

CITY OF ROSSLAND

Annual Water Report - 2017



Introduction

The City of Rossland provides drinking water to users connected to the Rossland Water System. This report is provided to City Council for their information, and in fulfillment of the City's obligations under the Provincial Drinking Water Act and associated regulations, as well as the terms and conditions of the City's Water System Operating Permit. Enforcement of the regulations and issuance of water system permits is the responsibility of the Interior Health Authority's Drinking Water Officer.

Raw Water

The City's raw water source is entirely surface water in three alpine creek catchments: Topping Creek, Hanna Creek and Murphy Creek, with intakes adjacent to Highway 3B between Red Mountain and Nancy Greene Summit, ranging in elevation from 1200m to 1550m above sea level. A map of the intake locations is provided in Appendix A.



Topping Creek Raw Water Intake

Raw water is collected at Hanna and Murphy Creek intakes and transmitted by pipeline ranging in size from 150mm to 250mm to Ophir Reservoir which has a capacity of approximately 165,000 cubic meters. Ophir Reservoir water is piped to Star Gulch Reservoir along with raw water from Topping Creek intake to fill approximately 120,000 cubic meters. During the Spring Freshet, all three creeks, and the reservoir, overflow water for many months as supply exceeds consumption.

The City of Rossland inspects intakes, pipes and areas immediately around the intakes on a monthly basis in summer, while winter and spring access limits inspections to a couple of times by snowshoe or snowmobile. Much of the watershed is used for recreation, with skiing, mountain biking, horse riding and hiking activities common. The City has erected signage near facilities and along hiking trails indicating that the area is part of the City's watershed.

Water Main Flushing

The City flushes the water mains annually as a health requirement during the month of May to help maintain water quality with our aging infrastructure. In the fall the City will flush specific areas around town where there are minimal flows.

Valve Replacement

The City has an ongoing program to replace aging valves in the water distribution system for better control of directional flushing as well as less disruption when a water repair is required.

The City sampled and undertook complete testing of our raw water sources in 2016 and the result of these tests is provided in Appendix B. (only required every 2 years)

Treated Water

Immediately south of the Star Gulch Reservoir is the City's Water Treatment Plant located adjacent to Highway 3B. This facility was built and in 1996 and comprises of three main buildings – two slow sand filter buildings and one control and pumping building. There are six slow sand filter bays drawing water directly from Star Gulch Reservoir. These bays are monitored daily and periodic maintenance includes the removal of build up on the surface of the Smutzdecke (active biological layer). Water passes through the filter bays and is then chlorinated using chlorine gas before being stored in the clearwater tank prior to distribution to the City.

Disinfection equipment is capable of providing sufficient dosage to the water at both high and low flow periods to ensure an appropriate, and compliant, level of residual disinfection capability throughout the distribution system. The dual control chlorinators can provide 0-9 kg per day during low water flow periods and 0-22 kg per day during high demand.

The chlorine disinfection system is maintained by City staff trained to operate the system and who provide scheduled maintenance/overhaul services, as well as do



Downtown Rossland

repair work as required. A stock of extra parts and equipment, as well as quick-connect plumbing and electrical connections ensure complete redundancy of the system at all times, to minimize the chance of extended breakdowns.

Distribution System

The City's distribution system is comprised of a variety of pipe materials, from ductile iron cement lined, mild steel, asbestos cement, copper, PVC and Polyethylene. Replacement of older pipe materials is a slow process, and as opportunities arise through subdivision, building permits, paving work or detected leaks, the City is replacing pipes and service connections.

The City, due to the range of elevations throughout the system, has five pressure zones, these are described below.

Red Mountain Zone

This zone is pumped from the treatment plant up to a concrete reservoir on Granite Mountain above the development in the base area of Red Mountain. A single pipeline in and out of the Granite reservoir proves to be an operational challenge for maintaining high quality water with low occupancy and slower development contributing to lower consumption rates in the base area. This storage also provides backup supply for the remainder of the City in the event of a power failure or other issues with the treatment plant.

Upper Rossland Zone

The Upper Rossland Zone is fed by gravity from the Treatment Plant. This zone essentially services properties at elevations at and above the downtown core.

Kirkup Zone

The Kirkup zone is supplied from a small pump station at the intersection of Kirkup Ave and Plewman Way which is in the Upper Rossland Zone. Water is pumped to a bolted steel reservoir located on Mount Kirkup and feeds residential properties that are located above the minimum pressure zone provided by gravity from the treatment plant.

