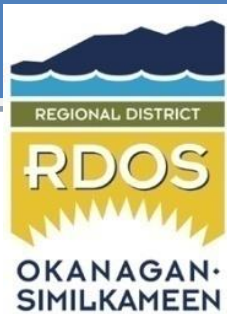


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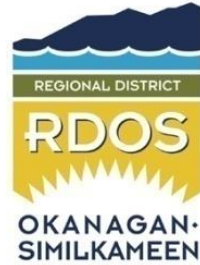
ANNUAL WATER QUALITY MONITORING REPORT NARAMATA WATER SYSTEM



Naramata Water Treatment Plant – UV
Disinfection Vessels

Regional District of Okanagan-Similkameen

November, 2022



**2021 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 2021 *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 Regulation*.

2. System Description

The Naramata water system is located within Electoral Area E, 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 2021.

The Ultraviolet Water Treatment Plant remained classified as a *Level II* Treatment Facility in 2021.

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
1162	X						X	
4194			X					
4840			X				X	
4839		X						X
6926			X					X
8761			X					X
9322		X						X

Table 1: RDOS Operator Certifications 2021

4. Annual Water Usage

The source water for the Naramata water systems is Okanagan Lake. In 2021, a total of 1,733,772m³ was pumped from Okanagan Lake, up from 1,428,857m³ in 2020.

4.1. Consumption Records

	Cubic Meters (m ³)	US Gallons	Date
Annual Total Usage	1,733,772	459,090,345	
Minimum Daily Flow	438	111,440	Feb 08/21
Maximum Daily Flow	18,963	4,410,870	June 30/21

