

Comox Valley Regional District Water Efficiency Plan

September 2009



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Introduction

Relying on glacial capped mountains for its drinking water, the Comox Valley will use its water efficiently in order for the community to continue to thrive in balance with its water resources. The Comox Valley Regional District's (CVRD) water efficiency plan has been designed to manage how domestic water is used in the Comox Valley water system (CVWS). More effective and efficient water use will result in numerous cost savings by:

- Reducing the size of capital infrastructure upgrades required in the near future (e.g. treatment facilities, pump stations, reservoirs);
- Deferring or potentially eliminating the need to construct water supply capital infrastructure upgrades (e.g. reservoirs, pump stations);
- Avoiding source water expansion projects (e.g. raising the dam); and
- Reducing variable operating costs (e.g. chlorination chemicals and electricity purchases for pumping).

The plan also recognizes that the water source, Comox Lake via the Puntledge River, is shared with other users, such as BC Hydro (for electricity generation) and the Federal Department of Fisheries and Oceans (for fisheries and conservation purposes), and has numerous ecological values. Effective and efficient use of water will enable the CVRD to better adapt to potential climate change impacts, such as increased frequency and magnitude of droughts, and to reduce greenhouse gases through decreased electricity use (from pumping etc.) and from avoiding the need to potentially raise the dam and flood additional surrounding land (resulting in decomposition and release of methane). Water use reductions may also have positive benefits for the Comox Valley's wastewater system through the reduction of incoming effluent volumes.

Much of the information used to develop this plan is derived from other recent studies and reports, including:

- Comox Valley Water System Universal Metering Study Update, 2007, Koers and Associates Engineering Ltd.(Koers)
- Water Conservation Strategy Review, 2009, Koers
- Water Conservation Plan Guidelines, US Environmental Protection Agency
- Various reports by the POLIS Water Sustainability Project located at University of Victoria

The ultimate success of this plan will be the shared responsibility of all users including residents, businesses, and local governments. The plan's effectiveness will be monitored regularly and modified as needed in order to achieve the desired water consumption reduction targets.

Background

As of 2008, the Comox Valley water system supplied water to approximately 40,406 people including residents of the City of Courtenay, Town of Comox and the following CVRD Local Service Areas (LSA):

- Comox Valley Water LSA
- Arden Water LSA
- Marsden/Camco Road LSA
- Greaves Crescent Water LSA
- England Road Water LSA

Water is drawn from Comox Lake by way of BC Hydro's penstock and intake on the Puntledge River that supplies their hydroelectric generation facility. Occasionally CVRD operates a backup intake and pump station on the Puntledge River (e.g. when BC Hydro is performing maintenance). Water is then treated at a chlorination facility prior to being supplied in bulk to the City of Courtenay, Town of Comox and LSAs by way of pump stations, storage reservoirs and large supply watermains. This bulk supply is metered and each supply customer is responsible for distribution of the water throughout their service area.

As of 2008 there were approximately 8,880 connections within the City of Courtenay, 4,313 in the Town of Comox and 1,603 within CVRD LSAs for a total of 14,796 connections. Estimates for number of connections are based on information gathered by Koers as part of their work on the 2007 Universal Metering Study Update and have been increased based on 2.8% growth as suggested in the study. The estimates for service population are based on an average ratio of 2.5 people per connection for the CVRD's LSAs and on 2008 BC Stats data for the Town of Comox and City of Courtenay. The City of Courtenay's population has been adjusted to account for connections they serve across municipal boundaries, areas within the City that are served by the Sandwick Improvement District and those that receive no water service.

Table 1: 2008 Populations and Connection Estimates

Area	2008 Connections	2008 Population
Arden	227	568
Comox	4,313	13,281
Comox Valley	1,261	3,154
Courtenay	8,880	23,118
England Road	19	46
Greaves Crescent	22	54
Marsden/Camco	74	185
TOTAL	14,796	40,406

*Estimates are approximate only and deemed sufficiently accurate for water efficiency planning.

Water System

The CVRD holds a Conditional Water License, issued by the Ministry of Environment, permitting a maximum annual diversion of 9,092,180 cubic metres (m³) and a maximum daily diversion of up to 70,464 m³ from the Puntledge River. This equates annually to only approximately 0.84% of the available allocated water with the rest being allocated to BC Hydro (82.54%) and Fisheries and Oceans Canada (16.62%). CVRD has previously applied for an increase to its licensed allocation, however the BC Ministry of Environment has not yet given this approval and it is expected that CVRD will be required to meet the provincial target set out in the Living Water Smart Plan stipulating that 50% of new municipal water needs are to be met through conservation.

