GLENMORE-ELLISON IMPROVEMENT DISTRICT

2017 Annual Water Quality Report

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For: Interior Health

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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.

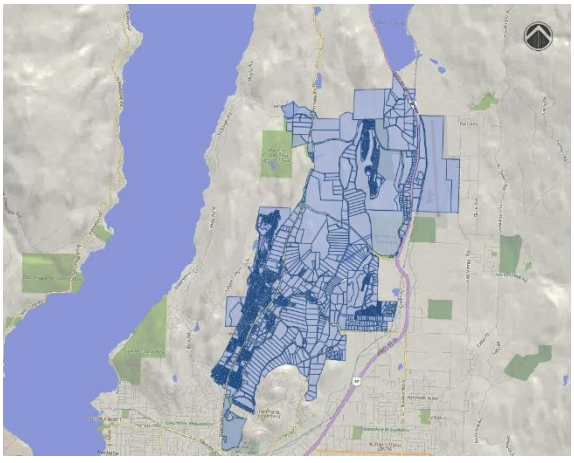
As required by the British Columbia Drinking Water Protection Act and Regulation, the Glenmore Ellison Improvement District (GEID) provides the following Annual Report that includes:

- System Description
- Source Assessment Synopsis
- Annual consumption data
- Updates to Water System Assessment and Capital Works Plan
- Updates to Water Monitoring Plan
- Updates to Emergency Response Plan
- Updates to Cross Connection Control Program
- Cross Connection Control Program Results
- 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.

The annual report covers the period from January 1st, 2017 to December 31st, 2017.

GLENMORE ELLISON IMPROVEMENT DISTRICT - DRINKING WATER SYSTEM



District Map

Glenmore-Ellison Improvement District (GEID) is one of five 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 is bonafide agricultural land. GEID supplies water to approximately 7,131 residential service connections, serving an estimated population of 17,830 people.

The distribution system consists of three distinct geographical areas, Glenmore, Ellison, and McKinley Landing.

Glenmore 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 a 9ML two cell concrete

Okanagan Lake

reservoir. There are five other balancing reservoirs in the Glenmore distribution system, namely the Union Road, Big Rock, Scenic Road, Quail Ridge, and UBCO Reservoirs.

McKinley Landing receives water directly from Okanagan Lake @ Dewdney P/S and will be receiving treated water from the Glenmore distribution system in early 2018. Water for McKinley Landing Water Works system is obtained directly from an intake on Okanagan Lake at the Dewdney Pump Station and treated with chlorine gas. The water is pumped from the Dewdney pump station to the Arthur Court Reservoir and gravity fed to the Shayler pump station which fills the Shayler Road Reservoir and McKinley Beach 640 reservoir which gravity feeds the rest of the system.

Mill Creek

Ellison receives water from 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 and #2 and the Ellison Well(inactive). The Ellison system is gravity supplied from Kelowna Creek for the majority of the year. However, the wells are used during spring freshet and times of major storm events to reduce the impacts of increased turbidity, and also to provide supplemental flows during periods of peak system demand.

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.

SOURCE ASSESSMENT SYNOPSIS

In October 2017, McKinley open bodied reservoir was taken off line and completely bypassed. The District began directly 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. 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.

Work completed in 2017 includes the Ellison separation design and engineering, the McKinley treated water reservoir, Union Rd. reservoir upgrades and the UBCO reservoir 3rd cell addition.

By utilizing low turbidity water from deep within Okanagan Lake, along with the state of the art UV disinfection, 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.

UPDATES TO WATER MONITORING PLAN

In 2017, 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, customer complaints and response, variances of normal operation and monthly laboratory results.

During 2018 GEID plans to develop a new Water Quality Monitoring Plan to monitor the better quality of water the Okanagan Lake pump station will provide to the Glenmore distribution system.

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 byproducts, 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 2017.