Table 2: Annual Water Consumption 2021

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

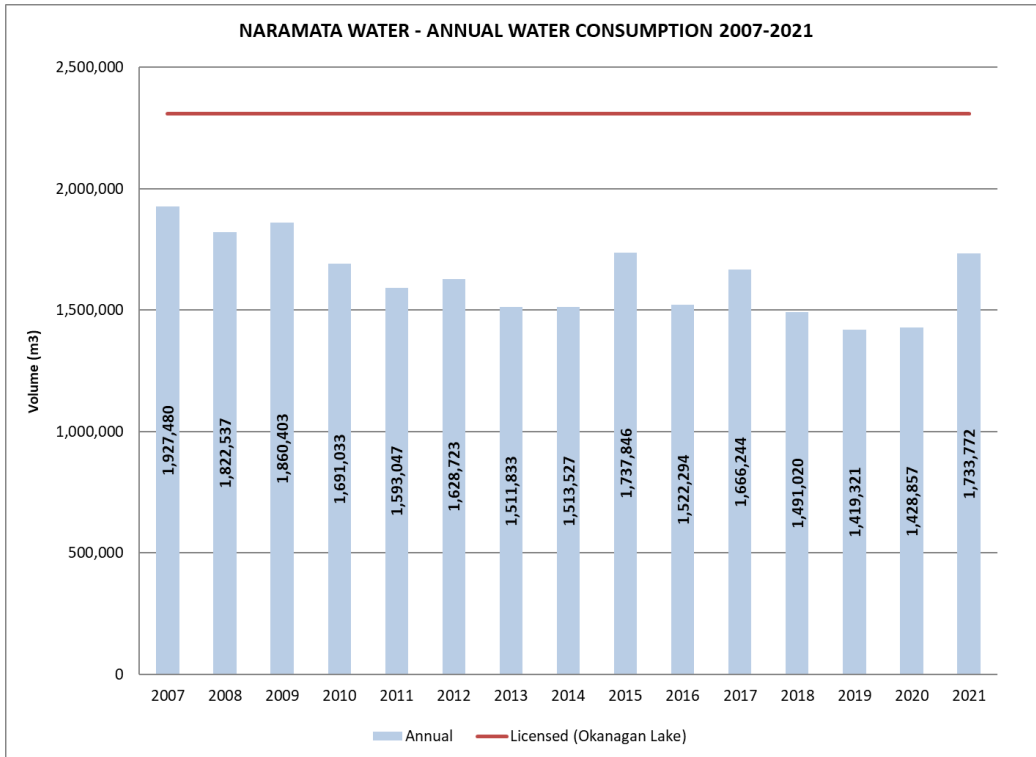


Figure 1: Annual Water Consumption 2007 to 2021

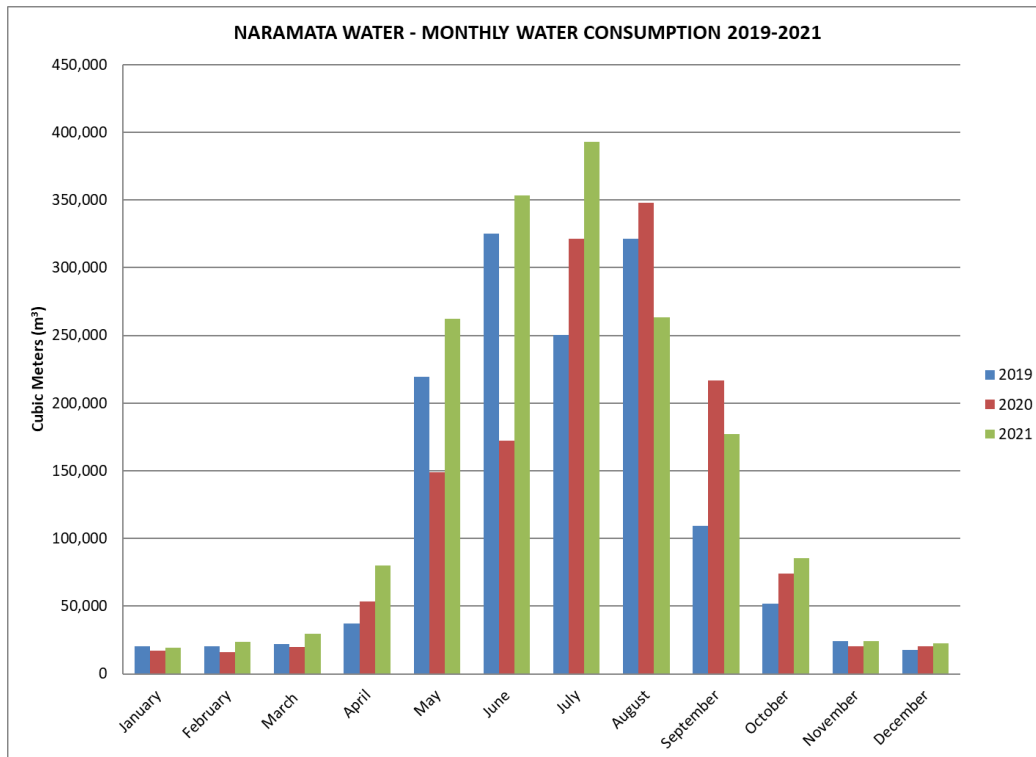


Figure 2: Monthly Water Consumption 2019 - 2021

4.2. Water Conservation

The Naramata water system started under Stage “Normal” water restrictions in 2021. The 2021 Heat Dome was over the Okanagan from late June to mid-July. On July 1st the Naramata water system was experiencing technical issues with meeting the demand for water. As a result users were asked to voluntarily reduce their water consumption by 30%. With the continued heat, by the end of July the decision was made to move all RDOS water systems to Stage 1, which limited watering to two days per week.

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 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 2021 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 2021 online and test kit turbidity data and three year turbidity trend are shown in the following two graphs.

