
2014 Annual Water Report



City of Revelstoke
Engineering and Public Works
Department



Table of Contents

| | |
|--|-----------|
| Introduction..... | 3 |
| Revelstoke Water Distribution System | 3 |
| <i>Greeley Creek Water Treatment Plant</i> | <i>3</i> |
| <i>Golf Course Well.....</i> | <i>5</i> |
| <i>Reservoirs</i> | <i>5</i> |
| <i>Distribution System</i> | <i>5</i> |
| <i>Pump Stations</i> | <i>6</i> |
| <i>SCADA (Supervisory Control and Data Acquisition).....</i> | <i>6</i> |
| <i>Pressure Zones.....</i> | <i>7</i> |
| Routine Maintenance Program:..... | 7 |
| <i>Distribution.....</i> | <i>7</i> |
| <i>Golf Course Well.....</i> | <i>7</i> |
| <i>Greeley Creek Water Treatment Plant</i> | <i>7</i> |
| <i>Reservoirs</i> | <i>7</i> |
| <i>Pump Stations</i> | <i>7</i> |
| 2014 Improvements:..... | 8 |
| 2015 Capital Projects and Improvements: | 8 |
| Big Eddy Waterworks..... | 8 |
| Water Consumption | 8 |
| Water Conservation..... | 11 |
| Water Sampling and Testing | 11 |
| <i>Bacteriological.....</i> | <i>11</i> |
| <i>Full Spectrum Analysis.....</i> | <i>11</i> |
| Water Quality Complaints | 11 |
| Cross Connection Program..... | 12 |

Emergency Response Plan 12

Appendix A: Bacteriological Testing 2014 13

Appendix B: Source Water Full Spectrum Analysis 20

Introduction

Under the terms of the City of Revelstoke's Operating Permit, the City is required to provide an annual report to users of the system that provides an overview of the water system, and a summary of water test results, maintenance and improvements made to the system. All water suppliers are required to provide a similar annual report to their users.

This report has been submitted to Interior Health and is posted on the City of Revelstoke website.

www.cityofrevelstoke.com

Revelstoke Water Distribution System

The City of Revelstoke has approximately 3007 residential and 313 commercial water connections serving the citizens of Revelstoke. These users primarily get their drinking water from Greeley Creek.

The City also utilizes a secondary source from the Golf Course well groundwater field.

Water from the Greeley Creek source is treated through a membrane treatment facility. However, under the City's "Permit to Operate" additional treatment with chlorine is required to ensure the integrity of the water is maintained while it travels through the distribution system. Water from the Golf Course well is treated with chlorine before it enters into the distribution system.



As part of the water distribution system the City maintains 98 km of water main, 2 reservoirs and 2 pump stations. Figure 1 shows the layout of the City's water distribution system.

Greeley Creek Water Treatment Plant

Located approximately 8km from the City of Revelstoke, the Greeley Water Treatment Plant is the primary water treatment facility for the City. The plant was constructed in 2000 and uses a micro filtration membrane system to remove water born parasites and particles. The plant also adds chlorine to the treated water to ensure the integrity of the water up to the user's tap. The plant is capable of supplying up to 175 l/s.

At the time of its construction the plant was one of the most advanced facilities in North America and the first of its kind in British Columbia.

