THE VILLAGE OF

NAKUSP

WATER OPERATIONS REPORT 2020

Well #1 and #2 Distribution

WTP UV System

7th Ave., Low-income hydrant installation

Nakusp Water System, Facility #0211995

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1.0 Introduction:

Under the terms of the Village of Nakusp Operating Permit for the Nakusp Water System, Facility #0211995, as per Section 8 of the *Drinking Water Protection Act*, the Village is required to provide an annual report to the public and users of the water system. This report is to provide a summary of the water system operation, maintenance, upgrades, and testing procedures and is submitted to Interior Health.

Please note that Sections 2, 3, 4 and 10 are taken directly from the Village of Nakusp Emergency Response Plan, as prepared by Austin Engineering, 2016.

Inquiries relating to the water system should be directed to the Public Works Department:

1325 Hot Springs Rd
Nakusp, BC, V0G 1R0
Office: 250-265-3556

2.0 CUSTOMER DEMOGRAPHICS:

2020 annual invoiced customers are as follows[1]:

Rate Code	Rate Description	Customer Count	Strata Units
01 W01	Water Single Family Dwelling	733	750
01 W02	Water Duplex, Triplex or Apartment - first unit	27	27
01 W03	Water Retail and Other Business	62	81
01 W04	Water Hotel/motel - owner/manager residence	2	2
01 W05	Water Cafe, Restaurant, Drive-in	8	8
01 W08	Water Large Grocer	1	1
01 W09	Church or Church Hall	8	8
01 W10	WATER HALL OR AMUSEMENT PLACE	3	3
01 W11	Water Licenced Lounge	4	4
01 W12	Water Car Wash - per wash unit	2	3
01 W13	Water bottling plant - $0.13464/cubic meter based on 2013 usage	3	3
01 W14	Water Hospital, Intermediate Care Facility - per bed	2	43
01 W17	WATER SPORTS COMPLEX	1	1
01 W18	WATER CONCRETE PLANT	1	1
01 W19	WATER CEMETERY	1	3
01 W20	WATER MOBILE HOME - each pad	5	64
01 W21	WATER Drive In Restaurant (no indoor seating)	2	2
01 W24	WATER LAUNDROMAT PER WASHER	1	12
01 W25	WATER BEACH PARK WASHROOMS	1	2
01 W26	WATER BEACH PARK SPRINKLING	1	5
01 W30	Water Campground - per site	2	41
01 W40	WATER FARM WITH LIVESTOCK	7	7
01 W41	Water Garage, Service Station or Body Shop	12	12
01 W52	Water - Apartment - each additional unit	25	79
01 W84	Water Hotel/motel - per room	8	122
01 W99	WATER Vacant lot with service available	2	2
01 WES	WATER NAKUSP ELEMENTARY SCHOOL	1	1
01 WSS	WATER NAKUSP SECONDARY SCHOOL	1	1
		926	**1,288.00**

Table 1: 2020 Invoiced Water Consumers

[1] A number of these connections are located outside of the Village of Nakusp's municipal boundary.

3.0 WATER COLLECTION, TREATMENT & DISTRIBUTION SYSTEM:

The Village of Nakusp's water system is supplied by both surface and groundwater sources. Typical system operation can be described as operating in two zones:

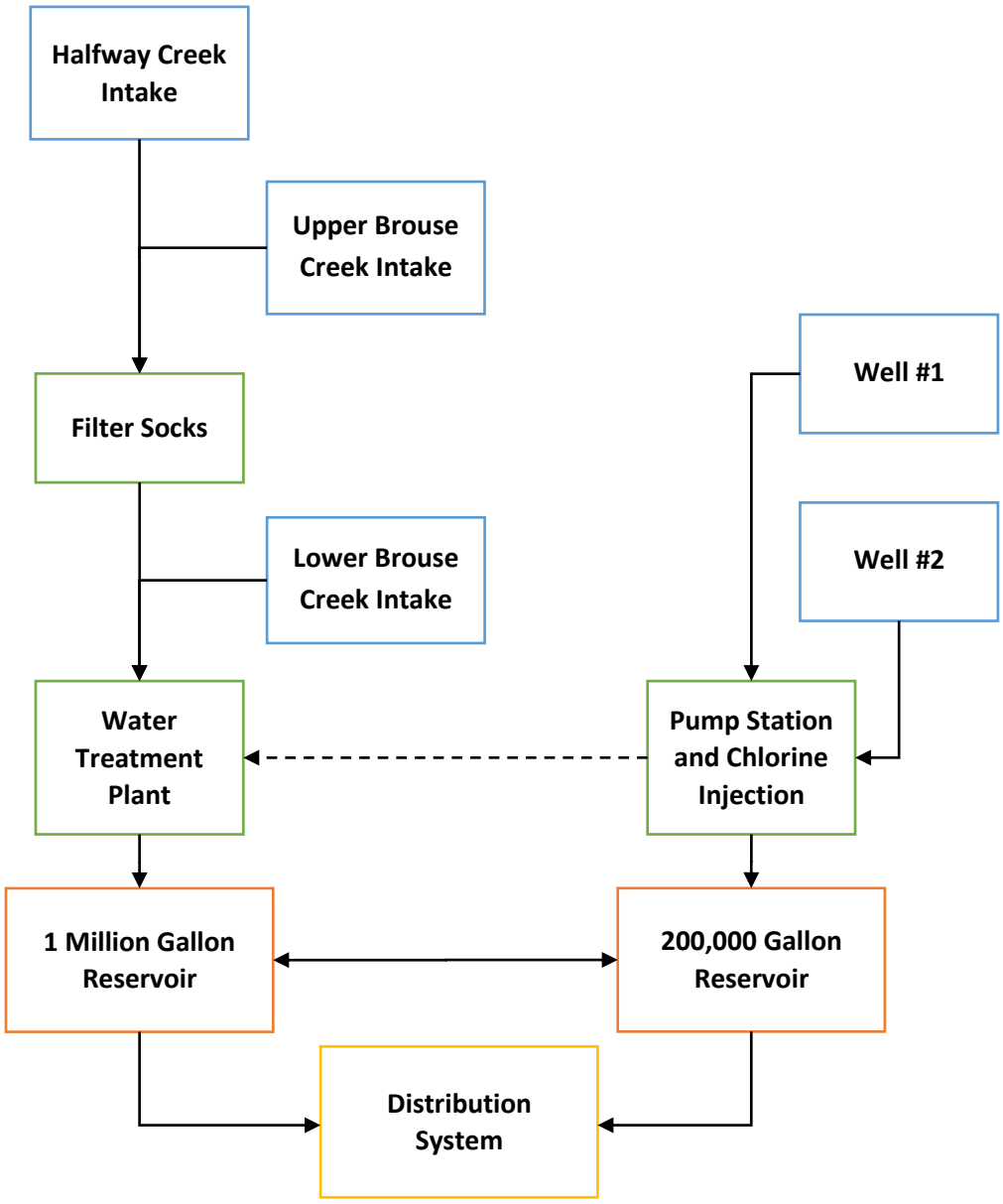


Figure 1: Nakusp Water System Schematic

Upper Distribution Zone

Raw water is supplied by surface water intakes on Halfway Creek, Upper Brouse Creek and Lower Brouse Creek. The surface water then undergoes membrane ultrafiltration, ultraviolet (UV) light, and chlorine injection treatment at the water treatment plant. The water treatment plant directly supplies the 1,000,000 gallons (3,785,000 L) upper reservoir which subsequently services the upper and lower distribution system

Lower Distribution Zone

Raw water is supplied by two (2) groundwater wells located in the same aquifer. Groundwater undergoes chlorine injection prior to suppling the 200,000 gallons (757,000 L) lower reservoir which subsequently services the lower distribution zone.

