# Identifying Opportunities for Community Streamflow Monitoring on East Coast Vancouver Island

*Prepared by:*

Thea Rodgers
British Columbia Conservation Foundation
Nanaimo, BC

*Prepared for:*

Jason Hwang
Pacific Salmon Foundation
Vancouver, BC

**December 2022**

BRITISH COLUMBIA CONSERVATION FOUNDATION

## SUMMARY

Water quantity and quality issues continue to be a management concern in small coastal streams, particularly in response to industrial and urban development pressures and the impacts of climate change. Monitoring is of critical importance to water resource management, as the effects of climate change will result in periods of longer, more intense drought, and changes to the timing and seasonality of precipitation and streamflow for East Coast Vancouver Island (ECVI).

An investigation into the status and location of existing provincial, federal, regional, and community hydrometric monitoring programs was undertaken for ECVI. Review shows a low proportion of small, first- and second- order watersheds are monitored for streamflow relative to the total. And, community groups currently make up the largest proportion of stations monitoring streamflow on first-order streams. Information and recommendations for improving the reach of existing monitoring by incorporating community monitoring into a tiered regional framework is summarized.

Community-based monitoring (CBM) can be an effective tool for addressing data gaps and supporting improved management. Studies of CBM programs increasingly support the validity and suitability of CBM. Many case studies verify that through standardized data collection protocols, data management, and data analysis, CBM data can be collected with high levels of accuracy.

This report is intended to help inform the expansion of future CBM-related streamflow monitoring efforts on Vancouver Island, and to highlight the importance of long-term monitoring for small coastal streams in the face of climate change.



**With funding and partnership support from:**

HABITAT CONSERVATION TRUST FOUNDATION

BRITISH COLUMBIA Ministry of Environment and Climate Change Strategy

PACIFIC SALMON FOUNDATION

BRITISH COLUMBIA Community Gaming Grants

Freshwater Fisheries Society of BC

# TABLE OF CONTENTS

**SUMMARY** ..... **I**

**LIST OF FIGURES** ..... **II**

**LIST OF TABLES** ..... **II**

**1 INTRODUCTION & OBJECTIVES** ..... **1**

**2 METHODS** ..... **2**

2.1 LOCATION ..... 2
2.2 DATA SOURCES ..... 2
2.3 DATA PROCESSING ..... 3

**3 RESULTS** ..... **5**

3.1 LICENSE DEMAND ..... 5
3.2 ACTIVE & PROPOSED STATIONS ..... 5
3.3 FRESHWATER ATLAS WATERSHED DISTRIBUTION ..... 6
3.4 DISCONTINUED STATIONS ..... 9
3.5 COMMUNITY PERFORMANCE AUDITS ..... 9

**4 DISCUSSION** ..... **10**

4.1 ZONE 28 MONITORING ..... 10
4.2 HISTORICAL MONITORING ..... 11
4.3 FEDERAL & PROVINCIAL MONITORING ..... 11
4.4 REGIONAL GOVERNMENT MONITORING ..... 12
4.5 FIRST NATIONS PROGRAMS ..... 15
4.6 THE CASE FOR COMMUNITY-BASED MONITORING ..... 16
4.7 LIMITATIONS OF COMMUNITY-BASED MONITORING ..... 17
4.8 ESTABLISHING A COORDINATED APPROACH ..... 18

**5 RECOMMENDATIONS** ..... **19**

**ACKNOWLEDGEMENTS** ..... **20**

**REFERENCES** ..... **21**

**APPENDIX A – DATA TABLES** ..... **24**

# LIST OF FIGURES

Figure 1. Licensed demand by watershed for East Coast Vancouver Island ..... 5
Figure 2. Active and proposed stations separated by licensed watershed group ..... 6
Figure 3. Active stream gauging station type in Hydrologic Zone 28 separated by Freshwater Atlas (FWA) watershed order ..... 7
Figure 4. Total number of Freshwater Atlas (FWA) watersheds in Hydrologic Zone 28, grouped by order ..... 7
Figure 5. Active stations in Hydrologic Zone 28 grouped by station elevation. ..... 7
Figure 6. All FWA watersheds in Hydrologic Zone 28 grouped by median elevation, with active gauged stations separated by type ..... 8

# LIST OF TABLES

Table 1. List of data layers used for analysis. ..... 4

# 1 INTRODUCTION & OBJECTIVES

The British Columbia Conservation Foundation (BCCF) has assisted community groups with streamflow monitoring on East Coast Vancouver Island (ECVI) for the past 10 years. Streamflow monitoring is conducted in relatively small, urbanized streams that support stocks of both wild and hatchery-raised salmon and trout. Monitoring is important for understanding the availability, variation, and timing of streamflow, providing a foundation for responsible decision-making, policy development, and ecosystem protection (Government of Canada 2013).

Streamflow monitoring is becoming critically important due to climate change as Vancouver Island is observing periods of longer, more intense drought (Rodenhuis *et al.* 2009). Changes to the timing and seasonality of streamflow may impact the productivity and survival of aquatic species of concern (Fleming *et al.* 2007). Low flow conditions are a limiting factor for fish habitat suitability, migration, and survival (Levy & Slaney 1993; Aadland 1993; McCabe 2011; Neuman & Newcombe 1977). Many smaller streams on ECVI have not had any long-term monitoring, even though they have historically supported valuable fish stocks and been subject to intensive water use (Stenhouse 2012).

Streamflow data are collected and shared by all levels of government across BC, including federal, provincial, regional, First Nation, and local governments. In general, the scale and resolution of data collected by federal and provincial government networks are of high quality, but may not adequately address smaller-scale regional or site-specific concerns (Luttmer 2018). Besides government entities, other sources of streamflow data include major utility providers, industrial users, engineering contractors, academia, and community-based or environmental organizations (Luttmer 2018).

The purpose of this report is to review the status and location of existing streamflow monitoring stations and programs on Vancouver Island and outline opportunities for incorporating community streamflow monitoring into a tiered framework. The specific objectives are to:

- Summarize the reach of active streamflow monitoring stations and programs on East Coast Vancouver Island (Hydrologic Zone 28).
- Identify existing license pressures and monitoring gaps that may be present.
- Provide a case for incorporating Community-Based Monitoring (CBM) into provincial and regional streamflow monitoring programs.

# 2 METHODS

## 2.1 Location

East Coast Vancouver Island (ECVI) has a high residential density with several urban development and resource development pressures. Hydrologic Zone 28 (Eastern Vancouver Island) was used as the corresponding location boundary for this report. A Hydrologic Zone delineates a region with similar characteristics, where gauged streamflow data can reasonably be used to estimate characteristics at ungauged sites (Government of British Columbia n.d.). Zone 28 extends from the south tip of the island to the northeast tip of the island, from approximately Sooke in the south to Hope Island in the north; this include portions of the Gulf Islands and Discovery Islands.

## 2.2 Data Sources

To summarize the reach of existing monitoring efforts across several agencies, a literature review and email outreach was undertaken. Discussions were held with staff within the Ministry of Environment and Climate Change Strategy (ENV), different regional government programs, and dozens of community groups. Private industrial or academic data were not summarized or included, as this project scope was limited to publicly available data. Additionally, although there are publicly available data for relevant parameters such as groundwater or snowpack monitoring (e.g., BC Groundwater Observation Well Network, VIU Coastal Hydrology Research Lab), this report scope focuses specifically on streamflow monitoring therefore groundwater, snow, and lake level data were not included in the summary.

Most government (provincial and federal) streamflow data are made publicly available via the *Canada-British Columbia Hydrometric Program*, a network co-managed by the Water Survey of Canada (WSC) and the BC Provincial Hydrology Program. The Water Survey of Canada (WSC) is a federal organization within the National Hydrologic Service of Environment and Climate Change Canada (ECCC). WSC is responsible for the operation, monitoring and maintenance of hydrometric stations and the standardized collection and interpretation of hydrometric data across the country (Government of Canada 2019). The federal Water Office hosts real-time and archived data for the *Canada-British Columbia Hydrometric Program* (hereafter referred to as "BC-Fed") on their website (https://wateroffice.ec.gc.ca/).

The BC Provincial Hydrology Program manages the collection of streamflow and river level data across the province, and is within the responsibility of the Groundwater, Hydrology and Hydrometric Program section of the Environmental Monitoring and Analysis Branch in the Ministry of Environment and Climate Change Strategy (ENV) (Government of British Columbia 2021). The province hosts datasets on the Aquarius Web Portal (https://aqrt.nrs.gov.bc.ca/), with additional web mapping products across several different websites (e.g., the BC Streamflow Inventory Map, BC Water Tool, Groundwater Portal, Drought Information Portal, etc.).

In addition to ENV, other provincial ministries also collect streamflow data including the Ministry of Forests (Water Authorizations), Ministry of Land, Water and Resource Stewardship (Fisheries), and the Ministry of Transportation & Infrastructure. Note that not all data collected by the various branches of the provincial government are included under the umbrella of the BC-Fed Hydrometric Program; data within the program are referred to as "integrated data", while data separate from the program (including data collected by ENV, FOR, LWRS, and MOTI) are referred to as "non-integrated data".

Publicly available datasets were exported from the BC Data Catalogue (https://catalogue.data.gov.bc.ca/) as GeoJSON or CSV files. Datasets were requested for the custom area of interest (AOI) encompassing Vancouver Island, Gulf Islands and Discovery Islands (Table 1). During review, it was noted that some files available on the web are not up-to-date; for example, the B.C. Streamflow Inventory Map summarizes stations not currently in operation by Water Survey of Canada. The most up-to-date information about active gauging stations was retrieved directly from organization websites and real-time data displays. During streamflow gauging station summary, latitude and longitude coordinates were obtained and plotted for each streamflow gauging station. Analysis of streamflow gauging stations and the datasets listed in Table 1 was performed using QGIS-Tisler (3.24.1) and Microsoft Excel (2019).

## 2.3 Data processing

Basemap imagery (Google Satellite) was downloaded using the QuickMapServices plugin and projected using the standard Geographic Coordinate Reference System (CRS) EPSG:4326 (WGS 84).

All GeoJSON files were imported to QGIS in the regional CRS EPSG:3005 (NAD83/BC Albers). All of the BC-Fed Stations, Other Government Stations, and Community Stations were imported as comma delimited files and reprojected to the regional CRS EPSG:3005. Streamflow gauging stations were separated into categories: Active, Intermittent, Proposed, and Discontinued stations.

All working layers (including the Freshwater Atlas (FWA) Watersheds, FWA Stream Networks, Water License points & watersheds files) were snipped to Hydrologic Zone 28 using a spatial query. The Water License watersheds polygons were further edited by hand using the vertex tool to exclude grouped watershed polygons overlapping the Zone 28 boundary or draining west of the boundary; “Fix Geometry” tool also had to be used to repair boundary geometries in the imported GeoJSON file.

A spatial query was run to count license points within license watershed polygons, and summarized as the total number of points per polygon. The ratio of total number of license points to watershed area ($km^2$) was calculated, with dark red being a higher ratio (more licenses per watershed area) and white being a lower ratio (fewer licenses per watershed area). This ratio was used as a quick metric for comparison due to the limited scope of the report and no Mean Annual Discharge (MAD) provided with the polygon dataset; though watershed area is closely related to total watershed discharge (Snider et al. 2007, Gianfagna et al. 2015, Cameron 2015) and allows for a relative comparison between license watersheds.

DEM tiles (1:250K) were imported as raster files and merged by grid block (092B –102I). Grid blocks were polygonised to vector points, and reprojected to the regional CRS EPSG:3005 (NAD83/BC Albers). All watershed polygons were spatially queried to summarize the total watershed area, and to output a median elevation value for each watershed.

**Table 1.** List of data layers used for analysis.

| Dataset name (searchable) | Shorthand | Object Name | Description | Purpose | Use | Publisher | Data Type | Notes |
|---|---|---|---|---|---|---|---|---|
| Hydrology: Hydrologic Zone Boundaries of British Columbia | *Hyd Zone 28* | HYDZ_HYDROLOGICZONE_SP | Zones that represent areas of homogeneous hydrologic and geomorphological characteristics. | Zones are used to estimate similar streamflows, flooding, annual runoff | Delineate relevant hydrologic zone for all input shapefiles | Government of British Columbia | Vector polygons | Isolating all data for Zone 28 to simplify analysis |
| Hydrometric Stations - Active and Discontinued | *BC-Fed Stations* | .csv file | A list of active and discontinued hydrometric stations (surface water level and flow data) that are part of the *Canada-British Columbia Hydrometric Program* network. | To identify existence, status and locations of active & discontinued hydrometric stations within the area of interest | Show points on map for active vs discontinued stations | Water Survey of Canada | Vector points | Retrieved from Real-Time Hydrometric Data Search and quality checked for accuracy |
| Streamflow stations – active, intermittent, and proposed | *Other Government Stations* | .csv file | A list of hydrometric stations (surface water level and flow data) that are part of other federal, provincial, regional, or local municipal monitoring. E.g., Fisheries and Oceans Canada (DFO), regional district Drinking Water and Watershed Protection programs, municipal license monitoring, and BC ENF, FOR, LWRS and TRAN. | To identify existence, status and locations of other government stations within the area of interest | Show points on map for stations | Various reports & online databases (FlowWorks, Aquarius) or unpub'd | Vector points | Sutherland 2015<br>Goodbrand et al. 2022<br>TranBC 2021<br>Municipality of North Cowichan 2021<br>B. Rudolph, pers. comm.<br>N. Goeller, pers. comm.<br>A. Anderson, pers. comm. |
| Streamflow stations – active and proposed | *Community Stations* | .csv file | A list of active and proposed hydrometric stations (surface water level and flow data) that are part of local community monitoring efforts. | To identify existence, status and locations of community stations within the area of interest | Show points on map for stations | Generally unpub'd | Vector points | Personal communication with ENGO and streamkeeper groups |
| Freshwater Atlas (FWA) Watersheds | *FWA Watersheds* | FWA_WATERSHEDS_POLY | All fundamental watershed polygons generated from watershed boundary lines, bank edges, delimiter edges, coastline edges, and administrative boundary edges. | Used in allocation decisions, boundary definitions, planning processes and environmental monitoring | Summarize information about watersheds in area of interest | Government of British Columbia | Vector polygons | 1:20,000 resolution |
| Freshwater Atlas (FWA) Stream Network | *FWA Stream Networks* | FWA_STREAM_NETWORKS_SP | Flow network arcs (observed, inferred and constructed). Contains no banks, coast or watershed boundary arcs. Directionalized and connected. Contains hierarchical key and route identifier. | Shows all streams as vector lines. | Identify all streams (including named streams) within the area of interest. | Government of British Columbia | Vector lines | To identify stream locations. |
| Digital Elevation Model (DEM) for British Columbia - CDED - 1:250,000 | *DEM layers* | */datasets/17562 4* ><br>092B, 092C, 092E, 092F, 092G, 092K, 092L, 102I | The gridded DEM map tiles of B.C. are at a 1:250,000 scale with additional slope, aspect and hillshade data, based on the Terrain Resource Information Management (TRIM) 1:20,000 DEM. This data is the TRIM DEM converted to the Canadian Digital Elevation Data (CDED). | Generation of three-dimensional graphics and use in calculations or modelling. | Establish a median elevation for each Third Order + Watershed. | Government of British Columbia | Raster DEM | To help with analyzing gaps in area vs elevation coverage. |
| Water Licensed Works - Points | *License points* | WLS_WATER_LICENCED_WRK_LOC_SP | Province-wide SDE layer showing point works associated with a Water Licence. Layer intended to display the location of point works, as licensed, under the Water Act. | Province-wide SDE layer showing point works associated with a Water Licence | To identify areas of high license demand | Government of British Columbia | Vector points | Snipped to License Watersheds |
| Water Licensing Watersheds | *License Watersheds* | WLS_WATER_LIC_WATERSHEDS_SP | Groupings of BC Freshwater Atlas (FWA) Assessment Watersheds dissolved to a manageable scale for water licensing. Each Natural Resource Region developed their own process for grouping and naming the watersheds based on the region's water management needs. | This dataset is intended for the public display of watersheds that may be identified in a groundwater licence document. | To identify watershed groupings | Government of British Columbia | Vector polygons | Snipped to Hyd Zone 28 |

# 3 RESULTS

## 3.1 License demand

The Southern Gulf Islands (Salt Spring, Pender, Prevost, Galiano), Northern Gulf Islands (Hornby, Denman, Lasqueti) and Shawnigan-Mill Bay watersheds have the highest license point-to-area ratio (Figure 1). The License Points layer did not contain metadata about the license type (groundwater vs. surface water) or total volume, but the Gulf Islands generally have few large surface water sources. The predominant forms of water consumption are rainwater and groundwater. Future scoping work could involve separation of licenses by type and volume to further refine the license pressure summary.

