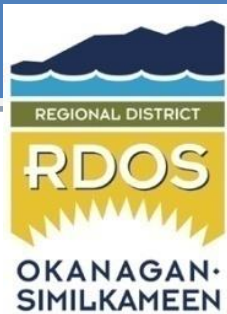


2022

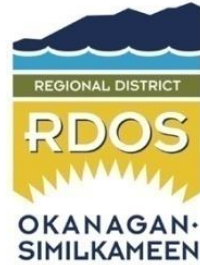
ANNUAL WATER QUALITY MONITORING REPORT NARAMATA WATER SYSTEM



Naramata Water Treatment Plant – UV
Disinfection Vessels

Regional District of Okanagan-Similkameen

March, 2024



**2022 ANNUAL WATER QUALITY MONITORING REPORT
NARAMATA WATER SYSTEM
NARAMATA, B.C.**

Copy prepared for:
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1. Introduction

As the owner and operator of the Naramata water system, the Regional District of Okanagan-Similkameen (RDOS) is responsible for the following Annual Report summarizing the results from the 2022 *Water Quality Monitoring Program*. The report is a conditional requirement of the *Permit to Operate* issued by the Interior Health Authority (IHA) and the *BC Drinking Water Protection Act and supporting Regulation*.

2. System Description

The Naramata water system is located within Electoral Area E, 15 km northeast of Penticton. The water system consists of a surface water intake in Okanagan Lake, an Ultraviolet Light Treatment Plant and a distribution system. The system supplies water to approximately 900 domestic connections, 255 irrigation connections and 20 commercial connections and supports fire protection. Source water is pumped from Okanagan Lake through the Raw Water Pump Station (RWPS) to the Naramata Ultraviolet Water Treatment Plant (WTP) where it undergoes two levels of treatment. The water is passed through ultraviolet light which inactivates harmful viruses and organisms (some of which are resistant to chlorine such as *Cryptosporidium*). After passing through the UV disinfection system, the water is chlorinated with sodium hypochlorite as the second level of disinfection. This chlorination also provides for protection of the water within the distribution system. From the WTP treated water is supplied to the distribution system directly by gravity and by pumps that move water to storage reservoirs at elevated locations throughout the distribution system.

3. System Classification and Operator Certifications

3.1. System Classification

The *British Columbia Environmental Operators Certification Program (BC EOCP)* is responsible for the classification of potable water systems in BC.

The Naramata distribution system remained as a *Level IV* Distribution System in 2022.

The Ultraviolet Water Treatment Plant remained classified as a *Level II* Treatment Facility in 2022.

3.2. Operator Certification

The *British Columbia Environmental Operators Certification Program (BC EOCP)* is also responsible for certification of all water system operators. Operators may hold certification(s) in the disciplines of Water Distribution and/or Water Treatment with four levels of certification achievable within each discipline. RDOS Operators annually attend courses, seminars and complete online training required to maintain their levels of certification. In addition, all operators annually continue to work on augmenting and furthering their levels of certification. All RDOS Operators are certified through the *BC EOCP* as indicated in the Table 1 below.

OPERATOR EOCP CERTIFICATION No.	WATER DISTRIBUTION CERTIFICATION LEVELS				WATER TREATMENT CERTIFICATION LEVELS			
	IV	III	II	I	IV	III	II	I
1126	X						X	
4194			X					
4840			X				X	
4839		X						X
6926		X						X
8761		X						X
9322		X						X

Table 1: RDOS Operator Certifications 2022

4. Annual Water Usage

The source water for the Naramata water systems is Okanagan Lake. In 2022, a total of 1,585,387m³ was pumped from Okanagan Lake, down from 1,733,772m³ in 2021.

4.1. Consumption Records

	Cubic Meters (m ³)	US Gallons	Date
Annual Total Usage	1,585,387	418,816,241	
Minimum Daily Flow	543	143,446	Jan 06/22
Maximum Daily Flow	15,026	3,969,462	Aug 08/22

Table 2: Annual Water Consumption 2022

Both annual and monthly water consumption has been trended as shown in the following two graphs.

