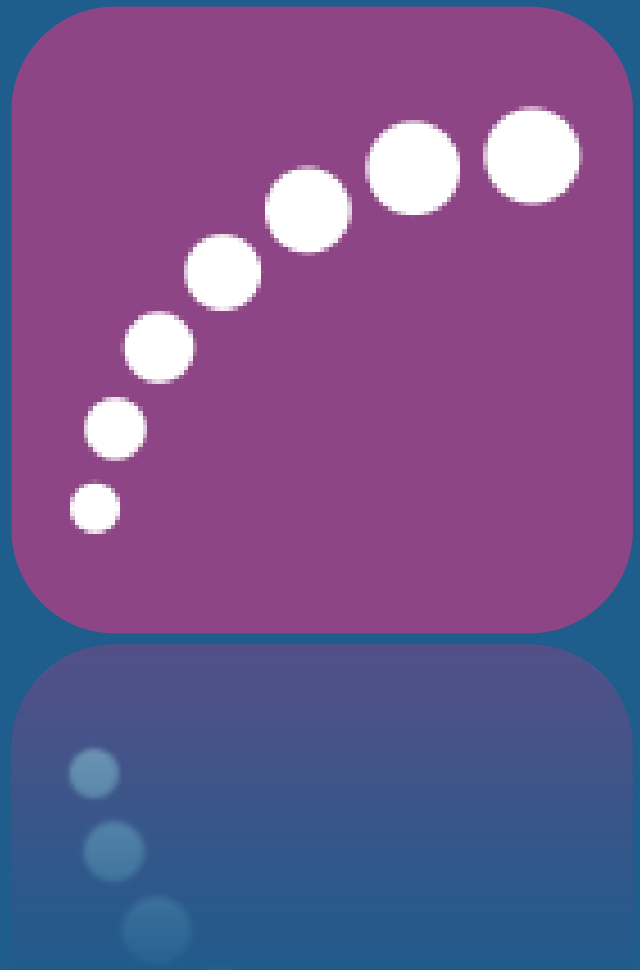
Rating Review Tool

What will I do with all this free time???

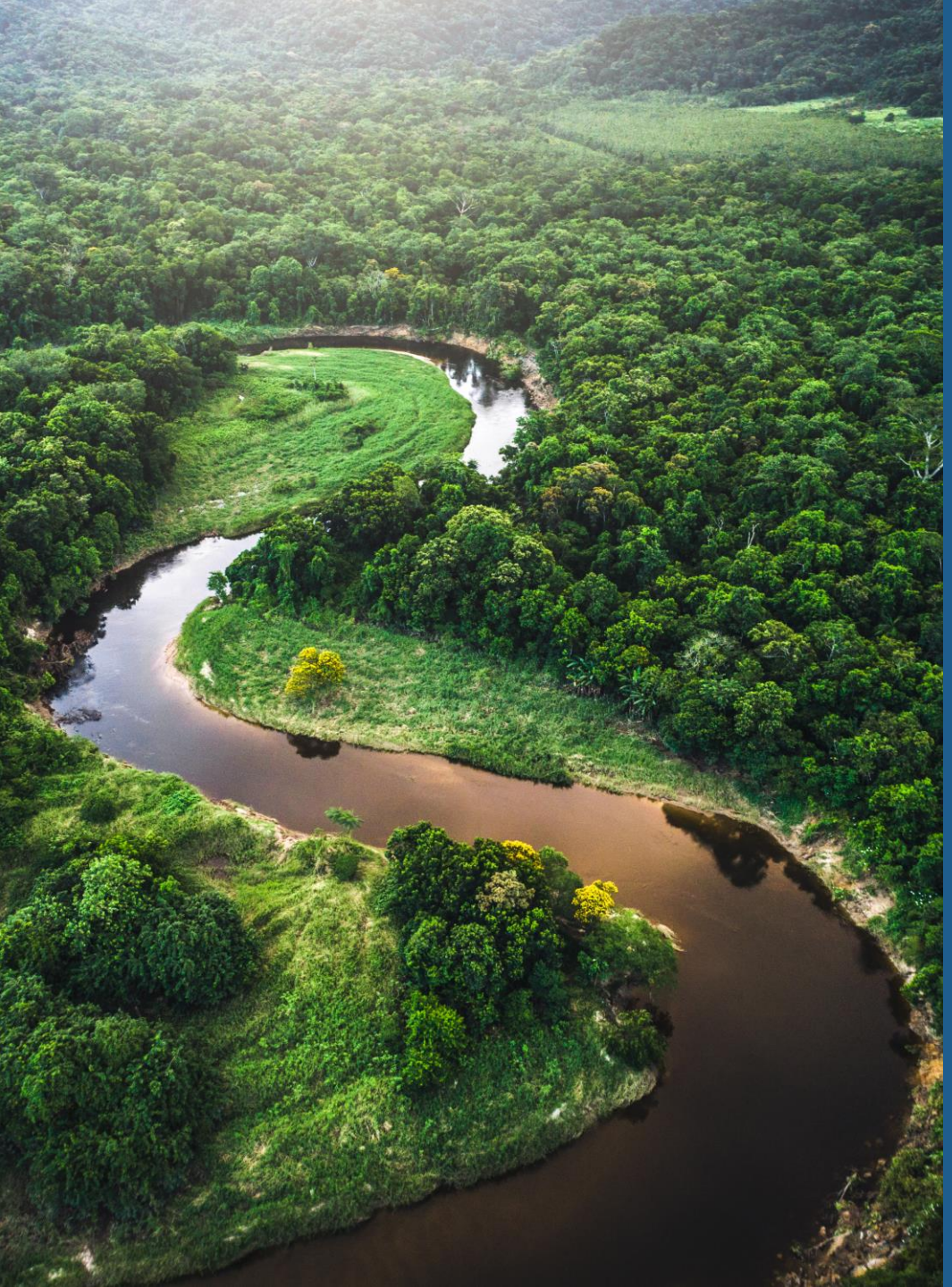


Grant Gilron, Education Specialist

USER POLL!

1. **What is your level of experience with Rating Curve Development?**
   (Between 0 and 10)

2. **Who uses the Rating Review Tool?**
   (show of hands)



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- A brief tour of the user interface
- How easy is it to create a shift?
- What have we added in the past ~year?
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  - Descriptive Equations now supported!
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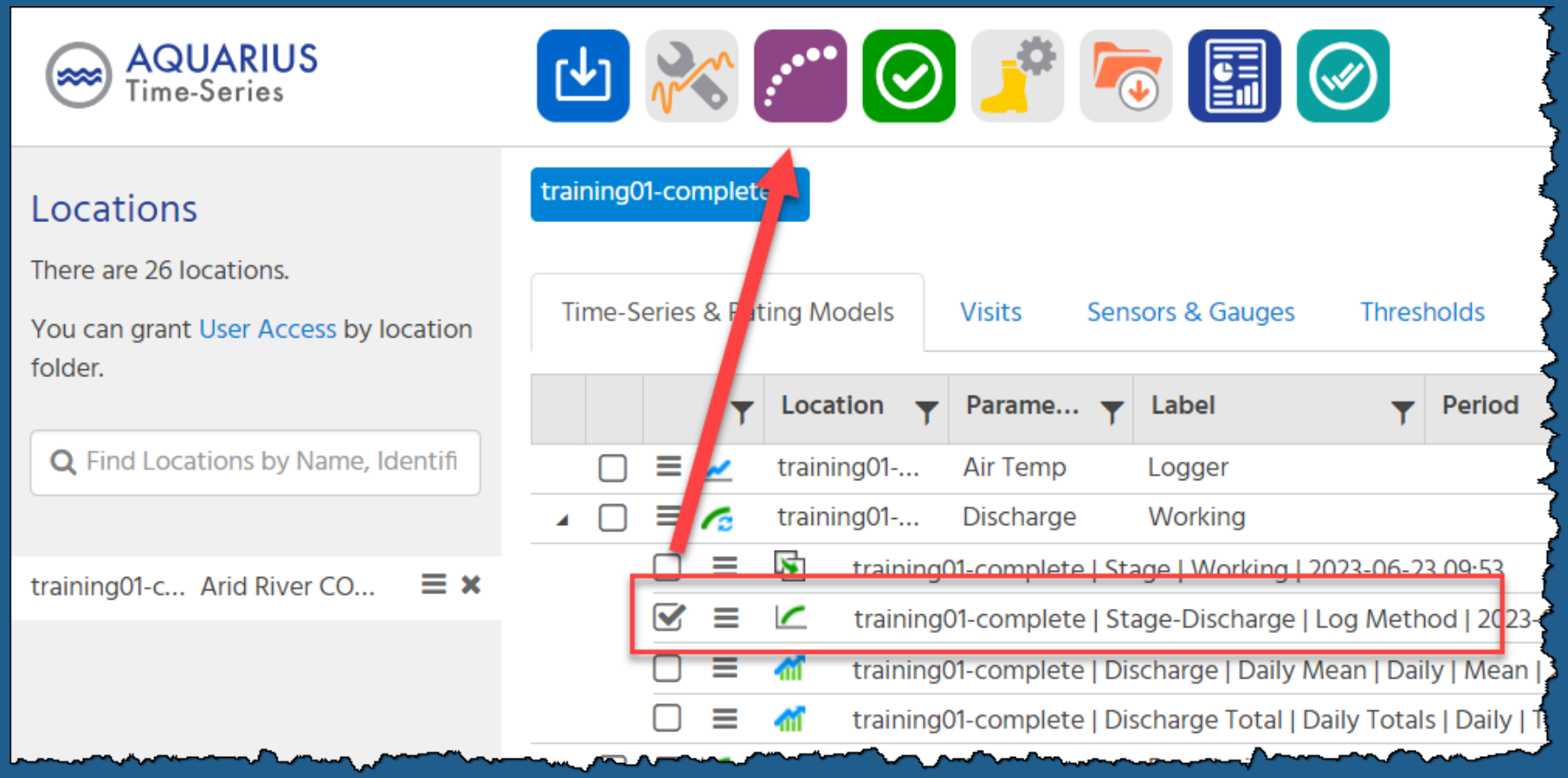
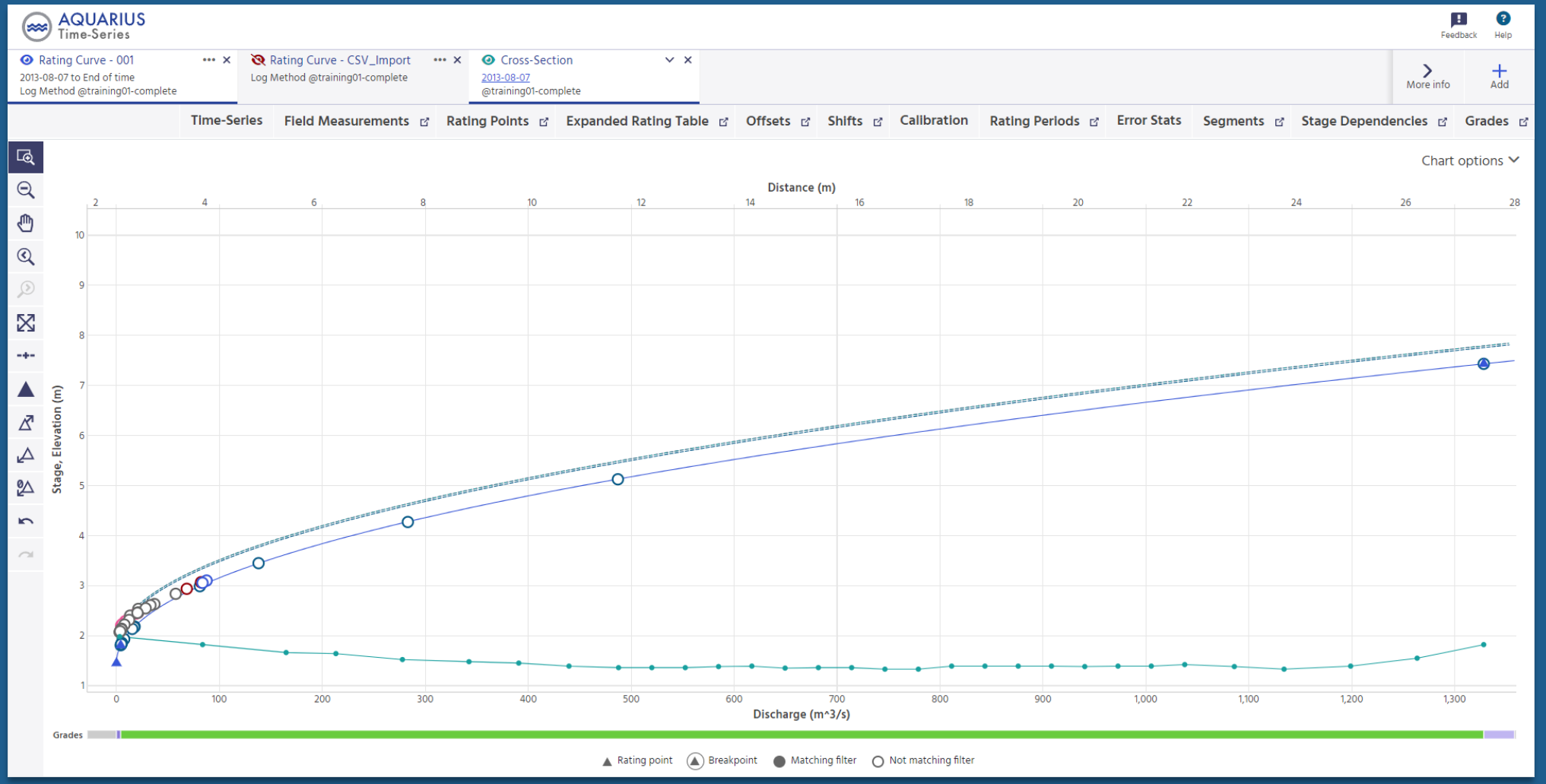
User Interface Tour

