GLENMORE-ELLISON IMPROVEMENT DISTRICT

2018 Annual Water Quality Report

Author unknown

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INTRODUCTION

The Glenmore Ellison Improvement District continually strives to provide high quality drinking water to its rate payers through responsible operation, monitoring, evaluation and management of its water system.

As required by the British Columbia Drinking Water Protection Act and Regulation, the Glenmore Ellison Improvement District (GEID) provides the following Annual Report that includes:

- System Description
- Source Assessment Synopsis
- Annual consumption data
- Water Quality Results
- Updates to Water System Assessment and Capital Works Plan
- Updates to Water Monitoring Plan
- Updates to Emergency Response Plan
- Provide Environmental Operators Certification Program updates

This report also describes where your water comes from, how it is distributed, and how we ensure it is safe to drink. The information in this report will allow people, especially those with special health needs to be better informed about their drinking water. Please contact GEID (250)-763-6506 or email dwilliams@geid.org if you have any questions.

This report discusses water quality parameter with potential health effects. For more information on drinking water health effects, the following websites are suggested.

Health Canada

https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water.html

US EPA

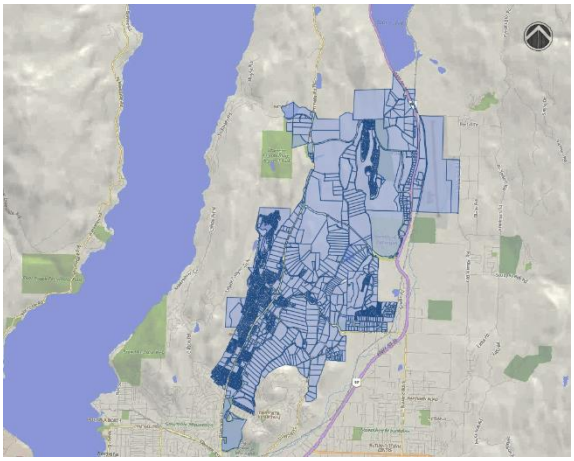
http://www.epa.gov/safewater/mcl.html

World Health Organization

http://www.who.int/water_sanitation_health/publications/2011/dwq_guidelines/en/index.html

The annual report covers the period from January 1st, 2018 to December 31st, 2018.

GLENMORE ELLISON IMPROVEMENT DISTRICT - DRINKING WATER SYSTEM



District Map

The Glenmore-Ellison Improvement District (GEID) is one of four main water purveyors in Kelowna, British Columbia. The District boundaries extend across an area of approximately 3,694 hectares (36.94 km^2, or 9,127.877 acres). Of the 1,750 hectares (4,330 acres) serviced with water 829 hectares are bonafide agricultural land. GEID supplies water to approximately 8,083 residential service connections, serving an estimated population of 20,000 people.

The distribution system consists of two distinct geographical areas, Glenmore and Ellison.

The Glenmore Distribution System receives water directly from Okanagan Lake (October 10th, 2017). The Glenmore distribution system begins at the intake on Okanagan Lake where the Joe Bulach Pump Station pumps raw water directly to the McKinley UV plant where it is treated then chlorinated and finally pumped into the 9ML Rojem Clearwell a two-cell concrete reservoir. There are eight other balancing reservoirs in the Glenmore distribution system, namely the Union Road, Big Rock, Scenic Road, Quail Ridge, 640, Shayler, Arthur Ct. and UBCO Reservoirs.

Okanagan Lake

McKinley Landing also receives treated water from the Glenmore distribution system. The old intake for McKinley landing @ Dewdney P/S has been shut down and now acts as a back-up water source in case of emergency.

Mill Creek Intake

Ellison currently has a modified distribution system. (Map 1.0) The majority of properties in Ellison are now serviced from the Glenmore Distribution System and receive water from Okanagan Lake (properties shown in blue).

The detailed design for the of the final phase of the Ellison Separation Project is underway. This project will see the separation of agricultural and domestic water, in order to supply clean, clear Okanagan Lake Water for domestic purposes to the remainder of 113 properties in Ellison. Creek water will only be used for the agricultural supply.

Kelowna Creek, which is drawn from an intake pond, and then passed through a coarse screen and piped to the Postill Pump Station and Reservoir, the head-works of the Ellison system. The Ellison distribution system includes a 2,000 m^3 enclosed concrete reservoir and pump-house equipped with a chlorine gas injection system. There are three wells in the Ellison system which include Airport Wells #1(inactive) and #2(Inactive) and the Ellison Well (inactive). Currently the

modified Ellison system is gravity supplied from Kelowna Creek which supplies part of the Ellison distribution system. However, the Airport wells #1 and #2 are currently not being utilized and will be used as a back-up source if needed. The Ellison well will be used to supply supplemental water to the upper zone of the Ellison system (properties shown in yellow) depending on system demand in the future. The Glenmore-Ellison Improvement District operates with a total of six interconnections with other adjacent water suppliers to provide an alternate supply of water in event of an emergency situation. Two of the six interconnections are with the Black Mountain Irrigation District water system and the remaining four are with the City of Kelowna water system.