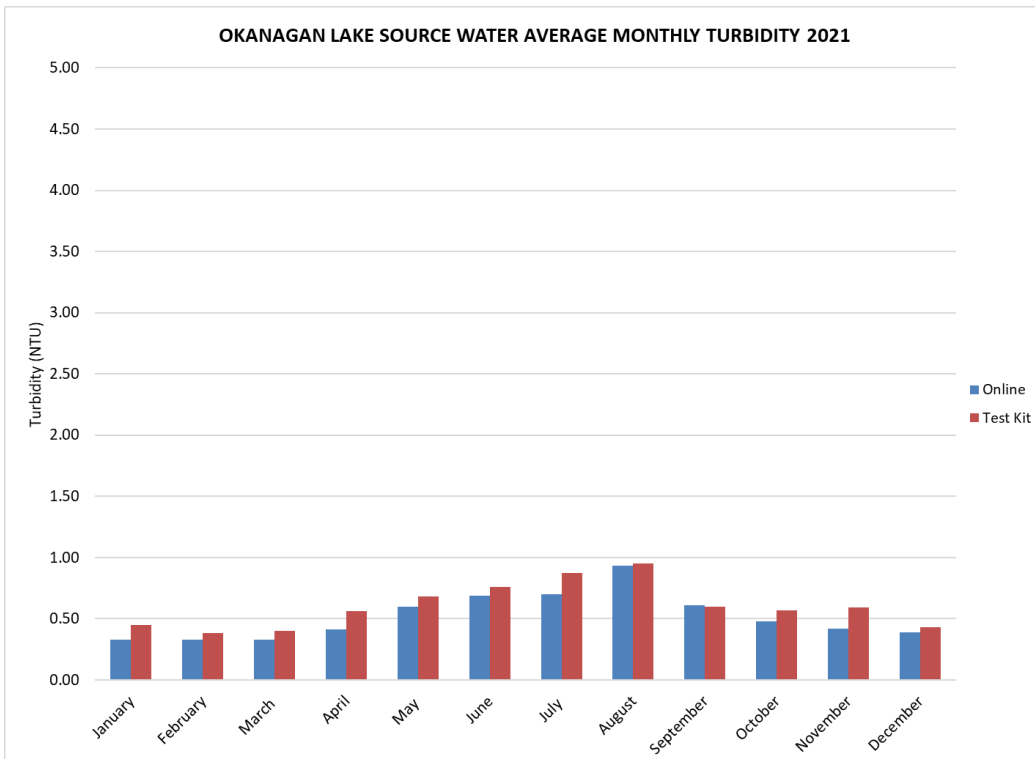


Figure 3: Okanagan Lake Average Monthly Turbidity 2021

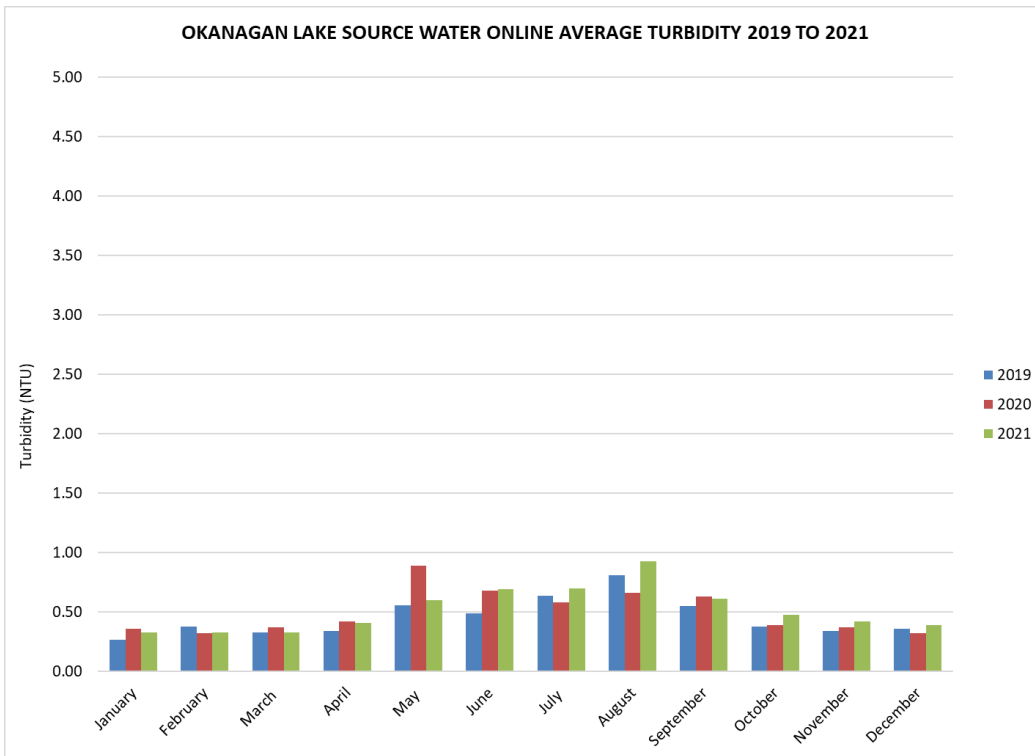


Figure 4: Okanagan Lake Online Average Turbidity 2019 to 2021

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 2021 online and laboratory UV transmittance data and three year UV transmittance trend are shown in the following two graphs.

