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To: Water Committee

From: Peter Marshall, Field Hydrologist, Environmental Management, Water Services

Date: March 26, 2024 Meeting Date: April 3, 2024

Subject: **Climate Impacts on the Water Supply Areas**

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### **RECOMMENDATION**

That the Water Committee receive for information the report dated March 26, 2024, titled "Climate Impacts on the Water Supply Areas".

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### **EXECUTIVE SUMMARY**

This report underscores the increasing influence of climate change on local weather, with 2023 emerging as the second warmest year on record since 1936. The combination of warm and dry conditions in the spring and summer caused extreme seasonal drought for the third consecutive year. Dry conditions led to an extreme wildfire season nationally, provincially, and locally.

Looking ahead, this report emphasizes the importance of climate resilience in managing regional water resources. With climate change exerting increasing pressure, proactive measures are essential to ensure the sustainability of water supply systems. Water Services continues to invest in climate monitoring programs and technological innovations to inform water supply decision-making and mitigate environmental impacts from the changing climate.

2024 is shaping up to be a slightly drier year with snow water equivalent (snowpack) levels at 65 per cent of the normal average for this time of year (March 15 data). Metro Vancouver is watching weather conditions closely and will continue to make adjustments to reservoir operations and watering restrictions as conditions warrant.

### **PURPOSE**

This report is intended to provide the Committee with a summary of the annual *Water Supply Areas Climate Report for 2023*. This includes information on weather and climate conditions in the water supply areas, and how these conditions relate to regional climate projections and historical norms.

### **BACKGROUND**

Water Services manages a network of automated hydro-meteorological stations, and conducts annual field sampling programs. This monitoring program provides reliable and timely information on source water quality and quantity, stream flow, and wildfire risk in the water supply areas. This information assists in managing source reservoirs and optimizing water treatment, which helps minimize risks to drinking water quality and quantity. The annual *Water Supply Areas Climate Report for 2023* summarizes key parameters including air temperature, precipitation, snowpack, and stream flow.

## **WEATHER AND CLIMATE HIGHLIGHTS**

### **Climate Change Projections**

*Climate Projections for Metro Vancouver* (2016) describes expected changes in temperature, precipitation, and other parameters in Metro Vancouver by 2050 and 2080. All models from these projections show an increase in daytime high and nighttime low temperatures. Warmer temperatures are anticipated to reduce peak spring snowpack levels, which in turn, will reduce late-spring and summer river inflows. For precipitation, the region can expect more intense and frequent rainfall events in the fall and winter months. Longer summer dry spells extending into fall droughts are also more likely in the future. Recent years have given a glimpse of what conditions may consistently be like in the coming decades. Recent observations illustrate how quickly the climate is changing, and how hard it is becoming to predict the severity of weather events based on historical conditions.

### **2023 Weather Summary**

The year 2023 was the second warmest on record since 1936 in Metro Vancouver, closely following 2015. It was also a very dry year, particularly during the spring and summer months. Warm and dry conditions led to extreme seasonal drought and elevated wildfire danger in BC, including the south coast, and Metro Vancouver. The information below provides an overview of key weather patterns and highlights significant deviations from historical norms.

#### Temperature Trends

Aside from a relatively cool winter and early spring, temperatures in Metro Vancouver were consistently above average. Notably, both May and December stood out with average temperatures exceeding 3°C above normal. One of the hottest days of the year occurred in the middle of May, which is very unusual.

#### Precipitation Patterns

Annual precipitation levels varied widely across the region, ranging from 70 to 95 per cent of normal. Metro Vancouver experienced well below-normal precipitation between May and December. Only 24 millimeters of precipitation fell between April 25 and June 10. There were several long dry spells this year, including a 33-day dry spell from May 8 to June 10.

#### Snowpack

Cool conditions were dominant during the winter and early spring. This helped the snowpack grow to a near-normal level by May 1 (99 per cent of historical average). However, hot and dry conditions in May and early June rapidly melted the snowpack, and by June 15, the snowpack in the watersheds was 30 per cent of the historical average. The reservoirs stopped spilling on June 24, which is the date water withdrawals and environmental flow releases from the reservoir exceed the inflow rate and lake starts to drawdown. This was approximately three weeks earlier than the 30-year average.

#### Drought and Wildfire Risk

The combination of warm and dry conditions led to extreme seasonal drought, amplifying the wildfire risk. The provincial drought level was rated 4 or 5 in the Lower Mainland basin from June 29 until September 28. Elevated fire danger persisted throughout the majority of the summer. The

water supply areas saw high or extreme fire danger rating for 65 days, which is double the 10-year average.

#### Environmental Flows

The 2023 drought conditions brought increased water temperatures and lower river flows throughout the region. Metro Vancouver is committed to ensuring the environmental flows downstream of our dams support healthy fish populations. As such, staff worked with Fisheries and Oceans Canada and the local First Nations to provide a supplemental pulse flow release in both the lower Capilano and lower Seymour Rivers in August and September respectively. These water releases during the key migration period assisted several hundred returning Coho Salmon navigate challenging stretches of habitat. Overall, 2023 Salmon returns were above average in the region despite the drought conditions.

#### Comparisons with Previous Years

Despite record-breaking drought and wildfire risk, the region did not face the weather extremes observed in 2021 and 2022. The hottest days were less scorching, and the coldest days were milder. This year's strongest storms paled in comparison to the November 2021 atmospheric river, which caused extensive flood damage in southwest British Columbia.

#### Current Conditions

Metro Vancouver is currently experiencing a lower-than-average snowpack year. The March 15 snow survey found the snow water equivalent (snowpack) to be 65 percent of the historical average. While it's still too early to tell what impact current conditions will have on the summer water supply, Metro Vancouver is continuing to monitor snow levels and weather patterns in advance of the high-demand season and will continue to adjust operations of its reservoirs and summer watering restrictions based on this information. Metro Vancouver also continues to work with its members to encourage them to proactively take water conservation measures including public education campaigns and robust local enforcement of the summer watering restrictions.

#### **ALTERNATIVES**

This is an information report. No alternatives are presented.

#### **FINANCIAL IMPLICATIONS**

Data collected and used in this report is funded by the Watersheds and Environment program budget as well as through partnerships with other organizations including Environment and Climate Change Canada and BC Hydro. Upgrades to snow monitoring methodologies and technologies have been funded by the GVWD Sustainability Innovation Fund.

#### **CONCLUSION**

The annual *Water Supply Areas Climate Report* for 2023 highlights the need for climate resilience in managing Metro Vancouver's water resources. The climate is changing rapidly, making it difficult to predict conditions based on historical conditions alone. By leveraging data-driven insights and embracing innovative technologies, Water Services is poised to navigate the challenges posed by a changing climate, and manage available summer water supply to meet the needs of the region's residents and the fisheries resources downstream of the water supply areas.

**ATTACHMENTS**

1. "Water Supply Areas Climate Report", dated, January 2024
2. Water Supply Areas Climate Report - Presentation

**REFERENCE**

1. [Climate Projections for Metro Vancouver \(2016\)](#)

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# WATER SUPPLY AREAS CLIMATE REPORT

## 2023 ANNUAL SUMMARY

WATERSHEDS & ENVIRONMENT  
WATER SERVICES  
January 2024

*Cover image: Coquitlam Glacier, October 2023 (P. Marshall)*

**Report prepared by:**

Peter Marshall

Field Hydrologist

Water Services / Watersheds and Environment

[Peter.Marshall@metrovancover.org](mailto:Peter.Marshall@metrovancover.org)

**About this Document**

This report summarizes weather, climate, and water supply conditions in Metro Vancouver's Capilano, Seymour, and Coquitlam watersheds in 2023. It also highlights some of the most impactful local and regional weather events of the year. Data for this report were collected from the network of hydro-meteorological stations in all three watersheds, supplemented by data from Environment and Climate Change Canada (ECCC), and BC Hydro. These stations monitor temperature, precipitation, stream flow, snowpack, and many other parameters. Data records for these stations vary from 10 years to over 100 years. Most plots and maps have been created specifically for this report. Credit is given to figures and images that are not original.

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## Executive Summary

Globally, 2023 was the warmest year on record – by a considerable margin. Many heat records crumbled around the world this year. Locally, this was the second warmest year on record since 1936. It was also a very dry year, particularly during the spring and summer months. Warm and dry conditions led to extreme seasonal drought and elevated wildfire danger in British Columbia, including Metro Vancouver. This summary provides an overview of key weather patterns and highlights significant deviations from historical norms.

### Temperature Trends:

- Aside from a relatively cool winter and early spring, temperatures in Metro Vancouver were consistently above average. Notably, both May and December stood out with average temperatures exceeding 3 degrees Celsius above normal. One of the hottest days of the year occurred in the middle of May, which is very unusual.

### Precipitation Patterns:

- Annual precipitation levels varied widely across the region, ranging from 70% to 95% of normal. Between May and December, the region experienced below-normal precipitation levels. Only 24 mm of precipitation fell between April 25 and June 10.

### Snowpack:

- Fortunately, cool conditions were dominant during the winter and early spring. This helped the snowpack grow to near-normal level by May 1. However, hot and dry conditions in May rapidly melted the snowpack and by June 15, the snowpack in the watersheds was 30% of historical average.

### Drought and Wildfire Risk:

- The combination of warm and dry conditions led to extreme seasonal drought, amplifying wildfire risk. The drought level was rated 4 or 5 in the Lower Mainland basin from June 29 until September 28. Elevated fire danger persisted throughout the majority of the summer.

### Comparisons with Previous Years:

- Despite record-breaking drought and wildfire risk, the region did not face the weather extremes observed in 2021 and 2022. The hottest days were less scorching, and the coldest days were milder. This year's strongest storms paled in comparison to the November 2021 atmospheric river, which caused extensive flooding in southwest British Columbia.

### Climate Projections:

- The observed trends in 2023 align with regional climate projections, suggesting the region will experience overall warming, reduced spring snowpack, drier and longer summers, and longer dry spells.

In summary, 2023 was a year characterized by above-average temperatures, below-normal precipitation, severe seasonal drought, and heightened wildfire risk. While not reaching the extremes of previous years, the trends observed in 2023 align with broader climate projections, emphasizing the importance of continued monitoring and adaptation efforts to address the evolving climate dynamics in Metro Vancouver.

## Overview Map

The map below highlights some of the monitoring stations used in this report. One of the main reference stations is the lower Capilano fire weather station on the east side of the Capilano reservoir. Loch Lomond (Seymour Watershed) and Palisade Lake (Capilano Watershed) monitoring stations are also referenced frequently.

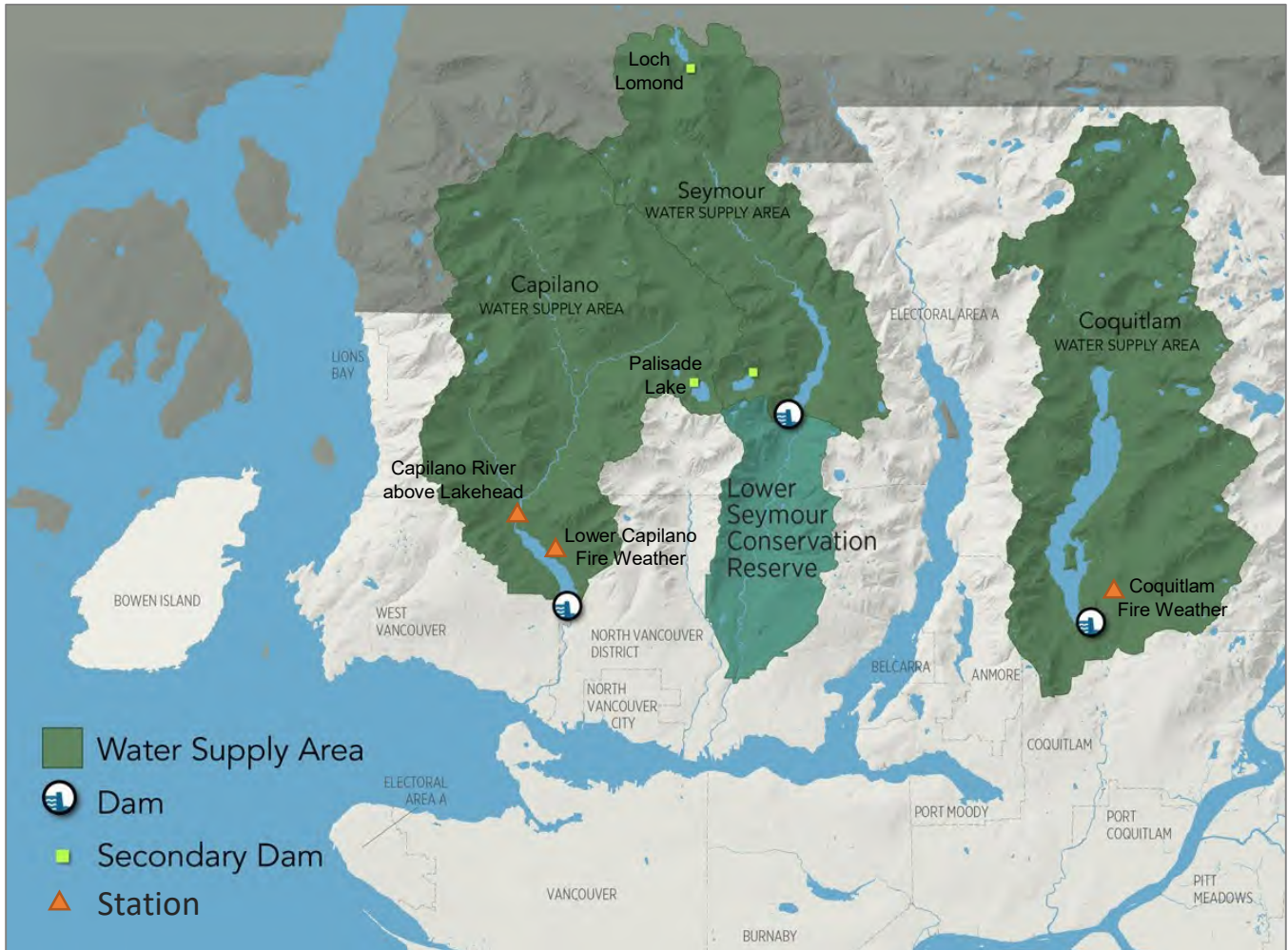


Figure 1: Map of Metro Vancouver and the watersheds ([Metro Vancouver](#))

## Global Overview

This year was marked by record-breaking heat. The average global temperature was 1.48°C warmer than the pre-industrial average, almost eclipsing the 1.5°C climate threshold (IPCC). The hottest day ever recorded occurred at the beginning of July, and each day for the following 6 weeks eclipsed the previous warmest day from 2016. Sea surface temperatures also shattered heat records for most of the entire year. Ocean temperatures were literally off the charts (Climate Reanalyzer, data from NOAA).

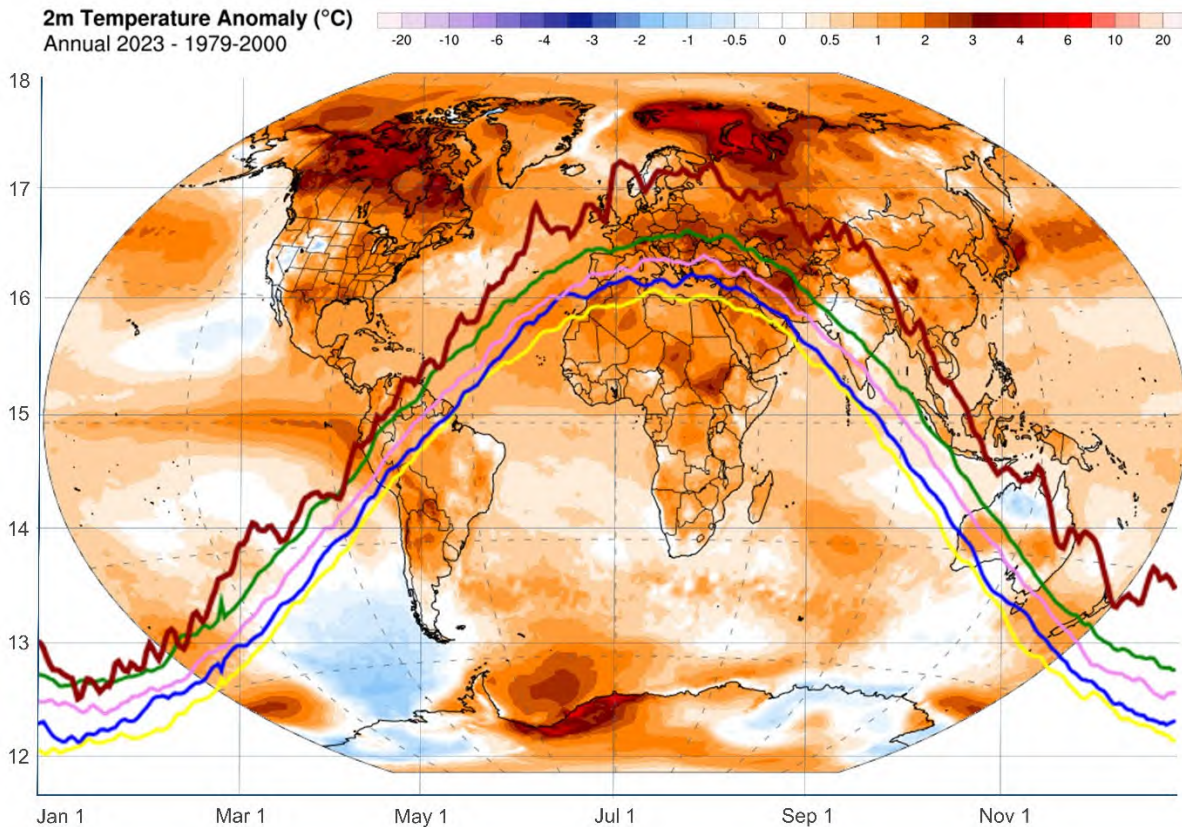


Figure 2: Global surface temperature anomaly in 2023 (1979-present). The solid red line shows average global 2023 temperatures. The yellow line is the average of 1980-89, the blue line is the average of 1990-99, the purple line is the average of 2000-2009, and the green line is the average of 2010-2019. Data: ECMWF reanalysis v5 (ERA5)

Many of the most significant climate or weather related events this year were related to the abnormal temperatures experienced. These include the [Canadian wildfires](#) and drought, [European heat waves](#) and wildfires, and South American winter heat waves and [extreme drought in the Amazon](#). Higher sea surface temperatures also fuelled strong storms around the world. [Hurricane Otis](#), which struck the west coast of Mexico in October, was one example of a rapidly intensifying hurricane. This storm strengthened from a tropical storm to a category 5 hurricane in less than 24 hours. [Cyclone Daniel](#) was another devastating example of extreme weather linked to climate change. This storm caused flooding in Greece, Bulgaria, and Turkey before impacting Libya with deadly flooding. Over 4000 died when dams collapsed near the city of Derna, with many still missing.

Typically, the largest source of year-to-year temperature variability is the El Niño – Southern Oscillation (ENSO) ocean climate pattern in the Pacific Ocean. ENSO will be discussed more in the following section; however, it's important to note that many of the warmest years on record coincide with El Niño (ENSO warm phase). This past year starting off under fading La Niña conditions (ENSO cool phase), and transitioned to El Niño by June. The biggest impacts of this strong El Niño event will not be felt until early 2024, which means new temperature records set in 2023 may not stand for long.

## Climate Drivers

ENSO and the Pacific Decadal Oscillation (PDO) have been identified as the two most influential ocean–atmosphere teleconnections on the hydro-climatology of western Canada. Both of these climate indices influence temperatures, snowpack, streamflow, and precipitation on British Columbia’s south coast. The oscillating warming and cooling pattern of ENSO happens over a period of 1-3 years, whereas the PDO is longer lasting and shifts in periods of 2-3 decades.

The PDO and ENSO are also linked. The PDO can either dampen or amplify the effect of ENSO events. For example, if both indices are negative there is a higher likelihood of below normal temperatures and deeper winter snowpack in southwest BC.

Weather Variable	ENSO/PDO Positive	ENSO/PDO Negative
Temperature	Warmer than normal	Cooler than normal
Precipitation	Drier than normal	Wetter than normal
Streamflow	Lower spring/summer flows	Higher spring/summer flows
Snowpack	Shallower snowpack	Deeper snowpack

Table 1: Effects of ENSO/PDO on western Canada

Understanding these climate drivers and their influence on regional climate variability is important for water supply planning and operations. Of course, it’s also important to consider the affects of anthropogenic climate change on these ocean-atmosphere patterns and regional conditions. We will look more closely at the link between these climate drivers and our local weather variables in coming sections.

The maps below show average sea surface temperature anomalies in January 2023 and December 2023. Negative PDO exhibits warmer than average sea surface temperatures in the northern Pacific, with relatively cool waters immediately off the coast of North America. ENSO – La Niña is defined by cooler than normal waters (>-0.5°C) in the equatorial Pacific, and El Niño sees warmer than normal conditions (>0.5). The patterns flip during the respective warm phases.

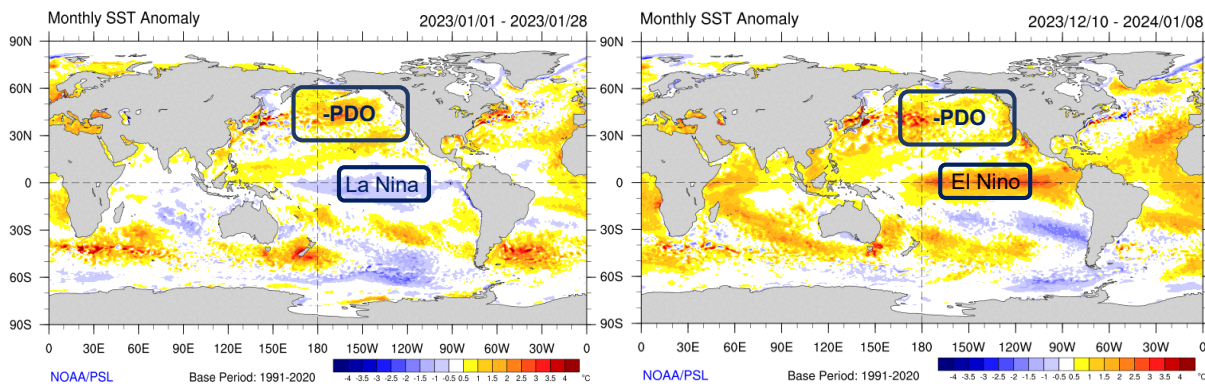


Figure 3: Seasonal sea surface temperature anomalies highlighting ENSO and PDO phases in 2023. January 2023 (La Niña) and December 2023 (El Niño). Data from NOAA/PSL.

## El Niño Southern Oscillation

El Niño, characterised by higher-than average sea surface temperatures in the eastern tropical Pacific and a weakening of the trade winds, typically has a warming influence on global temperatures. La Niña, which is characterised by below average sea surface temperatures in the central and eastern tropical Pacific and a strengthening of the trade winds, has the opposite effect. This temperature pattern is typically true for Western Canada as well. As a result, the snowpack on the North Shore Mountains is more likely to be below normal during warmer El Niño events, and above average during cooler La Niña winters.

The Oceanic Niño Index (ONI) is the primary index used to track ocean conditions in the ENSO region. It is the rolling 3-month average sea surface temperature anomaly in the east-central tropical Pacific. Weak La Niña conditions were present at the start of the winter, marking the third consecutive La Niña winter. Conditions transitioned to neutral by mid-winter, and El Niño was present by the beginning of June. The sea surface temperature anomaly gradually increased throughout the summer and fall, with strong El Niño conditions observed at the end of the year.

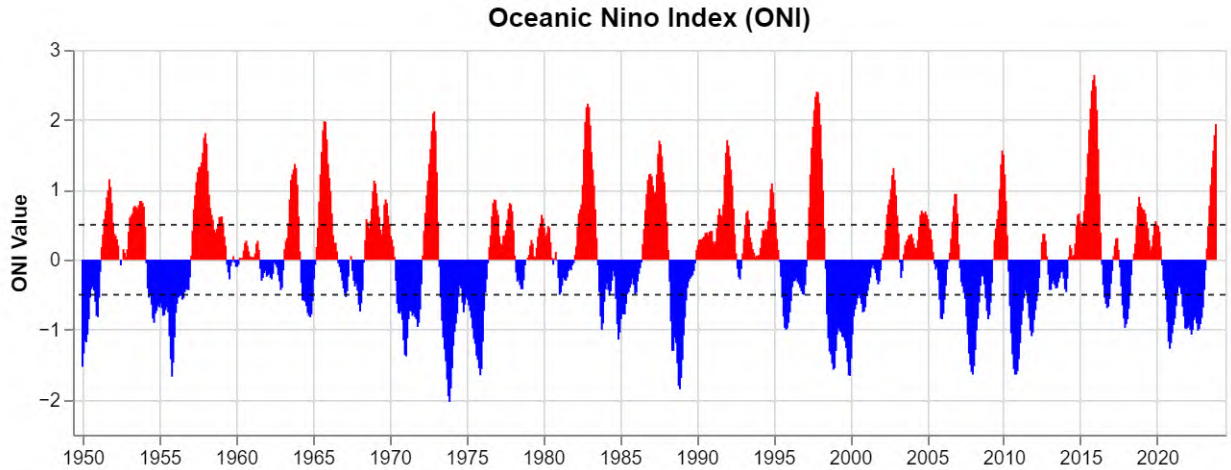


Figure 4: Historical ENSO-ONI Index values from 1950 to present (data from NOAA). Positive (El Niño) and negative (La Niña) thresholds are shown with dashed black lines.

### Pacific Decadal Oscillation

The Pacific Decadal Oscillation (PDO) is a large-scale climate system feature that influences the surface climate and hydrology of western North America. The PDO is commonly described as a long-lived El Niño-like pattern in the northeast Pacific; however, regime shifts typically happen every 20-30 years.

In the warm/positive PDO phase, the sea surface temperatures in the central and western Pacific become cooler than normal, and the waters close to the west coast of North America warm. The opposite pattern occurs during the cool/negative phase. The major regime shifts in the past 100 years occurred in 1924/25 (to warm phase), 1942/43 (to cool phase), 1976/77 (to warm phase), and 1997/98 (to cool phase). There was a brief change to warm phase between 2014 and 2016, which combined with strong El Niño conditions to produce the warmest years on record, both globally and locally. The PDO has been strongly negative (cool) since 2020.

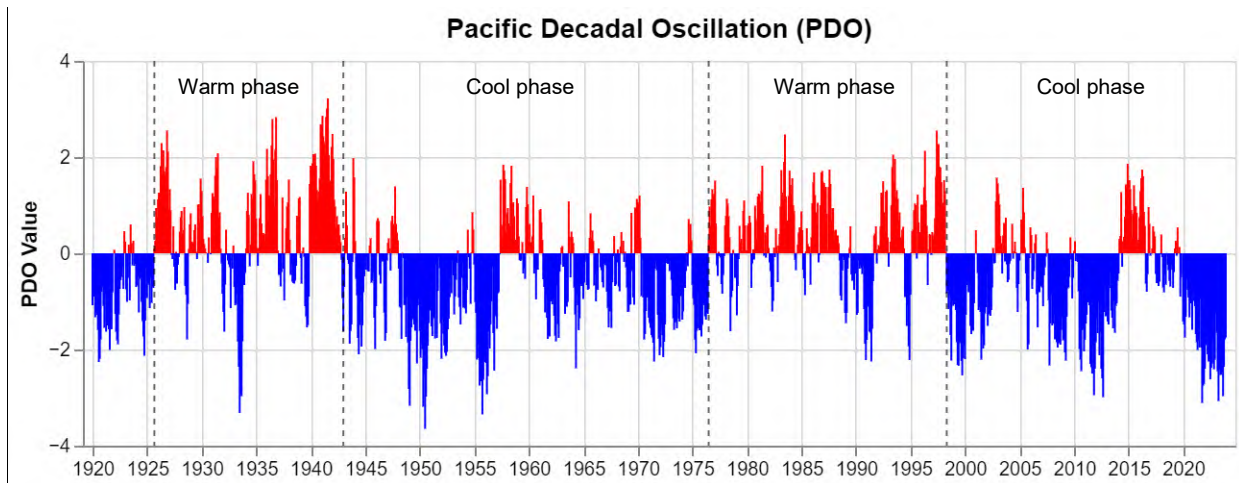


Figure 5: Historical PDO values from 1920 to present with primary phase changes (data from NOAA)

## Watershed Weather Conditions

The following sections describe the weather conditions in the watersheds in 2023. This includes summaries of air temperatures, precipitation, snowpack, and streamflow. This year's conditions are shown in relation to climate norms. Climate projections for each weather parameter are also highlighted.

The table below summarizes some of the weather extremes experienced in the watersheds in 2023, and compares these values to recent years. Some of the weather extremes experienced this year may not have been as pronounced as previous years, but overall annual extremes were much more significant.

Parameter	2023 value	2022 value	2021 value	Location	Date
Hottest temperature	<b>35.3°C</b>	36.0°C	42.9°C	Coquitlam, 300m	August 13
Coldest temperature	<b>-16.0°C</b>	-18.7°C	-20.7°C	Loch Lomond, 1070m	February 23
High temperature records	<b>28 days</b>	29 days	20 days	Lower Capilano, 250 m	~
Low temperature records	<b>10 days</b>	21 days	16 days	Lower Capilano, 250 m	~
Deepest measured snow	<b>556 cm</b>	745 cm	755 cm	Loch Lomond area, 1500m	March 17
Highest river inflow	<b>398 m<sup>3</sup>/s</b>	385 m <sup>3</sup> /s	506 m <sup>3</sup> /s	Capilano Lakehead	December 4
Highest river inflow	<b>113 m<sup>3</sup>/s</b>	132 m <sup>3</sup> /s	199 m <sup>3</sup> /s	Seymour Lakehead	December 4
Greatest 24-hr rainfall	<b>174 mm</b>	165 mm	198 mm	Palisade Lake, 900m	January 13
Greatest 48-hr rainfall	<b>282 mm</b>	262 mm	329 mm	Palisade Lake, 900m	January 13-14
Highest hourly rainfall	<b>26.5 mm</b>	21.4 mm	19.4 mm	Palisade Lake, 900m	December 4
Longest dry spell	<b>33 days</b>	27 days	31 days	Lower Capilano, 250m	May 8 - June 10
Longest wet spell	<b>19 days</b>	21 days	15 days	Lower Capilano, 250m	January 4-23

Table 2: Highlighted weather values from within the watersheds in 2023

## Air Temperatures

### Climate Projections – Air Temperatures:

- Warming temperatures, with the greatest increase in the summer months
- Warmer nighttime low temperatures
- Milder winters with fewer frost days

At the Vancouver Airport, this was the second warmest year since 1936 with a mean temperature of 11.0°C. 2015, which was a strong El Niño year, holds on to the record with an average annual temperature of 11.1°C. The warming trend of the last several decades is clear to see in the *warming stripes* graphic below. Each stripe represents the average annual temperature for each year since 1936. This past year was also the second warmest in the watersheds, also trailing just behind 2015 (20-year data record).

### Mean Annual Temperatures: Vancouver (YVR)

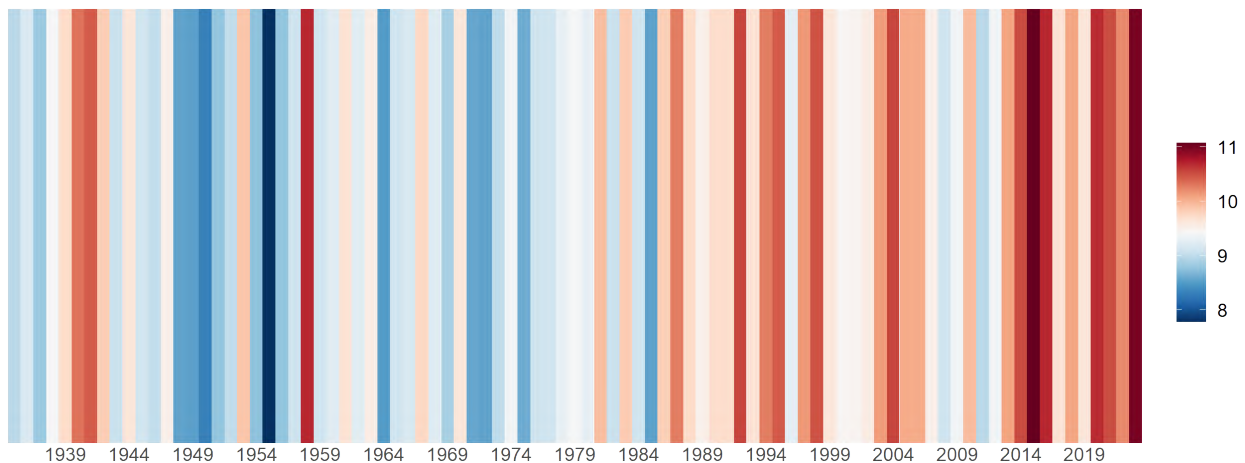


Figure 6: Mean annual air temperatures for the Vancouver International Airport (YVR) from 1936-2023 (data: ECCC)

The number of days with temperatures below freezing (frost days) was lower than average in 2023. Years with the fewest number of frost days are typically El Niño seasons (2004, 2010, 2015). The total number of days with high temperatures exceeding 25°C (heat days) was well above average. This past year ranked second in most heat days behind 2022.

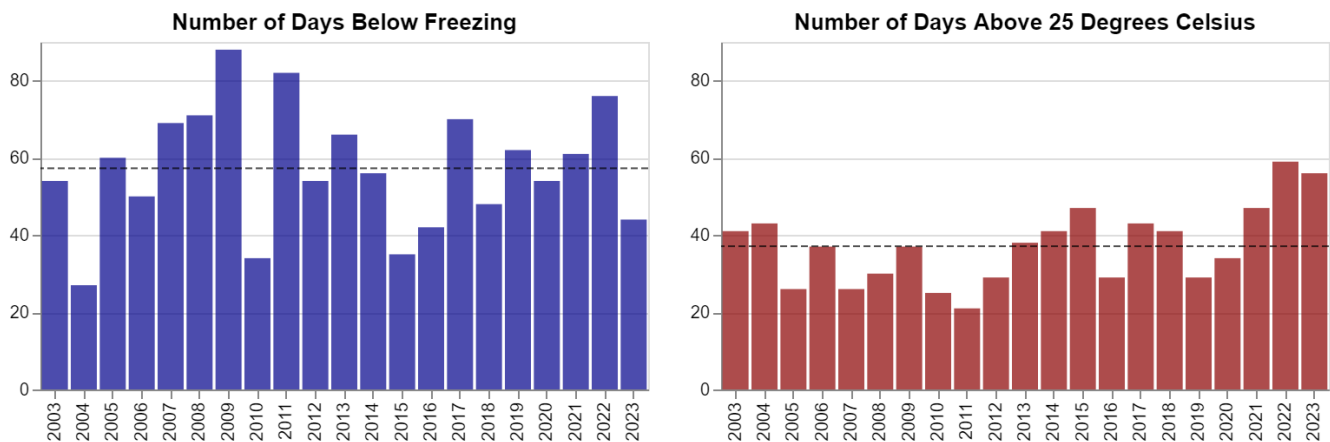
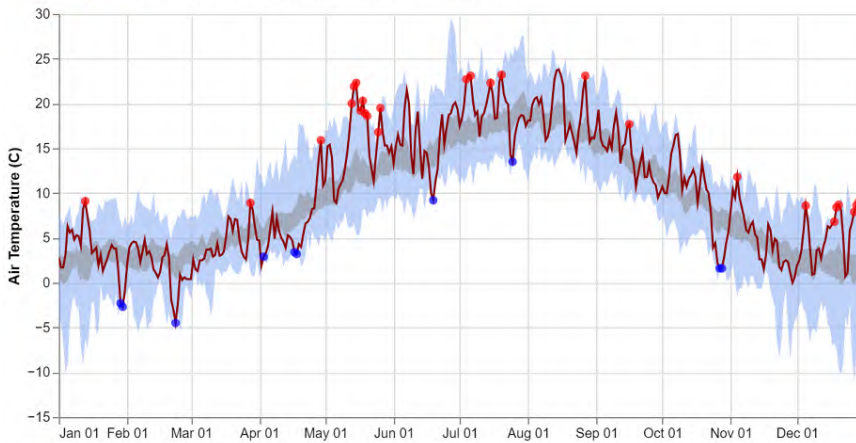


Figure 7: Number of frost days and days exceeding 25°C in the lower Capilano Watershed (dashed lines indicate average)



## Air Temperatures

Average daily temperatures in 2023



Information: Data is from a weather station in the lower Capilano watershed at 250 m. The period of record for this station is 2003 to present. This plot shows average daily air temperatures with the range of normal and maximum/minimum. The red and blue dots highlight new record high or low temperatures for that day.

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## Highlights

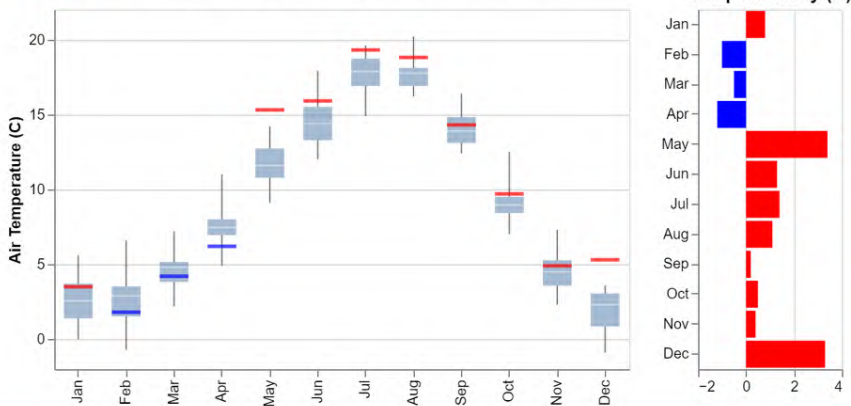
- The hottest day of the year was August 15 with an average daily temperature of 23.8°C
- The highest temperature recorded was 32.7°C on May 15
- The most exceptionally warm day was December 29, when the average daily temperature was 4.1°C higher than the previous record.
- The coldest day of the year was February 23 with an average daily temperature of -4.5°C
- The lowest temperature recorded was -8.4°C on February 24
- New daily high temperature records were set on 28 days, and new low temperature records were set on 10 days this year

Figure 8: Average daily air temperatures in the lower Capilano Watershed in 2023



## Air Temperatures

Average monthly temperatures in 2023



Information: Data is from a weather station in the lower Capilano watershed. The period of record for this station is 2003 to present. This plot shows average monthly air temperatures (red or blue tick). The boxplot shows the median (tick), the first and third quartiles (box), and the range of max/min (lines). The monthly temperature anomaly is shown in the bar plot on the right.

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## Highlights

- La Niña effects were evident with below normal temperatures in Feb, Mar, and April
- April was most notably cool and wet, which helped boost snowpack conditions heading into the melt season
- May saw record-breaking heat, averaging 3.4°C above normal
- Average monthly temperatures were above normal from May through December
- December was also exceptionally warm, averaging 3.3°C above normal and 1.7°C warmer than the previous record

Figure 9: Average monthly air temperatures in the lower Capilano Watershed in 2023

Month	2023 Temp (°C)	Average Temp (°C)	Temp Anomaly (°C)	2023 Precip (mm)	Average Precip (mm)	Percent of Normal (%)
January	3.5	2.7	+0.8	318	445	71
February	1.8	2.8	-1.0	333	231	144
March	4.2	4.7	-0.5	118	333	35
April	6.2	7.4	-1.2	313	198	158
May	15.3	11.9	+3.4	19	124	15
June	15.9	14.6	+1.3	41	91	45
July	19.3	17.9	+1.4	44	55	80
August	18.8	17.7	+1.1	53	61	88
September	14.3	14.1	+0.2	100	168	59
October	9.7	9.2	+0.5	298	328	91
November	4.9	4.5	+0.4	357	455	78
December	5.3	2.0	+3.3	448	378	118
<b>Annual</b>	<b>9.93</b>	<b>9.07</b>	<b>+0.86</b>	<b>2442</b>	<b>2867</b>	<b>85</b>

Table 3: 2023 monthly temperature and precipitation summaries for the lower Capilano Watershed (data from Lower Capilano fire weather station near the base of Grouse Mountain - 2003-2023).

## Precipitation

### Climate Projections – Precipitation:

- Stronger and more frequent extreme rainfall events
- Longer summer dry spells and an extension of the dry season into September
- Less precipitation falling as snow during the winter months

In general, there is a weak correlation between climate indices and precipitation on the BC south coast. Some research suggests there is less precipitation during La Niña years and negative PDO periods, and more precipitation in El Niño years and positive PDO periods. However, the precipitation data record in the watersheds is not really long enough to make this connection. On average we see *slightly* less precipitation in La Niña, but this varies significantly from year to year.

Overall, 2023 was a dry year, but it was particularly dry at the southern end of the watersheds and in urban areas. For example, Vancouver Airport received 69% of normal precipitation, and the Lower Capilano fire weather station saw 85% of normal precipitation. Higher elevation sites and areas further into the watersheds saw similar amounts to 2022, which were much closer to average. The annual precipitation totals at Palisade Lake, Orchid Lake, and Disappointment Lake were almost identical to 2022.

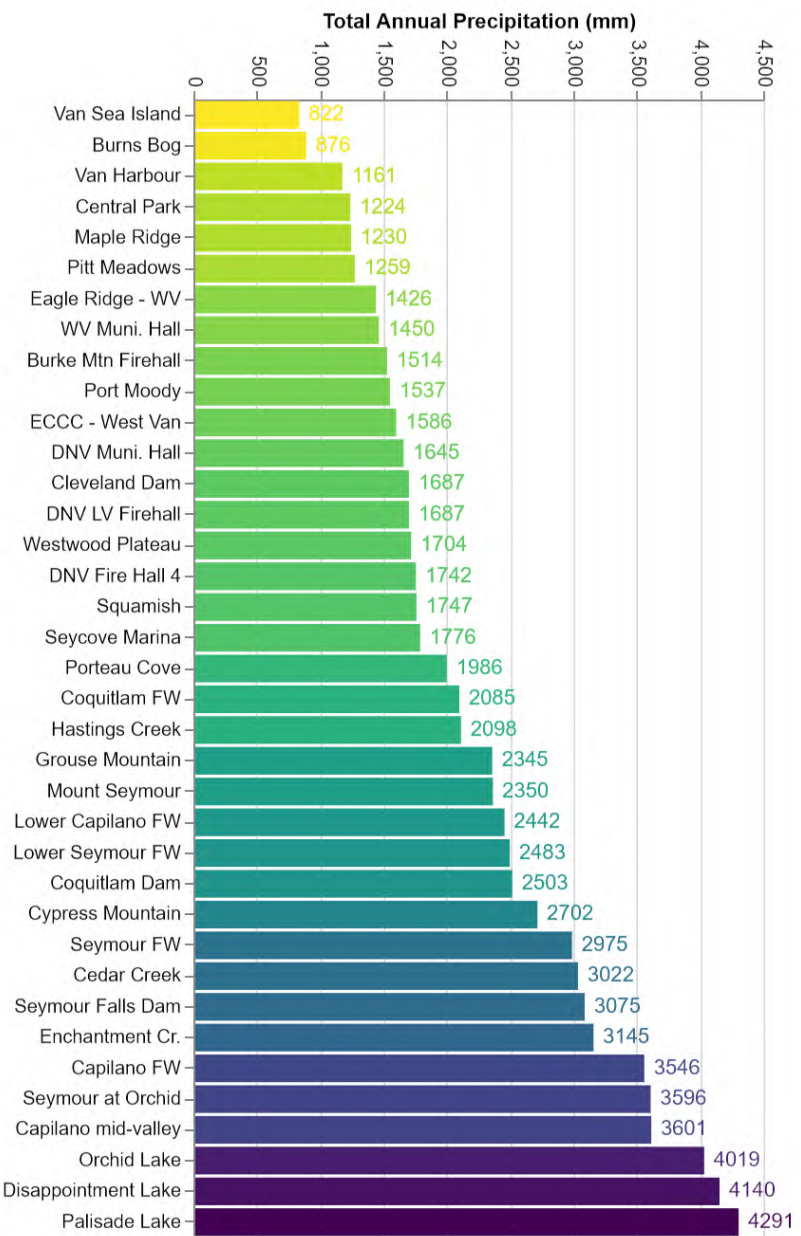
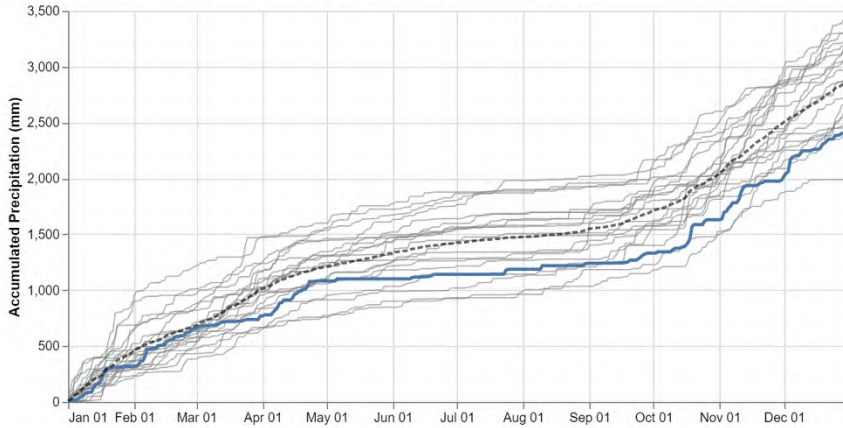


Figure 10: Annual total precipitation throughout Metro Vancouver and the watersheds



## Precipitation

Accumulated annual precipitation in 2023



Information: Data is from a weather station in the lower Capilano watershed. The period of record for this station is 2003 to present. This plot shows accumulated precipitation in 2023 (blue line), with each previous year (gray lines), and the annual average (black dashed line).

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## Highlights

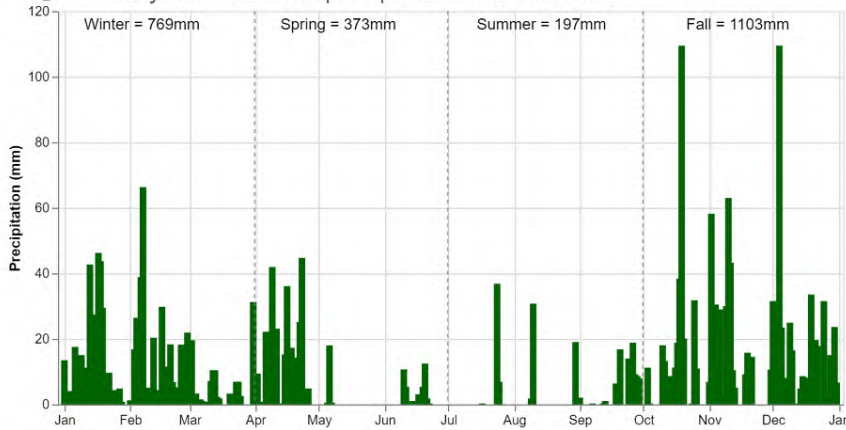
- 2023 was the third driest year on record, behind 2008 and 2019
- In total, 85% of normal precipitation fell in 2023

Figure 11: Accumulated precipitation at the Lower Capilano fire weather station



## Precipitation

Daily and seasonal precipitation totals in 2023



Information: Data is from a weather station in the lower Capilano watershed. The period of record for this station is 2003 to present. This plot shows daily precipitation in 2023 (green bars). Seasonal totals are shown at the top of the chart

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## Highlights

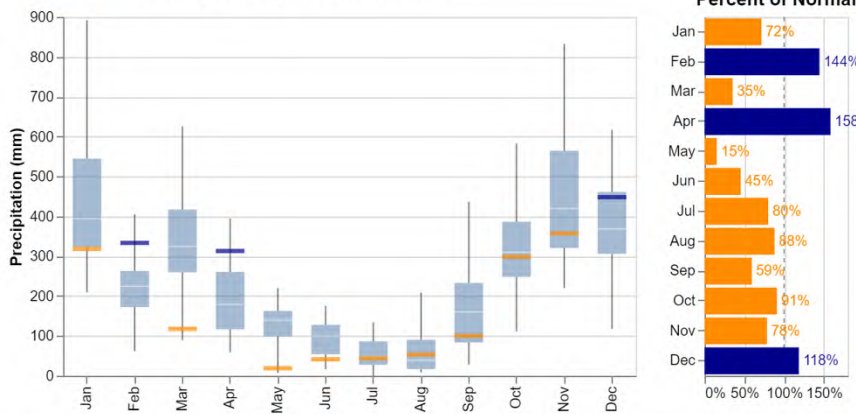
- There were extended dry spells of 33 days and 32 days (May 8-June 10 and June 22-July 24)
- The latter half of the summer experienced 1-2 weeks of dry weather followed by moderate rains
- The wettest days of the year were Oct 19 and Dec 4. Both received 110 mm of rain in one day
- *Note: There can be a large difference in precipitation amounts between this station and further north in the watersheds*

Figure 12: Daily and seasonal precipitation totals at the Lower Capilano fire weather station



## Precipitation

Monthly precipitation in 2023



Information: Data is from a weather station in the lower Capilano watershed. The period of record for this station is 2003 to present. This plot shows monthly precipitation totals (blue or orange ticks). The boxplot shows the median (tick), the first and third quartiles (box), and the range of max/min (lines). The percent of normal precipitation is shown in the bar plot on the right.

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## Highlights

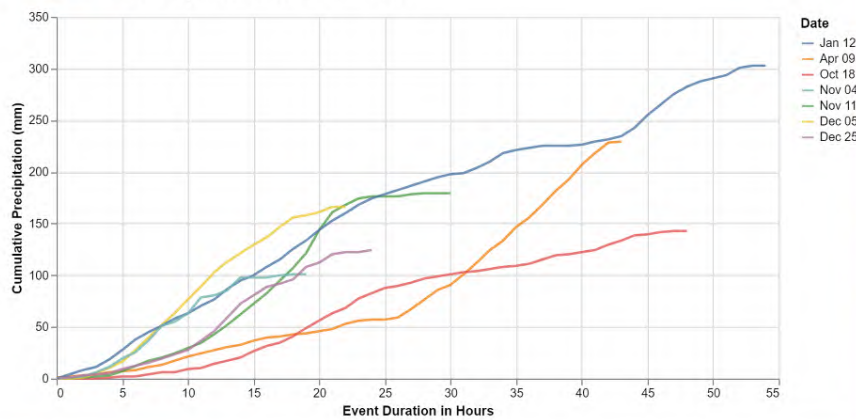
- February, April and December were the only months with above normal precipitation
- March, May and June were standout dry months with only 35, 15 and 45% normal precipitation
- Conditions were very dry from the end of April through most of September

Figure 13: Monthly precipitation totals at the Lower Capilano fire weather station



## Precipitation

Atmospheric Rivers in 2023



Information: Data is from a weather station at Palisade Lake in the Capilano watershed. This site is typically the wettest gauged location in the watersheds. This plot shows cumulative precipitation and the event duration for each atmospheric river.

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## Highlights

- There were approximately 7 AR events in 2023
- The January 12 event was the strongest in terms of total precipitation and duration
- It was very unusual to see a strong AR event in April
- The Dec 5 event had the highest rainfall intensities and resulted in the highest instantaneous river discharge

Figure 14: Atmospheric river events in 2023

## Snowpack

### Climate Projections – Snowpack:

- An overall decrease in snowpack, particularly in the spring months
- Higher average snowline elevation

Both ENSO and PDO have very noticeable effects on the North Shore mountain snowpack. As seen earlier, average winter temperatures are strongly influenced by ENSO. As a result, warmer El Niño (ESNO positive) winters tend to see less snow, while cooler La Niña winters (ESNO negative) see more snow. The same is true for the PDO. The plots below show the distribution of snow water equivalent (SWE) values at Grouse Mountain on April 1 by PDO and ENSO phases. ENSO/PDO are also correlated with the snow season duration (i.e. how long snow is on the ground).

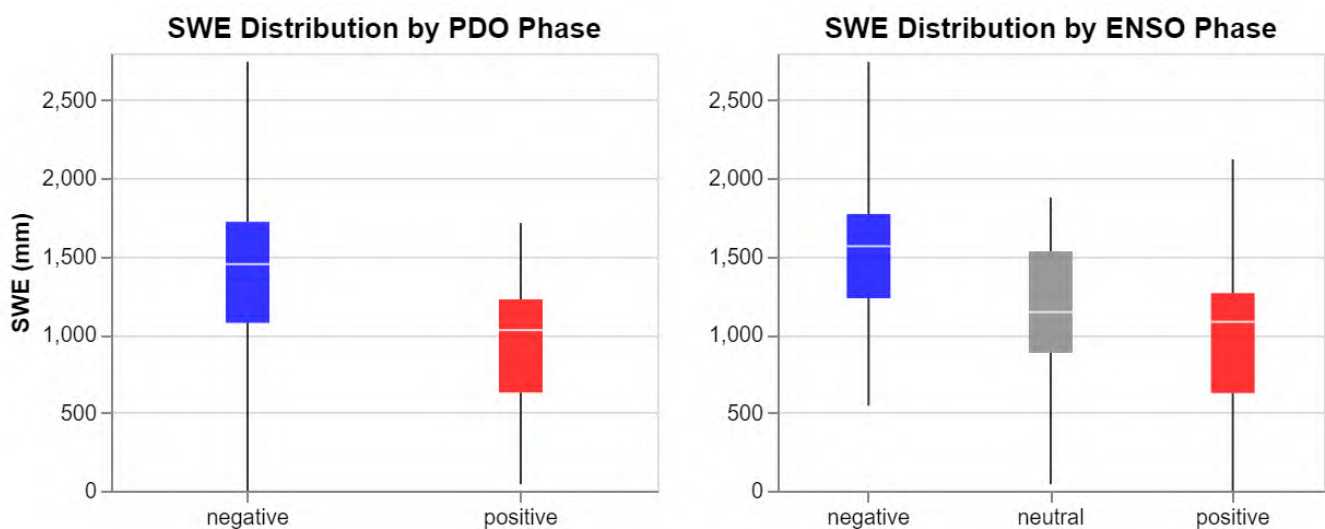


Figure 15: Distribution of snow water equivalent for April 1 at Grouse Mountain by PDO and ENSO phase

It was exceptionally warm and dry until October 21, then there was a rapid transition to cool and wet. Higher elevations did not see the usual fall rains this year. In general, the snowpack hovered close to average for most of the winter. Snow depth peaked on April 21, then rapidly melted over the following six weeks with exceptionally warm and dry weather. Most of the seasonal snowpack had completely disappeared by the middle of June. Typically, an average mid-elevation snowpack takes approximately three months to melt. This year it disappeared in only two months.

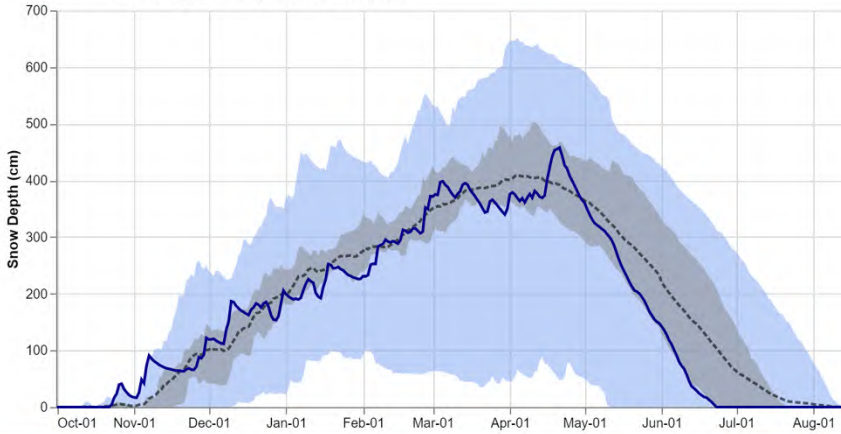


Figure 16: Measuring snow in the watersheds in 2023 (photo: Peter Marshall)



## Snowpack

Average daily snow depth



Information: Data is from an ultrasonic snow depth sensor at the Orchid Lake weather station (1200 m) in the Seymour Watershed. The data record is from 2006-2023. The blue line shows snow depth (cm) in 2023. The gray dashed line is the average, the gray shaded area is the range of normal, and the blue shaded area is the range of maximum and minimum.

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## Highlights

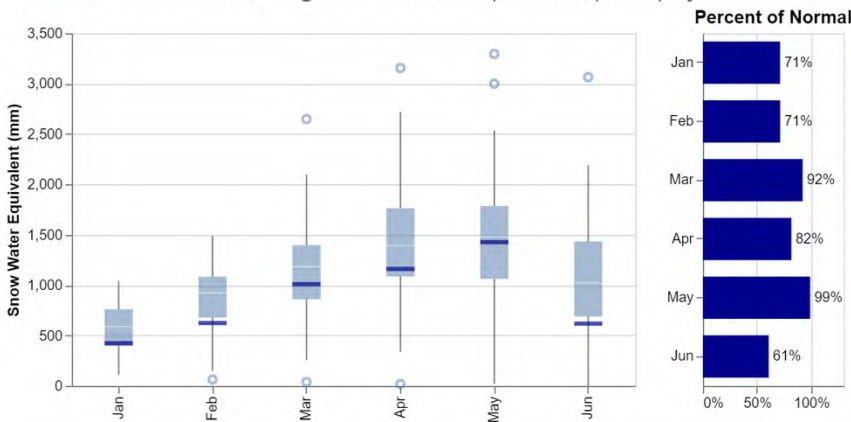
- Snow started to accumulate abruptly in late October as the weather changed from warm and dry to cool and wet
- Snow depth hovered around average for most of the season, but peaked above normal on April 21
- The snowpack melted rapidly over two months (April 21 to June 23)

Figure 17: Daily snow depth at Orchid Lake, Seymour Watershed



## Snowpack

Combined average snow water equivalent (SWE) by month



Information: Data is from manual snow surveys in the watersheds between 1996 and 2023. This plot shows combined average SWE (blue ticks). The boxplot shows the median (tick), the first and third quartiles (box), and the range of max/min (lines). The circles represent outliers. The percent of normal SWE in 2023 is shown in the bar plot on the right.