Map 1.0 - Modified Ellison Distribution System

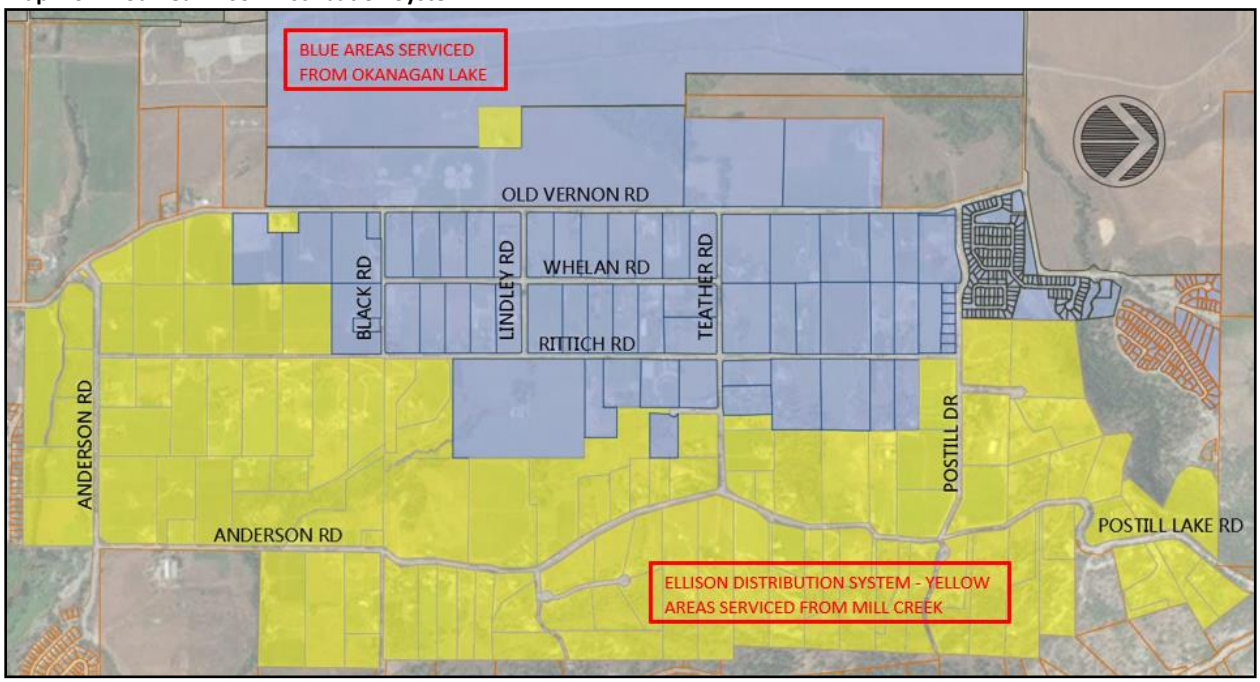


Table 1.0 - Non-Separated Address's

3510 ANDERSON RD	5274 ANDERSON RD	4291 BLACK RD	6221 POSTILL LAKE RD
3660 ANDERSON RD	5290 ANDERSON RD	4315 BLACK RD	6260 POSTILL LAKE RD
3675 ANDERSON RD	5371 ANDERSON RD	4333 BLACK RD	6320 POSTILL LAKE RD
3727 ANDERSON RD	5390 ANDERSON RD	4431 BLACK RD	6357 POSTILL LAKE RD
3750 ANDERSON RD	5450 ANDERSON RD	4450 BLACK RD	6503 POSTILL LAKE RD
3811 ANDERSON RD	5481 ANDERSON RD	4451 BLACK RD	4561 RITTICH RD
3820 ANDERSON RD	5530 ANDERSON RD	4521 BLACK RD	4771 RITTICH RD
3921 ANDERSON RD	5571 ANDERSON RD	5014 BOOTH RD	4801 RITTICH RD
4120 ANDERSON RD	5580 ANDERSON RD	5031 BOOTH RD	4751 TEATHER CRT
4121 ANDERSON RD	5630 ANDERSON RD	6105 FATHERS PL	4730 TEATHER RD
4170 ANDERSON RD	5671 ANDERSON RD	6127 FATHERS PL	4790 TEATHER RD
4210 ANDERSON RD	5675 ANDERSON RD	3911 OLD VERNON RD	4791 TEATHER RD
4280 ANDERSON RD	5731 ANDERSON RD	4053 OLD VERNON RD	5020 WHITETAIL DR
4350 ANDERSON RD	5760 ANDERSON RD	4401 OLD VERNON RD	5025 WHITETAIL DR
4425 ANDERSON RD	5771 ANDERSON RD	4665 POSTILL DR	5152 WHITETAIL DR
4475 ANDERSON RD	5777 ANDERSON RD	4720 POSTILL DR	5157 WHITETAIL DR
4490 ANDERSON RD	5781 ANDERSON RD	4775 POSTILL DR	5284 WHITETAIL DR
4610 ANDERSON RD	5831 ANDERSON RD	5955 POSTILL LAKE RD	5289 WHITETAIL DR
4660 ANDERSON RD	5850 ANDERSON RD	6030 POSTILL LAKE RD	5115 WHITETAIL RD

4781 ANDERSON RD	5861 ANDERSON RD	6051 POSTILL LAKE RD	
4787 ANDERSON RD	5951 ANDERSON RD	6091 POSTILL LAKE RD	
4851 ANDERSON RD	4150 BLACK RD	6131 POSTILL LAKE RD	
4891 ANDERSON RD	4151 BLACK RD	6160 POSTILL LAKE RD	
4918 ANDERSON RD	4240 BLACK RD	6161 POSTILL LAKE RD	
4951 ANDERSON RD	4261 BLACK RD	6191 POSTILL LAKE RD	
5210 ANDERSON RD	4281 BLACK RD	6220 POSTILL LAKE RD	

SOURCE ASSESSMENT SYNOPSIS

In October 2017, the McKinley open bodied reservoir was taken off line and completely bypassed and the District began pumping Okanagan lake water to supply the Glenmore distribution area. This includes the Glenmore Valley, the Sexsmith area, UBCO, the Kelowna Airport and Quail Ridge. GEID's intake now provides solely Okanagan Lake water to the Glenmore distribution system which includes McKinley Landing and parts of the Ellison distribution system. The intake is currently the deepest intake on Okanagan Lake, and is situated in a desirable location, with low turbidity distant from local valley creeks and less impact from seasonal fluctuations.