Since water is drawn out of BC Hydro's penstock, the CVRD also has an agreement with BC Hydro for this use, which includes compensation for lost power sales as well as a maximum withdrawal rate of 79,556 m³ per day. Adherence to these limits is an important factor in the design of the CVRD's water efficiency plan. Other limitations exist in the water system's physical infrastructure, which includes:

Reservoirs

The West Courtenay, Marsden, Comox, Crown Isle and East Courtenay (twinning project underway) reservoirs are required for fire storage, emergency storage, water pressure and to balance flow throughout the day (including meeting peak hourly demand).

Pump Stations

The Ryan and Dingwall pump stations are required to distribute water throughout the supply system when gravity supply is not possible. The Puntledge River pump station is the Comox Valley's backup source during periods when BC Hydro is undertaking maintenance or repairs on the penstock.

Chlorination Facility

The chlorination station on the Puntledge River is required to disinfect the water to safe standards set out in the Canadian Drinking Water Guidelines.

Supply Watermains

Supply watermains are required to distribute large volumes of water throughout the system, for example from the chlorination station to the reservoirs.

The design and sizing of this infrastructure is based on required water pressures, fire flows (volume and duration), and the maximum day or peak hourly water demands. Increasing water consumption will result in the need to increase the size of existing system components and eventually to construct new facilities and watermains. CVRD will be analyzing the current and required capacities of this infrastructure over the course of 2009-2010 in order to determine required future upgrades. While the CVRD uses a development cost charge (DCC) bylaw to ensure that future growth and development pays for its fair share of this infrastructure, various upgrades will be required for existing residents. This may include a new intake on Comox Lake and a new water treatment facility to achieve emerging water quality standards. While the exact scope and scale of these projects is not known definitively, estimates have been developed that have the new intake at \$53 million (based on conceptual design undertaken by CH2M HILL in 2008) and a new water treatment facility at

\$30-60 million (based on benchmarks from similar constructed facilities elsewhere in the province). The scope and costs of these projects is largely dependant on water quality in Comox Lake, evolving drinking water standards, water consumption levels and the ability to prolong the functional life of the existing facilities. While these estimates are approximate at this time, they point to the opportunity for 10's of millions of dollars in cost savings associated with reduced water demand as a result of the water efficiency plan.

In addition to water system infrastructure, the wastewater collection and treatment system is also impacted by high water consumption and will similarly benefit from reduced water demand.

Water Demand

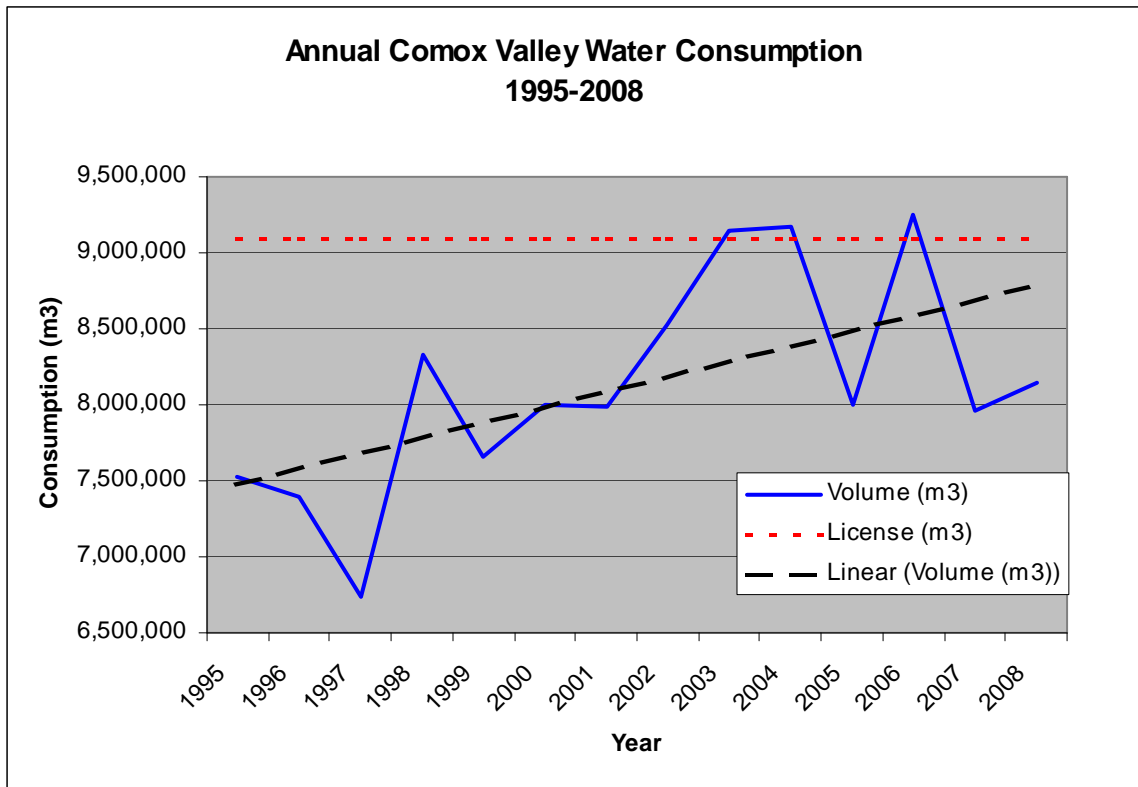
Annual water consumption data for the Comox Valley system varies due to water conservation efforts, climatic differences, and other factors. Consumption data from 1995 – 2008 collected through the bulk meters, is shown in Table 2 below.

