Whitevale Water Utility
2022 Annual Report

Regional District of North Okanagan
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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS

BPD	Backflow Prevention Device
BWN	Boil Water Notice
Caro	Caro Analytical Services
CCCP	Cross Connection Control Program
CFU	Colony Forming Units
COP	Conditions on Permit
CT	Contact Time
DBP	Disinfection By-Product
DWO	Drinking Water Officer
DWPA	Drinking Water Protection Act
DWPR	Drinking Water Protection Regulation
DWTO	Drinking Water Treatment Objectives (Microbiological) for Ground Water Supplies
E. coli	Escherichia coli
EOCP	Environmental Operator Certification Program
ERP	Emergency Response Plan
FUS	Fire Underwriters Survey
GARP	Ground Water At Risk of Containing Pathogens
GCDWQ	Guidelines for Canadian Drinking Water Quality
GWUDI	Ground Water Under Direct Influence of Surface Water
HAA	Haloacetic Acids
IH	Interior Health
MoE	Ministry of Environment
NTU	Nephelometric Turbidity Units
OP	Operating Permit
PCBs	Polychlorinated Biphenyls
PLC	Programmable Logic Controller
RDNO	Regional District of North Okanagan
SCADA	Supervisory Control and Data Acquisition
SS	Sample Site
Teale's	Teale's Water Utility Service
THM	Trihalomethanes
VOC	Volatile Organic Compounds
WQA	Water Quality Advisory
WVW	Whitevale Water Utility

1.0 INTRODUCTION

As required by the *Drinking Water Protection Act* (DWPA) of BC, the Regional District of North Okanagan (RDNO) provides the following annual report in accordance with Operating Permit (OP) for the Whitevale Water Utility (WVW).

This report provides an overview of the following:

- The water system of WVW,
- the operations of the water system including the management, Environmental Operator Certification Program (EOCP) classification, and operations programs,
- source assessment and groundwater protection,
- the annual water quality monitoring program and a summary of the 2022 water quality analysis,
- water consumption,
- emergency response,
- reporting requirements,
- annual completed works, and
- long-term plans.

The annual reports are available to the public on the RDNO website at www.rdno.ca/wvw.

2.0 WATER SYSTEM OVERVIEW

2.1. SYSTEM OVERVIEW

The WVW system was constructed in the mid-1970s and was operated as a private utility until 1992 when it became a function of the RDNO. Appendix A provides the water service boundary and properties serviced by WVW.

The WVW system consists of a single well source, Well 2 (well plate identification number (WPID) 16643 and well tag number (WTN) 90803), that pumps into a below ground reservoir. The reservoir provides storage for demand variations, fire demand (not to FUS standards), and contact time for disinfection. Two separate pumps meet the distribution system demand under various flow conditions and a third pump will provide additional flow for fire demand but this flow does not

meet FUS standards. Two redundant pumps dose 12% sodium hypochlorite into the reservoir inlet during well runs. Online free chlorine residual and turbidity analyzers monitor water entering the distribution system. A natural gas generator supplies emergency backup power.

The WVW system has 90 residential connections and 1 institutional connection. There are no industrial or agricultural customers on this system.

The water system is outlined below:

- The 715 Franklyn Road site has the following:
    - The pump house contains the two distribution pumps to pressurize the distribution system, one fire demand pump, two chlorine dosing pumps, a chlorine analyser that continuously monitors residual, and a turbidity analyser that continuously monitors turbidity. These items are available to operations on-line.
    - one groundwater well within the well house (Whitevale Well 2),
    - one 246 m^3 (65,000 US gal) in-ground concrete reservoir, and
    - one back up generator (Genset) to supply backup power, installed in 2017.
- The well water is chlorinated to achieve a free chlorine residual of between 0.4 and 0.9 mg/L as the water leaves the reservoir. The reservoir provides chlorine contact time, and from here it is pumped into the distribution system. The objective is to achieve a minimum of 0.2 mg/L at the ends of the distribution system.
- System operation is controlled by a Programmable Logic Controller (PLC) and monitored both locally and remotely with a Supervisory Control and Data Acquisition (SCADA) system with alarms set for pertinent parameters.
- The capacity of the WVW reservoir is 246 m^3 and the flow of the fire demand pump at normal distribution pressure is 37.8 L/sec. To meet the FUS for single family residential, the reservoir would require a minimum storage capacity of 324 m^3 for fire storage (plus additional volume for maximum day demand and 25% for emergency storage) and 60 L/s minimum for fire flows. More reservoir capacity and flows are required for multifamily, institutional, commercial and industrial protection. The institutional connection has an onsite reservoir for fire protection that is supplied by the WVW system.

2.2. WATER SOURCE

The water source for the WVW system is groundwater drawn from a well screened within a confined aquifer. Water quality from this well is good with consistently low turbidity and no Escherichia coli (E. coli) presence. See Sections 5.2.1 and 5.2.2 for more information on source bacteria and turbidity.

2.3. TREATMENT REQUIREMENTS

The treated water quality objectives for all BC water systems using a groundwater source need to meet the Drinking Water Treatment Objectives (Microbiological) for Ground Water Supplies (DWTO) in BC.

WVW is supplied by a well located within a confined aquifer and is classified as a "groundwater" supply and not at risk of being classified as *Ground Water at Risk of Containing Pathogens* (GARP) or *Ground Water Under Direct Influence of Surface Water* (GWUDI) (Golder, 2008). Higher levels of treatment (i.e. filtration or uv) are not required for groundwater wells where the turbidity is consistently below 1.0 NTU with no Total Coliform or E. coli and low mineral content (i.e. manganese or iron). The water quality at the WVW well consistently meets all standards. RDNO chooses to chlorinate for protection against virus which can travel long distances in aquifers and to maintain residual within the distribution system to protect against regrowth.

Even under the worst-case scenario conditions of summer peak flows or the failure of one of the chlorine dosing pumps, the required Contact Time (CT) of 8 min-mg/L for 4-log virus is met. Hence, the CT under normal operating conditions is easily met (Appendix B).

3.0 OPERATIONS

3.1. MANAGEMENT

WVW is owned and managed by RDNO. The Manager, Small Utilities is responsible for the management of the utility and oversees operations with oversight provided by the Utilities, General Manager and the RDNO Board of Directors. The water quality monitoring program is coordinated and monitored by the water quality staff of the RDNO. RDNO operators complete day to day operation and maintenance tasks. An RDNO operator will respond to emergencies, 24 hours a day, 7 days a week.

Interior Health (IH) is the regulator of water utilities and is responsible for ensuring compliance with legislation and Provincial standards. IH also issues the Operational Permit (Appendix C). The IH representative is often an Environmental Health Officer or a Drinking Water Officer (DWO) and this IH representative works closely with the water utility to ensure Conditions on Permit (COP) are met. There is no letter on file outlining COPs for WVW.

3.2. EOCP CLASSIFICATION

The WVW is classified as a Small Water System (SWS) and is certified by the EOCP as SWS Facility No. 0411221.

See Table 1 for the list of the operators certified through the EOCP and employed by RDNO. The RDNO operators are responsible for operating and maintaining the source, treatment, and distribution system and also sampling as required by the water quality monitoring program.

