



Annual Water Quality Report 2015

Facility Name: City of Castlegar Water Distribution System

Facility Number: 0210617

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City of Castlegar

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1.0 Introduction

The City of Castlegar is required under its Operating Permit, issued by the Interior Health Authority, and mandated by the Drinking Water Protection Act to provide an Annual Water Quality Report. The Annual Water Quality Report is meant to provide water system users with a deeper understanding of their drinking water.

The City of Castlegar is committed to providing clean, safe drinking water through the responsible management and maintenance of local water infrastructure. This report will provide an overview of the water system including a summary of water treatment and monitoring procedures, system maintenance work and an overview of recent system improvements.

This report has been submitted to the Interior Health Authority and will be posted on the City of Castlegar website once it has been endorsed by Castlegar City Council.

2.0 Castlegar Water Distribution Overview

2.1 Source

Water for the City of Castlegar is drawn from Lower Arrow Lake, a 230km long reservoir that is part of the Columbia River watershed. The City's intake is situated on the west shore of the reservoir, immediately upstream of the Hugh Keenleyside Dam. The watershed upstream of this point encompasses 36,500km².

2.2 Water Treatment Centre

From the initial pump house at the intake, water is piped to the Water Treatment Centre where water is treated, tested and monitored for quality before being directed throughout the distribution system.

2.3 Reservoirs

Once treated, water is directed to eight reservoirs, or storage tanks, throughout the City of Castlegar. The total available reservoir storage capacity is 11.5 Megaliters.

2.4 Distribution System

The City's 95.8 km water distribution system is made up 10.8km of Hyprescon pipe, 45.6km of Asbestos Cement pipe, 20.7 km of Ductile Iron pipe, and 18.7km PVC pipe. Pipe sizes range from 575mm (22") to 100mm (4"0).

2.5 Pump Stations

2.5.1 Meadowlark Pump house.

The Meadowlark Pump house consists of eight high capacity pumps, which are split into two stages. Three Stage 1 pumps assist in filling the Meadowlark Reservoir. Five Stage 2 pumps fill the Park, and School Reservoir sites.

2.5.2 Park Pump House

The Park Pump house consist of 4 high capacity pumps. The 4 pumps are referred to as the stage III pumps. The stage III pumps fill the upper bench reservoirs, Meadowbrook, Merry creek, and the Blueberry Reservoirs.

2.5.3 Grandview booster station

The Grandview booster pump station is equipped with 2 small and 2 large booster pump. The pumps provide additional pressure for the Grandview subdivision residents.

2.5.4 Highland drive booster station

The Highland drive booster pump station is equipped with one booster pump to boost the pressure to the residents of Highland drive in times of peak demand on the water distribution system.

2.6 Pressure zones

There are 7 pressure zones in the City of Castlegar's Distribution System and are referred to as follows: North zone, Woodland Drive zone, Park zone, School zone, Upper bench zone, Blueberry zone and the Twin Rivers zone. The system pressure ranges from 40psi – 150psi.

2.7 Emergency Well Water System

The City of Castlegar maintains a well system that can be brought on line in case of an emergency. The well and pump are rated at approximately 1400 igpm. Consultation with IHA and communication with the residents of Castlegar would be required prior to running the emergency well water system.

3.0 Castlegar Water Supply and Disinfection Requirements

3.1 Drinking Water Objectives

The Guidelines for Canadian Drinking Water Quality (GCDWQ) are established by the Federal-Provincial-Territorial Drinking Water Committee (CDW) to outline the Maximum Acceptable

Concentration (MAC) of drinking water contaminants. These guidelines are used to assess the safety of drinking water and to help determine treatment needs. The guidelines state the objective as 4-3-2-1-0, as described below.

- 4: 4 log (99.99%) inactivation of Viruses
- 3: 3 log (99.9%) inactivation of protozoa (Giardia Lamblia and Crptosporidium Parvum)
- 2: Minimum of two barriers for microbiological protection.
- 1: Maximum of 1 NTU Turbidity
- 0: Zero Total and Fecal Coliforms

The City of Castlegar is fortunate to have a raw water supply that is of excellent quality. However, when the 4-3-2-1-0 treatment objective came in to effect in 2003, the City's single disinfection barrier was no longer satisfactory to the Interior Health Authority.