Table 2: 1995 - 2008 Comox Valley Annual Water Consumption.

Year	Volume (m3)
1995	7,529,160
1996	7,398,150
1997	6,734,348
1998	8,332,323
1999	7,657,018
2000	7,996,537
2001	7,989,981
2002	8,528,680
2003	9,148,649
2004	9,170,526
2005	8,005,882
2006	9,255,646
2007	7,967,079
2008	8,145,190

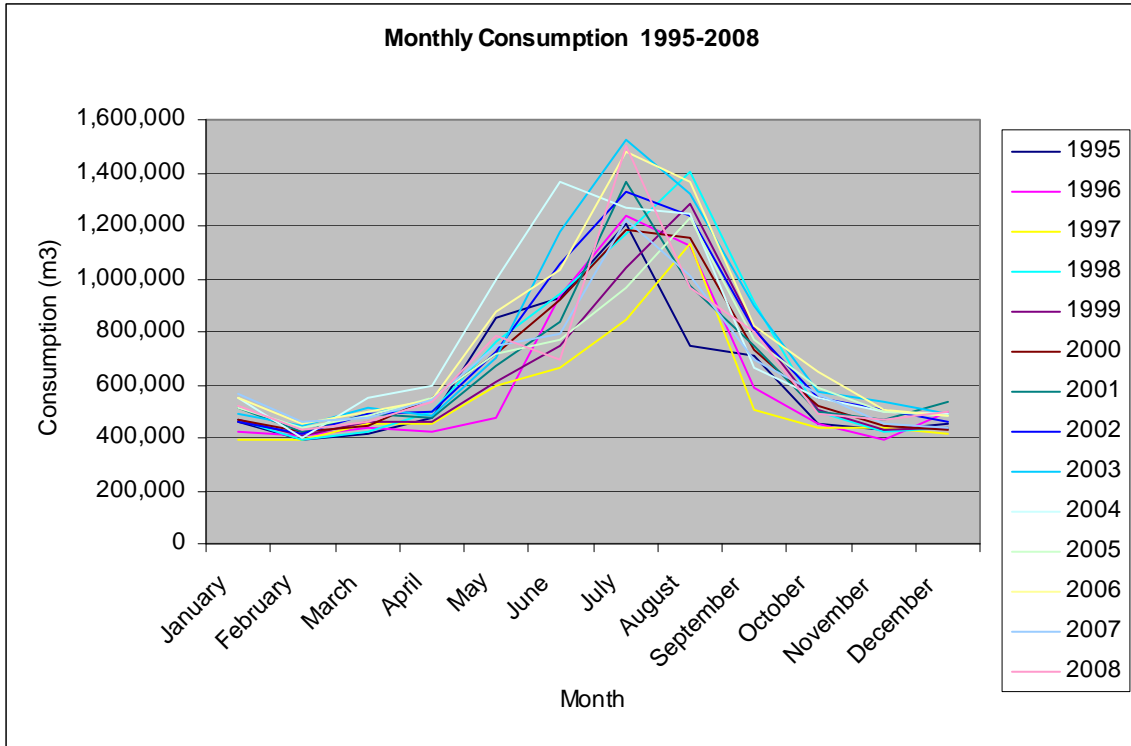
Graph 1 below shows clearly that though annual water consumption in the Comox Valley varies, the overall trend (shown in linear scale) is of increasing consumption, and further that annual water consumption has exceeded CVRD's licensed withdrawal in 2003, 2004, and 2006.

Graph 1: 1995 – 2008 Comox Valley Annual Water Consumption



Variations in water use occur throughout the year, largely associated with lawn and garden sprinkling, and are shown in Graph 2 below. This clearly shows that water use is very level through much of the year, begins to increase in May and peaks in July due to sprinkling, then decreases back to normal by October.

