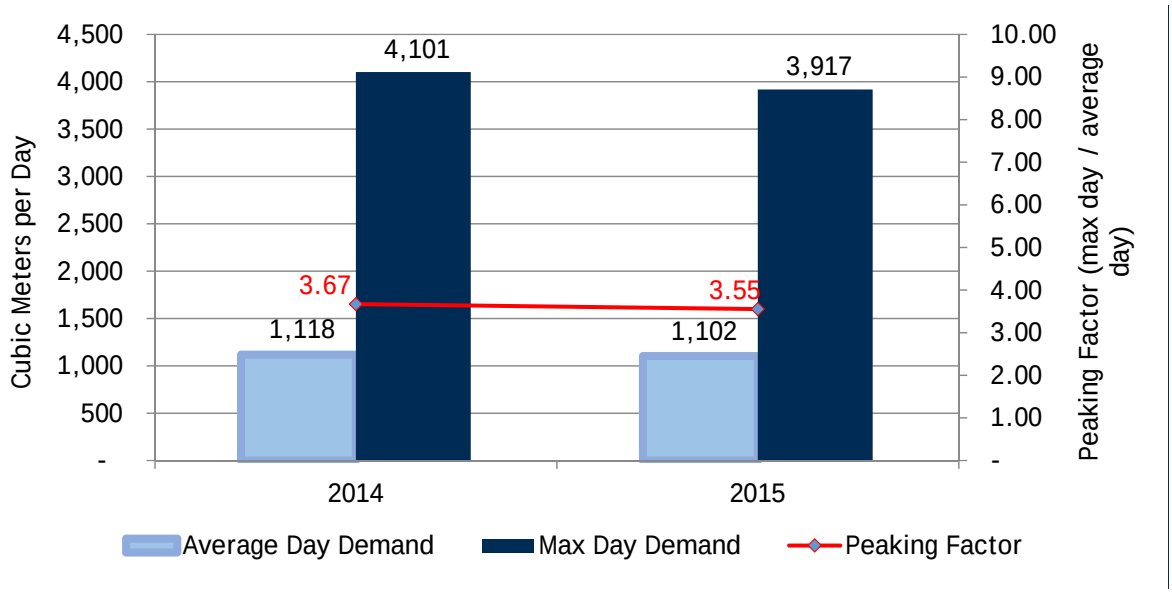

Figure 9: Average and Maximum Day Demand for the West Bench System (2014-2015)

2.1.4 Olalla Water System

The Olalla water system serves residents of a small unincorporated community approximately 45 kilometres southwest of the City of Penticton. A groundwater well replaced the original gravity-fed mountain stream source in 1999. The 233 water connections in this system serve an estimated 583 individuals.

In contrast to the other water systems for which historical total water use data is available, it remained relatively stable for the Olalla system over the 2005-2015 timeframe, and increased slightly in 2014 and 2015 (Figure 10). This increase in use may be due to an increase in the number of individuals or water connections serviced; however, historical service population data are not available to verify this. Since an increase in water use over this timeframe is inconsistent with patterns observed in other RDOS water systems and elsewhere in North America, another possible explanation is an increase in non-revenue water from leakage.

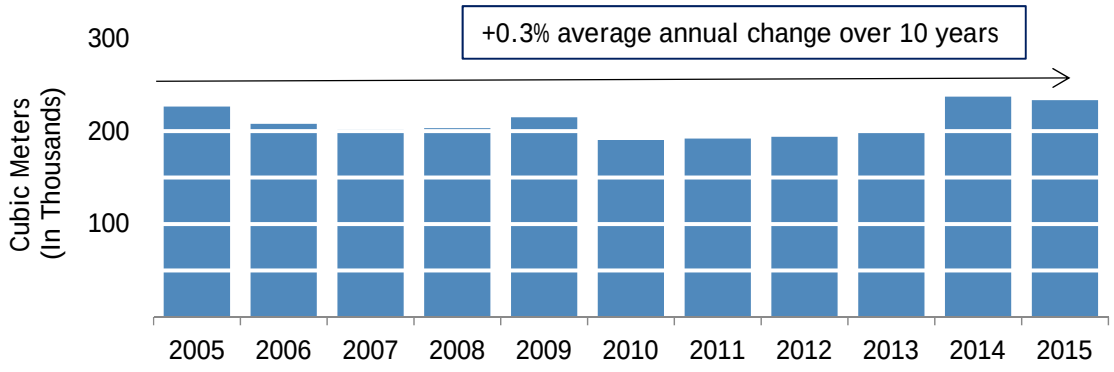

Figure 10: Historic Total Water Use for the Olalla System (2005-2015)

Water use in the Olalla system peaks in the warm summer months of July and August (see Figure 11). Figure 11 also illustrates that there was considerable inter-annual variability in water use during the May-June shoulder season from 2009 - 2014.

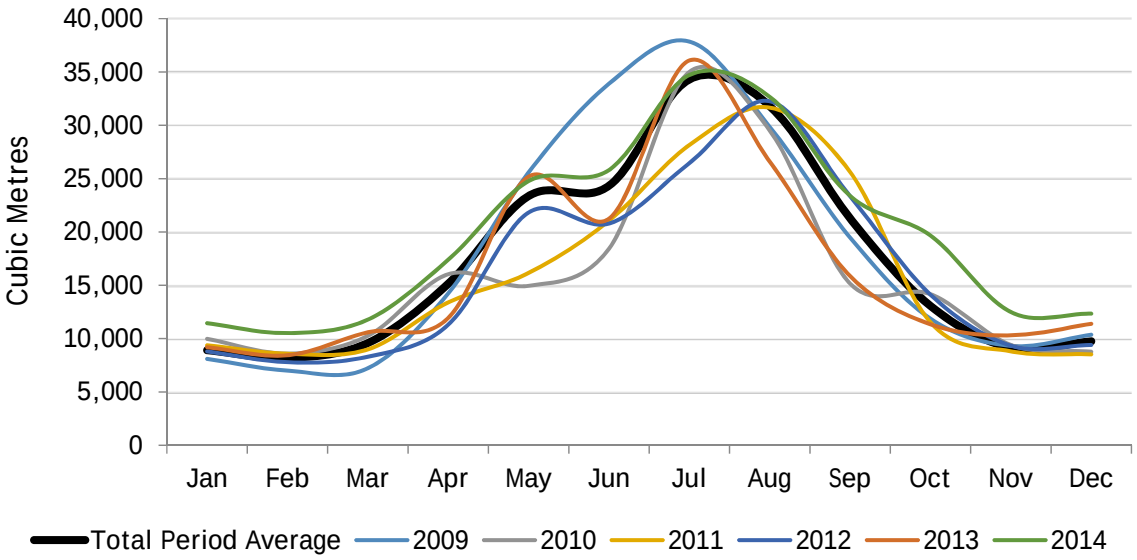

Figure 11: Average Total Monthly Water Use for the Olalla System (2009-2014)

The peaking factor for the Olalla system, or the difference between *maximum day demand* and *average day demand*, ranged from a high of 3.69 in 2010, to the low figure of 2.05 in 2015 (see the red font in Figure 12). The somewhat low peaking factors for the Olalla system relative to others may indicate less seasonal, outdoor (i.e., discretionary) use of water, or high leakage in the system that contributes to high water use figures year-round.

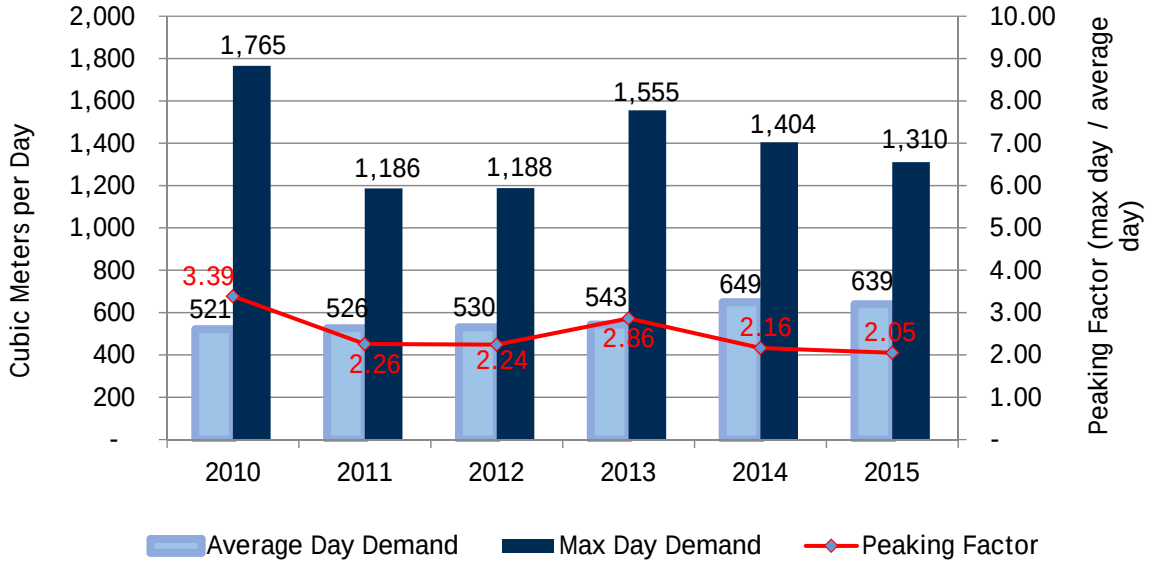

Figure 12: Average and Maximum Day Demand for the Olalla System (2010-2015)

2.1.5 Willowbrook Water System

The Willowbrook water system was acquired by the RDOS in July of 2016. It supplies 79 single-family properties from a deep groundwater well. Figure 13 illustrates some preliminary monthly total water use for this system based on partial 2016 and 2017 data, and Figure 14 shows the differences between *maximum* and *average day demand* and associated *peaking factors* for the same timeframe.