On August 12, 2013 the City of Castlegar commissioned the installation of a Trojan Ultra Violet light system (UV system). The UV light installation provided the residents of the City of Castlegar with a second disinfection barrier to ensure consistently safe drinking water and brought the City into compliance with the Canadian Drinking Water Guidelines.

3.2 Source-to-Tap Assessment

The Drinking Water Protection Act (DWPA) enables enforcement of the Canadian Water Quality Guidelines. The DWPA requires that water purveyors undertake a comprehensive drinking water Source-to-Tap Assessment. The primary aim of this assessment is to identify hazards and vulnerabilities that may threaten the safety and sustainability of the water supply throughout the system. The assessment process is broken down into the following 8 modules:

1. Delineate and characterize drinking water sources.
2. Conduct contaminate source inventory.
3. Assess water supply elements.
4. Evaluate water system management.
5. Audit water quality and availability.
6. Review financial capacity and governance of the water service agency.
7. Characterize risks from source to tap.
8. Recommend actions to improve drinking water protection.

The City of Castlegar has systematically worked through the 8 modules in recent years, culminating in the Castlegar Source Assessment Report (Urban Systems, 2014). The intent of the source assessment is to identify existing or potential hazards to the source water quality at the City's intake and to make recommendations to reduce the risks. Due to the size of the Arrow Lakes Reservoir, implementing the recommendations of the Source Assessment Report requires substantial input from many organizations.

4.0 Castlegar Water Supply and Disinfection

Currently the City of Castlegar is using UV light as its primary disinfectant and chlorine gas as its secondary disinfectant. The UV system is designed to maintain at a minimum a dose of 12.2 mW.s/cm² in order to provide the required 3 log (99.9%) protozoan inactivation. The chlorination system is intended as the secondary disinfectant to provide 4 log (99.99%) inactivation of Viruses. The free chlorine residual is commonly referred to as a Distribution Management Tool, as it leaves a residual disinfectant in the water supply. This residual disinfectant is extremely important to ensure potable water is delivered to the residents of the City of Castlegar. The rate of chlorine injection can vary through the year depending largely on source water temperature and organic concentrations. The provincial health standard is to maintain a minimum free chlorine residual of 0.20mg/l at the outermost areas of the water distribution system. Rate of injection at the Water Treatment Center can vary from 0.75mg/l - 1.00mg/l to achieve that free chlorine residual of 0.20mg/l.

The free chlorine residual is analyzed by online instrumentation throughout the water distribution system and is transferred to the City of Castlegar's Supervisory Control and Data Acquisition system (SCADA). The SCADA system has the ability to alarm out if the chlorine concentration drifts outside of predetermined ranges.

5.0 Testing and Monitoring Program

5.1 Chlorine Residual Testing

To ensure water quality, City of Castlegar staff perform chlorine residual testing daily at several locations throughout the City. If required the online chlorine analyzers are calibrated to ensure proper trending and alarm capabilities of the City SCADA system.

5.2 Bacteriological Testing

As required under our Operating Permit, City staff perform weekly bacteriological testing for E-coli and Total Coliform Bacteria throughout the distribution system. Sampling locations are as follows: (Water Treatment Center raw water, Meadowlark Pump house, Park Pump house, Civic Works Yard, Airport and Blueberry). Every week, these six samples are sent to a third party lab for bacteriological testing.

See Appendix A for 2015 test results

5.3 Full Chemical Analysis Testing

City Staff collect quarterly raw water samples from the Water Treatment Center and submit it for a full chemical analysis. Parameters such as Alkalinity, Hardness, Conductivity, pH, Fluoride, Arsenic, Lead, Mercury, and turbidity are reported.

There is continuous turbidity monitoring, Chlorine residual monitoring, and UV dose monitoring at the Water Treatment Centre. Daily, operators inspect monitoring equipment performance and alarm set points.

In addition, City of Castlegar staff perform quarterly Trihalomethane testing from ends of the distribution system (Blueberry and the airport), quarterly Halo Acetic Acid testing from the mid point of the distribution system (Park Pump house), weekly Chlorophyll A testing in September and October.