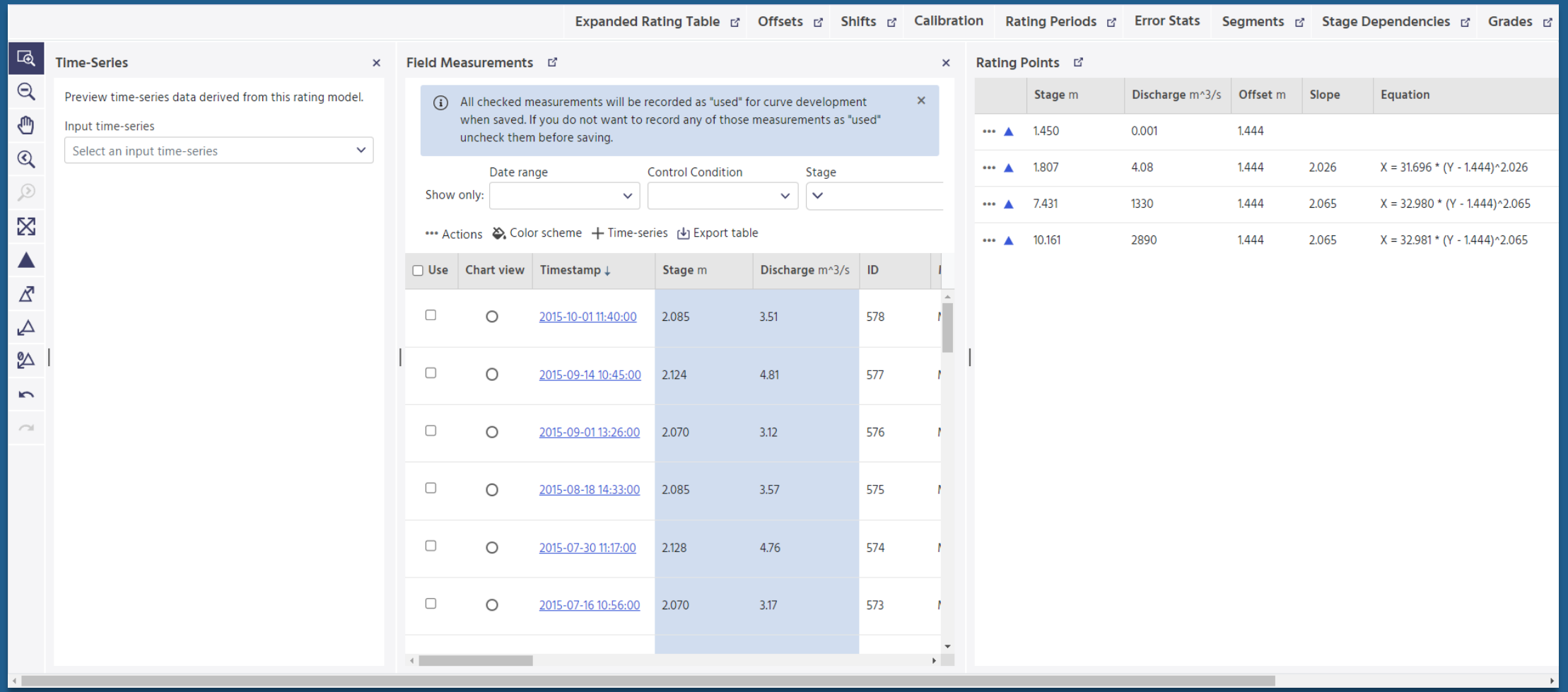
- From Springboard



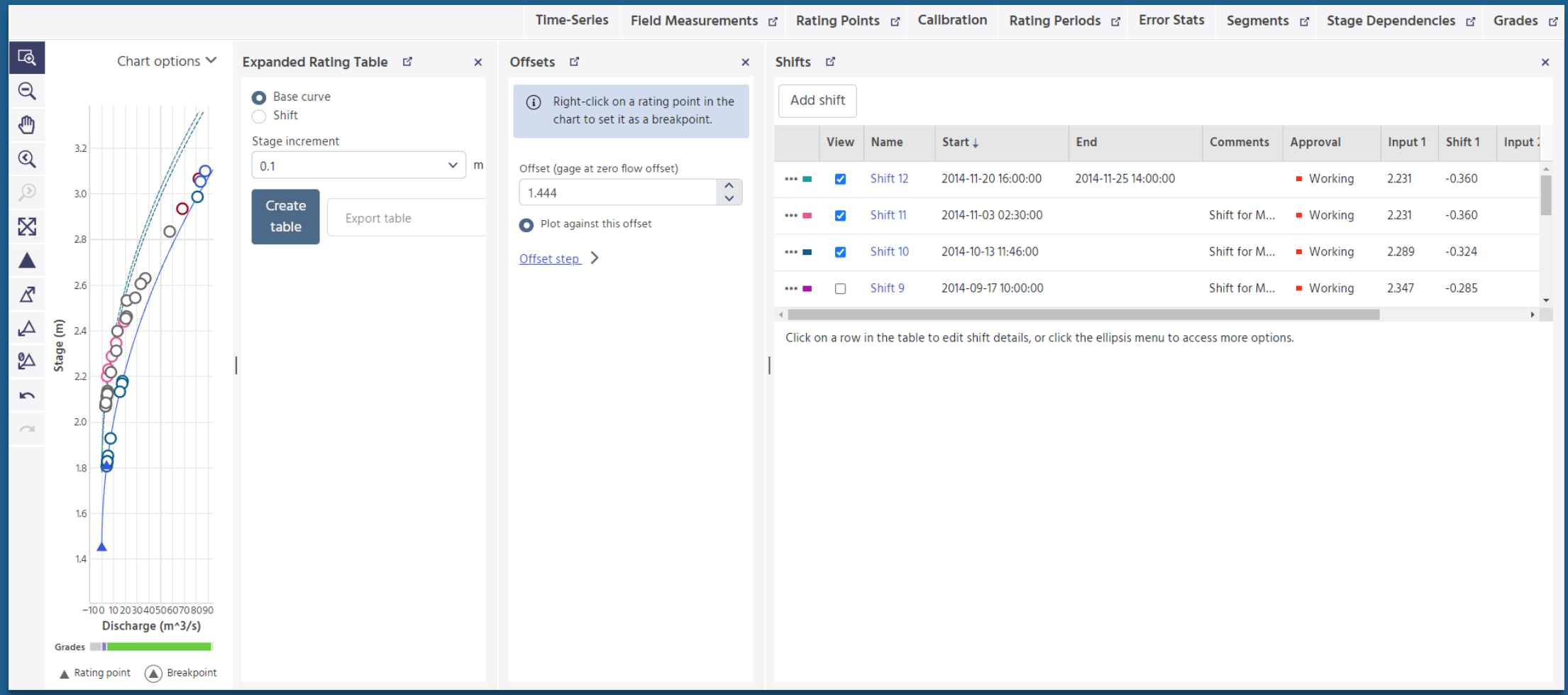
User Interface Tour



Additional Panes: Time-Series, FVs and Rating Points...

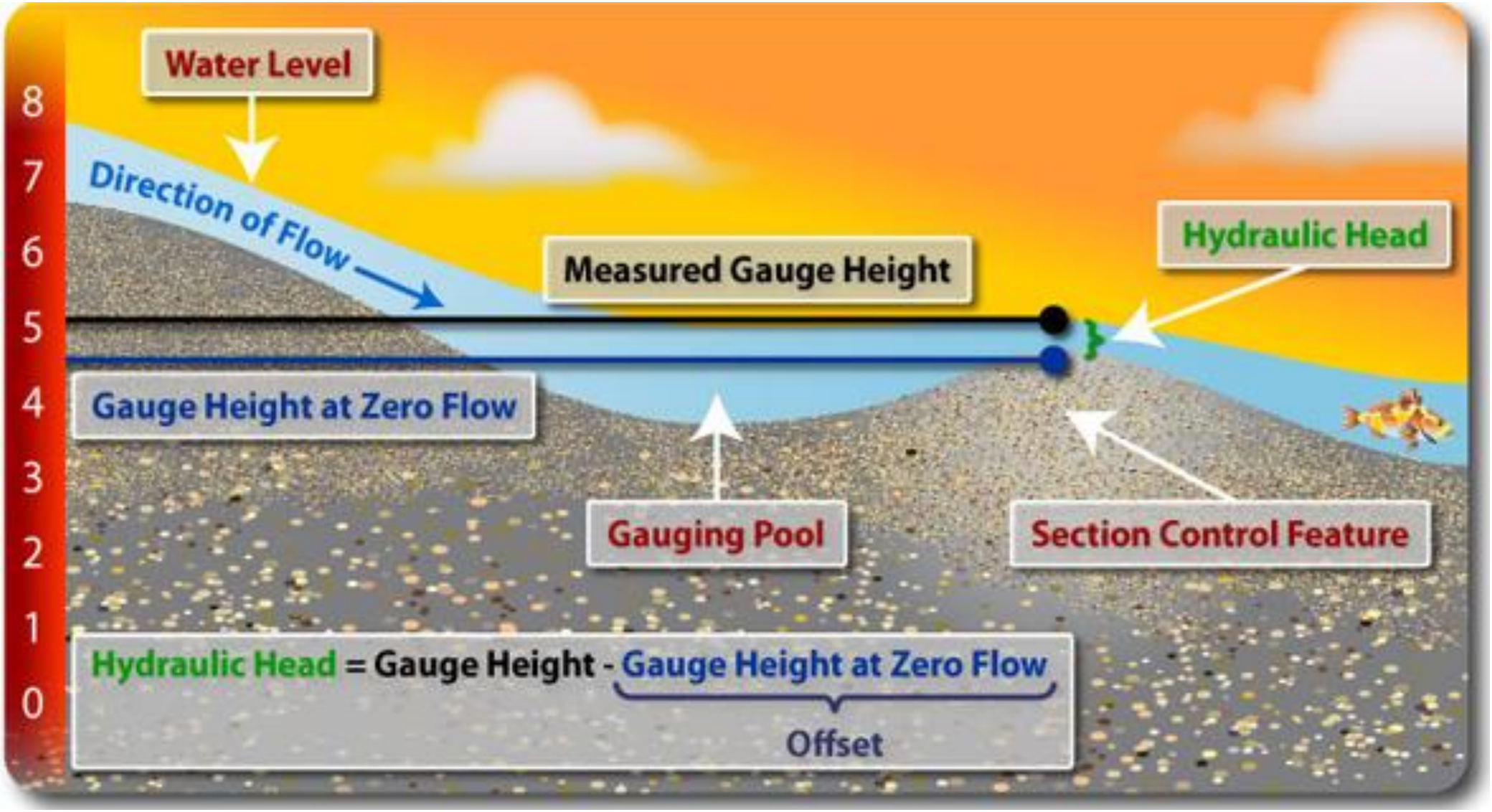


Additional Panes: Expanded Rating Table, Offsets and Shifts

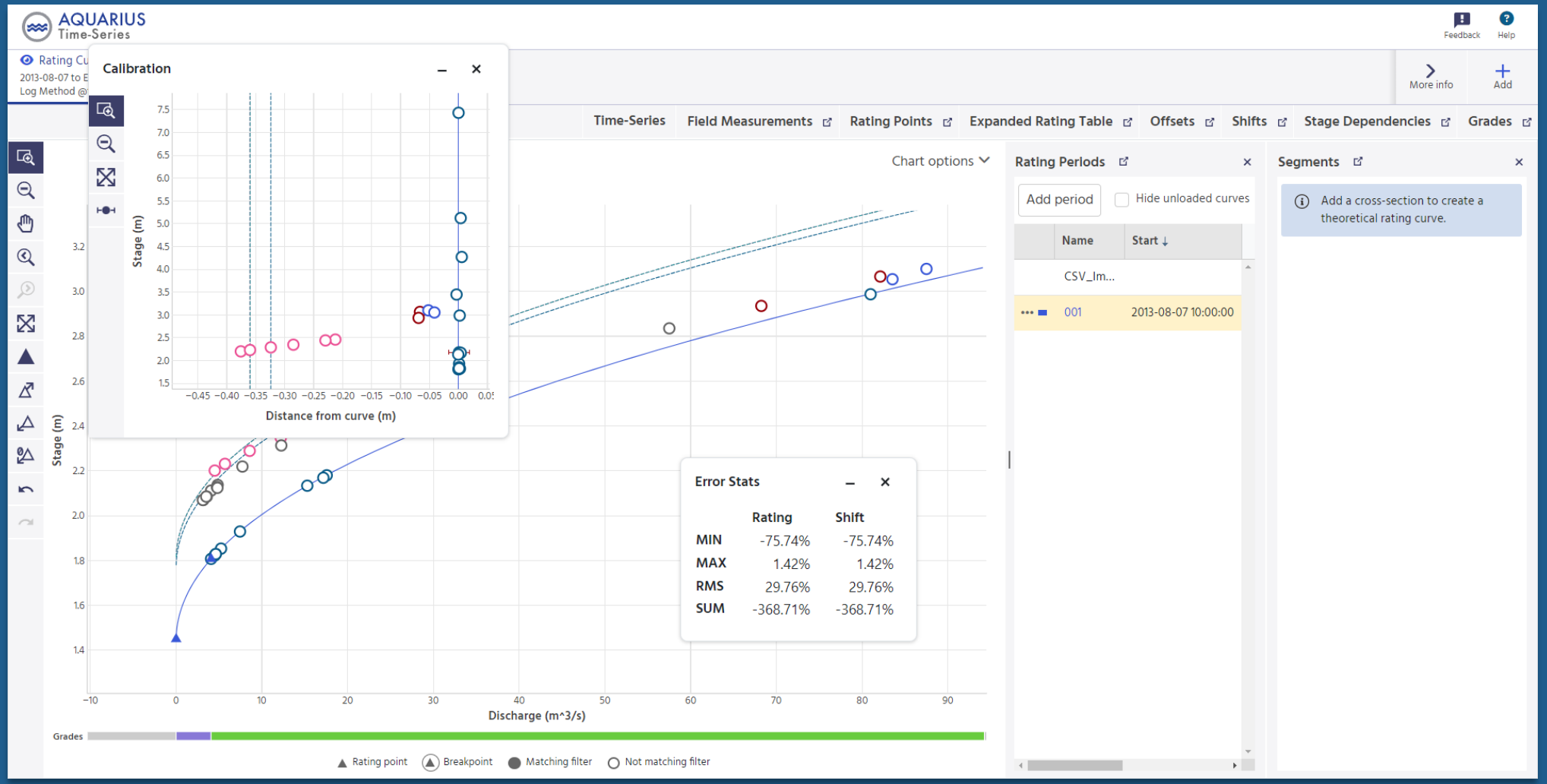


What is an Offset again???

