GLENMORE-ELLISON IMPROVEMENT DISTRICT

2021 ANNUAL WATER QUALITY REPORT

GLENMORE-ELLISON IMPROVEMENT DISTRICT

Prepared by: Gordon Ross – Water Quality Technician

Reviewed by: Mike Rojem, Kevin Burtch, Dawn Williams

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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

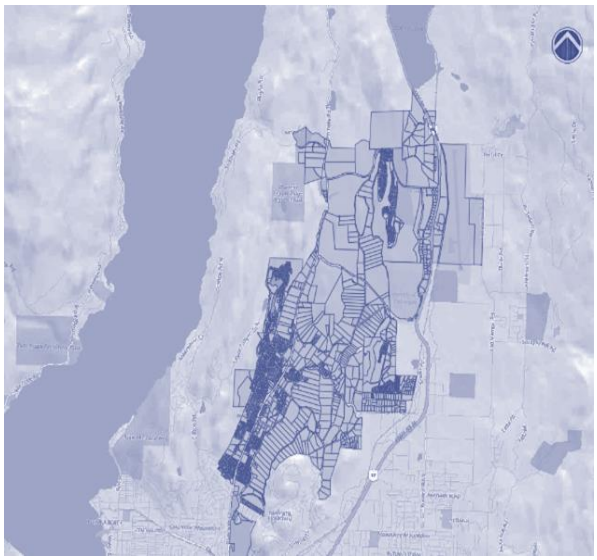
World Health Organization

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

The annual report covers the period from January 1st, 2021 to December 31st, 2021.

GEID DRINKING WATER SYSTEM

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 3,681.346 hectares (36.813 km^2, or 9,096.803 acres). Of the 1,899.701 hectares (4,694.263 acres) serviced with water, 826.08 hectares are bonafide agricultural land. GEID supplies water to approximately 9,375 residential service connections, serving an estimated population of 23,310 people.



Glenmore Distribution System

The Glenmore Distribution system is sourced by Okanagan Lake from which water is pumped directly to the McKinley UV Treatment Plant where the water is treated with UltraViolet (UV) light to achieve a minimum 3 log removal (99.9%) of Cryptosporidium and Giardia Lamblia cysts. After UV treatment, the water is chlorinated to kill any bacteria or viruses that may be present and stored in the 9 million-liter (ML) Rojem Reservoir (Clearwell). From the Clearwell, water flows via gravity into the distribution system. The Glenmore Distribution System includes eight additional storage reservoirs and eleven pump/booster stations.

Alternate Sources

In the event of an emergency, GEID has three wells (Ellison Well, Airport Wells #1 and #2) that can be brought online. A total of 7 potable interconnects with adjacent water suppliers are available.

SOURCE ASSESSMENT SYNOPSIS

Okanagan Lake

In October 2017, the McKinley open bodied reservoir was taken off line and completely bypassed. With the bypass in place, the District began pumping Okanagan Lake water directly to the McKinley UV Plant to supply the Glenmore Distribution System. The Okanagan Lake intake is currently the deepest intake on Okanagan Lake, providing consistently high-quality water with low turbidity. The intake is situated in a desirable location, far from creek inlets making it less susceptible to 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 and high-quality drinking water that meets both Canadian Drinking Water Guidelines and the Drinking Water Treatment Objectives for Surface Water Suppliers in BC.

In support of the long-term management of the GEID Lake Okanagan Intake requirements, a Technical Inspection program, that includes contingency planning, was first implemented in December 2014. With the support CTQ Engineering, a DD Subsea Engineer & a Diving Safety Specialist, regular inspections of the intake pipe and assembly are completed and documented. Checking for marine growth on the intake assembly is also part of the program. The inspection data will assist managers and the G.E.I.D. Board with both short and long-term asset management decisions.

Larratt Aquatic is currently developing a Source Protection Plan for the Okanagan Lake intake with an expected completion in 2022.