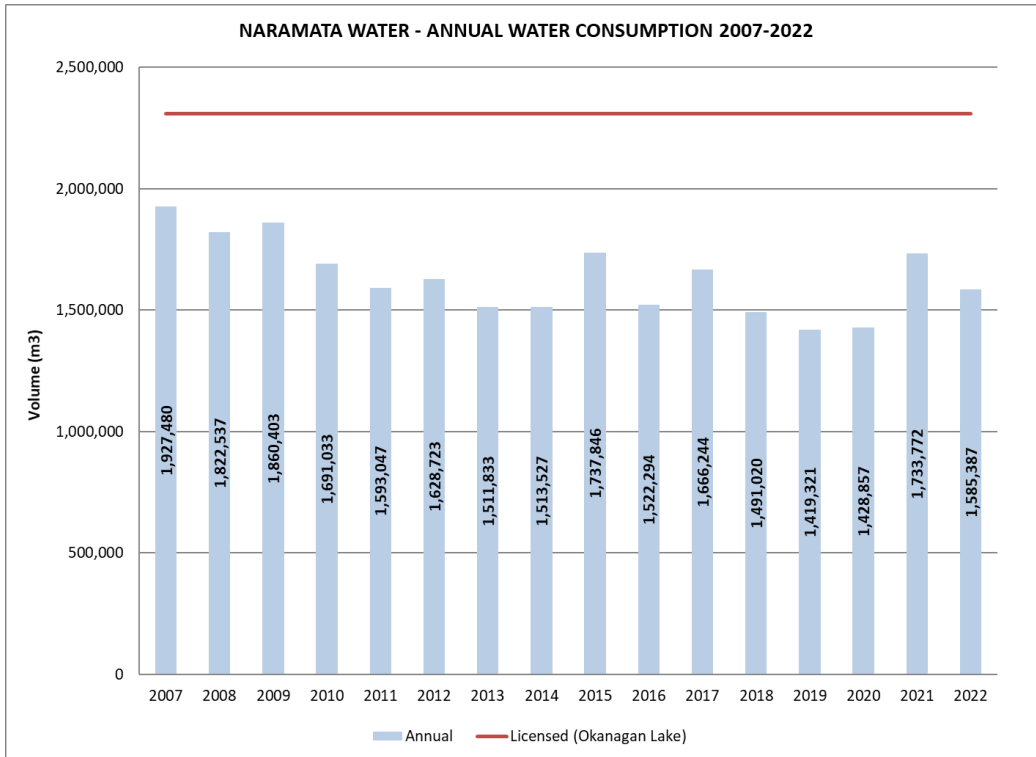


Figure 1: Annual Water Consumption 2007 to 2022

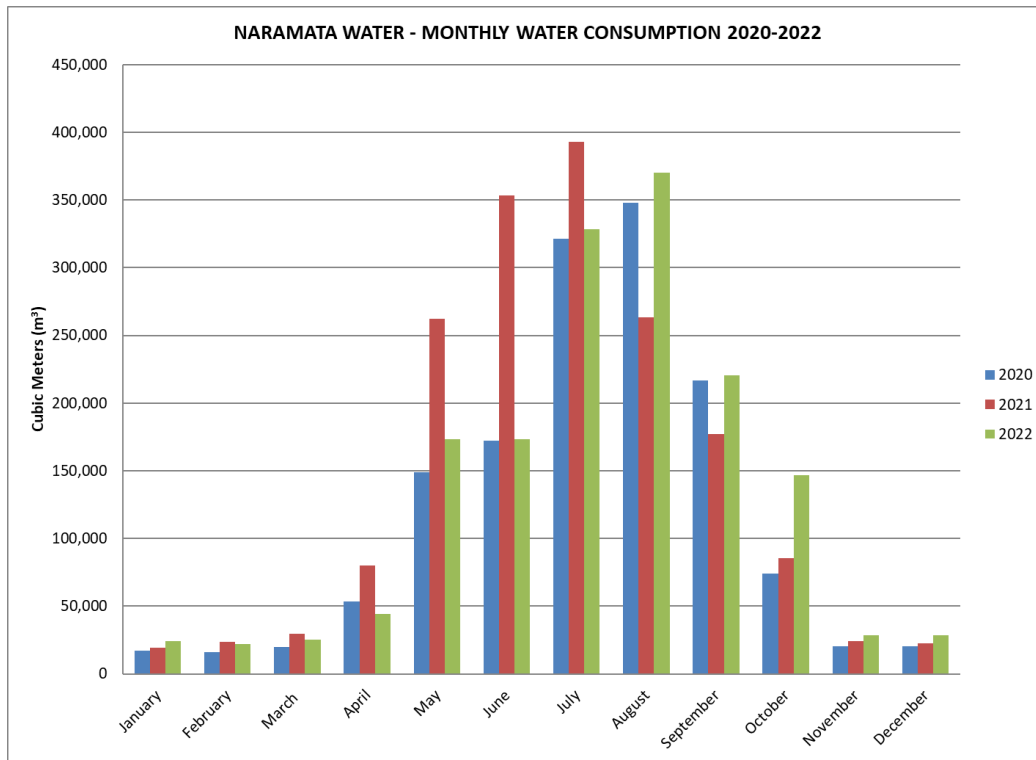


Figure 2: Monthly Water Consumption 2020 - 2022

4.2. Water Conservation

The Naramata water system started under Stage “Normal” water restrictions in 2022 and remained at this level for the remainder of the season.

5. Source Water Quality Monitoring

All untreated source water quality parameters are compared to the applicable criteria set out in the *British Columbia Drinking Water Protection Act* and supporting *Regulation (DWPA)*, the *Guidelines for Canadian Drinking Water Quality (GCDWQ)*, Interior Health Authority programs and Operational Guidelines (OG). The *DWPA* and *GCDWQ* define these parameters and set Aesthetic Objectives (AO) and Maximum Allowable Concentrations (MAC).

All 2022 accredited laboratory tests were performed by Caro Analytical Services (Kelowna, B.C.).

5.1. Source Water Turbidity Monitoring

Turbidity is a measure of the relative clarity or cloudiness of water measured in Nephelometric Turbidity Units (NTU). Turbidity is measured by passing light through a sample and measuring how light reflects off of the suspended particles within the sample.

The Interior Health Authority requires source water turbidity values to be evaluated against the following criteria. Exceedances of the criteria, typically compared to the average 24 hour turbidity value, will require a level of public notification as described below.

Source Water Quality	Turbidity Range	Public Notification Required
Good	NTU < 1	None
Fair	1 < NTU < 5	Water Quality Advisory (WQA)
Poor	5 ≤ NTU	Boil Water Notice (BWN)

Online continuous turbidity monitoring and trending of the Okanagan Lake source water is part of the SCADA (Supervisory Control and Data Acquisition) system. In addition to the online monitoring, grab samples are drawn on a weekly basis and measured using portable field test kits to verify the operation of the online instrumentation.

The 2022 online and test kit turbidity data and three year turbidity trend are shown in the following two graphs.

