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1 INTRODUCTION

The annual report is an important part of providing West Kelowna residents with information regarding the quality and the risks associated with the drinking water supply system. It also provides users with educational information, ongoing challenges, and planned improvements to the water supply system. The water systems are governed by the *British Columbia Drinking Water Protection Act* which sets out requirements for drinking water operators and suppliers to ensure the provision of safe drinking water to their customers. West Kelowna has a plan to guide future improvements to the water system and continuing to provide residents with safe drinking water.

Drinking water can be a complex issue and much of the information provided in the report is technical in nature. Please contact the City of West Kelowna’s Engineering Services department should you have any questions.

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2 BACKGROUND

Water System Background

The City of West Kelowna is a growing community located in British Columbia’s Okanagan Basin. The municipality was incorporated in December 2007. Prior to the incorporation of the municipality it formed part of the Regional District of Central Okanagan. The population was estimated by BC Statistics in 2016 to be 34,930 residents.

The incorporation of West Kelowna in 2007 included the operation and administration of the West Kelowna Estates, Sunnyside and Pritchard water systems from Regional District of the Central Okanagan. The Lakeview Irrigation District and the Westbank Irrigation District, incorporated in 1951 and 1922 respectively, were dissolved and transferred to the West Kelowna municipality on December 31, 2010. Each of the legacy water systems evolved according to its own customer requirements resulting in a range of levels of service currently being delivered to the customers.

Key characteristics of each former water utility are:

- **Lakeview Irrigation District**

The Lakeview water system was originally constructed to provide irrigation water for agricultural customers and relies on Lambly Creek for the supply of raw water. The raw water supply is robust and reasonably easy to operate given the water storage reservoirs at the Big Horn and the Rose Valley dams. The raw water is chlorinated and then primarily supplied by gravity to the roughly 3,800 domestic customers and 226 Ha. of irrigation land.

- **Pritchard Water System**

Is a small water system that was constructed to provide potable water to a development consisting of 150 single family domestic services. The water system relies on raw water drawn from Okanagan Lake with treatment consisting of chlorination for disinfection.

- **Sunnyside Water System**

The Sunnyside system is a developer constructed water system that supplies chlorinated Okanagan Lake water to 1,100 single family domestic services and 36.4 ha. of irrigation land.

- **Westbank Irrigation District**

This system was originally constructed to supply irrigation water to agricultural customers. The water system supplies raw water diverted from Powers Creek that is then treated with the Powers Creek water treatment plant to be fully compliant with Provincial drinking water guidelines. This water system supplies treated water to both approximately 5,000 domestic customers and 385 Ha. of irrigation land.

- **West Kelowna Estates Water System**

Is a water system that developed in conjunction with the primarily single family development that occurred in the West Kelowna Estates area. The distribution system supplies roughly 1,200 domestic customers with chlorinated water drawn from Okanagan Lake.

One of the challenges within the West Kelowna water systems is that they must meet the needs of two very different customer classifications. Domestic customers require high quality water, while agricultural water requires no water quality treatment. Agricultural water demand is seasonal but accounts for a significant portion of overall water demand and it drives the peak demand, which sets the capacity requirement for the design of the overall system. For the supply of water to the domestic customers, the City has developed a plan to meet Provincial Objectives “Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia” that is supported by Interior Health. As outlined by recommendations from the West Kelowna Water Utility Master Plan, the City has moved forward with plans for a new water treatment plant at the Rose Valley Dam, estimated to cost \$49 million, by receiving grant funding from The Government of British Columbia’s Clean Water and Wastewater Fund for \$41,002,000.

In 2017 West Kelowna completed a Water Rates Study to adequately recover funds for the water system. The study reviewed the long-term financial needs of the utility and equitably recovered

funds from users of all types. Capital cost requirements included the \$41,002,000 grant funding West Kelowna received for the Rose Valley Water Treatment Plant, required capital improvement needs, and the ongoing operation and maintenance costs to maintain the utility. As part of the Rate Study the three lake-fed systems were merged with the Lakeview system into the Rose Valley Water System. The Westbank Water System was renamed to the Powers Creek Water System. The names were chosen from their water source. At the completion of the Rose Valley Water Treatment Plant and system interconnections, all users of the municipal water system will receive the same quality of water and will be charged one unified rate. At that time, the City will merge the two water systems into one system to service West Kelowna.

3 WATER TREATMENT

Existing Water Systems

West Kelowna relies on raw water from Powers Creek, Lambly Creek and Okanagan Lake to meet the water demands of the community. These existing sources have successfully supplied the community for many years and they have sufficient capacity to continue to be the principle water sources.

