



# Saanich Water Distribution System 2021 Annual Water Quality Report

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## 1.0 Introduction

This report is the 2021 annual overview of the results from water quality samples collected from the Saanich Drinking Water System (Map 1). The report summarizes data from District of Saanich owned and operated infrastructure with sample locations including reservoirs, pump stations, pressure regulating stations and locations from the distribution system. The parameters that are routinely monitored in the distribution systems for determining the microbiological quality of the drinking water are *E. coli*, total coliforms, turbidity, and chlorine residual. The water samples are collected by the Capital Regional District (CRD) water quality staff and analytical testing is performed at the CRD Water Quality Lab. Monthly and weekly summary reports on water quality data are posted on the CRD's website at: [www.crd.bc.ca/about/data/drinking-water-quality-reports](http://www.crd.bc.ca/about/data/drinking-water-quality-reports)

## 2.0 Water System Description

The District of Saanich purchases bulk water from the Capital Regional District (CRD) Integrated Water Services. The bulk water typically originates from the Sooke Lake Reservoir. Once a year, usually in December, the CRD supplies water from their Goldstream water source while performing maintenance on the Sooke Lake Reservoir. The water travels from Sooke Lake Reservoir to Saanich through several transmission mains. These mains are shown on the Saanich Water Pressure Zones & Water Mains 2018 map (Appendix A). Saanich is supplied by CRD Transmission Mains No. 1, 3, and 4.

There are 19 water connections from the CRD transmission system into the Saanich distribution system.

The Saanich Distribution system consists of 31 different pressure zones where source water comes directly from a Capital Regional District supply main or from another Saanich pressure zone.

The distribution system consists of 18 pumping stations, 49 pressure reducing stations, and 4 water reservoirs.

The Saanich Distribution System reservoirs are used to store and supply drinking water but also provide system balancing and fire and emergency storage. Listed from largest to smallest:

- |                            |  |
|----------------------------|--|
| 1. Rithet Reservoir:       | 15,750 m <sup>3</sup> (3,464,516 imperial gallons) |
| 2. Mount Tolmie Reservoir: | 4,063 m <sup>3</sup> (893,735 imperial gallons)    |
| 3. Wesley Reservoir:       | 2,632 m <sup>3</sup> (578,959 imperial gallons)    |
| 4. Hartland Reservoir:     | 797 m <sup>3</sup> (175,316 imperial gallons)      |

### 3.0 Water Quality Regulations

The District of Saanich Water Distribution System must comply with the British Columbia Drinking Water Protection Act (BCDWPA) and Drinking Water Protection Regulation (BCDWPR) as well as follow federal Guidelines for Canadian Drinking Water Quality (GCDWQ).

The water quality standards for potable water systems are shown in Schedule A of the British Columbia Drinking Water Protection Regulation and in the Guidelines for Canadian Drinking Water Quality Summary Table. These standards are provided in Table 1:

*Table 1 - Water Quality Standards for Potable Water – BCDWPR & GCDWQ*

Parameter:	Standard:
<i>Escherichia coli</i>	No detectable <i>Escherichia coli</i> per 100 ml
Total coliform bacteria	
(a) 1 sample in 30 day period	No detectable total coliform bacteria per 100 ml
(b) More than 1 sample in a 30 day period	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
	No detectable total coliform from consecutive samples from the same site

Schedule B of the BCDWPR requires the number of water samples collected to correspond with population size as shown in Table 2:

*Table 2 - Frequency of Monitoring Samples for Prescribed Water Supply Systems - BCDWPR*

Population Served by the Prescribed Water Supply System:	Number of Samples Per Month:
Less than 5,000	4
5,000 to 90,000	1 per 1,000 population
More than 90,000	90 plus 1 per 10,000 population in excess of 90,000

## 4.0 Water Quality Monitoring

The population of Saanich is approximately 117,735 (based on 2021 Census data). Based on Schedule B of the BCDWPR, Saanich is required to collect 93 compliance samples per month. In 2021, a total of 1,166 samples were collected from 64 dedicated sampling stations within Saanich. The requirements from Schedule B of the BCDWPR and the actual samples taken from the Saanich Distribution System are summarized in Table 3.