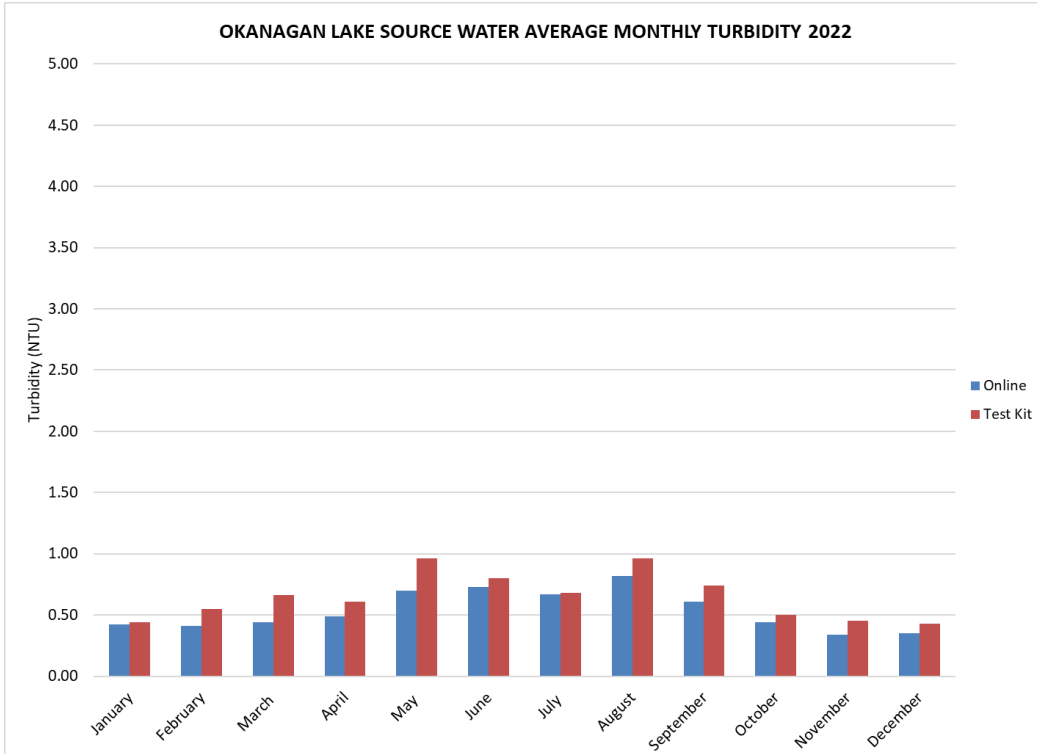


Figure 3: Okanagan Lake Average Monthly Turbidity 2022

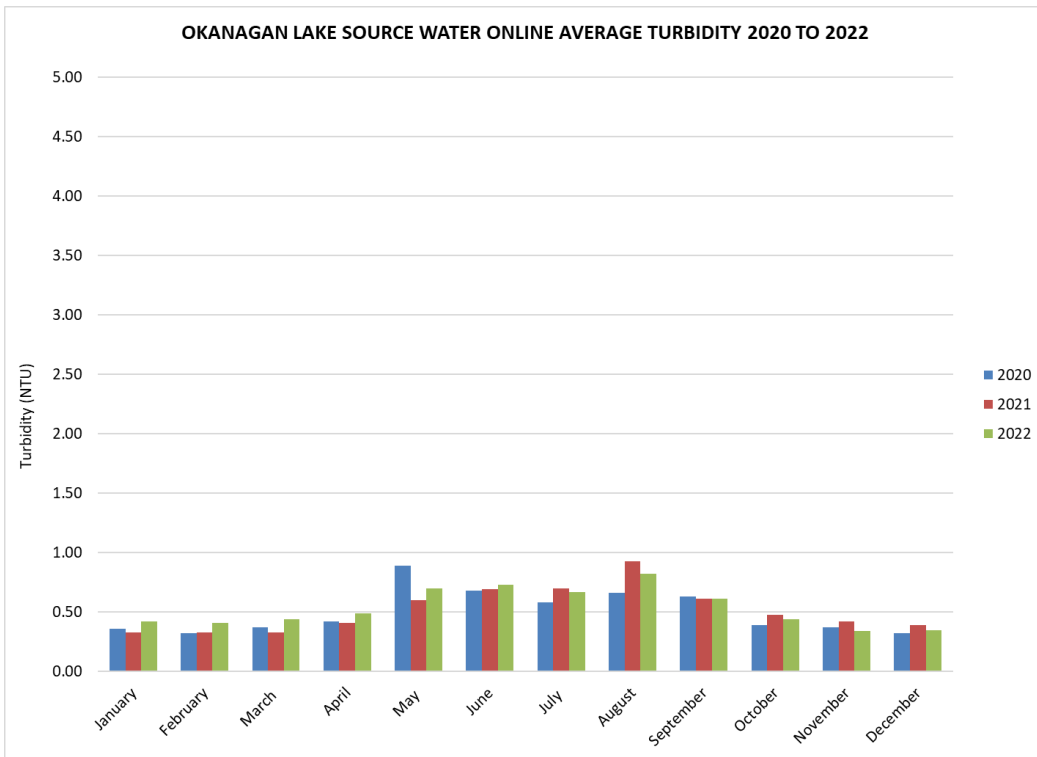


Figure 4: Okanagan Lake Online Average Turbidity 2020 to 2022

5.2. Source Water Ultraviolet Transmittance Monitoring

Ultraviolet transmittance is defined as the amount of ultraviolet light @ 254 nm wavelength that is transmitted through a 1cm² sample indicated as a percentage (%UVT). UV disinfection systems are designed based on the UV transmittance of the source water.

The amount of UV light required to achieve the required UV dose is dependent on the flow rate and % UVT of the source water. The Naramata UV System is validated to operate down to 80% UVT. When changes in the source water quality result in values below 80%, operational changes and/or public water quality notifications may be required.

Online continuous % UV transmittance monitoring and trending of the Okanagan Lake source water is part of the SCADA (Supervisory Control and Data Acquisition) system. In addition to the online monitoring, grab samples are drawn on a weekly basis and sent to a laboratory for %UV transmittance analysis to verify the operation of the online instrumentation.

The 2022 online and laboratory UV transmittance data and three year UV transmittance trend are shown in the following two graphs.

