September 18, 2014

Drinking Water Management Plan

2014 Progress Report

Capilano Reservoir

Seymour Reservoir

Coquitlam Reservoir

Drinking Water Management Plan
2014 Progress Report

Drinking Water Supply in Metro Vancouver

Metro Vancouver, member municipalities, and Tsawwassen First Nation work together to supply clean, safe drinking water to over 2.3 million people and associated businesses in the Metro Vancouver region. The sources of water supply are the Capilano, Seymour and Coquitlam Watersheds. Six dams (three valley and three alpine) in the three watersheds impound water and provide releases to the drinking water system and to downstream rivers for fish and wildlife.

In September 2005, the Greater Vancouver Water District Board approved the first Drinking Water Management Plan (DWMP) for the GVWD and member municipalities. In 2011, a new DWMP was developed to contribute to a healthy sustainable region through wise stewardship of our drinking water resource and to ensure that our region's water needs will be met affordably and sustainably for years to come. This DWMP continues to take an adaptive management approach that includes providing a progress report every two to three years. This is the first progress report since the 2011 DWMP was approved.

The 2011 Drinking Water Management Plan has the following three goals:

1. Provide Clean, Safe Drinking Water
2. Ensure the Sustainable Use of Water Resources
3. Ensure the Efficient Supply of Water

To achieve the above goals the DWMP identifies 8 strategies, 56 actions, and 10 performance measures. The current status of each of these actions is provided in Appendix A at the back of the report:

The following Metro Vancouver websites provide additional information on other pertinent Metro Vancouver water initiatives:

Water Planning: http://www.metrovancouver.org/services/water/planning/Pages/default.aspx
Water Treatment and Supply: http://www.metrovancouver.org/services/water/Pages/default.aspx
Water Conservation: http://www.metrovancouver.org/services/water/conservation/Pages/default.aspx
Tap Water Campaign: http://www.metrovancouver.org/region/tapwater/Pages/default.aspx

Goal One: Provide Clean, Safe Drinking Water

There are three strategies to achieve this goal:

- Use a risk management multi-barrier approach from source to tap;
- Manage watersheds to provide clean, safe drinking water; and
- Identify and secure additional water supplies for the region.

Performance Measures

The DWMP identifies the following three performance measures to monitor progress in providing clean, safe drinking water.

Performance Measure 1:

Treated water samples negative for *E. coli* bacteria (striving for 100%)

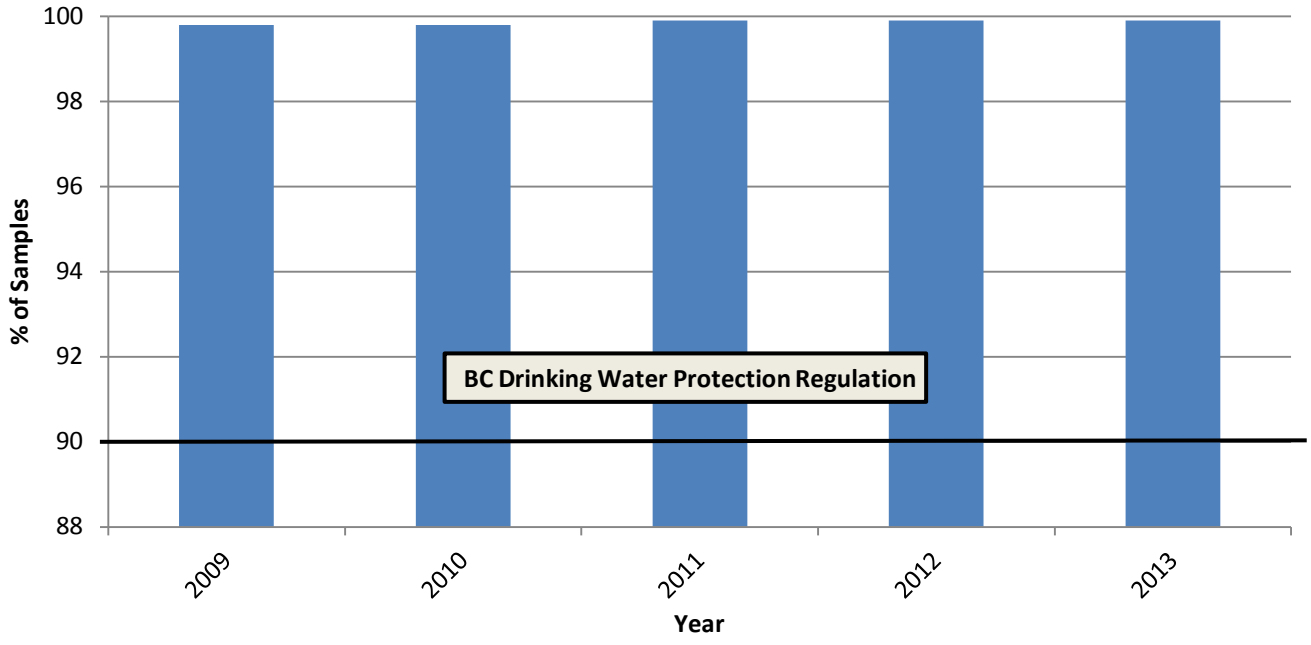
The detection of Escherichia coli (*E. coli)* bacteria, in a treated water sample, triggers a protocol which involves immediate notification of health and municipal officials, resampling, and an investigation into the possible cause. In 2011, two water samples tested positive for *E. coli* in GVWD transmission mains. Sampling indicated that chlorine residual levels were good. Follow-up water samples tested negative for *E. coli*. In 2012 and 2013, no treated water samples tested positive for *E. coli* bacteria

Performance Measure 2:

Treated water samples negative for total coliforms (striving for high percentages)

Water quality analysis of more than 29,000 treated water samples, in 2013, validates that the drinking water provided by the GVWD is safe. Total coliform bacteria are used as an indicator of primary (or source) disinfection efficiency and bacterial regrowth in the water distribution system. Total coliform levels are low and have dropped significantly since improvements in the water distribution system rechlorination stations and municipal watermain flushing programs were implemented in 1998. Figure 1 illustrates that municipal treated water samples testing negative for total coliforms were typically in the 99.8% to 99.9% range over the 2009 to 2013 period and well within the BC Drinking Water Protection Regulation of 90% or better.

Figure 1: Percent of Treated Water Samples Negative for Total Coliforms

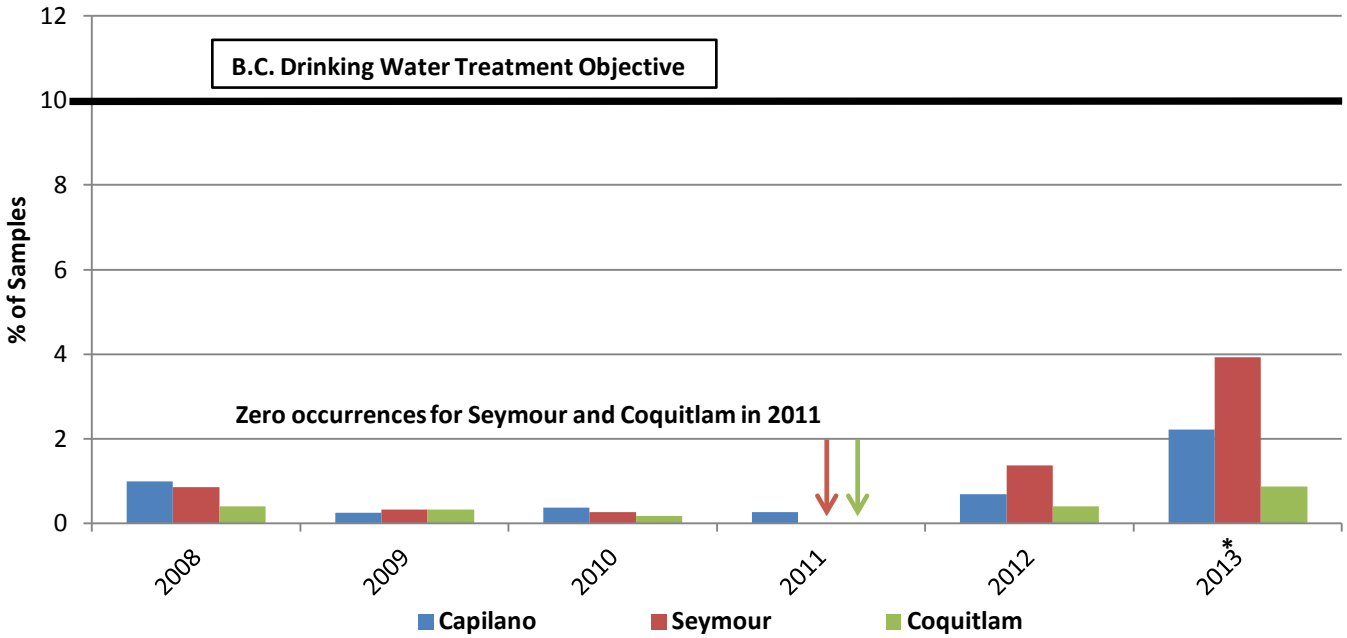


Performance Measure 3:

Percent of untreated source water samples exceeding 20 *E. coli*/100ml (striving for low percentage)

The quality of the source water is an indicator of the degree of contamination and the treatment required to ensure a safe drinking water supply. From 2008 to 2013, samples taken from our source water (i.e. before treatment and/or disinfection) were very low for *E. coli* bacteria and well below the Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia limit (Figure 2). Levels were higher in 2013 than previous years due to an unusual rain storm/turbidity event in late August and warmer summer temperatures. Nonetheless, the samples were well within the guideline limit of 10% or less.