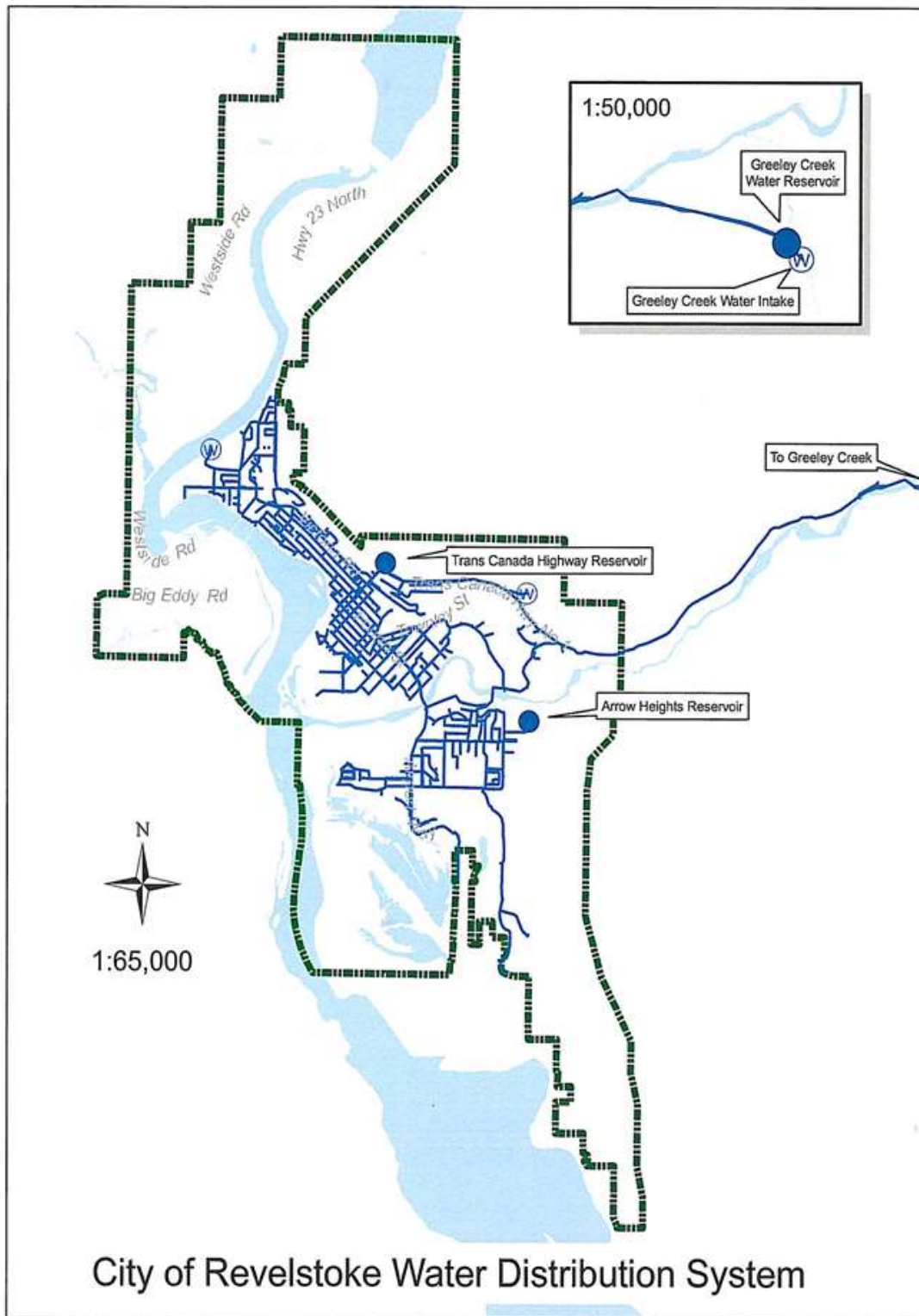


Figure 1 City of Revelstoke Water Distribution System

Golf Course Well

The City of Revelstoke operates a groundwater well and disinfection station located adjacent to the Columbia River on the City of Revelstoke's municipally owned golf course. The well is used as a back-up water supply to the Greeley Creek water source as well as providing additional water to the system during periods of peak demand. Additionally, the well provides raw water to the golf course for irrigation purposes.

The well is capable of supplying 70 l/s. Disinfection at the site is provided through a sodium hypochlorite injection system.

Reservoirs

The Trans Canada Highway Reservoir is located off the Trans Canada Highway and the Arrow Heights Reservoir is located above upper Arrow Heights.

The Trans Canada Highway Reservoir is a steel tank which holds 4.55 million liters of water. A new tank was constructed in 2011. The reservoir is the primary reservoir for the City of Revelstoke. The Arrow Heights Reservoir, constructed in 2004 is a 2.27 million liter concrete tank.

Distribution System

The City's 98 km water distribution system is made up of 10.8 km cast iron pipe, 11 km of ductile iron pipe, 3.7 km of galvanized pipe, 37.1 km of asbestos concrete pipe and 35.2 km PVC pipe. Pipe sizes range from 50mm to 300mm in diameter.

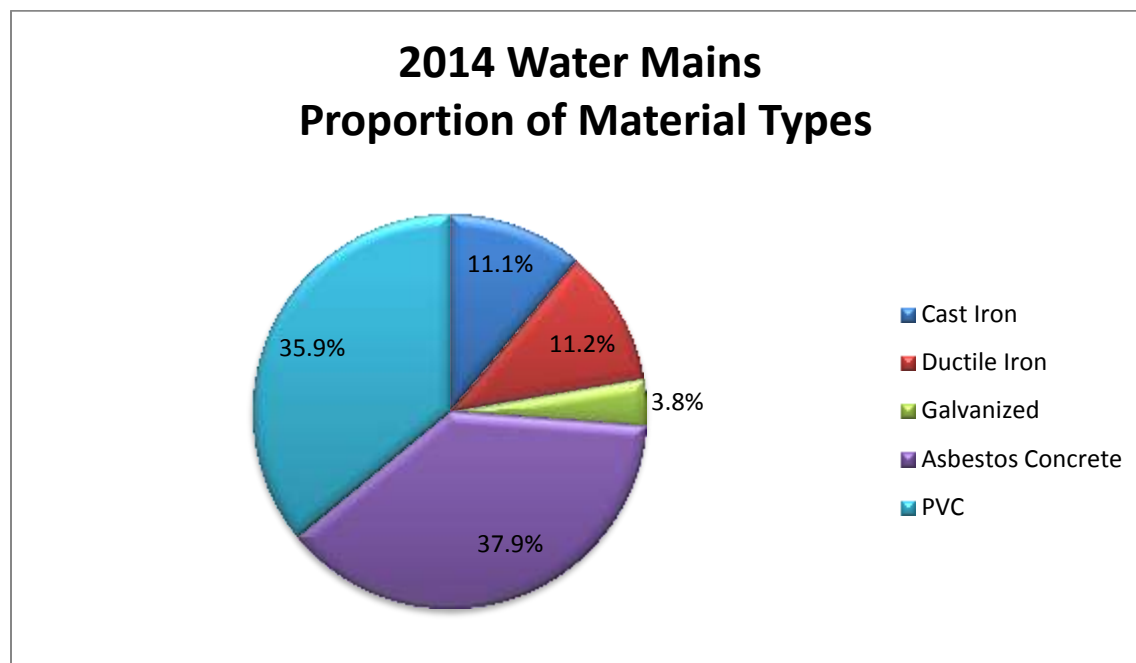


Figure 2 Water mains by material type

The age of the water mains range from new to approximately 82 years old. The age of the pipe does not necessarily reflect the need to replace it as the various material types have different average life expectancies. For example cast iron pipe can last up to 100 years whereas galvanized pipe may only last up to 40 years.

The City has an active program to replace pipes that are either inadequately sized, in poor condition or have reached the end of their functional life.

