



**NORTH VANCOUVER
DISTRICT**

2021 ANNUAL DRINKING WATER QUALITY REPORT

August 4, 2022.

District of North Vancouver Utilities Department

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EXECUTIVE SUMMARY

This report is the twentieth Drinking Water Quality Annual Report prepared by the District of North Vancouver. It provides water consumers with information about the quality of the potable water and the programs that support drinking water quality. Submission of this report to the Office of the Medical Health Officer for North Shore Vancouver Coastal Health fulfills regulatory obligations of the Drinking Water Protection Act, the British Columbia Drinking Water Protection Regulation and our application to the Medical Health Officer for an annual Drinking Water System Permit to operate a potable water system. This report adheres to Metro Vancouver’s “Water Quality Monitoring and Reporting Plan for the GVWD and Member Municipalities,” a template for the Greater Vancouver Water District and member municipalities water quality monitoring and reporting.

The Greater Vancouver Water District and the District of North Vancouver employ a multi-barrier science-based approach that encompasses water from the source to the point of delivery. This approach ensures consistent delivery of a reliable supply of safe drinking water. All potable water supplied to District of North Vancouver is treated at the Seymour Capilano Filtration Plant. In 2021, the District of North Vancouver’s scheduled water sampling consistently met or exceeded regulatory requirements. The combined efforts of the Greater Vancouver Water District and the District of North Vancouver once again resulted in excellent water quality for our customers.

1 SOURCE WATER

All water supplied to the District of North Vancouver (DNV) by the Greater Vancouver Water District (GVWD or Metro) comes from the Capilano or Seymour surface water reservoirs, followed by secondary treatment at the Seymour Capilano Filtration Plant (SCFP). Metro uses multiple barriers to protect, treat and supply safe drinking water, including watershed protection, water treatment, source quality testing, transmission point quality testing and ongoing operation and maintenance of the water systems.

Prior to 2009, Metro's treatment of both the Capilano and Seymour sources was primary disinfection, including chlorine. In 2010, Seymour source water was treated at the Seymour Capilano Filtration Plant (SCFP). The SCFP incorporates multiple disinfection processes, including filtration, ultraviolet radiation disinfection and chlorine. In 2015, tunnels were commissioned that linked the Capilano source water to the SCFP, marking a significant water treatment and quality milestone for the DNV and the region.

Metro analyzes source water for bacteriological, chemical and physical parameters according to the "BC Drinking Water Protection Regulation." The "Greater Vancouver Water District 2021 Water Quality Annual Report - Volume 1 & 2" summarizes water quality for all of the Metro Vancouver service area and is available on their website www.metrovancouver.org. The report will demonstrate that drinking water supplied by Metro to DNV met or exceeded all water quality standards and guidelines in 2021.

2 DNV DISTRIBUTION SYSTEM & QUALITY ASSURANCE TESTING

2.1 General

The DNV water distribution system delivers potable water to its customers through a waterworks system incorporating 363 km of water mains, seven water pumping stations, 12 water storage reservoirs, and 35 pressure reducing stations. A population of approximately 88,168 is served through 21,264 service connections.

In 2021, Metro measured 18.7 million cubic metres of water delivered to the DNV distribution system through 18 metered connections. A map of the overall water distribution pipe system showing the 36 sampling stations and the 26 pressure zones is in Appendix A. Sampling and testing is performed in three scheduled categories according to the requirement of the British Columbia Drinking Water Protection Regulation (the Regulation):

1. **Weekly** (Bacteriological, chemical and physical parameters)
2. **Quarterly** (Disinfection by-products)
3. **Semi-Annually** (Metals)

Health Canada's Guideline for Drinking Water Quality (the Guideline) sets category parameter limits on peer-reviewed scientific-based research as either maximum acceptable concentrations, aesthetic objectives or operational guidance values.

- Maximum Acceptable Concentrations (MAC) are set for parameters that are known to detrimentally affect human health.

- Aesthetic Objectives (AO) are set for parameters which consumers base opinions about the drinkability of water.
- Operational Guidelines (OG) are set for parameters that could detrimentally affect water quality in the distribution system.

With the exception of temperature and free chlorine residual, which are analyzed and recorded by DNV staff at the time of sampling, all other parameters are analyzed and reported by the accredited Lake City Metro lab after being collected and transported by DNV operators.

2.1.1 Scheduled Weekly Sampling

In 2021, DNV staff collected 1,177 regular scheduled samples from 36 sample sites or an average of 98 samples per month. This meets the Regulations population-based sample requirement for DNV of 36 sites and 86 samples per month. Three of the previous 39 sites were removed in July 2019 to improve the efficiency of the sampling program. Sample collection is scheduled weekly on a rotating basis using a strategic grouping of sample sites distributed across the system. Generally, 12 samples are collected twice weekly for a total of 24 samples per week.

Locations of weekly sample points are distributed according to the regulation recommendations as follows:

- 18% of sampling points at “source” (supply points from Metro transmission mains)
- 33% of sampling points at locations with medium flow
- 36% of sampling points at locations with low flow
- 13% of sampling points at system dead-ends (very low flow)

Scheduled weekly analysis can be grouped into two categories bacteriological and chemical or physical parameters. Standards for water distribution systems are dictated by the requirements of the Regulation and Health Canada’s Guidelines for Canadian Drinking Water Quality. The guidelines provide either a maximum allowable concentration (MAC), an aesthetic objective (AO) or an operational guidance (OG) value.

- Bacteriological parameters guidelines are:
 - Escherichia coli (E coli): MAC none detectable per 100mL
 - Total coliform: MAC none detectable in 100mL
 - Heterotrophic plate count (HPC): OG less than or equal to 500 CFU/mL
 - Turbidity: OG less than or equal to 5.0 NTU
- Chemical or physical parameter guidelines are:
 - Chlorine: OG between 0.04 – 2.0 mg/L
 - Temperature: AO less than or equal to 15° C
 - pH: OG between 7.0 and 10.5

Figure 1 below shows the number of scheduled weekly samples collected and analysed in 2021 on a monthly basis

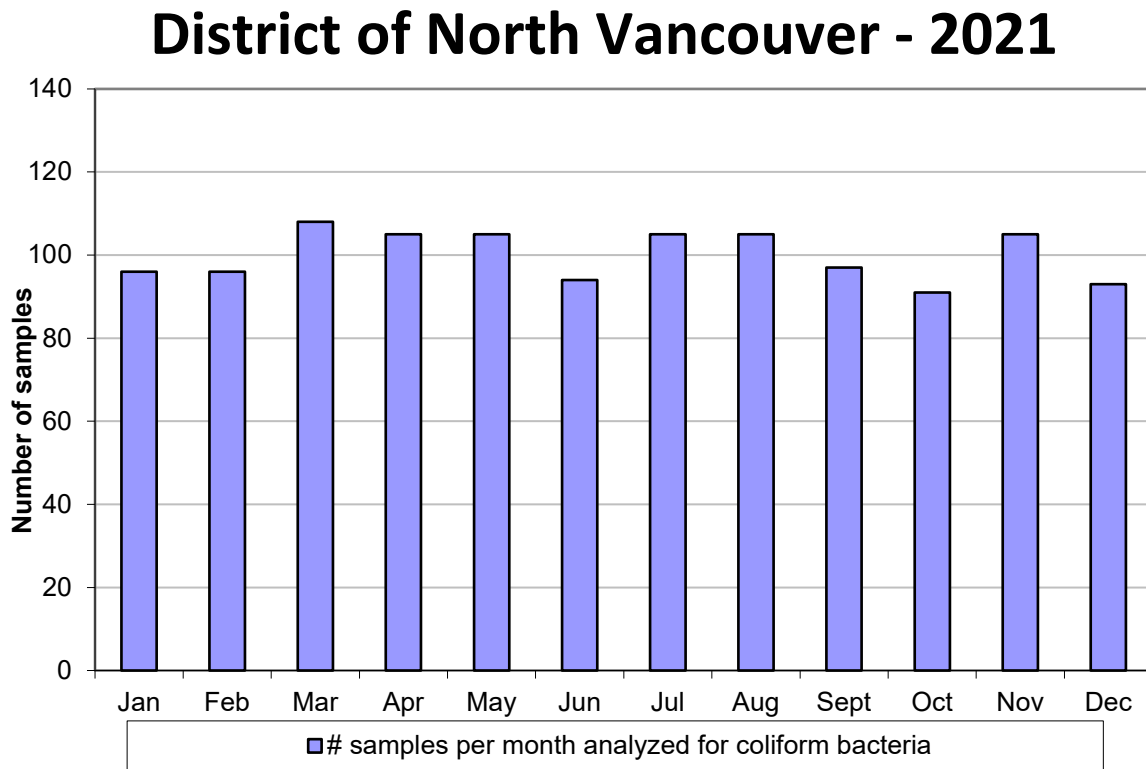


Figure 1. Number of Scheduled Weekly Samples Collected

2.1.2 Quarterly Disinfection By-Products Sampling

Haloacetic acids (HAA) and Trihalomethanes (THM) are groups of compounds that can form as by-products when water is treated with chlorine. The Guideline maximum allowable concentrations for the running quarterly averages are 80 ppb for HAA and 100 ppb for THM, with the added recommendation that they be kept as low as reasonably achievable (ALARA) without compromising disinfection.

In conformance with the regulation, DNV staff collected 16 samples for HAA and THM disinfection by-product analysis.

2.1.3 pH

A measurement of pH in the distribution system is made at the same time as the disinfection by-products at one of the four locations on a quarterly basis. The Guideline does not provide a required value but sets a target range of 7.0-10.5 and is primarily for corrosion control. Metro controls and stabilizes pH at the source.

2.1.4 Metal Semi-Annual Sampling

In 2021, DNV staff collected eight samples for analysis at four locations for metal testing in conformance with regulatory requirement.

2.1.5 Unscheduled Sampling

In addition to the scheduled weekly, quarterly and semi-annual samples, additional samples are collected and analyzed when warranted for water quality complaints, operational concerns or maintenance activities. All water quality complaints are investigated immediately. The majority of water quality complaints received are about discoloured water. The cause of discoloured water in the DNV tend to fall into one of two categories:

1. An unintentional consequence of DNV or private activities (water main flushing, hydrant flow testing, construction activities or pipe breaks). Planned and unexpected work is performed in a manner that limits the impact on water quality, however, sometimes it occurs.
2. Spontaneous degradation of cast iron pipe. Cast iron pipe naturally breaks down and can release corrosion products that can, in sufficient concentration, make water appear discoloured, typically orange or brown in colour. In response to the issue, we slightly altered our practice for renewing water services on cast iron mains and reduced the force used for post-work flushing.

In 2021, 56 unscheduled samples were collected and analyzed.

3 RESULTS

The DNV water sampling program meets the regulatory requirements for sample location, frequency and quantity. Analytical results are provided by Metro to DNV on a weekly basis and reviewed internally upon receipt. The five-year summary of scheduled weekly sample results (free chlorine residual, total Coliform, HPC, E-coli and turbidity) for each sample site are presented in Appendix B. A summary of the results by parameter is provided below.

3.1 Scheduled Weekly Bacteriological Parameter Results

Bacteriological standards for water distribution systems are dictated by the requirements of the Regulation and by Health Canada's Guidelines for Canadian Drinking Water Quality, which provide the following criteria:

- **E. coli:** Escherichia coli is an indicator of potential micro bacteriological contamination and possible pathogens. Some strains of E. coli are pathogenic. The Guideline states that the MAC is zero detectable E. coli per 100 mL sample.
- **Total Coliform:** Coliforms occur naturally in water sources and alone are not pathogenic but indicate the potential presence of pathogens. The Guideline states that the MAC is 10 or less total coliform per 100 mL sample and that 90% or more of the samples for a given month must have zero detectable total coliform per 100 mL sample.
- **HPC:** Heterotrophic plate count is used to monitor general bacteriological quality. The Guideline does not provide an allowable level but instead offers the OG that increases in HPC concentrations above a baseline level of 500 CFU/mL s are undesirable.
- **Turbidity:** Particles in drinking water can inhibit treatment and indicate potential quality concerns. The Guideline suggest an OG of supply water turbidity target of < 1 Nephelometric Turbidity Unit (NTU) or "best possible" and should not exceed 5.0 in distribution systems.

The scheduled samples collected in 2021 met the guidelines for safe potable water. There were no occurrences of detectable E. coli nor Total Coliform. One sample was collected in 2021 with turbidity over 5 NTU, which was the result of fire fighting efforts in response to a structure fire. The site was resampled the following day and was back to acceptable levels. The HPC and turbidity levels are stable over time. The annual DNV average HPC and turbidity for the last five years are presented below.