REGULATORY REQUIREMENTS

Several projects GEID plans to implement 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 1.0 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 1.0 - Treated Water Microbiological (Bacteria)

Parameter	Number of Samples	Number of Exceedances	Drinking Water Regulations
Total Coliforms	750	*5	0 counts per 100 (ml)
E. coli	750	0	0 counts per 100 (ml)

*For Total Coliforms exceedances, the test station was re-sampled. In all cases the re-test results were <1

Table 2.0 - 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 99.4% of samples with no detectable Total Coliforms.

WATER QUALITY MONITORING

On December 11th, 2017 in consultation with Interior Health the Glenmore Ellison Improvement District removed the long-standing Water Quality Advisory for the Glenmore System which was first put in place in 2006.

Water sampling and testing is carried out regularly in the 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.

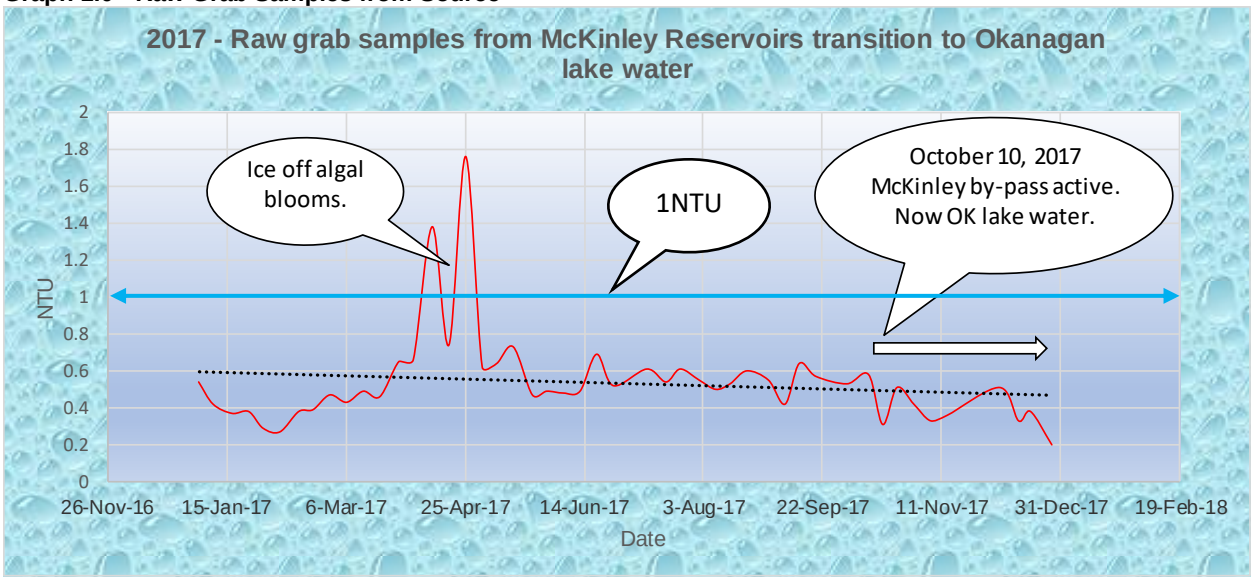
The GEID's water quality sampling and testing program has been set up in conjunction with the Interior Health Authority. The program samples water quality at source, reservoirs, test stations, dead end watermains, and various pressure zones.

Collected water samples are uniquely identified and sent to a provincially approved laboratory for testing. Test results are uploaded by the lab into 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 at several points within the water systems. The following graph 1.0 illustrates turbidity from Okanagan Lake water being pumped into McKinley reservoir (raw grab sample) measured at the point right before UV treatment and chlorination followed by (raw grab samples) while McKinley by-pass is active due to by-passing McKinley reservoir in October of 2017.

Graph 1.0 - Raw Grab Samples from Source



The Guidelines for Canadian Drinking Water Quality recommends a maximum acceptable concentration (MAC) of 1 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.