Figure 2: Percent of Untreated Source Water Samples Exceeding 20 *E. Coli*/100ml



*2013 levels were higher than normal due to a rain storm/turbidity event in late August and warmer summer temperatures

Progress on Key Actions to: Provide Clean, Safe Drinking Water

Metro Vancouver Actions

Significant progress continues on the upgrading of Metro Vancouver's water treatment system to meet the Guidelines for Canadian Drinking Water Quality and to provide more reliable treatment. For example, the Seymour-Capilano Filtration Project is nearing completion and the UV Disinfection Facility on the Coquitlam source is now in operation.

The Seymour-Capilano Filtration Plant continues to produce high quality drinking water since going into service and filtering water from the Seymour source in late 2009. In addition, the amount of chlorine required to maintain a residual in the distribution system has dropped approximately 50% from the levels required before filtration.

Work is nearing completion on the twin tunnels linking the Capilano source with the Seymour-Capilano Filtration Plant. Filling, flushing, and commissioning of the tunnels for filtration of the Capilano source water is expected to commence in Fall 2014, with actual in-service dates and overall project completion projected for early 2015. In addition to enabling filtration of water from the Capilano source, once the twin tunnels are in service and the Capilano Pump Station is fully operational, the ability to drawdown and supply water from the Capilano Reservoir will increase and enhance capacity from the Capilano system.

In February 2014, the Coquitlam UV Disinfection Facility began operating and successfully treating water from the Coquitlam source (Figure 3). Ultraviolet disinfection enhances disinfection of micro-organisms such as *Cryptosporidium* and *Giardia* by complementing the existing ozone and chlorination processes.

Figure 3: Coquitlam Ultraviolet Disinfection Facility

Other notable actions to protect drinking water quality include:

- The multi-year Watershed Road Deactivation program is expected to be completed by the end of the 2014. To date, over 150 kilometres of road have been deactivated. Roads that were decommissioned were no longer essential; and
- Upgrades are underway that will enable staff to isolate GVWD distribution system reservoirs for cleaning without impacting transmission system operations.

Municipal Actions

Municipalities continue to implement best management practices for monitoring and preserving water quality in their distribution systems. Most municipalities implement, administer, and maintain backflow prevention and cross-connection programs. However, some municipalities recognized that there is room for further improvement.

Priorities Moving Forward

Following completion of the Seymour-Capilano Filtration Project, an assessment of the secondary disinfection system will commence to optimize the Metro Vancouver and municipal rechlorination programs.

Conceptual design of a proposed new second intake on the Coquitlam source, along with the associated treatment and transmission facilities to increase the long term water supply capacity for the region, is underway. Geophysical surveys of priority routings for conveyance infrastructure have also been completed. The schedule for storage expansion is being refined based on population projections and water consumption trends.

Metro Vancouver continues to assess climate change impacts on the regional drinking water system and adapt accordingly in consultation with external organizations who are conducting similar work.

Goal Two: Ensure the Sustainable Use of Water Resources

There are three strategies to attain this goal:

- Use drinking water sustainably;
- Match water quality to usage requirements; and
- Manage and protect watersheds as natural assets.

Performance Measures

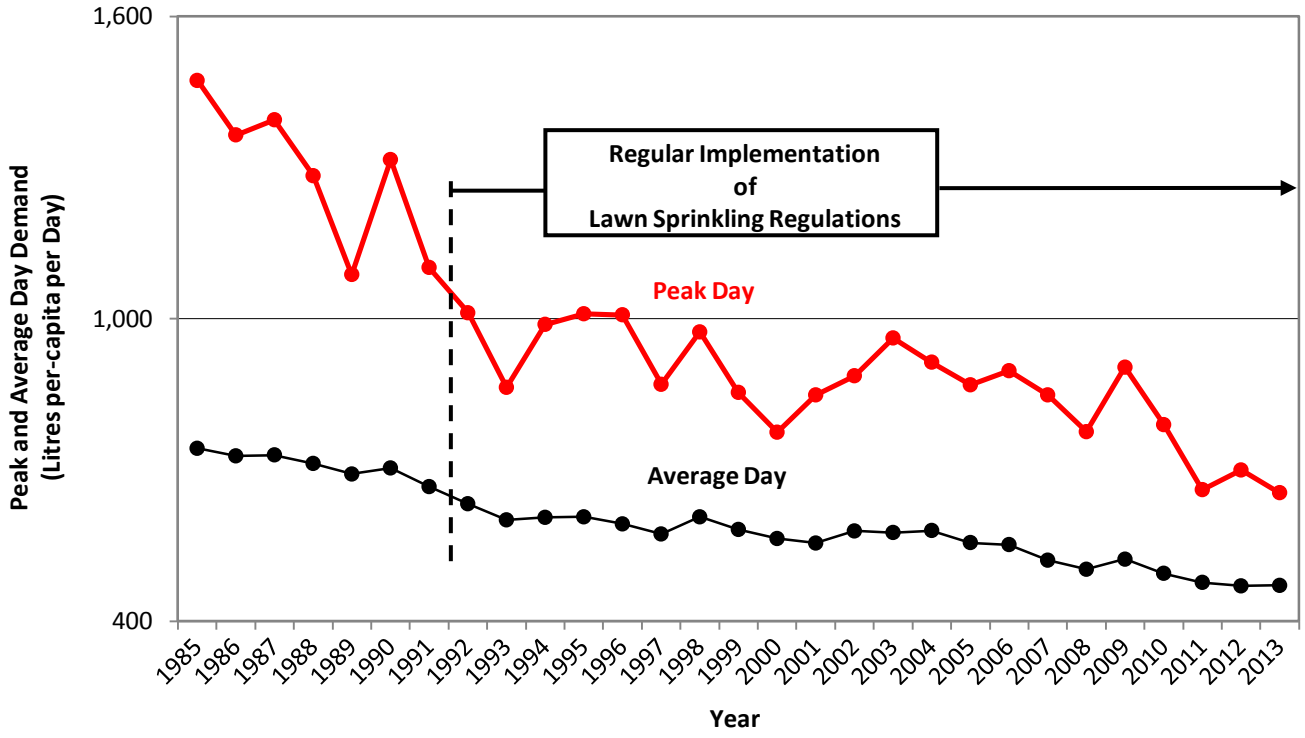
The plan includes the following four performance measures to monitor progress in ensuring the sustainable use of water.

Performance Measure 4:

Per-capita water use by residential customers (trend over time and compare to other jurisdictions)

The overall trend for the per-capita use of water for all users has been declining since 1985 (Figure 4). The per-capita water use by residential customers in the Metro Vancouver region is expected to be declining at about the same rate as that of total usage by all customers.

Figure 4: Metro Vancouver Peak Day and Average Day Water Use (inclusive of all users)