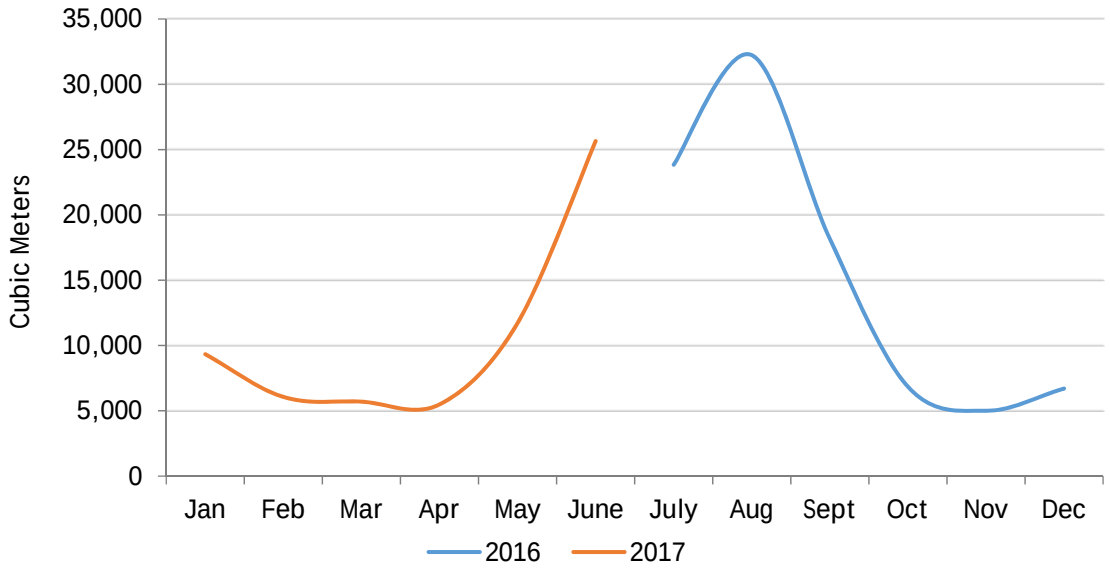

Figure 13: Average Total Monthly Water Use for the Willowbrook System (2016-2017)

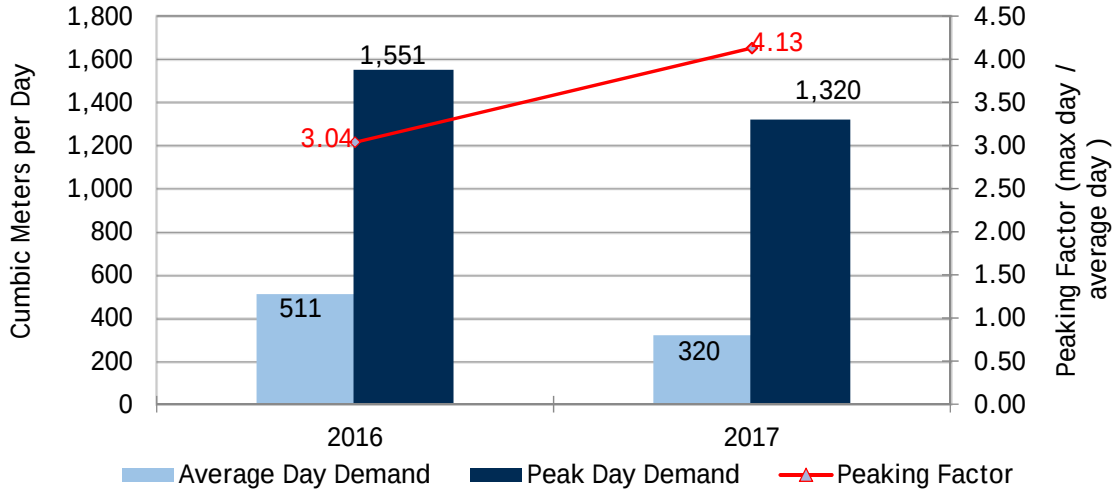

Figure 14: Average and Maximum Day Demand for the Willowbrook System (2016-2017)

2.1.6 Sun Valley Water System

The Sun Valley water system was acquired by the RDOS in January of 2017 and has 52 domestic connections. Insufficient data was available at the time of writing to conduct reliable analysis of baseline water use for this system.

2.1.7 Per Capita Total Water Use in Selected Regional District-Owned Systems

The availability of current service population estimates and daily use data for four of the water systems owned and operated by the Regional District enabled per capita total water use estimates to be calculated for 2015 (see Table 2). With the exception of the Faulder system, these per capita levels are quite high relative to the latest British Columbia estimate of 500 litres per capita per day for both metered and unmetered systems combined (Honey-Rosés et al., 2016). However, total water use per capita is not typically used as a metric to compare water systems due to the wide variety of water uses between systems. Residential per capita consumption is more typically used as a benchmark, but this data is unavailable for most RDOS water systems due to the limited coverage of metering.

The prevalence of agricultural activities in the Naramata service area may explain the high volume of water produced in that system relative to the size of the service population. Possible explanations of the high per capita use in the West Bench and Olalla systems are high system loss, erroneous readings from bulk meters, or high outdoor residential use from watering lawns or crops on semi-rural properties. The low use level in the Faulder system likely reflects a history of considerable supply limitations that, which influenced water-use behaviour.

Table 2: Total Water Use Per Capita per Day (2015)

	Naramata	Faulder	West Bench	Olalla
Daily Per Capita Total Water Use in 2015 (litres per capita per day)	2,369	474	1,050	1,096

2.2 The Sage Mesa Water System

In addition to owning and operating the above water systems, the RDOS also operates the Sage Mesa Water system. It has approximately 300 residential connections and two golf courses. Service connections are partially metered, and the water is sourced from Okanagan Lake.

3.0 Linkages to Community Policies

The water conservation initiatives outlined in this Regional Water Conservation Strategy support many of RDOS's existing strategic priorities and actions. The strategy is consistent with the *2006 Drought Management Plan for Naramata, Olalla, and Faulder*, and it is consistent with the direction of the following conservation plans that pertain to individual water systems:

- the Naramata Water Conservation Plan (2010),
- the Water Conservation Plan – Faulder System (2016), and
- the West Bench Water System Water Conservation Strategy (2016).

The Strategy addresses several recommendations in the 2017 Auditor General for Local Government's performance audit of three RDOS water systems (Naramata, Faulder, and Olalla), including:

- Recommendation 5: The Regional District of Okanagan-Similkameen should improve data collection, analysis, monitoring and reporting on its water services as part of a continual improvement process;
- Recommendation 14: The Regional District of Okanagan-Similkameen should develop a regional district-wide water conservation and demand management strategy; and,
- Recommendation 15: The Regional District of Okanagan-Similkameen should consider implementing a structured and results-based approach to water accounting to manage drinking water consumption and losses.

It also supports many goals, objectives, and actions outlined in the *2015-19 RDOS Strategic Plan*, and the *South Okanagan Regional Growth Strategy Bylaw 2770 (2017)*. Linkages between these important governance documents and this Regional Water Conservation Strategy are outlined in Table 4 on the next page.

Water demand management is also supported in numerous regional, provincial, and federal policies, including but not limited to *Living Water Smart: BC's Water Plan* (Government of British Columbia, 2008) and the *Water Charter* (Council of Federation, 2010).

Table 3: Linkages between the Conservation Strategy and RDOS Governance Policies

Policy Document	Linkage to the Regional Water Conservation Strategy
2015-19 RDOS Strategic Plan	The strategy will help advance the Value Statement on Environmental Responsibility by reducing water and energy use: *We believe that a healthy environment promotes healthy living in our communities. We have a responsibility to maintain, enhance and protect the environment through the consideration of environmental, fiscal and social impacts in our decision-making process.*
	The strategy will help achieve Strategic Goal 3 by reducing water and energy use: *Build a Sustainable Community by developing an economically sustainable organization and an environmentally sustainable community.*
South Okanagan Regional Growth Strategy Bylaw, No. 2770, 2017	This strategy is directly related to the Regional Vision Element: *Water and energy conservation and efficiency are supported by incentive programs and funding.*
	This strategy will help advance Goal 2 by encouraging water conservation and increasing the security of water supplies: *Protect the health and biodiversity of ecosystems in the south Okanagan.* as well as its underlying principle: *Water supply, conservation, and quality are key environmental concerns and priority considerations for environment resource management initiatives.*
	The strategy will directly advance Objective 2d: *Promote and enhance water conservation and sustainability.* as well as many of its proposed Supporting Policies: *2D-1 Apply and promote best management practices for residential, commercial, institutional, industrial and agricultural uses.* *2D-5 Continue collaborating with the Water Sustainability Committee of the BC Water and Waste Association, the Okanagan Basin Water Board, local governments and other local stakeholders on basin-wide water management and conservation initiatives.* *2D-6 Support the continued provision of adequate water resources for the agriculture sector, and ensure that adequate and secure access to water for the agriculture sector is a priority over non-essential urban uses.* *2D-7 Recognize that each jurisdiction has a responsibility to sustainably manage and conserve water resources in times of drought, or where stream health is threatened.* *2D-8 Promote the implementation of universal metering for water service connections, in collaboration with the Okanagan Basin Water Board.*
	This strategy will directly advance Objective 3-C: *Minimize environmental impacts of infrastructure and services.* and Supporting Policy 3C2: *Support projects to improve water resource management, including water conservation and reuse, ground water management, and stormwater.*
	This strategy will indirectly advance Goal 7 through the reduction in energy use associated with water conservation: *Reduce energy emissions and ensure the South Okanagan is prepared for a changing climate.*

4.0 The Case for Water Conservation in Okanagan-Similkameen

Water conservation can result in environmental, financial, and community benefits, some of which are listed below in Table 4. It also helps the RDOS meet local, provincial, and federal policy and regulatory requirements.

