Community Flow Monitoring Network

Vancouver Island

FALL 2025 Network Meeting

November 28, 2025

10:00 AM - 12:00 PM

Via Zoom

Project funding and support provided by:

British Columbia | Ministry of Environment and Parks

Pacific Salmon Foundation

Regional District of Nanaimo

BC | BC Conservation & Biodiversity Awards

The McLean Foundation

British Columbia Community Gaming Grants

the partnership for water sustainability in bc

Agenda

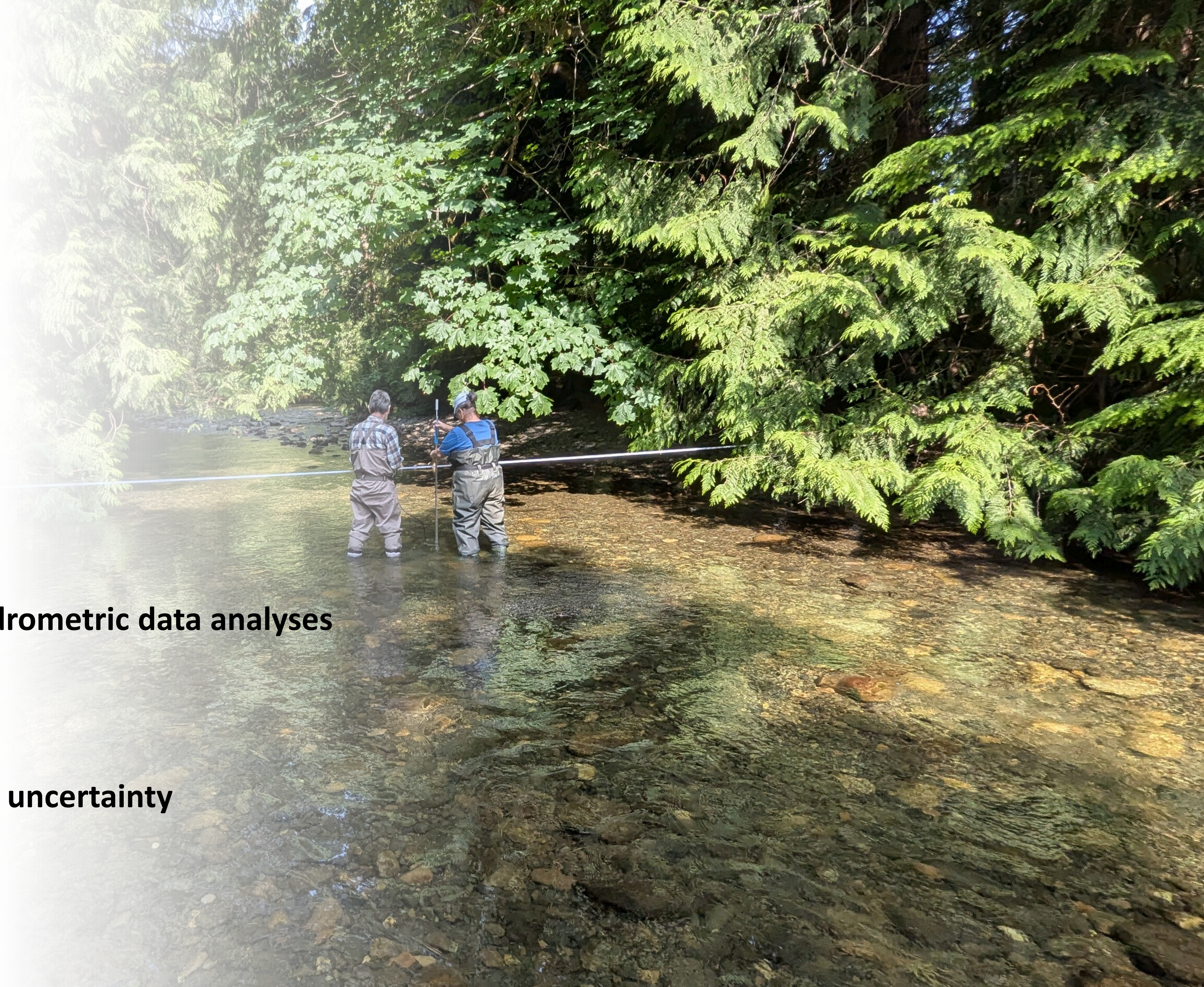
1) Brief program update

- 2025 Recap
  - New station
  - New equipment
  - Station info and reports
  - Measurements summary
- High flow safety
- Plans for 2026

2) Sarah Hardy - Examples of hydrometric data analyses

3) Question / Discussion Period

4) Sarah Hardy – Evaluating data uncertainty



Flo-Mo Network 2025

Community Flow Monitoring Network

Vancouver Island

BRITISH COLUMBIA CONSERVATION FOUNDATION

New station

Nanoose Creek near HWY 19 crossing – 08HB0010

Flo-Mo Network 2025 (so far)

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10 stations (9 continuing, 1 new)

103 site visits !!

310+ volunteer hours





2025 – What’s new

Community Flow Monitoring Network

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Direct read cables

Station handouts

3-year Summary Report

2025 – What's new

Community Flow Monitoring Network

Vancouver Island

BRITISH COLUMBIA CONSERVATION FOUNDATION

Direct read cables →

Station handouts

3-year Summary Technical Report

- **Installed at 3/10 stations**
- **Allow download without removing logger from housing**
- **Need Solinst cap**

2025 – What's new

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- Direct read cables
- **Station handouts** →
- 3-year Summary Report

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HYDROMETRIC STATION DESCRIPTION

Station #:	08HB0031	Operating Period:	annual
Station Name:	Beach Creek @ Hemsworth Road		
Date Established:	2020-07-23		
Operating Agency:	QBS	Contact:	S. Woroniak
Technician:	S. Woroniak	Region:	Qualicum Beach
Latitude (dec.):	49.349083	Longitude (dec.):	-124.43
Telemetry (Y/N):	N	Telemetry Type:	

Station Description and Purpose:
Monitoring stage-discharge for Beach Creek, small 2nd order tirbutary (not accurately represented in Freshwater Atlas: check Town of Qualicum Beach OCP (2018) for accurate stream & watershed description).

Location Description:
Site is located beneath the walking path connecting Hemsworth Rd and Village Way. Two parking options (off Village Way, or corner of Hemsworth & Chester).

Access Method:	Vehicle	Station Type:	S/D
Regulated (Y/N):		U/S Allocation:	

Parameters Collected (Y/N):

Water Temp	Y	Air Temp	N	Baro Pressure	N	Stage	Y

Reference Gauge Method:
Staff gauge mounted to culvert face (downstream side of culvert)

Measurement Sections and methods:
Perched culvert located ~ 30 m us culvert, great for bucket fills at low flow.
Tricky to find good cross section for transect. 20-30 m d/s culvert can work (mod- to high flows only) - watch for cutbanks and eddies. Straight shallow section ~150m d/s from culvert also works, but only at higher flows.

Control Description:
Highly mobile bed material on low-flow section control, avoid stepping here if possible. Issues with vegetation growing into control riffle from early spring to fall. Site prone to foot traffic/vandalism by kids

OHS/Other Considerations:
- QBSS does regular bucket fills in the summer and borrows a FT to do higher flows in winter
- walk down to gauge can be slippery when wet - grassy hill off of walking path (not flagged, small trail on northwest side of railing.)
- fish monitoring and water quality sampling occurs nearby

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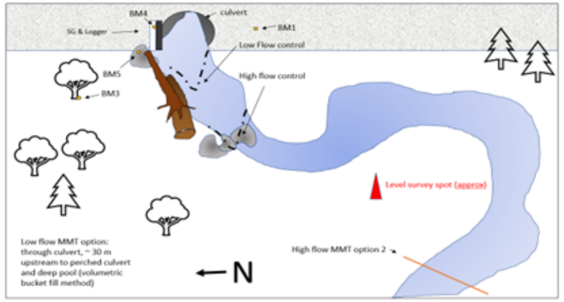
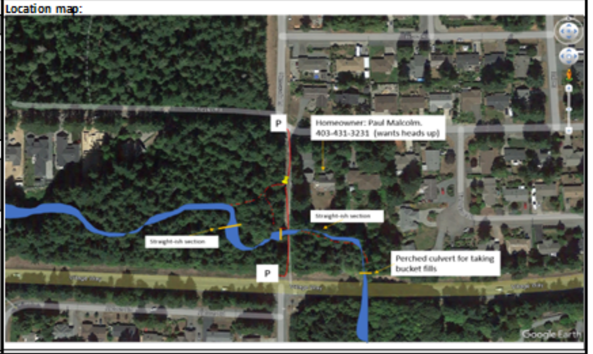
HYDROMETRIC SITE SKETCHES

Site Map of benchmarks and surrounding features:



Location map:



2025 – What's new

Community Flow Monitoring Network
Vancouver Island

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Direct read cables

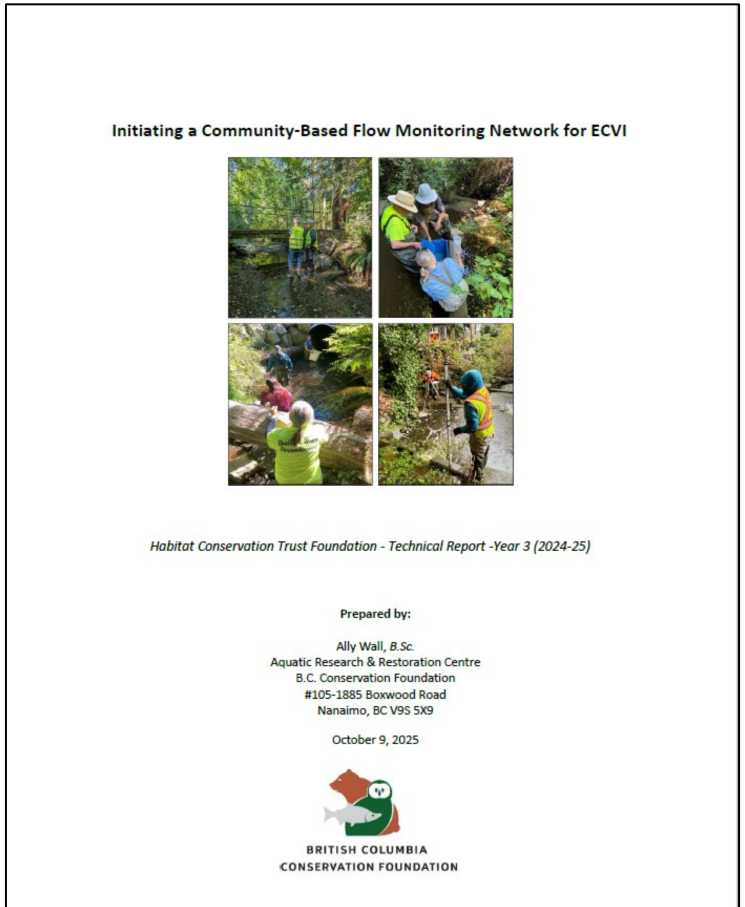
Station handouts

3-year Summary Report

Prepared for HCTF

Covers April 2022 – Mar 2025

Available on website under Resources tab



Initiating a Community-Based Flow Monitoring Network for ECVI

Habitat Conservation Trust Foundation - Technical Report -Year 3 (2024-25)

Prepared by:

Ally Wall, *B.Sc.*
Aquatic Research & Restoration Centre
B.C. Conservation Foundation
#105-1885 Boxwood Road
Nanaimo, BC V9S 5X9

October 9, 2025

BRITISH COLUMBIA CONSERVATION FOUNDATION

2025 Site Visit Summary

Community Flow Monitoring Network
Vancouver Island

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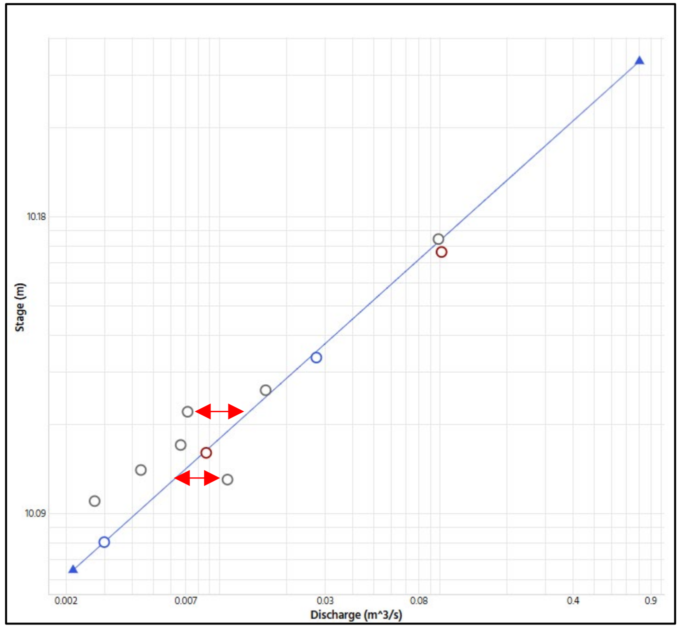
Station	# Site Visits			% Error		Uncertainty (%)	
	Stage-Discharge	Stage only	Total	Min	Max	Min	Max
Tsolum River	6/6	0	6	-0.66	8.40	±2.6	±4.0
Wilfred Creek	5/6	2	7	-10.95	-31.66	±4.1	±6.9
Cook Creek	6/6	0	6	0.53	69.22	±5.2	±24.3
Grandon Creek	4/6	19	23	-1.54	-17.77	±2.1	±9.9
Beach Creek	4/6	1	6	-20.74	89.19	±4.3	±11.8
Departure Creek	6/6	4	10	-2.19	64.27	±4.5	±9.5
Morrison Creek	7/6	0	7	-1.52	-34.91	±2.4	±6.4
Walley Creek	8/6	1	9	-3.18	75.07	±4.2	±19.2
Cottle Creek	11/6	15	26	1.05	-24.82	±2.3	±12.0
Nanoose Creek	2/6	1	3	-	-	±2.3	±8.0



High Flow Safety

2026 Spring Measurements

Community Flow Monitoring Network
Vancouver Island

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Often February – April is best time to measure

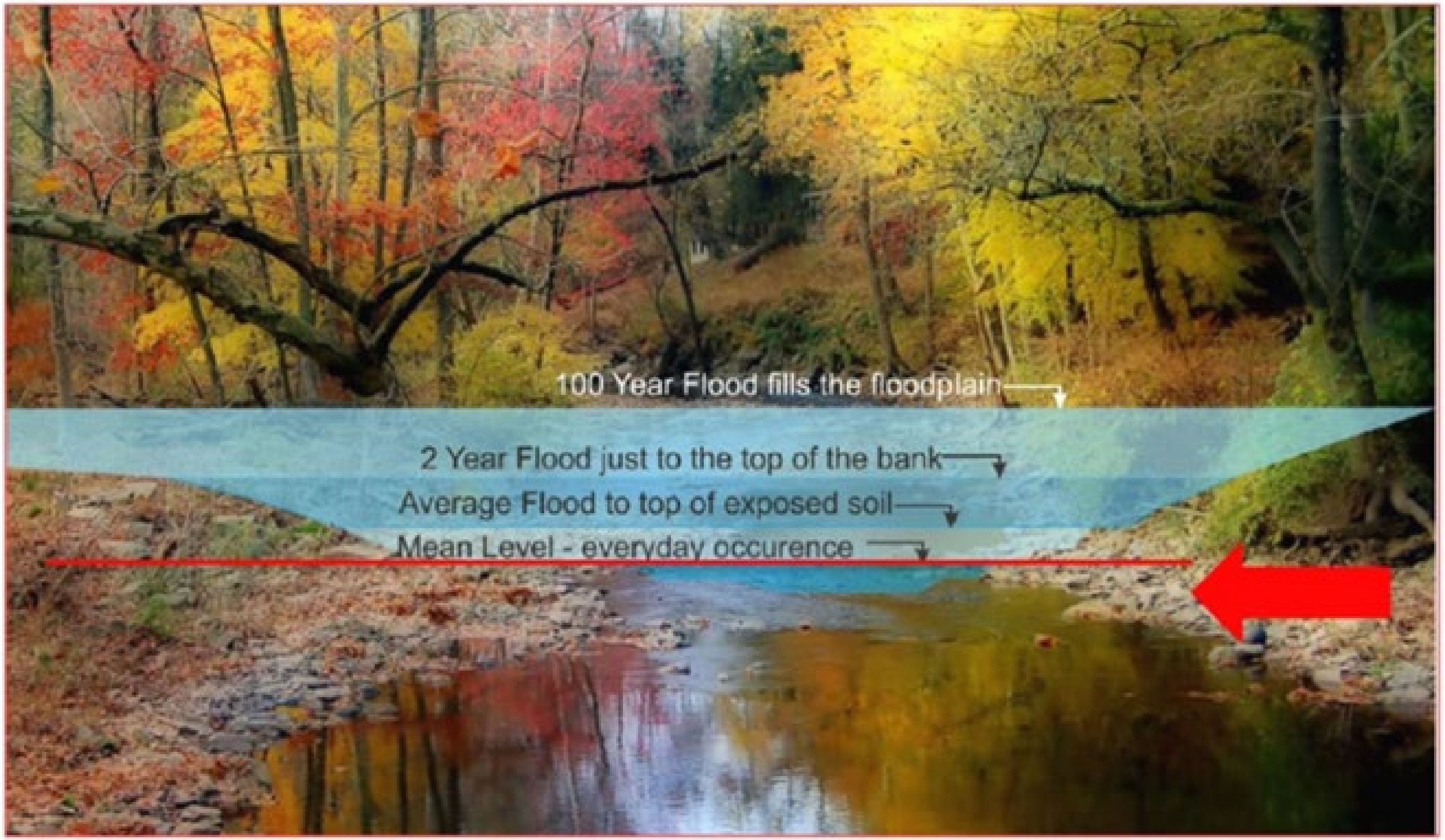
- Clear control

- Can observe many conditions (high, mid, low flow)

Flow Data Analysis and Interpretation

- What questions are you interested in answering with your flow data?
- What types of information would be most valuable to you and/or others who you wish to share data with (e.g., local government)?

  - How do we apply the flow data to answer our questions/objectives?
  - How can we link it to other information we have?
  - What methods of analysis are available? – e.g., %MAD, CEFT, FPST
  - What supports are available to help with analysis and interpretation?