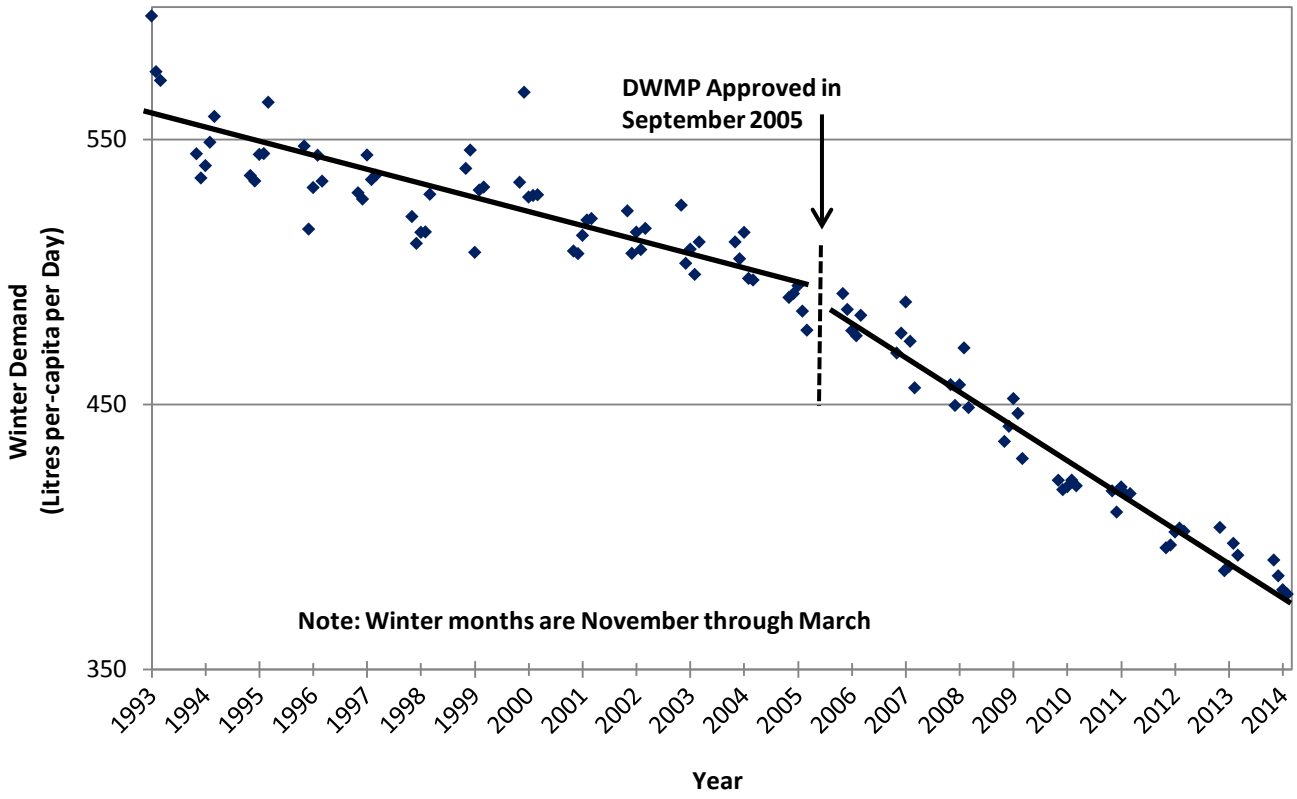
Performance Measure 5:

Per-capita water use by all customers (trend over time and compare to other jurisdictions).

The average day water use in litres per-capita per day (lower line in Figure 4) for the years 1985 to 2013 has declined. As part of the 2014 Metro Vancouver budget, the Board approved a performance indicator target for average day per-capita water use to trend downward by one percent per year. Since 1993, municipalities and Metro Vancouver have progressively increased their water conservation actions contributing to a decline in average day per-capita water demand of 26% between 1993 and 2013. The downward trend between 1993 and 2013 is about 1.3% per year, which exceeds the regional target of 1% per year.

Because average day water use may vary depending on weather conditions (i.e. more in drier years and less in wetter years), winter water use was analyzed to determine trends in water consumption as outdoor water use is minimal and water use is insensitive to weather conditions during the winter period. Figure 5 shows the monthly regional per-capita water use for the winter months of November to March for 1993 to 2013. As expected, the rate of decline in winter per-capita water use has increased since the implementation of the Drinking Water Management Plan in September 2005.

Figure 5: Monthly Metro Vancouver Winter Per-Capita Water Use



Since 2005, per-capita winter water use has been trending downward at a rate of over 2% per year due to the following:

- Actions to reduce the liters per flush volume of toilets from 20 litres (pre-1995 regulation) to 6 litres (2005 DWMP) to 4.8 litres (October 2010);
- Regulations requiring more energy efficient and water efficient fixtures and appliances;
- Water conservation education programs aimed at schools, businesses, and the public;
- Improvements to water metering and leak reduction programs.

Performance Measure 6:

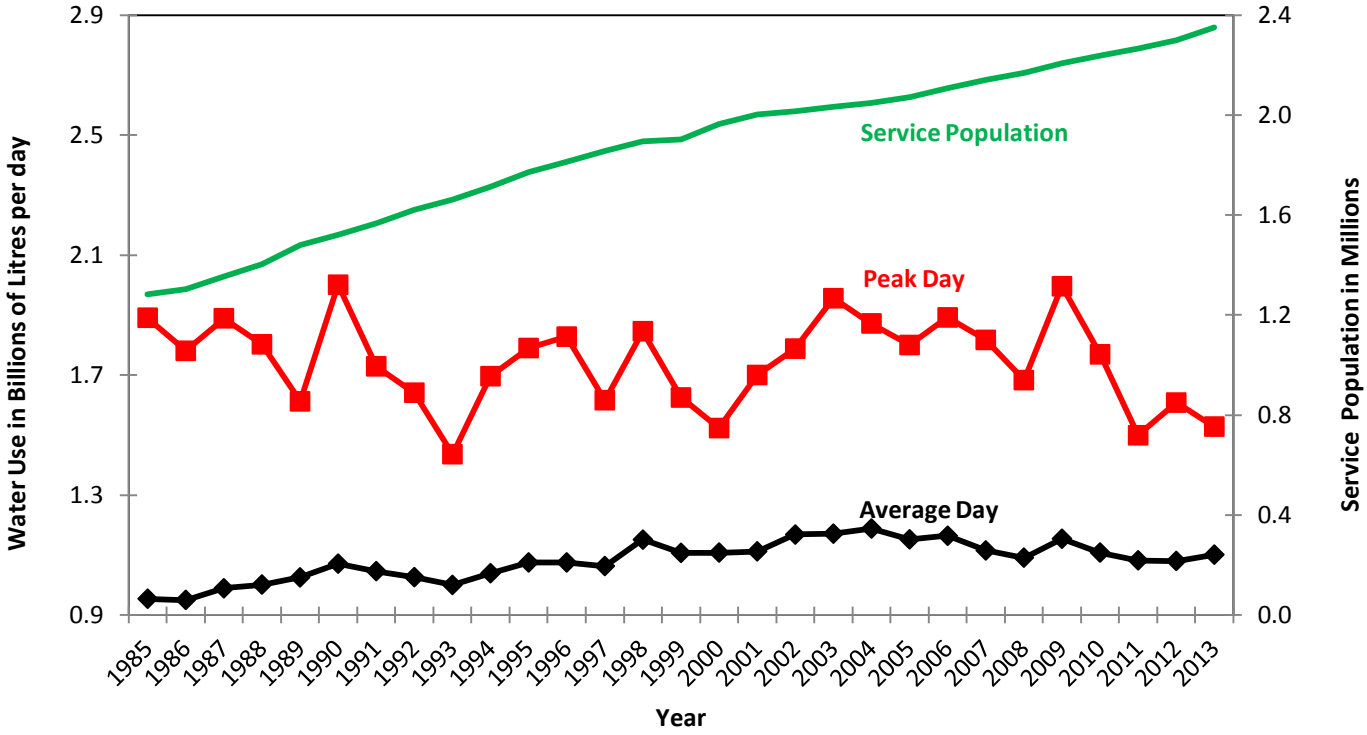
Peak day per-capita water use by all customers (trend over time and compare to other jurisdictions)

The upper line in Figure 4 shows peak day water use in litres per-capita per day for the years 1985 to 2013. This is total water use in the region, inclusive of water system leakage and all water uses at home, work and school. Peak day water use is responsive to summer weather conditions, being higher in years with hot-dry summers such as 2003 and 2009 and lower in years with cool-wet summers such as 2011 and 2012. The lawn sprinkling regulations, implemented every summer since 1992, in combination with other water conservation initiatives, help to reduce peak day water use.

In its 2013 Action Plan, the Board approved a target for reduction in peak day per capita water use of 5% by 2015, compared to 2010 levels (1% reduction per year). Since 2010, peak day per capita water use has been trending downward at a rate of over 2% per year, which exceeds the Board's target of 1% per year.

As shown in Figure 6, despite a growing service population, average day water use in the region has remained roughly constant in recent years. This trend is forecast to continue for the foreseeable future.

Figure 6: Metro Vancouver Peak Day and Average Day Water Use (inclusive of all users)



Performance Measure 7:

Greenhouse gases generated in treating and delivering water (per cubic meter of water delivered by Metro Vancouver and net of energy recovery)