See Appendix B for 2015 test results

5.3 System Control: SCADA

The City of Castlegar utilizes a computerized Supervisory Controlled and Data Acquisition system (SCADA). The SCADA system continuously monitors the Water Treatment Center and Water Distribution System for the following parameters: raw and treated water turbidity, UV Transmittance, UV dose, Chlorine residual, flow, and pH. In the case of a significant change or component failure, an alarm is sent to the phones of appropriate personal and after hours to the City of Castlegar emergency phone. This gives the City of Castlegar several levels of confidence for alarm conditions.

6.0 System Maintenance

6.1 Pipes

Asbestos Cement (AC) pipe samples are collected annually throughout the distribution system and sent out for analysis to detect signs of deterioration and to identify priority areas for upgrades.

6.2 Fire Hydrants

All Fire Hydrants are inspected and flushed annually. The City of Castlegar has established 3 quadrants and on a rotational basis once every three years each Fire Hydrant in that quadrant will under go a complete tear down and inspection of all internal parts.

6.3 Emergency Well Water System

The well is operated monthly to ensure that it is ready in case of emergency.

6.4 Pump Stations

The Meadowlark Pump house and the Park Pump house are inspected daily. The Grandview booster station and the Highland drive booster station are inspected weekly. All pumps and motors are serviced as per manufactures specifications.

6.5 Castlegar Water Treatment Center

The Water Treatment Center is inspected daily to ensure that the UV and chlorination disinfection systems are operating correctly. Once a month, the magnetic flow meter is validated, as is the UV reference sensor. Once a year, the UV reference probes are validated by a third party.

6.6 Reservoirs

Reservoirs are inspected bi-weekly to make sure that the site is secure and operating as intended. All reservoir levels are monitored on the City's SCADA system, alarms will be triggered if reservoir levels change drastically or a high level or low level situation occurs.

6.7 Pressure Reducing Stations

The City of Castlegar operates and maintains 9 Pressure Reducing Valve stations (PRV's). The PRV stations are inspected weekly for leaks and verification of proper operation.

6.8 Security

A combination of measures is utilized to provide security for the distribution system. The Water Treatment Centre has been equipped with a security system and security cameras. All reservoirs have been fenced with locked ladder access. Both the Meadowlark and Park Pump houses have been equipped with security system and security cameras. All Pressure Reducing Valve sites are securely locked.

7.0 Annual Water Consumption

7.1 Volume of Treated Water

YEAR	Volume of Treated Water
2011	2.62 million m ³
2012	2.47 million m ³
2013	2.95 million m ³
2014	2.81 million m ³
2015	3.15 million m ³

Table 1: Annual volume of water treated by the City of Castlegar in millions of cubic meters from 2011-2015.

In late 2012 the City extended its water system boundaries to include the Airport grounds. Previously, the airport and surrounding businesses were supplied by the airport small water system. This increased usage is reflected in the total volume of treated water in 2013 (see Table 1).

The annual volume of treated water is very climate dependent, as the majority of treated water is used by residents for irrigation purposes. Hot dry springs and summers will have a drastic influence on the volume of water treated, as seen in 2015 (see Fig.1).