AQUATIC Informatics

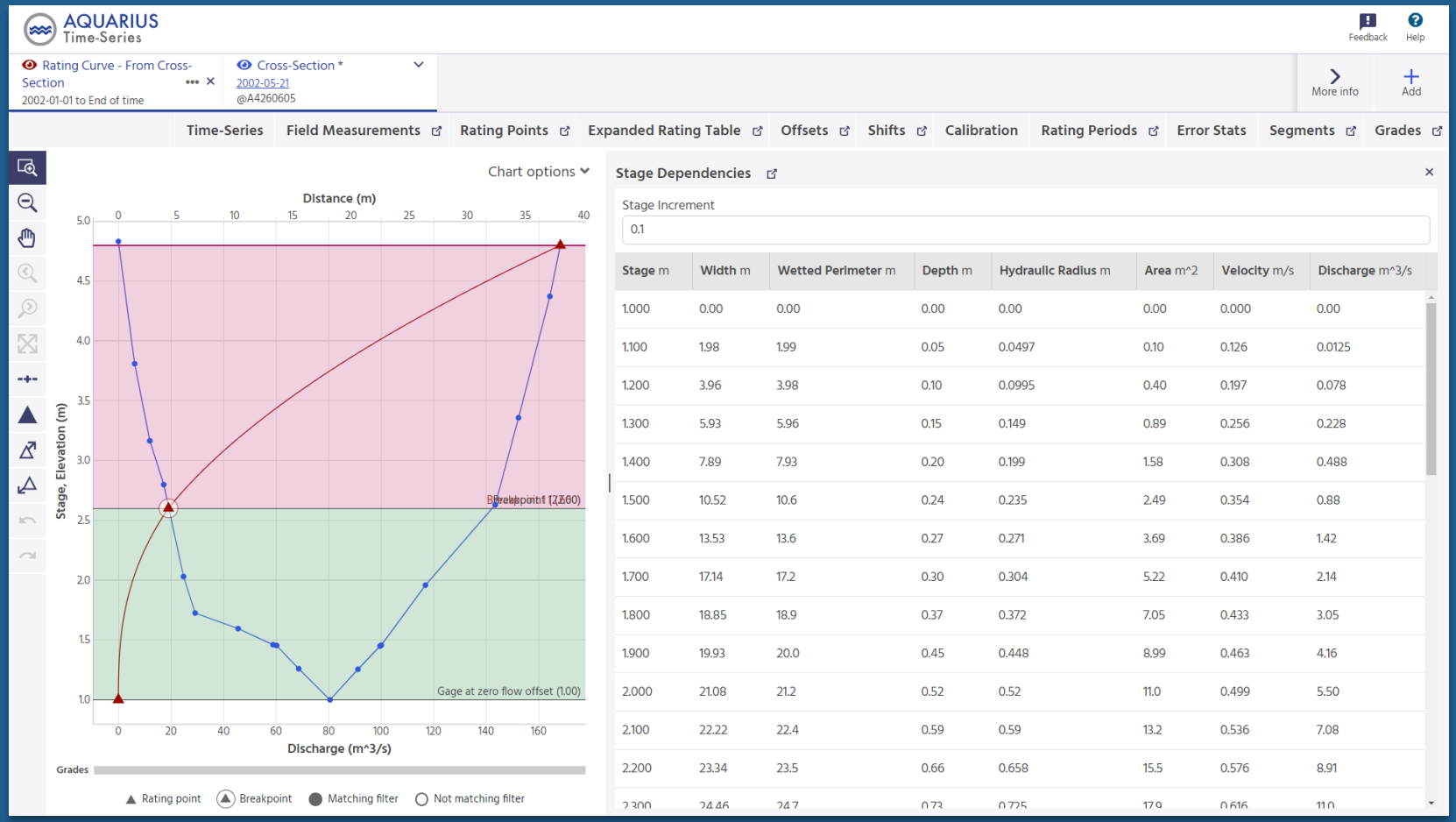


Additional Panes: Calibration, Error Stats, Rating Periods…

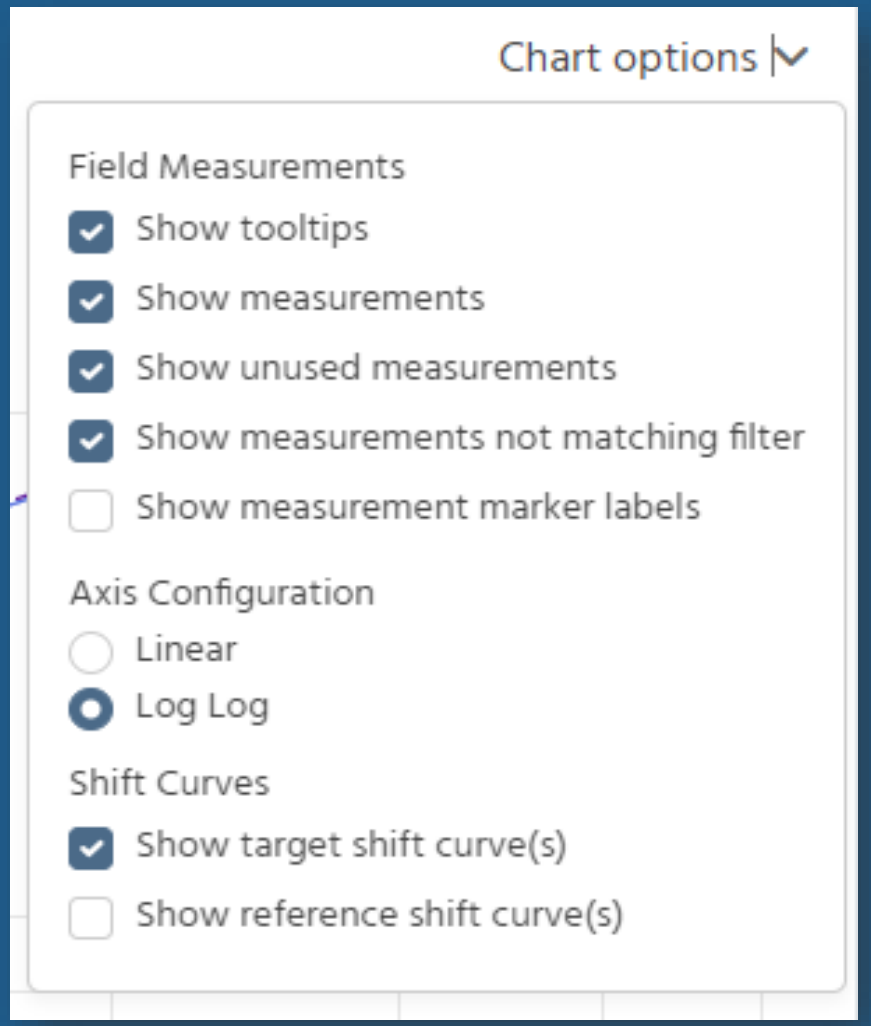


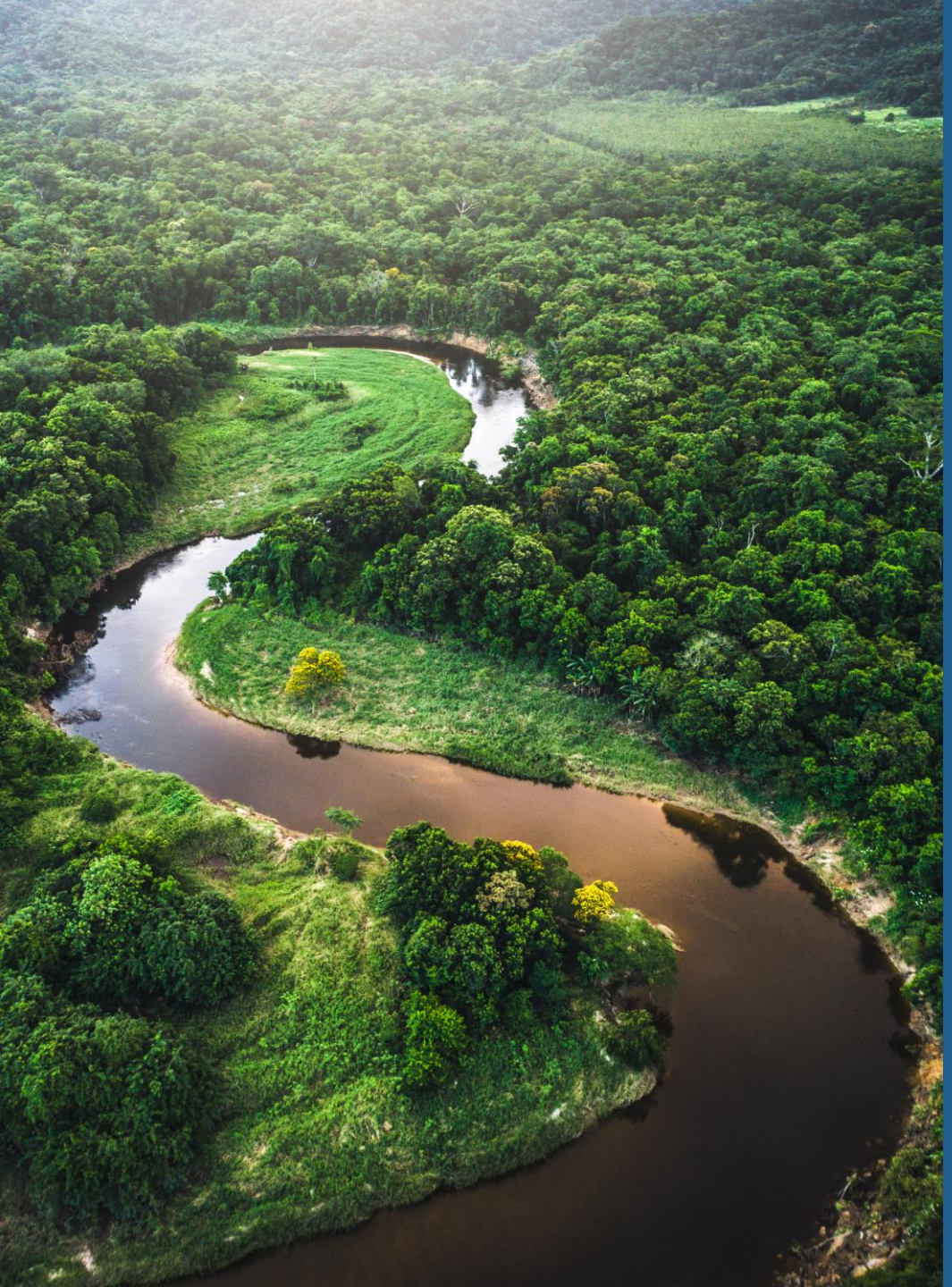
Additional Panes: Stage Dependencies…

- Populates when a cross-section is loaded
- Calculated from the true geometry of a selected cross-section
- Displays velocity and discharge derived from the selected rating curve



What are all those Chart Options?





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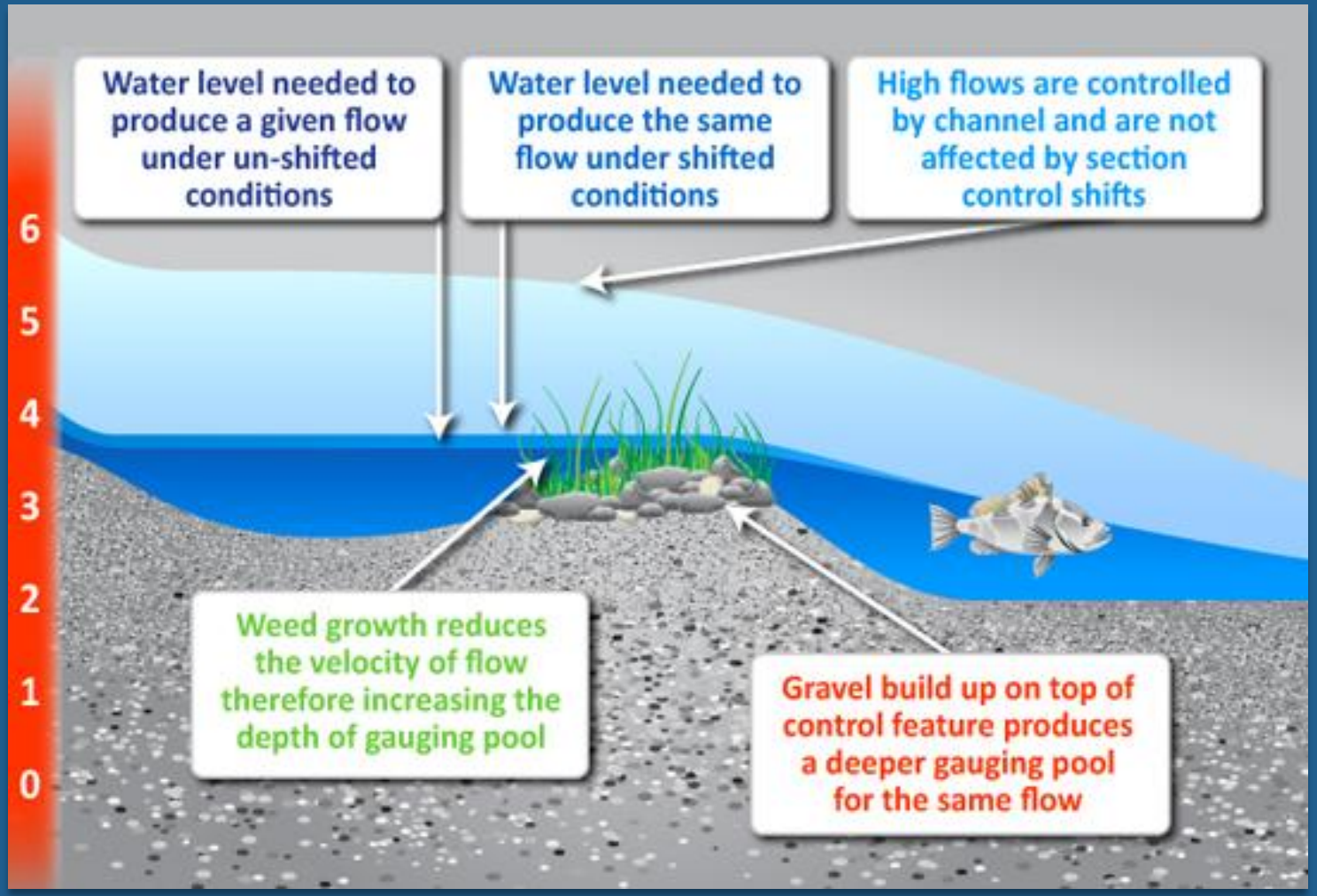
What is a Shift?

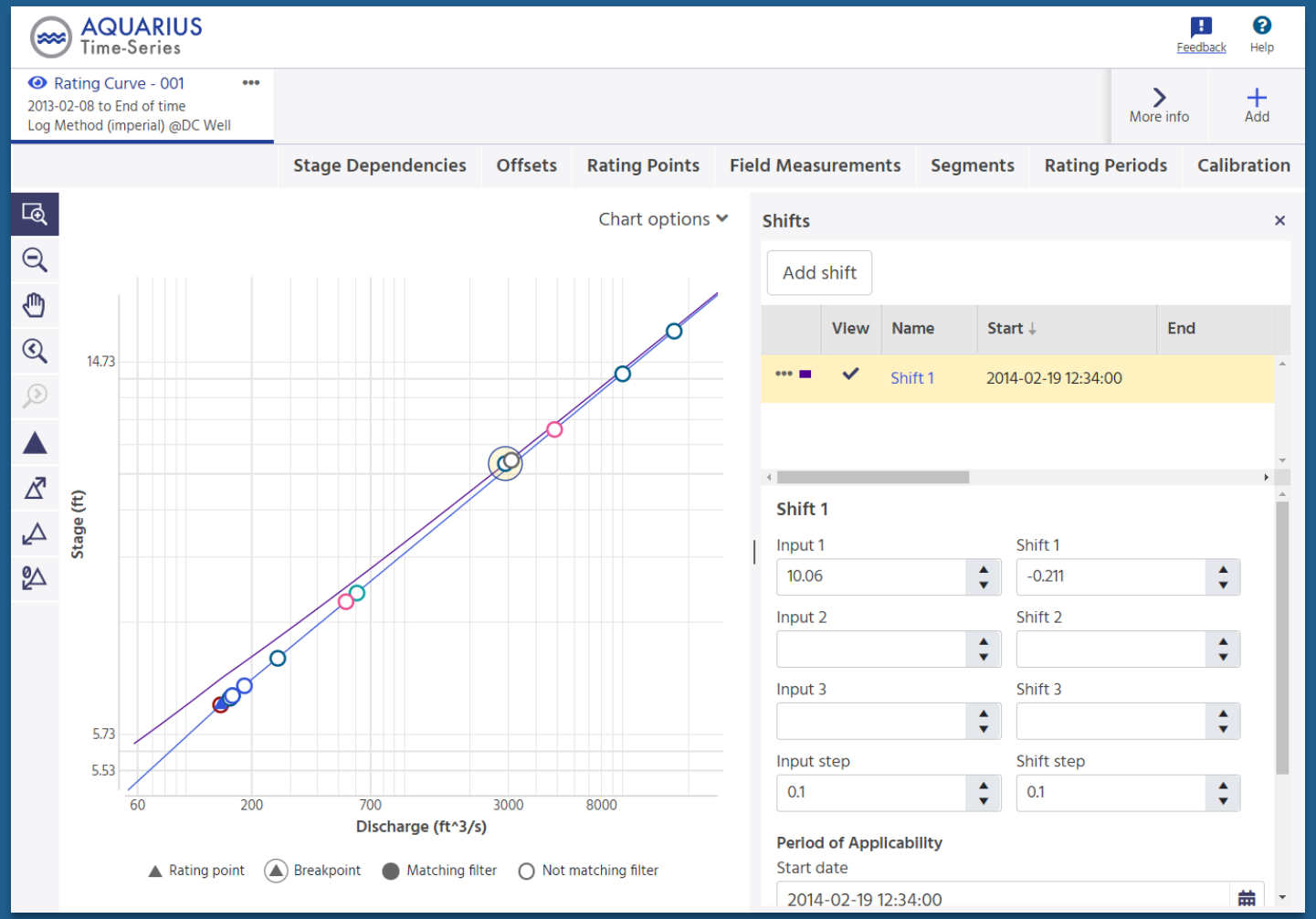


What is a Shift?

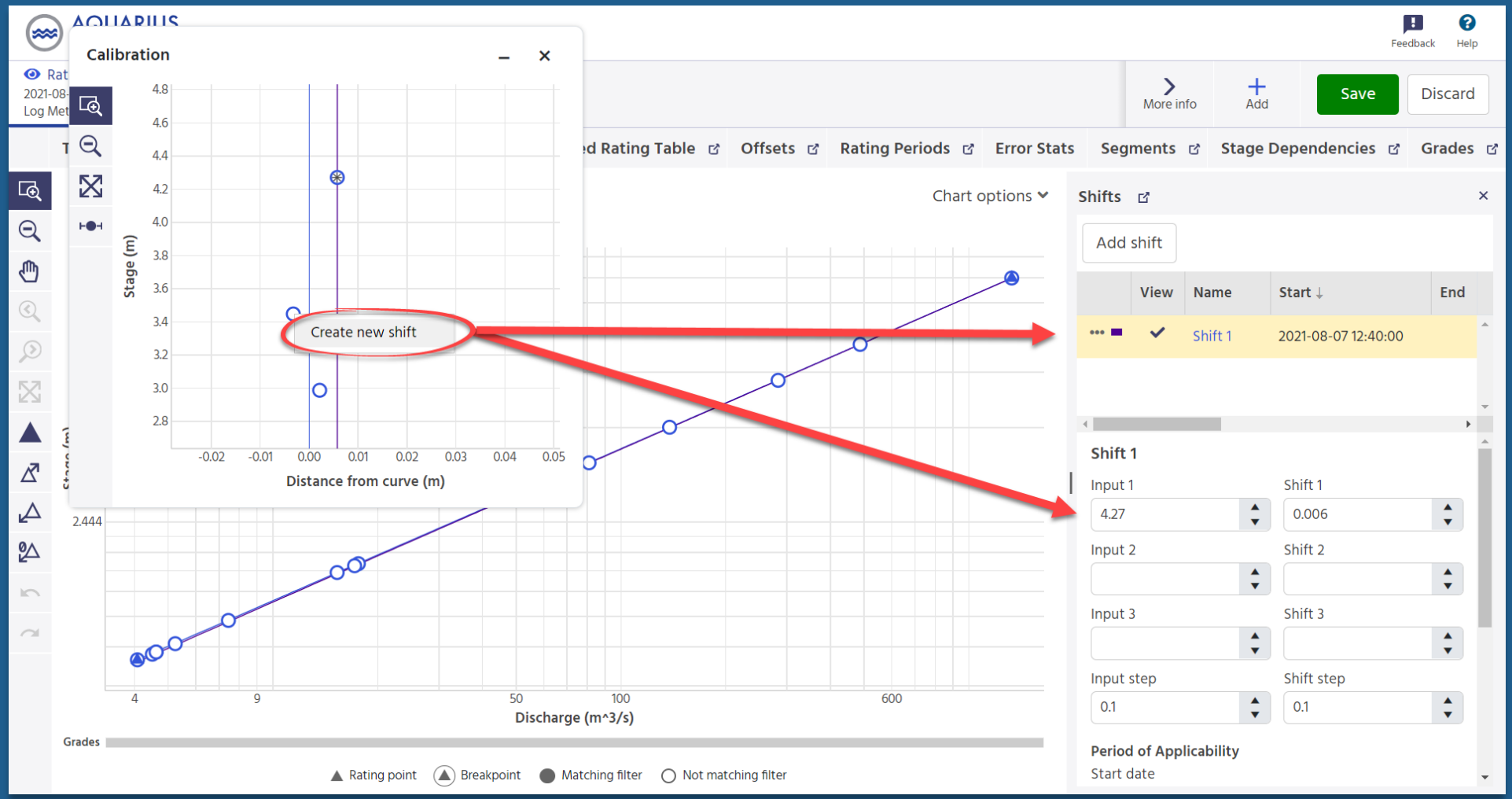
- A rating model may contain any number of different transformations over period
- Individual rating transformations can have one or more shifts applied to it
- Natural hydrometric controls can cause changes to the rating curve
- Shifts allow for the development of temporary adjustments to a rating curve

How do you create a Shift?

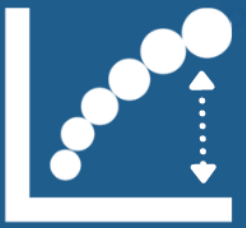
- Add and update shifts
- Include up to three shift points, with an input and shift value
- Or...



Right-click in the Calibration pane!

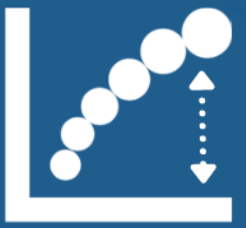


What are the rules for Shifts?