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## Highlights

- The snowpack was slightly below average for most of the winter
- Cool and wet weather in early April pushed the snowpack to near-normal by May 1
- The snowpack rapidly melted in May with exceptionally warm and dry weather
- By June 15, the snowpack was at 30% of historical average

Figure 18: Combined average snow water equivalent in 2023 with historical statistics

## Streamflow

### Climate Projections – Streamflow:

- More intense precipitation may lead to more frequent high streamflow events and flooding
- Increased possibility of landslides from extreme rainfall events
- Longer and drier summers may result in lower river inflows in the late summer and early fall

There is a relationship between both the ENSO and PDO conditions with reservoir inflows for the June to September period. Lowest flows during this period are typically associated with El Niño or ENSO-neutral conditions and warm (positive) PDO phase. This is due to warmer air temperatures and a shallower snowpack during the warm phases of these climate drivers.

Cumulative annual river inflow at Capilano River above Lakehead during the 2023 water year (Oct. 1 – Sep. 30) was approximately 76% of the historical average, and ranked as the 11<sup>th</sup> driest year on record. Average inflows for the calendar year were approximately 90% of historical average.

Inflows were notably below average from June until the last week of September. Record-low monthly inflows were observed in July and August. Conditions were so dry during the summer that moderate rainfall events made almost no impact on river inflows. Fall rains came earlier this year than in 2022, with the first notable weather system arriving at the end of September.

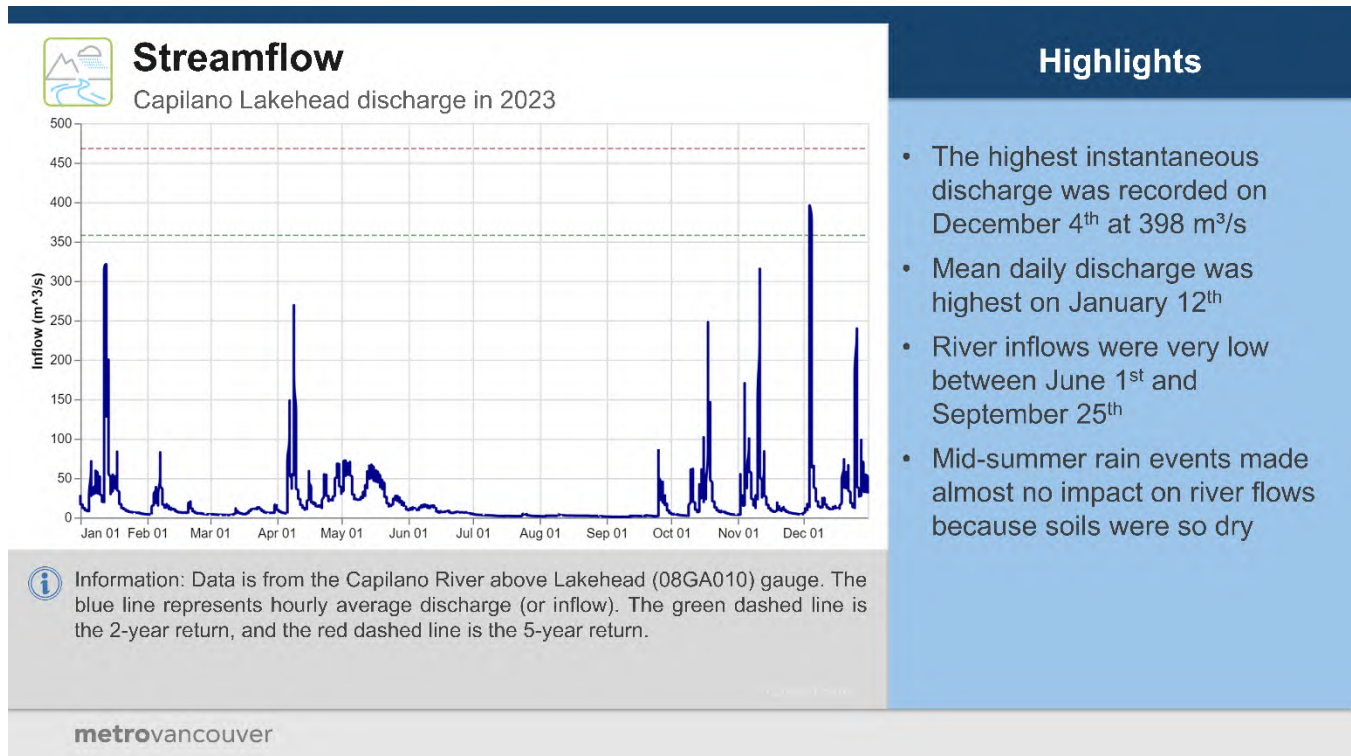


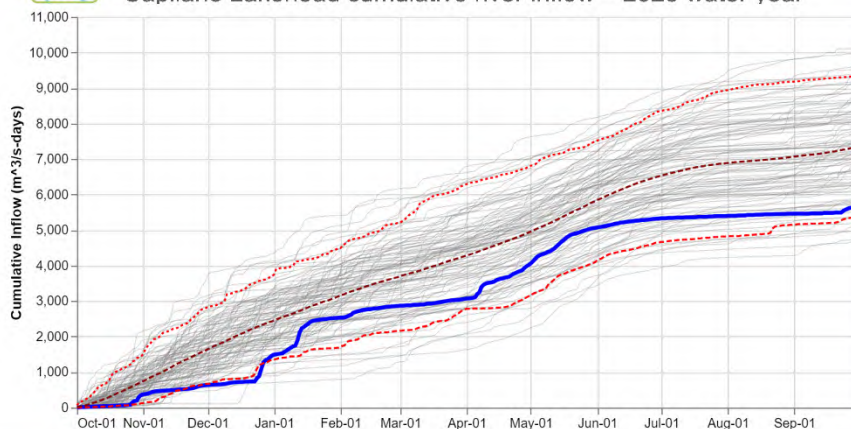
Figure 19: River inflows in 2023 at Capilano River above Lakehead

The Cleveland Dam (CLD) stopped spilling on June 18, which was earlier than average and approximately one month earlier than 2022. It started spilling again on September 28. The duration of the reservoir drawdown was around 102 days this year, which is well above the historical average of 70 days.



## Streamflow

Capilano Lakehead cumulative river inflow – 2023 water year



**i** Information: Data is from the Capilano River above Lakehead (08GA010) gauge with discharge data from 2014-2023. The blue line shows cumulative inflow from October 1 (0) to September 30 (365). The red dashed line highlight the median, and 5<sup>th</sup> and 95<sup>th</sup> percentiles. Each gray line represents a year between 2014 and 2022.

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## Highlights

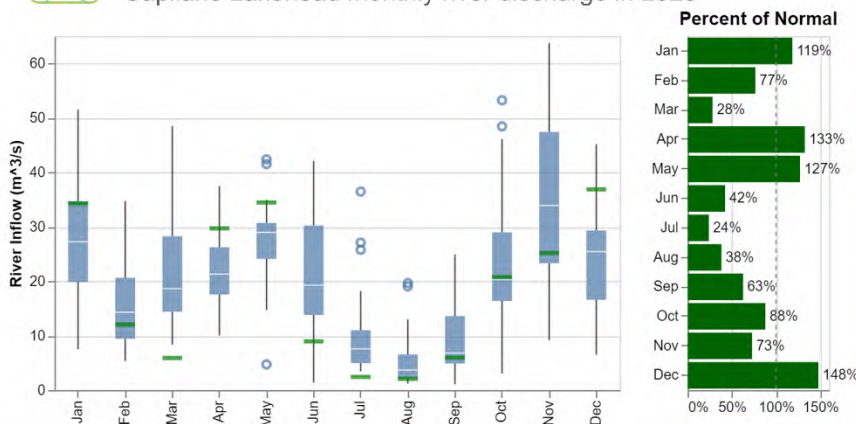
- The 2023 water year was a dry year with 76% of normal river inflows
- This year ranked 11<sup>th</sup> out of 108 years (1 being the driest). 1979 is the driest on record. 2014 is the driest of the past 20 years.
- River inflows were very low between June 1 and September 30

Figure 20: Cumulative river inflows during 2023 at Capilano River above Lakehead



## Streamflow

Capilano Lakehead monthly river discharge in 2023



**i** Information: Data is from the Capilano River above Lakehead (08GA010) gauge from 1998 to 2023. This plot shows monthly average inflow (green ticks). The boxplot shows the median (tick), the first and third quartiles (box), and the range of max/min (lines). The circles represent outliers. The percent of normal inflow is shown in the bar plot on the right.

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## Highlights

- Cold and dry conditions in March resulted in new record low monthly inflows (28% of normal)
- Inflows in May were almost entirely driven by snow melt
- Monthly river inflows dropped to record low levels in July and August
- December saw above average inflows driven by heavy rain and very warm temperatures

Figure 21: Average monthly river inflows during 2023 at Capilano River above Lakehead

## Notable Events and Weather Stories

This section highlights notable local or regional weather events in 2023. Some of these events had devastating impacts across Canada and other parts North America. This report focuses on the regional impacts from these events. The three selected weather events include:

- The May heat wave
- Relentless wildfire season
- Historic drought

All three of these events were truly exceptional. Hot and dry conditions in May set the stage for a very long and dry summer. Fires started to pop up, and explode, in many parts of the country in the middle of May. These fires would not relent for several months. In British Columbia, fire hot spots moved around throughout the season, but almost all fire zones experienced active seasons. Conditions leading to record-breaking wildfires also caused unprecedented drought. Most of Canada experienced severe or extreme drought conditions in 2023. This was the third consecutive year with elevated drought conditions on BC's south coast. You can read more about these weather stories in Environment and Climate Change Canada's [top 10 weather stories of 2023](#).

## May Heat Wave

The temperatures in May were exceptionally warm. Average temperatures for the month were 3.4°C warmer than normal. May 15<sup>th</sup> was one of the hottest days of the year. Typical spring rains were also absent this year. There was a single rainfall event this month. Only 19 mm of rain fell in May, and only 24 mm of rain fell between April 25<sup>th</sup> and June 10<sup>th</sup>. This is an incredibly long spring dry spell.

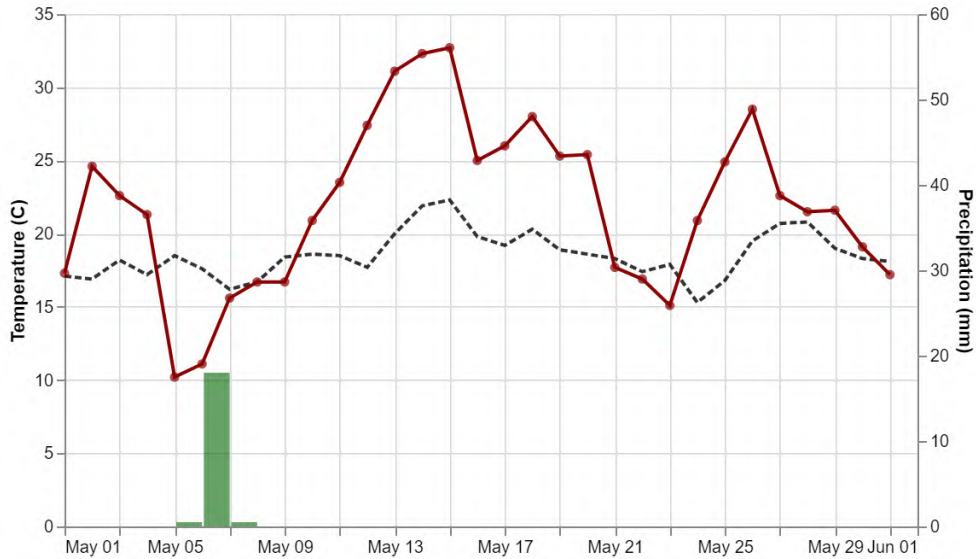


Figure 22: Maximum daily air temperatures in May 2023 (red line), compared to record daily maximum temperatures (dashed line). Daily precipitation totals are shown with green bars (19 mm total for the month).

The snowpack rapidly melted during this period. Peak snow water equivalent occurred on approximately April 27, and the combined average SWE was 99% of historical average on May 1. Almost 70% of the snowpack melted during the month of May alone. By June 15 the watershed snowpack was only 30% of historical average. The maps below show SWE in the upper Seymour Watershed on two separate LiDAR flights – April 27 and May 25. The change between these two surveys, and the rate of snow melt during this period, is truly astonishing.

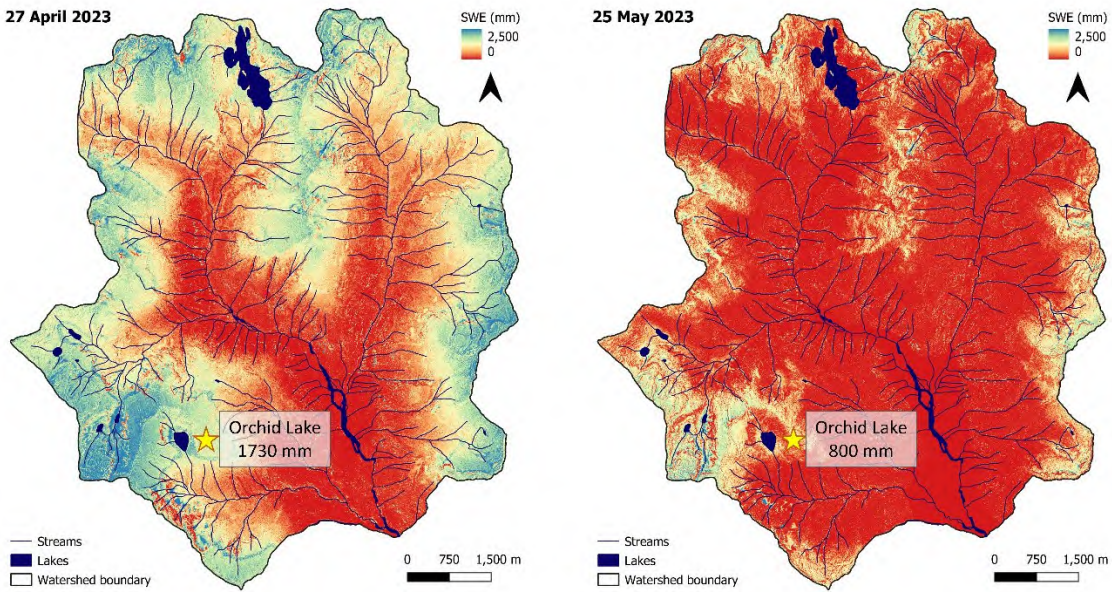
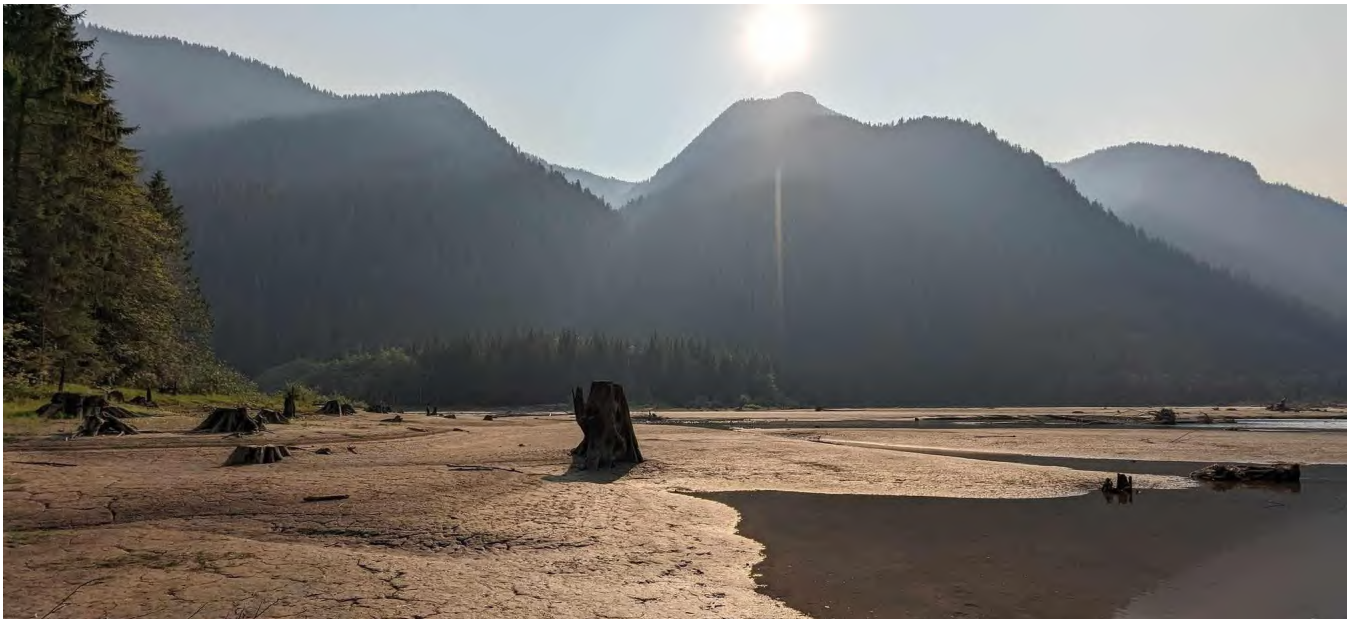


Figure 23: LiDAR-derived snow water equivalent in the upper Seymour Watershed in 2023

## Historic Drought

Last year was marked by an exceptionally warm and dry late-summer and early-fall, which led to very significant and prolonged drought on the BC south coast, and in many other parts of British Columbia. Typically, the south coast sees seasonal drought that ends abruptly with the first large fall rain events in September or early October. This was not the case in 2022. Elevated drought lasted well into November. When wetter weather finally arrived, the temperatures dropped rapidly and snow started to accumulate in the mountains. Higher elevations essentially missed out on typical wet fall weather.

Moving into 2023, the dry season came very early. The spring was phenomenally dry and warm. Drought conditions were already elevated by the beginning of June. The Lower Mainland basin was rated at level 3 by June 8, more than two months earlier than 2022.



*Figure 23: North end of Seymour Reservoir in the summer of 2023 (Photo: G.J. Denizmen).*

Warm and dry weather continued into the summer, and drought levels continued to climb. The Lower Mainland was rated at drought level 5 (highest level) from the middle of August until the end of September. In drought level 5, adverse impacts are almost certain. Provincially, almost every single basin reached drought level 5 this season, and most spent many weeks at this level.

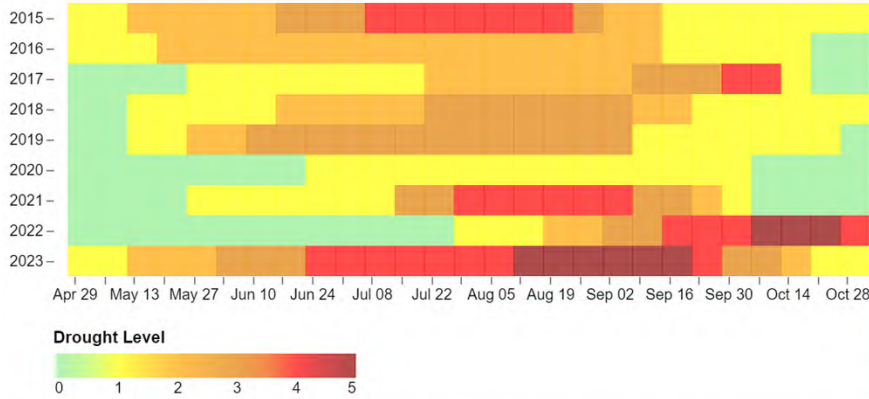
To manage water supply, Metro Vancouver moved to stage 2 water restrictions on August 4. This was the first time this step was taken since 2015. Fortunately, near-normal snowpack conditions at the beginning of spring kept source water storage within the normal range throughout the summer and fall.

Drought conditions gradually improved in late September and October as a series of fall storms made landfall. The first atmospheric river of the season arrived on October 19 spreading very heavy rain throughout the watersheds, and essentially ending the historic 2023 drought on the south coast. Parts of the BC interior and northeast were still experiencing exceptional drought as the year came to a close. Additionally, the snow conditions on January 1, 2024 were well below normal for most of the province, especially on the south coast, Vancouver Island, and Fraser River basins. Will drought continue to impact western Canada in 2024?



# Drought

Drought levels in the Lower Mainland/South Coast basin



Information: Data is from the Water Management Branch, BC Ministry of Forests, Lands, and Natural Resources. The chart shows the drought level (0-5) for the Lower Mainland/South Coast basin from 2015 to 2023. More information can be found [here](#).

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## Highlights

- Hot and dry conditions, and rapid snowmelt in May caused elevated drought levels earlier this season
- The Lower Mainland basin climbed to drought level 4 in late June, and level 5 by the middle of August
- Conditions gradually improved in September and October as the fall rains returned
- 2023 was the second consecutive year with extreme drought conditions

Figure 24: Drought levels for the Lower Mainland/South Coast basin between 2015 and 2023

# North American Drought Monitor

August 31, 2023

(Released Thursday, Sep. 14, 2023)

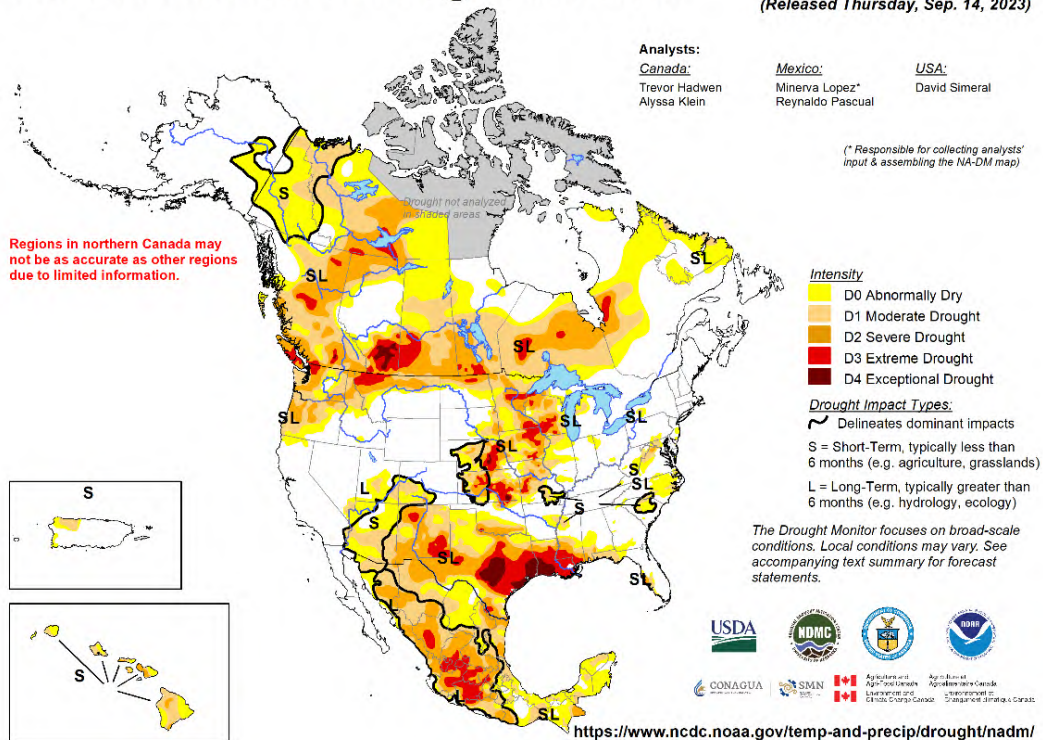


Figure 25: Drought in North America on August 31, 2023

## Relentless Wildfire Season

The summer of 2023 will be remembered as the most destructive and challenging wildfire season in history for many parts of Canada. The total burned area in Canada more than doubled the previous record with over 16.5 million hectares burned. The fire season was especially challenging in British Columbia, Alberta, Yukon, Northwest Territories, Quebec, and Nova Scotia.

Provincially, the BC Wildfire Service (BCWS) detected 2245 wildfires resulting in approximately 2.84 million hectares of area burned. This was more than double the previous record for area burned, which was 1.36 million hectares in 2018.

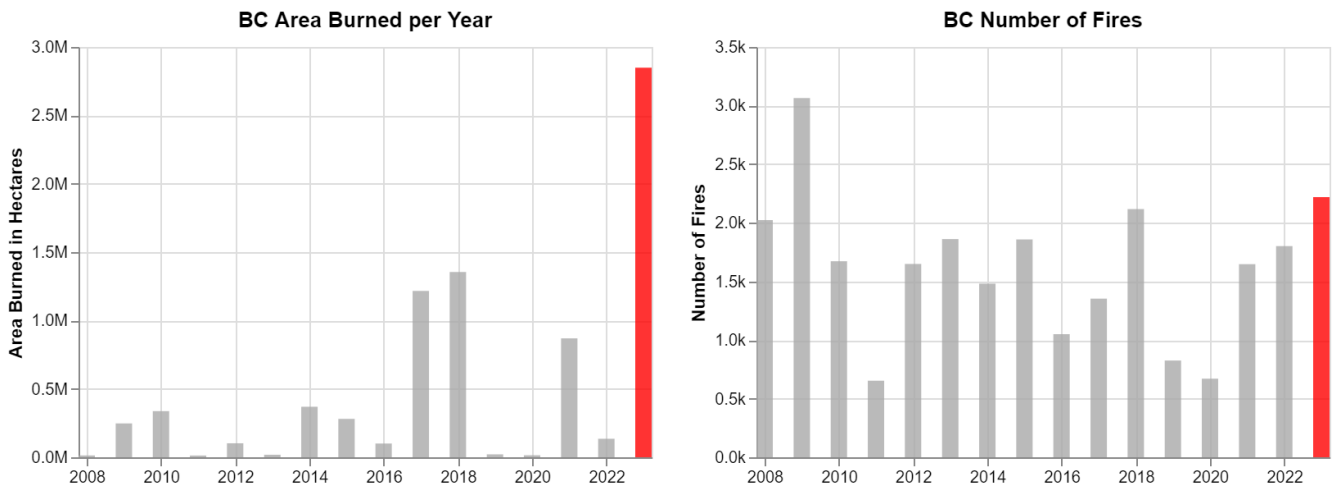


Figure 26: Annual area burned and number of fires in British Columbia (data: BC Wildfire Service)

Notable fires included the Donnie Creek fire in northeast BC. This fire sparked on May 12 and grew to 520,000 hectares. In August, a vigorous dry cold front swept through the BC interior following a heat wave. This caused extreme fire behaviour and exponential growth on numerous wildfires including the McDougall Creek wildfire near Kelowna, the Kookipi Creek wildfire in the Fraser Canyon, and wildfires near Adams Lake in the Shuswap. Many BC communities were threatened by wildfires. An estimated 208 evacuation orders and 386 evacuation alerts were issued. Numerous homes and structures were lost to fire this season.

It was also a very long and challenging wildfire season in Metro Vancouver. Watershed Protection staff were on-call for fire response from May 11 until September 25. Crews responded to a total of 16 separate incidents, with the first occurring on May 14. Local incidents included one lightning-strike fire in the Coquitlam Watershed, one fire on Mount Seymour (LSCR), and one in Lynn Headwaters Regional Park. Protection crews also assisted the BCWS with several incidents as part of Metro Vancouver's



Figure 27: Donnie Creek wildfire on May 18, 2023 (photo: European Space Agency (ESA))

resource sharing agreement for wildfire incidents within the Coastal Fire Centre. Notably, crews spent many days working on the Kookipi Creek fire near Boston Bar.

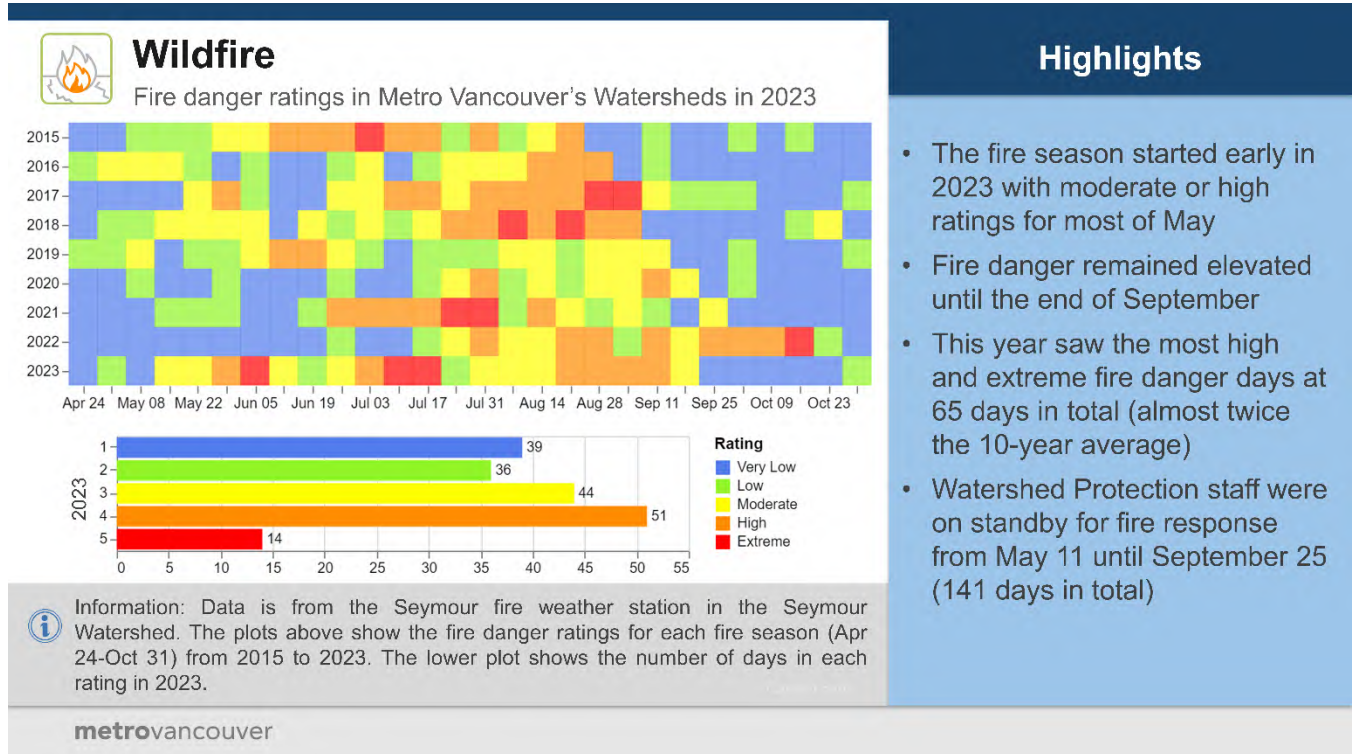


Figure 28: Wildfire danger ratings in the watersheds

Smoky summer skies have become commonplace in Metro Vancouver. Most years since 2015 have experienced periods of smoke and poor air quality. This year was no exception. Metro Vancouver issued air quality advisories for high concentrations of fine particulate matter (PM 2.5) for August 19-22, and August 25-29. Many other parts of British Columbia suffered from poor air quality for much of the summer. Smoke from Canadian wildfires also affected the central and eastern United States. Smoke even drifted across the Atlantic reaching parts of Europe.

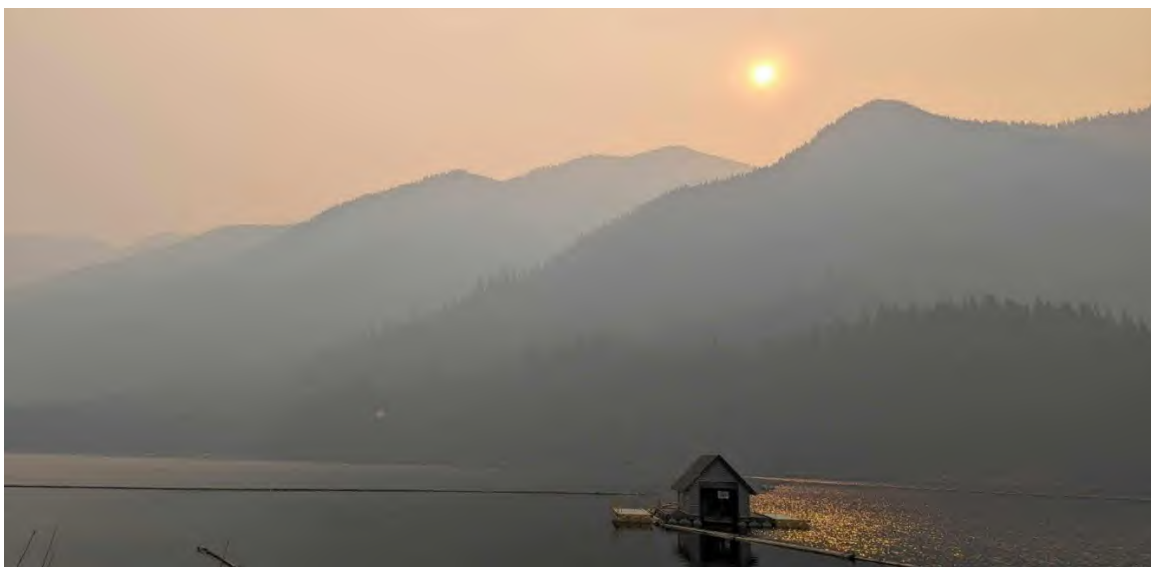
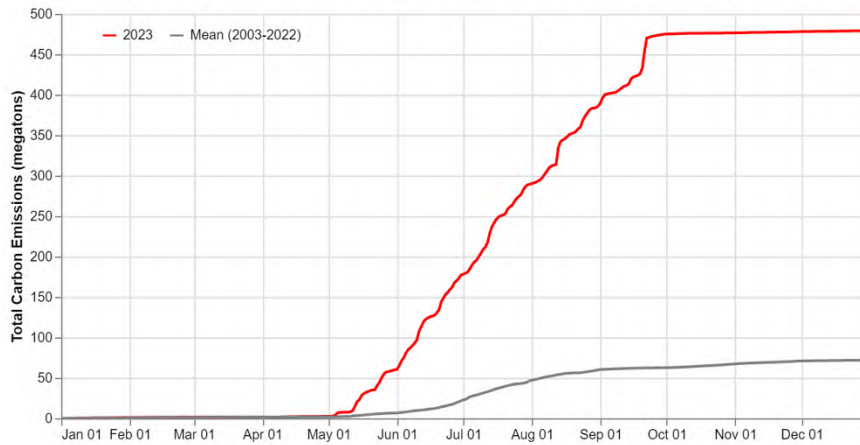


Figure 29: Wildfire smoke hangs over the Capilano reservoir and North Shore Mountains (Photo: G.J. Denizmen)



## Wildfire

Cumulative total wildfire carbon emissions for Canada in 2023



Information: Data is from the Copernicus Atmospheric Monitoring Service (CAMS). CAMS uses satellite observations to estimate levels of fine particulate matter in the atmosphere.

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## Highlights

- Many parts of Canada experienced a very challenging wildfire season in 2023
- These fires generated the highest carbon emissions on record (~5 times the 20 year average)
- Canada accounted for almost a quarter of global wildfire carbon emissions in 2023
- Smoke from wildfires affected air quality for large parts of North America

Figure 30: Cumulative estimated total wildfire carbon emissions in Canada in 2023

## References

- Climate Change Projections for Metro Vancouver, Report (2016). <http://www.metrovancouver.org/services/air-quality/AirQualityPublications/ClimateProjectionsForMetroVancouver.pdf#search=%22climate%20projections%22>
- Dieraurer, J.R., Allen, D.M., Whitfield, P.H. (2020). Climate change impacts on snow and streamflow drought regimes in four ecoregions of British Columbia. *Canadian Water Resources Journal*, 46, issue 4, 168-193. <https://doi.org/10.1080/07011784.2021.1960894>
- Harpold, A., Dettinger, M.D., & Rajagopal, S. (2017). Defining snow drought and why it matters. *Eos, Earth and Space Science News*, 98. <http://dx.doi.org/10.1029/2017EO068775>.
- Kiffney, P.M., Bull, J.P., & Feller, M. C. (2002). Climatic and hydrologic variability in a coastal watershed of southwestern British Columbia. *Journal of the American Water Resources Association*, 38, 1437–1451.
- McCabe, G.J., & Dettinger, M.D. (2002). Primary modes and predictability of year-to-year snowpack variations in the western united stations from teleconnections with Pacific Ocean climate. *Journal of Hydrometeorology*, 3, 13–25.
- Mood, B.J., Coulthard, B, Smith, D.J. Three hundred years of snowpack variability in southwestern British Columbia reconstructed from tree-rings. *Hydrological Processes*. 2020; 34:5123–5133. <https://doi.org/10.1002/hyp.13933>
- Mood, B.J. & Smith, D.J. (2021) A multi-century July-August streamflow reconstruction of Metro Vancouver's water supply contribution from the Capilano and Seymour watersheds in southwestern British Columbia, Canada, *Canadian Water Resources Journal*, 46:3, 121-138, DOI: 10.1080/07011784.2021.1931458
- Rounce, D.R. et al. 2023. Global Glacier Change in the 21<sup>st</sup> Century: Every Increase in Temperature Matters. *Science*, Vol 379, Issue 6627: 78-83. DOI: 10.1126/science.abo1324
- Sellars, C. D., Garret, M., & Woods, S. (2008). Influence of the Pacific Decadal Oscillation and El Niño Southern Oscillation on the operation of the Capilano water supply reservoir, Vancouver, British Columbia. *Canadian Journal of Water Resources*, 33, 155–164.
- Thakur, B., Kalra, A., Lakshmi, V., Lamb, V. W., Miller, W. P., & Tootle, G. (2020). Linkage between ENSO phases and western US snow water equivalent. *Atmospheric Research*, 236, 104827.
- Wang, J.Y., P. Whitfield and A. Cannon. 2006. Influence of Pacific Climate Patterns on Low-Flows in British Columbia and Yukon, Canada. *Canadian Water Resources Journal*, 31: 25-40.
- Whitfield, P.H., Moore, D.J., Fleming, S.W., Zawadzki, A. (2010) Pacific Decadal Oscillation and the Hydroclimatology of Western Canada—Review and Prospects, *Canadian Water Resources Journal*, 35:1, 1-28, DOI: 10.4296/cwrj3501001

E1



Seymour Reservoir during summer 2023 drought

# Water Supply Areas Climate Report

## 2023 ANNUAL WEATHER AND CLIMATE SUMMARY

Peter Marshall

Field Hydrologist, Environmental Management, Water Services

Water Committee – April 3, 2024  
65824955

**metro**vancouver

### 2023 YEAR IN REVIEW



#### Temperature

- Second warmest year
- +0.9°C above average
- Record warm May & Dec
- 2<sup>nd</sup> highest number of days >25°C (behind 2022)



#### Precipitation

- 85% normal precipitation
- Record dry May and June
- 33 and 32 day dry spells
- Rapid snowmelt in May and early Jun



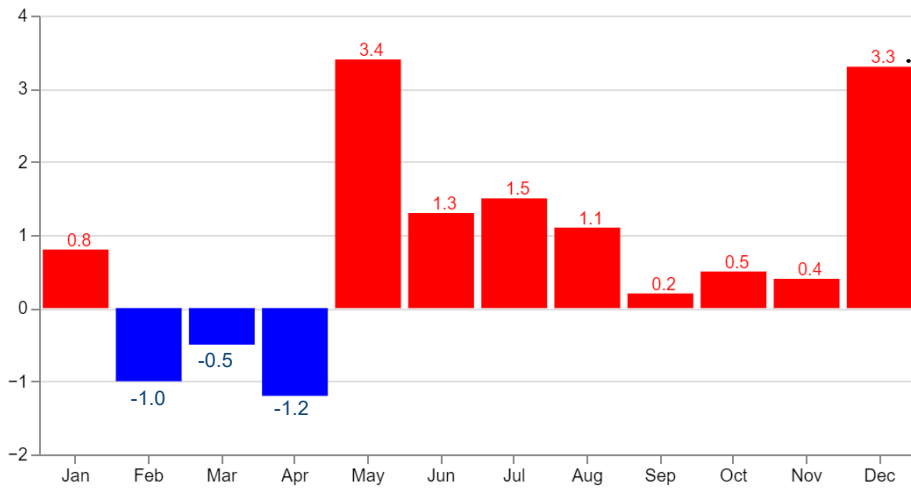
#### Impacts

- Earlier reservoir stop-spill
- Extreme drought
- Stage 2 water restrictions
- Long and challenging wildfire season



## Air Temperatures

Average monthly temperatures in 2023



Information: Data is from a weather station in the lower Capilano water supply area. The period of record for this station is 2003 to present.

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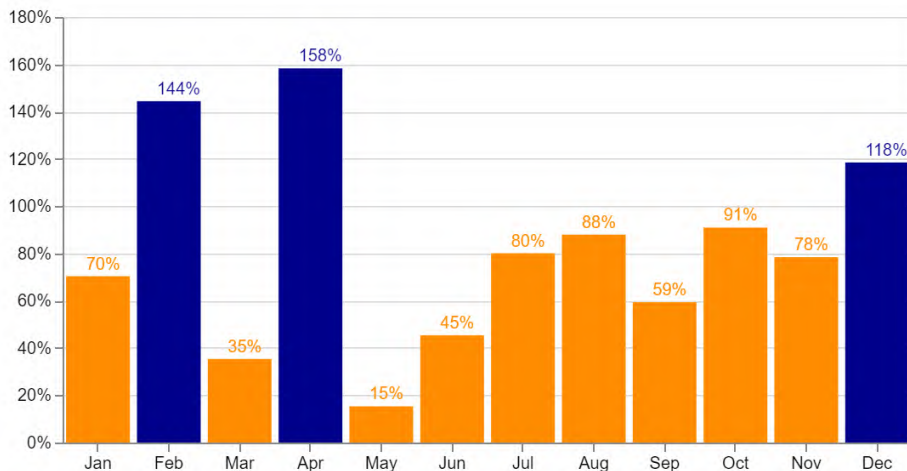
## Highlights

- Below normal temperatures in Feb, Mar, and Apr
- Cool winter and early spring helped boost snowpack conditions heading into the melt season
- May saw record-breaking heat, averaging 3.4°C above normal
- Average monthly temperatures were above normal from May through Dec
- Dec averaged 3.3°C above normal and 1.7°C warmer than the previous record



## Precipitation

Percent of normal monthly precipitation in 2023



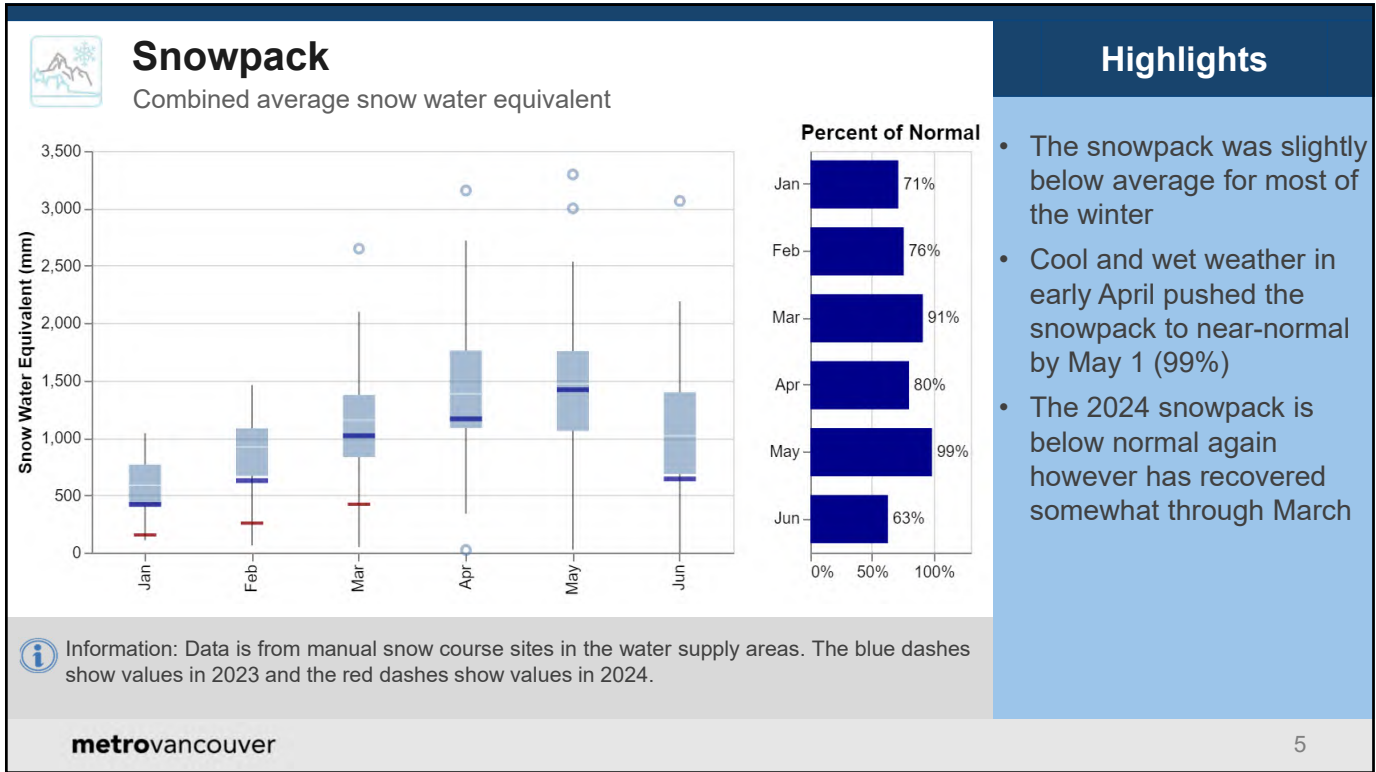
Information: Data is from a weather station in the lower Capilano water supply area. The period of record for this station is 2003 to present.

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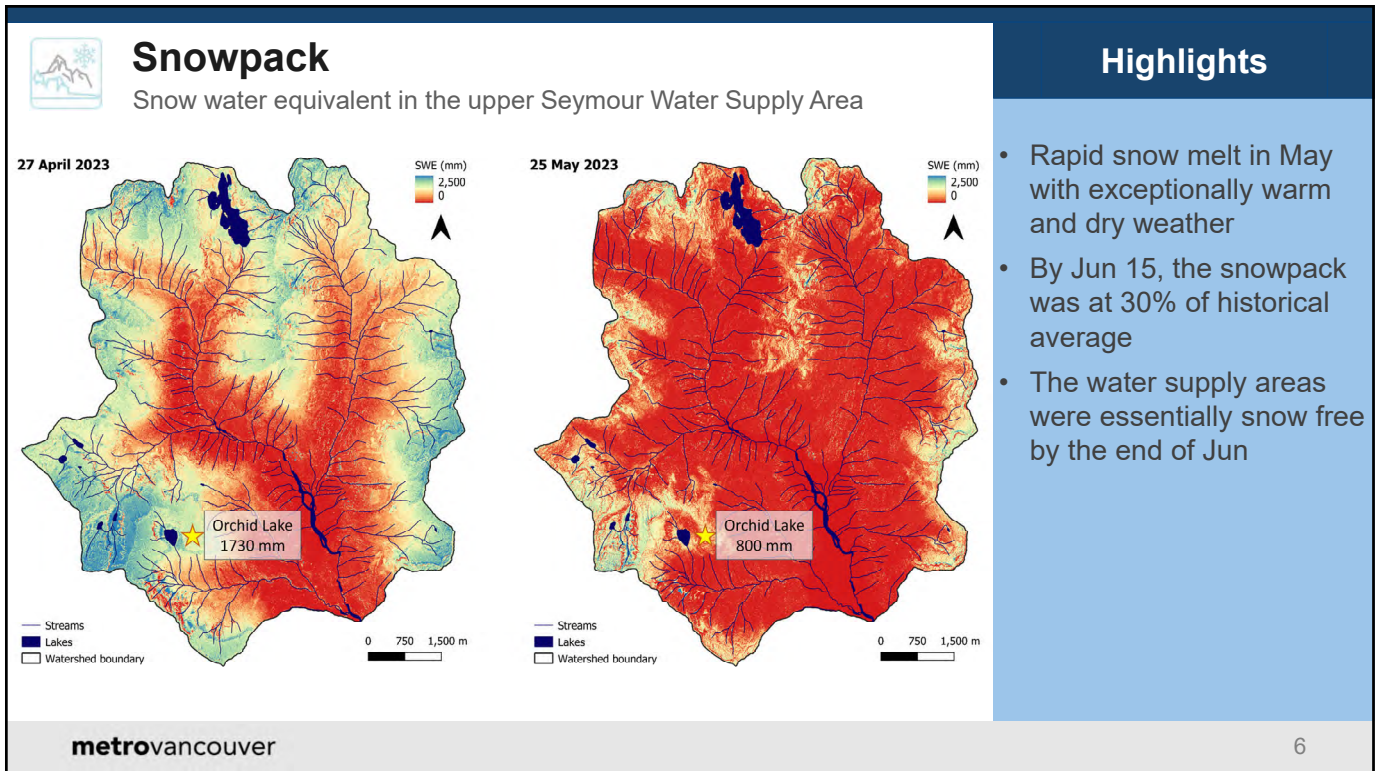
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## Highlights

- The water supply areas received 85% of normal precipitation in 2023
- Feb, Apr, and Dec were the only 'wet' months
- Mar, May, and Jun were standout dry months with only 35, 15, and 45% normal precipitation
- Conditions were very dry from Apr 27 until Sep 25



- ### Highlights
- The snowpack was slightly below average for most of the winter
  - Cool and wet weather in early April pushed the snowpack to near-normal by May 1 (99%)
  - The 2024 snowpack is below normal again however has recovered somewhat through March

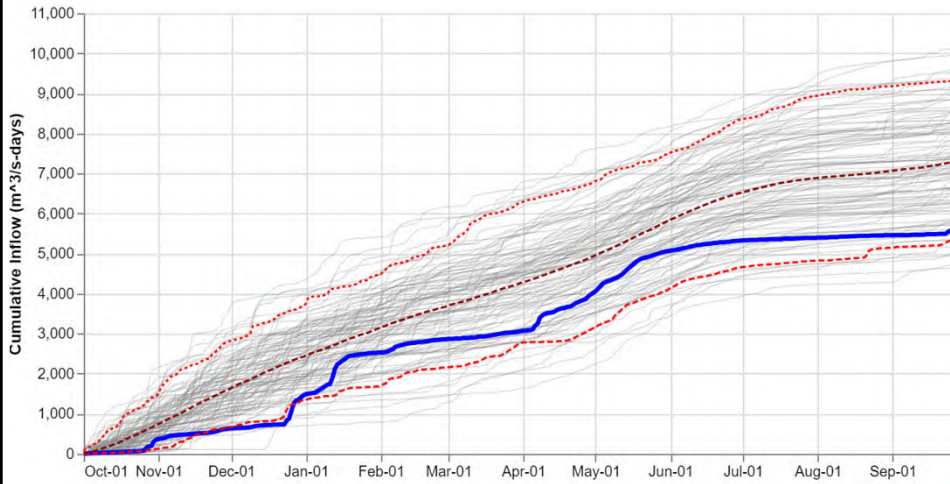


- ### Highlights
- Rapid snow melt in May with exceptionally warm and dry weather
  - By Jun 15, the snowpack was at 30% of historical average
  - The water supply areas were essentially snow free by the end of Jun



## Streamflow

Capilano Lakehead cumulative river inflow – 2023 water year



**i** Information: Data is from the Capilano River above Lakehead (08GA010) gauge with discharge data from 1914-2023.

## Highlights

- The 2023 water year was a dry year with 76% of normal river inflows
- This year ranked 11 out of 108 years (1 being the driest).
- Inflows in May and early Jun were almost entirely driven by snow melt
- Monthly average river inflows dropped to record low levels in Jul and Aug



North end of the Seymour Lake. August 2023

## DROUGHT

- Third consecutive summer with severe drought
- The Lower Mainland basin was rated at level 5 drought from Aug 17 until Sep 21
- Stage 2 water restrictions were implemented on Aug 4
- Relief came in late Sep with the first significant rainfall



Coquitlam water supply area fire, September 2023.

## WILDFIRE

- Fire danger was high or extreme for 65 days this year (double the 10-year average)
- Wildfire smoke spread over the Lower Mainland resulting in air quality advisories in Jul and Aug
- Watershed staff were on standby for fire response from May 11 until Sep 25

## ACTIONS - WATER SERVICES

Preparing for Impacts from Climate Change

- Promoting drinking water conservation
- Planning for the future to meet the drinking water needs of our growing population (Coquitlam Lake Water Supply Project)
- Adjusting Annual Operations based on Conditions
- Collecting and sharing valuable information about environmental conditions in the water supply areas
- Using new technologies to enhance our monitoring programs



Loch Lomond weather station, Seymour Water Supply Area

Questions?

**metro**vancouver

To: Water Committee

From: Heidi Walsh, Director, Watersheds and Environment, Water Services

Date: March 11, 2024 Meeting Date: April 3, 2024

Subject: **2023 Contribution Agreement Annual Reports – Seymour Salmonid Society and Coquitlam River Watershed Roundtable**

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### **RECOMMENDATION**

That the Water Committee receive for information the report dated March 11, 2024, titled “2023 Contribution Agreement Annual Reports – Seymour Salmonid Society and Coquitlam River Watershed Roundtable”.

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### **EXECUTIVE SUMMARY**

The Seymour Salmonid Society (SSS) operates the Seymour River Hatchery on Greater Vancouver Water District (GVWD) land and conducts stewardship activities in the Seymour River Watershed. The GVWD had a three-year (2021 – 2023) Contribution Agreement with the SSS for \$125,000 per year, and a new agreement is now in place for 2024 – 2026. The SSS released 540,000 juvenile salmonids from their hatchery in 2023 and continued to improve fish habitat conditions in the Seymour River Watershed.

The GVWD has a current four-year (2023 – 2026) Contribution Agreement with the Coquitlam River Watershed Roundtable (CRWR) for \$34,000 annually (plus 3 percent/ year). The CRWR continues to focus on community outreach and stewardship activities to enhance environmental protection measures in the Coquitlam River Watershed.

The SSS and CRWR have met the requirements of the respective 2023 GVWD Contribution Agreements and the attached reports provide details of their annual activities.

### **PURPOSE**

To provide the Committee with the SSS’s and CRWR’s 2023 annual reports in accordance with the contribution agreements between the GVWD and these two community-based non-profit societies, describing their contributions to environmental restoration and stewardship in Metro Vancouver.

### **BACKGROUND**

#### **Seymour Salmonid Society**

The Seymour River Hatchery is located on GVWD land immediately downstream of the Seymour Falls Dam. The hatchery commenced operations in 1977 in response to declining fish stocks in the Seymour River and Burrard Inlet. The hatchery was managed by the BC Institute of Technology for its first decade of operation. The SSS was formed in 1987 to oversee hatchery operations, volunteer activities, and educational programming.

In addition to Fisheries and Oceans Canada (DFO) financial allocation, the GVWD began contributing to core funding for the SSS in 1996. The relationship between the GVWD, DFO, and the SSS remains a highly collaborative initiative in fisheries management, restoration, and stewardship in the Seymour River Watershed. The SSS utilized core funding from the GVWD and DFO to administer routine hatchery operations in 2023. They also leveraged significant additional funding (\$278,724) through government grants along with a strong showing from corporate and private donors. These funds go toward education programs, habitat enhancement projects, maintenance, and upgrades of hatchery infrastructure.

The SSS welcomed back 1,660 students to its *Gently Down the Seymour* children's education program following post-pandemic adjustments. This unique program has elementary school classes attending the hatchery and immersing in the natural environment to learn about salmon life cycles and natural processes.

### **Coquitlam River Watershed Roundtable**

The CRWR was formed in 2011 with roots back to a Coquitlam River Watershed Strategy (2007) developed by local stakeholders and area interest groups. The CRWR registered as the Coquitlam River Watershed Society under the BC *Societies Act* in 2020. Priorities of the CRWR pertain to advocacy and actions contributing to improvements in development practices, anti-littering and dumping, stormwater management, and invasive species management.

The CRWR primarily utilized the GVWD funding to support the full-time Roundtable Coordinator position and important community activities and initiatives contributing to the *Watershed Plan* implementation. They also leveraged additional funding (\$72,250) from ongoing core partnerships with the kʷikʷəłəm (Kwkwetlem) First Nation, the City of Coquitlam, and the City of Port Coquitlam. Additional funding grants were received in 2023 from DFO and a stewardship-minded local business.

### **Contribution Agreements**

The first three-year Contribution Agreement between the GVWD and SSS came into effect in 2015 and formalized a funding arrangement dating back to the 1990s. At its November 10, 2020 meeting, the GVWD Board adopted the following resolution to endorse the third term between GVWD and SSS:

*“That the GVWD Board approve the renewal of the Contribution Agreement between the Greater Vancouver Water District and the Seymour Salmonid Society for a three-year term, and annual contribution of \$125,000, commencing on January 1, 2021 and ending on December 31, 2023”.*

The attached report from SSS completes the reporting commitment for this term of the Agreement. A fourth Contribution Agreement is now in place with the SSS for 2024 – 2026. Reporting for this new Agreement will begin in 2025.

The first four-year Contribution Agreement between the GVWD and CRWR came into effect in 2019 and provided funding via the Watershed Watch Salmon Society (acting as Financial Trustee). At its

September 23, 2022 meeting, the GVWD Board adopted the following resolution to endorse a second term between the GVWD and CRWR:

*“That the GVWD Board approve the Contribution Agreement between the Greater Vancouver Water District and the Watershed Watch Salmon Society for a four-year term and annual contribution of \$34,000 plus 3% per year, commencing on January 1, 2023 and ending on December 31, 2026”.*

As with the SSS, the CRWR is required to submit annual reports on their activities for the prior year as a term of the Agreement.

#### **ALTERNATIVES**

This is an information report. No alternatives are reported.

#### **FINANCIAL IMPLICATIONS**

The GVWD is a primary contributor to the SSS and CRWR, providing \$125,000 annually through 2023, and \$34,000 (plus 3 percent CPI / year) annually through 2026, respectively. Funds are allocated in the Watersheds and Environment Program operational budget.


#### **CONCLUSION**

Both organizations had successful 2023 operating years and fulfilled the obligations of their respective contribution agreements.