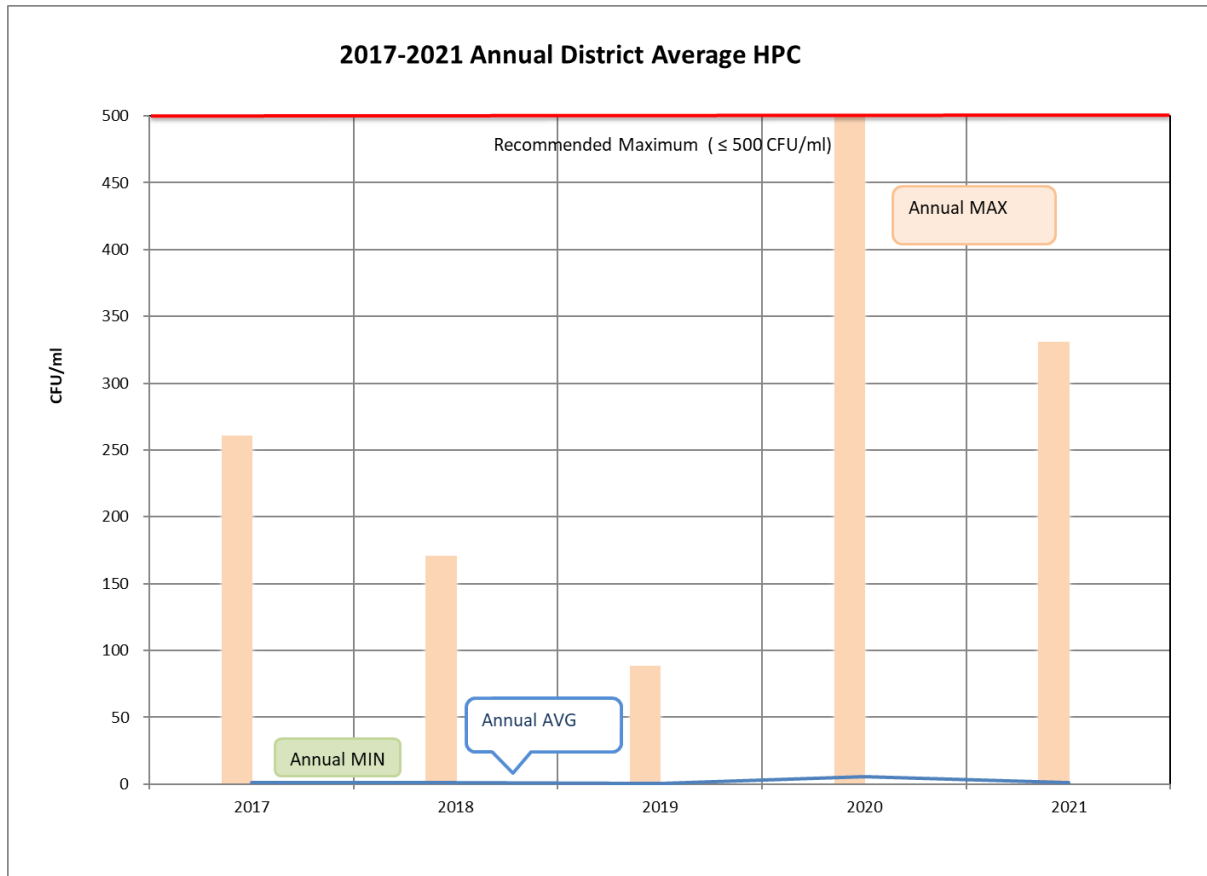


Figure 2. HPC Five Year Annual Average and Maximum Values.

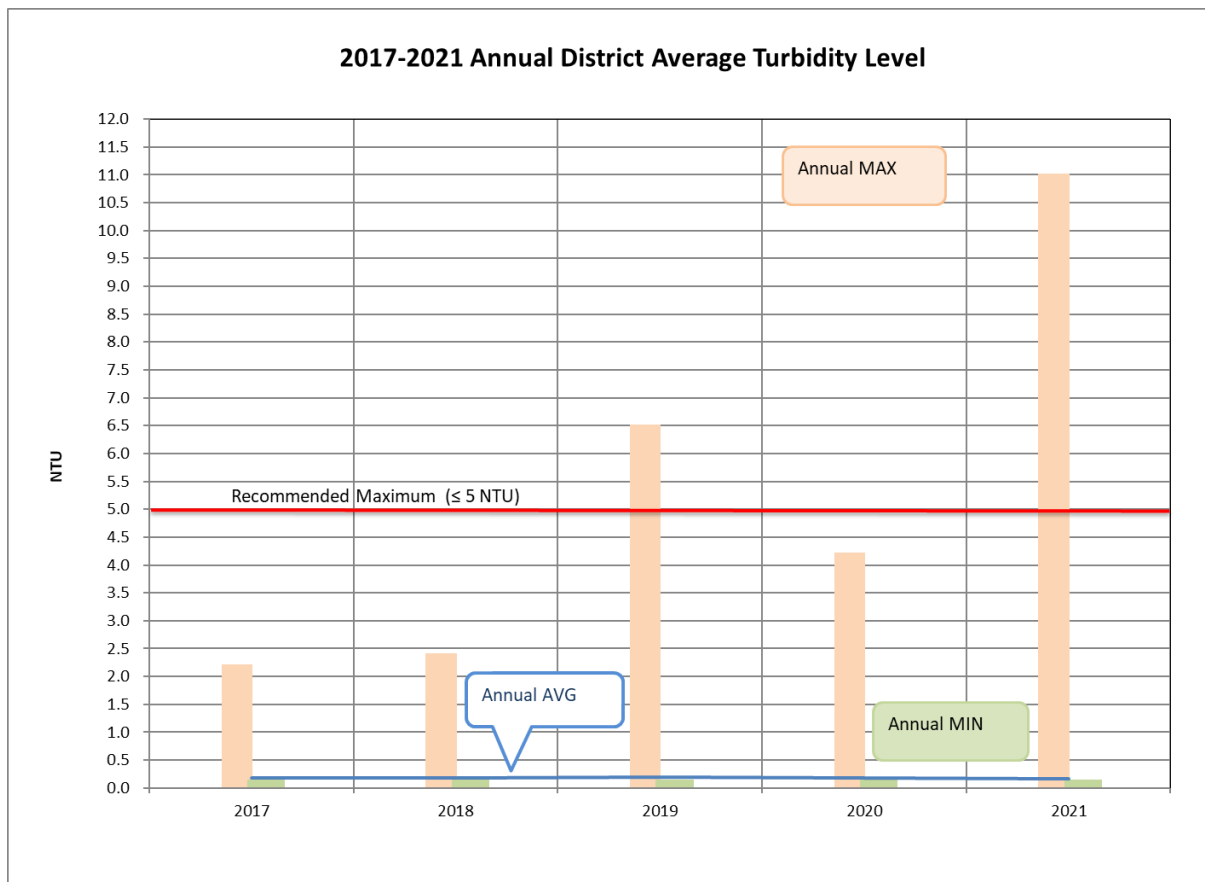


Figure 3. Turbidity Five Year Annual Average and Maximum Values.

3.2 Scheduled Weekly Chemical and Physical Parameter Results

Chemical and physical parameters, chlorine, temperature and pH results for 2021 are summarized below:

- Chlorine:** Chlorine is used in the disinfection process, and a residual amount in the distribution system is desirable to maintain potable water quality. In 2021, all samples were within the OG range for residual chlorine, 0.04-2.0 mg/L and above the OG of 0.2 mg/L. The average system-wide chlorine residual was 0.70 mg/L. The minimum recorded chlorine residual was 0.28 mg/L. The maximum recorded chlorine residual was 0.95 mg/L. The annual DNV average free chlorine for the past five years is presented below in Figure 4.
- Temperature:** The temperature of drinking water can impact water quality and is an aesthetic parameter. The guidelines provide an AO for water temperature at less than or equal to 15°C. In 2021, 100 samples or 8% were above 15°C and occurred primarily during July, August and September. The highest temperature recorded was 18 °C, the lowest temperature recorded was 0 °C and the annual system average was 8.7 °C.

- pH:** pH is a measure of acidity/basicity and can impact corrosion rates of the distribution systems. The operational guideline is 7.0-10.5 in drinking water, and the average pH for our system in 2021 was 8.0.

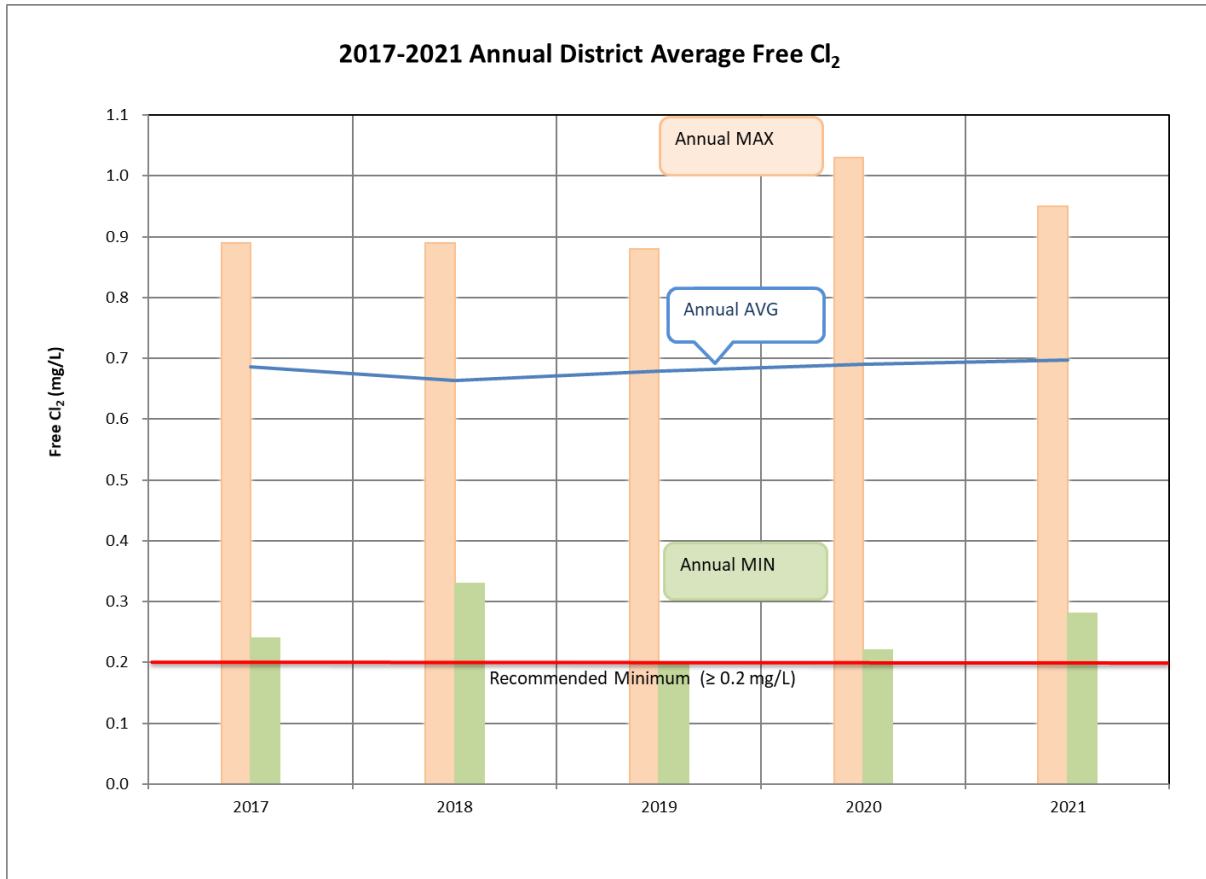


Figure 4. Free Cl₂ Five Year Annual Minimum, Average and Maximum Values.

3.3 Quarterly Disinfection By-products Results

Quarterly disinfection by-products tested were well below guideline limits and are presented below in Table 1.

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total THM Quarterly Average (Guideline Limit 100 mnh)
DNV-727	25-Feb-20	<1	<1	<1	20	21	23	<0.5	7	<1	<2	6	13	16
DNV-727	26-May-20	<1	<1	<1	20	21	21	<0.5	8	<1	<2	7	15	14
DNV-727	11-Aug-20	<1	<1	<1	20	22	21	<0.5	7	<1	<2	5	12	13
DNV-727	2-Dec-20	<1	<1	<1	21	22	22	<0.5	10	<1	<2	9	20	15
DNV-727	24-Feb-21	<1	<1	<1	21	21	22	<0.5	8	<1	<2	6	16	16
DNV-727	2-Jun-21	<1	<1	<1	17	19	21	<0.5	7	<1	<2	3	10	15
DNV-727	24-Aug-21	<1	<1	<1	17	19	20	<0.5	7	<1	<2	4	11	14
DNV-727	24-Nov-21	<1	<1	<1	23	25	21	<0.5	10	<1	<2	6.7	17	13
DNV-733	25-Feb-20	<1	<1	<1	17	18	26	<0.5	6	<1	<2	5	11	18
DNV-733	26-May-20	<1	<1	<1	19	20	22	<0.5	8	<1	<2	7	15	16
DNV-733	11-Aug-20	<1	<1	<1	17	19	20	<0.5	7	<1	<2	5	13	13
DNV-733	2-Dec-20	<1	<1	<1	25	26	21	<0.5	11	<1	<2	11	24	16
DNV-733	24-Feb-21	<1	<1	<1	24	25	23	<0.5	8	<1	<2	9	20	18
DNV-733	2-Jun-21	<1	<1	<1	17	18	22	<0.5	9	<1	<2	7	18	19
DNV-733	24-Aug-21	<1	<1	<1	19	21	23	<0.5	7	<1	<2	4	11	18
DNV-733	24-Nov-21	<1	<1	<1	24	25	22	<0.5	9	<1	<2	5.7	15	16
DNV-734	25-Feb-20	<1	<1	<1	20	21	23	<0.5	7	<1	<2	7	14	15
DNV-734	26-May-20	<1	<1	<1	21	22	22	<0.5	9	<1	<2	7	16	16
DNV-734	11-Aug-20	<1	<1	<1	18	20	22	<0.5	8	<1	<2	6	14	15
DNV-734	2-Dec-20	<1	<1	<1	22	23	22	<0.5	11	<1	<2	11	24	17
DNV-734	24-Feb-21	<1	<1	<1	23	23	22	<0.5	8	<1	<2	8	17	18
DNV-734	2-Jun-21	<1	<1	<1	17	19	21	<0.5	8	<1	<2	5	15	17
DNV-734	24-Aug-21	<1	<1	<1	19	21	22	<0.5	8	<1	<2	4	12	17
DNV-734	24-Nov-21	<1	<1	<1	26	27	23	<0.5	10	<1	<2	6.6	18	15

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total THM Quarterly Average (Guideline Limit 100 ppb)
DNV-736	25-Feb-20	<1	<1	<1	22	23	27	<0.5	8	<1	<2	9	17	20
DNV-736	26-May-20	<1	<1	<1	25	26	26	<0.5	11	<1	<2	12	24	20
DNV-736	11-Aug-20	1	<1	<1	25	27	26	<0.5	8	<1	<2	7	16	18
DNV-736	2-Dec-20	<1	<1	<1	24	25	25	<0.5	10	<1	2	12	24	20
DNV-736	24-Feb-21	<1	<1	<1	24	25	26	<0.5	7	<1	<2	6	15	20
DNV-736	2-Jun-21	<1	<1	<1	21	23	25	<0.5	11	<1	<2	11	24	20
DNV-736	24-Aug-21	<1	<1	<1	26	28	25	<0.5	6	<1	<2	4.2	11	19
DNV-736	24-Nov-21	<1	<1	<1	30	31	27	<0.5	8	<1	<2	9.4	18	17

Table 1. Quarterly Disinfection By-products 2021 Results

3.4 Scheduled Semi-Annual Metal Results

A total of eight samples from four locations were analyzed for metals, including copper, lead and zinc. Sample sites, results, and maximum concentrations are given in Table 2 below. All samples tested for metals were below the maximum acceptable concentration guidelines for Canadian Drinking Water Quality. Where the guideline limit is 'none,' Health Canada has determined that there is currently no scientific evidence of aesthetic or detrimental health effects for that parameter at the levels typically found in drinking water.