Table 4: Benefits of Water Conservation

Environmental Benefits	Reduced chemical use and disposal for water and wastewater treatment
	Reduced sewage disposal to the environment
	Less energy use and GHG emissions from reduced pumping and water treatment
	Enhanced environmental flows for streams, fish, and aquatic ecosystems
	Reduced or avoided impacts from construction of new infrastructure
	Contributes to Climate Action Planning Goals
Financial Benefits	Reduced and less variable operations and maintenance costs
	Cost savings for the RDOS and for residents from water reduced pumping and energy use
	Adopting best practices improves the chances of senior government funding and grants
	Reduced maximum day and week demand can lead to deferrals of new infrastructure
	Improved certainty about future demand and revenue
	More accurate costing and rate setting for water services
Community Benefits	Enhanced resilience to prolonged drought and a changing climate
	Potential for stimulation of investment and innovation in the tourism sector
	More water retained in reservoirs for firefighting and other emergency needs
	Promotion of a stewardship ethic within the community
	More secure, reliable, and sustainable water services for a variety of needs
	Helps offset the impacts on water supplies of population growth and climate change
Policy and Legislative Benefits	Supports objectives in the RDOS Strategic Plan and the Regional Growth Strategy
	Contributes to targets for the OBWB vision of maintaining the water basin's integrity
	Contributes to meeting obligations under the Province's *Water Sustainability Act*, *Environmental Management Act*, and Municipal Wastewater Regulations
	Supports the goals put forth in the Province's water plan, *Living Water Smart*
	Supports the federal Council of the Federation's *Water Charter*
	Improved compliance with water license conditions under the *Water Sustainability Act*

4.1 The Link Between Greenhouse Gas Emissions and Water Conservation

The reductions in greenhouse gas emissions (GHGs) associated with water efficiency are widely recognized due to the large amounts of energy required to pump, treat, and distribute water to users (Mass, 2009). Local governments are increasingly adopting corporate- and even community-wide targets for greenhouse gas reductions to contribute to climate change mitigation efforts. Water conservation strategies and climate targets can therefore go hand-in hand to support environmental objectives, such as those outlined in RDOS' Strategic Plan, the South Okanagan Regional Growth Strategy, and the Community Climate Action Plans.

To assist with meeting GHG targets or analyzing the costs and benefits of investing in water conservation strategies, projected GHG reductions associated with individual or cumulative water conservation measures is sometimes calculated by water utilities. Due to the limited availability of water use data for different customer categories and end uses in RDOS systems, such projections aren't possible. However, the RDOS can retroactively calculate GHG emission reductions from observed and quantified reductions in water use in the course of evaluating the effectiveness of water conservation efforts.

Several resources are available to help local governments understand GHG emissions associated with their operations, as well as quantify and reduce them. The BC Ministry of Environment (2016) and the Climate Action Secretariat (2017) have produced several such resources in recent years. The Alliance for Water Efficiency's Water Conservation Tracking Tool uses a standard methodology to calculate water savings and GHG reductions from an extensive inventory of conservation activities, and is clearly well tailored to water service provision roles.

5.0 Current Water Conservation Efforts

This section provides an overview of the RDOS's current and recent water conservation initiatives. Understanding the strengths and weaknesses of existing programming provides a foundation for developing future initiatives. Existing programs are organized by the following headings:

- incentives,
- outreach,
- marketing and education,
- metering, and
- outdoor water use regulations.

5.1 Incentives

Incentives involve things like product rebates, home audits, or giveaways such as shower timers and lawn watering gauges. Research from the fields of environmental psychology and social marketing shows that such measures can have a substantial impact on a variety of sustainable activities, including water use efficiency. In recent years, the RDOS has offered several incentive-based programs described below.

5.1.1 Rain Barrel Workshops and Rainwater Harvesting Workshops

Rain barrels are provided at no cost to residents in limited quantities. Most of the barrels are sourced as a by-product from the water treatment process and are otherwise not recyclable, so they come at no cost and have the side benefit of diverting solid waste from the landfill.

These giveaways are offered in conjunction with workshops hosted throughout the region. Since 2014, 16 such events have been held with over 475 attendees in total. Shorter training sessions are also provided at garden and hardware retail stores and community centres. These teach homeowners how to retrofit barrels, and also instill the importance of proper installation and maintenance. While it is recognized that the immediate water savings from the barrels themselves may not be great, this program helps foster a community of conservation and encourages people to look for other ways to improve efficiency around their yards and homes.

Figure 15: Barrels Used for the RDOS Rain Barrel Workshops

5.1.2 "Love Your Lawn" Compost Program

Since 2012, the RDOS has had a program of providing free compost to residents to apply to lawns to improve their health and reduce the need for summer watering. This compost is collected and processed by the RDOS and neighbouring municipalities, so this program also has the benefit of diverting a solid waste stream and its entails minimal direct costs (mostly staff time and a small amount of advertising). Over 1,084 tonnes have been given away to date, and over 200 properties participated in 2016. Staff members also provide instructions to residents on how to apply the compost and how it will lead to healthier lawns, which will require less irrigation to maintain a healthy lawn in the long term.

Figure 16: RDOS Staff Member Applying Compost to a Lawn

5.1.3 Tap-by-Tap Indoor Water Saving Kits

Between 2013 and 2015, the RDOS gave away over 800 indoor water savings kits in partnership with Fortis BC.[2] These kits included a low flow showerhead, tap aerators for the kitchen and bathroom, and a shower timer. They were given out at various outreach events as described in the next section, and are estimated to reduce water consumption for each fixture by 50%.

Figure 17: Sample Indoor Water Savings Kit Distributed by RDOS and Fortis BC

[2] Kits were provided to 500 to Naramata users, and 300 to West Bench, Sage and Olalla users.

5.2 Outreach

RDOS staff members employ various channels including community events, demonstration facilities, and direct mail to reach out to residents about water sustainability. These provide valuable opportunities to convey information to people who might otherwise not choose to access RDOS's programs.

5.2.1 Community Events

Various events are hosted or attended throughout the year including:

- staffed booths at community events, farmers markets, and the like;
- on-demand visits to elementary and middle schools to give the 'Source-to-Tap' presentation, particularly around Earth Day in April;
- information kiosks at 14 bank branches around region to support RBC Blue Water Day;
- support for Irrigation Association of BC training for irrigation installers; and,
- guest speaker events including "Managing Water Workshops", which often attract large crowds at RDOS venues.

Figure 18: RDOS Staff Conducting Public Outreach Related to Water Conservation

5.2.2 Rain Garden Demonstration Garden

Thanks in part to funding from the RBC Blue Water Project, a demonstration rain garden was constructed at the RDOS Regional District Office in Penticton (see Figure 19). This central location provides easy access for both RDOS and City of Penticton staff to use as a teaching garden or as part of educational tours. It was constructed as part of a larger project that includes three other facilities around the greater Okanagan region.

Figure 19: RDOS's Demonstration Rain Garden

5.2.3 Leak Detection Direct Mail Campaign

Advanced metering infrastructure at all connections in the West Bench service area allows staff to monitor for signs of continuous flow, which often indicates a leak inside the property boundary. When this occurs for periods longer than 35 days, staff analyze the data and send a letter to the homeowner along with a customized report, instructions for detecting leaks and toilet dye tabs. Anecdotal reports suggest these reports are usually well received by residents, and neighbouring jurisdictions are interested in replicating this approach. The RDOS staff estimate that as a result of the mail-outs, approximately 75% of the volume of water loss initially detected is fixed.

5.3 Marketing and Education

Marketing and education involve providing information to customers to help them understand how they use water now and how they can become more efficient in the future. This category includes all forms of marketing communications through all channels (mass media advertising, websites, social media, brochures, etc.). Poorly executed education and marketing efforts often have little or no impact on changing environmental behaviour. However, well-executed campaigns that employ carefully constructed messages, target specific behaviours, and emphasize personal contact lay a critical foundation for effective water demand management.

5.3.1 "Make Water Work!" Campaign

The RDOS partners with other local governments in the region to support the *Make Water Work!* campaign, led by the Okanagan Basin Water Board under the "Okanagan Waterwise" brand. This broad and prominent campaign employs numerous channels to deliver valley-wide messages, primarily about minimising outdoor water use. The advantages of a single, consistent approach across local government boundaries are many. Channels used include:

- pledge campaign
- contests
- yard signs
- Facebook ads
- e-newsletter
- rack cards
- stories in community newspapers and newspaper inserts
- commercials, live liners, promo spots on SUN FM radio
- signs on billboards, bus shelters, public benches
- door magnets for local government fleet vehicles
- branded "Frisbee" style lawn watering gauge giveaways
- dedicated website (www.makewaterwork.ca)

Figure 20: The *Make Water Work!* Website Homepage

5.3.2 RDOS-Branded Material

In addition to the large suite of region-wide material produced under *Make Water Work!*, the RDOS also puts out a small quantity of locally branded educational print and online material, including the following:

- print brochures and handouts on specific topics including as leak detection, rain barrels, and water wise lawn care; these are distributed at outreach events and have been inserted into water bills in the past;
- an Okanagan-Similkameen Rain Garden Guide;
- a Regional Drought and Flood Update newsletter in 2016;
- door handers for those watering on the wrong day; and,
- online content on the RDOS website and limited use of corporate social media channels (see https://www.rdos.bc.ca/index.php?id=232).

Figure 21: RDOS's Water Conservation Brochures

5.4 Customer Metering

While the RDOS lags behind some other communities in the region on customer metering, significant progress has been made in this area in recent years. The entire West Bench service area was recently fully metered and implementation of volume-based pricing proceeded in 2017. A number of connections in Olalla are metered (strata properties and a mobile home park), as well as in the Sage Mesa system, and 103 meters were installed in Naramata as part of a pilot project. Finally, most commercials properties in all service areas are metered.

5.5 Outdoor Water Use Regulations

Judicious use of lawn watering regulations prevents gross wastage outdoors and also reminds people that it is inefficient to irrigate more often than needed or during the heat of the day when most water is lost to evaporation. The RDOS currently has tailored restrictions for each service area it operates. Stages are numbered 1 through 4. Each stage has its own water-use restrictions and conservation targets. Each April, the RDOS moves into Stage 1 in all systems in preparation for increased demand and usage over the summer.

Specific requirements vary by system, but at Stage 1, most adhere to some variation of three days per week, mornings- and evenings-only watering (mornings only for automatic systems).[3] Restrictions may escalate by stages, depending on the status of the water supply.

For more information on current outdoor water use regulations, see www.rdos.bc.ca/departments/public-works/water-systems/water-restrictions/.