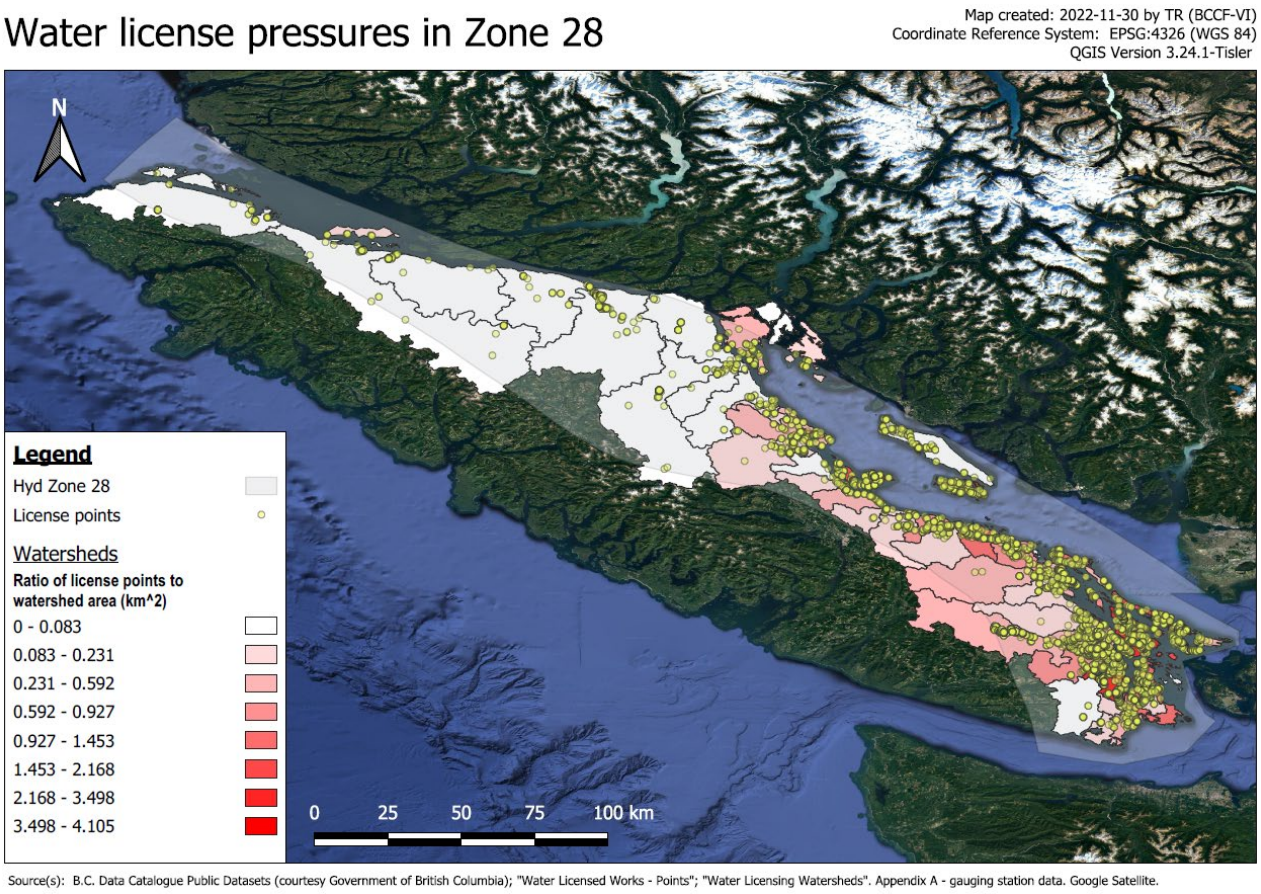


**Figure 1.** Licensed demand by watershed for East Coast Vancouver Island.

## 3.2 Active & proposed stations

A list of 95 currently active stream gauging stations in Zone 28 on ECVI were identified using existing public data sources, direct contact with organizations, and literature review. For the purposes of this report, an active station is defined as a site that is currently staffed or listed in an online database, and where data is actively being collected either manually or through real-time upload (telemetry). Of these, 40 stations (42%) are operated by the Water Survey of Canada as part of the *Canada-British Columbia Hydrometric Program* ("BC-Fed stations"). An additional 32 stations (34%) are operated by different federal, provincial regional, or local government agencies ("Other Government stations"), and the final 23 stations (24%) are operated by community groups ("Community stations") (Figure 2).

An additional 7 stream gauging stations were classified as “intermittent”, meaning sites where monitoring has occurred within the past 5-10 years, but data is infrequently updated or not currently operational; all of these were operated by Other Government programs. A further 20 stream gauging stations were identified as “proposed”, meaning station locations that have been shortlisted in recent reports or by an active organization for establishment or renewal of future monitoring effort. Of these, 15 (or 75%) have been identified by government agencies, and 5 (or 25%) have been identified by community groups. In total, this brings all identified sites (active, intermittent, and proposed) to 122 stream gauging stations.

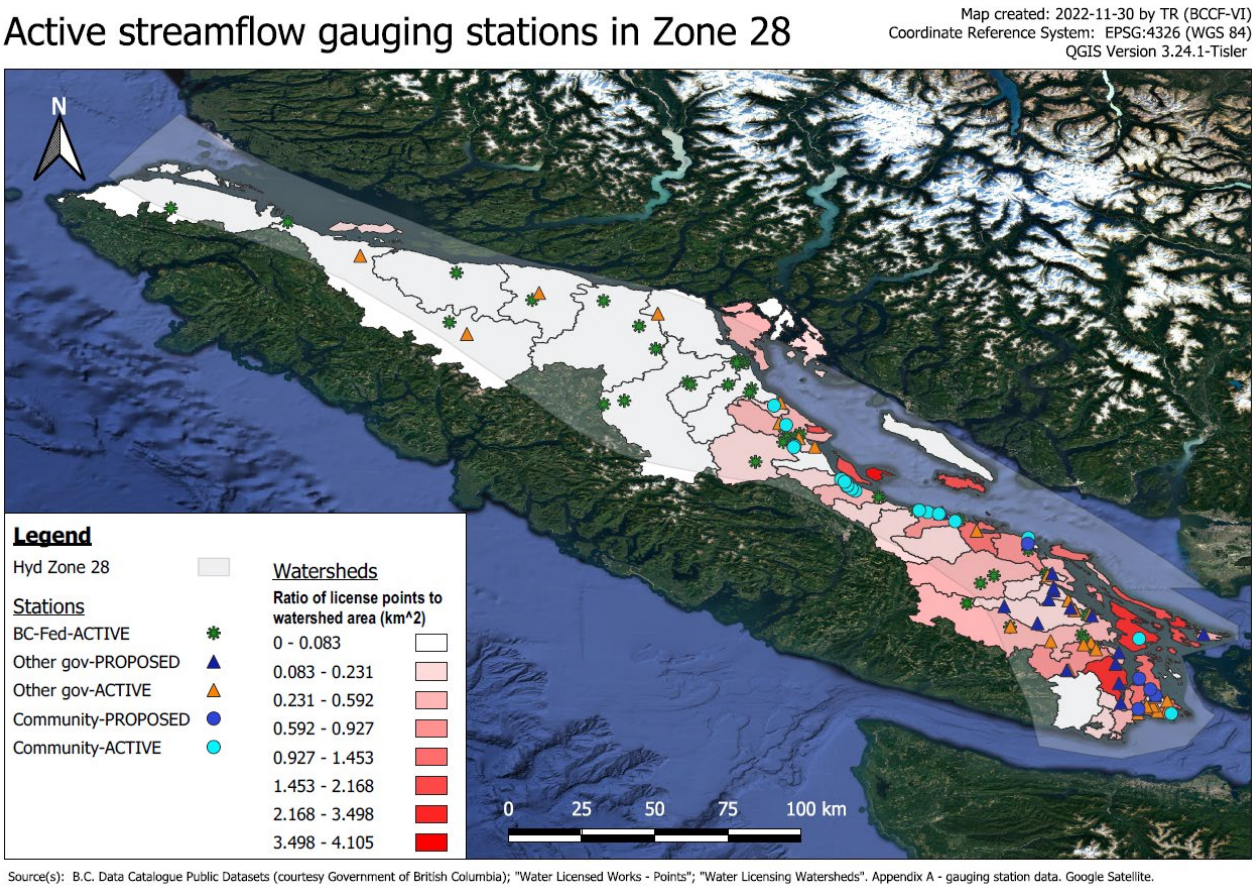


**Figure 2**. Active and proposed stations separated by licensed watershed group.

## 3.3 Freshwater Atlas watershed distribution

A trend is observed for gauged station type by watershed order (Figure 3). BC-Fed stations make up the majority of active stations monitoring large, sixth- and seventh-order watersheds (85% and 80%, respectively). Other Government stations are approximately split between the different watershed orders, with a trend toward more influence in the small- to moderate- (e.g., first- to fifth-order) watersheds. Community stations make up the majority of active stations monitoring small, first-order watersheds (56%); the large majority of FWA watersheds are first- and second-order (Figure 4). There is also a difference in station elevation (Figures 5). BC-Fed stations range in station elevation from 12 to 536 meters above sea level (masl). Other Government and Community stations are situated at lower elevations (17 to 317 and 28 to 141 masl, respectively) with Community stations covering the smallest range in elevation. Gauged stations are generally below 500 masl, with the majority located below 150 masl (Figure 6).

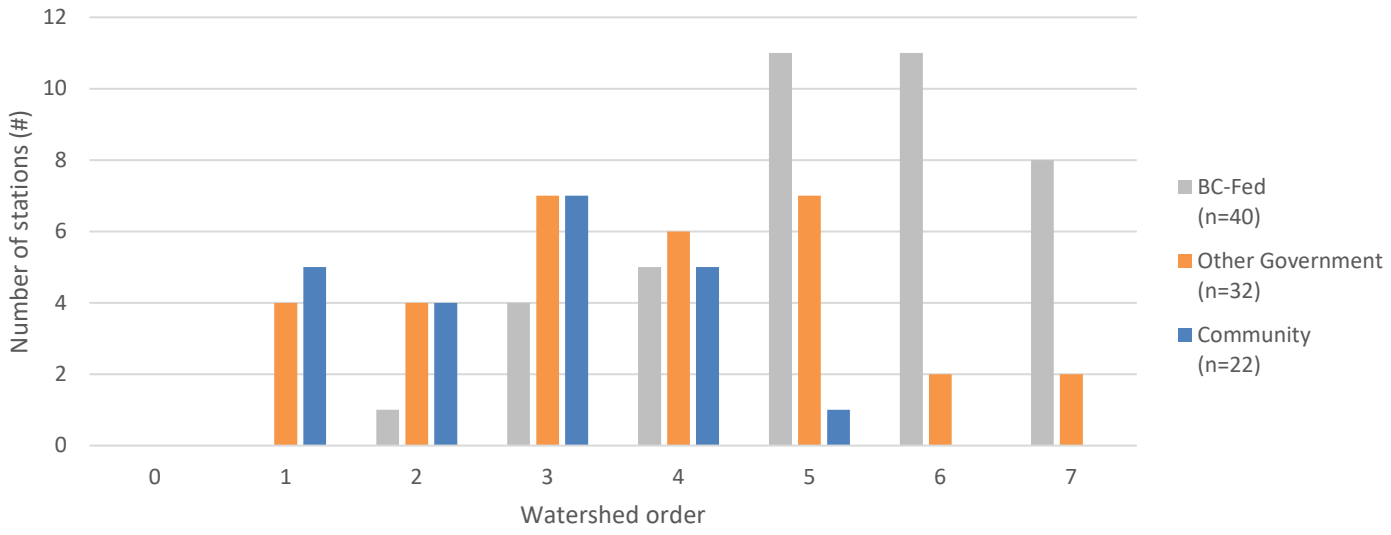


**Figure 3**. Active stream gauging station type in Hydrologic Zone 28 separated by Freshwater Atlas (FWA) watershed order.