Parameter	Canadian Guideline Limit	DNV-721	DNV-721	DNV-730	DNV-730	DNV-734	DNV-734	DNV-747	DNV-747
		2838 Panorama Dr.	2838 Panorama Dr.	Braemar Reservoir	Braemar Reservoir	1181 West 22nd	1181 West 22nd	1231 Lennox St. PRV	1231 Lennox St. PRV
		04/20/2021 9:05	11/08/2021 11:25	04/20/2021 10:30	11/08/2021 8:55	04/20/2021 11:00	11/08/2021 7:50	04/20/2021 9:35	11/08/2021 10:45
Aluminium Total (µg/L)	200	25	51	24	52	20	47	21	50
Antimony Total (µg/L)	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic Total (µg/L)	10 (ALARA)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Barium Total (µg/L)	2000	3.4	3.2	2.9	2.8	2.9	2.7	2.9	2.6
Boron Total (µg/L)	5000	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium Total (µg/L)	7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	none	4580	7930	4340	7960	4310	7630	4300	7430
Chromium Total (µg/L)	50	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cobalt Total (µg/L)	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Total (µg/L)	≤2000	1.2	7.6	0.6	<0.5	6.0	3.2	<0.5	<0.5
Iron Total (µg/L)	≤ 300	8	13	7	8	<5	9	<5	9
Lead Total (µg/L)	5 (ALARA)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium Total (µg/L)	none	174	179	181	191	181	186	185	183
Manganese Total (µg/L)	120	9.5	2.8	11.6	2.7	2.1	2.0	6.0	3.4
Mercury Total (µg/L)	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Molybdenum Total (µg/L)	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel Total (µg/L)	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Potassium Total (µg/L)	none	170	147	170	151	171	145	169	142
Selenium Total (µg/L)	50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium Total (µg/L)	≤ 200,000	1630	1520	1640	1560	1640	1490	1620	1440
Zinc Total (µg/L)	≤ 5000	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table 2. 2021 Semi Annual Metal parameter, Guideline Limits and Results

3.4.1 Lead

Lead, along with 21 other metals, is one of the parameters analyzed semi-annually at the four locations listed above. Our lead levels are consistently less than 0.5 µg/L or parts per billion (ppb); the Canadian Guideline Limit is 5.0 µg/L. Metro Vancouver samples and tests our source water. Metro Vancouver's results show lead levels <0.5 µg/L.

In March 2019, the Canadian Drinking Water Guideline limits for maximum allowable concentration (MAC) of lead in drinking water was reduced from 10 µg/L to 5 µg/L or as low as reasonably achievable (ALARA). Based on a Government of Canada news release, Health Canada lowered the limit to safeguard the health of Canadians. The previous limit of 10 µg/L was set in 1992. Since then, lead levels in Canada have fallen dramatically due to strong actions taken by the Government of Canada to reduce exposure to lead. The new limits reflect the changed risk levels and were developed in collaboration with the provinces, territories, and other federal departments.

The primary source of lead in drinking water is leaching from distribution and plumbing system parts. The District does not currently use nor has ever used lead pipes in our drinking water distribution system, including services. Lead was historically used in private plumbing for the service lines that connect a home or business to the municipal water service and in plumbing fittings and solders. Until 1975, lead was an acceptable material in pipes based on the National Plumbing Code of Canada, so it is more likely to be found in older homes and neighbourhoods. The best approach to minimize lead exposure is the removal of private lead services.

Vancouver Coastal Health offers information and advice for anyone concerned about lead in their drinking water coming from their private plumbing. Information is available at the following link: <http://www.vch.ca/Documents/Lead-in-drinking-water-protecting-yourself.pdf>. The District of North Vancouver does not have jurisdiction and is not required, to test private property.

3.5 **Unscheduled Results**

In addition to scheduled samples, 56 unscheduled samples were collected and analyzed in 2021. Twelve samples were in response to customer or staff requests, 35 were for new construction and nine were due to watermain breaks. All results were within the guideline-recommended limits.

4 **OPERATIONS, MAINTENANCE & CAPITAL PROGRAMS**

4.1 **Water System Scheduled Maintenance**

Scheduled annual system maintenance programs that support water quality include water main flushing, reservoir cleaning and scheduled water facility inspections. We follow the AWWA flushing program standards. Our 2021 flushing program focused on 1,465m of cast iron pipe, which is known to create discoloured water.

The DNV uses permanent flushing stations or regularly scheduled flushing to maintain water quality in areas with chronic aesthetic issues related to cast iron pipe. We are eliminating the flushing stations by upgrading cast iron with our standard water main pipe, cement-lined ductile iron. Six permanent flushing stations remain in our system at the following locations:

- 4011 Lions Avenue: Dead end 4-inch cast iron main
- 4331 Arundel Road: Dead end 4-inch cast iron main
- Bridgeman Avenue at West 21st Street: 6-inch cast iron main
- Cortell Street at W 21st Street: 8-inch ductile iron main (downstream of chronic cast iron mains)

- 1953 Pemberton Avenue: 10-inch asbestos cement main (downstream of chronic cast iron mains)
- 3248 Milton Avenue: 6-inch ductile iron main (downstream of chronic cast iron mains)

The DNV uses an integrated SCADA system to optimize pumping, reservoir filling and retention time to support water turnover and quality.

4.2 Capital Upgrades

The DNV has a fully funded water main replacement program that uses a risk-based protocol with 17 weighted hazard criteria. The DNV's water main replacement program takes into consideration multiple parameters to prioritize the annual replacement schedule. The DNV standard replacement water main is ANSI/AWWA C151 & C140 special class 50 cement-lined ductile iron pipe and specified in our Design Guidelines of our Development Servicing Bylaw. In 2018, we began using TR Flex Restraint Joint Pipe wrapped in polyethylene for all our installations.

Our prioritization protocol heavily weighs the potential of failure, consequence of failure, and water quality. In 2021, DNV construction crews completed the replacement of 4,334 metres of pipe.

The water mains replaced in 2021 is listed in Table 3.

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN02365	1964	CI	150	Aintree WMRP	200	2	Ductile Iron
WTRMN02229	1964	CI	100	Aintree WMRP	200	127	Ductile Iron
WTRMN01625	1968	AC	150	Aintree WMRP	150	49	Ductile Iron
WTRMN02787	1978	DI	150	Aintree WMRP	200	9	Ductile Iron
WTRMN02367	1952	CI	150	Bluebonnet Bedford WMR	200	97	Ductile Iron
WTRMN02362	1952	CI	150	Bluebonnet Bedford WMR	200	69	Ductile Iron
WTRMN02230	1951	CI	100	Bluebonnet Bedford WMR	200	115	Ductile Iron
WTRMN02363	1951	CI	150	Bluebonnet Bedford WMR	200	40	Ductile Iron
WTRMN10586	1972	AC	150	Byron WMR	200	162	Ductile Iron
WTRMN04896	1972	AC	150	Byron WMR	200	223	Ductile Iron
WTRMN00635	1945	WOODSTAVE	150	Canfield Cresc WMR	200	78	Ductile Iron
WTRMN10442	1953	CI	150	Canterbury WMR	200	146	Ductile Iron
WTRMN10441	1953	CI	150	Canterbury WMR	200	153	Ductile Iron

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN10216	1956	AC	200	Dollarton Frontage WMR	200	245	Ductile Iron
WTRMN10215	1956	AC	200	Dollarton Frontage WMR	200	242	Ductile Iron
WTRMN02044	1971	AC	200	Fairway Dr WMR	200	247	Ductile Iron
WTRMN02043	1971	AC	200	Fairway Dr WMR	200	229	Ductile Iron
WTRMN04822	1967	AC	150	Fromme WMR	250	38	Ductile Iron
WTRMN01979	1959	AC	200	Fromme WMR	250	125	Ductile Iron
WTRMN00542	1953	CI	100	Greentree WMRP	200	174	Ductile Iron
WTRMN03309	2001	DI	200	Greentree WMRP	200	48	Ductile Iron
WTRMN02346	1952	CI	150	Greentree WMRP	200	123	Ductile Iron
WTRMN02265	1950	CI	100	Maplewood WMR	200	197	Ductile Iron
WTRMN02432	1950	CI	150	Maplewood WMR	200	78	Ductile Iron
WTRMN01102	1950	CI	100	Maplewood WMR	200	31	Ductile Iron
WTRMN01815	1962	AC	150	Naomi WMR	200	187	Ductile Iron
WTRMN01027	1962	AC	150	Naomi WMR	200	12	Ductile Iron
WTRMN01027	1962	AC	150	Naomi WMR	200	109	Ductile Iron
WTRMN01658	1968	AC	150	Stanley WMRP	200	87	Ductile Iron
WTRMN02392	1955	CI	150	Stanley WMRP	200	67	Ductile Iron
WTRMN02034	1965	AC	200	Strathcona WMRP	200	65	Ductile Iron
WTRMN02037	1965	AC	200	Strathcona WMRP	200	46	Ductile Iron
WTRMN02036	1965	AC	200	Strathcona WMRP	200	104	Ductile Iron
WTRMN02035	1965	AC	200	Strathcona WMRP	200	19	Ductile Iron
WTRMN02033	1958	AC	200	Strathcona WMRP	200	125	Ductile Iron
WTRMN00791	1970	AC	300	Viney WMR	300	20	Ductile Iron
WTRMN04976	1963	CI	100	Viney WMR	200	139	Ductile Iron
WTRMN02163	1970	AC	300	Viney WMR	300	82	Ductile Iron
WTRMN02384	1954	CI	150	Wiliam Ave WMRP	200	60	Ductile Iron
WTRMN02386	1966	CI	150	Wiliam Ave WMRP	200	10	Ductile Iron

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN02386	1966	CI	150	William Ave WMRP	200	204	Ductile Iron

Table 3. Water Mains Replaced in 2021

The planned water main replacement for 2022 is listed in Table 4.

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN02005	1967	AC	200	Berkley Rd WMRP	200	88	Ductile Iron
WTRMN02010	1966	AC	200	Berkley Rd WMRP	200	84	Ductile Iron
WTRMN01857	1959	AC	150	Berkley Rd WMRP	200	85	Ductile Iron
WTRMN01832	1962	AC	150	Berkley Rd WMRP	200	81	Ductile Iron
WTRMN02003	1959	AC	200	Berkley Rd WMRP	200	89	Ductile Iron
WTRMN02003	1959	AC	200	Berkley Rd WMRP	200	89	Ductile Iron
WTRMN01838	1968	AC	150	Berkley Rd WMRP	200	102	Ductile Iron
WTRMN01848	1961	AC	150	Berkley Rd WMRP	200	105	Ductile Iron
WTRMN01584	1963	AC	150	Burrill and Mcewen WMR	200	100	Ductile Iron
WTRMN01573	1970	AC	150	Burrill and Mcewen WMR	200	112	Ductile Iron
WTRMN01577	1963	AC	150	Burrill and Mcewen WMR	200	52	Ductile Iron
WTRMN01584	1963	AC	150	Burrill and Mcewen WMR	200	100	Ductile Iron
WTRMN02204	1954	CI	100	Cheviot Tudor WMR	200	61	Ductile Iron
WTRMN02205	1954	CI	100	Cheviot Tudor WMR	100	75	Ductile Iron
WTRMN02200	1954	CI	100	Cheviot Tudor WMR	200	220	Ductile Iron
WTRMN11186	2015	DI	150	Cheviot Tudor WMR	200	27	Ductile Iron

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN00797	1958	AC	100	Crestlynn & E 27th WMR	100	55	Ductile Iron
WTRMN02062	1958	AC	250	Crestlynn & E 27th WMR	250	125	Ductile Iron
WTRMN02061	1958	AC	250	Crestlynn & E 27th WMR	200	108	Ductile Iron
WTRMN01710	1958	AC	150	Crestlynn & E 27th WMR	150	59	Ductile Iron
WTRMN02063	1958	AC	250	Crestlynn & E 27th WMR	250	81	Ductile Iron
WTRMN02154	1955	AC	300	Fromme - Ross to Harold WMR	300	56	Ductile Iron
WTRMN02155	1955	AC	300	Fromme - Ross to Harold WMR	300	131	Ductile Iron
WTRMN10530	1959	AC	150	Garden Ave WMR	200	28	Ductile Iron
WTRMN01781	1959	AC	150	Garden Ave WMR	200	156	Ductile Iron
WTRMN02146	1957	AC	300	Mahon WMR	300	158	Ductile Iron
WTRMN02150	1957	AC	300	Mahon WMRP	300	77	Ductile Iron
WTRMN01714	1970	AC	150	Masefield Rd WMR	200	80	Ductile Iron
WTRMN01708	1970	AC	150	Masefield Rd WMR	200	91	Ductile Iron
WTRMN01718	1970	AC	150	Masefield Rd WMR	200	122	Ductile Iron
WTRMN01707	1959	AC	150	Masefield Rd WMR	200	71	Ductile Iron
WTRMN01805	1959	AC	150	McGuire Ave WMR	300	45	Ductile Iron
WTRMN01780	1959	AC	150	McGuire Ave WMR	300	155	Ductile Iron
WTRMN01487	1964	AC	150	Prime St WMR	150	45	Ductile Iron
WTRMN01498	1964	AC	150	Prime St WMR	200	106	Ductile Iron
WTRMN10275	1961	AC	300	Prospect Road WMR	300	202	Ductile Iron
WTRMN02109	1964	AC	300	Prospect Road WMR	300	85	Ductile Iron
WTRMN10276	1962	AC	300	Prospect Road WMR	300	201	Ductile Iron
WTRMN10139	1965	AC	400	Ralph St WMR	200	271	Ductile Iron

