

## The Development of a Hydrologic Cycle and Rating Curve For Beaver Creek

### 2023/24 Flow Monitoring Period

Report was prepared for Area A RDKB and Living Lakes Canada

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### Beaver Creek “Bubbles” Hydrology Station

(GPS coordinates 49.0687, -117.6024)

Located at the “Bubbles” rock canyon narrows about 300 m upstream from the Hwy 3b bridge near the mouth of the Beaver Creek and Columbia River.



## **Preamble**

The deliverables for this project were to (1) install a hydrology station to monitor water level, temperature and flow or discharge at the “Bubbles” location of lower Beaver Creek, (2) develop a seasonal Hydrograph illustrating high and low water level cycling and (3) develop a Rating Curve from flow measurements at different water levels. This hydrological information is important to water managers and planners, especially Area A RDKB, Montrose, Fruitvale and Provincial Parks, as the data can be used in the prediction of creek carrying capacity in terms of water abundance to water users and wildlife as well as minimum levels to sustain a healthy and productive ecosystem.

## **Why monitor water level and flow?**

A Hydrograph is useful to compare seasonal water level cycles. It tells us about the peak flows and ebbs through water level changes during the year. Our mountain streams can be flashy during major snow melt times in the Spring and during extreme precipitation events from thunderstorms. With the added complication of climate warming, this can manifest in either flooding, or extended periods of summer drought well into October.

Extreme weather events such as heavy rainfall can cause creeks to swell and overflow their banks leading to flooding; At the other end, extended periods of drought due to lack of rainfall can lead to limitations or restrictions of water use, problems in meeting urban waste discharge license limits, and affect ecosystem health and fish passage.

A Rating Curve, developed by measuring discharge (cubic meters per second) at that particular water level, is useful as one can estimate the discharge easily from from an observation of the water level indicated by a Staff Gauge or measuring stick at the hydrology station. High discharge levels can overwhelm culverted streams and cause flooding. Low discharge may affect urban water needs and stress riparian habitat.

## **Supportive Funds**

Grant funding was provided by Area A of RDKB for the restoration of older HOBO water level loggers used for part of the year. Area A RDKB also provided ReDi funds to support the install of the station and hydrology readings of 2023/24. Living Lakes Canada, through the LeRoi Foundation, supported the purchase of a new Solinst water level logger for the “Bubbles” station.

## **Results**

The location of the station was carefully selected to meet requirements that the logger and staff would be in deep enough water during lowest water times but not affected by the thunderous energy during spring freshet. The rock walls and rock bottom shelf were ideal for securing a Stillwell. The location is the furthest point upstream from the popular fishing and

swimming holes used by residents. However, people are curious and the old loggers were pulled out of the water several times. The location is also good for salt dilution flow measurements as it affords good mixing and a stable measurement point downstream from the rapids.

The following table documents the work visits made to the Beaver Creek Bubbles Hydrology Station in 2023/24. A HOBO U20 logger, attached to a 20 lb weight, was deployed on November 18 2023. Ten more visits were made to check on the status of logger and upload the data; 7 of those included flow measurements for discharge determinations.

Beaver Creek "Bubbles" Water Level Logger & Flow Log 2023/24

Date	WL Staff m	WL logger	Temp C	pH	Bkg Cond uS/cm	Q cms
18-Nov-23	0.58	0.71				
03-Feb-24	1.22	1.559				
30-Mar-24	1.34	1.64				
09-Apr-24	1.43	1.56			148	10.1
17-Apr-24	1.24	1.53			135	8.62
02-May-24	1.26	1.4	7.76		131	6.8
13-May-24	1.35	1.44			113	8.88
03-Jul-24	0.72	0.696	12.6	8.01	175	2.62
25-Jul-24	0.54	0.556	16.9		207	1.77
19-Aug-24	0.485	0.43			278	0.359
17-Sep-24	0.5	0.5				

The Table indicates observed water level from the crude hand held measurement stick (Staff), recorded water level from the pressure transducer HOBO U20 logger, temperature, pH and conductivity as well as discharge (Q) in cubic meters per second determined from flow measurements. Of worthy mention is that on September 17 2024, the Stillwell station was installed and water levels from Staff and logger should have better agreement. Additionally, a Solinst logger with bluetooth connectivity was deployed replacing the HOBO U20 loggers which were repurposed at the Beaver Creek Watershed station. This means that data can be off-loaded from the logger without moving it.