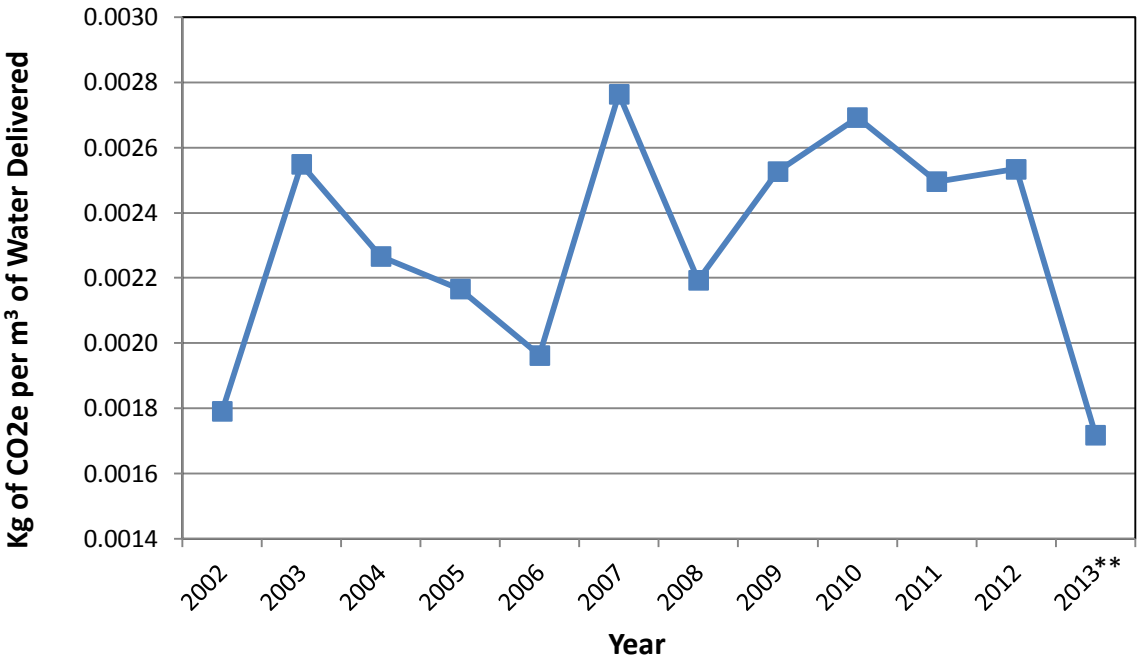
The greenhouse gases generated to treat and deliver water (kilograms of CO_2 per cubic metre of water delivered) has trended upward over the past few years, with the exception of 2013 (Figure 7). The upward trend is primarily attributed to the commissioning of new water treatment facilities (e.g. the Seymour-Capilano Filtration Plant) to meet new Guidelines for Canadian Drinking Water Quality. The upward trend is expected to continue over the next few years due to the commissioning of the new UV Disinfection Facility in Coquitlam in early 2014 and the addition of pumping of Capilano source water to the Seymour-Capilano Filtration Plant and then treatment at the filtration plant beginning in early 2015. There was a significant decrease in the estimated amount of greenhouse gases in treating and delivery of drinking water between 2012 and 2013. The main reason for this decrease is the change in the greenhouse gas intensities[1] for purchased electricity which were 25 tonnes of CO_2e per GWh and 14 tonnes of CO_2e per GWh for 2012 and 2013, respectively.

Nonetheless, Metro Vancouver employs innovative strategies to help reduce greenhouse gases generated. For example, a geo-exchange heating and cooling system is used at the Seymour-Capilano Filtration Plant and a

[1] B.C. Ministry of Environment publishes greenhouse gas intensities for purchased electricity in *B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions – Including Guidance for Public Sector Organizations, Local Governments and Community Emissions* (http://www.env.gov.bc.ca/cas/mitigation/pdfs/BC-Best-Practices-Methodology-for-Quantifying-Greenhouse-Gas-Emissions.pdf)

hydronic heating and cooling system is used to save energy at the Coquitlam UV Disinfection Facility. In addition, energy efficient UV lamps are used at both plants.

Figure 7: Greenhouse Gases Generated in Treating and Delivering Water (Kg of CO_2 equivalents per m^3*)



*CO_2 equivalent = measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide (CO_2) as the reference

**The greenhouse gas intensity used for 2013 is 14 tonnes CO2e per GWh. The greenhouse gas intensity used for previous years (2002-2012) was 25 tonnes CO2e per GWh.

Progress on Key Actions to: Ensure the Sustainable Use of Water

Metro Vancouver Actions

Progress is being made on promoting behavioral change through communication and education programs to ensure the sustainable use of water. For example, Metro Vancouver's outreach includes the Water Wagon (Figure 8), advertising (e.g. lawn sprinkling restrictions), media coverage, and online communications. It highlights the region's water quality, the need for water conservation and encourages tap water over bottled water, thereby helping to lower per-capita water use and reduce waste from single-use water bottles. In 2013, nearly 20,000 people visited the Water Wagon at various events throughout the region.

Figure 8: Metro Vancouver's Water Wagon at the Dragon Boat Festival

Metro Vancouver strives to maintain sustainable water rates that reflect the cost of regional water supply.

The on-going Capilano smolt trap and truck program (Figures 9 & 10) helps to protect and conserve fish populations by moving on average 23,000 coho and 200 steelhead smolts (over the 2008 to 2013 period) safely around the Cleveland Dam. This action will continue to protect natural assets while ensuring a sustainable supply of drinking water for the region.

Figure 9: Rotary Screw Trap used to Capture Smolts in the Capilano River

Figure 10: Fish Net used to Capture Smolts in the Capilano Reservoir

Municipal Actions

Most municipalities have reassessed the merits of developing residential water metering programs or are in the process of doing so. Based on the assessment, some municipalities have embraced metering while other municipalities have not at this time, because their review showed a lack of financial benefits, or because other water programs had a higher priority. It is expected that this reassessment will be complete by 2015.

Municipalities accounting for 69% of GVWD water sales currently have residential water metering programs that will ultimately lead to universal metering in their municipality.

Most municipalities have reassessed the merits of developing water rebate programs, or are in the process of doing so. It is expected that these reassessments will also be complete by 2015.

Many municipalities work with the business sector on water conservation and water use initiatives, or are in the process of doing so. However, some municipalities have no active programs specifically targeting this sector.

Priorities Moving Forward

To further improve on progress to reduce peak per-capita summer and average day water use, Metro Vancouver will implement expanded region-wide public awareness, social marketing, and water conservation programs, in partnership with municipalities, to promote the efficient use of water.

Goal 3 - Ensure the Efficient Supply of Water

There are two strategies to attain this goal:

- Manage infrastructure proactively; and
- Optimize capacity through effective partnerships.

Performance Measures

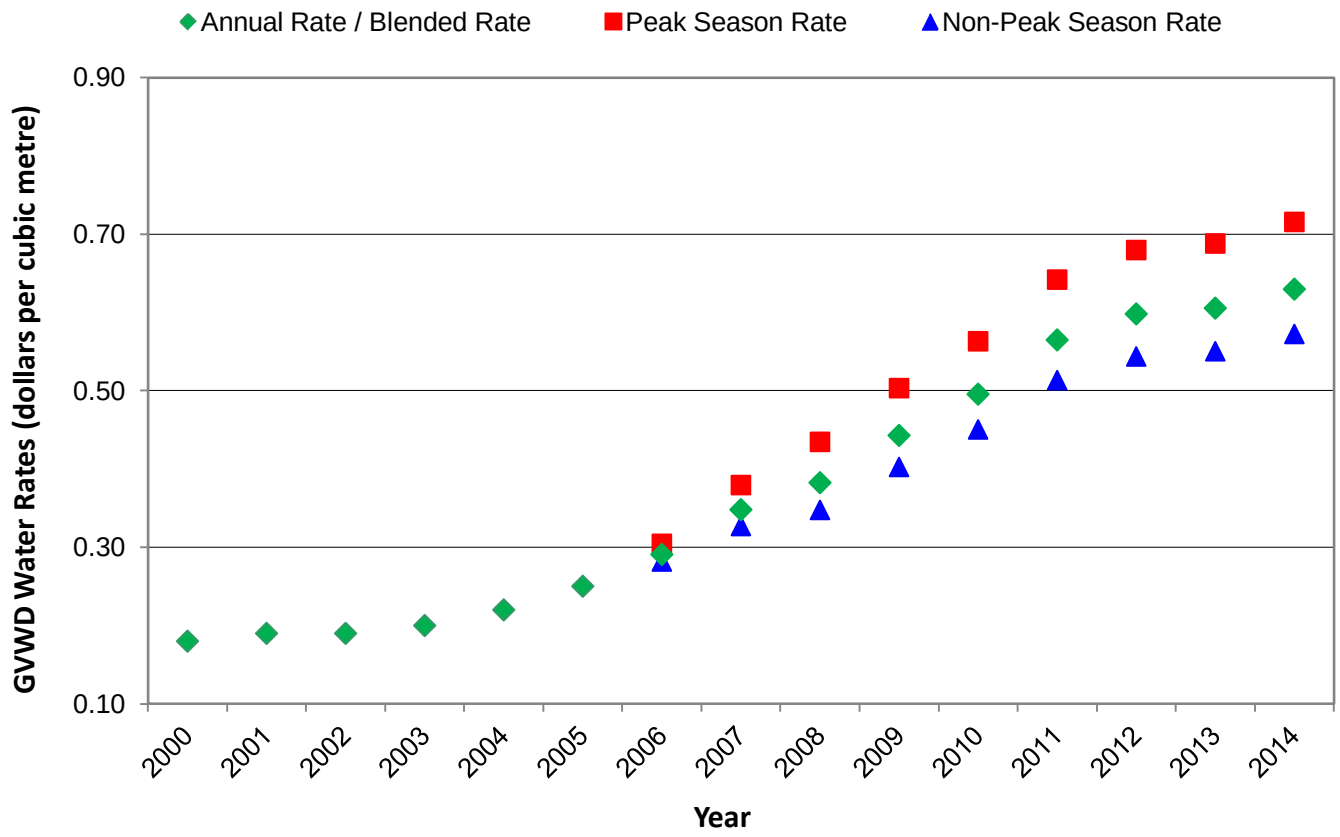
The plan identified the following three performance measures to monitor progress in ensuring the efficient use of water.