Together these systems contain one (1) treatment plant, two (2) groundwater wells, three (3) surface water intakes, 26.7 km of water main, two (2) reservoirs, (1) pressure reducing station and one (1) booster pump station.

The upper reservoir is capable of supplying water to the lower reservoir (gravity) and the lower reservoir to the upper reservoir (by means of the booster station) therefore each source can indirectly supply water to any location within the system providing system

redundancy under emergency circumstances. An overview schematic for the Nakusp water system can be found in **Error! Reference s ource not found.**.

Village of Nakusp Water Treatment Plant (WTP)

The Village of Nakusp Water Treatment Plant (WTP) is supplied with raw water from the surface water intakes located at Brouse Creek and Halfway Creek. Raw water is gravity fed through a coarse filter sock chamber and a micro hydro facility before reaching the WTP. At the plant water is treated using membrane ultrafiltration, ultraviolet (UV) light, and chlorine disinfection. The maximum capacity of the WTP is 25 L/s. A general process for the water treatment plant can be found below in Figure 2: General WTP Process.

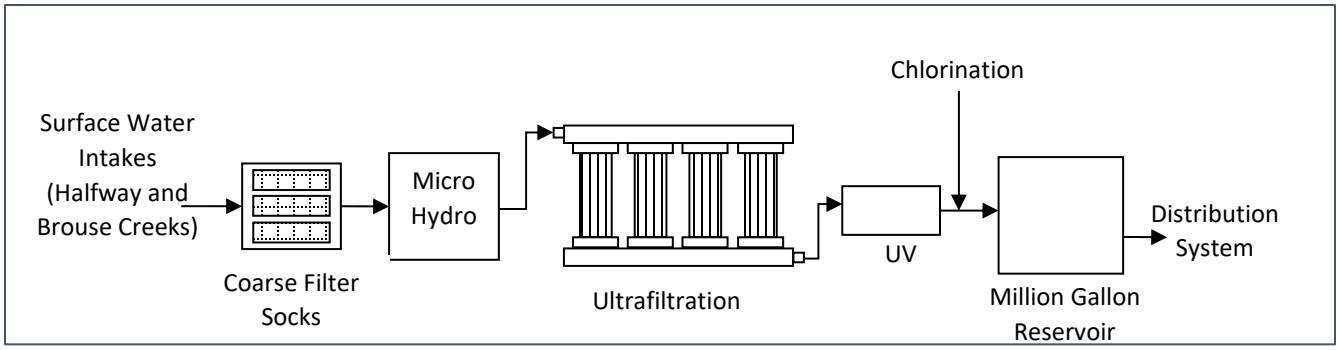


Figure 2: General WTP Process

Groundwater Wells

The Village of Nakusp water system contains two (2) groundwater wells (Well #1 and Well #2). Both wells are located in close proximity to each other, north of the arena in the Nakusp Recreation Park within a "confined to semi-confined aquifer comprised of coarse-grained alluvial fan sediments overlain by silt and clay" with a static water level of approximately 18 m below ground surface (Golder Associates, 2014).

Groundwater sourced from the wells undergoes chlorine injection prior to being routed directly into the 200,000 Gallon Reservoir and the rest of the distribution system. Connection between the WTP and the groundwater wells is available however this is typically bypassed.

Due to the proximity of the two groundwater wells, a groundwater contamination event is likely to impact both wells. The wells can therefore only be considered as redundant to each other for supply related emergency situations. Neither well should be utilized if the other has a contaminant related emergency as both are likely to be impacted.

A summary of well characteristics is outlined below in Table 2.

	Well #1 (Golder Associates, 2014)	Well #2 (Golder Associates, 2014 & Village of Nakusp)
BC Ministry of Environment Well Tag Number	88581	104165
Installation Year	2004	2015
Total Depth	84.0 m	124.4 m
Capacity[2] (Limited Based on Current Pump)	46.6 L/s (675 US gpm)	81 L/s[3] (1,270 US gpm)
Current Pump	50 hp	75 hp
Typical Pump Flowrate at Maximum Power	23 L/s (364 US gpm)	28 L/s (444 US gpm)

Table 2: Well Summary (Golder Associates, 2014 and the Village of Nakusp)

[2] **Capacity is limited due to the current pump installed in the wells**

[3] **Limited to a maximum of 63 L/s (1,000 US gpm) as an environmental assessment has not been completed under the *BC Environmental Assessment Act*.**

4.0 OPERATIONS & MAINTENANCE:

Operations and maintenance procedures are important safeguards for several potential emergency risks and can help to reduce the impact of unavoidable emergency situations. Notable operations and maintenance procedures that the Village of Nakusp employs, related to potential emergencies and their response, are outlined in Table 3 below.

O&M Procedure	Emergency Effects	Potential for Improvement
Locked buildings, fenced reservoir	Protection from tampering	Increased security measures (cameras/security company/better signage/lock gates providing vehicle access to intake locations.
SCADA system connected to all water system entities	Response time is reduced due to on-going/constant surveillance and effective notification system	
Recorded routine O&M checks performed and recorded	Likelihood of unexpected failure reduced	
Documented cross connection control program in place	Reduce likelihood of contamination	
Multiple water supply sources available for whole system (Groundwater wells and WTP)	Redundancy for potential loss/reduction of available water supply	Investigate options to increase supply from the surface water Halfway and Brouse Creeks intakes. Investigate options for a the third well to increase redundancy and water production.
Distribution system flushing program (annually in spring and fall)	Reduce potential of stagnation/ contamination	

Table 3: Operations and Maintenance Procedures

5.0 WATER QUALITY SAMPLING:

Water quality sampling frequency and procedures are important to the realization of a potential emergency event. The *BC Drinking Water Protection Regulation* –
Schedule B outlines the required frequency of monitoring samples. The Village of Nakusp's Water System falls into the category for populations of less than 5,000 which requires four (4) samples per month. The Village of Nakusp currently meets this sampling requirement by taking samples from seven (7) distinct locations within the system. Approximate sampling locations are outlined in Figure 3.

Samples for external analysis are taken by qualified Water Operators and sent monthly to qualified laboratories (CARO Analytical Services, or BC Centre for Disease Control Laboratory Services). All lab results are documented and kept on file. A summary of water system monitoring is outlined in Table 4.