Asset_Id of Existing Main	Existing Main Year	Existing Main Material	Existing Main Size	Project Name	New Main Size	Length (m)	New Main Material
WTRMN01512	1954	AC	150	Ralph St WMR	200	261	Ductile Iron
WTRMN02180	1963	AC	400	Ramsay WMR	400	135	Ductile Iron
WTRMN10357	1967	AC	150	Sandringham Cresc WMR	200	171	Ductile Iron
WTRMN10358	1967	AC	150	Sandringham Cresc WMR	200	178	Ductile Iron
WTRMN01858	1974	AC	150	Seymour Blvd WMR	150	154	Ductile Iron
WTRMN02039	1966	AC	200	Seymour Blvd WMR	200	93	Ductile Iron
WTRMN02026	1973	AC	200	Seymour Blvd WMR	200	71	Ductile Iron
WTRMN02108	1959	AC	300	Skyline WMR	300	142	Ductile Iron
WTRMN02106	1959	AC	300	Skyline WMR	300	28	Ductile Iron
WTRMN08975	1948	CI	150	W 20th WMR	200	186	Ductile Iron
WTRMN01995	1966	AC	200	W Keith Road WMR	200	176	Ductile Iron
WTRMN01996	1966	AC	200	W Keith Road WMR	200	251	Ductile Iron
WTRMN04713	1955	AC	150	W Keith Road WMR	200	148	Ductile Iron
WTRMN01758	1969	AC	150	W Keith Road WMR	200	51	Ductile Iron

Table 4. Proposed Water Main Replacement 2022

4.3 Operator Training & Qualification

The DNV's distribution system is EOCP classified as a Level 3 system. The DNV currently has distribution system operators with Level 3 operator's certification from the EOCP, keeping the DNV fully compliant with current requirements.

5 ISSUES, INCIDENTS & RESPONSE PLANS

5.1 Boil Water Advisory

A precautionary boil water advisory is issued when, in consultation with Vancouver Coastal Health, a situation exists that increases the risk of possible contamination. No precautionary boil water advisories were issued in 2021.

5.2 Customer Complaints

We recorded 52 customer complaints for either colour or odour. The DNV investigates all water quality complaints from customers. For complaints stemming from known operational activities (water main breaks, fire fighting, water main flushing), customers may be advised to run outside taps until the water clears up.

5.3 Ductile Iron Supply & Storage

In 2018, we had an incident that resulted in repeat total coliform detected in new ductile iron pipe not yet tied into the system. This led us to investigate and change our pipe storage and purchase practices. As a result, pipe stored in our secondary area (Beach Yard) is elevated on skids. This practice continued in 2021.

5.4 Security

DNV water storage reservoirs and pumping facilities have signage, secured access, intrusion detection linked to the automated SCADA alarm system and designed fail-safe valve operation to inhibit or reduce the impact of security threats. In addition, each facility is attended frequently for inspection and routine operation and maintenance.

5.5 Water Main Breaks

We responded to 12 emergency water main breaks in 2021. Water main break response protocol includes maintaining positive pressure to protect the water system from potential contamination.

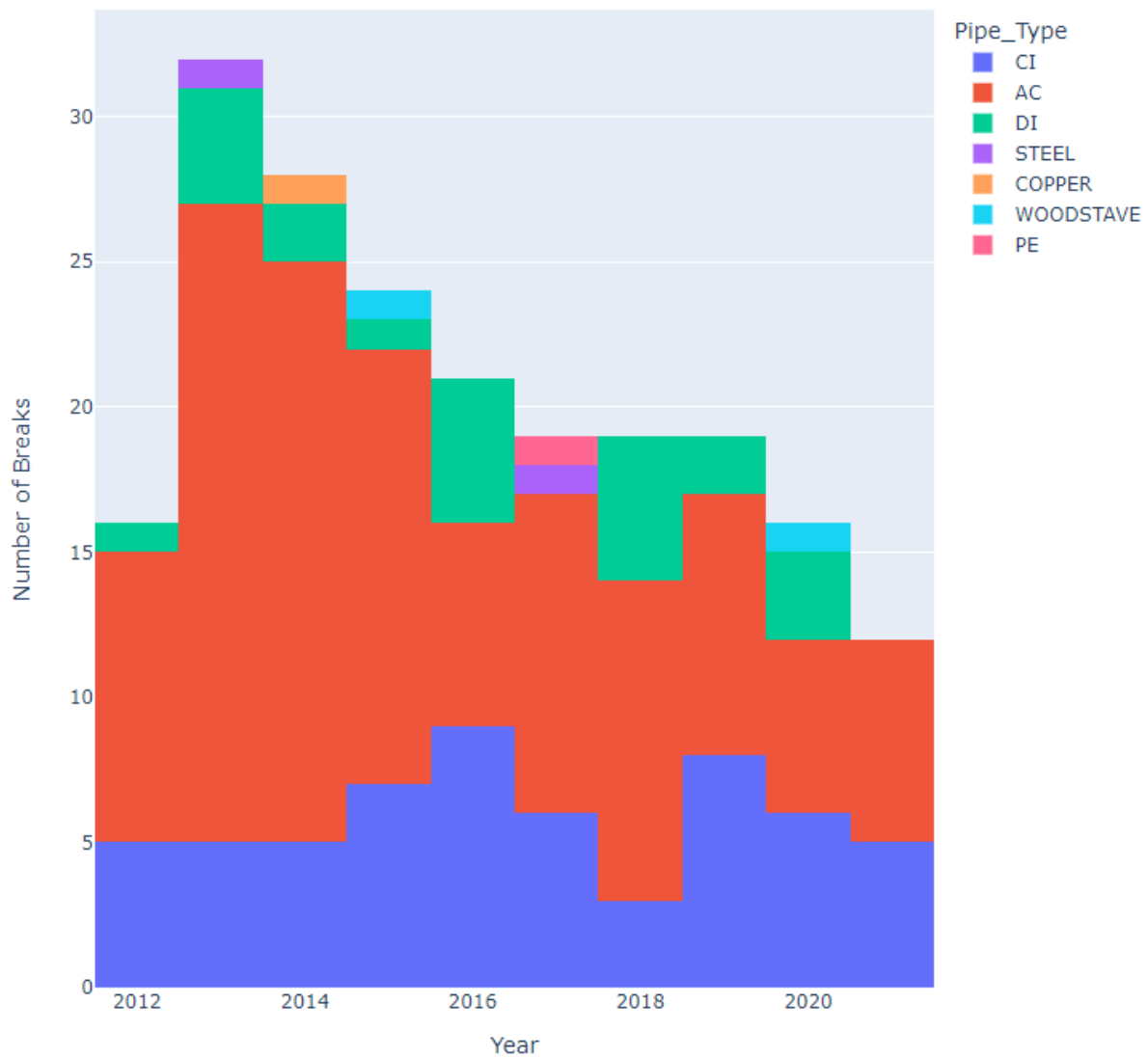


Figure 5. 10-Year Water Main Break Summary

5.6 Notification & Emergency Response

The table below outlines our notification process for unusual situations that could potentially affect water quality and notification is required.

NOTIFICATION FOR UNUSUAL SITUATIONS POTENTIALLY AFFECTING WATER QUALITY			
Situation	Notifying Agency	Agency Notified	Time Frame For Notification
<i>E. coli</i> -positive sample	GVWD	DNV and Vancouver Coastal Health (North Shore)	Immediate
Chemical Contamination	GVWD DNV	Vancouver Coastal Health (North Shore)	Immediate
Turbidity > 5 NTU (Coquitlam Reservoir only)	GVWD	DNV and Vancouver Coastal Health (North Shore)	Immediate
GVRD Source treatment failure	GVWD	DNV and Vancouver Coastal Health (North Shore)	Immediate in any situation in which the BCSDWR or the GCDWQ may not be met
Loss of pressure	GVWD DNV	GVWD Operations and Vancouver Coastal Health (North Shore)	Immediate
Water main break with contamination suspected	DNV	Vancouver Coastal Health (North Shore) PEP	Immediate
Water main break with no suspect contamination	DNV	Vancouver Coastal Health (North Shore) PEP	As required by Health Authority. PEP as soon as possible

Table 5. Water Quality Notification

5.7 Response Plans

The flow diagram below illustrates the process that has been put in place for response to incidents that could potentially affect water quality during a loss of system integrity. Additional or cascading response protocols are outlined after the chart.

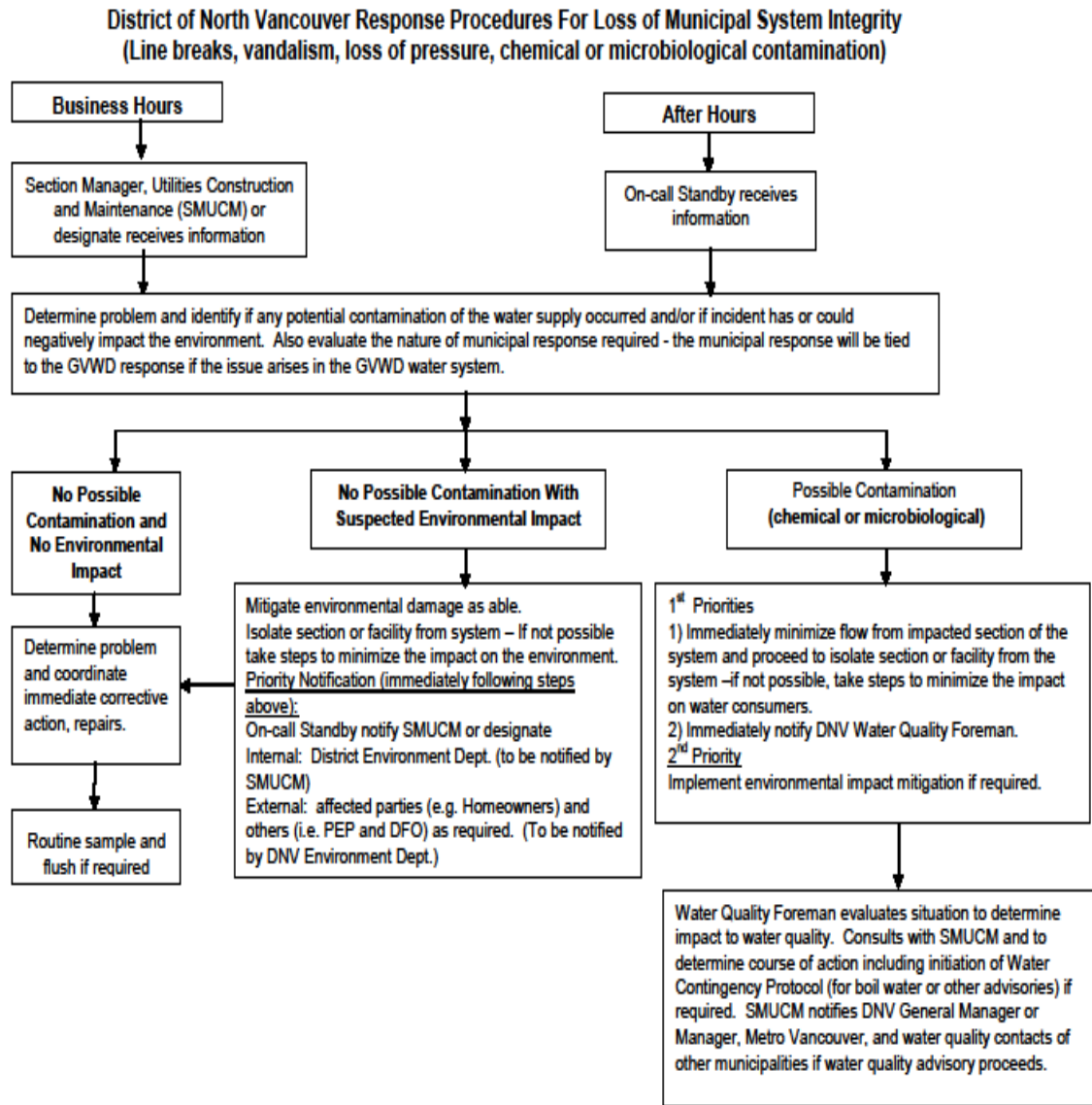


Figure 6. Loss of System Integrity Response

- Water main Breaks**

Water main breaks pose an increased risk for potential contamination. Response procedure and repair practices are in place to reduce the risk of contamination. In instances where contamination of the system is suspected, DNV Utilities crews make adjustments to isolate the section or facility from the system. The DNV immediately consults with Vancouver Coastal Health (North Shore) regarding further

actions, and all water quality complaints from the public will be immediately and thoroughly investigated for potential contamination.

Following all water main breaks, water samples are analyzed from the vicinity of the break and tested for bacteriological, chemical and physical parameters.

- *Turbidity Events*

Turbidity in the DNV water distribution system is monitored on a regular basis through the water sampling program. Water sampling results yielding readings greater than 1 NTU are scrutinized. All areas from which turbidity results > 5 NTU are flushed and re-sampled for free chlorine and turbidity. Flushing in areas with turbidity < 5NTU is at the operator's discretion.

- *Loss of Pressure Due to High Demand*

In the event of adverse pressure loss due to high demand, DNV Utilities crews make adjustments to the system to isolate the section or facility and then take measures to supplement pressure in the affected area. The DNV immediately consults with GVWD and Vancouver Coastal Health (North Shore) regarding further actions and all water quality complaints from the public are immediately investigated.