*Table 3 - District of Saanich Frequency of Sampling as per Schedule B of BCDWPR*

Year	Population	Number of Sample sites	Required Number of Samples per Month <sup>1</sup>	Actual	
				Average Number of Samples Per Month Collected	Number of Samples Per Year Collected
2021	117,735	64	93	97.2	1,166

<sup>1</sup> Minimum number of samples per month required by Schedule B of BCDWPR and Island Health Drinking Water Officer

In 2021, the water quality samples were collected by Capital Regional District staff for compliance samples each month. The monthly average number of samples has exceeded minimum requirements of 93 samples per month. However, December had 1 sample fewer than compliance due to the cold weather and snow event in late December which caused difficulties for CRD staff to access water quality sites, see Table 4.

## 5.0 Bacteriological and Physical Water Quality Results

Microbiological pathogens are considered to be the most significant threat to public drinking water affecting the public’s health. The effects of microbiological pathogens are acute. If they are ingested, pathogens can give people gastro-intestinal illness within a matter of hours or days. In some cases, ingesting microbiological pathogens can result in permanent damage to internal organs or lead to chronic health issues. In the most severe instances, ingesting pathogens can be fatal.

### 5.1 Escherichia coli (*E. coli*)

*E. coli* is used as an indicator of the microbiological safety of drinking water. *E. coli* is a member of the coliform group of bacteria that is naturally found in the intestines of humans and warm blooded animals. No detectable presence in a 100mL water sample is the maximum acceptable concentration (MAC) for potable water. Monitoring for *E. coli* provides information on the microbial condition of the distribution system. The presence of

*E. coli* indicates recent fecal contamination and the potential presence of microorganisms capable of gastrointestinal illnesses. The absence of *E. coli* in drinking water generally indicates that the water system is free of gastrointestinal illness causing bacteria.

If *E. coli* is detected in a water sample, the BCDWPA stipulates that the lab conducting the analysis (CRD) must notify the water supplier (Saanich), the Drinking Water Officer, and the Medical Health Officer. In turn Saanich must also immediately notify the Drinking Water Officer and the Medical Health Officer. Together, an assessment will be made of the possible health risk to the public and the most effective means to protecting the public. The assessment will take into account past water samples, the temperature, turbidity, chlorine residual of the water sample as well as operational changes or disturbances creating low pressures and other relevant information. The water will be resampled immediately. If the risk assessment deems the water system is operating as expected, a decision may be made to wait for results from the second water sample to determine if further action is required.

In 2021, there were 1,166 water samples taken with no samples resulting in an *E.coli* positive.

## 5.2 Total Coliforms

In 2021, there were 1,166 water samples taken with 6 testing positive for total coliforms. None of the positive samples exceeded the 10 CFU/100 ml total coliform concentration standard. The sampling stations that tested positive were immediately retested and subsequent results showed no total coliforms present. Therefore, there were no consecutive samples from the same sample site showing total coliforms which is in compliance with the BCDWPR. The remaining 1,160 water samples tested all passed the BCDWPR standard and Canadian Drinking Water Quality Guidelines.

Saanich Water Distribution system complied with the BCDWPR with all months exceeding 90% of samples with no coliform present. The annual average total coliform percentage positive was below the 10% limit at 0.5% (Table 4).

Coliform bacteria are used as operational indicators in water distribution systems. Their presence indicates water quality has degraded, possibly by bacterial regrowth or system contamination. Alternatively, coliform bacteria positive samples can also indicate contamination during sample collection.

Monitoring for total coliforms allows for the detection of changing conditions, intrusion of contaminants, or areas of reduced water quality, which can then be investigated and corrective actions determined.