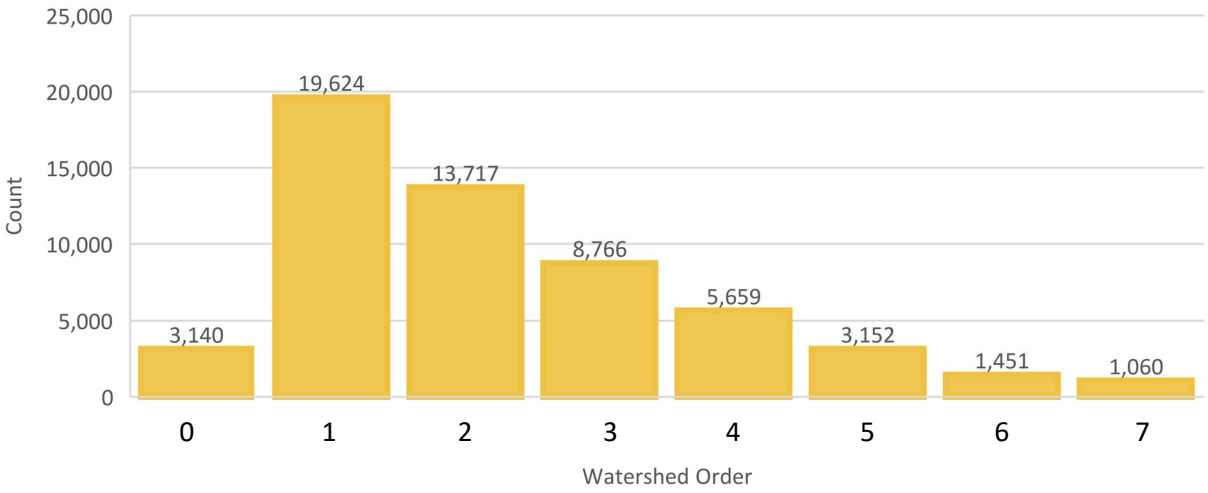


**Figure 4.** Total number of Freshwater Atlas (FWA) watersheds in Hydrologic Zone 28, grouped by order.

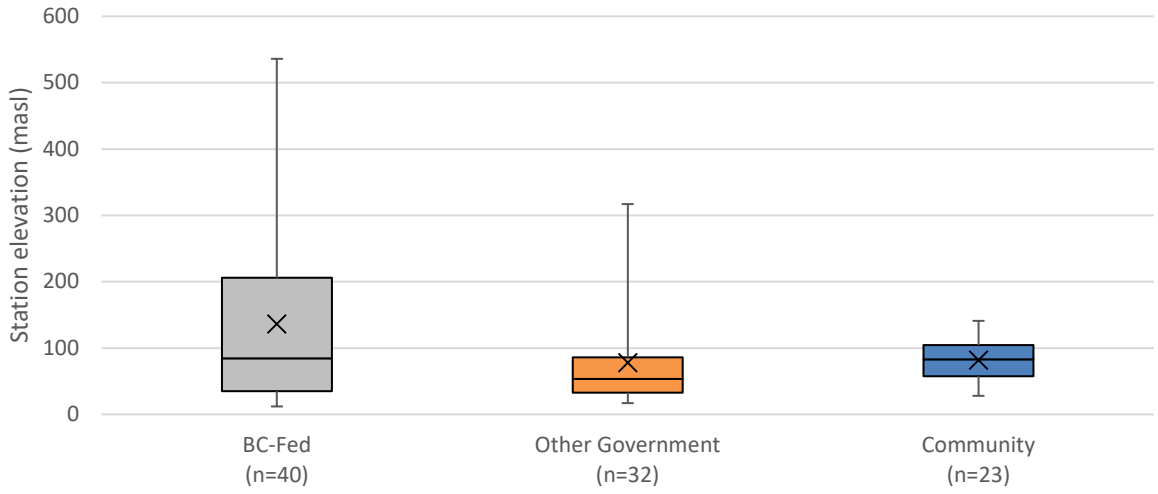


**Figure 5.** Active stations in Hydrologic Zone 28 grouped by station elevation.

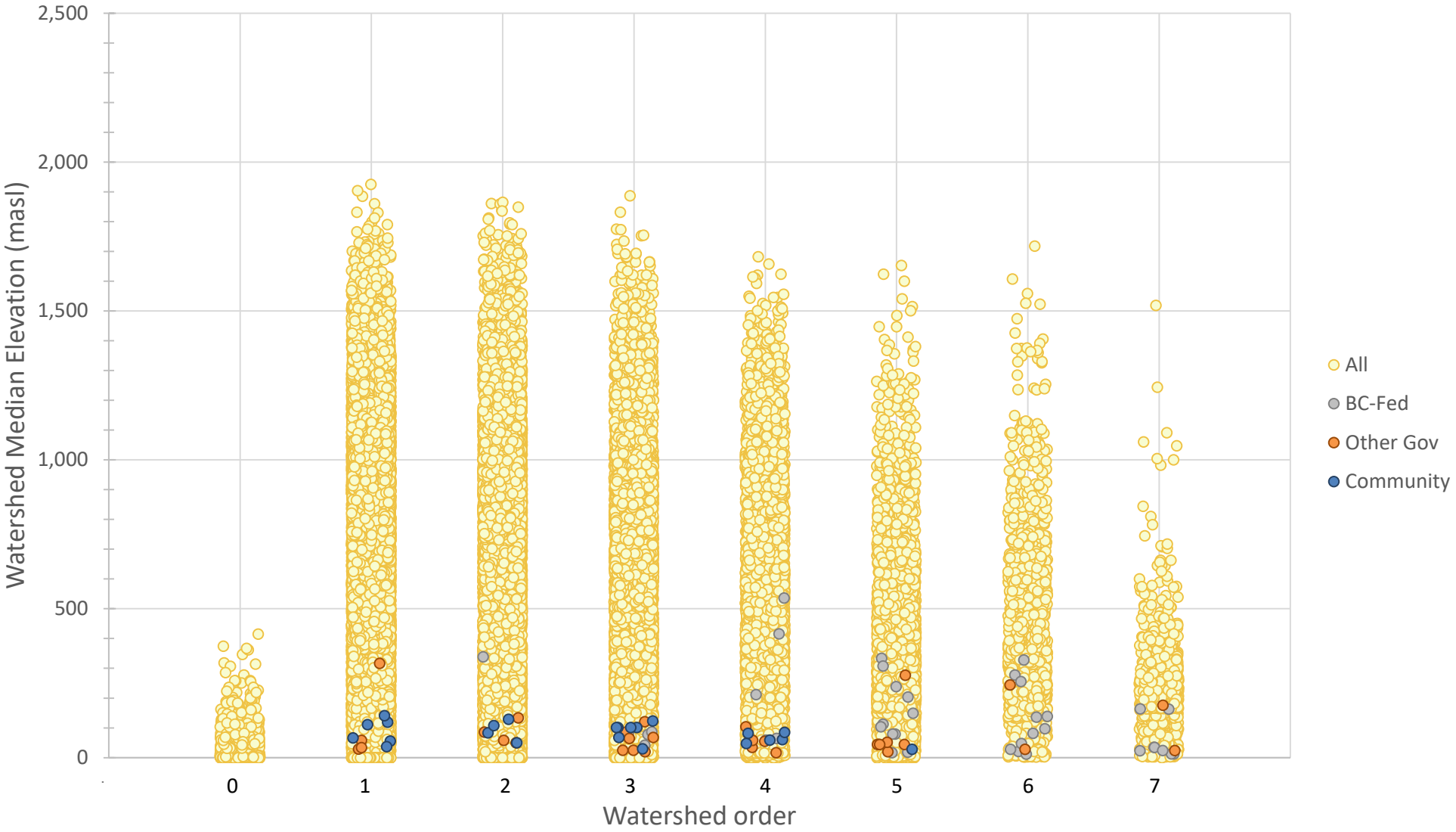


**Figure 6.** All FWA watersheds in Hydrologic Zone 28 grouped by median elevation, with active gauged stations separated by type (jitter applied).

## 3.4 Discontinued stations

Historical streamflow monitoring by the federal government in Hydrologic Zone 28 has been extensive, with several streamflow records dating back to the earliest years of the 20th century. A list of historical stations is available on Water Survey of Canada webpage and is summarized for Zone 28 (Appendix A).

A total of 91 discontinued BC-Fed Hydrometric Program stream gauging stations were identified for Zone 28, of which 2 stations are currently identified as "proposed" stations for renewed monitoring by different groups or agencies. A summary of historical Other Government or Community stations was not able to be completed due to inaccessibility of this data.

## 3.5 Community performance audits

A preliminary audit of 7 stations monitored by 5 different community groups was undertaken in 2022. These stations ranged in age from 2 to 10 years. All 7 stations were found to be of data grade "U" (Unknown), meaning the data does not currently meet RISC criteria as established by the Resources Inventory Committee of the Province of BC. This means data quality is questionable, and cannot be used with confidence for decision-making.

6 of the 7 stations did not have a plan for the end use of data collected, other than wanting to collect data for the sake of having a long-term dataset. 6 of 7 stations did not have capacity to create a stage-discharge rating curve or knowledge of what this entailed. Continuous stage was being collected, but no adjustments were being made for control changes, aggradation, or equipment fouling. Stations had some discrete discharge data collected, but not at any defined time in relation to stream stage height. Several groups have requested BCCF's assistance to generate flow data from stage loggers, but the ability to do so is severely limited without a station history, benchmarks, reference gauge observations, or a desired end goal for data collection.

Beginning in 2022, these 7 pilot stations began receiving equipment upgrades and quality checks. All 7 sites now contain a stage reference gauge, while 5 of 7 stations received station benchmarks which were surveyed. 1 station was downgraded from Stage-Discharge to Stage only, due to presence of an established government station downstream; this Stage station will likely be removed altogether due to low volunteer capacity and site access challenges. Community groups developed a monitoring objective for each station, which is tied in to a local conservation action project or their organization's mission. Overall data quality is now "U but improving" for 6 of the original 7 stations, with an objective of meeting Grade C data quality by end of 2023.

# 4 DISCUSSION

This report reviews and summarizes the location and status of existing streamflow gauging stations and monitoring programs within Hydrologic Zone 28 on Vancouver Island. Specifically, we aimed to review all active stations (including all stations operated by Water Survey of Canada (WSC), Fisheries and Oceans Canada (DFO), the provincial Ministry of Environment and Climate Change (ENV), Ministry of Forests (FOR), Ministry of Transportation and Infrastructure (TRAN), as well as multiple regional/local government and community stewardship groups.

## 4.1 Zone 28 Monitoring

The current hydrometric monitoring network for Zone 28 was summarized. There are a multitude of methods for evaluating optimal monitoring network density (Mishra and Coulibaly 2009), most of which are far beyond the scope of this report. Several methods make use of survey- or demand-based models to help identify areas of greatest pressure, in order to inform optimal network expansion.

The northern and southern Gulf Islands and the Shawnigan-Mill Bay watersheds have the highest water license pressure per watershed area. There is also very limited streamflow monitoring in these regions (see Figure 2). The ratio of total water license points to total watershed area was summarized to identify a simple metric for regional water license pressures; however, there are drawbacks to this method including a lack of specification regarding total license volume and type (e.g., groundwater vs. surface water). However, it provided a quick and simple way to evaluate general license pressure within a watershed group, and identifies these as generally high-demand water use areas.

Fourth-order streams or lower, with station elevations of less than approximately 70 masl, are those most frequently monitored by community groups on ECVI. Most Community stations are located in seaside communities where watersheds either drain directly to the ocean or are tributary to a larger stream located near the coast. Gauged watersheds operated under the *Canada-British Columbia Hydrometric Program* ("BC-Fed Stations") tend to be large, with no watersheds under 12 $km^2$ currently included in the list of active gauging stations (Appendix A); community stations currently fill this gap, with the majority of programs collecting data for small, urban watersheds ranging from <5 to 10 $km^2$.

Community stations are currently addressing a niche in the lowest-order watersheds where BC-Fed stations are minimally established, and Community stations outnumber Other Government stations in the very smallest, first-order watersheds. The expansion of community flow monitoring into more first-, second, and third-order watersheds could shift some of the effort by Other Government monitoring in these areas to focus on sites with more difficult access or logistical concerns that prevent community groups from monitoring those sites effectively.

The majority of streams on the Gulf Islands are first- or second-order, with only one notable third-order stream (Fulford Creek). Given the suitability for Community groups to monitor streams of this small size, this presents a good opportunity to expand more community monitoring support to the Gulf Islands. The Shawnigan-Mill Bay watersheds should also be explored for increased monitoring effort. Additionally, given the predominant forms of water consumption are rainwater and groundwater for the Gulf Islands, groundwater well monitoring should be explored as an additional activity to incorporate into a regional Community-Based Monitoring (CBM) framework for water quantity.

## 4.2 Historical Monitoring

Several watersheds in Zone 28 have historically been monitored, although few (approx. 30%) are still active today. As early as 1999, it was identified that more and more long-term monitoring stations were being discontinued and would pose an issue for future decision-making (Scott et al. 1999).

Many years' worth of historical streamflow data can be found publicly online such as the Water Survey of Canada HYDAT database, or the Government of BC Aquarius Web Portal. It is significantly more challenging to locate historical data collected by private companies or community groups, unless this data has been shared to an existing platform under a data sharing agreement.

Several factors, including the recent introduction of the Water Sustainability Act's *Environmental Flow Needs Policy,* concerns over increased flood risk, and a growing momentum for municipalities and regional districts to develop regional watershed protection plans have caused a mounting interest in renewing or reinstating some previously discontinued streamflow monitoring stations (CVRD 2020a, Sutherland 2015).

While frameworks are in place to guide streamflow estimation through the use of similar gauged basin data (e.g. "PUB", or prediction in ungauged basins) (Ahmed 2017), there is some uncertainty in the analysis that depends on the skill level of the hydrologist (N. Goeller, pers. comm., November 2022) and the availability of existing data at a relevant scale (Mishra and Coulibaly 2009). Streamflow estimations could potentially miss changing climatic or site-specific influences (e.g., unaccounted land use impacts, undocumented or illegal water withdrawals, etc.) without on-the-ground monitoring.

Spence et al. (2007) studied the impact of reduced hydrometric network coverage in western Canada, and found that discontinuing hydrometric stations increases the error and uncertainty in regional streamflow prediction. Mishra and Coulibaly (2009) used an economic benefit-to-cost ratio developed for British Columbia to estimate that the economic benefit of 12 discontinued stations in the Mackenzie Basin was approximately 19:1 (i.e., a 19-fold economic benefit relative to the annual cost of operating the station).

## 4.3 Federal & Provincial Monitoring

The *Canada-British Columbia Hydrometric Program* is jointly funded by the federal and provincial governments, with cost recoveries for some stations from third parties. The program is operated by the federal government through the Water Survey of Canada (Government of British Columbia n.d.). This data is the highest quality, real-time data available for public use, and is used for decision-making across several sectors.

Also federal, DFO operates a network of telemetry hydrometric stations, known as the Pacfish VI Hydromet stations, primarily for west coast stations but including a number of stations for ECVI and Zone 28. These stations only monitor water level (stage), but some stations (e.g. Haslam Creek) have begun to be monitored more frequently by provincial partners to develop more robust discharge data.

The BC ENV hydrometric monitoring unit will be expanding its provincial (non-integrated) monitoring network in the Vancouver Island region as a result of additional funding through the Climate Preparedness and Adaptation Strategy (N. Goeller, pers. comm., April 2022). Locations that have

recently started monitoring as part of the provincial network expansion include French Creek, Haslam Creek, and Nanoose Creek; with Goldstream River, Upper San Juan and Gordon Rivers as additional sites of interest. These sites are currently being operated in partnership with regional districts and/or DFO. An additional 6 stations (across 6 watersheds) are considered candidate sites that may have potential to be incorporated into the provincial monitoring network at some point in future (N. Goeller, pers. comm., September 2022).

The BC Ministry of Forests (FOR) Water Allocations unit also monitors sites relevant to water licensing issues, including the Tsolum, Koksilah, and Chemainus Rivers. The Ministry of Transportation and Infrastructure (TRAN) monitors select sites as relevant to infrastructure projects (e.g. Dry Bend Creek) (A. Anderson, pers. comm., November 2022).

While government monitoring generally does not involve community members, the value of community monitoring is recognized. Supports are being implemented to further assist community-led monitoring (N. Goeller, pers. comm., September 2022) as part of a shifting approach towards coordinated watershed management.

## 4.4 Regional Government Monitoring

There are a variety of monitoring plans and initiatives underway across various regional & local governments within Hydrologic Zone 28 on Vancouver Island that have potential to support or facilitate community monitoring:

### *4.4.1 Capital Region*

In 2017, the Capital Regional District (CRD) published a *Regional Water Supply Strategic Plan*. One of the three key commitments of this plan is to provide an adequate, long-term supply of drinking water. Under this commitment, a core action is to "develop a higher level of public understanding of the drinking water supply system and value of water", including to "explore opportunities for mutually beneficial collaborative partnerships to carry out research and monitoring initiatives in the water supply area and across the system" (CRD 2017, pg. 15).

Currently, data from 7 regional gauging stations (on 6 creeks) are collected in real-time and stored on FlowWorks (B. Rudolph, pers. comm., November 2022). Various stewardship groups, including the Friends of Bowker Creek, Peninsula Streams Society, World Fisheries Trust, Victoria Golden Rods and Reels Fishing and Social Club, and Esquimalt Anglers are involved in streamflow assessments in some capacity, and several have expressed interest in expanding or improving their current monitoring efforts.

### *4.4.2 Cowichan Valley Regional District*

In 2020, the Cowichan Valley Regional District (CVRD) published the *One Water One Region* strategy to guide a new *Drinking Water and Watershed Protection Program* (DWWP) 2020–2030. The strategy contains 14 priority action areas, including "improving climate and water monitoring networks" (CVRD 2020a). Specific action items include: "attaining better information on a range of metrics including water quality, levels and flow", and "to develop and establish hydrometric and climate monitoring networks".

The CVRD recently produced a *Regional Hydrometric and Climatic Monitoring Strategy and Implementation Workplan* (Goodbrand et al. 2022) to help guide the expansion of a surface hydrometric monitoring network. This report recommended surface discharge monitoring stations be installed at 11 new or reinstated locations, to complement the existing 23 stations operated within the district by a combination of the WSC, BC Hydro, BC TRAN, District of North Cowichan, DFO, and CVRD.

The DWWP program emphasizes partnerships and collaborations as part of its guiding principles and main program areas. The CVRD produced a *Partnership Policy* (CVRD 2020b) that outlines the criteria for non-profit or other governmental entities to be involved in the developing DWWP strategy. Cowichan Tribes intermittently conducts flow monitoring on the North and South arms of the Cowichan River, near the estuary. Several volunteer-based stewardship groups and programs exist within the CVRD, but we are not aware of any programs currently conducting community-led flow monitoring. Possible partners for future monitoring might include the Cowichan Community Land Trust (and members of the "Friends of Cowichan Creeks" initiative), Cowichan Valley Naturalists, Lake Cowichan Salmonid Enhancement Society, or Cowichan Lake and River Stewardship Society, among others.

### *4.4.3 Regional District of Nanaimo*

In 2015, the Regional District of Nanaimo (RDN) produced a *Regional Climate and Hydrometric Monitoring Network Scoping Study* (Sutherland 2015). The outcomes of the study identified priority locations and potential partnerships to support enhanced hydrometric monitoring in the region. Three priority streams were listed for long-term monitoring (French Creek, Nanoose Creek, and Haslam Creek) while two were listed as priority for short-term monitoring (Morningstar Creek and Hokkanen Creek). The Province of BC is currently monitoring the three long-term priority sites in partnership with WSC and RDN. To date, we are not aware of any groups doing regular monitoring of streamflow in Morningstar or Hokkanen Creeks.