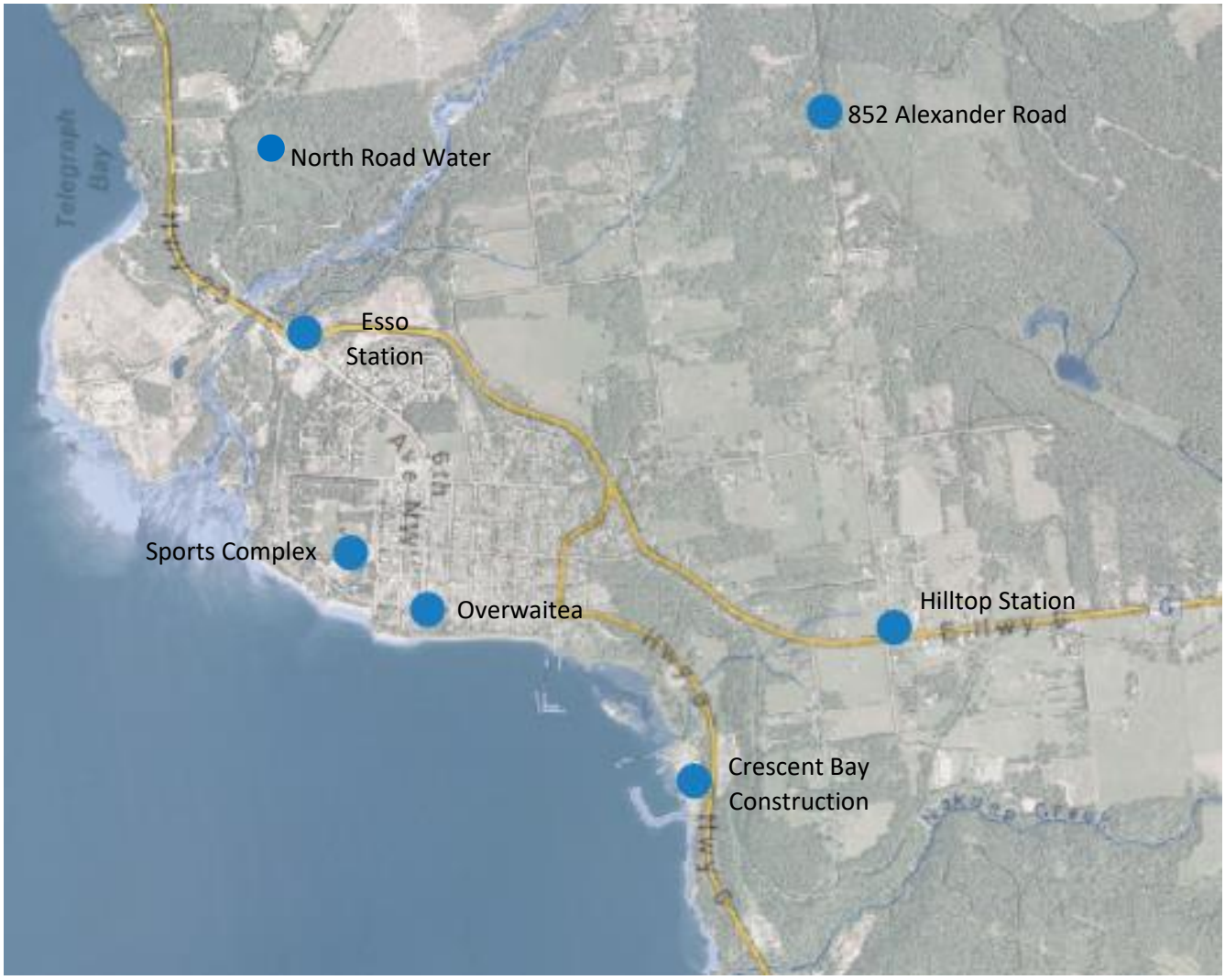


Figure 3: Sampling Locations

Contamination Events

In the event of suspected or realized contamination in the water system, further water quality sampling is a critical step in resolving the situation. Due to the time required for sampling, laboratory analysis, and results, it should occur as quickly as possible (notification of Interior Health and possible public notification are the priority).

Potential water contaminants that would need to be sampled for in an emergency event can be categorized as:

- Microbial Pathogens
- Chemical and Physical
- Radiological

In the event of a water quality emergency, both the relevance of a test and the turn-around time for result delivery required for decision making, should be considered on a case-by-case basis as required. Once results are available, a comparison should be made to the relevant *BC Water Quality Guideline*. Water sampling Standard Operating Procedures (SOPs) should be followed under all situations.

Frequency	Test
Weekly	Microbial (E.Coli and Total Coliform)
Monthly	Turbidity monitoring data UV and UV sensor data Chlorine monitoring data
Quarterly	Trihalomethane Haloacetic acids
Semi-Annually	Baseline analysis for potential contaminants of groundwater, including: hydrocarbons (benzene, toluene, ethylbenzene & xylene, light and heavy extractable petroleum hydrocarbons -including polyaromatic hydrocarbons, volatile organic compounds; herbicides and pesticides; metals, nitrates; nitrites and phosphorus; and/or microbiological parameters (coliforms, E. coli); Specific contaminants of concern
Annually	Full comprehensive raw water analysis for each source

Table 4: Sampling Overview

6.0 2020 WATER QUALITY ANALYSIS RESULTS

SITE	DATE	Residual Cl ppm	TC Count/100ML	EC Count /100 ML
Hilltop Station				
	Feb-4-20	0.68	L1	L1
	24-Mar-20	0.42	L1	L1
	12-May-20	0.64	L1	L1
	2-Jul-20	STAT		
	18-Aug-20	0.45	L1	L1
	6-Oct-20	0.55	L1	L1
	24-Nov-20	0.67	L1	L1
NRW				
	Feb-11-20	0.12	L1	L1
	31-Mar-20	0.31	L1	L1
	19-May-20	0.22	L1	L1
	14-Jul-20	0.2	L1	L1
	25-Aug-20	0.44	L1	L1
	14-Oct-20	0.21	RESAMPLED	RESAMPLED
	20-Oct-20	0.37	L1	L1
852 Alexander Rd.				
	8-Jan-20	0.53	L1	L1
	Feb-19-20	0.48	L1	L1
	7-Apr-20	0.39	L1	L1
	26-May-20	0.38	L1	L1
	7-Jul-20	0.42	L1	L1
	1-Sep-20	0.48	L1	L1
	20-Oct-20	0.68	L1	L1
	8-Dec-20	0.35	L1	L1
	8-Jan-20	0.53	L1	L1
Sports Complex				
	Feb-26-20	0.34	L1	L1
	15-Apr-20	0.32	L1	l1
	2-Jun-20	0.31	L1	L1
	21-Jul-20	0.23	L1	L1
	Sept-10-20	0.28	L1	L1
	27-Oct-20	0.55	L1	L1
	15-Dec-20	0.43	L1	L1
Crescent Bay Const.				
	14-Jan-20	0.51	L1	L1
	3-Mar-20	0.53	L1	L1
	21-Apr-20			
	9-Jun-20	0.25	L1	L1
	28-Jul-20	0.23	L1	L1
	15-Sep-20	0.25	L1	L1
	3-Nov-20	0.39	L1	L1
	22-Dec-20	snow storm		
Overwaitea				
	10-Mar-20	0.41	L1	L1
	28-Apr-20	0.64	L1	L1
	16-Jun-20	0.27	L1	L1
	5-Aug-20	0.23	L1	L1
	22-Sep-20	0.33	L1	L1
	12-Nov-20	0.53	L1	L1
	29-Dec-20	0.54	L1	L1
Esso Station				
	21-Jan-20	0.84	L1	L1
	29-Jan-20	0.31	L1	L1
	17-Mar-20		L1	L1
	5-May-20	0.4	L1	L1
	23-Jun-20	0.3	L1	L1
	11-Aug-20	0.12	L1	L1
	29-Sep-20	.13- retest .18	L1	L1