RDNO Operations ensure the processes are running as they should by analyzing SCADA trends, maintaining equipment, and by performing a variety of duties on a weekly, monthly, and annual basis. Operations is responsible for verifying and performing maintenance on analyzers; maintaining, adjusting and troubleshooting the sodium hypochlorite disinfection system to verify correct dose; exercising emergency equipment such as the fire pump and generator; taking in-house and third-party samples; maintaining and upgrading the operating software, communication equipment and process alarm software; maintaining the facilities and property; executing workplace inspections and safety checks and remedying any issues; and recording data and maintenance tasks completed. RDNO Operations also complete most operational projects for the WVW system.

All alarms are responded to by an operator. If immediate attention is required, the operator will proceed to the site to respond. If required, the system operator will contact management for guidance or assistance.

3.3. OPERATIONS PROGRAMS

The operations programs were developed based on Best Management Practices and criteria specified in the OP and are as follows:

3.3.1. FLUSHING AND HYDRANT MAINTENANCE

Annual water main flushing is undertaken by Teale's Water Utility Service (Teale's) of Vernon.

Fire hydrant maintenance was completed by Teale's fall 2022.

There are two dead-ends on the system with blow offs installed at these locations that are flushed as needed to maintain water quality in the system by the system operator. These blow offs are located at:

1. 808 Fraser Road

2. 792 Eastwood Road (this is considered a dead-end valve to the school, the school was closed in 2010)

3.3.2. CROSS CONNECTION CONTROL PROGRAM

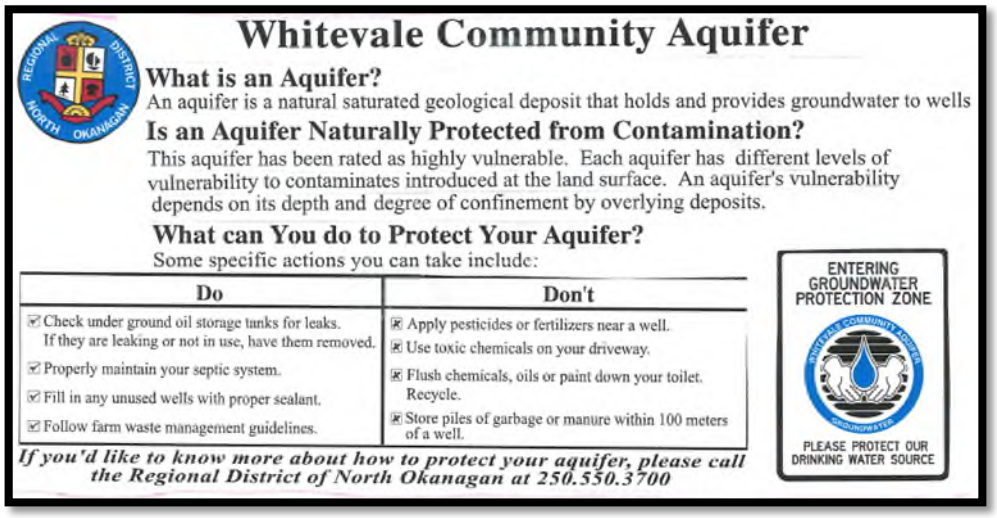
The RDNO has a Cross Connection Control Program (CCCP) for all water utilities owned by RDNO, including WVW. The CCCP program is focused on identifying high and medium backflow risks and ensuring annual compliance of Backflow Prevention Device (BPD) testing for these facilities. Currently all connections in Whitevale are residential and therefore considered low backflow risk according to standards with the exception of the school, which was opened in 2022 and considered medium hazard. The CCCP did not have record of backflow protection onsite and will be investigated.

4.0 SOURCE ASSESSMENT AND WATERSHED PROTECTION PLANNING

Golder Associates Ltd. completed *"Preliminary Steps in the Development of a Groundwater Protection Plan, Whitevale, BC"* issued in May 2008. The Whitevale Well 2 installed in the summer of 2006 was classified as being completed within a confined aquifer and was constructed to BC Groundwater Protection Regulation standards with the surface annular seal extending into the confining aquifer (Golder, 2008).

The highest risk identified to the Whitevale Well 2 was the old Whitevale Well 1, which was subsequently decommissioned by capping the old well in June of 2010.

The following signage is posted at the well site to inform Whitevale residents on Groundwater Protection.



5.0 WATER QUALITY MONITORING

The goal of the water quality program at WVW is to monitor the quality of the raw water and treated water within the distribution system to detect the presence of microorganisms or other issues that can degrade water quality. Operations staff can respond to correct any issues or appropriately notify customers as required.

5.1. PROGRAM AND SCHEDULE

Water quality monitoring for WVW is based on the requirements of the Drinking Water Protection Regulation (DWPR) Schedules A and B (Government of BC, 2003), the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) (Health Canada, 2017), and the Drinking Water Treatment Objectives (microbiological) for Ground Water supplies in British Columbia (Health, 2015).

The Water Quality Monitoring Program for WVW was reviewed in January 2022 and the updated sampling program and schedules are provided in Appendix D. RDNO provides an updated Water Quality Monitoring Plan to IH at the beginning of each year after the program is developed. Included in this program is a monitoring schedule for 2022, the parameters, and frequency of samples taken at different times of the year.

To meet Schedule B in the DWPR for populations less than 5,000, a minimum of four microbiological samples are required per month. In 2022, WVW met this requirement for all months.

RDNO staff collect bacterial samples and the samples are processed for shipment to Caro Analytical Services (Caro). Caro sends results to IH and uploads results to ENKI, a third party online database the RDNO utilizes to store lab data.

5.2. SOURCE

This section outlines the bacterial, turbidity, pH, temperature, and annual chemical results for 2022 raw water at WVW.

5.2.1. BACTERIA

At least one monthly raw water sample is collected from the well. The WVW system has a good microbial history as demonstrated in Table 2 which summarizes the source water bacterial results from Caro.

Total Coliforms and E.coli are monitored as indicator bacteria to assess changes or contamination in the raw water. The DWTO has the following guidelines for bacteria:

- No detectable bacteria per 100 mL of drinking water
- Where more than 1 sample is collected in a 30 day period the standard for Total Coliform is at least 90% of the samples may have no detectable Total Coliform per 100 mL and no sample has more than 10 total coliform bacteria per 100 mL.

In 2022, the E.coli results in the raw water had all recorded results of < 1 Colony Forming Unit (CFU) / 100 mL (Table 2). All Total Coliform results in the raw water were <1 CFU/100 mL in 2022 (Table 2). This is well within the DWTO criteria.

5.2.2. TURBIDITY

Turbidity measurements relate to the optical properties of water. Turbidity is caused by suspended matter such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, and other microscopic organisms. Excessively high turbidity can have a negative effect on disinfection techniques and changes to turbidity in a groundwater source well can indicate a cross connection or issue with the source. A provincial guidance document issued in April 2013, *the Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water* (Ministry of Health, 2013) assists RDNO during turbidity events and communication with the water customers.