#### **ATTACHMENTS**

1. Seymour Salmonid Society’s 2023 Annual Report for GVWD
2. Coquitlam River Watershed Roundtable’s 2023 Annual Report for GVWD

2023



Seymour Salmonid Society's  
Annual Report For  
Greater Vancouver Water District



Seymour Salmonid Society

PO Box 52221, North Vancouver, V7J 3V5

December 2023



## **Mission Statement**

To enhance Seymour River salmon and educate the public about the importance of the river as a resource for drinking water, wildlife and the forest.

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## Executive Summary

### Acknowledgements

The Seymour Salmonid Society (SSS) would like to recognise the significant annual contribution of \$125,000 by Greater Vancouver Water District (GVWD) to support enhancement and education efforts at the Seymour Hatchery. The money that GVWD contributes to the hatchery operations allows the SSS to leverage monies from other sources, including Fisheries and Oceans Canada (DFO) and other external funding sources. These contribute a significant proportion of our annual operating budget.

We would also like to thank significant financial contributions from BC Salmon Restoration and Innovation Fund (BCSRIF), the Pacific Salmon Foundation (PSF), Royal Bank of Canada, Ocean Film Festival, Port of Vancouver in 2023. These funds were generously provided for the habitat enhancement and monitoring activities, hatchery operations and equipment improvements. We are also extremely grateful for the ongoing support by the DNV Firefighters Charitable Society, Neptune Terminals, TELUS Friendly Future Foundation, BC Gaming for our community education programs and for the many community donations provided by local individuals and stakeholders.

We wish to thank GVWD and the District of North Vancouver for their ongoing support with staff hours or in-kind contributions for ongoing hatchery operations. We would also like to thank our DFO Community Advisor and the DFO Habitat and Restoration group for their support and technical guidance. We would also like to acknowledge the Ministry of Land, Water, and Resource Stewardship (LTSA) for their ongoing support of our steelhead program.

We are most grateful for the contribution by our over 750 registered volunteers, who are an integral part of the operation of the hatchery and SSS. Without the significant community involvement, our staff would not be able to accomplish a fraction of what is completed at the hatchery or the work we do in the watershed.

### Habitat Conservation and Enhancement

The SSS and its partners have continued to work hard to mitigate the effects of the rockslide and continue moving into a post-rockslide restoration strategy. We confirm that adult salmon and steelhead are continuing to successfully migrate through the Seymour Canyon to spawn within the river upstream, albeit at certain flow conditions. The additional restoration works at the Junior Creek enhancement area were completed through the installation of an additional sediment pond, with significant input from GVWD and DFO. GVWD has provided significant in-kind support for materials and machinery operator time for the remediation works at the site both in 2023 and the years prior. Without this in-kind support the Junior Creek site and project could not be maintained and remediated.

The SSS will continue to monitor the inlet channel to ensure it maintains flows into the habitat ponds throughout the winter and spring 2023/24. Despite the natural challenge of the rockslide over the past six years, and thanks to GVWD's continued support, fish populations on the Seymour River have a realistic long-term future within the watershed.

### Broodstock Collection and Production

We released 22,000 fed fry above the Seymour Falls Dam on June 22 to Jamieson Branch and Rustad Branch, along with an additional 4,800 fed fry on July 27 to Rustad Branch. A total of 451,695 chum fry comprising approximately 48,871 Seymour origin and 402,824 Alouette origin were released in the lower river in May. Smolt releases were successful for both our coho and

summer/winter run steelhead, with 47,259 coho smolts released from the hatchery into Hurry Creek, 7,500 smolts released to seapens at Port Moody, and 14,728 summer run steelhead smolts transported to West Vancouver laboratory and released directly into the ocean.

This year saw our broodstock anglers out regularly during the summer and fall periods for steelhead, pink and chum salmon. This was in addition to the four hatchery pool seine events to collect adult broodstock.

We spawned 112 pairs of Seymour pink salmon by the end of September, 10 pairs of Seymour chum by the end of November and anticipate spawning up to 55 pairs of coho by the end of December. In addition, we spawned 130 pairs of Alouette chum and 12 pairs of Chilliwack pink salmon. We continue to search for summer and winter run steelhead adults in preparation for spawning in spring 2024, with four pairs of summer run steelhead currently onsite. We are also continuing the egg incubation activities to ensure sufficient fry and smolt production for the coming year ahead.

### **Environmental Monitoring**

Radio telemetry studies were ongoing to monitor progress of the rockslide remediation project and passage of returning adults to the spawning grounds above the rockslide. A total of 31 adult coho had gastric radio tags installed and released immediately downstream of the rockslide. The tagged fish were monitored using two primary identification approaches, these being four fixed receiver telemetry stations and mobile telemetry tracking both upstream and downstream of the rockslide. To date we have registered three tagged fish upstream of the rockslide, but regularly tracked fish downstream of the rockslide. This is the final season of radio telemetry monitoring on the Seymour River for the rockslide mitigation project.

Hatchery staff also undertook mark and recapture activity during broodstock collection, along with carcass recovery surveys between October and December. A total of 596 out of the 951 fish captured during our hatchery pool seine events had their left operculum punched before being released back to the river. This mark and recapture process is then used during carcass recovery activity to estimate the total number of adult coho returning to the river in 2023. To date we have identified 152 coho carcasses during surveys, with 17 having had the left operculum punch (i.e., 11.2%). At this stage it is too early to estimate the total adult coho run for 2023, since we anticipate ongoing carcass recovery monitoring into January 2024.

### **Community Outreach and Education**

Further to our visitors and community volunteer input to the hatchery and watershed, the SSS successfully operated the chum fry release at Maplewood Farm, our Open House at the Seymour hatchery, the Family Fishing day at Rice Lake, and our World River Day event at the Seymour Estuary. The SSS also attended two community events organised by others including the annual fishing derby and the Blueridge Community event.

Our annual chum release at Maplewood Farm was undertaken in April. Hatchery staff and volunteers helped to fill each bucket with chum salmon fry for the kids to release an estimated 15,000 chum fry on the day. We hosted our annual Open House in September to allow the public to visit the hatchery and learn about the work being undertaken at the hatchery and learn more about the Society's enhancement, education, and habitat restoration activities. GVWD's Education Team also attended and provided information about the watershed, our drinking water,

and the dam. For World Rivers Day we organised an estuary clean-up and replanting at the river mouth in the fall, with help from GVWD staff and SSS volunteers.

The District of North Vancouver Firefighters, a major financial supporter of our education program, were also able to hold their annual Fishing Derby in September. The derby was a great success, attended by many boat fishing entries, the significant support and prize donations from local businesses, along with the organisational support from Highwater Tackle. The fishing derby resulted in a significant donation from the District of North Vancouver Firefighters of \$37,000 towards our education program for 2024. We were also able to attend the Blueridge Community event at Blueridge elementary school during May to support the community event.

We also operated a full GDS program during 2023, with over 1,660 elementary school children, along with 462 teachers and parents visiting the hatchery and education centre during Spring and Fall. The GDS program was successfully undertaken with 53 classes (1,115 students) in spring and 20 classes (505 students) in the fall. We have secured the necessary funds to operate the in-person GDS program during spring and fall 2024 for Grade 2-6 students.

### **Hatchery Infrastructure Upgrades and Maintenance**

We continued our ongoing facility infrastructure and maintenance upgrades during 2023, including installation of a new 10,000L septic storage tank, a new aquarium at the welcome area kiosk, along with renovations to the hatchery building roof. The new septic storage tank involved digging a suitable hole in the ground adjacent to the wood/ATV storage garage and installation of a 10,000L concrete storage tank, which doubles the storage capacity for the hatchery. The hatchery building roof renovation involved fixed weather damaged roof cladding, along with installation of snow guards to the roof to prevent further damage. We also connected electricity to the ATV garage, so it now has its own designated circuit.

The new aquarium within the welcome area kiosk was constructed from acrylic and installed on the site during summer, to provide visitor viewing of our coho and steelhead fry. We also purchased and received a new ATV vehicle for use during hatchery operations, especially during hatchery pool seines, broodstock transport and general site maintenance activities.

## Human Resources

The following provides an overview of the hatchery facility staffing and governance for the Seymour Salmonid Society.

### Board of Directors

<b>President</b>	Shaun Hollingsworth
<b>Treasurer</b>	Darren Radons
<b>Secretary</b>	Graeme Budge

<b>Directors</b>	Stephen Vincent
	Nick Martinovic
	Naomi Yamamoto
	Mardy Grossman
	Kate Keogh
	Glen Parker
	Mark Whorrall
	Sean Ramsden
	Derek James
	Mardy Grossman

### Hatchery Staff

**Marc Guimond:** Executive Director & Hatchery Manager

Marc grew up in Toronto and attended the University of Guelph, earning a degree in Biological Sciences in 1995. In 1997 he moved to Vancouver and volunteered at the Vancouver Aquarium teaching students about marine invertebrates. The following year, Marc joined the SSS and has been overseeing all aspects of salmonid production and monitoring for over 25 years.



**Megan Samson:** Program Coordinator & Fisheries Technician

Megan was born in Vancouver and raised in White Rock before pursuing her interest in science at BCIT. She completed her diploma in Fish, Wildlife and Recreational Management in 2021 and worked for Freshwater Fisheries Society of BC at the Nechako White Sturgeon Conservation Centre in Vanderhoof (BC) following her diploma, before joining the SSS in August to assist with hatchery operations and radio telemetry monitoring education and volunteer coordination.

## Habitat Conservation and Enhancement

Hatchery staff supported by GVWD and DFO undertook a series of habitat activities within the watershed during 2023. The following provides an overview of activities undertaken based on habitat area.

### Seymour Rockslide Remediation Project

The objective of the 2023 work was to observe and monitor the rockslide area to confirm ongoing fish passage through the Seymour Canyon. Given the significant mobilisation of material during 2021 and 2022 we did not consider it necessary to undertake rock drilling and breaking activities during summer 2023.

Although we are yet to confirm the actual number of fish that moved through the canyon in 2023 (i.e., as carcass recovery counts continue into January 2024), we successfully seine netted over 951 coho above the rockslide this year. Of these, 596 coho were marked with a left operculum punch (LOP) and released for later carcass recovery monitoring, 200 were released above the dam and 155 were transported to the hatchery for broodstock. The aim is to spawn up to 65 pairs of coho between September – December 2023, along with up to five pairs of steelhead between March - May 2024. We also visually observed good numbers of spawning coho salmon in the tributaries and mainstem during our ongoing carcass recovery monitoring.

We are continuing our coho carcass recovery monitoring with the aim of improving our estimate of fish successfully migrating into the upper river to spawn naturally. To date we have found 127 coho during recovery operations, with 13 of these having LOP marks (i.e., 9.5% of those found). Our observations this year suggest that the number of adult coho moving through the rockslide was greater than 2022.

We successfully angled 20 chum salmon (10 pairs) in the lower river, for use in our hatchery broodstock program (refer Table 1). In addition, we successfully angled and spawned 113 pairs of pink salmon via broodstock angling in the lower river. Pink and chum salmon were not observed above the rockslide; however, it's noted that chum have never negotiated their way through the canyon, and the last time pink salmon were observed above the canyon was in 2013. Once water levels recede in spring 2024 we will again visually survey the canyon area to understand the fish passage potential following the 2024 fall and winter flows. SSS staff are also aiming to undertake snorkel-dive activities during the winter period to better understand the underwater conditions throughout the Seymour Canyon, and to identify locations where summer and winter run steelhead may be holding in the upper river.

### Fish Above Seymour Falls Dam Project

Coho salmon once migrated up the Seymour River to habitat that is now isolated upstream of Seymour Falls Dam. The agreement with GVWD and DFO allows the release of up to 400 adults above the dam each year (i.e., 200 pairs). This figure is based on the Bradford's bio-standard of 85 smolts/female and a target of producing 17,000 wild smolts from natural habitat above dam each year. Annual wild spawned fry releases will be augmented by up to 40,000 hatchery fed fry above the dam. This will continue until it is possible to release more than 200 adults (i.e., 100 pairs) above the dam each year. After which the plan would be to reduce hatchery fed fry releases accordingly.

Ultimately, we would like to reach a point where 400 adults are transported above the dam annually, thereby negating the need to augment the upper watershed with any hatchery fed fry. Transporting adult coho above the dam would partially mitigate the historic impact of dam construction and re-establish wild salmonid stocks in a pristine area that is more resilient to future stressors such as climate change given the lower water temperatures in the upper watershed. The number of adult coho being transported above the dam annually is determined by the number of adult fish returning to the river, along with the number of fish we can collect as part of our broodstock program.

On July 20th, September 21th, October 12<sup>th</sup> and 13th, with the assistance of GVWD staff, the SSS transported a total of 200 adult coho salmon (i.e., 100 pairs) and released these into the Seymour River above the dam. These fish were captured during river seining events at the hatchery pool and were either transported on the same day as the seine event, or retained at the hatchery until sufficient fish were secured for transport. The fish were released at the 21km mark in the upper watershed at a location known locally as Rustad Branch. Each fish was transferred via catch net from the hatchery truck tank and released directly to the river. In contrast, we were unable to release adult summer run steelhead salmon above the dam in 2023, due to insufficient numbers of adults captured during the period of annual return.

## River Fertilisation Project

The program was originally initiated by LTSA to mitigate impact from the Seymour Falls dam on the downstream habitat of summer-run juvenile steelhead, and to make up for poor ocean conditions for salmon resulting in reduced adult returns. The prevailing thought is that the over-wintering period and ocean survival for juvenile steelhead is a population concern for the Seymour River. Thus, making the fry bigger and (presumably) healthier during the summer/fall months because of greater food availability, would improve over-winter survival of the juvenile steelhead population, resulting in a greater number of larger smolts that would then out-migrate to the ocean in the spring (with the assumption that sending more and larger fish to the ocean would result in lower predation and more fish coming back).

The fertilisation program, now overseen by GVWD and SSS hatchery staff continued in 2023. Hatchery staff and volunteers filled burlap bags with fertiliser pellets and placing them in three locations in the river each spring. Fertiliser bags were deployed on June 20th by hatchery staff, GVWD and volunteers. Loading rates were the same as previous eight years (i.e., 1,350kg of fertiliser total: 27 bags at Bear Island Bridge, 54 bags at Hatchery Pool, and 54 bags at Spur 4). The pellet fertiliser used was supplied by Ostara (Ostara.com) and the product is called Crystal Greene, with a pellet size of SGN 300. Concurrent with this fertiliser installation, GVWD performed bi-weekly water quality sampling during the summer growth period (June to October) at locations upstream and downstream of the fertiliser release sites as described in the monitoring section of this report.

## Junior Creek Enhancement Area

The Junior Creek enhancement area comprises a man-made channel that flows between Paton Creek and the juvenile rearing ponds of the enhancement area. The bank along a small section of this man-made inlet channel has degraded over time and required additional work to ensure it maintains sufficient flow to the Junior Creek ponds. The primary focus of work in 2023 included repairs to the inlet channel and ponded area using a mechanical excavator and operator from GVWD and DFO habitat specialists to clear fines and sand materials from the settling pond in the inlet channel.

The Junior Creek project is primarily being led by GVWD and DFO, with advice and input from SSS. GVWD has provided significant in-kind support for materials and machinery operator time for the remediation works at the site both in 2023 and the years prior. Without this in-kind support the Junior Creek site and project could not be maintained and remediated.

Works were undertaken during February 2023 during low flows and improved the armouring to improve flows to the Junior Creek ponds and outlet spawning channel. Figure 1 and Figure 2 show Junior Creek following repair works undertaken during February 2023.



**FIGURE 1 JUNIOR CREEK FOLLOWING COMPLETION OF REPAIR WORKS VIEWED UPSTREAM**

SSS Staff undertook regular visual inspections of the Junior Creek inlet creek and restoration works during the summer and Fall period to ensure that the repair works were operating as designed. Visual observations of the lower section of Junior Creek (i.e., downstream of the Junior Creek ponds) were also undertaken during the mark and recapture monitoring program. The results of visual surveys in summer and fall indicate that the 2023 restoration works have achieved the desired result. Water is now flowing through the inlet channel, depositing fines in the inlet pond and providing sufficient water depth for effective spawning habitat for the returning salmon in the outlet channel to the Junior Creek habitat ponds.



**FIGURE 2 JUNIOR CREEK FOLLOWING COMPLETION OF REPAIR WORKS VIEWED DOWNSTREAM**

However, during a high rainfall event during November, the culvert berm of the settling pond was partially washed away and will require remedial works once low flow conditions prevail (Figure 3).



**FIGURE 3 SETTLING POND BERM DAMAGE AT JUNIOR CREEK IN NOVEMBER 2023**

In addition, the Junior Creek outlet channel was observed as requiring remediation works, with the channel banks eroding to within one metre of the Seymour River mainstem. If the bank eroded through then it would result in a loss of approximately 150m of spawning and rearing creek habitat within the Junior Creek system. Furthermore, the elevation drop at the new exit would be too great to allow adult salmon passage into the Junior Creek habitat area at all. Thus, discussions with DFO and GVWD have been ongoing since 2022 to find a solution to the outlet channel erosion issue. The approach identified is to create a new outlet channel slightly further inland and away from the mainstem, with the outlet channel entering the Seymour mainstem approximately 50 metres downstream of existing.

The draft outlet channel design has been completed and the proposals are currently going through the approval stage with DFO and GVWD (i.e., as the new channel flows through old growth forest). We anticipate the new channel works will be undertaken during 2024 in time for the adult return window; however, timing is subject to regulatory approvals being undertaken by others.

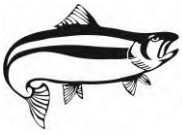
## Mid-Valley Enhancement Area

The Mid-Valley enhancement area is man-made and was established over 20 years ago to provide significant salmonid juvenile rearing and adult spawning habitat. This enhancement area supplements for aquatic habitat lost in the upper watershed via historical human activities. This area also benefits the watershed by providing valuable habitat for other aquatic species such as amphibians, birds, insects and invertebrates.

The aim of the habitat works at Mid-Valley during 2023 was to visually monitor the enhancement area to confirm the beaver dams have not been re-built, and that the habitat area is being utilised by both juvenile salmonids and returning adult spawners. We also opened the inlet valve to increase water flow down the inlet channel with the aim of flushing some of the fine sediments from the channel. The aim of the flushing event was to improve the spawning gravel useability within the inlet channel.

Monthly site visits were undertaken by SSS staff during spring, summer and fall, which confirmed the beaver had not returned and that the entrance channel remains free of obstructions. In addition, without the beaver dam impoundment and opening the inlet valve, flows through the inlet channel and habitat area also improved and allowed mobilisation of some finer sediments within the inlet channel. Following the sediment flushing we have suggested to DFO that additional spawning gravel introduction into the inlet channel would be beneficial.

Thus, the Mid-Valley habitat area remains free of fish passage issues and visual inspections confirmed that salmon fry used the habitat area for juvenile rearing purposes. Carcass recovery surveys during Fall 2023 also confirmed that returning adult salmonids were regularly using the habitat area for spawning purposes.



## Broodstock Collection and Production

The following provides an overview of the broodstock collection and production activities undertaken in the Seymour watershed during 2023. Table 1 provides a summary of the fish collected from these broodstock activities for the Seymour Hatchery fish production program.

**TABLE 1 BROODSTOCK COLLECTION FOR THE SEYMOUR RIVER HATCHERY IN 2023**

<b>Species</b>	<b>Seine Netting</b>	<b>Broodstock Fishing</b>	<b>Pairs Spawned, or Eggs Collected</b>
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**FIGURE 4 HATCHERY POOL SEINE EVENT DURING SEPTEMBER 2023**



**FIGURE 5 SUMMER RUN STEELHEAD DURING HATCHERY POOL SEINE EVENT**

## Broodstock Angling

Our broodstock anglers were out regularly during the August to December period for summer run steelhead, pink and chum salmon, along with the January to May 2023 period for winter run steelhead. The aim of the broodstock program was to capture as many returning adult pink and chum salmon from the lower river for spawning at the hatchery in fall 2023, and begin capturing the summer and winter run steelhead in preparation for spawning in Spring 2024 (Table 1).

## Egg Transplants

Further to our ongoing broodstock collection within the Seymour River, each fall hatchery staff visit the Alouette River with DFO to collect additional eggs to continue rebuilding the chum salmon population in the Seymour River. During Fall 2023 we collected an additional 130 pairs of chum (305,500 eggs) from the Alouette River for this purpose (Table 1). Fecundity has been estimated at 2,350 eggs per adult Alouette female in 2023.

As part of the GDS program we also support DFO's Salmon in the Classroom program. Approximately 4,200 fertilised chum salmon eggs were transported from the Seymour hatchery and delivered to schools in Vancouver. Each school receives approximately 100 eggs that are then housed in an aquarium in the classroom, so that students can see the eggs hatch in spring, before the children release them to a local creek.

## Hatchery Broodstock Production

The SSS are contracted by DFO to produce three salmonid species: coho and chum annually, and pink salmon every odd numbered year. The SSS also has an agreement with the LTSA to produce summer and winter run steelhead smolts. The SSS's goal is to enhance and maintain salmonid populations within the Seymour River to historical levels. The 2022 brood were incubated at the hatchery over winter 2022/23 and released as fry in selected habitats throughout the LSCR and above the Seymour Reservoir in spring 2023.

Whereas the current 2023 brood year eggs will be incubated at the hatchery over winter 2023/24 and be released as fry in the upper-reaches of the river above the dam during spring 2024. All fry releases augment the numbers of adult coho that spawn in the watershed during each fall to maintain fry numbers to historical wild production levels. We released 26,800 coho fry above the Seymour Falls dam on June 22, 2023. Table 2 illustrates the fry and smolts that were released in 2023.

**TABLE 2 SMOLT AND FRY RELEASES FROM THE SEYMOUR HATCHERY IN 2023**

Species	Brood year	Number
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## Environmental Monitoring

### Radio Telemetry

As part of the rockslide mitigation project, radio telemetry studies continued to monitor adult coho salmon migration through the Seymour canyon area. The SSS completed the monitoring program to determine when and if fish can migrate through the canyon where the rockslide occurred. A total of 31 adult coho salmon had gastric radio tags installed on the riverbank before being released downstream of the rockslide. The fish were released immediately downstream of the rockslide or at Pool 88 within one hour of radio tag insertion (Figure 6).



**FIGURE 6 RELEASING A RADIO TAGGED COHO SALMON IN THE LOWER RIVER**

The tagged fish were monitored using two primary identification approaches, these being four fixed receiver telemetry stations and mobile telemetry tracking. The fixed receivers are set up along the river, one at Spur 4 (above the rockslide), one at Twin Bridges (above the rockslide), the third at Pool 91 (below the rockslide) and the fourth at the fish fence (below the rockslide 1km from the river mouth). These fixed receivers record if any of the radio tagged fish pass by them. Mobile tracking was undertaken regularly from October until December 2023 by hatchery staff. The tagged adults were detected at one of the fixed stations downstream of the rockslide. We have confirmed three tagged fish upstream of the rockslide to date through fixed stations at Twin Bridges and Spur 4. This is the final year of radio tag monitoring for the rockslide.

### Coho Escapement, Mark and Recapture

As a compliment to the radio telemetry monitoring project, hatchery staff began carcass recovery monitoring in October 2023 and will continue through until January 2024. During seines upstream of the canyon and below the dam, adult coho are given a visualised mark (usually a left operculum hole punch (LOP)) and released to remix with the population. Once adults begin to spawn in the tributaries and enhancement sites, staff and volunteers regularly walk these waterways to find carcasses to examine whether they are marked or not. Data such as date, location, sex, origin (W or H), LOP observed or not, and percent spawn of females is recorded and the carcass is cut in half to avoid recounting. The data from marking and carcass recovery are used to formulate an adult return population estimate.

Carcass recovery monitoring was undertaken at least twice per week to maximise the number of fish identified. This data enables us to formulate an estimate of coho numbers that migrated through the rockslide during Fall 2023.

A total of 596 coho were LOP marked and released during our hatchery pool seine events. To date we have identified 152 coho carcasses during surveys, of which 17 had the LOP (i.e., 11.2% of those found). It's currently too early to estimate the number of adult coho that returned in 2023 as we will continue our carcass recovery monitoring into January 2024.

## Drift Dive and Stream Walk Surveys

Two drift surveys were undertaken in winter/spring 2023 primarily to identify the current fish passage status of the rockslide area and fish presence. Surveys were undertaken on February 14 and March 30 between the dam down to Pats Pool. Two hatchery steelhead were observed during the February 14 survey paired up in faster water. Further stream walk surveys identified 17 redds were identified during two river walks from Spur 7 upstream to Paton Pool between March 30 and April 5. Further surveys are anticipated during fall and winter 2023/24 to continue assessing fish passage through the Seymour Canyon, along with overwintering summer run steelhead in the middle reaches of the river.

## Water Quality Monitoring

GVWD continues to lead the water quality sampling during the summer growth period downstream of the dam. These samples are collected as part of the fertiliser release project on the river as presented in the Habitat Conservation and Enhancement section of this report. Background water quality samples were collected on June 9th prior to fertiliser installation on June 20th, while eight post-installation sampling sessions were undertaken every second Friday thereafter (i.e., June 23, July 7 and 24, August 4 and 18, September 1, 15 and 29). Samples were processed at ALS Labs. The Seymour Hatchery, as part of hatchery operations, also monitors water temperature from several sources including reservoir, groundwater seepage, chilled and boiler water, and dissolved oxygen regularly. Water from the Seymour Reservoir feeds into an aeration tower on the hatchery site and maintenance and flow levels are regularly monitored.

## Community Education Programs

### Gently Down the Seymour (GDS)

A field trip to the Seymour Hatchery expands student learning of the salmon life cycle to include experience and observation of salmon habitat and the surrounding watershed ecosystem. Students, teachers and parents have an opportunity to connect with their local ecosystem and gain a greater understanding of how urban development impacts natural resources. We hope visitors become greater stewards for salmon, ensuring there will be salmon in our region for generations to come.

The Gently Down the Seymour (GDS) program has a lasting impact on participants as shown by the considerable volume of thank you letters received from the students, along with teachers regularly commenting on how students recall details and experiences from the field trip many years later. Following two years of GDS closures from Covid-19, we successfully re-started our education program in spring and fall 2023. The BC Wildlife Federation (BCWF) was contracted to provide the educators to implement GDS for 2023 (Figure 7).

Overall, a total of 1,660 students and 462 parents and teachers enjoyed the GDS 2023 program at the Hatchery. The following provides a summary of the Spring and Fall programs.

As part of the GDS program we also support DFO's Salmon in the Classroom program. In 2023 produced and provided over 4,200 fertilised chum salmon eggs for delivery to schools in Vancouver. Each school receives approximately 100 eggs that are then housed in an aquarium in the classroom, so that students can see the eggs hatch in spring. The hatched fry and then transported to a local creek and the children release these as part of their learning program.



**FIGURE 7 SPAWNING DEMONSTRATION BY HATCHERY STAFF DURING A GDS EDUCATION DAY**

## Spring 2023

A total of 53 classes were booked for the Spring GDS program, with 52 classes going ahead. One class was cancelled at the last minute by the school as the school could not secure a bus to transport the students to the hatchery. Bookings for all GDS Spring filled up in less than one day and resulted in an additional 20 classes on the waitlist for Spring 2023. The 52 classes hosted at the hatchery came from West Vancouver, North Vancouver, Vancouver and Burnaby school districts. A total of 1,155 visiting students were accompanied by 336 teachers and parents between March and June 2023.

Teachers were emailed a link to a feedback form at the conclusion of their field trip. Feedback was submitted by 57% of teachers and showcased strong support for GDS. Overall, all responding teachers strongly agree the GDS program met expectations. All participating teachers strongly agree this program supports their Salmonids in the Classroom experience. The teacher feedback confirms the following:

- **Overall** - all responding teachers strongly agree the GDS program met expectations. All participating teachers strongly agree this program supports their Salmonids in the Classroom experience
- **Program Design** - teachers strongly agree the GDS program has grade appropriate content and activities and supports current school curriculum
- **Field Trip Delivery** - teachers recorded the students were engaged and learning at field trip stations, with 28/29 agreeing to the educators being informative and working well with students
- **Supporting Materials** - 22/29 teachers surveyed used the teacher resource provided by the GDS program for the field trip
- **Application of Learning** - 27/29 teachers strongly agree students will apply the GDS program experience to classroom studies. 28/29 teachers strongly agree students will apply the GDS program experience outside the classroom. 25/29 teachers agree they will use the techniques from the GDS field trip to assess their stream during the salmon fry release
- **Community Reach** - 28/29 teachers strongly agree that they will share the GDS program experience with the school and parent community.

## Fall 2023

A total of 20 classes were booked for the Fall GDS program, with 20 classes going ahead onsite, and one undertaken in the school classroom from weather conditions closing the watershed. One class was cancelled at the last minute by the school as the school could not secure a bus to transport the students to the hatchery. Bookings for all GDS Spring filled up in less than five days. The 20 classes hosted at the hatchery came from Vancouver, North Vancouver, Richmond and Burnaby school districts, along with three from independent schools. A total of 505 visiting students were accompanied by 126 teachers and parents during October 2023.

Zoom in on the Seymour (ZIS) is still available for use during our education program should the watershed be closed due to inclement weather conditions. Only one on-site GDS education day had to be cancelled in Fall 2023 due to a watershed closure. Instead, the three BCWF educators travelled to the school and performed ZIS and other activities on the day for the class that couldn't visit the hatchery.

Teachers were emailed a link to a feedback form at the conclusion of their field trip. Feedback was submitted by 50% of teachers and showcased strong support for GDS. The teacher feedback during the Fall 2023 program confirms the following:

- **Overall** - all responding teachers strongly agree the GDS program met expectations. All participating teachers strongly agree this program supports their Salmonids in the Classroom experience
- **Program Design** - teachers strongly agree the GDS program has grade appropriate content and activities and supports current school curriculum
- **Field Trip Delivery** - teachers recorded the students were engaged and learning at field trip stations, with 10/10 agreeing to the educators being informative and working well with students
- **Supporting Materials** - teachers surveyed the teacher resource provided by the GDS program for the field trip. 6/10 teachers used the resource
- **Application of Learning** - 10/10 teachers strongly agree students will apply the GDS program experience to classroom studies. 10/10 teachers strongly agree students will apply the GDS program experience outside the classroom. 8/10 teachers agree they will use the techniques from the GDS field trip to assess their stream during the salmon fry release
- **Community Reach** - 9/10 teachers strongly agree that they will share the GDS program experience with the school and parent community

## Community Outreach

### Visitors

The hatchery was open for access to the public and volunteers throughout 2023 and we had significant volunteer support from the community, high school students and the board of directors (Figure 8). In addition, over 2,000 people were estimated to have visited the hatchery facility during the year via the hiking and cycle trails of the LSCR. The community outreach visitor figures do not include the 1,660 students and 462 parents and teacher attendees for our GDS education program.

### Volunteers

Volunteers are an integral aspect of the operation of the hatchery and SSS. Without the high level of public involvement, the staff would not be able to accomplish a fraction of what is completed at the Hatchery or SSS events. The SSS currently has over 750 volunteers registered to assist with the ongoing activities at the hatchery or within the watershed. Our hatchery and conservation activities were supported by over 2,100 volunteer working hours during 2023 (Figure 8). Student participation also improved as we were able to provide volunteer opportunities for high school students during the summer and fall periods. We are most grateful for the volunteer assistance we receive each year and would not be able to undertake all the work we do in the watershed without their help. The following provides a summary of the types of activities that volunteers and students assisted hatchery staff and Board of Directors during 2023:

- Community event table participation
- Community event set-up/breakdown and general support
- Fin clipping our coho and steelhead fry
- River seine events for adult salmon and steelhead capture
- Broodstock angling for adult broodstock, specifically pink and chum salmon, along with summer and winter run steelhead
- Hatchery grounds maintenance and cleaning activities, including wood chopping, painting, general maintenance and repairs
- Assistance with fry releases in the upper watershed, along with smolt and fry releases into the lower watershed, or at West Vancouver laboratories
- Assistance with maintenance activities at the habitat enhancement areas throughout the watershed
- Technical input into education information for GDS, information signage, along with engineering input into maintenance activities

FIGURE 8 ESTIMATED NUMBER OF VISITORS TO THE SEYMOUR RIVER FISH HATCHERY IN 2022

## Community Events

Further to our visitors and community volunteer input to the hatchery and watershed, the SSS successfully operated the chum fry release at Maplewood Farm, the Family Fishing Day at Rice Lake, our Open House at the Seymour hatchery, and our World River Day event at the Seymour Estuary. The SSS also attended two community events organised by others including the Blueridge Days Community Event and the annual Firefighters Fishing derby, along with attendance at the Ocean Film Festival. The following provides an overview of the community events that the SSS either organised or attended during 2023.

### ***Maplewood Farm Chum Fry Release***

Our annual chum release at Maplewood Farm was undertaken on April 9th during the farms Easter event. Maplewood farm is approximately 500m upstream from the Seymour Estuary and has Maplewood Creek running through it (Figure 9). People of all ages were welcome to come and help release chum salmon into the creek. Hatchery staff and volunteers helped to fill each bucket with chum salmon fry for the kids to then release and watch them swim downstream as they start their journey to the sea. We estimated that approximately 20,000 chum fry were released on the day.



FIGURE 9 MAPLEWOOD FARM CHUM RELEASE APRIL 9

### ***Blueridge Days Festival***

Blueridge community event was held on Sunday June 11th and was well attended by the local community. We enjoyed hosting our community event table and interacting with the local community on all things salmon and our wild places. Our event table was hosted by the Society's Board of Directors, along with hatchery staff on the day (Figure 10).



FIGURE 10 BLUERIDGE DAYS FESTIVAL JUNE 11

### ***Family Fishing Day***

Our annual Family Fishing day event was operated again for the first time since Covid restrictions prevented the event from going ahead. We operated the event with the support of Metro-Vancouver at Rice Lake on Sunday June 18th. The event was very well attended by the local community and we had hundreds of kids able to learn how to fish at Rice Lake (Figure 11). We also operated our community events tent and GDS education tent for visitors, along with other community organisations such as Go Fish BC, the British Columbia Wildlife Federation (BCWF), local MLA's such as Susie Chant, the Black Bear Society among other attendees. A great day at Rice Lake was had by all attendees.



**FIGURE 11 FAMILY FISHING DAY JUNE 18**

### ***Seymour Hatchery Open House***

We hosted our annual Open House on September 17 to allow the public to visit the hatchery and learn about the work being undertaken at the hatchery (Figure 12). Hatchery tours operated throughout the day and enabled guests to learn more about the Society's enhancement, education, and habitat restoration program. GVWD's Education Team also attended and provided information about the watershed, our drinking water, and the dam. This year's event was an amazing opportunity to come and visit the hatchery and see dedicated conservation in action.

Shuttle buses started running from 10am from Rice Lake gatehouse and left every half hour until 3pm. For those looking to learn more about the dam, there will be a bus stop prior to coming to the hatchery. Some of the festivities include a concession, live music, a fin clipping demonstration, among other community outreach tables such as GVWD, District of North Vancouver (DNV), Jonathan Wilkinson MP, the Pacific Salmon Commission, North Shore Black Bear Society, among others. We were also lucky to have Urban Wood Fired Pizza food truck for sustenance and Backspin Bluegrass band for entertainment.



FIGURE 12 SEYMOUR HATCHERY OPEN HOUSE SEPTEMBETR 17

### ***Firefighters Fishing Derby***

The District of North Vancouver Firefighters, a major financial supporter of our education program, were able to hold their annual Fishing Derby on September 22, and we were able to set-up our community events table for the day at the Lions Gate Marina and attend the weigh in event at the end of the day. The fishing derby was a great success, attended by many boat fishing entries, the significant support and prize donations from local businesses, along with the organisational support from Highwater Tackle. The fishing derby resulted in a significant donation from the District of North Vancouver Firefighters of \$37,000 towards our education program for 2024 (Figure 13).



FIGURE 13 FISHING DERBY WEIGH IN AT LIONS GATE MARINA

### ***World Rivers Day Event***

For World Rivers Day we organised an estuary clean-up and replanting at the river mouth on September 24th. With help from GVWD staff and volunteers from the SSS, we were able to undertake considerable replanting and cleanup work at the Seymour Estuary (Figure 14). A significant amount of invasive plant species was removed and replaced with native shrubs and tree species, while many bags of trash were also removed from the site. We would also like to acknowledge the District of North Vancouver for collecting and disposing of the invasive plants and trash from the day.



**FIGURE 14 WORLD RIVERS DAY AT SEYMOUR ESTUARY SEPTEMBER 24**

### ***Ocean Film Festival***

The Society was a recipient of the inaugural Ocean Film Festival event held at the Centennial Theatre in North Vancouver on November 9<sup>th</sup> (Figure 15). The Ocean Film Festival was created in Australia ten years ago with the aim to inspire the world to explore and enjoy our oceans, protect, and respect them, promote ocean conservation, and unite people to celebrate its wonders. In just ten years, the Film Festival worldwide has hosted nearly 1,000 screenings, with over 300,000 audience members.

The Ocean Film Festival evening included a unique selection of films of varying lengths and styles covering topics such as ocean adventure and exploration, the oceanic environment, marine creatures, ocean related sports, coastal cultures and ocean lovers. It was at the event that the Society had our event table in the foyer to allow us to showcase the vital work we do in the Seymour watershed. The event was sold out, with 600 people attending and enjoying an evening of ocean related films, along with presentations from VIPS, including our President Shaun Hollingsworth. The event was such a success that the festival is being planned again for 2024 and the Society is excited to be involved again.



FIGURE 15 OCEAN FILM FESTIVAL NOVEMBER 9

## Social Media

The SSS continues to operate our website ([www.seymoursalmon.com](http://www.seymoursalmon.com)), with the assistance of Rudy Kehler (The Simplify Company). We are currently in the process of re-designing a new society website, which will include multiple new links on the site to improve the ability to access the donations page, along with education links. We are also hopefully the new site will improve the booking and scheduling arrangement for our education programs. The new website went schedule to go live in February 2023 in time for the Spring GDS registrations.

The SSS also continues to communicate through social media via our Instagram and Facebook internet platforms. The SSS Facebook page has gone from 747 followers in 2018 to over 1,000, while our Instagram site has increased from 256 followers in 2018 to 1,116 followers in 2023. These social media platforms are two effective ways for members of the community to see what we are doing on a weekly basis.

Following a review of our social media presence by BCIT management students (i.e., as part of a student project), we decided to focus more of our social media present attention on our Instagram profile. The change in focus included more regular postings onto Instagram (i.e., one to two posts per week), more postings showing people/volunteers/staff involved in activities (i.e., to show how humans are connected to our activities), along with more hashtags and stakeholder tagging (i.e., # and @ mentions).

## Hatchery Infrastructure Upgrades and Maintenance

We continued our ongoing facility infrastructure and maintenance upgrades during 2023 as summarised in the following sections.

### ***Old Woodshed Removal***

Given that the old woodshed had been used as a bat roost we had been undertaking a program of monitoring following installation of seven bat boxes onto the aeration tower, net shed, workshop and main hatchery buildings. Bats roost in structures like the old woodshed during the spring/summer period, before migrating south during the fall and winter. Once we had confirmed that the bats were using the bat boxes in during spring/summer 2022 we were able to schedule demolishing and removal our old woodshed during February 2023. Removal of the woodshed involved pulling down the old structure and transporting the material to the waste transfer station for wood recycling.

### ***Old Fish Fence Donated and Removed***

Removal of the fish fence was undertaken in late spring 2020 from the lower Seymour River, following a high flow event in February 2020 that damaged the fish fence beyond repair. However, as the structure of the fish fence panels were intact, we stored the old fence at the hatchery in the hopes that another conservation organisation may re-use the structure on another river system. In July 2023 in conjunction with DFO we received a request for the fence from Tsilhqot'in National Government (TNG) as part of their Chinook enhancement program. The Chilcotin River is west of Alexis Creek and Williams Lake. We were glad to donate the old fish fence structure for their use on the Chilcotin River as part of their chinook enhancement. Seymour Hatchery and DFO staff loaded the fish fence panels onto a flatbed trailer, and DFO transported it to the Chilcotin for installation.

### ***Hatchery Office Firebox***

Our old firebox that heats the hatchery office was over 20 years old and required replacement. Thanks to generous funding via the BCSRIF program we successfully purchased and installed a new firebox in preparation for the fall/winter season. Originally the BCSRIF funds were scheduled to be used for upgrades to the hatchery kitchen; however, heating the hatchery office was a higher priority compared to kitchen renovations. The firebox is now operating successfully at the hatchery and keeping the office warm during the winter period.

### ***Welcome Area Aquarium***

Following completion of the new signage and welcome area kiosk at the hatchery in 2022, we began searching for funds to build and install a new aquarium at the welcome area pavilion. We were very grateful for the funds supplied by the Pacific Salmon Foundation for the new aquarium. The aquarium was installed during September 2023 and now contains multiple summer run steelhead and coho fry for view by visitors to the hatchery.

### ***Septic Storage Tank Installation***

The objective of the 2023 work was to install a new 10,000 litre septic storage tank at the Seymour River Hatchery, following funding via the BCSRIF program. The septic tank system engineering design, permitting and purchase of the tank and associated equipment was undertaken during the 2022/23 using funds allocated for the 2022/23 fiscal year. Preparation and submission of the

permit application to Vancouver Coastal Health was undertaken during the 2022/23 fiscal year and received approval in April 2023. Delivery of the septic tank system, site preparation and excavation, installation and connection to the hatchery building was undertaken during the 2023/24 fiscal year and were completed during summer 2023.

### ***Hatchery Building Roof Repairs***

The hatchery building roof renovation involved fixed weather damaged roof cladding, along with installation of snow guards to the roof to prevent further snow damage. We also connected electricity to the ATV garage, so it now has it's on designated circuit.

### ***Starlink Installation***

As part of upgrades to our office computers and website we went through the process of installing Starlink to our system, while removing our old satellite internet connection. Starlink is now operational and provides significantly faster interned speeds for the same cost. In addition, we upgraded our phone system to add Ooma internet phone to our system, which works in conjunction with Starlink.

### ***New All-Terrain Vehicle***

Hatchery staff use an all-terrain vehicle (ATV) is an essential piece of equipment for the hatchery, without which we cannot undertake our activities within the watershed. Unfortunately, our >15-year-old ATV ceased to operate in December 2022, so the Society started fundraising for a replacement ATV for delivery by summer 2023.

We were very fortunate to receive multiple donations to purchase a new ATV for use at the hatchery, including a local corporate sponsor donating \$10,000, along with an additional \$600 in donations from the local community. We were also fortunate to receive approval from the Pacific Salmon Foundation for an emergency fund application during summer for \$10,000 toward a new ATV.

We placed an order for a new Honda Pioneer 520 ATV during June and we picked up the new vehicle and delivered it to the hatchery during August. The final cost for the ATV was \$18,263, (with an additional \$1,990 spent using Society funds attempting to repair (unsuccessfully) our old ATV vehicle).

## Financials

The following sections provide an overview of the funding proposals, revenue and expenditure for the SSS during 2023. Please note that the SSS's fiscal year runs between April 1, 2023 to March 31, 2024.

### Significant 2023 Funding Approvals

Multiple funding proposals were prepared by hatchery staff and submitted for consideration of funding for the hatchery and education centre, along with our conservation activities within the watershed. Successful funding agreements outside of our annual contribution agreements from DFO and GVWD are summarised in the following sections.

#### *BC Salmon Restoration and Innovation Fund (BCSRIF) - Habitat*

The final contract was agreed on July 9, 2020 for funding from the BCSRIF totalling \$76,081 for the 2023/24 fiscal year. These funds are allocated for radio telemetry monitoring, along with other habitat restoration and enhancement activities within the watershed. The SSS completed habitat restoration and enhancement works for 2023, while radio telemetry monitoring work will continue into January 2024. We are grateful to BCSRIF for this significant funding agreement, without which mitigation and monitoring works would not have been possible for the rockslide.

#### *BCSRIF – Hatchery Infrastructure*

The final contract was agreed on July 28, 2021 for funding from the BCSRIF totalling \$34,320 for the 2023/24 fiscal year. These funds are allocated for installation of a new septic storage tank. We completed the septic storage tank installation during summer 2023. The final report for this project has been submitted and no further work or funds are subject to this contract. We are grateful to BCSRIF for this significant funding agreement, without which our hatchery infrastructure repair and improvements would not have been possible.

#### *Pacific Salmon Foundation*

A series of proposals were submitted to the Pacific Salmon Foundation during 2021 and 2023 for production of a new society website (Fall 2021 - \$10,000), construction and installation of a new aquarium for the welcome area kiosk (spring 2022 - \$12,000), roof repairs and office equipment (spring 2023 - \$16,000), along with an emergency application for contribution towards a new ATV for the hatchery (summer 2023 - \$10,000). The proposals were approved shortly thereafter for aforementioned items. We decided to not submit a Fall 2023 funding application to the Pacific Salmon Foundation since we had already been generously funded for the ATV as part of an emergency application.

We are most grateful to the Pacific Salmon Foundation for their significant and ongoing funding support for the Seymour River Hatchery and Education Centre, without which the information signage replacement would not have been possible.

#### *DNV Fire Fighters Charitable Society*

The DNV Firefighters Charitable Society again continue to generously contribute towards our education program, as part of their annual Firefighters Fishing Derby, which was held on September 22, 2023. Funding from the firefighters has been an annual funding contribution and this year the contribution was \$37,000. The SSS have allocated these funds to help operate the

GDS education program and we are most appreciative for this funding support, without which the GDS education program would not be possible.

### *Neptune Terminals*

Neptune Terminals generously contributed \$10,000 towards our community education programs and is a contribution that Neptune have generously provided for over eight years. Funding from the Neptune Terminals is based on a three-year funding contribution for education, without which the GDS education program would not be possible.

### *TELUS Friendly and Future Foundation*

We were successful in our application to TELUS Friendly Future Foundation for funding towards our GDS education program. TELUS Friendly Future Foundation is a Canadian registered charity that believes all youth, regardless of circumstance, deserve an equal opportunity to reach their full potential. The foundation have funded more than 500 charities each year that provide education and health programs, many enabled by technology, TELUS Friendly Future Foundation is helping more than two million youth in communities across Canada build skills, gain confidence and feel a sense of belonging. We are most grateful to TELUS Friendly Future Foundation for the \$20,000 towards our GDS education program, which is instrumental in enabling our program to go ahead in 2024.

### *British Columbia Community Gaming Grants*

We were successful in our application to BC Gaming as part of their Community Gaming Grant Fund, who generously contributed \$15,000 towards our GDS education program for 2024. Funding from BC Gaming will go towards the GDS education program. Without this funding we would not be able to run our education program at the hatchery for elementary school students.

### *Port of Vancouver*

We were successful in our application to the Port of Vancouver for additional \$10,000 that will contribute towards the Seymour Estuary restoration Masterplan project. This was following a generous donation of \$10,000 from PoV during 2022 to also contribute towards the masterplan project. This series of generous funding has enabled the estuary project to move forward.

### *Ocean Film Festival*

We were very excited at the prospect of partnering with the Ocean Film Festival as part of their inaugural event in Canada during November 2023. The Ocean Film Festival Canada showcases exceptional ocean-related cinematic works but also creating positive change in society and raising awareness for environmental issues. As part of our partnership the Ocean Film Festival Canada committed to donate 25% of the festival's ticket sale proceeds directly to the Society. Following a very successful and sold-out event we received a donation of \$2,830 from the Ocean Film Festival to go towards our facility operations and is very much appreciated.

### *Royal Bank of Canada (RBC) Volunteer Day*

We hosted staff from RBC Vancouver at the hatchery and education for a day of volunteering as part of their corporate team building activities. We are most grateful to the group of volunteers from RBC Bank for assisting us fin clip almost 8,000 summer run steelhead during September and were also most grateful for the generous \$1,500 donation to the hatchery operations.



## Seymour Salmonid Society 2022 Revenue

Table 3 provides a summary of the SSS revenue for 2023.

**TABLE 3 SEYMOUR SALMONID SOCIETY OPERATIONS REVENUE 2023**

<b>Funding Partner</b>	<b>Allocations</b>	<b>Funding Amount</b>
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## Seymour Salmonid Society 2023 Expenditures

Table 5 provides a summary of the SSS expenditure for 2023.

**TABLE 5 SEYMOUR RIVER HATCHERY OPERATIONAL EXPENDITURE 2023**

**Expenditure Type**

**Expenditure**

## Looking Forward

The year ahead is expected to be as busy as the last, with the most significant major projects we will be focusing on are as follows:

- **Seymour River Canyon (Rockslide) Monitoring** – snorkel dives during winter 2023/24 and above-water review in spring 2024 following freshet will be undertaken to identify fish passage constraints during all flow conditions
- **Juvenile Coho Salmon and Steelhead Smolt Releases** - juvenile steelhead and coho will continue rearing in the ponds over the winter and released directly to Hurry Creek during spring 2024
- **Juvenile Coho Salmon Fry Releases** – release of coho fry upstream of the dam during spring 2024. However, given the 100 pairs of coho adult released above the dam this season, we anticipate there may be a reduced number of fry released above the dam in 2024 to account for the greater natural fry production in the upper watershed
- **Juvenile Pink and Chum Salmon fry Releases** - The chum and pink salmon fry will also be released to the lower river during spring 2024
- **Adult Carcass Recovery Monitoring** - within the river and tributaries to better understand the number of coho migrating through the rockslide to spawn naturally. We have been undertaken carcass recovery monitoring since October 2023 and aim to complete this work during January 2024. The 2024 monitoring will begin again during October 2024
- **Habitat Restoration Activities** – for existing and new aquatic habitat for both juvenile rearing and adult spawning activities, along with ongoing monitoring of our existing habitat restoration sites to ensure they continue to operate as designed, with some remediation required. DFO are planning to establish a new outlet channel for Hurry Creek habitat area, so that the new outlet channel will be operational in time for the fall 2024 adult returns. In addition, DFO are planning remedial works at the settling pond of Junior Creek inlet channel following storm damage. The existing inlet and outlet channels will continue to operate in the interim, especially to allow outmigration of coho smolt from the habitat area in spring 2023
- **GDS Education Program** – we have secured sufficient funding to operate a spring and fall GDS program in 2024. This will include on-site education days and has been contracted to BCWF to undertake the education program
- **Community Events and Enhancement Program** – we would welcome the ability to host and/or attend community events in 2024 and will continue at least with involvement at the following events: Maplewood Farm chum release, Blueridge Days Festival, Family Fishing Day, Hatchery Open House, the World Rivers Day Estuary Cleanup, Firefighters Fishing Derby and the Ocean Film Festival
- **Ongoing Hatchery Infrastructure Renewal** – to secure the hatchery and education facility for the next generation of community volunteers, elementary school children and fisheries



# 2023 ANNUAL REPORT

*Revitalizing our roots for new growth*

[coquitlamriverwatershed.ca](http://coquitlamriverwatershed.ca)

Coquitlam River  
Watershed Roundtable



*Prepared By*  
Coquitlam River  
Watershed Society

**DRAFT**  
February 16, 2024

## **Our Mission**

*To preserve and enhance the health of the Coquitlam River Watershed through collaboration, education, and advisory action.*



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## EXECUTIVE SUMMARY

2023 set the stage for a new phase of growth for the Coquitlam River Watershed Roundtable.

This year, the Roundtable committed significant effort toward organizational restructuring, resulting in the decision to move forward as a single entity, The Coquitlam River Watershed Society (CRWS).

The transition to a fully integrated Society provides greater organizational transparency and efficiency, paving the way for the Coquitlam River Watershed Society to move confidently forward in 2024.

While the members of the Roundtable devoted a great deal of time, thought and effort to the transition to become a fully integrated Society, we continued to advance projects and activities to implement the Lower Coquitlam River Watershed Plan (LCRWP). The Report on Barriers and Facilitators to Low Impact Development was brought to a successful completion after two years of consultation and development with partners.

Other projects focused on building-up and maintaining existing accomplishments. The Lions Park Demonstration Rain Garden was this year cared for entirely by Roundtable and Community Volunteers.



Roundtable members marshalled watering equipment, water access, and an app to sign up for watering shifts over the summer of 2023. The Roundtable's website and digital media presence was updated and enhanced by removing outdated content and plugins, replicated or un-used social media accounts.

Other accomplishments of 2023 are listed below:

- Undertook a work planning process, identifying achievable goals for 2023 and 2024.
- Hired two new part-time contractors: Jenny Zheng came onboard as an engagement coordinator, Jacqueline Chan came on board as a communications coordinator.
- Completed major upgrades our website's structure, and website content was renewed.
- Aligned identity and links across a variety of social media platforms.
- Initiated an outreach program to local Elementary Schools, beginning with a workshop at Castle Park Elementary in Port Coquitlam.
- Undertook an invasive species pull with Lime Bikes and staff from the City of Coquitlam, helping to remove blackberry from a 20 metre section of the Coquitlam River Trail.
- Created a volunteer sign-up system and engaged members and partners of the Roundtable to water and support the Rain Garden from spring through autumn 2023.
- Undertook a clean-up event with QMC Water metering Inc, removing 15 m<sup>3</sup> of trash from the Coquitlam River in Gates Park, Port Coquitlam.
- Produced a comprehensive research paper on Low Impact Development with participation of municipal partners.
- Held a successful Community Roundtable Event, featuring presentations from six environmental professionals and municipal staff on various aspects of watershed health in the Coquitlam River Watershed.
- Participated in 9 events and public festivals within the Community, including Salmon Day at Colony Farm, organized by Watershed Watch Salmon Society (WWSS).
- Completed the Terms of Reference (TOR) and Society Bylaws Task Force review, resulting in an organizational restructuring to streamline the Coquitlam River Watershed Roundtable as a Society. The Society Board will provide the operational direction for our organization to move forward.

The CRWS also gained new funding through the Fish and Wildlife Compensation Program (FWCP), which provided \$1000 toward our Annual Community Event. Our received funds this year totaled \$106,250, with a carry-over from 2022 of \$21,661. Cash expenditures totaled \$111,132.18. Together with a \$10,000 annual contribution to our contingency fund, there was a carry-over from 2022-2023 of \$6,778.82. Generous in-kind support was contributed in 2023 with 397.0 hours valued at \$10,720.08.

In January, Georgia Ohm moved into a full-time Coordinator role with support from Margaret Birch, who continued to provide support for specific projects, and invaluable advice to the Coordinator. Jenny Zheng was hired as a part-time engagement coordinator to assist with outreach events and school programs. A part-time communications coordinator role was created and filled by Jacqueline Chan, who brought much needed technical expertise to stabilize the CRWS's website, and align social media accounts.

The CRWS' 2023 Annual Community Event, *Vital Signs: Checking our Watershed's Health* received much community interest and support, drawing 41 participants, as well as attention from local media. As the CRWS moves forward into 2024, the accomplishments of 2023 and the years preceding it provide a solid foundation for future growth and development.

## ACKNOWLEDGEMENTS

Through 2023, the Coquitlam River Watershed Roundtable received financial support from the City of Coquitlam, the Greater Vancouver Water District (Metro Vancouver), Kʷikwə́ləm First Nation, the City of Port Coquitlam, Jack Cewe Construction Ltd, Fisheries and Oceans Canada, and the Fish and Wildlife Compensation Program. We wish to thank these organizations for their generous financial support in 2023.



Invaluable in-kind contributions of staff and resources were provided by the following partners:

- City of Coquitlam
- City of Port Coquitlam
- Tri-City Green Council
- Hoy/Scott Watershed Society
- Kʷikwə́ləm First Nation
- Arts Connect
- Allard Contracting Ltd.
- Watershed Watch Salmon Society
- Jack Cewe Construction Ltd.
- Fisheries and Oceans Canada
- Living Resources Environmental Consultants
- Fish and Wildlife Compensation Program
- North Fraser Salmon Assistance Project
- Originelle Designs Photography

Finally, our deep gratitude is extended to the many stewards and volunteers who regularly contributed their time to support the Roundtable's events activities through 2023.

*Thank you!*

# CORE COMMITTEE SECTORS AND REPRESENTATIVES

The Core Committee comprises a team of 19 sector representatives from 13 diverse sectors, all of whom contribute their time in-kind to attend Core Committee and Community Roundtable meetings, sit on sub-committees, and attend outreach events. Without their dedication and collaborative efforts, the Roundtable would not be what it is today. Each member sits on the Core Committee for 18–24-month terms, although many continue for years beyond their tenure. We wish to thank our Core Committee members for their generous contributions of time in 2023.

**Saara Majuri**  
*Vancity*

Industrial



**Isaac Nelson**  
*Fisheries and Oceans Canada*

Federal Government



**Scott Walmsley**  
*City of Port Coquitlam*

Local Government



**Cllr. Nancy McCurrach**  
*City of Port Coquitlam*

Local Government



**Lillian Kan**  
*Colliers International*


Real Estate Dev.



**Katy Jay**  
*BC Hydro*

Utilities

Photo not available



**Sherry Carroll**  
*ArtsConnect*

Arts & Culture



**Jesse Montgomery**  
*Greater Vancouver Water District*

Regional Government



# CORE COMMITTEE SECTORS AND REPRESENTATIVES

Stewardship



**Tony Matahija**

*North Fraser Salmon Assistance Project*

Local Government

**Cllr. Trish Mandewo**

*City of Coquitlam*



Local Government



**Caresse Selk**

*City of Coquitlam*

Industrial



**Kirsten Wilson**

*Jack Cewe*

First Nations Gov.



**Lance Meyers**

*Kw̓ikw̓əl̓á m First Nation*

Stewardship



**Anne Woosnam**

*Hoy-Scott Watershed Society*

Stewardship

**Eve Gauthier**

*Tri-City Green Council*



First Nations Gov.

**Cllr. George Chaffee**

*Kw̓ikw̓əl̓á m First Nation*



Industrial

**Sophie Mullen**

*Lehigh Hansen Materials*



# SOCIETY DIRECTORS

**Kirsten Wilson**  
*Jack Cewe*



Industrial

**Tony Matahija**  
*North Fraser Salmon Assistance Project*



Stewardship

**Eve Gauthier**  
*Tri-City Green Council*




Stewardship

**Jim Allard**  
*Allard Contracting Ltd.*



Industrial

**Caresse Selk**  
*City of Coquitlam*



Local Government

**Saara Majuri**  
*Vancity*



Industrial

**Scott Walmsley**  
*City of Port Coquitlam*



Local Government

**Craig Orr**  
*Kwíkʷaλá m First Nation Staff*



First Nations Gov.