Table 4 - Saanich Distribution System Bacteriological Water Quality 2021

Month	Bacterial Water Samples Collected	Total Coliforms				E.coli Samples > 0 CFU/100ml
		Samples TC > 0 CFU/100ml	TC > 0 Percent	Resamples TC > 0 CFU/100ml	Samples TC > 10 CFU/100ml	
January	96	0	0.0	0	0	0
February	99	1	1.0	0	0	0
March	100	0	0.0	0	0	0
April	100	0	0.0	0	0	0
May	94	0	0.0	0	0	0
June	97	1	1.0	0	0	0
July	97	1	1.0	0	0	0
August	98	1	1.0	0	0	0
September	101	2	2.0	0	0	0
October	95	0	0.0	0	0	0
November	97	0	0.0	0	0	0
December	92	0	0.0	0	0	0
Total	1,166	6	0.5	0	0	0

### 5.3 Chlorine Residual

The annual median chlorine residual in the Saanich Water Distribution System was 1.44 mg/L (Table 5). The lowest monthly median was in January (0.82 mg/L) and the maximum monthly median was in June and July (1.52 mg/L) (Figure 1). The recommended acceptable range concentration for chlorine in drinking water is 0.2 mg/L - 3.0 mg/L.

Chlorine is used to treat the raw water from Sooke Lake to produce potable, disinfected water. The Chlorine residual in the drinking water post treatment is there to safeguard against microbial regrowth or contamination in the drinking water system. Monitoring the chlorine residual in the drinking water system gives valuable information on the condition of the water currently in the system. A stable chlorine residual indicates that there is no microbial regrowth in the system. Alternately, if the chlorine residual were to suddenly decrease or disappear altogether would indicate that something has changed in the system and further investigation is needed to determine the cause to ensure that there has not been a contamination event in the water system.