Turbidity of the raw water in the WVW Well 2 is historically below one NTU and ranges from 0.05 to 0.11 NTU with an average of 0.06 NTU in 2022 (Figure 1 and Table 3). The reservoir outlet turbidity, which represents treated water, also showed similar numbers (Figure 1 and Table 8).

5.2.3. CHEMISTRY

The Canadian Drinking water guideline for source temperature is an Aesthetic Objective (AO) guideline at 15 °C, and the Canadian Drinking water guideline for pH is a range of 7.0-10.5 to maximize treatment effectiveness.

Table 4 summarizes the field pH, temperature, and conductivity for the raw water in 2022. All results were within guidelines.

5.2.4. ANNUAL COMPREHENSIVE

Comprehensive sampling is completed annually. The annual sampling is rotated between spring and fall to ensure the groundwater meets water quality guidelines during different times of the year. The 2022 comprehensive samples were taken in October. All parameters were well within the GCDWQ limits (Appendix E).

5.3. TREATMENT PROCESS

WVW is sourced from groundwater and the water quality parameters of the raw water are stable throughout the year and the chlorine demand is consistent. As the source is from a confined aquifer, the well was built to current standards that includes an annular seal into the confining layer and monitoring of parameters indicate a stable raw water, WVW does not need to be treated other than with chlorine.

5.3.1. TURBIDITY

Under normal operations, the water turbidity leaving the reservoir is < 0.20 NTU. Continuous online turbidity monitoring is completed with an analyzer that monitors the turbidity after water passes through the reservoir and enters the distribution (Table 5). In the event of high level turbidity, an alarm will notify the on-call operator to address the situation. The SCADA turbidity in 2022 had a monthly average of 0.04 NTU, a minimum of 0.03 NTU in April and May, and a maximum of 0.05 mg/L in September, November, and December (Table 5).

5.3.2. CHLORINE

Under normal operations, the target chlorine residual in the water leaving the reservoir is 0.40 to 0.90 mg/L depending on demand in the system. This target is to maintain a minimum residual of free chlorine of 0.20 mg/L at the end of the distribution system.

Chlorine is injected into the well supply line before water enters the reservoir. Continuous online chlorine monitoring is completed with an analyzer that monitors the free chlorine after water passes through the reservoir (Table 5). In the event of low level chlorine, an alarm will notify the on-call operator to avoid low free chlorine residual water entering the distribution system. The SCADA free chlorine in 2022 had a monthly average of 0.86 mg/L, a minimum of 0.80 mg/L in September and December and a maximum of 0.91 mg/L in January (Table 5).

Beginning in 2017 data is backed up daily to the RDNO office server to avoid potential loss of data. This process helps minimize lost data. The WVW on-site computer was re-built in 2021 to allow the complete database, trends and display, to be copied to the office server for regular backups for greater system security.

5.4. DISTRIBUTION

Distribution sampling follows the WVW Water Quality Monitoring Program as outlined in Appendix D. Additional parameters and monitoring can occur for individual projects.

5.4.1. BACTERIA

Schedule A of the DWPR requires the following criteria be met for potable water:

1. **No detectable Escherichia coli (E.coli) per 100 ml.**

   In 2022, there was no detectable E.coli in the WVW distribution system (Tables 6 and 7). WVW met this regulation.

2. **At least 90% of samples have no detectable Total Coliform bacteria per 100 ml.**

   In 2022, there were 2 samples from August 9, 2022 sampling that had Total Coliform counts. Whitevale Reservoir sample returned with 1 CFU/100mL and 792 Eastwood road Sample Station returned with 5 CFU/100mL (Tables 6 and 7). A resample was taken August 12 with results at both locations returning < 1CFU/100mL. WVW met this regulation.

3. **No sample has more than 10 Total Coliform per 100 ml.**

   In 2022, no samples had more than 10 Total Coliform (Tables 6 and 7). WVW met this regulation.

The results met the GCDWQ and DWPR and Tables 6 and 7 summarize the distribution bacterial results.

5.4.2. TURBIDITY

Turbidity is monitored with a hand held turbidity meter at the reservoir and the two distribution sites at a minimum of twice a week. Operators record the residual readings and field parameters on an electronic operator log sheet which is backed up to the RDNO system by water quality staff monthly. Field parameters are also recorded on the submitted requisition sheets to Caro with bacterial samples and entered into ENKI.

The turbidity of the distribution sites in 2022 ranged from 0.05 to 0.16 NTU with an average of 0.07 NTU. This is well within guidelines. A minimum turbidity grab sample of 0.05 NTU occurred at the Whitevale Reservoir. A maximum turbidity grab sample of 0.16 NTU occurred at the 808 Fraser Sample Station (Table 8).

5.4.3. CHLORINE

Total and free chlorine is also monitored with a hand held chlorine meter concurrently with the turbidity readings.

The free chlorine of the distribution sites in 2022 ranged from 0.66 to 1.04 mg/L. The average distribution free chlorine in 2022 for all sites (208 samples) was 0.81 mg/L (Table 8). A minimum free chlorine grab sample of 0.66 mg/L occurred at the Whitevale Reservoir. Minimum free chlorine residual at the longest retention time at Fraser Road Sample Station was 0.67 mg/L.
A maximum chlorine grab sample of 1.04 mg/L occurred at the Whitevale Reservoir (Table 8).

There is very little chlorine degradation in the distribution as demonstrated by all sites showing very similar chlorine readings. This also indicates that water quality is good for this system, and providing additional evidence of the source water classification of “groundwater” with low to no organics to consume chlorine.

5.4.4. CHEMISTRY

Table 8 provides the average field pH, temperature, and conductivity for each site in the distribution system in 2022. The average pH of the distribution sites in 2022 was 7.80 pH (Table 8). All pH results were within guidelines 2022. Conductivity readings were consistent throughout the year. All parameters were within guidelines.

Average temperature readings of the distribution sites in 2022 ranged from 4.0 to 15.4 degrees Celsius. All temperature results in 2022 were within guidelines (Table 8). In 2022, four samples were > 15 degrees Celsius from August 23 to 29 at 808 Fraser SS. The GCDWQ Aesthetic Objective (AO) for temperature is 15 degrees Celsius. This is an aesthetic objective not a health guideline.

The minimal variation throughout the year demonstrates how stable and consistent this water source is and provides additional evidence that the source water classification of “groundwater” with no influence from land use or surface water.

5.4.5. DISINFECTION BY-PRODUCTS

Disinfection by-products (DBP) trihalomethanes (THMs) and haloacetic acids (HAAs) are not sampled at WVW. These parameters are not a concern for this utility, as groundwater usually does not contain organic materials which react with chlorine to form THMs (Connell, G. F., 1996). The low degradation of chlorine within the distribution system outlined in Section 5.4.3 provides evidence of the low to no presence of organics.

6.0 WATER CONSUMPTION

Table 9 provides the monthly consumption within the Whitevale subdivision in 2022. Figure 2 provides a graph of the monthly consumption from December 2018 - 2022. Water use within the WVW system is currently entirely residential, therefore flows are variable depending on the time of day and seasonal demands.