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 3.0 - 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 4.0 - System Water Quality

Parameter	Units	29-Sep-17	3-Oct-17	29-Sep-17	Objective
		Union Rd. post Reservoir	Postill Rd. T/S	Arthur Ct. Res.	
Anions					
Alkalinity, Total as $CaCO_3$	mg/L	117	23	112	
Chloride	mg/L	9.09	5.53	7.5	AO≤250
Fluoride	mg/L	0.31	<0.10	0.5	MAC = 1.5
Nitrogen, Nitrate as N	mg/L	<0.010	0.034	0.042	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	MAC = 1
Sulfate	mg/L	30.5	2.3	29.4	AO≤500
General Parameters					
Colour, True		<5	<5.0	<5	AO≤15
Conductivity	uS/cm	298	71.9	278	
Cyanide, total		<0.0020	<0.0020	<0.0020	MAC = 0.2
pH		7.6	6.86	7.56	AO = 6.5-8.5
Turbidity	NTU	0.42	0.81	0.25	MAC = 1.0
Hardness, Total (as $CaCO_3$)	mg/L	137	29.8	124	
Solids, Total Dissolved	mg/L	175	35.4	163	AO≤500
Total Recoverable Metals					
Aluminum	mg/L	<0.0050	0.0607	0.006	MAC=9.5
Antimony	mg/L	<0.00020	<0.00020	<0.00020	MAC = 0.006
Arsenic	mg/L	0.00054	<0.00050	<0.00050	MAC = 0.01
Barium	mg/L	0.0233	<0.0050	0.21	MAC = 1
Boron	mg/L	0.0124	0.006	0.0115	MAC = 5
Cadmium	mg/L	< 0.00001	<0.000010	<0.000010	MAC = 0.005
Calcium	mg/L	35.1	7.6	32.8	N/A
Chromium	mg/L	<0.00050	<0.00050	<0.00050	MAC = 0.05
Cobalt	mg/L	< 0.00010	<0.00010	<0.00010	N/A
Copper	mg/L	0.00297	0.00247	0.0305	AO = ≤ 1
Iron	mg/L	0.01	0.253	<0.010	AO=0.3
Lead	mg/L	<0.00020	<0.00020	0.0003	MAC = 0.01
Magnesium	mg/L	11.8	2.62	10.1	N/A
Manganese	mg/L	0.0117	0.00651	0.00109	AO = ≤ 0.05
Mercury	mg/L	<0.000010	<0.000010	<0.000010	MAC = 0.001
Molybdenum	mg/L	0.00357	0.00035	0.00353	MAC=0.25
Nickel	mg/L	0.00043	0.00067	0.00205	N/A
Potassium	mg/L	2.76	0.79	2.56	N/A
Selenium	mg/L	<0.00050	<0.00050	<0.00050	MAC = 0.01
Sodium	mg/L	14.3	2.38	12.4	AO = ≤ 200
Uranium	mg/L	0.00244	0.000071	0.00245	MAC = 0.02
Zinc	mg/L	< 0.004	<0.0040	0.016	AO = ≤ 5
Microbiological Parameters					
Coliforms, Total	CFU/100ml	<1	<1	<1	MAC <1
E. Coli	CFU/100ml	<1	<1	<1	< 10 E. coli/100ml;90th percentile (minimum 5 samples)