By utilizing low turbidity water from deep within Okanagan Lake, along with the state-of-the-art UV disinfection facility, GEID is providing safe, cost effective, high quality drinking water that meets Canadian Guidelines year-round and the drinking Water Treatment Objectives for Surface Water Supplies in BC.

Works completed in 2018 include Phase One and Two of the Ellison Separation Project (See Map 1.0)

UPDATES TO WATER MONITORING PLAN

In 2018, GEID continued to monitor its water supply with a Water Quality Sampling Program that was previously approved by IH in 2011. The monthly reports submitted to IH contain detailed information on sampling locations, sampling frequency, bacteriological testing results, chlorine residuals, operational activities, treatment objectives achieved, customer complaints and response, variances of normal operation and monthly laboratory results.

During 2018 GEID developed a new Water Quality Monitoring Plan to monitor the better quality of water the Okanagan Lake pump station provides to the Glenmore distribution system (waiting approval).

The goals of the sampling program are to:

- meet or exceed the minimum sampling frequency for microbiological parameters set out in the BC Drinking Water Protection Regulation.
- update general water quality parameters such as dissolved iron and manganese on a periodic basis

- assess source water quality. This includes an assessment of reservoir lake conditions which will be completed by a consultant. The consultant conducts ongoing sampling to identify microorganisms such as algae in the lakes, and nutrient conditions that can affect water quality; and
- assess quality of water delivered to customers. This includes measurement of parameters that directly impact water quality, such as disinfection by-products, and measurement for parameters that are indirectly related to water system maintenance.

GEID continued to work on improving the reliability of online instrumentation and real-time monitoring in 2018.

REGULATORY REQUIREMENTS

Several projects GEID has implemented over the past 5 years include those that are related to water quality improvements. Interior Health (IH) requires all water suppliers meet Drinking Water Objectives for Surface Water Supplies in BC. This means provide drinking water that meets the following objectives:

- 4 log inactivation of viruses;
- 3 log removal or inactivation of *Giardia lamblia* and Cryptosporidium;
- 2 treatment processes for all surface drinking water systems;
- 1 refers to less than 1 NTU of turbidity with a target of 0.1 NTU;
- 0 Total Coliforms and E coli.

There are a number of treatment options available to meet these objectives. Selection of the appropriate treatment depends on several factors that include the raw water characteristics.

The following Table 2.0 illustrates the GEID's disinfection system met the bacteriological standards for potable water as set out in schedule A of the Drinking Water Protection Regulation.

Table 2.0 - Treated Water Microbiological (Bacteria)

Parameter	Number of Samples	Number of Exceedances	Drinking Water Regulations
Total Coliforms	781	0	0 counts per 100 (ml)
E. coli	781	0	0 counts per 100 (ml)

Table 3.0 - Water Quality Standards for Potable Water

Parameter	Standard
Escherichia Coli	No detectable Escherichia Coli per 100 ml
Total Coliform Bacteria	At least 90% of samples have no detectable total coliforms bacteria per 100ml and no sample has more than 10 total coliform bacteria per 100 ml

*GEID has 100% of samples with no detectable Total Coliforms.

WATER QUALITY MONITORING

Water sampling and testing is carried out regularly at source and distribution piping systems to ensure the drinking water remains safe and meets legislated drinking water requirements.

The Guidelines for Canadian drinking water quality are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and the availability of treatment and analytical techniques. Operational considerations are factored in when the presence of a substance may interfere with or impair a treatment process or technology (e.g. turbidity interfering with chlorination) or adversely affect drinking water infrastructure (e.g. corrosion in pipes).

In general, the highest priority guidelines are those dealing with microbiological contaminants such as bacteria, protozoa and viruses. Any measures taken to reduce concentrations of chemical contaminants should not compromise the effectiveness of disinfection.

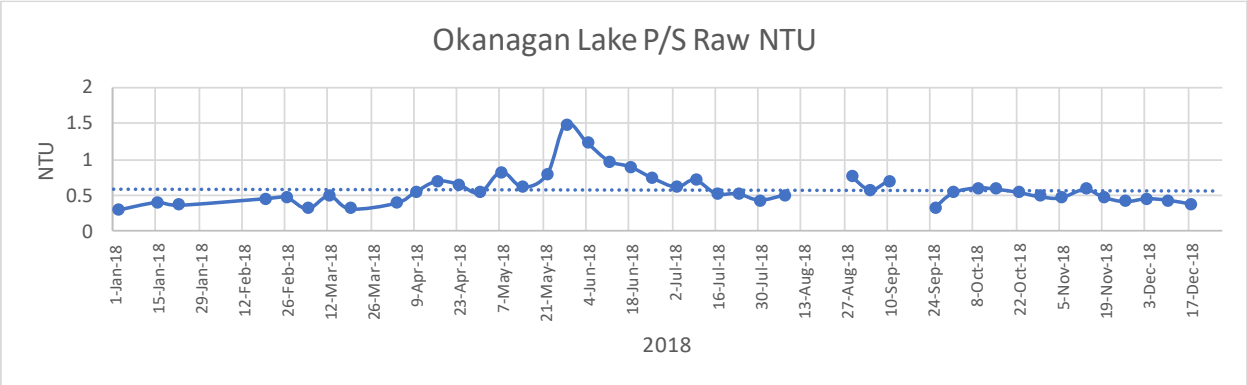
The GEID's water quality sampling and testing program has been set up in conjunction with the Interior Health Authority. The program samples water quality at source, reservoirs, test stations, dead end watermains, and various pressure zones.