Stream Water Levels - at various flow conditions

Basic Data Analysis

General Statistics

- Compare trends on a seasonal and annual basis over time
- Typically use long-term datasets ideally over 10 years

- Mean Annual Discharge (MAD)
- Mean Monthly Discharge (MMD)
- Extremes (instantaneous or average minimum and maximum)
- Percentiles
- Return period

General Statistics

- Compare trends on a seasonal and annual basis over time
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- **Mean Annual Discharge (MAD)**
- **Mean Monthly Discharge (MMD)**
- Extremes (instantaneous or average minimum and maximum)
- Percentiles
- Return period

- Averaging daily discharge values over year (MAD) or month (MMD)
- Drought modeling often reports current streamflow conditions as %MAD
  - Often related to biological habitat availability
  - Flows of >20%MAD for rearing fish (BC)

General Statistics

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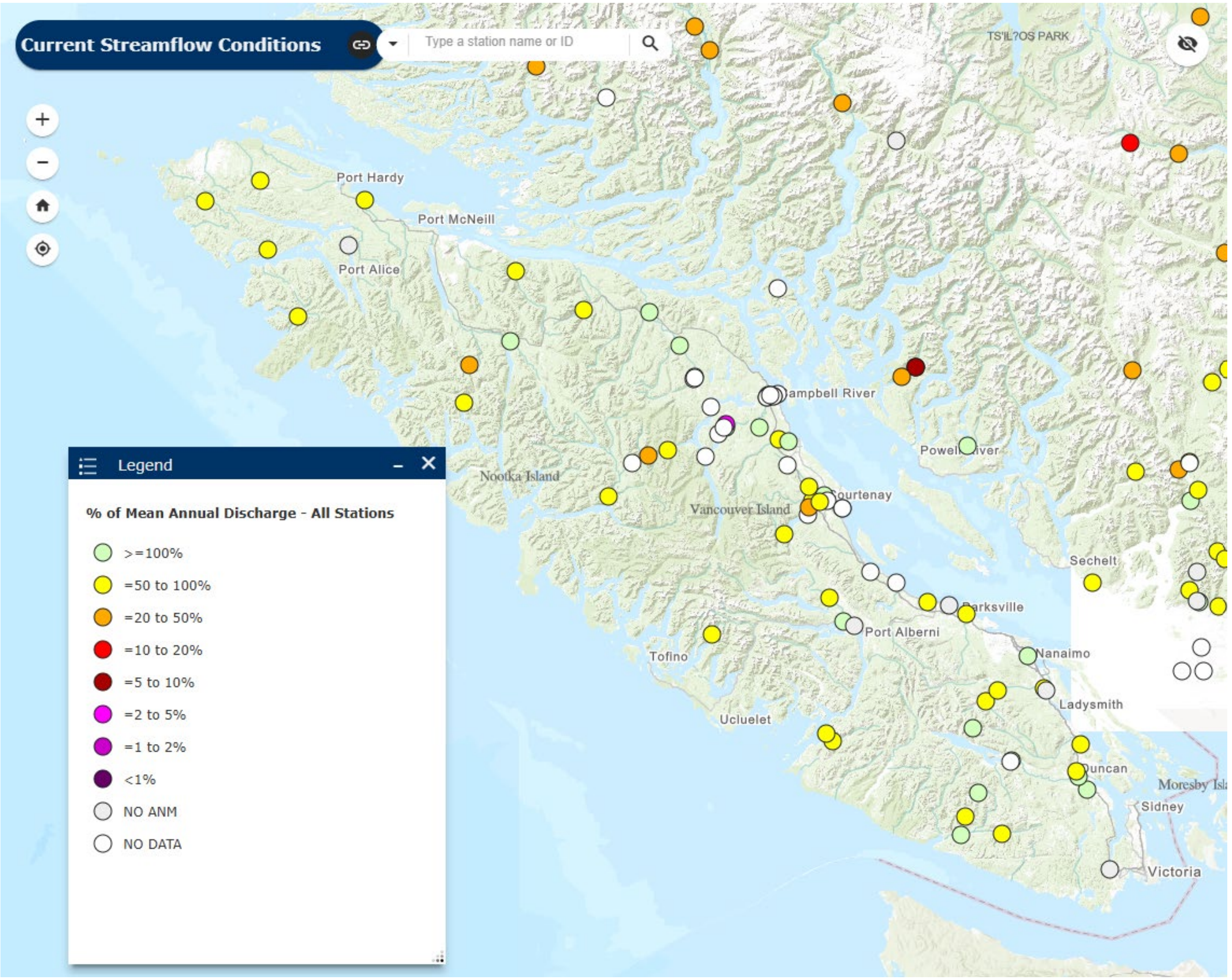

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- **Percentiles**
- Return period

- Statistical measure that indicates the value below which a given percentage of data in a group of data falls
- Water Survey Canada uses the following classes of percentiles to assess streamflow
  - > 75th percentile is considered above normal
  - 25th – 75th percentile is considered normal
  - < 25th percentile is considered below normal

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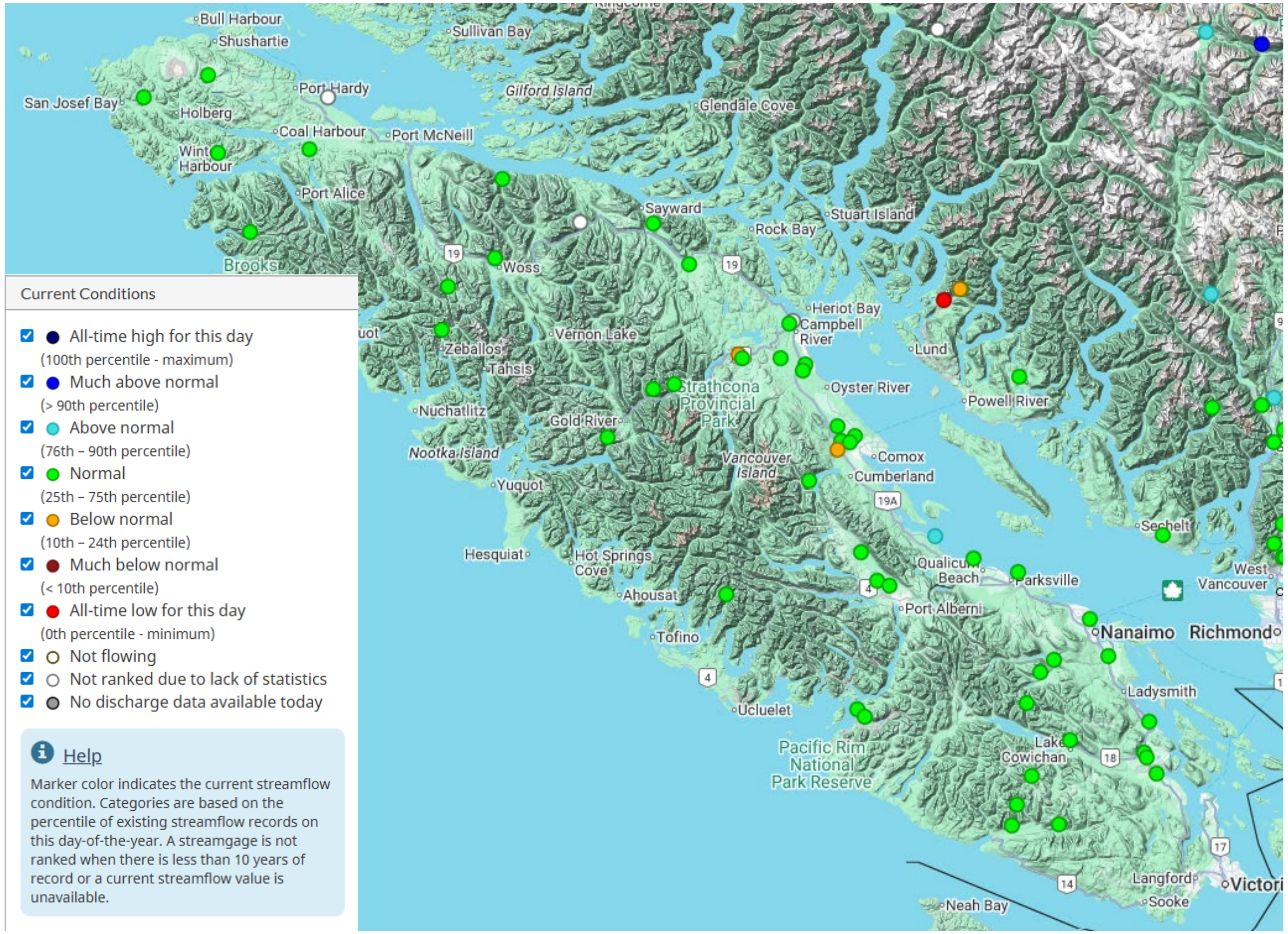

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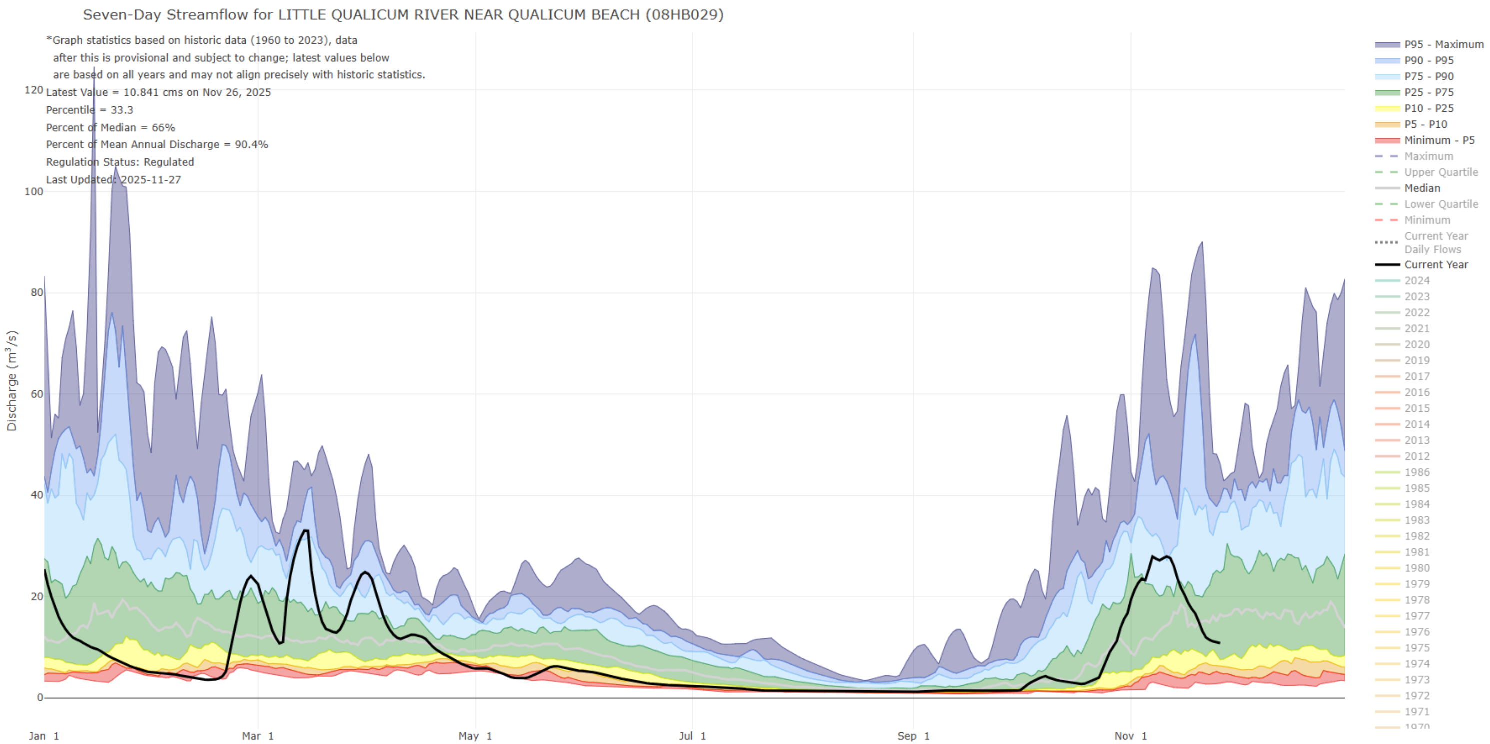