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

Table 5.0 - Raw Water Chemical Properties

Parameter	Units	5-May-17	29-Sep-17	29-Sep-17	Objective
		OK Lake P/S (Raw)	OK Lake P/S (Raw)	McKinley Reservoir Raw	
Anions					
Alkalinity, Total as $CaCO_3$	mg/L	113	116	119	
Chloride	mg/L	4.86	4.56	5.56	AO≤250
Fluoride	mg/L	0.2	0.29	0.52	MAC = 1.5
Nitrogen, Nitrate as N	mg/L	0.089	0.086	<0.010	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	MAC = 1
Sulfate	mg/L	30.3	31.3	30.2	AO≤500
General Parameters					
Colour, True		<5	<5.0	<5	AO≤15
Conductivity	uS/cm	285	281	299	
Cyanide, total		<0.0020	<0.0020	<0.0020	MAC = 0.2
pH		8.01	7.65	7.76	AO = 6.5-8.5
Turbidity	NTU	0.37	0.25	0.48	MAC = 1.0
Hardness, Total (as $CaCO_3$)	mg/L	120	124	141	
Solids, Total Dissolved	mg/L	160	165	175	AO≤500
Total Recoverable Metals					
Aluminum	mg/L	0.0096	0.0090	0.0054	MAC=9.5
Antimony	mg/L	< 0.001	<0.00020	<0.00020	MAC = 0.006
Arsenic	mg/L	< 0.0005	<0.00050	0.0056	MAC = 0.01
Barium	mg/L	0.0217	0.021	0.0242	MAC = 1
Boron	mg/L	0.013	0.0118	0.012	MAC = 5
Cadmium	mg/L	< 0.00001	<0.000010	<0.000010	MAC = 0.005
Calcium	mg/L	32.3	32.6	36.1	N/A
Chromium	mg/L	< 0.0005	<0.00050	<0.00050	MAC = 0.05
Cobalt	mg/L	< 0.00010	<0.00010	<0.00010	N/A
Copper	mg/L	0.00481	0.00287	0.00206	AO = ≤ 1
Iron	mg/L	0.015	0.012	0.012	AO=0.3
Lead	mg/L	0.0003	0.00044	<0.00020	MAC = 0.01
Magnesium	mg/L	9.43	10.4	12.4	N/A
Manganese	mg/L	0.00141	0.00154	0.0143	AO = ≤ 0.05
Mercury	mg/L	< 0.00002	<0.000010	<0.000010	MAC = 0.001
Molybdenum	mg/L	0.00361	0.00356	0.00383	MAC=0.25
Nickel	mg/L	0.00037	0.00111	0.00045	N/A
Potassium	mg/L	2.33	2.58	2.9	N/A
Selenium	mg/L	< 0.0005	<0.00050	<0.00050	MAC = 0.01
Sodium	mg/L	11.3	12.4	14.9	AO = ≤ 200
Uranium	mg/L	0.00248	0.00243	0.00247	MAC = 0.02
Zinc	mg/L	< 0.004	<0.0040	0.0516	AO = ≤ 5
Microbiological Parameters					
Coliforms, Total	CFU/100ml	2	<1	70	MAC <1
E. Coli	CFU/100ml	<1	<1	<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 - Well Water Chemical Properties