UPDATES TO WATER MONITORING PLAN

In 2021, GEID continued to monitor its water supply with a Water Quality Sampling Program that was developed with Interior Health (IH) approval. The program includes monthly reports submitted to IH containing information on sampling locations, sampling frequency, bacteriological testing results, turbidity levels, chlorine residuals, operational activities, treatment objectives achieved, customer complaints and responses, variances of normal operation, weekly and quarterly laboratory results.

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 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 2021.

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 providing drinking water that, at minimum, 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.

GEID was able to meet these treatment requirements for the Glenmore System by effectively operating the McKinley UV Plant.

WATER QUALITY MONITORING

Water sampling and testing is carried out regularly throughout the potable distribution system to ensure the drinking water remains safe and meets legislated drinking water requirements.

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 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.

GEID's water quality sampling and testing program has been set up in conjunction with Interior Health. The program outlines the collection of samples for water quality at source, reservoirs, test stations, dead end/low use zones, and various pressure zones. GEID operations staff as well as outside consultants are utilized to collect the samples.

For samples requiring third party analysis, collected water samples are uniquely identified and sent to a provincially approved laboratory for testing. Once completed, test results are emailed and reviewed.

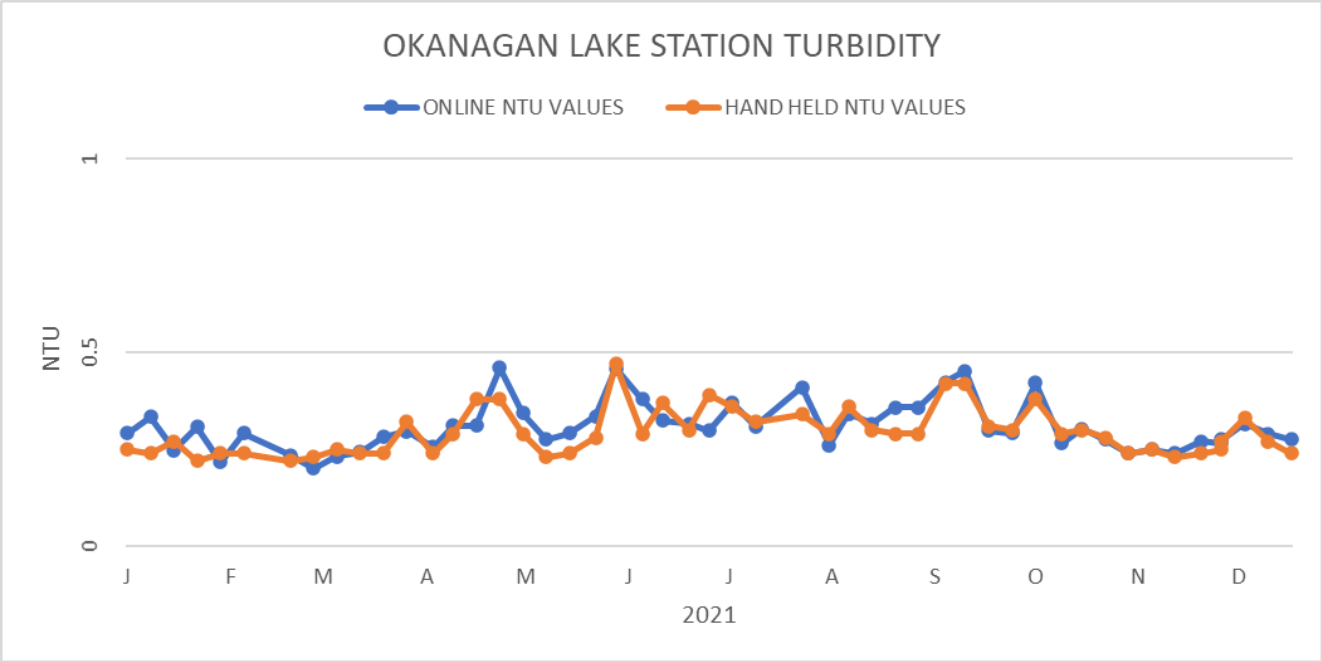
Key water quality parameters such as turbidity, free chlorine residual and %UVT are continuously monitored with online analyzers. The data from these analyzers is viewable remotely on the GEID SCADA system and is also stored in the SCADA Database. To ensure the analyzers are providing reliable and accurate data, samples are collected and analyzed in-house and compared to the online values.