[3] For example, most systems use the "evens and odds" house-number approach to specify allowable watering days, but this cannot be used in the Faulder system due to the peculiarities of civic numbers in that service area.

6.0 Conservation Measures

This section recommends measures to guide conservation efforts in the RDOS over the next five years. The program measures emphasize improving the availability of water-use information and influencing behaviour through metering and volume-based pricing, and enhancing communication and incentives to encourage reduced consumption during summer months.

Table 5 below provides a consolidated list of program measures, and indicates in the last column whether they are new measures or enhanced ones that build on existing practices and programs. The strategy is organized by six themes:

- implement a long-term metering strategy,
- enhance non-revenue water management,
- demonstrate leadership in water efficiency,
- manage outdoor residential usage,
- ensure efficient agricultural water use, and
- enhance water conservation education and outreach.

Though not discussed here at length, this strategy also assumes that several existing economic and encouragement tools already in place to support conservation efforts among the RDOS customers will continue, specifically incentives, outreach, and marketing and education.

Table 5: Conservation Strategy Program Measures

Theme	Code	Program Measure	Status
Implement a long-term metering strategy	1.1	Enable metering in all water systems for all customers through regulation	Underway
	1.2	Require installation of meters and/or meter boxes at new developments	New
	1.3	Prioritize additional metering in areas that will mostly likely result in reduced customer demand and/or system losses	New
	1.4	Transition metered users to volume-based pricing as soon as practicable	Underway
Enhance non-revenue water management	2.1	Conduct utility water audits on all major water systems	New
	2.2	Develop and implement a system loss control program	New
	2.3	Continue and expand the customer leak notification program	Continue
Demonstrate leadership in water efficiency	3.1	Efficient technology in Regional District facilities	Enhance
	3.2	Best management practices in RDOS-managed landscapes	Enhance
Manage outdoor residential usage	4.1	Update and standardize outdoor watering allowances	Enhance
	4.2	Prohibit wasteful usage of water	New
	4.3	Explore regulatory & incentive measures to improve irrigation efficiency	New
	4.4	Educate residents on non-consumptive fire-prevention methods	New
Ensure efficient agricultural water use	5.1	Prioritize metering and volume-based billing for *Farm-Use Properties*	Enhance
	5.2	Work with OBWB on educational material for agricultural users	New
	5.3	Continue to promote best practices in farm irrigation	Enhance
Enhanced Water Conservation Education & Outreach	6.1	Continue to promote the *Make Water Work!* campaign in partnership with OBWB and other regional agencies	Enhance
	6.2	Continue and enhance education and awareness efforts targeting residential, commercial, and agricultural users	Enhance

Theme #1: Implement a Long-term Metering Strategy

Universal metering offers a range of benefits for water utilities, primarily in the form of enhanced fiscal management, asset management, and water demand management. With respect to impacts on community water consumption, authoritative sources typically estimate that demand reductions in the order of 10% to 30% will be achieved after the metering installation program is complete (see, for example, AWE, 2010; White, 1998). Similar results have been achieved in various BC communities (see, for example, Zapp, n.d.). It is also highly effective in helping design and monitor the effectiveness of water conservation measures.

Metering is important for controlling system loss because it allows service providers to implement improved water accounting and to gain better control over water that is lost throughout the system. Once meters are universally installed, it is possible to account for all the water consumed in homes and businesses and to compare this with water supplied to the whole system through master meters. In simple terms, the difference is non-revenue water, most of which tends to be leakage. Water service providers can use this information to decide what pressure management and leak detection and repair measures to take in order to reduce system loss to a level where it no longer makes economic, social or environmental sense to go further. Metering also provides an ability to identify and control real and apparent losses due to theft, main flushing, firefighting, meter errors, etc.

Based on consideration of both the challenges and benefits, the BC Water and Wastewater Association adopted the following position statement with respect to metering in order to guide members in implementing best practices to support the safeguarding of public health and the environment:

> *Every water utility should actively work towards accurately metering all water taken into its system and all water distributed from its system at its customers' point of service, read its meters at sufficiently frequent intervals to support consumption-based rate structures and enhance the ability to manage its water system (BCWWA, 2012).*

The BCWWA's position is consistent with those of other professional associations, including the American Water and Wastewater Association (AWWA, 2010) and the Canadian Water and Wastewater Association. Universal metering also directly supports policy 2D-8 in the new South Okanagan Regional Growth Strategy (2017):

> *Promote the implementation of universal metering for water service connections, in collaboration with the Okanagan Basin Water Board.*

As noted in Section 5.4, the current status of metering in the RDOS service areas is as follows:

- West Bench water system – universally metered;
- Olalla water system – several strata properties and a mobile home park are metered;
- Naramata water system - 103 meters were installed as part of a pilot project; and,
- Most commercials properties in all water systems are metered.

Building on this foundation, the RDOS should continue to work towards universal metering across all service areas in a staged fashion. The forthcoming Regional *Water Use Regulation*

and Conservation Bylaw proposes mandatory metering for all Farm-use Properties[4], and Measure 5.1 in this strategy identifies additional considerations to help ensure this regulatory approach achieves the significant water-saving potential it has.

The metering pyramid shown in Figure 22 illustrates that there is a spectrum of options available to increase the use of meters in all communities. For RDOS, this includes requiring meters or meter-readiness (i.e., meter boxes) in all new development and for new or repaired water services, offering voluntary metering, incrementally metering on a water system-by-water system basis, or universal metering through a single major project. Obviously, total expense increases with each step up the pyramid. However, efficiencies and economies of scale are also gained.

Figure 22: Water Metering Pyramid

The RDOS's own experience with the Naramata metering pilot program illustrated that metering also has the potential to reduce operation and maintenance costs and enable future capital costs to be deferred or avoided altogether. This can be achieved through reductions in water use from a combination of leak detection and more conscientious water use. The associated financial savings can help offset the initial capital costs associated with acquiring and installing meters. Wireless transmitting technology has also greatly reduced costs associated with ongoing reading of meters.

Going forward, the measures below are recommended to move the RDOS incrementally toward an ultimate objective of universal metering in all water systems.

[4] Farm-use Properties are those within a water service area and classified as 'farm' by the British Columbia Assessment Authority.

Measure 1.1: Enable metering in all water systems for all customer categories through regulation and require metering of all Farm-use Properties

Enabling language in current bylaws to provide authority for the RDOS to meter water service customers is inconsistent, and in some cases does not exist. This should be remedied through completion of the *Regional Water Use Regulation and Conservation Bylaw* consolidation project, with enabling language for metering in all water systems, and a mandatory provision for metering all *Farm-use Properties*. This is currently underway in parallel with the development of this strategy. Further considerations for mandatory metering of *Farm-use Properties* are identified in Measure 5.1.

Measure 1.2: Require meters or meter box vaults to be installed at all new developments and property-adjacent pipe replacement projects in all water systems

The RDOS should mandate meters and/or meter boxes at any new construction or major redevelopment and impose associated costs on developers.[5] Similarly, meters and/or meter box vaults should be routinely installed when infrastructure upgrades such as road repairs or pipe replacement is taking place on the RDOS-owned land adjacent to unmetered private properties, as well as when additional connections are added or existing connections are under repair. Both these steps are standard practices in many other jurisdictions and will help avoid costs and disturbances associated with retrofitting these homes and businesses later.

Measure 1.3: Prioritize additional metering in areas that will mostly likely result in reduced customer demand and/or system losses

Additional future metering projects will be subject to available budget. Subject to availability of resources, we recommend that the RDOS proceed incrementally toward universal metering on a system-by-system basis, similar to the approach recently taken with West Bench. In the absence of other drivers, the criteria used to select the next system should be a combination of either suspected high per capita use, or suspected high levels of system loss. These can be identified by considering average per capita total demand,[6] average lot size (larger lots tend to use more water for irrigation), average age of pipe infrastructure, and frequency of call-outs for pipe repair.

The cursory baseline water usage analysis in Section 2.1 suggests the Olalla and Naramata Water Systems may be good candidates for system-wide metering due to high per capital total use, but further consideration of the likelihood of system loss in each system is warranted. Theme #2, below, discusses issues around management of system loss further, and it is important to understand that water metering is an important tool for managing leakage.

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[5] Full installation of meters and meter boxes is preferable in water systems where there are plans to implement universal metering in the near term. Meter boxes (or "meter readiness") are generally preferable if full metering may still be some time down the road. This helps avoid installation of meters that are not used.

[6] Average per capita total demand is defined as total water supplied to the system divided by estimated total population in the system.

Measure 1.4: Transition metered users to volume-based pricing as soon as practicable

Under any metering scenario, it is recommended that metered customers be transitioned to volume-based billing, preferably following a period of 'mock billing' to allow them to anticipate changes in costs and adjust water-use behaviour. It is important to reiterate that many of the benefits of metering will only be fully achieved (and the downsides associated with resistance from the community avoided) if the program is accompanied by the adoption of an incremental volume-based rate structure and a well planned and executed communication program.

Summary and Evaluation Framework

Table six summarizes the core actions under this theme. Table 7 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward the attainment of a long-term metering strategy.

Table 6: Summary of Theme 1 Measures (Implement a Long-term Metering Strategy)

Code	Program Measure	Status
M1.1	Enable metering in all water system for all customer categories under bylaw	Underway
M1.2	Require installation of meters and/or meter boxes at all new developments	New
M1.3	Prioritize additional metering in areas that will mostly likely result in reduced customer demand and/or system losses	New
M1.4	Transition metered users to volume-based pricing as soon as practicable	Underway

Table 7: Theme 1 Outcomes & Monitoring Indices (Implement a Long-term Metering Strategy)

Outcomes	Indicators	Metrics	Methods
RDOS customer water demand is measured and customers pay based on the volume they consume	Percent of customers that are metered	Metered Properties / Total Properties	Tracking by staff
	Percent of customers that pay based on volume consumed	Accounts Charged by Volume / Total Accounts	Tracking by staff

Theme 2: Enhance Non-revenue Water Management

To effectively manage water, it is important to know how and where it is used throughout the RDOS's water systems. *Non-revenue water (NRW)* currently accounts for an unknown portion of the water that is treated. *NRW* has many components (see Figure 23). Some are legitimate uses, such as main flushing, fire hydrant testing, and irrigation of public parks. Others are sources of waste, such as easily repairable leaks and overflows. The portion of this water lost to leakage involves significant costs and affects the credibility of the RDOS's other work to encourage the community to manage consumption. Management of *NRW* is often one of the most cost-effective conservation measures available. We recommend the measures below to improve the RDOS's management of *NRW*.