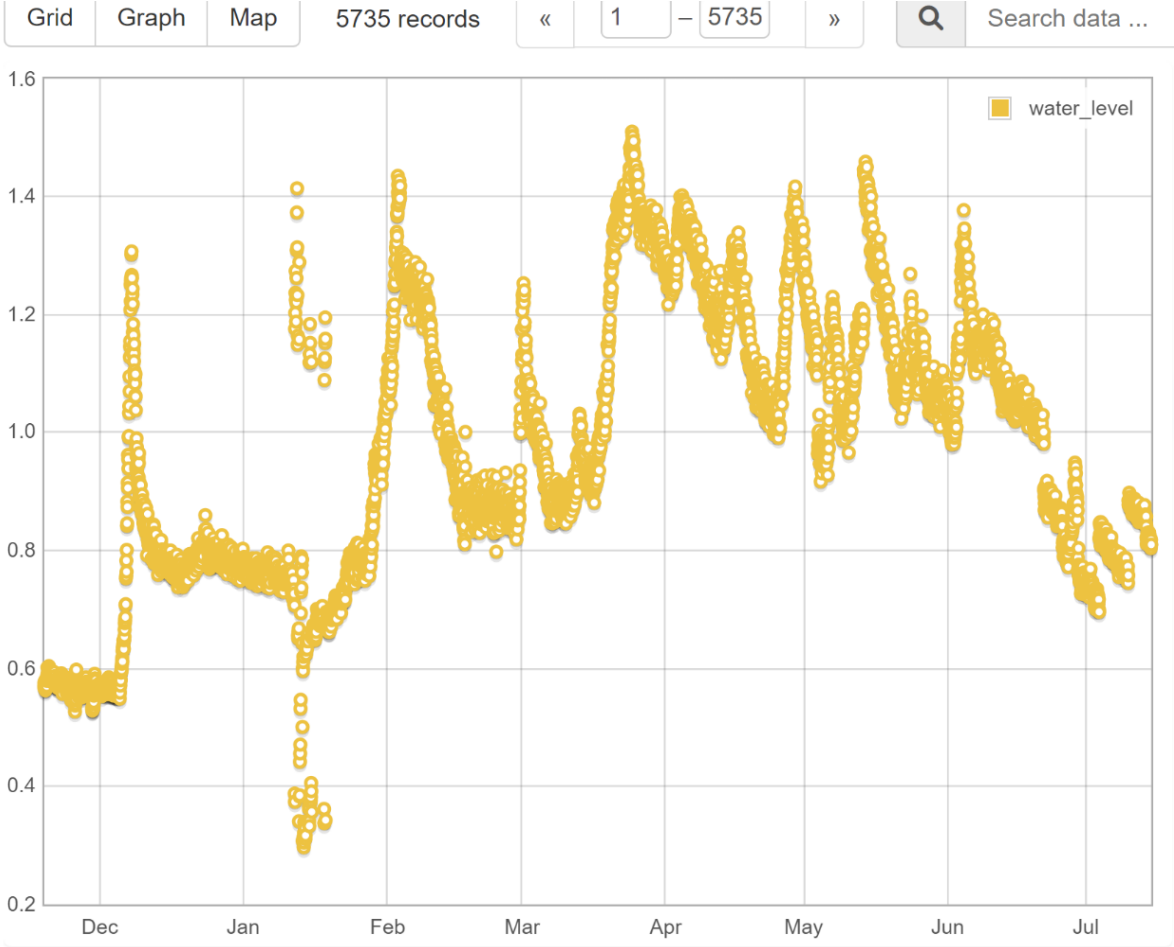
Seven flow measurements were taken during freshet through summer. High discharge levels of greater than 5 cms challenged the detectable limits of the salt dilution technique. Thunderous discharge levels of greater than 10 cms were measured in April and May. This is in agreement with what Water Survey Canada measured at this site between 1969 – 1978.



Rossland Streamkeepers gratefully acknowledge volunteers and the opportunity to apply their tools, techniques, monitoring equipment and software to the expansion of the hydrology network in the RDKB Area A region.

**Hydrograph**

The hydrograph for “Bubbles” capturing water levels between 18 November 2023 and 25 July 2024 is displayed below.