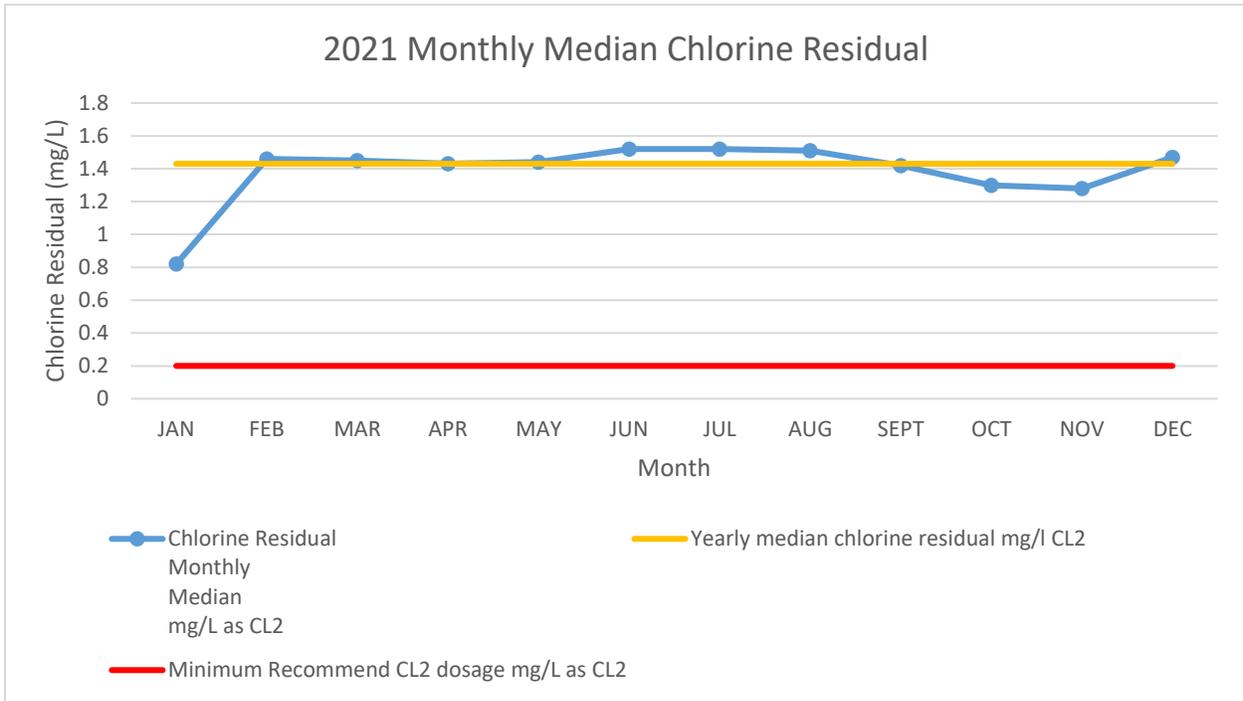


Figure 1 - 2021 Monthly Median Chlorine Residual

#### 5.4 Water Temperature

The CRD’s Sooke Lake Reservoir is a surface raw water source subject to a wide seasonal variation in temperatures which affects the water temperature within the Saanich Distribution System. Guidelines for Canadian Drinking Water Quality classify temperature as being an aesthetic objective. Preferably, the drinking water temperature would be  $\leq 15^{\circ}\text{C}$ . Aesthetic objective limits apply to certain characteristics of the drinking water that can lower user acceptance due to the perceived palatability of the water. Temperatures above  $15^{\circ}\text{C}$  in the water system can lead to unpleasant tastes and odours. From a consumer perspective, cool water tastes better than warm water.

The annual median water temperature in the Saanich Water Distribution System was  $11.8^{\circ}\text{C}$ . Monthly medians ranged from  $7.3^{\circ}\text{C}$  in March to  $19.3^{\circ}\text{C}$  in August (Figure 2). Drinking water temperatures in the Saanich Distribution System were below the Aesthetic Objective limit for most of the year except during the three summer months from July to September.

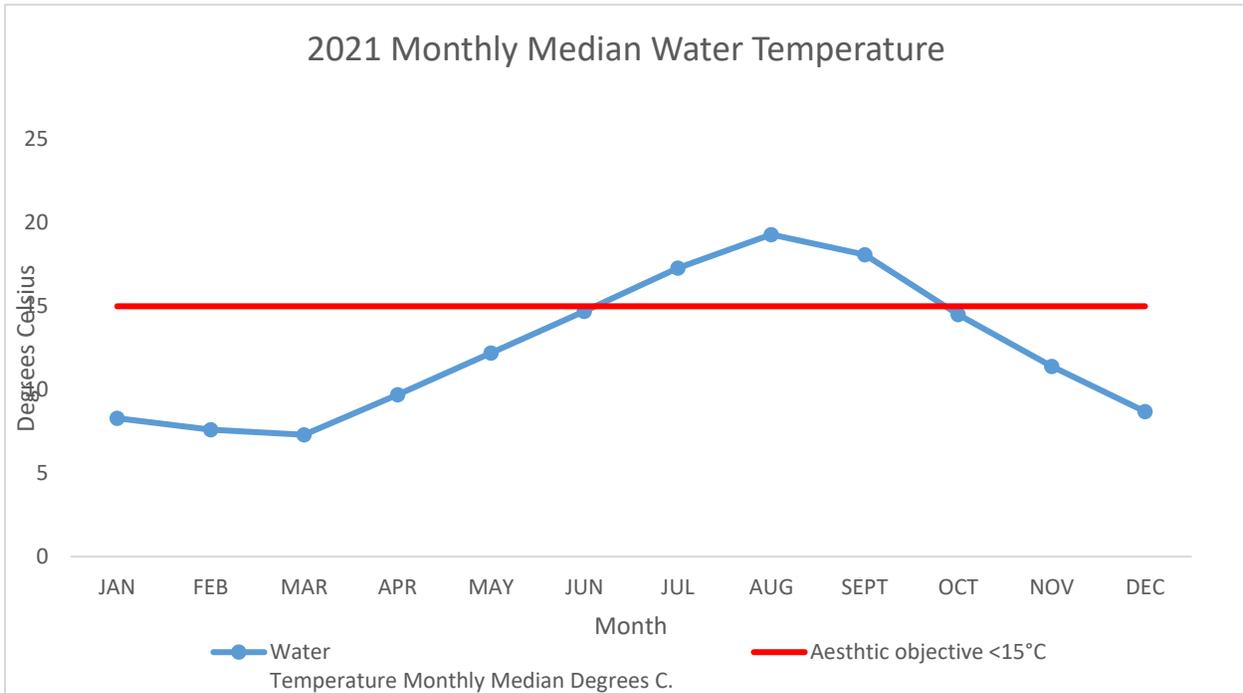


Figure 2 - 2021 Monthly Median Water Temperature (degrees Celsius)