**Lillian Kan**  
*Colliers International*



Real Estate Dev.

# STAFF AND SUPPORT

The following representatives are not members of the Core Committee but provide vital services to the Roundtable.

The Financial Trustee contributes a large portion of their time in-kind to attend meetings and participate in sub-committees.

Financial Trustee

**Dawn Roumieu**

*Watershed Watch  
Salmon Society*



Coordinator



**Georgia Ohm**

*Coquitlam River  
Watershed Roundtable*

Communications

**Jacqueline Chan**

*Coquitlam River  
Watershed Roundtable*



Communications

**Trish Hall**

*Coquitlam River  
Watershed Roundtable*



Project Support



**Margaret Birch**

*Coquitlam River  
Watershed Roundtable*

Engagement

**Jenny Zheng**

*Coquitlam River  
Watershed Roundtable*



# SUB-COMMITTEES

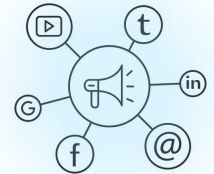


## Resilience and Capacity Building Committee

Cllr. Nancy McCurrach, Cllr. Trish Mandewo, Jesse Montgomery, Caresse Selk, Dawn Roumieu, Kirsten Wilson, Margaret Birch, Georgia Ohm

## Communications Committee

Jenny Tough, Jenny Zheng, Jacqueline Chan, Georgia Ohm

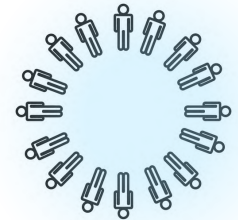


## Development Project Committee

Geoff Nagle, Lilian Kan, Melissa Chaun, Margaret Birch

## Roundtable Public Event Planning Committees

Sherry Carroll, Jenny Zheng, Jacqueline Chan, Margaret Birch, Georgia Ohm



## Stormwater Management Committee

Scott Walmsley, Eve Gauthier, Georgia Ohm

## Roundtable TOR and Society Bylaws Review Task Force

Eve Gauthier, Tony Matahlija, Jim/Dan Allard, Dianne Ramage, Sherry Carroll, Caresse Selk, Kirsten Wilson, Margaret Birch, Georgia Ohm



## Society Board

Lillian Kan, Craig Orr, Scott Walmsley, Caresse Selk, Eve Gauthier, Kirsten Wilson, Jim Allard, Sherry Carrol, Tony Matahalija

## SUBCOMMITTEE MEMBERSHIP



The Terms of Reference and Society Bylaws Task Force put in significant effort this year to steer the Roundtable toward its transition to a fully integrated Society. The committee met once in late 2022, and three times in 2023, contributing approximately 30 volunteer hours. Additionally, much time was spent by the members of this committee in informal discussion, research, and review. This important contribution from many of the Roundtable's active members, including Eve Gauthier, Tony Matahlija, Jim and Dan Allard, Dianne Ramage, Sherry Carroll, Caresse Selk and Kirsten Wilson, comprised the majority of subcommittee work in 2023.



The Resilience and Capacity Building Committee was also very active in maintaining the Roundtable's financial well-being through 2023. Cllr. Nancy McCurrach joined the Committee as Port Coquitlam's representative from Council, and Cllr. Trish Mandewo took over from Cllr. Steve Kim as Coquitlam's City Council representative. Cllr. Nancy McCurrach, Cllr. Trish Mandewo, Jesse Montgomery, Caresse Selk, Dawn Roumieu, Kirsten Wilson participated in this committee through 2023. During the RCBC's final meeting of 2023, it was agreed that Scott Walmsley be invited to join the RCBC as a staff representative of Port Coquitlam.

Stewardship seats remained stable for the most part from 2022 through 2023, though Anne Woosnam took over from Robbin Whachell as the representative from Hoy Scott Watershed Society. With the transition to a Society, there is the possibility of reviewing the membership and structure of the Core Committee in 2024, to broaden participation to other community groups.



In 2023 Georgia Ohm moved from a part-time role into a full-time Coordinator role at 35 hours per week. Her work focused on CRWS operations including meeting administration, coordination and note taking and distribution, hiring additional Roundtable support, communications within the Roundtable and other community partners, coordinating outreach events and applying for and reporting on grants, and completing work plans and the annual report.

Georgia was supported by additional Roundtable contractors who contributed expertise toward more focused initiatives. Margaret Birch remained in a part-time capacity to support the completion of important projects where her background proved uniquely valuable. These included supporting the work of the Terms of Reference and Society Bylaws Task Force, which was aided by Margaret's long history with the Roundtable. With a background with municipalities, Margaret also brought valuable knowledge to support the collaborative development of the Report on Low Impact Development (LIDS), with valuable contributions from the CRWS's municipal partners.

Jenny Zheng was hired as an Engagement Coordinator, bringing experience working with youth and the school system. Over the course of June to November, Jenny developed and presented a workshop for elementary school students on watershed ecosystems, created new activities, posters and social media content, and attended stewardship and outreach events. With other full-time employment, Jenny's schedule was limited, but her warm vibrancy and enthusiasm for watershed health made her a valued part of the CRWS.

In late 2022, several content updates were ready to be loaded to our website. Unfortunately, around that time, the CRWS suffered a malware attack on our website. Despite efforts from staff, including Trish Hall, who has been a supporter and contractor for the Roundtable, as well as New Earth Marketing, the website remained vulnerable to disruption over the course of several months. In May 2023, Jacqueline Chan was hired by the CRWS as a Communications Coordinator. With a B.Sc. in Computer Science, Jacqueline brought much needed expertise, and quickly re-established the stability of our website. She also made significant improvements to our social media presence, aligning social media accounts, developing dedicated email addresses to allow for consistency between staff in these roles. A digital communications manual was developed to assist future staff.

## COQUITLAM RIVER WATERSHED SOCIETY



The Coquitlam River Watershed Society (CRWS) was incorporated on November 2, 2020, under the *BC Societies Act*, enabling the Coquitlam River Watershed Society to access insurance for its members. Over the following two years, the Society Board remained a mostly nominal body, with the Core Committee acting as the decision-making body of the organization.

In November 2022, The Core Committee approved a motion to form “The Terms of Reference and Society Bylaws Task Force”. The Task Force fulfilled a commitment stated in the Roundtable Terms of Reference to conduct an annual review of the Terms of Reference. This also provided an opportunity to review and clarify our organizational structure, which now included a Society.

The Task Force met four times from November 2022 – December 2023. Through this process, research was conducted by members and external advice was sought. Board Governance Coach Hazel Postma worked with the Task Force to provide guidance. Legal advice was provided by Dejager Volkenant Barristers and Solicitors. In September 2023 a legal workshop for all Core Committee members was held with Luke Johnson of Dejager Volkenant Barristers and Solicitors. Through this process Roundtable members received answers to critical legal questions, and develop a shared understanding of the benefits of moving forward as a Society.

Through this work, it became clear that to move forward as a Society would provide greater clarity to Roundtable members and the community at large. Being organized as a Society would also confer legal clarity for our organization, streamline operations and decision-making, and provide a stronger foundation for future growth. In light of these considerations, in December 2023, sector representatives passed a motion that “The Coquitlam River Watershed Roundtable will operate as one entity, which is a Society, and that the Society Board shall provide financial, legal, governance and stewardship knowledge and oversight.”

In 2024, the Society Board will be responsible for completing this transition. An interim board that includes previous Board members, as well as members of the Society Task Force, will establish Board member roles and responsibilities, new bylaws, and recruit new board members. Meanwhile, the Core Committee will continue to offer educational and stewardship opportunities to the community within the Coquitlam River Watershed, facilitate collaboration among its members, and preserve and enhance the health of the Coquitlam River Watershed through the strategies described in the Lower Coquitlam River Watershed Plan.

This year, the Society Directors met once in a dedicated meeting on June 14, 2023. Since all Society Directors were also Core Committee members, information was shared and discussed between Directors at Core Committee meetings as well.

## WATERSHED PLAN IMPLEMENTATION

Through 2023 the Roundtable continued to implement its Lower Coquitlam River Watershed Plan through stewardship activities, educational workshops and displays, and advisory action.



## DEVELOPMENT



The need for new homes and infrastructure to house a growing population continues to drive rapid urban growth. Since 2018, the Development Committee has supported research to reduce the impact of development on the Watershed.

In recognition that development is the top-rated pressure in the Coquitlam River Watershed and affects the highest number of ecosystem and community components in the Watershed, the Development Committee commissioned a paper titled "*The Effects of Urban Development on Watersheds, and Low Impact Development Strategies*". This paper, finalized in 2021, reviews green infrastructure opportunities for consideration by municipalities and the development community.

In summer 2022 a new research study focused on Low Impact Development (LID). The study followed a definition of LID as the "systems and practices that use or mimic natural processes that result in infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated habitat."

The Roundtable contracted researchers at UBC's Centre for Law and the Environment, Dr. Stepan Wood, and graduate law student Paul Johnson. Initially, the researchers were contracted to review the techniques and related building codes, bylaws, policies, and regulations and other publicly available documents that were provided by the Development Committee.

Through 2023, as drafts of the document were shared with municipal staff at the cities of Coquitlam and Port Coquitlam, the scope and timeline of this project was extended to include a comprehensive review of the many municipal documents that address LID. The resulting research paper demonstrates that both cities generally favour Low Impact Development, and each include numerous provisions that support LID explicitly and implicitly. There were no fundamental barriers to LID. As quoted by the authors, "...local government laws and regulations do not prevent the two cities from making LID an integral part of land use planning and development." Further, there were many opportunities identified, big and small, that could make the current framework of local bylaws and regulations more supportive of LID.


The Report is currently being finalized, and funding is being sought to share its findings with members of the public and the Development Community in 2024. Late in 2023, the Province of BC passed Bill 44, which allows for multi-unit construction on previously single-family lots, and Bill 47, which sets minimum standards for increased zoning around transit hubs. As the CRWS moves forward with presenting the report in 2024, it will seek and opportunity to review the impact that these Bills will have on the LIDS laws and regulations reviewed in the Report.




## STORMWATER MANAGEMENT

In 2021, as an initiative of the Stormwater Committee, a demonstration rain garden was installed in Lions Park, Port Coquitlam. With support from Vancity, the Kʷikwə́łəm First Nation, and Jack Cewe Construction, CRWS volunteers placed soils, mulch, and young plants adjacent to a Field House, demonstrating the ability of rain gardens to absorb and filter excess stormwater run-off.

Stormwater is another high-rated pressure in the watershed. As surface water runs off the built environment, foreign and excess material is introduced, degrading water quality and aquatic habitats. With increased frequency and intensity of Climate Change related storms, flooding and associated erosion increase damage to riparian areas and streambeds.

Since 80%  the land in the Coquitlam River watershed is privately owned, there is significant potential for stormwater reduction through retention and diversion on private property. The demonstration rain garden is meant to encourage private property owners to take steps on their land to reduce stormwater runoff.

Through 2022, The rain garden was maintained and cared for with the help of the Parks staff from the City of Port Coquitlam. A salmon sculpture, donated by Fisheries and Oceans staff was added to the Rain Garden. An interpretive sign were created with help from staff from City of  Port Coquitlam.

In 2023, Rain Garden care and maintenance was carried out by dedicated Roundtable and Community volunteers. Members of the Stormwater Committee, particularly Eve Gauthier, worked with the city's Environmental Coordinator, Scott Walmsley to establish a water source and install a garden box with on-site watering equipment at the rain garden. The Stormwater Committee also created an app to allow volunteers to sign up for watering shifts. An instructional video on the app helped volunteers access equipment, water the Garden thoroughly, and store equipment correctly. Over the summer of 2023, eight volunteers from the community and the Roundtable contributed a total of 40 hours of volunteer time to care for the Garden.

## ANTI-LITTERING AND DUMPING



Litter and illegal dumping along waterways put pressure on the health of the watershed by introducing contaminants to waterways.

Conflict with wildlife also increases as animals are attracted to eat garbage. Wildlife entering urban areas in search of garbage may suffer health impacts of consuming garbage or be trapped and in some cases killed.

This year, the Coquitlam River Watershed Society worked with QMC Metering Solutions, a water metering company, to clean-up a riverside section of Gates Park in Port Coquitlam. In August, eleven staff from the QMC joined CRWS staff for a morning clean-up lasting 2.5 hours. Participants removed approximately 15m<sup>3</sup> of garbage from the riverside. Staff from the City of Port Coquitlam assisted with the removal of collected garbage.

## INVASIVE SPECIES



Invasive species are identified as a high-pressure affecting Watershed Health. Many non-native and invasive plants have shallow root systems, which can lead to greater bank and shoreline instability. With increased erosion, the amount of sediment and pollutants carried into our waterways also increases, leading to poorer water quality. Other plants simply out-compete native species that can be beneficial to wildlife and the ecosystem.

In July 2023, Roundtable staff joined staff from the City of Coquitlam, and volunteers from Lime Bikes Micromobility to remove invasive Himalayan blackberry from a 30 - metre section of the Coquitlam River Trail near Gabriola Drive in Coquitlam. Five volunteers from Lime Bikes worked for two hours, removing blackberries by the root, allowing City of Coquitlam staff to subsequently re-plant the area with native species.

## EDUCATION AND OUTREACH



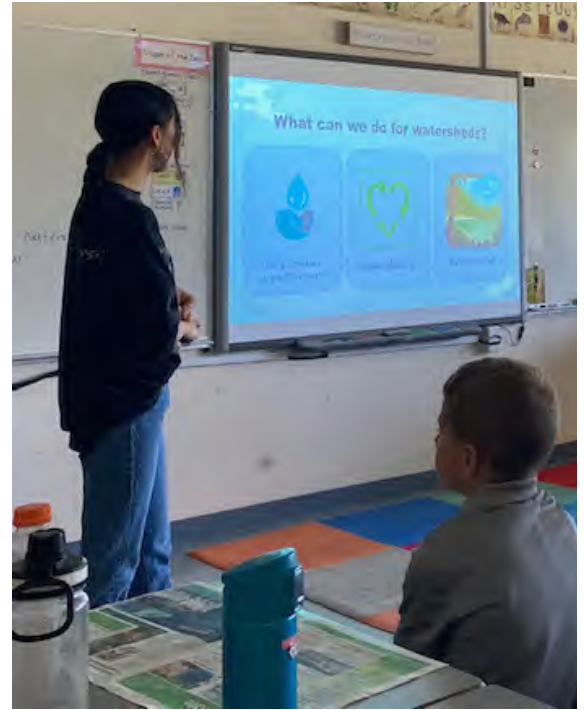
Education and Outreach are strategies that address the pressure of Mainstream Cultural Norms, rated in the Lower Coquitlam River Watershed Plan as a medium-level pressure on the watershed.

This pressure results from disconnection and a lack of understanding of the value of local ecosystem services provided to people by local natural resources. The stresses caused by mainstream cultural norms include apathy, decreased stewardship, lack of environmental knowledge and awareness, and lack of a sense of place or connection with nature.

A number of events and activities were undertaken in 2023 to promote understanding and appreciation of the Coquitlam River watershed.

## Outreach to Schools

In early 2023, school teacher Michelle Oulette at Castle Park Elementary reached out to the CRWS to share art made by her Grade 2/3 students to raise awareness about the disturbance to salmon redds and habitat that off-leash dogs in the river presented. In recognition of the effort and concern shown by Mrs. Oulette and her students, the CRWS's Jenny Zheng created a presentation on the Coquitlam River Watershed, from headwaters to the ocean.



## Outreach at Festivals and Events

Through participation at Festivals and Events, the CRWS reaches many residents and community members who have varying levels of awareness about the watershed and its value. This year, the Coquitlam River Watershed Roundtable maintained a booth with information and activities at



Salmon Leave Home, at the Hoy Creek Hatchery in Coquitlam, Canada Day at Coquitlam's Town Centre Park, Salmon Day at ʕéxətəm (tla-hut-um) Regional Park (formerly Colony Farm Regional Park) in Port Coquitlam, and Salmon Come Home Day at Hoy Creek Hatchery. Visitors to the CRWS table can also view a banner-sized map of the watershed, and discuss any concerns or questions with CRWS staff and volunteers and participate in educational activities.

Visitors to the CRWS table were invited to play a guessing game about salmon habitat. The new game, created by staff member Jenny Zheng, invited participants to consider the threats and barriers faced by salmon attempting to access spawning habitat in the Coquitlam River.

# ROUNDTABLE COMMUNITY EVENT



The Roundtable’s 2023 Community Event this year was titled “Vital Signs: Checking our Watershed’s Health”. The theme of the event was inspired by the many questions that were heard by CRWS staff during public events and over email. Questions such as, “How are the fish?”, and “How much is the drought affecting water levels?” are evidence that many community members are concerned and curious about their watershed.



The meeting featured short presentations on key ecological aspects of the Coquitlam River Watershed, offering participants insight into the natural systems that sustain our community. Featured presentations included:

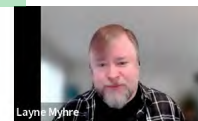
- ***Coquitlam River Water Quality Monitoring***, Angela Yeung, Environmental Services Projects Specialist, City of Coquitlam
- ***Trends in Adult Salmon Returns to the kwikwə́łəm River***, Jason McNair, Principal, Living Resources Environmental Consultants
- ***kwikə́wə́łəm (Coquitlam) Sockeye Restoration***, Rodney Lee, Project Coordinator, leading Coquitlam River Sockeye Restoration on behalf of the Kwikwə́łəm First Nation
- ***Challenges and Opportunities in Managing Our Urban Forest***, Erin Gorby, Urban Forestry and Parks Services Manager, City of Coquitlam
- ***City of Coquitlam's Climate Action Plan***, Laura Sampliner, Environmental Sustainability Manager, City of Coquitlam
- ***Making Maple Creek Fish Friendly***, Theo Mahdi, Engineering and Public Works, City of Port Coquitlam

Following presentations, the audience and speakers engaged through a short Q&A panel discussion. Seven tables from local community organizations, offered additional opportunities for participants to learn through conversation and educational resources.

The meeting was very well attended, with 41 participants. This represents a 65% increase in attendance from the Roundtable's 2022 Community Event. Of those attending in 2023, 25 were not regular members of the CRWS.

Strong promotion of the event via community news, posters, and social media may help to explain the increase in attendees in 2023. The Tri-City News published a story about the event, and social media postings were shared widely among our partners.

Minutes of the event, with links to each of the presentations are available on our website and here: [Click here to access meeting minutes](#)



# Watershed Monitoring in the Coquitlam River

Monitoring Toxicology and eDNA in Partnership with the kʷikʷəłəm First Nation



Meetings between partner organizations is critical to achieving the collaborative governance mission of the Roundtable. Presentations from Community Partners to the Core Committee during meetings included:

- Metro Vancouver: A Brief Glacial History And Geomorphology Of The Coquitlam River Watershed
- BC Watershed Security Coalition: Presentation on the Provincial Watershed Security Fund
- Zachary Sherker, PhD Candidate at Pacific Salmon Ecology & Conservation Lab at University of British Columbia: Fish Friendly Flood Infrastructure
- Layne Myhre, Ph.D., Co-Chair, Dept. of Biology, Kwantlen Polytechnic University: Watershed Monitoring in the Coquitlam River: Monitoring Toxicology and eDNA in Partnership with the kʷikʷəłəm First Nation.

Early in 2023, the Core Committee gathered for a half-day strategic work planning session. Members considered how we have implemented the three pillars of our mission: Collaboration, Education and Advisory Action, and how we might build upon these achievements in 2023 and beyond. The operational and administrative requirements of the organization were considered, as were the goals set out in the Lower Coquitlam River Watershed Plan. A SWOT analysis, to consider strengths, weaknesses, opportunities and threats was also undertaken. Several themes emerged during the Work Planning Session:

- Collaboration is one of the unique strengths of the Roundtable. Strengthening our relationships with our partners, particularly the Kʷikwə́łəm First Nation, was identified as a top priority for the Roundtable.
- The value of aligning our research projects and priorities with those of our partners was highlighted.
- There was a call to hire an engagement coordinator to assist the Roundtable to take a more coordinated programmatic approach to outreach and education efforts.

Following from the priorities that were identified, significant efforts were made to connect with our KFN partners, including written requests for documents outlining KFN project priorities, and offers to visit the Band Office, or schedule an on-line meeting. During the early part of the year, many competing demands on staff time proved a challenge to meeting this goal, but in the latter half of 2023, the KFN staff have been able to attend Core Committee meetings to contribute to setting plans and priorities for the CRWS.

Over the course of the year, the CRWS continued to provide letters of the support to the KFN for projects including:

- Support for the Renovation of a Designated Community Space for Kʷikwə́łəm Artistic Creation and Mentorship
- Support for Reeve Slough Salmon Habitat Reconnection Project
- Support for Trail Upgrades and Placement of Cultural Signage and Kiosks at Á́éxətəm Regional Park
- Support for Dike Improvements and Flood Prevention Measures along the Coquitlam River and the Fraser River

A letter of support was also provided to Layne Myhre of Kwantlen Polytechnic University in support of pilot project in partnership with the KFN to study Coquitlam River salmon and salmon pathogen eDNA.

On July 4, 2023, the Coordinator, Georgia Ohm delivered a Delegation Presentation to City of Port Coquitlam Council-in-Committee to share accomplishments of 2022 and renew our request for funding. The presentation was favorably received, the City of Port Coquitlam continues to be an active partner, informing and guiding the efforts of the CRWS through its representatives, Cllr Nancy McCurrach and Scott Walmsley. Late in 2023, Theo Mahdi, Civil Engineering Technologist from the City of Port Coquitlam joined the Core Committee and shared encouragement and information in support of proposed projects for 2024.



## WEBSITE AND COMMUNICATIONS

In late 2022, several content updates were ready to be loaded to our website. Unfortunately, around that time, the CRWS suffered a malware attack on our website. Despite efforts from staff and New Earth Marketing, the website remained vulnerable to disruption over the course of several months.

In May 2023, Jacqueline Chan was hired by the CRWS as a Communications Coordinator. With a B.Sc. in Computer Science, Jacqueline brought much needed expertise, and quickly re-established the stability of our website. She also made significant improvements to our social media presence, aligning social media accounts, developing dedicated email addresses to allow for consistency between staff in these roles. A digital communications manual was developed to assist future staff.

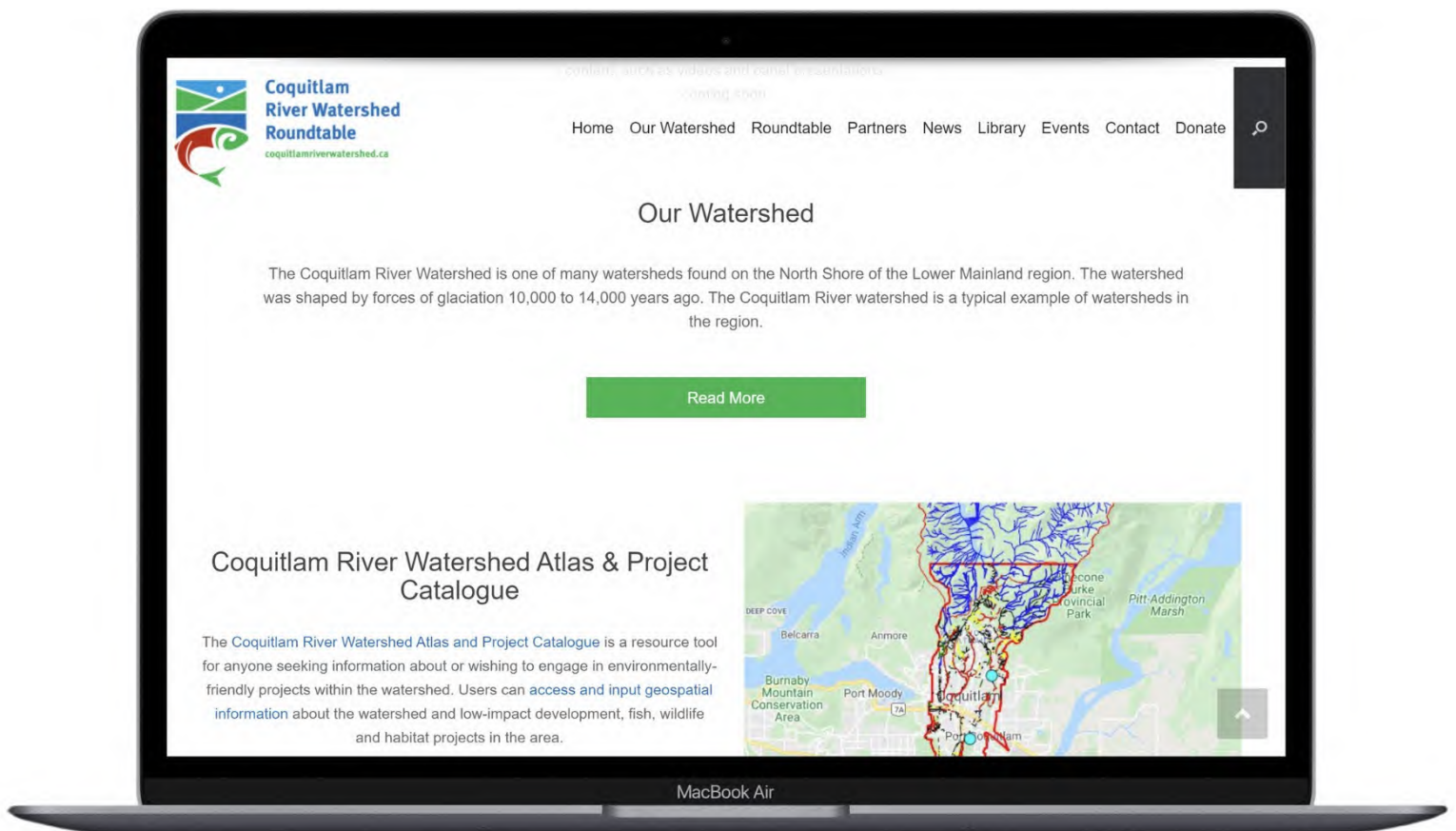
### Website

Significant enhancements to website stability were made throughout 2023, including:

- Updating WordPress plugins and resolving conflicting installations.
- Verified the status of the Basic SSL certificate to ensure secure connections through HTTPS, providing encryption for transferred website information.
- Resolved split email delivery issues in Bluehost, preventing email redirection problems.
- Addressed firewall issues and cache settings to assist consistency in page loading times and display.
- Conducted a review of website backups, ensuring proper storage and maintenance of data.
- Consistency and stability across different devices were improved.

Recent Changes to Google’s analytics and user tracking have been made over the course of 2023. The changes preclude a meaningful comparison between analytics generated in 2022 to 2023. That said, there were several noteworthy trends in website usage over 2023.

- Total users of website declined from 6,916 in 2022 to 3,900 in 2023. This is consistent with a general downward trend in website users since 2022.
- There is a consistent trend toward new users to the site with 87.5 % in 2022 and 97% in 2023. The way that Google determines a “new user” continues to be adjusted. In most cases a user signing on from a different device will appear as a new user. Typically a new user is defined as a device which has not accessed the webpage within the last 2 years.



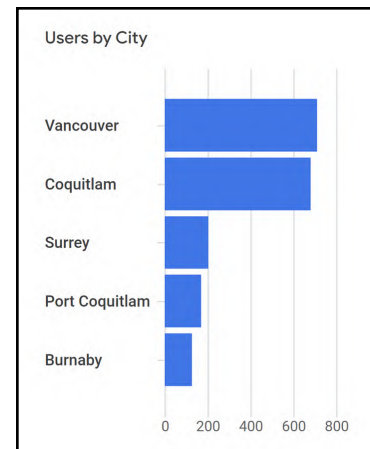
Page path and screen class	↓ Views	Users	Views per user	Average engagement time
	6,556 100% of total	3,146 100% of total	2.08 Avg 0%	44s Avg 0%
1 /	2,223	1,629	1.36	16s
2 /coquitlam-lake-dam/	386	310	1.25	46s
3 /kwikwetlem-first-nation/	343	224	1.53	56s
4 /hatcheries-habitats/	232	173	1.34	43s
5 /history/	191	143	1.34	57s
6 /location/	162	119	1.36	38s
7 /our-watershed/	157	121	1.30	42s
8 /roundtable/meetings-and-agendas/	138	50	2.76	1m 16s
9 /orthomaps/	136	102	1.33	31s
10 /roundtable/	121	70	1.73	31s

Despite the apparent drop in website users in 2023, there were 2,647 more visits to the Home Page, an increase of 119% over the previous year. This may be explained by the following factors:

- Website re-design made access across different devices more user-friendly.
- The 'Meetings and Agendas' page exhibits a noteworthy average engagement time, surpassing one minute. This page seems to be revisited by visitors, as evidenced by the highest views per user across the website, standing at 4.96 views per user. This observation underscores the page's role as a resource database, drawing repeated user engagement and interaction.
- This year, there were 53 file downloads (amongst 36 total users). That represents a significant increase compared to 26 downloads last year (amongst 20 total users).

Although CRWR primarily hosts events in the Coquitlam / Port Coquitlam area, the organization appears to be gaining traction outside of the Tri-Cities as well. As shown above – many users are from the City of Vancouver. Viewership is also received in Burnaby and Surrey, both of which are included in the top 5 cities with the most CRWR website traffic.

Although CRWR primarily hosts events in the Coquitlam / Port Coquitlam area, the organization appears to be gaining traction outside of the Tri-Cities as well. As shown via [Users by city.png](#) – many users are from the City of Vancouver. Viewership is also received in Burnaby and Surrey, both of which are included in the top 5 cities with the most CRWR website traffic.



## Social Media

Social Media trends established in 2021 have continued through 2022 and 2023:

- Women tend to lead men slightly in overall use and engagement across both Facebook and Instagram.
- Over the past year, both Facebook and Instagram visits have grown in number. However, Facebook grew substantially more (174%, compared to Instagram’s 69%).
- Instagram followers increased from 673 in 2022 to 760 in 2023.
- Facebook shows a strong increase in use, with 1068 users in 2023.
- Content that had the highest engagement across both platforms was content that was associated with partner organizations (for example, events organized by municipalities or stewardship groups). Calls-to-action, such as requests to register for an event, also appear to have a positive correlation with user engagement.

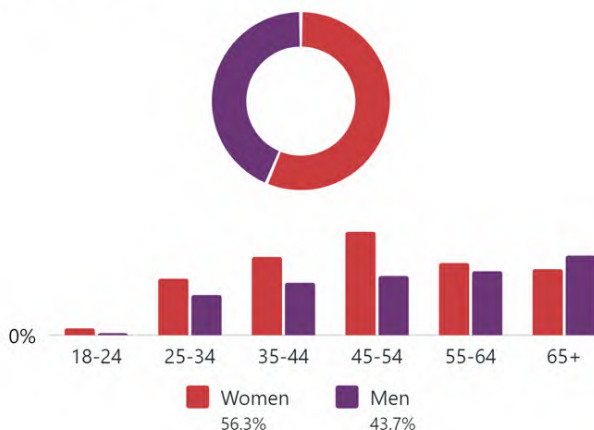
Facebook followers ⓘ

1,068

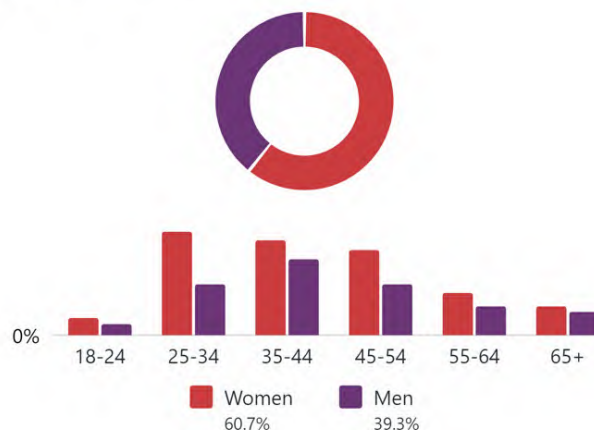
Instagram followers ⓘ

760

Age & gender ⓘ




Age & gender ⓘ



# Print Communications

This year, one Summer Backgrounder was produced, and our print communications were scaled back. Following advice expressed by Core Committee members at the Work Planning session early in 2023, less effort was placed on producing print publications this year in order to reduce cost and environmental impact, and focus on on-line communications.


Given the increasing use of social media to access information about the CRWS, it was felt that this was a more effective means communication tool than print.



## Coquitlam River Watershed Roundtable

Summer 2023

*Kwikwetlem, known as “Red fish up the river.”  
A living river that reveals its spirit.*



### The Coquitlam River Watershed Roundtable

The Coquitlam River Watershed Roundtable was founded in 2011 following a four-year community engagement process. During this development period, individuals and organizations representing a broad range of perspectives on the watershed came together to develop a solid foundation for the Roundtable, including developing a mission statement, values and guiding principles for the Roundtable.

The Roundtable coordinates and implements activities that promote the health and long-term sustainability of the watershed.

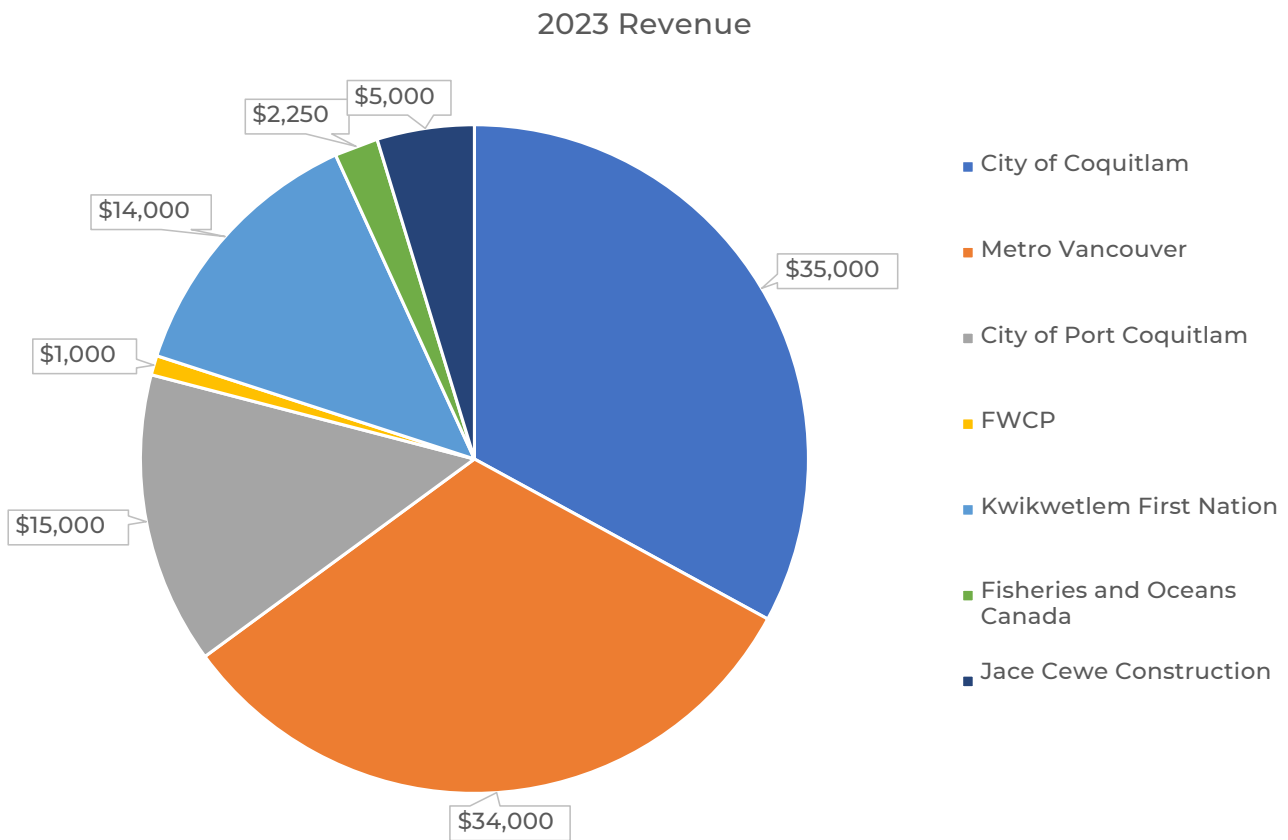
Anyone who supports the Roundtable’s mission can participate in Roundtable meetings, which are held once or twice a year. A multi-sector Core Committee, whose members represent the diverse sectors of interest in the watershed, meet on a regular basis to carry out the work of the Roundtable. Sectors represented on the Core Committee include municipal, provincial, regional and federal governments, First Nations elected officials and staff, industrial, arts and culture, education, community, real estate development and stewardship groups.

# FINACIALS AND IN-KIND CONTRIBUTIONS

The Roundtable’s success relies heavily on the generous contributions of time, staff resources and venue, event, and refreshment supplies. In-kind contributions for 2023 were valued at \$10,882.08. This figure includes approximately 403.0 Hours of volunteer time, contributed from Roundtable Members, staff from partner organizations, and community members. Stewardship activities including care and maintenance of the Rain Garden, the Community Roundtable Event, and regular Core Committee meetings were all areas that received significant support from volunteers.

## Revenue

In 2023, the Roundtable received \$106,250.

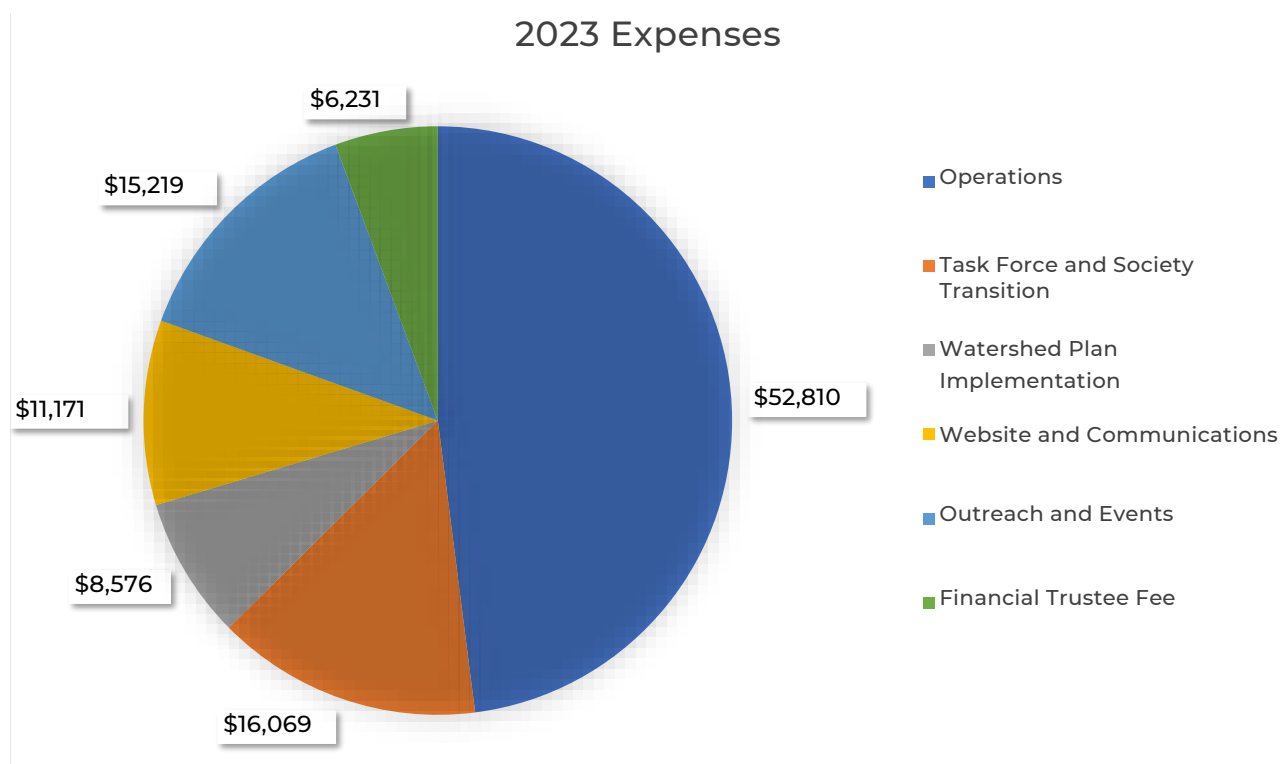


There was a slight decrease from the 2022's committed revenue of \$113,683. The discrepancy is due in part to the lack of support from the Government of Canada Summer Jobs Program in 2023. New funding, however, was received in 2023 from the Fish and Wildlife Compensation Program.

Since 2020, \$10,000 has been contributed annually to a contingency fund. The fund now has a balance of \$40,000.

## Expenditures

In 2023, the Roundtable's cash expenditures totalled \$111,132.18. When combined with in-kind contributions of 10,882.08 the organization's operating costs totalled 122,014.26.



At \$52,810, operations and administration comprised the largest proportion of total expenditures. This included costs associated with Core Committee and RCBC meetings, report writing and funding applications, software subscriptions, insurance, the storage locker and photography and other minor expenses. Wages included in this category totalled \$47,610.00.

The work of the Terms of Reference and Society Bylaws Task Force totalled \$16,069.00 in 2023. This category included Legal Fees, totalling \$4,256.00. This category also includes any associated costs of the Society, such as filing charges associated with the BC Societies Registry or meeting expenses. Wages in this category totalled \$11,171.00.

Outreach and Events totalled \$15,219.00. The Annual Community Event represents a significant proportion of this total, at \$8,041.37. Other outreach events, as well as a workshop at Castle Park Elementary were included in this category. Wages associated with Outreach and Events totalled \$14,221.

Watershed Plan Implementation costs included work on Development, Stormwater, Invasive Species, and Anti-littering. Any honoraria or fees associated with the LIDS report were paid in 2022, and so wages contributed the largest portion toward Watershed Plan Implementation at \$8,039.04.

With the significant effort and achievements to stabilize and updated our website, and streamline the CRWS' social media, website and communications expenditures totalled \$11,171.00. While this total includes service fees for New Earth Marketing, wages contribute \$10,541.00.

While 2023 experienced a slight decrease in revenue and an increase in expenditures from 2022, the CRWS nonetheless enters 2024 with a modest carry-over of \$6,779.00. The CRWS maintained its annual contribution of \$10,000 to the contingency fund, which now stands at \$40,000.

Early this year, a revised the Financial Trustee Agreement was finalized with Watershed Watch Salmon Society (WWSS). The services provided by WWSS include holding CRWS funds in trust, record-keeping, payment of invoices, and communication regarding finances with the CRWS coordinator. In 2023, the administrative fee for these services totalled \$6,231, representing 6% of CRWS revenue. 2023's fee is slightly higher than in 2022, owing to an attempt to balance more modest fees that were paid out using a different calculation from 2020 - 2022.

Going forward, WWSS' financial trustee fee will stabilize at 5% of CRWS revenue through 2026. This represents a modest charge, generally below industry average. It is worth noting the significant improvements in financial tracking and communication achieved by WWSS' staff over 2023 have contributed to greater financial clarity for the CRWS. The service is much valued by CRWS staff and members, and WWSS has provided assurance of continued willingness to support the CRWS.

## YEAR IN REVIEW

2023 was a year to resolve several of the more complex questions that the Roundtable has faced in recent years.

While our organization had chosen to become a Society in 2020, the implications of this choice were not apparent or deeply considered at the time. At the outset of 2023, the Roundtable continued to function as it had since its inception in 2011, as an informal association of individuals who came together around a common cause.

As the Terms of Reference and Society Bylaws Task Force embarked on their assignment in late 2022 to provide a report and recommendation on our Society status to the Core Committee, they began with only a vague expectation of the process and outcomes associated with integrating the established structure of the Roundtable with the structure of a Society. The meetings, staff time, informal discussions, research, legal review, and consultation with external experts, that were required to progress strategically represented a significant commitment of time and thought.

The Roundtable has chosen a path forward that will lead to a clearer organizational structure, more direct oversight, and a more streamlined organizational structure that will benefit our members and community supporters.

Similarly, in 2023, the Roundtable was able to establish a stronger basis for continued and consistent digital communications. Transition of staff and volunteers over the course of a decade had resulted in inconsistencies, dis-used social media accounts, and a website in need of significant structural updates. With accounts aligned, an updated website, and an up-to-date digital communications manual, the Roundtable has the pieces in place to maximize the reach and effectiveness of our communications going forward.

While few new projects were initiated in 2023, the CRWS continued to support and complete several in-progress projects. The rain garden in Lions Park was given the care and attention needed to keep it thriving through summer 2023. The technical research report on Low Impact Development received significant time and consideration from our municipal partners, CRWS staff and contractors. With the completion of the report, the CRWS has a thorough review of bylaws affecting LIDS that can assist developers, City staff, and the public, in enacting and supporting Low Impact Development in the Watershed. Meanwhile, throughout 2023, we continued to build new partnerships through stewardship and educational outreach, and nurtured collaborative partnerships among the member representatives and organizations within the CRWS.



## MOVING FORWARD

The accomplishments of 2023 have cleared a path forward for 2024. The CRWS can advance with clarity of our organization's structure and legal status. However, there remains much work to be done to complete the transition. An interim board will need to create a new set of bylaws, clarify directors' roles, and recruit new members to our Board. Further, some established practices will need to be adjusted. Core Committee meetings will be split into informational Community meetings and Society Board meetings. Adjusting to new practices and roles will take some time and attention.

As we continue to grow into our Society over the coming year, advancing our Lower Coquitlam River Watershed Plan through projects will remain our focus and priority. At the time of writing this report, strategic planning for 2024 is underway, and funding is being sought for several proposed projects.

An application has been submitted for funding to hire a videographer through Canada Summer Jobs. This would allow us to continue to add to our collection of educational videos that provide up-to-date and easily accessible information about the Watershed to the community. Enhancements to our website and social media will allow us to communicate more efficiently and effectively with our members and the community.

With the Low Impact Development Report Complete, we hope to maximize its value to the development community and the broader community through a workshop that will introduce participants to key regulatory documents governing development in the Watershed, and establish a stronger understanding and appreciation for available approaches to Low Impact Development approaches that can be implemented by developers and homeowners.

In the early years of the Roundtable, several bus tours throughout the watershed proved an effective means to build shared understanding and collaboration between the diverse perspectives that were brought to the Roundtable. As we move forward with a new structure, there have been calls from members to host a bus tour once again through the Lower Coquitlam Watershed and into the Upper Watershed. This event would be open to new community partners and supporters, and build strong watershed awareness among participants.

With snowpack at record low levels in early 2024, the coming year will likely bring further drought. The Coquitlam River Watershed Society will continue to seek ways to respond to the increasing pressure of drought on the watershed, and share knowledge and recommendations to the community for an ecosystems-based approach to drought.

The CRWS was pleased this year to be able to offer a Watershed presentation and activity at Castle Park Elementary. Reaching out to students continues to be a priority. In 2024, the CRWS will look to working with agencies such as Green Bricks that develop and deliver school programs that meet curricula objectives and are effectively aligned with school system priorities. We hope again to hire an Outreach Coordinator who can facilitate collaboration to have Coquitlam River watershed content delivered in schools.

We will continue to prioritize strengthening our partnerships. In early 2024, the CRWS Coordinator has already presented to Coquitlam City Council to provide an update on our activities over the past year, and our organizational transition. The ongoing participation of our partner organizations through their representatives on the Society Board, Core Committee and sub-committees ensures that our organization will continue to collaborate with its members effectively. The Kwikwā'əm First Nation remains one of the CRWS's most long-standing and supportive partners. Continuing to find ways to align and collaborate with the KFN without over stretching their limited time and staff remains a top consideration in the operations of the CRWS.

The Roundtable would like to express its deepest gratitude to all partners, volunteers, and contributors for their ongoing support. The diversity of our partners across multiple sectors provides a solid foundation for the Roundtable. We look forward to working with all our partners and supporters for years to come.



## Coquitlam River Watershed Map

Points of Interest, Invasive Plant Hot Spots  
& Fish Habitat/Enhancement Sites



Coquitlam River  
Watershed Roundtable  
coquitlamriverwatershed.ca



### Contact Us! Get Involved!



info@coquitlamriverwatershed.ca  
coquitlamriverwatershed.ca



Coquitlam  
River Watershed  
Roundtable

Visit us at our website:  
coquitlamriverwatershed.ca

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To: Water Committee

From: Vanessa Anthony, Director, Policy, Planning and Analysis, Water Services

Date: March 25, 2024 Meeting Date: April 3, 2024

Subject: **Drinking Water Conservation Plan: 2023 Summer Support Program Update**

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### **RECOMMENDATION**

That the Water Committee receive for information the report dated March 25, 2024, titled "Drinking Water Conservation Plan: 2023 Summer Support Program Update".

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### **EXECUTIVE SUMMARY**

The Drinking Water Conservation Plan (DWCP) Summer Support Program (the Program), first implemented in 2022, was offered again in 2023 to assist member jurisdictions with the promotion and monitoring of regional lawn watering restrictions, and it will be implemented again in 2024 to interested member jurisdictions.

In 2023, the 11 participating member jurisdictions found the Program beneficial in complementing their existing education and enforcement programs. Program findings, including automatic versus manual watering observations and relationships between non-compliance and time of day, can be useful in developing or refining members' education and enforcement programs.

Metro Vancouver will continue working proactively to promote water conservation through public education while supporting the local enforcement efforts of members. Robust enforcement is key to managing the increased demand on the drinking water system in summer, which is driven by outdoor use. Members are encouraged to continue using the learnings from the Program to build and expand their water conservation education and enforcement programs, as opposed to relying solely on this Program.

### **PURPOSE**

The purpose of this report is to provide background on and summarize the outcomes of the 2023 Program, and to provide an update on the anticipated 2024 Program.

### **BACKGROUND**

Metro Vancouver's DWCP is a regional policy developed with member jurisdictions and other stakeholders to manage the use of drinking water during periods of high demand and during periods of water shortages and emergencies. The DWCP was last updated in November 2021, and all members adopted the changes into bylaws for implementation and enforcement in 2022. Metro Vancouver developed and funded this Program to support members in promoting and monitoring the amended lawn watering restrictions of the updated DWCP. The Program was offered again in 2023, and this transpired to be especially important that year as the region saw the activation of Stage 2 watering restrictions, which bans lawn watering, for the first time since 2015.

## 2023 PROGRAM OVERVIEW

A call for participation was sent to all member jurisdictions and resulted in 11 members participating in the Program, each defining the areas within their jurisdiction to which the Program was focused. Program staff monitored these areas on weekdays, when residential lawn watering is not permitted, and provided relevant regional communication campaign materials to households showing signs of non-compliant lawn watering in an attempt to bring them into compliance through targeted education. The addresses and evidential details were sent to member jurisdictions for follow-up. Program staff did not conduct enforcement activities such as ticketing, that is the responsibility of member jurisdictions.

Enforcement is critical in identifying and addressing non-compliance, and early morning spikes in Metro Vancouver's regional demand data indicate that early morning monitoring would be needed for improved detection and subsequent enforcement. While the Program was in place to support member jurisdictions, they are encouraged to increase their own monitoring, education, and enforcement efforts. The Program offers only monitoring and targeted education; it is not an enforcement program.

## 2023 PROGRAM OUTCOMES

Three key trends and observations were identified from results for participating members that can inform all members' future education and enforcement initiatives:

- The observed non-compliant automatic versus manual lawn watering demonstrates how residents' watering practices vary significantly between jurisdictions (see Figure 1)
- Non-compliant manual watering is more prevalent than non-compliant automatic watering later in the morning and during the evenings, whereas non-compliant automatic watering is more prevalent in the early morning (see Figure 2)
- Increased non-compliant lawn watering is observed with higher temperatures and decreased rainfall, as expected

Together with the data trends and observations from members' bylaw teams, these observations can inform changes to members' education and enforcement logistics and scheduling. For example, if automatic watering is prevalent in a local community, patrolling could be more effective in the early morning hours.

Data from 10 participating members showed that only one member followed up on all the potential non-compliances detected by Program staff while other members followed up on 0 to 61 per cent of potential non-compliances detected. In total, approximately 33 per cent of potential non-compliances were followed up on. Of those follow-ups, 47 per cent achieved confirmed or probable compliance, 2 per cent were suspected of continuing their non-compliant lawn watering, and 51 per cent of outcomes were unknown or unreported. These results show that follow-up strategies executed by local bylaw enforcement can prompt residents to comply with regulations and bylaws. Note that the level of detail provided by members concerning enforcement follow-ups varied substantially. Follow-up by members and the provision of related data for non-compliances observed by Program staff has been communicated as a condition for those participating in 2024.

**Non-Compliant Lawn Watering Analysis for Participating Members: Automatic vs Manual Watering**

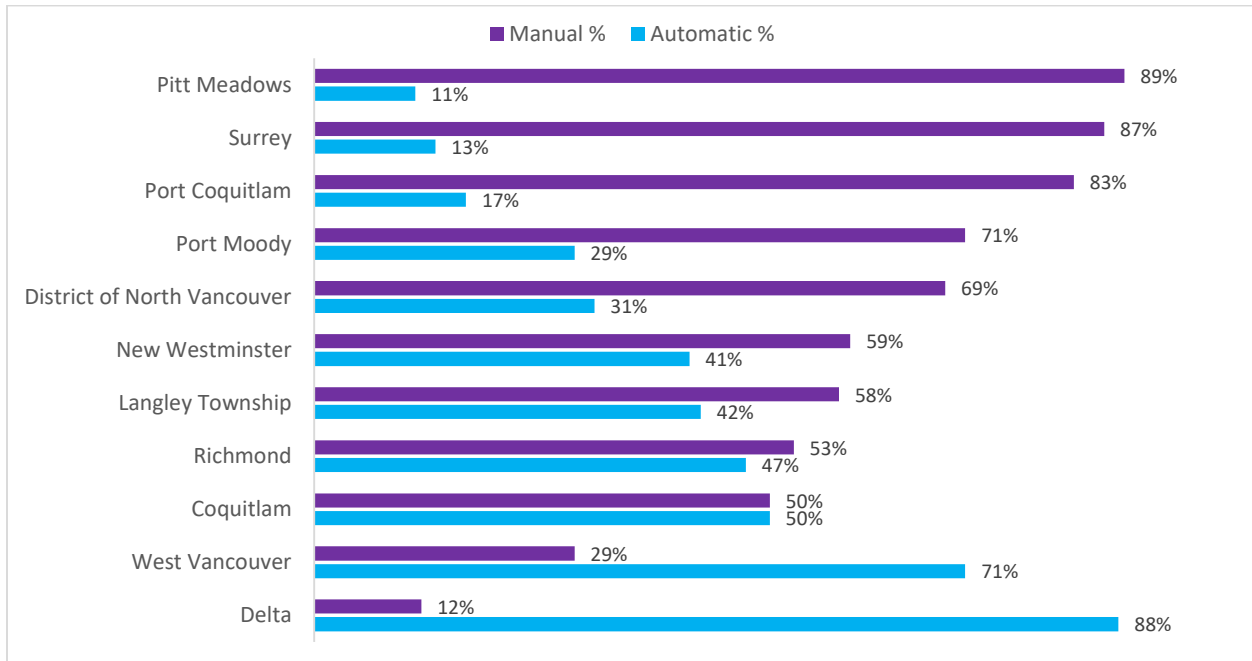


Figure 1: Automatic and manual lawn watering approaches noted during both morning and evening observed non-compliances by participating member jurisdiction

**Non-Compliant Lawn Watering: Time-Based Analysis**

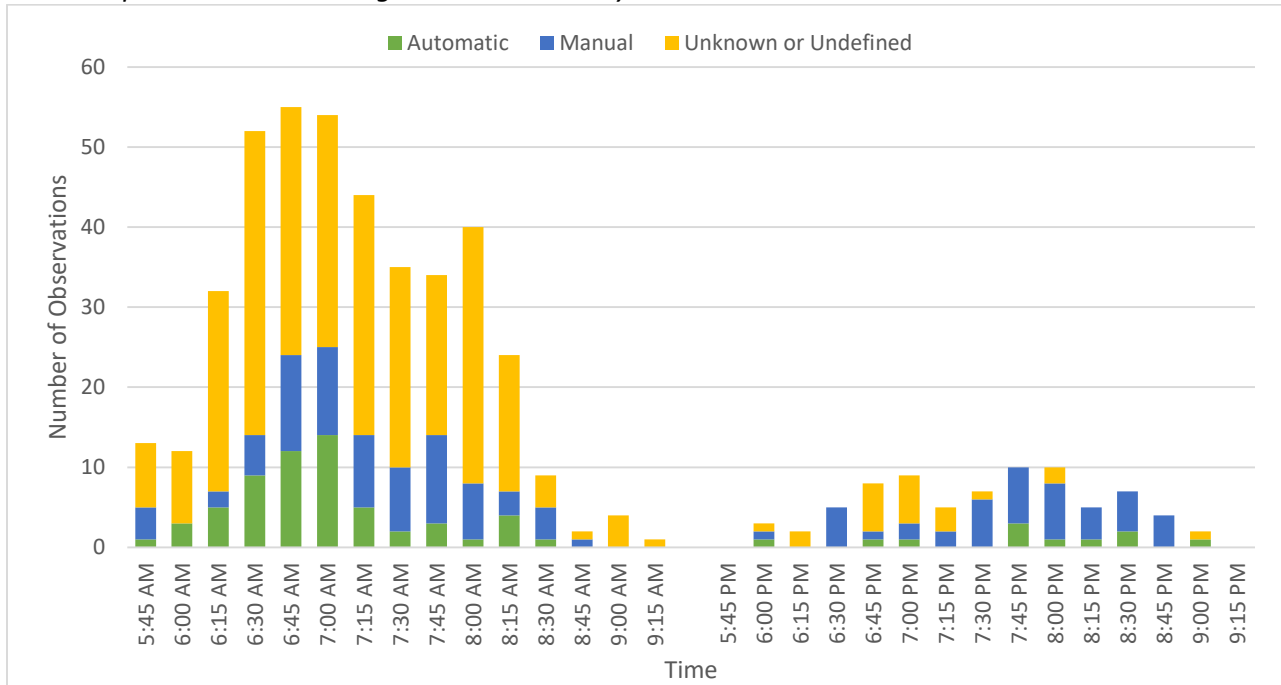


Figure 2: Time-based trend for automatic, manual, and undefined lawn watering for observed non-compliance in all participating member jurisdictions

## **2024 PROGRAM**

The Program was developed in 2022 with the understanding that it would provide short-term support to members during the implementation of the updated DWCP restrictions to encourage regional compliance with member jurisdiction bylaws. Enforcement of watering restrictions bylaws is, and remains, a member jurisdiction's responsibility. Given the Program's success to date, the Program will be offered in 2024, likely focusing on early morning shifts if feasible. As the Program was initially planned for one year only, staff are working with members to determine the best approach beyond 2024.