General Statistics

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- Extremes (instantaneous or average minimum and maximum)
- Percentiles
- **Return period**

- Return period or recurrence interval is the average length of time expected between two flows.
- Often used in flood forecasting and reflects the discharge rate associated with the probability of occurrence of the annual maximum discharge of the historical record.

General Statistics

- Compare trends on a seasonal and annual basis over time
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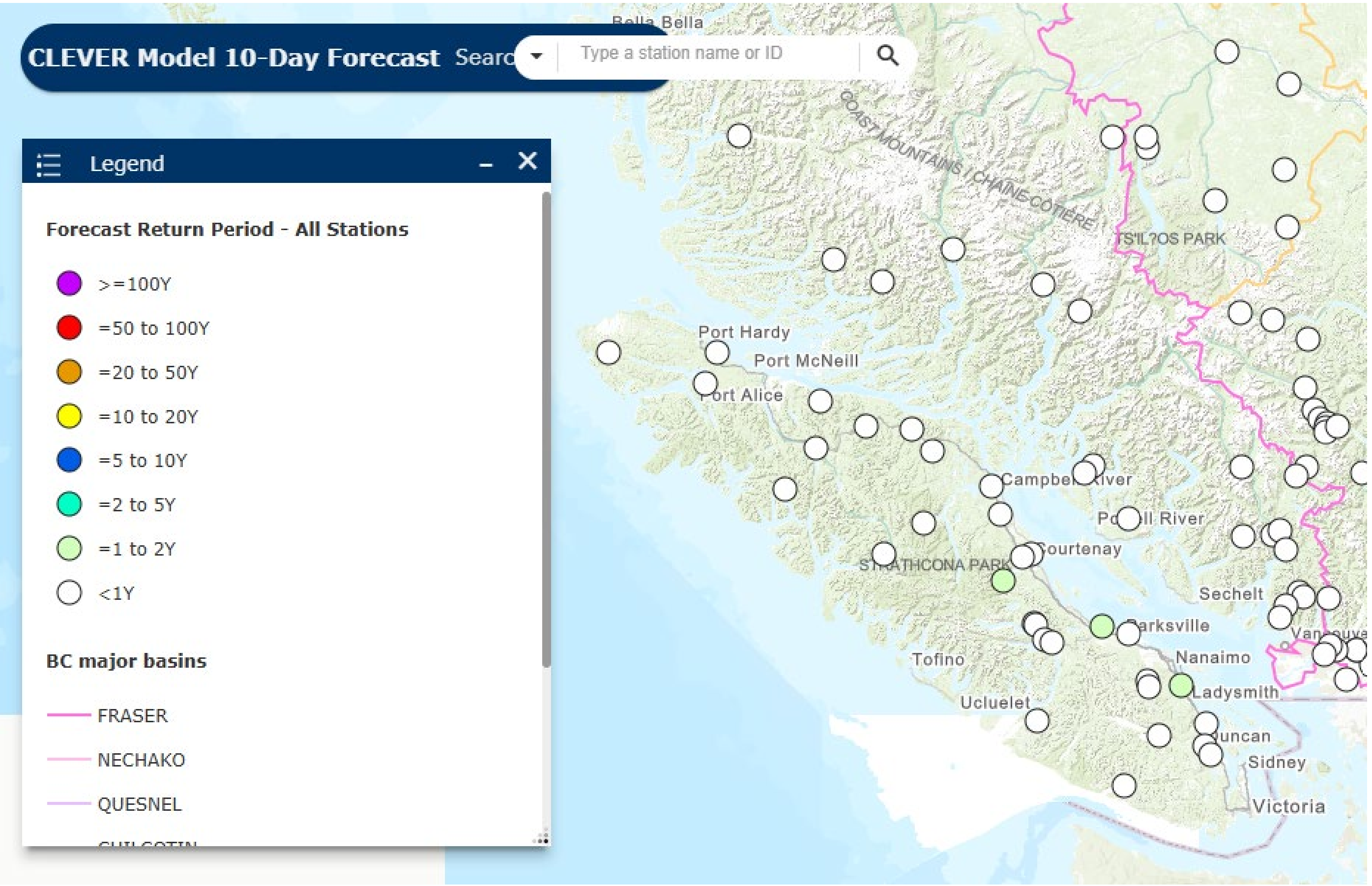
- **Return period**



Grandon Creek Analysis Example

- Data available from 2012 - present

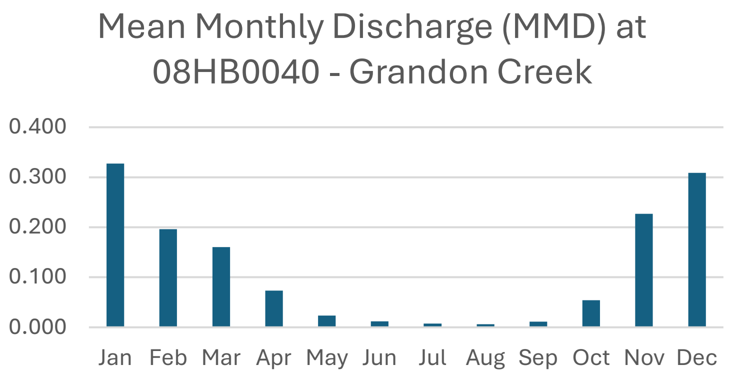


Table 1. Mean monthly discharge and mean annual discharge based on average daily values at Grandon Ck (08HB011).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012									0.0038	0.0462	0.169	0.325	
2013	0.144	0.0815	0.153	0.0353	0.0371	0.0257	0.0056	0.0062	0.0174	0.0236	0.0717	0.0365	**0.0531**
2014	0.168	0.306	0.437	0.1	0.0212	0.0148	0.0189	0.0155	0.0150	0.142	0.244	0.423	**0.158**
2015	0.205	0.355	0.123	0.0571	0.0125	0.0086	0.0045	0.0047	0.0116	0.0156	0.114	0.543	**0.12**
2016	0.34	0.323	0.372	0.027	0.0118	0.0112	0.0077	0.0039	0.0091	0.205	0.47	0.181	**0.163**
2017	0.166	0.367	0.2	0.203	0.032	0.0113	0.0084	0.0094	0.0184	0.0472	0.472	0.196	**0.142**
2018	0.725	0.207	0.0942	0.125	0.0187	0.0139	0.0083	0.0051	0.0210	0.0225	0.139	0.546	**0.161**
2019	0.375	0.106	0.0631	0.0585	0.0131	0.0073	0.0064	0.0064	0.0156	0.0192	0.0408	0.0925	**0.0671**
2020	0.67	0.328	0.0523	0.0396	0.0311	0.0126	0.0069	0.0035	0.0089	0.045	0.291	0.536	**0.169**
2021	0.442	0.0167	0.029	0.0273	0.0209	0.0142	0.0096	0.0037	0.0098	0.0505	0.501	0.395	**0.127**
2022	0.393	0.0748	0.101	0.144	0.0518	0.0148	0.0112	0.0036	0.0029	0.0040	0.0091	0.128	**0.0787**
2023	0.198	0.0626	0.103	0.0618	0.0156	0.0046	0.0021	0.0032	0.0053	0.0475	0.123	0.283	**0.0763**
2024	*0.3*	*0.123*	*0.117*	*0.0343*	*0.0161*	*0.0070*	*0.0034*	*0.0069*	*0.0054*	*0.04*	*0.303*	*0.328*	**0.107**
2025	*0.132*	*0.201*	*0.243*	*0.044*									
AVG (2013-2024)	**0.328**	**0.196**	**0.161**	**0.074**	**0.023**	**0.012**	**0.008**	**0.006**	**0.011**	**0.054**	**0.227**	**0.309**	**0.119**

Data Legend: RISC U | RISC C | *Italicized values are under review and subject to change*