Lower Rossland Zone

Two Pressure Reducing Valve (PRV) stations separate the upper and lower Rossland Zones. These are located outside City Hall on Columbia Avenue, and on Park Street above the Pinewood subdivision. This zone encounters operational challenges with older infrastructure and low flows in some sections.

Redstone Zone

With the completion of the first phase of the Redstone subdivision, residential water services were provided to this area. A PRV station along Esling Drive reduces the pressure from over 230 psi to around 20 psi to ensure that pressures within the subdivision do not exceed 150 psi.

Star Gulch Reservoir



Water Sampling and Testing Program

Drinking water delivered to users of the City system is subject to a comprehensive and rigorous testing program that ensures quality drinking water. Continuous monitoring of free chlorine residual readings, temperature and pH in the drinking water is accomplished with Hach meters located in the Water Treatment plant (disinfection takes place here). On a daily basis City staff test samples of drinking water from the plant. On a weekly basis City Staff test separate locations for free chlorine residuals (i.e. the presence of chlorine in the water). These tests are conducted with hand-held Hach meters that measure the minute amounts of disinfectant that must be in the drinking water throughout the system to meet regulations. Sample points are located at the start, middle and end of the entire City water distribution system to ensure the effectiveness of the disinfection program. At least 0.2 milligrams of chlorine must be present in every litre of water to meet these standards.

Over six hundred manual chlorine residual tests were conducted by City staff in 2017 at over 10 various locations around town. The lowest residual reading in the distribution system was 0.12 mg/l and the highest reading was 0.76 mg/l. Whenever staff determine that the readings may be trending too low they slightly increase the dosage of disinfectant at the Water Treatment Centre and confirm the results during the next day's tests indicating residual levels have increased.

Water samples are sent, on a weekly basis, to the Caro Environmental Services laboratories to be tested for the presence/absence e-coli and total coliform bacteria. City staff draws these samples and sends them to the Kelowna laboratory. Results are returned to the City within a week.

The standard protocol when a water sample is found to contain the presence of coliforms, however minute, is to resample the water immediately at the same location and resubmit for testing. The provincial Drinking Water Officer will determine if any action by the purveyor is necessary only after a second test also shows the presence of coliforms.

In 2017, the City submitted approximately 100 samples for ecoli and coliform testing and zero came back positive for either ecoli or coliforms.

Turbidity is monitored continuously after filtration with the highest reading at 0.10 and the lowest reading of 0.07 during 2017.

See Appendix C for bacteria test results

Records

The City uses SCADA (System Control and Data Acquisition) to continuously monitor water quality, flow, pressure and storage. This system assists City staff to maintain a safe drinking water supply by advising when dosage or residual disinfectant levels are outside of set parameters (either high or low) for the system. The SCADA system will alert staff by cell phone or computer message to ensure that corrections can be made before water quality can be adversely affected.

This data is stored at the Water Treatment plant. This data is forwarded on a monthly basis and is used to provide information to the provincial Drinking Water Officer, including the completion of this annual report.

Flow records are taken daily to determine the volume of treated water being produced and distributed. Future upgrades of this system would include the installation of further flow meters for raw water and treated water at key points in the distribution system.

Water Consumption

Water consumption in 2017 was more than last year. The total water consumption was 866,494 cubic meters as compared to 721,458 cubic meters in 2016. Since we started the metering program in 2009, there has been up to a 30% decrease in water usage.

See Appendix D Consumption Report

Consumption at Red Mountain is able to be measured separately as all of the water for this zone is pumped and passes through a flow meter. Typically, the consumption at Red Mountain is lower per unit than in the rest of the City, this is a function of less irrigated landscaping per lot, and lower occupancy levels in the summer.

Minimum daily demands are fairly constant in town throughout the year, ranging between 1,491-2,947 cubic meters per day. Maximum day demands occur during summer (June-September) and range approximately from 1,927-4,696 cubic meters for irrigation periods.

New Connections

In 2017, the City received 24 building applications for new dwellings which is up from 19 in 2016.

Regulatory and Administration

Water Metering and Conservation Program

The City approved Policy #06-04 "Residential Water Conservation Incentive Program" in May 2009. The Objectives are the City will provide to every existing residential home with a water meter.

There were 1747 water connections in early 2017 and 1709 of those were metered. By the end of 2017 there were 1758 total connections and 1725 were metered.