Parameter	Units	29-Sep-17	6-Jun-17	13-Jun-17	Objective
		Airport Well #1	Airport Well #1	Airport Well #2	
Anions					
Alkalinity, Total as $CaCO_3$	mg/L	181	186	163	
Chloride	mg/L	8.04	7.4	20.1	AO≤250
Fluoride	mg/L	0.54	0.18	0.12	MAC = 1.5
Nitrogen, Nitrate as N	mg/L	1.76	1.65	1.67	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	0.014	<0.010	MAC = 1
Sulfate	mg/L	15.5	16.2	20.4	AO≤500
General Parameters					
Colour, True		<5	<5	<5	AO≤15
Conductivity	uS/cm	389	409	427	
Cyanide, total		<0.0020	<0.0020	<0.0020	MAC = 0.2
pH		7.73	7.73	7.7	AO = 6.5-8.5
Turbidity	NTU	0.31	0.3	<0.10	MAC = 1.0
Hardness, Total (as $CaCO_3$)	mg/L	203	196	180	
Solids, Total Dissolved	mg/L	223	223	226	AO≤500
Total Recoverable Metals					
Aluminum	mg/L	<0.0050	0.0154	<0.050	MAC=9.5
Antimony	mg/L	<0.00020	<0.00010	<0.00010	MAC = 0.006
Arsenic	mg/L	0.00076	0.00075	<0.00050	MAC = 0.01
Barium	mg/L	0.0354	0.0341	0.0252	MAC = 1
Boron	mg/L	0.007	0.017	0.019	MAC = 5
Cadmium	mg/L	0.000057	0.000057	0.000053	MAC = 0.005
Calcium	mg/L	54.2	54.5	47.1	N/A
Chromium	mg/L	<0.0005.0	<0.00050	<0.00050	MAC = 0.05
Cobalt	mg/L	<0.00010	<0.00010	<0.00010	N/A
Copper	mg/L	0.00191	0.00314	0.00877	AO = ≤ 1
Iron	mg/L	0.086	0.083	<0.10	AO=0.3
Lead	mg/L	0.00048	0.00075	0.00039	MAC = 0.01
Magnesium	mg/L	16.4	14.5	15.2	N/A
Manganese	mg/L	0.088	0.0847	0.0144	AO = ≤ 0.05
Mercury	mg/L	<0.000010	< 0.00002	<0.00002	MAC = 0.001
Molybdenum	mg/L	0.00144	0.00142	0.00123	MAC=0.25
Nickel	mg/L	0.00164	0.00279	0.0049	N/A
Potassium	mg/L	2.09	1.89	1.91	N/A
Selenium	mg/L	0.00164	0.00186	0.00315	MAC = 0.01
Sodium	mg/L	8.29	7.65	14.5	AO = ≤ 200
Uranium	mg/L	0.00289	0.00269	0.00276	MAC = 0.02
Zinc	mg/L	0.0062	0.008	0.021	AO = ≤ 5
Microbiological Parameters					
Coliforms, Total	CFU/100ml	<1	<1	<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 - Well #1 Hydrocarbons

Parameter	Units	6-Jun-17	Objective
		Airport Well #1	
Aggregate Organic Parameters			
VHw (6-10)	100 µg/L	< 100	N/A
EPHw (10-19)	100 µg/L	<250	N/A
EPHw(19-32)	100 µg/L	<250	N/A
Polycyclic Aromatic Hydrocarbons (PAH)			
Acenaphthene	0.5 µg/L	< 0.05	N/A
Acenaphthylene	0.5 µg/L	<0.200	N/A
Acridine	0.10 µg/L	<0.050	N/A
Anthracene	0.5 µg/L	<0.010	N/A
Benzo (a) Anthracene	0.5 µg/L	<0.010	N/A
Benzo (a) pyrene	0.01 µg/L	<0.010	N/A
Benzo (b) fluoranthene	0.5 µg/L	< 0.05	N/A
Benzo (g,h,i) perylene	0.5 µg/L	< 0.05	MAC = 0.01
Chrysene	0.5 µg/L	< 0.05	N/A
Dibenz (a,h) anthracene	0.5 µg/L	< 0.05	N/A
Fluoranthene	0.5 µg/L	<0.030	N/A
Fluorene	0.5 µg/L	< 0.05	N/A
Indeno (1,2,3-cd) pyrene	0.5 µg/L	< 0.05	N/A
Naphthalene	0.30 µg/L	<0.200	N/A
Phenathrene	0.10 µg/L	< 0.10	N/A
Pyrene	0.10 µg/L	<0.020	N/A
Quinoline	0.10 µg/L	<0.050	N/A
Surrogate: Acridine-d9	60-130	73	
Surrogate: Naphthalene-d8	60-130	75%	N/A
Surrogate: Perylene-d12	60-130	94%	N/A
Volatile Organic Compounds (VOC)			
Benzene	0.5 µg/L	< 0.5	MAC = 5
Ethylbenzene	1.0 µg/L	AO<1.6	AO ≤ 1.6
Toluene	1.0 µg/L	AO<24	AO ≤ 24
Xylenes (total	2.0 µg/L	AO<20	AO ≤ 20
Surrogate: Toluene-d8	70-130	95%	70-130
Surrogate : 4-Bromofluorobenzene	70-130	111%	70-130

AO: Aesthetic Objective
MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.
Airport Well is sampled every two years for hydrocarbons.