Graph 2: 1995 –2008 Monthly Water Consumption

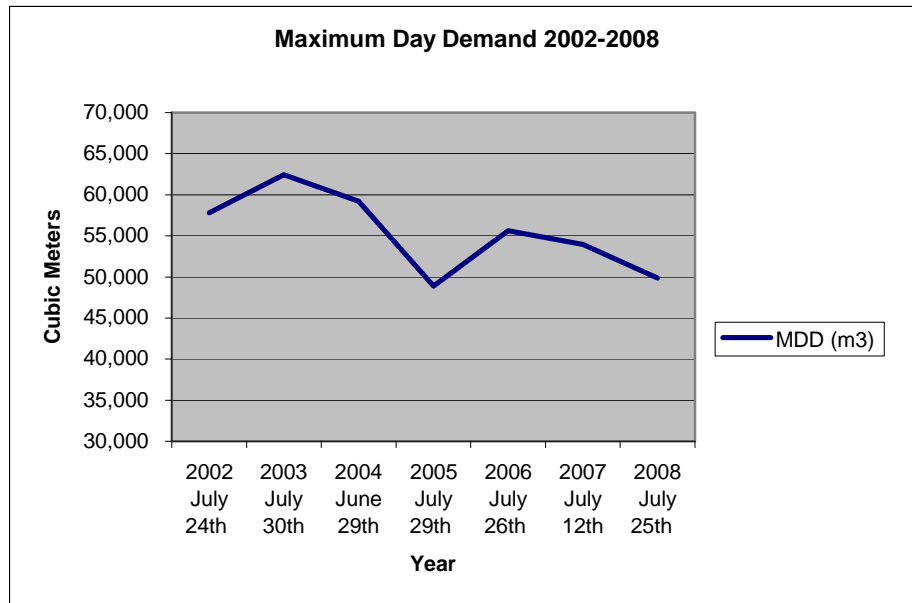


Maximum daily demand, which occurs in summer, is critical to the sizing and design life of the water system’s major infrastructure components, and has also been tracked annually (Table 3 and Graph 3 below).

Table 3: Maximum Day Demand (MDD) 2002-2008

MDD (m3)	Date
57,792	2002 July 24th
62,462	2003 July 30th
59,226	2004 June 29th
48,881	2005 July 29th
55,646	2006 July 26th
53,957	2007 July 12 th
49,854	2008 July 25 th

Graph 3: Maximum Day Demand 2002-2008



The decrease in maximum day demand can be attributed to education, increased sprinkling restrictions and recent wetter summers.

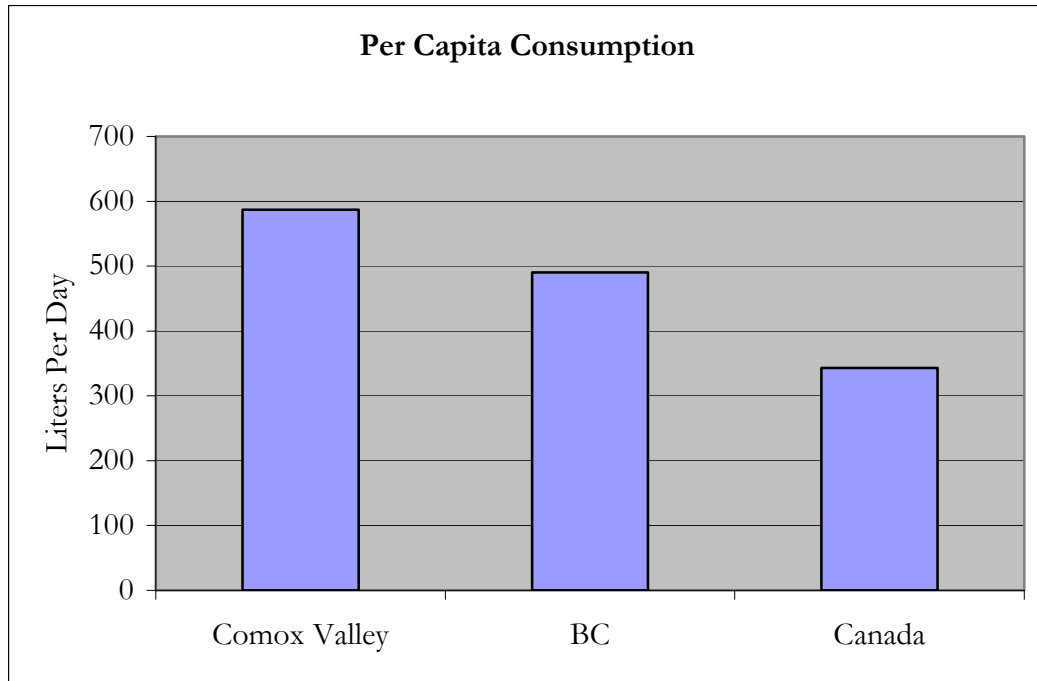
Detailed Water Demand Analysis

Koers undertook a detailed water use analysis for the 2009 Water Conservation Strategy Review. Their analysis shows that while annual consumption has increased at approximately 10.7% since 1995 (0.83% per year), that it is highly dependant on rainfall. This can be seen especially well over the last 3 years where water use was at its highest in 2006, while rainfall was near its lowest, and dropped in 2007 and 2008, when rainfall was much higher. The report also shows that the average monthly water consumption during cooler wetter months is just over 493,000m³, during warmer dryer months (May through September) nearly doubles and during the peak month (July for 2008), monthly consumption triples.