Performance Measurement 8:

Metro Vancouver's Water Rate (trend over time and compare to changes in Metro Vancouver to changes in other jurisdictions)

Metro Vancouver provides water on a wholesale basis to member municipalities. Metro Vancouver's costs to provide water are higher in the peak summer season of June through September as the natural inflows to its source lakes are lower, the demand for water is higher, and pumping increases. Consequently, in accordance with the Drinking Water Management Plan, the GVWD began phasing in seasonal pricing in 2006. In 2014, the GVWD is charging member municipalities a summer season rate of about $0.72 per cubic metre and an off-peak season rate of about $0.57 per cubic metre (Figure 11). The blended rate for 2014 is $0.63 per cubic metre. The water rates per cubic metre paid by residents and businesses in the Metro Vancouver region, include municipal water supply costs, and are typically in the range of $0.80 to $1.20 per cubic metre. Per cubic metre water rates in the Metro Vancouver region are still lower than other regions such as Calgary ($1.72), Edmonton ($1.80), and Toronto ($2.96).

Figure 11: GVWD Water Rates

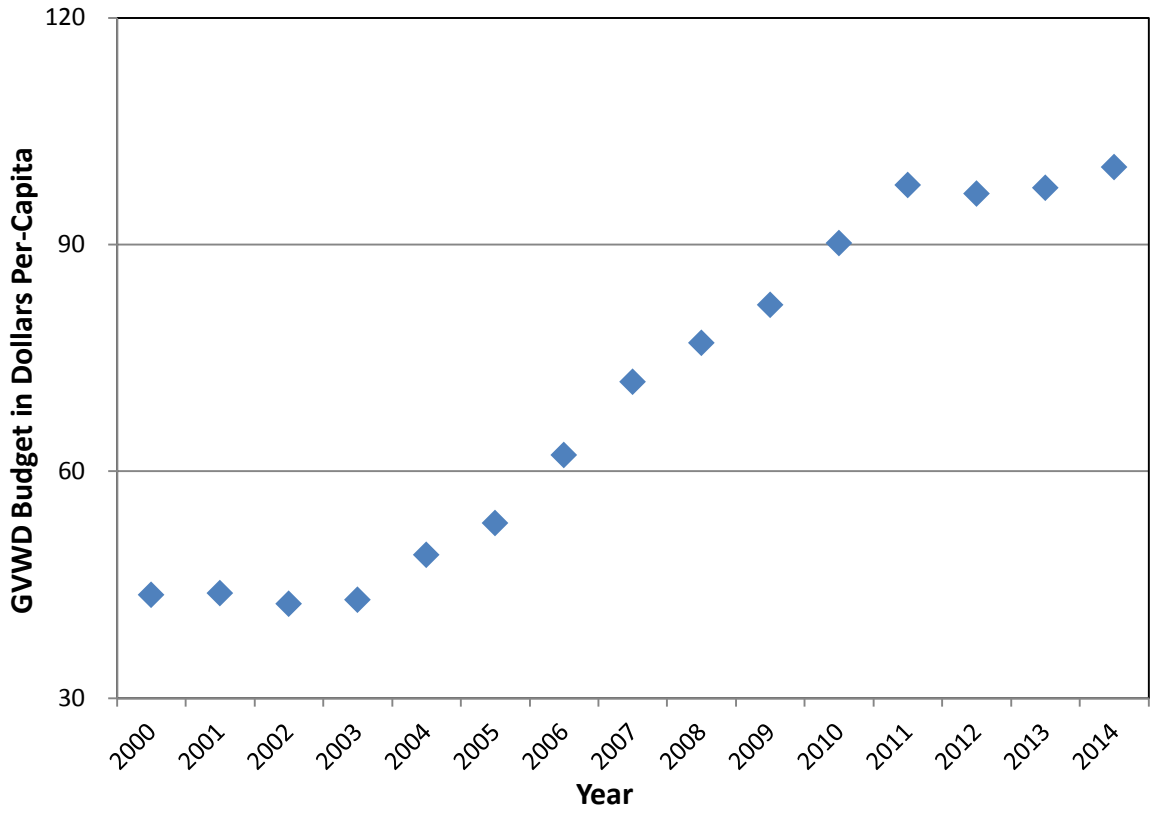


Performance Measurement 9:

Metro Vancouver's drinking water budget (trend over time and compare changes in Metro Vancouver to changes in other jurisdictions)

The annual budget for the GVWD has been increasing as the region's population and demand for water grow and as regulatory requirements necessitate additional capital improvements (Figure 12). Major capital programs undertaken to meet the new regulatory requirements include the Seymour-Capilano Filtration Project and the Coquitlam UV Disinfection Facility. The GVWD budget per capita in 2010 was $90, while in 2014 it is $100.

Figure 12: GVWD Per-Capita Budget



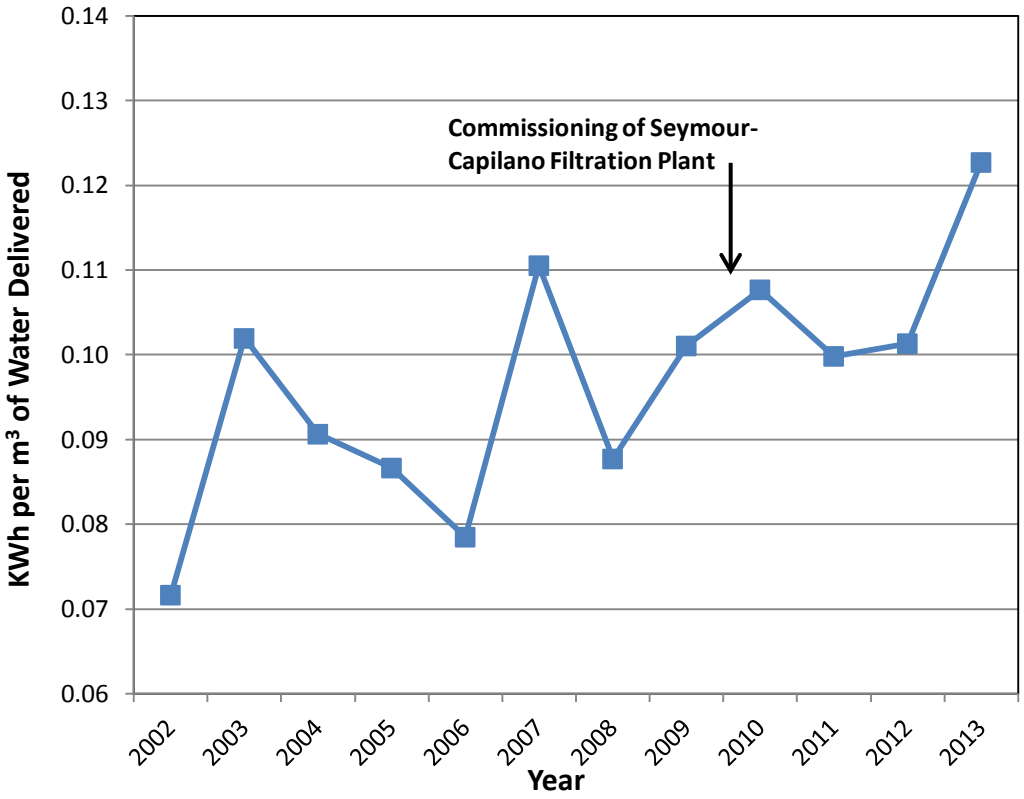
Performance Measurement 10:

Kilowatt hours of energy used in treating and delivering water (per cubic meter of water delivered by Metro Vancouver and net of energy recovery)

The slight increase in kilowatt hours of energy use in treating and delivering water over the past few years corresponds to the start-up of the Seymour-Capilano Filtration Plant in December 2009 (Figure 13). This use will likely increase over the next few years due to the new Coquitlam UV Disinfection Facility and because Capilano source water will be pumped to, and treated at, the filtration plant beginning in late 2014.

In recent years, the Seymour-Capilano Filtration Plant, the Westerly Transfer Pumping Stations, and the Coquitlam Ozonation Facility accounted for nearly 50% (20 million kWh) of the electrical usage and 58% of the total electricity costs ($1.6 million) to treat and deliver water to the region. Nonetheless, Metro Vancouver residents are fortunate to have their source water come from higher elevations, as water is largely gravity-fed to member municipalities of the region. As a result, Metro Vancouver is considered a low energy user and greenhouse gas generator when compared to other water utilities in North America.