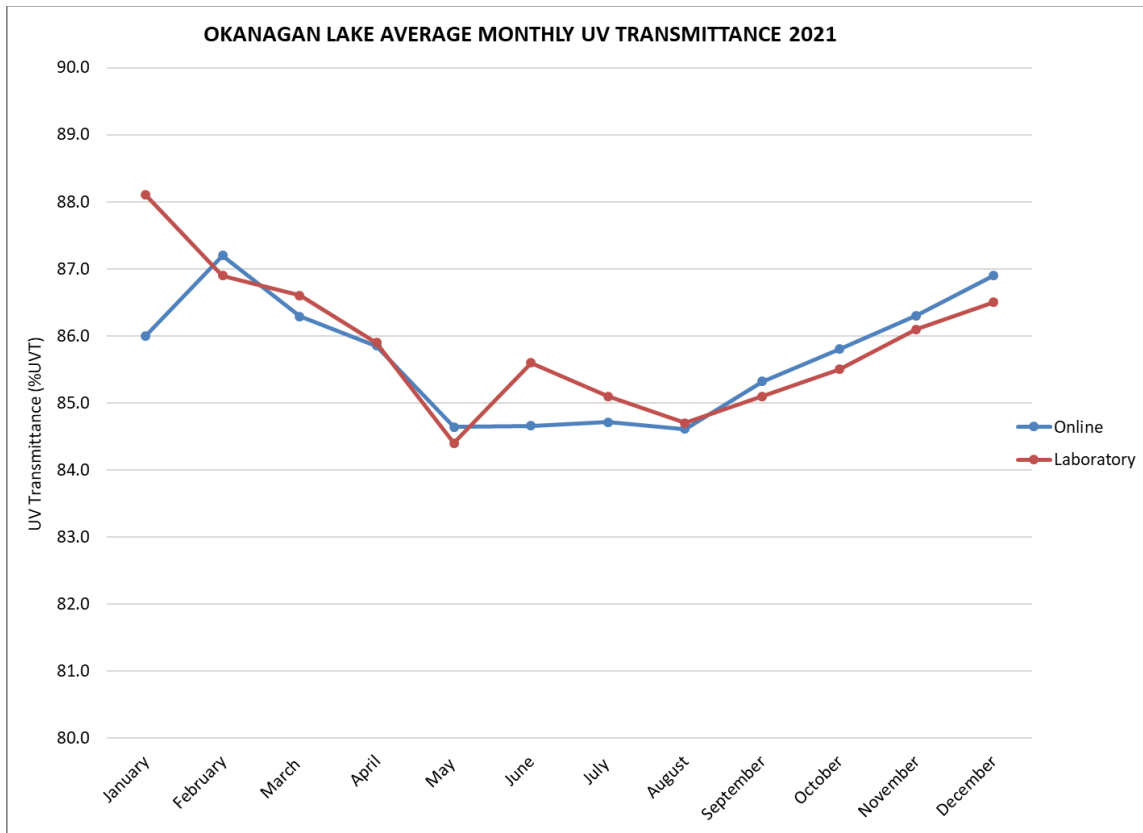


Figure 5: Okanagan Lake Average Monthly UV Transmittance 2021

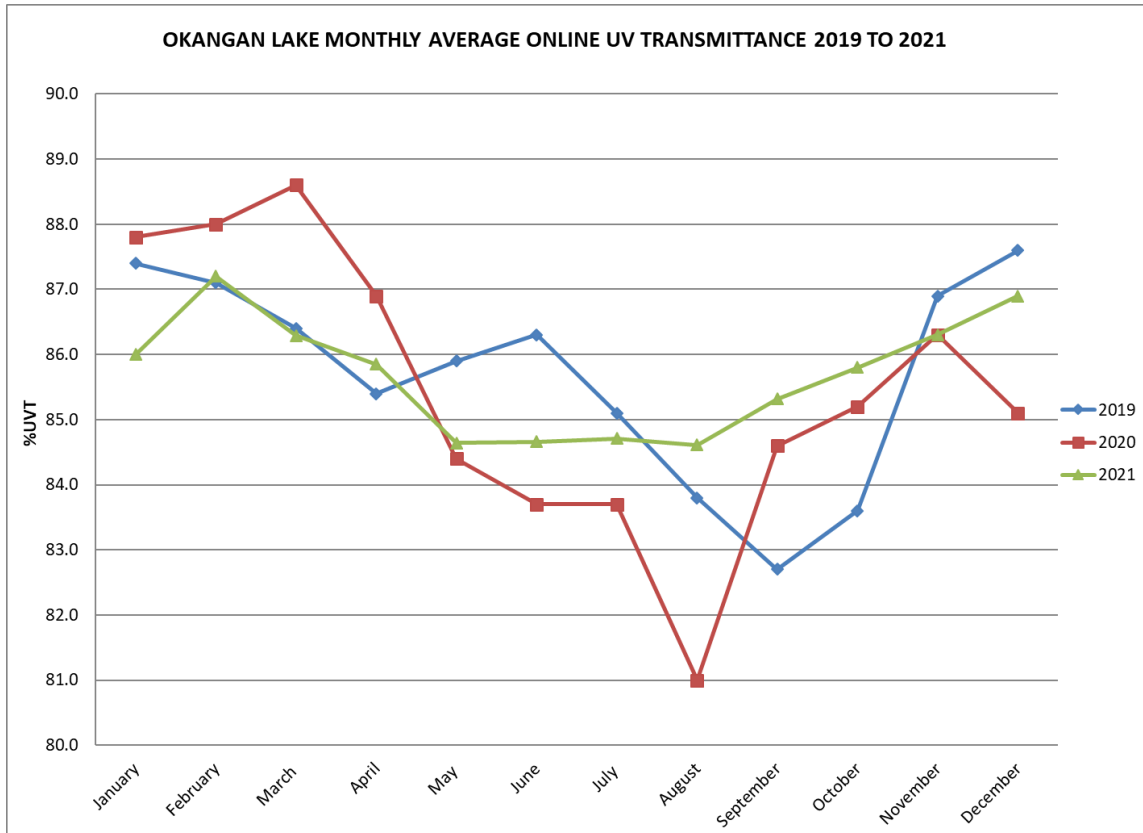


Figure 6: Okanagan Lake Monthly Average Online UV Transmittance 2019 to 2021

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*. 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	298	274	310	50
pH		8.26	7.75	8.57	50
Total dissolved solids	mg/L	211	194	222	50
Temperature	°C	9	4.2	15.1	50
Turbidity	NTU	0.61	0.33	1.11	50
Reading Type: Online Instrument					
Turbidity	NTU	0.59	0.3	2.22	51
Lab Results					
General					
Alkalinity (total, as CaCO ₃)	mg/L	117.9	93.7	136	28
Total organic carbon	mg/L	4.13	3.67	5.23	28
Colour	CU	4.2	<5.0	11	52
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	123	109	138	28
UV transmittance at 254 nm - unfiltered	%	85.1	83.3	88.8	51
Microbiological					
E. coli (counts)	CFU/100 mL	<1	<1	<1	1
E. coli (MPN)	MPN/100 mL	1	1	7	51
Total coliforms (counts)	CFU/100 mL	13	13	13	1
Total coliforms (MPN)	MPN/100 mL	45	1	1120	51
Total Metals					
Calcium (total)	mg/L	32.4	28.6	36.3	28
Magnesium (total)	mg/L	10.1	9.03	11.6	28

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. Only the MPN data was graphed for 2019.

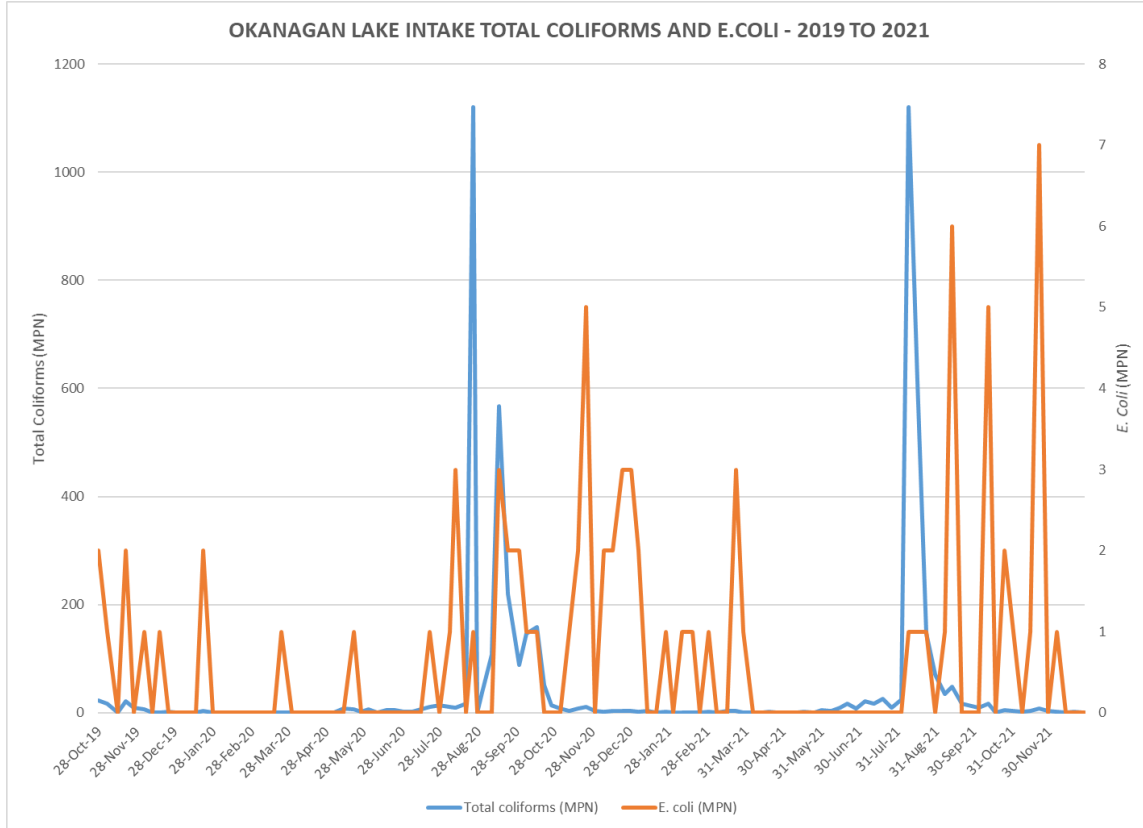


Figure 7: Okanagan Lake Monthly Total Coliform and E.coli 2019 to 2021

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 2021 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. A minimum of five sites are 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 2021, all distribution samples had no detections for Total Coliforms and *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						
E. coli (counts)	CFU/100 mL	<1	<1	<1	257	0
Total coliforms (counts)	CFU/100 mL	<1	<1	<1	257	0