Emergency Response Plan and Dam Management

In 2016, as part of the review of the emergency preparedness, the City started to work with Engineers and started a formal geotechnical assessment of Star Gulch reservoir and are in the process of submitting the Emergency Preparedness Plan and the Operation, Maintenance and Surveillance Plan for Star Gulch Dam to the Ministry. The City has completed the dam safety review on Star Gulch in 2016 and the OMS and EPP for Ophir Reservoir and currently working on the Star Gulch OMS and EPP for 2018 completion.

Staffing

Trained, certified City staff work to maintain the 24 hour per day supply of safe drinking water to users in Rossland. This is accomplished by ensuring that staff is on call every day of the year and that the previously mentioned surveillance, operating and control system (SCADA) is operating continuously. Water distribution work is also done by staff certified for their tasks: water main replacement, water service installation, fire hydrant and valve maintenance. Special tasks such as reservoir cleaning and leak detection are undertaken by qualified staff with the proper equipment and experience to complete the work.

The City has two Water Treatment – Level 1 and Level 2 Operators, and 1 Water Treatment Plant Operator in Training, two Water Distribution Level 1, one Water Distribution Level 2, and three operators trained in Chlorine Handling.

Capital Expenditures

In 2016 & 2017, the City of Rossland, with the assistance of Grant Funding, was able to upgrade 2051 meters of water mains plus multiple service lines at a cost of \$2,234,423.55 that has improved the quality of water being distributed in Rossland.

Conclusion

This 2017 City of Rossland Water System Report is presented to the public, by way of posting on the City of Rossland website, as required by the British Columbia Drinking Water Protection Act and Regulations, as well as to meet the terms and conditions of the City's Water System Operating Permit CITYRO 950 issued by the Interior Health Drinking Water Officer.

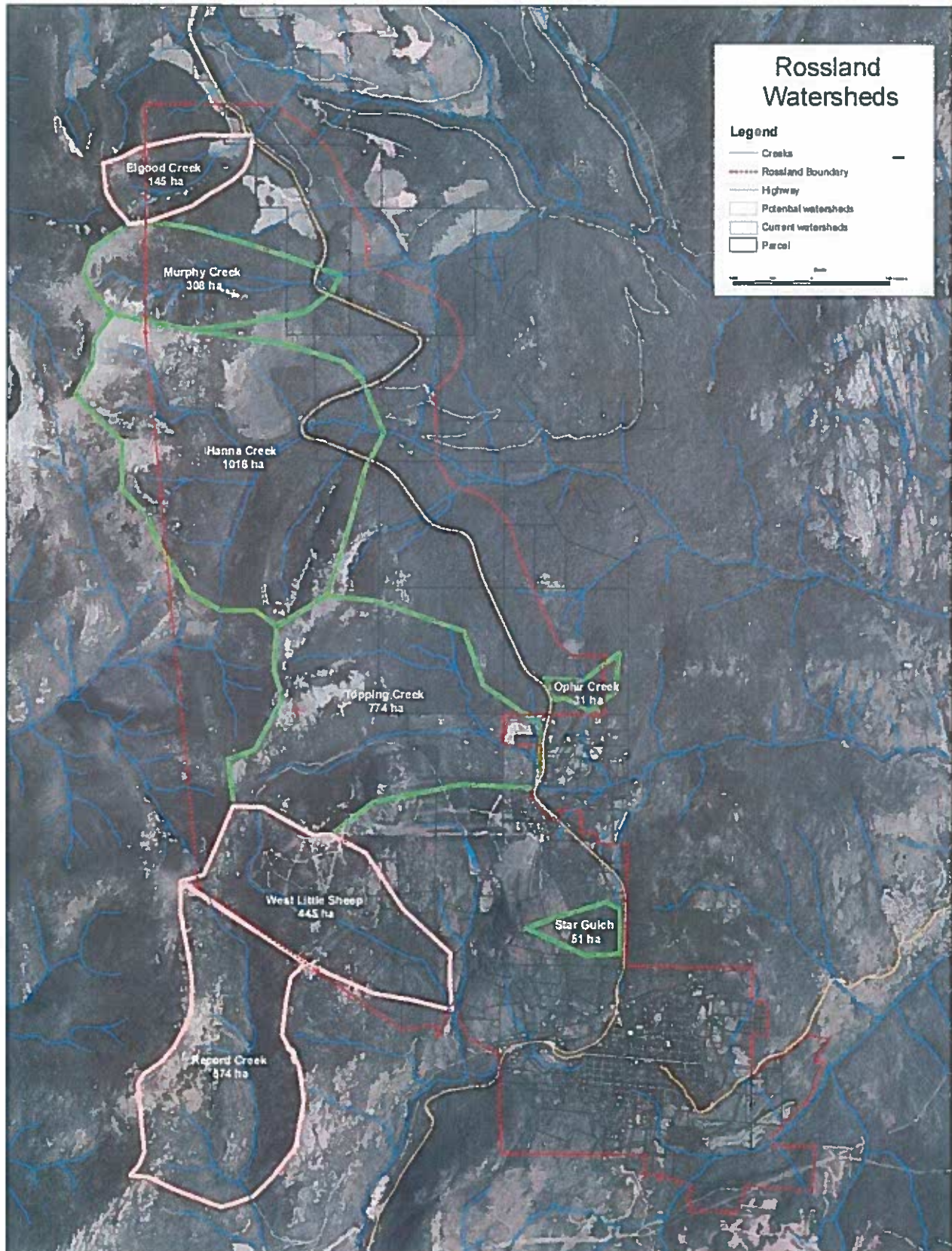
Attachments:

- Appendix A – Watershed Map
- Appendix B – CARO Water Analysis Raw Water Tests 2016
- Appendix C – CARO Drinking Water Analysis E.coli and Coliforms 2017
- Appendix D – Rossland Water Consumption 2010-2017
- Appendix E – Rossland Water Flows: Highs & Lows 2005-2017

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Appendix A - Watershed Map



Appendix B



CERTIFICATE OF ANALYSIS

REPORTED TO	Rossland, City of 1899 Columbia Ave- PO Box 1179 Rossland, BC V0G 1Y0	TEL	1(250)362-7396
		FAX	(250) 362-9634
ATTENTION	Accounts Payable	WORK ORDER	6101204
PO NUMBER		RECEIVED / TEMP	2016-10-19 08:40 / 9°C
PROJECT	General Potability	REPORTED	2016-11-23
PROJECT INFO	Water Samples	COC NUMBER	No Number

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.

Authorized By: **Ed Hoppe, B.Sc., P.Chem.**
Division Manager, Kelowna

***If you have any questions or concerns, please contact your Account Manager:
Kristin McKeown (kmckeown@caro.ca)***

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www.caro.ca

REPORTED TO PROJECT Rossland, City of
General Potability

WORK ORDER REPORTED 6101204
2016-11-23

Analysis Description	Method Reference	Technique	Location
Alkalinity in Water	APHA 2320 B*	Titration with H2SO4	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Coliforms, Total (MF-Endo) in Water	APHA 9222 B	Membrane Filtration / Incubation on m-Endo Agar	Kelowna
Colour, True in Water	APHA 2120 C	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	APHA 2510 B	Conductivity Meter	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection Analysis with In-Line Ultraviolet Digestion and Amperometric Detection	Kelowna
E. coli (MF-NA+MUG) in Water	APHA 9222 G	Membrane Filtration / Nutrient Agar with MUG	Kelowna
Hardness (as CaCO3) in Water	APHA 2340 B*	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Estimated)	N/A
Langelier Index in Water	APHA 2330 B	Calculation	N/A
Mercury, total by CVAFS in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	APHA 4500-H+ B	Electrometry	Kelowna
Solids, Total Dissolved (calc) in Water	APHA 1030 E	Calculation: 100 x ((Cations)-[Anions])/([Cations]+[Anions])	N/A
Temperature (lab) in Water	APHA 2550 B	Thermometer	Kelowna
Total Metals by ICPMS in Water	APHA 3030E* / APHA 3125 B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Richmond
Turbidity in Water	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
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods

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)
°C	Degrees Celcius
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

REPORTED TO Rossland, City of
PROJECT General Potability

WORK ORDER 6101204
REPORTED 2016-11-23

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 Rossland, City of
General Potability

WORK ORDER 6101204
REPORTED 2016-11-23

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: Topping Creek (6101204-01) [Water] Sampled: 2016-10-18 08:45

Anions

Chloride	0.39	AO ≤ 250	0.10	mg/L	N/A	2016-10-21	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	N/A	2016-10-21	
Nitrate (as N)	0.020	MAC = 10	0.010	mg/L	N/A	2016-10-21	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2016-10-21	
Sulfate	1.4	AO ≤ 500	1.0	mg/L	N/A	2016-10-21	