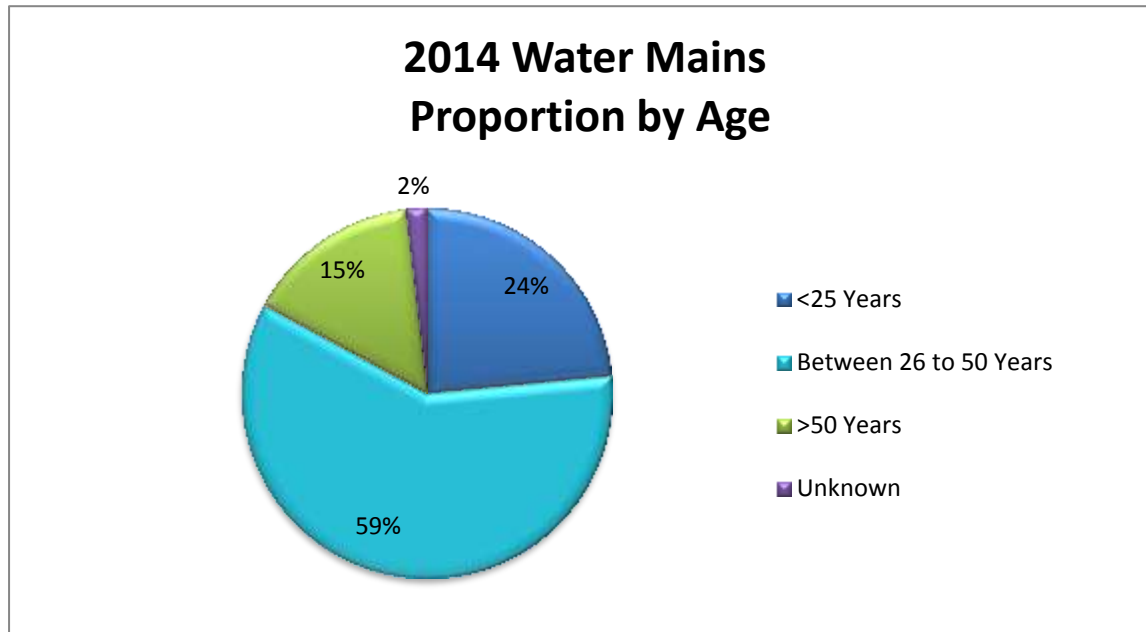


Figure 3 City of Revelstoke Water Mains Proportion by Age

Pump Stations

The Arrow Heights Pump Station is used to fill the Arrow Heights Reservoir. The station was constructed in 2005 at the same time as the Arrow Heights Reservoir.

Revelstoke Mountain Resort completed the Revelstoke Mountain Resort Booster Station in 2010 for the City. The station regulates the line pressure to Mackenzie Landing and Monashee Estates at present. In the future, the station will also be used to fill additional storage reservoirs that will need to be constructed as the resort grows.

SCADA (Supervisory Control and Data Acquisition)

A SCADA computer control system is used by the City to monitor and control the functions of the water treatment plant, pump stations and reservoirs. This system allows the Engineering and Public Works Department to monitor reservoir levels, the on/off status and flows of pumps, and chlorine residuals

within the system. The operator can change set points and monitor the systems remotely 24 hours per day, seven days per week. Alarms are set to alert operators to potential problems within the systems.

Pressure Zones

The City is divided into 5 pressure zones. The system pressure in each Zone ranges from 40 psi to 130 psi. As part of its Water Regulations Bylaw, the City requires all service connections to the City's water system to have a pressure reducing valve where the service line enters into the premises.

Routine Maintenance Program:

Distribution

Fire hydrants are inspected and flushed annually. Starting in 2011 the City initiated a program to exercise water main valves to make sure that they are operating properly. A valve exerciser has been purchased and is used extensively.

Golf Course Well

The City carries out a regular preventative maintenance program at the golf course well and disinfection station. The program includes a daily site visit, running the well pump daily to insure that it is at the ready if required as well as insuring the disinfection stations are operating within normal parameters.

Greeley Creek Water Treatment Plant

As part of the preventative maintenance program for the plant, the site is visited daily and the chlorine disinfection unit is inspected.

As part of the routine maintenance of the membrane filtration system, individual filtration units are taken off line after a set volume of water has passed through them. The isolated unit is put through a chemical back wash to clean the filter and then put back on line. Each filter unit must be replaced at least once every 10 years.



Reservoirs

The City's reservoirs are inspected daily to make sure the site and structure are secure. In the case of the Arrow Heights Reservoir the flow through the reservoir is monitored to insure that there is adequate turnover of water within the tank to maintain chlorine residuals.

Pump Stations

The Arrow Heights and Revelstoke Mountain Resort pump stations are inspected daily. All pumps and motors are inspected and serviced annually as per the operations and maintenance protocols for each facility.

2014 Improvements:

- New System (Fire Flow Improvements)
 - Installed a Pressure Reducing Valve (PRV) on CPR Hill
 - Installed a water main from new PRV to Cedar Street

- Existing System Upgrades/Replacements:
 - Abandoned a 50mm galvanized iron water main on Laforme Blvd.
 - Replaced Greeley Source flow meter
 - Completed inventory of fire hydrants and replaced 5 hydrants upgraded to full hydrant with pumper port
 - Improvements to chlorination system at Greeley



2015 Capital Projects and Improvements:

In 2015, the City of Revelstoke is planning to undertake the following projects:

- Replacement of watermain outside City Hall
- Complete upgrades at the Water Treatment Plant
- Continue Fire Hydrant Replacement program

Big Eddy Waterworks

Drinking water in the Big Eddy neighbourhood is provided by the Big Eddy Water District. In August 2014 the City received a letter from the Big Eddy Water District requesting to discuss potential transferring ownership and responsibility for operations of the Big Eddy Waterworks. The City is working with the Big Eddy Water District to address long term water supply and quality concerns and in 2014 engaged an consultant to undertake a utility acquisition study to review the infrastructure, management and finances of the Big Eddy Water District.

Water Consumption

In 2014, the City treated 1.8 million cubic meters of water. The average volume of water being treated over the last 10 years is 2.28 million cubic meters/yr. Monthly water consumption peaks during July and August during irrigation and seen in Figure 4. Water consumption for all months in 2014 were below the 10 year average monthly water consumption. Annual Peak Day flow at Greeley water treatment plant can be seen in Figure 5.