Annual Volume of Treated Water 2011-2015 *(in millions of cubic metres)*

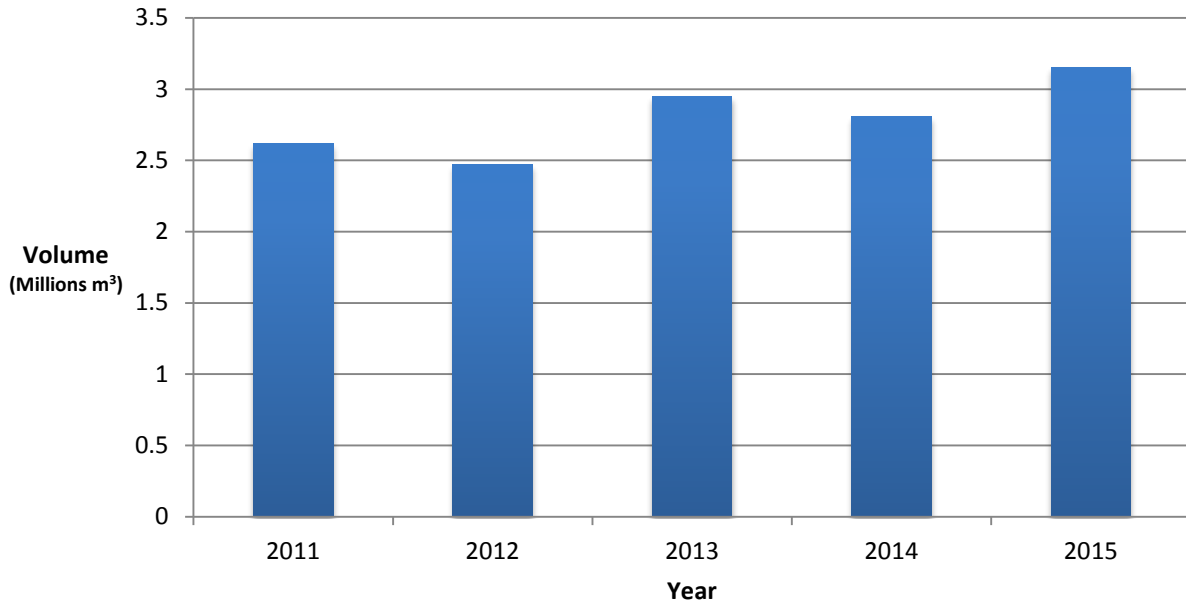


Figure 1: Annual volume of water treated by the City of Castlegar in millions of cubic meters from 2011-2015.

7.2 Water Metering Program

The City of Castlegar is implementing a universal Water Metering program as a method of addressing excessive water usage and promoting water conservation. This program is a key component in demand management and could realize as much as a 25% reduction in demand.

City of Castlegar has approximately 2750 residential service connections and 400 commercial service connections. Currently, the City of Castlegar has 2500 residential service connections metered and 158 commercial service connections metered, which is approximately 91% of all residential service connections and 40% of commercial service connections metered. It is proposed that all connections will be metered by the end of 2016.

8.0 Water Quality

8.1 Water Quality Complaints

The City of Castlegar issued a Boil Water Advisory on October 8, 2015. The following notice was issued to water users:

“Due to a chlorination system malfunction, chlorine residual levels have dropped below recommended levels in the Castlegar Water System. The City is currently flushing the

water system throughout town to restore chlorine levels. It is anticipated that recommended chlorine residual levels will be achieved at approximately 4pm Today Thursday October 8, 2015. People with undeveloped immune or severely weakened immune systems, infants and elderly may be at increased risk.

Due to the above concerns and as a precautionary measure, water users are advised to bring all water to a rolling boil for at least one minute and let it cool before using it or, use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth and food preparation until further notice. The City will advise the public when the Water Quality Advisory is removed.”

The Civic Works Department received a few complaints about turbid or cloudy water, typically following water distribution system maintenance work. City staff advised complainants to run their water for 15 minutes and if the water did not clear up, to call Castlegar Civic Works for further direction. To reduce/eliminate these types of complaints in the future, the City is developing and implementing a UDF program.

8.2 Source protection plan

The “Arrow Reservoir Source Assessment Report” (Urban Systems, 2014) identified key recommendations and priorities for the protecting the drinking water supply. Due to the size of the Arrow Lakes Reservoir, implementing the recommendations of the Source Assessment Report requires substantial input from many organizations. The City of Castlegar is planning an all-stakeholders meeting in September, 2016 to discuss activities in Zones 1-3 of the Arrow Reservoir.

9.0 Operator Education and Training

The City of Castlegar has established a training program that follows ‘Environmental Operators Certification Program’ (EOCP) guidelines for required training. The City of Castlegar staff has the following levels of EOCP certification:

EOCP Current Certifications

Employee	Certification Number	Active Levels
William McMillan	EOCP #2086 Cross Connection # 11441	WD-IV, WT-I, CH, CCC tester, CCC inspector.
Brain McCreight	EOCP # 6802	WD-I
Cindy Monsen	Working towards EOCP certification	
Charles Moser	EOCP # 3346	WD-I, WT-I, CH.
Brad Spender	EOCP # 1436 Cross Connection # 4599	WD-II, CH, WT-I CCC tester.
Jesse Reel	EOCP # 6096	WD II, WT-II, CH.
Leford Lafayette	EOCP # 1743	WD-I
Garry Sauer	EOCP # 1438	WD-I

Table 2: Current EOCP certification levels for City of Castlegar employees, 2015.