2020 Annual Comprehensive Source Water Analysis (Untreated Water)

Well #1 (20L0195-01) 1 Matrix: Water 1 Sampled: 2020-12-01 13:15

Anions	Results	Guideline	RL Units	Analyzed
Chloride	5.73	AO≤250	0.10 mg/L	2020-12-02
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2020-12-02
Nitrate (as N)	0.642	MAC = 10	0.010mg/L	2020-12-02
Nitrite (as N)	< 0.010	MAC = 1	0.010,g/L	2020-12-02
Sulfate	6.1	AO≤500	1.0 mg/L	2020-12-02

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	169	None	0.5 mg/L	NIA
Langelier Index	0.2	NIA	-5.0	2020-12-09
Nitrogen, Organic	< 0.0500	NIA	0.05 mg/L	NIA
Solids, Total Dissolved	178	AO :: 500	1 mg/L	NIA

General Parameters	**Results**	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	155	NIA	1 mg/L	2020-12-04	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	NIA	1 mg/L	2020-12-04	
Alkalinity, Bicarbonate (as CaCO3)	155	NIA	1 mg/L	2020-12-04	
Alkalinity, Carbonate (as CaCO3)	< 1.0	NIA	1 mg/L	2020-12-04	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	NIA	1 mg/L	2020-12-04	
Ammonia, Total (as N)	< 0.050	None	0.05 mg/L	2020-12-02	
Carbon, Total Organic	0.51	NIA	0.5 mg/L	2020-12-04	
Colour, True	< 5.0	AO :: 15	5 CU	2020-12-02	
Conductivity (EC)	310	NIA	2 µS/cm	2020-12-04	
Cyanide, Total	< 0.0020	MAC = 0.2	0.002 mg/L	2020-12-07	
Nitrogen, Total Kjeldahl	< 0.050	NIA	0.05 mg/L	2020-12-04	
pH	7.77	7.0-10.5	0.1 pH	2020-12-04	HT2
Phosphorus, Total (as P)	0.0082	NIA	0.005 mg/L	2020-12-04	
Sulfide, Total	< 0.020	AO :: 0.05	0.02 mg/L	2020-12-04	
Temperature, at pH	22.3	NIA		2020-12-04	HT2
Turbidity	0.14	OG < 1	0.1 NTU	2020-12-03	
UV Transmittance @ 254nm	99.0	NIA	0.1 % T	2020-12-03	

Microbiological Parameters	**Results**	**Guidelines**	**RL Units**	**Analyzed**
Coliforms, Total	< 1	N/A	1 MPN/100	2020-12-02
E. coli	< 1	N/A	1 MPN/100	2020-12-02

Total Metals	**Results**	**Guideline**	**RL Unit**	**Analyzed**
Aluminum, total	< 0.0050	OG < 0.1	0.005 mg/L	2020-12-08
Antimony, total	< 0.00020	MAC = 0.006	0.0002 mg/L	2020-12-08
Arsenic, total	< 0.00050	MAC = 0.01	0.0005 mg/L	2020-12-08
Barium, total	0.462	MAC = 2	0.005 mg/L	2020-12-08
Boron, total	< 0.0500	MAC = 5	0.05 mg/L	2020-12-08
Cadmium, total	< 0.000010	MAC = 0.005	0.00001	2020-12-08
Calcium, total	53.1	None Required	0.2 mg/L	2020-12-08
Chromium, total	0.00324	MAC = 0.05	0.0005	2020-12-08
Cobalt, total	< 0.00010	NIA	0.0001	2020-12-08
Copper, total	0.00503	MAC = 2	0.0004	2020-12-08
Iron, total	< 0.010	AO :: 0.3	0.01 mg/L	2020-12-08
Lead, total	0.00050	MAC = 0.005	0.0002	2020-12-08
Magnesium, total	8.71	None	0.01 mg/L	2020-12-08
Manganese, total	0.00144	MAC = 0.12	0.0002	2020-12-08
Mercury, total	< 0.000010	MAC = 0.001	0.00001	2020-12-08
Molybdenum, total	0.00023	NIA	0.0001	2020-12-08

Well #1 (20L0195-01) l Matrix: Water l Sampled: 2020-12-01 13:15 (continued)

Nickel, total	< 0.00040	NIA	0.0004	2020-12-08
Potassium, total	1.55	NIA	0.1 mg/L	2020-12-08
Selenium, total	< 0.00050	MAC = 0.05	0.0005	2020-12-08
Sodium, total	5.14	AO :: 200	0.1 mg/L	2020-12-08
Strontium, total	1.02	7	0.001 mg/L	2020-12-08
Uranium, total	0.00205	MAC = 0.02	0.00002	2020-12-08
Zinc, total	0.0256	AO :: 5	0.004 mg/L	2020-12-08

Well #2 (20L0195-02) | Matrix: Water | Sampled: 2020-12-01 13:05

Anions	Results	Guideline	RL Unit	Analyzed
Chloride	5.80	AO≤250	0.10 mg/L	2020-12-02
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2020-12-02
Nitrate (as N)	0.519	MAC = 10	0.010 mg/L	2020-12-02
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2020-12-02
Sulfate	4.6	AO≤500	1.0 mg/L	2020-12-02

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	130	None required	0.500 mg/L	NIA
Langelier Index	0.2	N/A	-5.0	2020-12-09
Nitrogen, Organic	< 0.0500	N/A	0.0500 mg/L	NIA
Solids, Total Dissolved	178	AO≤250	1.00 mg/L	NIA

General Parameters	Results	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	117	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Bicarbonate (as CaCO3)	117	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Ammonia, Total (as N)	< 0.050	None	0.020 mg/L	2020-12-02	
Carbon, Total Organic	0.97	N/A	0.50 mg/L	2020-12-04	
Colour, True	< 5.0	AO≤15	5.0 CU	2020-12-02	
Conductivity (EC)	243	N/A	2.0 µS/cm	2020-12-04	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2020-12-07	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2020-12-04	
pH	7.56	7.0-10.5	0.10 pH units	2020-12-04	HT2
Phosphorus, Total (as P)	0.0086	N/A	0.0020 mg/L	2020-12-04	
Sulfide, Total	< 0.020	AO≤ 0.05	0.020 mg/L	2020-12-04	
Temperature, at pH	22.5	N/A	°C	2020-12-04	HT2
Turbidity	0.11	OG < 1	0.10 NTU	2020-12-03	
UV Transmittance @ 254nm	98.0	N/A	0.10% T	2020-12-03	HT1