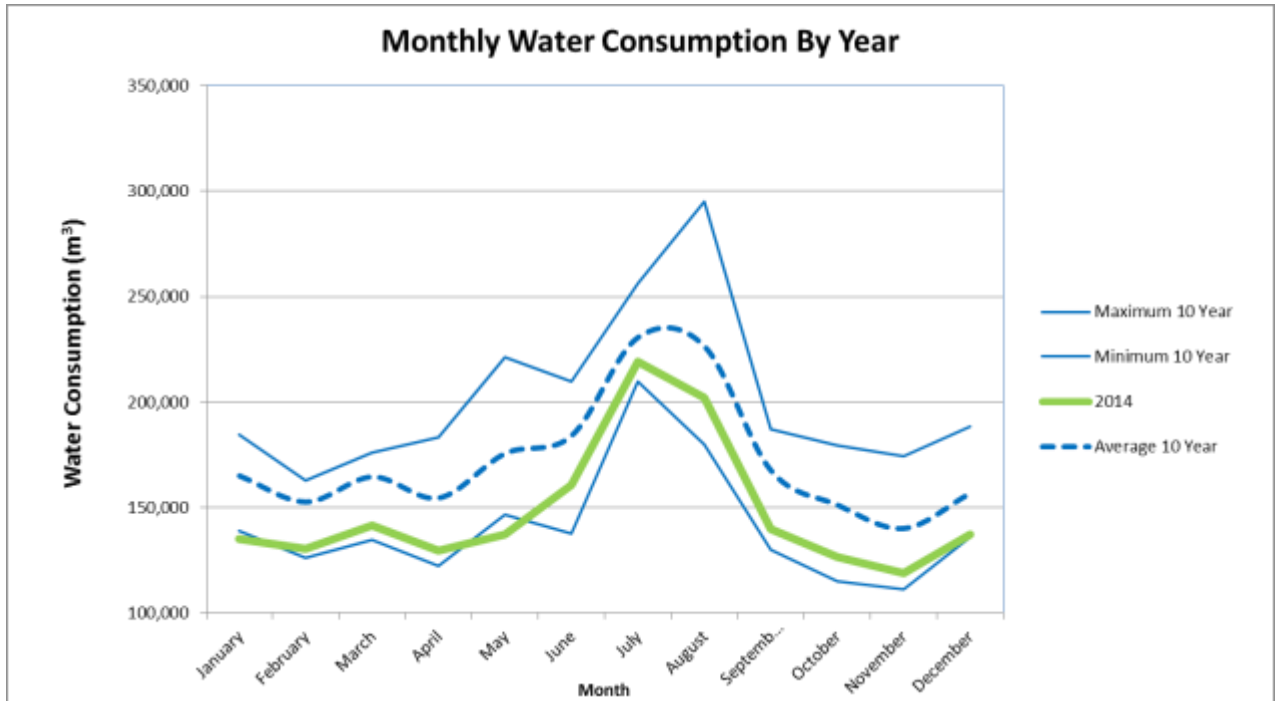


Figure 4 Monthly Water Consumption By Year

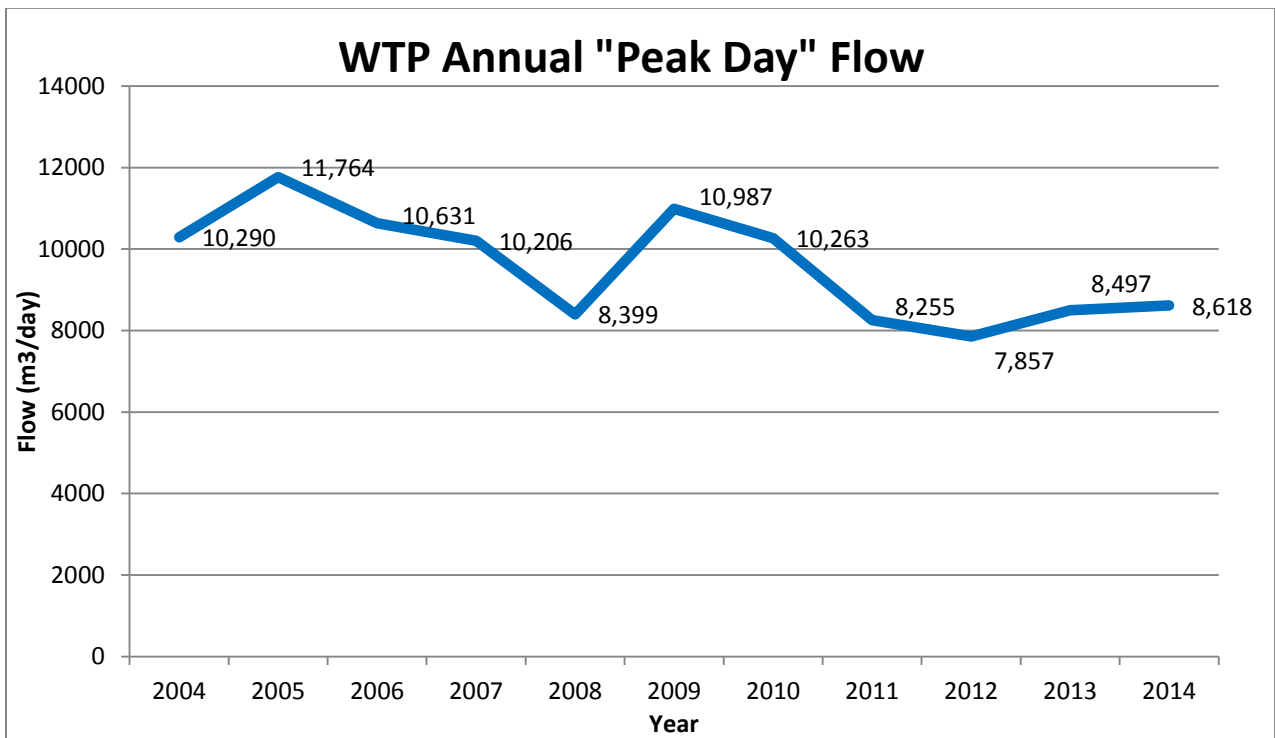


Figure 5 Annual Peak Day flow at the water treatment Plant

In 2014 the operational cost to produce treated water was \$0.84 per cubic metre.

| | 2012 | 2013 | 2014 |
|-------------------------------------|-------------|-------------|-------------|
| Operational Costs | | | |
| Administration | \$145,808 | \$143,362 | \$143,663 |
| Transmission/ Distribution Costs | \$671,225 | \$456,593 | \$568,212 |
| Interest | \$296,059 | \$296,047 | \$292,856 |
| Total | \$1,113,093 | \$896,003 | \$1,004,732 |
| | | | |
| Capital Costs | | | |
| Debt Principal | \$152,085 | \$152,085 | \$152,085 |
| Reserve Fund Transfers | \$350,000 | \$500,000 | \$330,000 |
| | | | |
| Total | \$1,615,178 | \$1,548,088 | \$1,486,817 |
| | | | |
| Cubic Meters Treated | 1,785,000 | 1,688,000 | 1,778,000 |
| | | | |
| Cost/m ³ | \$0.90 | \$0.92 | \$0.84 |