Aug MMD = 5%MAD

Most recent years low Sep values

Most recent years below MAD

Last discharge mmt on 2025-10-02 was 0.0152 m^3/s = 12%MAD

Grandon Creek Analysis Example

Table 2. Instantaneous monthly and annual maximum values at Grandon Creek (08HB011)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012									0.00908	0.536	0.91	1.16	
2013	0.916	0.32	0.552	0.132	0.373	0.19	0.0149	0.102	0.449	0.122	0.495	0.0707	**0.916**
2014	1.74	1.47	1.62	0.286	0.156	0.0918	0.122	0.0849	0.0568	1.18	1.15	2.28	**2.28**
2015	0.894	1.77	0.62	0.286	0.0239	0.235	0.0651	0.0961	0.59	0.205	0.589	1.75	**1.77**
2016	2.25	1.16	1.94	0.0676	0.0468	0.259	0.107	0.0477	0.131	0.872	1.57	0.446	**2.25**
2017	1.36	2.45	0.476	0.71	0.103	0.133	0.0142	0.0276	0.166	0.726	2.49	0.801	**2.49**
2018	3.31	0.495	0.36	0.521	0.105	0.195	0.035	0.00987	0.315	0.203	1.09	1.97	**3.31**
2019	2.03	0.231	0.0988	0.237	0.0314	0.0989	0.0732	0.0574	0.162	0.211	0.421	0.621	**2.03**
2020	2.84	3.38	0.317	0.335	0.238	0.088	0.211	0.134	0.311	0.681	1.46	1.68	**3.38**
2021	2.55	0.0559	0.0608	0.0428	0.0448	0.0411	0.0183	0.031	0.138	0.262	2.93	1.02	**2.93**
2022	1.6	0.366	0.403	0.634	0.2	0.108	0.135	0.00528	0.00449	0.077	0.0672	1.2	**1.6**
2023	0.757	0.2	0.464	0.433	0.109	0.0936	0.0309	0.0593	0.165	0.5	0.804	1.35	**1.35**
2024	*0.919*	*0.525*	*0.268*	*0.112*	*0.205*	*0.0762*	*0.0383*	*0.42*	*0.0513*	*0.644*	*1.09*	*1.47*	**1.47**
2025	*0.562*	*1.49*	*1.45*	*0.162*									
MAX (Entire Period)	**3.31**	**3.38**	**1.94**	**0.71**	**0.373**	**0.259**	**0.211**	**0.42**	**0.59**	**1.18**	**2.93**	**2.28**	**3.38**
Data Legend	RISC U	RISC C	Italicized values are under review and subject to change										

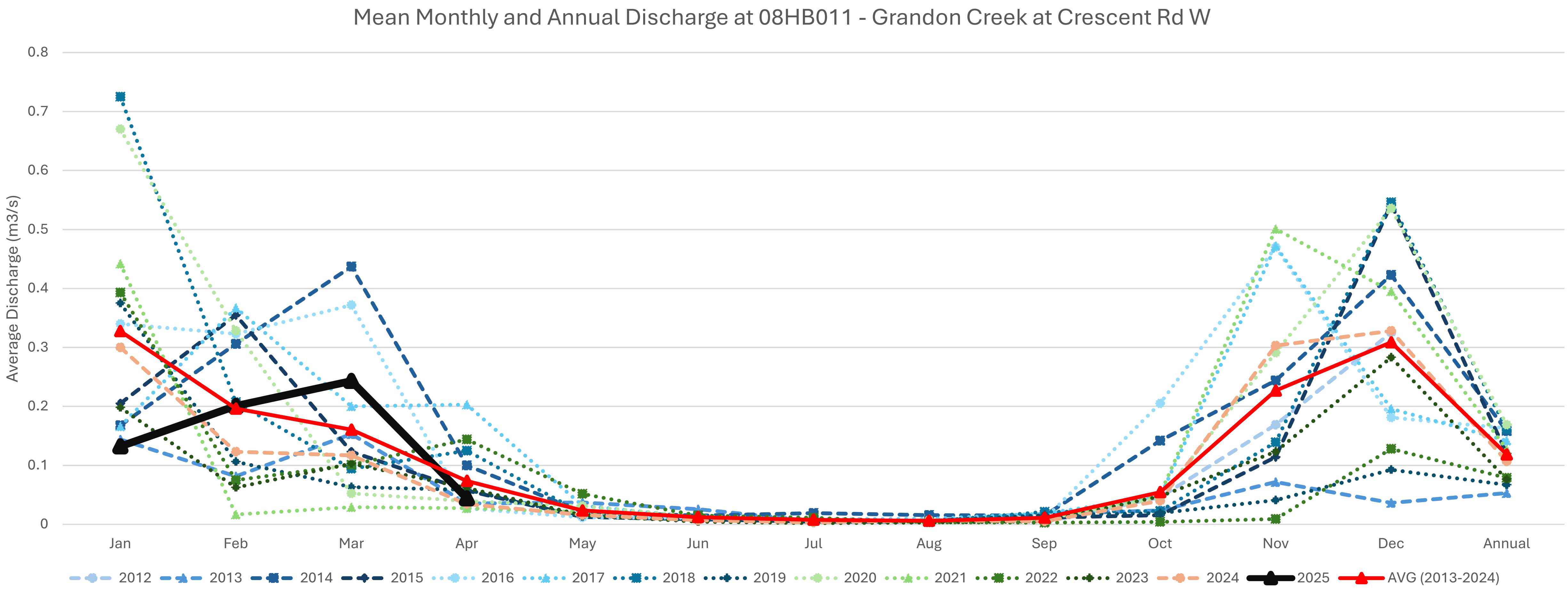
Table 3. Instantaneous monthly and annual minimum values at Grandon Creek (08HB011)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012									0.000125	0	0.024	0.0779	**0**
2013	0.0489	0.0394	0.0326	0.012	0.00647	0.0108	0.00236	0.000858	0.00269	0.0103	0.0124	0.0165	**0.000858**
2014	0.0378	0.0192	0.177	0.0277	0.012	0.00849	0.00874	0.00861	0.00719	0.00846	0.043	0.0602	**0.00719**
2015	0.0533	0.0549	0.0428	0.019	0.00773	0.00353	0.000495	0.00213	0.00206	0.00515	0.0167	0.0745	**0.000495**
2016	0.0807	0.118	0.0504	0.0127	0.00783	0.00518	0.00253	0.00111	0.00313	0.00514	0.126	0.0572	**0.00111**
2017	0.0305	0.0331	0.0806	0.0475	0.0107	0.00679	0.00557	0.00548	0.0121	0.0116	0.0178	0.0492	**0.00548**
2018	0.167	0.0869	0.034	0.0274	0.00942	0.00723	0.00442	0.00366	0.0038	0.00877	0.0209	0.0538	**0.00366**
2019	0.0737	0.042	0.0238	0.016	0.00687	0.00359	0.00328	0.00364	0.00421	0.0064	0.00685	0.0165	**0.00328**
2020	0.087	0.0562	0.0204	0.0117	0.00726	0.00379	0	0	0	0.0146	0.0348	0.166	**0**
2021	0.0224	0.000795	0.00327	0.0149	0.0123	0.00866	0.00388	0.00081	0	0.00221	0.067	0.132	**0**
2022	0.0614	0.024	0.0386	0.0443	0.0139	0.00507	0.00295	0.00239	0.00189	0.000894	0.00381	0.00585	**0.000894**
2023	0.0368	0.0248	0.0171	0.0154	0.00426	0.00179	0.000778	0.000978	0.00149	0.00209	0.0201	0.044	**0.000778**
2024	*0.0466*	*0.0495*	*0.0365*	*0.0112*	*0.00305*	*0.00268*	*0.000294*	*0.000513*	*0.00181*	*0.00383*	*0.0398*	*0.061*	**0.000294**
2025	*0.0281*	*0.0221*	*0.0757*	*0.013*									**0.013**
MIN (Entire Period)	**0.0224**	**0.000795**	**0.00327**	**0.0112**	**0.00305**	**0.00179**	**0**	**0**	**0**	**0**	**0.00381**	**0.00585**	**0**
Data Legend	RISC U	RISC C	Italicized values are under review and subject to change										

Almost all monthly max values observed in 2020 and earlier

Almost all monthly min values observed since 2020

Grandon Creek Analysis Example



Uncertainty Checks

Uncertainty Checks

- Look at field visits (frequency and range), dataset grades, and review documents for clues

- Describing uncertainty in datasets according to RISC grades

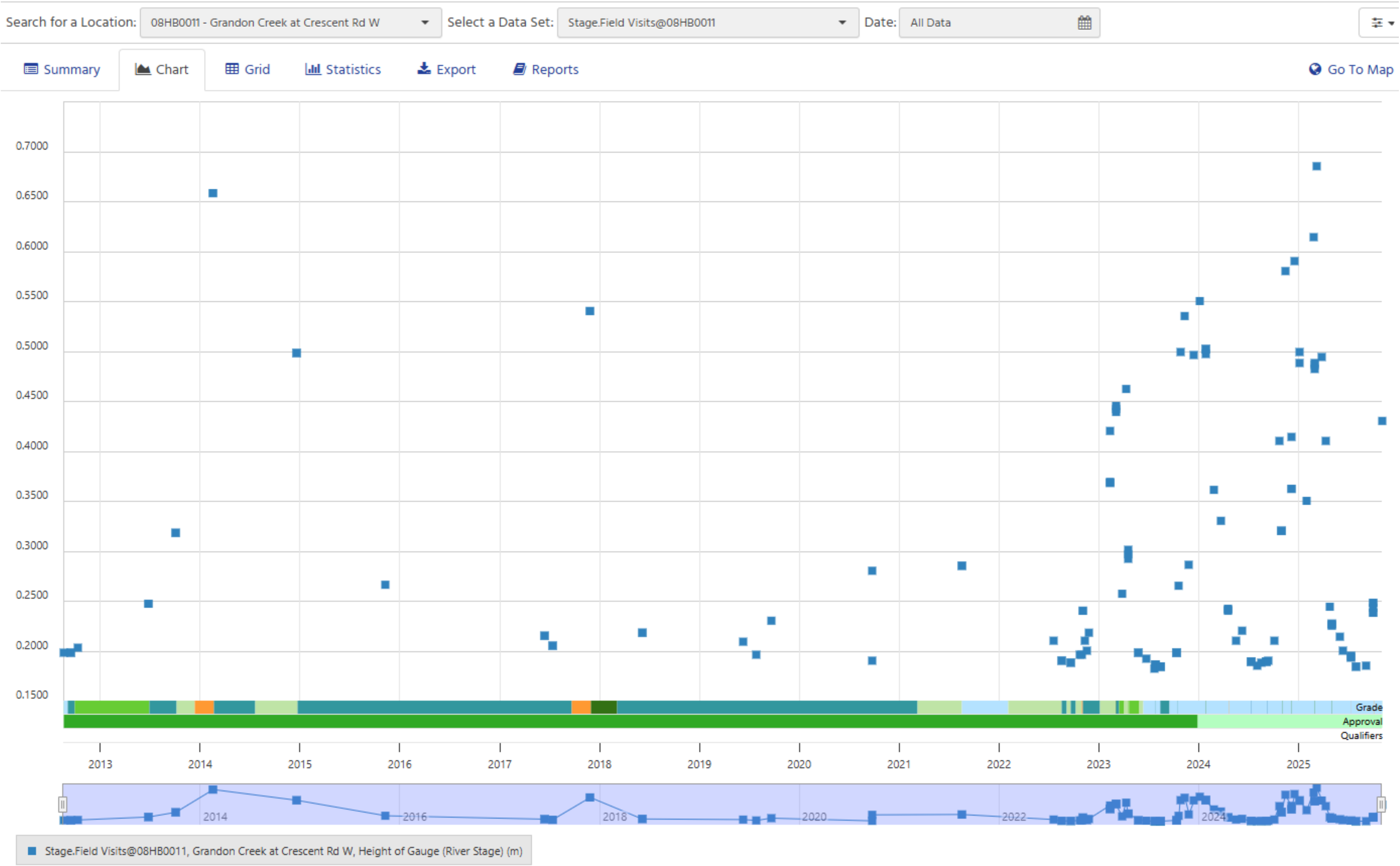
  - RISC C
    - 10mm accuracy for stage.working
    - 25% rating error for discharge.working