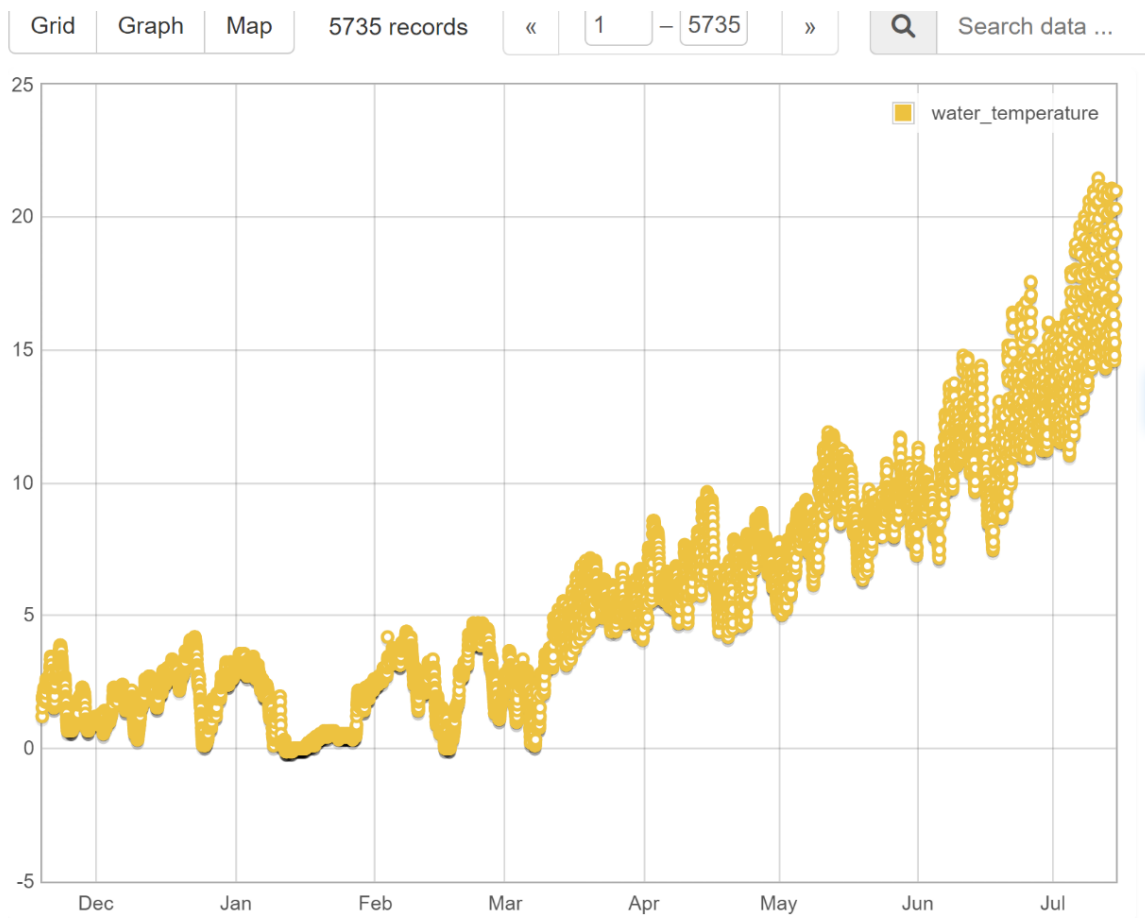


Two days of heavy rain on December 6 & 7 2023 caused flash flooding conditions which is generally seen in the Spring. Water levels jumped from 0.57 m to over 1.3 m on Dec 6 2023. A prolonged steady strong freshet occurred through the months of late March, April, May and June. A peak water level of 1.8 m was measured on March 22.

There were a few logger interruptions due to people interference. Several times the logger was found out of the water on the rocks. These disturbances occurred mid Jan, mid July and mid August. Data has been removed from the dataset.

Historical hydrological data is available for this site. Water Survey Canada performed periodic discharge measurements on stn#08NE106 between 1969 – 1978.

In conjunction with the water level data, the logger records water temperature. The graph below shows temperature over the same time frame as the water level hydrograph.



Coldest water temperatures of 0 C were recorded in January. Warmest water temperatures of over 20 C occur in mid July to mid August when the sun is the strongest and the flow is the lowest.