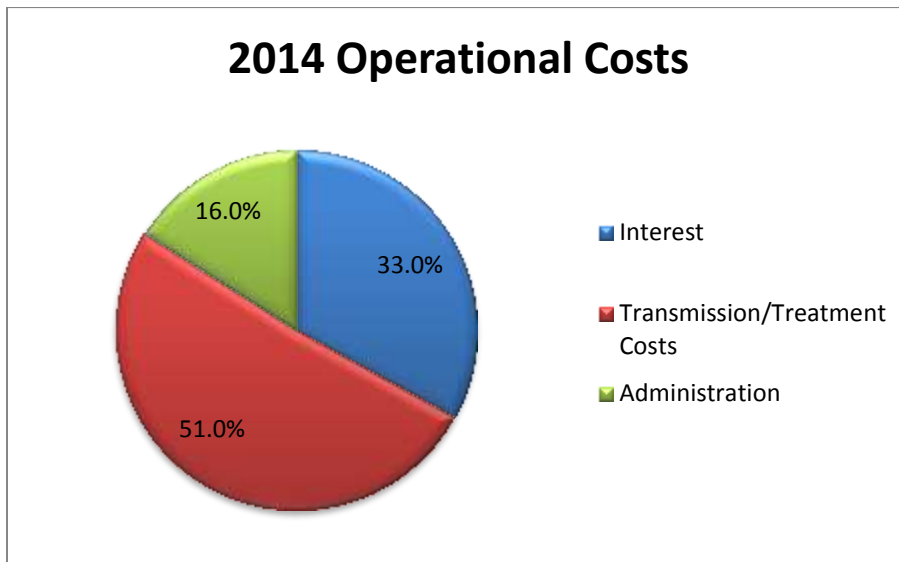


Figure 6 Operational costs for the City of Revelstoke in 2014

As the population in the City grows, the cost of supplying and treating our water grows as well. These increases push the City to review infrastructure and plan improvements to offset these costs on an ongoing basis.

Water Conservation

The City is a member of the Columbia Basin WaterSmart Program. A metering study completed in 2013 recommended the city's water conservation activities focus on water loss management. In 2014 the City's completed the verification and calibration of all eleven flow meters in the distribution system.

A City staff member attends Farmer's market to provide information on water conservation, including education and distribution of hose nozzles and timings and tips to maintain a healthy lawn while being water conscience.



The City has watering restrictions in place all year round and during the hot dry summer of 2014 the City increased bylaw enforcement to aid in increased compliance with the bylaw.

Water Sampling and Testing

Bacteriological

As required by the Interior Health Authority (IHA), City staff takes weekly samples of the water for bacteriological testing for Total Coliforms and e-Coli Bacteria. There are nine different sampling sites used throughout Revelstoke. In addition, water samples are taken from within project areas after any work on infrastructure.

See Appendix A for 2014 test results.

Full Spectrum Analysis

City staff also sends samples from the source water for a full spectrum analysis. Parameters such as alkalinity, metals, pH, turbidity, and hardness are tested.

See Appendix B

Water Quality Complaints

The Engineering and Public Works Department received very few complaints in 2014 about water quality. The local Health Authority requires that our water be tested weekly and that a minimum chlorine residual be present at all points in the system. In 2014 there was routine test samples taken from 12 different sites throughout the City.

Complaints about dirty water are rare though large flow alterations, such as occur during system flushing or in the event of a water main break, can stir up residues in the pipes. These disruptions are

unavoidable and customers are advised to allow their taps to run (after repairs are complete or main flushing has stopped) until the system clears.

Cross Connection Program

The City is developing a Cross Connection Control Program to address the potential for the water system to be compromised by high risk service connections which could introduce contaminated water into the City's water system.

Emergency Response Plan

The City has an Emergency Response Plan pertaining to the water supply system. The Emergency Response Plan identifies a number of potential emergencies that could occur and provides a systematic approach on how the City will deal with the emergency. The plan is set to be reviewed in the coming year.

Appendix A: Bacteriological Testing 2014

| SAMPLE NAME | DATE | ANALYTE | RESULT | RL | UNITS |
|-----------------|------------------|------------------|--------|------------|------------|
| 2nd + Mackenzie | 8/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/26/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/26/2014 | E. coli | < | 1 | CFU/100 mL |
| 2nd + Orton | 8/26/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/26/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/25/2014 | E. coli | < | 1 | CFU/100 mL |
| Chevron | 1/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/8/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/8/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/13/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/13/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/10/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/10/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/12/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/14/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/14/2014 | E. coli | < | 1 | CFU/100 mL |
| 11/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL | |
| 11/12/2014 | E. coli | < | 1 | CFU/100 mL | |
| 12/10/2014 | Coliforms, Total | < | 1 | CFU/100 mL | |
| 12/10/2014 | E. coli | < | 1 | CFU/100 mL | |
| City Hall | 1/28/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/28/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/22/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/22/2014 | E. coli | < | 1 | CFU/100 mL |
| City Works Yard | 4/8/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/8/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/12/2014 | E. coli | < | 1 | CFU/100 mL |

| | | | | | |
|------------------|------------|------------------|---|---|------------|
| | 12/10/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/10/2014 | E. coli | < | 1 | CFU/100 mL |
| | 1/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/13/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/13/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/10/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/10/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/12/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/14/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/14/2014 | E. coli | < | 1 | CFU/100 mL |
| Court House | 1/21/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/21/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/20/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/20/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/17/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/19/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/19/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/17/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/21/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/21/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/16/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/16/2014 | E. coli | < | 1 | CFU/100 mL |
| Golf Course Well | 1/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 1/28/2014 | Coliforms, Total | 1 | 1 | CFU/100 mL |
| | 1/28/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/18/2014 | E. coli | < | 1 | CFU/100 mL |