The study recommended a regional monitoring network "must consider […] potential partnerships with other agencies or stakeholders to support on-going costs and operation" (Sutherland 2015, pg. 2-1). BCCF and other local stewardship groups are listed as potential partners for hydrometric monitoring in that report. Several stewardship groups are actively pursuing flow monitoring on local streams within the RDN, including the Qualicum Beach Streamkeepers, Mid Vancouver Island Habitat Enhancement Society, Walley Creek Streamkeepers, and Friends of French Creek Conservation Society. Additional community monitoring partners could include the Nanaimo Area Land Trust, Departure Creek Streamkeepers, or Mount Arrowsmith Biosphere Region Research Institute.

### *4.4.4 Comox Valley Regional District*

In 2016, the Comox Valley Regional District (CVRD) published a *Comox Lake Watershed Protection Plan*. The plan identified risks, management objectives, and data gaps to be addressed in order to provide safe drinking water to the region.

In addition to the Watershed Protection Plan, the CVRD has a "Connected by Water" education program that aims to "build capacity, community, and connection to support watershed protection and water conservation efforts" (Comox Valley Regional District n.d.).

A recommendation from the Watershed Protection Plan included the establishment of a water quality monitoring program for all major tributaries to Comox Lake, including water level (stage) monitoring. The report also identified "flow data for tributaries to Comox Lake" as a data gap for managing drought risk (Comox Valley Regional District 2016, pg. 60).

The Comox Valley is fortunate to have several conservation partnerships and strong support for community monitoring. Stewardship groups currently pursuing flow monitoring in the region include the Tsolum River Restoration Society, Beaufort Watershed Stewards, and Morrison Creek Streamkeepers. Additional partners could include the Comox Valley Naturalists, Little River Enhancement Society, Brooklyn Creek Watershed Society, or Millard-Piercy Watershed Stewards.

### *4.4.5 qathet Regional District*

The majority of the qathet Regional District falls outside the boundary of Hydrologic Zone 28, except for Texada and Lasqueti islands. White the qRD does not have a dedicated surface monitoring program, a D*rinking Water Conservation Plan* was recently produced in February 2022 (MSR Solutions Inc. 2022) to help manage water use during period of high demand, shortage, or emergency. The Van Anda and Gillies Bay Improvement Districts oversee Texada Island's water supply. Potential stewardship partners in future monitoring could include the Texada Stickleback Group (a local stewardship organization), although their current level of monitoring activity is unclear.

### *4.4.6 Strathcona Regional District*

We were unable to find specific watershed monitoring plans or projects related to streamflow monitoring on the Strathcona Regional District (SRD) webpage. Some flood risk assessment maps, feasibility studies and reports have been produced, but no record of current monitoring initiatives could be found. Individual municipalities within the SRD generally oversee their own water conservation and stewardship programs, e.g., the City of Campbell River has a watershed protection advisory group (Technical Watershed Committee), and the Quadra Island Climate Action Network (ICAN) is currently undertaking a geohydrological survey of the island which will involve hydrometric watershed assessment. Potential stewardship partners in future monitoring within the SRD could include the A-Tlegay Fisheries Society, Oyster River Enhancement Society, North Island College students, Quadra ICAN, or the Campbell River Fish and Wildlife Club.

### *4.4.7 Regional District of Mount Waddington*

We were unable to find specific streamflow monitoring plans or projects on the Regional District of Mount Waddington (RDMW) webpage, although recent groundwater well monitoring work is mentioned (RDMW 2022). Individual municipalities within the RDMW generally oversee their own water conservation and stewardship programs. The 'Namgis First Nation has been operating a number of stations cooperatively with DFO and private consultants in the north island region (N. Goeller, pers. comm., November 2022). Potential stewardship partners in future monitoring within the RDMW could include the Northern Vancouver Island Salmonid Enhancement Association, or a number of the many Coastal Stewardship Network Guardian Watchmen programs.

### *4.4.8 Islands Trust*

The Islands Trust is a special purpose government that includes 13 major islands, several of which fall within Hydrologic Zone 28 and the Regional District boundaries mentioned above. In 2021, the Trust published a *Freshwater Sustainability Strategy* to help address water challenges and support climate change adaptation. This strategy (2022-2032) identifies actions for Islands Trust to help protect water resources over the longer term. A core objective is to "Improve information and knowledge about the quality and quantity of water resources" (Islands Trust 2021, pg. ii), with a statement that "identifying and monitoring environmental flow in streams, wetlands, and lakes assists with determining the vulnerability of freshwater networks to over-use for human needs" (pg. 9).

The islands within the Trust rely heavily on non-surface water sources (e.g., groundwater) for drinking water. Specific to groundwater, Groundwater Sustainability Science Action #2 is to "develop a coordinated long-term water monitoring program"; and, "Islands Trust may […] engage local stewardship groups and residents to participate in data collection" (pg. 20). The Salt Spring Island Watershed Protection Alliance currently conduct streamflow monitoring, and other potential monitoring partners across the Gulf Islands could include the Pender Island Conservancy Association, the Hornby Water Stewardship project, Parks Canada, and others.

## 4.5 First Nations Programs

A key step on the path toward reconciliation is recognizing and asserting First Nations' right to self-governance, including natural resource governance (Department of Justice Canada 2018). "Indigenous Community-Based Monitoring" (ICBM) employs both Indigenous knowledge and Western science to tackle environmental issues (Beausoleil et al. 2022). Limited streamflow-specific programs within Hydrologic Zone 28 have been found through an online search and literature review, however several programs have staff taking part in project-specific streamflow monitoring throughout the region (e.g., Cowichan Tribes, Snuneymuxw First Nation, 'Namgis First Nation).

Other First Nations programs in Western Canada stand out as having flow monitoring plans or monitoring components:

- Situated adjacent to Hydrologic Zone 28, on the Sunshine Coast, a *Watershed Plan* was produced by Tla'amin Nation in March 2021. Recommendation 2.3 of that plan is to "develop and implement a hydrometric monitoring program" and to establish a Research Watershed in the Bunster Range/Sliammon Creek catchment (Chapman & Patrick 2021); results are not yet available online.
- Recent projects approved for funding under the federal Indigenous Community-Based Climate Monitoring Program include long-term hydrological monitoring on behalf of Katzie First Nation; monitoring climate change indicators in glacial and non-glacial streams by Gitanyow Nation; and two separate hydrometric and climate monitoring programs on behalf of Hupacasath First Nation and Uchucklesaht Tribe Government. These four projects aim to develop monitoring programs that evaluate environmental conditions, to better assess climate-induced changes.

- Further east, an ICBM program tracking the impacts of discharge on traditional territory access along the Peace–Athabasca Delta is led by the Athabasca Chipewyan First Nation and Mikisew Cree First Nation (Beausoleil et al. 2022). This unique study is correlating how declining Athabasca River water levels are impacting the loss of access to traditional territory, and aim to set thresholds for traditional use known as "in-stream flow needs for Aboriginal Navigation" (Carver & MacLean 2016). This has led to communities requesting limitations to water withdrawals in the Athabasca, "especially during low times and critical use periods, to improve security in traditional navigational pathways (Beausoleil et al. 2022, pg. 421). This distantly mirrors the *Environmental Flow Needs* policy in BC, highlighting a unique application of flow monitoring geared toward indigenous interests.

Examples from the Yukon River Basin highlight how ICBM programs are "both a method for generating data useful for decision-making, and an expression of governance itself" (Wilson et al. 2018). ICBM as a strategy should be led collaboratively with First Nations governments directly, and ICBM programs should be closely tied with indigenous environmental governance strategies (Wilson et al. 2018). Enhanced capacity to collaborate and support indigenous-led monitoring should be a primary goal of any regional community flow monitoring framework for Vancouver Island.

## 4.6 The Case for Community-Based Monitoring

Community-based monitoring (CBM) is gaining momentum in Canada as a tool to combine data collection with outreach and education, while engaging members of the public in the scientific process (Dickinson et al 2012). CBM's wide uptake in Canada is being driven by a growing concern on behalf of communities about the state of their local environment (Carlson & Cohen 2018) and a desire to engage in local stewardship action. Several regional programs across Hydrologic Zone 28 already have existing provisions that allow for incorporation of CBM into local government programs, such as the Regional District of Nanaimo and Cowichan Valley Regional District (see section 4.4).

Lack of established streamflow monitoring in small (<10 $km^2$) watersheds often requires scientists and decision-makers to rely on discharge estimates based on historical data from similar basins (Ahmed 2017), but there is a risk that these data may not accurately reflect real-world conditions (Miller et al. 2018). Calculations could potentially over- or under-estimate the environmental flow needs of a stream, which has far-reaching implications: over-estimations may lead to economic or operational disadvantages for licensed agricultural or industrial users, while under-estimations may result in irreparable damages to the environment and sensitive aquatic species (Miller et al. 2018).

"Dense networks" for streamflow monitoring with high temporal and spatial resolution are needed to effectively guide evidence-based decision making about sustainable watershed management (Njue *et al.* 2019). Government resources are frequently insufficient for widespread environmental monitoring, thus CBM efforts are becoming more common to supplement government operations (Lehtiniemi *et al*. 2020; Carlson & Cohen 2018). CBM allows for increased spatial coverage and frequency of monitoring, while also providing an opportunity for communities to engage in local stewardship action (Carlson & Cohen 2018).

Data collected by community groups provides a valuable record of water quantity in streams where there has historically been little to no, or previously discontinued, monitoring. These data are used by streamkeeper groups directly, but can also be used by decision-makers if data is quality-checked and graded appropriately, made publicly available with a data sharing agreement, and stored in an accessible place (N. Goeller, pers. comm., November 2022). Community groups are also ideal for monitoring small streams with small drainage catchments nearby to their local community, filling a niche that is often not able to be supported by higher levels of government.

Several recommendations to help improve confidence in hydrometric networks are provided by Mishra and Coulibaly (2009), which broadly includes the following:

1. Acknowledge that once time has passed, historical data cannot be re-collected; the discontinuation of hydrometric stations today impacts our ability to undertake effective resource management in the future.
2. Finer spatiotemporal resolution for hydrologic data will assist with future research about floods, droughts, and low flow conditions.
3. Further research is needed at the catchment scale to address climate variability.
4. Most hydrometric network research has focused on flood and flow predictions; a focus on effective network design to address low flows and droughts is needed.

The above recommendations can all be addressed cost-effectively through incorporation of CBM, if able to be managed and delivered in accordance with existing government data standards.

## 4.7 Limitations of Community-Based Monitoring

The challenge with streamflow monitoring as a community pursuit is in the collection of sound data. Accurate streamflow monitoring is challenging even for government, industry, and private consultants. Streamflow monitoring requires a breadth of experience and understanding of instrument handling, equipment limitations, site-specific conditions, and quality control measures. The practice of streamflow monitoring differs greatly from water quality monitoring, as it requires a set of skills and background knowledge that goes above and beyond what is typically required for a water quality monitoring program. This can strain the participation of volunteers who have limited time and resources to dedicate to a monitoring program.

Despite these challenges, several community groups are already putting in efforts to monitor streamflow on Vancouver Island (although often with limited guidance or professional oversight, as evidenced by recent station audits). Lack of a coordinated, region-wide monitoring approach and oversight for community data quality is hindering the work being done by community groups. Without quality control oversight, much of this data may not be considered usable in decision-making by government agencies, nor could it be used for assessments at a regional scale (N. Goeller, pers. comm., May 2022).

Although many stations do not yet meet RISC criteria for data quality, recent efforts have shown that several stations can be improved simply through installation of a reference gauge and benchmarks. Further time invested in standardization, training, and communication with community groups will

only help improve the quality of data collected across a wider scale. A coordinated regional approach to streamflow monitoring through the establishment of a CBM network will be a necessary and highly valuable addition to current efforts being undertaken by government agencies and community groups on Vancouver Island.

Funding to support a community monitoring network would typically be sourced solely through grants and donations from private charitable foundations. Given the push for inclusion of community data into policy- and decision-making, the financial burden of supporting this type of community network could be equally shared among local communities, different levels of government, private industry, and charitable foundations. The recently published Watershed Security Strategy (2022) indicates the public response identifies the benefits of community monitoring for watershed security, although there is a current lack of capacity across B.C. Respondents' top priorities for use of a Watershed Security Fund included increased monitoring and reporting of water quantity data, as well as "Provincial guidance and support for watershed data collection, standardization of data formats, […] and data access" (Ministry of Land, Water and Resource Stewardship 2022).

## 4.8 Establishing a Coordinated Approach

Discussions have been held with potential funding partners, different regional monitoring programs, and with staff in the Groundwater, Hydrology, and Hydrometric Program in the BC Ministry of Environment and Climate Change Strategy (ENV). These discussions have been used to help guide suggestions for incorporating CBM into a tiered regional monitoring framework.

BCCF is delivering a pilot program ("FLOW-MO": Community Flow Monitoring Network) in 2022, in partnership with the BC ENV. The goal is to develop a more coordinated approach to streamflow monitoring among a small pilot selection of community groups on East Coast Vancouver Island (Figure 5). Over the long-term, this pilot program will develop a CBM network for groups that are currently pursuing (or seeking to start) streamflow monitoring in their local watersheds, and will provide training and support to ensure streamflow data is collected to provincial RISC standards, quality checked, and made publicly available. Beginning in 2022, the seven stations mentioned in section 3.5 began receiving equipment upgrades and quality checks as part of the FLOW-MO Network. Plans are in place to continue expanding community station supports as capacity allows.

Community monitoring relies on volunteer effort. Since 2012, BCCF has tracked more than 90 volunteer participants in streamflow monitoring, with individual time commitments ranging from 2 to 30+ hours per year. Several volunteers return each year to participate in the program. The FLOW-MO pilot program will continue to develop and incorporate more partners as program budget and staff capacity allows, to ensure that community groups working in water stewardship throughout the region of interest have access to this program.

# 5 RECOMMENDATIONS

This report has summarized three main categories of streamflow monitoring on East Coast Vancouver Island (ECVI): the *Canada-British Columbia* ("BC-Fed") *Hydrometric Monitoring Program*; several other government monitoring programs (including provincial and regional programs); and, a number of one-off community monitoring programs. In total, at least 94 streamflow monitoring stations are currently active, with at least 20 more stations proposed for installation.

Community monitoring is actively occurring, albeit disjointedly, in several watersheds across ECVI. There is a lack of adequate support for community-based streamflow monitoring, which is currently an untapped resource that could help improve the reach of provincial and regional monitoring networks. A pilot monitoring network program is currently in development, and there are plans to expand this network to include greater supports for indigenous-led monitoring, focus on regions with high water license pressures, and establishment of stations that may be too small in scale for dedicated government monitoring (e.g. first- and second- order streams).

Despite advancements in technology and modelling research, a decline in the amount of flow data being collected in many parts of Canada means that decision-makers have less ability to monitor and forecast water supplies – at a time when populations and water demands are increasing, and climate change is simultaneously intensifying extreme weather events and water shortages (Mishra and Coulibaly 2009). This directly impacts future management of aquatic species and habitats.

The following five recommendations may be used to help inform the Pacific Salmon Foundation's granting priorities for climate- and streamflow-related projects in the Vancouver Island region:

1) Strategic monitoring in response to a changing climate is essential in order to develop adaptive policies and better science-based management strategies. Community-Based Monitoring (CBM) should be explored as a viable option for increasing the reach of government-funded monitoring networks, and enhanced collaboration and support for indigenous-led monitoring must be prioritized.

2) Ongoing operational and financial support for a regional Community Flow Monitoring Network should be pursued and supported by a variety of stakeholders.

3) Outreach with municipalities and regional districts that have existing Watershed Protection Programs should be undertaken to explore how CBM can be incorporated into current or proposed monitoring efforts.

4) Future scoping work could involve production of higher-resolution maps specific to each Regional District, and further classification of water license pressures, to better illustrate specific monitoring and potential gaps within district boundaries. Additionally, further analysis of watershed characteristics (i.e. physiography, soils, land use, vegetation cover, precipitation, etc.) will help improve hydrometric gap analysis and network expansion.

5) Continued engagement in pursuit of a collaborative Watershed Security Fund for BC will help provide a long-term source of funding to help support community monitoring programs in future.

# ACKNOWLEDGEMENTS

We would like to recognize the Pacific Salmon Foundation, BC Ministry of Environment and Climate Change, Habitat Conservation Trust Foundation, BC Community Gaming Grant, and Freshwater Fisheries Society of BC for providing financial support. The Ministry of Forests has also provided in-kind partnership support.