Water consumption begins to significantly increase in June with peak consumption usually observed in July and August (Figure 2). This consumption corresponds with outdoor water usage.

Based on the consumption provided in Table 9, the daily average water use based on 92 houses and an average of 2.4 persons per house (Statistics Canada, 2017), is the following in 2022 in litres per day per person (L/d/p):

- Winter water use was approximately 547 L/d/p in 2022. This is considered to represent indoor domestic water use only. However, in early 2022 two leaks were detected in the water distribution system. Whitevale subdivision flow rates saw a decrease following repairs in February and March 2022 with residential estimation of 399 L/d/p for winter water use.
- Peak water use in July was 1,091 L/d/p or 2,620 L/day per household. This is very high water use considering that it is a primarily single family residential subdivision. For reference, Greater Vernon Water average summer residential water use is 382 L/d/p.
- The average annual water use in 2022 was 580 L/d/p, which is considered high compared to Greater Vernon Water which is 226 L/d/p and the Canadian average of 223 L/d/p (Statistics Canada, 2021).

2022 water use was significantly higher than previous years especially during the winter months. Significant water service leaks were found in December 2021 and repaired early January 2022, and another found late January 2022 and repaired in February 2022. This could be the reason for the higher water use in 2022. Utilities staff noticed a decrease in water use mid-February (Figure 2)

The water use for WVW is considered high compared to metered water utilities. WVW currently has voluntary restrictions which are odd/even watering days based on address, which can be enforced by a restrictions bylaw. Currently, there are no flow or well capacity issues with the water system. RDNO monitors the Bessette watershed conditions closely and issues regulated water restrictions based on drought conditions as needed.

7.0 EMERGENCY RESPONSE PLANNING

7.1. THE ERP

A comprehensive update of the WVW Emergency Response Plan (ERP) was completed in 2018 and a review is completed annually. Sampling methods and RDNO small utility ERP training for the operators occurs annually.

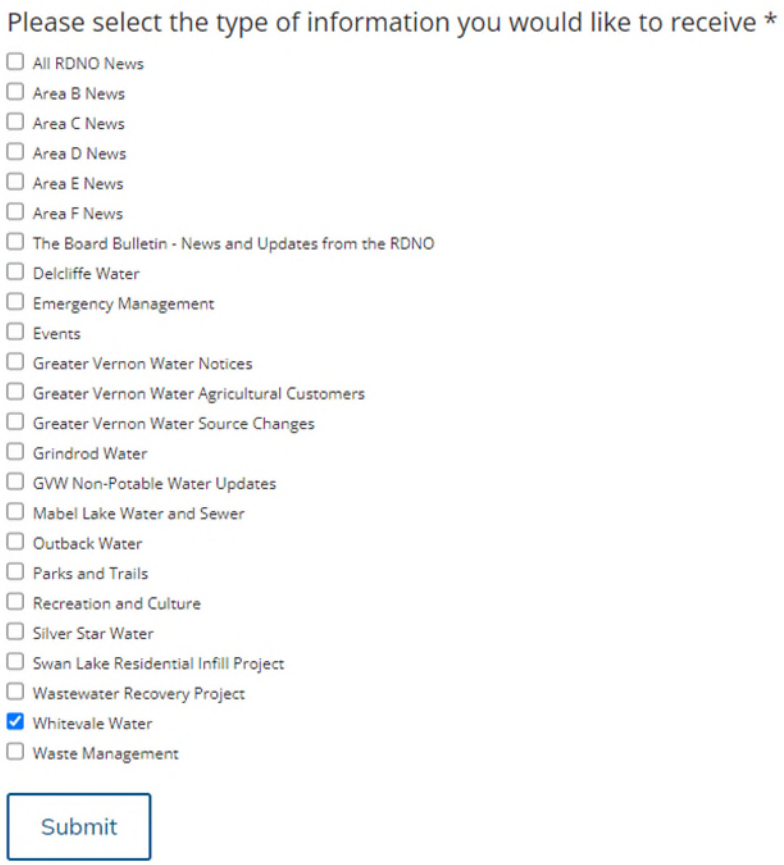
RDNO Utilities staff, as well as the operators are all instructed on how to use the following supporting documents in times of water quality changes or emergencies:

1. WVW Emergency Response Plan
2. WVW Water Quality Deviation Response Plan

The above documents contain the contacts, criteria, and procedures necessary to assist operators and staff to make timely, informed decisions. Staff typically try to conduct mock emergency training scenarios annually.

WVW must inform customers when their drinking water does not meet standards with the appropriate notifications based on risk. A Water Quality Advisory (WQA) is released when the water poses a modest health risk. A Boil Water Notice (BWN) is released when there is a known or higher risk of a possible health impact to the customer.

An advisory or notice is delivered as quickly and efficiently as possible. Notification may include “Alert” road signs, radio and/or media releases. Under specific circumstances notification is hand-delivered. Customers are advised to subscribe to the Whitevale Water Mailing List by going to www.rdno.ca/subscribe and subscribe for Whitevale Water email updates (shown below).



7.2. INCIDENT TRACKING

In 2022, there was one incident of a service leak in February 2022 (Table 10) Reporting of incidents are required by RDNO or operations staff when there is a deviation from normal operating procedure or a water quality issue. Incident reporting allows staff to track and review issues to assess if improvements could reduce the risks from each issue.

7.3. NOTIFICATION

In 2022, one public notice (Table 11) was sent out for customers advising of planned maintenance at the Whitevale Water Treatment Plant and that potential impacts to water supply and water quality was to be expected.

In 2022, there were two water quality complaints (Table 12).

8.0 REPORTING REQUIREMENTS

Monthly and annual reports are submitted to IH as per the OP and are available to the public at the RDNO website www.rdno.ca. Monthly reports for the last twelve months are available on the website and if historical reports are wanted, please contact RDNO at 250-550-3700.

9.0 WORKS COMPLETED IN 2022

- FIRE HYDRANT DRAIN PIT INSTALLATION – installed drain pits at three hydrants that were missing drain pits. This helped protect the water infrastructure from being damaged due to freezing when a hydrant is used during cold weather.

10.0 PLANNED WORKS

10.1. 2023 WORK PLANS

Works planned for 2023 include:

- NEW FIRE PUMP STARTER AND DISTRIBUTION SYSTEM PRESSURE RELIEF VALVE (PRV) – replace the fire pump starter and PR as these are aging.

10.2. LONG TERM PLANS

WVW is a small water utility that meets provincial water quality and treatment requirements and development is static with no foreseeable growth, hence no projects for enhanced treatment or expansion are planned at this time. An Asset Management Investment Plan was completed in 2018 for all RDNO small utilities that included WVW. This information has been incorporated into the financial plans and rate structure for WVW to plan for renewal requirements and ensure a sustainable water utility into the future.

11.0 CLOSING

RDNO has made significant strides in fulfilling the RDNO program objectives, meeting Provincial Standards and requirements outlined by IH, and in implementing BC's DWPA and DWPR at WVW. RDNO will strive for implementation of system improvements within the constraints of the WVW budget and through applications for grant funding.