General Parameters

Alkalinity, Total (as CaCO3)	9	N/A	2	mg/L	N/A	2016-10-20	
Alkalinity, Phenolphthalein (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-10-20	
Alkalinity, Bicarbonate (as CaCO3)	9	N/A	2	mg/L	N/A	2016-10-20	
Alkalinity, Carbonate (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-10-20	
Alkalinity, Hydroxide (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-10-20	
Colour, True	22	AO ≤ 15	5	CU	N/A	2016-10-20	
Conductivity (EC)	27	N/A	2	µS/cm	N/A	2016-10-20	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	N/A	2016-10-25	
pH	7.04	6.5-8.5	0.01	pH units	N/A	2016-10-20	HT2
Temperature	21	N/A		°C	N/A	2016-10-20	HT2
Turbidity	0.97	OG < 0.1	0.10	NTU	N/A	2016-10-19	

Calculated Parameters

Hardness, Total (as CaCO3)	12.0	N/A	4.99	mg/L	N/A	N/A	
Langelier Index	-2.9	N/A	-5.0	-	N/A	2016-10-26	
Solids, Total Dissolved (calc)	14.0	N/A	2.00	mg/L	N/A	N/A	

Total Metals

Aluminum, total	0.233	OG < 0.1	0.005	mg/L	2016-10-24	2016-10-25	
Antimony, total	< 0.0010	MAC = 0.006	0.0001	mg/L	2016-10-24	2016-10-25	
Arsenic, total	< 0.0050	MAC = 0.01	0.0005	mg/L	2016-10-24	2016-10-25	
Barium, total	< 0.050	MAC = 1	0.005	mg/L	2016-10-24	2016-10-25	
Boron, total	0.245	MAC = 5	0.004	mg/L	2016-10-24	2016-10-25	
Cadmium, total	< 0.00010	MAC = 0.005	0.00001	mg/L	2016-10-24	2016-10-25	
Calcium, total	3.7	N/A	0.2	mg/L	2016-10-24	2016-10-25	
Chromium, total	< 0.0050	MAC = 0.05	0.0005	mg/L	2016-10-24	2016-10-25	
Cobalt, total	< 0.00050	N/A	0.00005	mg/L	2016-10-24	2016-10-25	
Copper, total	< 0.0020	AO ≤ 1	0.0002	mg/L	2016-10-24	2016-10-25	
Iron, total	0.10	AO ≤ 0.3	0.01	mg/L	2016-10-24	2016-10-25	
Lead, total	< 0.0010	MAC = 0.01	0.0001	mg/L	2016-10-24	2016-10-25	
Magnesium, total	0.66	N/A	0.01	mg/L	2016-10-24	2016-10-25	
Manganese, total	0.0034	AO ≤ 0.05	0.0002	mg/L	2016-10-24	2016-10-25	
Mercury, total	< 0.00002	MAC = 0.001	0.00002	mg/L	2016-10-25	2016-10-25	
Molybdenum, total	< 0.0010	N/A	0.0001	mg/L	2016-10-24	2016-10-25	
Nickel, total	< 0.0020	N/A	0.0002	mg/L	2016-10-24	2016-10-25	
Potassium, total	0.62	N/A	0.02	mg/L	2016-10-24	2016-10-25	
Selenium, total	< 0.0050	MAC = 0.05	0.0005	mg/L	2016-10-24	2016-10-25	
Sodium, total	1.45	AO ≤ 200	0.02	mg/L	2016-10-24	2016-10-25	
Uranium, total	0.00024	MAC = 0.02	0.00002	mg/L	2016-10-24	2016-10-25	
Zinc, total	< 0.040	AO ≤ 5	0.004	mg/L	2016-10-24	2016-10-25	

REPORTED TO	Rossland, City of 1899 Columbia Ave- PO Box 1179 Rossland, BC V0G 1Y0	TEL	1(250)362-7396
		FAX	(250) 362-9634
ATTENTION	Accounts Payable	WORK ORDER	6111635
PO NUMBER		RECEIVED / TEMP	2016-11-23 08:20 / 3°C
PROJECT	General Potability	REPORTED	2016-11-30
PROJECT INFO	Water Samples	COC NUMBER	no num

General Comments:

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Division Manager, Kelowna

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REPORTED TO PROJECT Rossland, City of
General Potability