### 5.5 Turbidity

Turbidity refers to the suspension of small particles of sediment or organic matter within water that causes a cloudy appearance. Turbidity is measured by the amount of light scattered by the particles within the water sample. Turbidity is measured in nephelometric turbidity units (NTU). Guidelines for Canadian Drinking Water Quality recommends that water entering a water distribution system have turbidity of 1.0 NTU or less.

In 2021, there were 33 turbidity samples taken at various locations within the distribution system with 1 sample in February exceeding the guidelines. When localized turbidity events occur, they are likely caused by water main flushing activities, fire hydrant use, and/or velocity/flow changes due to construction or maintenance activities. The resulting dis-colouration or cloudiness can be an aesthetic concern to customers. Turbidity is generally temporary and flushing of cold water taps can clear up the water.

*Table 5 - Saanich Distribution System Turbidity, Chlorine Residual, and Water Temperature 2021*

Month	Turbidity		Chlorine Residual Monthly Median mg/l as CL2	Water Temperature Monthly Median Degrees C
	Samples Collected	Adverse > 1 NTU		
January	3	0	0.82	8.3
February	5	1	1.46	7.6
March	4	0	1.45	7.3
April	3	0	1.43	9.7
May	2	0	1.44	12.2
June	3	0	1.52	14.7
July	3	0	1.52	17.3
August	1	0	1.51	19.3
September	3	0	1.42	18.1
October	2	0	1.30	14.5
November	2	0	1.28	11.4
December	2	0	1.47	8.7
Total or Median	33	0	1.44	11.80

<sup>1</sup> Exceeded Canadian Drinking Water Quality guidelines of  $\leq 15^{\circ}\text{C}$

## 6.0 Lead in Drinking Water

In March of 2019, Health Canada revised the guideline for lead in drinking water. The maximum acceptable concentration (MAC) was lowered from 0.01 mg/L to 0.005 mg/L, based on a sample taken at the tap. More information on the background for this guideline revision and potential public health implication can be found in the reference links provided in Appendix B.

Lead is commonly found in the environment, both naturally and as a result of human activities. Lead is not known to be naturally occurring in the source water for Greater Victoria but can be found in drinking water where it has leached out of distribution and plumbing system components, particularly in aggressive (corrosive) water. Low pH is the most common cause of corrosive water. The extent of leaching depends on the type and age of plumbing materials, corrosiveness of the water, and the length of time that the water is stagnant in the plumbing fixtures.

Lead service lines (the pipe connecting the municipal water main to the private water system at property line) were not commonly used in the Saanich Distribution system as they were in other parts of Canada. At this time, there are no known lead service lines in use. If a lead service line is found in use, Saanich policy is to immediately replace the

water service. In the past ten years, only a handful of lead service lines have been found active in the distribution system and were subsequently replaced.

The Canadian Standards Association standard for plumbing supply fittings changed in 2012 to revise the requirement for “lead free” plumbing components from 8% Lead to 0.25% lead by weight. This means that houses built as late as 2012 could have fixtures with 8% lead in their components, potentially enough to cause stagnant (first flush or first draw) water samples to exceed the MAC. If homeowners are concerned or uncertain about whether their private residence has leaded plumbing components, best practice is to flush the tap or fixture until the water runs cold after water has not been used for several hours or overnight. This will flush out the water in the lines and replace with fresh water from the water distribution main on the street.

Data from the CRD shows that Greater Victoria has Neutral pH water with the treated water leaving the treatment plant having a pH of 7.3 -7.8. Those values indicate that the water distribution network is not aggressively leaching lead or metals from pipes or fixtures.