<table>
<tr><td rowspan="8">System Input Volume</td><td rowspan="4">Authorized Consumption</td><td rowspan="2">Billed Authorized consumption</td><td>Billed Metered Consumption</td><td rowspan="2">Revenue water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Non Revenue Water (NRW)</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="4">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and/or Distrubution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to point of Customer Metering</td></tr>
</table>

Source: Winarni (2009)

Figure 23: Standard IWA Water Balance for the Infrastructure Leakage Index

Measure 2.1: Conduct utility water audits on all water systems

A water audit is robust process that breaks down the components of *NRW* and develops a program for reduction. Ideally, this should generally follow International Water Association or American Water Works Association methodologies (see, for example, AWWA, 2009), which are considered industry best practice.[7]

There is a significant challenge with estimating *NRW* as percentage of total demand in most of the RDOS's systems because the residential sector is largely unmetered. Consumption values are not readily available, so contribution to total demand has to be estimated. This in turn affects the estimation of *NRW* because it has to be calculated by subtracting the sum of all other sector uses from the total demand.

As a result, the RDOS will want to include night flow analysis as a key component of the audit. This allows for a more accurate estimation of real losses from within each water system. A night flow analysis is conducted during hours of minimum consumption (e.g., 12am to 4am) to determine the average rate of flow for one hour through a particular network zone (ideally night time in spring or fall when irrigation is minimal). For zones containing non-metered users, real-loss volumes are calculated by subtracting total estimated consumption (depending on connection type) from the volume entering the metered zone, typically estimated in litres per second (L/s). Ideally, data should be verified by checking valve integrity and meter accuracies before calculating real losses (Delgado, 2008). Costs can vary depending on the level of precision and effort desired (e.g., from installing data loggers, to take reads over a number of days and nights, to doing simple manual checks of meters a few hours apart during the night).

[7] Note that the IWA/AWWA methodologies are designed for larger systems, so application in whole will likely not be appropriate for the RDOS water systems. However, these can still offer a useful guiding framework for this work.

Results from the water audit will also help refine estimates of average customer consumption in non-metered areas, which will assist in targeting other conservation programs in this strategy (e.g., metering roll-out under Theme #1, above). In many cases, the audit will also identify contributions to apparent losses (e.g., leaks) that can be easily remedied at low cost.

Measure 2.2 Develop and implement a system loss control program

Based on the results of the water audit, the RDOS should next design and implement a system loss control program. This may include, for example, an ongoing active leak detection program or pressure management in specific water systems. Other measures may include checking valve integrity, meter accuracies through calibration, and installing additional zone metering.

Measure 2.3 Continue and expand the customer leak notification program

As discussed in Section 5.2 above, the RDOS staff has already implemented a successful and highly customized leak notification program in the recently metered West Bench system. This program should continue and be expanded, as made possible with the expansion of similar metering capabilities in other water systems.

Summary and Evaluation Framework

Table 8 summarizes the core actions under this theme. Table 9 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward the attainment of enhancing non-revenue water management.

Table 8: Summary of Theme 2 Measures (Enhance Non-revenue Water Management)

Code	Program Measure	Status
M2.1	Conduct utility water audits on all major water systems	New
M2.2	Develop and implement a system loss control program	New
M2.3	Continue and expand the customer leak notification program	Continue

Table 9: Theme 2 Outcomes & Monitoring Indices (Enhance Non-revenue Water Management)

Outcomes	Indicators	Metrics	Methods
Improved information on *NRW* and better control of losses currently occurring in water systems	Volume of water losses	m^3/service connection/year	Water Audit
	Improved customer attention to leaks on private property as metering permits	# of apparent leaks remedied by customers after notifications sent	Staff to estimate based on meter data

Theme 3: Demonstrate Leadership in Water Efficiency

This theme addresses measures that will improve the water efficiency of the RDOS's own operations and facilities. While the impacts of these measures often result in only minor reductions in use, they are important for ensuring that the Regional District demonstrates leadership to residents and other water users and maintains credibility in its role as a water service provider.

This work will build on successful projects already implemented by the RDOS, such as the demonstration rain garden at the Regional District Office in Penticton (see Figure 17), which continues to be used as a teaching garden and as a feature of educational tours.

We recommend the following measures to improve efficiency of the RDOS's current operations and facilities:

Measure 3.1 Efficient technology in Regional District facilities

Some effort has already been invested in updating water-use technology in Regional District buildings. With this positive context in mind, the RDOS should launch an audit program to review municipally-owned and managed facilities for conservation opportunities. This will include gathering information on construction dates, whether equipment has been updated, how many fixtures (e.g., toilets, sinks, showers, water-cooled equipment, air conditioning units, etc.) exist in each premise, and any metered water-use data. Audits may also consider outdoor water use for landscaping purposes. Installation of water-saving devices should continue until water-efficiency opportunities are maximized. A prioritized list of facilities to audit should be created early in the development of this program.

Examples of facilities the RDOS should include in the review include: the head office, fire halls, public washrooms associated with parks (e.g., Mariposa, Selby, Lions Parks) and the Naramata Museum, washrooms and kitchens in recreation centres and offices, and outdoor water features, such as the water park at Okanagan Falls.

Measure 3.2 Best management practices in RDOS-managed landscapes

In recent years, the RDOS has improved the water resilience of selected landscape installations using strategies such as xeriscaping and irrigation system optimization. With the support of RBC, one of these projects has been leveraged into a demonstration project for the community (see Section 5.2.2).The RDOS has also invested in advanced irrigation systems with electronic controls, valve timers, and rain sensors in some cases.

Given the manageable number of parks and boulevards maintained by the RDOS, the organization should continue to lead by example in water awareness by implementing best practices in landscape irrigation and design in all those it is responsible for maintaining. This can be achieved through a focus on the use of native and/or drought-tolerant landscaping, as well as continuing to adjust irrigation schedules according to weather conditions and the conservation stages in effect. Expanding metering to connections in parks and boulevards would easily facilitate performance monitoring of irrigation systems. These activities will demonstrate a commitment to water-conscious landscaping habits to the broader community and translate into improved credibility with all customers.

Summary and Evaluation Framework

Table 10 summarizes the core actions under this theme. Table 11 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward leadership in water efficiency.

Table 10: Summary of Theme 3 Measures (Demonstrate Leadership in Water Efficiency)

Code	Program Measure	Status
M3.1	Efficient technology in RDOS facilities	Enhance
M3.2	Best management practices in RDOS-managed parks and boulevards	Enhance

Table 11: Theme 3 Outcomes & Monitoring Indices (Demonstrate Leadership in Water Efficiency)

Outcome	Indicators	Metrics	Methods
Reduced water use in municipal and utility operations	Water use in municipally-owned and operated buildings	Metered water use compared to baseline	Metered consumption
	Water use in municipal greenspace	Metered water use compared to baseline	Metered consumption
Enhanced credibility with water users	Compliance with updated water conservation stages and other water-use bylaw provisions	Number of incidences of non-compliance with watering stages	Bylaw compliance monitoring
	Complaints from residents and water users regarding RDOS's water-use practices	Number of calls, emails, or in-person	Tracking by staff

Theme #4: Manage Outdoor Residential Usage

Outdoor water use creates demands on the RDOS's systems that can be almost five times greater than average use. Even in RDOS systems in which commercial irrigation is limited, high per capita use and peaking factors suggest that seasonal residential outdoor uses, such as lawn watering and irrigation of subsistence gardens or crops, is commonplace and accounts for a significant volume of water used in all systems. The Faulder system appears to be an exception, due to significant limitations in water supply availability. In all others, improving the efficiency of residential irrigation systems and changing behaviour and expectations with respect to lawn and landscape maintenance hold significant potential for conservation. Associated advantages include more certainty that communities will have enough water, that it will be of the highest available quality, and that costs will remain reasonable for users.

The RDOS is in the midst of a review and consolidation of water use bylaws across all its systems. Effective outdoor watering regulations will ensure sufficient capacity to meet community demands, and to minimize impacts on aquatic ecosystems and other water resource needs in the Okanagan-Similkameen Basin during times of shortage.

Regulatory tools such as restrictions can work in tandem with incentive-based tools such as product giveaways and education programs. As noted above, the RDOS has a solid foundation of these kinds of programs on which to build. In addition to the existing rain barrel workshops

and compost giveaways, the recommended program measures under this theme are outlined below.

Measure 4.1: Update and standardize outdoor watering regulations

Regulations for outdoor water use currently vary across the RDOS-owned water systems, and in some cases are non-existent or unclear. Addressing these discrepancies by adopting the proposed Schedule of Water Conservation Stages in the forthcoming *Regional Water Use Regulation and Conservation Bylaw* is recommended. The Schedule identifies five standard stages that would apply to all water systems; however, it is designed to enable the RDOS to enact the stages at different times in each system to account for variation in water supply availability.

Measure 4.2: Prohibit wasteful usage of water

Historically high water use in the Okanagan region and the absence of meters in most RDOS water systems can contribute to excessive use of water, whether accidentally or knowingly. The RDOS should adopt a regulatory provision to ensure sufficient authority to deter, cease, and penalize excessive use of water. This can be achieved by accepting the proposed definition of 'Excess Water Use' in the forthcoming *Regional Water Use and Conservation Bylaw* and including enforceable prohibitions.

Measure 4.3: Investigate regulatory and incentive-based measures to improve irrigation efficiency

While effective, regulatory approaches (i.e., bylaws or design standards) that require water-efficient landscape installations or practices are not yet commonplace in North America. This may be a desirable and more practicable medium or long-term approach for the RDOS. Significant reductions in outdoor water use on residential and commercial properties are likely attainable through voluntary measures, particularly if combined with education efforts and incentives.