Table 4 Distribution Water Bacteriological Testing Summary for 2021

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 five 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	0.47	0	0.98	28
	Flagstone Rise	mg/L	0.34	0.01	0.96	26
	Hayman Road	mg/L	0.98	0.68	1.35	25
	McPhee Road	mg/L	1.2	1.02	1.44	27
	Noyes and Mariposa Rd	mg/L	0.66	0.14	0.94	26
	NW Office	mg/L	1.01	0.62	1.29	26
	Smethurst PRV	mg/L	0.7	0.13	1.22	25
	South End	mg/L	0.85	0.45	1.13	26
	Upper Debeck	mg/L	0.7	0.21	1.28	25
	Workman Pl Ph 1	mg/L	0.41	0.04	0.83	25

Table 5: Annual Distribution Free Chlorine Residual Summary for 2021

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 five sites were monitored on a weekly basis in conjunction with the bacteriological sampling.

Analyte	Unit	Average	Minimum	Maximum	Number of Results
Field Results					
Conductivity	µS/cm	314	275	338	250
pH		8.32	7.7	8.77	250
Total dissolved solids	mg/L	223	197	240	250
Temperature	°C	11.2	3.6	21.1	249
Turbidity	NTU	0.47	0.17	3.39	253

Table 6: Annual Field Water Quality Parameter Testing Summary for 2021

6.4. Distribution System Disinfection By-Product Monitoring

The following is a summary of the disinfection-by-products laboratory results for the distribution system. The Total Trihalomethanes (THMs) results are 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 with a Maximum Allowable Concentration of 0.100 mg/L (GCDWQ). The Bromodichloromethane results are based on the quarterly results with a Maximum Allowable Concentration (MAC) of 0.016mg/L

6.4.1. Distribution System Quarterly Bromodichloromethane and Total Trihalomethanes

Analyte	Sampling Location	Unit	Average	Minimum	Maximum	Number of Results	Number of Results with Exceedances
Lab Results							
Halogenated Methanes							
Bromodichloromethane	End of Mill Rd	mg/L	0.008	0.0066	0.0108	4	0
	Noyes and Mariposa Rd	mg/L	0.0079	0.0066	0.0089	4	0
	South End	mg/L	0.008	0.0065	0.01	4	0
Total Trihalomethanes	End of Mill Rd	mg/L	0.0908	0.0667	0.132	4	1
	Noyes and Mariposa Rd	mg/L	0.1078	0.0772	0.148	4	3
	South End	mg/L	0.0951	0.0734	0.119	4	1

Table 7: Quarterly Bromodichloromethane and THM Results 2021

6.4.2. Distribution System Annual Locational Running Total Trihalomethane Averages

Sampling Location	Date Sampled	Lab Results
		Halogenated Methanes
		Total Trihalomethanes (LRAA) (calculated)
		mg/L
End of Mill Rd	16-Feb-21	0.0719
End of Mill Rd	25-May-21	0.0822
End of Mill Rd	07-Sep-21	0.077
End of Mill Rd	13-Dec-21	0.0908
Noyes and Mariposa Rd	22-Feb-21	0.102
Noyes and Mariposa Rd	25-May-21	0.0896
Noyes and Mariposa Rd	07-Sep-21	0.109
Noyes and Mariposa Rd	13-Dec-21	0.108
South End	22-Feb-21	0.0941
South End	25-May-21	0.0838
South End	07-Sep-21	0.0871
South End	13-Dec-21	0.0951
GCDWQ MAC		0.100 ^{1.1}

Table 8: Annual THM Locational Running Averages 2021

6.5. Water Quality Complaints

In September a complaint was received of dirty water from the top of Ellis St. Flushing of this dead-end was done to improve water quality.

In October, a resident on Ellis St. indicated that they had noticed an iodine taste after leaving tap water to sit for a few minutes. Crews flushed the watermains in the local area as initial it was thought it may just be stagnant water. Free chlorine was present before flushing at approximately 0.6 mg/L and 0.98 mg/L post flushing. A survey of the owner's private water system was conducted by email with no anomalies present that would possibly be linked to the water quality in the home. This was brought to the attention of the IHA's Drinking Water Officer and the recommendation was made to have the residents consult with their family physician.

7. Source and Distribution Water 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 2021, 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.