Collected water samples are uniquely identified and sent to a provincially approved laboratory for testing. Test results are uploaded by the lab into (WaterTrax) a data management system.

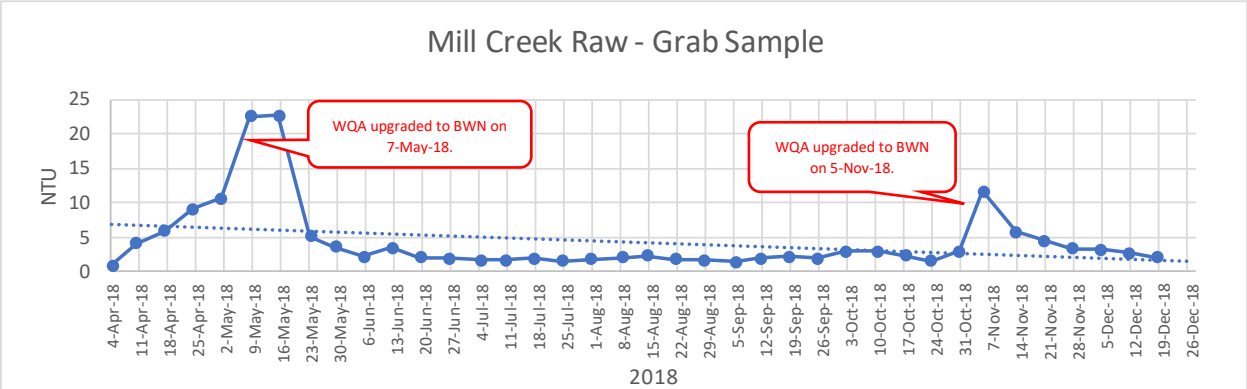
According to the guidelines for Canadian Drinking Water Quality parameters are either health based and listed as *Maximum Acceptable Concentrations (MAC),* based on aesthetic considerations and listed as *Aesthetic Objectives (AO)* or established based on operational considerations and listed as *Operational Guidance Values (OG).*

The GEID's water turbidity is continuously measured and monitored at several points within the water systems. The following (Graph 1.0) illustrates turbidity from the Okanagan Lake pump station at source (raw grab sample) measured at the point right before it is pumped 3.5 km to be treated by UV and chlorinated. (Graph 2.0) illustrates turbidity grab samples taken at source where kelowna Creek meets Mill Creek at the intake pond for the Ellison distribution system.

Graph 1.0 - Raw Grab Samples from Source



Graph 2.0 - Raw Grab Samples from Mill Creek Source



The Guidelines for Canadian Drinking Water Quality recommends a maximum acceptable concentration (MAC) of 1.0 Nephelometric Turbidity unit (NTU) and to ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less. Particles can harbour microorganisms, protecting them from disinfection. Periodic turbidity spikes do happen and cannot last for more than 24 hours without going on a WQA or BWN.

The Glenmore Ellison Improvement District's water is typically moderately hard to hard 120-124 (mg/L). In Okanagan Lake there is natural calcium and magnesium as well as natural limestone in the Okanagan valley that contributes to the hardness of our source water. An indicator of having hard water in your home means it will take more soap to form a lather and a slight scum will appear while washing. Hard water can also form a limescale on the inside of kettles and water fittings. Hard water is not a health concern and is perfectly safe for consumption.

Table 4.0 - Hard/Soft Water Classification

Classification	Hardness (mg/L)	Hardness (grains/gal)
Soft	0-60	0-3.5
Moderately Hard	61-120	3.5-7.0
Hard	121-180	7.0-10.5
Very Hard	>180	>10.5