## 6.1 Greater Victoria pH & Corrosion Study

Starting in August 2019, the District of Saanich partnered with the CRD, along with the City of Victoria, and the District of Oak Bay to commence the “Greater Victoria pH & Corrosion Study”. The study, under the lead of the CRD, assessed corrosiveness of the water in all parts of the water systems to identify areas with higher corrosion potential. The study examined factors such as corrosiveness index, the age of buildings, with the assumption that older homes in the region will likely have a higher likelihood of lead-containing plumbing fixtures.

The first phase of the study developed a comprehensive water sampling plan that covered all water systems in the study area utilizing existing infrastructure such as pump stations, valve stations, fire hydrants, reservoirs and water sampling stations. Water sampling occurred September to October 2019. Each sampling location was field tested for pH and temperature and a water sample was taken for laboratory testing of corrosivity relevant parameters, including total lead concentration. All sample locations tested in the Saanich Water Distribution System produced results that were lower than the maximum allowable concentration (MAC) of 0.005 mg/L (5 µg/L). The data produced from sampling locations within the distribution systems were used to produce a corrosion potential map based on a corrosivity index for the Saanich Distribution System and all other systems sampled in the study.

The second phase of the Greater Victoria pH & Corrosion Study occurred during April of 2021 where a total of 104 tap samples were taken from selected areas of Saanich, Oak Bay, Victoria, Esquimalt, Sooke, and Westshore Communities. All locations had first draw (after 6 hours of stagnation) and a 30 minute stagnation samples taken. Following 6 hours (or overnight) the tap water would be sampled with the first water out of the fixture, then would be flushed for 5 minutes and allowed to stagnate for 30 minutes before resampling.

The first draw sample is used to try to capture the highest levels of lead or the worst case scenario. The 30 minute stagnation is used to try and capture typical exposure to lead at residential taps. One site of the 104 residential taps sampled had elevated lead levels for both the first draw and 30 minute stagnation samples. The homeowner with the high lead concentrations was notified and given advice on corrective actions.

The data obtained from both the public (water system) and private (residential taps) sampling has indicated that the water in the Greater Victoria Drinking Water System can be classified as passive to mildly corrosive. This indicates that there will always be a level of potential for lead to be leached into the drinking water, the risk of leaching metals into the drinking water is generally low.

Based on the Greater Victoria pH and Corrosion Study results, lead levels in drinking water in the Greater Victoria Drinking Water System does not pose a community health concern.

## 7.0 System Maintenance

Saanich undertakes daily, monthly, and annual maintenance functions to ensure that the drinking water system and its components are in good working order for reliability purposes in the event of emergency shut downs or repairs. These ongoing maintenance functions help to ensure that the system components have the longest service life possible and keep service disruptions to customers to a minimum.

### 7.1 Unidirectional Flushing Program

Saanich operates an annual Unidirectional Flushing Program to remove sediment and biofilm from the water mains in order to maintain good water quality. Unidirectional flushing involves isolating segments of the water system by closing valves in order to flush sequentially from source to periphery of system.

Removing sediment and biofilm is important as sediment in water mains gives bacteria a place to live and hide from the chlorine residual in the water. Sediment reduces the flow capacity of the pipe network and sediment and biofilm may get disturbed if normal flow patterns change during fire hydrant use or construction work. Flushing out the sediment on an annual basis helps maintain proper flow and reduce dirty water complaints.

The Saanich water distribution system consists of over 540 km of pipe. During the 2021 unidirectional flushing program, 425.9 km of water mains were flushed. Due to the size of the distribution system, it typically takes two years to complete the whole program. The two largest water pressure zones in the system are flushed every other year with the remaining 29 pressure zones typically flushed yearly.