7.1. Source Water General Parameters 2021

Analyte	Unit	Guideline		Raw Water Pump 28-Sep-21
		GCDWQ MAC	GCDWQ AO	
Lab Results				
General				
Alkalinity (total, as CaCO ₃)	mg/L	NG	NG	93.7
Total organic carbon	mg/L	NG	NG	3.80
Chloride	mg/L	NG	250	5.40
Colour	CU	NG	15	<5.0
Conductivity	µS/cm	NG	NG	276
Total cyanide	mg/L	0.2 ^{1.1}	NG	<0.0020
Fluoride	mg/L	1.5	NG	0.20
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	NG	NG	118
Langelier Index		NG	NG	0.2
pH		NG	7.0 - 10.5 ^{2.1}	8.14
Sulphate	mg/L	NG	500 ^{2.2}	30.4
Sulphide (total, as S)	mg/L	NG	0.047 ^{2.3}	<0.020
Turbidity	NTU	N ^{1.2}	NG	0.30
UV transmittance at 254 nm - filtered	%	NG	NG	85.0
Nutrients				
Ammonia (total, as N)	mg/L	NG	NG	<0.050
Nitrate (as N)	mg/L	10	NG	0.099
Nitrite (as N)	mg/L	1	NG	<0.010

See Guideline Notes in Section 7.3

Table 9: Okanagan Lake General Potability Parameters 2021

7.2. Source Water General Parameter Summary 2018 to 2020

Analyte	Unit	Guideline		Average	Minimum	Maximum	Number of Results
		GCDWQ MAC	GCDWQ AO				
Lab Results							
General							
Alkalinity (total, as CaCO ₃)	mg/L	NG	NG	115	105	152	88
Total organic carbon	mg/L	NG	NG	4.25	3.07	9.50	93
Chloride	mg/L	NG	250	7.03	4.19	11.9	3
Colour	CU	NG	15	4.3	<5.0	12	159
Conductivity	µS/cm	NG	NG	275	270	281	3
Total cyanide	mg/L	0.2 ^{1.1}	NG	<0.0020	<0.0020	<0.0020	3
Fluoride	mg/L	1.5	NG	0.21	<0.10	0.43	3
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	NG	NG	121	105	141	93
Langelier Index		NG	NG	0.0	-0.5	0.3	3
pH		NG	7.0 - 10.5 _{2.1}	7.88	7.45	8.10	3
Sulphate	mg/L	NG	500 ^{2.2}	27.3	23.7	29.7	3
Sulphide (total, as S)	mg/L	NG	0.047 ^{2.3}				3
Turbidity	NTU	N ^{1.2}	NG	0.77	0.49	1.26	3
UV transmittance at 254 nm - filtered	%	NG	NG	85.8	79.8	88.6	59
UV transmittance at 254 nm - unfiltered	%	NG	NG	84.8	72.9	88.2	155
Nutrients							
Ammonia (total, as N)	mg/L	NG	NG	0.063	0.056	0.068	3
Nitrate (as N)	mg/L	10	NG	0.020	<0.010	0.051	3
Nitrite (as N)	mg/L	1	NG	<0.010	<0.010	<0.010	3

See Guideline Notes in Section 7.3

Table 10: Okanagan Lake General Potability Parameters 2018 to 2020 Summary

7.3. 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).

7.4. Source Water Total Metals 2021

Analyte	Unit	Guideline		Raw Water Pump 28-Sep-21
		GCDWQ MAC	GCDWQ AO	
Lab Results				
Nutrients				
Potassium (total)	mg/L	NG	NG	2.51
Total Metals				
Aluminum (total)	mg/L	2.9 ^{1.1}	0.100 ^{2.1}	0.0139
Antimony (total)	mg/L	0.006	NG	<0.00020
Arsenic (total)	mg/L	0.010 ^{1.2}	NG	<0.00050
Barium (total)	mg/L	2.0 ^{1.3}	NG	0.0224
Boron (total)	mg/L	5	NG	<0.0500
Cadmium (total)	mg/L	0.007 ^{1.4}	NG	0.000013
Calcium (total)	mg/L	NG	NG	31.2
Chromium (total)	mg/L	0.05	NG	<0.00050
Cobalt (total)	mg/L	NG	NG	<0.00010
Copper (total)	mg/L	2 ^{1.5}	1	0.00287
Iron (total)	mg/L	NG	0.3	0.019
Lead (total)	mg/L	0.005 ^{1.6}	NG	<0.00020
Magnesium (total)	mg/L	NG	NG	9.74
Manganese (total)	mg/L	0.12 ^{1.7}	0.02 ^{2.2}	0.00174
Mercury (total)	mg/L	0.001	NG	<0.000010
Molybdenum (total)	mg/L	NG	NG	0.00356
Nickel (total)	mg/L	NG	NG	0.00057
Selenium (total)	mg/L	0.05	NG	<0.00050
Sodium (total)	mg/L	NG	200	12.0
Strontium (total)	mg/L	7.0 ^{1.8}	NG	0.271
Uranium (total)	mg/L	0.02	NG	0.00247
Zinc (total)	mg/L	NG	5.0	0.0049

See Guideline Notes in Section 7.6

Table 11: Okanagan Lake Total Metals Potability 2021

7.5. Source Water Total Metals Summary 2018 to 2020

Analyte	Unit	Guideline		Average	Minimum	Maximum	Number of Results
		GCDWQ MAC	GCDWQ AO				
Lab Results							
Nutrients							
Potassium (total)	mg/L	NG	NG	2.42	2.35	2.47	3
Total Metals							
Aluminum (total)	mg/L	2.9 ^{1.1}	0.100 ^{2.1}	0.0240	0.0093	0.0481	3
Antimony (total)	mg/L	0.006	NG	<0.0020	<0.0020	<0.0020	3
Arsenic (total)	mg/L	0.010 ^{1.2}	NG	0.00054	0.00053	0.00056	3
Barium (total)	mg/L	2.0 ^{1.3}	NG	0.0222	0.0221	0.0225	3
Boron (total)	mg/L	5	NG	0.0197	0.0134	0.0207	3
Cadmium (total)	mg/L	0.007 ^{1.4}	NG	0.000015	<0.000010	0.000023	3
Calcium (total)	mg/L	NG	NG	32.5	27.8	38.0	93
Chromium (total)	mg/L	0.05	NG	0.00042	0.00050	0.00052	3
Cobalt (total)	mg/L	NG	NG	<0.00010	<0.00010	<0.0010	3
Copper (total)	mg/L	2 ^{1.5}	1	0.00324	0.00287	0.00379	3
Iron (total)	mg/L	NG	0.3	0.036	0.018	0.072	3
Lead (total)	mg/L	0.005 ^{1.6}	NG	0.00041	0.00021	0.00076	3
Magnesium (total)	mg/L	NG	NG	9.63	8.60	11.1	93
Manganese (total)	mg/L	0.12 ^{1.7}	0.02 ^{2.2}	0.00217	0.00150	0.00302	3
Mercury (total)	mg/L	0.001	NG	<0.000010	<0.000010	<0.000010	3
Molybdenum (total)	mg/L	NG	NG	0.00353	0.00341	0.00363	3
Nickel (total)	mg/L	NG	NG	0.00062	0.00048	0.00077	3
Selenium (total)	mg/L	0.05	NG	0.00036	<0.00050	0.00059	3
Sodium (total)	mg/L	NG	200	11.4	10.7	12.1	3
Strontium (total)	mg/L	7.0 ^{1.8}	NG	0.280	0.274	0.285	3
Uranium (total)	mg/L	0.02	NG	0.00251	0.00238	0.00264	3
Zinc (total)	mg/L	NG	5.0	0.0083	0.0051	0.0106	3