Source Water Turbidity

The Guidelines for Canadian Drinking Water Quality recommend a maximum acceptable concentration (MAC) of 1.0 Nephelometric Turbidity unit (NTU) for water entering the distribution system. Turbidity can harbour microorganisms, protecting them from disinfection. If turbidity exceeds 1.0 NTU on average for 24 hours, GEID, in consultation with IH will call a Water Quality Advisory or a Boil Water Notice (>5.0 NTU) for the affected water system.

The following graph illustrates turbidity grab sample results and online analyzer values at Okanagan Lake Pump Station (Graph 1.0).

1 Graph 1.0 - Okanagan Lake Raw Turbidity



Source Water Bacteriological

Okanagan Lake

Okanagan Lake is sampled weekly for Total Coliforms and Escherichia Coli (E. Coli). There are two sample sites, (one at Okanagan Lake Pump station, the other at the McKinley UV plant) that are drawn from, on a bi-weekly rotation. In 2021 a total of 54 samples were collected. The results of these samples are summarized below.

2 Table 1.0 - Okanagan Lake Source Bacteriological Summary

2021 Okanagan Lake Source Raw Bacteriological Data (MPN/100mL)					
	# of Samples	Detects	Min	Max	Avg
E. Coli	54	3	<1.0	2	1
Total Coliforms	54	29	<1.0	78	6.9

Comprehensive Water Quality Results

3 Table 2.0 - Raw Water Quality for GEID's Potable Water System

		GEID			
DATE 2021-11-15	Units	Okanagan Lake P/S	Airport Well #1	Airport Well #2	Std (GCDWQ)
Parameter		Values	Values	Values	
Anions					
Chloride	mg/L	5.31	2.66	7.77	AO<=250
Fluoride	mg/L	0.25	0.27	<0.10	MAC=1.5
Nitrate (as N)	mg/L	0.087	0.01	3.95	MAC=10
Nitrite (as N)	mg/L	<0.010	<0.010	<0.010	MAC=1
Sulfate	mg/L	30.1	9	18.6	AO<=500
Calculated Parameters					
Langelier Index	-	0.01	<-5.0	<-5.0	N/A
Hardness, Total (as CaCO3)	mg/L	128	150	174	None Required
Solids, Total Dissolved (calc)	mg/L	175	179	214	AO<=500
General Parameters					
Temperature, at pH	°C	19.8	19.8	19.8	N/A
Colour, True	CU	<5.0	<5.0	<5.0	AO<=15
Alkalinity, Total (as CaCO3)	mg/L	129	174	168	N/A
Alkalinity, Phenolphthalein (as CaCO3)	mg/L	<1.0	-	-	N/A
Alkalinity, Bicarbonate (as CaCO3)	mg/L	129	-	-	N/A
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.0	-	-	N/A
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.0	-	-	N/A
Cyanide, Total	mg/L	<0.0020	<0.0020	<0.0020	MAC=0.2
Turbidity	NTU	0.2	1.33	0.38	OG<1
pH	pH units	7.81	8.05	7.79	7.0-10.5
Conductivity (EC)	uS/cm	284	279	331	N/A
Total Metals					
Aluminum, total	mg/L	<0.0079	<0.0050	<0.0050	OG<0.1
Antimony, total	mg/L	<0.00020	<0.00020	<0.00020	MAC=0.006
Arsenic, total	mg/L	0.00052	0.00053	<0.00050	MAC=0.01
Barium, total	mg/L	0.0235	0.0267	0.0295	MAC=2
Boron, total	mg/L	0.05	<0.0100	<0.0100	MAC=5
Cadmium, total	mg/L	<0.000010	0.000027	0.000149	MAC=0.005
Calcium, total	mg/L	35.6	42.3	44.5	None Required
Chromium, total	mg/L	<0.00050	<0.00050	<0.00050	MAC=0.05
Cobalt, total	mg/L	<0.00010	0.00005	0.00022	N/A
Copper, total	mg/L	0.00144	0.00577	0.0538	MAC=2
Iron, total	mg/L	<0.010	0.172	0.123	AO<=0.3
Lead, total	mg/L	<0.00020	0.00034	0.00612	MAC=0.005
Magnesium, total	mg/L	9.59	10.7	15.2	None Required
Manganese, total	mg/L	0.00087	0.0175	0.136	MAC=0.12
Mercury, total	mg/L	<0.000010	<0.000010	<0.000010	MAC=0.001
Molybdenum, total	mg/L	0.00366	0.00192	0.00064	N/A
Nickel, total	mg/L	0.0004	0.0005	0.0017	N/A
Potassium, total	mg/L	2.3	1.85	1.58	N/A
Selenium, total	mg/L	<0.00050	0.00114	<0.00050	MAC=0.05
Sodium, total	mg/L	12.8	5.87	6.8	AO<=200
Strontium, total	mg/L	0.272	0.265	0.228	7
Uranium, total	mg/L	0.00254	0.00181	0.00132	MAC=0.02
Zinc, total	mg/L	<0.0040	0.0043	0.0248	AO<=5