Thank you to Mick Collins of the Golden Rods and Reels club, Eldan Goldenberg of the Friends of Bowker Creek and Katrina Adams of the Peninsula Streamkeepers Society for providing initial insight into monitoring initiatives in the Capital Regional District. Thank you also to the many community partners involved in local streamflow monitoring.

Thank you to Neil Goeller, Jon Jeffery and Jamison Romano of the provincial West Coast Region hydrometric program for program insight, collaboration, and report review. Thank you also to James Craig, Haley Tomlin, and Jamieson Atkinson for ongoing program feedback and report review.

# REFERENCES


Aadland, L. P. 1993. Stream habitat types: their fish assemblages and relationship to flow. *North American Journal of Fisheries Management,* 13(4), pp. 790-806.

Ahmed, A. 2017. Inventory of Streamflow in the South Coast and West Coast Regions. Knowledge Management Branch, British Columbia Ministry of Environment and Climate Change Strategy, Victoria, B.C. 253 pp.

Beausoleil, D., Munkittrick, K., Dubé, M.G. and Wyatt, F. 2022. Essential components and pathways for developing Indigenous community-based monitoring: Examples from the Canadian oil sands region. *Integrated Environmental Assessment and Management, 18*(2), pp.407-427.

Cameron, C., 2015. Relationship Between Watershed Area and Discharge of West Prong Roaring River, Wilkes County, NC. Journal of North Carolina Academy of Science, 131(1), pp.13-14.

Chapman, K., & Patrick, R. 2021. Tla'amin Watershed Protection Plan. 188 pp. Available from: https://www.tlaaminnation.com/wp-content/uploads/2021/08/TLAAMIN-WATERSHED-PLAN_MAR-30-2021-FINAL.pdf [accessed 2022-11-23].

CRD. 2017. Regional Water Supply 2017 Strategic Plan. 21 pp. Available from: https://www.crd.bc.ca/docs/default-source/crd-document-library/plans-reports/drinking-water/iws2017stratplan.pdf?sfvrsn=417009ca_4 [accessed 2022-11-15].

CVRD. 2020a. Drinking Water and Watershed Protection Program 2020–2030. Draft. 24 pp. Available from: https://www.cvrd.ca/DocumentCenter/View/102038/CVRD-One-Water-one-Region-Strategy-summary-2020 [accessed 2022-09-22].

CVRD. 2020b. Drinking Water and Watershed Protection Program Partnership Policy. 3 pp. Available from: https://www.cvrd.ca/DocumentCenter/View/105033/DWWP-Partnership-Policy-2021-03-15 [accessed 2022-11-15].

Comox Valley Regional District. 2016. Comox Lake Watershed Protection Plan. 106 pp. Available from: https://www.comoxvalleyrd.ca/sites/default/files/docs/Projects-Initiatives/2-20160603_cvrd_wpp_final.pdf [accessed 2022-11-18].

Comox Valley Regional District. n.d. Connected by Water. Services webpage (Web). Available from: https://www.comoxvalleyrd.ca/connectedbywater [accessed 2022-11-18].

Department of Justice Canada. 2018. Principles Respecting the Government of Canada's Relationship with Indigenous Peoples (Web). Available from: https://www.justice.gc.ca/eng/csj-sjc/principles.pdf [accessed 2022-11-23].

Fleming, S.W., Whitfield, P.H., Moore, R.D. and Quilty, E.J., 2007. Regime-dependent streamflow sensitivities to Pacific climate modes cross the Georgia–Puget transboundary ecoregion. *Hydrological Processes: An International Journal, 21*(24), pp. 3264-3287.

Gianfagna et al. Gianfagna, C.C., Johnson, C.E., Chandler, D.G. and Hofmann, C., 2015. Watershed area ratio accurately predicts daily streamflow in nested catchments in the Catskills, New York. Journal of Hydrology: Regional Studies, 4, pp.583-594.

Goodbrand, A., Kerr, B., Eckstrand, H., Plewes, R., MacDonald, R., Chernos, M. 2022. Development of a Regional Hydrometric and Climate Monitoring Strategy and Workplan for the Cowichan Valley Regional District. Prepared by MacDonald Hydrology Consultants Ltd (Foundry Spatial Ltd., Clear Viz Aquatic Consulting) for the Cowichan Valley Regional District. 40 pp. + Appendices

Government of British Columbia. n.d. B.C. Streamflow Inventory (Web). Available from: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-science-data/water-data-tools/provincial-hydrology-program/resources/streamflow-inventory [accessed 2022-11-27].

Government of British Columbia. 2021. Provincial Hydrology Program (Web). Available from: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-science-data/water-data-tools/provincial-hydrology-program [accessed 2022-04-18].

Government of Canada. 2013. Canada-British Columbia Agreement on Hydrometric Monitoring. 46 pp. Available from: https://www.bclaws.gov.bc.ca/civix/document/id/oic/arc_oic/0047_2013 [accessed 2022-11-27].

Government of Canada. 2019. Water Survey of Canada (Web). Available from: https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html [accessed 2022-04-18].

Islands Trust. 2021. Freshwater Sustainability Strategy. 43 pp. Available from: https://islandstrust.bc.ca/document/freshwater-sustainability-strategy/ [accessed 2022-11-23].

Islands Trust. 2022. Overview of Islands Trust. (Web). Available from: https://islandstrust.bc.ca/about-us/overview-of-islands-trust/#:~:text=Islands%20Trust%20is%20a%20special, and%20natural%20and%20cultural%20places. [accessed 2022-11-23].

Levy, D. A., & Slaney, T. L. 1993. A review of habitat capacity for salmon spawning and rearing. Resources Inventory Standards Committee. 48 pp.

Luttmer, C., 2018. Water Monitoring in British Columbia: Scanning the Data Landscape. Report prepared for the Water Monitoring Working Group of the BC Water Funders Collaborative. 46 pp.

McCabe, D. J. 2011. Rivers and Streams: Life in Flowing Water. *Nature Education Knowledge 3*(10):19

Miller K, Green Nylen N, Doremus H, Fisher A, Fogg G, Owen D, Solis SS, Viers J, Kiparsky M. 2018. Issue Brief: California's Stream Flow Monitoring System is Essential for Water Decision Making. UC Water and Berkeley Law, Wheeler Water Institute at CLEE. 4 pp.

Ministry of Land, Water and Resource Stewardship. 2022. Watershed Security Strategy and Fund Discussion Paper: What We Heard. 52 pp. Available from: https://engage.gov.bc.ca/app/uploads/sites/121/2022/11/WatershedSecurityStrategy-FundDiscussionPaper_WWH.pdf [accessed 2022-12-16].

Mishra, A.K. and Coulibaly, P. 2009. Developments in hydrometric network design: A review. *Reviews of Geophysics, 47*(2).

MSR Solutions Inc. 2022. qathet Regional District Drinking Water Conservation Plan. 20 pp. Available from: https://www.qathet.ca/wp-content/uploads/2022/06/Myrtle-Pond-Water-Service-Drinking-Water-Conservation-Plan.pdf [accessed 2022-11-15].

Municipality of North Cowichan. 2021. Chemainus Well Project. (Web). Available from: https://www.northcowichan.ca/EN/main/departments/utilities/water/chemainus-well-project.html [accessed 2022-11-29].

Neuman, H. R., & Newcombe, C. P. 1977. Minimum acceptable stream flows in British Columbia: a review. Fish and Wildlife Branch. 48 pp.

Njue, N., Kroese, J.S., Gräf, J., Jacobs, S.R., Weeser, B., Breuer, L. and Rufino, M.C. 2019. Citizen science in hydrological monitoring and ecosystem services management: State of the art and future prospects. *Science of the Total Environment, 693*, p.133531.

Palmer, C., O'Neill, C., Fleenor, W., Palmer, J. and Gemmell, J. 2020. Morrison Creek Headwaters Wetland and Tributary Mapping & Hydrological Study. 34 pp. Available from: https://morrisoncreek.org/wp-content/uploads/Morrison-Headwaters-Technical-Report-Mapping-Hydrology.pdf [accessed 2022-11-18].

RDMW. 2022. Regional District of Mount Waddington Board of Directors Meeting Agenda - May 17, 2022. Available from: http://www.rdmw.bc.ca/media/2022%2005%2012%20RDMW%20Board%20Agenda%20Package.pdf [accessed 2022-11-18].

Rodenhuis, D., Bennett, K.E., Werner, A.T., Murdock, T.Q., and Bronaugh, D., revised 2009. Hydro-climatology and future climate impacts in British Columbia. Pacific Climate Impacts Consortium, University of Victoria. Victoria, BC. 132 pp.

Salt Spring Island FreshWater Catalogue. 2022. (Web). Available from: http://ssifwc-webgis.s3-website-us-east-1.amazonaws.com/ [accessed 2022-11-30].

Scott, D., T. R. Yuzyk, and C. Whitney (1999), The evolution of Canada's hydrometric network: A century of development, in *Partnerships in Water Resource Management: Proceedings of the Canadian Water Resources Association 52nd Annual Conference, Nova Scotia, June 1999*, pp. 42–54, Can. Water Resour. Assoc., Ottawa, Ont., Canada.

Snider, D. 2007. Part 630 Hydrology National Engineering Handbook. Chapter 16 Hydrographs. United States Department of Agriculture Natural Resources Conservation Service. Washington, DC. 50 pp.

Spence, C., Saso, P. and Rausch, J. 2007. Quantifying the impact of hydrometric network reductions on regional streamflow prediction in northern Canada. *Canadian Water Resources Journal, 32*(1), pp.1-20.

Stenhouse, S. 2012. Improving Water for Fish in Flow Sensitive Streams on The East Coast of Vancouver Island. Report prepared for the Habitat Conservation Trust Foundation. Victoria, BC. 55 pp.

Sutherland, C. 2015. Regional Climate and Hydrometric Monitoring Network Scoping Study. 46 pp. Available from: https://www.rdn.bc.ca/dms/documents/dwwp-reports/region-wide-reports/rdn_regional_hydrometric_and_climate_monitoring_scoping_study_-_2015.pdf [accessed 2022-10-05].

TranBC. 2021. Rejuvenating and Reopening the Popular Cowichan Valley Trail. (Web). Available from: https://www.tranbc.ca/2021/03/30/rejuvenating-and-reopening-the-popular-cowichan-valley-trail/ [accessed 2022-11-29].

Weaver, D. 2021. Beaufort Watershed Stewards – 2021 Hydrological Health Report Card on Four Watersheds. 39 pp. Available from: http://agendaminutes.comoxvalleyrd.ca/Agenda_minutes/CVRDBoard/BRD/07-Dec-21/xDelegation%20Weaver%20Beaufort%20Watershed%20BRD%207Dec21.pdf [accessed 2022-11-27].

Wilson, N.J., Mutter, E., Inkster, J. and Satterfield, T. 2018. Community-Based Monitoring as the practice of Indigenous governance: A case study of Indigenous-led water quality monitoring in the Yukon River Basin. *Journal of Environmental Management, 210,* pp.290-298.

## PERSONAL COMMUNICATION

Barri Rudolph. Environmental Science Officer, Capital Regional District. Victoria, BC. Email communication with T. Rodgers, November 2022.

Neil Goeller. Unit Head, Groundwater, Hydrology, and Hydrometric Programs. Nanaimo, BC. Email communication with T. Rodgers, May, June, & November 2022.

Andrew Anderson. Water Resources, Environmental Management. Ministry of Transportation and Infrastructure. Victoria, BC. Email communication with T. Rodgers, November 2022.

# APPENDIX A – DATA TABLES

Table A1. Water Survey of Canada (BC-Fed) Active Stations

| wkt_geom | Station ID | Station Name | Latitude_y | Longitude_x | Data Available (Past 6 hours) | Elevation_median |
|---|---|---|---|---|---|---|
| Point (-123.72547000000000139 48.78922000000000025) | 08HA016 | BINGS CREEK NEAR THE MOUTH | 48.78922 | -123.72547 | Yes | 29 |
| Point (-125.06924999999999967 49.69283000000000072) | 08HB025 | BROWNS RIVER NEAR COURTENAY | 49.69283 | -125.06925 | Yes | 62 |
| Point (-125.26757999999999527 50.03363999999999834) | 08HD022 | CAMPBELL RIVER AT CAMPBELL RIVER LODGE | 50.03364 | -125.26758 | Yes | 3 |
| Point (-125.26757999999999527 50.03363999999999834) | 08HDX22 | CAMPBELL RIVER AT CAMPBELL RIVER LODGE (AUXILIARY STATION) | 50.03364 | -125.26758 | Yes | 3 |
| Point (-125.29471999999999809 50.03806000000000154) | 08HD003 | CAMPBELL RIVER NEAR CAMPBELL RIVER | 50.03806 | -125.29472 | Yes | 5 |
| Point (-125.28691999999999496 50.03735999999999962) | 08HD035 | CAMPBELL RIVER NEAR CAMPBELL RIVER CABLEWAY | 50.03736 | -125.28692 | Yes | 4 |
| Point (-123.70463999999999771 48.8783600000000007) | 08HA001 | CHEMAINUS RIVER NEAR WESTHOLME | 48.87836 | -123.70464 | Yes | 16 |
| Point (-124.24926999999999566 48.93352000000000146) | 08HA072 | COTTONWOOD CREEK HEADWATERS | 48.93352 | -124.24927 | Yes | 418 |
| Point (-124.05304999999999893 48.82591000000000037) | 08HA002 | COWICHAN RIVER AT LAKE COWICHAN | 48.82591 | -124.05305 | Yes | 164 |
| Point (-123.71447000000000571 48.77308000000000021) | 08HA011 | COWICHAN RIVER NEAR DUNCAN | 48.77308 | -123.71447 | Yes | 13 |
| Point (-125.9067100000000039 49.84107000000000198) | 08HC006 | CREST LAKE NEAR HIGHWAY 28 | 49.84107 | -125.90671 | Yes | 329 |
| Point (-125.21402999999999395 49.57878000000000185) | 08HB074 | CRUICKSHANK RIVER NEAR THE MOUTH | 49.57878 | -125.21403 | Yes | 154 |
| Point (-125.08571999999999491 49.73657999999999646) | 08HB075 | DOVE CREEK NEAR THE MOUTH | 49.73658 | -125.08572 | Yes | 63 |
| Point (-125.81268000000000029 49.85723000000000127) | 08HD018 | ELK RIVER ABOVE CAMPBELL LAKE | 49.85723 | -125.81268 | Yes | 266 |
| Point (-124.28526999999999703 49.31611000000000189) | 08HB002 | ENGLISHMAN RIVER NEAR PARKSVILLE | 49.31611 | -124.28527 | Yes | 6 |
| Point (-126.23243100000000538 50.31628599999999807) | 08HF015 | EVE RIVER BELOW KUNNUM CREEK | 50.316286 | -126.232431 | Yes | 200 |
| Point (-124.18680999999999415 49.02497000000000327) | 08HB041 | JUMP CREEK AT THE MOUTH | 49.02497 | -124.18681 | Yes | 313 |
| Point (-127.34866999999999848 50.67197000000000173) | 08HF014 | KEOGH RIVER NEAR PORT HARDY | 50.67197 | -127.34867 | Yes | 5 |
| Point (-123.67081000000000301 48.72782999999999731) | 08HA003 | KOKSILAH RIVER AT COWICHAN STATION | 48.72783 | -123.67081 | Yes | 8 |
| Point (-125.23197000000000401 49.91158000000000072) | 08HD023 | LITTLE OYSTER RIVER AT YORKE ROAD | 49.91158 | -125.23197 | Yes | 77 |
| Point (-124.48340000000000316 49.35459999999999781) | 08HB029 | LITTLE QUALICUM RIVER NEAR QUALICUM BEACH | 49.3546 | -124.4834 | OFFLINE | 10 |
| Point (-123.96903000000000361 49.1773900000000026) | 08HB032 | MILLSTONE RIVER AT NANAIMO | 49.17739 | -123.96903 | Yes | 63 |
| Point (-123.88693999999999562 49.06860999999999962) | 08HB034 | NANAIMO RIVER NEAR CASSIDY | 49.06861 | -123.88694 | TIMESTAMP ISSUE STILL LOGGING | 20 |
| Point (-124.65238999999999692 49.41852999999999696) | 08HB022 | NILE CREEK NEAR BOWSER | 49.41853 | -124.65239 | Yes | 21 |
| Point (-126.61081000000000074 50.21482999999999919) | 08HF005 | NIMPKISH RIVER ABOVE WOSS RIVER | 50.21483 | -126.61081 | Yes | 127 |
| Point (-125.24174999999999613 49.89457999999999771) | 08HD011 | OYSTER RIVER BELOW WOODHUS CREEK | 49.89458 | -125.24175 | Yes | 75 |
| Point (-127.88224999999999909 50.73449999999999704) | 08HF012 | PUGH CREEK NEAR NAHWITTI LAKE | 50.7345 | -127.88225 | Yes | 171 |
| Point (-125.03418999999999528 49.6880299999999977) | 08HB006 | PUNTLEDGE RIVER AT COURTENAY | 49.68803 | -125.03419 | Yes | 24 |
| Point (-125.08722000000000207 49.66832999999999743) | 08HB084 | PUNTLEDGE RIVER BELOW DIVERSION | 49.66833 | -125.08722 | Yes | 125 |
| Point (-125.52531000000000461 49.94147000000000247) | 08HD026 | QUINSAM DIVERSION NEAR CAMPBELL RIVER | 49.94147 | -125.52531 | Yes | 314 |
| Point (-125.50964000000000453 49.92983999999999867) | 08HD021 | QUINSAM RIVER AT ARGONAUT BRIDGE | 49.92984 | -125.50964 | Yes | 294 |
| Point (-125.33897000000000332 49.92963999999999913) | 08HD027 | QUINSAM RIVER BELOW LOWER QUINSAM LAKE | 49.92964 | -125.33897 | Yes | 150 |
| Point (-125.29999999999999716 50.02920999999999907) | 08HD005 | QUINSAM RIVER NEAR CAMPBELL RIVER | 50.02921 | -125.3 | Yes | 10 |
| Point (-125.29999999999999716 50.02920999999999907) | 08HDX05 | QUINSAM RIVER NEAR CAMPBELL RIVER (AUXILIARY STATION) | 50.02921 | -125.3 | Yes | 10 |
| Point (-125.74481000000000108 50.19727999999999923) | 08HD007 | SALMON RIVER ABOVE MEMEKAY RIVER | 50.19728 | -125.74481 | Yes | 82 |
| Point (-125.66974999999999341 50.09367000000000303) | 08HD032 | SALMON RIVER BELOW CAMPBELL LAKE DIVERSION | 50.09367 | -125.66975 | OFFLINE | 222 |
| Point (-125.90749999999999886 50.31246999999999758) | 08HD006 | SALMON RIVER NEAR SAYWARD | 50.31247 | -125.9075 | Yes | 10 |
| Point (-124.12628999999999735 49.06016000000000332) | 08HB092 | SOUTH NANAIMO RIVER NEAR JUNCTION | 49.06016 | -124.12629 | Yes | 239 |
| Point (-126.57850999999999431 50.44035999999999831) | 08HF004 | TSITIKA RIVER BELOW CATHERINE CREEK | 50.44036 | -126.57851 | Yes | 65 |
| Point (-125.01147000000000276 49.70586000000000126) | 08HB011 | TSOLUM RIVER NEAR COURTENAY | 49.70586 | -125.01147 | Yes | 7 |