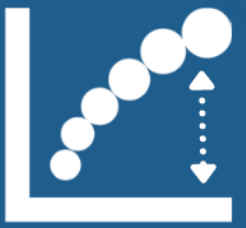
- Number of shifts per rating curve
- Overlapping shifts and blends
- Fully and partially locked shift
- Non-monotonic curves & prorated shifts

Rules for Shifts: Number of shifts per rating curve



- Minimum requirement: Each shift must include at least one shift point; each shift point must include both input and shift values.
- Maximum limit. You can add up to three shifts points to a rating curve.

Rules for Shifts: Overlapping Shifts

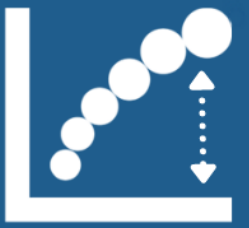


- Open | Open
  An open-ended shift **can** overlap another open-ended shift on the same rating curve.

- Closed | Open
  A closed shift **cannot** overlap an open shift on the same rating curve.

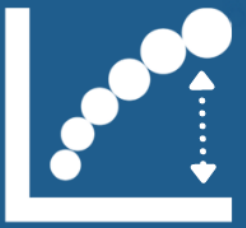
- Closed | Closed
  A closed shift **cannot** overlap another closed shift on the same rating curve.

Rules for Shifts: Overlapping Blends



- Closed | Blend.
  A closed shift **cannot** overlap a blended shift on the same rating curve.

Rules for Shifts: Fully Locked



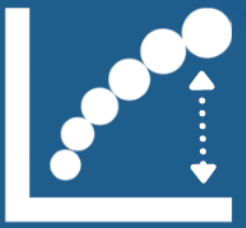
A shift is fully locked when it meets the following conditions:

- **Condition 1**
  Open-ended, overlaps an Approved Period of the rating model.

Or

- **Condition 2**
  Closed, falls entirely within an Approved Period of the rating model.

Rules for Shifts: Partially Locked



A shift is partially locked when it meets the following conditions:

- **Condition 1**
  Closed, overlaps an Approved Period of the rating model.

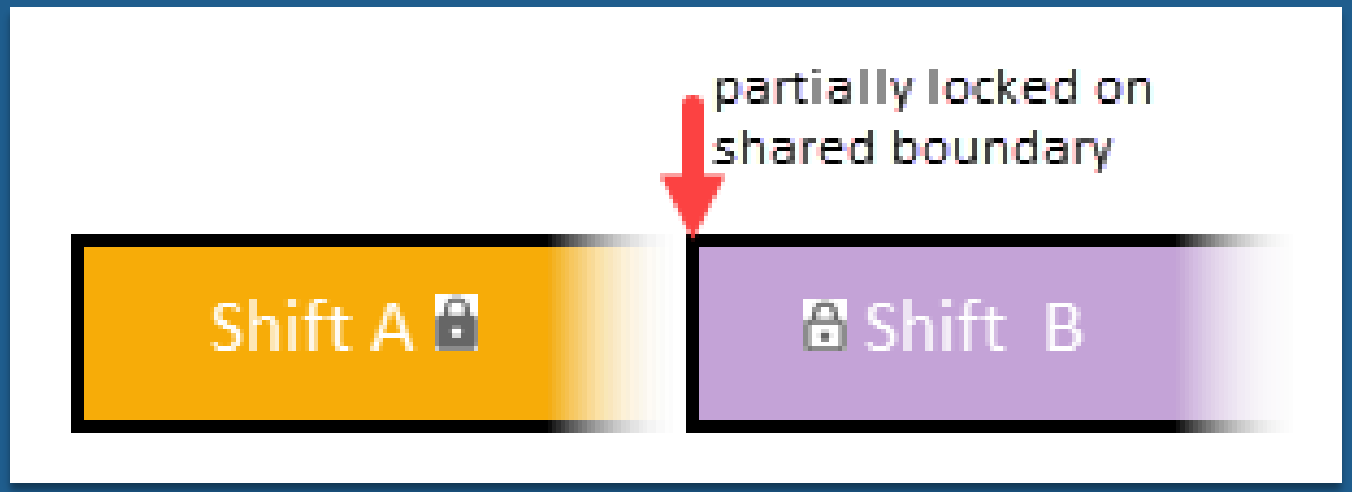
Or

- **Condition 2**
  An open-ended shift (Shift B) lies adjacent to a fully locked open-ended shift (Shift A).

Rules for Shifts: Partially Locked

Partial locked example...

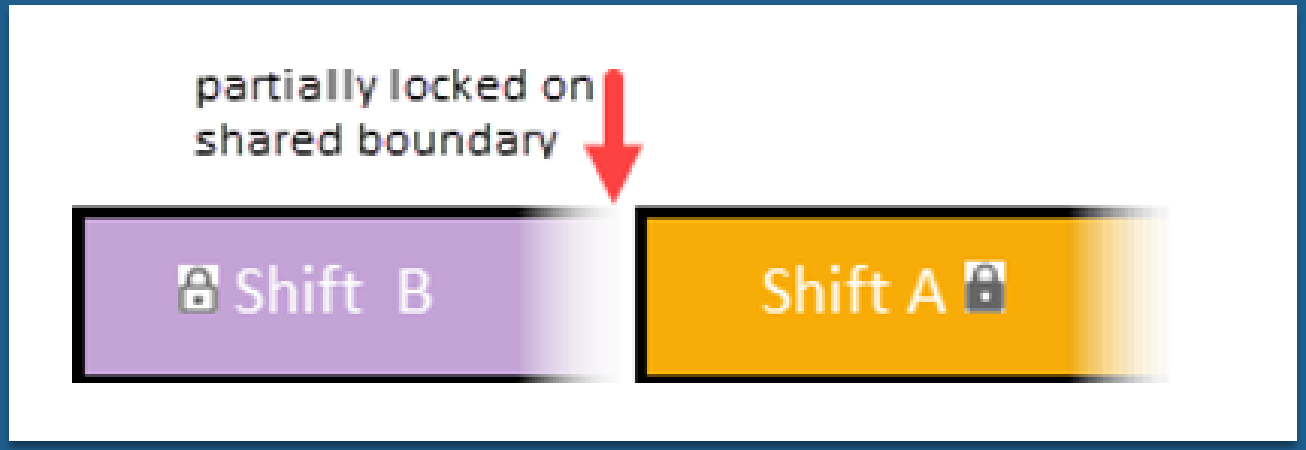
If Shift A precedes Shift B, you can edit Shift B's end date (on its right-side boundary) but you cannot edit its start date (on its left-side boundary) because its start date lies adjacent to Shift A's open, but locked end date.



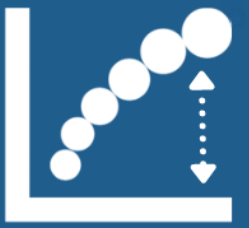
Rules for Shifts: Partially Locked

Another partial locked example...

Conversely, if Shift B *precedes* Shift A, you can edit Shift B's start date (on its left-side boundary) but you cannot edit its end date (on its right-side boundary) because its end date lies adjacent to Shift A's locked start date.



Rules for Shifts: Non-monotonic and Prorated

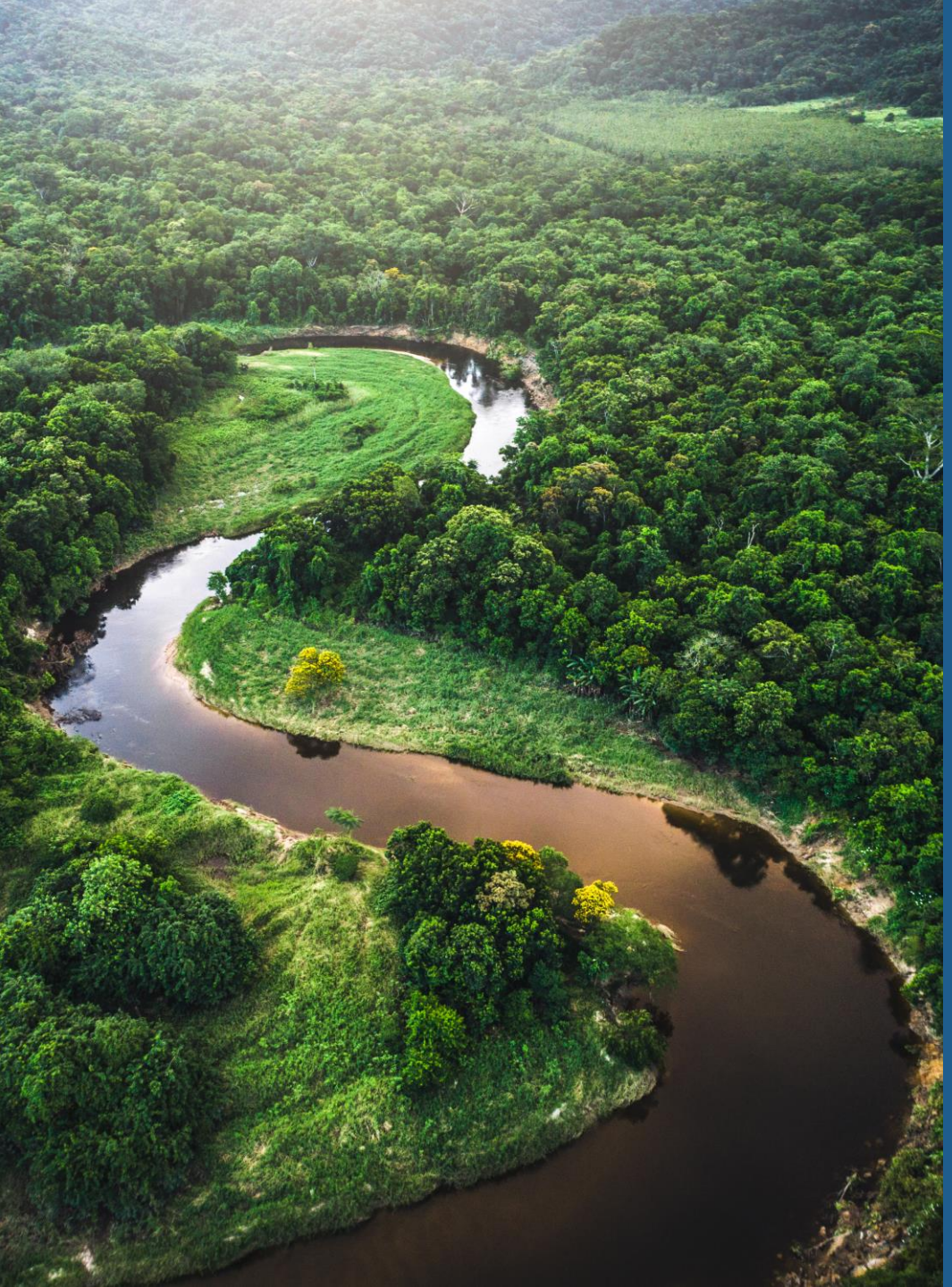


Non-monotonic Curves:

- You cannot create shifts for non-monotonic curves.

Prorated shifts:

- You cannot add a shift following a locked prorated shift.



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What NEW features have been added to RRT over the past year?

2023.2

Graphically change shift timings

2023.3

Support for descriptive equations

2023.4

Rating Development Toolbox removed 🥺

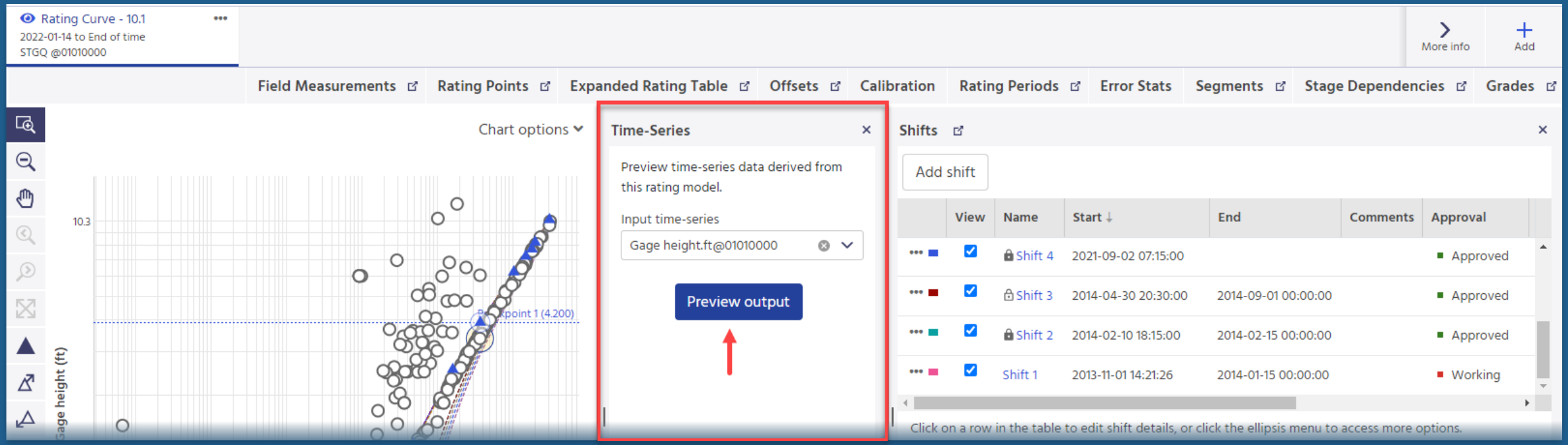
2024.1

Support for Weirs and Flumes

2024.2

- Calibration pane enhanced (shifting)
- New Chart Options
- Right-click on measurements

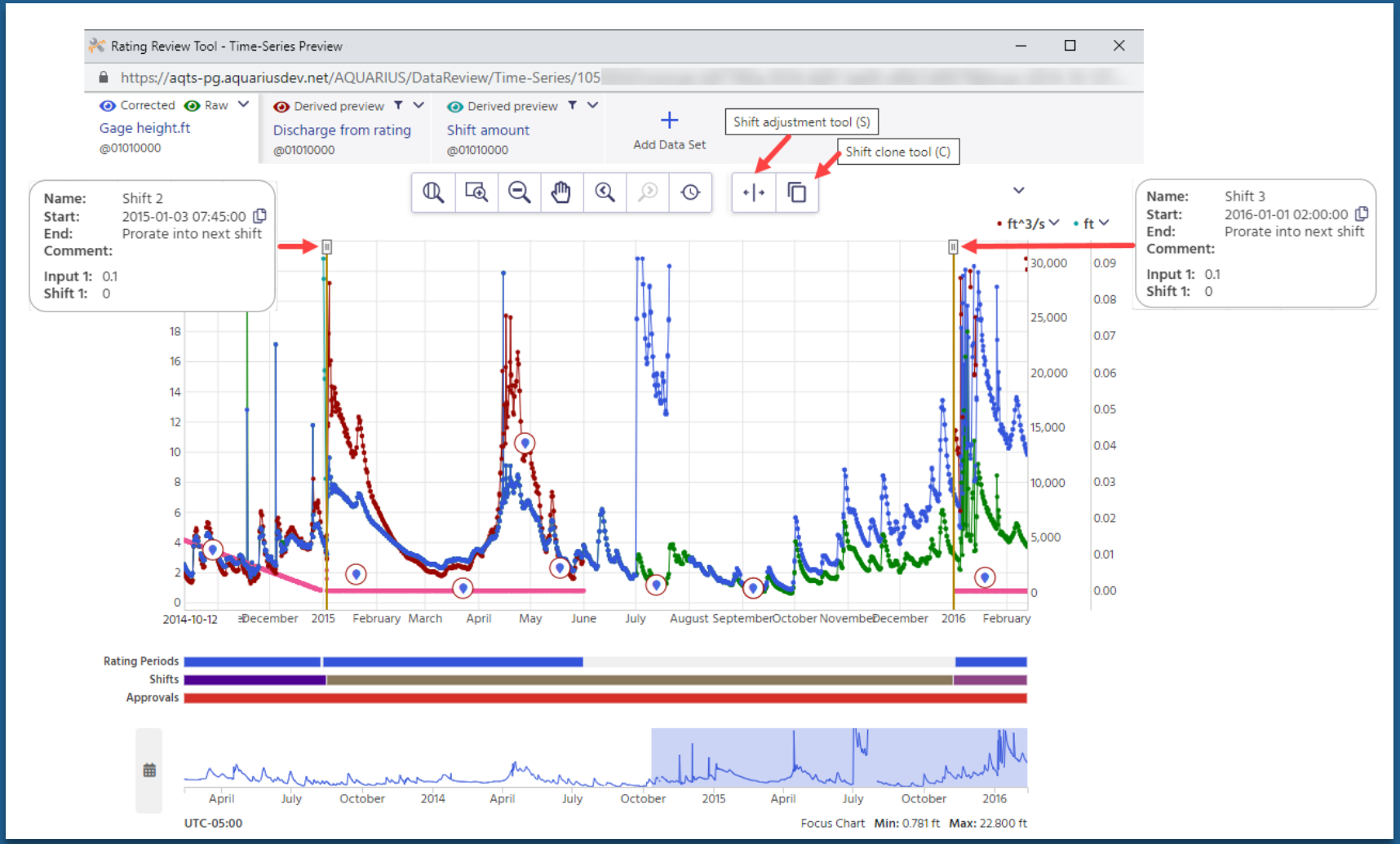
Shifts displayed in the Time-Series Preview Chart!