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

Hardness

A parameter commonly inquired upon by ratepayers is Hardness. Water in the Glenmore system is classified as hard (~130mg/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.

Ellison Well has very hard water (almost 300m/L). Very hard water is typical of groundwater sources due to high concentrations of dissolved minerals.

An indicator of hard water is taking 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.

4 Table 3.0 - Water Hardness Classification

Classification	Hardness (mg/L)
Soft	0-60
Moderately Hard	61-120
Hard	121-180
Very Hard	>180

Trihalomethanes (THM's) / Halo Acetic Acids (HAAs)

GEID, like most water purveyors, uses chlorine as the primary disinfection agent. While chlorine has proven to be effective for ensuring potable water systems are safe for consumption, it can also produce disinfection by-products when organic matter is present in the source water.
THMs and HAAs are the most commonly monitored disinfection by-products (DBPs). The level of THMs and HAAs in treated water will depend on numerous factors including: total organic carbon, temperature, pH, chlorine dose and water age within the distribution system.

In the Glenmore System, GEID monitors for THMs and HAAs at four locations of the distribution system, representing beginning (Clearwell Outflow), middle (GEID Office) and far/end points (PRV #7 and Ellison Well Domestic T/S) of the system. Ellison Well Domestic T/S was added as an end of line sample point upon completion of the Ellison Separation Project.

5 Table 4.0 - THM and HAA Summary

Sample Date	Distribution System THM Results (mg/L Total Trihalomethanes)				
	Ellison Well Domestic T/S	GEID Office/Lab	PRV # 7	Clearwell Outflow	Standard Guideline
4-Mar-21	0.07	0.06	0.08	0.04	MAC = 0.1
3-May-21	0.08	0.05	0.13	0.05	MAC = 0.1
16-Aug-21	0.10	0.05	0.09	0.03	MAC = 0.1
15-Nov-21	0.14	0.14	0.11	0.09	MAC = 0.1
Running Average	0.10	0.08	0.10	0.05	MAC = 0.1
Sample Date	Distribution System HAA Results (mg/L HAA5)				
	Ellison Well Domestic T/S	GEID Office/Lab	PRV # 7	Clearwell Outflow	Standard Guideline
4-Mar-21	0.06	0.06	0.08	0.04	MAC = 0.08
3-May-21	0.06	0.04	0.06	0.03	MAC = 0.08
16-Aug-21	0.10	0.05	0.04	0.02	MAC = 0.08
15-Nov-21	0.07	0.07	0.03	0.05	MAC = 0.08
Running Average	0.07	0.06	0.05	0.04	MAC = 0.08

Distribution System Bacteriological Results

Table 5.0 illustrates how GEID's distribution systems met the bacteriological standards for potable water as set out in Schedule A of the Drinking Water Protection Regulation. Positive results for Total Coliforms occurred on three occasions. A new sample from the same location was collected following laboratory confirmation and each time, the result came back with no detectable total coliforms.