West Kelowna is in the process of improving its treated water in order to ensure that it is compliant with Provincial Guidelines to all municipal users by the year 2022. Currently the Powers Creek Water Service Area is fully compliant with the Drinking Water Treatment Objectives. The remaining four sources require additional treatment to reduce the risk of protozoa and will be serviced by the Rose Valley Water Treatment Plant, which is currently being designed.

Table 3.1: Existing Treatment Methods for the City

Current Water Supply System	Water Source	Current Treatment
Powers Creek	Powers Creek	Multi-barrier treatment plant that fully meets Provincial Guidelines requirements
Rose Valley	Rose Valley Lake	Chlorination only of a surface water source that is subject to seasonal turbidity and algae events
Rose Valley	Okanagan Lake (Pritchard)	Chlorination only at lake intake
Rose Valley	Okanagan Lake (Sunnyside)	Chlorination only at lake intake

Rose Valley	Okanagan Lake (West Kelowna Estates)	Chlorination only at lake intake
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Currently, treatment of the Rose Valley water sources do not include treatment to reduce the risk of protozoa. Those with chronic health conditions, or in a high risk group with compromised immune systems, should take additional precautions in the four service areas where additional treatment is recommended.

People who have a greater chance of getting sick include:

- people with weakened immune systems, such as persons with HIV/AIDS
- Persons who have had an organ or bone marrow transplant, or who have had cancer treatment;
- babies;
- older adults; and
- people with a chronic disease.

For further information, residents are encouraged to visit the website below and to consult with their health care professional to determine if they need to take extra precautions.

<https://www.healthlinkbc.ca/healthlinkbc-files/preventing-water-borne-infection>

Water Quality Regulations and Treated Water Goals

Water suppliers are responsible for delivering safe drinking water that meets the requirements of the Drinking Water Protection Act and the Drinking Water Protection Regulation. The Act outlines general requirements for water suppliers, and the Regulation addresses the immediate health risk associated with the potential for pathogens to be present within the water supply. The health authorities' Drinking Water Officers are responsible for providing the oversight to ensure compliance and drinking water safety.

BC Drinking Water Protection Act: Water Quality Requirements

Table 3.2: BC Drinking Water Protection Act Water Quality Requirements

Parameter	Units	Long Term Goal
Fecal coliform bacteria	organisms/ 100 mL	No detectable fecal coliform
<i>Escherichia coli</i>	organisms/ 100 mL	No detectable <i>Escherichia coli</i>
Total coliform bacteria - (a) 1 sample in a 30 day period	organisms/ 100 mL	No detectable total coliform bacteria

<p>Total coliform bacteria - (a) more than 1 sample in a 30 day period</p>	<p>organisms/ 100 mL</p>	<ul style="list-style-type: none"> • At least 90% of samples have no detectable total coliform bacteria • No sample has more than 10 total coliform bacteria
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The Drinking Water Officers’ Guide contains all provincial policy related to drinking water. It was initially released in 2007 to guide drinking water officers and public health engineers in their decision-making process. Part B of the Drinking Water Officers’ Guide contains Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia. This document provides guidance for water purveyors trying to establish long term goals and the general objectives include the following water quality parameters:

- 4-log reduction or inactivation of viruses.
- 3-log reduction or inactivation of Giardia and Cryptosporidium.
- Two treatment processes for surface water.
- Less than or equal to (\leq) 1 nephelometric turbidity unit (NTU) of turbidity.
- No detectable E. Coli, fecal coliform and total coliform.

These drinking water treatment objectives provide a minimum performance target for the treatment of water to produce microbiologically safe drinking water. Depending on specifics to the source water, the actual amount of treatment required will depend on the risks identified and may require greater levels of treatment. Water treatment is only one part of the multi-barrier approach to providing safe drinking water. Choosing an appropriate water source, protecting that source and reducing distribution system risks can be essential complementary steps to providing treatment when dealing with microbiological risks.

Long Term Water Treatment Goals

West Kelowna is currently in the process of designing the \$49,000,000 Rose Valley Water Treatment Plant that will provide the remaining users with a state of the art water treatment facility. In 2017, the City obtained a Project Manager and Design Consultant in order to complete the design and construction of the facility as soon as possible. Construction is expected to begin in late 2018, or early 2019. The plant is expected to be commissioned in 2020 or 2021. Once the facility is commissioned, West Kelowna will begin the process of interconnecting the three lake sourced areas. The addition of the water treatment plant will provide the necessary infrastructure to meet the treatment standards identified in Section 4 of the Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in BC.