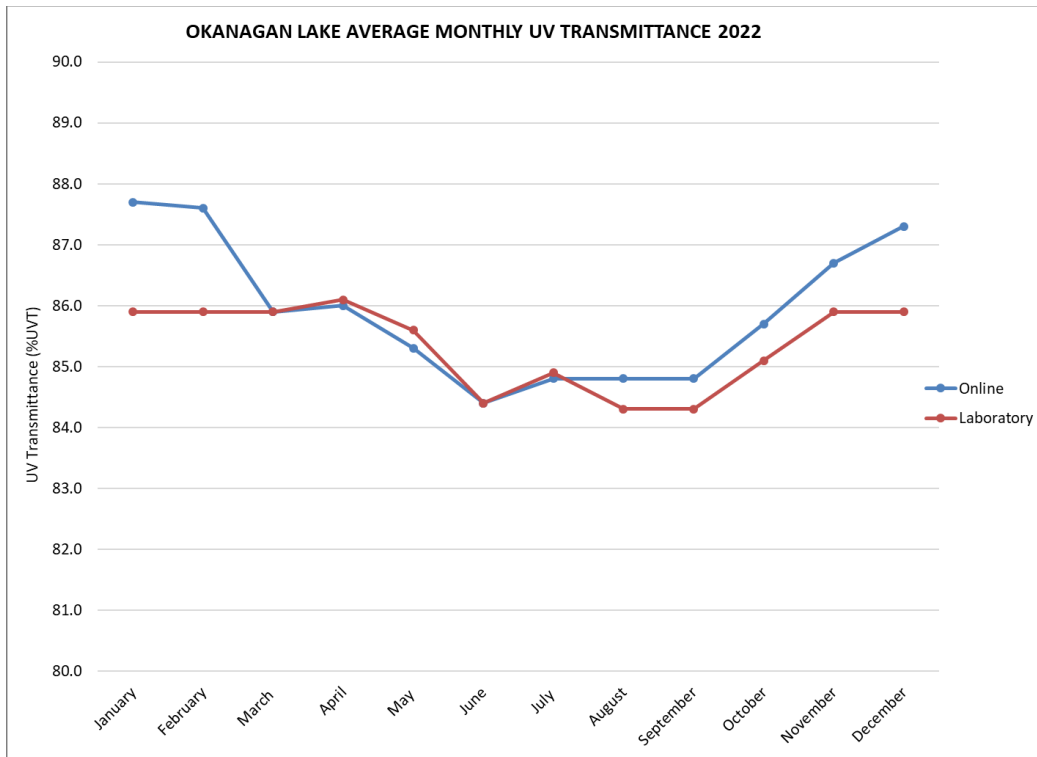


Figure 5: Okanagan Lake Average Monthly UV Transmittance 2022

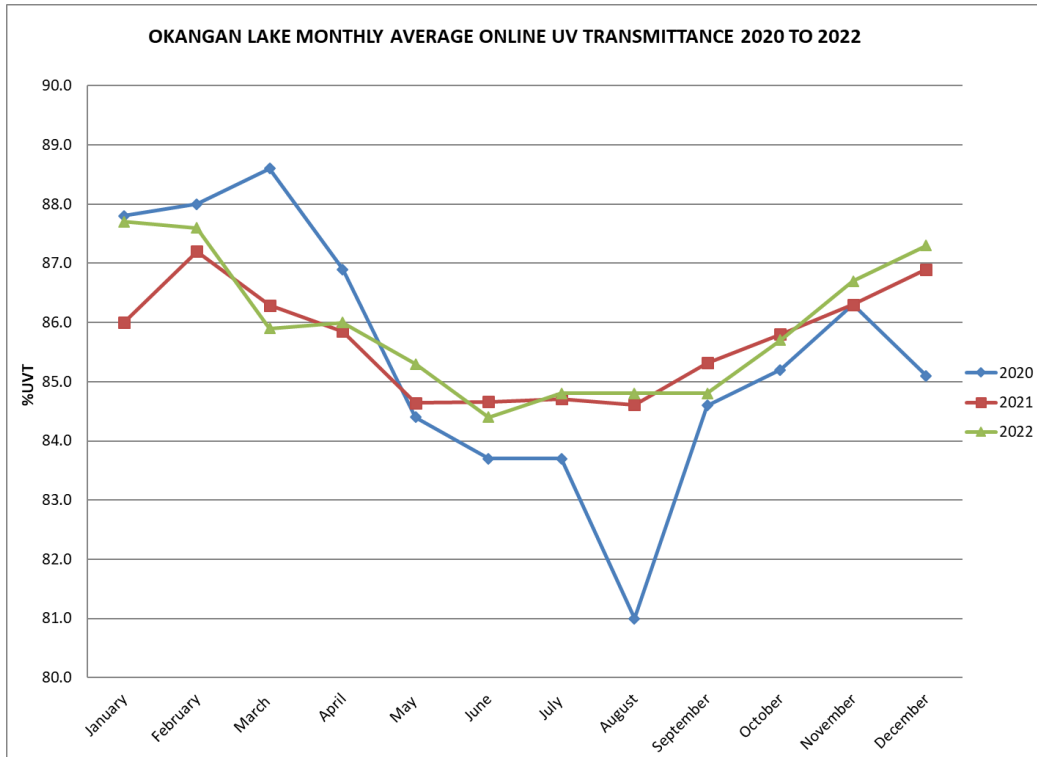


Figure 6: Okanagan Lake Monthly Average Online UV Transmittance 2020 to 2022

5.3. Source Water Weekly/Bi-Weekly Monitoring

Various parameters are monitored weekly and bi-weekly on the source water. These parameters provide support for both operational decisions and the *Source Water Protection Plan*, discussed later in this report. The following is a summary of these parameters that are monitored by both field kits, online instrumentation and grab samples that are sent to the laboratory for analysis.

Analyte	Unit	Average	Minimum	Maximum	Number of Results
Field Results					
Reading Type: Test Kit					
Conductivity	µS/cm	302	251	338	62
pH		8.14	7.22	8.45	62
Total dissolved solids	mg/L	215	206	228	57
Temperature	°C	8.1	3.5	13.9	62
Turbidity	NTU	0.66	0.28	1.59	61
Reading Type: Online Instrument					
Turbidity	NTU	0.53	0.26	0.98	60
Lab Results					
General					
Alkalinity (total, as CaCO ₃)	mg/L	124	102	170	26
Total organic carbon	mg/L	4.24	3.73	5.24	26
Colour	CU	4	<5.0	14	52
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	121	110	135	26
UV transmittance at 254 nm - unfiltered	%	85.3	83.6	86.7	51
Microbiological					
Total coliforms (MPN)	MPN/100 mL	5	1	28	52
E. coli (MPN)	MPN/100 mL	1	1	4	52
Total Metals					
Calcium (total)	mg/L	32.7	30.3	37	26
Magnesium (total)	mg/L	9.48	8.35	10.3	26

Table 3: Weekly/Bi-Weekly Source Water Parameter Summary

The following graph shows the three year trend for Total Coliforms and E.coli from the Okanagan Lake intake. Note, the laboratory changed analytical methods for the raw water bacteriological testing from Membrane Filtration (MF CFU/100ml) to Most Probable Number (MPN) in late 2019.

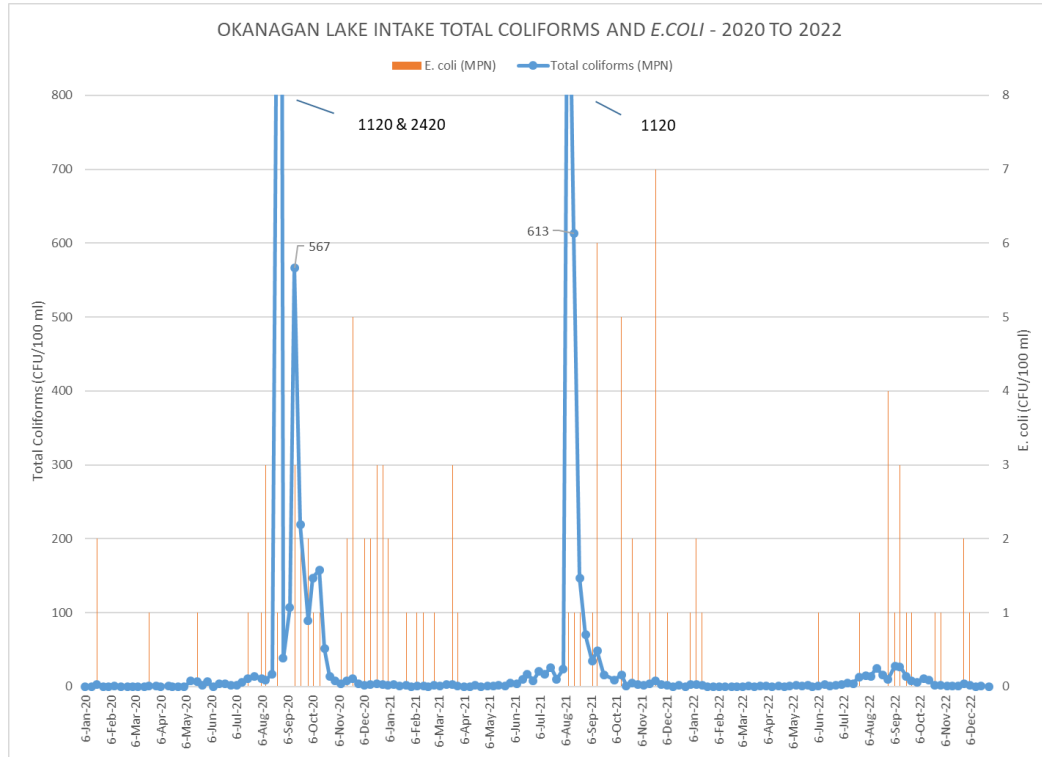


Figure 7: Okanagan Lake Monthly Total Coliform and E.coli 2020 to 2022

6. Distribution System Water Quality

All treated distribution water quality parameters are compared to the applicable criteria set out in the *British Columbia Drinking Water Protection Act and Regulation (DWPA)*, the *Guidelines for Canadian Drinking Water Quality (GCDWQ)*, Interior Health Authority programs and Operational Guidelines (OG). The *DWPA* and *GCDWQ* define these parameters and set Aesthetic Objectives (AO) and Maximum Allowable Concentrations (MAC).

All 2022 accredited laboratory tests were performed by Caro Analytical Services (Kelowna, B.C.).

6.1. Distribution System Bacteriological Results

The following is a summary of the bacteriological laboratory results from the treated water distribution system. There are ten regular sampling sites throughout the distribution system. In 2022 IHA reduced the required weekly distribution samples from five (5) sites to two (2) sites monitored on a weekly basis.