Microbiological Parameters	Results	Guidelines	RL Units	Analyzed
Coliforms, Total	< 1	MAC = 0	1 CFU/100	2020-12-02
E. coli	< 1	MAC = 0	1 CFU/100	2020-12-02

Total Metals	Results	Guideline	RL Unit	Analyzed
Aluminum, total	< 0.0050	OG < 0.1	0.0050	2020-12-08
Antimony, total	< 0.00020	MAC = 0.006	0.00020	2020-12-08
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	2020-12-08
Barium, total	0.333	MAC = 1	0.0050	2020-12-08
Boron, total	< 0.0500	MAC = 5	0.0050	2020-12-08
Cadmium, total	0.000019	MAC = 0.005	0.000010	2020-12-08
Calcium, total	41.4	None Required	0.20 mg/L	2020-12-08
Chromium, total	0.00204	MAC = 0.05	0.00050	2020-12-08
Cobalt, total	0.00012	N/A	0.00010	2020-12-08
Copper, total	0.00932	AO≤1	0.00040	2020-12-08
Iron, total	< 0.010	AO≤ 0.3	0.010 mg/L	2020-12-08
Lead, total	0.00028	MAC = 0.01	0.00020	2020-12-08
Magnesium, total	6.45	None	0.010 mg/L	2020-12-08
Manganese, total	0.05220	AO≤0.05	0.00020	2020-12-08
Mercury, total	< 0.000010	MAC = 0.001	0.000010	2020-12-09
Molybdenum, total	0.00025	N/A	0.00010	2020-12-08
Nickel, total	0.00103	N/A	0.00040	2020-12-08
Potassium, total	1.48	N/A	0.10 mg/L	2020-12-08
Selenium, total	< 0.00050	MAC = 0.05	0.00050	2020-12-08
Sodium, total	4.50	AO≤200	0.10 mg/L	2020-12-08
Strontium, total	0.75	N/A	0.0010 mg/L	2020-12-08
Uranium, total	0.00088	MAC = 0.02	0.000020	2020-12-08
Zinc, total	0.0175	AO≤5	0.0040 mg/L	2020-12-08

Well #2 (20L0195-02) | Matrix: Water | Sampled: 2020-12-01 13:05 (continued)

Surface (20L0195-03) | Matrix: Water | Sampled: 2020-12-01 11:50

Anions	Results	Guideline	RL Unit	Analyzed
Chloride	< 0.10	AO≤250	0.10 mg/L	2020-12-02
Fluoride	< 0.10	MAC = 1.5	0.10 mg/L	2020-12-02
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	2020-12-02
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2020-12-02
Sulfate	11.5	AO≤500	1.0 mg/L	2020-12-02

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	52	None required	0.500 mg/L	NIA
Langelier Index	1.2	N/A	-5.0	2020-12-09
Nitrogen, Organic	< 0.0500	N/A	0.0500 mg/L	NIA
Solids, Total Dissolved	60	AO≤250	1.00 mg/L	NIA

General Parameters	Results	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	43	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Bicarbonate (as CaCO3)	43	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2020-12-04	
Ammonia, Total (as N)	< 0.050	None	0.020 mg/L	2020-12-02	
Carbon, Total Organic	0.75	N/A	0.50 mg/L	2020-12-04	
Colour, True	< 5.0	AO≤15	5.0 CU	2020-12-02	
Conductivity (EC)	107	N/A	2.0 µS/cm	2020-12-04	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2020-12-07	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2020-12-04	
pH	7.38	7.0-10.5	0.10 pH units	2020-12-04	HT2
Phosphorus, Total (as P)	0.0056	N/A	0.0020 mg/L	2020-12-04	
Sulfide, Total	< 0.020	AO≤ 0.05	0.020 mg/L	2020-12-04	
Temperature, at pH	22.3	N/A	°C	2020-12-04	HT2
Turbidity	0.15	OG < 1	0.10 NTU	2020-12-03	
UV Transmittance @ 254nm	95.0	N/A	0.10% T	2020-12-03	HT1

Microbiological Parameters	Results	Guidelines	RL Units	Analyzed
Coliforms, Total	5	MAC = 0	1 CFU/100 mL	2020-12-02
E. coli	< 1	MAC = 0	1 CFU/100 mL	2020-12-02

Total Metals	Results	Guideline	RL Unit	Analyzed
Aluminum, total	0.0099	OG < 0.1	0.0050	2020-12-08
Antimony, total	< 0.00020	MAC = 0.006	0.00020	2020-12-08
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	2020-12-08
Barium, total	0.044	MAC = 1	0.0050	2020-12-08
Boron, total	< 0.0500	MAC = 5	0.0050	2020-12-08
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2020-12-08
Calcium, total	17.6	None Required	0.20 mg/L	2020-12-08
Chromium, total	0.00102	MAC = 0.05	0.00050 mg/L	2020-12-08
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2020-12-08
Copper, total	0.00501	AO≤1	0.00040 mg/L	2020-12-08
Iron, total	< 0.010	AO≤ 0.3	0.010 mg/L	2020-12-08
Lead, total	0.00047	MAC = 0.01	0.00020 mg/L	2020-12-08
Magnesium, total	1.89	None Required	0.010 mg/L	2020-12-08
Manganese, total	0.00094	AO≤0.05	0.00020 mg/L	2020-12-08
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2020-12-09
Molybdenum, total	0.00114	N/A	0.00010 mg/L	2020-12-08
Nickel, total	< 0.00040	N/A	0.00040 mg/L	2020-12-08
Potassium, total	0.74	N/A	0.10 mg/L	2020-12-08
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2020-12-08
Sodium, total	1.65	AO≤200	0.10 mg/L	2020-12-08
Strontium, total	0.64	N/A	0.0010 mg/L	2020-12-08
Uranium, total	0.00096	MAC = 0.02	0.000020 mg/L	2020-12-08
Zinc, total	0.0126	AO≤5	0.0040 mg/L	2020-12-08

2020 Trihalomethane (THM) Results

Each water sample is tested for: Bromodichloromethane; Bromoform; Chloroform; and Dibromochloromethane. Results are reported in mg/L. The method reporting limit for each compound is less than 0.001 mg/L. Only results exceeding 0.001 mg/L are shown below:

DATE	SITE	BROMODICHLOROMETHANE	BROMOFORM	CHLOROFORM	DIBROMO-CHLOROMETHANE	TOTAL THM
March 5/20	Crescent Bay	<0.0010	<0.0010	<0.0015	<0.0010	<0.00451
June 2/20	Sports complex	<0.0010	<0.0010	0.001	<0.0010	<0.00400
Sept. 5/20	Alexander Road	<0.0010	<0.0010	0.033	<0.0010	0.033
Dec.	North Road	0.0015	<0.0010	0.0201	0.0016	0.0232

2020 Haloacetic Acid (HAA) Results

Another major group of chlorinated disinfection by-products found in drinking water, besides Trihalomethanes, are Haloacetic Acids. Together they can be used as indicators for the presence of all chlorinated disinfection by-products. The Maximum Allowable Concentration of HAAs is 80 micrograms/Litre.