*17.1 grains/gal = 1 mg/L

WATER QUALITY RESULTS

Table 5.0 - Raw and Treated Water Quality

Parameter	Units	4-Sep-18	4-Sep-18	4-Sep-18	4-Sep-18	Objective
		Glenmore		Ellison		
		Ok lake P/S (Raw)	Union Rd. Post Reservoir	Mill Creek (Raw)	Postill Rd. T/S	
Anions						
Alkalinity, Total as $CaCO_3$	mg/L	112	111	25.8	13.8	
Chloride	mg/L	4.85	6.75	1.7	8.87	AO≤250
Fluoride	mg/L	0.2	0.16	0.11	0.1	MAC = 1.5
Nitrogen, Nitrate as N	mg/L	0.084	0.083	<0.010	0.086	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	<0.010	MAC = 1
Sulfate	mg/L	30.3	29.3	2.9	2.8	AO≤500
General Parameters						
Colour, True		6	<5.0	57	20	AO≤15
Conductivity	uS/cm	282	282	58.8	65.1	
Cyanide, total		<0.0020	<0.0020	<0.0020	<0.0020	MAC = 0.2
pH		7.46	7.05	6.88	6.48	AO = 6.5-8.5
Turbidity	NTU	0.56	0.24	21.9	0.86	MAC = 1.0
Hardness, Total (as $CaCO_3$)	mg/L	125	122	26.1	24.8	
Solids, Total Dissolved	mg/L	161	160	32.5	32.1	AO≤500
Total Recoverable Metals						
Aluminum	mg/L	0.0262	0.0078	0.0972	0.0887	MAC=9.5
Antimony	mg/L	<0.00020	<0.00020	<0.00020	<0.0020	MAC = 0.006
Arsenic	mg/L	0.00055	0.00054	<0.00050	<0.00050	MAC = 0.01
Barium	mg/L	0.0226	0.0219	<0.0050	<0.0050	MAC = 1
Boron	mg/L	0.0126	0.0121	0.0071	<0.0050	MAC = 5
Cadmium	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	MAC = 0.005
Calcium	mg/L	33.6	32.9	6.88	6.57	N/A
Chromium	mg/L	<0.00050	<0.00050	<0.00050	0.0005	MAC = 0.05
Cobalt	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	N/A
Copper	mg/L	0.00413	0.00199	0.00125	0.00978	AO = ≤ 1
Iron	mg/L	0.039	0.017	0.242	0.216	AO=0.3
Lead	mg/L	0.00093	<0.00020	<0.00020	<0.00020	MAC = 0.01
Magnesium	mg/L	9.95	9.58	2.16	2.03	N/A
Manganese	mg/L	0.0051	0.00149	0.00689	0.0073	AO = ≤ 0.05
Mercury	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	MAC = 0.001
Molybdenum	mg/L	0.00367	0.00359	0.00037	0.00035	MAC=0.25
Nickel	mg/L	0.00041	<0.00040	0.00073	0.0008	N/A
Potassium	mg/L	2.39	2.31	0.81	0.77	N/A
Selenium	mg/L	0.0005	0.00051	<0.00050	<0.00050	MAC = 0.01
Sodium	mg/L	11.7	11.4	2.29	2.17	AO = ≤ 200
Strontium	mg/L	0.288	0.281	0.046	0.0443	N/A
Uranium	mg/L	0.00256	0.00256	0.000081	0.000073	MAC = 0.02
Zinc	mg/L	<0.0040	<0.0040	<0.0040	<0.0040	AO = ≤ 5
Microbiological Parameters						
Coliforms, Total	CFU/100ml	<1	<1	320	<1	MAC <1
E. Coli	CFU/100ml	<1	<1	12	<1	< 10 E. coli/100ml;90th percentile (minimum 5 samples)

AO: Aesthetic Objective
MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.

Table 6.0 - Watershed 0.5 m - Raw Properties

Parameter	Units	Bulman	South	Postill	Objective
Depth	meters	0.5	0.5	0.5	
Anions					
Total Alkalinity	mg/L	23.6	23.4	12.9	
Nitrogen, Nitrate as N	mg/L	0.039	<0.010	0.051	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	MAC = 1
General Parameters					
Colour, True		110	53	57	AO ≤ 15
pH		6.99	6.88	6.69	AO = 6.5 - 8.5
Turbidity	NTU	4.01	0.7	1.61	MAC = 1.0
UV Transmittance @ 254 nm	%	21.5	42.1	42.4	
Solids, Total Dissolved	mg/L	72	49	35	AO ≤ 500
Microbiological Parameters					
Coliforms, Total	CFU/100ml	38	72	≥1	MAC < 1
E.coli	CFU/100ml	<1	<1	<1	MAC <1

AO: Aesthetic Objective
MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.

Table 7.0 - Watershed Bottom Sample - Raw properties

Parameter	Units	Bulman	South	Postill	Objective
Depth	meters	7.0	5.0	6.0-7.0	
Anions					
Total Alkalinity	mg/L	27.2	25.6	13.8	
Nitrogen, Nitrate as N	mg/L	0.055	0.123	0.032	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	0.01	<0.010	MAC = 1
General Parameters					
Colour, True		150	64	75	AO ≤ 15
pH		6.67	6.71	6.48	AO = 6.5 - 8.5
Turbidity	NTU	5.04	1.42	6.91	MAC = 1.0
UV Transmittance @ 254 nm	%	15.8	40.4	36.4	
Solids, Total Dissolved	mg/L	82	67	40	AO ≤ 500
Microbiological Parameters					
Coliforms, Total	CFU/100ml	19	≥18	≥27	MAC < 1
E.coli	CFU/100ml	<1	<1	<1	MAC <1

AO: Aesthetic Objective
MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.

Watershed sampling takes place in September of each year for Bulman, South and Postill reservoirs. It is completed by Larratt Aquatic with GEID staff assisting. The watershed report is available upon request.

TRIHALOMETHANES

South Lake Reservoir

When chlorine is added to water to disinfect it for drinking and it mixes with naturally occurring organic matter forming disinfection by-products. Trihalomethanes (THM's are the most common type of disinfection by-product). The level of THM's in treated water will depend on numerous factors including: total organic carbon, temperature, pH and chlorination dose which are monitored very closely by GEID Operators.

Table 8.0 - System Trihalomethanes

Parameter	Date	Units	Ellison Postill Rd. T/S	Glenmore GEID office Lab	Glenmore Shayler Rd. T/S	Glenmore Clearwell Outflow	Objective
Total Trihalomethanes	14, 15-May-18	**mg/L**	**0.324**	**0.0614**	**0.0649**	**0.0444**	**MAC = 0.1**
Total Trihalomethanes	24-Aug-18	**mg/L**	**0.235**	**0.0636**	**0.0833**	**0.0472**	**MAC = 0.1**
Total Trihalomethanes	21-Dec-18	**mg/L**	**0.282**	**0.0920**	**0.120**	**0.0693**	**MAC = 0.1**
Total Trihalomethanes	**Running Average**	**mg/L**	**0.28**	**0.07**	**0.09**	**0.05**	**MAC = 0.1**

*MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.