*Table 6 - Kilometers of Water Main Flushed by Year*

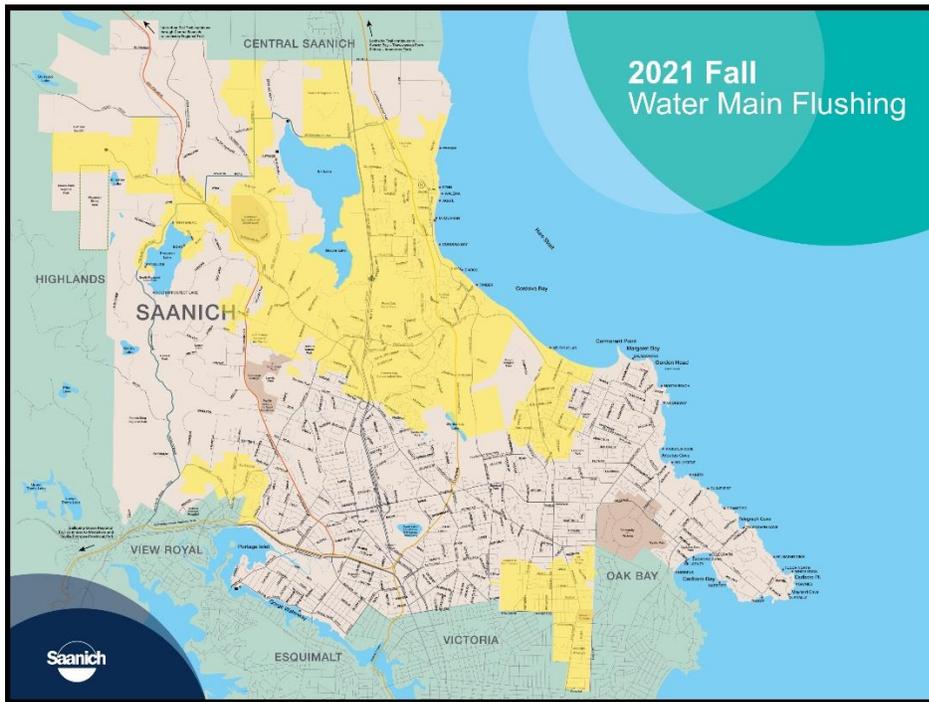
Year	Total Kilometers Flushed
2021	425.9
2020	409.4
2019	286.3
2018	244.2
2017	295.0

The Unidirectional Flushing program runs twice a year during Spring and Fall flushing seasons. Spring flushing runs from February to June. Fall flushing typically runs from mid-September to the end of December or into January.

*Map 1 - 2021 Spring Flushing Areas*



Map 2 - 2021 Fall Flushing Areas



## 7.2 Monthly Flush Program

Saanich operates an ongoing Monthly Flush Program to flush out water from dead end sections of water main to maintain water quality and reduce customer complaints caused by taste and odours. Dead end sections of water main tend to have higher water age (length of time from treatment to consumption) than other parts of the system. Typically the higher water age on these dead end water mains are because the localized customer demand is not enough to effectively exchange the water in the pipe adequately. These dead end sections are also more prone to sedimentation where particles that enter the water system from Sooke Lake Reservoir can settle out due to the low flow.

The locations that are currently part of the Monthly Flush Program have been determined by customer complaints, field data and observations from Saanich staff throughout the years. The Monthly Flush Program is used to pro-actively maintain water quality in the dead end water mains within the Saanich Distribution System by removing sediment and bringing in fresh water with a higher chlorine residual to help prevent microbial growth in these areas.

### 7.3 Autoflush Locations

When site conditions are favourable, Saanich Waterworks has begun to install autoflushes at the end of dead end sections of water main. These autoflushes are the equivalent of an irrigation valve on a set programmed timer. This will allow these sites to run weekly, bi-weekly, or as needed to pro-actively maintain water quality in the dead end water mains within the Saanich Distribution System.

The autoflushes are designed and installed to avoid freezing so they can operate year round. They have a built in drain system with a de-chlorination system to ensure water discharged into the environment is de-chlorinated appropriately.

Four additional autoflushes were installed in 2021. Autoflushes are primarily buried below ground with only a small portion out of the ground in a small protective box to minimize the impact to the neighbourhood boulevard.