Greely Intake

| | | | | |
|-----------|-------------------------------|-------|--------|------------|
| 3/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 3/25/2014 | E. coli | < | 1 | CFU/100 mL |
| 4/8/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 4/8/2014 | E. coli | < | 1 | CFU/100 mL |
| 6/24/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 6/24/2014 | E. coli | < | 1 | CFU/100 mL |
| 7/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 7/9/2014 | E. coli | < | 1 | CFU/100 mL |
| 7/22/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 7/22/2014 | E. coli | < | 1 | CFU/100 mL |
| 8/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 8/12/2014 | E. coli | < | 1 | CFU/100 mL |
| 9/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 9/2/2014 | E. coli | < | 1 | CFU/100 mL |
| 9/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 9/9/2014 | E. coli | < | 1 | CFU/100 mL |
| 9/23/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| 9/23/2014 | E. coli | < | 1 | CFU/100 mL |
| 12/1/2014 | Chloride | < | 0.10 | mg/L |
| 12/1/2014 | Fluoride | < | 0.10 | mg/L |
| 12/1/2014 | Nitrate as N | 0.099 | 0.010 | mg/L |
| 12/1/2014 | Nitrite as N | < | 0.010 | mg/L |
| 12/1/2014 | Sulfate | 13.0 | 1.0 | mg/L |
| | Alkalinity, Total as | | | |
| 12/1/2014 | CaCO ₃ | 34 | 1 | mg/L |
| 12/1/2014 | Colour, True | < | 5 | CU |
| 12/1/2014 | Conductivity (EC) | 98 | 2 | uS/cm |
| 12/1/2014 | Cyanide, Total | < | 0.010 | mg/L |
| 12/1/2014 | pH | 7.66 | 0.01 | pH units |
| 12/1/2014 | Turbidity | 0.2 | 0.1 | NTU |
| | UV Transmittance | | | |
| 12/1/2014 | @ 254nm | 97.2 | 0.1 | % T |
| | Hardness, Total | | | |
| 12/1/2014 | (Total as CaCO ₃) | 39.9 | 5.0 | mg/L |
| | Solids, Total | | | |
| 12/1/2014 | Dissolved | 51.3 | 2.0 | mg/L |
| 12/1/2014 | Aluminum, total | < | 0.05 | mg/L |
| 12/1/2014 | Antimony, total | < | 0.001 | mg/L |
| 12/1/2014 | Arsenic, total | < | 0.005 | mg/L |
| 12/1/2014 | Barium, total | < | 0.05 | mg/L |
| 12/1/2014 | Beryllium, total | < | 0.001 | mg/L |
| 12/1/2014 | Boron, total | < | 0.04 | mg/L |
| 12/1/2014 | Cadmium, total | < | 0.0001 | mg/L |
| 12/1/2014 | Calcium, total | 13.3 | 2.0 | mg/L |
| 12/1/2014 | Chromium, total | < | 0.005 | mg/L |
| 12/1/2014 | Cobalt, total | < | 0.0005 | mg/L |
| 12/1/2014 | Copper, total | < | 0.002 | mg/L |
| 12/1/2014 | Iron, total | < | 0.10 | mg/L |
| 12/1/2014 | Lead, total | < | 0.001 | mg/L |
| 12/1/2014 | Magnesium, total | 1.6 | 0.1 | mg/L |
| 12/1/2014 | Manganese, total | < | 0.002 | mg/L |

| | | | | | |
|---------------|------------|-------------------|--------|--------|------------|
| | 12/1/2014 | Mercury, total | < | 0.0002 | mg/L |
| | 12/1/2014 | Molybdenum, total | < | 0.001 | mg/L |
| | 12/1/2014 | Nickel, total | < | 0.002 | mg/L |
| | 12/1/2014 | Phosphorus, total | < | 0.2 | mg/L |
| | 12/1/2014 | Potassium, total | 1.1 | 0.2 | mg/L |
| | 12/1/2014 | Selenium, total | < | 0.005 | mg/L |
| | 12/1/2014 | Silicon, total | < | 5 | mg/L |
| | 12/1/2014 | Silver, total | < | 0.0005 | mg/L |
| | 12/1/2014 | Sodium, total | 1.2 | 0.2 | mg/L |
| | 12/1/2014 | Uranium, total | 0.0002 | 0.0002 | mg/L |
| | 12/1/2014 | Vanadium, total | < | 0.01 | mg/L |
| | 12/1/2014 | Zinc, total | < | 0.04 | mg/L |
| | 12/1/2014 | Coliforms, Total | 33 | 1 | CFU/100 mL |
| | 12/1/2014 | E. coli | 12 | 1 | CFU/100 mL |
| Hospital | 2/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/19/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/19/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/17/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/21/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/21/2014 | E. coli | < | 1 | CFU/100 mL |
| Jacobson Ford | 3/4/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/4/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/12/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/7/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/7/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/4/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/4/2014 | E. coli | < | 1 | CFU/100 mL |
| | 1/7/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/7/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/5/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/5/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/6/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/6/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/3/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/3/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/1/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/1/2014 | E. coli | < | 1 | CFU/100 mL |
| Lagoon | 1/7/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/7/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/5/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/5/2014 | E. coli | < | 1 | CFU/100 mL |

| | | | | | |
|------------------------|------------|------------------|---|---|------------|
| | 3/4/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/4/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/6/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/6/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/3/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/3/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/12/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/12/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/9/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/9/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/7/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/7/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/4/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/4/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/1/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/1/2014 | E. coli | < | 1 | CFU/100 mL |
| NAPA | 1/28/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/28/2014 | E. coli | < | 1 | CFU/100 mL |
| | 2/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 2/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/22/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/22/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/27/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/27/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/24/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/24/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/22/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/22/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/23/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/23/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/29/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/29/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/16/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/16/2014 | E. coli | < | 1 | CFU/100 mL |
| New Main - Burke Side | 9/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/17/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/18/2014 | E. coli | < | 1 | CFU/100 mL |
| New Main - Jordan Side | 9/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/17/2014 | E. coli | < | 1 | CFU/100 mL |