Schedule A of the B C *Drinking Water Protection Regulation* provides bacteriological testing criteria as given below.

Schedule A
Water Quality Standards for Potable Water
(sections 2 and 9)

Parameter:	Standard:
Fecal coliform bacteria	No detectable fecal coliform bacteria per 100 ml
<i>Escherichia coli</i>	No detectable <i>Escherichia coli</i> per 100 ml
Total coliform bacteria	
(a) 1 sample in a 30 day period	No detectable total coliform bacteria per 100 ml
(b) more than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml

In 2022, all but two (2) distribution samples had no detections for Total Coliforms and *E.coli*. The two samples that had detections for Total Coliforms both reported 1 CFU/100ml. No distribution samples had positive reports for *E.coli*. The following is a summary of the laboratory bacteriological results from the treated water distribution system.

Analyte	Unit	Average	Minimum	Maximum	Number of Results	Number of Results with Exceedances
Lab Results						
Microbiological						
Background bacteria	CFU/100 mL				0	0
Total coliforms (counts)	CFU/100 mL	1	1	1	109	2
E. coli (counts)	CFU/100 mL				109	0

Table 4 Distribution Water Bacteriological Testing Summary for 2022

6.2. Distribution System Free Chlorine Residuals

The following is a summary of the field free chlorine residual measurements from the distribution system. Free chlorine residuals are required to be maintained between 0.2 mg/L and 2.0 mg/L. There are ten regular sampling sites throughout the distribution system. Typically, two (2) sites were monitored on a weekly basis in conjunction with the bacteriological sampling. Flushing of water mains occurred at all locations when measured residual levels were below 0.2 mg/L free chlorine.

Analyte	Sampling Location	Unit	Average	Minimum	Maximum	Number of Results
Field Results						
Chlorine (free)	End of Mill Rd	mg/L	0.42	0.04	0.75	10
	Flagstone Rise	mg/L	0.44	0.03	1.26	11
	Hayman Road	mg/L	1	0.72	1.19	9
	McPhee Road	mg/L	1.24	1.01	1.38	12
	Mill Rd	mg/L	0.59	0.32	0.76	3
	Noyes and Mariposa Rd	mg/L	0.58	0.09	0.79	14
	NW Office	mg/L	0.98	0.48	1.27	10
	Smethurst PRV	mg/L	0.78	0.44	1.19	11
	South End	mg/L	0.87	0.65	1.08	13
	Upper Debeck	mg/L	0.68	0.35	0.88	10
	Workman PI Ph 1	mg/L	0.7	0.36	1.09	11

Table 5: Annual Distribution Free Chlorine Residual Summary for 2022

6.3. Distribution System Water Quality Field Parameter Testing

The following is a summary of the field parameters that are measured routinely in the distribution system. There are ten regular sampling sites throughout the distribution system. Typically, two (2) sites were monitored on a weekly basis in conjunction with the bacteriological sampling.

Analyte	Unit	Average	Minimum	Maximum	Number of Results
Field Results					
Total coliforms (MPN)	MPN/100 mL				0
Conductivity	µS/cm	318	299	400	114
pH		8.24	7.69	8.86	115
Total dissolved solids	mg/L	226	211	284	114
Temperature	°C	10.7	4	20.2	115
Turbidity	NTU	0.47	0.17	2.08	114

Table 6: Annual Field Water Quality Parameter Testing Summary for 2022

6.4. Distribution System Disinfection By-Product Monitoring

Disinfection by-products are a result of chlorine reacting with naturally occurring organic matter such as decaying leaves and vegetation that can be present in surface water sources. The health risks from improperly treated surface water sources far out weigh the health risks from disinfection by-products found in properly treated surface water. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection.

6.4.1. Trihalomethane Monitoring

Total Trihalomethanes (THMs) results are based on a locational running annual average (LRAA) of a minimum of quarterly samples taken at the point in the distribution system with the highest potential THM levels with a Maximum Allowable Concentration of 0.100 mg/L (GCDWQ).

The following is a summary of the trihalomethane laboratory results and locational running average for the distribution system monitoring.

Sampling Location	Date Sampled	Lab Results
		Halogenated Methanes
		Total Trihalomethanes (LRAA) (calculated)
		mg/L
End of Mill Rd	11-Apr-22	0.149
End of Mill Rd	30-May-22	0.11
End of Mill Rd	08-Aug-22	0.0915
End of Mill Rd	14-Nov-22	0.102
Noyes and Mariposa Rd	11-Apr-22	0.0592
Noyes and Mariposa Rd	30-May-22	0.0697
Noyes and Mariposa Rd	08-Aug-22	0.0718
Noyes and Mariposa Rd	14-Nov-22	0.077
South End	11-Apr-22	0.0613
South End	30-May-22	0.0544
South End	08-Aug-22	0.051
South End	14-Nov-22	0.0627
GCDWQ MAC		0.100 ^{1.1}

Table 7: Quarterly Distribution System LRAA Results 2022

6.4.2. Guidelines Notes for Trihalomethanes

1. **Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)**

Note 1.1 for Total Trihalomethanes (LRAA) (calculated):

Trihalomethanes refers to the total of chloroform, bromodichloromethane, dibromochloromethane and bromoform compounds. The maximum acceptable concentration (MAC) for trihalomethanes (THMs) in drinking water is 0.100 mg/L (100 µg/L) based on a locational running annual average of a minimum of quarterly samples taken at the point in the distribution system with the highest potential THM levels. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection.

6.4.3. Haloacetic Acid Monitoring

Haloacetic Acid (HAAs) results are based on a locational running annual average (LRAA) of a minimum of quarterly samples in the distribution system with a Maximum Allowable Concentration of 0.08 mg/L (GCDWQ).

The following is a summary of the haloacetic acid laboratory results and locational running annual average for the distribution system monitoring.

Sampling Location	Date Sampled	Lab Results
		Haloacetic Acids
		Haloacetic acids (LRAA) (calculated)
		mg/L
End of Mill Rd	14-Nov-22	0.0539
Mill Rd	14-Nov-22	0.00294
Noyes and Mariposa Rd	11-Apr-22	0.0514
Smethurst PRV	14-Nov-22	0.0491
South End	11-Apr-22	0.049
Workman PI Ph 1	14-Nov-22	0.0512
GCDWQ MAC		0.08 ^{1.1}

Table 8: Quarterly Distribution System Haloacetic LRAA Results 2022

The following is a summary of the haloacetic acid laboratory results and locational running annual average for the treated water leaving the UV Treatment Plant.

Sampling Location	Date Sampled	Lab Results
		Haloacetic Acids
		Haloacetic acids (LRAA) (calculated)
		mg/L
WTP Supply	11-Apr-22	0.0289
WTP Supply	8-Aug-22	0.0259
WTP Supply	14-Nov-22	0.0259
GCDWQ MAC		0.08 ^{1.1}

Table 9: Quarterly UV Treatment Plant Haloacetic Results 2022

6.4.4. Guidelines Notes for Haloacetic Acids

1. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)

Note 1.1 for Haloacetic acids (LRAA) (calculated)::

Total haloacetic acids refers to the total of monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid and dibromoacetic acid. The maximum acceptable concentration (MAC) for total haloacetic acids in drinking water is 0.08 mg/L (80 µg/L) based on a locational running annual average of a minimum of quarterly samples taken in the distribution system. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection.