WORK ORDER REPORTED 6111635
2016-11-30

Analysis Description	Method Reference	Technique	Location
Alkalinity in Water	APHA 2320 B*	Titration with H2SO4	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Coliforms, Total (MF-Endo) in Water	APHA 9222 B	Membrane Filtration / Incubation on m-Endo Agar	Kelowna
Colour, True in Water	APHA 2120 C	Spectrophotometry (456 nm)	Kelowna
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E. coli (MF-NA+MUG) in Water	APHA 9222 G	Membrane Filtration / Nutrient Agar with MUG	Kelowna
Hardness (as CaCO3) in Water	APHA 2340 B*	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Estimated)	N/A
Langelier Index in Water	APHA 2330 B	Calculation	N/A
Mercury, total by CVAFS in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	APHA 4500-H+ B	Electrometry	Kelowna
Solids, Total Dissolved (calc) in Water	APHA 1030 E	Calculation: 100 x (([Cations]-[Anions])/([Cations]+[Anions]))	N/A
Temperature (lab) in Water	APHA 2550 B	Thermometer	Kelowna
Total Metals by ICPMS in Water	APHA 3030E* / APHA 3125 B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Richmond
Turbidity in Water	APHA 2130 B	Nephelometry	Kelowna

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EPA United States Environmental Protection Agency Test Methods

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AO Aesthetic objective

MAC Maximum acceptable concentration (health based)

OG Operational guideline (treated water)

°C Degrees Celcius

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

REPORTED TO Rossland, City of
PROJECT General Potability

WORK ORDER 6111635
REPORTED 2016-11-30

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

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REPORTED TO PROJECT Rossland, City of
General Potability

WORK ORDER REPORTED 6111635
2016-11-30

Analyte	Result / Recovery	Standard / Guideline	MRL / Units Limits	Prepared	Analyzed	Notes
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Sample ID: Murphy Creek (6111635-01) [Water] Sampled: 2016-11-22 08:30

Anions

Chloride	0.12	AO ≤ 250	0.10 mg/L	N/A	2016-11-25	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	N/A	2016-11-25	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2016-11-25	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	N/A	2016-11-25	
Sulfate	< 1.0	AO ≤ 500	1.0 mg/L	N/A	2016-11-25	

General Parameters

Alkalinity, Total (as CaCO ₃)	6	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Bicarbonate (as CaCO ₃)	6	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Carbonate (as CaCO ₃)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Hydroxide (as CaCO ₃)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Colour, True	9	AO ≤ 15	5 CU	N/A	2016-11-25	
Conductivity (EC)	19	N/A	2 µS/cm	N/A	2016-11-24	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	N/A	2016-11-25	
pH	6.66	6.5-8.5	0.01 pH units	N/A	2016-11-24	HT2
Temperature	23	N/A	°C	N/A	2016-11-24	HT2
Turbidity	0.20	OG < 0.1	0.10 NTU	N/A	2016-11-24	

Calculated Parameters

Hardness, Total (as CaCO ₃)	8.30	N/A	0.50 mg/L	N/A	N/A	
Langelier Index	-3.6	N/A	-5.0 -	N/A	2016-11-30	
Solids, Total Dissolved (calc)	7.85	N/A	1.00 mg/L	N/A	N/A	

Total Metals

Aluminum, total	0.075	OG < 0.1	0.005 mg/L	2016-11-25	2016-11-25	
Antimony, total	0.0002	MAC = 0.006	0.0001 mg/L	2016-11-25	2016-11-25	
Arsenic, total	< 0.0005	MAC = 0.01	0.0005 mg/L	2016-11-25	2016-11-25	
Barium, total	0.005	MAC = 1	0.005 mg/L	2016-11-25	2016-11-25	
Boron, total	0.013	MAC = 5	0.004 mg/L	2016-11-25	2016-11-25	
Cadmium, total	0.00001	MAC = 0.005	0.00001 mg/L	2016-11-25	2016-11-25	
Calcium, total	2.6	N/A	0.2 mg/L	2016-11-25	2016-11-25	
Chromium, total	< 0.0005	MAC = 0.05	0.0005 mg/L	2016-11-25	2016-11-25	
Cobalt, total	< 0.00005	N/A	0.00005 mg/L	2016-11-25	2016-11-25	
Copper, total	0.0003	AO ≤ 1	0.0002 mg/L	2016-11-25	2016-11-25	
Iron, total	0.01	AO ≤ 0.3	0.01 mg/L	2016-11-25	2016-11-25	
Lead, total	< 0.0001	MAC = 0.01	0.0001 mg/L	2016-11-25	2016-11-25	
Magnesium, total	0.43	N/A	0.01 mg/L	2016-11-25	2016-11-25	
Manganese, total	0.0006	AO ≤ 0.05	0.0002 mg/L	2016-11-25	2016-11-25	
Mercury, total	< 0.00002	MAC = 0.001	0.00002 mg/L	2016-11-28	2016-11-29	
Molybdenum, total	0.0006	N/A	0.0001 mg/L	2016-11-25	2016-11-25	
Nickel, total	< 0.0002	N/A	0.0002 mg/L	2016-11-25	2016-11-25	
Potassium, total	0.17	N/A	0.02 mg/L	2016-11-25	2016-11-25	
Selenium, total	< 0.0005	MAC = 0.05	0.0005 mg/L	2016-11-25	2016-11-25	
Sodium, total	0.88	AO ≤ 200	0.02 mg/L	2016-11-25	2016-11-25	
Uranium, total	0.00033	MAC = 0.02	0.00002 mg/L	2016-11-25	2016-11-25	
Zinc, total	< 0.004	AO ≤ 5	0.004 mg/L	2016-11-25	2016-11-25	