Table 8.0 - 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	25.6	27.9	14.3	
Nitrogen, Nitrate as N	mg/L	0.066	0.043	0.04	MAC = 10
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	MAC = 1
General Parameters					
Colour, True		110	50	60	AO ≤ 15
pH		6.99	7.02	6.87	AO = 6.5 - 8.5
Turbidity	NTU	1.66	0.83	1.58	MAC = 1.0
UV Transmittance @ 254 nm	%	22.4	39.5	38.8	
Solids, Total Dissolved	mg/L	72	53	47	AO ≤ 500
Microbiological Parameters					
Coliforms, Total	CFU/100ml	28	28	38	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.

South Lake Reservoir

TRIHALOMETHANES

When chlorine is added to water to disinfect it for drinking and it mixes with naturally occurring organic matter forming disinfection by-products. Trihalomethanes (THMs 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 9.0 - System Trihalomethanes

Parameter	Units	31-May-17	13-Jun-17	19-Jun-17	Objective
		Rittich Rd. T/S	GEID Office Lab	Arthur Ct. Res	
Total Trihalomethanes	mg/L	0.0271	0.0902	0.08252	MAC = 0.1
		29-Sep-17	**29-Sep-17**	**29-Sep-17**	
Total Trihalomethanes	mg/L	0.211	0.077	0.070	MAC = 0.1
		19-Dec-17	**19-Dec-19**	**21-Dec-17**	
Total Trihalomethanes	mg/L	0.024	0.0712	0.0902	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 two out of three distribution systems during the summer. The Ellison distribution system which is supplied by surface water from Postill, Bulman and South Lakes during the summer which are high in organics. The reaction of chlorine and organics leave elevated levels of Trihalomethanes. During months with low system demands, the Ellison distribution system is supplied by groundwater and does not report levels above the maximum acceptable concentration (MAC).

WATER QUALITY CONCERNS

Occasionally the GEID receives concerns from the rate payers regarding the quality of their drinking water. During the course of 2017, the district received 14 such enquiries and the most common issue of concern related to water color and the smell of chlorine. 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:

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

If you have any water quality concerns please contact Andrew Cammell at the GEID office. 250-763-6506 or acammell@geid.org

UV TREATMENT PLANT

McKinley Bypass pre-sinking

While the McKinley UV Plant has been used to treat Okanagan Lake water from the McKinley reservoir since July 2016, the full treatment benefits were not realized until the October 2017 McKinley by-pass was fully functional. The by-pass allowed the GEID to treat the Okanagan Lake water directly. The Okanagan Lake water has lower turbidity, organic materials, microbial organisms and is cooler.

McKinley UV Plant

The following tables show the UV T%, Log i, and performance of the two UV trains for the last three months of 2017 with Okanagan Lake water, demonstrating the plant has been operating within the required parameters.

McKinley Reservoir

Table 10.0 - UVT% and Log i Removal Average

Okanagan lake Raw UV T%				McKinley UV plant Log i (average)	
Month	Min	Max	Average	Train 110	Train 120
October	87.28	91.25	88.69	3.47	3.47
November	88.26	89.59	88.96	Not run	3.76
December	83.5	91.54	89.91	3.74	4.04

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
October	0.4	0.1	1	218	0.0029	4.43
November	0	0	0	0	0	0
December	0.1	0	4	5859	0.01011	80.34

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
October	0.1	0	15	23203	0.04	222.74
November	0	0	0	11119	0	151.52
December	0	0	0	4930	0	65.85