See Guideline Notes in Section 7.6

Table 12: Okanagan Lake Total Metals Potability 2018-2020 Summary

7.6. 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.

7.7. Distribution Water General Parameters 2021

Analyte	Unit	Guideline		Sampling Location Date Sampled South End 28-Sep-21
		GCDWQ MAC	GCDWQ AO	
		Lab Results		
General				
Alkalinity (total, as CaCO ₃)	mg/L	NG	NG	122
Total organic carbon	mg/L	NG	NG	3.97
Chloride	mg/L	NG	250	9.52
Colour	CU	NG	15	<5.0
Conductivity	µS/cm	NG	NG	288
Total cyanide	mg/L	0.2 ^{1.1}	NG	<0.0020
Fluoride	mg/L	1.5	NG	0.20
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	NG	NG	116
Langelier Index		NG	NG	0.3
pH		NG	7.0 - 10.5 ^{2.1}	8.17
Total dissolved solids (computed)	mg/L	NG	500	172
Sulphate	mg/L	NG	500 ^{2.2}	30.4
Sulphide (total, as S)	mg/L	NG	0.047 ^{2.3}	<0.020
Turbidity	NTU	N ^{1.2}	NG	0.32
UV transmittance at 254 nm - unfiltered	%	NG	NG	88.6
Nutrients				
Ammonia (total, as N)	mg/L	NG	NG	0.099
Nitrate (as N)	mg/L	10	NG	0.038
Nitrite (as N)	mg/L	1	NG	<0.010

See Guideline Notes in Section 7.3

Table 13: Distribution General Potability Parameters 2021

7.8. Distribution Water General Parameter Summary 2018 to 2020

Analyte	Unit	Average	Minimum	Maximum	Number of Results
Lab Results					
General					
Alkalinity (total, as CaCO ₃)	mg/L	112	111	113	3
Total organic carbon	mg/L	4.88	3.92	7.73	5
Chloride	mg/L	10.47	7.41	14.9	3
Colour	CU	<5.0	5.0	5.0	3
Conductivity	µS/cm	291	287	294	3
Total cyanide	mg/L	<0.0020	<0.0020	<0.0020	3
Fluoride	mg/L	0.24	0.15	0.37	3
Hardness (as CaCO ₃), from total Ca/Mg	mg/L	120	117	125	3
Langelier Index		0.0	-0.5	0.3	3
pH		7.87	7.39	8.13	3
Total dissolved solids (computed)	mg/L	166	164	168	3
Sulphate	mg/L	27.4	23.7	29.8	3
Sulphide (total, as S)	mg/L	<0.020	<0.020	<0.020	3
Turbidity	NTU	0.37	0.20	0.53	3
UV transmittance at 254 nm - filtered	%	89.3	88.2	90.1	3
UV transmittance at 254 nm - unfiltered	%	88.9	88.6	89.2	2
Nutrients					
Ammonia (total, as N)	mg/L	0.046	0.039	0.060	3
Nitrate (as N)	mg/L	0.039	<0.010	0.095	3
Nitrite (as N)	mg/L	<0.010	<0.010	<0.010	3

See Guideline Notes in Section 7.3

Table 14: Distribution General Potability Parameters 2018 to 2020 Summary

7.9. Distribution Water General Parameter Summary 2018 to 2020

Analyte	Unit	Guideline		Sampling Location Date Sampled South End 28-Sep-21
		GCDWQ MAC	GCDWQ AO	
Lab Results				
Nutrients				
Potassium (total)	mg/L	NG	NG	2.57
Total Metals				
Aluminum (total)	mg/L	2.9 ^{1.1}	0.100 ^{2.1}	0.0110
Antimony (total)	mg/L	0.006	NG	<0.00020
Arsenic (total)	mg/L	0.010 ^{1.2}	NG	<0.00050
Barium (total)	mg/L	2.0 ^{1.3}	NG	0.0226
Boron (total)	mg/L	5	NG	<0.0500
Cadmium (total)	mg/L	0.007 ^{1.4}	NG	<0.000010
Calcium (total)	mg/L	NG	NG	30.3
Chromium (total)	mg/L	0.05	NG	<0.00050
Cobalt (total)	mg/L	NG	NG	<0.00010
Copper (total)	mg/L	2 ^{1.5}	1	0.0110
Iron (total)	mg/L	NG	0.3	0.014
Lead (total)	mg/L	0.005 ^{1.6}	NG	0.00028
Magnesium (total)	mg/L	NG	NG	9.81
Manganese (total)	mg/L	0.12 ^{1.7}	0.02 ^{2.2}	0.00121
Mercury (total)	mg/L	0.001	NG	<0.000010
Molybdenum (total)	mg/L	NG	NG	0.00362
Nickel (total)	mg/L	NG	NG	0.00053
Selenium (total)	mg/L	0.05	NG	<0.00050
Sodium (total)	mg/L	NG	200	15.3
Strontium (total)	mg/L	7.0 ^{1.8}	NG	0.273
Uranium (total)	mg/L	0.02	NG	0.00253
Zinc (total)	mg/L	NG	5.0	0.0062