- *Positive E-coli Results*

If a sample submitted from DNV and analyzed by the Metro Vancouver laboratory or the BC Centre for Disease Control tests positive for E. coli, the following response plan will be put into action:

- i) Results of interim samples, if any, from the site will be examined by the lab. Interim samples are any samples that may have been taken from the site in the period between when the E. coli -positive sample was taken and when it was determined to be positive.
- ii) The chlorine residual noted on the sampler's field sheet will be reviewed by the lab and compared to previous readings to determine if there had been a localized loss of disinfectant residual.
- iii) The DNV Section Manager of Utilities Construction and Maintenance (SMUCM) or designate and Vancouver Coastal Health (North Shore) will be notified immediately by the laboratory.
- iv) Arrangements will be made for the immediate collection of a repeat sample (including, where possible, samples from upstream and downstream of the positive sample location).
- v) Vancouver Coastal Health (North Shore) will be contacted and the need for a "boil water" advisory will be evaluated.
- vi) If a "boil water" advisory is warranted, the public notification process as outlined in the Water Quality Monitoring And Reporting Plan For The GVRD and Member Municipalities will be followed.

- vii) The lab will contact the DNV with repeat sample results and the results of the species identification tests. The DNV will contact Vancouver Coastal Health (North Shore) to evaluate these results and to determine whether or not the advisory can be lifted.

- ***Chemical Contamination***

In the event of chemical contamination in the DNV water distribution system, Vancouver Coastal Health (North Shore) will be immediately notified. Immediate steps will be taken to isolate the contaminated area and the level of contamination will be determined through water sampling and testing. The chemical will be identified and any public health risk factors associated with the chemical presence will be determined. Through consultation with Vancouver Coastal Health (North Shore), a public advisory will be carried out.

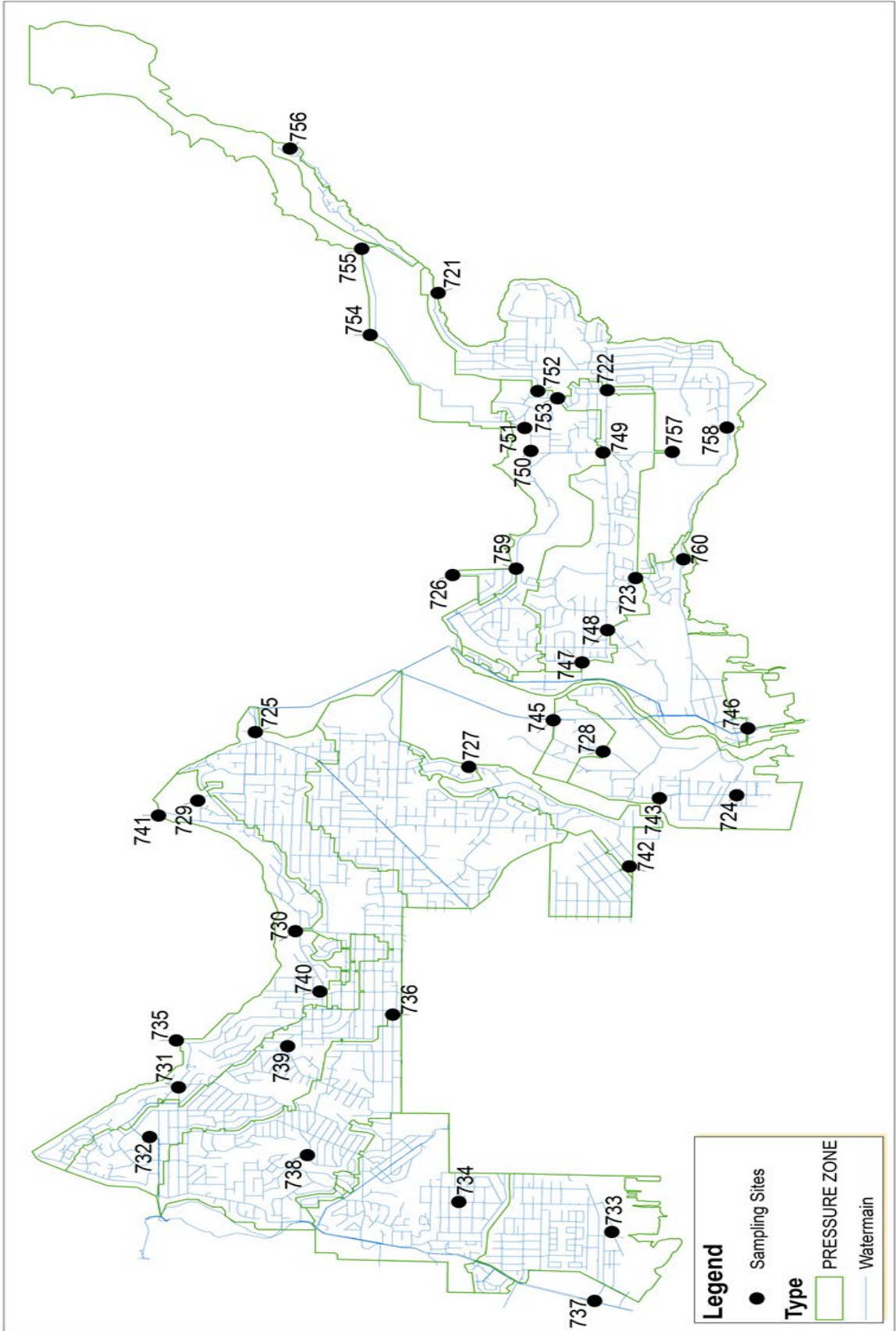
- ***Source Water Event***

In 2007, a task force comprised of Metro Vancouver, Vancouver Coastal Health, Fraser Health and member municipalities developed a communications template for source water major turbidity events. The template outlines the responsibilities of Metro Vancouver, the Health Authorities, and municipalities for notification and communications to each other and the public.

- ***GVRD Disinfection Failure***

Upon notification by GVWD Operations that an interruption in disinfection has occurred, DNV Water Quality personnel will immediately commence monitoring free chlorine residual levels at strategic locations and will contact the Vancouver Coastal Health (North Shore) if continued loss of residual is observed.

APPENDIX A: Water System, Sample Sites and Sample Schedule.



Published June 15, 2011
 Date: 11/13/09

District of North Vancouver Water Quality Sampling Sites

GIS DEPARTMENT
 GEOSPATIAL INFORMATION SYSTEMS
 600-731-7311 ext. 2400 or 2401
 www.cityofnv.ca

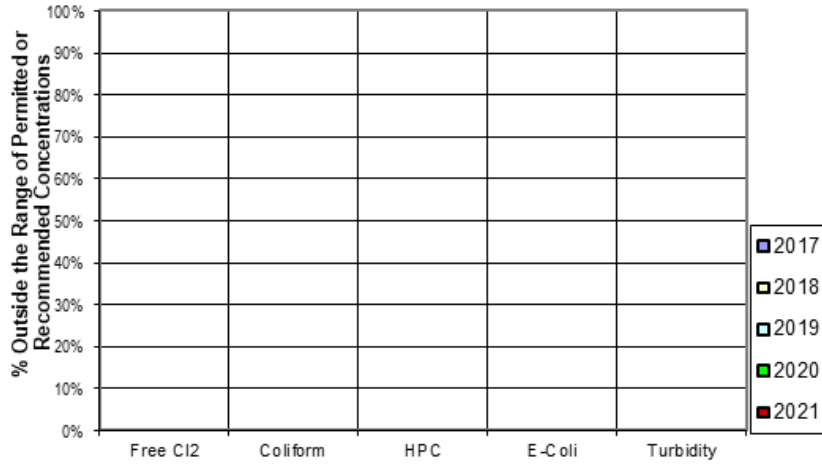
Site I.D.	Lab No.	Sample Site Location	Flow Rate
1	721	2838 Panorama Dr.	Dead End
2	722	Fairway & Mt Seymour Pkwy.	Medium
3	723	Plymouth Dr & Fairfield Dr.	Medium
4	724	LS #13 Dominion & Mountain Hwy.	Low
5	725	Marion Pump Station	Source
6	726	Hyannis Reservoir	Low
7	727	Hoskins Rd & Kilmarnock Cres.	Medium
8	728	Lillooet Road	Low
9	729	Ramsay Pump Station	Medium
10	730	Braemar Reservoir	Low
11	731	Skyline Pump Station	Medium
12	732	Sarita Pump Station	Source
13	733	McKeen Ave & Phillip Ave.	Dead End
14	734	Pemberton Heights	Low
15	735	Prospect Reservoir	Low
16	736	PRV #4 (W Queens Rd. & Lonsdale Ave.)	Low
17	737	N. of BC Rail Tracks just East of Lower Cap. Rd.	Source
18	738	3906 Sunnycrest Dr.	Medium
19	739	376 Cartelier Rd.	Medium
20	740	PRV #5 (190 E. Braemar Rd.)	Medium
21	741	Mountain Hwy Reservoir (North up access Rd., N. of Mountain Hwy.)	Low
22	742	PRV # 11 (Across from 1086 Cloverly St.)	Source
	743	Not in Use	
	744	Not in use	
23	745	PRV # 13 (N. of 1388 Monashee Drive (Capilano College))	Source
24	746	PRV #17 (60 Riverside Dr.)	Source
25	747	PRV # 19 (1231 Lennox St.)	Source
26	748	PRV # 16 (2592 Bendale Rd.)	Low
27	749	PRV # 18 (3728 Mt. Seymour Parkway)	Medium
	750	Not in Use	Medium
	751	Not in Use	Low
28	752	PRV # 25 (4068 Deane Pl.)	Medium
29	753	PRV # 20 (1501 Theta Ct.)	Low
30	754	Woodlands reservoir (2.1 km N. of Hixon Rd. on Indian River Dr.)	Low
31	755	PRV # 26 3.7 km NE of Hixon Rd. on Indian River Dr.	Low
32	756	End of Fire Lane # 7 (Firelane #7 is 3.6 km from Hixon Rd.)	Dead End
33	757	PRV 200 m south of 879 Roche Point Dr.	Medium
34	758	3860 Dollarton Hwy.	Medium
35	759	Hyannis Pump Station (1919 Hyannis drive)	Low
36	760	3000 Block Dollarton Hwy.	Dead End

**DISTRICT OF NORTH VANCOUVER
WATER QUALITY SAMPLING AND REPORTING
CALENDAR - 2020**

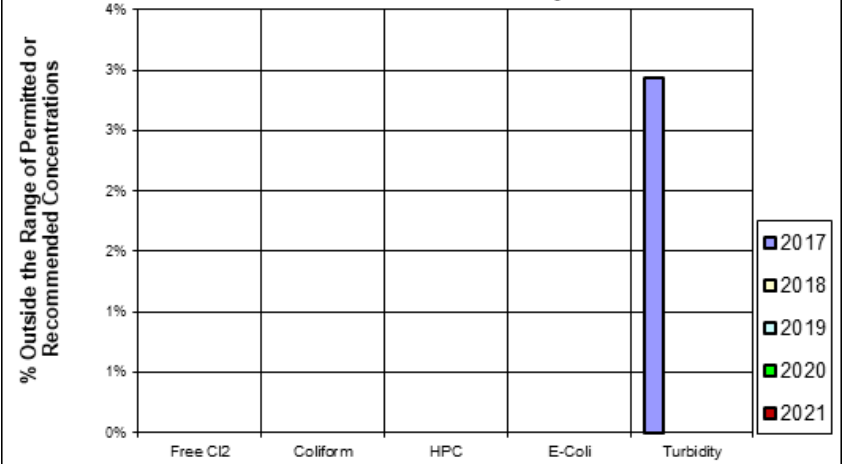
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<u>DISTRIBUTION SYSTEM SAMPLING</u>												
bacteria, turbidity, chlorine, temperature (twice weekly)	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx	xx xx
HAA's, THM's, pH (quarterly)		X			X			X				X
metals - copper, lead, zinc (semi-annually)					X							X
<u>NOTIFICATION</u>												
Annual Report:												
Annual report send to MHO						X						
MHO responds								X				
Staff report to Council									X			
Post on Web										X		

**APPENDIX B: Five Year Results by Water Quality
Sample Site. 2017 - 2021**

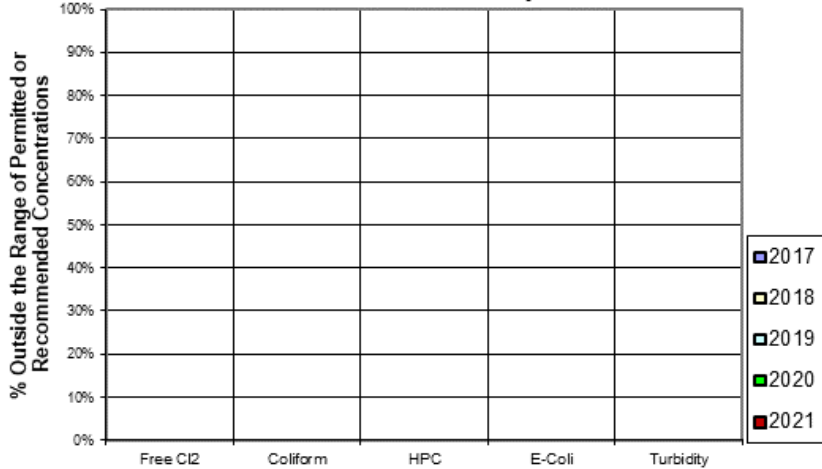
**Site 721 - 2838 Panorama Dr
2017 - 2021 Water Quality Results**



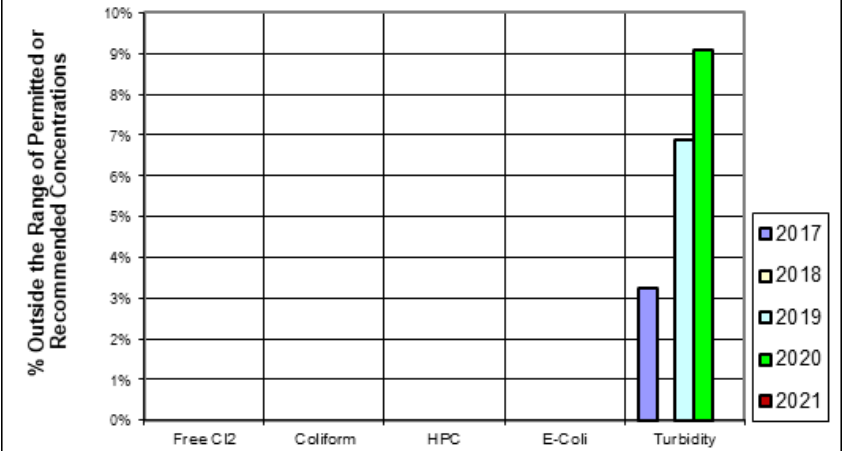
**Site 722 - Fairway & Mt Seymour Pkwy
2017 - 2021 Water Quality Results**