According to The Guidelines for Canadian Drinking Water Quality Trihalomethane results are acceptable for one out of two distribution systems based on the running average. The modified Ellison distribution system which is supplied by surface water from Postill, Bulman and South Lakes all year which are high in organics. The reaction of chlorine and organics leave elevated levels of trihalomethanes.

WATER QUALITY CONCERNS

Occasionally the GEID receives concerns from the rate payers regarding the quality of their drinking water. During the course of 2018, the district received 6 such enquiries and the most common issue of concern related to water color and odour. Every individual enquiry was investigated by the districts water supply and distribution operations staff and the appropriate action was taken to resolve the appropriate water quality concern.

Typical examples of water quality concerns such as colored water arise as a result of the following:

- Freshet
- Water main flushing
- Fire fighting
- Water main breaks
- Local construction/development
- Lake turnover/algae blooms
- Changes in flows and system dynamics
-

UV TREATMENT PLANT

During October 2017 the McKinley by-pass was fully functional and allowed the GEID to treat the Okanagan Lake water directly. The Okanagan Lake water has lower turbidity, organic materials, microbial organisms and is cooler.

The following tables show the Ultra Violet Transmittance (UV T%), 3-Log-i, and treatment performance of the two UV trains for 2018 with Okanagan Lake water, demonstrating the plant has been operating within the Interior Health requirement parameters.

McKinley Reservoir, future agricultural water source.

Table 9.0 - UV T% and 3-Log-i Removal Average

UV Plant Raw UV T%				McKinley UV plant 3-Log-i (average)	
Month	Min	Max	Average	Train 110	Train 120
January	86.28	91.04	88.90	3.58	3.97
February	86.3	87.38	86.74	3.06	3.44
March	85.7	87.63	86.51	3.09	3.34
April	85	87.25	86.26	3.08	3.33
May	83.7	87.9	86.2	3.13	3.31
June	84.5	87.2	86.2	3.17	3.32
July	84.6	87.0	86.1	3.16	3.21
August	84.7	87.5	86.2	3.21	3.24
September	85.2	86.9	86.2	3.10	3.15
October	83.1	87.1	86.2	3.09	3.07
November	84.1	86.8	85.5	3.09	3.10
December	84.4	86.4	85.5	3.06	3.08

Table 10.0 - Glenmore Distribution System 4-Log-i

Distribution System	Month - 2018	4-Log-i Removal Achieved
Glenmore Distribution System	**August**	**Yes**
Glenmore Distribution System	**September**	**Yes**
Glenmore Distribution System	**October**	**Yes**
Glenmore Distribution System	**November**	**Yes**
Glenmore Distribution System	**December**	**Yes**

*Partial year tracked for 4-log-i.

Table 11.0 - Train 110 Off Spec

McKinley UV Water Treatment Plant - Train 110						
Month	Off-SPEC by Time Percent	Off-SPEC by Volume Percent	Off-SPEC by Time Minutes	Total run time Minutes	Off-SPEC by Volume ML	Total Treated Volume ML
January	0.8	0.1	48	5753	0.06	75.76
February	0	0	0	5316	0	71.30
March	0	0	0	5928	0	76.83
April	0	0	4	7321	0.03	95.47
May	0	0	3	14477	0.04	229.02
June	0	0	7	14237	0.02	219.47
July	0	0	3	35197	0.07	735.14
August	0	0	0	21122	0	428.75
September	0	0	0	18257	0	257.78
October	0.1	0	5	9676	0.01	91.37
November	0.1	0	4	6721	0.01	88.22
December	0	0	0	5561	0	72.67

Table 12.0 - Train 120 Off Spec

McKinley UV Water Treatment Plant - Train 120						
Month	Off-SPEC by Time Percent	Off-SPEC by Volume Percent	Off-SPEC by Time Minutes	Total run time Minutes	Off-SPEC by Volume ML	Total Treated Volume ML
January	0.8	0.1	42	5259	0.06	72.80
February	0	0	0	4979	0	66.81
March	0	0	0	6409	0	84.46
April	0	0	0	7528	0	99.57
May	0	0	5	20033	0.05	311.34
June	0	0	0	26529	0	434.02
July	0	0	0	9443	0	175.88
August	0	0	5	21982	0.53	420.76
September	0	0	0	11651	0	165.83
October	0	0	1	7743	0.01	107.29
November	0.2	0.1	14	6575	0.05	86.19
December	0.1	0.1	5	6728	0.05	88.54

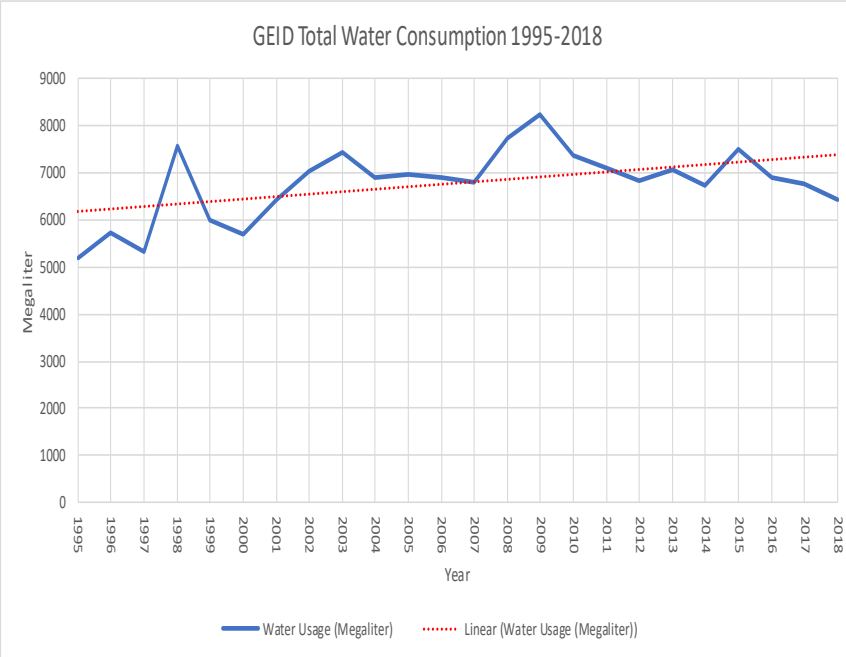
*Off Spec by volume % should be no greater than 5% as recommended by the US EPA UV Disinfection Guidance Manual.