6 Table 5.0 - Glenmore System Microbiological Results

Parameter	No. of Samples	No. of Exceedances	Drinking Water Regulations
Total Coliforms	555	0	No detectable CFU/100 (ml)
E. Coli	555	0	No detectable CFU/100 (ml)

Parameter	Standard
Escherichia Coli	No detectable Escherichia Coli per 100 ml
Total Coliform Bacteria	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

WATER QUALITY CONCERNS

Occasionally the GEID receives concerns from the rate payers regarding the quality of their drinking water. During the course of 2021, the district received minimal enquiries with 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:

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

McKINLEY UV TREATMENT PLANT PERFORMANCE

McKinley UV Treatment Plant receives raw water directly from Okangan Lake via the Okangan Lake Pump Station. The intake is on average 35 m below the surface of the water. This deep intake structure provides constistant water quality conditioins in regards to organics, turbidity, % UltraViolet (%UVT), pH and temperature.

The UV Plant operates to provide 3 log (99.9%) inactivation of Cryptosporidium and Giardia lamblia cycts. The plant has two UV Reactors, with one reactor able to provide adequate treatment during regular operation, while the other acts as a stand-by reactor to provide redundancy if an issue arises. If the reactors fail to adequately treat the water (<3.0 Log), Off-spec water is produced. The Off-spec water volumes and event durations are logged and recorded. A minimum of 95% of the water flowing through the reactors must meet the validated treatment criteria[1]. GEID strives to ensure that 100% of water provided is treated with adequate UV dosage. In 2021, only 0.01% of water produced failed to meet 3 log inactivation requirements. The Off-Spec volume that accumulated in the Reactors' PLCs, was due to new Surge Vault Programing Logic being installed and tested.

Additionally, log inactivation for viruses (4 log inactivation is required) is calculated on a daily basis. The calculation uses data collected by online, chlorine analyzers, temperature sensors, a pH probe, level transmitters and flow meters to calculate the required Concentration Time (CT value) that must be maintained in order the achieve the treatment goal.

[1] US EPS UV Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule

The following tables show the 2021 raw water Ultra Violet Transmittance (%UVT), reactor log inactivation performance, 4 log summary for viruses and treatment performance of the two UV Reactors. Overall, the UV Plant operated within the required parameters as set by IH.

7 Table 6.0 McKinley UV Treatment Plant Raw Water %UVT

Raw %UVT			
Month	Min	Max	Average
January	83.4	86.7	85.9
February	85.4	87.0	86.1
March	85.7	86.8	86.3
April	85.2	88.9	86.3
May	84.6	87.7	86.2
June	84.8	86.0	85.9
July	85.0	86.3	85.7
August	84.4	86.7	86.0
September	85.6	86.7	86.1
October	83.4	86.7	85.9
November	85.6	87.0	86.3
December	85.5	87.2	86.5

Values taken every four hours from the GEID SCADA Database and averaged on a monthly basis.

8 Table 6.1 - GEID's System 4-Log Virus Summary

Month	Daily 4-Log-i Achieved
January	Yes
February	Yes
March	Yes
April	Yes
May	Yes
June	Yes
July	Yes
August	Yes
September	Yes
October	Yes
November	Yes
December	Yes

9 Table 6.2 - UV Reactor 110 Performance Summary

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	Avg. Log Inactivation
January	0	0	0	7843	0	101.95	3.59
February	0	0	0	7654	0	99.81	3.59
March	0	0	0	6644	0	86.26	3.59
April	0	0	0	15428	0	215.07	3.62
May	0.1	0.1	23	30596	0.6	502.65	3.63
June	0	0	0	13678	0	294.80	3.62
July	0.2	0.3	100	43979	3.39000	1176.60	3.61
August	0	0	0	35425	0	681.95	3.64
September	0	0	0	17487	0.00000	247.27	3.6
October	0	0	2	7378	0.00346	96.07	3.61
November	0.1	0	8	7239	0.03332	97.11	3.6
December	0.1	0.1	11	7824	0.11312	105.59	3.6
Totals	0.5	0.5	144	201175	1.1399	3705.13	