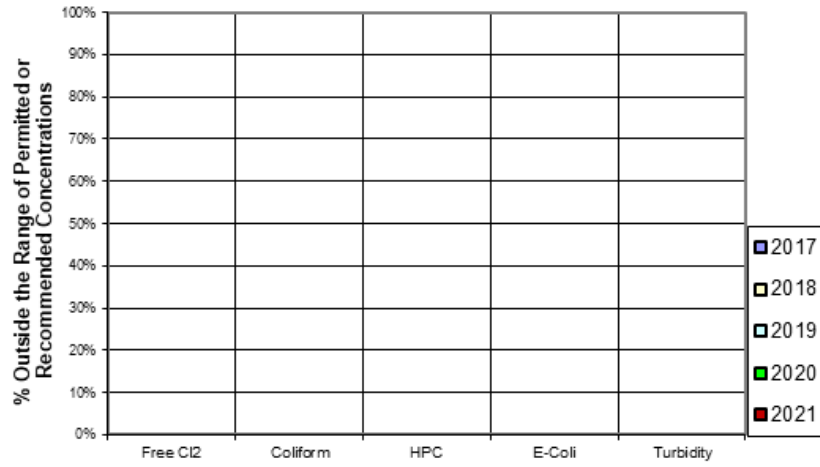
**Site 723 - Plymouth Dr & Fairfield Dr
2017 - 2021 Water Quality Results**



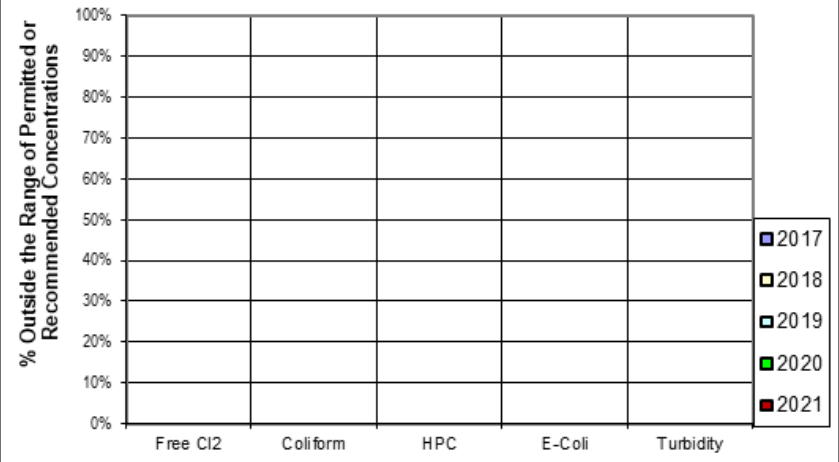
**Site 724 - LS #13 Dominion & Mountain Hwy
2017 - 2021 Water Quality Results**



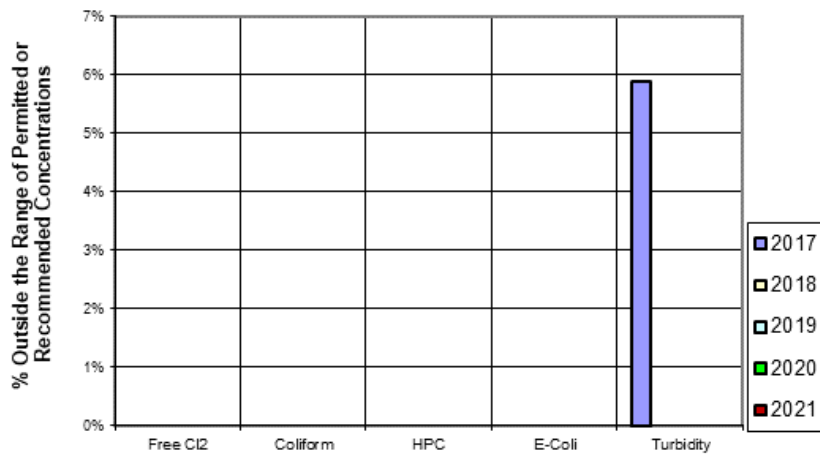
**Site 725 - Marion Pump Station
2017 - 2021 Water Quality Results**



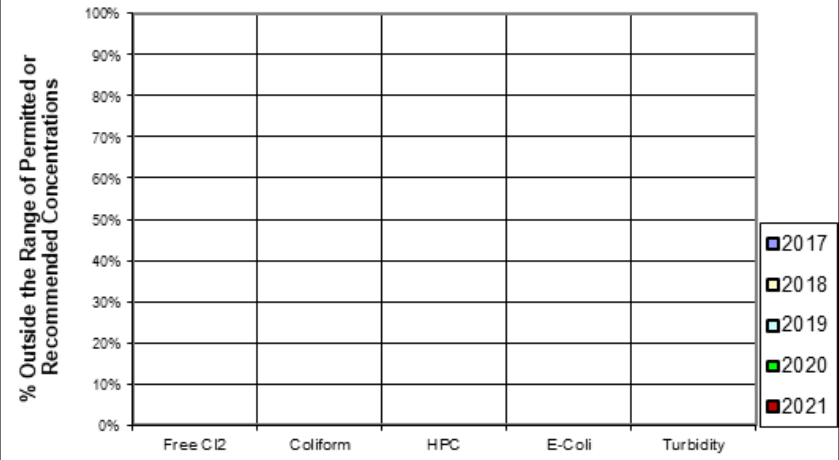
**Site 726 - Hyannis Reservoir
2017 - 2021 Water Quality Results**



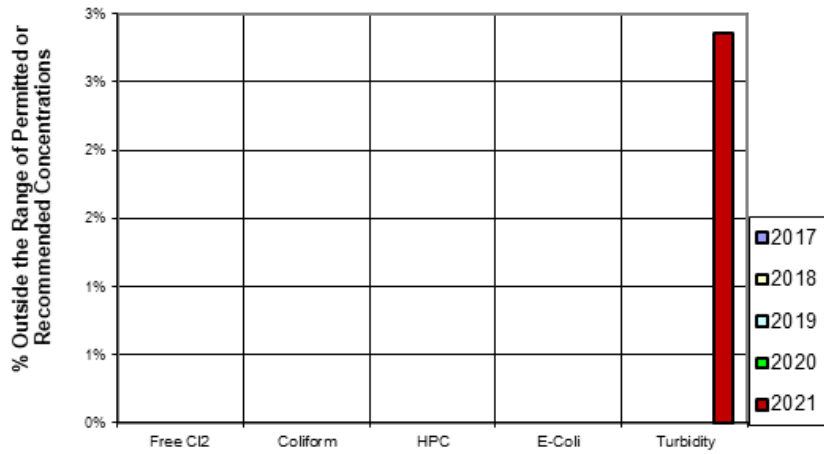
**Site 727 - Hoskins Rd & Kilmarnock Cres
2017 - 2021 Water Quality Results**



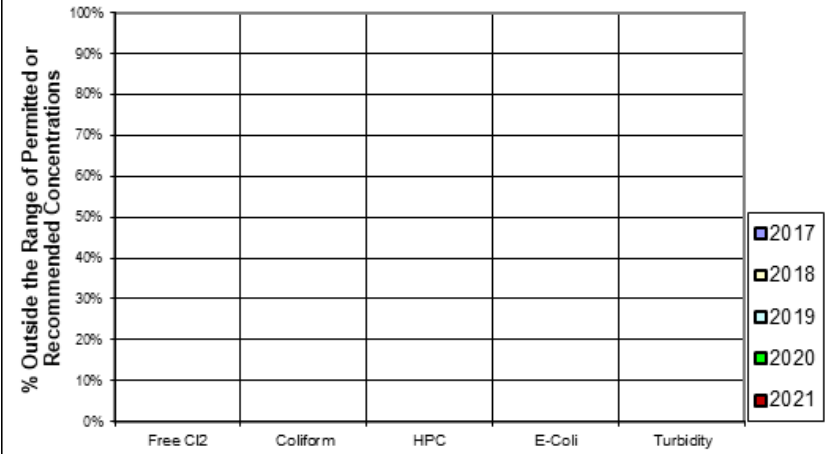
**Site 728 - Lillooet Road
2017 - 2021 Water Quality Results**



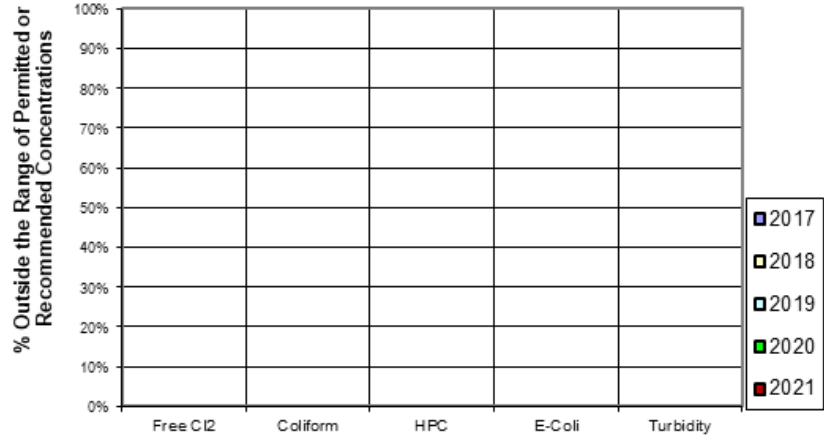
**Site 729 - Ramsay Pump Station
2017 - 2021 Water Quality Results**



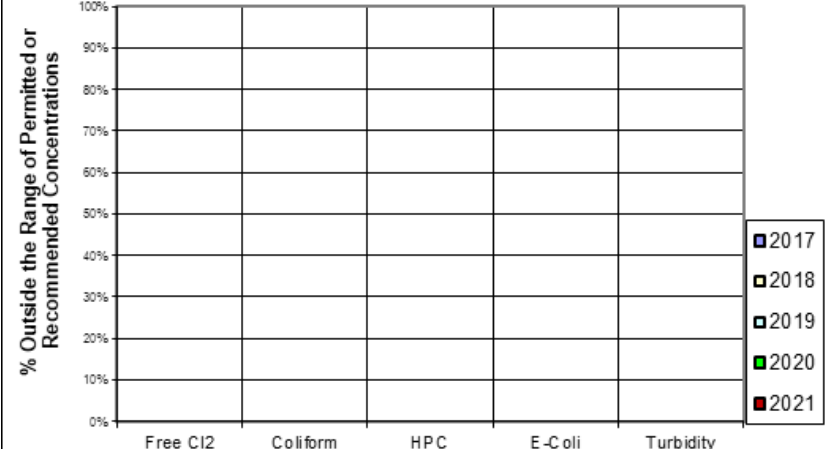
**Site 730 - Braemar Reservoir
2017 - 2021 Water Quality Results**



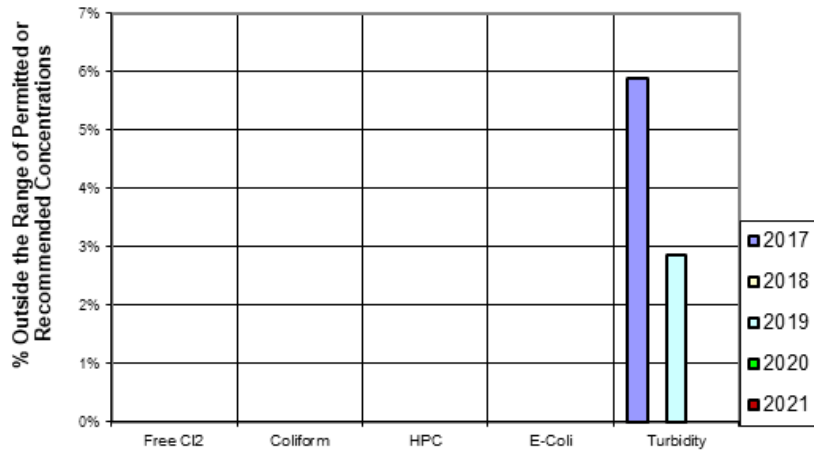
**Site 731 - Skyline Pump Station
2017 - 2021 Water Quality Results**



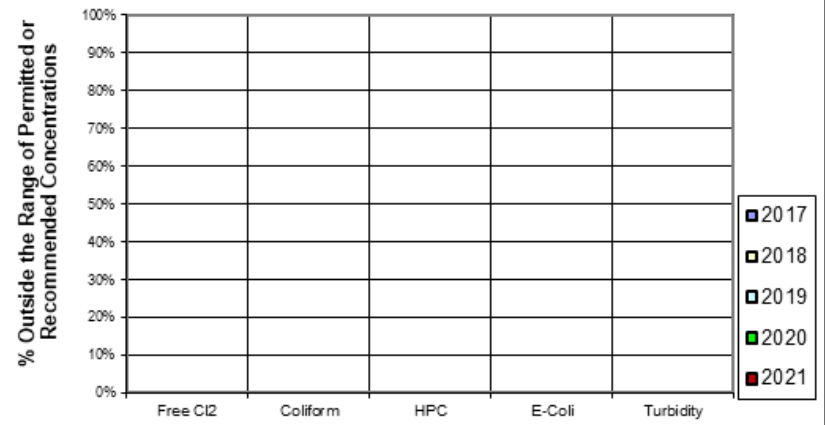
**Site 732 - Sarita Pump Station
2017 - 2021 Water Quality Results**