DATE	SITE	MONOCHLOROACETIC ACID (MCA)	DICHLOROACETIC ACID (DCA)	TRICHLOROACETIC ACID (TCA)	MONOBROMOACETIC ACID (MBA)	DIBROMOACETIC ACID (DBA)	TOTAL HAA5
Mar. 5/20	Crescent Bay	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00200
June 2/20	Sports Complex	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00200
Sept. 5/20	Alexander Rd	<0.0020	0.0138	0.0184	<0.0020	<0.0020	0.0322
Dec.	NRW	<0.0020	0.0073	0.0133	<0.0020	<0.0020	0.0206

7.0 OPERATOR CERTIFICATION:

Utilities and Utility Operators are certified through the Environmental Operators Certification Program (EOCP). Following an EOCP re-evaluation the Village WTP remains classified as a Water Treatment Level II and Water Distribution Level II Facility, which requires Level II Operators to run it.

At this time, our staff is certified to the following levels:

Employee	Water Treatment	Water Distribution
Bob Gresiuk	WT-III	WD - lll
Terry Flamond	WT-I	WD - I
Gilbert Battersby	-	WD – II
Taylor Cooke	-	Multi-Utility
Cory Jackson	-	Multi-Utility

8.0 CHALLENGES & DIFFICULTIES:

Perhaps the biggest challenge is addressing aging water infrastructure and securing funding for improvement initiatives. Water utility projects are notoriously difficult to fund compared to other infrastructure initiatives. One major reason is that these systems are much less visible compared to roads and bridges, which makes it harder to generate public support for improvement and maintenance. As the old saying goes, out of sight, out of mind.

Another challenge is water consumption. Our water use can increase up to 50% in summer and early fall, largely due to lawn watering.

The supply of water for future growth is another challenge facing the Village of Nakusp.

9.0 WATER CONSUMPTION DATA:

Water Supplied:

Groundwater source: 145,098 m3
Well #1: 98,541 m3
Well #2: 434,286 m3
Total: 677,925 m3

Average 2020 per capita consumption based on the number of Village strata units 1,288 = 526 m3 per unit including industrial, commercial and institutional usage. In comparison to the 2019 average per capita consumption of 568 m3 by 1,281 strata units, this accounts for a total reduction of 42 m3 per unit or 7.4% less water used per unit. Total 2020 consumption of 677,925 m3 was down 50,914 m3 from 2019 annual consumption of 728,839 m3 for a 6.99% overall reduction in water usage.

These reduced numbers may be accounted for by some water leak repairs that took place in 2020 and possibly the fact that consumers are becoming more cognizant of the need to reduce usage in order to conserve our resource.