Water System Profile

With approximately 40,406 people served by the water system, current daily per capita water consumption is estimated at approximately 552 litres based on annual usage. With past estimates as high as 675 litres per capita per day (5-year average of 605 litres, 3-year average of 586 litres) water consumption has dropped in recent years for reasons explained above (e.g. education, climate). However, consumption is still high and compares poorly to the provincial residential average of 490 litres and national average of 343 litres per capita per day (Graph 4).

Graph 4: Daily Per Capita Water Use Comparison



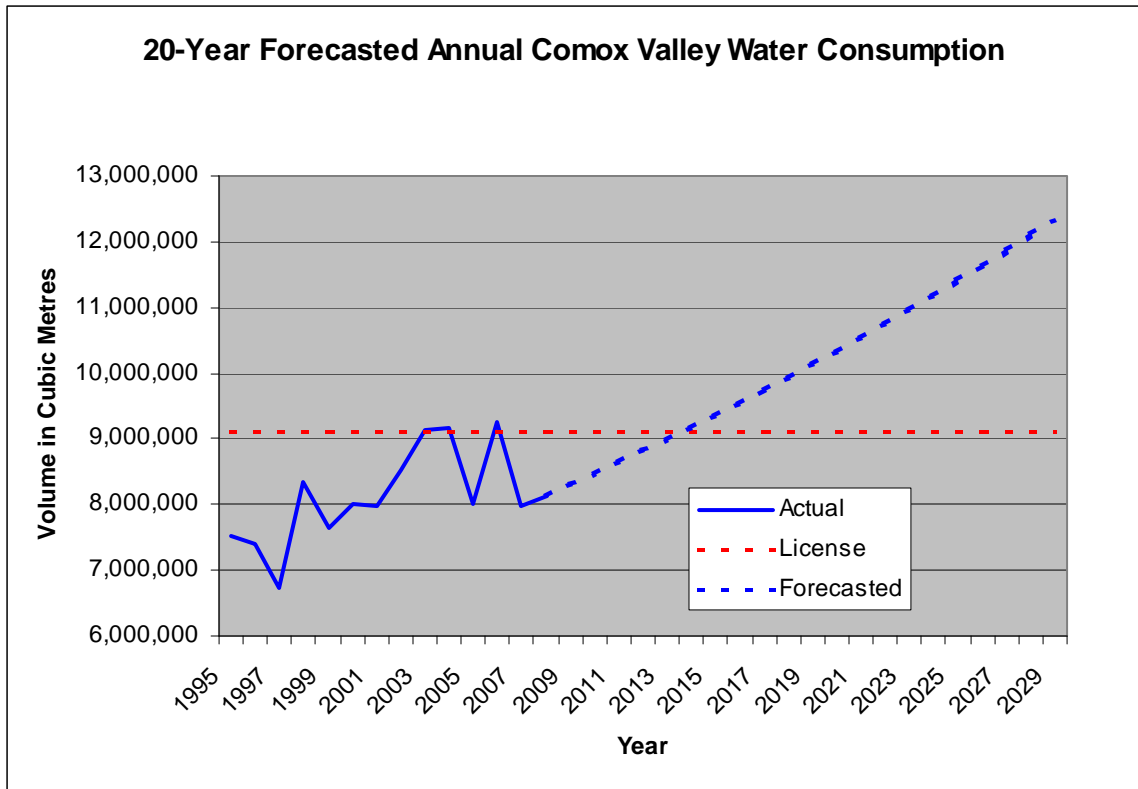
*Using 3-year average in Comox Valley and provincial/national data from BC Living Water Smart Plan http://www.livingwatersmart.ca/watersmart/images/residential_use.gif

The per capita consumption increases significantly in summer when daily water use can reach as high as 1,238 litres per person (based on maximum day demand in 2008). On a per connection basis (per home), the average annual water consumption works out to approximately 1,508 L per day.

Forecasts

Over the past 18 years water consumption has risen by just over 40%, or approximately 2.27% per year. However, most of the increase occurred early in this period and since 1995 the increase has been approximately 10.7%, or 0.83% per year. For forecasting purposes, the 2007 Universal Metering Study suggests using a conservative annual increase of 2%. Graph 5 below shows the forecasted annual water consumption over the next 20 years based on this increase.