10.0 Emergency Response Plan

Emergency response planning is an essential part of the governance of a drinking water system. As required under our Operating Permit, the City of Castlegar has prepared an Emergency Response Plan for the City's water system (2014). The goal of the emergency response plan is to identify potential emergency conditions that could occur and have documented response procedures in place. The Emergency Response Plan has the endorsement from the following agencies: Castlegar Fire Department, the RCMP, and the Interior Health Authority.

This Emergency Response Plan is scheduled for a review and update in 2016.

11.0 Cross Connection Control Program

The City has developed and adheres to a Cross Connection Control Program. This program was established to identify high risk service connections that could compromise the City's water supply. High risk service connections are required to install back flow prevention devices.

12.0 System Improvements and Capital Works Projects

The City of Castlegar's Water Management Plan (Urban Systems, 2009) provides a comprehensive assessment of the City's water source, treatment, and distribution systems. This report outlined improvements necessary for reliable water provision along with associated timelines. The City of Castlegar has accomplished many of the capital works projects identified in this report. The most recent upgrades and projects are listed below:

2013 Improvements and Capital Projects:

- Completion of the UV light installation at the WTC.
- Continuation of the water main replacement program.
- Rebuilt the Mikes PRV and converted it to a District Metered Area (DMA).
- Reconfiguring the 37th street PRV into a District Metered Area (DMA).
- New SCADA computer installed at the Civic Works office
- Connected new control system at WTC to SCADA system

2014 Improvements and Capital Projects:

- Continuation of the water main replacement program.
- Continuation of the residential metering program.
- Creating (in draft) Uni Directional Flushing (UDF) maps City wide.
- Reconfiguring the 15th street PRV into a District Metered Area (DMA).
- Continued upgrades to the City SCADA system.
- Installation of approximately 20 water distribution valves to allow for isolation of the schools and hospitals in the case of a water main break.

2015 Improvements and Capital Projects

- Purchased redundant Siemens chlorination system for the WTC.
- Upgraded the controls at the Park and Meadowlark pump house. Upgrades included flow monitoring, remote pump control, installation of HMI screens so operators can view the water system from the pump house.
- Installation of a cathodic protection system at the Meadowbrook Reservoir.
- Installation of fall protection devices so operators can safely access reservoir roof hatches, to perform proactive maintenance and for water quality sampling.
- Confirming City wide Uni Directional Flushing (UDF) routes.
- Installation of 10 water distribution system valves for implementation of the Uni Directional Flushing program.
- City of Castlegar granted Level II Water Treatment designation.
- Upgrades to the SCADA communication tower, included new radios, new batteries and doubling the capacity of the solar power system.
- Installation of an online chlorine analyzer at the Airport grounds.
- Installed new piloting on the altitude valves at the Merry Creek and the Blueberry reservoir.
- Recoated the distribution piping in the Park pump house.
- Confined space elimination engineering on 1st ave , 27 street, 37 street, and the 33 street Pressure Reducing Stations

Planned 2016 Improvements and Capital Projects

- Continued SCADA system upgrades.
- Finalizing City wide Uni Directional Flushing (UDF) routes.
- Install 10 additional valves for Uni Directional work.
- Install generator at the Park Pump house for back up power supply
- Complete metering of all residential connections in the City of Castlegar
- Concrete reservoir integrity testing.
- Internal camera inspections of all reservoirs.
- Installation of Chlorine storage compound at the Water Treatment Center for efficiency and worker safety.
- Chemically strip and paint distribution piping within the Meadowlark Pump house as proactive maintenance.

13. Conclusion

The City of Castlegar has worked with the local Health Officials to develop a water quality monitoring program that exceeds the Drinking Water Protection Act. The City will continue with this monitoring program as part of its commitment to deliver a safe potable water supply to consumers in an environmentally and fiscally sustainable manner.