An incentive program could be offered to encourage property owners to convert conventional spray irrigation systems to drip/trickle (i.e., micro) systems, which are associated with reduced water use. The incentives could be extended to include devices that aid in scheduling of irrigation, such as rain or soil moisture sensors. Costs for incentive programs can easily be contained by setting program caps and making them available to only those who apply before the program cap is reached. The program could also be launched on a pilot or a time-limited basis to help manage public expectations and ensure it is having the desired effect. Rebate programs currently offered by the Regional District of Nanaimo provide a helpful template. Landscape or garden supply centres commonly partner with water utilities in other jurisdictions to promote incentive programs.

Encouraging rainwater harvesting by offering financial incentives for large water storage structures (e.g., cisterns that hold a minimum of 1,000 gallons or 4,546 litres) can also help reduce reliance on RDOS-supplied water during periods when supplies are likely to be most limited, and in turn help improve drought resilience. Providing incentives for rain barrels is not recommended due to their low cost, free availability through existing programming, and since they do not store sufficient water to bridge gaps in precipitation events in the region.

Consideration could be given to incentives that encourage less water-intensive development. Possible approaches include expediting applications, allowing higher density, waiving permit fees, or issuing tax credits for proposed developments with water-conserving design features (e.g., use of drought-tolerant plants or significant rainwater storage capacity).

Measure 4.4: Educate residents on non-consumptive fire-prevention methods

There are anecdotal accounts that some RDOS residents water vegetation in close proximity to dwellings to reduce the risk of damage from forest fires. Though difficult to quantify, changing this behaviour by informing residents of alternative fire-prevention strategies may present an opportunity to reduce outdoor water use during the peak summer period when supplies are most limited and competing demands are highest. Alternative measures that can be promoted as an alternative to water use include:

- removing tree branches and dead vegetation from roofs, gutters, and the perimeter (out to 10 metres) of dwelling structures;
- creating fire breaks between houses and surrounding forested areas through the use of rock, mulch, or lightly-landscaped areas;
- disposing of yard clippings and branches at green waste facilities; and,
- maintaining landscape features that are low to the ground (e.g., 10cm) around the perimeter of dwellings. (Ecora Engineering & Resource group Ltd., 2016)

These alternative fire-prevention strategies can be promoted on the RDOS website, through the creation of a brochure distributed at community events, and through incorporation in content delivered through existing community presentations and workshops. Partnership with local fire departments is recommended to ensure consistency in communication.

Summary and Evaluation Framework

Table 12 summarizes the core actions under this theme. Table 13 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward improved management of outdoor residential water use.

Table 12: Summary of Theme 4 Measures (Manage Outdoor Residential Water Use)

Code	Program Measure	Status
M4.1	Update and standardize outdoor watering allowances	Enhance
M4.2	Prohibit wasteful usage of water through an updated bylaw	New
M4.3	Explore regulatory and incentive-based measures to improve irrigation efficiency	New
M4.4	Educate residents on non-consumptive fire-prevention methods	New

Table 13: Theme 4 Outcomes & Monitoring Indices (Manage Outdoor Residential Water Use)

Outcome	Indicators	Metrics	Methods
Reduced summer water demand	Compliance with updated outdoor water-use allowances	Number of incidences of non-compliance with watering stages	Bylaw compliance monitoring
	Monthly and annual water use in each water system	Daily Per capita total water use Peaking factors	Tracking and analysis by staff
Less waste of water through excessive and unnecessary use by customers	Type of irrigation systems	Number of rebates provided	Bylaw compliance monitoring
	Complaints received regarding wasteful water-use practices	Number of email, phone, and in-person complaints received	Tracking by staff

Theme #5: Ensure Efficient Agricultural Water Use

Agricultural activities are a major consumer of water in the Regional District and account for an estimated 55% of water use throughout the Okanagan Region (Okanagan Basin Water Board, 2011). Furthermore, water demand for irrigation in the Okanagan is likely to increase in the future due to the anticipated climate change impacts of lower summer precipitation and higher temperatures (BC Ministry of Forests, Lands, and Natural resource Operations, 2015; British Columbia Agriculture & Food Climate Action Initiative, 2016).

From a farm perspective, reducing water use can significantly enhance drought resiliency, reduce energy use and greenhouse gas emissions, improve the security and sustainability of community water systems, reduce need for fertilizers and herbicides/pesticides, and reduce costs for farm owners through savings in energy and water expenses.

Given the significant use of water for irrigation of commercial agricultural operations irrigation in the Naramata service area in particular, the apparent high outdoor usage in most RDOS systems (see Section 2.1), and the potential for increased demand to service both small scale 'hobby' farming and commercial agriculture, the actions outlined below are recommended to improve agricultural water-efficiency.

Measure 5.1: Prioritize metering and volume-based billing for Farm-use Properties

The forthcoming *Water Use Regulation and Conservation Bylaw* proposes a requirement that all *Farm-use Properties* are metered. Combining metering with the introduction of volume-based rates that charge users lower unit costs for lower volumes consumed is recognized as an effective technique to encourage conservation among agricultural users (Vickers, 2001). To advance the long-term objective of universal metering (Theme #1) and improve agricultural water use efficiency, the Regional District should:

- use a combination of education and compliance monitoring to ensure all *Farm-use Properties* have meters installed;
- begin to measure water use by *Farm-use Properties* to help set appropriate volume-based water rates for this category of users; and,

- implement volume-based rates preceded by a mock billing period to allow these water users to anticipate changes in costs and to adjust their water use accordingly through improvements in efficiency.[8]

Measure 5.2: Work with OBWB to produce educational material for agricultural users

To increase the consistency of water conservation messaging across the Okanagan region, in partnership with the OBWB, produce an educational product that can be distributed to *Farm-use Properties* with water bills and at community events. Adopting the existing *Make Water Work!* brand will likely improve the effectiveness and reach of the product due to consistency with existing water conservation materials and an ability to distribute it through OBWB channels, such as the *Make Water Work!* website. The RDOS should explore strategic partnerships to help distribute the materials, such as with irrigation and farm supply companies.

The educational product should inform agricultural water users of best practices for agricultural water use, outline incentives to improve water efficiency, and direct them to additional resources where they can find more information. Producing the product in Punjabi as well as English is recommended to reach all target water users. A sample list of relevant resources to aid in the production of this material is outlined in Table 15.

Table 14: Online Resources Related to Agricultural Water Efficiency

Resource Titles, Author(s), and Web Links	
Water Conservation Factsheet: Irrigation Water-Saving Tips	Author: BC Ministry of Agriculture
Web link: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/water/500-series/500310-2_irrigation_water_saving_tips.pdf	
Water Conservation Factsheet: Irrigation Tips to Conserve Water on the Farm	Author: BC Ministry of Agriculture
Web link: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/water/500-series/500310-1_irrigatiion_tips_to_conserve_water.pdf	
BC Irrigation Management and Scheduling Resources	Author: BC Ministry of Agriculture
Web link: http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/water/irrigation/irrigation-management-guide	
Agricultural Irrigation Workshop (handout from a 2012 event held to help local governments understand agricultural irrigation)	Author: BC Ministry of Agriculture
Web link: http://bclna.com/wp-content/uploads/2014/10/Nursery-Irrigation-Workshop-Booklet-July-11-2012.pdf	
Opportunities in Agriculture: Smart Water Use on your Farm or Ranch	Author: Sustainable Agriculture Network

[8] During mock billing periods, flat-rate pricing continues, but customers are provided with a mock bill with information about what will happen to costs after the volume-based approach is introduced. To be most effective in reducing demand and community concerns, bills should be accompanied by educational information about how to improve the efficiency of water use.

Web link: https://www.oregon.gov/owrd/docs/Ag_water_conservation.pdf

Measure 5.3: Promote best practices in farm irrigation

There is a wide range of practices that can reduce water use for irrigation, such as the use of flow-control devices, water-conserving nozzles, windbreaks, ground cover, use of water-resilient crops and compost. Focusing efforts on working with agricultural water users and industry associations, such as the Irrigation Industry Association of BC, specifically to improve the efficiency of irrigation is recommended to optimize resources.

The best practices below should be promoted through education and outreach activities. The relatively small number of *Farm-use Properties* served by the RDOS' water systems presents an opportunity to engage directly with these customers individually or in small, targeted group settings. In addition to distributing the educational product discussed above (Measure 5.2), the RDOS should host workshops to introduce agricultural water users to more efficient irrigation techniques and resources, possibly in partnership with the BC Irrigation Industry Association of BC.

Encourage use of more efficient irrigation systems

Drip/trickle irrigation systems (also referred to as micro-irrigation) are considerably more efficient than sprinkler irrigation systems due to reduced water loss from evapotranspiration, runoff, and wind (van der Gulik, n.d.; Alliance for Water Efficiency, 2016). However, farms in BC use more sprinkler-based systems than other Canadian jurisdictions (Statistics Canada, 2011) and approximately 70% of irrigation systems in the Okanagan region are sprinkler-based (e.g., hand/wheelmove guns, solid set sprinklers, etc.) (van der Gulik, 2010).

Drip/trickle irrigation systems are well suited to fruit crops due an ability to target the root zone of plants. The predominance of grape and fruit crops in the RDOS's service areas suggests that encouraging agricultural users to transition to more efficient irrigation systems could significantly reduce water use, potentially for both commercial agricultural users and semi-rural residential properties practicing small-scale subsistence farming. Consideration should be given to introducing incentives for transition to more efficient irrigation systems, in conjunction with a program for residential properties (Measure 4.3), and introducing the program to *Farm-use Properties* in combination with meters to measure consumption.

Encourage strategic scheduling of irrigation

At a minimum, agricultural producers should be encouraged to irrigate through the night, in the early morning, or late in the evening to reduce water loss from evapotranspiration during the warmest periods of the day. More sophisticated irrigation scheduling that takes into account soil moisture content and other climatic conditions can further reduce water use. The availability of online tools that use existing climate stations throughout the province makes it possible for farmers to adopt these techniques at very little cost. Two such examples are the Agricultural Irrigation Scheduling Calculator and the BC Agriculture Water Calculator.