Figure 13: Kilowatt Hours of Energy Used in Treating and Delivering Water

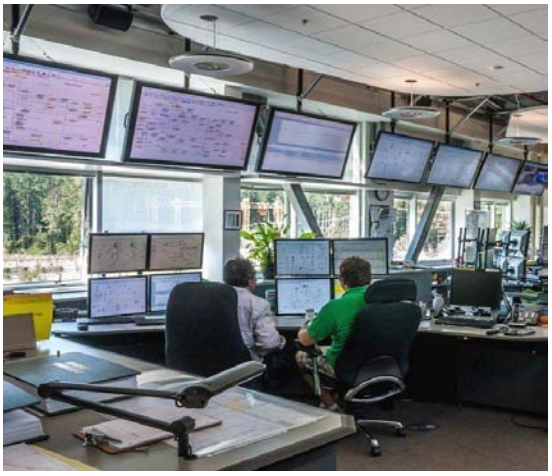


Progress on Actions to: Ensure the Efficient Supply of Water

GVWD and municipal water system assets continue to be managed proactively in accordance with water utility best practices (Figures 14 & 15). Steps are being taken to be more energy efficient, to improve the water monitoring and metering systems, and reduce leakage. The GVWD is continuing to assess risks to the water system and providing appropriate improvements on an ongoing basis.

Figure 14: Repairing Watermain Leak

Figure 15: Metro Vancouver's Control Room



Metro Vancouver Actions

Metro Vancouver's infrastructure is currently in good condition. As infrastructure ages, increasing resources are being devoted to asset management to continue to deliver reliable and cost-effective drinking water services to the region.

Energy conservation, energy recovery, and energy generation opportunities in the water system continue to be examined at facilities (e.g. treatment facilities, pump stations and transmission system) to reduce greenhouse gas emissions. However, energy use will continue to rise due to new treatment facilities and pump stations.

Municipal Actions

To ensure the efficient supply of water, most municipalities believe they are adequately renewing and replacing their infrastructure to maintain required levels of service based on risk analysis and cost-benefit priorities to their municipality.

When undertaking cost-effective leak detection programs, most municipalities indicate that they are doing a fair to good job.

Priorities Moving Forward

To ensure the efficient supply of water, Metro Vancouver continues to implement its infrastructure risk management program, including key projects such as the Port Mann and Second Narrows Water Supply Tunnels (Figure 16). Approximately 60% of the in-system reservoirs and pump stations have been seismically upgraded on a priority basis. This work is targeted for completion within the current long range (10-year) capital plan. In addition, Metro Vancouver will renew and replace infrastructure to maintain required levels of service based on risk analyses, cost-benefit priorities, and energy efficiency (Figure 17).

Figure 16: Port Mann Water Tunnel Shaft

Figure 17: Capilano Energy Recovery Facility

Drinking Water and a Strategic Direction for a Livable Region

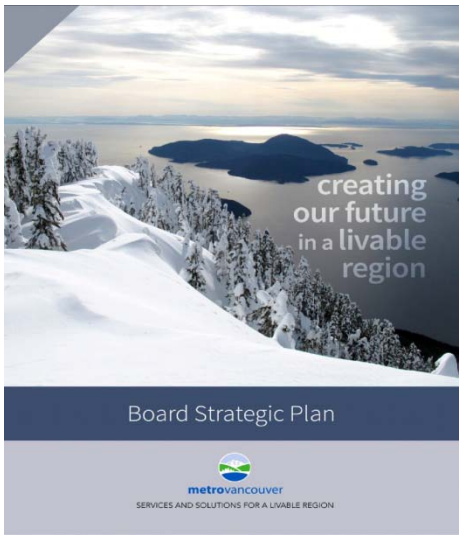
The Metro Vancouver Board of Directors has endorsed the 2014 Board Strategic Plan "**creating our future in a livable region**" that sets the direction for the organization to seek a livable, prosperous and sustainable region - for now and into the future. The Plan also provides a process for linking the Drinking Water Management Plan with other regional management plans like the *Integrated Liquid Waste and Resource Management Plan*, the *Integrated Air Quality and Greenhouse Management Plan*, and the *Metro Vancouver 2040: Shaping our Future* Plan.

The section below on *Water* is taken from the Board Strategic Plan adopted in March 2014.

Context: *Drinking Water Management Plan*

We commit to provide clean, safe drinking water and ensure its sustainable use.

1. Provide clean, safe drinking water.
2. Ensure the sustainable use of water resources.
3. Ensure the efficient supply of water.



Strategic Direction:

1. **Ensure water resources are conserved and used efficiently throughout the region.**

    a. In partnership with members, develop and implement communication, public awareness and social marketing campaigns that promote efficient and appropriate use of drinking water, including:
        - Producing communications that foster a greater understanding of the critical importance of Metro Vancouver's role in the provision and protection of the region's drinking water.
        - Comparing regional per capita water usage rates to similar jurisdictions.
        - Identifying the challenges associated with aligning the seasonal nature of water demand with the region's hydrologic cycle including climate change projections.
        - Articulating the cost of providing clean, safe drinking water
        - Publicizing the current target to reduce peak day per capita water use by 5% by 2015 from the 2010 level and identify additional targets.

    b. In partnership with members, implement policies and tools that promote water conservation and efficient use of water resources. This could include:
        - Basing new policies and tools on an analysis of the effectiveness of sprinkling regulations, metering, and low flow/water efficient appliances and fixtures on reducing per capita use.

- Communicating how the design of new residential and commercial developments as well as the lawns and gardens of existing residences can reduce the need for irrigation and sprinkling.

c. Expand on the success of the Tap Water Campaign.

2. **Ensure the long-term financial and functional resilience of the regional drinking water system.**

a. On a regular basis, review and update the long-term plan for managing, maintaining, operating, and expanding the drinking water system. This review should include:
   - Revising the water demand forecast based on current and projected water consumption trends.
   - Evaluating the buffer between system capacity (i.e., storage, treatment and transmission capacity) and projected water use in a growing region.
   - Assessing how changing climatic conditions will affect the region's water supply and demand.
   - Evaluating the triple bottom line implications of future supply alternatives.
   - Continuing to implement seismic upgrading projects and other emergency management measures for the drinking water utility.

b. In the context of this long-term perspective, adopt a strategic plan for prioritizing projects.
   - Continuing to develop triple bottom line business cases for all major projects.
   - Continuing to model regional growth patterns.

c. Maintain user pay approach for financing the regional drinking water system. This will involve:
   - Evaluating alternatives to the current model for assigning costs associated with growth, including consideration of regional DCCs for water.
   - Assessing how effective financial incentives, including metering, are in reducing water use.

3. **Engage other stakeholders in realizing the goals of the Drinking Water Management Plan.**

a. In coordination with members, enhance existing mechanisms to deliver water, maintain water quality and promote conservation.
b. Identify the potential implications of new transportation, port and energy infrastructure projects on the regional drinking water system and work with other orders of government and appropriate agencies to mitigate the impact of these projects on Metro Vancouver service delivery.
c. Implement and fund projects to ensure the protection of the region's drinking water supply.
d. Maintain and enhance relations with regional public health authorities to support the provision of continuously high quality drinking water.
e. Engage water research organizations in a forward-looking research agenda related to the region's water resources.

APPENDIX A: DETAILED DWMP ACTIONS

The following section is a complete listing of all actions in the DWMP, with the current implementation status.

Goal 1: Provide Clean, Safe Drinking Water

Strategy 1.1 Use a risk management multi-barrier approach from source to tap

DWMP Actions:	Current Status on the Actions:
1.1.1 MV Will: Complete the Seymour-Capilano Filtration Project by 2013.	All of the major construction contracts for the Seymour-Capilano Filtration Project are complete except for the twin tunnels and the energy recovery facility. Filling, flushing and commissioning of the tunnels for filtration of Capilano source water is expected to commence in Fall 2014, with overall project completion projected for early 2015.
1.1.2 MV Will: Improve the primary disinfection treatment of Coquitlam source water for Cryptosporidium by adding ultraviolet treatment by 2013.	The Coquitlam UV Disinfection Plant has been successfully treating water from the Coquitlam source since February 2014. An official opening of the new UV treatment plant took place on June 11, 2014.
1.1.3 MV Will: Complete the reassessment of the secondary disinfection system after completion of the Seymour-Capilano Filtration Project by 2016.	The reassessment of the secondary disinfection system will begin in 2015 after completion of the Seymour-Capilano Filtration Project.
1.1.4 MV Will: Preserve water quality in the Metro Vancouver system by utilizing best management practices that include urban reservoir cleaning and circulating water to maintain appropriate chlorine levels.	Reservoir chlorine residuals are measured and reviewed on an ongoing basis and operating adjustments are made as required to maintain chlorine residuals. Water storage reservoirs are cleaned on a rotating basis with a target of cleaning each reservoir once every five years.
1.1.5 MV Will: Monitor water supply and water quality and use this information to optimize source water treatment, operation of the Metro Vancouver water system and rechlorination programs, and communicate system changes to agencies and municipalities as appropriate.	Water supply and quality in the GVWD water system is monitored on an on-going basis and source water treatment and water distribution adjusted to optimize water supply, treatment and quality. Advisories of significant system adjustments (i.e., sources in/out service; flow split adjustments between sources, etc.) are sent to medical health and municipal staff when appropriate. Information is shared with medical health and municipal staff through regular meetings and monthly and annual Drinking Water Quality Reports.
1.1.6 MV Will: Implement, administer, and maintain backflow prevention and cross-connection control programs within the Metro Vancouver system to protect the public water system from hazards originating on customers' premises or from temporary connections.	The GVWD system has been screened for risks to water quality from backflow. All new connections to the GVWD system are designed and constructed to prevent backflow and cross connections.
1.1.7 MV Will: Ensure continuous improvement for the management and operation of the Metro Vancouver water system by ongoing application of Metro Vancouver's Management System for Drinking Water.	Work has continued since 2011 on the documentation of GVWD's operation and management of the drinking water system. Considerable progress has been made in refining the process for hazard identification and risk management in order to make the information flowing from the process readily useable for work planning and budgeting purposes.