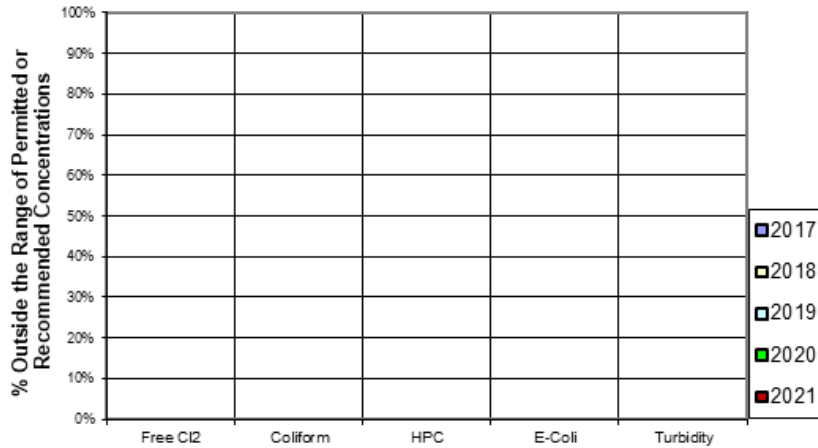
Site 733 - McKeen Ave & Phillip Ave
2017 - 2021 Water Quality Results



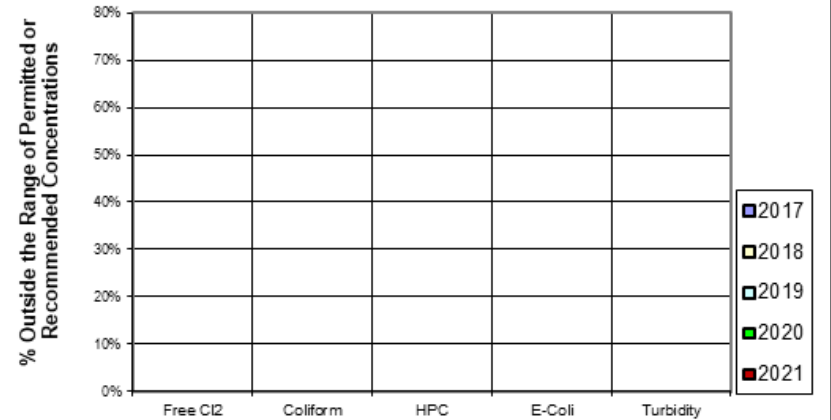
Site 734 - Pemberton Heights
2017 - 2021 Water Quality Results



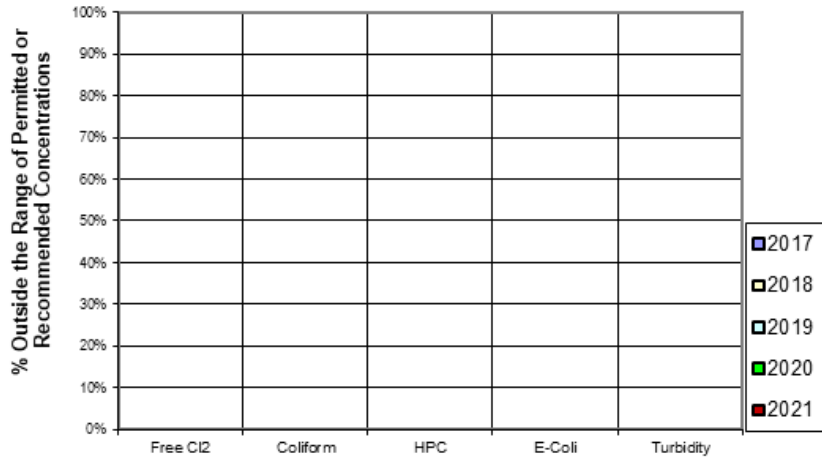
Site 735 - Prospect Reservoir
2017 - 2021 Water Quality Results



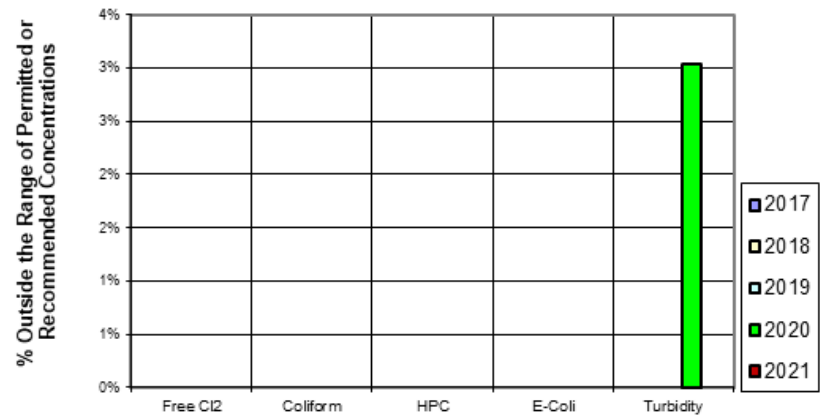
Site 736 - W Queens Rd & Lonsdale Ave
2017 - 2021 Water Quality Results



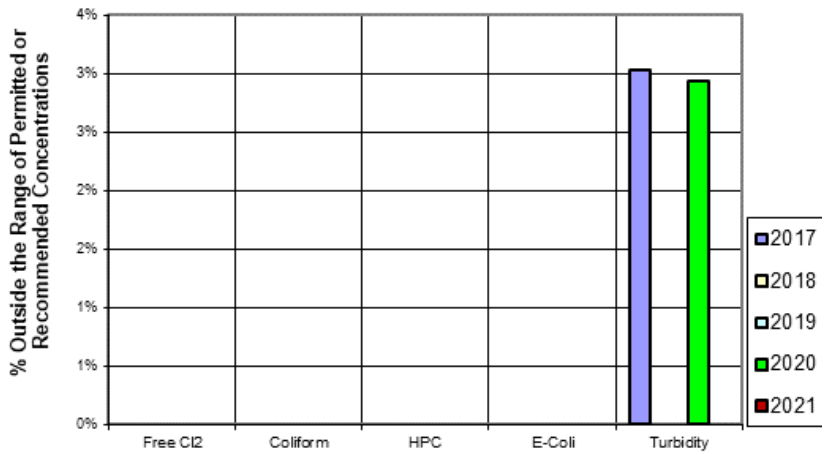
Site 737 - N. of BC Rail Tracks on Lower Cap. Rd
2017 - 2021 Water Quality Results



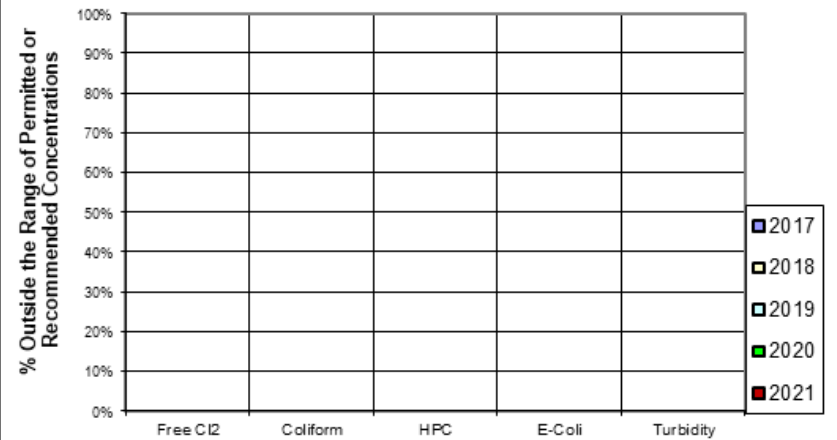
Site 738 - 3906 Sunnycrest Dr
2017 - 2021 Water Quality Results



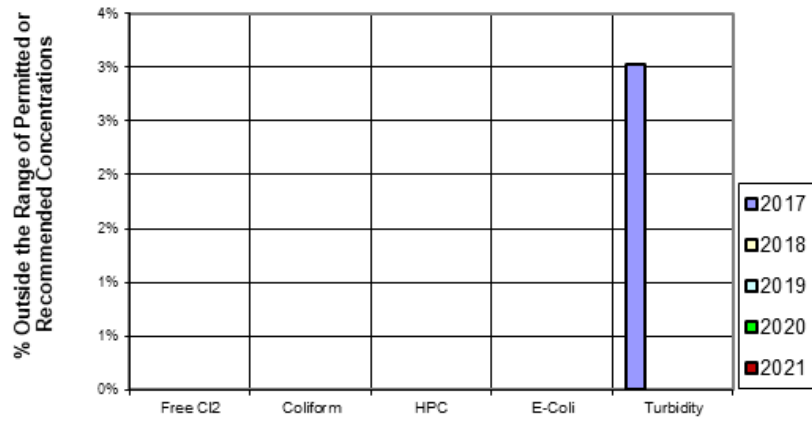
Site 739 - 376 Cartelier Rd.
2017 - 2021 Water Quality Results



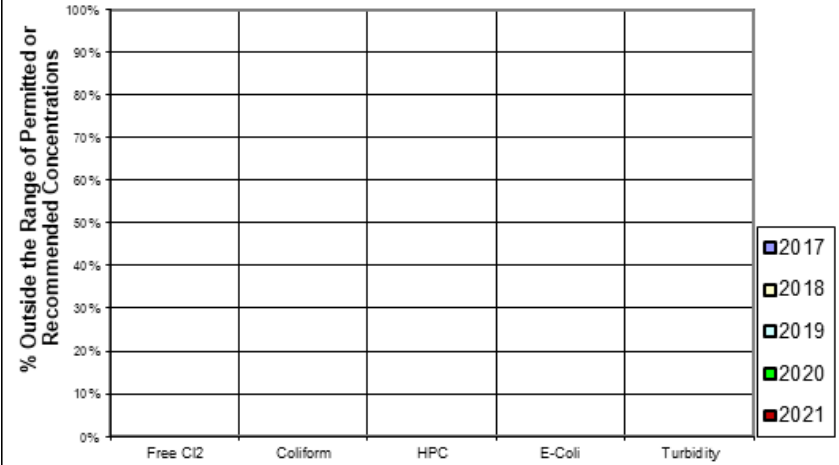
Site 740 - PRV #5 (190 E. Braemar Rd.)
2017 - 2021 Water Quality Results



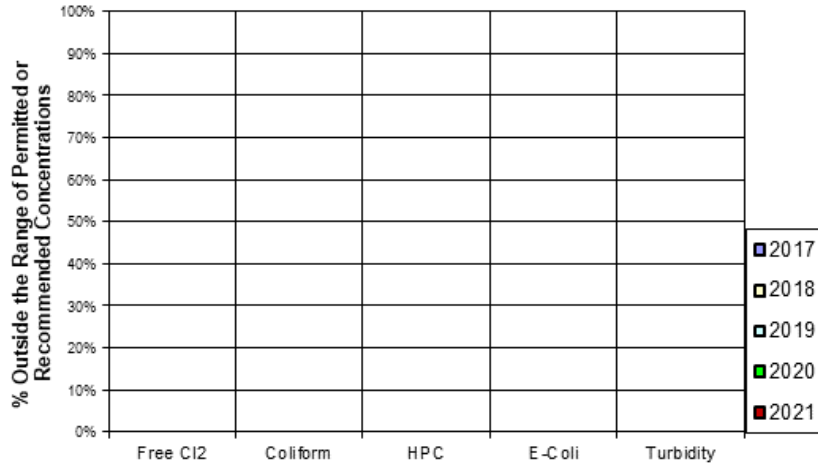
Site 741 - Mountain Hwy Reservoir, North of Mountain Hwy
2017 - 2021 Water Quality Results



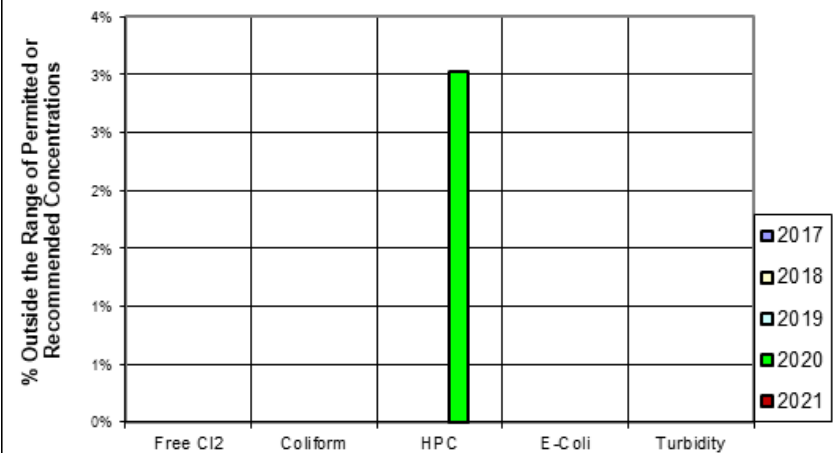
Site 742 - PRV # 11 (Across from 1086 Cloverly St.)
2017 - 2021 Water Quality Results



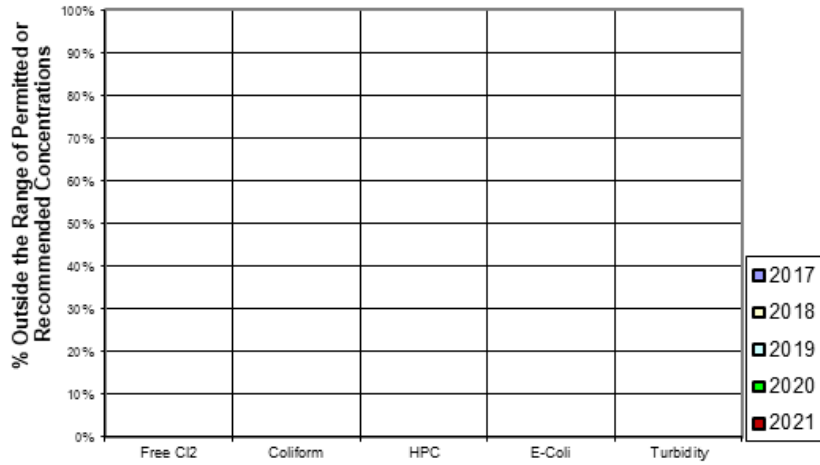
Site 745 - PRV # 13 (N. of 1388 Monashee Dr, Cap College)
2017 - 2021 Water Quality Results