Conservation efforts across the region are trending behind the projections incorporated into Metro Vancouver's long-term water supply planning. Greater conservation efforts are needed, and members are encouraged to consider the information and lessons learned through the Program to build or expand their own enforcement programs in 2024 and onwards, as opposed to relying solely on this Program. Metro Vancouver staff are available to discuss the Program, its development, and the learnings from it with member jurisdictions who may find this information helpful in the development of their programs.

## **ALTERNATIVES**

This is an information report. No alternatives are presented.

## **FINANCIAL IMPLICATIONS**

The 2023 Program cost is \$149,971 in consulting fees. The allocated amount for supporting the DWCP in 2024 is \$100,000; this will be used for a focused version of the Program. Currently, the Program is not budgeted beyond 2024.

## **CONCLUSION**

The Program results indicate that educating residents in a targeted fashion, together with members communicating with residents regarding non-compliances, substantially reduces non-compliant lawn watering. Over the last two years, the Program has been very helpful for members during the initial implementation of the updated DWCP, especially benefiting those with existing education and enforcement programs. The Program will be offered in 2024, and member jurisdictions are strongly encouraged to use the outcomes and information learned through the Program development to build or expand their own education and enforcement programs in support of the regional watering restrictions. Enforcement of watering restriction bylaws is, and remains, a member's responsibility. The Program was not intended to be an annual program and is not currently budgeted beyond 2024; however, staff are working with members to determine the best approach beyond 2024.

## **REFERENCES**

1. [Drinking Water Conservation Plan](#). Metro Vancouver, November 1, 2021
2. [Regional Communication Campaign Materials](#). Metro Vancouver, 2023

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To: Water Committee

From: Shellee Ritzman, Division Manager, Corporate Communications  
Dana Carlson, Project Coordinator, Corporate Communications

Date: March 25, 2024 Meeting Date: April 3, 2024

Subject: **Drinking Water Conservation Plan: 2024 Communications and Public Outreach**

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### RECOMMENDATION

That the Water Committee receive for information the report dated March 25, 2024, titled “Drinking Water Conservation Plan: 2024 Communications and Public Outreach.”

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### EXECUTIVE SUMMARY

Metro Vancouver delivers drinking water communications and public outreach initiatives to support the understanding of and compliance with water conservation policies and programs in the *Drinking Water Conservation Plan*. On April 8, Metro Vancouver will begin communicating Stage 1 watering restrictions that come into effect May 1. Promotional materials will be distributed to member jurisdictions for public education and enforcement purposes.

The campaign will educate residents that our drinking water is a limited resource. With an increasing population and climate change driving increased risk of drought in the summer months, emphasis will be placed on reducing water demand to ensure our drinking water is available all summer for where it’s needed most: drinking, cooking, and cleaning. A media buy will include digital, social media, broadcast, and outdoor promotions.

The Water Wagon will be engaged for approximately 40 event days, plus 15 days at the PNE.

### PURPOSE

To update the Water Committee on communications plans and public outreach for water restrictions and conservation initiatives.

### BACKGROUND

Metro Vancouver provides high quality drinking water through its member jurisdictions to 2.8 million people and associated businesses, institutions, and industries in the region. Metro Vancouver’s ability to capture, store, treat, and distribute available water is limited, and like all natural resources, water must be managed and used wisely.

Metro Vancouver’s communications initiatives support the *Drinking Water Conservation Plan*. Water conservation is a key component of ensuring the sustainable and efficient use of water resources throughout the region. Population growth and climate change will have continued impacts on our drinking water supply and system. Successful conservation across the region will help our system meet these challenges, while ensuring we have drinking water for the future where it’s needed most: drinking, cooking, and cleaning.

## **WATER CONSERVATION COMMUNICATIONS**

### **Watering Restrictions Communications**

Metro Vancouver will bring awareness to lawn watering restrictions that are in effect from May 1 to October 15 by:

- Distributing watering restriction information to industry stakeholders, including irrigation and lawn care businesses, the week of March 25;
- Developing and distributing promotional materials to support member jurisdiction's communications and enforcement programs, March 25 to April 5;
- Issuing a media release on April 8;
- Notifying the public of the restrictions through social media from April 15 to October 15; and
- Sending a direct mail postcard to homes with lawns reminding residents of watering restrictions and conservation tips, the week of July 1

Metro Vancouver will have communications materials available to member jurisdictions for display, distribution, and to supplement members' bylaw enforcement programs. Items will include social media content and co-branded assets such as posters, rack cards, and other digital media and translated material upon request.

To support residents in maintaining healthy lawns while reducing water use, communications will be shared about best practices for lawn maintenance. Communications will direct residents to Metro Vancouver's lawn watering restrictions web page, which will feature a schedule of allowable watering activities, water-efficient lawn care, and low-water gardening content through links to Metro Vancouver's Grow Green Guide. Examples of communications materials to support the regional watering regulations are included in Attachment 1.

### **Water Conservation Campaign Communications**

Since 2016, Metro Vancouver has used the *We Love Water* platform for the water conservation campaign, which focused on educating residents on how to use less water around the home with water saving tips. Recent focus groups reflected that while the sentiment "*We Love Water*" is positive, it doesn't communicate the issue. We also learned that residents' understanding of changes in weather over the past few years, and experience with browning lawns, have allowed us to shift our conservation messaging to be more straightforward. This year the campaign will place heavier emphasis on the tagline developed in 2018, *It's all Drinking Water*, which was seen as a powerful reminder that drinking water is a precious resource that's not to be wasted.

This year's snowpack is below average levels, and the region is again expecting warmer than normal temperatures this spring. Climate change impacts and a growing population contribute to increasing risk of drought and water shortages in the summer months. Within this context, the campaign encourages more mindful water use to reduce overall water consumption. Emphasis will be placed on lawn watering and outdoor water use, which are activities that use the most water during the hot, dry summer season when water demand increases by 50 per cent or more.

Running June 24 to September 1, promotional tactics under consideration for the campaign include:

- Television and radio broadcast partnerships, featuring endorsements by media personalities;
- Commercials on television and radio networks;
- Weather-triggered digital billboards on major transportation routes throughout the region;
- Digital and social media advertising; and
- Direct mail postcard

See Attachment 1 for new, draft concepts supporting the conservation campaign. All materials will lead to the campaign website for lawn watering restrictions information, lawn care tips, indoor and outdoor water conservation tips, and information about Metro Vancouver's water sources and system. Communications materials will be shared with member jurisdictions for distribution and co-branding opportunities.

### **Water Wagon**

The Water Wagon provides free water bottle refills at community events in the region to highlight our water system, encourage drinking tap water, and reduce single-use bottled water. Outreach staff engage with residents through interactive displays to share the '*Mountain to Tap*' story of our drinking water.

Requests for events will open to member jurisdictions in March, and remaining dates will open for community event requests in April. The Water Wagon will be engaged for an anticipated 40 event days, plus an additional 15 days at the PNE.

### **ALTERNATIVES**

This is an information report. No alternatives are presented.

### **FINANCIAL IMPLICATIONS**

The 2024 watering restrictions communications, regional water conservation campaign, and Water Wagon program have a total budget of \$644,158. These costs are included in the 2024 Water Services communication program budget managed by External Relations.

### **CONCLUSION**

Metro Vancouver will support the annual watering restrictions with communications starting April 8 with a media release, followed by social media, digital advertising, and promotional materials distributed to member jurisdictions for public education and enforcement through the summer. The regional water conservation campaign will begin on June 24 when social, television, radio, outdoor, and digital advertising will be in-market. Creative materials will be shared with members to amplify through their own communications channels. The Water Wagon program will proceed in 2024 for an anticipated 40 event days, plus 15 days at the PNE.

### **ATTACHMENT**

1. Water Communications and Public Outreach Update Materials Examples

## REFERENCES

1. Water conservation campaign: [www.welovewater.ca](http://www.welovewater.ca)
2. Lawn Watering Regulations: [www.metrovancouver.org/lawns](http://www.metrovancouver.org/lawns)
3. Grow Green Guide: [www.growgreenguide.ca](http://www.growgreenguide.ca)

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Water Communications and Public Outreach Update Materials Examples

Water Restrictions ads DRAFT



Water conservation lawn care tips ads DRAFT



Water conservation weather-triggered digital billboard DRAFT



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To: Water Committee

From: Aby Sharma, Program Manager, Maintenance and Business Support, Water Services

Date: March 11, 2024 Meeting Date: April 3, 2024

Subject: **GVWD Electrical Energy Use, Generation, and Management**

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### **RECOMMENDATION**

That the Water Committee receive for information the report dated March 11, 2024, titled “GVWD Electrical Energy Use, Generation, and Management”.

---

### **EXECUTIVE SUMMARY**

The GVWD Electrical Energy Use, Generation, and Management report outlines electrical usage by the water utility, as well as energy generation and energy management projects. In 2023, the GVWD has avoided electricity purchases of \$750,000 annually by generating electrical energy at four facilities. Energy management projects completed since 2015 provide an additional estimated annual savings of \$208,000.

### **PURPOSE**

To provide the Water Committee with information on the water utility electrical usage, generation, and energy management, and to describe the water utility’s contributions to continuous improvement and ongoing electrical energy savings.

### **BACKGROUND**

Metro Vancouver’s water supply system is comprised of a network of reservoirs, pump stations, and transmission water mains. Water is sourced from three primary source supply reservoirs: Capilano, Seymour, and Coquitlam. Additional capacity is available from three alpine lakes. Throughout most of the year and across a significant portion of the region, the system utilizes gravity to convey water via transmission mains from the treatment plants to pump stations and in-system reservoirs. Subsequently, these facilities supply water to GVWD member jurisdictions’ distribution systems.

Despite the advantageous use of gravity, additional energy is needed for the treatment and transmission of drinking water. Over the past five years, approximately 99% of the total energy purchased by Water Services was for electricity. The remaining source of energy was from diesel fuel, purchased for backup power generators deployed at pump stations and water treatment plants.

### **ELECTRICAL ENERGY USE**

In 2023, Water Services purchased approximately \$5.7 million (approximately 54 GWh) of electricity from external producers. Metro Vancouver’s *Corporate Energy Management Policy* outlines ongoing commitments to carbon neutrality and fiscal responsibility, and also highlights the importance of reducing energy use, where feasible.

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## ELECTRICAL ENERGY GENERATION/OFFSETS

The natural topography of the region provides opportunities to harness energy from surplus pressure available in the water system. Electricity is generated at four water facilities, specifically:

### 1. The Capilano Energy Recovery Facility

The Capilano Energy Recovery Facility (CERF) is the largest generation facility in the water utility. CERF receives treated water from the Seymour Capilano Filtration Plant by gravity and surplus pressure is used to drive a water-driven turbine to generate electricity. The electricity generated is used to partially offset the electrical usage requirements of the Capilano Raw Water Pump Station (CRWPS), the largest pumping facility in the water utility. In 2023, CERF generated 6.8 GWh, equivalent to approximately \$590,000 in avoided electricity purchases.

In accordance with the 20-year agreement signed with BC Hydro in 2015, for the years when the CERF generates less than 9.5 GWh, Water Services incurs penalty costs from BC Hydro's *Incentive Funding Clawback*. For the years 2016 to 2017, \$82,000 in penalties were paid to BC Hydro. For the years 2018 to 2023, an estimated \$144,000 will be paid to BC Hydro as a consequence of CERF turbine outages; however, since 2016, CERF has also generated 43.7 GWh, which is equivalent to approximately \$3.8 million in avoided electricity purchases.

### 2. The Cleveland Dam Pump House

The Cleveland Dam Pump House uses gravity flow from the Capilano Reservoir to drive eight water-driven pumps, which supply drinking water to the Districts of North Vancouver and West Vancouver. The water-driven pumps offset all electricity needed to pump this water. Installed in the 1950s, this pump house has been supplying drinking water to the region for nearly seven decades without the need to purchase electricity for pumping. In 2023, the Cleveland Dam Pump House saved the equivalent electrical energy requirement of 0.71 GWh, or approximately \$58,000 in avoided electricity purchases.

### 3. Cleveland Dam Turbine

The Cleveland Dam Turbine is located at the Cleveland Dam Pump House. Water conveyed from the reservoir to the Pump House is used to drive the turbine to generate electricity. The turbine is the primary source of electrical power at the Cleveland Dam for lighting and valve operations. In 2023, the Cleveland Dam Turbine generated 0.67 GWh, and saved approximately \$52,000 in electricity purchases. Water passing through the turbine is then conveyed from the Pump House to the Capilano River (minimum flow provision) and Capilano River Hatchery.

### 4. Seymour Falls Turbine

The Seymour Falls Turbine was installed in the late 1950s and is located at the Seymour Falls Dam. Water from Seymour Reservoir is used to drive the turbine and generate electricity. The turbine provides the primary source of electricity at the Seymour Falls Dam for lighting and valve operations. The turbine also supplies electricity to the Seymour River Fish Hatchery for their operations. In 2023, the Seymour Falls Turbine generated 0.44 GWh, and saved approximately \$46,000 in electricity purchases.

In 2023, the total amount of electrical energy generated by these four facilities was 8.6 GWh, of which 7.9 GWh was used as useful energy for Metro Vancouver’s facilities, which avoided electricity purchases of approximately \$746,000.

**ENERGY MANAGEMENT PROJECTS**

Since 2015, Water Services has completed a number of equipment upgrades and process automation improvements that provide ongoing annual electrical energy savings of 2.1 GWh, or approximately \$208,000. Table 1 provides a list of completed projects, including their electricity savings, initial investment, and net present value. Net present value measures the total value achieved by implementing each energy management project, and accounts for the initial investment, annual cost savings, and the time value of money over a period of 15 years.

**Table 1 – Water Services Energy Management Projects**

Year	Facility	Project	Annual Electricity Savings		Capital Investment	Net Present Value
			kWh	\$	\$	\$
2015	Seymour Capilano Filtration Plant	EcoRay UV Lamps Phase 2	52,900	4,655	175,000	(112,362)*
2016	Seymour Capilano Filtration Plant	Coagulant Mixing Control	69,000	6,072	3,600	79,202
	Seymour Capilano Filtration Plant	UV Revalidation	104,000	9,152	238,000	(113,196)*
2017	Seymour Capilano Filtration Plant	Outdoor Lighting Upgrade	149,441	13,151	162,168	19,806
2018	Seymour Capilano Filtration Plant	HVAC Control Improvements	316,377	27,841	6,210	392,702
	Seymour Capilano Filtration Plant	Lime Mixer Blower Shutdown	152,638	13,432	4,530	187,927
2019	Coquitlam Water Treatment Plant	Minimum Ozone Dose Reduction	121,977	11,100	7,650	146,148
	Port Mann North and South Valve Chambers	Heating Energy Reduction	183,000	24,705	6,000	224,740
2020	Seymour Capilano Filtration Plant	LED Interior Lighting Upgrade	662,605	70,400	188,601	680,930
	Seymour Capilano Filtration Plant	LED Interior Lighting Upgrade	112,382	11,940	21,750	125,728
2021	No projects were completed in 2021**					
2022	Seymour Capilano Filtration Plant	LED Interior Lighting Upgrade	116,044	8,957	22,459	133,337
	Coquitlam Water Treatment Plant	Ozone Cooling Water Temp Reduction	81,893	6,156	3,300	106,646
2023	Summaries for 2023 are not yet available					
Total			2,122,257	\$ 207,561		

\* These projects had other positive benefits in addition to energy savings

\*\* Projects that were scheduled to be completed in 2021 were completed in 2022

In 2023, the following progress was achieved towards energy management related projects:

- Testing of surge valve adjustments commenced for the Grandview Pump Station as part of a pump performance study, potentially leading to energy savings for 2024. Testing for the Capilano Raw Water Pump Station operating strategy will continue through 2024.
- A BC Hydro-funded energy efficiency feasibility study on reducing sidestream pumping energy use at the Coquitlam Water Treatment Plant (CWTP) was completed in 2020. The Water Service's Engineering and Construction Group has since been working to implement the recommendations from that study with project completion planned in 2024.
- A BC Hydro-funded energy efficiency feasibility study on the heating, ventilation, air conditioning (HVAC) and lighting systems at CWTP was completed in 2021. Implementation of select energy conservation measures identified in the study began in 2022, with completion targeted in 2024.
- Development of Strategic Energy Management Plans (SEMP) at Seymour Capilano Filtration Plant (SCFP), CWTP, and CRWPS facilities aimed at achieving ongoing enhancements in energy performance. These SEMP's will establish the necessary processes and systems to integrate energy considerations and management into daily operations.

#### **ALTERNATIVES**

This is an information report. No alternatives are presented.

#### **FINANCIAL IMPLICATIONS**

In the year 2023, the GVWD water utility procured electricity at a cost of around \$5.7 million. Additionally, the utilization of water-driven turbines allowed GVWD to generate 8.9 GWh of electricity, resulting in savings of \$750,000 that would have otherwise been spent on electricity purchases. Furthermore, energy management initiatives undertaken since 2015 have yielded savings of approximately 2.1 GWh, equivalent to roughly \$208,000.

#### **CONCLUSION**

The water utility is committed to the Corporate Energy Management Policy, ensuring targets and key performance indicators are developed and tracked. The water utility takes advantage of the region's natural topography to reduce pumping, and to produce electricity when technically feasible and cost-effective. Additionally, equipment upgrades and process automation improvements throughout the utility contribute to continuous improvement and ongoing electrical energy savings.

To: Water Committee

From: Vanessa Anthony, Director, Policy, Planning and Analysis, Water Services

Date: March 25, 2024 Meeting Date: April 3, 2024

Subject: **Water Use by Sector in Metro Vancouver: 2000 - 2021 Regional Results**

---

### **RECOMMENDATION**

That the Water Committee receive for information the report dated March 25, 2024, titled "Water Use by Sector in Metro Vancouver: 2000 - 2021 Regional Results".

---

### **EXECUTIVE SUMMARY**

The "Greater Vancouver Water District and Member Jurisdiction Water Use by Sector Report 2000 - 2021 Regional Results" (the 2021 Report) outlines the trends in water use in the Metro Vancouver region. The 2021 Report analyzes water rates charged by member jurisdictions, overall water use, water use by sector, and per capita water use. The Report is based on metered water data provided by 19 member jurisdictions.

Residential water use accounted for 65% of total drinking water consumption in the region in 2021. The average residential water use is slightly higher than in 2019, up by 2.3%, possibly due to the the 2020 and 2021 pandemic lockdowns, remote or hybrid work arrangements, and peak summer events such as the 2021 heat dome.

Water use per capita has generally declined since 2000, although overall water consumption for the region has increased. This is likely due to population growth and will be monitored closely in the coming years as the population is projected to grow at a faster rate than previously projected. Metro Vancouver has one of the highest per-capita drinking water consumption rates in Canada, so there is more work to do. Water use by sector trends in the region provides valuable information for utility planning and developing water conservation and efficiency programs.

### **PURPOSE**

To provide the Water Committee with information on water use trends and statistics by sector in the Metro Vancouver region.

### **BACKGROUND**

The 2021 Report is the latest edition of a detailed report that provides information on the region's drinking water use patterns and trends. The first edition of this report was completed in 1997, and Metro Vancouver committed to updating the work regularly by including it in annual work plans. The last edition of this report was the ninth update and had data and results from 1985 to 2019. The 2021 Report supersedes all previous editions and was included in the Water Services 2023 work plan. The 2021 Report only reports on the study period 2000 to 2021. Data and results before 2000 have been excluded since they cannot be reliably verified, have limited relevance to the latest

trends in the region, and add to the report size without providing much value. Historical data remains within Metro Vancouver records.

A request for municipal water billing and metering data from 2020 and 2021 was sent to the member jurisdiction staff in April 2022. Members provided their submissions to Metro Vancouver between April 2022 and March 2023. Metro Vancouver staff worked collaboratively with member jurisdiction staff and completed final verification and data correction work between March 2023 and January 2024. Staff continue to work and improve the data sets for future reports.

The findings, key metrics, and general trends were presented and discussed at the Regional Engineers Advisory Committee (REAC) meeting on March 1, 2024. The REAC members noted the value of the report results and supported continuing the program.

### **TRENDS IN WATER USE BY SECTOR IN METRO VANCOUVER**

The average residential use is slightly higher than in 2019, up by 2.3%, and this needs to be monitored in the coming years. It is possible that the 2020 and 2021 results were impacted by the pandemic lockdowns, remote or hybrid work arrangements, and peak summer events such as the 2021 heat dome. Data for several years after 2021 will have to be studied and compared to pre-2019 levels before a clear assumption can be made.

The following summary points are based on the data provided for this report with a comparison to the 2019 Water Use by Sector report data:

- 1) Metering Practices in the GVWD Region: In 2021, there were 168,569 metered accounts in the GVWD region, representing 35% of the total serviced connections and 47% of total water consumption. In 2019, metered accounts in the GVWD region represented 38% of the total serviced connections and 50% of total water consumption. The decrease in serviced metered connections is attributed to the improvements in the accuracy of members' billing systems. As such, no correlation can be established between one report and the next on metered accounts at this time.
- 2) Consumer Water Rates: water rates charged by the member jurisdictions were summarized and compared to determine average rates in the region. As of 2021, the average unmetered flat rate in the region was \$689/year for single-family residences and \$458/year for multi-family residences, respectively. The 2021 average unit rate for metered connections was \$1.56/m<sup>3</sup>. Compared to 2019, the average unmetered flat rates increased by 18% and 7% for single-family and multi-family residences, respectively. The average unit rate for metered connections increased from 2019 to 2021 by around 18%.
- 3) Regional Water Consumption Trends: in 2021, the total water consumption supplied from GVWD and member jurisdictions' sources was 398 million m<sup>3</sup>, representing an average water consumption of 414 litres per capita per day (L/capita/day) for the region. The average residential use was approximately 65% of total consumption or at least 268.5 L/capita/day, using a residential weighted average across members. The water use per capita has generally

declined since 2000, although overall water consumption for the region has increased. This is likely due to population growth and will be monitored closely in the coming years.

Figure 1, below, shows overall water use trends by the eight sectors that have metered data, with the unmetered consumption. Since 2002, there has been a gradual increase in water use within the single-family and multi-family sectors. The Industrial, Commercial and institutional (ICI) sector's water consumption has been relatively constant. For this report, the ICI sector includes connections and consumptions at properties categorized as Agriculture, Other, and Unknown. Unmetered water consumption cannot be categorized into any of the sectors. Since the ICI sector is generally 100% metered across all member jurisdictions, unmetered consumption is assumed to be all residential.

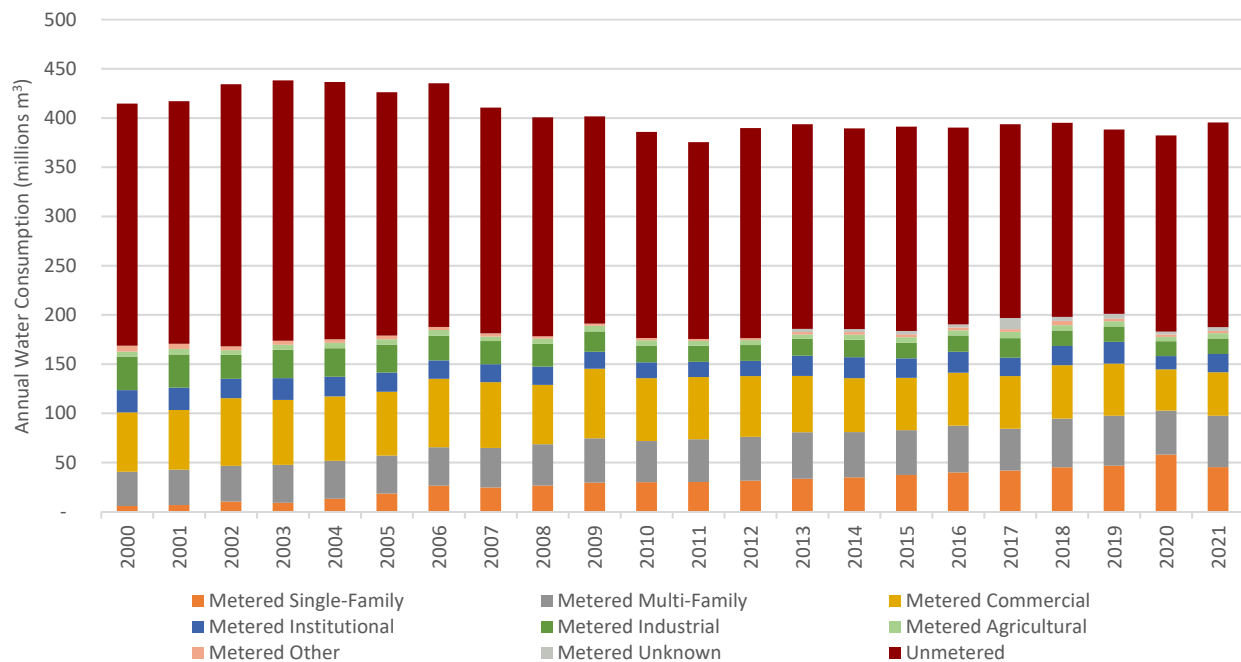


Figure 1: Water Use by Sector Trends from 2000 to 2021

\* Unmetered consumption includes system losses in this chart.

Figure 2 on the following page shows a breakdown of water use by sector in 2021. Unmetered consumption was approximately 40% of total water consumption during 2021 and is assumed to comprise unmetered residential consumption. However, the unmetered sector consumption is subject to the accuracy of system losses, which was reported as generally higher in 2021 and estimated to be between 12.1% and 12.7% of total water consumption. At least 0.8% of the total metered water consumption is from 'unknown' accounts with no assigned sector. The consumption from these unknown accounts is assumed to be primarily commercial.

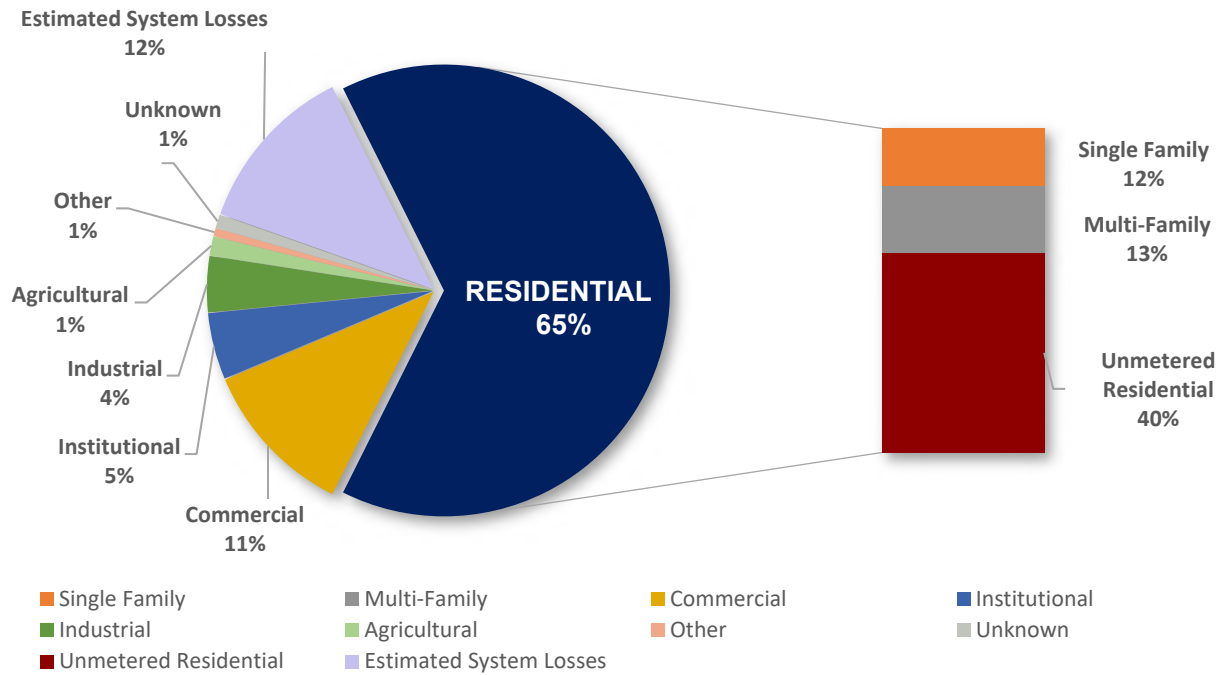


Figure 2: Breakdown of Water Use by Sector in 2021

\*values are rounded to the nearest whole number.

Figure 3, below, illustrates the 2021 ICI sector water use, further disaggregated into twenty-one subsectors. The chart is ranked left to right in decreasing order according to consumption in 2021. A comparison of the sub-sector consumption in 2010 and 2019 is also provided.

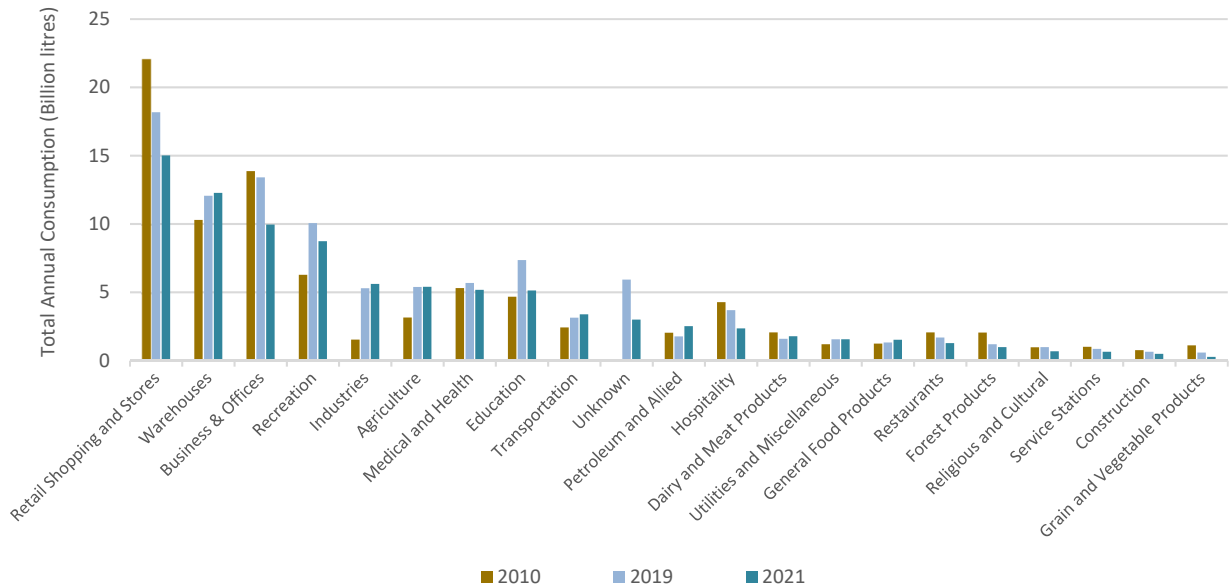


Figure 3: Annual Water Consumption by ICI subsectors 2010 to 2021.

## **ALTERNATIVES**

This is an information report. No alternatives are presented.

## **FINANCIAL IMPLICATIONS**

The report is developed collaboratively between staff from Metro Vancouver and member jurisdictions. The Water Services, Policy, Planning and Analysis program budgets cover the data collection, processing and reporting of regional results.

## **CONCLUSION**

The 2021 Report was developed in collaboration with member jurisdiction staff and presents water use patterns by sector in the Metro Vancouver region.

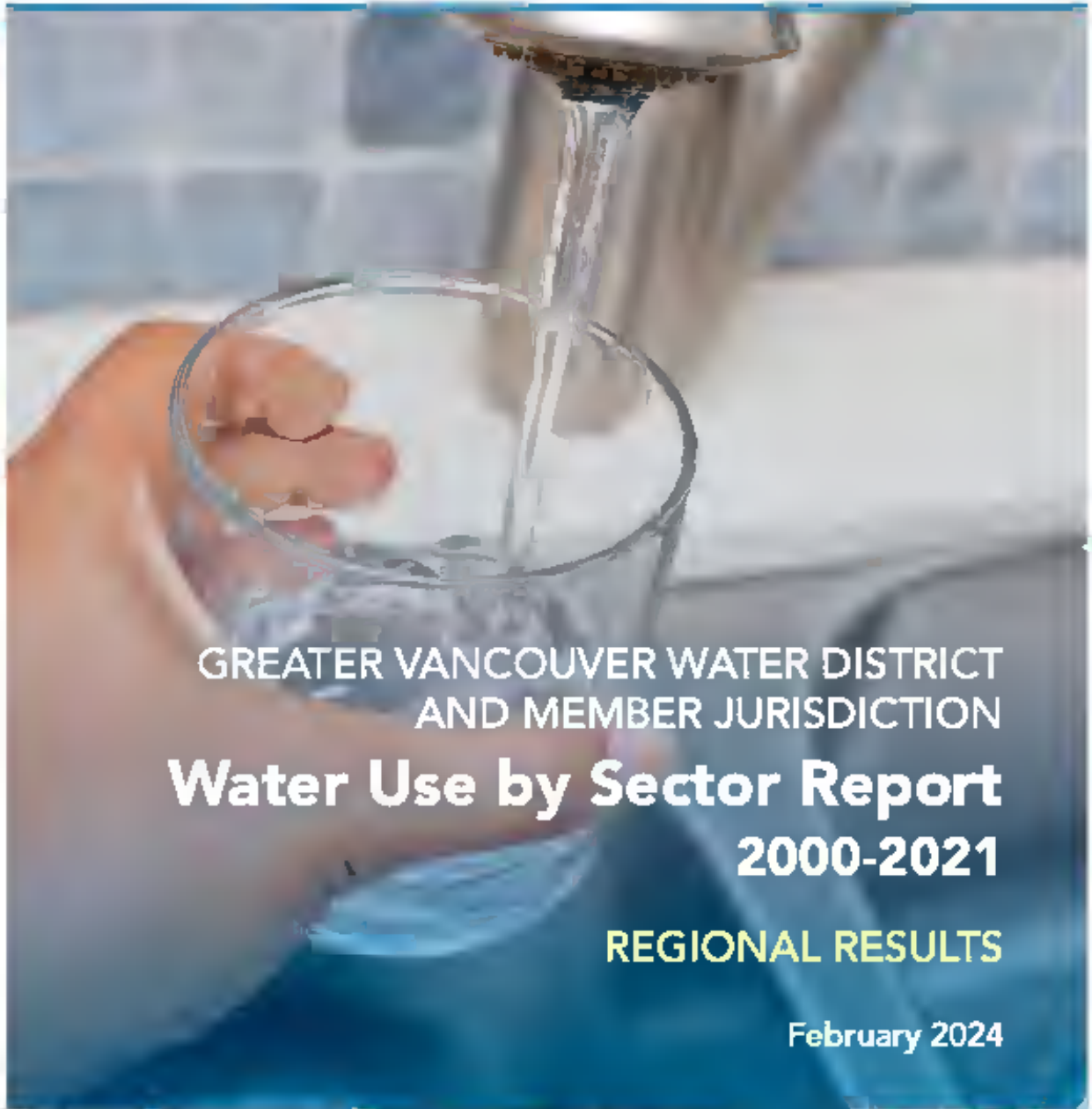
The per capita residential consumption is 268.5 L/capita/day, and the consumption from metered connections accounts for 47% of the total water consumption in the region. The per capita consumption is higher than in 2019 (last report), and this will be monitored in the coming years to determine if the rise was due to the COVID-19 pandemic's impacts on consumption and lifestyles or if there are other contributing factors.

Water use by sector trends in the region provides valuable information for utility planning and developing water conservation and efficiency programs. Historical water use patterns in the region can inform the planning and effectiveness of implementing drinking water management practices used by the GVWD and member jurisdictions.

## **ATTACHMENT**

1. Greater Vancouver Water District and Member Jurisdiction Water Use by Sector Report 2000 - 2021, Regional Results

metrovancover | WATER



GREATER VANCOUVER WATER DISTRICT  
AND MEMBER JURISDICTION  
**Water Use by Sector Report**  
**2000-2021**

**REGIONAL RESULTS**

February 2024












## Executive Summary

This edition of the *Greater Vancouver Water District (GVWD) and Member Jurisdiction Water Use by Sector Report* appends water consumption statistics for 2020 and 2021 to published information from 1985 to 2019 in previous reports. This report supersedes all previous editions of the report and only provides data for the study period, 2000 to 2021. Data and visualizations from 1985 through 1999 are presented in the *Greater Vancouver Water District (GVWD) and Member Jurisdiction Water Use by Sector Report 1985 to 2017*. The data collected from 1985 to 2021 remains with Metro Vancouver for reference.

The report provides information on consumer water rates, water consumption, consumption by sector, and consumption per capita for the region using water billing data of metered accounts provided by 19 member jurisdictions. The data in this report includes all drinking water supplied by the GVWD and member jurisdictions but does not include water supplied by private sources or the populations serviced by these private sources.

The following table summarizes the key metrics based on the data provided for this report with a comparison to the 2019 Water Use by Sector report results.

Metric		2019 Report	2021 Report	Change %
Metered accounts	% of Total Serviced connections in the Region	38 %	35%	 7 %
Metered Consumption	% of Total Drinking Water Consumption in the Region	50 %	47 %	 3 %
Annual Flat Rate for unmetered Single Family connections	\$ / year	\$583	\$ 689	 18 %
Average Unit Rate for metered connections	\$/ cubic meter	\$1.32	\$1.56	 18 %
GVWD Wholesale Blended Rate	\$/ cubic meter	\$0.76	\$0.83	 10 %
Total Annual Consumption – supplied by GVWD and member jurisdictions	Billion Litres	393	398	 1.2 %
Population served by GVWD	Number of persons	2,565,550	2,647,243	 3.2 %
Total Regional per capita water use	Litres per capita per day	425	414	 2.5 %
Estimated average residential use	Litres per capita per day	263	269	 2.3 %

Unmetered consumption was approximately 40% of total water consumption during 2021 and is assumed to comprise unmetered residential consumption and excludes system losses. However, the unmetered sector consumption is subject to the accuracy of estimated system losses self-reported by members. System losses in 2021 were reported as generally higher than in previous years and are estimated regionally to be between 12.1% and 12.7% of total water consumption.

Metered water consumption by sector included 25% for residential use, 11% for commercial, 5% for institutional, close to 4% for industrial, over 1% for agricultural, and 0.5% for other connections, as a percentage of the total water consumption in the region. At least 0.8% of the total metered water consumption is from 'unknown' accounts with no assigned sector. The consumption from these unknown accounts is assumed to be primarily commercial and requires verification.

Water consumption for the Industrial, Commercial, Institutional (ICI) and Agricultural sectors was divided into 20 sub-categories. The Retail Shopping and Stores sector had the highest total drinking water consumption and most connections in 2021. However, the Petroleum and Allied Industry sector had the highest consumption per connection.

## Acknowledgements

Staff at the following member jurisdictions and organizations provided valuable assistance in compiling and interpreting member jurisdiction metering data and reviewing some of the sections in this report. Their contributions are gratefully acknowledged.

- Village of Anmore
- Village of Belcarra
- City of Burnaby
- City of Coquitlam
- City of Delta
- City of Langley
- Township of Langley
- City of Maple Ridge
- City of New Westminster
- City of North Vancouver
- District of North Vancouver
- City of Pitt Meadows
- City of Port Coquitlam
- City of Richmond
- City of Surrey
- scə́wáθən məsteyəxʷ (Tsawwassen First Nation)
- University Endowment Lands
- City of Vancouver
- District of West Vancouver

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## List of Acronyms

AUC	Actual Use Code
BC	British Columbia
BCAA	British Columbia Assessment Authority
BSC	By-Sector Classification
GVWD	Greater Vancouver Water District
ICI	Industrial, Commercial and Institutional ( <i>includes Agriculture in this report</i> )
MJ/ Member(s)	Member Jurisdiction of the GVWD, ( <i>includes UEL/ UBC, and scáwáθān mǎsteyǎx<sup>w</sup> although not a member jurisdiction</i> )
MF	Multi-Family
SF	Single-Family
SIC	Standard Industrial Classification
SQL	Structured Query Language
UBC	University of British Columbia
UEL	University Endowment Lands

### Notes:

1. In this report, the terms water consumption, water use, water demand, water and drinking water refer to the drinking water supplied by GVWD and member jurisdictions and used by the regional population, meeting drinking water quality regulations and guidelines.
2. Metro Vancouver collects, stores and manages data provided by GVWD members to produce this report. Metro Vancouver's internal privacy program has vetted the data management process, and a privacy impact assessment was completed during the 2017 report cycle. Consent to use and analyze the data and distribute aggregated data and results to member jurisdictions, their staff, and Metro Vancouver's staff and contractors is implied and assumed.
3. Metro Vancouver receives data from its members and relies on their reporting systems. Therefore, the accuracy and reliability of any data or information collected, calculations completed, and results presented are not guaranteed and should not be assumed. All data and results presented in this report are subject to change with each iteration or as members provide updated data and additional comments during data verification and updates.
4. Metro Vancouver or its member jurisdictions are not responsible for any further inferences and conclusions made from the results presented in this report.

## Conversions

100 cubic feet = 2.8316847 m<sup>3</sup> = 2831.684659 Litres

1 m<sup>3</sup> = 1,000 Liters

## 1.0 Introduction

The Greater Vancouver Water District (GVWD) supplies drinking water to its member jurisdictions, who in turn distribute the water to individual households and businesses. The GVWD was formed in 1924 as a cooperative joint venture of member jurisdictions and has expanded over the years to include most jurisdictions within the Metro Vancouver Region. As of 2021, the GVWD provided drinking water through its twenty member jurisdictions to approximately 2.7 million residents<sup>1</sup>.

The *GVWD and Member Jurisdiction Water Use by Sector Report 2021* (the Report) summarizes water consumption data provided by the member jurisdictions and partially reconciles it with metered GVWD's water sales data. This report supersedes all previous editions of the Report and only provides data for the Study Period, 2000 to 2021. The data collected from 1985 to 2021 remains with Metro Vancouver for reference. For data and visualizations that include 1985 through 1999, please refer to the Greater Vancouver Water District (GVWD) and Member Jurisdiction Water Use by Sector Report from 1985 to 2017. The purpose of the Report is to:

1. Characterize and illustrate the historical use of water in the region by member jurisdictions from 2000 to 2021.
2. Collect and compare water usage patterns and water management practices within the region.
3. Facilitate planning and implementation of GVWD and member jurisdiction programs for drinking water conservation and demand side management.

The GVWD supplies 98% of drinking water to 18 member jurisdictions, one Electoral Area and one treaty First Nation in the region. The City of Delta, the Township of Langley, and the District of West Vancouver derive a portion of their water supply from their own managed sources. In addition, a small population within the Village of Anmore, the Village of Belcarra, the Township of Langley, the District of North Vancouver, the City of Maple Ridge, and the City of Surrey use water from private sources. This report analyzes the consumption data of the water supplied by the GVWD and member jurisdictions and excludes the data for the water supplied or populations serviced by private sources.

## 2.0 Methodology

This report appends 2020 and 2021 drinking water consumption data to previously published historical data. This report supersedes all previous editions of the report and only provides data for the Study Period, 2000 to 2021. Significant effort was made to correct data included in the previous versions of the report, as member jurisdictions periodically update their data to reflect existing conditions with increasing accuracy. Therefore, this report supersedes all previous editions.

### Data Management

Between 1985 and 1996, not all GVWD-supplied member jurisdictions submitted data. Table 2.1 outlines the participating member jurisdictions and the corresponding year when the collection of water consumption data began.

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<sup>1</sup> Source: 2021 Water Consumption Statistics Report, May 2023

Table 2.1: Member jurisdiction participation in the Water Use by Sector Report

Member Jurisdiction	Start of Data Collection
Village of Anmore	2013
Village of Belcarra	2013
City of Burnaby	1991
City of Coquitlam	1993
City of Delta	1996
City of Langley	1987
Township of Langley	1991
City of Maple Ridge	1988
City of New Westminster	1990
City of North Vancouver	1986
District of North Vancouver	1986
City of Pitt Meadows	1988
City of Port Coquitlam	1989
City of Port Moody	1987
City of Richmond	1985
City of Surrey	1990
scəwáθən məsteyəx <sup>w</sup>	2018
University Endowment Lands and University of British Columbia Utilities	1986
City of Vancouver	1986
District of West Vancouver	1985

Before 2018, water consumption by scəwáθən məsteyəx<sup>w</sup> was included as part of the City of Delta data. Similarly, before 2013, water consumption by the Village of Anmore was included as part of the City of Port Moody data and water consumption by the Village of Belcarra was included as part of the District of North Vancouver data.

The data for this report is derived from drinking water billing records for metered accounts requested by GVWD from members who receive drinking water from the GVWD. The data is then processed and aggregated into municipal-level and regional-level results. The Report provides water use by sector results from 2000 to 2021 for the 19 members that submitted data. All consumption data are presented in cubic metres (m<sup>3</sup>).

## Data Requests

For this report, each member jurisdiction was requested to provide the following data for 2020 and 2021:

- Number of service connections, both metered and unmetered, and a breakdown of either category by sector
- Sources of water and volume consumed from each member jurisdiction's water source (GVWD and all other non-GVWD sources)
- Population served by non-GVWD sources
- Water and sewer rates (both flat rates and metered rates)
- An estimate of system losses
- An estimate of the percentage of metered connections in eight major sectors
- Water consumption by billing period or by year, including the type of land use (classified by British Columbia [BC] Assessment Authority, Actual Use Codes [AUCs])

Member jurisdictions were requested to provide the BC Assessment Authority AUC standard classification for each property account to analyze water consumption by sector. Before 2005, Metro Vancouver staff assigned codes based on judgment using the customer's name or other attributes and verified ambiguous data with member jurisdictions.

Since 2005, 22 new “By Sector Classification” (BSC) codes have been developed to report industrial, commercial, and institutional sectors, as shown in Table 2.2. Member jurisdictions can classify accounts according to BSC codes, providing flexibility for data reporting. For the ICI sector, the data from 2009 to 2021 is used for all comparisons as these are member-reported.

The most recent data request included an instructional guideline for submission requirements, templates, and a checklist of primary data checks to be signed.

For some members, additional information and discussions were needed to clarify, correct, or update the data provided in previous years.

## Data Received

Before the 2005 report, member jurisdictions supplied data in hard copy or electronic format (ASCII text file, Excel spreadsheet or Access database). Metro Vancouver staff then converted it to the requisite format. In most cases, members provided billing summaries of metering data upon request. However, when billing summaries were unavailable, individual meter cards were obtained, and Metro Vancouver staff calculated consumption figures from the meter readings. If errors arose, the data was verified between each member jurisdiction and Metro Vancouver. Once the data for each member jurisdiction were entered into the database, all consumption values were converted to cubic metres. Each customer was assigned sector codes and Standard Industrial Classification (SIC) codes.

Since 2005, member jurisdictions have provided summarized water consumption data, billing information, and AUC for each metered billing account. The members provide de-identified billing records for metered accounts within their jurisdiction and additional municipal system information via a questionnaire. In response to requests for data sent between April and July 2022, 15 out of 20 member jurisdictions responded with data for 2020 and 2021. Data from four members were received in late 2022 and the first quarter of 2023.

## Data Integrity, Quality and Processing

The data provided by member jurisdictions was reviewed to ensure that each account with consumption data was assigned a corresponding AUC or BSC code. Members providing data were requested to ensure

basic checks to the data were completed, such as removing duplicates and maintaining ‘Null’ accounts (accounts with no assigned AUCs) to within 1-5% of total consumption.

Data analysis was performed using descriptive statistics and Microsoft Excel 2016 pivot tables where necessary to determine percentile distributions, the number of unique accounts, the proportion of duplicates and check for unique AUCs. Once the integrity levels were established, the cleaning and verification process included, but not limited to the following:

- Checking for changes in water rates and service connection information
- Assigning a nominal “999” code to any account that does not have a corresponding AUC
- Verifying missing and erroneous data with member jurisdictions
- Updating regional results and background information as updated data is received

The programmed AUC codes were updated using the 2022 BC Assessment Authority AUC list for this report. Some adjustments were required to the program following the learnings from the previous report cycle.

Some members required corrections to their data sets from previous years. Algorithms processed the billing data across the years and the region, converted the AUCs to BSCs (for the ICI sector), and then converted them into eight sectors for the region.

### By Sector Categorization and Conversions

For this report, it is assumed that the residential sector had a high level of accuracy in assigned AUC codes across the region. However, water consumption data in the ICI sectors presents a unique challenge since BSC classifications are applied to define water consumption.

There are differences in the assignment of AUCs between member jurisdictions and the reporting periods. For example, a bank may have the AUC ‘210 – bank’, classified as BSC ‘2-business or office’, or the more generic AUC ‘200 – stores and service –commercial’ classified as BSC ‘16-retail shopping and stores’. Some buildings may also be classified by only one of their multiple uses, such as medical offices, stores, restaurants and offices. Therefore, the number of connections and corresponding consumption under each BSC category should be considered an estimate. Table 2.2 shows the BSC codes that categorize and analyze the industrial, commercial, and institutional sector data with their corresponding General Sector categories used for this report.

Table 2.2: By Sector Classification codes and their corresponding General Sector categories

Sector	By Sector Classification (BSC) code	General Sector Categories
Single-Family Residential	0	Single-Family Residential (1)
Agriculture	1	Agricultural (6)
Business and Offices	2	Commercial (3), Institutional (4), Industrial, (5)
Construction	3	Commercial (3), Industrial (5)
Dairy and Meat Products	4	Industrial (5)
Education	5	Institutional (4)
Forest Products	6	Industrial (5)
General Food Products	7	Industrial (5)
Grain and Vegetable Products	8	Industrial (5)
Hospitality	9	Commercial (3)
Industries	10	Industrial (5)
Medical and Health	11	Commercial (3), Institutional (4)
Petroleum and Allied	12	Industrial (5)
Recreation	13	Commercial (3), Institutional (4)
Religious and Cultural	14	Institutional (4)
Restaurants	15	Commercial (3)
Retail Shopping and Stores	16	Commercial (3)
Service Stations	17	Commercial (3)
Transportation	18	Commercial (3), Industrial (5), Other (7)
Warehouses	19	Commercial (3), Industrial (5)
Utilities and Miscellaneous	20	Other (7), Institutional (4)
Multi-Family Residential	21	Multi-Family Residential (1)

This report presents most of the results and graphs for the following eight General Sector categorizations:

- |                              |                 |
|------------------------------|-----------------|
| 1) Single-Family Residential | 5) Industrial   |
| 2) Multi-Family Residential  | 6) Agricultural |
| 3) Commercial                | 7) Other        |
| 4) Institutional             | 8) Unknown      |

The “Other” sector represents connections to transportation, communications, utilities, and other member jurisdiction facilities not classified under institutional.

The “Unknown” sector is assumed to represent commercial water use based on consumption volumes. These accounts appear as “NULL” or blank with no AUCs assigned in the billing records provided. These “Unknown” accounts without a corresponding AUC code were given an unused code and processed into the eighth sector.

The conversion from 206 BC Assessment Authority AUCs to 22 BSCs, then to the eight General Sector codes and code details are shown in Appendix A.

### Data Analysis

Once the data was cleaned or adjusted as required and, where possible, verified by the member jurisdiction, it was uploaded onto the intranet web app by year and member jurisdiction. Inbuilt algorithms converted the AUC codes into eight sector codes and produced regional results, which Metro Vancouver staff used for further analysis. Statistics were compiled for consumption by sector, and the composite results were formatted into tables and graphs featured in this Report.

The regional results were appended to information from previous editions. Data from each member jurisdiction was analyzed to produce the aggregated regional results covering the study period from 2000 to 2021. The 2017 data for Burnaby was used for the 2018 period to complete the report and to ensure that meaningful results were presented for the remaining member jurisdictions.

With the categorization of all consumption data into respective AUCs and BSCs codes and the eight sector categories described above, consumption data was aggregated, and consumption by sector was determined for each member jurisdiction and, where available, for each billing period. Regional results for water consumption by sector were generated and analyzed further, forming the basis of this Report.

### Unmetered Consumption

For each member jurisdiction, unmetered consumption is derived by subtracting the total metered consumption from the total volume of water billed by the GVWD. The total volume of water billed by the GVWD is derived from the *2021 Water Consumption Statistics Report*, which reports on the volume supplied to members at designated supply points in the transmission system.

$$\begin{array}{rcccl}
 & & \text{Total Volume} & & \\
 & & \text{Billed by GVWD} & & \\
 \\
 \text{Unmetered} & = & \text{PLUS} & - & \text{Total Metered} \\
 \text{Consumption} & & & & \text{Consumption (from} \\
 & & \text{Total Volume} & & \text{billing data provided} \\
 & & \text{supplied by} & & \text{by members)} \\
 & & \text{Member sources} & & 
 \end{array}$$

The difference between the totals was calculated and categorized as unmetered water consumption in each member jurisdiction and for the region. Unmetered consumption includes member jurisdiction system losses, unmetered residential consumption, a small proportion of unmetered ICI consumption, and unmetered member jurisdiction facilities and parks. Slightly more than half (an estimated 52.7%) of the drinking water consumption in the GVWD region is not metered by member jurisdictions.

## System Losses

System losses include leaks in member jurisdiction distribution systems, faulty meters, fire-fighting needs, flushing of water mains, and other unmetered water uses in the distribution process. System losses do not refer to losses on private property or unmetered residential, commercial, industrial, institutional, agricultural or other end-use water consumption. Losses incurred during water treatment and GVWD transmission are not included in the ‘system losses’ category and are not included in this report.

For the City of Langley, which has implemented universal metering, the difference between the total volume of water billed by the GVWD and total metered consumption was attributed to system losses. For the District of West Vancouver, which is also universally metered, the losses were the difference between the total water consumption (i.e., GVWD supplied plus District supplied) and the total metered consumption.

Member jurisdictions provided estimates of annual system losses as a percentage of total consumption. These estimates typically ranged between 10 to 15%, depending on the member jurisdiction and year. Where no estimates were provided, a 10% system loss was assumed and applied to each member jurisdiction in the previous years. In 2021, a weighted average calculation of losses showed a higher system-wide loss at close to 12.3%, which was applied to determine the by-sector distribution shown in Figure 3.27.

## Residential Consumption

The majority of residential consumption is not metered in the region. Since many member jurisdictions fully meter ICI connections, total unmetered consumption minus system losses can be attributed to residential consumption. The following equation estimates the percentage of total consumption attributable to residential use for member jurisdictions with unmetered residential consumption:

$$\text{Residential Consumption} = \text{Unmetered Consumption} + \text{Metered Single-Family Consumption} + \text{Metered Multi-Family Consumption} - \text{System Losses (\%)} \times \text{Total Consumption}$$

Estimates for residential consumption were only calculated if unmetered non-residential water use was assumed to be negligible compared to unmetered residential water use. That is, all other sectors were close to 100% metered. The total volume of water consumption for the City of Port Moody was not included in the regional estimates for residential water consumption as data was not provided at the time of this report.

## Regional Population

Population estimates for member jurisdictions and the region for the study period 2000 to 2021 are presented in Tables 2.3A and 2.3B. Regional population figures from 2013 were updated to current population estimates and are expected to generally align with those provided in the *2021 Water Consumption Statistics Report*. The regional population estimates published in the *2021 Water Consumption Statistics Report* are obtained from Metro Vancouver’s Planning Analytics Division within the Department of Regional Planning and Electoral Area.

The regional population in 2021 is estimated to be 2.7 million residents.

### Per Capita per Day Consumption Estimates

Water consumption per capita per day statistics are based on annual population estimates for each member jurisdiction. Two estimates of water use per capita per day are provided in Figure 3.26:

1. Total water consumption per capita per day
2. Estimated residential consumption per capita per day

The estimated residential per capita per day consumption is determined using a weighted average of all member jurisdiction residential consumptions. It is determined using the weighted average of residential consumptions across member jurisdictions. The proportion of residential consumption to total consumption varies across the region and is subject to residential and non-residential distribution, the extent of metering, reported system losses, and varying population estimates.