1.1.8 MV Will: Present an annual Metro Vancouver Water Quality Report to the Board of Directors.	An annual Water Quality report is presented in the spring to the Utilities Committee and GVWD Board.
1.1.9 Municipalities Will: Complete the reassessment of the secondary disinfection system within the municipal distribution network in coordination with Metro Vancouver after completion of the Seymour- Capilano Filtration Project by 2016.	The reassessment of the secondary disinfection system will begin in 2015 after completion of the Seymour-Capilano Filtration Project.
1.1.10 Municipalities Will: Monitor water quality in the municipal distribution systems and use this information to optimize water quality through operation of the municipal water system.	Municipalities continue to improve their programs to monitor and preserve water quality in their distribution system.
1.1.11 Municipalities Will: Preserve water quality in the distribution system through proactive maintenance programs that include water main flushing, cleaning of municipal reservoirs, and eliminating dead-ends where possible.	Municipalities preserve water quality in their distribution systems through proactive maintenance programs.
1.1.12 Municipalities Will: Implement, administer, and maintain backflow prevention and cross-connection control programs within the municipal distribution system to protect the public water system from hazards originating on customers' premises or from temporary connections.	Most municipalities implement and maintain backflow prevention and cross-connection control programs. However, some municipalities recognized that there is room for further improvement.

Strategy 1.2 Manage watersheds to provide clean, safe water	
DWMP Actions:	**Current Status on the Actions:**
1.2.1 MV Will: Where feasible and appropriate, restore disturbed areas and deactivate watershed roads that are no longer required to minimize the risk of landslides and erosion, and reduce long-term maintenance costs by 2013.	Road deactivation program is expected to be complete by the end of 2014. To date, over 150 kilometers of roads have been deactivated.
1.2.2 MV Will: Provide reliable and timely information on source water quality, stream flow, and fire risk to minimize risks to water quality, manage source reservoirs and optimize water treatment.	Numerous monitoring stations throughout the watersheds are used to provide reliable and timely data on source water quality and supply based on snowpack levels, stream flow discharge, turbidity, and fire risk parameters. This information is used to help manage source reservoirs and optimize water treatment. Equipment is regularly maintained, calibrated, and upgraded as required.
1.2.3 MV Will: Manage the watersheds with a minimum intervention approach. Intervention is only necessary for building infrastructure or if there are risks to water quality or human safety.	Closed watersheds are administered according to nine implementation programs all of which are based on a set of conservative principles designed to protect the watershed lands.
1.2.4 MV Will: Work in cooperation with adjoining municipalities and other organizations with infrastructure on watershed lands to minimize risks to water quality.	Metro Vancouver requests, approves and monitors Environmental Management plans for all infrastructure work associated with BC Hydro and Fortis operations within the Capilano and Coquitlam Watersheds. In addition, MV liaises with the Province and member municipalities on potential interface fire strategies as appropriate.
1.2.5 MV Will: Reduce the risk from microbiological or chemical contamination by restricting access to the source watersheds as specified in Metro Vancouver's Watershed Access Policy.	Restricted entry to the drinking water watersheds is based on Board policy and corporate procedures and includes a thorough permit process.

Strategy 1.3 Identify and secure additional water supplies for the region	
DWMP Actions:	**Current Status on the Actions**
1.3.1 MV Will: Complete the Seymour-Capilano Filtration Project and initiate conceptual design of the new Coquitlam intake facility to access additional water supplies by 2013.	Completion of the Seymour-Capilano Filtration Project will allow the Capilano pump station to access greater quantities of water at lower elevations to increase water supply capacity from Capilano Reservoir. In Coquitlam watershed, initial conceptual design work for the new intake facility is underway. A preferred location for the second intake has been preliminary identified. Geophysical assessment of two priority routings for conveyance infrastructure has been completed. A detailed work plan is being developed to guide further conceptual design and project definition work for this additional supply.
1.3.2 MV Will: Provide for additional capacity by securing full access to the Coquitlam source under the Coquitlam Water Use Plan and the current forecast predicts expanding storage capacity in Seymour and Capilano Watersheds by 2050. The schedule for storage expansion will be monitored and storage expanded as needed.	Preliminary discussions with BC Hydro are underway on securing and pricing additional water from the Coquitlam source. The schedule for storage expansion is being re-evaluated based on population projections and water consumption trends.
1.3.3: Other Governments and Agencies Will: Senior governments, universities, and research agencies continue to assess the potential impacts of climate change on the need for additional water supplies or storage capacity and advise Metro Vancouver on the results of this research.	Metro Vancouver staff continue to engage with external organizations completing relevant work, including Simon Fraser University-Adaptation to Climate Change Team, BC Water and Waste Association, Fraser Basin Council, City of Vancouver sustainability staff and the Water Research Foundation.

Goal 2: Ensure the Sustainable Use of Water Resources

Strategy 2.1 Use drinking water sustainably

DWMP Actions	Current Status on the Actions:
2.1.1 MV Will: Deliver education programs promoting behaviour change by means of: sustainability education resources; watershed field trips; sustainability initiatives at schools; information outreach programs promoting behaviour change and sustainable use of water.	Outreach continues on sustainable use of water through the Water Wagon (June to September) and through conservation messaging (advertisements, and shared materials with municipalities) on sprinkling regulations. Metro Vancouver staff continues to work with School Districts (Administrators and teachers) in delivering watershed education and specific teacher training programs and professional development activities, and targeted youth leadership development programming that includes a significant water conservation and sustainability component.
2.1.2 MV Will: Implement a region wide water conservation program targeting the industrial, commercial, institutional and agricultural sectors in partnership with municipalities. Program elements include water audits, informative resources and case studies.	Program under development for implementation in 2015.
2.1.3 MV Will: Deliver the Tap Water Campaign to educate people about Metro Vancouver's high quality drinking water and to reduce the environmental impact of bottled water.	Tap Water Campaign is delivered year round and in particular through the Metro Vancouver Water Wagon in the summer period. A trained outreach team provides materials on water source and quality and promotes the use of tap water over bottled water. Also in the summer period, aps such as TapMap.ca, developed in collaboration with Member Municipalities, help residents to easily locate water fountains and places to get a drink or refill their bottle.
2.1.4 MV Will: Set the wholesale water rates and water rate structure to reflect the cost of regional water supply, and achieve water conservation and other sustainability objectives.	During the 2011 to 2014 period, finance budget processes related to the setting of annual seasonal rates to reflect the cost of the regional water supply were based on a review and approval of target water rates. The setting of target rates considered the rates of prior years and considered any budget changes in capital and operational plans. The annual (2011-2014) Water budgets and seasonal water rates were Board approved.
2.1.5 MV Will: Work with the business sector on water conservation and water reuse initiatives in partnership with municipalities.	Program under development for implementation in 2015.
2.1.6 MV Will: Develop the Seymour Water Treatment and Watershed Academy to support innovative research and demonstration projects.	The proposed Seymour Academy will not be proceeding at this time. However, innovative research and demonstration projects are being explored through other initiatives.

2.1.7 Municipalities Will: Reassess the merits of developing residential water metering programs and municipal rebate programs for water efficient fixtures and appliances by 2015.	Since 2011, most municipalities have reassessed the merits of developing residential water metering programs and municipal rebate programs for water efficient fixtures and appliances or are in the process of doing so. Municipalities accounting for 69% of GVWD water sales have residential water metering programs that will ultimately lead to universal metering. Other municipalities have decided not to add water metering at this time because their review showed a lack of financial benefits, or because other water programs had a higher priority. Some municipalities have rebate programs while other municipalities have determined they are not appropriate at this time.
2.1.8 Municipalities Will: Develop, implement and enforce consistent bylaws to encourage water efficiency and implement Metro Vancouver's Water Shortage Response Plan.	All municipalities have developed, implemented, and are enforcing bylaws to encourage water efficiency and implement the Metro Vancouver Water Shortage Response Plan.
2.1.9 Municipalities Will: Work with the business sector on water conservation and water reuse initiatives in partnership with Metro Vancouver.	Many municipalities work with the business sector on water conservation and water use initiatives or are in the process of doing so. However, some municipalities have no active program specifically targeting the business sector.
2.1.10 Municipalities Will: Achieve a retail water rate structure that reflects the cost of regional water supply and, if practical, the regional seasonal price structure.	Most municipalities achieve a water rate structure that reflects the cost of regional water supply. Several municipalities have a rate structure that reflects the regional seasonal price structure.
2.1.11 Municipalities Will: Deliver education programs promoting behaviour change and sustainable use of water.	Most municipalities have educational programs promoting behaviour change and sustainable use of water.