ANNUAL WATER CONSUMPTION STATISTICS

The historic GEID water consumption since 1995 is illustrated below in (Table 13.0). The figure shows the actual recorded water consumption in Megaliters per year (MLY). It should be noted that McKinley Landing was integrated into the GEID system in 2006. In 2017 the McKinley Landing Water Works was switched over to the Glenmore distribution system. In 2018, the District obtained approximately 77.3% of its water from the Joe Bulach Pump Station and Dewdney Pump station on Okanagan Lake, 17.4% of its water from the Kelowna Creek Watershed, which includes Postill Lake, Bulman Lake, and South Lake, and pumped 5.3% from two of the four main wells located in the Glenmore and Ellison areas. The total consumption was 6446.5 ML, of which 341.9 ML was supplied from groundwater sources, and 8.8 ML was supplied to McKinley Landing from Okanagan Lake. The new Okanagan Lake Pump Station delivered 4975.1 ML to the Glenmore

distribution and McKinley systems. The balance of the water, 1120.7 ML. was supplied from Kelowna Creek directly to the Ellison distribution system.

Table 13.0 – Water Usage Per Year



Geid Water Usage	
Year	Water Usage (Megaliter)
1995	5198
1996	5748
1997	5329
1998	7571
1999	5996
2000	5709
2001	6434
2002	7037
2003	7442
2004	6907
2005	6985
2006	6907
2007	6804
2008	7730
2009	8240
2010	7381
2011	7107
2012	6852
2013	7062
2014	6722
2015	7513
2016	6915
2017	6763
2018	6446.5

MAINTENEANCE AND FLUSHING PROGRAM

Flushing in Progress

Regular inspections, maintenance and water quality testing is performed by certified operators to ensure optimal operation of the districts water system. The district performs uni-directional flushing of the distribution piping system as needed each year. Flushing is a process of sending a rapid flow of water through the water piping to clean them. This helps to maintain water quality by removing sediments and stagnant water.

Flushing may cause temporary discoloration of your water. If this happens wait an hour and turn your cold water on and let it run for ten to fifteen minutes. If your water does not start to clear up after this process, please contact GEID at 250-763-6506.

EMERGENCY RESPONSE PLAN

The emergency response plan is updated annually, and copies of the updated plan were provided to IH in 2018. Updates include changes to contact numbers (including GEID staff, consultants, contractors and regulatory agencies), as well as changes to the plans that may be required including the addition of new facilities.

CROSS CONNECTION CONTROL PROGRAM

The cross-connection control program for GEID and the Kelowna Joint Water Committee is administered by the City of Kelowna and results are reported annually to IH in order to protect the quality of the water in our distribution systems.

There is a full time Cross Connection Control Coordinator to develop, implement and maintain a program which focuses an all Industrial, Commercial, Institutional, and Agricultural water customers in our water utility.

The Cross-Connection Control Coordinator checks connections (industrial, commercial, institutional and agricultural) to determine whether pipes, vessels or other devices exist that would allow fluid contaminants to enter the water system by backflow. Potentially hazardous cross connections are eliminated or backflow prevention assemblies (testable) or devices (non-testable) are installed. All installations are subject to yearly testing and inspection programs administered by the Cross-Connection Control Coordinator.

OPERATOR CERTIFICATION

GEID's water distribution system is classified as a Level IV by the Environmental Operators Certification Program (EOCP).

Water system operators are the first line of defense for water quality issues, as they identify, manage, and remedy risks to the water supply. The tasks completed by GEID's operators are essential in ensuring safe, reliable, water supply, including:

- Bi-weekly system checks of critical infrastructure such as pump stations and chlorinators
- Daily monitoring of SCADA system to assess system performance
- Response to system alarms 24 hours a day, seven days a week
- Water main flushing as needed to enhance water quality
- Completion of water system maintenance, repair and renewal works
- Instrument testing and calibration
- Watershed monitoring and protection

In addition to the operation of the water system, water quality sampling was also completed in 2018 by qualified operators. Three of the 5 operators are graduates of Okanagan College's Water Quality and Environmental Engineering Technology program. The two-year water engineering technology diploma program is designed for the water and wastewater industry and provides instruction in areas such as water system design, maintenance, water treatment, and water quality testing and analysis.