Table A2. Water Survey of Canada (BC-Fed) Discontinued Stations

| wkt_geom | Station ID | Station Name | Latitude_y | Longitude_X | Operating Agency | Operation Schedule | Status | Elevation_median |
|---|---|---|---|---|---|---|---|---|
| Point (-123.68332999999999799 48.75583000000000311) | 08HA045 | KOKSILAH RIVER BELOW KELVIN CREEK | 48.75583 | -123.68333 | | Seasonal | Discontinued | -2 |
| Point (-124.91582999999999997 50.11527999999999849) | 08HD017 | BASIL BROOK ON CORTES ISLAND | 50.11528 | -124.91583 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 0 |
| Point (-124.73111000000000104 49.50666999999999973) | 08HB045 | GRAHAM CREEK AT THE MOUTH | 49.50667 | -124.73111 | | Continuous | Discontinued | 1 |
| Point (-123.70860999999999308 48.38971999999999696) | 08HA025 | DE MAMIEL CREEK AT THE MOUTH | 48.38972 | -123.70861 | | Seasonal | Discontinued | 2 |
| Point (-124.84166999999999348 49.51749999999999829) | 08HB024 | TSABLE RIVER NEAR FANNY BAY | 49.5175 | -124.84167 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 2 |
| Point (-125.12360999999999933 49.86889000000000038) | 08HD002 | OYSTER RIVER NEAR CAMPBELL RIVER | 49.86889 | -125.12361 | | Seasonal | Discontinued | 4 |
| Point (-123.67888999999999555 48.87722000000000122) | 08HA073 | BONSALL CREEK NEAR THE MOUTH | 48.87722 | -123.67889 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 6 |
| Point (-125.28749999999999432 50.03730999999999796) | 08HDX03 | CAMPBELL RIVER NEAR CAMPBELL RIVER (TEST STATION) | 50.03731 | -125.2875 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 6 |
| Point (-123.71138999999999442 48.41360999999999848) | 08HA029 | SOOKE RIVER BELOW CHARTERS RIVER | 48.41361 | -123.71139 | | Miscellaneous | Discontinued | 7 |
| Point (-124.93055999999999983 49.63944000000000045) | 08HB044 | TRENT RIVER NEAR ROYSTON | 49.63944 | -124.93056 | | Seasonal | Discontinued | 8 |
| Point (-124.20360999999999763 49.26500000000000057) | 08HB039 | NANOOSE CREEK AT THE MOUTH | 49.265 | -124.20361 | | Seasonal | Discontinued | 10 |
| Point (-124.61499999999999488 49.39417000000000257) | 08HB001 | QUALICUM RIVER NEAR BOWSER | 49.39417 | -124.615 | | Continuous | Discontinued | 10 |
| Point (-123.71500000000000341 48.79693999999999932) | 08HA015 | AVERILL CREEK NEAR DUNCAN | 48.79694 | -123.715 | | Seasonal | Discontinued | 11 |
| Point (-124.77277999999999736 49.46278000000000219) | 08HB037 | ROSEWALL CREEK AT THE MOUTH | 49.46278 | -124.77278 | | Continuous | Discontinued | 11 |
| Point (-123.39888999999999442 48.46750000000000114) | 08HA047 | COLQUITZ RIVER AT VIOLET AVENUE | 48.4675 | -123.39889 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 12 |
| Point (-123.36306000000000438 48.54111000000000331) | 08HA028 | NOBLE CREEK AT THE MOUTH | 48.54111 | -123.36306 | | Seasonal | Discontinued | 12 |
| Point (-123.40221999999999998 48.46916999999999831) | 08HA037 | COLQUITZ RIVER AT HYACINTH ROAD | 48.46917 | -123.40222 | | Continuous | Discontinued | 13 |
| Point (-123.47028000000000247 48.77472000000000207) | 08HA055 | FULFORD CREEK ON SALTSPRING ISLAND | 48.77472 | -123.47028 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 13 |
| Point (-125.90555999999999415 50.34027999999999992) | 08HD012 | SPRINGER CREEK NEAR SAYWARD | 50.34028 | -125.90556 | B.C. MINISTRY OF ENVIRONMENT | Continuous | Discontinued | 14 |
| Point (-123.71305999999999869 48.85443999999999676) | 08HA022 | BONSALL CREEK ABOVE WHITEHOUSE CREEK | 48.85444 | -123.71306 | | Seasonal | Discontinued | 18 |
| Point (-123.68332999999999799 48.78555999999999671) | 08HA014 | SOMENOS CREEK NEAR DUNCAN | 48.78556 | -123.68333 | | Miscellaneous | Discontinued | 19 |
| Point (-124.37471999999999639 49.34000000000000341) | 08HB078 | FRENCH CREEK ABOVE PUMPHOUSE | 49.34 | -124.37472 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 19 |
| Point (-123.43860999999999706 48.46305999999999869) | 08HA034 | CRAIGFLOWER CREEK BELOW BURNSIDE ROAD, VICTORIA | 48.46306 | -123.43861 | | Continuous | Discontinued | 20 |
| Point (-123.71277999999999508 48.74611000000000161) | 08HA056 | GLENORA CREEK NEAR DUNCAN | 48.74611 | -123.71278 | | Seasonal | Discontinued | 20 |
| Point (-123.46056000000000097 48.59111000000000047) | 08HA063 | HAGAN CREEK NEAR THE MOUTH | 48.59111 | -123.46056 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 21 |
| Point (-123.39722000000000435 48.58028000000000191) | 08HA060 | SANDHILL CREEK AT PAT BAY HIGHWAY | 48.58028 | -123.39722 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 23 |
| Point (-125.88472000000000151 50.29889000000000001) | 08HD009 | STOWE CREEK NEAR SAYWARD | 50.29889 | -125.88472 | | Seasonal | Discontinued | 27 |
| Point (-123.67139000000000237 48.78806000000000154) | 08HA021 | QUAMICHAN CREEK AT OUTLET OF QUAMICHAN LAKE | 48.78806 | -123.67139 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 28 |
| Point (-125.33666999999999803 50.11222000000000065) | 08HD013 | BARRON CREEK NEAR BLOEDEL | 50.11222 | -125.33667 | | Seasonal | Discontinued | 32 |
| Point (-125.25360999999999478 50.13389000000000095) | 08HD016 | HYACINTHE CREEK ON QUADRA ISLAND | 50.13389 | -125.25361 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 33 |
| Point (-123.38750000000000284 48.59027999999999992) | 08HA007 | PELKY SPRING NEAR SAANICHTON | 48.59028 | -123.3875 | | Seasonal | Discontinued | 36 |
| Point (-123.94333000000000311 49.14777999999999736) | 08HB054 | CHASE RIVER NEAR NANAIMO | 49.14778 | -123.94333 | | Miscellaneous | Discontinued | 41 |
| Point (-127.01416999999999291 50.52277999999999736) | 08HF002 | NIMPKISH RIVER NEAR ENGLEWOOD | 50.52278 | -127.01417 | | Seasonal | Discontinued | 42 |
| Point (-123.55249999999999488 48.46110999999999791) | 08HA039 | GOLDSTREAM RIVER IN GOLDSTREAM PROVINCIAL PARK | 48.46111 | -123.5525 | B.C. MINISTRY OF ENVIRONMENT | Continuous | Discontinued | 43 |
| Point (-123.65778000000000247 48.72361000000000075) | 08HA019 | PATROLAS CREEK NEAR COWICHAN STATION | 48.72361 | -123.65778 | | Miscellaneous | Discontinued | 44 |
| Point (-123.53833000000000197 48.87556000000000012) | 08HA046 | DUCK CREEK AT OUTLET OF ST. MARY LAKE | 48.87556 | -123.53833 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 44 |
| Point (-123.53888999999999498 48.87610999999999706) | 08HA027 | DUCK CREEK BELOW OUTLET OF ST. MARY LAKE | 48.87611 | -123.53889 | | Seasonal | Discontinued | 44 |
| Point (-123.56888999999999612 48.65805999999999898) | 08HA033 | SHAWNIGAN CREEK NEAR MILL BAY | 48.65806 | -123.56889 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 47 |
| Point (-124.95110999999999999 49.63944000000000045) | 08HB042 | ROY CREEK AT CUMBERLAND ROAD | 49.63944 | -124.95111 | | Seasonal | Discontinued | 48 |
| Point (-124.12082999999999799 49.25110999999999706) | 08HB052 | INDIAN RESERVE CREEK (SOUTH FORK) NEAR LANTZVILLE | 49.25111 | -124.12083 | | Seasonal | Discontinued | 50 |
| Point (-124.12111000000000161 49.25110999999999706) | 08HB051 | INDIAN RESERVE CREEK (NORTH FORK) NEAR LANTZVILLE | 49.25111 | -124.12111 | | Seasonal | Discontinued | 51 |
| Point (-123.71250000000000568 48.42443999999999704) | 08HA059 | SOOKE RIVER ABOVE CHARTERS RIVER | 48.42444 | -123.7125 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 54 |
| Point (-123.74166999999999916 48.78472000000000008) | 08HA008 | BINGS CREEK NEAR DUNCAN | 48.78472 | -123.74167 | | Seasonal | Discontinued | 54 |
| Point (-123.54860999999999649 48.40361000000000047) | 08HA064 | METCHOSIN CREEK AT HAPPY VALLEY ROAD | 48.40361 | -123.54861 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 56 |
| Point (-124.15888999999999953 49.28694000000000131) | 08HB030 | ENOS CREEK AT OUTLET OF ENOS LAKE | 49.28694 | -124.15889 | | Continuous | Discontinued | 58 |
| Point (-125.12417000000000655 49.83138999999999896) | 08HD008 | BLACK CREEK NEAR MIRACLE BEACH PARK | 49.83139 | -125.12417 | | Seasonal | Discontinued | 61 |
| Point (-123.90778000000000247 49.03999999999999915) | 08HB003 | HASLAM CREEK NEAR CASSIDY | 49.04 | -123.90778 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 62 |
| Point (-123.92360999999999649 49.07222000000000151) | 08HB005 | NANAIMO RIVER NEAR EXTENSION | 49.07222 | -123.92361 | | Miscellaneous | Discontinued | 62 |
| Point (-123.96056000000000097 49.14972000000000207) | 08HB099 | CHASE RIVER LOWER SPILLWAY | 49.14972 | -123.96056 | WATER SURVEY OF CANADA (DOE) (CANADA) | Miscellaneous | Discontinued | 64 |
| Point (-123.82721999999999696 49.14916999999999803) | 08HB046 | HOGGAN CREEK AT OUTLET OF HOGGAN LAKE | 49.14917 | -123.82722 | | Continuous | Discontinued | 66 |
| Point (-124.10083000000000197 49.24777999999999878) | 08HB040 | KNARSTON CREEK AT SUPERIOR ROAD | 49.24778 | -124.10083 | | Seasonal | Discontinued | 67 |
| Point (-123.43193999999999733 48.58167000000000257) | 08HA071 | GRAHAM CREEK AT STELLY'S CROSS ROAD | 48.58167 | -123.43194 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 68 |
| Point (-125.12082999999999799 49.76610999999999763) | 08HB090 | HEADQUARTERS CREEK ABOVE TSOLUM RIVER | 49.76611 | -125.12083 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 68 |
| Point (-123.71250000000000568 48.43193999999999733) | 08HA018 | SOOKE RIVER ABOVE TODD CREEK | 48.43194 | -123.7125 | | Seasonal | Discontinued | 70 |
| Point (-125.14249999999999829 49.80805999999999756) | 08HD014 | BLACK CREEK AT STURGESS ROAD | 49.80806 | -125.1425 | | Seasonal | Discontinued | 71 |
| Point (-123.54860999999999649 48.39943999999999846) | 08HA065 | BILSTON CREEK AT GLEN FOREST WAY | 48.39944 | -123.54861 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 74 |
| Point (-123.43778000000000361 48.52472000000000207) | 08HA054 | TOD CREEK BELOW PROSPECT LAKE | 48.52472 | -123.43778 | WATER SURVEY OF CANADA (DOE) (CANADA) | Seasonal | Discontinued | 74 |
| Point (-124.05222000000000548 49.20611000000000246) | 08HB027 | MILLSTONE RIVER NEAR WELLINGTON | 49.20611 | -124.05222 | | Continuous | Discontinued | 79 |
| Point (-123.55777999999999395 48.64222000000000179) | 08HA066 | WILKEN CREEK NEAR MILL BAY | 48.64222 | -123.55778 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 81 |
| Point (-125.19503000000000027 49.80881000000000114) | 08HB089 | TSOLUM RIVER BELOW MUREX CREEK | 49.80881 | -125.19503 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 83 |
| Point (-124.42499999999999716 49.30472000000000321) | 08HB038 | FRENCH CREEK AT COOMBS | 49.30472 | -124.425 | | Seasonal | Discontinued | 90 |
| Point (-124.26667000000000485 49.47943999999999676) | 08HB047 | OGDEN CREEK AT OUTLET OF OGDEN LAKE | 49.47944 | -124.26667 | | Continuous | Discontinued | 90 |
| Point (-123.56944000000000017 48.64417000000000257) | 08HA067 | HANDYSEN CREEK NEAR MILL BAY | 48.64417 | -123.56944 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 91 |
| Point (-126.57889000000000124 50.42472000000000065) | 08HF008 | CATHERINE CREEK NEAR THE MOUTH | 50.42472 | -126.57889 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 99 |
| Point (-123.45444000000000528 48.81166999999999945) | 08HA026 | CUSHEON CREEK AT OUTLET OF CUSHEON LAKE | 48.81167 | -123.45444 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 100 |
| Point (-123.76443999999999335 48.80306000000000211) | 08HA043 | BINGS CREEK AT DRINKWATER ROAD | 48.80306 | -123.76444 | | Seasonal | Discontinued | 106 |
| Point (-123.62193999999999505 48.39110999999999763) | 08HA023 | VEITCH CREEK AT THE MOUTH | 48.39111 | -123.62194 | | Seasonal | Discontinued | 109 |
| Point (-123.76749999999999829 48.80306000000000211) | 08HA042 | BINGS CREEK (WEST BRANCH) NEAR DUNCAN | 48.80306 | -123.7675 | | Seasonal | Discontinued | 110 |
| Point (-123.62999999999999545 48.65943999999999647) | 08HA004 | SHAWNIGAN CREEK BELOW SHAWNIGAN LAKE | 48.65944 | -123.63 | B.C. MINISTRY OF ENVIRONMENT | Continuous | Discontinued | 117 |
| Point (-124.67499999999999716 49.34000000000000341) | 08HB018 | QUALICUM RIVER AT OUTLET OF HORNE LAKE | 49.34 | -124.675 | | Continuous | Discontinued | 124 |
| Point (-125.09305999999999415 49.66389000000000209) | 08HB007 | PUNTLEDGE RIVER NEAR CUMBERLAND | 49.66389 | -125.09306 | CANADIAN COLLIERS (DUNSMUIR) LIMITED | Continuous | Discontinued | 135 |
| Point (-125.21402999999999395 49.57878000000000185) | 08HBX74 | CRUICKSHANK RIVER NEAR THE MOUTH NEW LOCATION | 49.57878 | -125.21403 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 154 |
| Point (-123.72777999999999565 48.49721999999999866) | 08HA017 | LEECH RIVER AT THE MOUTH | 48.49722 | -123.72778 | | Continuous | Discontinued | 163 |
| Point (-125.38889000000000351 50.00222000000000122) | 08HD001 | CAMPBELL RIVER AT OUTLET OF CAMPBELL LAKE | 50.00222 | -125.38889 | | Continuous | Discontinued | 179 |
| Point (-123.70055999999999585 48.51832999999999885) | 08HA005 | SOOKE RIVER NEAR SOOKE LAKE | 48.51833 | -123.70056 | CITY OF VICTORIA | Seasonal | Discontinued | 183 |
| Point (-123.70055999999999585 48.51832999999999885) | 08HA006 | SOOKE RIVER (VICTORIA WATER SUPPLY) | 48.51833 | -123.70056 | CITY OF VICTORIA | Continuous | Discontinued | 183 |
| Point (-124.58333000000000368 49.29082999999999997) | 08HB004 | LITTLE QUALICUM RIVER AT OUTLET OF CAMERON LAKE | 49.29083 | -124.58333 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 190 |
| Point (-124.27778000000000702 48.89556000000000324) | 08HA036 | COWAN BROOK NEAR YOUBOU | 48.89556 | -124.27778 | | Seasonal | Discontinued | 199 |
| Point (-125.39444000000000301 49.96249999999999858) | 08HD010 | QUINSAM RIVER BELOW QUINSAM LAKE | 49.9625 | -125.39444 | OCEAN SCIENCE AND SURVEYS (DFO) (CANADA) | Seasonal | Discontinued | 203 |
| Point (-124.19666999999999746 49.22361000000000075) | 08HB079 | BONELL CREEK NEAR NANOOSE | 49.22361 | -124.19667 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 207 |
| Point (-125.67821999999999605 50.09042000000000172) | 08HD015 | SALMON RIVER ABOVE CAMPBELL LAKE DIVERSION | 50.09042 | -125.67822 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 221 |
| Point (-125.66974999999999341 50.09367000000000303) | 08HD020 | SALMON RIVER DIVERSION NEAR CAMPBELL RIVER | 50.09367 | -125.66975 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 222 |
| Point (-125.58611000000000502 49.96500000000000341) | 08HD004 | CAMPBELL RIVER NEAR QUINSAM | 49.965 | -125.58611 | | Continuous | Discontinued | 223 |
| Point (-126.85555999999999699 50.51666999999999774) | 08HF001 | KOKISH RIVER AT BEAVER COVE | 50.51667 | -126.85556 | | Continuous | Discontinued | 226 |
| Point (-126.82555999999999585 50.47972000000000037) | 08HF003 | KOKISH RIVER BELOW BONANZA RIVER | 50.47972 | -126.82556 | BRITISH COLUMBIA HYDRO AND POWER AUTHORITY | Continuous | Discontinued | 244 |
| Point (-126.41943999999999448 50.32471999999999923) | 08HF007 | RUSSELL CREEK NEAR THE MOUTH | 50.32472 | -126.41944 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 254 |
| Point (-124.39806000000000097 49.08388999999999669) | 08HB033 | NANAIMO RIVER ABOVE ROCKYRUN CREEK | 49.08389 | -124.39806 | | Miscellaneous | Discontinued | 279 |
| Point (-124.65694000000000585 49.24582999999999799) | 08HB019 | CAMERON RIVER NEAR ALBERNI | 49.24583 | -124.65694 | | Miscellaneous | Discontinued | 296 |
| Point (-124.53471999999999298 49.22111000000000303) | 08HB080 | ARROWSMITH CREEK AT OUTLET OF ARROWSMITH LAKE | 49.22111 | -124.53472 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 857 |
| Point (-125.34028000000000702 49.75) | 08HD030 | PIGGOTT CREEK AT MOUNT WASHINGTON | 49.75 | -125.34028 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 904 |
| Point (-125.30472000000000321 49.77389000000000152) | 08HB091 | PYRRHOTITE CREEK AT BRANCH 126 | 49.77389 | -125.30472 | WATER SURVEY OF CANADA (DOE) (CANADA) | Continuous | Discontinued | 1174 |