Strategy 2.2 Match water quality to usage requirements	
DWMP Actions:	**Current Status on the Actions:**
2.2.1 MV Will: Install facilities for water reclamation at wastewater treatment plants to provide reclaimed water for use within and outside wastewater plants where feasible. 2011-2016	All existing wastewater treatment plants provide reclaimed water for use within the wastewater plant. However, none of the existing wastewater treatment plants provide reclaimed water for outside use. Use of reclaimed wastewater within proposed new wastewater treatment plants (e.g. Lions Gate) is expected to be feasible. Use of reclaimed water beyond the proposed new wastewater treatment plants is being examined.
2.2.2 MV Will: Evaluate alternatives to potable water for specific purposes, including: rainwater harvesting for irrigation; greywater and reclaimed wastewater for residential, commercial, institutional, and agricultural use; groundwater for irrigation; river and sea water for waterfront businesses.	Program under development for implementation in 2015.
2.2.3 Municipalities Will: Update municipal bylaws, utility design standards and neighbourhood design guidelines to enable and encourage on-site rainwater management as appropriate, so that it can be used for non-potable purposes such as irrigation.	Some municipalities have, or are developing, rain water management requirements for new developments that encourage water re-use for non-potable purposes.
2.2.4 Other Governments, Agencies, and Associations Will: Revise the Provincial health regulations to allow specific residential and commercial uses of non-potable water (greywater and rainwater) after discussions with Metro Vancouver and municipalities.	Some work on revising Provincial regulation has been done in recent years. Further work to tailor and apply these revised regulations in the Metro Vancouver region is required.
2.2.5 Other Governments, Agencies, and Associations Will: Facilitate networking for re-use of process wastewater with business associations, institutions, and non-governmental organizations.	More emphasis on this action will occur in upcoming years to match water quality to usage requirements.

Strategy 2.3 Manage and protect watersheds as natural assets	
DWMP Actions:	**Current Status on the Actions:**
2.3.1 MV Will: Manage watershed lands and their biological diversity to advance regional sustainability.	The watershed forest lands are protected. All MV projects follow Best Management Practices with respect to flora and fauna protection. MV supports high standard ecological research in the watersheds and currently is partnering with the Province on species at risk studies.
2.3.2 MV Will: Manage the on-drainage watershed lands with a minimum intervention approach.	MV takes an ecosystem-based approach to managing the watersheds. Intervention is only used to protect water quality (e.g. erosion control), infrastructure (e.g. access bridges, facilities), and human safety (e.g.danger trees) or for habitat restoration purposes.
2.3.3 MV Will: Protect and conserve fish populations while continuing to provide clean, safe drinking water.	MV, often in conjunction with stewardship groups and related fishery committees, examines and undertakes fish conservation projects while protecting drinking water quality. Examples include: managing the Capilano Smolt trap and truck program; supporting the Seymour River Fish Hatchery (Seymour Salmonid Society) and, participating in the Kwikwetlem Salmon Restoration Program.
2.3.4 MV Will: Provide non-motorized recreational opportunities on off-drainage watersheds lands where appropriate.	Continual maintenance of 100 kilometers of recreational trails and associated infrastructure. Examples include: 10km Seymour Valley Trailway, mountain bike trails suitable for various skill levels, development of alpine hiking and snowshoe trails with BC Parks.
2.3.5 MV Will: Develop and implement a Joint Water Use Plan for the Seymour and Capilano Watersheds.	A draft Seymour-Capilano JWUP was sent to the Province in March 2013. MV staff are working with the Province to complete the review/approval process. It is anticipated that the JWUP will be approved in late 2014.

Goal 3: Ensure the Efficient Supply of Water

Strategy 3.1 Manage infrastructure proactively

DWMP Actions:	Current Status on the Actions:
3.1.1 MV Will: Develop and implement an Asset Management Plan targeted at maintaining delivery of reliable and cost-effective drinking water services to the region over the next 100 years.	Metro Vancouver is currently reviewing its comprehensive asset management strategy to determine tasks required to complete asset management plan implementation.
3.1.2 MV Will: Renew and replace aging infrastructure to maintain required levels of service based on risk analyses (including seismic risk) and cost-benefit priorities.	This work is on-going (using a variety of tools) and is implemented through the Long Range Capital Plan. This item will be incorporated in the Asset Management planning review.
3.1.3 MV Will: Undertake cost-effective leak identification and repair programs targeting water transmission mains with high breakage rates or that are older than 50 years.	Unaccounted for water is determined on a monthly basis and the department maintains a detailed database for water transmission main leak history.
3.1.4 MV Will: Implement, where feasible and appropriate, pressure reduction or pressure management programs (including pressure transients) to reduce leakage and potentially extend the life of the infrastructure.	MV is working with various municipalities to review and understand the appropriate pressure targets within the regional and municipal water supply systems; adjustments to the regional system are made when appropriate – taking into consideration the impact to regional system or other municipal customers.
3.1.5 MV Will: Conduct hazard assessments specific to trespassing, excavations over pipes and pressure loss and implement emergency and security programs to reduce risks.	Metro Vancouver has a program for dealing with identified proximal construction issues and is re-evaluating becoming a member of BC One Call to afford the system better protection from trespass incidents.
3.1.6 MV Will: Upgrade the energy efficiency of the system by prioritizing gravity systems and where possible recovering surplus energy and upgrading pump and motor efficiencies.	The GVWD water transmission system is managed to meet service level targets by maximizing the use of gravity and minimizing the amount of pumping used whenever practicable. Opportunities for energy recovery throughout the distribution system are under review. Recovery of energy from the twin tunnels (Capilano Energy Recovery Facility) for use at the Capilano Pump Station is expected to commence in 2015.
3.1.7 MV Will: Upon completion of a Joint Water Use Plan for the Capilano and Seymour Watersheds, assess the feasibility of developing hydropower at the Cleveland and Seymour Falls dams.	A draft Seymour-Capilano JWUP was sent to the Province in March 2013. MV staff are working with the Province to complete the review/approval process. It is expected that the JWUP will be approved in late 2014. Once the JWUP is approved, further technical and financial assessment of the proposed hydropower projects will proceed.

3.1.8 Municipalities Will: Renew and replace aging infrastructure to maintain required levels of service based on risk analyses and cost-benefit priorities specific to the needs of each municipality.	Municipal staff indicate that municipalities are adequately renewing or replacing their infrastructure to maintain required levels of service based on risk analysis and cost-benefit priorities specific to their municipality.
3.1.9 Municipalities Will: Undertake cost-effective leak identification and repair programs targeting the municipal water system.	Many municipalities have leak detection and repair programs targeting the municipal water system. Others are in the process of developing these programs.
3.1.10 Municipalities Will: Implement, where feasible and appropriate, pressure reduction or pressure management programs (including pressure transients) to reduce leakage and potentially extend the life of the infrastructure.	Many municipalities are in the process of implementing/exploring pressure management programs to reduce water leakage and extend the life of the infrastructure.

Strategy 3.2 Optimize capacity through effective partnerships	
DWMP Actions:	**Current Status on the Actions:**
3.2.1 MV Will: Maintain a system of seasonal pricing and confirm that the cost of providing water in the summer season continues to be 1.25 times the cost of providing water during the remainder of the year and make seasonal pricing adjustments accordingly by 2014.	MV staff are currently reviewing seasonal water pricing costs.
3.2.2 MV Will: Based on the projected growth in population and economic activity in Metro Vancouver's approved Regional Growth Strategy, plan and construct required Metro Vancouver facilities.	On an annual basis, the growth component of the GVWD Long Range Capital Plan is updated to reflect the latest information on population growth and water consumption. On the 10-year 2014 LRP, approximately 1.3 billion dollars of growth upgrading was identified.
3.2.3 MV Will: Install water meters on all new municipal system connections to Metro Vancouver's water mains.	Meters are being incorporated into the design and construction of all new connections to Metro Vancouver's watermains. In addition, existing connections to existing watermains are also being upgraded to include water meters, where feasible.
3.2.4 MV Will: Further enhance lawn sprinkling regulations to address both seasonal and peak day consumption issues in partnership with municipalities.	The GVWD Board revised the regional Water Shortage Response Plan (WSRP) in 2011, to spread lawn sprinkling over seven days of the week and restrict permitted times for lawn sprinkling to morning hours only. To date, these changes to the lawn sprinkling hours are reducing per-capita peak hour and peak day demands on the GVWD and municipal water transmission systems.
3.2.5 Municipalities Will: Further enhance lawn sprinkling regulations to address both seasonal and peak day consumption issues in partnership with other municipalities and Metro Vancouver.	In 2011, most municipalities changed their information materials and bylaws to implement the 2011 WSRP revisions to the permitted times for lawn sprinkling. The morning-only sprinkling hours were fully implemented by all GVWD members in summers 2012 and 2013. To date, these changes to the lawn sprinkling hours are reducing per-capita peak hour and peak day demands on the GVWD and municipal water transmission systems.