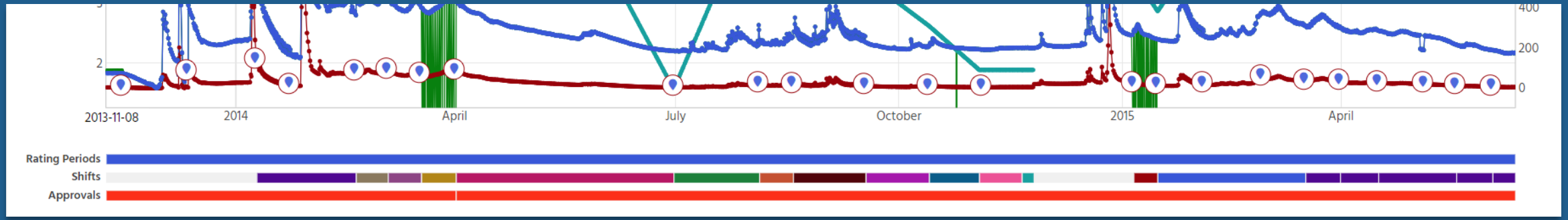
Edit shifts from the Time-Series Preview!

Use the Shift Adjustment tool to change the start date for an existing shift

Use the Shift Clone tool to clone an existing shift.



Rating Timeline Enhanced!



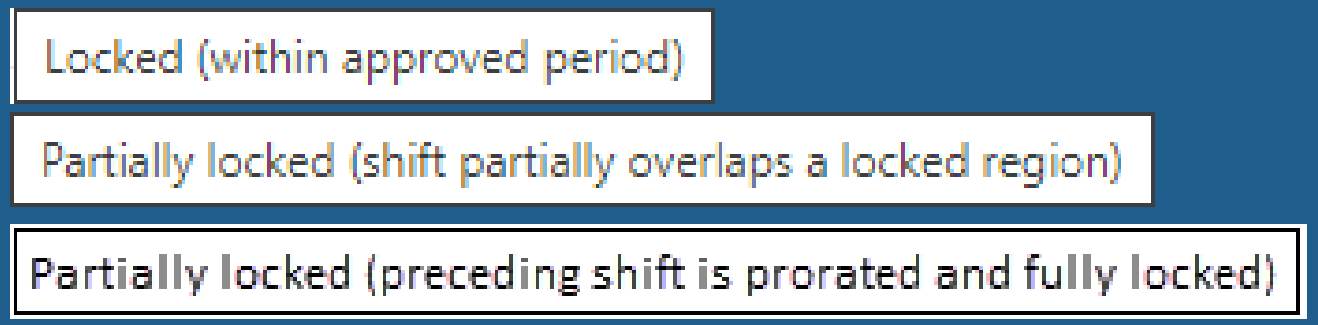
The timeline “carpet” now has the following sections:

1. Rating Periods
2. Shifts
3. Approvals

Displays the duration of each associated with the rating model.

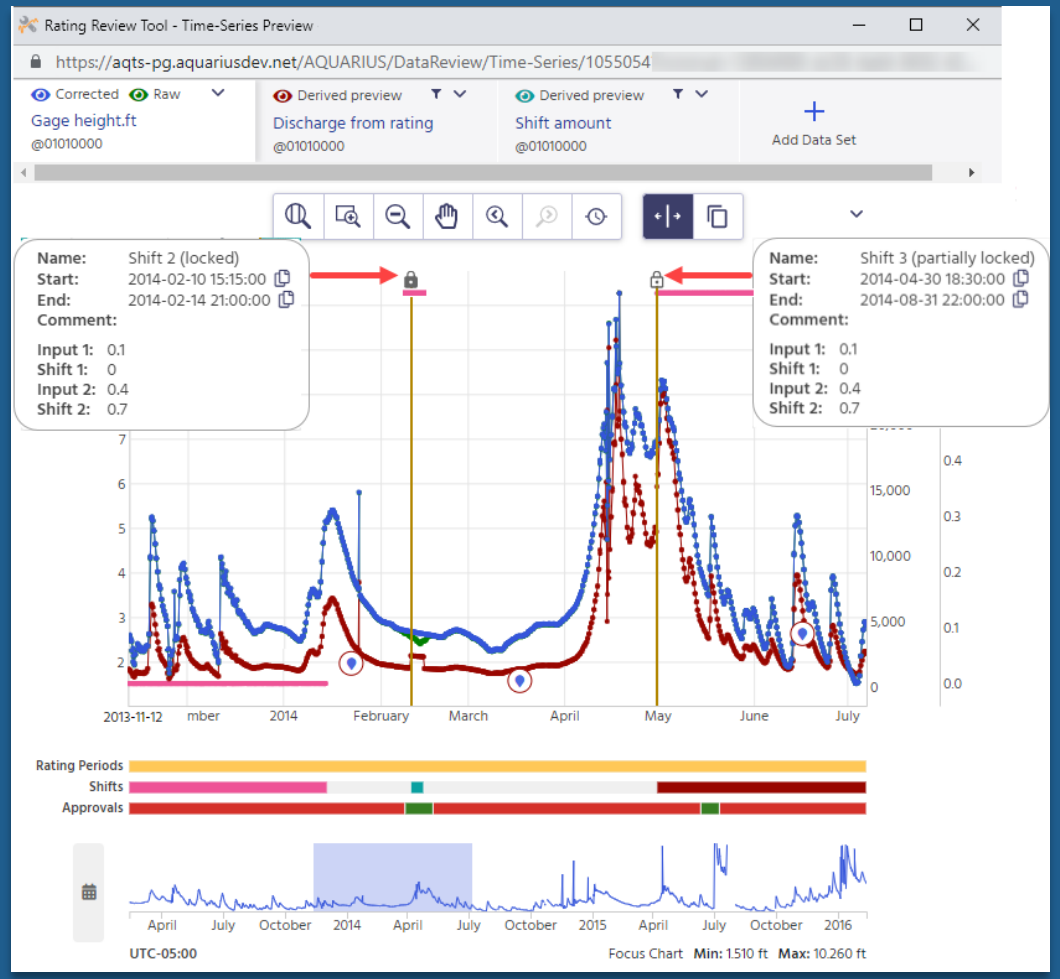
Locked shifts: Improved icons, and labels

- The icon representing fully locked shifts differs from the icon for partially locked shifts.
- The tooltips for locked and partially locked shifts are now unique:



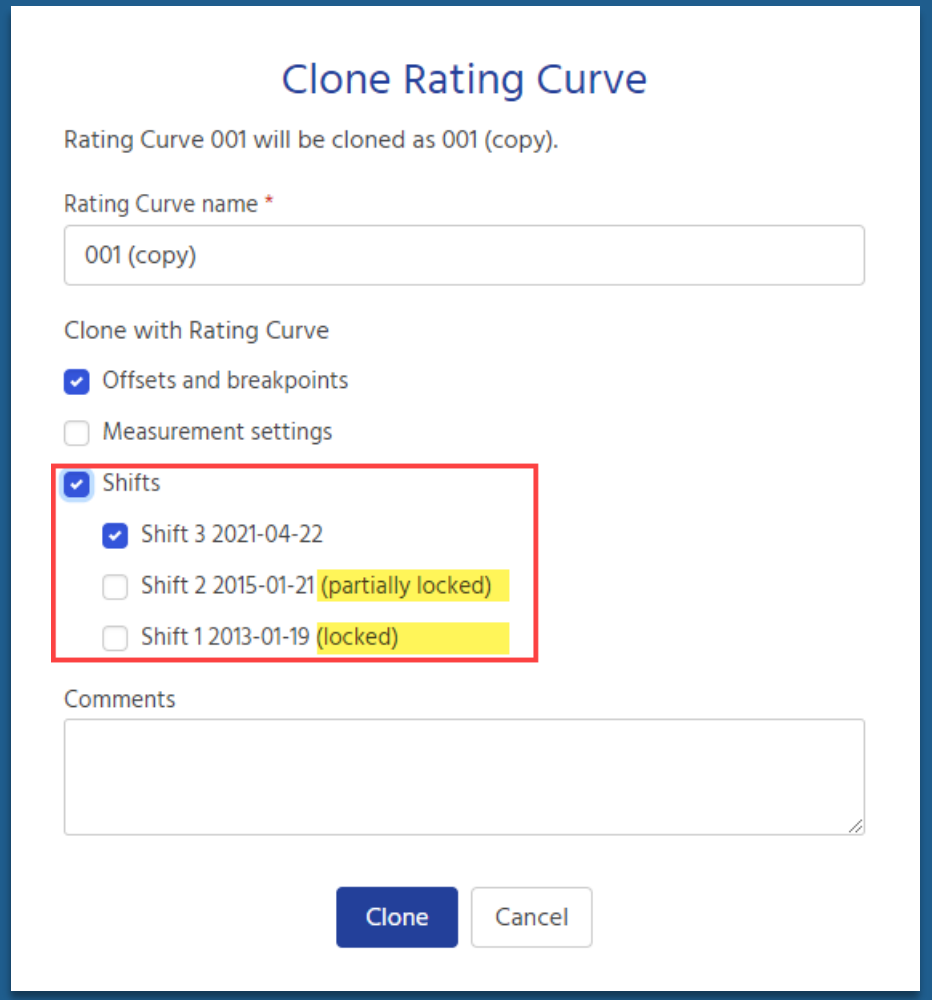
Locked shifts: Improved icons and labels

- If a shift is fully or partially locked, this information is now clearly visible from the chart's icons and tooltips in **Time-Series Preview**



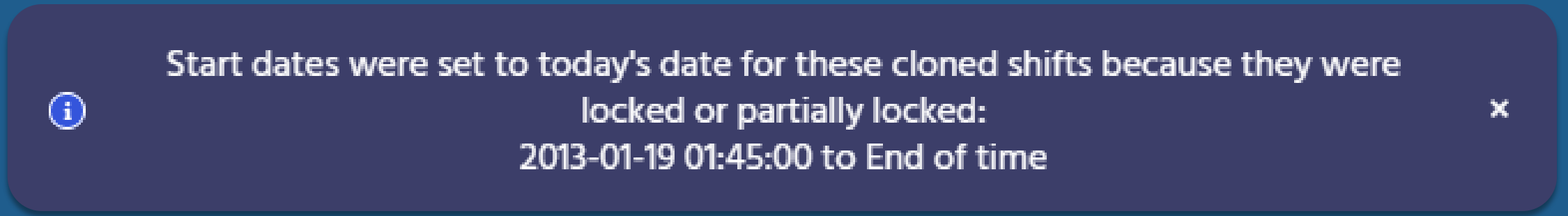
Locked shifts: Improved labels, and messages

- If a shift is fully or partially locked, it is now clearly visible within the **Clone Rating Curve** dialog and workflow.



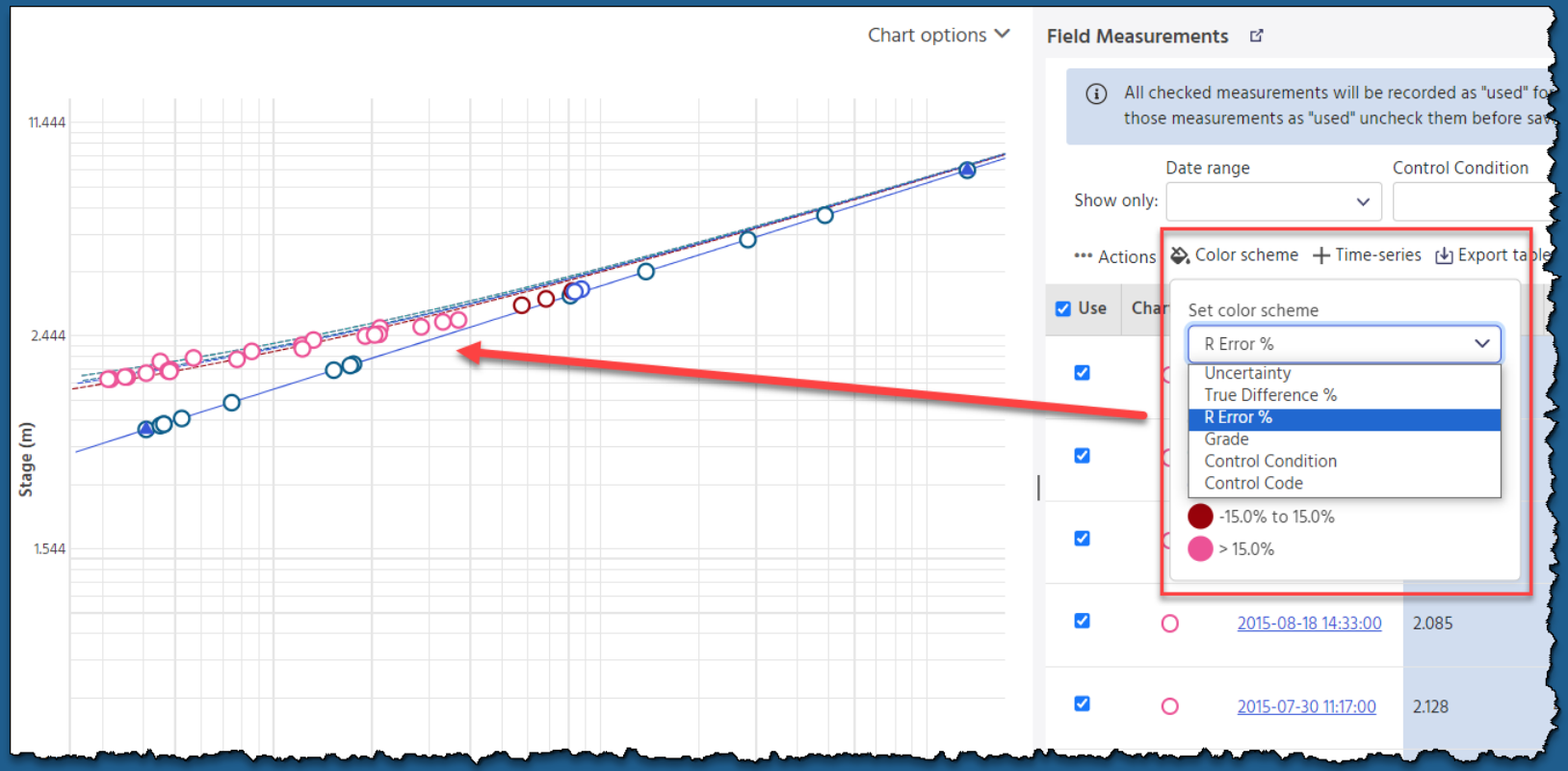
Locked shifts: Improved messages

If an action that contradicts the rules for locked or partially locked shifts is attempted, messages that clearly explain why the action cannot be completed, or why a default value has taken effect, are displayed:



For example, if you attempt to clone a locked or partially locked shift, the default start date for the cloned shift will be set to the current date.

Colour Scheme Options for Field Measurements!