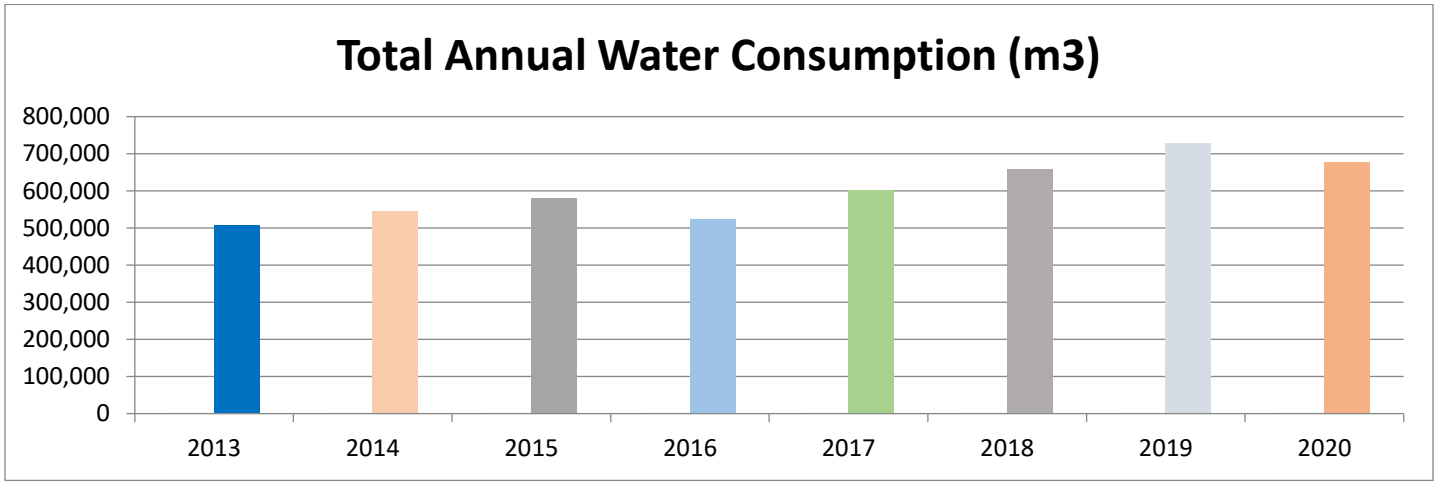


Figure 4: 2013 - 2020 Total Annual Water Consumption

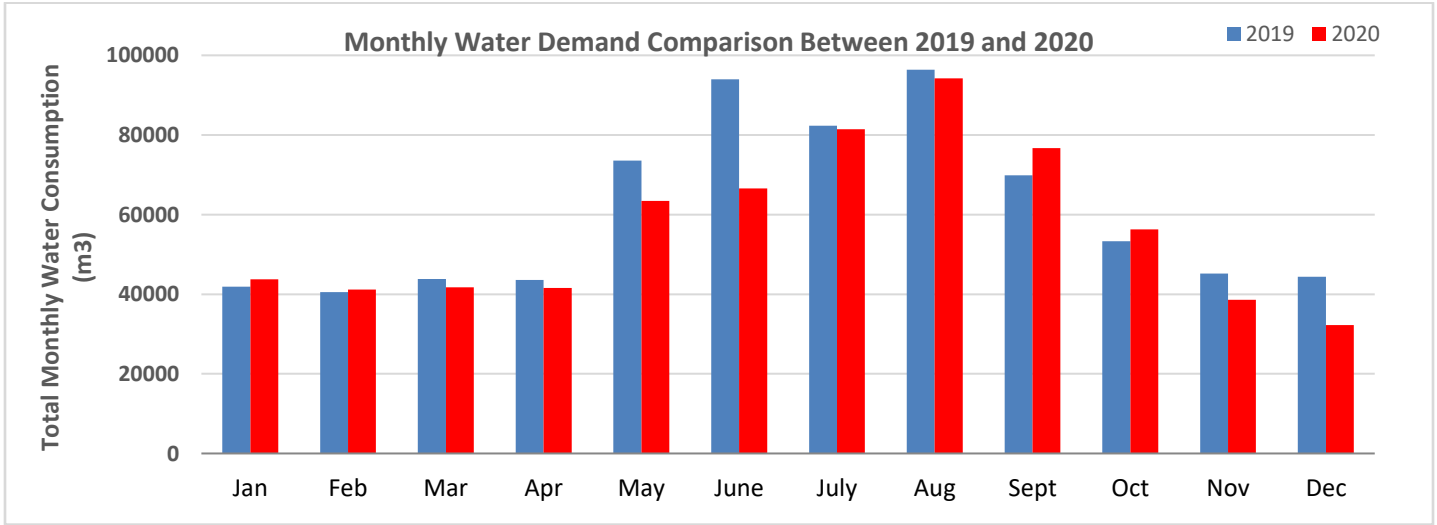


Figure 5: Monthly Water Demand Comparison Between 2019 - 2020

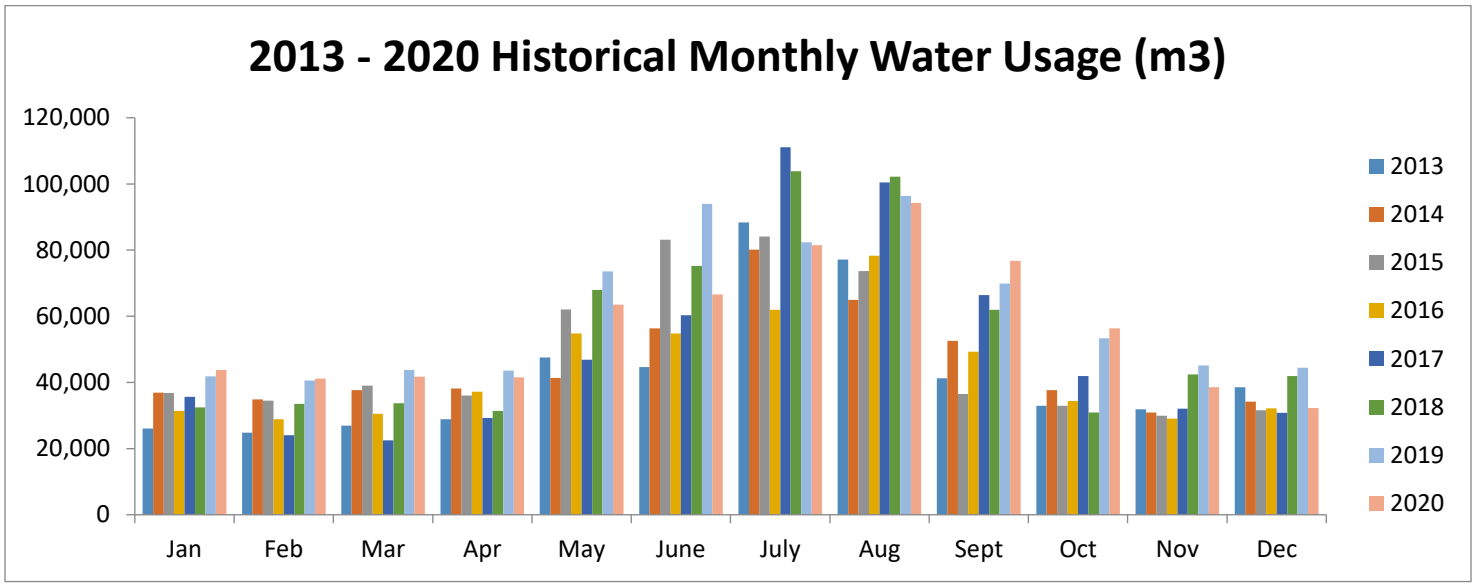


Figure 6: 2013 – 2020 Historical Water Usage

2020 GRAVITY SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF MONTH	READING FOR MONTH M3	DAILY AVG
January	31	527	3	12	9	597,648	608,855	11,207	362
February	28	532	9	15	3	608,885	618,591	9,706	347
March	31	572	1	133	13	618591	630,127	11,536	372
April	30	472	4	34	26	630,127	639,249	9,122	304
May	31	640	21	1	8	639,249	643,738	4,489	145
June	30	583	23	82	1	643,738	655,201	11,463	382
July	31	961	21	2	178	655,201	674,371	19,170	618
August	31	1,157	1	12	2	674,371	694,627	20,256	653
September	30	741	1	29	359	694,627	710,533	15,906	530
October	31	455	4	262	6	710,533	721,775	11,242	363
November	30	408	21	61	14	721,775	730,418	8,643	288
December	31	528	6	226	16	730,418	742,776	12,358	399

2020 WELL #1 SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF MONTH	READING FOR MONTH M3	DAILY AVG
January	0								
February	3	1065	29	14	28	1,276,757	1277887	1,130	377
March	21	1489	2	397	31	1,277,887	1307558	29,671	1413
April	10	1103	10	689	13	1,307,558	1329238	21,680	2168
May	11	476	30	111	14	1,329,238	1331599	2,361	215
June	11	1389	25	17	26	1,331,599	1335992	4,393	399
July	11	561	30	4	8	1,335,992	1337734	1,742	158
August	27	815	11	5	90	1,337,734	1346874	9,140	339
September	24	382	24	2	26	1,346,874	1351852	4,978	207
October	3	15	28	8	28	1,351,852	1351886	34	11
November	4	1257	28	549	30	1,351,886	1355609	3,723	931
December	31	1085	16	428	7	1355609	1375298	19,689	635

2020 WELL #2 SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF NEXT MONTH	READING FOR MONTH M3	DAILY AVG.
January	31	1737	2	706	6	1724847	1757409	32,562	1050
February	28	1731	3	712	17	1757409	1787770	30,361	1084
March	4	176	25	107	6	1787770	1788331	561	140
April	9	1586	29	1	5	1788331	1799094	10,763	1196
May	31	2458	20	1130	19	1799094	1855709	56,615	1826
June	30	2433	2	308	25	1855709	1906436	50,727	1691
July	31	2743	31	869	2	1906436	1967001	60,565	1954
August	31	2548	10	1395	15	1967001	2031836	64,835	2091
September	30	2374	12	1467	24	2031836	2087673	55,837	1861
October	31	2104	6	819	30	2087673	2132696	45,023	1452
November	25	1727	14	680	4	2132696	2158915	26,219	1049
December	3	194	2	3	17	2158915	2159133	218	73

9.0 CROSS CONNECTION CONTROL PROGRAM:

The Village of Nakusp has developed a Cross Connection Control Program, as required by the Drinking Water Protection Act. The purpose of this program is to protect public health, by preventing potential non-potable water sources from cross contaminating the domestic water supply. This is achieved through the installation, maintenance, and inspection of back-flow prevention devices.
Utilities Operator Terry Flamond received Backflow training and certification in 2020. All VON backflow devices were tested and certified in 2020.

10.0 EMERGENCY RESPONSE:

Notifications

Clear and timely communication to all stakeholders in an emergency situation is critical to the effective management and resolution for any situation. Internal, government and public notifications should be made in a timely manner as each situation necessitates.

In the event of water quality exceedances, the first point of contact is the local public health officer at Interior Health. Any laboratory drinking water sample with positive E. coli or fecal coliform bacteria results, or threat of unsafe drinking water must be reported to Interior Health as per the *BC Drinking Water Protection Act*:

- During regular Interior Health office hours (weekdays, 08:00 to 16:30) the local public health officer should be the first point of contact.
- Should the local public health officer be unavailable during office hours the Nelson Health Unit, Health Protection Office can be contacted as an alternate.
- The Medical Health Officer Emergency Contact Number should only be used for emergency situations that occur outside of regular office hours.