| | | | | | |
|-------------------------|------------|------------------|---|---|------------|
| | 9/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/18/2014 | E. coli | < | 1 | CFU/100 mL |
| New Main - Source | 9/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/17/2014 | E. coli | < | 1 | CFU/100 mL |
| New Main CPR PRV North | 10/29/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/29/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/30/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/30/2014 | E. coli | < | 1 | CFU/100 mL |
| New Main CPR PRV Source | 10/29/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/29/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/29/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/29/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/30/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/30/2014 | E. coli | < | 1 | CFU/100 mL |
| Queen Victoria Hospital | 1/21/2014 | Coliforms, Total | 1 | 1 | CFU/100 mL |
| | 1/21/2014 | E. coli | < | 1 | CFU/100 mL |
| | 1/28/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 1/28/2014 | E. coli | < | 1 | CFU/100 mL |
| | 3/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 3/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 4/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 4/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 5/20/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/20/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/17/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/17/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/15/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/15/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/18/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/18/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/16/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 12/16/2014 | E. coli | < | 1 | CFU/100 mL |
| RCFC | 5/20/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/20/2014 | E. coli | < | 1 | CFU/100 mL |
| Rec Center | 5/27/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 5/27/2014 | E. coli | < | 1 | CFU/100 mL |
| | 6/24/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 6/24/2014 | E. coli | < | 1 | CFU/100 mL |
| | 7/22/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 7/22/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/2/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/2/2014 | E. coli | < | 1 | CFU/100 mL |
| | 9/23/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 9/23/2014 | E. coli | < | 1 | CFU/100 mL |
| | 10/29/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 10/29/2014 | E. coli | < | 1 | CFU/100 mL |
| | 11/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 11/25/2014 | E. coli | < | 1 | CFU/100 mL |
| | 12/16/2014 | Coliforms, Total | < | 1 | CFU/100 mL |

| | | | | | |
|--------|------------|------------------|---|---|------------|
| Source | 12/16/2014 | E. coli | < | 1 | CFU/100 mL |
| | 8/25/2014 | Coliforms, Total | < | 1 | CFU/100 mL |
| | 8/25/2014 | E. coli | < | 1 | CFU/100 mL |

Appendix B: Source Water Full Spectrum Analysis

REPORTED TO Revelstoke, City of
1200 East Victoria Road, Box 170
Revelstoke, BC V0E 2S0

TEL (250) 837-2001
FAX (250) 837-2059

ATTENTION Doug Pendergast

WORK ORDER 4120057

PO NUMBER

RECEIVED / TEMP Dec-02-14 08:20 / 4°C

PROJECT Comprehensive

REPORTED Dec-09-14

PROJECT INFO

COC NUMBER B06219

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.



Issued By:

Karin Miyazaki For Jennifer Shanko, ASCT
Administration Coordinator

Please contact CARO if more information is needed or to provide feedback on our services.

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499 Fax: 604-279-1599

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646 Fax: 250-765-3893

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100 Fax: 780-489-9700

www.caro.ca

REPORTED TO PROJECT Revelstoke, City of Comprehensive

WORK ORDER REPORTED 4120057 Dec-09-14

| Analysis Description | Method Reference | Technique | Location |
|---------------------------|-----------------------------------|--|----------|
| Alkalinity (Total) | APHA 2320 B | Titration with H2SO4 to pH 4.5 | Kelowna |
| Anions in Water by IC | APHA 4110 B | Ion Chromatography with Chemical Suppression of Eluent Conductivity | Kelowna |
| Colour, True | APHA 2120 C * | Spectrophotometry (456 nm) | Kelowna |
| Conductivity in Water | APHA 2510 B | Conductivity Meter | Kelowna |
| Cyanide, Total in Liquids | APHA 4500-CN- C / APHA 4500-CN- E | Distillation / Colorimetry | Kelowna |
| E. coli (CCA) | APHA 9222 * | Membrane Filtration | Kelowna |
| Hardness (as CaCO3) | APHA 2340 B | Calculation | N/A |
| pH in Water | APHA 4500-H+ B | Electrometry | Kelowna |
| Solids, Total Dissolved | APHA 1030 E | Calculation | N/A |
| Total Coliforms (CCA) | APHA 9222 * | Membrane Filtration | Kelowna |
| Total Recoverable Metals | APHA 3030E * / APHA 3125 B | HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma Mass Spectrometry (ICP-MS) | Richmond |
| Transmissivity at 254 nm | APHA 5910 B | Ultraviolet Absorption | Kelowna |
| Turbidity | APHA 2130 B | Nephelometry | Kelowna |

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

APHA Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL Method Reporting Limit
 < Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
 AO Aesthetic objective
 MAC Maximum acceptable concentration (health based)
 OG Operational guideline (treated water)
 % T Percent Transmittance
 CFU/100 mL Colony Forming Units per 100 millilitres
 CU Colour Units (referenced against a platinum cobalt standard)
 mg/L Milligrams per litre
 NTU Nephelometric Turbidity Units
 pH units pH < 7 = acidic, pH > 7 = basic
 µS/cm Microsiemens per centimetre

Standards / Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Oct 2014)

Website: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

REPORTED TO PROJECT Revelstoke, City of Comprehensive

WORK ORDER REPORTED 4120057 Dec-09-14

| Analyte | Result / Recovery | Standard / Guideline | MRL / Limits | Units | Prepared | Analyzed | Notes |
|---------|-------------------|----------------------|--------------|-------|----------|----------|-------|
|---------|-------------------|----------------------|--------------|-------|----------|----------|-------|

Sample ID: Greely Intake (4120057-01) [Water] Sampled: Dec-01-14 09:20

CT1,
PRES

Anions

| | | | | | | | |
|------------------------|--------------|-----------|-------|------|-----|-----------|--|
| Chloride | < 0.10 | AO ≤ 250 | 0.10 | mg/L | N/A | Dec-02-14 | |
| Fluoride | < 0.10 | MAC = 1.5 | 0.10 | mg/L | N/A | Dec-02-14 | |
| Nitrogen, Nitrate as N | 0.099 | MAC = 10 | 0.010 | mg/L | N/A | Dec-02-14 | |
| Nitrogen, Nitrite as N | < 0.010 | MAC = 1 | 0.010 | mg/L | N/A | Dec-02-14 | |
| Sulfate | 13.0 | AO ≤ 500 | 1.0 | mg/L | N/A | Dec-02-14 | |