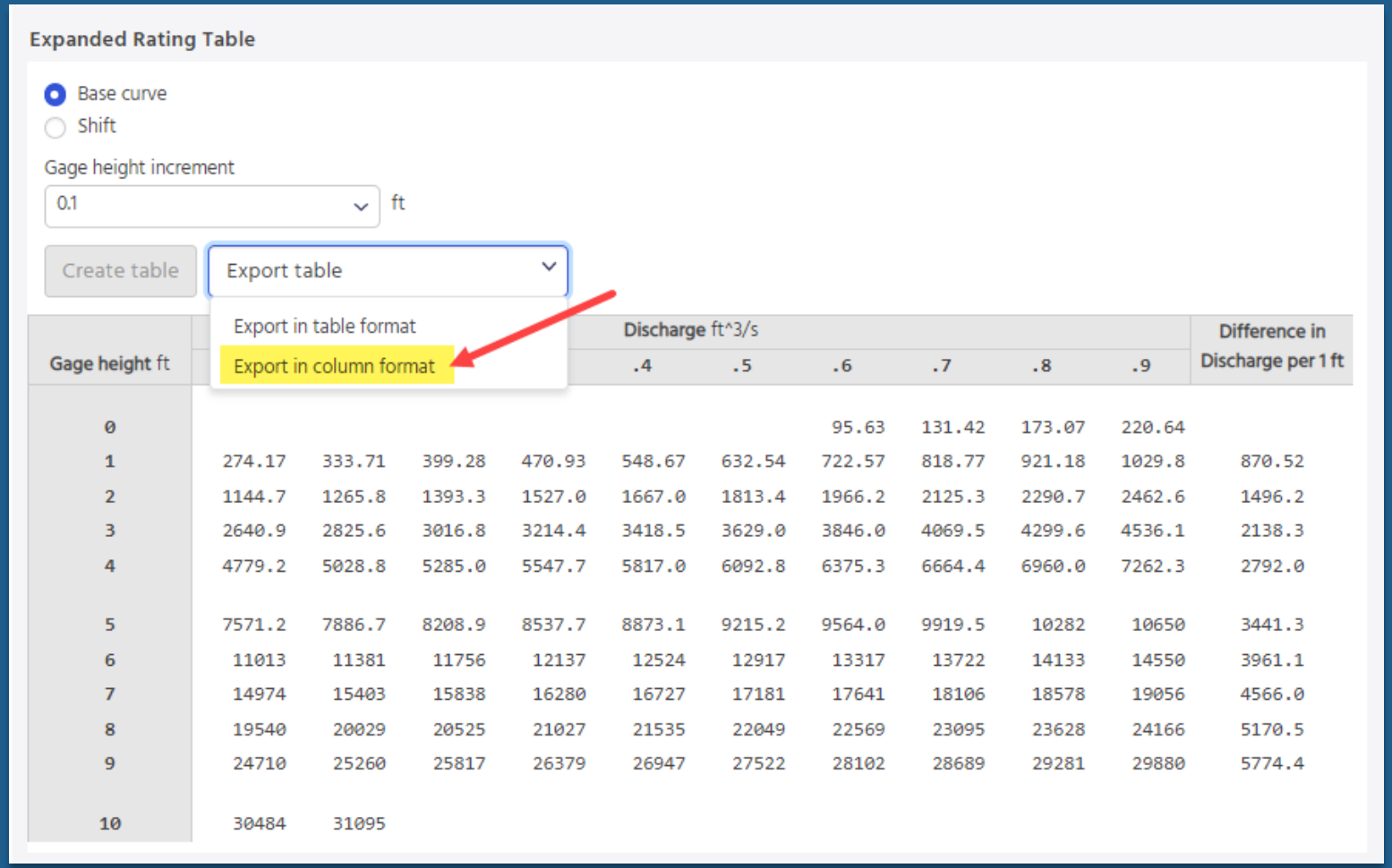


Field measurements colour schemes can be based on:

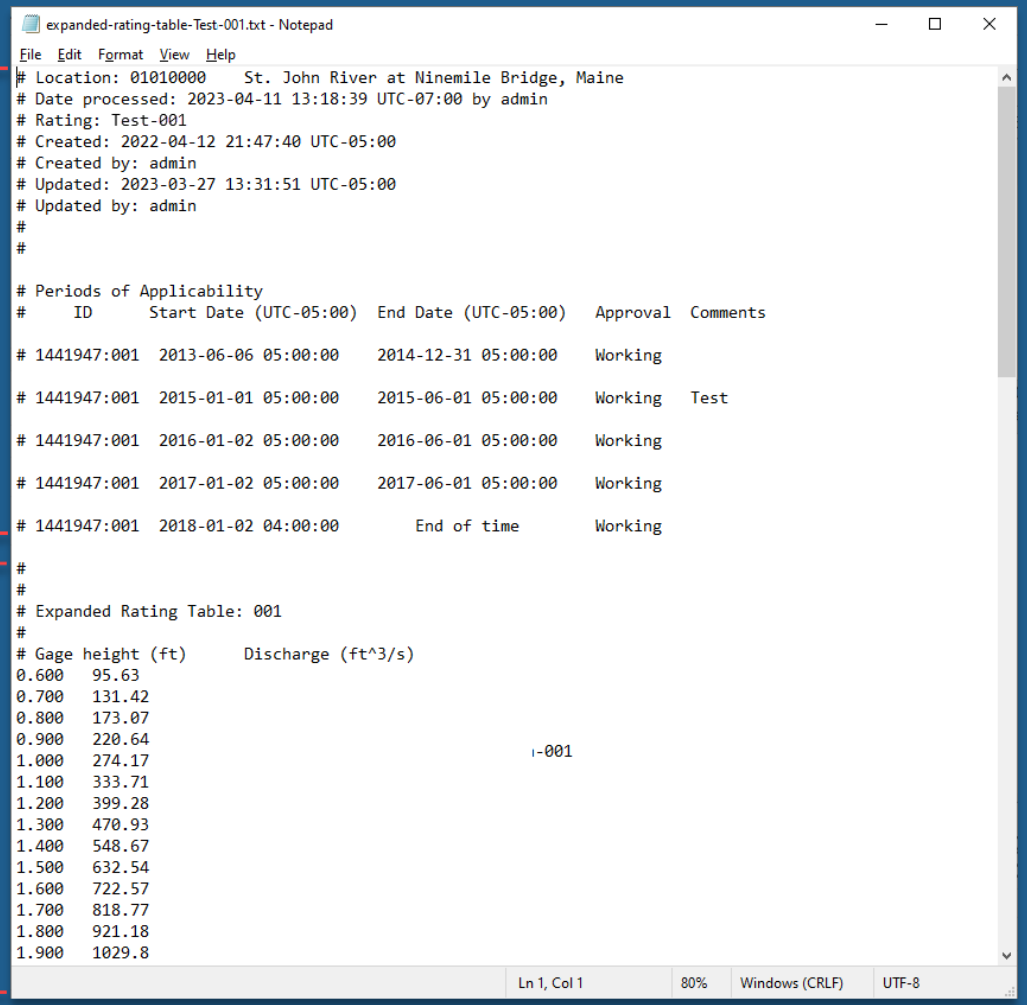
- True Difference
- Rating Error %
- Grade
- Control Condition
- Control Code

Expanded Rating Table: Export Options

- Table *and* Column formats now supported



Expanded Rating Table: Column Format

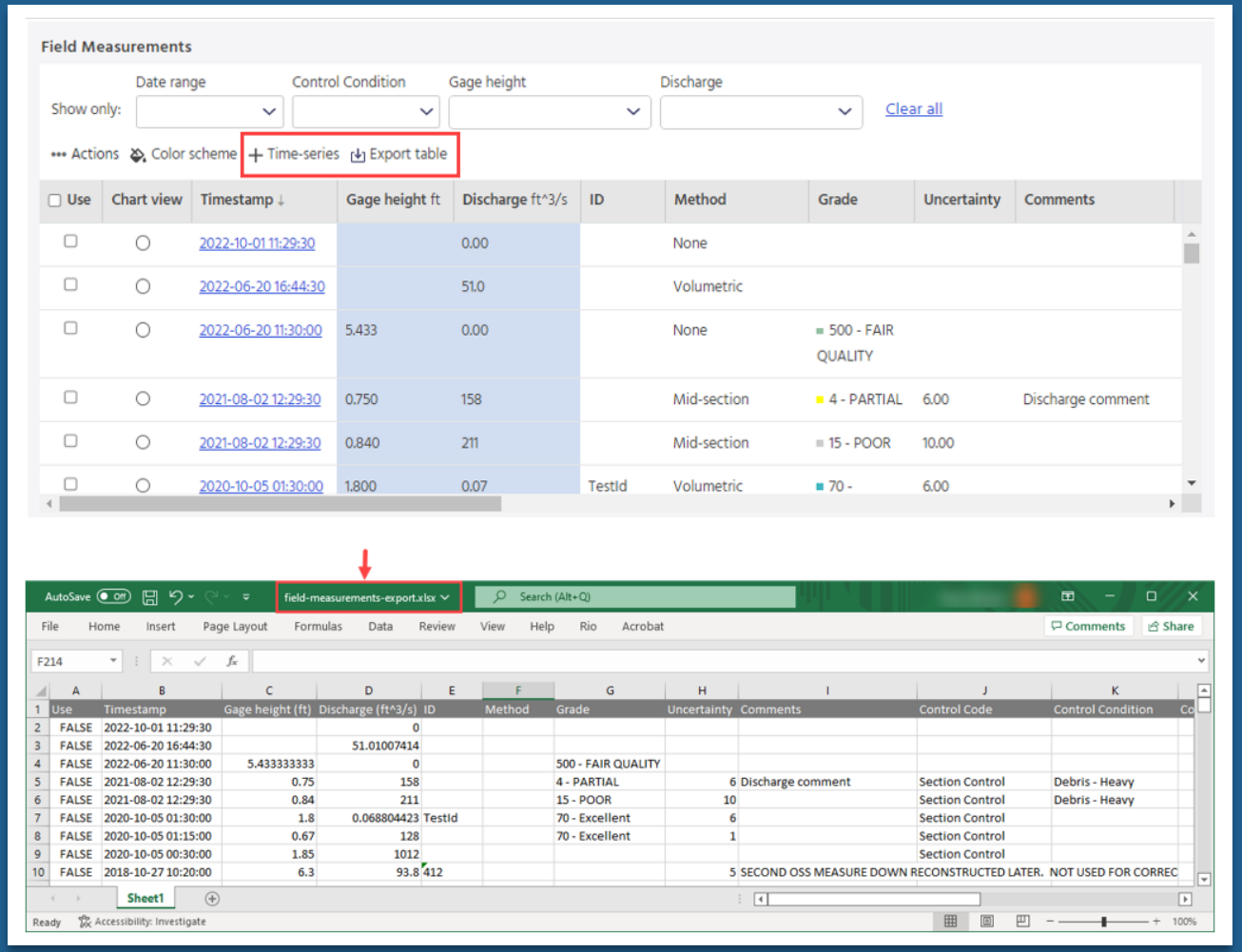


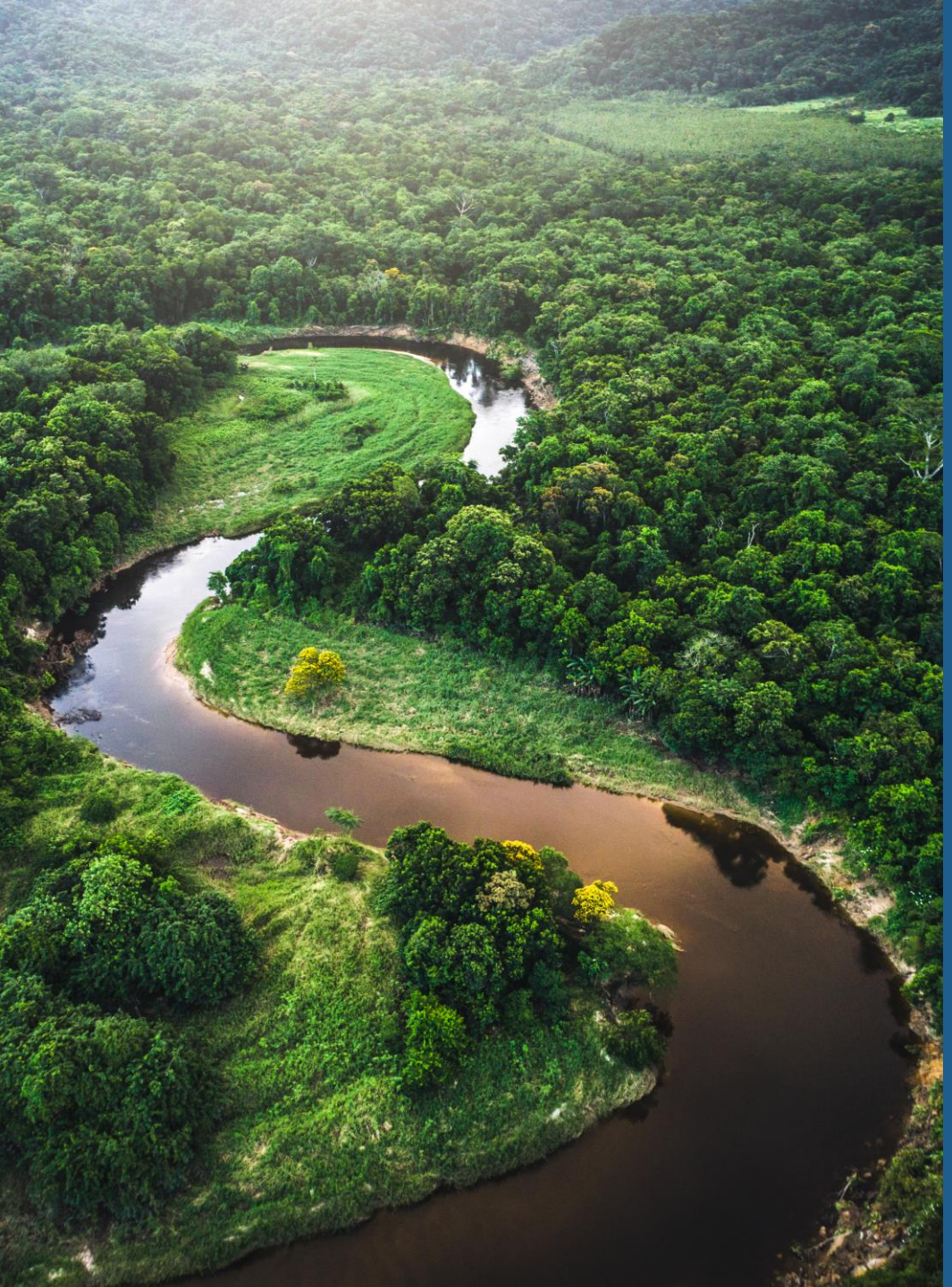
Includes:

- A header section with location and rating model metadata
- Offsets
- Breakpoints, and
- Periods of applicability

Export Field Measurements

- The spreadsheet maintains your settings for filters, sort order, and column order.
- Also prior to export, you can add other time-series to the Field Measurements table





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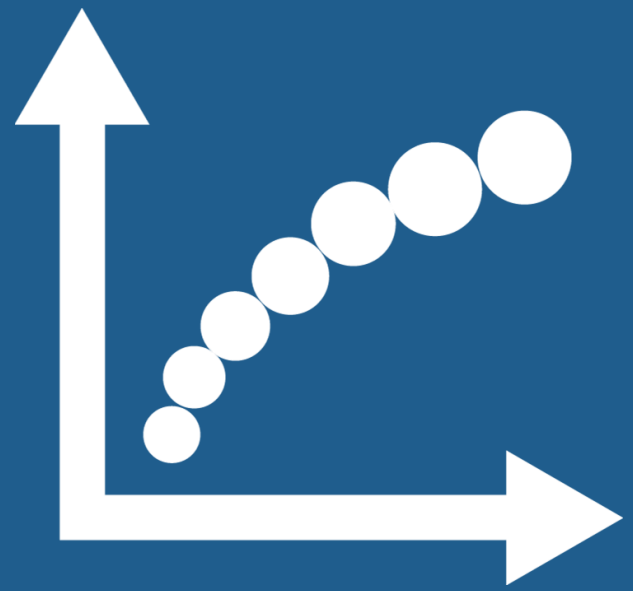
Rating Review Tool – Types of Curves

Rating curves types:

- Logarithmic
- Linear
- Standard Equation
- Descriptive Equation (NEW!)
- ISO Standard Equation (NEW!), *more on that later!*



Can be created from…

- Field measurements (Stage / Discharge), or
- An existing equation
- Cross-sections!!