  - RISE E (estimated)
    - estimated data due to gap fill in discharge.working
    - rating curve extrapolation in discharge.working
      - Lower threshold:< ½ lowest measured discharge
      - Upper threshold: >2x highest measured discharge

  - RISC U (unknown)
    - typically due to unknown reference gauge stability

Grandon Creek Analysis Example

Uncertainty Check



Grandon Creek Analysis Example

Uncertainty Check

Station Analysis

Station Number	08HB0011
Station Name	Grandon Creek at Crescent Rd
Computational Period	2012-2022
Operating Agency and Contact Details	BCCF – Ally Badger (abadger@bccf.com)
Computational Lead	Ally Badger/Thea Rodgers
Data Approver	Jon Jeffery P.Ag – Ministry of Environment and Climate Change

Site Details

Telemetry (Y/N)	N	**Regulated (Y/N)**	N	**Continuous or Discrete**	Continuous	**Power Type:**	Internal battery
Purpose:	Installed by BCCF for regional community stream network.						

Equipment

Eg. Stage sensors and discharge meters

Device Make and Model	Unit Measured	Precision	Period Used	Logging Interval	Date of Last Calibration
Solinst Levellogger (assumed 1-5m)	m	±0.05% FS	2012-2022	Hourly	Unknown
Solinst Levellogger (assumed 1-5m)	˚C	± 0.05 ˚C	2012-2022	Hourly	Unknown
Barometric logger make/model Unknown	kPa	Unknown	2012-2022	Hourly	Unknown – data downloaded from Qualicum Beach Airport (ECCC – MSC)

Reference Gauge and Benchmark Stability

Number of benchmarks	0	**Number of Level Checks made in computational period**	None	**Reference Network Stable (Y/N)**	Unknown
Reference Gauge Used	Staff gauge	**Start to End Date**	2012-2022	**Correction Applied**	0.000m
Datum	Assumed: referenced from bottom of staff gauge				

No benchmarks were installed at this site for the period from 2012 to 2022. A staff gauge was installed during this time. The location of the staff gauge was in a concrete wingwall at the outlet of a culvert. It is assumed, with reasonable confidence, based on site observations that this reference gauge was stable during the period of operation.

It should be acknowledged that without a benchmark reference network to monitor the stability of the staff gauge there is no way of confirming the gauge correction nor the stability of the staff gauge during this period and therefore no ability to confirm water level sensor accuracy. As such, all stage data derived during this period is graded RISC-U (unknown) meaning all derived discharge data will be graded similarly.

Figure 1 - Photo of reference gauge used during operations from 2012 to 2022. Staff gauge is assumed to be stable and a gauge correction of 0.000m applied.

Factors Influencing Measurement of Stage

Site visits occurred sporadically from 2012 to 2021 due to operational challenges. Site visits tended to be during low flows in the summer. On average two annual visits occurred to download the logger.

During each visit the staff gauge would be read and, if safe, a discharge measurement taken using a Acoustic Doppler Velocimeter (Flowtracker 1 or 2) or the bucket fill method. The staff gauge reading was used to validate the water level sensor and was used as the mean gauge height for rating curve development and validation.

Stage record was overall of fair quality. The stage sensor is an unvented pressure transducer with full scale accuracy of approximately 2.5mm logging at hourly intervals. The barometric sensor type and accuracy is unknown but was assumed to be close to 5mm. Hourly barometric data from Qualicum Beach Airport (ECCC-MSC) approximately 6km away was used to compensate the stage data. Barometric data was converted from kPa to metres and the elevation difference between the barologger location and the hydrometric site was corrected for.
Factors affecting stage during 2012-2022:

- *Corrections were applied in the Aquarius Next Generation 23.3.248.0 timeseries software. Offset corrections to the assumed datum (bottom of staff gauge) were applied between download periods.*
- *Drift corrections were applied to account for any further inconsistencies noted between the reference gauge reading during field visits and the corrected offset stage reading. Drift corrections ranged from 0.024m to -0.024m during the computational period. Visit frequency was limited during some operational years and likely contributed to the magnitude of drift observed. Another contributing factor was a minor drift in the sensor location due to sediment accumulation in the stilling well. It is not possible to determine exactly when this accumulation occurred due to lack of field visits and maintenance activities at the gauge.*

Stage RISC Grades Applied

Start Date	End Date	RISC Grade	Reason
20120817	20230210	U	Reference gauge stability unverified

Factors Influencing Measurement of Discharge

Discharge measurements at this site are done using the velocity area method with Flowtracker 1 or Flowtracker 2 usually at a cross-section approximately 100m upstream in a nearby park. During storm events this cross-section likely misses some inflow from municipal drains.

Low flow discharge measurements are done using the volumetric bucket fill method with up to 10 trials repeated and averaged for volumetric flow. Bucket fill measurements are done at the outlet of the gauge pool where a confined and reliable pour point from the concrete weir exists.

Discrete Discharge Grade Applied

Number	Date	Discharge (m^3/s)	Method	RISC Grade
020	2022-08-17	0.003	Volumetric	BP
021	2022-09-19	<0.001	Volumetric	BP
022	2022-11-04	0.017	Volumetric	BP

Discharge measurements conducted between 2012 and 2021 were not used for rating curve development or for validation of the output discharge dataset. When assessed, these measurements plotted consistently to the left of the developed rating curve. Use of standard practices used during their collection could not be verified due to lack of meta data.

Stage-Discharge Curve

Curve No.	Start Date (YYYYMMDD)	End Date (YYYYMMDD)	Type of Control	Comments
1.00	20120817	20230210	Concrete Weir	Assumed stable

See Rating Development Document.

Computation of Discharge

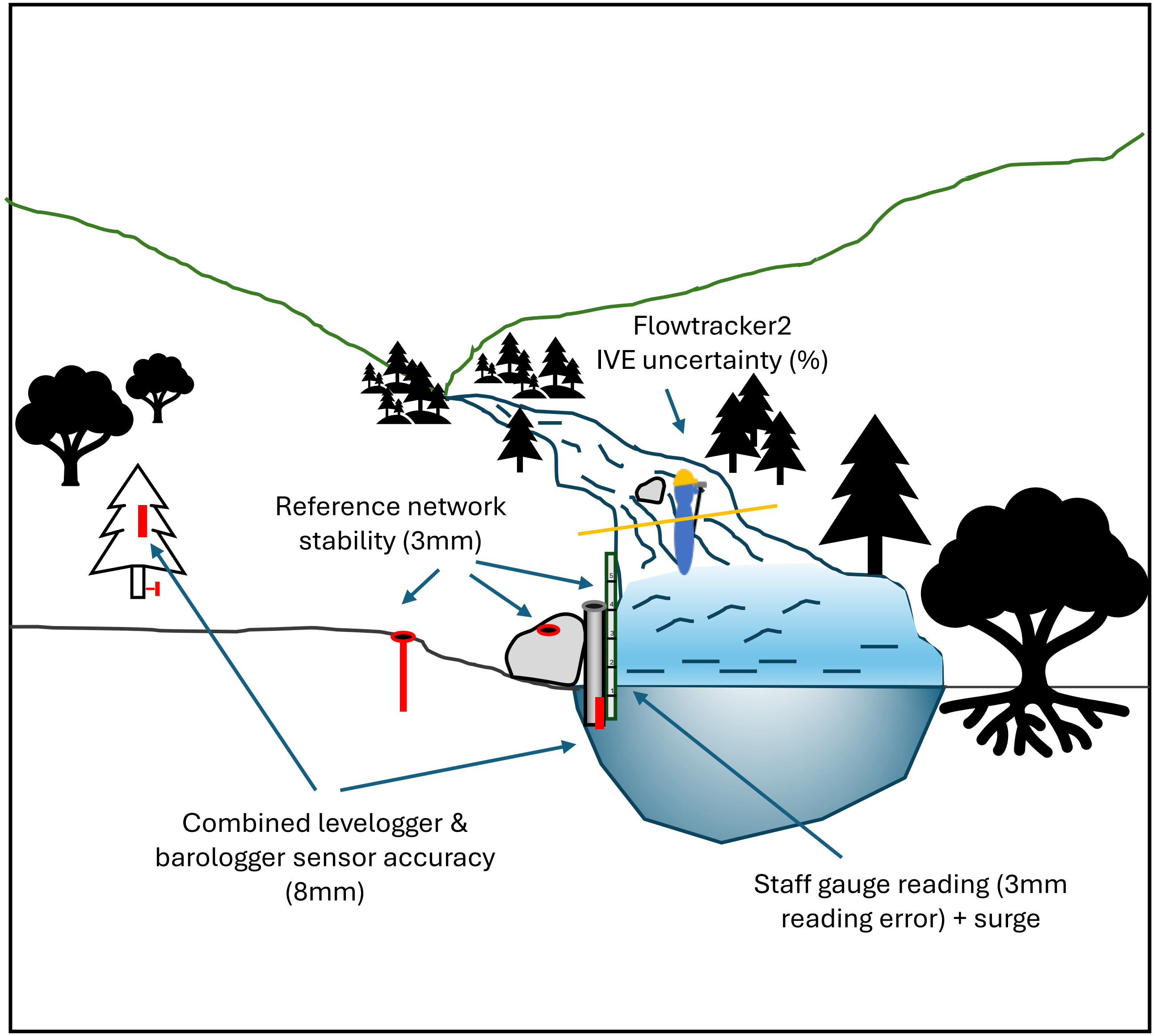
The control was assumed to be stable for the computational period. The output discharge dataset was left mostly unshifted for the 2012-2022 period due to the fact that there were not enough visits to apply shifts with confidence.