As of year-end 2018, GEID had the following certified water distribution operators:

Table 14.0 - Current Operators

Name	Certification Level	Position
Brandon Fletcher	Operator level 4, Water Treatment 1	Projects Assistant
Mike Rojem	Operator Level 3, Water Treatment 1	Projects Coordinator
Daniel King	Operator Level 3	System Operator
Kelvin Giesbrecht	Operator Level 2, Water Treatment 1	System Operator
Ernie Schmidt	Operator Level 2, Water Treatment 1	System Operator (Part Time)
Kevin Burtch	Operator Level 1	Operations Manager
Shawn McGaw	Operator Level 3	System Operator
Chris Mackay	Operator Level 3	System Operator
Andrew Cammell	Operator Level 1	Water Quality Technician

STAFF CONTACTS

Table 15.0 - Staff Contacts

Name	Title	Telephone
Dawn Williams	Administrator	250-763-6506 ext. 102
Kevin Burtch	Operations Manager	250-763-6506 ext. 109
Sherree Carter	Administrative Treasurer	250-763-6506 ext. 104
Mike Rojem	Projects Coordinator	250-763-6506 ext. 103
Andrew Cammell	Water Quality Technician	250-763-6506 ext. 106

COMPLETED PROJECTS 2018

The Glenmore Ellison Improvement District saw the Ellison Separation Phase One and Two completed during 2018.

AVAILABILITY OF THE REPORT

This report may be found on the district's website at www.glenmoreellison.com under the water quality tab.

GLOSSARY

Aesthetic Objective (AO) – conforming to accepted notions of good taste.

Bacteria – many different types of bacterial organisms are found in drinking water. Most municipal treated water is essentially bacteria free due to the addition of chlorine. Some forms of cyst type bacteria have a degree of immunity to chlorine due to the cocoon-like shell around the organism, such as Giardia Lamblia, and Cryptosporidium.

Canadian Drinking Water Quality Guidelines – standards established by health Canada that recommend the maximum acceptable concentrations (MAC) for physical, microbiological, chemical and radiological substances in drinking water.

Chemical Parameter – properties of water relating to the molecular composition, such as mineral or metal concentrations.

Chlorine – widely used in the disinfection of water available as a gas, a liquid in sodium hypochlorite, or as a solid in calcium hypochlorite.

Coliform Bacteria – a group of organisms primarily found in human and animal intestines and wastes, and thus widely used as an indicator organism to show the presence of such wastes in water and the possible presence of pathogenic bacteria.

Color (Apparent Color (PtCo) – to determine the color of water within a sample without turbidity removal.

Contact Time – the time from when the chlorine is added to the water, to when the water reaches the first customers.

Corrosion – the deterioration of a material, specifically metals in water, caused by reactions and affected by complex interactions between pH, hardness, alkalinity and temperature of the water.

CT Values – the product of contact time and free chlorine concentration. It is used to calculate the percent removal of viruses and bacteria.

Disinfection by-products (DBP) – are created when the chlorine added to water reacts with naturally occurring matter in the water.

Disinfection – a process used to eliminate any harmful substance or micro-organism in water.

Drinking Water Protection Regulation (DWPR) – defines regulatory standards under

the Provincial Water Act that must be met to ensure water is safe to drink and fit for domestic purposes.

Escherichia coli (E. Coli) – are bacteria present in the intestine and feces of warm blooded animals. E. Coli are a member species of the fecal coliform group of indicator bacteria. Their concentrations are expressed as number of colonies per 100 mL of sample.

Free Chlorine – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as residual chlorine.

Hardness – a characteristic of natural water due to the presence of dissolved calcium and magnesium.

Inactivation – to destroy or ensure the loss of the ability to cause disease.

Log Removal – indicates how effective disinfection is in eliminating protozoa. For example, 4-log-i removal guarantees 99.99% disinfection of pathogenic organism, 3-log-i removal guarantees 99.9%, and 2-log-i removal guarantees 99% removal.

Maximum Acceptable Concentration (MAC) – defines the upper most limit of a parameter before it can become a health concern.

NTU (Nephelometric Turbidity Units) – the standard unit of measurement for turbidity (cloudiness) in water. It detects the amount of light that is scattered by fine suspended particles in water.

Organic – derived from plant or animal matter, as opposed to inorganic matter which is derived from rocks and minerals. Organic matter is characterized by it carbon-hydrogen structure.

pH – the expression of the acidity of a solution by the negative logarithm of the hydrogen ion concentration; pH of 1 is very acidic; pH of 14 is very basic (alkaline); pH of 7 is neutral. The neutral point of 7 indicates the presence of equal concentrations of free hydrogen and free hydroxide ions.

Physical Parameters – these are often observable properties such as color, taste and odour.

Potable Water – water which is considered safe and fit for human consumption, culinary and domestic purposes and meets the requirements of the health authority having jurisdiction which is the Vancouver Island Health Authority in this region.

Raw Water – untreated water from wells, surface sources (i.e. lakes and rivers) or any water before it reaches a water treatment device or process.

Reservoir – a receptacle used for storing water within the water system.

Residual Chlorine – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as free chlorine.

Surface Water – water collecting on the ground or in a stream, river, lake sea or ocean, as opposed to groundwater, which is contained in underground aquifers.

Trihalomethanes (THMs) – a single carbon compound formed in drinking water as a result of the reaction between chlorine and organic matter.

Total Coliform – an indicator group of organisms mostly of intestinal origin used to appraise the microbiological risks to drinking water.

Turbidity – the measurement of how cloudy or murky water is. Its measurement relates to the optical property of water that causes light to be scattered and absorbed in a cloudy sample rather than transmitted in a straight line. Measured in NTU (Nephelometric Turbidity Units).

Virus – the smallest form of life known to be capable of producing disease or infection, usually considered to be of large molecular size. They multiple by assembly of component fragments in living cells, rather than by cell division as do most bacteria.