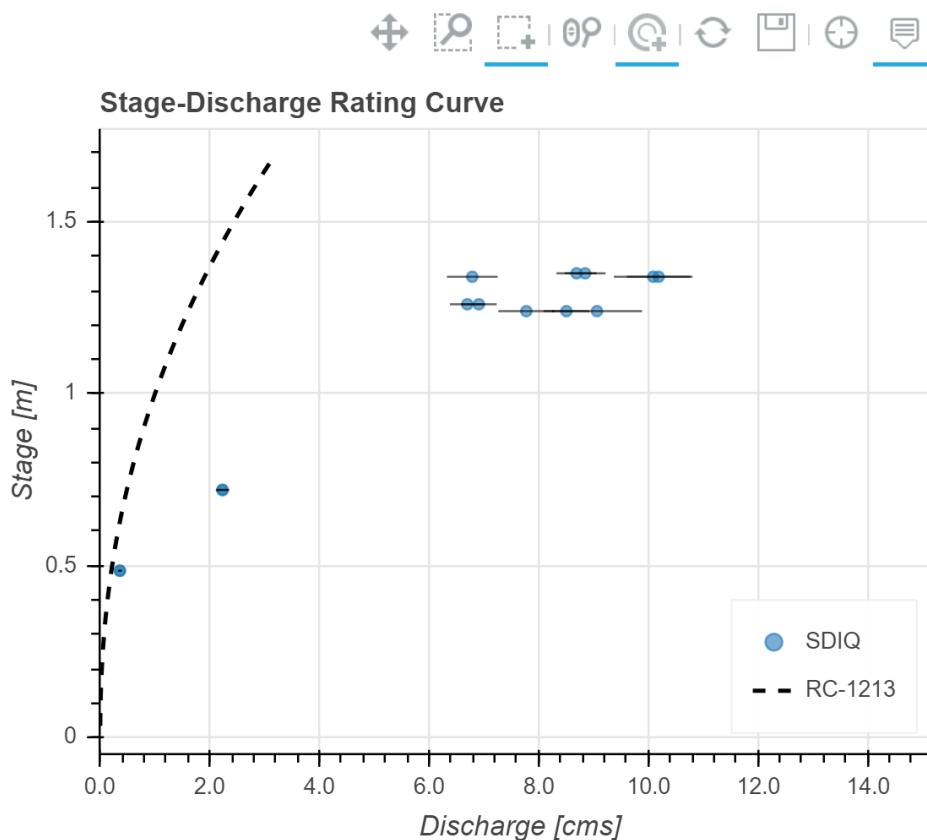


Beaver Creek hydrologic data is currently stored in the publically assessable Columbia Basin Water HUB database under the Rossland Streamkeepers organization. (see <https://data.cbwaterhub.ca/>). <https://data.cbwaterhub.ca/organization/rossland-streamkeepers> The HUB is managed by Living Lakes Canada.

### Stage - Rating Curve

Discharge was determined from salt dilution flow measurements using QQ Fathom Scientific technology at different water levels. The Rating Curve is a plot of water level against discharge. Water level can be observed from the Staff or taken from the logger WL records.

## Rating Curve



Although 7 flow measurements were made the curve needs more data to make it more reliable. What is note worthy is that discharge can vary between 0.3 cms in the late summer/fall to over 10 cms during spring freshet which is a factor of 33 times! Discharge can be estimated from the curve by simply noting the water level from the Staff gauge at the station. A water level peak of 1.8m on March 22 2024 equates to about 12 cms.

The Rating Curve requires annual verification. To ensure curve accuracy, more flow measurements will be taken in 2024/25 focusing on the middle of the curve between 0.7m and 1.2m which relates to early summer.

### **Beaver Creek Wetland**

(GPS coordinates 49.14668 N, -117.51795 W)

In order to study the flow dynamics of a watershed it is important to examine the water levels and flows through the system or at least at the outflow, middle and source. Beaver Creek Bubbles location has the outflow covered and Living Lakes Canada has a hydrology monitoring station on Kelly Creek. During times of climate warming it is important to monitor the water levels in wetlands as they support an abundance of wildlife.

Monitoring at a wetland location east of the Marsh Creek Campground started 17 September 2024. The retired HOBO U20L water level loggers from the Bubbles station were repurposed to the wetland station. A Staff gauge and logger was affixed to an old railway trestle (marker 152) over the Beaver “marsh” Creek. Data will be presented in next year’s hydrology report.



### **Workplan for 2024/25**

1. Maintain the hydrometric station by making necessary repairs to the Stillwell, removing debris or rocks at the well and staff gauge.
2. Record water level on the staff gauge and off-load logger data; Review data for accuracy. Upload data to Living Lakes Canada water HUB database.

3. Perform water flow measurements using salt dilution QQ methods especially in the Rating Curve gap - June to July. Verify the Rating Curve.
4. Perform a station record survey. Inquire with land surveyors if there is a BM nearby to determine absolute water elevation.