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Rossland, City of
General Potability

WORK ORDER REPORTED 6111635
2016-11-30

Analyte	Result / Recovery	Standard / Guideline	MRL / Units Limits	Prepared	Analyzed	Notes
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Sample ID: **Murphy Creek (6111635-01) [Water] Sampled: 2016-11-22 08:30, Continued**

Microbiological Parameters

Coliforms, Total	22	MAC = None Detected	1 CFU/100 mL	N/A	2016-11-23	
E. coli	< 1	MAC = None Detected	1 CFU/100 mL	N/A	2016-11-23	

Sample ID: **Hanna Creek (6111635-02) [Water] Sampled: 2016-11-22 08:45**

Anions

Chloride	0.73	AO ≤ 250	0.10 mg/L	N/A	2016-11-25	
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	N/A	2016-11-25	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2016-11-25	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	N/A	2016-11-25	
Sulfate	< 1.0	AO ≤ 500	1.0 mg/L	N/A	2016-11-25	

General Parameters

Alkalinity, Total (as CaCO3)	8	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Phenolphthalein (as CaCO3)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Bicarbonate (as CaCO3)	8	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Carbonate (as CaCO3)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Alkalinity, Hydroxide (as CaCO3)	< 1	N/A	2 mg/L	N/A	2016-11-24	
Colour, True	11	AO ≤ 15	5 CU	N/A	2016-11-25	
Conductivity (EC)	23	N/A	2 µS/cm	N/A	2016-11-24	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	N/A	2016-11-25	
pH	6.86	6.5-8.5	0.01 pH units	N/A	2016-11-24	HT2
Temperature	23	N/A	°C	N/A	2016-11-24	HT2
Turbidity	0.33	OG < 0.1	0.10 NTU	N/A	2016-11-24	

Calculated Parameters

Hardness, Total (as CaCO3)	9.46	N/A	0.50 mg/L	N/A	N/A	
Langelier Index	-3.2	N/A	-5.0 -	N/A	2016-11-30	
Solids, Total Dissolved (calc)	10.5	N/A	1.00 mg/L	N/A	N/A	

Total Metals

Aluminum, total	0.073	OG < 0.1	0.005 mg/L	2016-11-25	2016-11-25	
Antimony, total	0.0002	MAC = 0.006	0.0001 mg/L	2016-11-25	2016-11-25	
Arsenic, total	< 0.0005	MAC = 0.01	0.0005 mg/L	2016-11-25	2016-11-25	
Barium, total	0.006	MAC = 1	0.005 mg/L	2016-11-25	2016-11-25	
Boron, total	0.009	MAC = 5	0.004 mg/L	2016-11-25	2016-11-25	
Cadmium, total	0.00001	MAC = 0.005	0.00001 mg/L	2016-11-25	2016-11-25	
Calcium, total	2.7	N/A	0.2 mg/L	2016-11-25	2016-11-25	
Chromium, total	< 0.0005	MAC = 0.05	0.0005 mg/L	2016-11-25	2016-11-25	
Cobalt, total	< 0.00005	N/A	0.00005 mg/L	2016-11-25	2016-11-25	
Copper, total	0.0007	AO ≤ 1	0.0002 mg/L	2016-11-25	2016-11-25	
Iron, total	0.05	AO ≤ 0.3	0.01 mg/L	2016-11-25	2016-11-25	
Lead, total	< 0.0001	MAC = 0.01	0.0001 mg/L	2016-11-25	2016-11-25	
Magnesium, total	0.64	N/A	0.01 mg/L	2016-11-25	2016-11-25	
Manganese, total	0.0023	AO ≤ 0.05	0.0002 mg/L	2016-11-25	2016-11-25	

Appendix C



CERTIFICATE OF ANALYSIS

REPORTED TO	Rossland, City of 1899 Columbia Ave- PO Box 1179 Rossland, BC V0G 1Y0	TEL	1(250)362-7396
		FAX	(250) 362-9634
ATTENTION	Accounts Payable	WORK ORDER	7041225
PO NUMBER		RECEIVED / TEMP	2017-04-19 09:45 / 6°C
PROJECT	Drinking Water	REPORTED	2017-04-20
PROJECT INFO	Water Samples	COC NUMBER	No Number

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.