Table 2.3A: GVWD and member jurisdiction serviced populations, 2000 - 2021<sup>1</sup> (Village of Anmore to the District of North Vancouver)

	Anmore <sup>2</sup>	Belcarra <sup>2</sup>	Burnaby	Coquitlam <sup>2</sup>	Delta	Langley City	Langley Township <sup>2</sup>	Maple Ridge <sup>2</sup>	New Westminster	North Vancouver City	North Vancouver District <sup>1</sup>	TOTAL Regional Population <sup>4</sup>	TOTAL GVWD Serviced Population <sup>5</sup>
<b>2000</b>	N/A	N/A	198,593	115,074	98,984	24,349	64,000	56,524	55,724	45,823	85,954	<b>2,040,276</b>	<b>1,918,055</b>
<b>2001*</b>	N/A	N/A	201,790	117,451	99,365	24,598	67,000	57,839	56,864	46,446	86,493	<b>2,074,687</b>	<b>1,950,363</b>
<b>2002</b>	N/A	N/A	202,532	117,934	99,406	24,751	74,185	58,997	57,131	46,455	86,582	<b>2,097,200</b>	<b>1,996,628</b>
<b>2003</b>	N/A	N/A	203,273	118,417	99,447	24,905	74,556	60,155	57,397	46,465	86,671	<b>2,116,015</b>	<b>2,018,936</b>
<b>2004</b>	N/A	N/A	204,326	118,981	99,433	24,903	76,327	61,060	58,053	46,646	86,703	<b>2,135,530</b>	<b>2,048,562</b>
<b>2005</b>	N/A	N/A	206,407	119,389	99,411	24,902	78,081	62,002	58,792	47,253	86,789	<b>2,139,756</b>	<b>2,073,086</b>
<b>2006*</b>	N/A	N/A	210,507	119,607	99,388	24,899	74,266	63,593	60,533	47,501	86,904	<b>2,140,543</b>	<b>2,109,014</b>
<b>2007</b>	N/A	N/A	214,965	120,075	99,833	25,161	75,889	64,519	61,599	47,664	87,062	<b>2,172,789</b>	<b>2,140,286</b>
<b>2008</b>	N/A	N/A	218,499	122,059	100,020	25,272	78,656	65,837	64,144	48,270	87,249	<b>2,206,034</b>	<b>2,170,188</b>
<b>2009</b>	N/A	N/A	223,488	124,725	100,513	25,390	80,106	69,558	65,205	48,850	87,633	<b>2,244,797</b>	<b>2,208,582</b>
<b>2010</b>	N/A	N/A	225,342	127,183	101,232	25,543	83,122	70,208	66,717	49,367	87,994	<b>2,277,184</b>	<b>2,239,679</b>
<b>2011*</b>	N/A	N/A	227,704	128,997	101,870	25,585	83,741	71,580	67,302	49,521	88,150	<b>2,343,007</b>	<b>2,282,217</b>
<b>2012</b>	N/A	N/A	229,339	131,889	102,620	25,911	87,784	72,674	67,967	50,148	88,925	<b>2,426,266</b>	<b>2,313,764</b>
<b>2013</b>	2,060	700	235,900	134,000	102,400	26,000	111,500	79,900	69,300	1,900 <sup>5</sup>	89,100	<b>2,475,760</b>	<b>2,361,757</b>
<b>2014</b>	2,060	700	240,300	136,700	103,000	26,100	114,200	81,100	71,500	53,600	89,800	<b>2,520,660</b>	<b>2,397,832</b>
<b>2015</b>	2,060	700	241,800	139,400	103,400	26,300	117,000	82,300	72,900	55,500	90,400	<b>2,549,460</b>	<b>2,437,305</b>
<b>2016*</b>	2,178	700	244,600	142,500	104,100	26,400	120,100	83,600	74,700	56,100	91,400	<b>2,587,582</b>	<b>2,479,209</b>
<b>2017</b>	2,183	700	247,300	145,000	105,000	27,000	123,000	81,381	76,400	56,900	91,600	<b>2,623,960</b>	<b>2,495,852</b>
<b>2018</b>	2,373	440	250,300	152,289	107,715	27,715	114,200	83,500	78,200	57,700	91,900	<b>2,661,210</b>	<b>2,526,714</b>
<b>2019</b>	2,373	450	254,000	156,071	108,800	28,085	114,200	84,200	80,100	58,600	92,500	<b>2,708,920</b>	<b>2,599,845</b>
<b>2020</b>	2,183	460	259,200	160,100	110,100	28,600	119,364	84,100	82,100	59,700	93,400	<b>2,761,070</b>	<b>2,658,845</b>
<b>2021</b>	2,183	466	263,300	163,500	110,500	29,000	121,500	85,300	83,900	60,500	94,800	<b>2,801,370</b>	<b>2,689,736</b>

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.

<sup>2</sup> Population on private wells excluded for the Village of Anmore, the Village of Belcarra, the City of Coquitlam (2002 – 2008), the Township of Langley, the City of Maple Ridge, the District of North Vancouver, and the City of Surrey.

<sup>3</sup> UEL/UBC population does not include the UBC daytime population (Table 2.3B).

<sup>4</sup> Regional population totals are calculated from 2016 onward and will be reconciled with the Water Consumption Statistics 2022 Report in the next report cycle.

<sup>5</sup> Total Serviced Population from Water Consumption Statistics 2021 Report

\* indicates a census year for which member jurisdiction population figures are based on published census figures with an undercount adjustment. The 2021 population is to be updated in the next report cycle

Table 2.3B: GVWD and member jurisdiction serviced populations, 2000 - 2021<sup>1</sup> continued (City of Pitt Meadows to the District of West Vancouver)

	Pitt Meadows	Port Coquitlam	Port Moody	Richmond	Surrey	scwáθen msteyax <sup>w</sup>	UEL/UBC <sup>3</sup>	Vancouver	West Vancouver <sup>2</sup>	TOTAL Regional Population <sup>4</sup>	TOTAL GVWD Serviced Population <sup>5</sup>
<b>2000</b>	15,219	52,358	24,145	167,656	352,788	N/A	7,923	562,132	44,772	<b>2,040,276</b>	<b>1,918,055</b>
<b>2001*</b>	15,496	53,349	24,778	170,985	362,013	N/A	8,132	569,074	44,815	<b>2,074,687</b>	<b>1,950,363</b>
<b>2002</b>	15,607	53,473	25,343	173,253	371,118	N/A	8,931	574,758	44,872	<b>2,097,200</b>	<b>1,996,628</b>
<b>2003</b>	15,719	53,598	25,908	175,521	380,222	N/A	9,731	580,442	44,931	<b>2,116,015</b>	<b>2,018,936</b>
<b>2004</b>	15,961	53,912	26,673	177,775	389,778	N/A	10,136	587,590	45,011	<b>2,135,530</b>	<b>2,048,562</b>
<b>2005</b>	16,225	54,058	27,629	180,250	400,516	N/A	11,121	593,881	45,050	<b>2,139,756</b>	<b>2,073,086</b>
<b>2006*</b>	16,554	54,543	28,747	182,652	412,847	N/A	11,600	601,203	45,198	<b>2,140,543</b>	<b>2,109,014</b>
<b>2007</b>	16,848	55,098	30,100	185,186	425,442	N/A	11,980	605,844	45,524	<b>2,172,789</b>	<b>2,140,286</b>
<b>2008</b>	17,758	55,713	31,724	187,403	436,445	N/A	12,499	608,503	45,983	<b>2,206,034</b>	<b>2,170,188</b>
<b>2009</b>	17,939	56,647	32,995	190,673	450,087	N/A	12,708	611,883	46,398	<b>2,244,797</b>	<b>2,208,582</b>
<b>2010</b>	18,039	57,187	33,482	192,744	464,585	N/A	13,099	614,614	46,724	<b>2,277,184</b>	<b>2,239,679</b>
<b>2011*</b>	18,281	57,474	33,638	194,301	477,864	N/A	13,297	616,910	46,794	<b>2,343,007</b>	<b>2,282,217</b>
<b>2012</b>	18,283	58,138	33,735	197,494	488,722	N/A	13,786	621,950	46,902	<b>2,426,266</b>	<b>2,313,764</b>
<b>2013</b>	18,800	58,400	34,500	200,100	507,700	N/A	14,700	642,500	46,400	<b>2,475,760</b>	<b>2,361,757</b>
<b>2014</b>	19,100	59,300	34,600	202,800	521,000	N/A	15,500	652,900	46,600	<b>2,520,660</b>	<b>2,397,832</b>
<b>2015</b>	19,400	60,500	34,800	205,100	531,500	N/A	16,000	660,100	46,100	<b>2,549,460</b>	<b>2,437,305</b>
<b>2016*</b>	19,600	61,500	35,000	207,300	542,700	N/A	16,400	665,900	46,700	<b>2,587,582</b>	<b>2,479,209</b>
<b>2017</b>	20,000	61,700	35,600	211,100	554,000	N/A	29,900	670,800	46,800	<b>2,623,960</b>	<b>2,495,852</b>
<b>2018</b>	20,400	61,800	36,300	215,200	565,500	2,253	30,200	675,900	47,500	<b>2,661,210</b>	<b>2,526,714</b>
<b>2019</b>	20,900	62,000	37,000	220,200	579,000	2,858	30,700	682,600	48,100	<b>2,708,920</b>	<b>2,599,845</b>
<b>2020</b>	21,400	62,200	37,500	224,400	592,400	3,500	31,300	692,300	48,800	<b>2,761,070</b>	<b>2,658,845</b>
<b>2021</b>	21,700	62,400	37,900	227,100	602,000	4,200	31,900	700,300	49,200	<b>2,801,370</b>	<b>2,689,736</b>

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.<sup>2</sup> Population on private wells excluded for the Village of Anmore, the Village of Belcarra, the City of Coquitlam (2002 – 2008), the Township of Langley, the City of Maple Ridge, the District of North Vancouver, and the City of Surrey.<sup>3</sup> UEL/UBC population does not include the UBC daytime population. (Table 2.3B).<sup>4</sup> Regional population totals are calculated from 2016 onward and will be reconciled with the Water Consumption Statistics 2022 Report in the next report cycle.<sup>5</sup> Total Serviced Population from Water Consumption Statistics 2021 Report

\* indicates a census year for which member jurisdiction population figures are based on published census figures with an undercount adjustment. The 2021 population is to be updated in the next report cycle

### 3.0 Regional Results

This section presents regional results of all water consumption data received from 2000 to 2021. Table 3.1 presents a checklist of data received from each member jurisdiction organized by year.

Amalgamated data for the region was compiled based on the analysis of metering data provided by the member jurisdictions.

Table 3.1: Data received by member jurisdiction during study period 2000 – 2021

Member Jurisdiction	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Anmore														○	○	○	○	○	○	○	○	○
Belcarra														○	○	○	○	○	○	○	○	○
Burnaby <sup>1</sup>	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●
Coquitlam	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Delta	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
City of Langley	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Township of Langley	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Maple Ridge	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
New Westminster	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
City of North Vancouver	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
District of North Vancouver	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Pitt Meadows	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Port Coquitlam	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Port Moody	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○				
Richmond	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Surrey	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
sc̓w̓aθ̓ən məsteyəx <sup>w</sup>																			●	●	●	●
UEL <sup>2</sup>	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Vancouver	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
West Vancouver	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Legend: ● - data provided    ○ - partial data provided     - data not provided or not available

<sup>1</sup> Burnaby did not provide data for 2018. This report has used 2017 data as 2018 data for processing.

<sup>2</sup> University Endowment Lands (UEL) is not technically a member jurisdiction but is an Electoral Area, a wholesale customer and therefore a member of the GVWD Board. Their metering data was only provided by UBC Utilities for properties on UBC grounds for 2002 – 2012.

## Drinking Water Sources

The GVWD treats and delivers drinking water from the Capilano, Seymour, and Coquitlam reservoirs and is the sole drinking water provider for most member jurisdictions in the region. However, three member jurisdictions also derive water from non-GVWD sources to supplement their drinking water supply by the GVWD. In 2021, approximately 1.2% of water consumed in the City of Delta was from their municipal sources, while the Township of Langley and the District of West Vancouver used their own municipal sources to supply 29.6% and 42.8% of their water consumption, respectively. Furthermore, a small percentage of the population in the Villages of Anmore and Belcarra, the City of Delta, the Township of Langley, the City of Maple Ridge, the District of North Vancouver, and the City of Surrey have private wells and sources.

This report presents consumption statistics for all water supplied by the GVWD and member jurisdictions. Water supplied by private sources and the populations serviced by private sources are not included in the calculation or results presented in this report.

## Metering Practices in the GVWD Region

Metering practices and the extent of metering vary by sector and member jurisdiction. An estimate of the sectors metered in each member jurisdiction in 2021 is summarized in Table 3.2. Members provide these estimates in the questionnaire, and estimates vary year over year. The extent of metering in Table 3.2 is self-reported by members and may not reflect the data results on metered water consumption in this report.

Table 3.2: Member jurisdiction metering estimates in 2021

Member Jurisdiction	Estimated Percentage of Metered Connections by Sector in 2021					
	Single-Family	Multi-Family	Commercial	Institutional	Industrial	Agricultural
Anmore <sup>1</sup>	96% - 100%	N/A	N/A	96% - 100%	N/A	N/A
Belcarra <sup>1</sup>	96% - 100%	N/A	N/A	N/A	N/A	N/A
Burnaby	0% - 5%	0% - 5%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Coquitlam	0% - 5%	0% - 5%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Delta	6% - 35%	0% - 5%	66% - 95%	66% - 95%	66% - 95%	66% - 95%
City of Langley	96% - 100%	96% - 100%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Township of Langley	0% - 5%	0% - 5%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Maple Ridge	6% - 35%	36% - 65%	66% - 95%	36% - 65%	66% - 95%	36% - 65%
New Westminster	0% - 5%	96% - 100%	96% - 100%	96% - 100%	96% - 100%	N/A
City of North Vancouver	0% - 5%	0% - 5%	96% - 100%	N/A	96% - 100%	N/A
District of North Vancouver	0% - 5%	6% - 35%	36% - 65%	N/A	N/A	N/A
Pitt Meadows <sup>2</sup>	0% - 5%	0% - 5%	66% - 95%	36% - 65%	96% - 100%	96% - 100%
Port Coquitlam	0% - 5%	0% - 5%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Port Moody	0% - 5%	66% - 95%	36% - 65%	96% - 100%	96% - 100%	N/A
Richmond	96% - 100%	36% - 65%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
Surrey <sup>3</sup>	66% - 95%	36% - 65%	96% - 100%	96% - 100%	66% - 95%	66% - 95%
sc̥awaθan məsteyəx <sup>w</sup>	N/A <sup>4</sup>	N/A <sup>4</sup>	96% - 100%	N/A	N/A	N/A
University Endowment Lands	96% - 100%	96% - 100%	96% - 100%	96% - 100%	N/A	N/A
Vancouver	6% - 35%	96% - 100%	96% - 100%	96% - 100%	96% - 100%	96% - 100%
West Vancouver	96% - 100%	96% - 100%	96% - 100%	N/A	N/A	N/A

<sup>1</sup> Single-family residential homes in the Villages of Anmore and Belcarra are mostly metered but still charged a flat rate (not based on consumption).

<sup>2</sup> All multi-family residential (townhouses and apartments) in the City of Pitt Meadows are metered but charged a flat rate (not based on consumption).

<sup>3</sup> The City of Surrey provides water to agricultural properties for the purpose of domestic use only.

<sup>4</sup> For sc̥awaθan məsteyəx<sup>w</sup>, meters have been installed at new single and multi-family homes but are not currently billed as meter connections. N/A – not applicable; OR there are no identified connections of this sector type, OR Institutional connections could be metered but may not appear as billed accounts for certain member jurisdictions.

Table 3.3 shows the region's total number of unmetered and metered connections over the 2000 to 2021 study period.

Figures 3.1, 3.2 and Table 3.4 provide the number of unmetered and metered connections as a percentage of total serviced connections. Note that if a property has several separately metered connections assigned different account numbers by the member jurisdiction, each connection is counted individually.

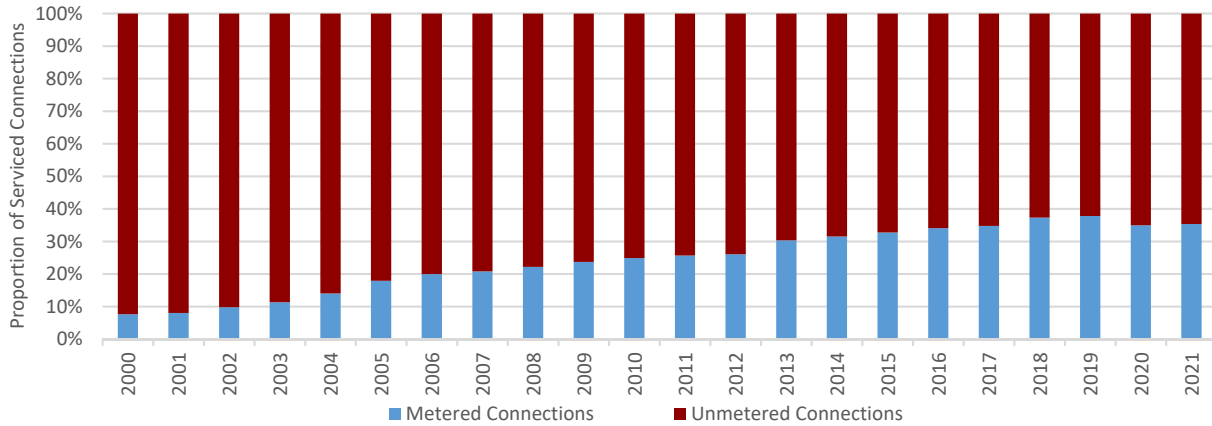


Figure 3.1: Proportion of metered and unmetered connections in the GVWD region\*

\* The proportion of metered connections is slightly lower in 2020 and 2021 due to a substantial increase in the total number of connections attributed to improvements in billing system accuracies. The data is to be verified in the next report cycle.

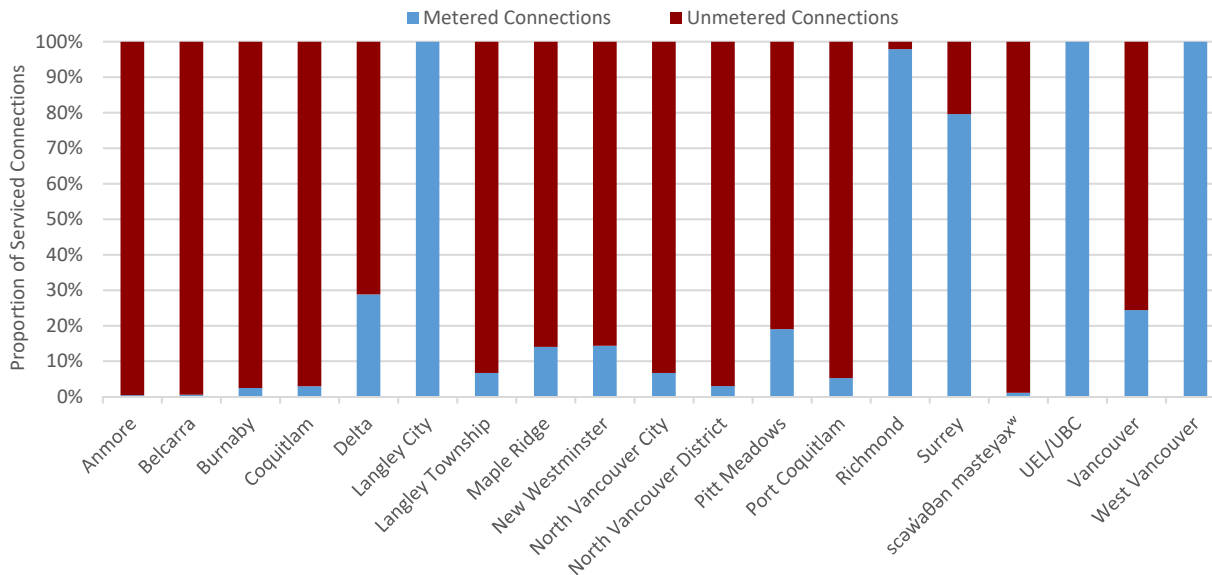


Figure 3.2: Proportion of metered and unmetered connections in 2021 by member jurisdiction\*

\* The Villages of Anmore and Belcarra and the scəwəbən məsteyəx\* are shown as unmetered as they continue to bill properties as unmetered. However, they are extensively metered, and since their consumption is within 0.5% of regional consumption, their consumption is counted as metered consumption for later parts of this report.

Table 3.3: Total number of unmetered and metered serviced connections in the GVWD, 2000 - 2021<sup>1</sup>

Year	Total Number of Serviced Connections	Number of Unmetered Connections	Number of Metered Connections	Breakdown of Metered Connections							
				Single-Family	Multi-Family	Commercial	Institutional	Industrial	Agricultural	Other <sup>2</sup>	Unknown <sup>3</sup>
2000	425,451	394,457	32,587	7,367	6,549	13,625	2,084	1,594	936	837	0
2001	428,769	395,946	34,559	8,933	6,628	13,805	2,154	1,620	978	849	0
2002	443,374	399,879	43,495	11,710	11,028	15,879	2,150	1,287	962	479	0
2003	455,663	404,108	51,555	19,433	11,196	16,009	2,214	1,300	995	408	0
2004	463,948	398,907	65,041	32,353	11,502	16,160	2,249	1,300	1,079	398	0
2005	462,908	380,111	82,797	49,280	12,057	16,317	2,304	1,316	1,111	412	0
2006	465,599	372,554	93,035	58,368	12,523	17,013	2,533	1,134	1,069	395	0
2007	469,570	371,940	97,613	62,455	12,837	17,039	2,554	1,136	1,125	467	0
2008	475,512	369,029	105,024	68,983	13,676	16,881	2,551	1,145	1,503	285	0
2009	469,978	358,563	111,415	74,962	13,951	17,298	2,528	787	1,644	245	0
2010	474,123	356,293	117,830	80,837	14,413	17,278	2,555	796	1,695	256	0
2011	476,998	354,579	122,419	85,156	14,667	17,246	2,588	780	1,725	257	0
2012	486,001	359,361	126,640	88,770	15,073	17,293	2,702	800	1,743	259	0
2013	445,137	310,097	135,040	92,668	17,005	16,897	2,802	817	1,692	306	2,853
2014	447,611	306,628	140,983	98,253	17,211	16,908	2,838	823	1,757	308	2,885
2015	449,742	302,481	147,261	104,268	17,489	16,930	2,870	832	1,779	316	2,777
2016	458,351	297,643	153,614	110,205	17,975	16,980	2,883	840	1,780	324	2,627
2017	458,066	298,886	159,880	114,879	17,609	16,714	2,920	817	1,865	337	4,039
2018 <sup>4</sup>	428,613	268,728	159,885	117,746	16,502	16,865	2,823	763	1,955	628	2,603
2019 <sup>5</sup>	431,073	268,117	162,956	120,964	16,413	16,859	2,826	754	1,958	635	2,547
2020 <sup>5</sup>	473,368	307,639	165,417	126,674	14,422	16,863	2,770	743	2,035	562	1,348
2021	477,206	308,637	168,569	128,259	15,685	17,233	3,006	754	2,048	586	998

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.<sup>2</sup> "Other" consists mainly of connections to utilities and municipal facilities not classified under institutional.<sup>3</sup> "Unknown" represents serviced connections with no sector codes assigned, assumed to be the ICI sector.<sup>4</sup> The City of Burnaby data for 2018 was not provided, so 2017 data was used for calculations and charts.<sup>5</sup> The large increase in unmetered connections from 2019 to 2020 is attributed to increased billing system accuracies by the City of Burnaby during system upgrades in 2019.

Table 3.4: Percentage of unmetered and metered serviced connections in the GVWD, as a percentage of all serviced connections, 2000 - 2021<sup>1</sup>

Year	Total Number of Serviced Connections	Number of Unmetered Connections	Number of Metered Connections	Breakdown of Metered Connections							
				Single-Family	Multi-Family	Commercial	Institutional	Industrial	Agricultural	Other <sup>2</sup>	Unknown <sup>3</sup>
2000	100.0%	92.7%	7.7%	1.7%	1.5%	3.2%	0.5%	0.4%	0.2%	0.2%	0.0%
2001	100.0%	92.3%	8.1%	2.1%	1.5%	3.2%	0.5%	0.4%	0.2%	0.2%	0.0%
2002	100.0%	90.2%	9.8%	2.6%	2.5%	3.6%	0.5%	0.3%	0.2%	0.1%	0.0%
2003	100.0%	88.7%	11.3%	4.3%	2.5%	3.5%	0.5%	0.3%	0.2%	0.1%	0.0%
2004	100.0%	86.0%	14.0%	7.0%	2.5%	3.5%	0.5%	0.3%	0.2%	0.1%	0.0%
2005	100.0%	82.1%	17.9%	10.6%	2.6%	3.5%	0.5%	0.3%	0.2%	0.1%	0.0%
2006	100.0%	80.0%	20.0%	12.5%	2.7%	3.7%	0.5%	0.2%	0.2%	0.1%	0.0%
2007	100.0%	79.2%	20.8%	13.3%	2.7%	3.6%	0.5%	0.2%	0.2%	0.1%	0.0%
2008	100.0%	77.6%	22.1%	14.5%	2.9%	3.6%	0.5%	0.2%	0.3%	0.1%	0.0%
2009	100.0%	76.3%	23.7%	16.0%	3.0%	3.7%	0.5%	0.2%	0.3%	0.1%	0.0%
2010	100.0%	75.1%	24.9%	17.0%	3.0%	3.6%	0.5%	0.2%	0.4%	0.1%	0.0%
2011	100.0%	74.3%	25.7%	17.9%	3.1%	3.6%	0.5%	0.2%	0.4%	0.1%	0.0%
2012	100.0%	73.9%	26.1%	18.3%	3.1%	3.6%	0.6%	0.2%	0.4%	0.1%	0.0%
2013	100.0%	69.7%	30.3%	20.8%	3.8%	3.8%	0.6%	0.2%	0.4%	0.1%	0.6%
2014	100.0%	68.5%	31.5%	22.0%	3.8%	3.8%	0.6%	0.2%	0.4%	0.1%	0.6%
2015	100.0%	67.3%	32.7%	23.2%	3.9%	3.8%	0.6%	0.2%	0.4%	0.1%	0.6%
2016	100.0%	64.9%	33.5%	24.0%	3.9%	3.7%	0.6%	0.2%	0.4%	0.1%	0.6%
2017	100.0%	65.2%	34.8%	25.1%	3.8%	3.6%	0.6%	0.2%	0.4%	0.1%	0.9%
2018 <sup>4</sup>	100.0%	62.7%	37.3%	27.5%	3.9%	3.9%	0.7%	0.2%	0.5%	0.1%	0.6%
2019	100.0%	62.2%	37.8%	28.1%	3.8%	3.9%	0.7%	0.2%	0.5%	0.1%	0.6%
2020	100.0%	65.0%	34.9%	26.8%	3.0%	3.6%	0.6%	0.2%	0.4%	0.1%	0.3%
2021	100.0%	64.7%	35.3%	26.9%	3.3%	3.6%	0.6%	0.2%	0.4%	0.1%	0.2%

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.<sup>2</sup> "Other" consists mainly of connections to utilities and municipal facilities not classified under institutional.<sup>3</sup> "Unknown" represents serviced connections with no sector codes assigned.<sup>4</sup> Burnaby data for 2018 was not provided, so 2017 data was used for calculations and charts.

## Residential Metering

The residential sector comprises single-family and multi-family residential connections across the region. This sector is experiencing the most significant changes in water consumption and patterns across the region. Continued net population growth, increase in transit-oriented housing and mixed-use developments, and densification of urban and semi-urban areas within member jurisdictions are all contributing factors.

The data used for this report provides an estimate of the metered residential consumption, and it is assumed that unmetered consumption is primarily residential connections. However, there are inconsistencies in the data from past report periods regarding residential counts and the number of connections versus the regional housing numbers.

For 2020 and 2021, members were requested to provide a breakdown of the types and number of metered and unmetered connections, including single-family and multi-family connections. The reported results for the region are summarized in Table 3.5 below for information only. These numbers are not used in the report calculations, tables and charts.

*Table 3.5: Member Jurisdictions reported number of connections by sector for 2020 and 2021*

<b>UNMETERED CONNECTIONS</b>	<b>2020</b>	<b>2021</b>
Single-family (can also include basement suites, laneway houses, etc.)	197,135	196,220
Multi-family	83,378	86,902
Commercial	24,590	24,831
Industrial	199	284
Institutional	115	114
Agricultural	326	315
Other	256	323
Unknown <sup>1</sup>	24,332	24,267
<b>METERED CONNECTIONS</b>		
	<b>2020</b>	<b>2021</b>
Single-family (can also include basement suites, laneway houses, etc.)	127,298	129,391
Multi-family (provide additional breakdowns by type, if available)	38,918	40,588
Commercial	18,320	18,258
Industrial	1,264	1,256
Institutional	2,807	2,848
Agricultural	2,246	2,264
Other	658	770
Unknown	120	119

<sup>1</sup> These unmetered connections are assumed to be residential since the ICI sector is almost fully metered. Regional data is to be verified with updated connections data from members in the next report cycle.

The number breakdowns for connection types will continue to be requested in subsequent report cycles and will help track changes in the residential sector and verify regional results.

For 2021, the numbers reported by member jurisdictions in Table 3.5 are within 0.6% and 0.7% of the unmetered and metered connections, respectively, shown in Table 3.3 and as determined by the AUCs and provided data. Further work is needed on the breakdown of the unmetered connections provided by member jurisdictions.

### Single-family Residential

As reported in Table 3.4, an estimated 64.7% of serviced connections in the region are unmetered as of 2021. It assumed that this comprises only residential properties, although the distribution of unmetered connections between single-family and multi-family properties requires more and improved data. The exceptions are single-family homes in the City of Langley, the City of Richmond, and the District of West Vancouver, the three-member jurisdictions in the region that have 100% metering of the single-family sector.

For the reporting period 2000 to 2021, metering programs in the Cities of Surrey and Vancouver effectively increased water metering for single-family residences by 63,872 and 8,859 more metered connections, respectively. In 2021, the City of Surrey and the City of Vancouver had policies and by-laws that mandated the installation of meters with the construction of new homes or significant renovations to existing homes.

### Multi-family Residential

Most member jurisdictions have a portion of their multi-family residential connections metered. Multi-family residential refers to legal apartment buildings, townhouses, duplexes, condominiums, and other structures that provide more than one self-contained dwelling unit. All multi-family connections are metered in the City of Langley, the City of New Westminster, University Endowment Lands, the City of Vancouver and the District of West Vancouver. The multi-family connections across the region are counted per strata or building or complex and not individual units.

The unmetered connections by sector distribution continue to be a data gap for the compilation of this report, and Table 3.5 is a start to track the metering changes in the residential sector.

Figure 3.3 shows the by-sector distribution of metered connections in the region.

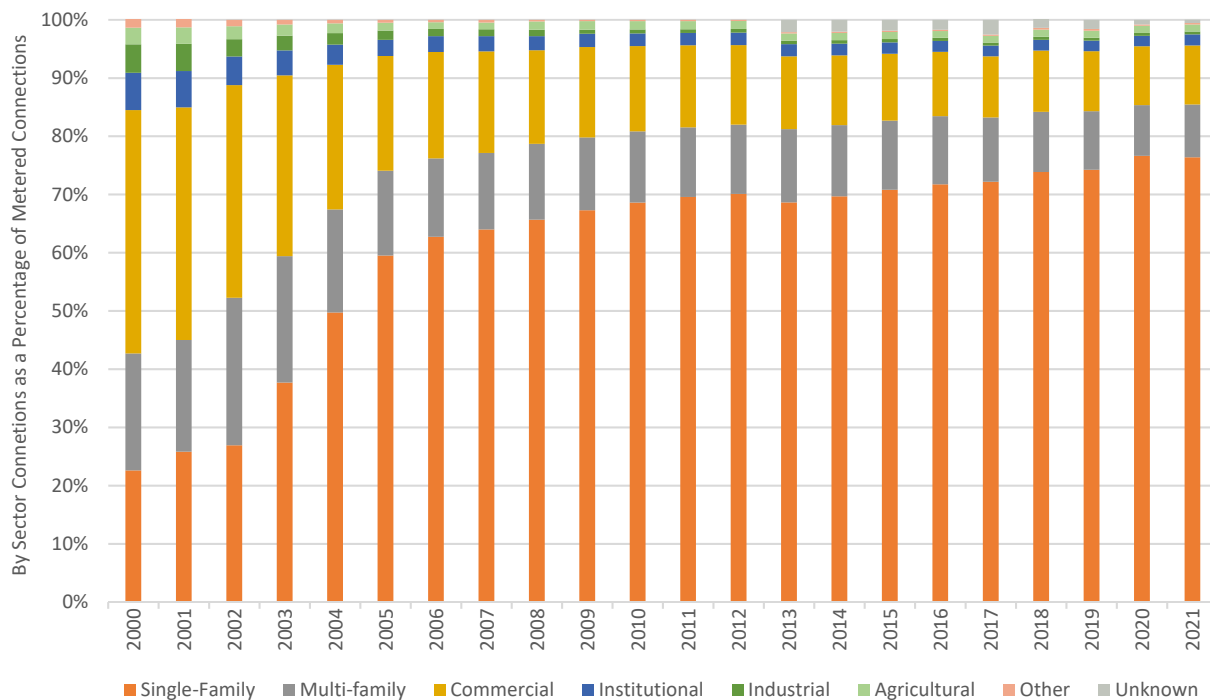


Figure 3.3: By sector distribution of metered connections in the region, 2000 – 2021

### Industrial, Commercial, Institutional and Agricultural Metering

The region's industrial, commercial, institutional and agricultural connections are mostly metered. Common exceptions to ICI connections' metering include properties owned and operated by member jurisdictions, such as parks, cemeteries, yards and public washrooms. As of 2021, ICI connections in most member jurisdictions are fully metered. The number of connections in the ICI sector has remained fairly constant (Figure 3.4), although the number of 'Unknown' connections (with no assigned AUC) has increased since 2013. This report assumes that 'Unknown' connections are within the commercial sector as a subset of the ICI sector.

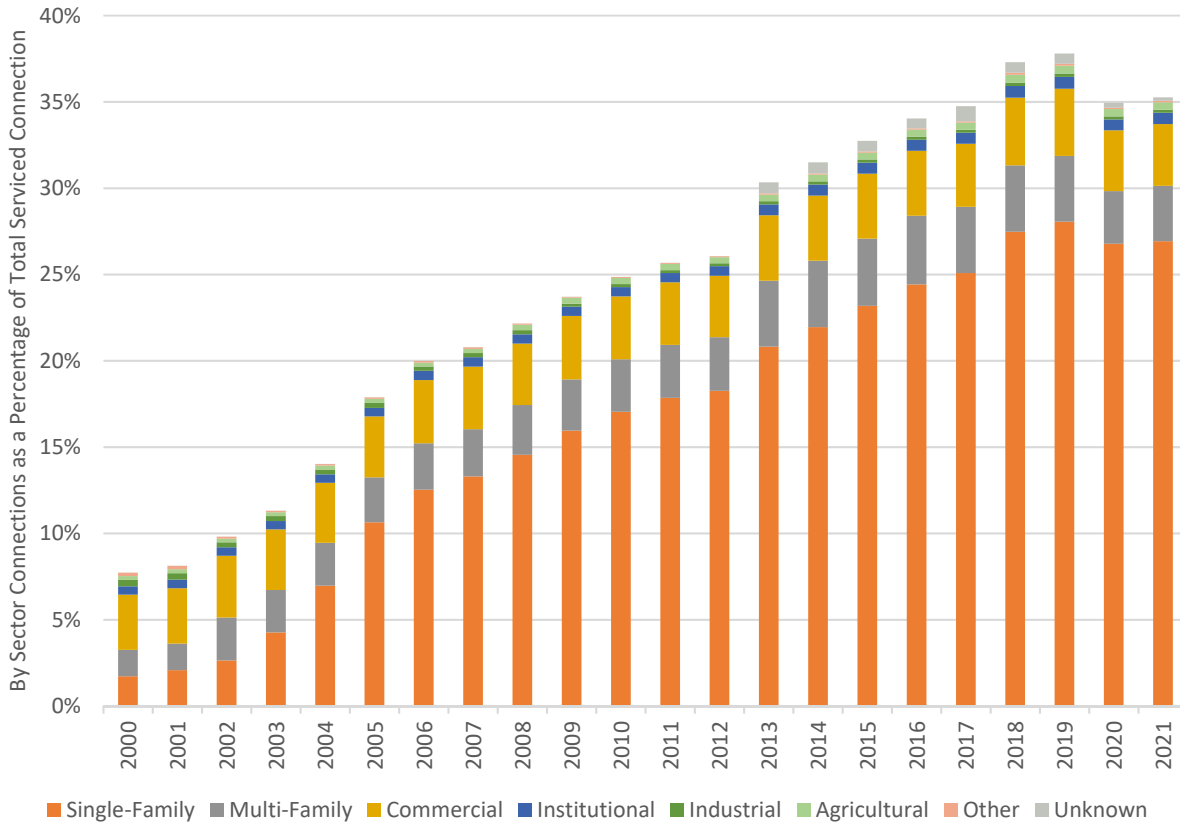


Figure 3.4: By sector distribution of metered connections as a percentage of all serviced connections in the region, 2000 to 2021\*

\*2020 to 2021 data are lower than the 2019 data due to a substantial increase in the total number of connections attributed to improvements in billing system accuracies. The total serviced and unmetered connections in 2020 significantly increased compared to the 2019 data. Therefore, the total number of serviced, unmetered and metered connections from 2020 and 2021 are deemed more accurate. However, information verification will continue into the next report cycle to improve data accuracy for 2013 to 2019.

## Consumer Water Rates in the GVWD Region

This section summarizes the rates charged for water services throughout the region.

### Flat Rates (Unmetered)

Unmetered single- and multi-family residential connections are typically charged a flat rate fee dependent on member jurisdiction, based on the type of connection and the number of dwelling units on the property.

Figure 3.5 and Table 3.6 provide flat rate fees for unmetered single-family connections in each jurisdiction. Flat rate fees for unmetered multi-family connections are shown in Figure 3.6 and Table 3.7. The City of Richmond still has a flat rate in their by-laws and billing system.

As of 2021, the average flat rate in the region for unmetered single-family homes was \$689/year; for unmetered multi-family homes, it was \$458/year. The average wholesale flat rate of \$202/year is estimated using the per capita per day consumption in 2019, average persons per household and the average wholesale rate used by the GVWD.

Note for Figures 3.5 and 3.6, the City of Langley, the City of New Westminister (multi-family only), the University Endowment Lands and UBC, and the District of West Vancouver are universally metered and do not charge flat rates for these connections, so are not shown in the figures.

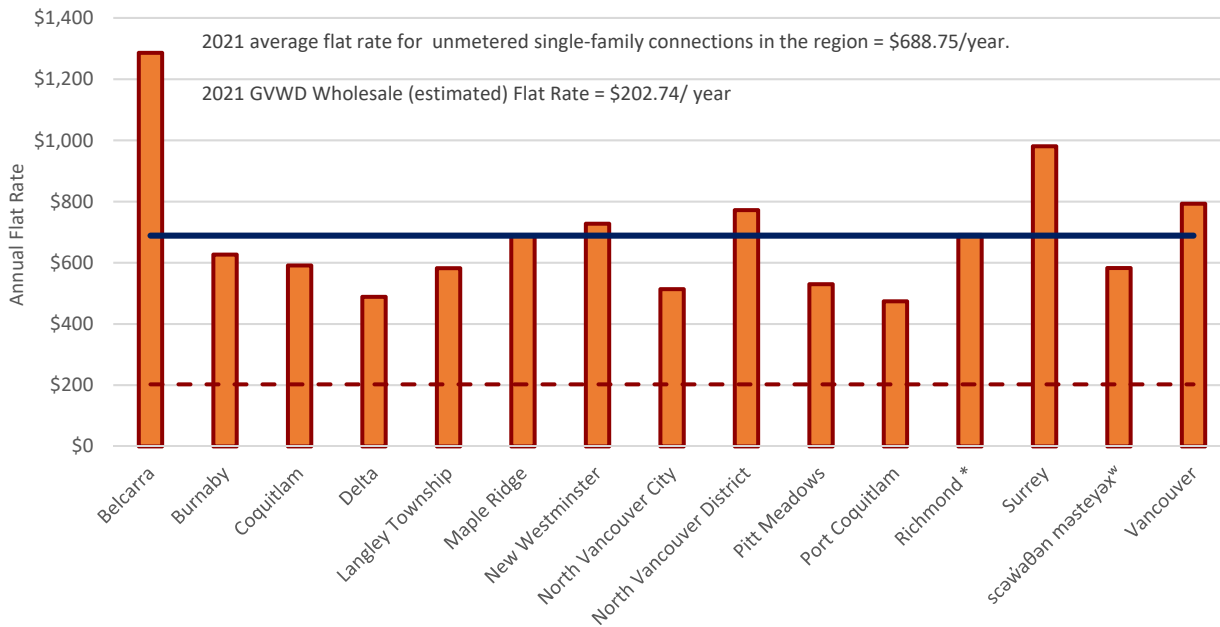


Figure 3.5: Single-family flat rates for unmetered connections in 2021.

Note: The GVWD Wholesale rate is estimated as a flat rate for unmetered connections, using average annual residential consumption. \*The City of Richmond carries a flat rate for unmetered single-family connections in its bylaws, although it is 100% metered in the single-family sector.

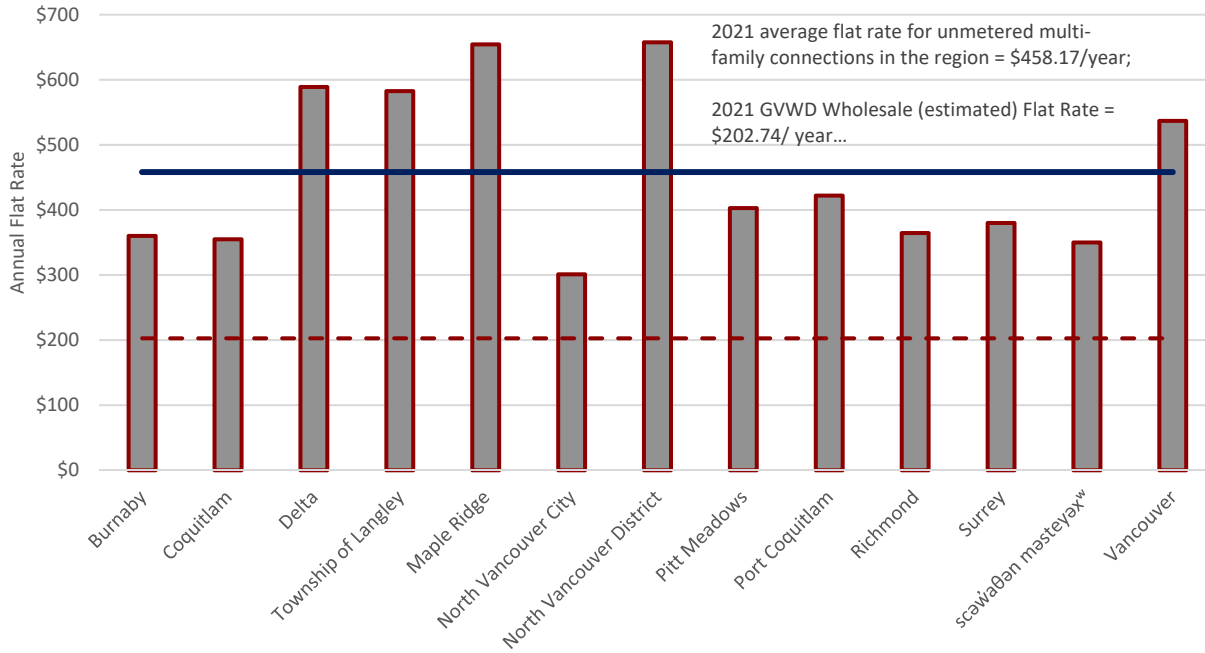


Figure 3.6: Multi-family flat rates for unmetered connections in 2021.

Note: The GVWD Wholesale rate is estimated as a flat rate for unmetered connections, using average annual residential consumption.

### Metered Rates

The region's rate structures for metered consumption include declining block rate, inclining block rate, and seasonal and uniform rate structures. Nine member jurisdictions have adopted a consistent rate structure for all connections and through all seasons. The Cities of New Westminister and Port Coquitlam have a four-block declining rate structure. The District of West Vancouver has a four-block inclining unit rate for single-family residential and applies the same constant rate for multi-family and commercial connections. All other member jurisdictions have one rate for connections regardless of sector or property use type. The University Endowment Lands and the City of Vancouver are the only ones to have adopted seasonal pricing, with rates rising by \$0.57 and \$0.31, respectively, from June 1 to September 30.

Figure 3.7 and Table 3.8 provide metered rates by member jurisdiction in the GVWD region. The average metered rate in the region was \$1.56/m<sup>3</sup> in 2021. The average wholesale metered rate in 2021 was \$0.83/m<sup>3</sup>.

In addition to the metered rates, some member jurisdictions have a minimum charge for consumption up to a specified volume. Some member jurisdictions charge an additional fee based on the size of the metered connection, while others charge a base fee plus the metered rate for each unit volume consumed. Seventeen members have flat rates for unmetered connections, including the City of Richmond, which is 100% metered in the single-family sector.

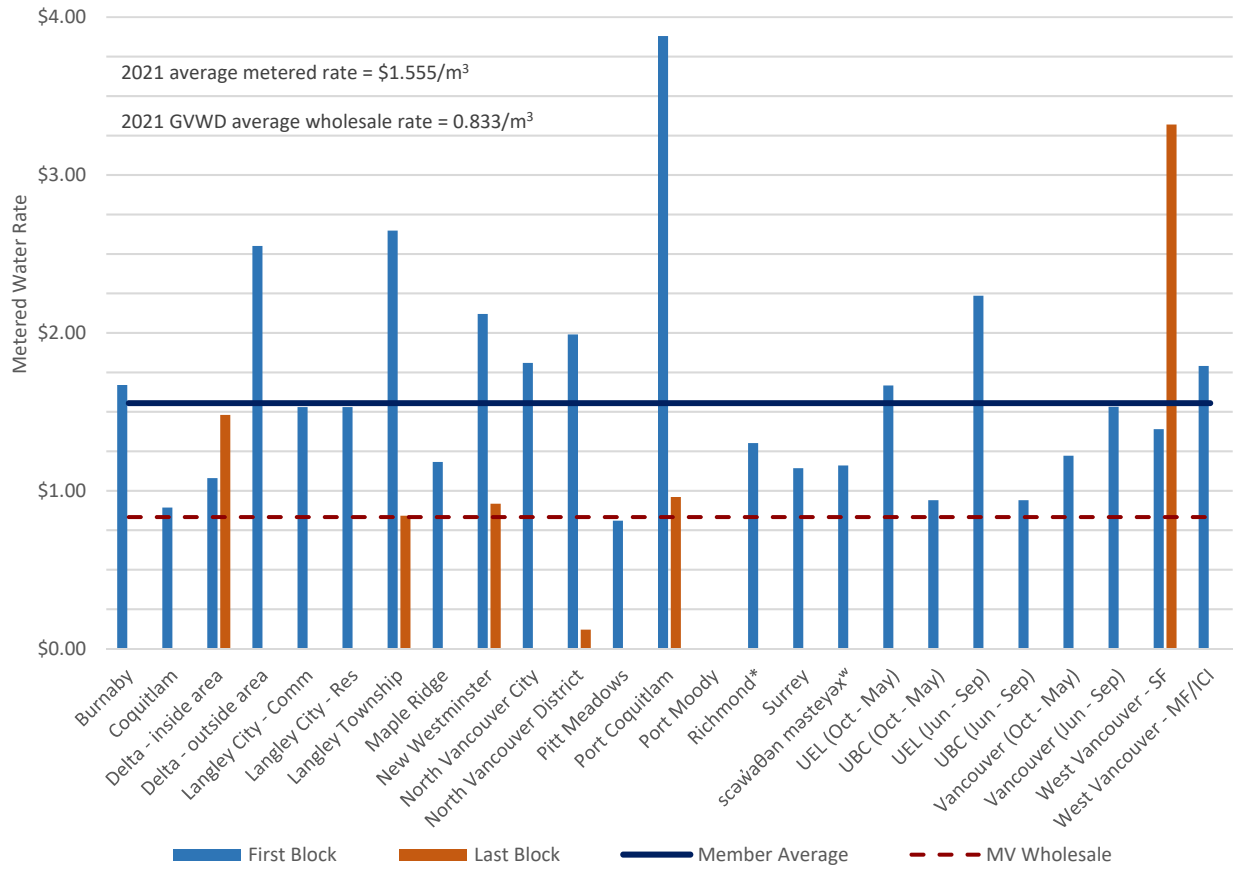


Figure 3.7: Metered rates in 2021 showing first and last blocks where applicable.

Note: The City of Richmond has a flat rate for unmetered connections in its bylaws, and discounts metered unit rates by 10% if paid on time.

Table 3.6: Flat rates for unmetered Single-family residential connections, by member jurisdiction (\$/year), 2000 - 2021<sup>1</sup>

Year	Belcarra	Burnaby	Coquitlam	Delta	Langley Township	Maple Ridge	New Westminster	North Vancouver City	North Vancouver District	Pitt Meadows	Port Coquitlam	Port Moody	Richmond <sup>2</sup>	Surrey	scawāḅən mesteḅəx <sup>3</sup>	Vancouver	West Vancouver Min <sup>3</sup>	West Vancouver Max <sup>3</sup>
2000	N/A	\$180.02	\$175.00	N/A	\$140.00	\$158.00	\$176.30	\$160.00	\$232.00	\$162.00	\$179.42	\$176.00	\$212.05	\$212.00	N/A	\$256.00	\$251.00	\$286.00
2001	N/A	\$189.03	\$175.00	N/A	\$143.01	\$171.00	\$176.30	\$165.00	\$237.00	\$168.00	\$179.42	\$177.00	\$225.62	\$212.00	N/A	\$261.00	\$264.00	\$300.00
2002	N/A	\$209.92	\$175.00	\$125.00	\$145.88	\$221.00	\$176.30	\$170.00	\$242.00	\$181.00	\$179.42	\$182.00	\$255.65	\$238.70	N/A	\$264.00	\$277.00	\$315.00
2003	N/A	\$222.52	\$189.00	\$132.00	\$145.88	\$230.00	\$179.83	\$176.00	\$258.00	\$208.00	\$197.28	\$182.00	\$273.64	\$238.70	N/A	\$271.00	\$296.00	\$337.00
2004	N/A	\$235.87	\$205.00	\$145.00	\$145.88	\$239.00	\$192.42	\$183.00	\$276.00	\$225.00	\$214.72	\$192.00	\$304.85	\$238.70	N/A	\$287.00	\$317.00	\$361.00
2005	N/A	\$257.69	\$225.00	\$158.00	\$148.43	\$253.60	\$205.70	\$190.00	\$292.00	\$245.00	\$230.25	\$214.00	\$328.02	\$251.00	N/A	\$306.00	\$339.00	\$386.00
2006	N/A	\$281.53	\$257.00	\$183.00	\$268.46	\$268.80	\$215.94	\$197.00	\$307.00	\$270.00	\$244.00	\$227.00	\$372.37	\$329.00	N/A	\$329.00	\$403.33	\$458.88
2007	N/A	\$307.57	\$287.00	\$214.00	\$288.60	\$293.00	\$249.62	\$207.00	\$325.00	\$299.00	\$260.98	\$265.00	\$426.36	\$415.00	N/A	\$349.00	N/A	N/A
2008	N/A	\$341.40	\$304.00	\$225.00	\$302.16	\$319.40	\$274.80	\$215.00	\$345.00	\$334.00	\$274.03	\$281.00	\$451.52	\$473.00	N/A	\$361.00	N/A	N/A
2009	N/A	\$382.37	\$328.00	\$263.00	\$317.26	\$348.10	\$324.57	\$221.00	\$369.00	\$338.00	\$306.50	\$302.00	\$501.64	\$526.00	N/A	\$379.00	N/A	N/A
2010	N/A	\$435.90	\$359.00	\$300.00	\$348.19	\$379.50	\$349.24	\$248.00	\$415.00	\$362.00	\$334.00	\$322.00	\$525.23	\$600.00	N/A	\$417.00	N/A	N/A
2011	N/A	\$483.85	\$384.00	\$340.00	\$382.83	\$413.65	\$387.66	\$283.00	\$509.00	\$395.00	\$368.00	\$347.00	\$580.19	\$637.00	N/A	\$467.00	N/A	N/A
2012	N/A	\$512.88	\$407.00	\$370.00	\$420.92	\$450.90	\$410.54	\$331.00	\$550.00	\$409.00	\$393.00	\$356.00	\$621.51	\$650.88	N/A	\$513.00	N/A	N/A
2013	\$236.00	\$543.65	\$423.00	\$478.00	\$433.34	\$475.70	\$424.91	\$351.00	\$594.00	\$419.00	\$417.00	\$356.00	\$642.16	\$677.00	N/A	\$528.00	N/A	N/A
2014	\$246.00	\$573.55	\$436.00	\$491.00	\$458.12	\$501.85	\$450.40	\$380.00	\$618.00	\$438.00	\$427.00	\$357.00	\$654.66	\$738.00	N/A	\$546.00	N/A	N/A
2015	\$250.00	\$590.76	\$457.00	\$493.00	\$481.76	\$529.45	\$477.42	\$400.00	\$630.00	\$438.00	\$427.00	\$371.00	\$661.30	\$779.00	N/A	\$568.00	N/A	N/A
2016	\$254.00	\$602.58	\$475.00	\$500.00	\$493.32	\$553.30	\$503.68	\$440.00	\$643.00	\$431.00	\$427.00	\$403.00	\$667.72	\$810.00	N/A	\$616.00	N/A	N/A
2017	\$262.00	\$608.60	\$475.00	\$512.00	\$500.97	\$578.20	\$523.85	\$454.00	\$656.00	\$442.00	\$430.63	\$403.00	\$684.02	\$839.00	N/A	\$616.00	N/A	N/A
2018	\$878.00	\$608.60	\$475.00	\$440.00	\$507.23	\$604.20	\$555.30	\$468.00	\$679.00	\$453.00	\$430.63	\$432.00	\$624.30	\$869.00	\$502.00	\$653.00	N/A	N/A
2019	\$1,018.00	\$620.77	\$507.00	\$456.00	\$532.09	\$631.40	\$594.15	\$494.00	\$703.50	\$476.00	\$448.05	\$463.00	\$657.51	\$909.00	\$531.00	\$716.00	N/A	N/A
2020	\$1,119.00	\$626.98	\$568.00	\$469.00	\$558.20	\$659.80	\$727.87	\$489.00	\$738.75	\$505.00	\$464.99	N/A	\$679.83	\$951.00	\$563.00	\$785.00	N/A	N/A
2021	\$1,286.00	\$627.00	\$591.00	\$489.00	\$582.50	\$689.49	\$727.87	\$514.00	\$772.00	\$530.00	\$474.29	N/A	\$691.17	\$981.00	\$583.00	\$793.00	N/A	N/A

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.<sup>2</sup> The City of Richmond discounts rates by 10% if paid on time.<sup>3</sup> Universal metering was achieved in the District of West Vancouver in 2007; previously, single-family rates varied based on lot size.

N/A – information not available or not applicable

Table 3.7: Flat rates for unmetered Multi-family residential connections, by member jurisdiction (\$/unit/year), 2000 - 2021<sup>1</sup>

Year	Burnaby <sup>1</sup>		Coquitlam	Delta	Langley Township	Maple Ridge	North Vancouver City	North Vancouver District	Pitt Meadows <sup>1</sup>		Port Coquitlam		Port Moody	Richmond <sup>1,2</sup>		Surrey	scwāḡəḡən masteveḡw <sup>w</sup>	Vancouver <sup>1</sup>		West Vancouver
	Min	Max							Min	Max	Min	Max		Min	Max			Min	Max	
2000	\$103.38	\$134.99	\$175.00	\$201.00	\$140.00	\$158.00	\$138.00	\$198.00	\$124.00	\$162.00	\$172.06	\$179.42	\$176.00	\$145.28	\$183.32	\$200.00	N/A	\$92.00	\$174.00	\$220.00
2001	\$108.55	\$141.75	\$175.00	\$208.00	\$143.01	\$171.00	\$142.00	\$202.00	\$128.00	\$168.00	\$172.06	\$179.42	\$177.00	\$140.00	\$192.11	\$200.00	N/A	\$94.00	\$177.50	\$231.00
2002	\$120.54	\$157.42	\$175.00	\$225.00	\$145.88	\$210.00	\$147.00	\$206.00	\$138.00	\$181.00	\$172.06	\$178.03	\$182.00	\$138.23	\$214.93	\$220.00	N/A	\$94.00	\$179.00	\$243.00
2003	\$127.77	\$166.87	\$189.00	\$232.00	\$145.88	\$218.40	\$153.00	\$220.00	\$159.00	\$208.00	\$189.15	\$194.54	\$182.00	\$148.40	\$229.93	\$220.00	N/A	\$95.00	\$183.00	\$260.00
2004	\$135.44	\$176.88	\$205.00	\$245.00	\$145.88	\$227.14	\$159.00	\$235.00	\$172.00	\$225.00	\$205.84	\$211.76	\$192.00	\$165.18	\$256.33	\$220.00	N/A	\$101.00	\$194.00	\$278.00
2005	\$147.97	\$193.24	\$225.00	\$258.00	\$148.43	\$240.80	\$165.00	\$249.00	\$187.00	\$245.00	\$220.76	\$227.08	\$214.00	\$177.73	\$275.81	\$214.00	N/A	\$108.00	\$207.00	\$297.00
2006	\$161.66	\$211.11	\$257.00	\$283.00	\$268.46	\$255.25	\$171.00	\$262.00	\$206.00	\$270.00	\$233.98	\$240.68	\$227.00	\$196.43	\$304.83	\$214.00	N/A	\$117.00	\$223.00	\$353.33
2007	\$176.61	\$230.64	\$287.00	\$314.00	\$288.60	\$278.20	\$176.00	\$277.00	\$228.00	\$299.00	\$250.22	\$257.39	\$265.00	\$224.91	\$349.03	\$214.00	N/A	\$124.00	\$236.00	N/A
2008	\$196.04	\$256.01	\$304.00	\$325.00	\$302.16	\$303.20	\$178.00	\$294.00	\$255.00	\$334.00	\$262.73	\$270.26	\$281.00	\$238.18	\$369.62	\$214.00	N/A	\$128.00	\$244.00	N/A
2009	\$219.56	\$286.73	\$328.00	\$363.00	\$317.26	\$330.50	\$181.00	\$314.00	\$258.00	\$338.00	\$272.86	\$287.28	\$302.00	\$264.62	\$410.65	N/A	N/A	\$134.00	\$256.00	N/A
2010	\$250.30	\$326.87	\$359.00	\$400.00	\$348.19	\$360.25	\$183.00	\$353.00	\$276.00	\$362.00	\$297.00	\$313.00	\$322.00	\$277.06	\$429.96	N/A	N/A	N/A	\$282.00	N/A
2011	\$277.83	\$362.83	\$384.00	\$440.00	\$382.83	\$392.65	\$187.00	\$433.00	\$301.00	\$395.00	\$328.00	\$345.00	\$347.00	\$306.05	\$474.95	N/A	N/A	N/A	\$316.00	N/A
2012	\$294.50	\$384.60	\$407.00	\$470.00	\$420.92	\$428.00	\$193.00	\$468.00	\$312.00	\$409.00	\$351.00	\$369.00	\$356.00	\$327.85	\$508.77	N/A	N/A	N/A	\$347.00	N/A
2013	\$312.17	\$407.68	\$423.00	\$478.00	\$433.34	\$451.55	\$205.00	\$506.00	\$320.00	\$419.00	\$371.00	\$391.00	\$356.00	\$338.74	\$525.68	\$269.00	N/A	N/A	\$358.00	N/A
2014	\$329.34	\$430.10	\$436.00	\$491.00	\$458.12	\$476.40	\$223.00	\$526.00	\$334.00	\$438.00	\$380.00	\$400.00	\$357.00	\$345.33	\$535.91	\$281.00	N/A	N/A	\$371.00	N/A
2015	\$339.22	\$443.00	\$420.00	\$493.00	\$481.76	\$502.60	\$234.00	\$537.00	\$334.00	\$438.00	\$380.00	\$400.00	\$371.00	\$348.83	\$541.34	\$287.00	N/A	N/A	\$385.00	N/A
2016	\$346.00	\$451.94	\$399.00	\$500.00	\$493.32	\$525.20	\$257.00	\$548.00	\$329.00	\$431.00	\$380.00	\$400.00	\$403.00	\$352.21	\$546.59	\$322.00	N/A	N/A	\$417.00	N/A
2017	\$349.46	\$456.45	\$399.00	\$512.00	\$500.97	\$548.85	\$266.00	\$559.00	\$337.00	\$442.00	\$383.23	\$403.40	\$403.00	\$360.81	\$559.93	\$332.00	N/A	N/A	\$417.00	N/A
2018	\$349.46	\$361.00	\$540.00	\$507.23	\$573.55	\$274.00	\$578.50		\$345.00	\$507.23	\$383.23	\$432.00		\$329.31	\$342.00	\$301.00	\$342.00	\$442.00	N/A	N/A
2019	\$356.45	\$345.00	\$556.00	\$532.09	\$599.35	\$289.00	\$599.25		\$362.00	\$532.09	\$398.74	\$463.00		\$346.83	\$356.00	\$319.00	\$346.83	\$485.00	N/A	N/A
2020	\$360.01	\$341.00	\$569.00	\$558.20	\$626.30	\$286.00	\$629.25		\$384.00	\$558.20	\$413.81	N/A		\$358.60	\$370.00	\$338.00	\$358.60	\$532.00	N/A	N/A
2021	\$360.00	\$355.00	\$589.00	\$582.50	\$654.48	\$301.00	\$657.57		\$403.00	\$582.50	\$422.09	N/A		\$364.58	\$380.00	\$350.00	\$364.58	\$537.00	N/A	N/A

<sup>1</sup>Min and max charges are shown for member jurisdictions with rates dependent on the type of dwelling (e.g., apartments, townhouses, strata units, duplexes if applicable).