Table A3. Community group Active and Proposed Stations

| wkt_geom | STN_ID | STN_NAME | LOCATION | LATITUDE_y | LONGIDUTE_x | TYPE | REGION | OWNER |
|---|---|---|---|---|---|---|---|---|
| Point (-124.428200000000000391 49.34922000000000253) | 08HB0031 | BEACH CREEK | WALKING PATH BETWEEN CHESTER RD AND HEMSWORTH RD | 49.34922 | -124.4282 | Community | QUALICUM | QUALICUM BEACH STREAMKEEPERS |
| Point (-125.12954000000000576 49.83478999999999814) | 08HD0001 | BLACK CREEK | AT THOMSON PROPERTY | 49.83479 | -125.12954 | Community | BLACK CREEK | BCCF |
| Point (-123.316710000000000049 48.430929999999999648) | | BOWKER CREEK | OAK BAY HIGH SCHOOL | 48.43093 | -123.31671 | Community | CAPITAL REGION | FRIEND OF BOWKER CREEK |
| Point (-124.758369999999999932 49.44679000000000002) | 08HB0032 | COOK CREEK | UPSTREAM OF HWY 19A | 49.44679 | -124.75837 | Community | FANNY BAY | BWS |
| Point (-124.823610000000000217 49.49907000000000323) | | COWIE CREEK | AT HWY 19A | 49.49907 | -124.82361 | Community | FANNY BAY | BWS |
| Point (-124.376869999999999671 49.34143000000000256) | 08HB0014 | FRENCH CREEK | 815 Miller Rd | 49.34143 | -124.37687 | Community | FRENCH CREEK | FRIENDS OF FRENCH CREEK |
| Point (-124.467420000000000417 49.35728000000000293) | 08HB0011 | GRANDON CREEK | AT W CRESCENT RD | 49.35728 | -124.46742 | Community | QUALICUM | QUALICUM BEACH STREAMKEEPERS |
| Point (-125.044039999999999542 49.65966999999999842) | | MORRISON CREEK | FIRST SUPPLY | 49.65967 | -125.04404 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.042799999999999973 49.65861999999999991) | | MORRISON CREEK | NELLIE CREEK | 49.65862 | -125.0428 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.041420000000000223 49.65686999999999784) | | MORRISON CREEK | TRIB 8 | 49.65687 | -125.04142 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.041550000000000086 49.655949999999999715) | | MORRISON CREEK | TRIB 8-B | 49.65595 | -125.04155 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.039190000000000494 49.65306999999999996) | | MORRISON CREEK | SILL LOG TRIB | 49.65307 | -125.03919 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.035749999999999307 49.651569999999999954) | | MORRISON CREEK | MAINSTEM HIGH | 49.65157 | -125.03575 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.035749999999999307 49.650979999999999701) | | MORRISON CREEK | ET | 49.65098 | -125.03575 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-125.039619999999999932 49.645339999999999736) | | MORRISON CREEK | MONKEYFLOWER TRIB | 49.64534 | -125.03962 | Community | COURTENAY COMOX | MORRISON CREEK STREAMKEEPERS |
| Point (-124.796670000000000598 49.467460000000000265) | | MUD BAY CREEK | AT HWY 19A | 49.46746 | -124.79667 | Community | FANNY BAY | BWS |
| Point (-124.775499999999999386 49.455590000000000083) | 08HB0008 | ROSEWALL CREEK | DOWNSTREAM OF HWY 19A | 49.45559 | -124.7755 | Community | FANNY BAY | BWS |
| Point (-124.303150000000000225 49.307720000000000332) | 08HB0027 | SHELLEY CREEK | UPSTREAM OF HAMILTON AVE | 49.30772 | -124.30315 | Community | PARKSVILLE | MOF |
| Point (-125.074309999999999699 49.74660000000000082) | | TSOLUM RIVER | AT MCNAUGHTON PROPERTY | 49.7466 | -125.07431 | Community | COURTENAY COMOX | TSOLUM RIVER RESTORATION SOCIETY |
| Point (-123.968620000000000137 49.231329999999999981) | | WALLEY CREEK | MORNINGSIDE PARK? | 49.23133 | -123.96862 | Community | NANAIMO | WALLEY CREEK STREAMKEEPERS |
| Point (-124.795240000000000683 49.470480000000000201) | | WATERLOO CREEK | AT HWY 19A | 49.47048 | -124.79524 | Community | FANNY BAY | BWS |
| Point (-124.807389999999999805 49.487520000000000351) | 08HB0024 | WILFRED CREEK | DOWNSTREAM OF HWY 19A | 49.48752 | -124.80739 | Community | FANNY BAY | BWS |
| Point (-123.463449999999999459 48.772429999999999995) | | SALTSPRING | SEVERAL STATIONS | 48.77243 | -123.46345 | Community | GULF ISLANDS | SSIWPS |
| Point (-123.971010000000000681 49.205700000000000022) | | DEPARTURE CREEK | NEAR CENTENNIAL PARK | 49.2057 | -123.97101 | Community | NANAIMO | DEPARTURE BAY STREAMKEEPERS |
| Point (-123.463300000000000382 48.590769999999999913) | | HAGAN CREEK | AT HISTORICAL STATION DOWNSTREAM OF W SAANICH RD | 48.59077 | -123.4633 | Community | CAPITAL REGION | PENINSULA STREAMS |
| Point (-123.388890000000000351 48.513249999999999932) | | HALIBURTON BROOK | UPSTREAM OF ELK/BEAVER LAKE | 48.51325 | -123.38889 | Community | CAPITAL REGION | PENINSULA STREAMS |
| Point (-123.466340000000000242 48.451760000000000016) | | MILLSTREAM CREEK | AT FISH LADDER NEAR LAGOON | 48.45176 | -123.46634 | Community | CAPITAL REGION | PENINSULA STREAMS |
| Point (-123.412499999999999432 48.541530000000000162) | | O'DONNELL CREEK | UPSTREAM OF ELK/BEAVER LAKE (BROOKLEIGH RD?) | 48.54153 | -123.4125 | Community | CAPITAL REGION | PENINSULA STREAMS |

| MONITORING PARTNERS | PROGRAM | TYPE_1 | STATUS | PARAMETER | TIMEFRAME | DATA START | DATA END | TIMEFRAME_1 | INTERVAL | EQUIPMENT | DWWP PRIORITY | NOTES | Elevation_median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2020 | | ANNUAL | 15 MINUTE | MANUAL | | | 40 |
| MOF | CBFMN | STEWARDSHIP | ACTIVE | STAGE | CONTINUOUS | 2012 | | ANNUAL | HOURLY | MANUAL | | | 54 |
| CRD | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2018 | | SEASONAL | NA | MANUAL | | | 17 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | | ANNUAL | HOURLY | MANUAL | | | 18 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2020 | | ANNUAL | 15 MINUTE | MANUAL | | | 1 |
| MOF | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | HOURLY | MANUAL | | | 13 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2012 | | ANNUAL | 15 MINUTE | MANUAL | | | 7 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 83 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 84 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 88 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 91 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 98 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 97 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 99 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | | ANNUAL | NA | MANUAL | | UNSURE CURRENT STATUS | 122 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2020 | | ANNUAL | 15 MINUTE | MANUAL | | | 5 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2012 | | ANNUAL | HOURLY | MANUAL | | | 18 |
| MVIHES | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2018 | | SEASONAL | HOURLY | MANUAL | | | 38 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2012 | | ANNUAL | HOURLY | MANUAL | | | 41 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | DISCRETE | 2019 | | SEASONAL | NA | MANUAL | | | 25 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2020 | | ANNUAL | 15 MINUTE | MANUAL | | | 4 |
| BCCF/MOF | CBFMN | STEWARDSHIP | ACTIVE | DISCHARGE | CONTINUOUS | 2018 | | ANNUAL | HOURLY | MANUAL | | | 6 |
| NA | NA | STEWARDSHIP | ACTIVE | DISCHARGE | DISCRETE | 2017 | | SEASONAL | NA | MANUAL | | UNSURE CURRENT STATION LOCATIONS, LOTS OF SITES LISTED ON WEBPAGE | 5 |
| NA | NA | STEWARDSHIP | PROPOSED | DISCHARGE | NA | NA | | SEASONAL | NA | MANUAL | 0 | | 8 |
| TSARTLIP FN | PSS | STEWARDSHIP | PROPOSED | DISCHARGE | NA | NA | | ANNUAL | NA | MANUAL | 1 | | 15 |
| BEES, GR&R | PSS | STEWARDSHIP | PROPOSED | DISCHARGE | NA | NA | | ANNUAL | NA | MANUAL | 2 | | 68 |
| GVSEA | PSS | STEWARDSHIP | PROPOSED | DISCHARGE | NA | NA | | ANNUAL | NA | MANUAL | 1 | | 20 |
| BEES, GR&R | PSS | STEWARDSHIP | PROPOSED | DISCHARGE | NA | NA | | ANNUAL | NA | MANUAL | 1 | | 81 |