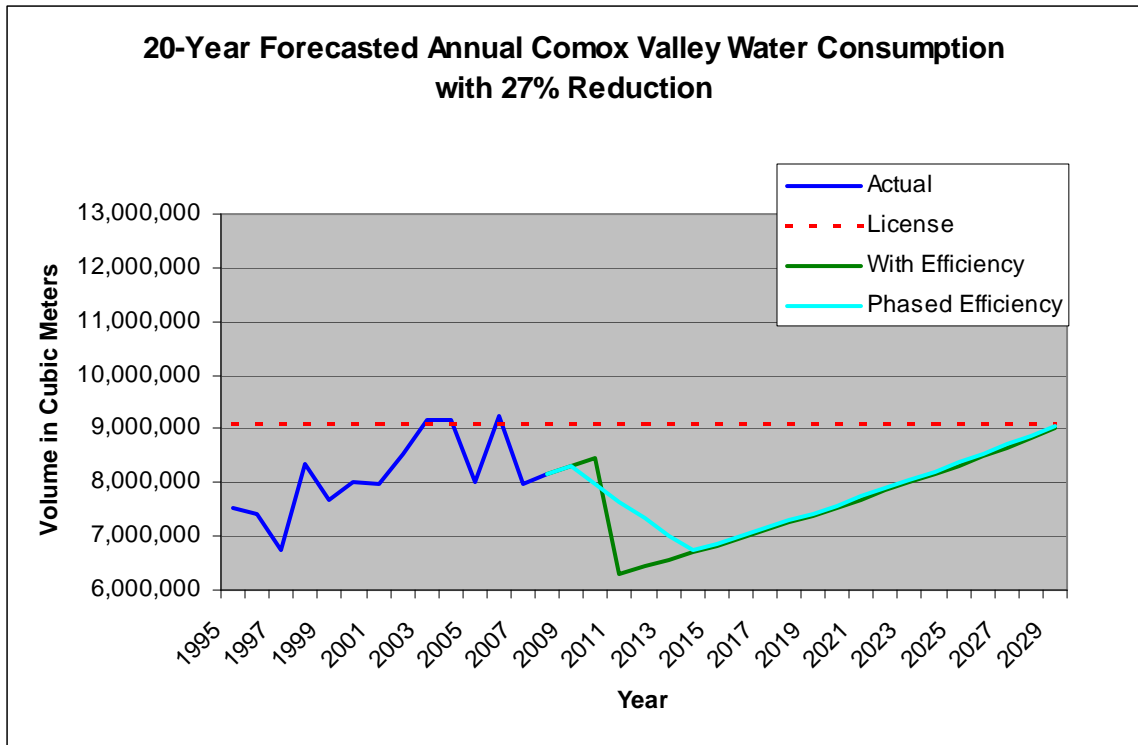
Graph 5: 20-Year Annual Water Use Forecast



Water Efficiency Targets

From the above sections it is clear that water consumption in the Comox Valley needs to be reduced. For setting targets numerous factors have been considered, including limitations of existing infrastructure, provincial targets set out in the Living Water Smart Plan and the CVRD's existing water license. With the forecast above, the CVRD will continually exceed the maximum permitted volume set out in the water license in the year 2014. In order to stay below this volume for the next 20 years, system wide annual consumption needs to be reduced by approximately 27% compared to the forecasted 2014 consumption (Graph 6). This will also exceed the Living Water Smart Plan target of acquiring 50% of new water through conservation which would require an annual 1% reduction or 20% reduction over 20 years. As the capacity of the current system is being modeled and analyzed in 2010, it is too early to determine reduction targets based on system limits. As such the water license targeted reduction of 27% by 2014 is deemed to be the most suitable target for the Comox Valley given its local relevance. This reduction target would result in average annual consumption being approximately 6,696,149m³ by 2014 (rather than the current forecasted consumption of 9,172,807m³ for that year). Monitoring will take place throughout the year to determine progress and enable modification of the water efficiency plan as required. Consumption information and progress will be reported publicly throughout the year. The 27% reduction could be achieved immediately or more gradually as measures are phased in over the years leading up to 2014 (approximately 6% per year).

Graph 6: Results of 27% Reduction in Annual Water Use



Water Efficiency Measures

Currently in the Comox Valley, a number of measures are utilized to reduce water consumption. This includes education through school programs, a communication program utilizing the CVRD website and other media (e.g. newspapers, radio, fleet vehicle stickers) as well as three-stage sprinkling restrictions (Comox Valley Water Conservation Bylaw No. 2867).

In order to achieve the targeted reduction in water use, a number of additional measures are required and will form the basis of the water efficiency plan. The plan will aim to reduce water use from indoor as well as outdoor water uses in order to reduce both overall annual consumption and maximum day demand by 27% before 2014.

Education/Media Plan

The CVRD as well as City of Courtenay and Town of Comox will expand upon the water efficiency education and communication plans. This will include the following measures:

- Media – Improved and expanded information on programs (e.g. rebates, restrictions) and efficient water use will be included in newspaper/radio/television advertisements and on local government websites.
- Xeriscaping Demonstrations – Each local government will provide at least one demonstration garden and instructions on how to plant and maintain drought resistant and/or native vegetation. For example, the CVRD may utilize the compost education center while member municipalities may utilize parks or other green space such as boulevards as available. At a minimum the gardens should be

accessible and include self guided informative displays. Preferably there will be workshops offered at strategic times through the year for residents to take part in.