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

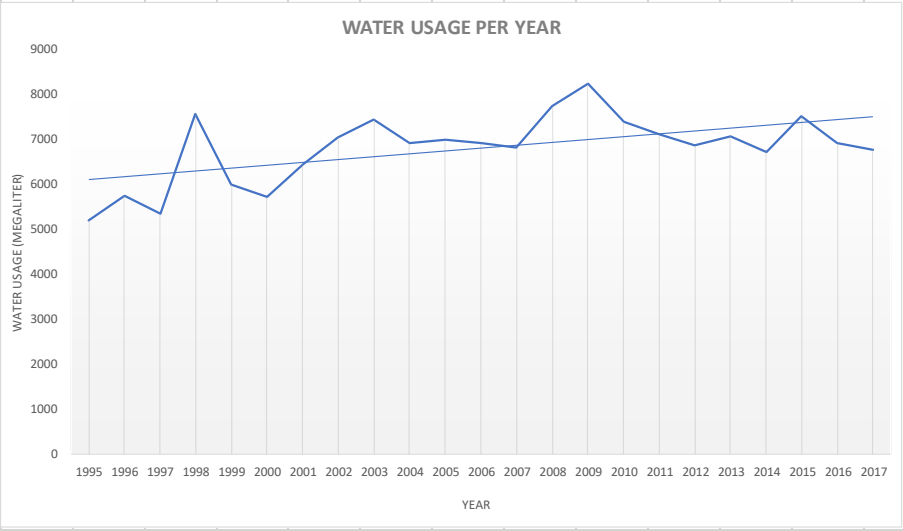
ANNUAL WATER CONSUMPTION STATISTICS

The historic GEID water consumption since 1995 is illustrated below. 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 2017, the District obtained approximately 74% of its water from the Joe Bulach Pump Station and Dewdney Pump station on Okanagan Lake, 16% of its water from the Kelowna Creek Watershed, which includes Postill Lake, Bulman Lake, and South Lake, and pumped 10% from two of the four main wells located in the Glenmore and Ellison areas. The total consumption was 6806.21 ML, of which 683.61 ML was supplied from groundwater sources, and 156.33 ML was supplied to McKinley Landing from Okanagan Lake. The

balance of the water, 1105.68 ML. was supplied from Kelowna Creek directly to the Ellison distribution system. The new Okanagan Lake Pump Station delivered 4860.6 ML to the McKinley reservoir.

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



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 in the spring and fall of 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 bi-annually, and copies of the updated plan were provided to IH in 2017. 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:

- Daily 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 twice a year 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 2017 by qualified operators. Five of the 8 operators are graduates of Okanagan College's Water Quality and Environmental Engineering Technology program. The two-year Water Quality 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 2017, GEID had the following certified water distribution operators:

Table 14.0 - Current Operators

Name	Certification Level	Position
Drew Allingham	Operator Level 4, Water Treatment 1	Operations Foreman
Brandon Fletcher	Operator Level 4, Water Treatment 1	Projects Assistant
Mike Rojem	Operator Level 3, Water Treatment 1	Special Projects Coordinator
Kelvin Giesbrecht	Operator Level 2, Water Treatment 1	System Operator
Ernie Schmidt	Operator Level 2, Water Treatment 1	System Operator (Part Time)
Daniel King	Operator Level 2	System Operator
Shawn McGaw	Operator Level 2	System Operator
Chris Mackay	Operator Level 2	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
Vacant	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
Drew Allingham	Foreman	250-763-6506 ext. 108
Andrew Cammell	Water Quality Technician	250-763-6506 ext. 106

COMPLETED PROJECTS 2017

The Glenmore Ellison Improvement district saw a number of large projects finalized. The McKinley treated water reservoir was completed as well as the Union Rd. reservoir upgrades which included an overflow and altitude valve. The UBCO reservoir 3rd cell was also completed. The McKinley UV plant was officially commissioned and the district came off a long-standing water quality advisory.

AVAILABILITY OF THE REPORT

This report may be found on the districts 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 removal guarantees 99.99% disinfection of pathogenic organism, 3 log removal guarantees 99.9%, and 2 log 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.