<sup>2</sup>The City of Richmond discounts rates by 10% if paid on time.

N/A – information not available or not applicable.

Table 3.8: Metered rates by member jurisdiction (\$/m<sup>3</sup>), 2000 - 2021<sup>1</sup>

Year	Burnaby	Coquitlam			Delta			City of Langley			Township of Langley		Maple Ridge	New Westminster			City of North Vancouver	District of North Vancouver			
					Inside Area		Outside Area	Commercial	Residential												
					Rate	First <sup>2</sup>	Last <sup>3</sup>	Blocks <sup>4</sup>	First <sup>2</sup>	Last <sup>3</sup>											Blocks <sup>4</sup>
2000	\$0.478	\$0.550	\$0.190	5	\$0.572		1	\$0.91	\$0.70	\$0.63	\$0.317		\$0.350	\$0.488	\$0.208	4	\$0.367	\$0.459		1	
2001	\$0.502	\$0.550	\$0.190	5	\$0.592		1	\$0.94	\$0.77	\$0.63	\$0.323		\$0.379	\$0.502	\$0.215	4	\$0.378	\$0.470		1	
2002	\$0.557	\$0.551	\$0.187	5	\$0.640		1	\$1.02	\$0.74	\$0.74	\$0.330		\$0.380	\$0.516	\$0.222	4	\$0.390	\$0.480		1	
2003	\$0.590	\$0.598	\$0.203	5	\$0.660		1	\$1.05	\$0.74	\$0.74	\$0.330		\$0.395	\$0.526	\$0.226	4	\$0.405	\$0.512		1	
2004	\$0.625	\$0.649	\$0.229	5	\$0.700		1	\$1.10	\$0.74	\$0.74	\$0.330		\$0.410	\$0.562	\$0.240	4	\$0.421	\$0.547		1	
2005	\$0.683	\$0.713	\$0.264	5	\$0.65	\$0.74	2	\$1.16	\$0.76	\$0.76	\$0.335		\$0.435	\$0.600	\$0.258	4	\$0.438	\$0.579		1	
2006	\$0.746	\$0.780	\$0.300	5	\$0.65	\$0.81	2	\$1.27	\$0.77	\$0.77	\$0.386		\$0.461	\$0.647	\$0.280	4	\$0.453	\$0.610		1	
2007	\$0.815	\$0.810	\$0.370	5	\$0.65	\$0.90	2	\$1.41	\$0.79	\$0.79	\$0.415		\$0.503	\$0.766	\$0.332	4	\$0.489	\$0.643		1	
2008	\$0.905	\$0.830	\$0.440	5	\$0.65	\$0.91	2	\$1.42	\$0.81	\$0.81	\$0.436		\$0.548	\$0.841	\$0.364	4	\$0.528	\$0.682		1	
2009	\$1.014	\$0.758	\$0.527	5	\$0.69	\$0.96	2	\$1.51	\$0.81	\$0.81	\$0.458		\$0.597	\$0.946	\$0.410	4	\$0.576	\$0.728		1	
2010	\$1.156	\$0.748	\$0.633	5	\$0.71	\$0.98	2	\$1.55	\$0.89	\$0.89	\$0.503		\$0.651	\$1.017	\$0.441	4	\$0.645	\$0.819		1	
2011	\$1.283	\$0.698		1	\$0.78	\$1.08	2	\$1.72	\$0.97	\$0.97	\$0.553		\$0.709	\$1.130	\$0.491	4	\$0.731	\$1.007		1	
2012	\$1.360	\$0.735		1	\$0.83	\$1.16	2	\$1.90	\$1.03	\$1.03	\$0.608		\$0.773	\$1.197	\$0.519	4	\$0.860	\$1.088		1	
2013	\$1.442	\$0.764		1	\$0.85	\$1.18	2	\$1.96	\$1.07	\$1.07	\$0.626		\$0.816	\$1.240	\$0.537	4	\$0.911	\$1.180		1	
2014	\$1.522	\$0.787		1	\$0.88	\$1.22	2	\$2.03	\$1.12	\$1.12	\$0.662		\$0.861	\$1.314	\$0.569	4	\$0.989	\$1.220		1	
2015	\$1.568	\$0.795		1	\$0.89	\$1.23	2	\$2.06	\$1.14	\$1.14	\$0.696		\$0.908	\$1.391	\$0.604	4	\$1.038	\$1.250		1	
2016	\$1.600	\$0.795		1	\$0.91	\$1.25	2	\$2.11	\$1.16	\$1.16	\$0.713		\$0.949	\$1.469	\$0.636	4	\$1.142	\$1.280		1	
2017	\$1.616	\$0.795		1	\$0.94	\$1.29	2	\$2.18	\$1.16	\$1.16	\$1.190		\$0.992	\$1.529	\$0.660	4	\$1.179	\$1.307		1	
2018	\$1.616	\$0.795		1	\$0.99	\$1.36	2	\$2.30	\$1.46	\$1.31	\$2.306		\$0.733	\$1.036	\$1.529	\$0.660	4	\$1.215	\$2.18	\$1.35	2
2019	\$1.650	\$0.810		1	\$1.02	\$1.36	2	\$2.40	\$1.50	\$1.35	\$2.419		\$0.769	\$1.083	\$1.621	\$0.699	4	\$1.282	\$2.26	\$1.40	2
2020	\$1.670	\$0.859		1	\$1.04	\$1.43	2	\$2.46	\$1.44	\$1.44	\$2.537		\$0.807	\$1.131	\$2.120	\$0.918	4	\$1.680	\$1.99	\$0.12	2
2021	\$1.670	\$0.894		1	\$1.08	\$1.48	2	\$2.55	\$1.53	\$1.53	\$2.648	\$0.842	\$1.182	\$2.120	\$0.918	4	\$1.810	\$1.99	\$0.12	2	

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.

<sup>2, 3, 4</sup> “First” and “Last” - block rates in an inclining or declining block rate structure; “Blocks” - the total number of rate blocks per pricing structure. Where no “Blocks” are shown, member jurisdiction has a one-block rate, a unit rate or a constant rate structure. Minimum charges are only shown as unit rates if tied to a consumption volume; otherwise not shown.

Continues next page

Table 3.8 (cont'd): Metered rates by, member jurisdiction (\$/m<sup>3</sup>), 2000 - 2021<sup>1</sup>

Year	Pitt Meadows <sup>5</sup>	Port Coquitlam			Port Moody	Richmond <sup>6</sup>	Surrey	sc̓awaθan məsteyəx <sup>w</sup>	University Endowment Lands <sup>7</sup>		Vancouver				West Vancouver				
											Rate	Seasonal Pricing		SF Residential			MF	Commercial	
												Oct 1 - May 31	Jun 1 - Sep 30	First <sup>2</sup>	Last <sup>3</sup>	Blocks <sup>4</sup>	Constant Rate	Constant Rate	
2000	\$0.213	\$0.660	\$0.332	3	\$0.381	\$0.427	\$0.350			\$0.424	\$0.435	N/A	N/A	\$0.25	\$0.34	2	N/A	N/A	
2001	\$0.220	\$0.660	\$0.332	3	\$0.385	\$0.455	\$0.350			\$0.438	\$0.447	N/A	N/A	\$0.26	\$0.36	2	N/A	N/A	
2002	\$0.220	\$0.660	\$0.332	3	\$0.396	\$0.504	\$0.360			\$0.424	\$0.452	N/A	N/A	\$0.27	\$0.38	2	N/A	N/A	
2003	\$0.271	\$0.727	\$0.364	3	\$0.396	\$0.540	\$0.370			\$0.463	\$0.463	N/A	N/A	\$0.29	\$0.41	2	N/A	N/A	
2004	\$0.293	\$0.851	\$0.427	3	\$0.427	\$0.611	\$0.397			\$0.525	\$0.491	N/A	N/A	\$0.31	\$0.44	2	N/A	N/A	
2005	\$0.319	\$0.901	\$0.452	3	\$0.477	\$0.658	\$0.460			\$0.588	\$0.522	N/A	N/A	\$0.33	\$0.47	2	N/A	N/A	
2006	\$0.352	\$0.901	\$0.452	3	\$0.505	\$0.701	\$0.460			\$0.660	\$0.712	\$0.592	N/A	N/A	\$0.38	\$0.55	2	N/A	N/A
2007	\$0.392	\$1.010	\$0.509	3	\$0.590	\$0.753	\$0.530			\$0.766	\$0.888	\$0.596	N/A	N/A	\$0.42	\$0.78	3	\$0.49	\$0.56
2008	\$0.438	\$1.081	\$0.544	3	\$0.625	\$0.798	\$0.590			\$0.814	\$1.018	\$0.615	N/A	N/A	\$0.47	\$0.88	3	\$0.58	\$0.67
2009	\$2.250	\$1.204	\$0.607	3	\$0.671	\$0.886	\$0.660			\$0.942	\$1.178	\$0.645	N/A	N/A	\$0.53	\$0.97	3	\$0.64	\$0.73
2010	\$2.570	\$1.314	\$0.664	3	\$0.717	\$0.928	\$0.745			\$1.054	\$1.319	\$0.710	N/A	N/A	\$0.67	\$1.11	3	\$0.77	\$0.78
2011	\$0.565	\$1.448	\$0.731	3	\$0.773	\$1.025	\$0.745			\$1.202	\$1.503	\$0.795	N/A	N/A	\$0.74	\$1.40	3	\$0.88	\$0.88
2012	\$0.598	\$1.547	\$0.780	3	\$0.795	\$1.118	\$0.815			\$1.272	\$1.591	N/A	\$0.814	\$1.020	\$0.83	\$1.49	3	\$0.95	\$0.95
2013	\$0.616	\$1.642	\$0.830	3	\$0.795	\$1.078	\$0.822			\$1.288	\$1.611	N/A	\$0.842	\$1.055	\$0.90	\$1.56	3	\$1.02	\$1.02
2014	\$0.630	\$1.681	\$0.851	3	\$0.865	\$1.110	\$0.871			\$1.340	\$1.675	N/A	\$0.876	\$1.098	\$0.96	\$1.65	3	\$1.10	\$1.10
2015	\$0.640	\$1.681	\$0.851	3	\$0.939	\$1.112	\$0.895			\$1.362	\$1.702	N/A	\$0.913	\$1.144	\$1.04	\$1.73	3	\$1.20	\$1.20
2016	\$0.650	\$1.681	\$0.851	3	\$0.964	\$1.132	\$0.930			\$1.387	\$1.734	N/A	\$0.949	\$1.190	\$1.09	\$1.83	3	\$1.26	\$1.26
2017	\$0.670	\$1.695	\$0.858	3	\$1.006	\$1.159	\$0.990			\$1.413	\$1.789	N/A	\$0.814	\$1.020	\$1.15	\$1.93	3	\$1.33	\$1.33
2018	\$0.700	\$3.530	\$0.860	4	\$1.006	\$1.176	\$1.004	\$0.948		\$1.480	\$1.860	N/A	\$1.006	\$1.261	\$1.15	\$2.50	4	\$1.46	\$1.46
2019	\$0.740	\$3.670	\$0.980	4	\$1.077	\$1.238	\$1.053	\$1.003		\$1.570	\$1.970	N/A	\$1.104	\$1.383	\$1.27	\$2.76	4	\$1.61	\$1.61
2020	\$0.780	\$3.810	\$0.930	4	N/A	\$1.280	\$1.107	\$1.062		\$1.667	\$2.083	N/A	\$1.211	\$1.517	\$1.32	\$2.90	4	\$1.70	\$1.70
2021	\$0.810	\$3.880	\$0.960	4	N/A	\$1.302	\$1.143	\$1.160		\$1.667	\$2.235	N/A	\$1.222	\$1.532	\$1.39	\$3.32	4	\$1.79	\$1.79

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.

<sup>2,3,4</sup> “First” and “Last” - block rates in an inclining or declining block rate structure; “Blocks” - the total number of rate blocks per pricing structure. Where no “Blocks” are shown, member jurisdiction has a one-block rate, a unit rate or a constant rate structure. Minimum charges are only shown as unit rates if tied to a consumption volume; otherwise not shown.

<sup>5</sup> The City of Pitt Meadows blocks refer to ICI customers. Until 1995, residential and farm customers were charged the last block rate for all consumption.

<sup>6</sup> The City of Richmond discounts rates by 10% if paid on time.

<sup>7</sup> Rates shown for 2002 – 2005 and 2009 – 2012 are for UBC Utilities; UEL data was unavailable.

Rates are shown in three decimal places where possible.

N/A – information not available or not applicable.

## Regional Water Consumption Trends

Member jurisdiction metering data was analyzed and compiled to produce water consumption statistics for the region provided in this section.

It is important to note that not all metering data was received in some years during the study period, especially in some periods before 2000, when less than 95% of GVWD-supplied water was accounted for in the reporting of data by the member jurisdictions. Refer to Table 3.9: for an estimated percentage of data reporting (based on consumption and supplied volume). These information gaps may appear as an overestimation of unmetered consumption for those years and should be considered when reviewing the results presented in this section. In 2021, corrections were made with updated data from as far back as 2013, where possible. The results are shown in the following tables and charts.

## Regional Consumption and Population Trends

Figure 3.8 shows the total annual water consumption in the region from 2000 to 2021, along with estimates of the population serviced by the GVWD and member jurisdictions. Between 2000 and 2021, the regional population increased by about 38%, from 2.04 million in 2000 to 2.80 million in 2021. The population serviced by GVWD sources increased by 40% for the same period. The percentage of the population serviced by GVWD sources per year has increased slightly from 94% of the regional population in 2000 to 96 % in 2021. Overall, annual water consumption (per GVWD supplied records) decreased by 4.1%, from 415 million m<sup>3</sup> in 2000 to almost 398 million m<sup>3</sup> in 2021.

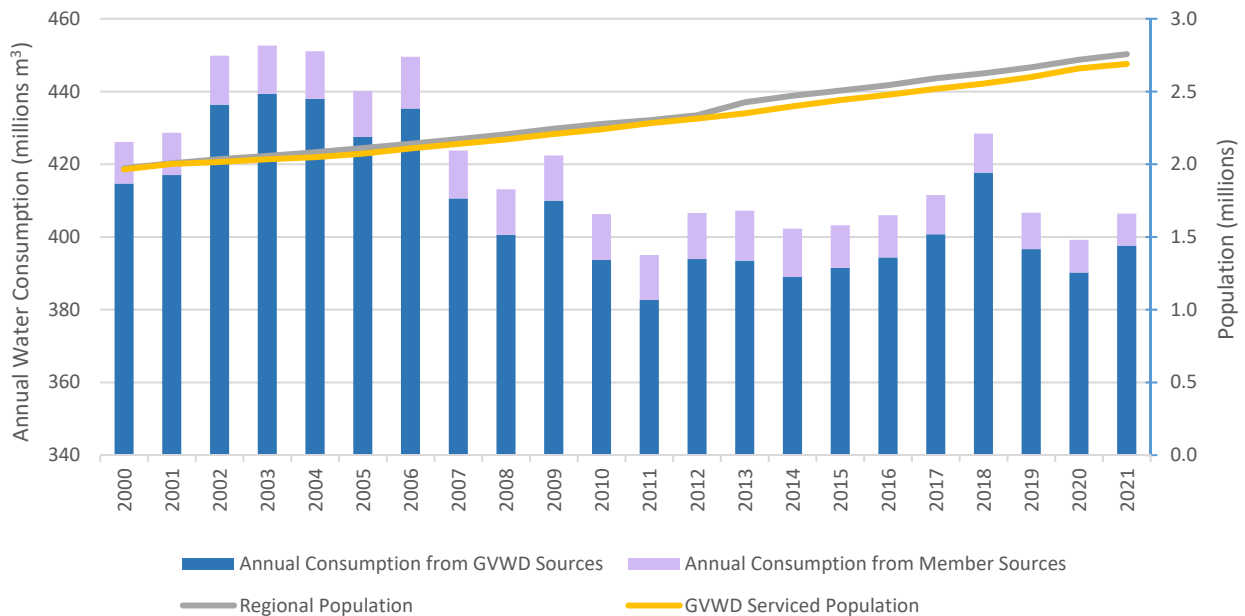


Figure 3.8: Total annual GVWD supplied water consumption and serviced population

Note: Annual consumption values are taken from GVWD records of total supplied volumes and include losses of member jurisdictions’ systems and unmetered consumption. Scale is not representative of actual volumes.

Figure 3.9 shows the proportional consumption of GVWD-supplied water by member jurisdictions over 20 years.

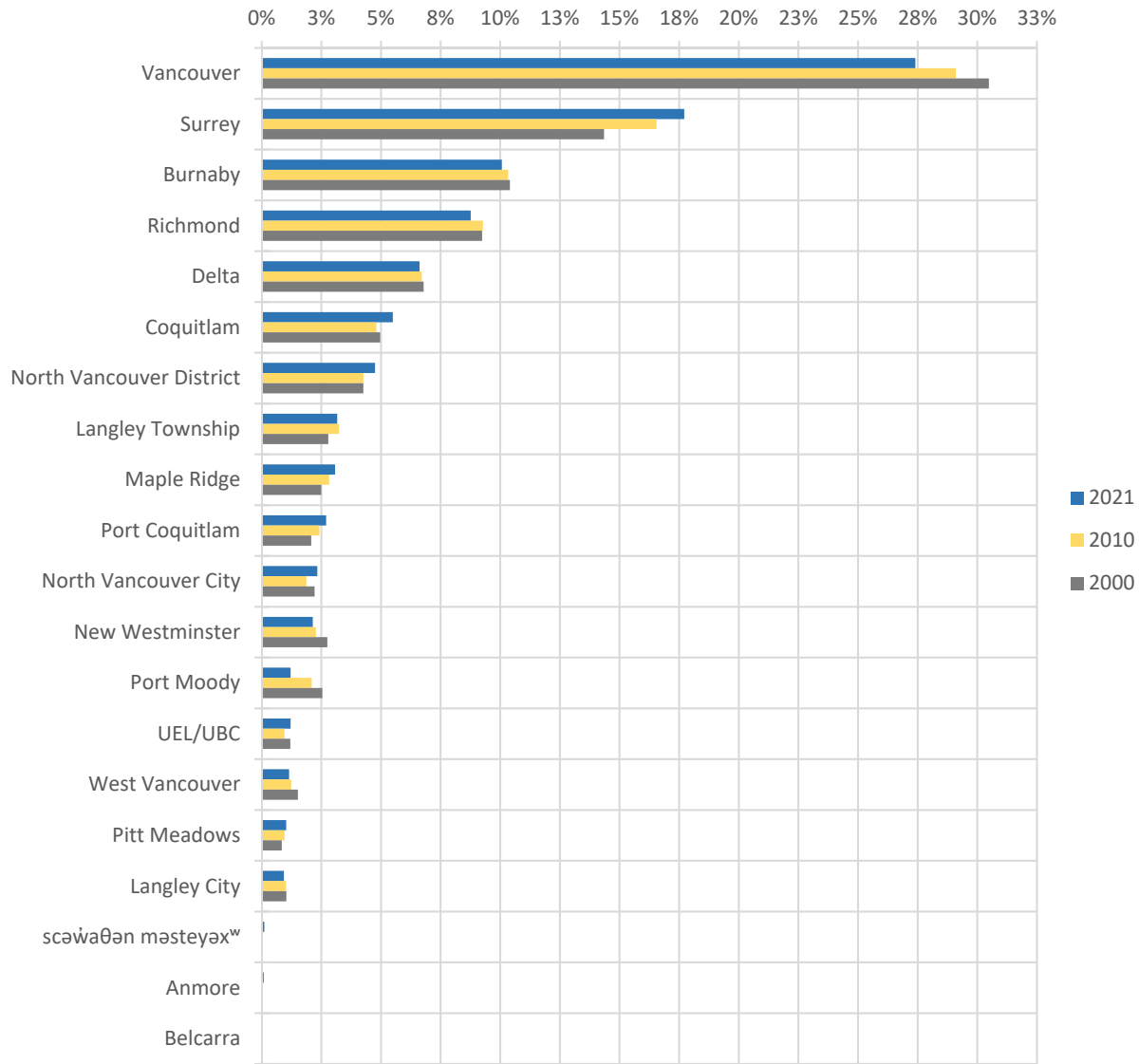


Figure 3.9: Proportional consumption of GVWD supplied water in 2021 by member jurisdiction, with comparisons to 2000 and 2010

Note: The City of Delta, the Township of Langley, and the District of West Vancouver supplement GVWD supplied water with member jurisdiction water sources. In 2021, approximately 1%, 30%, and 42% of total annual water consumed in these three member jurisdictions, respectively, was derived from non-GVWD sources (not represented in Figure 3.9). Member jurisdictions that receive 5% or more of GVWD-supplied drinking water, are considered as having regional significance to the regional results – for metering, consumption and by-sector consumption. For 2021 this includes (in alphabetical order) the cities of Burnaby, Coquitlam, Delta, Richmond, Surrey and Vancouver.

### Unmetered versus Metered Consumption

Figures 3.10 and 3.11 show the proportion of metered versus unmetered water consumption based on volume in the region and for each member jurisdiction.

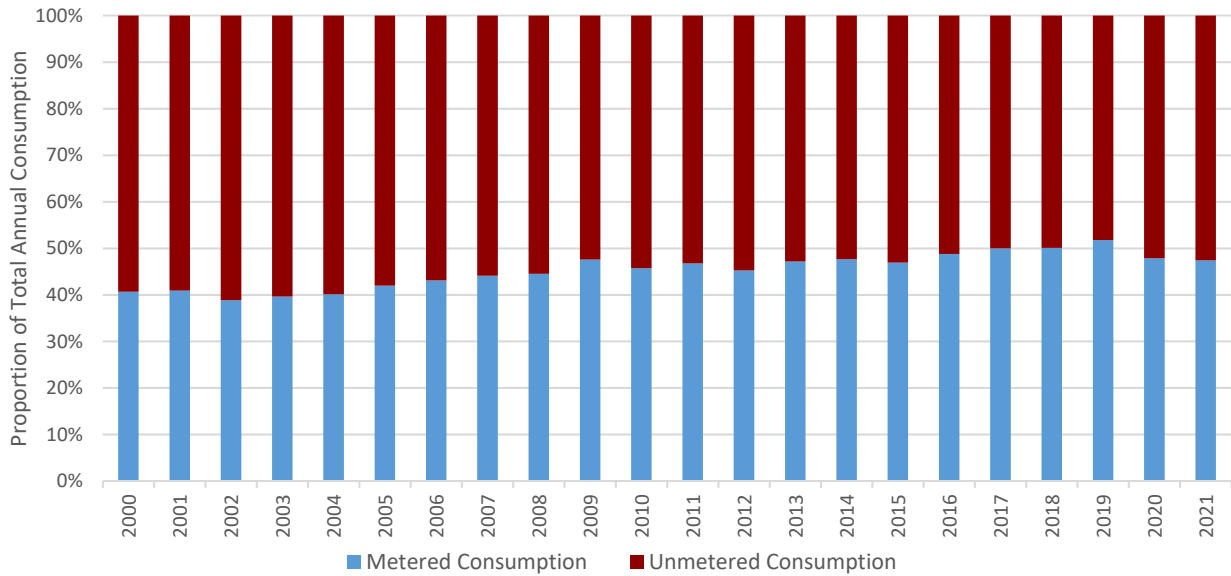


Figure 3.10: Proportion of metered and unmetered consumption in the GVWD region

\*Data received for the report represented 99.5% of total consumption in 2021.

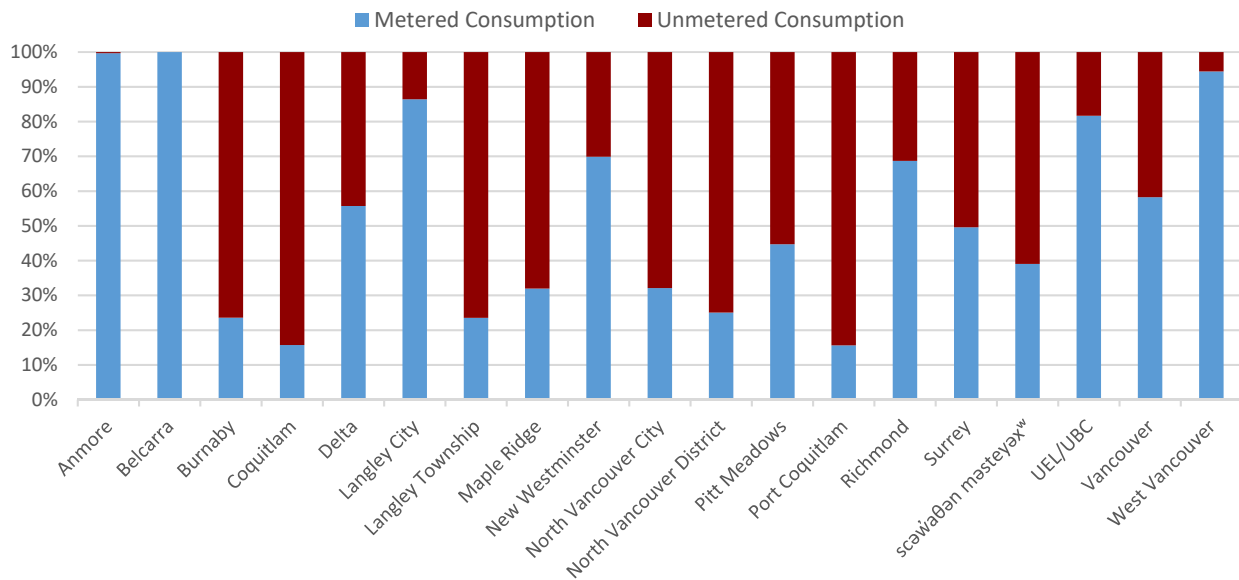


Figure 3.11: Proportion of metered and unmetered consumption in 2021 by member jurisdiction

Note: The City of Langley, the University Endowment Lands and UBC, and the District of West Vancouver are universally metered. Unmetered consumption shown for these member jurisdictions represents system losses, and data requires further verification. The Villages of Anmore and Belcarra and the scəwəθən məsteyəx\* are metered mainly, and their consumption is included in the metered category.

### Regional Water Consumption by Sector

Figure 3.12 illustrates overall water consumption by sector in the region from 2000 to 2021, based on metering data from the member jurisdictions. An increase in metered single-family and multi-family residential consumption can be seen throughout the study period. This can be attributed to the rise in regional residential metering rather than increased consumption. Metered ICI consumption has remained steady, with slight decreases since the mid-2000s. Unmetered consumption is provided as a bulk category because of the lack of data preventing further breakdown of unmetered water use. For example, a significant data gap exists in the residential sector where the number of unmetered single-family and multi-family connections is not defined. This applies to the 17 member jurisdictions that are not universally metered, while unmetered consumption accounts for 53% of the total annual regional consumption.

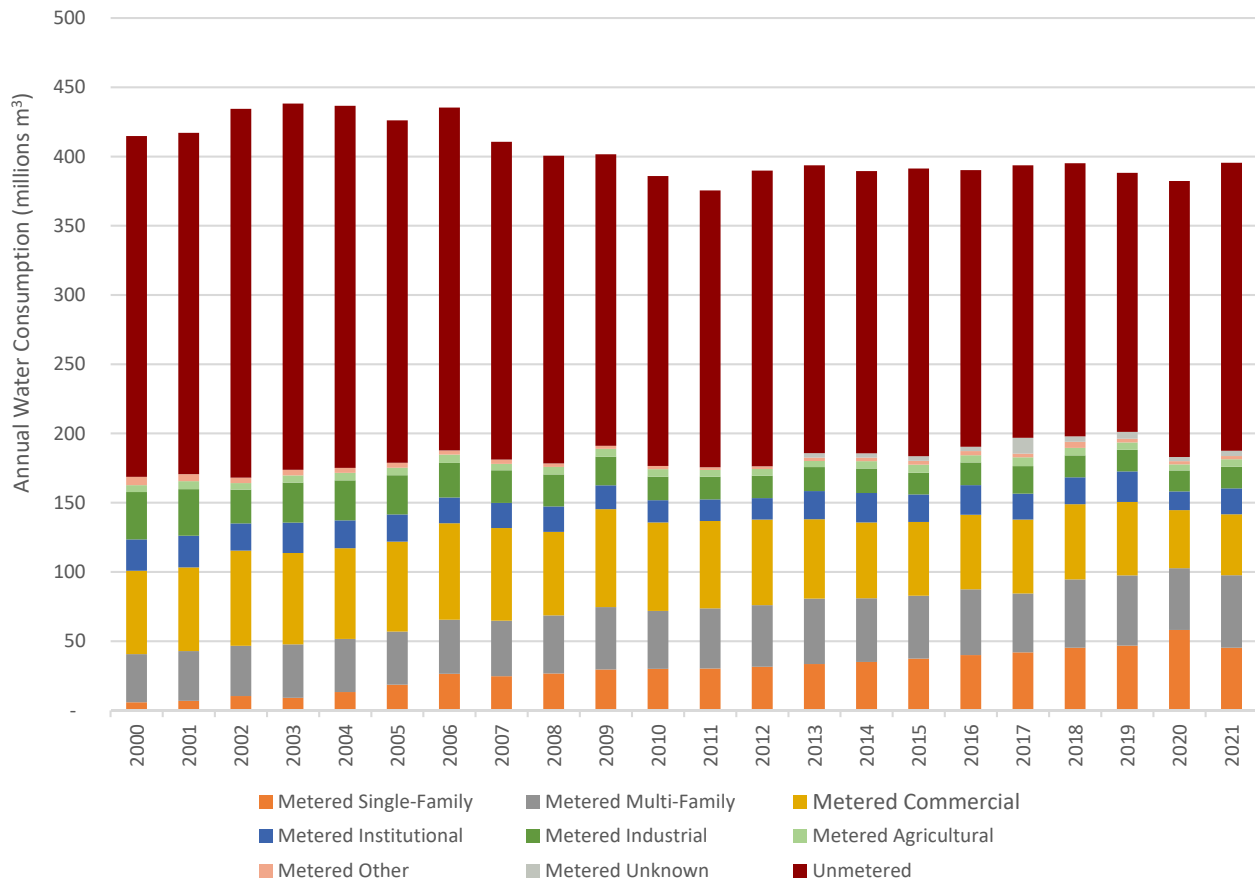


Figure 3.12: Water consumption by sector in the GVWD region

\* Data received for the report represented 99.5% of total consumption in 2021

Figures 3.13 to 3.21 provide the average consumption per connection type or sector by member jurisdiction in 2021. Where possible, the statistics show all member jurisdictions, even those without relevant and applicable data for that chart and visualization.

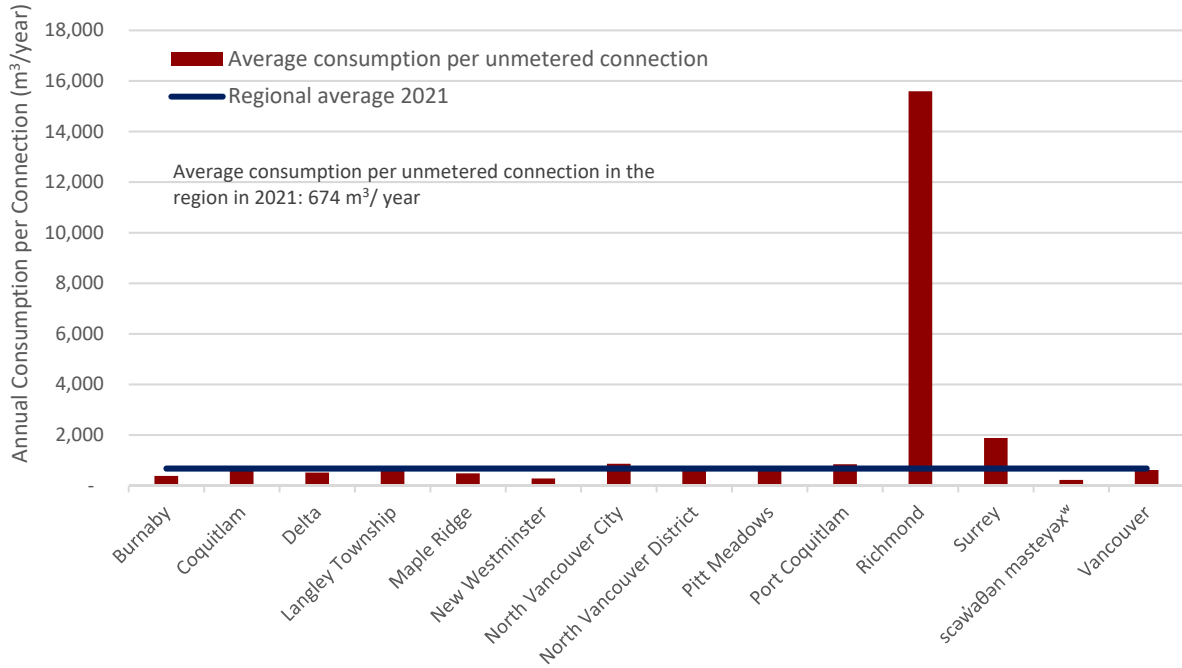


Figure 3.13: Unmetered water consumption in 2021 by member jurisdiction.

Note: Unmetered consumption includes single-family and multi-family, system losses, and other unmetered sectors.

\* Verifying the City of Richmond’s unmetered consumption data will be an ongoing process leading into the next version of the report.

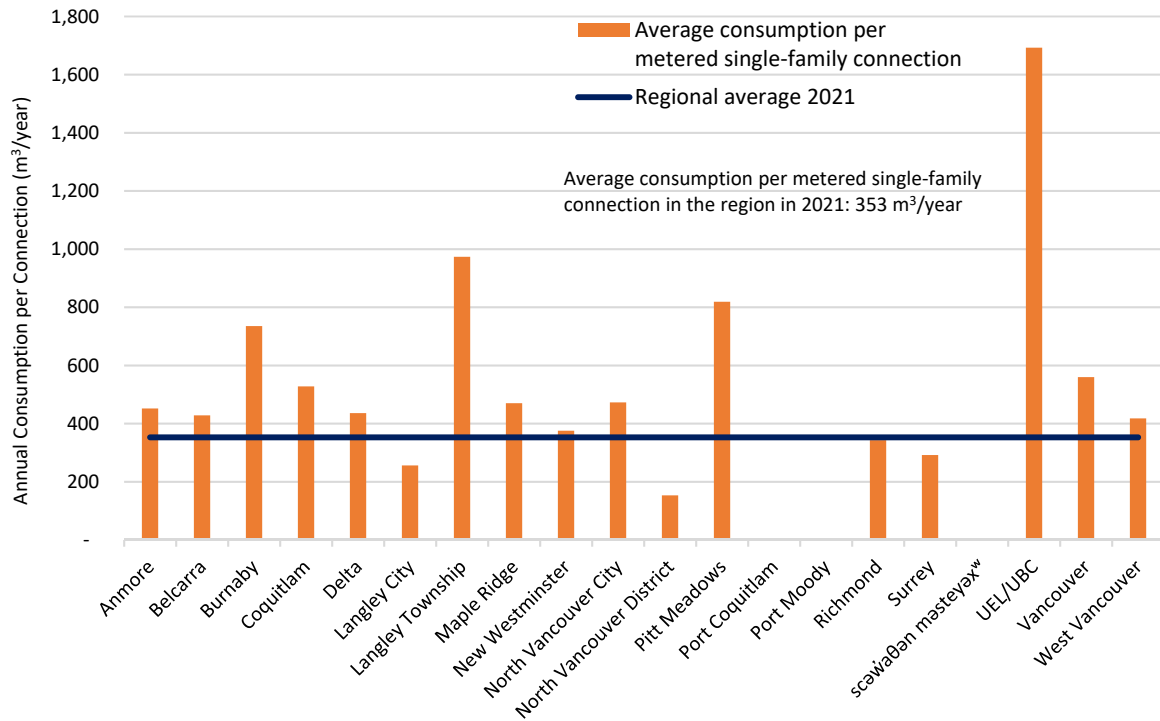


Figure 3.14: Metered single-family water consumption in 2021 by member jurisdiction.

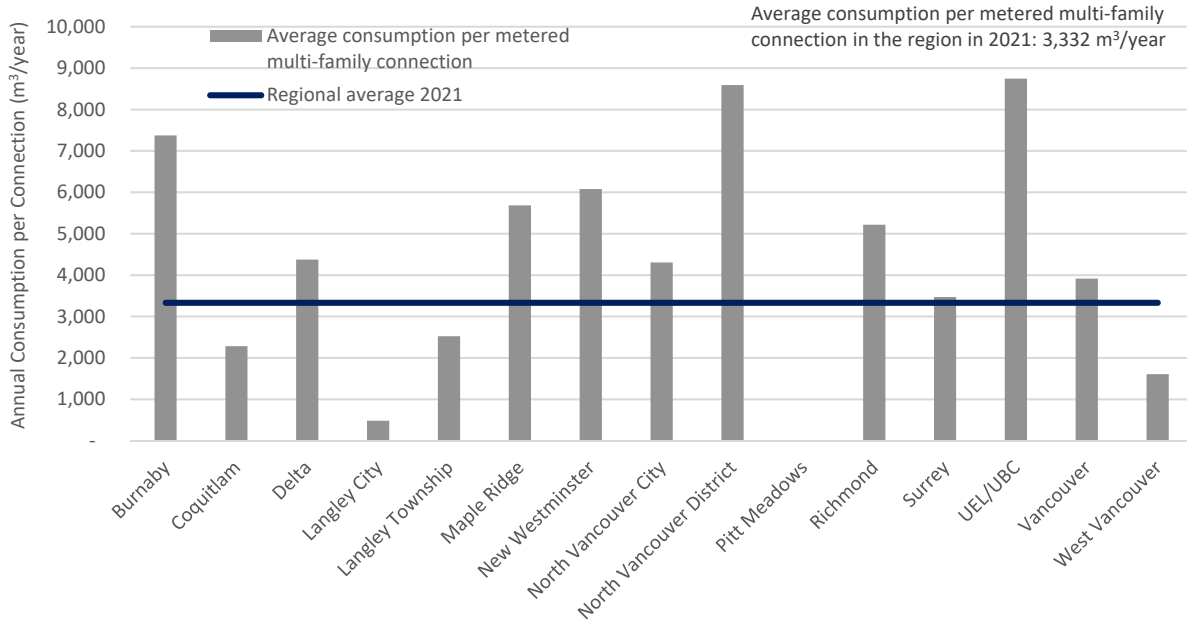


Figure 3.15: Metered multi-family water consumption in 2021 by member jurisdiction.

Note: Metered multi-family consumption for the City of Langley, District of North Vancouver, and UEL/UBC will be verified in the next report cycle.

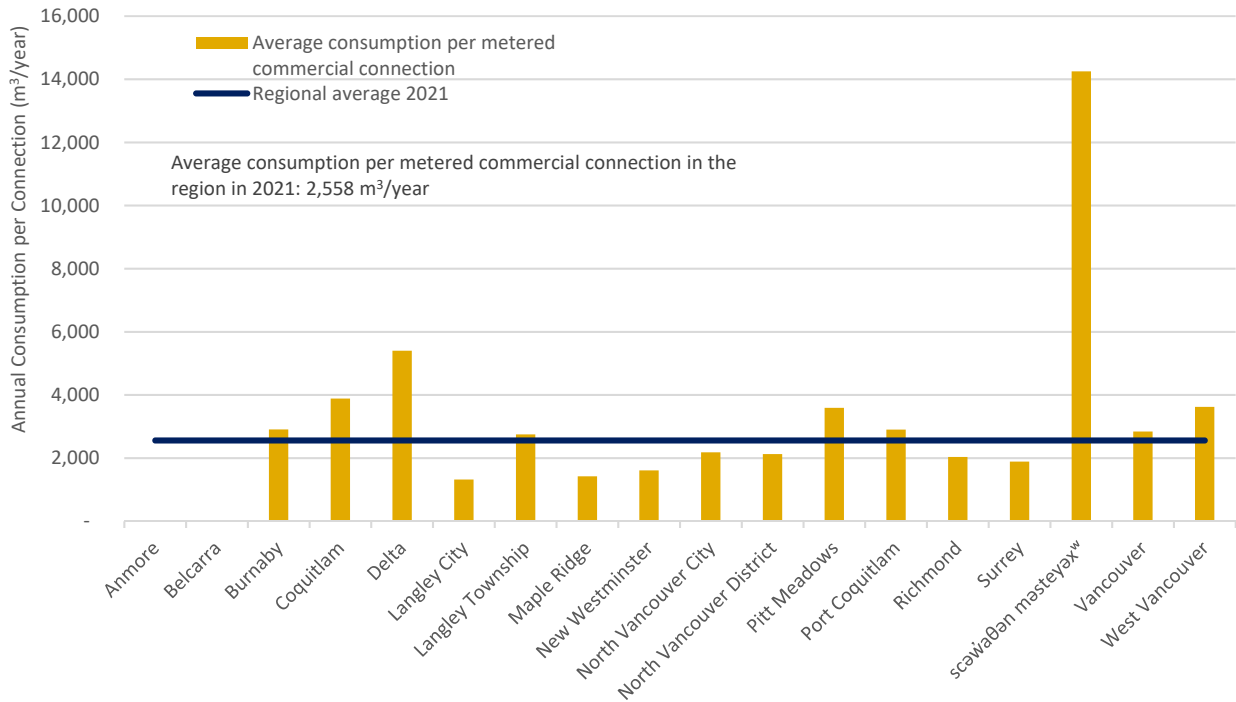


Figure 3.16: Metered commercial water consumption in 2021 by member jurisdiction.

Note: Metered commercial consumption for scəwəθən məsteyəx\* s is high due to a lower number of Commercial connections, to be verified in the next report cycle.

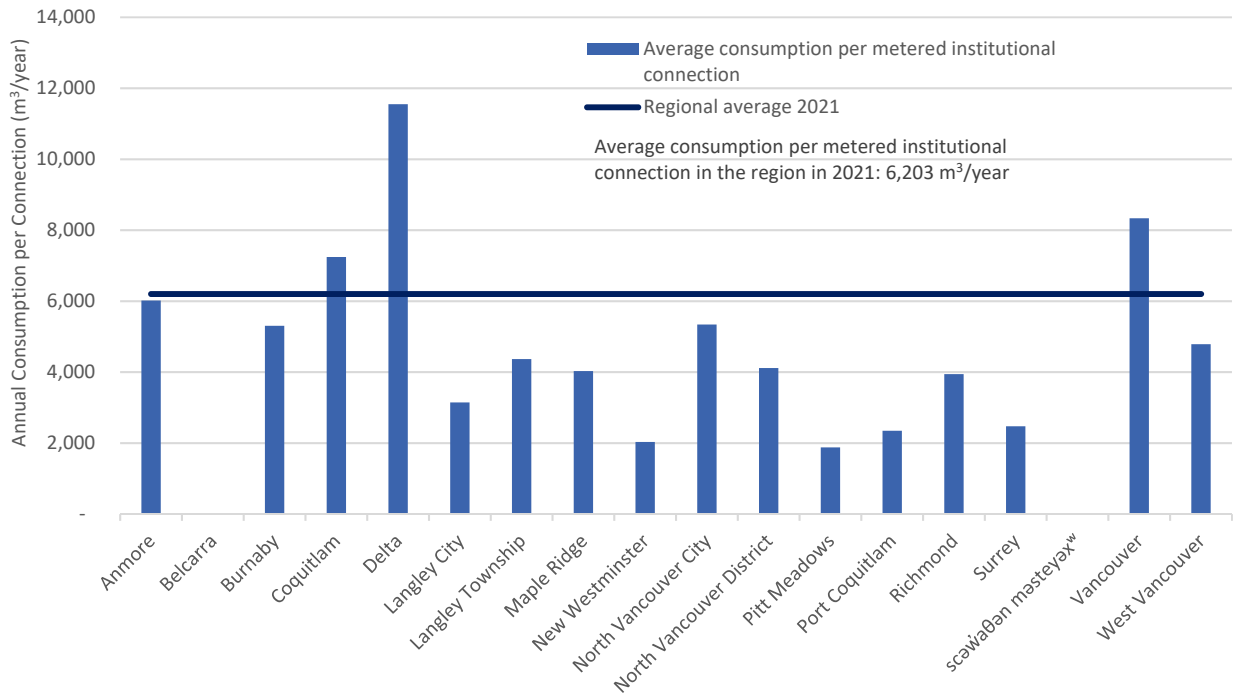


Figure 3.17: Metered Institutional water consumption in 2021 by member jurisdiction

Note: UEL/UBC is not shown for clarity (422,417 m³/ year consumption per institutional connection in 2021 - supplied to UBC).

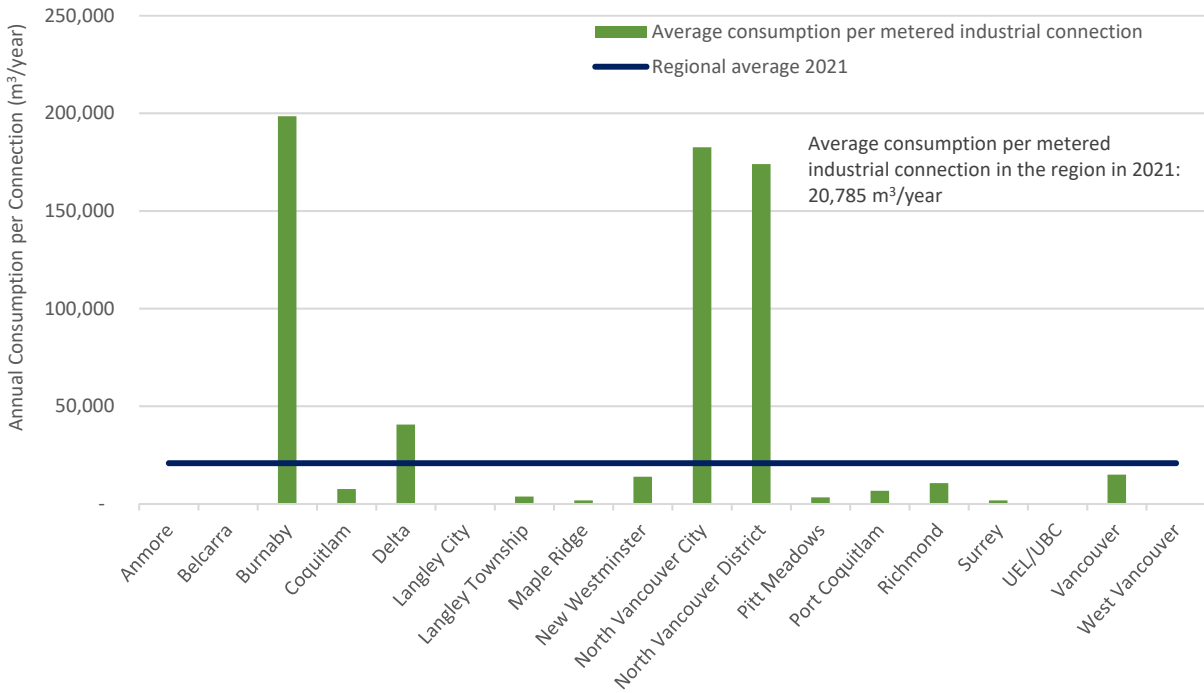


Figure 3.18: Metered Industrial water consumption in 2021 by member jurisdiction.

Note: Industrial consumption for the City of Langley and the City of Surrey is to be verified in the next report cycle.

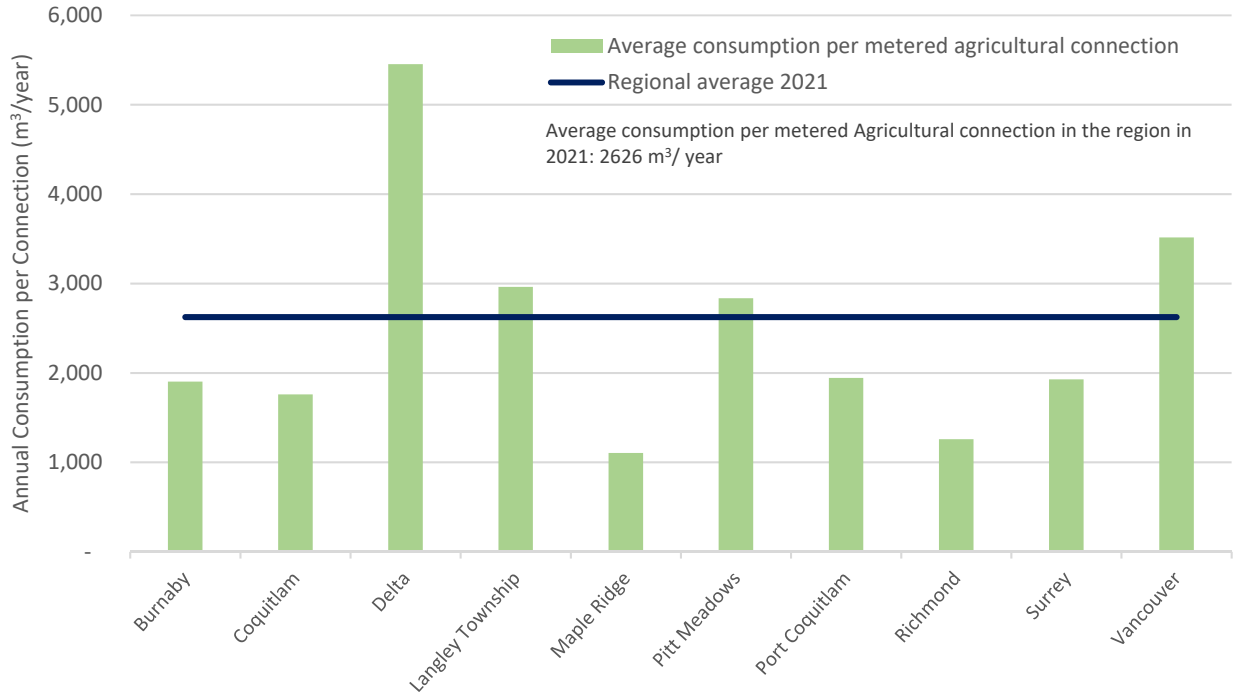


Figure 3.19: Metered Agricultural water consumption in 2021 by member jurisdiction

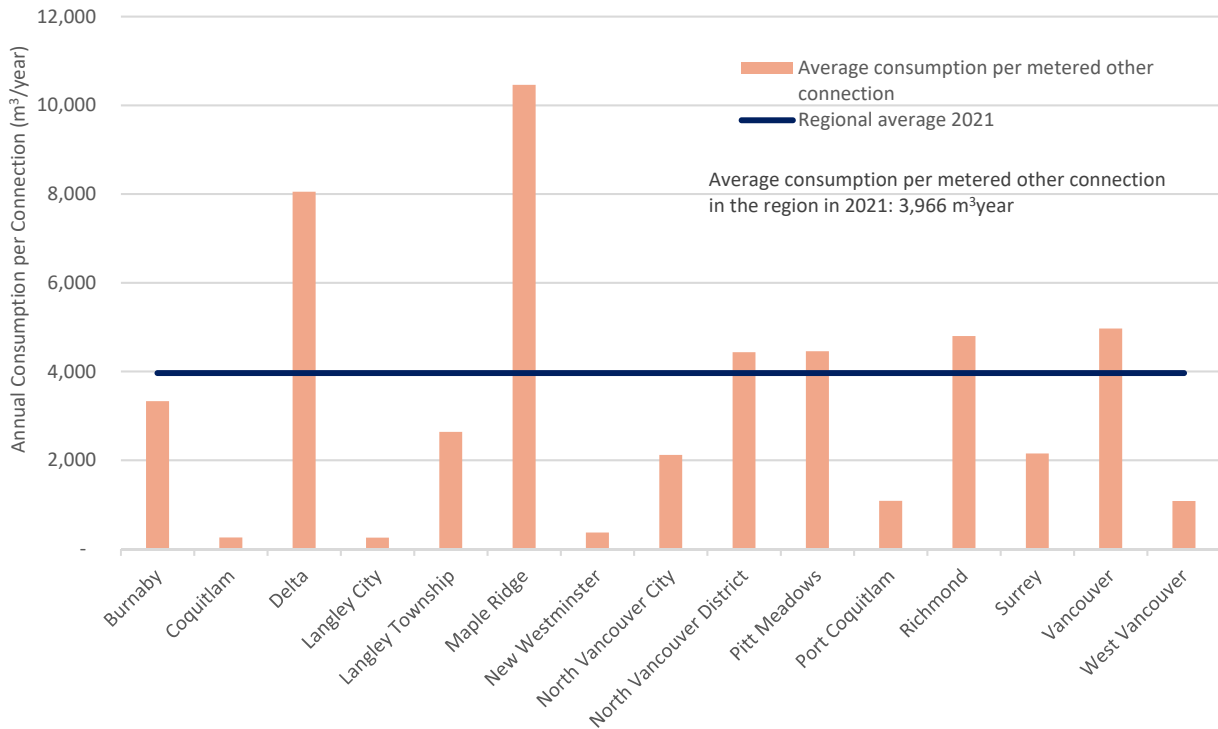


Figure 3.20: Metered "Other" water consumption in 2021 by member jurisdiction

Note: Pitt Meadows 2020 consumption per metered 'Other' connection includes ɁiɁáɁ (Katzie First Nation) for a total consumption of 27,759 m³ in 2021 and comprises single-family residential, commercial and industrial uses. Data will be confirmed in the next report cycle for members showing above-average consumption in 'Other' connections.

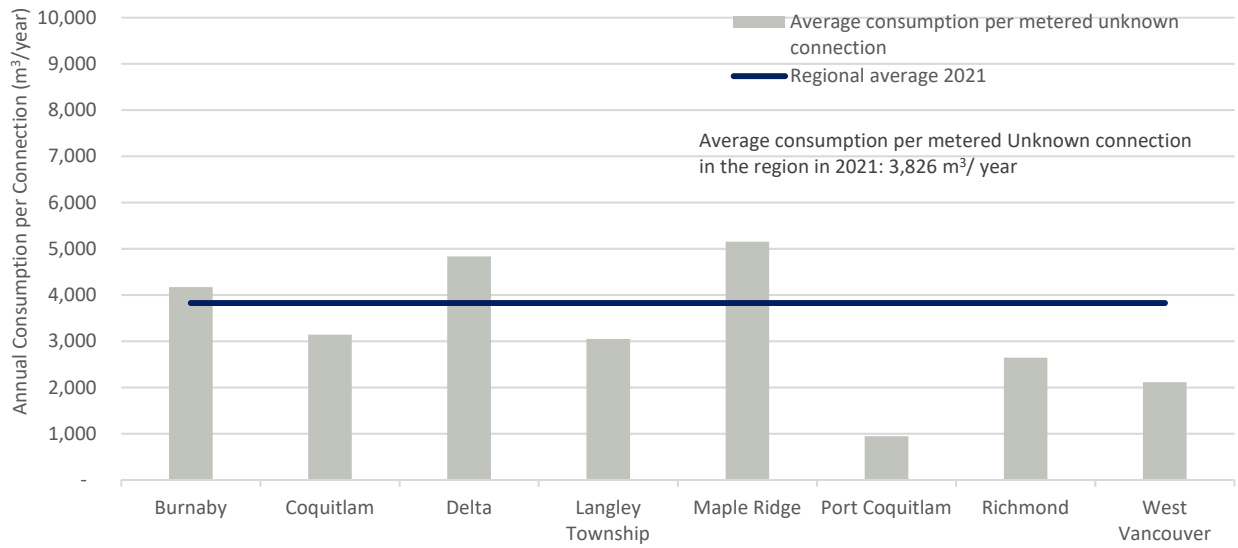


Figure 3.21: Metered "Unknown" water consumption in 2021 by member jurisdiction

Note: Average "Metered Unknown" consumption is assumed to be within the ICI sector due to the high consumption per connection and has been excluded from the regional residential consumption per capita (refer to Section 2.0 Methodology)

Table 3.9 and Table 3.10 outline this study's overall water consumption results.