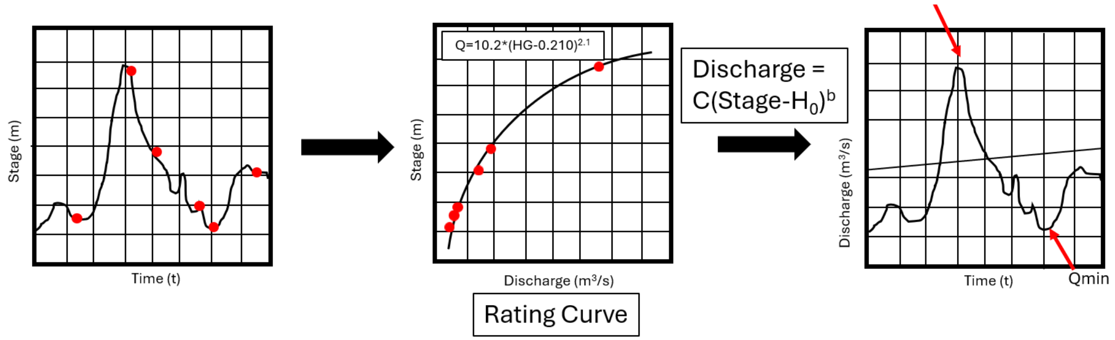
The most notable period that is qualified as suspect is for the 2021 operational year. This was due to debris that had accumulated at the outlet of the control. A single time based shift was applied for the 2021 operational year based on a visit on 2021-08-17. It is not known when this debris caught on the control nor when it was cleared. Based on stage trace, it appears that debris likely caught or was introduced to the control at the gauge pool outlet on 2021-02-04. This change in discharge roughly correlates to 60% of the shift observed on 2021-08-17. The next obvious stage increase caused by debris occurs on 2021-08-13 and accounts for the remaining 40% of the shift observed on 2021-08-17. It is not known when the debris cleared from the control. No obvious stage drops exist to suggest backwater clearing. Debris release was assumed to have occurred during high water later in 2021. The 2021-08-13 measurement shift was carried forward until 2021-10-16 when the stage at the control transitioned into the upper segment for the rest of the year. A time-based linear blend was applied to the peak on 2021-11-15 when the shift was assumed to return to zero. The 2021 period is still graded as U but is qualified as suspect based on the estimated application of shifts described above.

Discharge RISC Grades Applied

Start Date	End Date	RISC Grade	Reason
20120817	20221231	U	Input stage data is RISC U (unknown), hourly logging interval
20120817	20221231	E	Various days graded E (estimated) during gap fill. See missing data for summary

Uncertainty Everywhere!





Stage.Working

-reference network stability

-sensor accuracy

-staff gauge reading

-drift corrections

-offset corrections

-gauge corrections

Rating Curve

-mean gauge height

-discharge mmt IVE uncertainty (%)