Summary and Evaluation Framework

Table 15 summarizes the core actions under this theme. Table 16 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward more efficient agricultural water use.

Table 15: Summary of Theme 5 Measures (Ensure Efficient Agricultural Water Use)

Code	Program Measure	Status
M5.1	Prioritize metering and volume-based billing for *Farm-use Properties*	Enhance
M5.2	Work with OBWB to produce educational material for agricultural users	New
M5.3	Continue to promote best practices in farm irrigation	Enhanced

Table 16: Theme 5 Outcomes & Monitoring Indices (Ensure Efficient Agricultural Water Use)

Outcome	Indicators	Metrics	Methods
Farm-use Property water demand is measured and customers pay based on the volume they consume	Percent of *Farm-use Properties* that are metered	Metered *Farm-use Properties* / Total Properties	Tracking by staff
	Percent of *Farm-use Properties* that pay based on volume consumed	*Farm-use Properties* Charged by Volume / Total Accounts	Tracking by staff
More efficient water use by *Farm-use Properties*	Percent of drip/trickle irrigation systems in use	Drip or trickle irrigation systems in use / Total commercial irrigation systems in use	Voluntary (paper) survey, 'windshield' survey by staff, or inspections
	Total water demand from *Farm-use Properties*	Litres/day, month, or year	Meter reading and tracking by staff

Theme #6: Enhanced Water Conservation Education and Outreach

Education and outreach involve providing information to customers to help them understand how they use water and make changes. This category also includes all forms of marketing communications through all channels (mass media advertising, websites, social media, brochures, etc.), as well as communication through customer service staff, elected officials and other civic spokespeople. Poorly executed education and marketing efforts often have little or no impact on changing environmental behaviour. However, well-executed campaigns that employ carefully constructed messages, target specific behaviours and emphasize personal contact lay a critical foundation for effective water demand management.

The smaller size of the RDOS's water systems offers a significant advantage in terms of ease of access to residents and businesses to convey target messages and leverage word of mouth to encourage behavioural change. Selected core materials should also be produced in Punjabi to take into account the linguistic needs of more water customers. Recommended program measures under this theme are outlined below.

Measure 6.1 Continue to promote the Make Water Work! campaign in partnership with OBWB and other regional agencies

As noted in Section 5.3, the RDOS has partnered with OBWB and other agencies to deliver marketing communications about water conservation under the *Make Water Work*! campaign for a number of years. Benefits of this coordinated approach include lower costs, consistency of messaging across the region and across service areas, broader reach, and focused messaging on reducing outdoor demand, which is a significant and discretionary use of water across the Okanagan Region. The RDOS should enhance this strategic partnership in two ways:

- with the support of the OBWB, initiate a small-scale campaign under the *Make Water Work*! Brand targeting agricultural water users (see Measure 5.2 for details); and
- adopt the *Make Water Work*! brand (e.g., logo, font, and colour elements) for all online and print communications to offer more consistent branding across all RDOS programs.

Measure 6.2 Continue and enhance education and awareness efforts targeting residential, commercial, and agricultural users

The RDOS staff has successfully implemented a water conservation outreach campaign for a number of years that includes community events, workshops, print materials such as fact sheets, and an online presence. This multi-pronged approach increases the likelihood of engaging a variety of water users. The actions outlined below are recommended to enhance existing outreach efforts.

6.2.1 Create print materials to introduce the new watering regulations

Introduce a small suite of new print material (consistent with the *Make Water Work*! brand) to communicate to make all water users aware of the forthcoming updated conservation stages and to make it easy for them to understand the new regulations (e.g., rack card and a fridge magnet). and to encourage efficient agricultural water use (e.g., rack card or billing insert) (see Measure 5.2 for details).

6.2.2 Improve the RDOS water conservation webpage

The RDOS Water Conservation webpage (http://www.rdos.bc.ca/departments/public-works/water-systems/water-conservation/) currently hosts a lot of useful information to help customers reduce their water use. However, we recommend that a review of content and layout be undertaken to improve user-friendliness, potentially with support from communication specialists. The following are recommended website enhancements to increase traffic to the site, application of the information, and ultimately water conservation efforts:

- improve ease of navigation on the page by having a menu of page contents at the top of the page or in the sidebar menu;
- add links to water conservation strategies that are in effect;
- add a direct link to information about water conservation stages, and avoid using the negative term ‘restrictions’ to describe the outdoor water allowances enacted by bylaw;

- make the webpage more interactive by including a link to an external water use calculator, such as the one hosted on the Alliance for Water Efficiency website (http://www.home-water-works.org/calculator)[9]; and,
- include the Uniform Resource Locator (URL) for the Water Conservation webpage on all water-related print materials distributed to water users, including water bills, and when possible, include it in social media posts.

Appendix I provides concise overviews and website links for several online water conservation resources that could augment the quality and variety of information available on the RDOS website.

6.2.3 Build a website feature to communicate about water conservation stages in effect

Creating an interactive map-based website interface will facilitate instantaneous communication about water conservation systems across all water systems. [1] The Regional District of Nanaimo has a highly effective interactive map feature on its website that could be used as a template and likely replicated at a reasonable cost (see http://www.rdn.bc.ca/cms.asp?wpID=3661). This feature is also likely to be an effective interface for displaying information about water rates and related fees in all of RDOS's water systems.

6.2.4 Enhance awareness of water sources and services through social media

RDOS's existing social media profile should be leveraged and enhanced to increase online communication about water services. For instance, relevant posts to the Facebook page could include:

- profiles of each RDOS water system (e.g., water supply sources, service population sizes, location/type of treatment system, staff members operating the system, number of years/days in operation without service interruptions);
- reminders of regular water-related events (e.g., bill-payment deadlines, flushing, enactment of water conservation stages); and,
- water conservation tips.

Another social media platform, Twitter, has the advantage of facilitating very timely dissemination of concise, straight-forward information. The RDOS should consider using Twitter as a promising means of communicating about changes in water conservation stages across its water systems. As much as possible, social media postings should include hyperlinks to the RDOS's website to allow the target audience to find more detailed information, and also to drive traffic to the website and enhance its visibility.

[9] The Alliance for Water Efficiency's water calculator allows viewers to navigate through a three-dimensional home, where they are provided with information and asked questions about habits and the technology in use. The result is a personalised assessment of water consumption by activity in the home, a comparison of the user's consumption to others, and recommendations for efficiency improvements.

Summary and Evaluation Framework

Table 17 summarizes the core actions under this theme. Table 18 describes the expected outcomes and identifies indicators and methods that can be used to monitor progress and evaluate success toward enhanced water conservation education and outreach.

Table 17: Summary of Theme 6 Measures (Enhanced Water Conservation Education & Outreach)

Code	Program Measure	Status
M6.1	Continue to promote the *Make Water Work!* campaign in partnership with OBWB and other regional agencies	Enhance
M6.2	Continue and enhance education and awareness efforts targeting residential, commercial, and agricultural users	Enhance

Table 18: Theme 6 Outcomes & Monitoring Indices (Enhanced Water Conservation Education & Outreach)

Outcome	Indicators	Metrics	Methods
Reduced water use by customers	Total monthly and annual water use in each water system	Daily Per capita total water use Peaking factors	Tracking by staff
Enhanced awareness of water and RDOS water services	Level of engagement with water-related outreach activities	Number of print materials distributed, number of Facebook friends and likes, number of Twitter followers and retweets, number of website hits	Tracking by staff

7.0 Implementation Schedule

This section outlines a recommended timeframe for the implementation of the water conservation program. It is recommended that annual reports be presented to the RDOS Board of Directors documenting progress toward the recommended conservation measures in the reporting period, and priorities for the year ahead.

Measures		2018	2019	2020	2021	2022
Theme #1: Implement a Long-term Metering Strategy						
M1.1	Enable metering in all water system for all customer categories under bylaw	■				
M1.2	Require installation of meters and/or meter boxes at all new developments		■	▒		
M1.3	Prioritize additional metering in areas that will mostly likely result in reduced customer demand and/or system losses			■	■	▒
M1.4	Transition metered users to volume-based pricing as soon as practicable				■	■
Theme #2: Enhance Non-revenue Water Management						
M2.1	Conduct utility water audits on all water systems		■	■	▒	▒
M2.2	Develop and implement a system loss control program			■	■	▒
M2.3	Continue and expand the customer leak notification program		■	▒	▒	▒
Theme #3: Demonstrate Leadership in Water Efficiency						
M3.1	Efficient technology in Regional District facilities		■	▒	▒	▒
M3.2	Best management practices in RDOS-managed landscapes		■	▒	▒	▒
Theme #4: Manage Outdoor Residential Water Use						
M4.1	Update and standardize outdoor watering allowances	■				
M4.2	Prohibit wasteful usage of water	■				
M4.3	Investigate regulatory and incentive-based measures to improve irrigation efficiency		■	■	▒	▒
M4.4	Educate residents on non-consumptive fire-prevention methods			■	▒	▒
Theme #5: Ensure Efficient Agricultural Water Use						
M5.1	Prioritize metering and volume-based billing for *Farm-use Properties*			▒	■	■
M5.2	Work with OBWB to produce educational material for agricultural users			■	▒	
M5.3	Continue to promote best practices in farm irrigation			■	▒	▒
Theme #6: Enhanced Water Conservation Education & Outreach						
M6.1	Continue to promote the *Make Water Work!* campaign in partnership with OBWB and other regional agencies	■	▒	▒	▒	▒
M6.2	Continue and enhance education and awareness efforts targeting residential, commercial, and agricultural users	■	▒	▒	▒	▒

Legend

■ Program Development and Planning ▒ Ongoing implementation

8.0 Conclusion

Through adoption of this strategy, the Regional District of Okanagan-Similkameen is advancing its commitment to provide sustainable and safe water to the communities it serves, today and into the future. The RDOS will implement tried and tested conservation measures that have been proven to reduce consumption throughout the province and across the country.

Despite reductions in total water use in recent years, in per capita terms, it is considerably higher in most of the RDOS's water systems than other BC communities. The conservation measures in this strategy are designed to target high discretional uses of water, and importantly to improve understanding of its use and system loss so that conservation efforts can be monitored and refined in the future.