- Education Programs – Educators will provide school students with information on water efficiency. Information will also be provided to local nurseries, garden stores and landscaping companies. Various workshops on topics such as low water use gardening, micro drip irrigation systems, rainwater harvesting, etc. will be offered.
- Portable Water Efficiency Display – A permanent and portable display will be developed to be brought to various community events for education and outreach purposes. The display will be staffed by contract educators as well as summer students.

Water efficiency education is estimated to result in water reductions of upto 5% of total annual use.

Toilet Replacement Rebates

Rebates of \$75 (maximum of 2 per home) will be offered to residents by the participating customers (City of Courtenay, Town of Comox and CVRD local service areas). According to Koers' 2009 report, switching all toilets in a home to dual flush or high efficiency units would result in an 18% reduction in daily household use. An 18% reduction would result in reductions of approximately 271 L per participating home per day and when multiplied by 365 days and the recommended participation rate of 800 homes per year, this equates to an overall annual reduction of 79,132m³ in the Comox Valley. This is equivalent to an overall reduction of just under 1% of current annual consumption and if implemented for 2010-2014, four years, the cumulative annual reduction in 2014 would be 316,528 m³, or approximately 3.5% of the 2014 forecasted annual system consumption. At 800 homes, and \$150 per home maximum rebate, the cost of this rebate program would be about \$120,000.

Rebates will be provided for replacing a 13 or more litre/flush toilet with a dual flush or high efficiency version (4.8 litres/flush or less). Eligible rebate participants are all owner occupied legal dwelling units that are connected to the CVWS within the City of Courtenay, Town of Comox and within CVRD local service areas (Comox Valley Water, Arden Water, Marsden/Camco Road, Greaves Crescent Water, England Road Water). Old toilets will be required to be brought to the Comox Valley Waste Management Centre where they will be destroyed and recycled. Residents will then be issued a receipt and will be credited on their following water bill by their respective local government.

Faucet/Showerhead Retrofits

Retrofit kits worth approximately \$20 will be provided for a \$5 charge to a maximum of 1 per home. This kit will include faucet aerators, low flow showerhead, dye tablets for toilet leak testing and water efficiency information. These kits would result in a 9% reduction in daily household use. A 9% reduction would result in reductions of approximately 135.5L per participating home per day and when multiplied by 365 days and the recommended participation rate of 800 homes per year, this equates to an overall reduction of 49,457m³ in the Comox Valley. This is equivalent to an overall reduction of approximately 0.5% of current annual consumption and if implemented for 2010-2014, four years, the cumulative annual reduction in 2014 would be 197,828 m³, or approximately 2% of the 2014 forecasted annual system consumption.

Water Efficient Appliances

Residents will be directed to existing rebate programs offered by BC Hydro and the federal and provincial governments for efficient laundry and dishwashing appliances. After switching both laundry and dishwasher, a 9% reduction is expected similar to the faucet/showerhead retrofit, and thus for similar participation levels (800 homes per year) a 0.5% reduction from current overall Comox Valley annual water use. By 2014 this would equate to approximately a 2% reduction of the forecasted annual consumption.

Rainbarrel and Cistern Program

Rebates of \$50 will be offered for rain tanks/barrels of 150-600 litres and rebates of \$150 will be provided for tanks/barrels of 600 litres and up (maximum of 1 per property). Expected reductions are likely undetectable given the relatively small volume of water stored in rain barrels. However, they do promote efficient water use in other ways and are seen as more of an education or social marketing tool. Rainwater harvesting workshops will also be offered as part of the education program.

Outdoor Waterwise Pledge

Residents will be encouraged to take a “Better Futures, Better Choices” pledge to be waterwise with their lawn and garden, including adhering to efficient sprinkling techniques (or none at all). Residents will receive information on water efficiency as well as a lawn stake that will designate them publicly as a waterwise resident. Rain gauges will be purchased by CVRD and member municipalities and offered free of charge to residents who take the pledge in order to assist them with determining proper watering practices. Similar to rain barrels, this measure is for education and social marketing rather than reductions. However, proper landscaping and irrigation techniques can result in significant reductions.

Leak Detection and Pressure Reduction

With unaccounted for water use in the bulk supply system only accounting for an estimated 0.8% of total annual water use, the largest opportunity for reducing water loss through leaks is within the local distribution systems in City of Courtenay, Town of Comox and CVRD service areas. As water metering is not in place, leak detection opportunities are further diminished, as leaks will only be found on the main distribution system. The CVRD will assist member municipalities in undertaking a leak detection program to identify potential losses and a pressure reduction strategy will be developed. Leakage audits will also be performed at each connection by CVRD, Courtenay and Comox staff. Repairs will be made on high priority/volume leaks and leaks found on private properties will be reported to property owners for repair.