Authorized By:

Kristin McKeown
Client Service Representative

If you have any questions or concerns, please contact me at kmckeown@caro.ca

Locations:

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

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

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

www.caro.ca

ANALYSIS INFORMATION

REPORTED TO PROJECT Rossland, City of
 Drinking Water

WORK ORDER REPORTED 7041225
 2017-04-20

Analysis Description	Method Reference	Technique	Location
Coliforms, Total (MF-CCA) in Water	APHA 9222*	Membrane Filtration / Incubation on Chromocult Agar	Kelowna
E. coli (MF-CCA) in Water	APHA 9222*	Membrane Filtration / Incubation on Chromocult Agar	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)
- CFU/100 mL Colony Forming Units per 100 millilitres

Standards / Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Feb 2017)

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

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Rossland, City of
 Drinking Water

WORK ORDER REPORTED 7041225
 2017-04-20

Analyte	Result / Recovery	Standard / Guideline	MRL / Units Limits	Prepared	Analyzed	Notes
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Sample ID: Seven Summits Service (7041225-01) [Water] Sampled: 2017-04-18 09:30

Microbiological Parameters

Coliforms, Total	< 1	MAC = None Detected	1 CFU/100 mL	N/A	2017-04-19	
E. coli	< 1	MAC = None Detected	1 CFU/100 mL	N/A	2017-04-19	

Sample ID: City Shop (7041225-02) [Water] Sampled: 2017-04-18 09:45

Microbiological Parameters

Coliforms, Total	< 1	MAC = None Detected	1 CFU/100 mL	N/A	2017-04-19	
E. coli	< 1	MAC = None Detected	1 CFU/100 mL	N/A	2017-04-19	

Appendix D

ROSSLAND WATER CONSUMPTION 2010-2017

	2010	2011	2012	2013	2014	2015	2016	2017
January	68663	56230	50482	53491	50961	49222	58827	58818
February	61362	53097	47482	52612	48253	43970	56669	55216
March	62471	59542	53762	57500	51177	49705	55102	59180
April	62562	54956	50212	50873	46817	51013	50246	54629
May	70886	60844	56926	65888	52037	65600	65675	63872
June	67889	62548	60611	74757	67283	87438	72233	86305
July	114287	89100	78101	99716	92541	92457	82683	111829
August	111783	106997	100793	85315	96203	81345	89220	101026
September	71240	76889	73796	62511	73679	44337	54860	74588
October	60265	51258	58909	56520	49885	44827	46264	57899
November	53475	52883	43911	48823	42134	42837	40025	50899
December	55265	52266	49840	49087	46370	50711	49654	54992
TOTAL	860148	776610	724825	757093	717340	703462	721458	829253
% consumption decreased compared to 2009	-6%	-15%	-21%	-18%	-22%	-30%	-22%	-9%

of connections 1681 1692 1707 1723 1731 1735 1747 1758

of meters 647 1254 1615 1667 1682 1692 1709 1725

2009 Total 914992

Appendix E

HIGHEST AND LOWEST WATER FLOW FOR THE YEAR

<u>DATE</u>	<u>YEAR</u>	<u>CUBIC METERS</u>
01-Dec	2005	1,331
15-Aug	2005	4,840
07-Nov	2006	1,364
25-Jul	2006	6,215
04-Oct	2007	1,507
17-Jul	2007	6,776
17-Nov	2008	1,584
15-Jul	2008	4,862
09-Nov	2009	1,584
05-Aug	2009	5,390
16-Dec	2010	1,276
06-Aug	2010	4,950
03-Nov	2011	1,331
12-Jul	2011	4,950
10-Nov	2012	1,100
16-Aug	2012	4,330
31-Jan	2013	993
22-Jul	2013	3,968
15-Nov	2014	1,139
13-Aug	2014	3,875
24-Sep	2015	1,214
10-Jun	2015	3,972
03-Dec	2016	1,062
18-Jul	2016	3,716
11-Nov	2017	1,491
27-Jun	2017	4,696