Table A4. Other government streamflow monitoring stations

| wkt_geom | STN_ID | STN_NAME | LOCATION | LATITUDE_y | LONGIDUTE_x | TYPE | REGION | OWNER |
|---|---|---|---|---|---|---|---|---|
| Point (-125.10101000000000226 49.8493599999999723) | 08HB0022 | BLACK CREEK | AT MIRACLE BEACH DRIVE | 49.84936 | -125.10101 | Federal | BLACK CREEK | DFO |
| Point (-124.3709000000000006 49.344439999999999875) | 08HB0004 | FRENCH CREEK | BARCLAY CRESCENT CROSSING | 49.34444 | -124.3709 | Federal | FRENCH CREEK | DFO |
| Point (-123.880700000000000448 49.060929999999999904) | 08HB0007 | HASLAM CREEK | UPSTREAM OF RAIL BRIDGE | 49.06093 | -123.8807 | Federal | NANAIMO | DFO |
| Point (-126.531350000000000332 50.161720000000000253) | NA | NIMPKISH RIVER | UPPER NIMPKISH OFF RONA ROAD | 50.16172 | -126.53135 | Federal | NORTH ISLAND | DFO |
| Point (-127.017870000000000205 50.518149999999999856) | NA | NIMPKISH RIVER | LOWER NIMPKISH AT OUTLET OF LAKE, KILPALA RD BRIDGE | 50.51815 | -127.01787 | Federal | NORTH ISLAND | DFO |
| Point (-126.20171999999999457 50.34863) | NA | EVE RIVER | DS MONTAGUE CREEK CAMPGROUND | 50.34863 | -126.20172 | Federal | NORTH ISLAND | DFO |
| Point (-123.687060000000000245 48.883459999999999947) | 08HA0024 | CHEMAINUS RIVER | DOWNSTREAM OF CHEMAINUS RD BRIDGE | 48.88346 | -123.68706 | Provincial | CHEMAINUS | WATER AUTH |
| Point (-123.757329999999999606 48.903919999999999939) | 08HA0023 | CHEMAINUS RIVER | UPSTREAM BANNON CREEK | 48.90392 | -123.75733 | Provincial | CHEMAINUS | WATER AUTH |
| Point (-123.683109999999999922 48.755290000000000224) | 08HA0022 | KOKSILAH RIVER | AT RAIL TRESTLE ABOVE HWY 19 | 48.75529 | -123.68311 | Provincial | COWICHAN | WATER AUTH |
| Point (-125.105389999999999987 49.755609999999999723) | 08HA0038 | TSOLUM RIVER | AT FITZGERALD RD BRIDGE | 49.75561 | -125.10539 | Provincial | COURTENAY COMOX | WATER AUTH |
| Point (-124.049850000000000639 48.828539999999999672) | 08HA0036 | OLIVER CREEK | IN LAKE COWICHAN | 48.82854 | -124.04985 | Provincial | COWICHAN | ENV |
| Point (-123.867069999999999823 48.761400000000000185) | NA | DRY BEND CREEK | AT MOTI CULVERT ALONG COWICHAN VALLEY TRAIL | 48.7614 | -123.86707 | Provincial | COWICHAN | BC MOTI |
| Point (-123.717330000000000402 48.746330000000000038) | 08HA0002 | GLENORA CREEK | NEAR DOUPE RD | 48.74633 | -123.71733 | Provincial | COWICHAN | ENV |
| Point (-123.785460000000000049 48.629069999999999869) | 08HA0025 | KOKSILAH RIVER | AT PROVINCIAL PARK | 48.62907 | -123.78546 | Provincial | COWICHAN | ENV |
| Point (-125.016109999999999763 49.687019999999999686) | 08HB0018 | MORRISON CREEK | NEAR THE MOUTH | 49.68702 | -125.01611 | Provincial | COURTENAY COMOX | ENV |
| Point (-123.659809999999999312 48.724029999999999906) | 08HA0027 | PATROLAS CREEK | AT MOSS RD | 48.72403 | -123.65981 | Provincial | COWICHAN | ENV |
| Point (-124.943179999999999813 49.647120000000000103) | 08HB0002 | ROY CREEK | AT HWY 19A | 49.64712 | -124.94318 | Provincial | COURTENAY COMOX | ENV |
| Point (-125.659689999999999767 50.254609999999999956) | 08HD0003 | AMOR DE COSMOS CREEK | HWY 19 | 50.25461 | -125.65969 | Provincial | NORTH ISLAND | ENV |
| Point (-123.334199999999999561 48.452809999999999949) | NA | BOWKER CREEK | BROWNING PARK | 48.45281 | -123.3342 | Regional | CAPITAL REGION | CRD |
| Point (-123.379549999999999472 48.442790000000000224) | NA | CECELIA CREEK | DOWNSTREAM OF DOUBLE BARREL PIPES UNDER BRIDGE | 48.44279 | -123.37955 | Regional | CAPITAL REGION | CRD |
| Point (-123.400729999999999581 48.466779999999999997) | NA | COLQUITZ CREEK | VIOLET AVE | 48.46678 | -123.40073 | Regional | CAPITAL REGION | CRD |
| Point (-123.39415999999999994 48.507319999999999999) | NA | COLQUITZ CREEK | DOWNSTREAM OF ELK/BEAVER LAKE | 48.50732 | -123.39416 | Regional | CAPITAL REGION | CRD |
| Point (-123.468270000000000396 48.431759999999999704) | NA | COLWOOD CREEK | NEAR MOUTH | 48.43176 | -123.46827 | Regional | CAPITAL REGION | CRD |
| Point (-123.435900000000000373 48.457880000000000295) | NA | CRAIGFLOWER CREEK | NEAR FISH FENCE | 48.45788 | -123.4359 | Regional | CAPITAL REGION | CRD |
| Point (-123.335139999999999555 48.490149999999999986) | NA | DOUGLAS CREEK | HEADWATERS | 48.49015 | -123.33514 | Regional | CAPITAL REGION | CRD |
| Point (-123.429649999999999952 48.464880000000000085) | NA | HOSPITAL CREEK | IN MANHOLE OFF GALLOPING GOOSE | 48.46488 | -123.42965 | Regional | CAPITAL REGION | CRD |
| Point (-123.571100000000000127 48.657550000000000052) | NA | SHAWNIGAN CREEK | BELOW SHAWNIGAN LAKE (AT SHAWNIGAN MILL BAY RD BRIDGE) | 48.65755 | -123.5711 | Regional | MALAHAT | CVRD |
| Point (-123.786190000000000483 48.947110000000000212) | NA | STOCKING CREEK | DOWNSTREAM OF STOCKING LAKE COMMUNITY WATERSHED | 48.94711 | -123.78619 | Regional | CHEMAINUS | CVRD |
| Point (-124.204830000000000118 49.264839999999999952) | 08HB0010 | NANOOSE CREEK | NANOOSE CREEK AND HWY 19 | 49.26484 | -124.20483 | Regional | NANOOSE | RDN |
| Point (-123.757699999999999982 48.902059999999999875) | NA | CHEMAINUS RIVER SWA-1 | 1.2 KM UPSTREAM OF WELLS | 48.90206 | -123.7577 | Municipal | CHEMAINUS | NORTH COWICHAN |
| Point (-123.757699999999999982 48.902059999999999875) | NA | CHEMAINUS RIVER SWB 1-2 | 250 M DOWNSTREAM OF WELLS | 48.90206 | -123.7577 | Municipal | CHEMAINUS | NORTH COWICHAN |
| Point (-123.757699999999999982 48.902059999999999875) | NA | CHEMAINUS RIVER SWD-1 | AT RAIL BRIDGE | 48.90206 | -123.7577 | Municipal | CHEMAINUS | NORTH COWICHAN |
| Point (-123.168940000000000631 48.793729999999999649) | NA | LYALL CREEK | NEAR THE MOUTH | 48.79373 | -123.16894 | Federal | GULF ISLANDS | PARKS CANADA |
| Point (-123.547470000000000412 48.480240000000002) | 1AHA045 | GOLDSTREAM RIVER | AT HISTORIC STATION FISH FENCE NEAR HWY 1 | 48.48024 | -123.54747 | Regional | CAPITAL REGION | ENV PROPOSED |
| Point (-123.775800000000000382 48.912930000000000291) | NA | BANON CREEK | UPSTREAM OF RESERVOIR | 48.91293 | -123.7758 | Regional | CHEMAINUS | NA |
| Point (-123.927199999999999914 48.842660000000000219) | NA | CHEMAINUS RIVER | ABOVE CHIPMAN CREEK - ACCESS FROM MACMILLAN BLOEDEL FSR | 48.84266 | -123.9272 | Regional | CHEMAINUS | NA |
| Point (-124.078900000000000441 48.920430000000000319) | NA | CHEMAINUS RIVER | ABOVE RHEINHART CREEK - ACCESS FROM COPPER CANYON MAIN FSR | 48.92043 | -124.0789 | Regional | CHEMAINUS | NA |
| Point (-123.557000000000000216 48.709919999999999678) | NA | GARNETT CREEK | AT CHERRY POINT BEACH (TIDAL INFLUENCE) | 48.70992 | -123.557 | Regional | COWICHAN | NA |
| Point (-123.793700000000000118 48.628790000000000218) | NA | KOKSILAH RIVER | AT RENEFREW RD - UPSTREAM OF PROVINCIAL PARK | 48.62879 | -123.7937 | Regional | COWICHAN | NA |
| Point (-123.571100000000000127 48.657550000000000052) | NA | SHAWNIGAN CREEK | BELOW SHAWNIGAN LAKE (AT SHAWNIGAN MILL BAY RD BRIDGE) | 48.65755 | -123.5711 | Regional | COWICHAN | NA |
| Point (-123.555800000000000496 48.569090000000000276) | NA | SPECTACLE CREEK | AT EBADORA LANE | 48.56909 | -123.5558 | Regional | MALAHAT | NA |
| Point (-123.853099999999999775 48.991950000000000277) | NA | TYEE CREEK | ABOVE LADYSMITH | 48.99195 | -123.8531 | Regional | LADYSMITH | NA |
| Point (-123.860140000000000124 49.069690000000000136) | NA | HOKKANEN CREEK | NA | 49.06969 | -123.86014 | Regional | NANAIMO | RDN |
| Point (-124.361900000000000566 49.34718000000000016) | NA | MORNINGSTAR CREEK | NA | 49.34718 | -124.3619 | Regional | FRENCH CREEK | RDN |
| Point (-123.875839999999999662 48.952120000000000074) | NA | HOLLAND CREEK/LAKE | NA | 48.95212 | -123.87584 | Municipal | LADYSMITH | NA |
| Point (-123.678899999999999873 48.877220000000000122) | 08HA0001 | BONSALL CREEK | NEAR THE MOUTH | 48.87722 | -123.6789 | Regional | COWICHAN | DISCONTINUED WSC |
| Point (-123.853999999999999992 49.005279999999999906) | 1AHB033 | BUSH CREEK | ABOVE ISLAND HWY | 49.00528 | -123.854 | Regional | LADYSMITH | BC HYDRO INACTIVE |

| MONITORING PARTNERS | PROGRAM | TYPE_1 | STATUS | PARAMETER | TIMEFRAME | DATA START | DATA END | TIMEFRAME_1 | INTERVAL | EQUIPMENT | DWWP PRIORITY | NOTES | Elevation_median |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENV | PACFISH | GOV | ACTIVE | STAGE | CONTINUOUS | 2016 | 0 | ANNUAL | HOURLY | TELEMETRY | FALSE | | 3 |
| RDN/ENV | PACFISH | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2012 (PACFISH 2018) | 0 | ANNUAL | HOURLY | TELEMETRY | TRUE | | 6 |
| RDN/ENV | PACFISH | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | 0 | ANNUAL | HOURLY | TELEMETRY | TRUE | | 28 |
| NFN | PACFISH | GOV | ACTIVE | STAGE | CONTINUOUS | 2015 | 2022 | OFFLINE | HOURLY | TELEMETRY | FALSE | | 174 |
| NFN | PACFISH | GOV | ACTIVE | STAGE | CONTINUOUS | 2017 | 0 | ANNUAL | HOURLY | TELEMETRY | FALSE | | 25 |
| NFN | PACFISH | GOV | ACTIVE | STAGE | CONTINUOUS | 2017 | 0 | ANNUAL | HOURLY | TELEMETRY | FALSE | | 153 |
| ENV | BC HYDRO | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | 2021 | SEASONAL | 5 MINUTE | TELEMETRY | FALSE | | 5 |
| NA | WATER AUTH | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2018 | 0 | SEASONAL | 15 MINUTE | TELEMETRY | FALSE | | 36 |
| NA | WATER AUTH | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | 0 | SEASONAL | 5 MINUTE | TELEMETRY | FALSE | | 4 |
| NA | WATER AUTH | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2021 | 0 | SEASONAL | 5 MINUTE | TELEMETRY | FALSE | DISCRETE DATA IN 2021, CONTINUOUS STARTS IN 2022 | 55 |
| BC HYDRO | BC HYDRO | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2020 | 2022 | SEASONAL | HOURLY | TELEMETRY | FALSE | | 172 |
| NA | BC MOTI | GOV | ACTIVE | DISCHARGE | UNKNOWN | 2021 | 0 | ANNUAL | UNKNOWN | MANUAL | FALSE | | 76 |
| NA | BC GOV | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | 2019 | SEASONAL | 30 MINUTE | MANUAL | FALSE | | 23 |
| NA | BC GOV | GOV | ACTIVE | DISCHARGE | DISCRETE | 2018 | 2019 | SEASONAL | NA | MANUAL | FALSE | | 150 |
| NA | BC GOV | GOV | ACTIVE | DISCHARGE | DISCRETE | 2018 | 2022 | ANNUAL | HOURLY | TELEMETRY | FALSE | CONTINUOUS/TELEMETRY TW DATA, DISCRETE STAGE-Q DATA | 18 |
| NA | BC GOV | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2018 | 2019 | SEASONAL | 30 MINUTE | MANUAL | FALSE | | 42 |
| NA | BC GOV | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | 2019 | SEASONAL | 30 MINUTE | MANUAL | FALSE | | 5 |
| NA | NA | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2019 | 2022 | ANNUAL | HOURLY | MANUAL | FALSE | | 65 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 36 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 7 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 13 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 65 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 5 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 4 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 32 |
| NA | CRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | | TELEMETRY | FALSE | | 12 |
| NA | CVRD-DWWP | GOV | ACTIVE | STAGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | FALSE | | 28 |
| PALMER | CVRD | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2021 | 0 | ANNUAL | NA | TELEMETRY | FALSE | | 91 |
| ENV | RDN-DWWP | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2017 | 0 | ANNUAL | 30 MINUTE | TELEMETRY | TRUE | | 17 |
| NA | NORTH COWICHAN | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | 0 | ANNUAL | NA | MANUAL | FALSE | | 38 |
| NA | NORTH COWICHAN | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | 0 | ANNUAL | NA | MANUAL | FALSE | | 38 |
| NA | NORTH COWICHAN | GOV | ACTIVE | DISCHARGE | CONTINUOUS | 2016 | 0 | ANNUAL | NA | MANUAL | FALSE | | 38 |
| NA | NA | GOV | PROPOSED | NA | NA | NA | 0 | SEASONAL | NA | MANUAL | 0 | | 9 |
| CRD | CRD | GOV | PROPOSED | DISCHARGE | CONTINUOUS | 1998 | 2002 | ANNUAL | NA | TELEMETRY | 0 | | 6 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | TELEMETRY | 2 | | 139 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | TELEMETRY | 1 | | 259 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 1 | | 381 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 2 | | 6 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 1 | | 158 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 1 | | 28 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 2 | | 341 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 3 | | 128 |
| NA | RDN-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | SEASONAL | NA | MANUAL | 2 | | 19 |
| NA | RDN-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | SEASONAL | NA | MANUAL | 2 | | 6 |
| TOWN OF LADYSMITH | NA | GOV | PROPOSED | STAGE | CONTINUOUS | NA | 0 | ANNUAL | NA | NA | 0 | | 629 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | CONTINUOUS | NA | 0 | ANNUAL | NA | MANUAL | 1 | | 6 |
| CVRD | CVRD-DWWP | GOV | PROPOSED | DISCHARGE | DISCRETE | 1992 | 1992 | SEASONAL | DAILY | MANUAL | 3 | | 24 |

Table A5. Summary of Watershed order and Station type (FWA Watersheds Poly)

| Watershed order | Station type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | BC-Fed | % | Other Gov | % | Community | % | Total | Total FWA Watersheds | % monitored |
| **1** | 0 | 0% | 4 | 44% | 5 | 53% | **9** | 19624 | 0.05% |
| **2** | 1 | 11% | 4 | 44% | 4 | 42% | **9** | 27434 | 0.03% |
| **3** | 4 | 22% | 7 | 38% | 7 | 38% | **18** | 26298 | 0.07% |
| **4** | 5 | 31% | 6 | 37% | 5 | 30% | **16** | 22636 | 0.07% |
| **5** | 11 | 58% | 7 | 36% | 1 | 5% | **19** | 15760 | 0.12% |
| **6** | 11 | 85% | 2 | 14% | 0 | 0% | **13** | 8706 | 0.15% |
| **7** | 8 | 80% | 2 | 19% | 0 | 0% | **10** | 7420 | 0.13% |
| | | | | | | | **94** | **127878** | 0.07% |