TABLES

Table 1: RDNO Water Treatment Operators

2022 RDNO Operators			
Last Name	First Name	Certification #	Certification Held
Hartwig	Corey	9378	WTI
Heidt	Dustin	4498	WDIII, WTIV
Mykytuk	Becky	9086	WTII
Cimon	Caroline	1001075	WTII, WWTII
Tucker	Chris	6489	WWTTII, WTIV, WDII
Beckett	Jemma	1001610	WTI
Lockwood	Ryan	1000755	WTII,WDI

Table 2: Raw Water Bacterial Results for Whitevale Well 2

2022 Raw Water Bacterial Counts				
	Min	Max	Average	# Samples
Total Coliform (CFU/100 mL)	<1	<1	<1	4
E.coli (CFU/100 mL)	<1	<1	<1	4
Total Coliform (MPN/100 mL)	<1	<1	<1	8
E.coli (MPN/100 mL)	<1	<1	<1	8

Table 3: Raw Water Turbidity Results for Whitevale Well 2

2022 Raw Water Turbidity Statistics							
	Min	Max	Average	95% Percentile	# Samples	Counts <1 NTU	Counts >1 NTU
Well #2 Grab Samples (NTU)	0.05	0.11	0.06	0.08	96	96	0

*95% of the values are less than the calculated value of 0.08 NTU

Table 4: Raw Water Field Parameters for Whitevale Well 2

2022 Raw Water Field Parameters				
	Min	Max	Average	# Samples
pH	7.0	8.2	7.8	95
Temperature (degrees C)	7.8	9.0	8.1	95
Conductivity (uS/cm)	230	293	262	95

Table 5: Monthly Reservoir Free Chlorine and Turbidity SCADA Data

2022 SCADA Monthly Average

Month	Free Chlorine (mg/L)	Turbidity (NTU)
January	0.91	0.04
February	0.88	0.04
March	0.83	0.04
April	0.89	0.03
May	0.85	0.03
June	0.85	0.04
July	0.90	0.04
August	0.88	0.05
September	0.80	0.05
October	0.82	0.04
November	0.89	0.05
December	0.80	0.05
Monthly Min	**0.80**	**0.03**
Monthly Max	**0.91**	**0.05**
Monthly Average	**0.86**	**0.04**

Table 6: WVW Distribution Bacteriological Stats Summary for Three Distribution Sites

2022 Whitevale Distribution Bacteria Stats				
	Min	Max	Average	# Samples
Total Coliform (CFU/100 mL)	<1	5	<1	50
E.coli (CFU/100 mL)	<1	<1	<1	50

Table 7: WVW Distribution Bacteriological Summary of Sample Sites

2022 Whitevale Distribution Bacteria		
Whitevale Distribution Sample Sites	# Bacterial samples sent to Caro Analytical Laboratories	Results
Whitevale Reservoir	25	All samples were <1.0 for E. coli. One sample returned with 1 Total Coliform in August 9, 2022 and resample was complete Aug 12, 2022. All remaining samples were <1.0 for Total coliforms
792 Eastwood Road SS	14	All samples were <1.0 for E. coli. One sample returned with 5 Total Coliform in August 9, 2022 and resample was complete Aug 12, 2022 with results <1.0. All remaining samples were <1.0 for Total coliforms
808 Fraser Road SS	11	All samples were <1 for E. coli and Total coliforms
Total Samples	**50**	

Table 8: WVW Distribution Field Parameters with Stats Calculated for Distribution System

2022 Field Parameter Stats for Distribution System						
Parameter	Free Cl_2 (mg/L)	Total Cl_2 (mg/L)	Temp. (°C)	Turbidity (NTU)	pH	Conductivity (us/cm)
Min	0.66	0.71	4.0	0.05	6.7	240
Max	1.04	1.11	15.4	0.16	8.34	300
Average	0.81	0.88	8.8	0.07	7.8	268
# Samples	208	208	205	209	202	207

Table 9: Monthly Consumption Data

2022 Whitevale Consumption		
Month	Total Monthly Consumption (m3)	Average Daily Consumption (m3)
January	4156	134
February	2903	104
March	2557	82
April	2743	91
May	3165	102
June	3438	115
July	7466	241
August	6841	221
September	3766	126
October	3282	106
November	3119	104
December	3339	108
Monthly Average	**3898**	**128**
Monthly Min	**2557**	**82**
Monthly Max	**7466**	**241**
Total	46773	

Table 10: Incident Summary

2022 Whitevale Incidents		
Cause	Date Reported	Trigger Event
Service Leak	February 14, 2022	Customer called to have the water turned off because there was a leak shortly after the curb stop on the service line.

Table 11: Public Notification Summary

2022 Whitevale Water Utility Public Notifications		
Cause	Date	Action Items
Water Notice	April 1, 2022	Advised users of planned maintenance at the water treatment plant. Potential impacts to water supply and quality could be experienced.

Table 12: Water Quality Complaints

2022 Water Quality Complaints		
Cause	Date	Action Items
Iron in water	November 17, 2022	Provided annual comprehensive raw water results.
No Water	December 22, 2022	Operator investigated and determined it was an onsite issue, not involving the water system.