Table 3.3: West Kelowna Water System Infrastructure Upgrades

Infrastructure Upgrade	Year
Rose Valley Water Treatment Plant	Commissioning 2020/2021
West Kelowna Estates Transmission Main	2021
Sunnyside Transmission Main	2021
Connect Sunnyside and Pritchard	2021

Powers Creek Source Water Quality

The Powers Creek Water Treatment Plant was commissioned in 2007, providing residents with treated water from a source that provides turbidity and colour challenges at times throughout the year. The treatment plant employs an In-Filter Dissolved Air Flotation (DAF) to produce safe, clean drinking water that meets or exceeds the federal and provincial water quality guidelines and standards.

Powers Creek is an upland water supply that frequently demonstrates contamination with pathogenic bacteria (such as coliforms) and protozoa (such as Giardia). Bacterial contamination is generally more pronounced in the summer months, when warmer temperatures accelerate growth. Risk from Giardia and Cryptosporidium contamination is expected to be highest during the rainy season, when runoff carries topsoil containing fecal matter into the Creek. Raw water turbidity is also at its highest in the rainy season and spring freshet for this same reason. Raw water turbidity has averages up to 3 NTU in the month of April, with a peak in excess of 20 NTU.

Raw water true colour reaches a peak in April, with peak true colour of the order of 80 – 90 TCU (True Colour Units), significantly over the Canadian Federal aesthetic guideline for true colour of 15 TCU. True colour is a significant concern with respect to the palatability of the water, since water in the Creek has a tea-like appearance during the freshet months. Perhaps more importantly however, true colour is an indicator that naturally occurring organic compounds are present in the water and react with chlorine disinfectant to produce by-products such as the family of trihalomethanes (THM), linked to possible long term health effects in humans. Trihalomethanes have been documented to reach as high as 160 ug/L in parts of the Westbank system in the spring, significantly in excess of the Canadian Federal Maximum Acceptable Concentration of 100 ug/L. Since the commissioning of the treatment plant, the true colour of the treated water is less than 15 TCU and 50ug/L THM, and the disinfection by-products are compliant with the Canadian guidelines.

The existing Powers Creek water treatment plant functions well and reliably produces treated water that meets the Provincial Guidelines. The existing Powers Creek treatment facility is suitable to meet the long term treated water quality goals.



Rose Valley Lake Source Water Quality

The Water Utility Master Plan recommends a treatment facility for the Lambly Creek source near the outlet of the Rose Valley Lake. Currently, the City is in the process of Designing the treatment plant with the intent to begin construction in late 2018, or early 2019. The watershed that supplies Lambly Creek has similar characteristics and raw water quality to the Powers Creek watershed; therefore, the design for the Rose Valley Water Treatment Facility is a Dissolved Air Flotation and Granular Media Filtration methods utilized by the Powers Creek Water Treatment Plant.

The following are water quality parameters that are important for existing and future treatment of the Rose Valley source:

- **Turbidity:** While this in itself poses no known direct health concern, there is the potential for the physical masking of pathogens by turbidity particles, thereby reducing the effectiveness of disinfection. For the Rose Valley Reservoir the turbidity is typically in the order of 2.0 NTU with excursions that occasionally reach 10 NTU, which are related to storms or seasonal turn-over events. This means that the turbidity is typically low but not low enough to support filtration deferral as a long term strategy.
- **Protozoa (Giardia & Cryptosporidium):** Both of these chlorine-tolerant organisms have shown themselves to be present in watersheds throughout the province of British Columbia. This means that all surface water sources should be treated to provide 3-log inactivation/removal of Giardia & Cryptosporidium. Testing in the past supports that these parasites are present in Lambly Creek and the Rose Valley Reservoir, but at low concentrations meaning that a 3-log inactivation/removal target is acceptable.