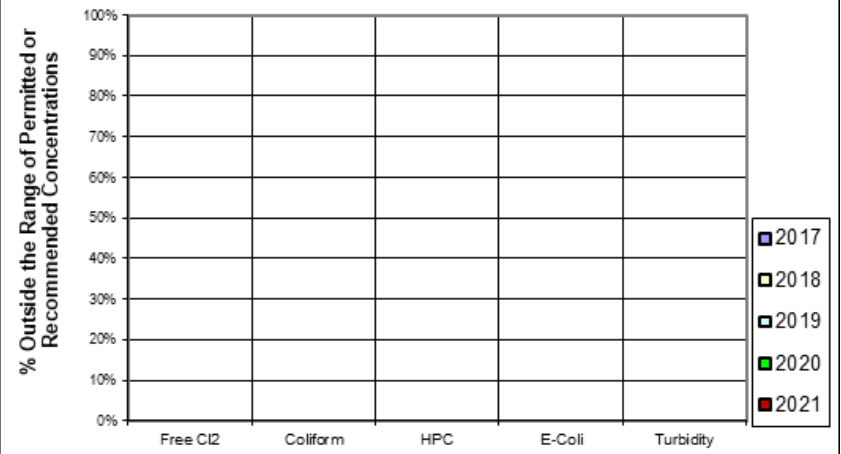
Site 746 - PRV #17 (60 Riverside Dr.)
2017 - 2021 Water Quality Results



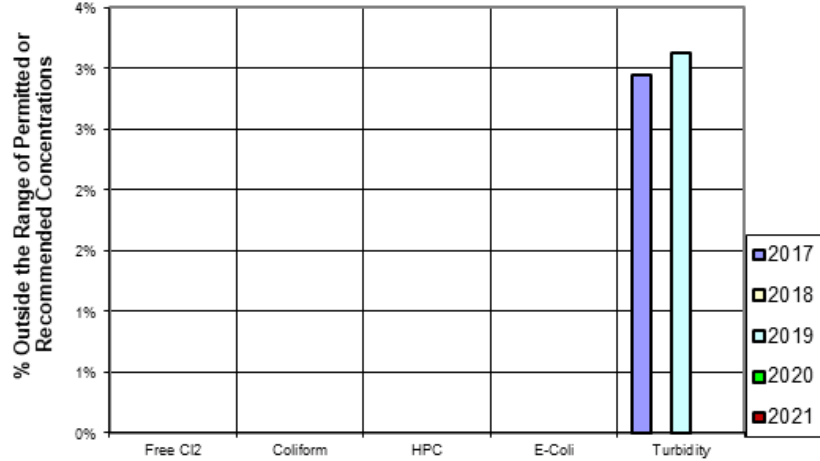
Site 747 - PRV # 19 (1231 Lennox St.)
2017 - 2021 Water Quality Results



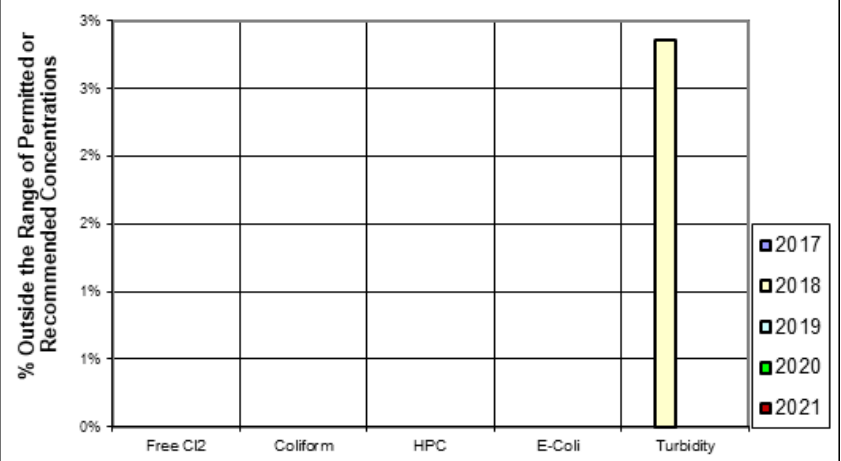
Site 748 - PRV # 16 (2592 Bendale Rd)
2017 - 2021 Water Quality Results



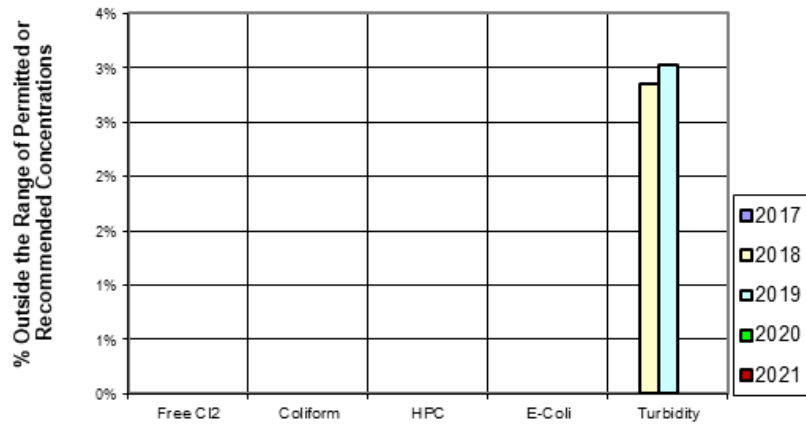
Site 749 - PRV # 18 (3728 Mt. Seymour Parkway)
2017 - 2021 Water Quality Results



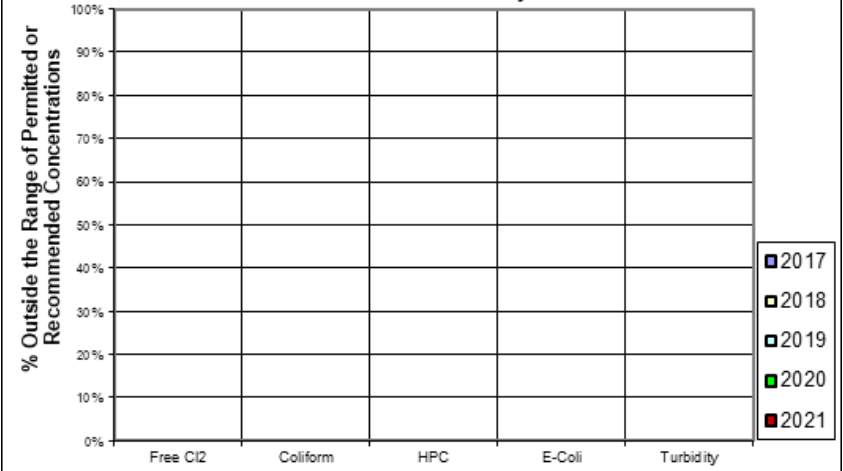
Site 752 - PRV # 25 (4068 Deane Pl.)
2017 - 2021 Water Quality Results



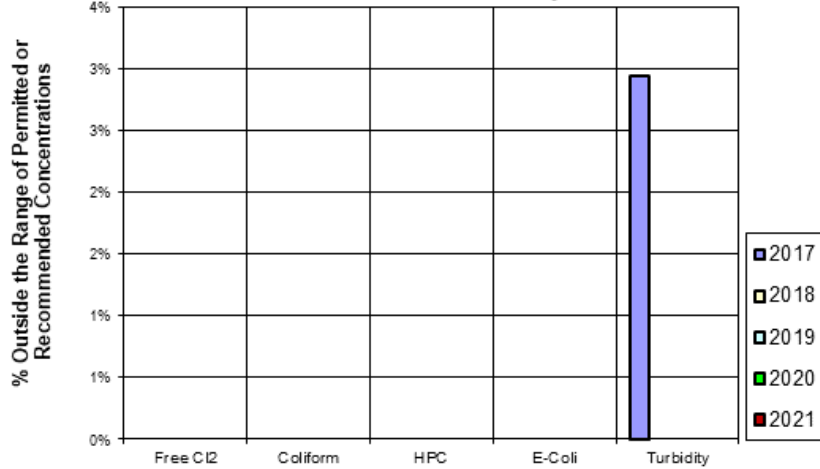
Site 753 - PRV # 20 (1501 Theta Ct.)
2017 - 2021 Water Quality Results



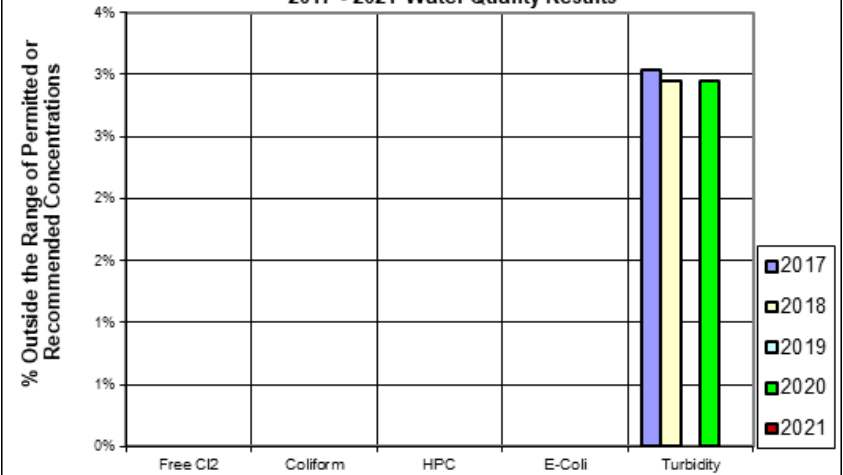
Site 754 - Woodlands Res, 2.1 km N. Hixon Rd on Indian River Dr
2017 - 2021 Water Quality Results



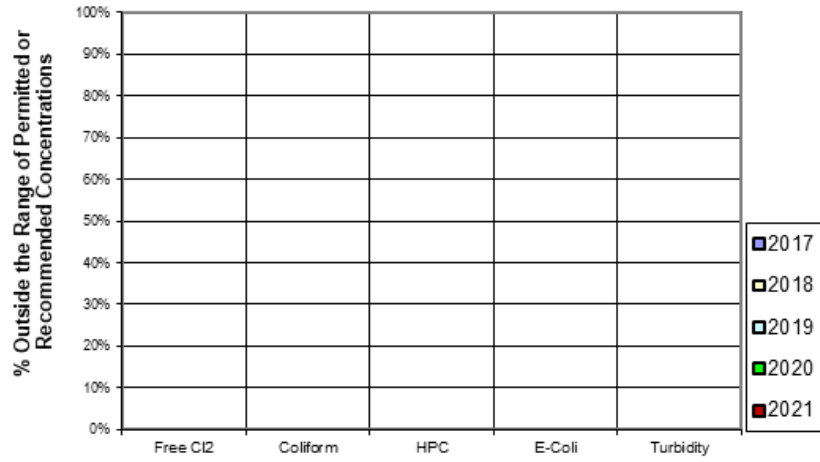
Site 755 - PRV # 26 3.7 km NE of Hixon Rd. on Indian River Dr.
2017 - 2021 Water Quality Results



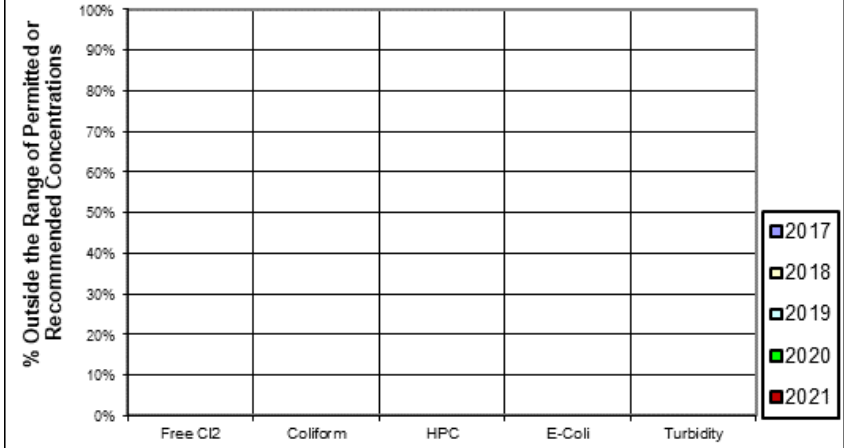
Site 756 - End of Fire Lane # 7, Firelane #7 - 3.6 km from Hixon Rd.
2017 - 2021 Water Quality Results



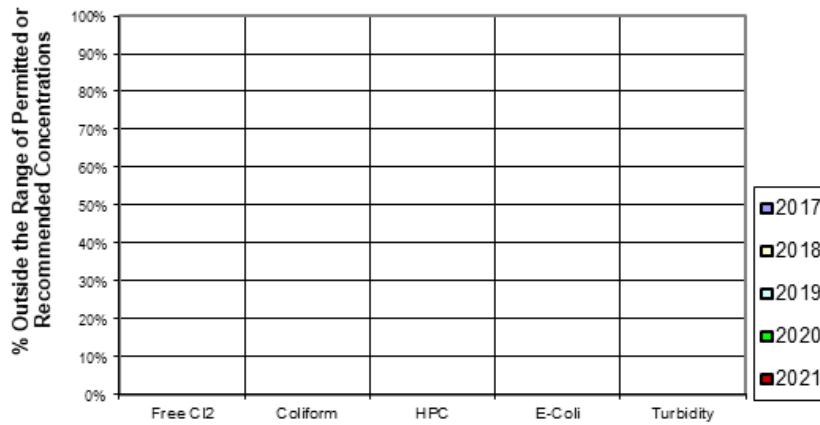
Site 757 - PRV 200 m south of 879 Roche Point Dr
2017 - 2021 Water Quality Results



Site 758 - 3860 Dollarton Hwy
2017 - 2021 Water Quality Results



Site 759 - 1919 Hyannis Drive
2017 - 2021 Water Quality Results



Site 760 - 3000 Block Dollarton Hwy (Burrard Reserve)
2017 - 2021 Water Quality Results