FIGURES

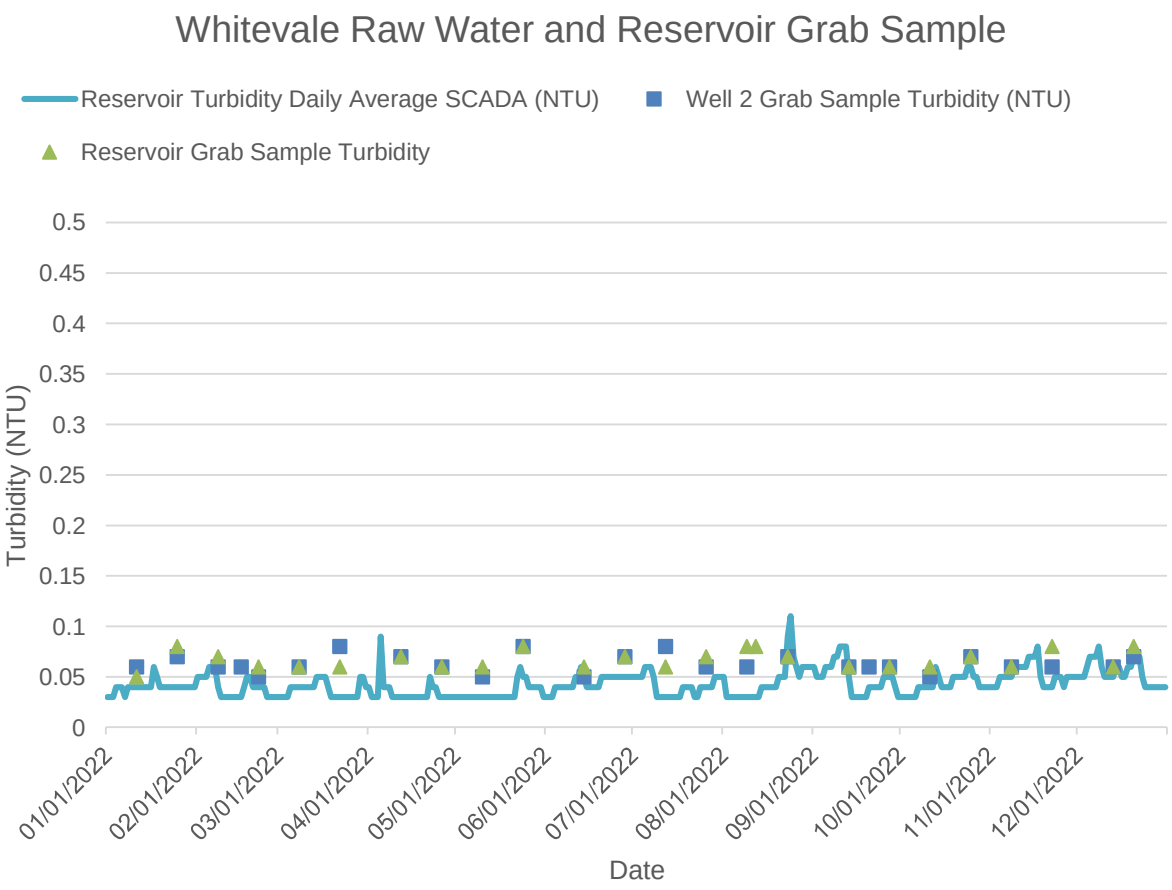
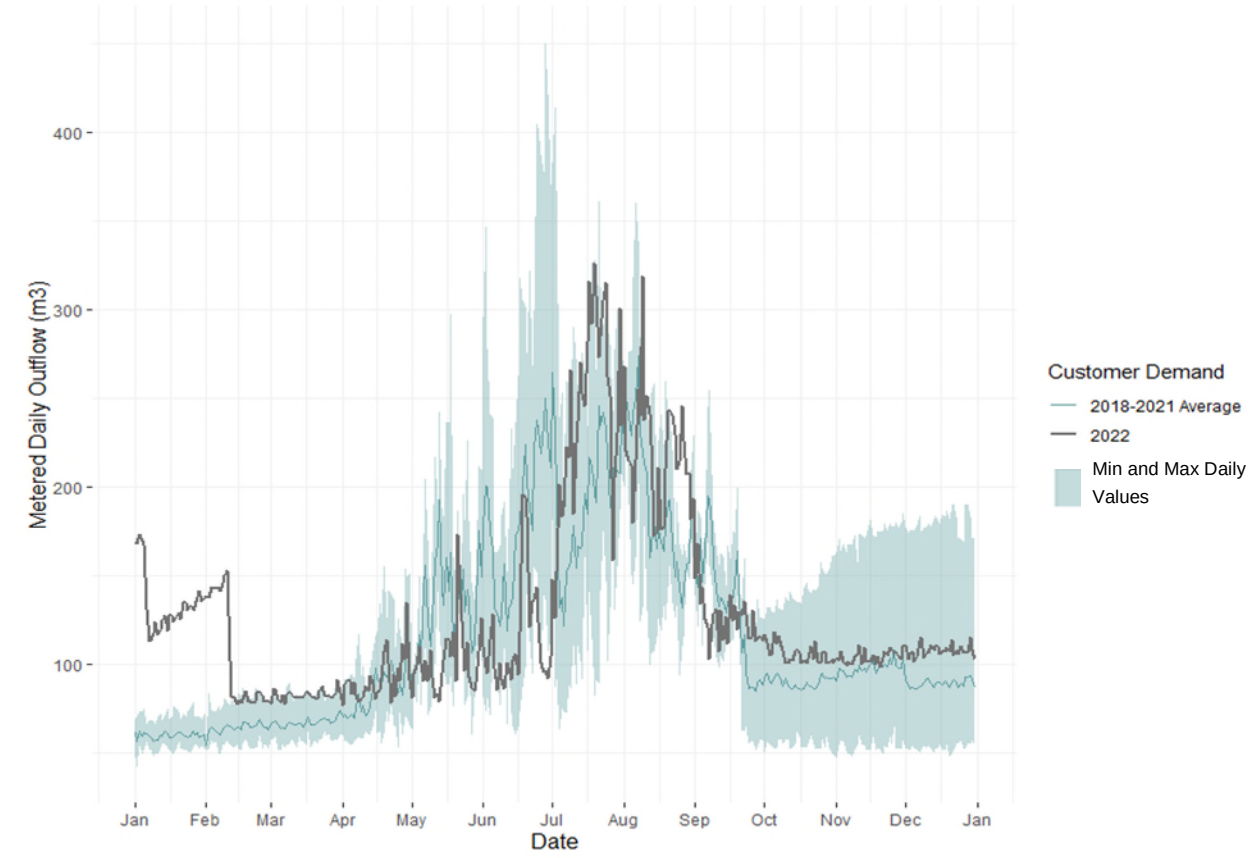