Water Restrictions and Enforcement

Beginning in May, the Stage 2 restrictions will be in force until the beginning of September. This corresponds with the highest water use periods associated with lawn and garden sprinkling. Staff will investigate the possibility of all jurisdictions collectively entering into a contract for a private company to be responsible for enforcement by patrolling directly before and after restriction times to ensure that residents are adhering to their allowed times. Enforcement would include responding to neighbor complaints. Should a resident be found to be out of compliance, an initial warning will be issued and any further infractions will be fined. Stage 3 restrictions will also be used when conditions are relatively bad (e.g. drought/water shortages, peak demand days, penstock maintenance, etc.). The Comox Valley Water Conservation bylaw will be reviewed and amended to better enable demand

management techniques which may include alternative restrictions scheduling (e.g. one-day per week sprinkling), clarifying the process for enforcement and identification of applicable fines for violation. Installing water meters on violating properties will be investigated as an alternative or in addition to fines.

These restrictions will be supported by media and education information about proper sprinkling techniques (“less than 1-inch/week”) as well as programs offered at the Compost Education Centre. Stage restriction signs will also be located strategically throughout the community indicating current stage as well as information about restrictions (similar to fire risk signs) Total reductions in water use are difficult to estimate, however it is expected that with proper enforcement and Stage 2 restrictions, reductions of approximately 10% could occur.

Corporate Efficiency

The CVRD and member municipalities, will voluntarily retrofit their corporate buildings including offices and recreation facilities to be more water efficient. This will include at a minimum dual flush or high efficiency toilets, all faucets and showerheads, and landscaping. Contracted and staff landscapers will be instructed to utilize water efficient maintenance and plant varieties. A greenspace irrigation analysis and recreation facility water audit will also be undertaken to identify measures for reducing consumption. These measures will aid in education and social marketing as well as reducing corporate water use. It is premature to estimate the expected reductions associated with modification of local government landscaping, irrigation techniques and facility water use.

Water Conservation Development Permit

Using the 2008 provincial Local Government (Green Communities) Statutes Amendment Act, (Bill 27), CVRD and member municipalities will create development permit areas to promote water conservation. This permit would require new developments to utilize water efficient measures such as drought resistant landscaping, rainwater collection systems, etc.

Water Metering

It is well established that water meters are the most effective measure for reducing water demand and locally a universal metering program is expected to result in annual reductions of 20-25% based on evidence from neighboring communities that have recently become universally metered. Further analysis is required to determine the most cost effective manner in which to proceed with metering in the Comox Valley.

Expected Reductions

Overall with implementation of the above-mentioned measures, and conservative estimates of possible reductions, the following overall annual reductions are expected:

Table 4: Potential Total Annual Comox Valley Water Reductions

Measure	Reduction
Education	5.0%
Toilet Rebate	3.5%*
Faucet/Showerhead Retrofit	2%*
Water Efficient Appliances	2%*
Rainbarrel	NA
Outdoor Waterwise Pledge	NA
Leakage Reduction	NA
Water Restrictions	10.0%
Corporate Retrofits	NA
Universal Water Metering	20.0%
TOTAL (By 2014)	42.5%

As seen in Table 4, a potential reduction of 42.5% could be achieved by 2014 if all measures were successfully implemented. Those measures with “NA” have no associated reduction estimates due to their focus on social marketing or the inability to accurately determine reductions. Those reduction percentages marked with an asterix (*) are based on participation rates of 800-1000 homes per year rather than adopted universally by all residents. Should universal water metering not be included in the CVRD’s water efficiency plan, total reductions are expected to be only 22.5%. It should be noted that reductions associated with other measures may be reduced without being combined with water meters.

Actual reductions will be monitored regularly and the water efficiency plan will be modified as needed to meet the targeted 27% reduction in annual use by 2014.

Implementation Plan

This plan will be reviewed and updated as needed according to results from water demand monitoring. Table 5 shows the funding estimate and responsibility.

Table 5 – Required Funding Estimates

Measure	Funding	Responsibility
Education	\$165,000/year	CVRD, Courtenay, Comox
Toilet Rebate	\$130,000/year	CVRD, Courtenay, Comox
Faucet/Showerhead Retrofit	\$12,000/year	CVRD, Courtenay, Comox
Water Efficient Appliances	NA	BC Hydo and Province of BC programs
Rainbarrels and Cisterns	\$75,000/year	CVRD, Courtenay, Comox
Outdoor Waterwise Pledge	\$10,000/year	CVRD, Courtenay, Comox
Water Restrictions	\$75,000/year	CVRD, Courtenay, Comox
Corporate Efficiency	\$65,000	CVRD, Courtenay, Comox
Leakage/Pressure Analysis	\$50,000	CVRD, Courtenay, Comox
Water Metering	TBD	CVRD, Courtenay, Comox
Other		
Development Permit	\$5,000	CVRD, Courtenay, Comox

The above implementation will result in annual cost of \$587,000 in 2010 and \$467,000 in subsequent years. Capital costs for metering, leakage repair and pressure management have not been included as these programs will be subject to further analysis.