Conserving water has many advantages for the RDOS and its water users. Most importantly, it saves energy and costs associated with treatment and distribution, it advances strategic objectives outlined in several governance and planning documents, and it enhances the RDOS's stewardship of our shared natural environment. Using water as efficiently as possible is the responsibility of each and every individual. If everyone does their part, these benefits can be enjoyed by the whole community, and the sustainability of the water systems will be greatly improved.

This strategy is considered to be a "living" document – one that is flexible, adaptable, and responsive to changes in technology, awareness, and other factors that will occur during the implementation period. Over the next five years, staff should continue to explore up-and-coming areas of water efficiency. By 2022, the RDOS will have a greatly improved understanding of water use throughout all of its systems and be able to build on this foundational program to design new measures that address the emerging issues of the next decade.

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Appendix I: Web-based Water Conservation Resources

Home Water Works - Alliance for Water Efficiency (Chicago, USA)
http://www.home-water-works.org/calculator

Website Feature: Water Calculator

The Alliance for Water Efficiency's water calculator allows viewers to navigate through a three dimensional home, where they are provided with information and asked questions about habits and the technology in use. The result is a personalised assessment of water consumption by activity in the home, a comparison of the user's consumption to others, and recommendations for efficiency improvements. Rather than develop an interactive tool such as this from scratch, it would be possible for the City to link to this existing website through a membership in AWE.

The Energy Savings Trust – Water Energy Calculator (United Kingdom)
http://www.energysavingtrust.org.uk/domestic/water-energy-calculator

Website Feature: Water-Energy Calculator

This water-energy calculator incorporates sleek graphics and is very easy to use. The assessment is financially based, rather than on volumes, and it therefore may provide more incentive for users to change habits or purchasing behaviour when they have information about much money they can save.

The City of Guelph, Ontario; California Urban Water Conservation Council
The City of Guelph http://guelph.ca/living/environment/water/water-conservation/
The California Urban Water Conservation Council: http://www.h2ouse.org/tour/index.cfm

Website Feature: Virtual Tour

The City of Guelph and the California Urban Water Conservation Council have websites that use an interactive virtual tour of the home to give tips and ask questions on appliances and habits in the bathroom, kitchen, laundry room, garage, basement and outdoors.

Save Our Water (California USA)
http://saveourwater.com/
Website Features: Simplicity and broad appeal

Save Our Water is a statewide program aimed at helping Californians reduce their everyday water use. Created in 2009 as a partnership between the Association of California Water Agencies and the California Department of Water Resources, the site offers ideas and inspiration for permanently reducing water use.

Other Resources

Think H2O: Links to some of the best water conservation resources from around the web:
http://www.thinkh2onow.com/water_conservation_websites_resources.php

Water Use It Wisely: US based private company that provides print and online resources
http://wateruseitwisely.com/

Living Water Smart Home Water Assessment: print guide produced by BC Ministry of Environment to assist with evaluating home water use
http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-planning/livingwatersmart_book.pdf

Appendix II: Recommendations to Improve Water-use Accounting, Monitoring, and Reporting for RDOS Water Systems

Purpose of this Appendix

1. To establish data collection procedures, and for select water systems, generate the baseline data required to:
   - measure changes in water produced by the RDOS's water systems over time;
   - assist with forecasting future demand to ensure the adequacy of existing water supplies/allocations, infrastructure, and revenues; and,
   - evaluate the effectiveness of the Conservation Strategy.
2. To address recommendations from the May 2017 report from the performance audit of three RDOS water systems carried out by the Auditor General for Local Government of British Columbia, including:
   - No. 5: the Regional District of Okanagan-Similkameen should improve data collection, analysis, monitoring and reporting on its water services as part of a continual improvement process; and
   - No. 15: the Regional District of Okanagan-Similkameen should consider implementing a structured and results-based approach to water accounting to manage drinking water consumption and losses.

Recommendation No. 1: On an hourly basis, record the 'total water use' for each water system using SCADA technology

The volume of water that exits treatment facilities and is measured by a bulk meter is referred to as 'total water use'. It includes water consumed by all customers, as well as *non-revenue water*[10], such as water lost to leakage or main flushing. Reliable water use data is required to understand how demand and water losses are changing over time, and in turn to plan for the provision of water services and ensure supplies and infrastructure are sufficient to meet future needs.

The more frequently water use data is collected, the greater insights it can provide for understanding and predicting the behaviour of water users. Hourly data collection is recommended, to take into account the significant variation in water use that occurs

[10] *NRW: Non-Revenue Water*. Water that has been treated and pumped to the distribution system, but is generally not metered, not billed, and therefore does not contribute to utility revenues. There are more than 20 sources of *NRW*, including consumptive uses such as distribution system leakage ("system loss") and hydrant water used by utility operations and fire departments for various maintenance and training purposes (AWWA, 2009).

throughout the day, and to ensure systems are designed to handle the spikes in consumption referred to as 'peak' use, which typically coincide with morning and dinner-time routines.

Use of a Supervisory Control and Data Acquisition (SCADA) system to facilitate automatic data collection and recording is recommended to reduce the incidence of human error, and to improve the efficiency of data collection routines and subsequent data analysis.

While transitioning from manual data collection to the adoption of SCADA systems, total water use should be recorded minimally once per day for each system, including on weekends when water consumption habits differ from week days. Care should be taken to ensure consistent data collection techniques. Over time, systematic scheduling of manual bulk meter readings by RDOS staff could produce an accurate picture of the hourly consumption habits of water users, and help water system operators identify peak-hour demand.

It is important to note that in most RDOS water systems, without additional metering or efforts to quantify non-revenue water, changes in total water use cannot definitively be attributed to changes in water-use behaviour by customers. Observed variation in water use could also by caused by changes in non-revenue water, such as increased leakage.

Recommendation No. 2: Update per capita water use estimates for each system

The 2010 South Okanagan Regional Growth Strategy and the Auditor General's performance audit report both identify per capita water consumption as a performance indicator for water services. Residential water use per capita per day (expressed in litres per capita per day or "LCD") is a standard benchmark used to measure the efficiency of residential water use in water systems.

Residential daily per capita use can easily be determined for the universally metered West Bench system using this calculation:

> *(total annual consumption of residential customers / size of the service population)/ 365 days = X litres per capita per day*

Residential per capital consumption estimates can similarly be calculated for the Olalla and Faulder systems by extrapolating the consumption of the homes that participated in metering pilot studies to the number of homes in the respective service areas of each.

For the water systems with no residential metering is in place, it is only possible for the RDOS to calculate **total daily water use per capita**, which includes both water used by customers, as well as non-revenue water:

> *(total annual water production from bulk meter / size of the service population)/ 365 days = X litres per capita per day*

It is important to note that total water use figures should not be used to compare water consumption levels between the RDOS water systems, or with systems in other jurisdictions, since the composition of water users and uses differs substantially between systems, as do quantities of non-revenue water.

By way of example, in per capita terms, almost five times as much water is produced per day by the Naramata system relative to the Faulder water system because a significant volume of water in Naramata is used for agricultural activities. While these figures provide no indication of the relative efficiency of water use in each system, they can and should be used to monitor changes in a system's water use over time. When used for this type of time series analysis, calculating per capita total water use can help evaluate changes in overall water efficiency (across all customer categories), and forecasting future water needs and revenues.

Recommendation No. 3: Regularly update service area population estimates for all water systems

Regardless of which per capita calculation is used to evaluate system efficiency, the RDOS should ensure accurate service population figures are used for all water systems. If the service boundaries for water systems align with census areas, official data from Statistics Canada can be used for this purpose. If the boundaries do not align, an estimated service population size can be calculated by multiplying the number of residential accounts by the average of 2.1 individuals per household in the Regional District (Statistics Canada, 2016)[11]. These values should be updated annually or as practicable since minor variations in population size can have considerable impacts on per capita consumption calculations due to the small size of the RDOS water systems.

Recommendation No. 4: Perform annual analyses to better understand and forecast water-use behaviour and serve as key performance indicators

The Auditor General's report recommends the development of a performance management and continuous improvement process using key performance indicators aligned with the RDOS' strategies and plans. To this end, it is recommended that the RDOS adopt the following metrics as key performance indicators that are reported on annually to the RDOS Board and public, to monitor the performance of each water system over time:

- average daily per capita total water use (expressed in litres per capita per day) to monitor trends in overall water needs and identify implications for supply and service management;
- average daily per capital residential water use (for West Bench, Olalla, Faulder, and other systems, as metering permits) to provide an indicator of residential water efficiency; and,
- peaking factors to provide an indication of the pressure on supplies and infrastructure from agricultural and discretionary residential uses, which can be used to adjust/enact water conservation stages and/or water rates.

  Peaking factor = total water use on the day of the year it was highest/average daily total water use (not expressed in units since it is a multiplication factor)

[11] Statistics Canada. (2017). *Okanagan-Similkameen, RD [Census division], British Columbia and British Columbia [Province]* (table). *Census Profile*. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released October 25, 2017.
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Additional analyses that can be produced with existing data to provide additional insights include:

- graphing monthly total water use can illustrate seasonal trends, which may be particularly valuable in water systems with high agricultural use and shifting water use behaviour in response to changing weather patterns;
- monthly and annual consumption by ICI users can be graphed to illustrate trends in water use behaviour and evaluate the potential for volume-based billing; and,
- graphical representation of monthly and annual consumption by other categories of users (e.g., agricultural) as metering permits can help identify trends in water use behaviour and evaluate the potential for volume-based billing.

Recommendation No. 5: Use historical water-use data and demand forecasts to inform annual rate adjustments and achieve full-cost recovery

As the RDOS acquires a better understanding of current water use in each system and sufficient data to observe trends over time, annual demand forecasts should be developed for each fiscal year and used to assist with water rate setting, to ensure sufficient revenues will be generated to cover the costs of the service. Many local governments are in the practice of creating an annual demand forecast (e.g., 2% decrease in total water demand per annum), based on the previous 3-5 years of actual consumption data, which they in turn use to distribute costs across water customers.