Figure 1: WVW Raw Water and Reservoir Turbidity in 2022



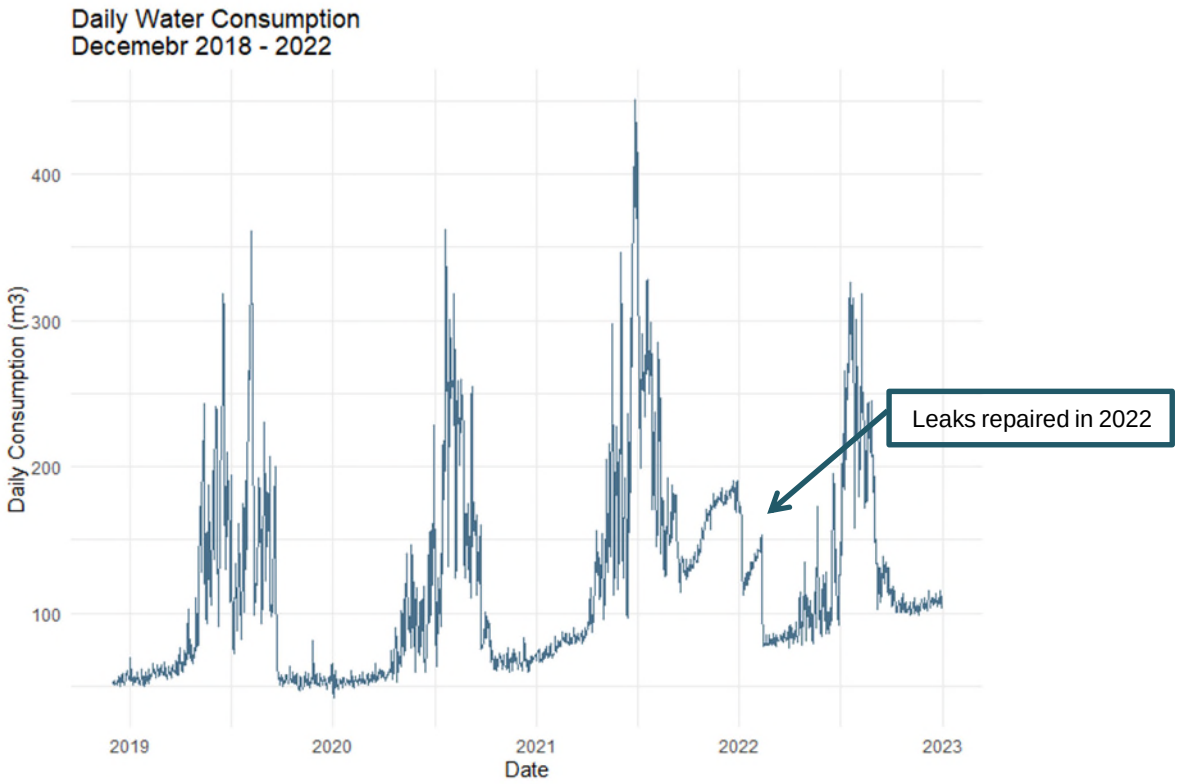


Figure 2: WVW Consumption from December 2018 to 2022

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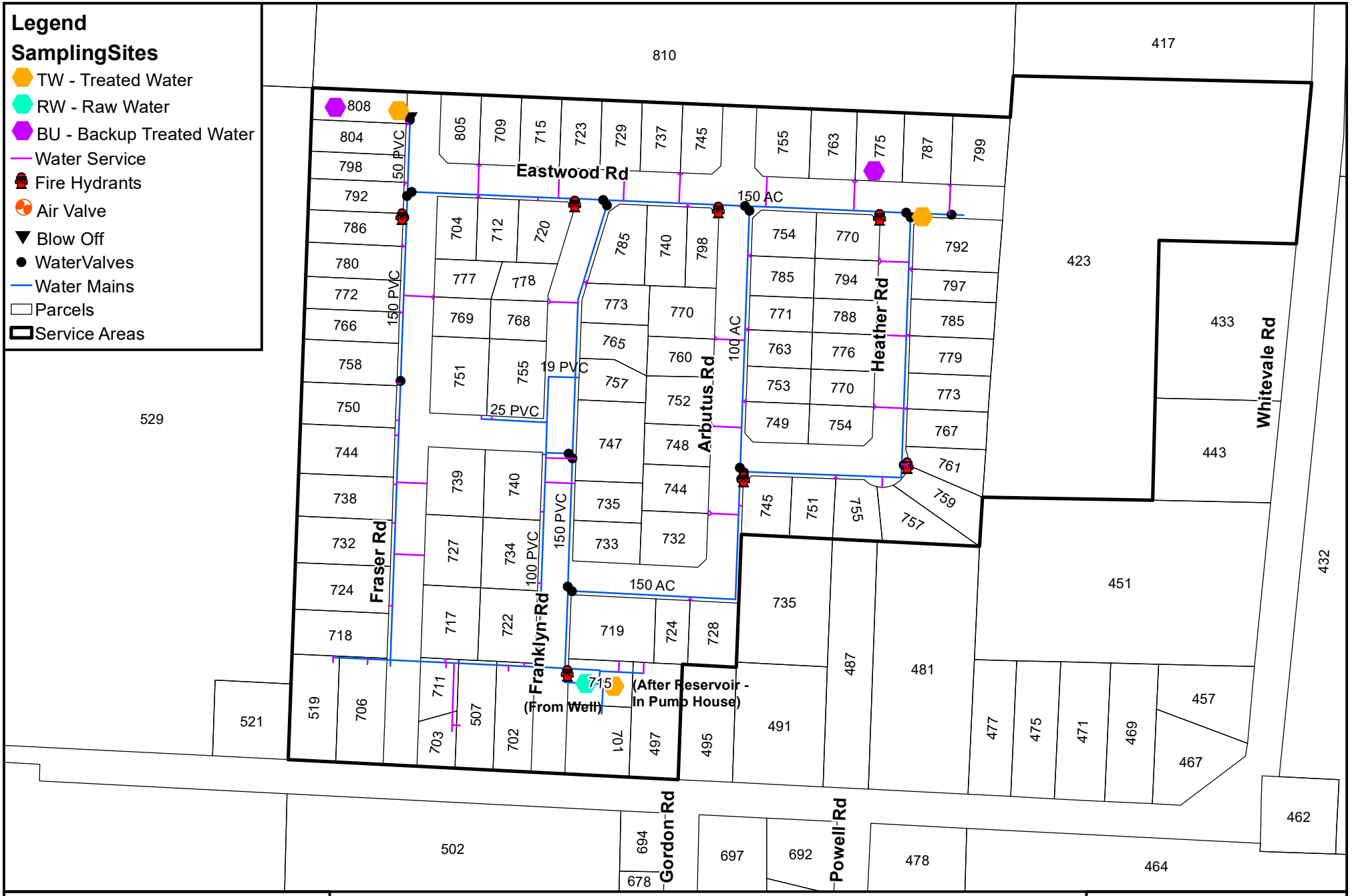
www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=PR&Code1=01&Geo2=PR&Code2=01&Data=Count&SearchText=Canada&SearchType=Begins&SearchPR=01&B1=Families,%20households%20and%20marital%20status&TABID=1

APPENDIX A

WATER SYSTEM MAP



This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Whitevale Water Utility

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

Plot Date: Jan 12, 2022

Scale: 1:3,000

Plot Size: 11" x 8.5"

0 75 150 300 Meters

APPENDIX B

CHLORINE CONTACT TIME

Whitevale Water Contact Time Calculation

13.1	m	Reservoir - Length (intake pipe enters south end of reservoir now)
2.7	m	Reservoir - Total Height
2.5	m	Reservoir - Height (to High Water Level - 100%)
2.13		Reservoir - Height (to Low Water Level - 85%)
7.3	m	Reservoir - Width
203	m^3	Reservoir - Volume at low level
75	us.gpm	Flow from Well to Reservoir
4.7	L/s	Flow from Well to Reservoir - peak hourly
0.0	m^3	Volume in Contact Pipe
449	minutes	Theoretical Detention Time (TDT) - V/Q
0.1		Baffling Factor (no baffling, jet flow from inflow)
45	minutes	Contact Time in Reservoir (TDT X Baffling Factor)

As WVW well is sourced from a confined aquifer, the water parameters are generally consistant with little to no change in chlorine demand.

CT calculation for 1 st customer - sampling point in pump house after reservoir

	Cl2 Residual mg/L (free)	Cl2 Injection mg/L	pH raw water	Raw Water temp °C	CT (Cl2 X CT in res)	CT - Virus	CTa/CTr	% Achieved
	Min.	Min.	Average	Average	min-mg/L	Required		
Normal Operation	0.70	0.83	8.00	8.7	31.4	8.0	3.93	100.00
1 chlorine pump fails	0.35	0.415	8.00	8.7	15.7	8.0	1.96	100.00

Completed by: ZM
Date: January 2, 2013

Date Printed: 1/7/2013, 12:39 PM

APPENDIX C

PERMIT TO OPERATE

Interior Health

Health Protection

Permit To Operate

Drinking Water System 15 - 300 Connections

Facility Number:	0411221
Name of Facility:	Whitevale Utilities
Address:	715 Franklyn Rd Lumby BC V0E 2G7 Canada
Primary owner	Regional District of North Okanagan
Conditions:	

April 01, 2017
Effective Date

Brian Gregory
Environmental Health Officer

April 20, 2017
Issue Date

This permit is nontransferable and must be displayed in a conspicuous place

PERMIT VALIDATION

Interior Health

ACCOUNTS RECEIVABLE
200-235 Lansdowne St. Kamloops BC Canada V2C 1X8
Toll Free: 1-844-868-5200 ext. 10365 Local calls: 778-362-6810 ext. 10365
accountsreceivable@interiorhealth.ca

operating permit, immediately affix this decal in the
on the permit. The Health Act Fees Regulation
ıtion permit is valid only if it bears an unexpired decal.