*Figure 3 - Example of an Autoflush location*

## 7.4 Valve Maintenance

Water distribution valves are installed in the system to isolate small areas for emergency maintenance or repairs. Saanich undertakes an extensive program of inspection, exercising (opening and closing), and maintenance of valves annually to ensure that valves operate when needed.

There are over 9,800 valves in the Saanich Water Distribution System. Due to the number of valves in the system it takes four to five years to complete the valve program. In 2021, staff exercised 22% of all valves.

*Table 7 - Water Valves Maintained by Year*

Year	Total Valves Maintained
2021	2,146
2020	2,340
2019	2,224
2018	2,538
2017	2,573

## 7.5 Hydrant Maintenance

The Saanich Water Distribution System has 2,342 fire hydrants. As part of the hydrant maintenance program all hydrants are inspected and serviced on a 3 - 4 year cycle. In 2021 29% of hydrants were serviced.

*Table 8 - Hydrants Maintained by Year*

Year	Total Hydrants Maintained
2021	691
2020	893
2019	942
2018	996
2017	891

## 8.0 Summary

1. The water quality data collected in 2021 indicates that the drinking water in the Saanich Distribution System is of good quality and safe to drink. Temperatures in the Saanich Distribution System stayed below the Aesthetic Objective of 15°C for most of the year except during the summer months.
2. The monthly average for water samples taken in 2021 was 97.16 samples. The monthly average exceeds the required number of samples each month of 93 based on the British Columbia Drinking Water Protection Act and Regulation. However, December had 1 sample fewer than compliance due to a winter storm event in late December which caused difficulties for CRD staff to access water quality sites.
3. The Saanich Distribution System had no *E. coli* positive sample in 2021. All 1,166 *E. coli* samples in 2021 were negative for *E. coli*.
4. The Saanich Distribution System had less than the 10% Total Coliform standard for all months with a monthly average at 0.5%. The system had no samples exceeding the 10 CFU/ 100 ml limit. The sample results that had Total Coliforms were immediately retested and found no consecutive Total Coliform positive samples from the same sample sites. This likely is an indication that the positive samples were contaminated during original collection.
5. Saanich participated in a regional pH and Corrosion study with the Capital Regional District to understand the presence (or lack thereof) of lead in the distribution system in response to the new Health Canada guidelines. The study indicated no community health concern from lead at residential taps.



*Appendix B - References*

Canadian Drinking Water Guidelines:

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

Guidelines for Canadian Drinking Water Quality Summary Table 2017:

[https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt\\_formats/pdf/pubs/water-eau/sum\\_guide-res\\_recom/sum\\_guide-res\\_recom-eng.pdf](https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf)

From Source to Tap: Guidance on the multi-barrier approach to Safe drinking Water:

[https://www.ccme.ca/files/Resources/water/source\\_tap/mba\\_guidance\\_doc\\_e.pdf](https://www.ccme.ca/files/Resources/water/source_tap/mba_guidance_doc_e.pdf)

British Columbia Drinking Water Protection Act:

[http://www.bclaws.ca/civix/document/id/complete/statreg/01009\\_01](http://www.bclaws.ca/civix/document/id/complete/statreg/01009_01)

British Columbia Drinking Water Protection Regulation:

[http://www.bclaws.ca/civix/document/id/complete/statreg/200\\_2003](http://www.bclaws.ca/civix/document/id/complete/statreg/200_2003)

Guidelines for Canadian Drinking Water Quality – Lead Guideline Technical Document:

<https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-lead/guidance-document/guidance-document.pdf>

Guidelines on Evaluating and Mitigating Lead in Drinking Water Supplies, Schools, Daycares and Other Buildings:

[Guideline on Reducing Exposure to Lead Through Drinking Water \(gov.bc.ca\)](#)

Vancouver Island Health Authority: Lead in Water webpage

[Lead in water | Island Health](#)

Vancouver Island Health Authority: Drinking Water webpage

[Drinking Water | Island Health](#)