6.5. Water Quality Complaints

No reports for 2022.

7. Source and Distribution System Potable Water Testing

Annually, the RDOS submits both an untreated source water sample from Okanagan Lake and a treated distribution water sample to an accredited lab for comprehensive potable water testing. The results of these test are compared against the *Guidelines for Canadian Drinking Water Quality*. The *GCDWQ* establishes Maximum Allowable Concentration (MAC), Interim Maximum Allowable Concentrations (IMAC) and Aesthetic Objectives (AO) for parameters if applicable. In 2022, there were no exceedances of the guidelines in either sample.

These comprehensive tests include physical parameters (e.g. color, turbidity, temperature, ultraviolet transmittance), chemical parameters (e.g. hardness, total metals and nutrients). Changes in these parameters may result in the need for water notifications for customers (i.e. Boil Water Notice or Water Quality Advisory) or the requirement for the implementation of treatment processes. The following tables display the results for the respective comprehensive potable water tests along with summaries of the previous three (3) years of data for comparison.

All tested source water and distribution water parameters met the applicable guidelines in 2022 with no notable increasing or decreasing trends.

7.1. Source Water General Parameters 2020 to 2022

		Sampling Location	Raw Water Pump 8-Sep-20	Raw Water Pump 28-Sep-21	Raw Water Pump 4-Jul-22
Analyte	Unit	Date Sampled			
		Guideline			
		GCDWQ MAC			
Lab Results					
General					
Alkalinity (total, as CaCO ₃)	mg/L	NG	112	93.7	120
Total organic carbon	mg/L	NG	9.5	3.8	4.27
Chloride	mg/L	NG	4.99	5.4	5.49
Colour	CU	NG	6.8	<5.0	<5.0
Conductivity	µS/cm	NG	270	276	279
Total cyanide	mg/L	0.2 ^{1.1}	<0.0050	<0.0020	<0.0020
Fluoride	mg/L	1.5	<0.10	0.2	0.11
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	NG	118	118	118
Langelier Index		NG	0.3	0.2	0.3
pH		NG	8.1	8.14	8.12
Total dissolved solids (computed)	mg/L	NG	156	149	165
Sulphate	mg/L	NG	28.4	30.4	31.1
Sulphide (total, as S)	mg/L	NG	<0.020	<0.020	<0.020
Temperature of observed pH	°C	NG	24.2	21.8	23.4
Turbidity	NTU	N ^{1.2}	1.26	0.3	0.53
UV transmittance at 254 nm - filtered	%	NG	84.1	85	87.7
UV transmittance at 254 nm - unfiltered	%	NG	82.2		
Nutrients					
Ammonia (total, as N)	mg/L	NG	0.065	<0.050	0.055
Nitrate (as N)	mg/L	10	<0.010	0.099	0.033
Nitrite (as N)	mg/L	1	<0.010	<0.010	<0.010
Potassium (total)	mg/L	NG	2.47	2.51	2.46

See Guideline Notes in Section 7.2

Table 10: Okanagan Lake General Parameters 2020 to 2022

7.2. Guidelines Notes for General Potability Parameters

1. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)

Note 1.1 for Total cyanide:

The MAC for free cyanide is 0.2 mg/L. A maximum of 0.2 mg/L was used, in this report, to identify exceedances for total cyanide as a means for determining the potential for exceeding the free cyanide guideline.

Note 1.2 for Turbidity:

"Waterworks systems that use a surface water source or a groundwater source under the direct influence of surface water should filter the source water to meet health-based turbidity limits, as defined for specific treatment technologies. Where possible, filtration systems should be designed and operated to reduce turbidity levels as low as possible, with a treated water turbidity target of less than 0.1 NTU at all times. Where this is not achievable, the treated water turbidity levels from individual filters should meet the requirements described in GCDWQ.

For systems that use groundwater that is not under the direct influence of surface water, which are considered less vulnerable to faecal contamination, turbidity should generally be below 1.0 NTU.

For effective operation of the distribution system, it is good practice to ensure that water entering the distribution system has turbidity levels below 1.0 NTU."

2. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)

Note 2.1 for pH:

The operational guideline for pH is a range of 7.0 to 10.5 in finished drinking water.

Note 2.2 for Sulphate:

There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L. Health authorities should be notified of drinking water sources containing above 500 mg/L.

Note 2.3 for Sulphide (total, as S):

The aesthetic objective for sulphide (as H₂S) is 0.05 mg/L. This is equivalent to 0.047 mg/L sulphide (as S).

7.3. Source Water Total Metals 2020 to 2022

Analyte	Unit	Sampling Location	Raw Water Pump	Raw Water Pump	Raw Water Pump
		Date Sampled	8-Sep-20	28-Sep-21	4-Jul-22
		Guideline			
		GCDWQ MAC			
Lab Results					
Total Metals					
Aluminum (total)	mg/L	2.9 ^{1.1}	0.0481	0.0139	0.0172
Antimony (total)	mg/L	0.006	<0.00020	<0.00020	<0.00020
Arsenic (total)	mg/L	0.010 ^{1.2}	0.00056	<0.00050	<0.00050
Barium (total)	mg/L	2.0 ^{1.3}	0.0221	0.0224	0.0215
Boron (total)	mg/L	5	<0.0500	<0.0500	<0.0500
Cadmium (total)	mg/L	0.007 ^{1.4}	0.000017	0.000013	0.00001
Calcium (total)	mg/L	NG	32.7	31.2	31.4
Chromium (total)	mg/L	0.05	0.0005	<0.00050	<0.00050
Cobalt (total)	mg/L	NG	<0.00010	<0.00010	<0.00010
Copper (total)	mg/L	2 ^{1.5}	0.00287	0.00287	0.00258
Iron (total)	mg/L	NG	0.072	0.019	0.016
Lead (total)	mg/L	0.005 ^{1.6}	0.00021	<0.00020	<0.00020
Magnesium (total)	mg/L	NG	8.82	9.74	9.59
Manganese (total)	mg/L	0.12 ^{1.7}	0.00302	0.00174	0.00151
Mercury (total)	mg/L	0.001	<0.000010	<0.000010	<0.000010
Molybdenum (total)	mg/L	NG	0.00341	0.00356	0.00329
Nickel (total)	mg/L	NG	0.00062	0.00057	0.00055
Selenium (total)	mg/L	0.05	0.00059	<0.00050	<0.00050
Sodium (total)	mg/L	NG	10.7	12	11.6
Strontium (total)	mg/L	7.0 ^{1.8}	0.274	0.271	0.272
Uranium (total)	mg/L	0.02	0.00238	0.00247	0.00227
Zinc (total)	mg/L	NG	0.0106	0.0049	<0.0040

See Guideline Notes in Section 7.4

Table 11: Okanagan Lake Total Metals 2020-2022

7.4. Guideline Notes for Total Metals Potability

1. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)

Note 1.1 for Aluminum (total): The maximum acceptable concentration (MAC) for total aluminum in drinking water is 2.9 mg/L (2 900 µg/L) based on a locational running annual average of a minimum of quarterly samples taken in the distribution system. (Update March 5, 2021)

Note 1.2 for Arsenic (total): Every effort should be made to maintain arsenic levels in drinking water as low as reasonably achievable.