-shift threshold

-control observations

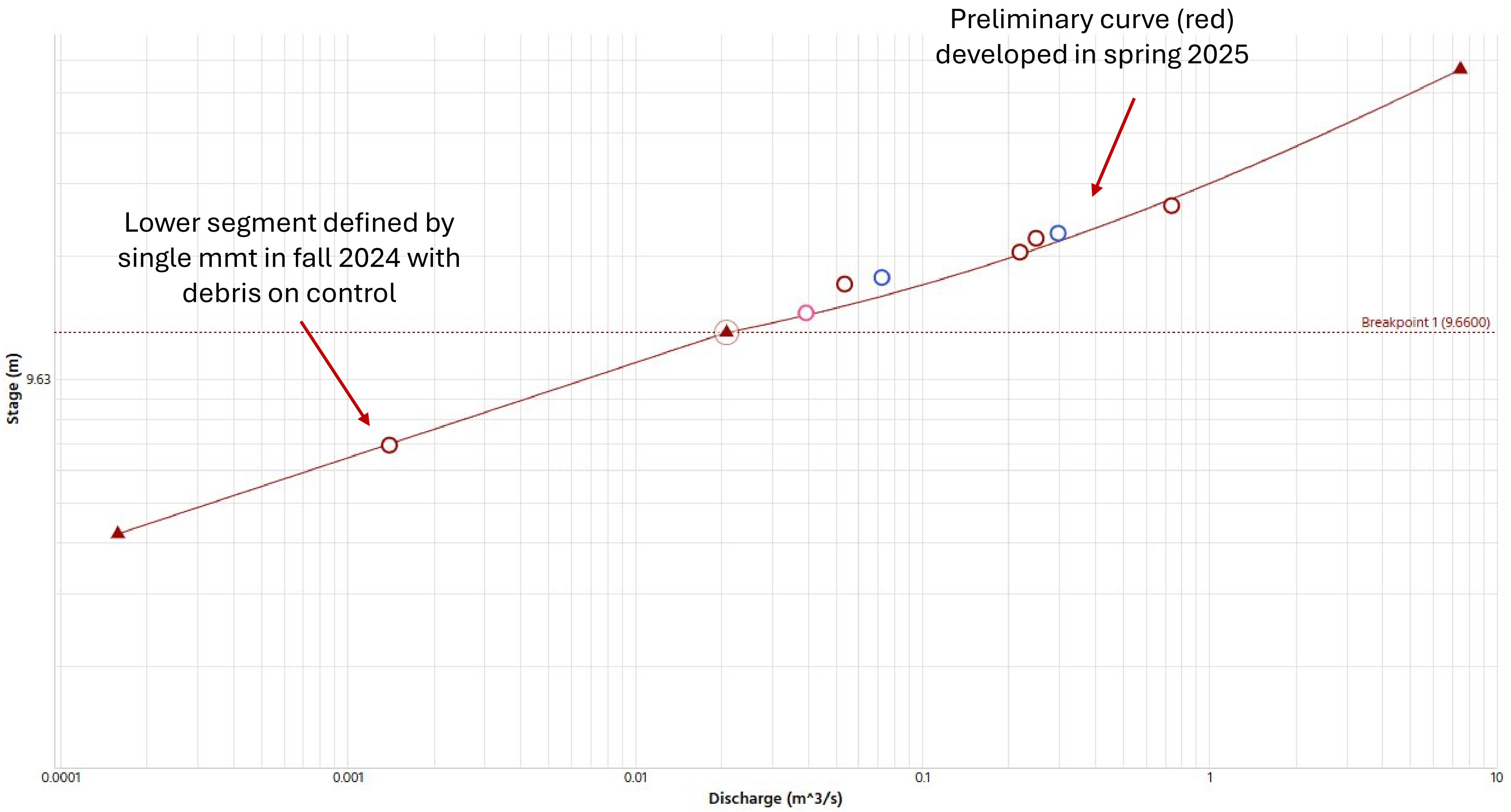
Discharge.Working

-input stage.working accuracy

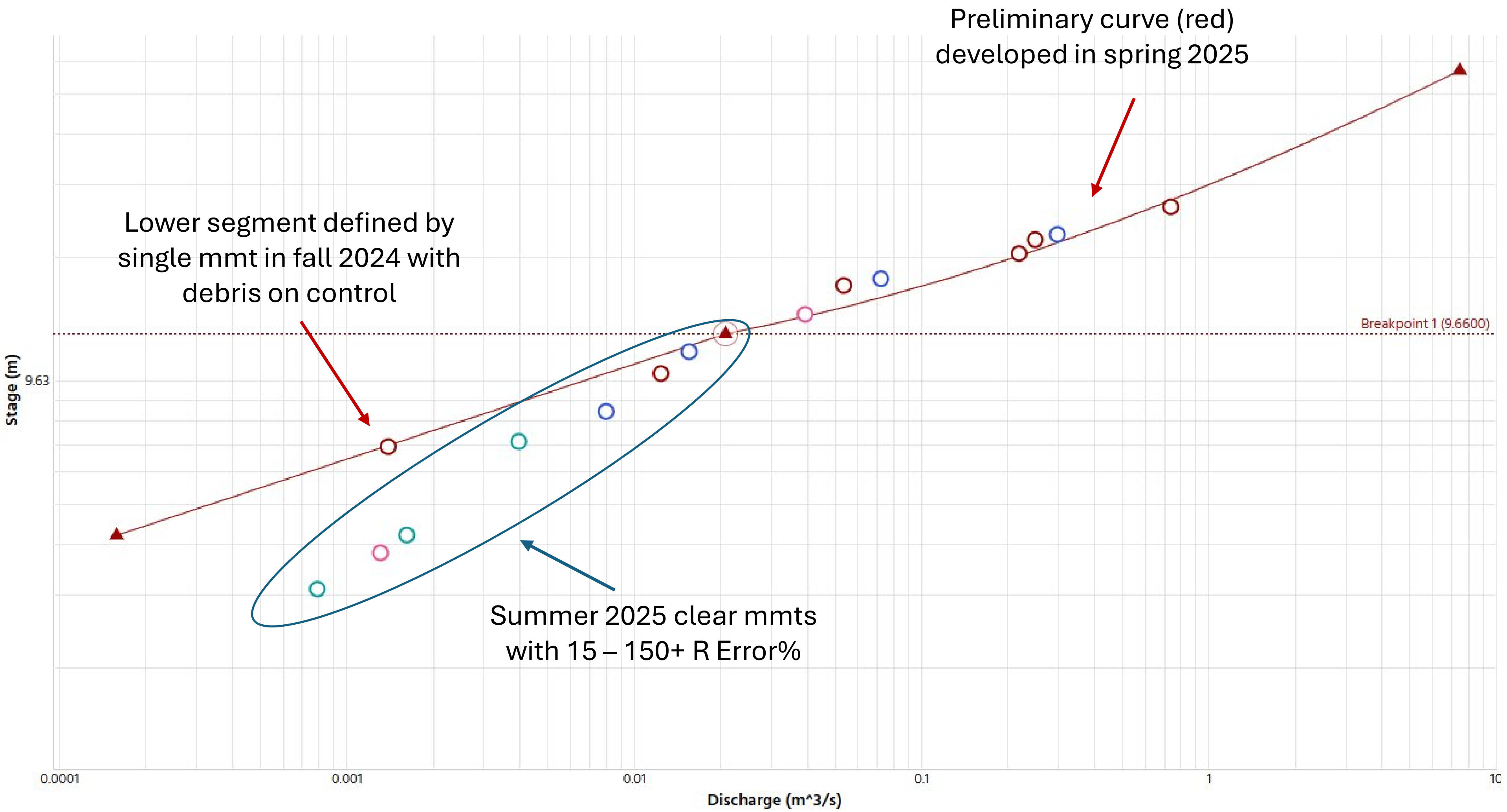
-discharge rating accuracy

-shift threshold

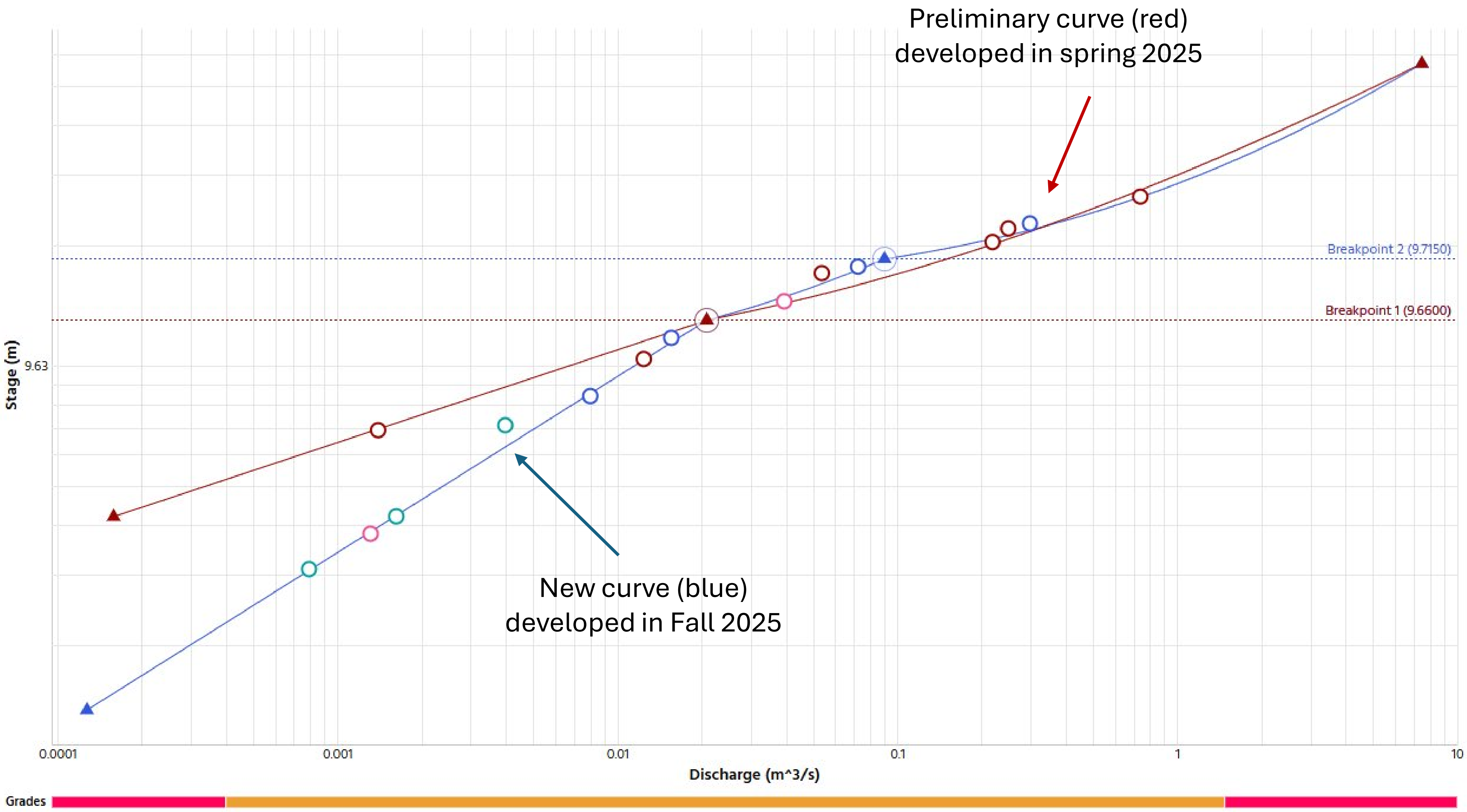
Cottle Creek Rating Curve Example



Cottle Creek Rating Curve Example

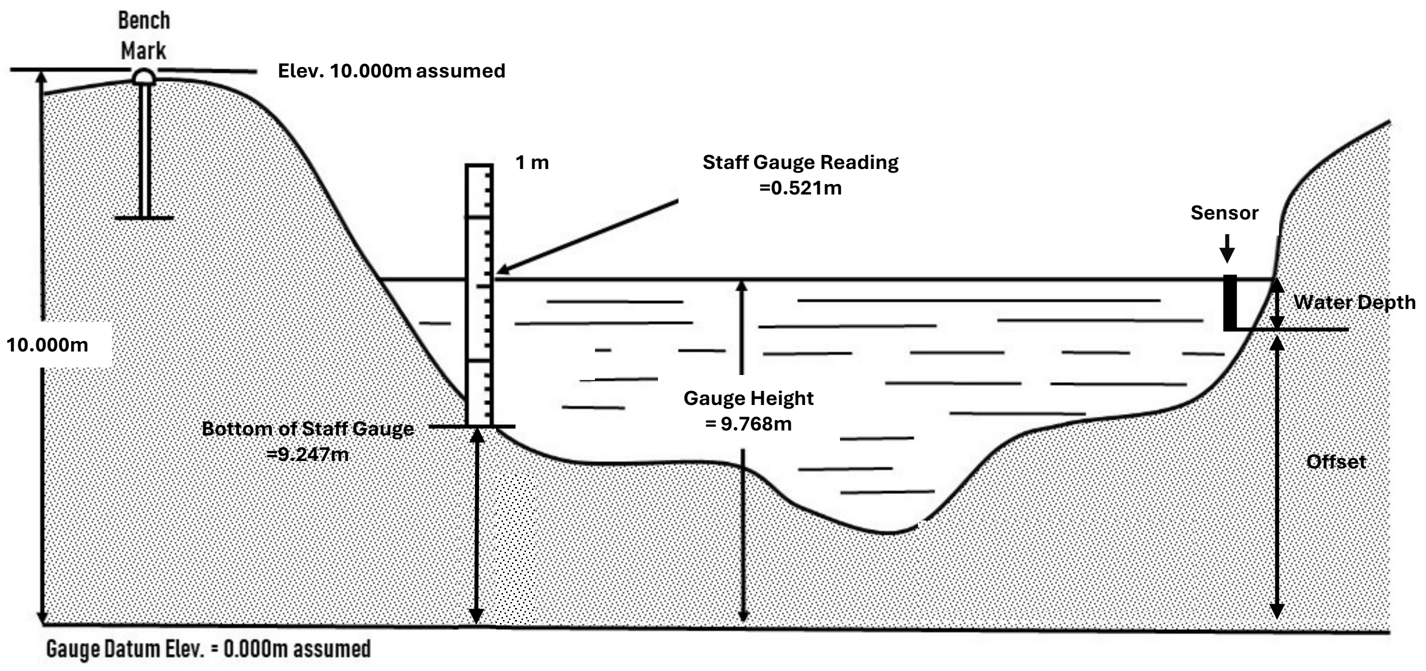


Cottle Creek Rating Curve Example



Converting to Local Assumed Datum

- The water level (i.e. the Gauge Height) is reported above a local assumed datum. An assumed datum is an arbitrary local coordinate system.
- The Gauge Height is equal to the Bottom of Staff Gauge elev. (9.247m) + Staff Gauge Reading (0.521m) = 9.768m



- The sensor measures water depth and is corrected to the water level (i.e. the Gauge Height) using an offset that is validated by Staff Gauge Readings.