10 Table 6.3 - UV Reactor 120 Performance Summary

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	Avg. Log Inactivation
January	0	0	0	5891	0	77.26	3.58
February	0.1	0	8	5116	0.01759	66.77	3.59
March	0	0	0	7694	0	100.45	3.61
April	0	0	2	12600	0.02446	173.27	3.61
May	0	0	0	12080	0	197.79	3.67
June	0	0	13	29695	0.24000	656.80	3.68
July	0	0	0	72	0.00000	0.89	* 0
August	0	0	0	8559	0	147.23	3.66
September	0	0	0	13800	0	195.70	3.6
October	2.8	0.2	229	8053	0.24009	103.76	3.61
November	18.7	0	1294	6936	0.02674	77.87	3.67
December	0.1	0	4	6126	0.01774	83.14	3.6
Totals	21.7	0.2	1550	116622	0.56662	1880.93	

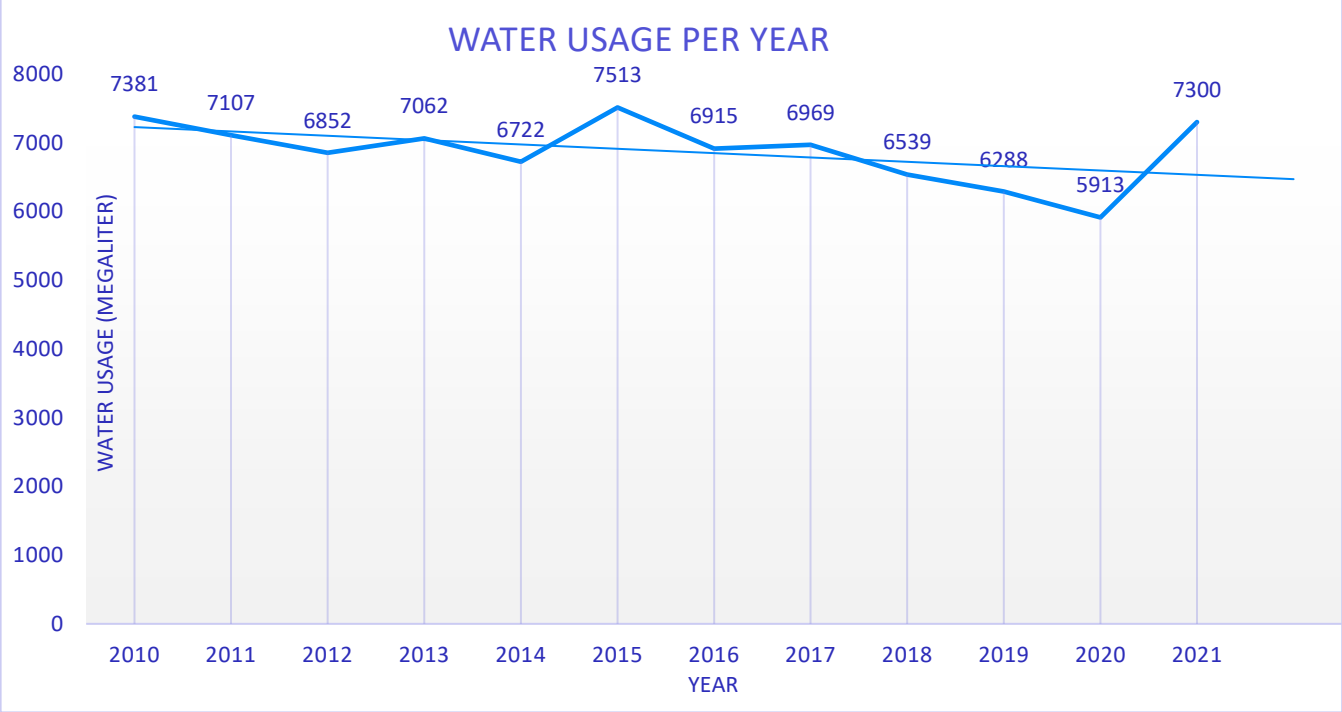
ANNUAL WATER CONSUMPTION STATISTICS

Table 7.0 shows the historic GEID water consumption over the past ten years in Megaliters (ML) and Acre Foot.