Table 3.9: Annual water consumption by sector (m<sup>3</sup>) in the GVWD, 2000 - 2021<sup>1</sup>

Year	Estimated Reporting of Volume Data	Total Consumption Volume	Volume Purchased From GVWD	Volume from Own Sources	Unmetered <sup>2</sup>	Total Metered	Breakdown of Metered Sectors							
							Single-Family	Multi-Family	Commercial	Institutional	Industrial	Agricultural	Other <sup>3</sup>	Unknown <sup>4</sup>
2000	100.0%	414,685,349	403,262,890	11,422,459	246,049,094	168,636,255	5,764,743	34,796,104	60,264,209	22,647,653	34,190,464	4,923,175	6,044,089	5,819
2001	100.0%	416,997,581	405,355,917	11,641,664	246,428,218	170,569,363	6,789,162	35,956,638	60,522,229	22,831,200	33,643,177	5,736,058	5,082,082	8,819
2002	99.8%	436,382,060	422,904,827	13,477,234	266,236,524	169,157,020	10,295,326	36,270,245	68,729,016	19,657,025	24,473,562	4,627,516	4,026,227	13,805
2003	99.7%	439,365,825	426,112,865	13,252,960	264,590,415	173,650,285	9,038,631	38,567,928	66,001,422	22,010,289	28,865,249	5,227,481	3,922,172	17,113
2004	99.7%	437,974,199	424,884,268	13,089,851	261,408,286	175,124,567	13,165,096	38,454,910	65,502,356	20,020,811	28,933,445	5,452,845	3,576,621	18,483
2005	99.7%	427,476,902	414,891,863	12,585,039	247,255,032	178,835,394	18,515,940	38,397,970	64,922,504	19,575,098	28,391,580	5,394,603	3,601,581	36,118
2006	100.0%	435,306,205	421,098,416	14,207,789	247,672,862	187,633,343	26,356,313	39,031,767	69,707,767	18,593,179	25,007,329	5,925,048	2,989,912	22,028
2007	100.0%	410,597,405	397,437,736	13,159,669	229,488,077	181,109,328	24,597,089	40,181,565	66,829,670	18,203,080	23,557,499	4,572,099	3,142,168	26,158
2008	100.0%	400,582,729	388,065,655	12,517,074	222,281,532	178,301,225	26,580,291	41,961,250	60,276,094	18,473,867	23,086,813	5,418,035	2,490,645	14,229
2009	98.0%	409,962,365	397,561,580	12,400,785	210,529,338	191,085,754	29,452,162	45,109,950	70,762,809	17,173,912	20,706,247	5,616,024	2,259,950	4,701
2010	98.0%	393,652,410	381,032,086	12,620,324	209,425,724	176,482,228	29,998,296	41,802,834	63,925,490	15,969,655	17,076,378	5,411,975	2,292,788	4,811
2011	98.1%	382,641,848	370,262,712	12,379,136	199,900,279	175,512,185	30,171,921	43,412,533	63,180,074	15,538,372	16,409,830	4,818,976	1,976,812	3,669
2012	98.9%	393,934,690	381,261,858	12,672,832	213,475,489	176,298,229	31,470,353	44,530,255	61,740,835	15,501,593	16,138,526	4,924,088	1,988,380	4,200
2013	100.0%	398,214,258	384,492,730	13,721,528	207,930,086	185,673,428	33,368,195	47,275,219	57,306,582	20,413,161	17,357,319	4,370,899	2,412,120	3,169,933
2014	100.0%	394,309,170	381,041,565	13,267,605	203,872,193	185,612,343	34,941,337	45,920,761	54,870,349	21,183,699	17,699,203	5,290,415	2,618,285	3,088,294
2015	99.9%	396,187,529	384,479,107	11,708,422	207,675,203	183,568,815	37,380,369	45,426,558	53,182,130	19,867,198	15,726,177	5,778,319	2,795,230	3,412,835
2016	98.9%	394,801,127	383,198,875	11,602,252	199,818,769	190,358,031	39,899,581	47,503,137	53,856,150	21,300,024	16,430,469	5,228,947	2,973,733	3,165,989
2017 <sup>5</sup>	98.2%	398,473,677	387,718,867	10,754,810	196,858,983	196,780,655	41,840,166	42,497,716	53,375,173	18,807,328	19,816,285	6,410,070	2,625,838	11,408,080
2018 <sup>6</sup>	94.6%	399,793,658	389,042,570	10,751,088	197,174,528	197,874,129	45,164,717	49,409,501	54,325,910	19,409,090	15,821,402	5,415,942	4,349,389	3,978,180
2019	97.8%	393,230,852	383,270,561	9,960,291	187,140,875	200,979,977	46,750,269	50,666,937	53,061,836	22,049,707	15,573,657	5,371,460	2,655,825	4,929,248
2020	98.0%	382,318,563	373,341,420	8,977,643	199,324,489	182,994,074	58,046,937	44,543,955	41,973,229	13,565,817	15,073,363	4,459,759	2,332,615	2,998,399
2021	99.5%	395,448,591	386,644,500	8,804,091	208,006,380	187,442,210	45,257,358	52,265,533	44,080,694	18,646,015	15,671,827	5,378,123	2,323,822	3,818,846

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.

<sup>2</sup> Unmetered consumption includes system losses, most residential, industrial, institutional and agricultural consumption, some commercial consumption, and consumption by some civic properties (e.g., parks and public washrooms).

<sup>3</sup> "Other" consists mainly of connections to utilities and municipal facilities not classified under institutional.

<sup>4</sup> "Unknown" represents serviced connections with no sector codes assigned.

<sup>5</sup> This data has not met MV's QA/QC standards and is not considered accurate. It will be evaluated in more detail for the next version of the report.

<sup>6</sup> Burnaby data for 2018 was not provided, so 2017 data was used for processing.

N/A – information not available or not applicable.

Table 3.10: Annual water consumption by sector (% of total consumption) in the GVWD, 2000 - 2021<sup>1</sup>

Year	Total Consumption Volume	Volume Purchased From GVWD	Volume from Own Sources	Unmetered <sup>1</sup>	Total Metered	Single-Family	Multi-Family	Breakdown of Metered Sectors					
								Commercial	Institutional	Industrial	Agricultural	Other <sup>2</sup>	Unknown <sup>3</sup>
2000	100%	97.25%	2.75%	59.33%	40.67%	1.39%	8.39%	14.53%	5.46%	8.24%	1.19%	1.46%	0.00%
2001	100%	97.21%	2.79%	59.10%	40.90%	1.63%	8.62%	14.51%	5.48%	8.07%	1.38%	1.22%	0.00%
2002	100%	96.91%	3.09%	61.01%	38.76%	2.36%	8.31%	15.75%	4.50%	5.61%	1.06%	0.92%	0.00%
2003	100%	96.98%	3.02%	60.22%	39.52%	2.06%	8.78%	15.02%	5.01%	6.57%	1.19%	0.89%	0.00%
2004	100%	97.01%	2.99%	59.69%	39.99%	3.01%	8.78%	14.96%	4.57%	6.61%	1.25%	0.82%	0.00%
2005	100%	97.06%	2.94%	57.84%	41.84%	4.33%	8.98%	15.19%	4.58%	6.64%	1.26%	0.84%	0.01%
2006	100%	96.74%	3.26%	56.90%	43.10%	6.05%	8.97%	16.01%	4.27%	5.74%	1.36%	0.69%	0.01%
2007	100%	96.79%	3.21%	55.89%	44.11%	5.99%	9.79%	16.28%	4.43%	5.74%	1.11%	0.77%	0.01%
2008	100%	96.88%	3.12%	55.49%	44.51%	6.64%	10.48%	15.05%	4.61%	5.76%	1.35%	0.62%	0.00%
2009	100%	96.98%	3.02%	51.35%	46.61%	7.18%	11.00%	17.26%	4.19%	5.05%	1.37%	0.55%	0.00%
2010	100%	96.79%	3.21%	53.20%	44.83%	7.62%	10.62%	16.24%	4.06%	4.34%	1.37%	0.58%	0.00%
2011	100%	96.76%	3.24%	52.24%	45.87%	7.89%	11.35%	16.51%	4.06%	4.29%	1.26%	0.52%	0.00%
2012	100%	96.78%	3.22%	54.19%	44.75%	7.99%	11.30%	15.67%	3.94%	4.10%	1.25%	0.50%	0.00%
2013	100%	96.55%	3.45%	52.22%	46.63%	8.38%	11.87%	14.39%	5.13%	4.36%	1.10%	0.61%	0.80%
2014	100%	96.64%	3.36%	51.70%	47.07%	8.86%	11.65%	13.92%	5.37%	4.49%	1.34%	0.66%	0.78%
2015	100%	97.04%	2.96%	52.42%	46.33%	9.44%	11.47%	13.42%	5.01%	3.97%	1.46%	0.71%	0.86%
2016	100%	97.06%	2.94%	50.61%	48.22%	10.11%	12.03%	13.64%	5.40%	4.16%	1.32%	0.75%	0.80%
2017	100%	97.30%	2.70%	49.40%	49.38%	10.50%	10.67%	13.39%	4.72%	4.97%	1.61%	0.66%	2.86%
2018 <sup>5</sup>	100%	97.31%	2.69%	49.32%	49.49%	11.30%	12.36%	13.59%	4.85%	3.96%	1.35%	1.09%	1.00%
2019	100%	97.47%	2.53%	47.59%	51.11%	11.89%	12.88%	13.49%	5.61%	3.96%	1.37%	0.68%	1.25%
2020	100%	97.65%	2.35%	52.14%	47.86%	15.18%	11.65%	10.98%	3.55%	3.94%	1.17%	0.61%	0.78%
2021	100%	97.77%	2.23%	52.60%	47.40%	11.44%	13.22%	11.15%	4.72%	3.96%	1.36%	0.59%	0.97%

<sup>1</sup> Data for the years 1985 to 1999 can be found in the Water Use by Sector Report 1985 – 2017.<sup>2</sup> Unmetered consumption includes system losses, most residential, industrial, institutional and agricultural consumption, some commercial consumption, and consumption by some civic properties (e.g., parks and public washrooms).<sup>3</sup> "Other" consists mainly of connections to utilities and municipal facilities not classified under institutional.<sup>4</sup> "Unknown" represents serviced connections with no sector codes assigned.<sup>5</sup> Burnaby data for 2018 was not provided, so 2017 data was used for processing.

N/A – information not available or not applicable.

## Regional Industrial, Commercial, Institutional, and Agricultural Consumption

Metered water consumption for the ICI sectors (industrial, commercial, institutional, and agricultural) was separated by sub-sectors using By Sector Codes (BSC), as defined in the Methodology. This was completed for each member jurisdiction, and member jurisdiction data were combined for the overall ICI consumption data in the region. Since agricultural sector consumption is less than 5% of regional consumption in 2021, it is included in the ICI sector.

The metered connections shown for each category are based on the coding of properties by the BC Assessment Authority and the codes assigned to ICI accounts by members within their jurisdiction. There could be overlaps between categories. For example, in the case of a restaurant located in an office building or shopping centre, the restaurant may have been included in the Business and Office sector or the Retail Shopping and Stores sector instead of the Restaurant sector. There are variations in the assignment between member jurisdictions as well.

Metered consumption for all ICI connections during 2021 was 89,919,319 m<sup>3</sup> or 246,354 m<sup>3</sup>/day. The ICI sector consumption in 2021 is 90% and 72% of the ICI sector consumption in 2017 and 2019. ICI consumption in the region from 2009 to 2021 is shown by BSC categories in Figure 3.23 and Figure 3.24. Metered connections and consumption by BSC category in the region from 2009 to 2021 are provided in Table 3.11, Table 3.12, and Table 3.13.

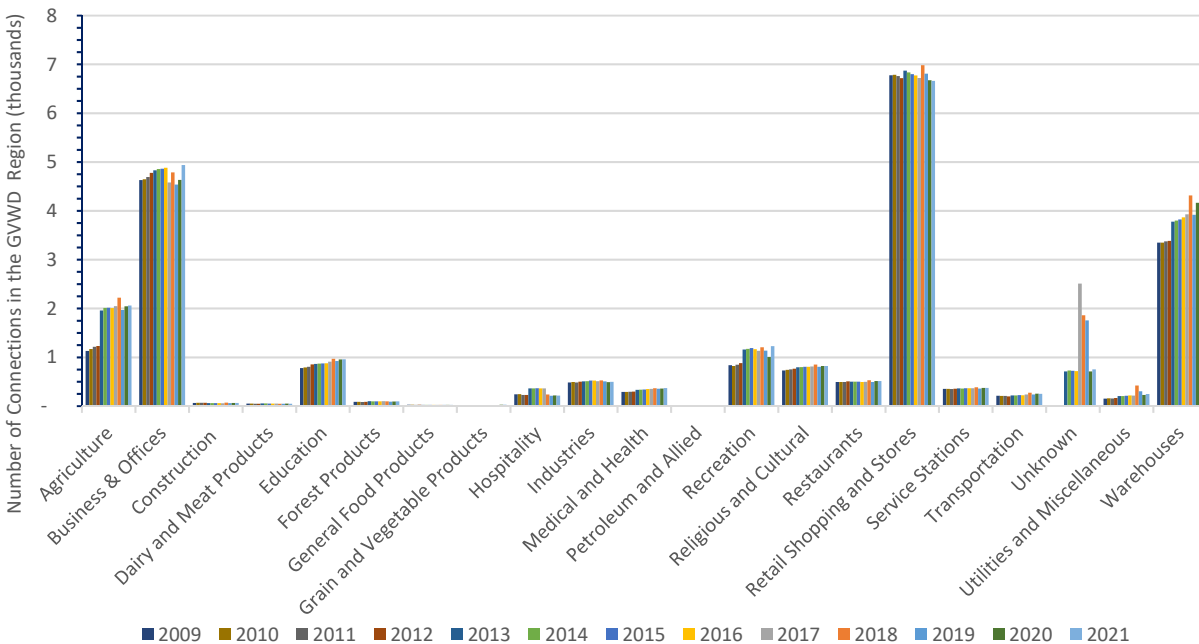


Figure 3.22: Number of metered ICI connections by sector in the region, 2009 to 2021

Note: Due to scale, several subsectors, such as General Food Products and Grain and Vegetable Products, show low numbers of connections on this chart. Refer to Table 11 for details of the number of connections. The 'Unknown' sub-sector consumption is assumed to be within the ICI sector due to the high consumption per connection and varies considerably from year to year. Therefore, the distribution of ICI consumption between the sub-sectors can only be assumed as correct. Reducing the 'Unknown' consumption could increase consumption in other ICI sub-sectors, although this correlation has not been established.

In 2021, there were 24,625 metered connections in the ICI sector in the region, representing a 15% overall increase in ICI connections since 2009. The most significant decrease in connections appears to

have been in the General Food Products and Hospitality sub-sector since 2009, according to data provided by members. Conversely, the leading increase in the number of connections for the same period, 2009 to 2021, is in the Agriculture subsector, followed by the Grain and Vegetable Products subsector. From the data provided for 2021, there are 752 accounts categorized as 'Unknown' that are assumed to be commercial. This data set needs to be revisited and reviewed with member jurisdictions.

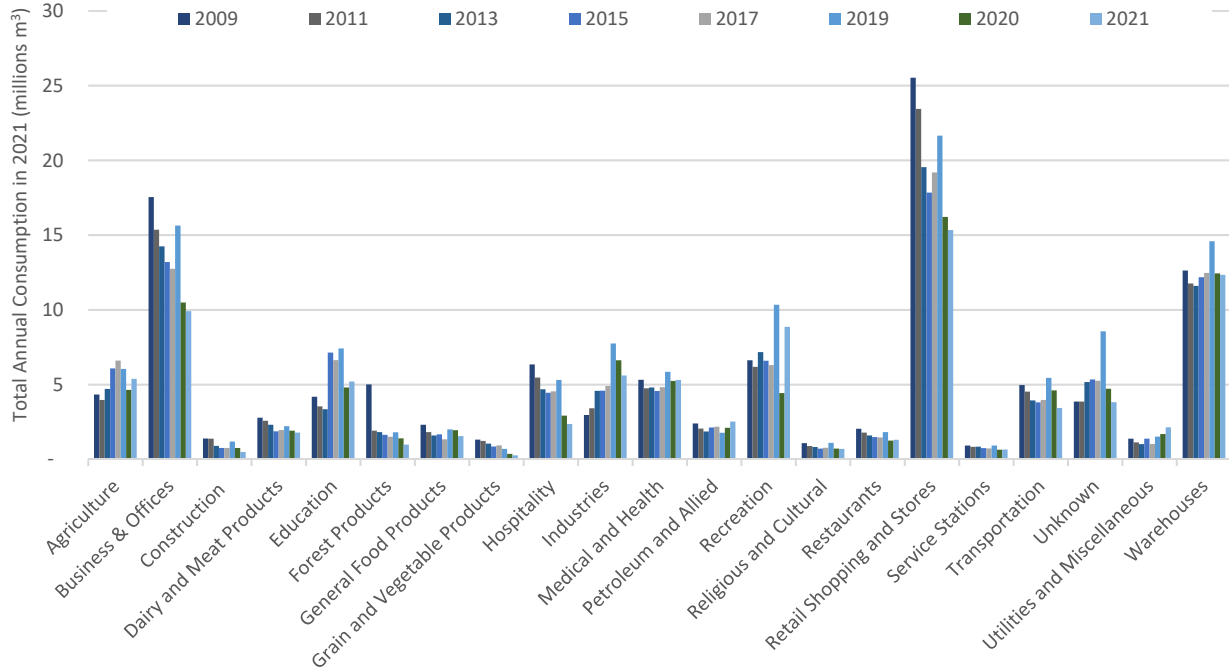


Figure 3.23: Metered ICI water consumption by sub-sector, 2009 to 2021, showing odd years (and 2020) for clarity

Notes: The report assumes the regional ICI sector is universally metered and, therefore, captured in the billing data provided by members. Several subsectors show noticeable reductions in consumption for 2020 and 2021 from 2019 levels.

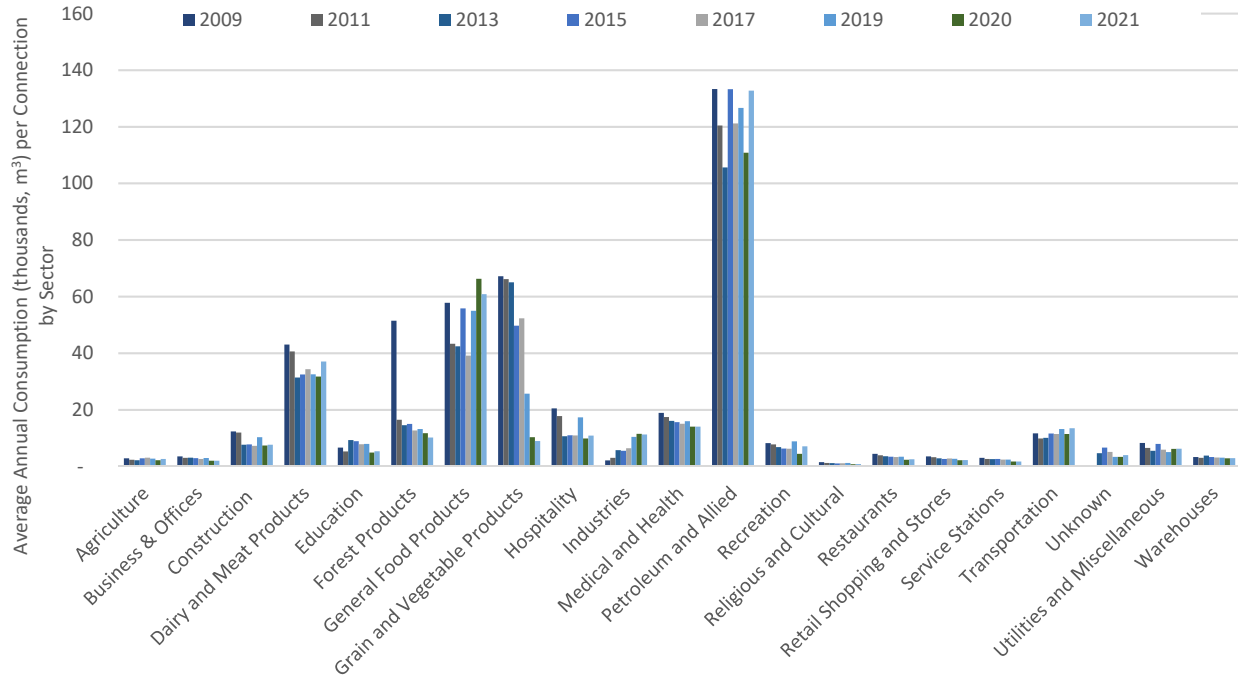


Figure 3.24: Average annual consumption per ICI connection by sector, 2009 to 2021, showing odd years (and 2020) only for clarity

Table 3.11: Number of metered ICI connections in the GVWD

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Agriculture</b>	1,130	1,168	1,213	1,232	1,957	2,012	2,014	2,008	2,047	2,219	1,967	2,044	2,060
<b>Business and Offices</b>	4,628	4,644	4,691	4,776	4,829	4,854	4,862	4,882	4,580	4,786	4,538	4,633	4,938
<b>Construction</b>	66	69	68	67	61	61	61	61	58	70	62	63	64
<b>Dairy and Meat Products</b>	51	51	49	49	56	55	52	51	50	49	49	51	48
<b>Education</b>	778	791	806	855	865	870	873	876	910	968	922	957	959
<b>Forest Products</b>	87	86	85	88	100	98	96	96	99	98	91	94	96
<b>General Food Products</b>	28	27	26	30	26	26	25	25	25	24	24	24	25
<b>Grain and Vegetable Products</b>	18	17	17	17	14	17	17	17	18	21	23	30	30
<b>Hospitality</b>	241	245	229	227	363	362	366	362	362	239	213	218	216
<b>Industries</b>	485	494	485	499	507	509	524	524	509	527	507	491	496
<b>Medical and Health</b>	291	290	293	297	333	335	340	348	354	365	355	361	368
<b>Petroleum and Allied</b>	18	18	17	19	17	17	16	16	18	17	14	19	19
<b>Recreation</b>	837	823	846	882	1,160	1,173	1,189	1,165	1,132	1,206	1,135	1,004	1,227
<b>Religious and Cultural</b>	730	744	753	766	796	800	806	806	813	850	806	821	821
<b>Restaurants</b>	494	495	495	506	500	500	500	495	497	531	495	515	512
<b>Retail Shopping and Stores</b>	6,777	6,784	6,760	6,715	6,871	6,835	6,800	6,773	6,720	6,983	6,807	6,673	6,662
<b>Service Stations</b>	352	354	351	356	364	361	365	367	365	385	359	372	374
<b>Transportation</b>	212	209	210	198	218	220	225	223	237	273	238	254	251
<b>Unknown*</b>	-	-	-	-	710	729	724	718	2,510	1,861	1,756	711	752
<b>Utilities and Miscellaneous</b>	153	159	157	166	204	207	212	217	216	423	305	229	248
<b>Warehouses</b>	3,349	3,348	3,373	3,384	3,776	3,801	3,822	3,867	3,927	4,315	3,918	4,165	4,208
<b>Total ICI</b>	<b>20,725</b>	<b>20,816</b>	<b>20,924</b>	<b>21,129</b>	<b>23,727</b>	<b>23,842</b>	<b>23,889</b>	<b>23,897</b>	<b>25,447</b>	<b>26,210</b>	<b>24,584</b>	<b>23,729</b>	<b>24,374</b>

\*"Unknown" represents serviced connections with no sector codes assigned and assumed to be ICI Sector.

Table 3.12: Total annual consumption (m<sup>3</sup>) by ICI Sector in the GVWD

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Agriculture</b>	4,336,682	4,215,148	3,964,478	5,042,936	4,705,448	7,640,916	6,072,204	5,373,715	6,597,694	6,273,281	6,045,211	4,637,919	5,378,123
<b>Business and Offices</b>	17,547,719	15,094,049	15,360,043	15,630,381	14,247,611	15,514,642	13,200,843	12,973,249	12,746,079	13,666,477	15,638,254	10,482,542	9,910,478
<b>Construction</b>	1,388,675	1,336,417	1,381,468	2,671,266	894,736	2,912,379	756,118	779,029	754,950	1,112,390	1,185,607	753,688	492,317
<b>Dairy and Meat Products</b>	2,783,485	2,652,213	2,578,208	3,972,238	2,312,569	4,212,503	1,870,166	2,004,884	1,953,913	2,203,958	2,207,708	1,911,956	1,779,941
<b>Education</b>	4,184,228	3,736,294	3,544,751	5,234,883	3,345,491	5,251,967	7,139,919	8,638,889	6,638,503	7,048,522	7,419,952	4,804,544	5,194,683
<b>Forest Products</b>	5,007,131	2,593,610	1,915,437	3,515,447	1,814,901	4,150,682	1,629,444	2,357,452	1,507,403	1,667,323	1,801,549	1,394,365	980,088
<b>General Food Products</b>	2,310,503	1,931,439	1,819,316	3,240,726	1,591,916	3,632,651	1,669,516	1,622,941	1,332,771	1,859,210	1,999,064	1,948,938	1,547,661
<b>Grain and Vegetable Products</b>	1,315,448	1,222,005	1,230,416	2,870,709	1,043,661	3,303,508	847,216	878,120	925,173	901,952	687,267	361,267	268,893
<b>Hospitality</b>	6,339,251	5,657,165	5,470,634	6,255,277	4,686,541	6,642,101	4,451,746	4,462,195	4,550,616	5,311,404	5,302,262	2,917,515	2,356,796
<b>Industries</b>	2,957,410	3,452,653	3,409,671	4,174,162	4,578,863	6,750,572	4,587,446	4,450,758	4,903,271	7,805,271	7,745,878	6,622,769	5,603,976
<b>Medical and Health</b>	5,314,930	4,978,337	4,747,868	6,164,287	4,797,611	6,848,972	4,567,131	4,649,686	4,820,521	4,835,580	5,855,041	5,239,564	5,306,914
<b>Petroleum and Allied</b>	2,398,995	2,033,414	2,046,423	3,952,676	1,860,520	4,503,989	2,128,707	2,237,140	2,176,946	1,975,135	1,773,323	2,103,918	2,522,573
<b>Recreation</b>	6,623,938	6,072,414	6,180,230	7,587,464	7,170,301	9,431,026	6,594,702	6,601,888	6,301,333	7,285,424	10,338,346	4,424,417	8,860,818
<b>Religious and Cultural</b>	1,078,441	973,840	882,139	2,515,389	814,981	2,897,463	710,580	772,544	767,084	865,152	1,093,503	717,086	692,864
<b>Restaurants</b>	2,038,305	1,892,296	1,786,211	3,372,541	1,591,285	3,584,820	1,488,838	1,477,518	1,458,559	1,511,811	1,818,119	1,247,762	1,306,203
<b>Retail Shopping and Stores</b>	25,524,992	23,407,842	23,445,109	22,400,049	19,543,507	21,002,548	17,840,289	18,219,282	19,189,424	20,900,177	21,653,512	16,213,640	15,336,268
<b>Service Stations</b>	921,564	889,038	830,731	2,519,964	841,020	2,851,621	748,805	732,020	720,545	1,676,081	912,434	641,082	650,416
<b>Transportation</b>	4,963,798	4,917,466	4,525,329	5,348,342	3,938,390	6,479,209	3,808,325	3,697,620	3,972,740	7,088,365	5,445,462	4,605,369	3,428,396
<b>Unknown*</b>	3,862,424	3,875,934	3,857,801	3,672,183	5,164,078	7,143,896	5,339,901	5,093,055	5,248,626	7,832,312	8,557,319	4,721,286	3,818,846
<b>Utilities and Miscellaneous</b>	1,380,067	1,302,460	1,133,684	2,733,592	1,010,123	3,124,436	1,376,400	1,511,347	1,021,664	1,556,859	1,518,959	1,691,335	2,138,669
<b>Warehouses</b>	12,624,654	11,924,493	11,763,230	11,328,671	11,597,934	14,595,691	12,178,094	12,411,569	12,469,152	14,386,135	14,587,271	12,433,869	12,344,398
<b>Total ICI</b>	<b>114,902,640</b>	<b>104,158,529</b>	<b>101,873,176</b>	<b>124,203,180</b>	<b>97,551,485</b>	<b>142,475,590</b>	<b>99,006,389</b>	<b>100,944,902</b>	<b>100,056,970</b>	<b>117,762,817</b>	<b>123,586,042</b>	<b>89,874,831</b>	<b>89,919,319</b>

\*"Unknown" represents serviced connections with no sector codes assigned and assumed to be ICI Sector.

Table 3.13: Average annual consumption per connection (m<sup>3</sup>) by ICI Sector in the GVWD

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Agriculture</b>	2,862	2,697	2,370	2,417	2,187	2,595	2,842	2,576	3,108	2,790	2,742	2,185	2,620
<b>Business and Offices</b>	3,520	2,986	2,685	2,968	3,094	2,858	2,919	2,779	2,623	2,538	2,955	2,039	2,016
<b>Construction</b>	12,357	11,117	11,962	9,832	7,680	7,544	7,767	7,633	7,300	9,345	10,343	7,405	7,692
<b>Dairy and Meat Products</b>	43,048	40,474	40,616	39,537	31,384	31,137	32,454	33,290	34,364	28,908	32,516	31,760	37,082
<b>Education</b>	6,632	5,909	5,315	5,149	9,287	9,636	8,905	10,474	7,849	7,793	7,974	4,923	5,352
<b>Forest Products</b>	51,463	23,898	16,506	17,714	14,551	17,821	15,014	21,791	12,692	11,986	13,192	11,712	10,206
<b>General Food Products</b>	57,805	45,906	43,359	38,461	42,417	43,507	55,828	50,494	39,174	51,740	55,002	66,308	60,883
<b>Grain and Vegetable Products</b>	67,208	65,665	66,160	63,349	65,045	68,069	49,718	47,592	52,334	42,208	25,687	10,297	8,963
<b>Hospitality</b>	20,507	17,428	17,785	17,338	10,638	10,581	11,028	10,827	10,924	16,035	17,321	9,900	10,907
<b>Industries</b>	2,117	3,099	3,039	3,016	5,752	5,980	5,547	5,112	6,445	10,410	10,441	11,495	11,309
<b>Medical and Health</b>	18,901	18,291	17,465	16,919	16,106	15,912	15,615	15,065	15,072	14,817	16,000	14,076	14,064
<b>Petroleum and Allied</b>	133,334	113,026	120,439	116,440	105,647	139,960	133,268	139,987	121,145	130,229	126,666	110,838	132,767
<b>Recreation</b>	8,221	7,632	7,755	7,411	6,829	6,947	6,314	6,366	6,278	6,818	8,867	4,474	7,125
<b>Religious and Cultural</b>	1,479	1,306	1,243	1,156	1,159	1,106	1,074	1,092	1,102	991	1,227	782	826
<b>Restaurants</b>	4,467	4,167	3,940	3,729	3,603	3,431	3,446	3,425	3,324	3,132	3,420	2,340	2,502
<b>Retail Shopping and Stores</b>	3,564	3,252	3,256	3,145	2,870	2,717	2,665	2,656	2,827	2,875	2,671	2,173	2,255
<b>Service Stations</b>	3,018	2,843	2,656	2,547	2,570	2,348	2,653	2,443	2,439	2,275	2,393	1,746	1,731
<b>Transportation</b>	11,675	11,620	9,870	12,265	10,095	13,639	11,635	10,857	11,477	11,957	13,197	11,439	13,473
<b>Unknown*</b>	-	-	-	-	4,670	5,351	6,654	5,934	5,107	3,066	3,374	3,389	3,990
<b>Utilities and Miscellaneous</b>	8,305	7,512	6,551	5,868	5,539	6,162	7,928	8,155	5,932	3,915	5,090	6,181	6,271
<b>Warehouses</b>	3,294	3,076	3,008	2,892	3,833	3,303	3,289	3,268	3,169	3,473	3,079	2,884	2,917

\*"Unknown" represents serviced connections with no sector codes assigned and assumed to be ICI Sector.

## Estimated Regional Residential Consumption

Estimated residential consumption was determined on a per-member jurisdiction basis, and these estimates were combined to produce estimates for the region. For member jurisdictions that meter all ICI connections, unmetered consumption minus system losses was assumed to represent all unmetered residential consumption. Along with metered residential consumption, this forms the total residential consumption for each member jurisdiction.

For 2021, data for the City of Port Moody was not provided. The consumption data for the City of Port Moody and UEL/UBC are not included in the regional estimates for residential water consumption due to a lack of data and diurnal changes in population, respectively. For more information on calculation methodology, refer to Section 2.0.

Based on these assumptions and the data provided and analyzed, it is estimated that residential consumption minus system losses accounted for approximately 65% of total water consumption in the region in 2021. This represents an annual volume of 305,521,742 m<sup>3</sup> for the residential sector in 2021. The weighted average residential consumption is estimated at 268.5 L/capita/day in 2021. Figure 3.25 shows the proportion of estimated residential consumption (including system losses of 12.2%) as part of overall consumption from 1985 to 2021. Figure 3.26 provides estimates on a per capita basis.

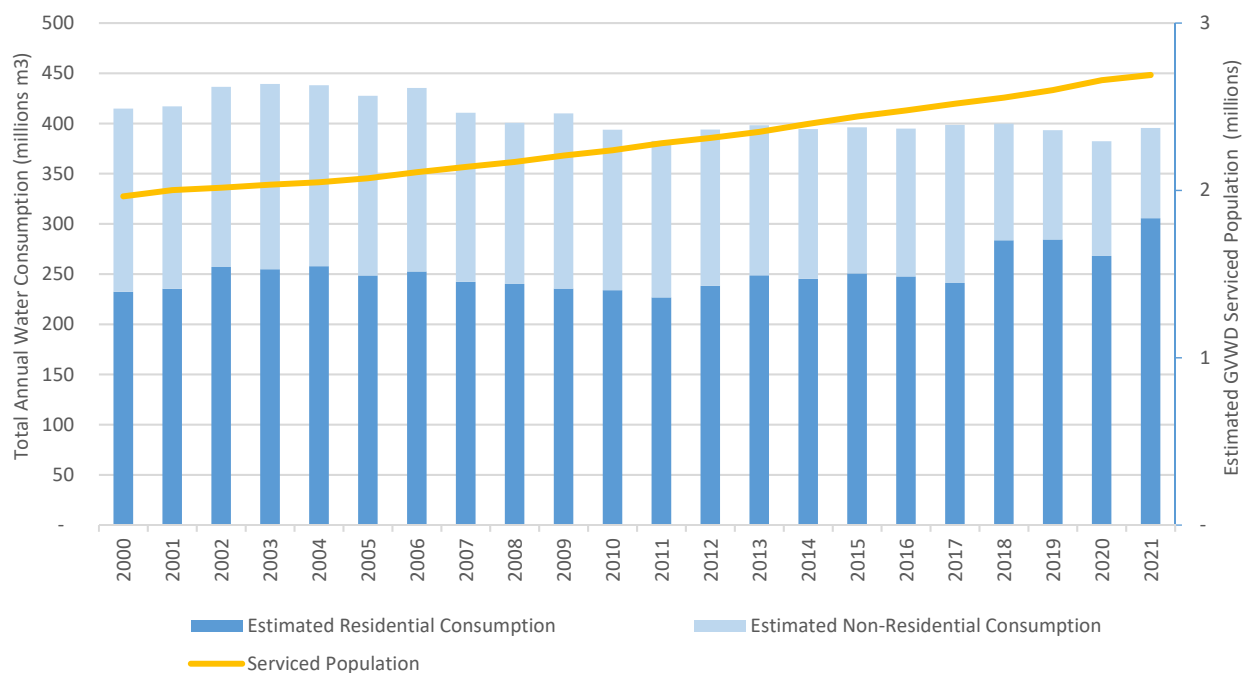


Figure 3.25: GVWD total and estimated residential consumption, 2000 to 2021

\*2017 data was used as 2018 data for Burnaby. Data from 2018 to 2021 needs verification.

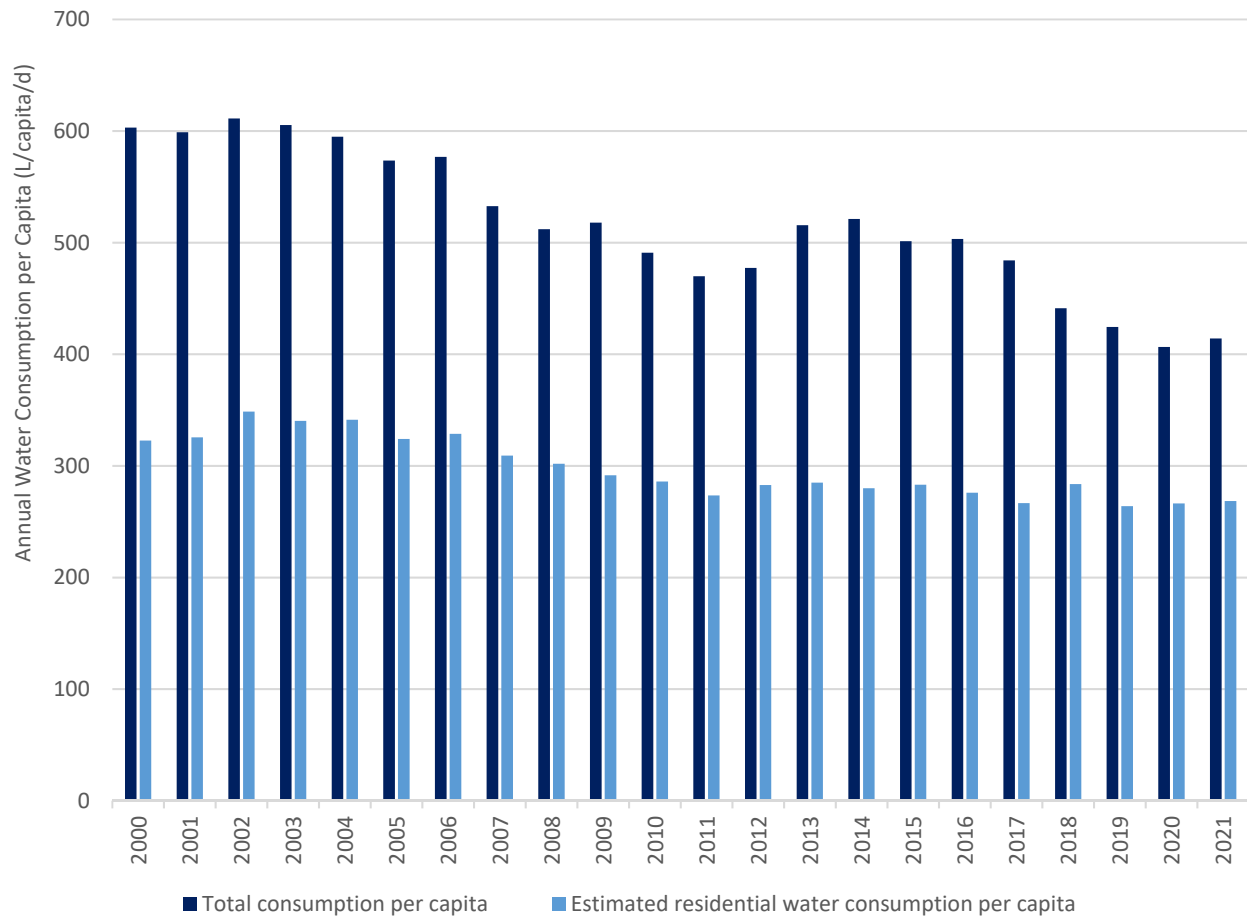


Figure 3.26: Per capita total and estimated residential consumption, 2000 to 2021

\*2017 data was used as 2018 data for Burnaby. Data from 2018 to 2021 needs verification.

Figure 3.27 illustrates the region's overall water use breakdown in 2021 based on estimates of residential use, metered consumption data, and self-reported member jurisdiction system losses.

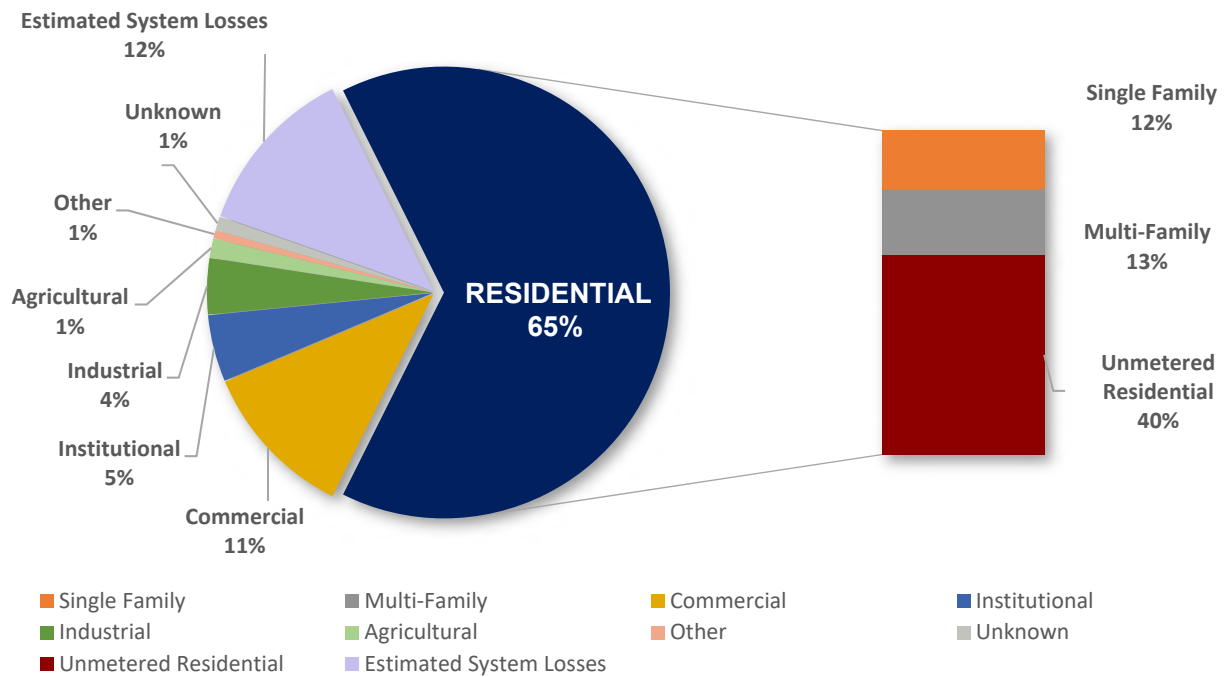


Figure 3.27: Water consumption in the GVWD region by estimated sectors in 2021

\* Estimated residential consumption values are intended to provide an approximated, relative and assumption-dependent indication of regional residential consumption. These estimates include several inaccuracies on unmetered connections, assumptions about metered and unmetered consumption, and self-reported system losses provided by member jurisdictions. The values presented should not be used when precision and accuracy are required. Residential consumption is subject to considerable change yearly and with each reporting cycle. As data quality and accuracy improve within member jurisdiction billing systems and residential metering programs achieve universal metering, further amendments to the results are likely. The data anomalies and inconsistencies between 2020 and 2021 and prior years (2000 to 2019) could be related to COVID-19 pandemic lockdowns, remote work arrangements and peak summer events such as the 2021 heat dome. However, data for at least another three years is needed to assess if consumption patterns revert to pre-2019 distribution and extent.

## **Appendix A: Classification Codes**

### General Sector Descriptions

General Sector	Description	Notes
1	Single-Family Residential	Single-family
2	Multi-Family Residential	Duplexes, strata, apartments, etc.
3	Commercial	Services, restaurants, retail, wholesale
4	Institutional	Education, religious buildings, recreation and parks, government
5	Industrial	Manufacturing, processing chemical, foods, forestry, mining, petroleum
6	Agricultural	Farms and farm related
7	Other	Transportation, utilities, miscellaneous
8	Unknown	No AUC codes assigned

### British Columbia Assessment Authority (BCAA) Actual Use Codes

BCAA Actual Use Code	Description
0 – 70	Residential
110 – 191	Farm
200 – 290	Commercial
400 – 490	Industrial
415 – 429	Industrial – Forestry
430 – 438	Industrial – Petroleum
500 – 590	Transportation, Communications, Utility
600 – 670	Civic, Institutional, Other

### By Sector Classification (BSC) Codes

BSC Code	Sector
0	Single-Family Residential
1	Agriculture
2	Business and Offices
3	Construction
4	Dairy and Meat Products
5	Education
6	Forest Products
7	General Food Products
8	Grain and Vegetable Products
9	Hospitality
10	Industries
11	Medical and Health
12	Petroleum and Allied
13	Recreation
14	Religious and Cultural
15	Restaurants
16	Retail Shopping and Stores
17	Service Stations
18	Transportation
19	Warehouses
20	Utilities and Miscellaneous
21	Multi-Family Residential

**BCAA Actual Use Codes Conversion to By Sector Classification (BSC) codes and General Sector Codes** (\* New or changes by BCAA since 2017 report)

Actual Use Code	Description	By Sector Code	General Sector
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**Single-Family Residential**

000	SINGLE FAMILY DWELLING	0	1
001	VACANT RESIDENTIAL LESS THAN 2 ACRES	0	1
002	PROPERTY SUBJECT TO SEC 19(8)	0	1
020	RESIDENTIAL OUTBUILDING ONLY	0	1
032	SINGLE FAMILY DWELLING WITH SUITE*	0	1
037	MANUFACTURED HOME - (WITHIN MANUFACTURED HOME PARK)	0	1
038	MANUFACTURED HOME - (NOT IN MANUFACTURED HOME PARK)	0	1
040	SEASONAL DWELLING	0	1
060	2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	0	1
061	2 ACRES OR MORE – VACANT	0	1
062	2 ACRES OR MORE - SEASONAL DWELLING	0	1
063	2 ACRES OR MORE - MANUFACTURED HOME	0	1
070	2 ACRES OR MORE - OUTBUILDING	0	1

**Agriculture**

110	GRAIN and FORAGE	1	6
111	GRAIN and FORAGE – VACANT	1	6
120	VEGETABLE and TRUCK	1	6
121	VEGETABLE and TRUCK - VACANT	1	6
130	TREE FRUITS	1	6
131	TREE FRUITS – VACANT	1	6
140	SMALL FRUITS	1	6
141	SMALL FRUITS – VACANT	1	6
150	BEEF	1	6
151	BEEF – VACANT	1	6
160	DAIRY	1	6
161	DAIRY – VACANT	1	6
170	POULTRY	1	6
171	POULTRY – VACANT	1	6
180	MIXED	1	6
181	MIXED – VACANT	1	6
190	OTHER	1	6
191	OTHER – VACANT	1	6

**Business and Offices**

208	OFFICE BUILDING (PRIMARY USE)	2	3
210	BANK	2	3
216	COMMERCIAL STRATA-LOT	2	3
217	AIR SPACE TITLE	2	3

Actual Use Code	Description	By Sector Code	General Sector
219	STRATA LOT - PARKING COMMERCIAL	2	3
228	AUTOMOBILE PAINT SHOP, GARAGES, ETC.	2	3
260	PARKING - LOT ONLY, PAVED OR GRAVEL	2	3
262	PARKING GARAGE	2	3
288	SIGN OR BILLBOARD ONLY	2	3
490	PARKING LOT ONLY (PAVED OR GRAVEL)	2	5
620	GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE)	2	4

#### Construction

276	LUMBER YARD OR BUILDING SUPPLIES	3	3
445	SAND and GRAVEL (VACANT AND IMPROVED)	3	5
446	CEMENT PLANTS	3	5
447	ASPHALT PLANTS	3	5
448	CONCRETE MIXING PLANTS	3	5

#### Dairy and Meat Products

402	MEAT and POULTRY	4	5
403	SEA FOOD	4	5
404	DAIRY PRODUCTS	4	5

#### Education

650	SCHOOLS and UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS	5	4
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#### Forest Products

415	SAWMILLS	6	5
416	PLANER MILLS (WHEN SEPARATE FROM SAWMILL)	6	5
417	PLYWOOD MILLS	6	5
418	SHINGLE MILLS	6	5
419	SASH and DOOR	6	5
420	LUMBER REMANUFACTURING (WHEN SEPARATE FROM SAWMILL)	6	5
421	MANAGED FOREST (VACANT)*	6	5
422	IC&I WATER LOT (VACANT)*	6	5
423	IC&I WATER LOT (IMPROVED)*	6	5
424	PULP and PAPER MILLS (INCLUDING FINE PAPER	6	5
425	PAPER BOX, PAPER BAG, AND OTHER PAPER REMANUFACTURING	6	5
426	LOGGING OPERATIONS	6	5
427	LOGGING ROADS and BRIDGES	6	5
428	MANAGED FOREST (IMPROVED)*	6	5
429	MISCELLANEOUS (FOREST AND ALLIED INDUSTRY)	6	5

#### General Food Products

406	CONFECTIONERY MANUFACTURING and SUGAR PROCESSING	7	5
407	SOFT DRINK BOTTLING	7	5
414	MISCELLANEOUS (FOOD PROCESSING)	7	5

Actual Use Code	Description	By Sector Code	General Sector
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**Grain and Vegetable Products**

400	FRUIT and VEGETABLE	8	5
405	BA KERY and BISCUIT MANUFACTURING	8	5
408	BREWERY	8	5
409	WINERY	8	5
410	DISTILLERY	8	5
413	FLOUR MILLS and BREAKFAST CEREAL PRODUCTS	8	5

**Hospitality**

230	HOTEL	9	3
232	MOTEL and AUTO COURT	9	3
233	INDIVIDUAL STRATA LOT - HOTEL/MOTEL	9	3
237	BED and BREAKFAST OPERATION 4 OR MORE UNITS	9	3
239	BED and BREAKFAST OPERATION LESS THAN 4 UNITS	9	3

**Industries**

401	INDUSTRIAL – VACANT	10	5
412	FEED MANUFACTURING	10	5
440	MINING – COAL	10	5
442	MINING and MILLING - METALLIC	10	5
443	MINING and MILLING - NON-METALLIC (INCLUDING ASBESTOS)	10	5
444	SMELTING and REFINING	10	5
449	MISCELLANEOUS (MINING AND ALLIED INDUSTRIES)	10	5
450	RUBBER and PLASTICS PRODUCTS	10	5
452	LEATHER INDUSTRY	10	5
454	TEXTILES and KNITTING MILLS	10	5
456	CLOTHING INDUSTRY	10	5
458	FURNITURE and FIXTURES INDUSTRY	10	5
460	PRINTING and PUBLISHING INDUSTRY	10	5
462	PRIMARY METAL INDUSTRIES (IRON and STEEL MILLS	10	5
464	METAL FABRICATING INDUSTRIES	10	5
466	MACHINERY MANUFACTURING (EXCLUDING ELECTRICAL)	10	5
468	TRANSPORTATION EQUIPMENT INDUSTRY (INCLUDING AIRCRAFT)	10	5
470	ELECTRICAL and ELECTRONICS PRODUCTS INDUSTRY	10	5
472	CHEMICAL and CHEMICAL PRODUCTS INDUSTRIES	10	5
474	MISCELLANEOUS and (INDUSTRIAL OTHER)	10	5

**Medical and Health**

285	NURSING HOME	11	3
286	CONGREGATE CARE FACILITY	11	3
287	GROUP HOME	11	3
640	HOSPITALS (NURSING HOMES REFER TO COMMERCIAL SECTION)	11	4

**Petroleum and Allied**

430	PETROLEUM AND GAS EXPLORATION (INCLUDING OIL AND GAS)	12	5
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Actual Use Code	Description	By Sector Code	General Sector
431	PRODUCTION PIPELINES	12	5
432	OIL REFINING PLANTS	12	5
433	GAS SCRUBBING PLANTS	12	5
434	PETROLEUM BULK PLANTS	12	5
435	LIQUID GAS STORAGE PLANTS	12	5
436	OIL and GAS TRANSPORTATION PIPELINES	12	5
437	OIL and GAS PUMPING and COMPRESSOR STATIONS	12	5
438	MISCELLANEOUS (PETROLEUM INDUSTRY)	12	5

#### Recreation

234	MANUFACTURED HOME PARK	13	3
236	CAMPGROUND (COMMERCIAL)	13	3
238	SEASONAL RESORT	13	3
250	THEATRE BUILDINGS	13	3
252	DRIVE-IN THEATRES	13	3
266	BOWLING ALLEY	13	3
270	HALL (COMMUNITY, LODGE, CLUB, ETC.)	13	3
600	RECREATIONAL and CULTURAL BUILDINGS (INCLUDES CURLING)	13	4
601	CIVIC, INSTITUTIONAL and RECREATIONAL - VACANT	13	4
610	PARKS and PLAYING FIELDS	13	4
612	GOLF COURSES (INCLUDES PUBLIC and PRIVATE)	13	4
614	CAMPGROUNDS (INCLUDES GOVERNMENT CAMPGROUNDS, YMCA)	13	4
654	RECREATIONAL CLUBS, SKI HILLS	13	4
660	LAND CLASSIFIED RECREATIONAL USED FOR	13	4

#### Religious and Cultural

642	CEMETERIES (INCLUDES PUBLIC OR PRIVATE)	14	4
652	CHURCHES and BIBLE SCHOOLS	14	4

#### Restaurants

254	NEIGHBOURHOOD PUB	15	3
256	RESTAURANT ONLY	15	3
257	FAST FOOD RESTAURANTS	15	3
258	DRIVE-IN RESTAURANT	15	3

#### Retail Shopping and Stores

200	STORE(S) AND SERVICE - COMMERCIAL	16	3
201	VACANT	16	3
202	STORE(S) AND LIVING QUARTERS	16	3
203	STORES AND/OR OFFICES WITH APARTMENTS	16	3
204	STORE(S) AND OFFICES	16	3
206	NEIGHBOURHOOD STORE	16	3
209	SHOPPING CENTRE - NEIGHBOURHOOD	16	3
211	SHOPPING CENTRE - COMMUNITY	16	3

Actual Use Code	Description	By Sector Code	General Sector
212	DEPARTMENT STORE	16	3
213	SHOPPING CENTRE - REGIONAL	16	3
214	SHOPPING CENTRE	16	3
215	FOOD MARKET	16	3
220	AUTOMOBILE DEALERSHIP	16	3
227	AUTOMOBILE SALES (LOT)	16	3
240	GREENHOUSES AND NURSERIES (NOT FARM CLASS)	16	3
290	MISCELLANEOUS RETAIL STORES	16	3

#### Service Stations

222	SERVICE STATION	17	3
224	SELF-SERVE SERVICE STATION	17	3
225	CONVENIENCE STORE/SERVICE STATION	17	3
226	CAR WASH	17	3

#### Transportation

280	MARINE FACILITIES – MARINA	18	3
476	GRAIN ELEVATORS	18	5
478	DOCKS and WHARVES	18	5
480	SHIPYARDS	18	5
500	RAILWAY	18	7
505	MARINE and NAVIGATIONAL FACILITIES (INCLUDES FERRY)	18	7
510	BUS COMPANY, INCLUDING STREET RAILWAY	18	7
515	AIRPORTS, HELIPORTS, ETC	18	7
590	MISCELLANEOUS (TRANSPORTATION and COMMUNICATION)	18	7
622	ALRT	18	7
623	ALRT/MIXED USE	18	7

#### Warehouses

218	STRATA-LOT SELF STORAGE-BUSINESS USE	19	3
272	STORAGE and WAREHOUSING - OPEN	19	3
273	STORAGE and WAREHOUSING - CLOSED	19	3
274	STORAGE and WAREHOUSING - COLD	19	3
488	STRATA-LOT SELF STORAGE-INDUSTRIAL USE	19	5

#### Utilities and Miscellaneous

520	TELEPHONE	20	7
525	FIBEROPTIC CONDUIT	20	7
530	TELECOMMUNICATIONS (OTHER THAN TELEPHONE)	20	7
540	COMMUNITY ANTENNA TELEVISION (CABLEVISION)	20	7
550	GAS DISTRIBUTION SYSTEMS	20	7
560	WATER DISTRIBUTION SYSTEMS	20	7
570	IRRIGATION SYSTEMS	20	7
580	ELECTRICAL POWER SYSTEMS (INCLUDING NON-UTILITY)	20	7

Actual Use Code	Description	By Sector Code	General Sector
615	GOVERNMENT RESERVES (INCLUDES GREENBELTS (NOT IN FARM USE))	20	4
625	GARBAGE DUMPS, SANITARY FILLS, SEWER LAGOONS, ETC.	20	7
630	WORKS YARDS	20	4
632	RANGER STATION	20	4
634	GOVERNMENT RESEARCH CENTRES (INCLUDES NURSERIES and)	20	4
670	AMUSEMENT and RECREATION, OTHRS NEC	20	7

**Multi-Family Residential**

029	STRATA LOT - PARKING RESIDENTIAL	21	2
030	STRATA-LOT RESIDENCE (CONDOMINIUM)	21	2
031	STRATA-LOT SELF STORAGE-RES USE	21	2
033	DUPLEX NON-STRATA – SIDE BY SIDE OR FRONT and BACK*	21	2
034	DUPLEX NON-STRATA - UP and DOWN*	21	2
035	DUPLEX STRATA - SIDE BY SIDE*	21	2
036	DUPLEX STRATA – FRONT and BACK*	21	2
039	ROW HOUSING - SINGLE UNIT OWNERSHIP	21	2
041	DUPLEX, STRATA – UP and DOWN*	21	2
042	STRATA-LOT SEASONAL DWELLING (CONDOMINIUM)	21	2
043	PARKING - LOT ONLY, PAVED OR GRAVEL	21	2
047	TRIPLEX	21	2
049	FOURPLEX	21	2
050	MULTI-FAMILY - APARTMENT BLOCK	21	2
051	MULTI-FAMILY - VACANT	21	2
052	MULTI-FAMILY - GARDEN APARTMENT and ROW HOUSING	21	2
053	MULTI-FAMILY - CONVERSION	21	2
054	MULTI-FAMILY - HIGH-RISE	21	2
055	MULTI-FAMILY - MINIMAL COMMERCIAL	21	2
056	MULTI-FAMILY - RESIDENTIAL HOTEL	21	2
057	STRATIFIED RENTAL TOWNHOUSE	21	2
058	STRATIFIED RENTAL APARTMENT - FRAME CONSTRUCTION	21	2
059	STRATIFIED RENTAL APARTMENT - HI-RISE CONSTRUCTION	21	2