Note 1.3 for Barium (total): Update January 24, 2020. The MAC was revised from 1.0 mg/L to 2.0 mg/L.

Note 1.4 for Cadmium (total): A maximum acceptable concentration (MAC) of 0.007 mg/L (7 µg/L) is established for total cadmium in drinking water, based on a sample of water taken at the tap. (Update July 14, 2020)

Note 1.5 for Copper (total): A maximum acceptable concentration (MAC) of 2 mg/L is established for total copper in drinking water, based on a sample of water taken at the tap. Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on Copper, June 2019.

Note 1.6 for Lead (total): The maximum acceptable concentration (MAC) for total lead in drinking water is 0.005 mg/L (5 µg/L), based on a sample of water taken at the tap and using the appropriate protocol for the type of building being sampled. Every effort should be made to maintain lead levels in drinking water as low as reasonably achievable (or ALARA). (GCDWQ: Guideline Technical Document; March, 2019)

Note 1.7 for Manganese (total): Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.

Note 1.8 for Strontium (total): Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on strontium, May 2019.

2. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)

Note 2.1 for Aluminum (total): The operational guidance (OG) value for total aluminum in drinking water is 0.100 mg/L (100 µg/L) to optimize water treatment and distribution system operations. This value is based on a locational running annual average. The sampling

frequency required to calculate the locational running annual average will vary based on the type of treatment facility and the sampling location. (Update March 5, 2021)

Note 2.2 for Manganese (total): Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.

7.5. Distribution Water General Parameters 2020 to 2022

Analyte	Unit	Guideline	Sampling Location			
		GCDWQ MAC	Date Sampled	Noyes and Mariposa Rd	South End	Workman PI Ph 1
				5-Jul-22	28-Sep-21	8-Sep-20
Lab Results						
General						
Alkalinity (total, as CaCO ₃)	mg/L	NG		119	122	112
Total organic carbon	mg/L	NG		3.86	3.97	7.73
Chloride	mg/L	NG		11.1	9.52	9.11
Colour	CU	NG		<5.0	<5.0	<5.0
Conductivity	µS/cm	NG		290	288	287
Total cyanide	mg/L	0.2 ^{1.1}		<0.0020	<0.0020	<0.0050
Fluoride	mg/L	1.5		0.11	0.2	0.2
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	NG		120	116	125
Langelier Index		NG		0.2	0.3	0.3
pH		NG		8.03	8.17	8.13
Total dissolved solids (computed)	mg/L	NG		174	172	168
Sulphate	mg/L	NG		29.5	30.4	28.8
Sulphide (total, as S)	mg/L	NG		<0.020	<0.020	<0.020
Turbidity	NTU	N ^{1.2}		0.39	0.32	0.53
UV transmittance at 254 nm - filtered	%	NG		88.3		88.2
UV transmittance at 254 nm - unfiltered	%	NG			88.6	
Nutrients						
Ammonia (total, as N)	mg/L	NG		0.068	0.099	0.06
Nitrate (as N)	mg/L	10		0.047	0.038	0.016
Nitrite (as N)	mg/L	1		<0.010	<0.010	<0.010
Potassium (total)	mg/L	NG		2.42	2.57	2.7

See Guideline Notes in Section 7.2

Table 12: Distribution General Parameters 2020 to 2022

7.6. Distribution Water Total Metals Summary 2020 to 2022

Sampling Location			Noyes and Mariposa Rd	South End	Workman PI Ph 1
Date Sampled			5-Jul-22	28-Sep-21	8-Sep-20
Analyte	Unit	Guideline			
		GCDWQ MAC			
Lab Results					
Total Metals					
Aluminum (total)	mg/L	2.9 ^{1.1}	0.012	0.011	0.015
Antimony (total)	mg/L	0.006	<0.00020	<0.00020	<0.00020
Arsenic (total)	mg/L	0.010 ^{1.2}	<0.00050	<0.00050	0.00069
Barium (total)	mg/L	2.0 ^{1.3}	0.0206	0.0226	0.0244
Boron (total)	mg/L	5	<0.0500	<0.0500	<0.0500
Cadmium (total)	mg/L	0.007 ^{1.4}	<0.000010	<0.000010	0.00001
Calcium (total)	mg/L	NG	32.9	30.3	33.8
Chromium (total)	mg/L	0.05	<0.00050	<0.00050	0.00057
Cobalt (total)	mg/L	NG	<0.00010	<0.00010	<0.00010
Copper (total)	mg/L	2 ^{1.5}	0.00765	0.011	0.028
Iron (total)	mg/L	NG	0.011	0.014	0.015
Lead (total)	mg/L	0.005 ^{1.6}	0.00022	0.00028	0.00035
Magnesium (total)	mg/L	NG	9.14	9.81	9.78
Manganese (total)	mg/L	0.12 ^{1.7}	0.00119	0.00121	0.00163
Mercury (total)	mg/L	0.001	<0.000010	<0.000010	<0.000010
Molybdenum (total)	mg/L	NG	0.00328	0.00362	0.00393
Nickel (total)	mg/L	NG	0.00055	0.00053	0.00052
Selenium (total)	mg/L	0.05	<0.00050	<0.00050	0.00062
Sodium (total)	mg/L	NG	15.6	15.3	14.9
Strontium (total)	mg/L	7.0 ^{1.8}	0.267	0.273	0.304
Uranium (total)	mg/L	0.02	0.00237	0.00253	0.00244
Zinc (total)	mg/L	NG	<0.0040	0.0062	0.0052

See Guideline Notes in Section 7.4

Table 13: Distribution Total Metals 2020 to 2022

8. Water System Notifications

The Interior Health Authority's team of drinking water officers are responsible for providing the oversight to ensure compliance and drinking water safety. The IHA is responsible for issuing *Permits to Operate* to drinking water systems purveyors. The Interior Health Authority has four types of public water notifications to inform users of negative impacts to water quality.

8.1. Water Quality Advisory (WQA)

There is some level of risk associated with consuming the drinking water but a *Boil Water Notice* is not needed. The risk is elevated for people with weakened immune systems, the elderly and infants and young children.

No WQAs issued in 2022.

8.2. Boil Water Notice (BWN)

There are organisms in the water that can make you sick. To safely consume (swallow) the water, you must bring it to a rolling boil for at least 60 seconds, or use a safe alternate source of water.

No BWNs issued in 2022.