General Parameters

| | | | | | | | |
|----------------------------|-------------|-----------|-------|----------|-----------|-----------|--|
| Alkalinity, Total as CaCO3 | 34 | N/A | 1 | mg/L | N/A | Dec-02-14 | |
| Colour, True | < 5 | AO ≤ 15 | 5 | CU | N/A | Dec-02-14 | |
| Conductivity (EC) | 98 | N/A | 2 | µS/cm | N/A | Dec-02-14 | |
| Cyanide, total | < 0.010 | MAC = 0.2 | 0.010 | mg/L | Dec-08-14 | Dec-08-14 | |
| pH | 7.66 | 6.5-8.5 | 0.01 | pH units | N/A | Dec-02-14 | |
| Turbidity | 0.2 | OG < 0.1 | 0.1 | NTU | N/A | Dec-03-14 | |
| UV Transmittance @ 254nm | 97.2 | N/A | 0.1 | % T | N/A | Dec-03-14 | |

Calculated Parameters

| | | | | | | | |
|----------------------------------|-------------|----------|-----|------|-----|-----|--|
| Hardness, Total (Total as CaCO3) | 39.9 | N/A | 5.0 | mg/L | N/A | N/A | |
| Solids, Total Dissolved | 51.3 | AO ≤ 500 | 2.0 | mg/L | N/A | N/A | |

Total Recoverable Metals

| | | | | | | | |
|-------------------|---------------|-------------|--------|------|-----------|-----------|-----|
| Aluminum, total | < 0.05 | OG < 0.1 | 0.05 | mg/L | Dec-04-14 | Dec-04-14 | |
| Antimony, total | < 0.001 | MAC = 0.006 | 0.001 | mg/L | Dec-04-14 | Dec-04-14 | |
| Arsenic, total | < 0.005 | MAC = 0.01 | 0.005 | mg/L | Dec-04-14 | Dec-04-14 | |
| Barium, total | < 0.05 | MAC = 1 | 0.05 | mg/L | Dec-04-14 | Dec-04-14 | |
| Beryllium, total | < 0.001 | N/A | 0.001 | mg/L | Dec-04-14 | Dec-04-14 | |
| Boron, total | < 0.04 | MAC = 5 | 0.04 | mg/L | Dec-04-14 | Dec-04-14 | |
| Cadmium, total | < 0.0001 | MAC = 0.005 | 0.0001 | mg/L | Dec-04-14 | Dec-04-14 | |
| Calcium, total | 13.3 | N/A | 2.0 | mg/L | Dec-04-14 | Dec-04-14 | |
| Chromium, total | < 0.005 | MAC = 0.05 | 0.005 | mg/L | Dec-04-14 | Dec-04-14 | |
| Cobalt, total | < 0.0005 | N/A | 0.0005 | mg/L | Dec-04-14 | Dec-04-14 | |
| Copper, total | < 0.002 | AO ≤ 1 | 0.002 | mg/L | Dec-04-14 | Dec-04-14 | |
| Iron, total | < 0.10 | AO ≤ 0.3 | 0.10 | mg/L | Dec-04-14 | Dec-04-14 | |
| Lead, total | < 0.001 | MAC = 0.01 | 0.001 | mg/L | Dec-04-14 | Dec-04-14 | |
| Magnesium, total | 1.6 | N/A | 0.1 | mg/L | Dec-04-14 | Dec-04-14 | |
| Manganese, total | < 0.002 | AO ≤ 0.05 | 0.002 | mg/L | Dec-04-14 | Dec-04-14 | |
| Mercury, total | < 0.0002 | MAC = 0.001 | 0.0002 | mg/L | Dec-04-14 | Dec-04-14 | CT5 |
| Molybdenum, total | < 0.001 | N/A | 0.001 | mg/L | Dec-04-14 | Dec-04-14 | |
| Nickel, total | < 0.002 | N/A | 0.002 | mg/L | Dec-04-14 | Dec-04-14 | |
| Phosphorus, total | < 0.2 | N/A | 0.2 | mg/L | Dec-04-14 | Dec-04-14 | |
| Potassium, total | 1.1 | N/A | 0.2 | mg/L | Dec-04-14 | Dec-04-14 | |
| Selenium, total | < 0.005 | MAC = 0.05 | 0.005 | mg/L | Dec-04-14 | Dec-04-14 | |
| Silicon, total | < 5 | N/A | 5 | mg/L | Dec-04-14 | Dec-04-14 | |
| Silver, total | < 0.0005 | N/A | 0.0005 | mg/L | Dec-04-14 | Dec-04-14 | |
| Sodium, total | 1.2 | AO ≤ 200 | 0.2 | mg/L | Dec-04-14 | Dec-04-14 | |
| Uranium, total | 0.0002 | MAC = 0.02 | 0.0002 | mg/L | Dec-04-14 | Dec-04-14 | |
| Vanadium, total | < 0.01 | N/A | 0.01 | mg/L | Dec-04-14 | Dec-04-14 | |

REPORTED TO PROJECT Revelstoke, City of Comprehensive

WORK ORDER REPORTED 4120057 Dec-09-14

| Analyte | Result / Recovery | Standard / Guideline | MRL / Limits | Units | Prepared | Analyzed | Notes |
|---------|-------------------|----------------------|--------------|-------|----------|----------|-------|
|---------|-------------------|----------------------|--------------|-------|----------|----------|-------|

Sample ID: Greely Intake (4120057-01) [Water] Sampled: Dec-01-14 09:20, Continued

CT1,
PRES

Total Recoverable Metals, Continued

| | | | | | | | |
|-------------|--------|--------|------|------|-----------|-----------|--|
| Zinc, total | < 0.04 | AO ≤ 5 | 0.04 | mg/L | Dec-04-14 | Dec-04-14 | |
|-------------|--------|--------|------|------|-----------|-----------|--|

Microbiological Parameters

| | | | | | | | |
|------------------|-----------|---------------------|---|------------|-----------|-----------|------|
| Coliforms, Total | 33 | MAC = None Detected | 1 | CFU/100 mL | Dec-02-14 | Dec-03-14 | MD-2 |
| E. coli | 12 | MAC = None Detected | 1 | CFU/100 mL | Dec-02-14 | Dec-03-14 | |

Sample / Analysis Qualifiers:

CT1 Incorrect Container(s) supplied for Hg and CN analysis
 CT5 This sample has been incorrectly preserved for Mercury analysis
 MD-2 Test method deviation - Total Coliform and E.coli analysis were run using Chromocult Coliform Agar , results are estimates.
 PRES Sample has been preserved for CN in the laboratory and the holding time has been extended.