In the event that public notice is required, multiple methods should be utilized to ensure all effected parties are adequately informed. This may include the use of notices, public meetings, radio advertisements, newspaper advertisements, television advertisements or direct individual notice.

Public notices regarding water quality issues have been developed for distribution in the following scenarios:

- **Water Quality Advisory:** Addresses situations where “at risk populations” (such as the elderly, infants, and people with weakened immune systems) may be at risk due to increased turbidity and potentially higher bacterial, virus, and parasite risks.
- **Boil Water Notice:** Addresses situations with high turbidity and potential bacterial, virus and parasite contamination of the water.
- **Do Not Consume Notice:** Addresses situations where water is not safe and should not be consumed due to untreated chemical contaminants, or other extreme cases in which contaminants cannot be inactivated by boiling water.

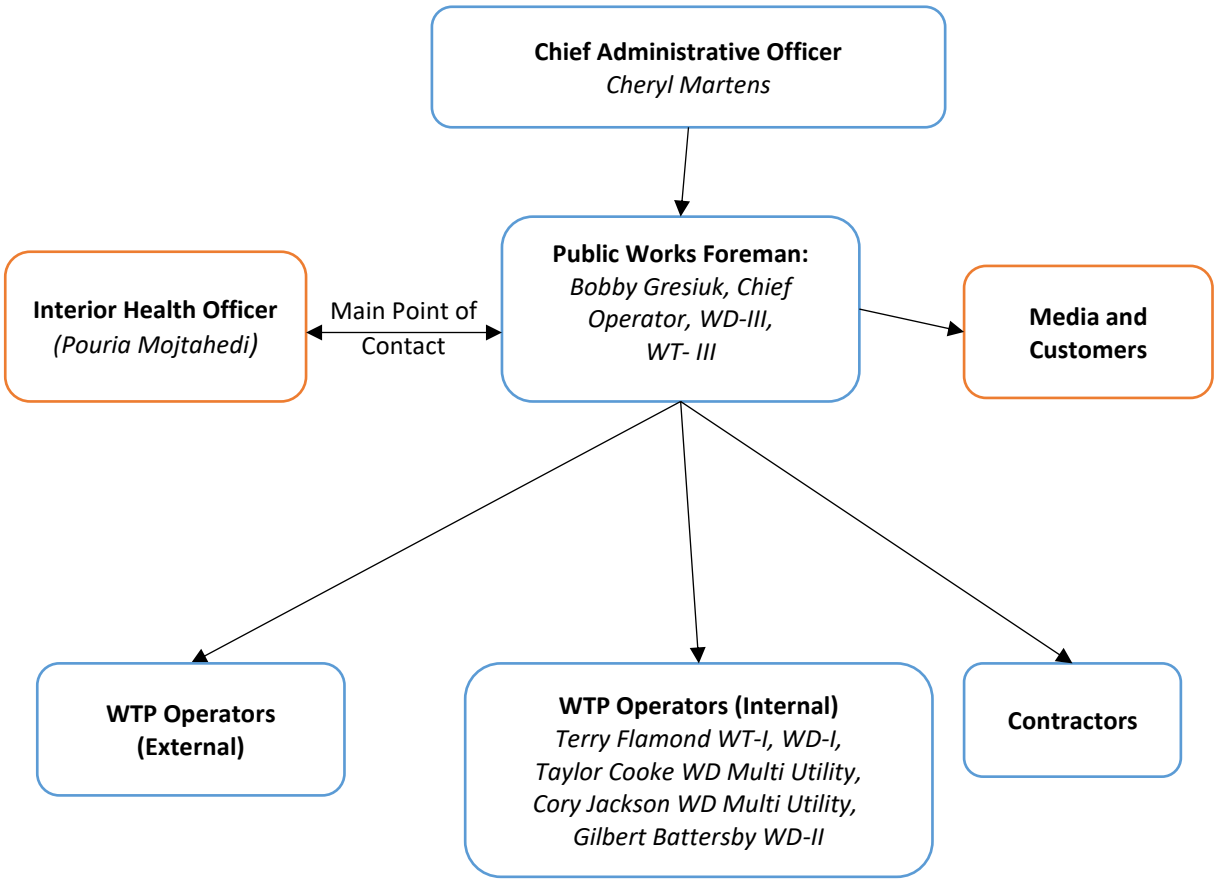
These notices should be tailored to each specific situation to provide the public with accurate and relevant information. Once the issues have been resolved, the public will also need to be informed that it is safe to resume with normal use of water. Notices for these situations can be found in Appendix A.

In the event that water use restrictions need to be implemented, it should be in accordance with the *Village of Nakusp Water Rates and Regulations Bylaw 656-2015.*

It is effective to designate a spokesperson to focus on communicating all relevant information to impacted parties. A summary of the ERP should be distributed and made available to all customers to alleviate questions and concerns in an emergency event.

Internal communication is also important in an emergency event, and a chain of command should be developed to ensure efficiency and that no information is lost.

The following is an example of a chain of command system for implementation.



NOTE:
**WT=Water Treatment Operator Certification*
**WD=Water Distribution Operator Certification*
**Village of Nakusp Requires Level II Distribution and Level II Treatment Operators*

11.0 PROJECTS & IMPROVEMENTS:

In cooperation with Village staff, 9dot Engineering Inc. (9dot) and Aqua Diversities Waterworks Inc. (Aqua) have developed a list of 2020 capital improvements and proposed engineering studies that will address the most pressing issues related to the Village of Nakusp

water utility. The following table outlines projects currently underway (in –progress) and the forthcoming projects anticipated for the remainder of 2020 and beyond.

Project Summary & Timeline

Capital Improvements	
Project Title	**Estimated Completion Date**
Alexander Road Flow Meter Install	Completed 2020
Flow Meter - SCADA System Integration Plan	Completed 2020
Shakespeare Road Water Line Replacement Design	2021
Well 3 design, build, install and tie-in	2021
New 200,000 Gallon reservoir design with possible construction start	2021
North Road Flow Meter installation	2021

Engineering Studies/Plans &Technical Reports	
Flow Meter Assessment Memorandum	Completed 2020
Water Treatment Systems Action Plan	Completed 2020
Well Data Collection & Analysis (Aqua)	Completed 2020
Well Study Report (9dot)	Completed 2020
Water Treatment Plant Optimization Study	
Water Master Plan	2021
Operations & Maintenance	
Upgraded new SCADA radios	Completed 2020
New underground communications cable from Well #2 to Well building	Completed 2020
Replaced 100 m AC watermain with 100m of C900 100mm PVC watermain on Hwy 6EW	Completed 2020
New water connections installed, 2 x 100mm , 4 x 19mm	Completed 2020
Installation of 2 new fire hydrants	Completed 2020
Well #1 50 hp motor replacement	Completed 2020
Replaced Transmembrane filters at water treatment plant	Completed October 2019
Ground Water (Well 1 and 2) Licensing Application	2021
Kuskanax Pipe Removal (including permitting)	2021
1 Mil Reservoir Inspection	2021
200K Reservoir Inspection (camera)	2021