8.3. Do Not Consume (DNC)

There are harmful chemicals or other bad things in the water that can make you sick. You cannot make the water safe by boiling. The water can make you sick if you consume (swallow) it. You cannot use the water for drinking, brushing teeth, washing/preparing/cooking food or pet's drinking water. You can bath, shower and water plants and gardens with the water.

No DNCs issued in 2022.

8.4. Do Not Use (DNU)

There are known microbial, chemical or radiological contaminants in the water and that any contact with the water with the skin, lungs or eyes can be dangerous. Do not turn on your tap for any reason and do not use your water. You CANNOT make the water safe by boiling it.

No DNUs issued in 2022.

9. Program Updates and Status

9.1. Cross Connection Control Program

The RDOS continued work in 2022 towards implementing an official Cross Connection Control program. In 2021, the RDOS adopted Bylaw No 2851, 2020 Cross Connection Control. Bylaw 2851 is a Regional bylaw that will be applicable to all RDOS owned water systems.

9.2. Capital Works / System Additions

In June of 2022 work commenced on upgrades required for servicing the new Grace Estates 11 lot bare land strata at 4650 North Naramata Rd. A temporary water line was installed on Gulch Rd. and North Naramata Rd. by the developer's contractor in June to accommodate water main upgrades. On July 4th there was a failure in a connection on this temporary line that resulted in significant localized flooding. The contractor conducted the necessary repairs. This temporary line remained in use until the upgraded water mains were tied into the existing system in September. A break with the Grace Estates system on December 24th required isolation until repairs were completed.

The RDOS was also involved in reviewing and commenting on this design provided by the developer for the 41 lot Vista subdivision which included a two booster pumping stations and new storage reservoir.

9.3. Emergency Response Plan

The Emergency Response Plan is scheduled to be updated in 2024.

9.4. Future System Upgrades

No items of note in 2023.

9.5. Supervisory Control and Data Acquisition (SCADA) System Upgrades

No items of note in 2022.

9.6. Source Water Assessment and Protection Plan / Filtration Exclusion

In 2020, Larratt Aquatic Ltd. (West Kelowna) conducted a study to assess the intake in Okanagan Lake that supplies the Naramata water system in order to produce a *Source Water Protection Plan (SWPP)*. Some of the components of this comprehensive study included; the review of historical data (water quality, GIS, LiDAR, land use), field monitoring and sampling, in situ monitoring (temperature, water currents and sediment measurements), and drone surveys.

Historically, surface water sources such as Okanagan Lake have encountered a multitude of factors within their watersheds that have the potential to negatively impact the source water quality. Some examples are logging, agricultural practices, cattle grazing, storm run-off, septic systems and treated wastewater discharges to name a few. Other factors that are becoming more prevalent in recent years are extreme weather events, wildfires and recreational activities.

The Province of BC has produced a *Comprehensive Source-To-Tap Assessment* tool to assist water purveyors in identifying the hazards and vulnerabilities that may threaten the safety and sustainability of a water supply. Completion of the *Assessment Phase* is the first step, followed by the creation of a *Source Water Protection Plan (SWPP)*. A *SWPP* is a living document that quantifies the source water quality, identifies hazards (natural and man-induced) and makes recommendations on protecting the source water quality and prescribes mitigations to help reduce any risks identified. Completion of these documents is part of Provincial regulations and is a requirement of the *Permit-to-Operate* issued for the Naramata water system by the Interior Health Authority (IHA). It should be noted that RDOS does not have jurisdiction over all activities within the watershed therefore mitigation and control of some factors may require the support of Provincial Ministries and/or other municipalities and stakeholders.

Water systems that utilize ultraviolet (UV) treatment and chlorination without filtration are required to apply for a *Filtration Exclusion* from the Interior Health Authority, as is the case with Naramata.

With the *SWPP* now complete, the next step is to have IHA review and provide comments on the *SWPP*. From there it will go to the RDOS Board for further comments and adoption followed by the RDOS developing a *Filtration Exclusion Plan*. The *Filtration Exclusion Plan* will look at the infrastructure required to mitigate the risks identified in the *SWPP*. Upon completion of *Filtration Exclusion Plan* the RDOS will apply to IHA for a *Filtration Exclusion* for the Naramata system.

In 2021 Larratt Aquatic was contracted by the RDOS to investigate the Okanagan Lake turbidity increase observed in August that resulted in a *Water Quality Advisory* for turbidity being issued. The investigation included a ROV (remotely operated vehicle) inspection of the lake intake, assessment of ash contribution to turbidity, field water chemistry, raw intake samples, creek samples, sediment disturbance and turbidity profiles. The findings of this investigation were included in a revision to the *Source Water Protection Plan* that was submitted in February of 2022.

As similar to other years, in 2022 Larratt Aquatic was consulted when increases in the Okanagan Lake turbidity were observed. A number of raw intake water samples from the Naramata Raw Water Pump Station were submitted to Larratt for microscopic algae identification. In addition, a field trip to the Naramata intake was conducted by Larratt on August 12, 2022 which included sampling and a turbidity profile.

9.7. System Maintenance/Upgrades

Both cells of the Juniper reservoir were cleaned, inspected and disinfected on March 15th/22nd, followed by the cleaning, inspection and disinfection of the Mckay reservoir on March 29th.

The Okanagan Lake intake line was inspected by divers on April 21st and reported in good condition based on the visual inspection. The intake screens were inspected and found to be in good condition with minimal organic material which resulted in the screens not being cleaned. The Raw Water Pump Station wet well was also inspected on April 21st. No structural or mechanical points of concern were noted.

A water main realignment was completed in April after the line was damaged in March. The work removed the water main from private property and moved it into the Clark Rd roadway. This realignment was from the intersection of North Naramata Rd., west down Clarke Rd. approximately halfway.

Between May 13th and 16th the UV Treatment system was forced into “Off-Spec” mode due to increase in turbidity reading from Okanagan Lake, above 1 NTU. No Water Quality Advisory issued.

In May the existing 2 inch/50mm main on Rosebud Ave. (Coleman Rd.) was renewed and extended from the intersection with Boothe Rd., north, to include servicing 4225 Rosebud Ave. This included renewing three (3) irrigation services and one (1) domestic service.

9.8. Water Meter Pilot Project

Data continued to be collected on a monthly basis in 2022 from the water meters installed in 2012.

9.9. Water Quality Monitoring Program

The Water Quality Monitoring Program is scheduled to be updated in 2024.

10. Summary

All tested source water parameters from the Okanagan Lake intake supplying the Naramata water system met the applicable criteria in 2022. In addition, in 2023, all tested distribution system parameters with the exception of the locational running annual average for trihalomethanes met the applicable criteria. It should be noted that the health risks from improperly treated surface water sources far outweigh the health risks from disinfection by-products found in properly treated surface water. Areas in the distribution system with low free chlorine residuals were flushed to increase residual levels. The operation of the Naramata UV Water Treatment Plant and distribution system by a team of RDOS *EOCP* certified Operators resulted in the continuous supply of high quality water to the community of Naramata. The RDOS continues to work on reviewing and upgrading the various programs that support facilitating the highest quality of water possible.