Regional District of North Okanagan
Whitevale Utilities
9848 Aberdeen Rd
Vernon BC V1B 2K9
Canada

Permit Number:	**003676**
Issue Date:	25-Feb-2022
Expiry Date:	31-Mar-2023
Facility Number:	0411221
Facility Name:	Whitevale Utilities

Drinking Water System 15 - 300 Connections

APPENDIX D

SAMPLING PROGRAM AND SCHEDULES

2022 Whitevale Water Utility Water Quality Monitoring Program

Whitevale Water Quality Monitoring Program

RDNO Operator Tasks	
Bottle Pick up	Caro bacterial bottles at DCWTP Lab
Sampling	Sampling will occur the second and fourth week of every month on Tuesday (potential exceptions due to holidays)
Chlorine	At all distribution sites use handheld meter and log data
Turbidity	At all distribution sites use handheld meter and log data
pH	At all distribution sites use handheld meter and log data
Requisition Sheets	All bacterial samples have requisition sheets for IHA
Bottle Drop off	**Samples must be dropped off at the DCWTP lab fridge or cooler outside DCWTP building on Tuesday by 10:00 am. The worksheet must be with the samples. Water quality will pick up the samples and copy the worksheet.** Microbiological samples must be at Caro lab within 36 hours or they cannot be processed.
Instument cleaning and calibration	Clean and calibrate handheld meters monthly

Sample Sites		
Site Type	**Sample Site Name**	**WaterTrax ID#**
Source	Whitevale Well 2	137BA
Treatment	Whitevale Reservoir	717B
Distribution	Eastwood Road SS	25ACC
Distribution	Fraser Road SS	25ACB

Instrument Calibration	
Handheld Instruments	Cleaned and calibrated monthly by RDNO operators
Online Instruments	Calibrated on a monthly basis or as specified in the instrument manual

Revision Date: July 27, 2022

2022 Whitevale Water Utility Water Quality Monitoring Program

Whitevale Water Quality Monitoring Program

Source Analysis		
Sample Sites	**Frequency**	**Caro Lab Parameters**
Whitevale Well 2	Once a month (4th week of the month)	Bacteria

Treatment Analysis		
Sample Sites	**Frequency**	**Caro Lab Parameters**
Whitevale Reservoir	Bi-weekly (2nd and 4th week of the month)	Bacteria

Distribution Analysis		
Sample Sites	**Frequency**	**Caro Lab Parameters**
Eastwood Road SS	Once a month (2nd week of the month)	Bacteria
Fraser Road SS	Once a month (4th week of the month)	Bacteria

5 Bacterial Samples Per Month

Revision Date: July 27, 2022

2022 Whitevale Water Utility Water Quality Monitoring Program

Whitevale Annual Comprehensive Source Sampling

Comprehensive Analysis Schedule		
Sample Site	**Frequency**	**When**
Whitevale Well 2	annually	June/October
Annual sampling rotates between June and October each year		
Bottles for Annual Sampling		
1 - Caro Baterial		
1 - 250 mL metals		
1 - Cyanide		
1 - 1 L Caro		

APPENDIX E

RAW WATER COMPREHENSIVE ANALYSIS

Whitevale Well #2 Water Quality 2022

Water System:	**Whitevale Water**
Source:	**Whitevale groundwater**
Facility:	**Whitevale**
Sampling Point:	**Well #2**
Date of Sample:	**10/11/2022**

REGIONAL DISTRICT NORTH OKANAGAN

		Canadian Drinking Water Guidelines	
Anions	**Results (mg/L)**	**Maximum Acceptable Concentration (MAC)**	**Aesthetic Objective (AO) Operational Guideline (OG)**
Chloride	1.14		<250
Fluoride	<0.10	1.5	
Nitrate (As N)	<0.010	10	
Nitrite (as N)	<0.010	1	
Sulphate	23.2		≤500
General Parameters	**Results (mg/L)**	**Maximum Acceptable Concentration (MAC)**	**Aesthetic Objective (AO) Operational Guideline (OG)**
Alkalinity, Total (as CaCO3)	115	N/A	
Alkalinity, Phenolphthalein (as CaCO3)	<1.0	N/A	
Alkalinity, Bicarbonate (as CaCO3)	115	N/A	
Alkalinity, Carbonate (as CaCO3)	<1.0	N/A	
Alkalinity, Hydroxide (as CaCO3)	<1.0	N/A	
Colour, True	<5.0	N/A	≤15 TCU
Conductivity (EC)	243	N/A	
Cyanide, Total	<0.0020	0.2	
pH	7.97	N/A	7.0 - 10.5
Turbidity	<0.10		OG <1
Calculated Parameters	**Results (mg/L)**	**Maximum Acceptable Concentration (MAC)**	**Aesthetic Objective (AO) Operational Guideline (OG)**
Hardness, Total	124	N/A	
Total Dissolved Solids	146		≤500
Total Metals	**Results (mg/L unless noted)**	**Maximum Acceptable Concentration (MAC)**	**Aesthetic Objective (AO) Operational Guideline (OG)**
Aluminum, total	<0.0050	N/A	OG ≤0.1
Antimony, total	<0.00020	0.006	
Arsenic, total	<0.00050	0.01	
Barium, total	0.0082	1	
Boron, total	<0.0500	5	
Cadmium, total	<0.000010	0.005	
Calcium, total	37.8	N/A	
Chromium, total	<0.00050	0.05	
Cobalt, total	<0.00010	N/A	
Copper, total	0.00118	2	<1
Iron, total	<0.010	N/A	≤0.3
Lead, total	<0.00020	0.005	
Magnesium, total	5.20	N/A	
Manganese, total	0.00128	0.12	≤0.02
Mercury, total	<0.00001	0.001	
Molybdenum, total	0.00127	N/A	
Nickel, total	<0.0004	N/A	
Potassium, total	2.08	N/A	
Selenium, total	<0.00050	0.05	
Sodium, total	4.27	N/A	≤200
Uranium, total	0.000154	0.02	
Zinc, total	<0.0040	N/A	≤5

Notes: No current Guideline ; Reference Health Canada

Hardness - no guideline - "Hardness Levels between 80 and 100 mg/L as CaCo3 are considered acceptable; levels greater than 200 are considered poor but can be tolerated; those in excess of 500 are normally considered unacceptable.

Turbidity - 1 NTU when disinfection required; <5 NTU aesthetic clarity

"<" = less than detection limit shown

">" = greater than upper range limit shown

"«" = less than number shown (Detected)

"»" = greater than number shown (Detected)

** Criteria Exceeded*