11 Table 7.0 - Combined Annual Water Usage

GEID WATER USAGE		
Year	**Water Usage (Megaliter)**	**Water Usage (Acre foot)**
2010	7381	5984
2011	7107	5762
2012	6852	5555
2013	7062	5725
2014	6722	5450
2015	7513	6091
2016	6915	5606
2017	6969	5649
2018	6539	5302
2019	6288	5078
2020	5913	4794
2021	7300	5919

12 Combined Annual Water Usage Graph



MAINTENANCE AND FLUSHING PROGRAM

Regular inspections, maintenance and water quality testing is performed by certified operators to ensure optimal operation of the GEID water systems. The district performed unilateral-directional flushing of each system in the fall of 2021 and conducted isolated area flushing as required due to maintenance, repair activities, and to maintain water quality.

13 Flushing in Progress

EMERGENCY RESPONSE PLAN

The emergency response plan is updated annually, and copies of the updated plan were provided to IH in 2021. 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.

The City of Kelowna employs 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 (Facility 497) is classified as a Level IV system by the Environmental Operators Certification Program (EOCP). Additionally, the McKinley UV Treatment Plant (Facility 2276) is classified as a Level II Facility by the 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:

- Regular 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
- Water Quality Sampling
- Watershed monitoring and protection

Four of the 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. Table 8.0 shows the certification levels of GEID employees as of the end of 2021.

14 Table 8.0 - Current Operations Staff

Name	Certification Level	Position
Kevin Burtch	Water Distribution Level 1	Operations Manager
Mike Rojem	Water Distribution Level 3 Water Treatment Level 1	Projects Coordinator
Brandon Fletcher	Water Distribution Level 4 Water Treatment Level 2	Projects Assistant
Chris MacKay	Water Distribution Level 3 Water Treatment Level 1	System Operator
Shaun McGaw	Water Distribution Level 3	System Operator

Name	Certification Level	Position
Kelvin Giesbrecht	Water Distribution Level 2 Water Treatment Level 1	System Operator
Julius Rideg	Water Distribution Level 2 Water Treatment Level 1	System Operator
Brad Wallace	Water Distribution Level 1	Water Meter Technician
Gordon Ross	Water Treatment Level 3 Water Distribution Level 2	Water Quality Technician / System Operator

15 South Lake Reservoir

STAFF CONTACTS

Name	Title	Telephone
Dawn Williams	Administrator	250-763-6506 ext. 102
Kevin Burtch	Operations Manager	250-763-6506 ext. 109
Annie Lynch	Administrative Treasurer	250-763-6506 ext. 104
Mike Rojem	Projects Coordinator	250-763-6506 ext. 103
Gordon Ross	Water Quality Technician	250-763-6506 ext. 125

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) – In terms of drinking water quality, refers standards above which, objectional taste, odour and/or appearance may occur.

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.

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.

Guidelines for Canadian Drinking Water Quality – A document established by Health Canada that recommends standards for potable water. The standards include; Maximum Acceptable Concentrations (MAC), Aesthetic Objectives (AO) and Operational Guidance (OG) for physical, microbiological, chemical and radiological substances in drinking water.

Haloacetic Acid (HAA) - a type of disinfection by-product resulting from the reaction of chlorine and organic matter in the water. The MAC for HAAs in drinking water is 0.0800mg/L.

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) – the major category of disinfection by-products in chlorinated drinking water. They are caused by the reaction of chlorine with organic matter present in the water. The MAC for THMs in drinking water is 0.100mg/L

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

Turbidity – the cloudiness or haziness of water caused by suspended solids that are usually invisible to the naked eye. Its measurement relates to the optical property of water that causes light to be scattered, rather than transmitted through the sample 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