- **Algae:** In most cases, algae do not pose a direct health threat; however, there is increasing concern regarding toxins formed as metabolites by certain types of algae, notably the family of blue-green algae. Algae can also create taste and odour problems and can clog filters in water treatment plants; presenting significant operation challenges. Historically, algae blooms occur during the summer within the Rose Valley Reservoir. In the past algae blooms were managed by adding a copper based compound. This practice is no longer considered acceptable meaning that any new treatment process needs to be designed to remove more algae with a clarifier prior to filtration. Given the algae concentrations measured in the past, filtration without clarification would not function sustainably during an algae bloom.
- **Nitrates:** Nitrates are naturally occurring ions within the environment and are widely used as inorganic fertilizers, and are also known as nutrients that support algae growth. There are links between nitrates and elevated occurrences of gastric cancer, making prolonged exposure to elevated levels of nitrates undesirable. This contaminate has not historically been a concern, but this parameter should continue to be monitored given the activity within the watershed. An additional consideration is the potential health risk to newborn infants less than 3 months of age. Overexposure to nitrates can result in Methaemoglobinaemia or “blue baby syndrome”.
- **True Colour and Natural Organic Matter:** This is first and foremost an aesthetic concern, as it impacts the visual appeal of the water. However, if the colour has been imparted by the presence of naturally occurring organic acids, including the families of humic and fulvic acids, there is an increased potential for the formation of chlorinated disinfection by-products (DBP’s), such as trihalomethanes or haloacetic acids. The organic acids are not known to pose direct health effects in drinking water. The levels of organic matter within the Rose Valley Reservoir could be categorized as moderate to high, resulting in the need for treatment to reduce this contaminate from the process flow.
- **Disinfection By-Products (DBP’s):** DBP’s are the by-products of the reaction of chlorine with organic substances, and in many cases have been linked to health effects such as cancer in humans. It is common for surface water to contain natural humic and fulvic acids released into the water through the decay of natural organic materials such as leaves, and other plant matter in the watershed. To address the amount of natural organic matter present through removal in the new treatment process will lower the interaction between chlorine and organic matter in turn lowering the DBP’s.



Okanagan Lake Source Water Quality

Okanagan Lake is the largest surface water source in the Okanagan Valley. Currently water is drawn from Okanagan Lake at the Prichard, Sunnyside, and West Kelowna pump stations. Currently these facilities use a single form of treatment, chlorine disinfection. As mentioned earlier, chlorine disinfection is not effective against protozoa. The quality of water entering a raw water intake from a surface water source is largely a function of its depth and location in relation to potential sources of contamination. A submerged lake intake can be subject to contamination from a multitude of sources, some of which include: tributary streams, seasonal lake turn-over events, surface contamination (i.e. spills), wastewater treatment outfalls, and the lake hydraulics (such as seiches).

In the coming years, the City’s plan is to finish the process of designing, constructing, and commissioning the Rose Valley Water Treatment Plant by 2021; then, to focus on connecting the three lake-supplied water service areas to the Lakeview Water Service areas in the following year. After these projects are to be completed, the Water Utility Master Plan advises upgrading storage capacity throughout all systems and replacing older water mains.

4 WATER QUALITY MONITORING

The West Kelowna Water Quality Program references the following legislation, regulation and guidelines to develop a Reporting and Monitoring Plan.

1. Guidelines for Canadian Drinking Water Quality (GCDWQ)
2. British Columbia Drinking Water Protection Act and Regulation (DWPA and DWPR)

3. British Columbia Approved Water Quality Guidelines (Criteria)
4. Drinking Water Treatment Objectives for Surface Water in BC
5. Decision Tree for Responding to Turbidity Event in Unfiltered Drinking Water

To ensure water quality parameters are met, West Kelowna works to provide water quality testing on a regular basis. West Kelowna continuously monitors water quality at the city's Powers Creek Water Treatment Plant and provides weekly reporting on water quality for its water distribution system by contracting testing to a certified laboratory, CARO Environmental Services in Kelowna. Water samples are tested for; chlorine residual, turbidity, total coliforms and E.coli.

Distribution sampling sites are visited on a weekly basis for water quality testing and random sites are periodically tested for additional coverage. All results are submitted to the Utilities Department and in the event of a result not meeting drinking water parameters the city will directly contact the IHA Drinking Water Officer. Depending on the location and type of test result, the City and Health Authority will institute one or more of the following responses in accordance with the Emergency Response Plan:

- a) Additional testing to confirm the previous test results;
- b) Main flushing to remove stagnant water;
- c) Disinfection, in the event of contamination from an external source; and
- d) Boil Water Advisory, if there is a health risk to users.

In addition to sampling throughout the system, West Kelowna contracts a yearly review with ongoing testing in the Lambly and Powers Creek watersheds to ensure the source water is entering the treatment facilities within acceptable parameters. These yearly reports are completed by Professional Biologists and are a valuable tool to ensure a high source water quality is provided from the watersheds.

The health of the water system and public trust in drinking water are paramount to West Kelowna.

Reference Documents

Water Utility Master Plan

<http://www.westkelownacity.ca/287/Water-Utility-Master-Plan>

Water Conservation Plan

<http://www.westkelownacity.ca/739/Conservation>