See Guideline Notes in Section 7.5

Table 15: Distribution General Potability Parameters 2021

7.10. Distribution Water Total Metals Summary 2018 to 2020

Analyte	Unit	Guideline		Average	Minimum	Maximum	Number of Results
		GCDWQ MAC	GCDWQ AO				
Lab Results							
Nutrients							
Potassium (total)	mg/L	NG	NG	2.51	2.38	2.70	3
Total Metals							
Aluminum (total)	mg/L	2.9 ^{1.1}	0.100 ^{2.1}	0.0106	0.0077	0.0150	3
Antimony (total)	mg/L	0.006	NG	<0.0020	<0.0020	<0.0020	3
Arsenic (total)	mg/L	0.010 ^{1.2}	NG	0.00061	0.00055	0.00069	3
Barium (total)	mg/L	2.0 ^{1.3}	NG	0.0231	0.0222	0.0244	3
Boron (total)	mg/L	5	NG	0.0192	0.0146	0.0181	3
Cadmium (total)	mg/L	0.007 ^{1.4}	NG	0.000007	<0.000010	0.000010	3
Calcium (total)	mg/L	NG	NG	32.0	31.1	33.8	3
Chromium (total)	mg/L	0.05	NG	0.00036	<0.00050	0.00057	3
Cobalt (total)	mg/L	NG	NG	<0.00010	<0.00010	<0.00010	3
Copper (total)	mg/L	2 ^{1.5}	1	0.03025	0.00595	0.0568	3
Iron (total)	mg/L	NG	0.3	0.010	<0.010	0.015	3
Lead (total)	mg/L	0.005 ^{1.6}	NG	0.00033	0.00030	0.00035	3
Magnesium (total)	mg/L	NG	NG	9.81	9.55	10.1	3
Manganese (total)	mg/L	0.12 ^{1.7}	0.02 ^{2.2}	0.00138	0.00111	0.00163	3
Mercury (total)	mg/L	0.001	NG	<0.000010	<0.000010	<0.000010	3
Molybdenum (total)	mg/L	NG	NG	0.00374	0.00357	0.00393	3
Nickel (total)	mg/L	NG	NG	0.00060	0.00052	0.00069	3
Selenium (total)	mg/L	0.05	NG	0.00047	<0.00050	0.00062	3
Sodium (total)	mg/L	NG	200	14.6	14.2	14.9	3
Strontium (total)	mg/L	7.0 ^{1.8}	NG	0.290	0.281	0.304	3
Uranium (total)	mg/L	0.02	NG	0.00255	0.00244	0.00271	3
Zinc (total)	mg/L	NG	5.0	0.0039	<0.0040	0.0052	3

See Guideline Notes in Section 7.7

Table 16: Distribution Total Metals Potability 2018-2020 Summary

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.

On July 31st, 2021 a *Water Quality Advisory* was issued in response to source water turbidity levels in Okanagan Lake increasing above 1 NTU. This WQA remained in effect until September 1st, 2021.

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 2021.

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 2021.

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 2021.

9. Program Updates and Status

9.1. Cross Connection Control Program

The RDOS continued work in 2021 towards implementing an official Cross Connection Control program and bylaw. On January 21, 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 and operated water systems.

9.2. Capital Works / System Additions

None to report.

9.3. Emergency Response Plan

The Emergency Response Plan is scheduled to be updated in 2022.

9.4. Future System Upgrades

In 2021 the RDOS initiated preliminary design work on the expansion of the Juniper storage reservoir in anticipation of applying for Federal grant funding in 2022.

9.5. Supervisory Control and Data Acquisition (SCADA) System

A SCADA system is an integral part of a modern water system. It is comprised of sensors, programmable controllers, communications and network devices installed at pump stations and treatment facilities. The SCADA system controls equipment such as pumps and monitors system operations while storing important data such as intake turbidity levels, pumping flow rates, and storage reservoir levels. The system also provides for efficiencies in operation and the response to system failures. This is achieved by the ability to monitor and view the system remotely through a software package along with the generation of alarms that will notify the system Operators when there is a problem or failure within a system.

In 2020 the RDOS had a consultant develop a SCADA Master Plan. This plan will assist with upgrades to the existing SCADA network along with providing a detailed plan on how to move forward into the future in an efficient manner.

In 2021 the RDOS implemented a new SCADA software package. This include new graphics that conformed to the specifications outlined in the Master Plan along with enhanced security for remote access and improved data trending capabilities.

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.

9.7. System Maintenance/Upgrades

In February 2021, two key Programmable Logic Controllers (PLCs) were upgraded at the Naramata Water Treatment Plant as per the SCADA Master Plan.

An ROV inspection was conducted in August 2021 to determine if there was damage to the Okanagan Lake intake that was resulting in the increased turbidity. No damage was noted.

9.8. Water Meter Pilot Project

Data continued to be collected on a monthly basis in 2021 from the water meters installed in 2012.

9.9. Water Quality Monitoring Program

The Water Quality Monitoring Program is scheduled to be updated in 2022.

10. Summary

All tested source water parameters from the Okanagan Lake supplying the Naramata water system met the applicable criteria with the exception of turbidity which resulted in a *Water Quality Advisory* being issued. All tested tread distribution water parameters met the applicable criteria in 2021. Areas 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.