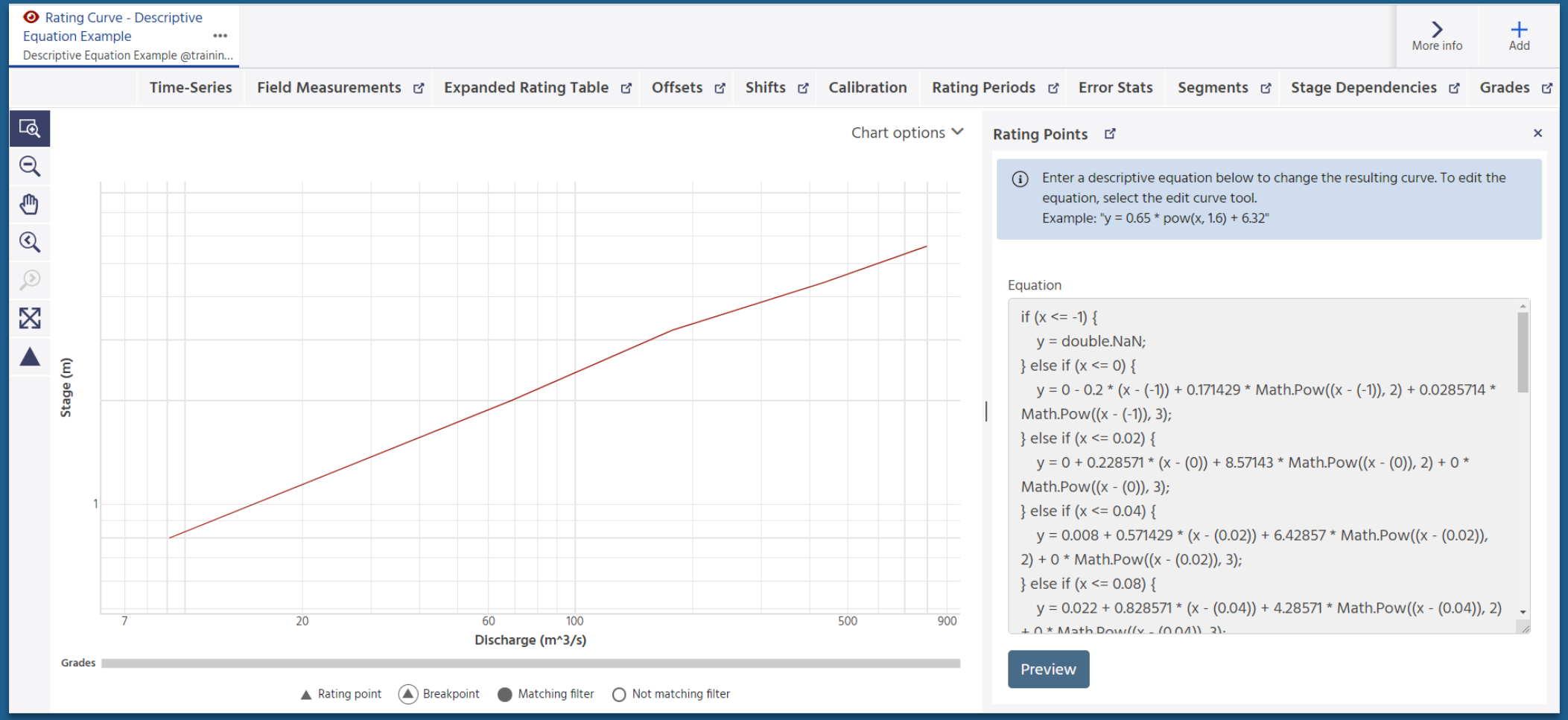
Descriptive Equation Rating Curves

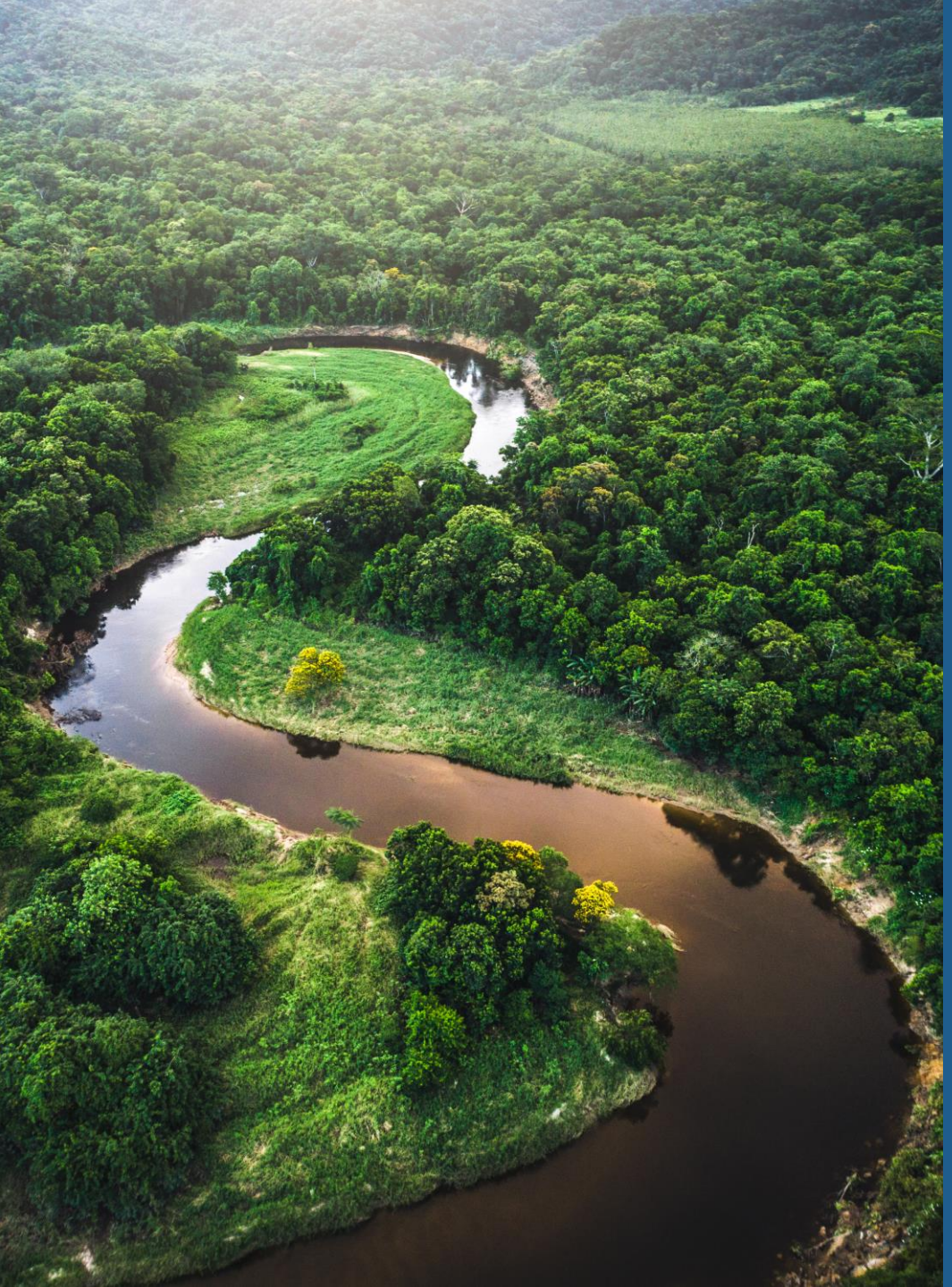
Create a rating with a custom equation that can…

- be a complex, free-form arithmetic formula
- contain conditional statements & math functions

Useful for rapidly changing river channels where more than three segments (two breakpoints) are required

Descriptive Equation Rating Curves - Example





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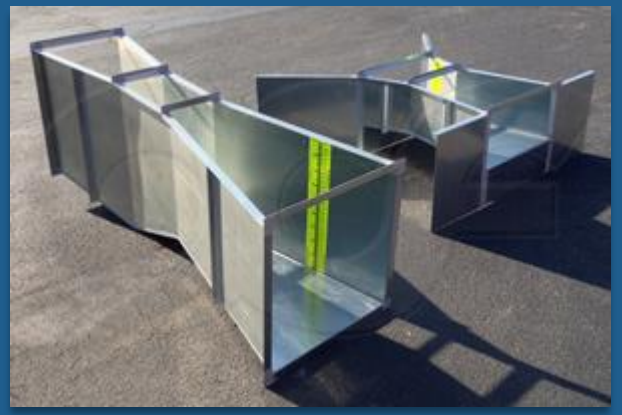
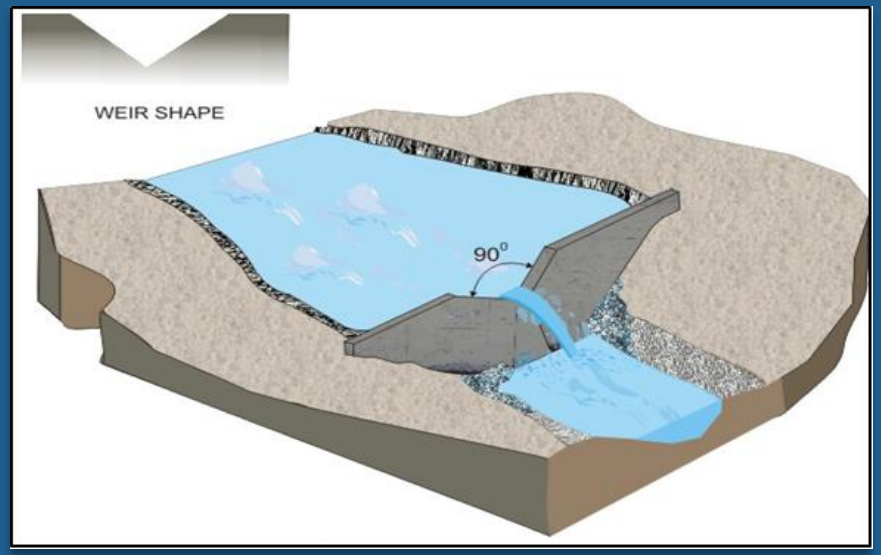
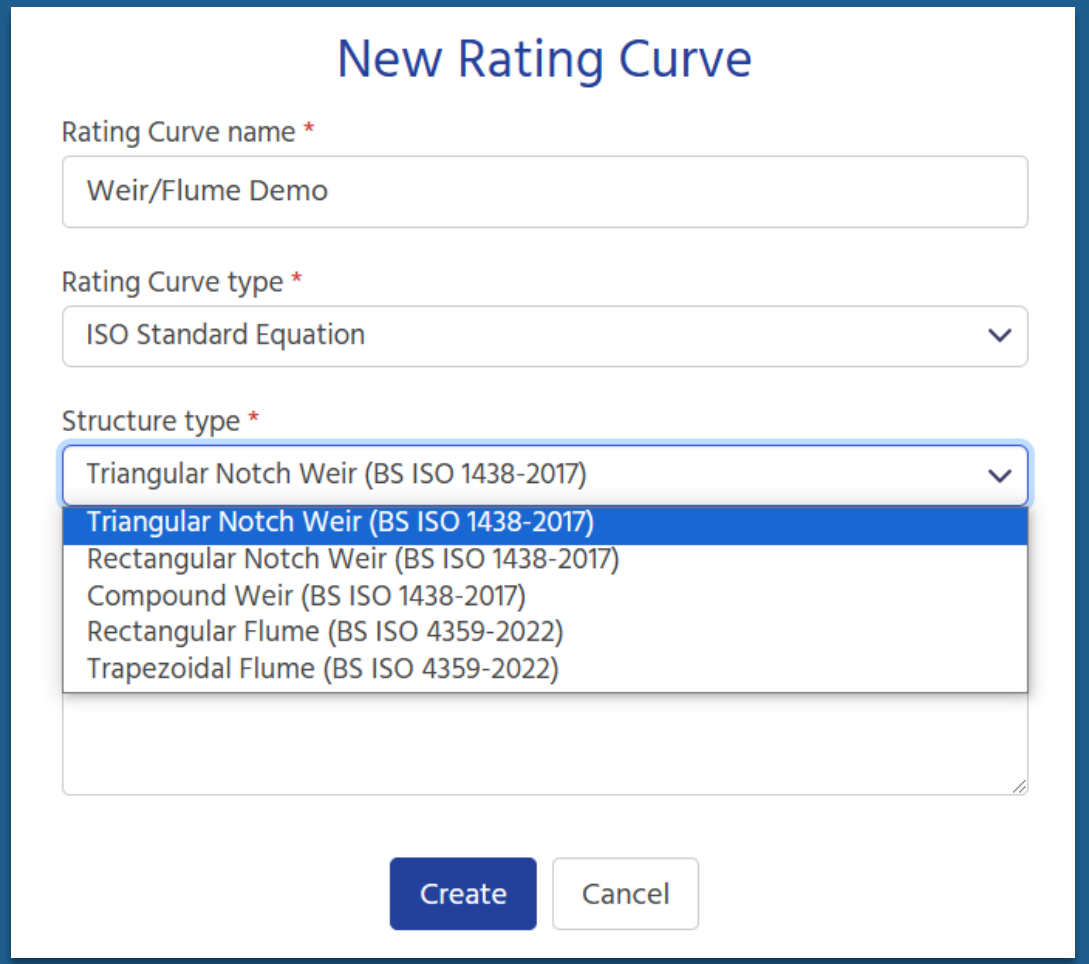
Support for Weirs and Flumes!



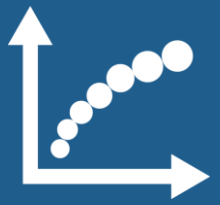


Support for Weirs and Flumes

- supports flow derivations from structures compliant with Hydrometric ISO Standards
- apply different calculations, or ratings, to different (time) periods
- data can be changed to either reflect a change in weir dimensions, or the addition of a new weir



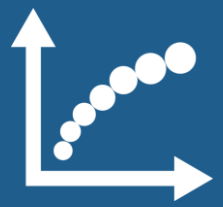
What is an ISO Standard Equation Rating Curve?



- Supports rating models for artificial structures that meet the specifications set out by the British Standards Institute (BSI) and the International Organization for Standardization (ISO)

- You can now build a rating model for a:
  - weir (BSI/ISO standard 1438-2017), or a
  - flume (BSI/ISO standard 4359 2022)

Rectangular Flume



Supply the values for the input dimensions and attributes of the flume structure, which are used to derive coefficients and constants:

- Approach channel width (B)
- Height of throat invert above approach channel bed (p)
- Throat length (L), and width (b)
- Roughness amplitude coefficient ks

$$Q = \frac{2}{3}^{\frac{3}{2}} \sqrt{g}\, C_d C_v b h^{\frac{3}{2}}$$

Trapezoidal Flume

Supply the values for the input dimensions and attributes of the flume structure,

which are used to derive coefficients and constants:

- Approach channel width (B)
- Height of throat invert above approach channel bed (p)
- Throat length (L), and width (b)
- Roughness amplitude coefficient (ks)
- Side slope of throat section (m)
  (Input value must be greater than 0.)
- Side slope of approach channel at gauging
  station (ma) (Input value must be greater than 0.)

$$Q = \frac{2}{3}^{\frac{3}{2}} \sqrt{g}\, C_d C_s C_v b h^{\frac{3}{2}}$$

Rectangular Thin-plate Weir

Supply the values for the input dimensions and attributes of the weir structure,

which are used to derive coefficients and constants:

- Maximum head (h_{max})
- Approach channel width (B)
  - Notch depth
- Notch height above channel bed (p)
- Notch width (b)

$$Q = C_d \frac{2}{3} \sqrt{2g} b_e h_e^{\frac{3}{2}}$$

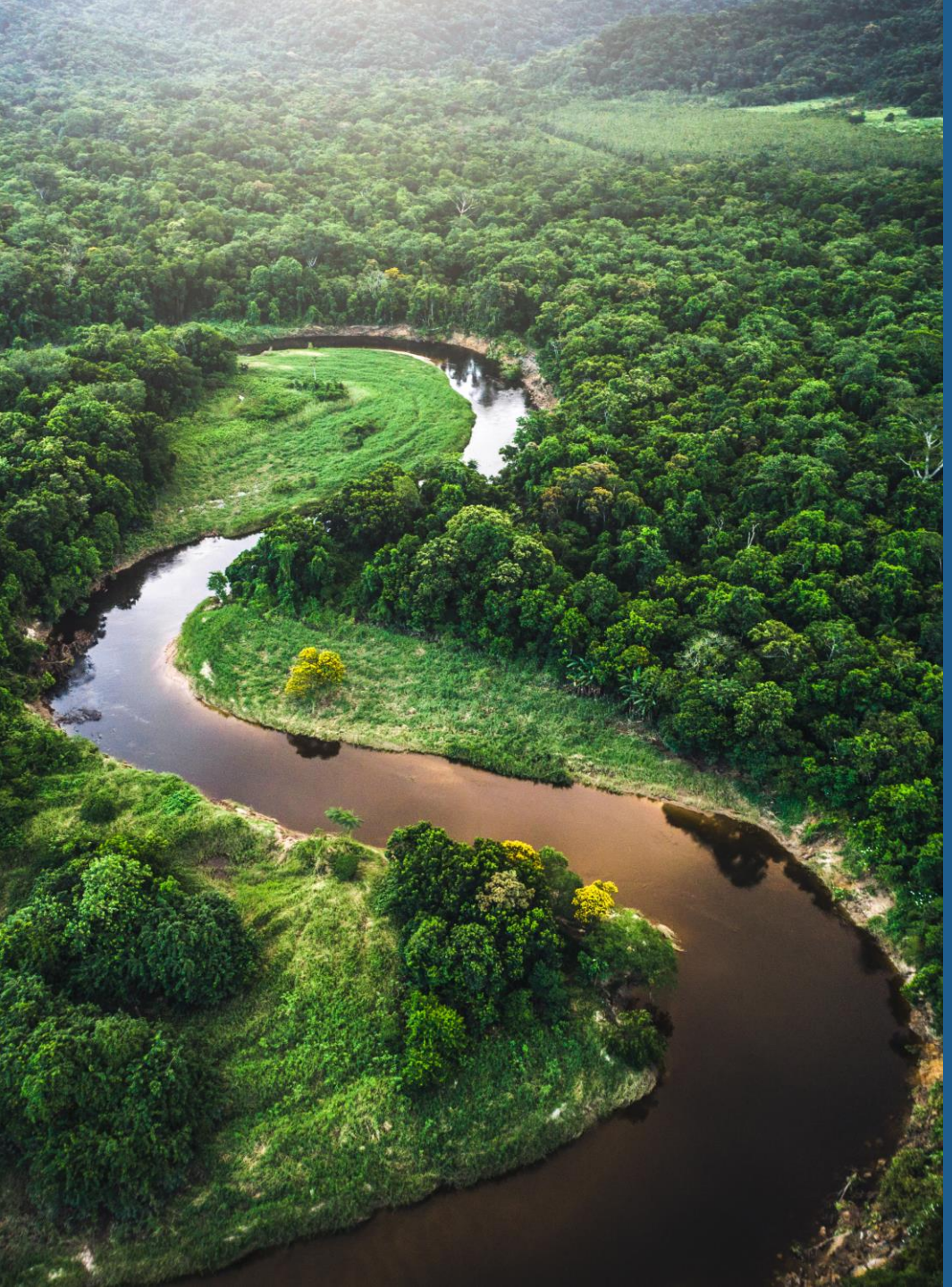
Triangular-notch Thin-plate Weir

supply the values for the input dimensions and attributes of the weir structure,

which are used to derive coefficients and constants:

- Maximum head (h_{max})
- Approach channel width (B)
  - Notch depth
- Notch height above channel bed (p)
- Notch width (b)
- Notch angle (a)

$$Q = C_d \frac{8}{15} \tan\frac{\alpha}{2} \sqrt{2g} h_e^{\frac{5}{2}}$$



AGENDA

- A brief tour of the user interface
- How easy is it to create a shift?
- What have we added in the past ~year?
- Overview of Rating curve types
  - Descriptive Equations now supported!
- Want to create a rating for a weir or a flume?
- **Want to create a rating curve from a Cross-Section?**
- What is a compound curve?
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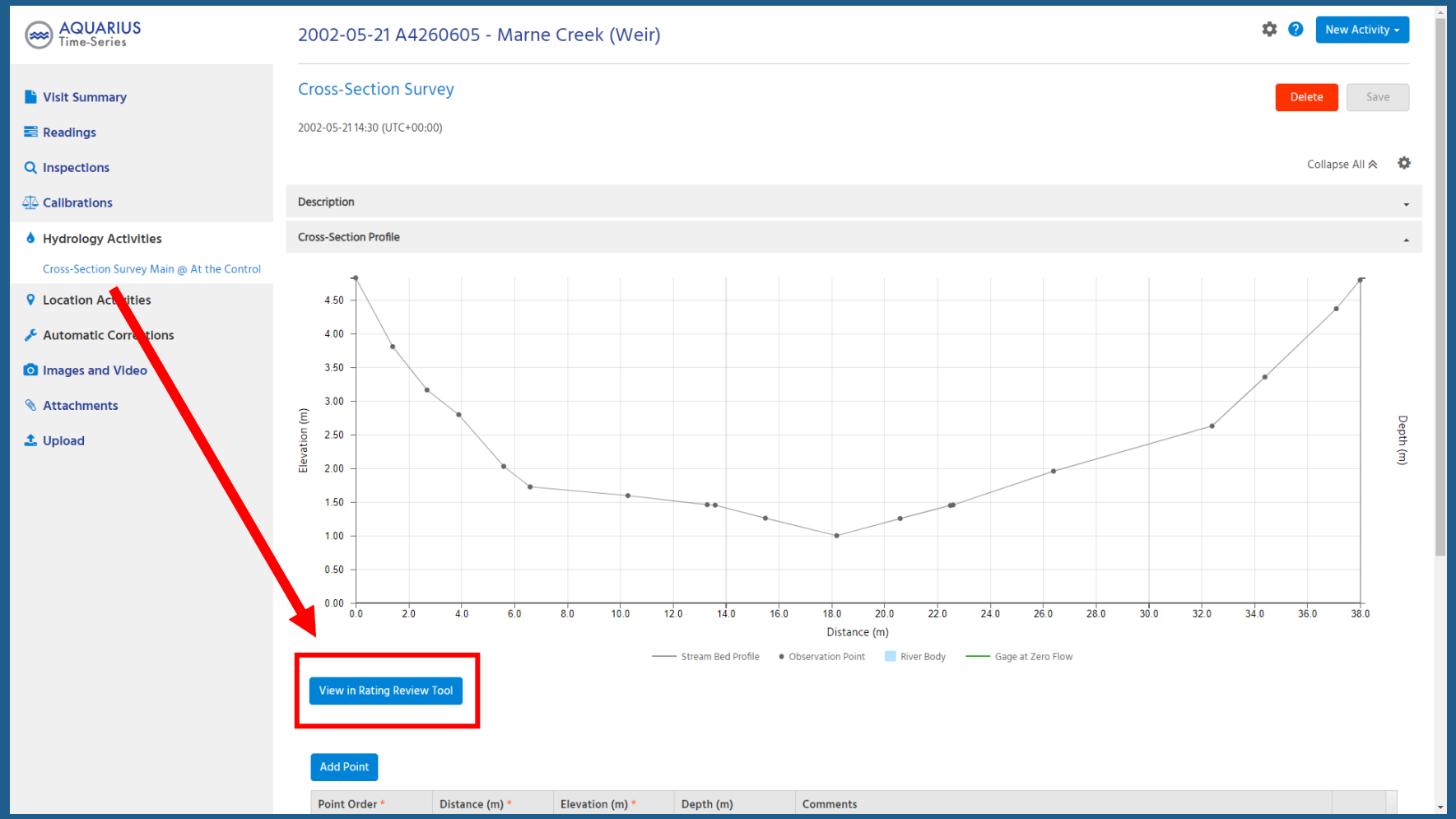
- Question and Answers

Create a Rating from a Cross-Section!?

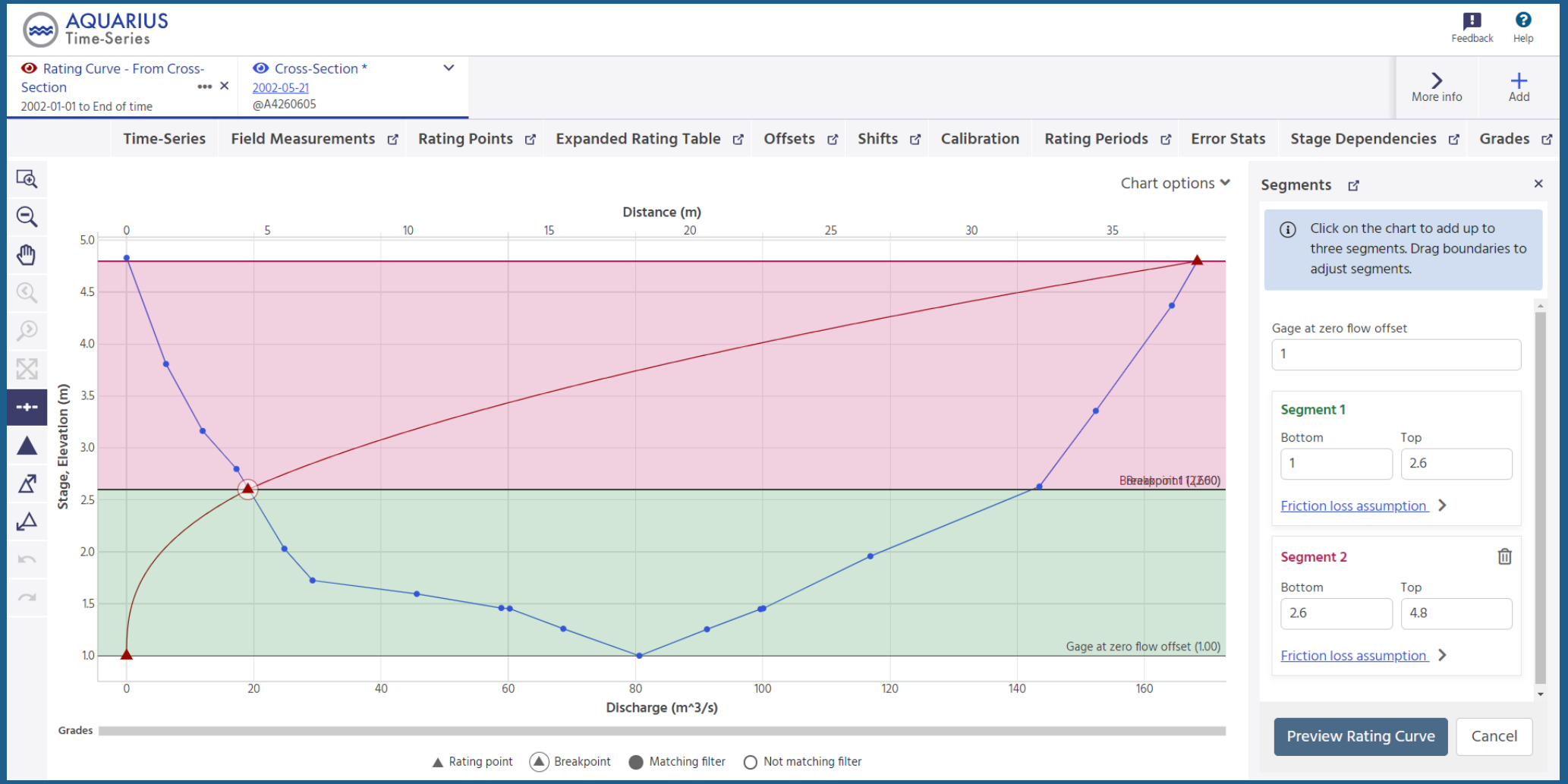
- In the Field Data Editor, from a cross-section…



Create a Rating from a Cross-Section!?

- No field measurements required… wait what!?
- The curve's shape is determined by the cross-section geometry
- Can also be "rotated" to align with existing field measurements by altering the Friction Loss Assumption

Create a Rating from a Cross-Section!?



User Input 1: Cross-section segmentation

- Up to three segments may be defined -
  with the boundary between successive segments
  represented as breakpoints

- Boundaries should be selected so that each segment is
  roughly ‘prismatic’ in shape

User Input 2: Friction Loss Assumption

Velocity Exponent

&

Velocity Coefficient

Friction Loss Assumption: Velocity Exponent

Either…

- **0.67** - for most natural channels

Or…

- **0.5** - for artificial or natural controls where there is a sudden drop in water level over the control feature

Friction Loss Assumption: Velocity Coefficient

- The channel slope and roughness can be entered, and the coefficient is calculated as the square root of slope divided by roughness
- If slope and roughness are not known, the coefficient can be directly entered
- Default values are as follows:
  - For 0.67, default coefficient = 1.0
  - For 0.5, default coefficient = 2.557 which is based on (⅔ g)0.5

VIDEO: Thompson River

Natural river geometry example…

Create a Rating Curve from an existing equation

For example:

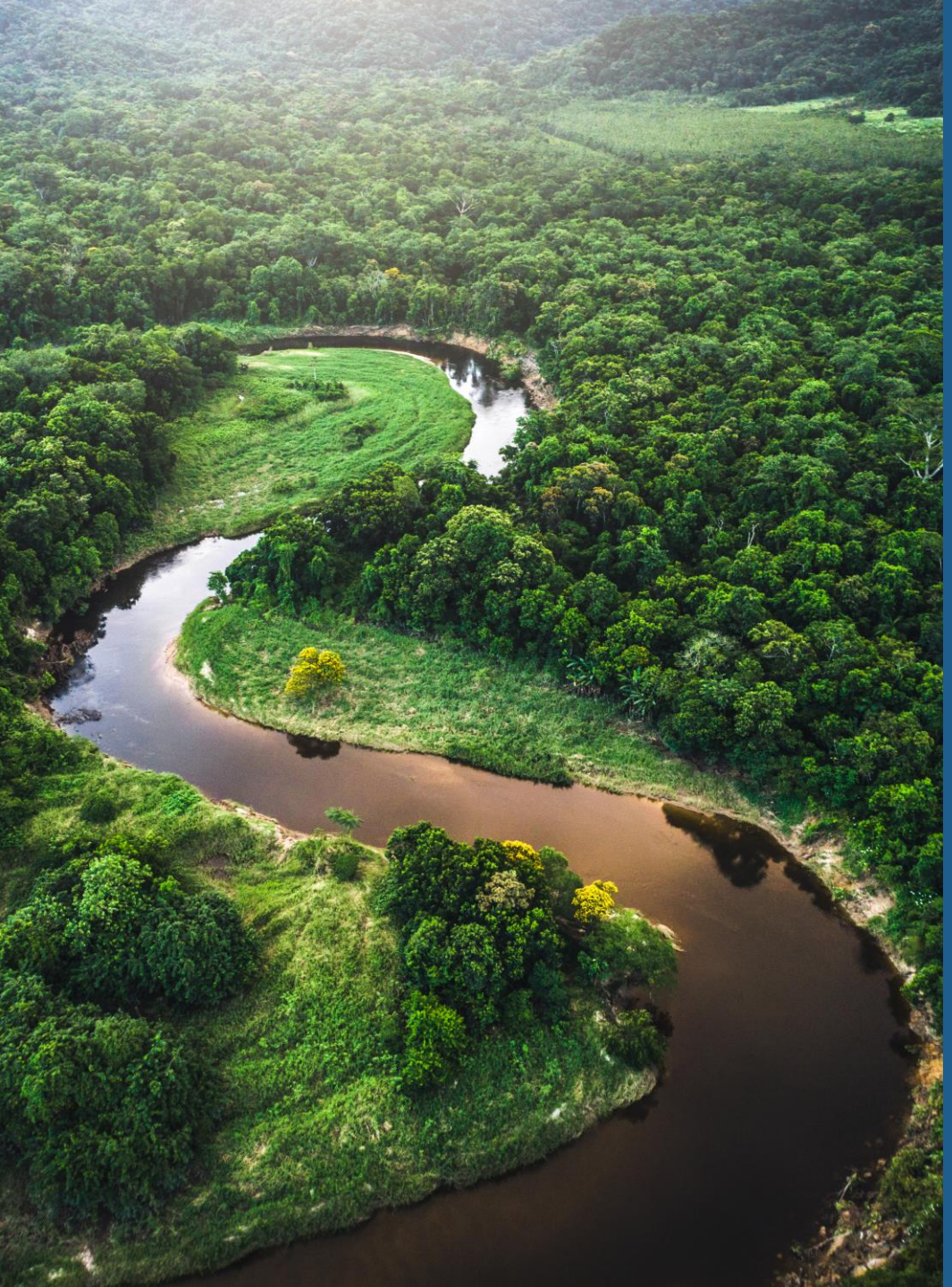
Q = 27.10896 * (1.77-1.37)^2.18959

- *Q = discharge*
- *H = water level/stage*
- *And an offset of 1.37 meters*

Create a Rating Curve from an existing equation

Derive the discharge value using the upper and lower stage values in the existing rating equation:

Low Stage value of 1.77 m:	**High Stage value of 7.62 m:**
Q = 27.10896 * (1.77-1.37)^2.18959	Q = 27.10896 * (7.62-1.37)^2.18959
Q = 3.646 m^3/s	Q = 1498.869 m^3/s



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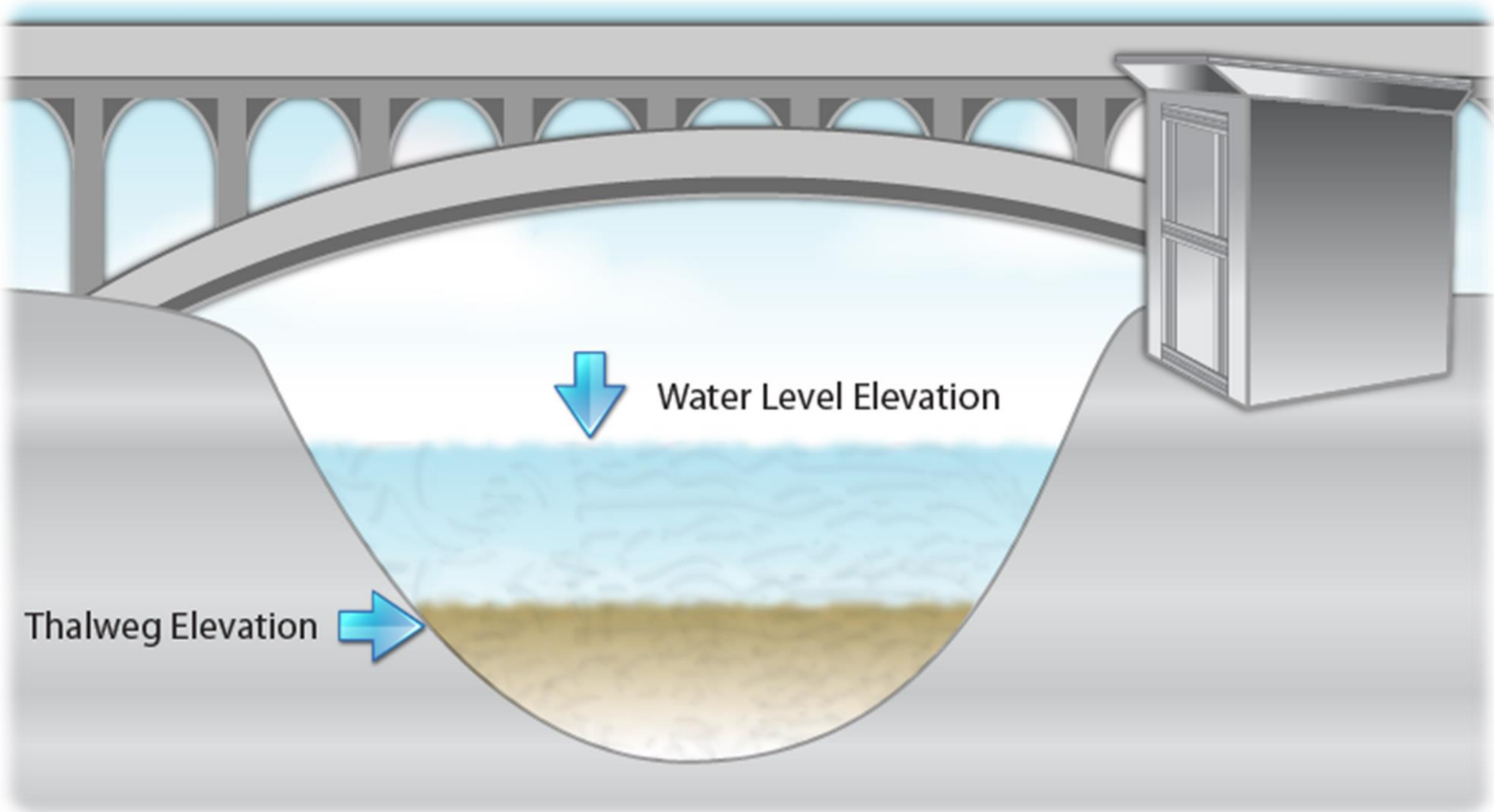
What is a Compound Curve?

- A rating curve that has more than one segment
- Requires one or more break points and therefore more than one offset

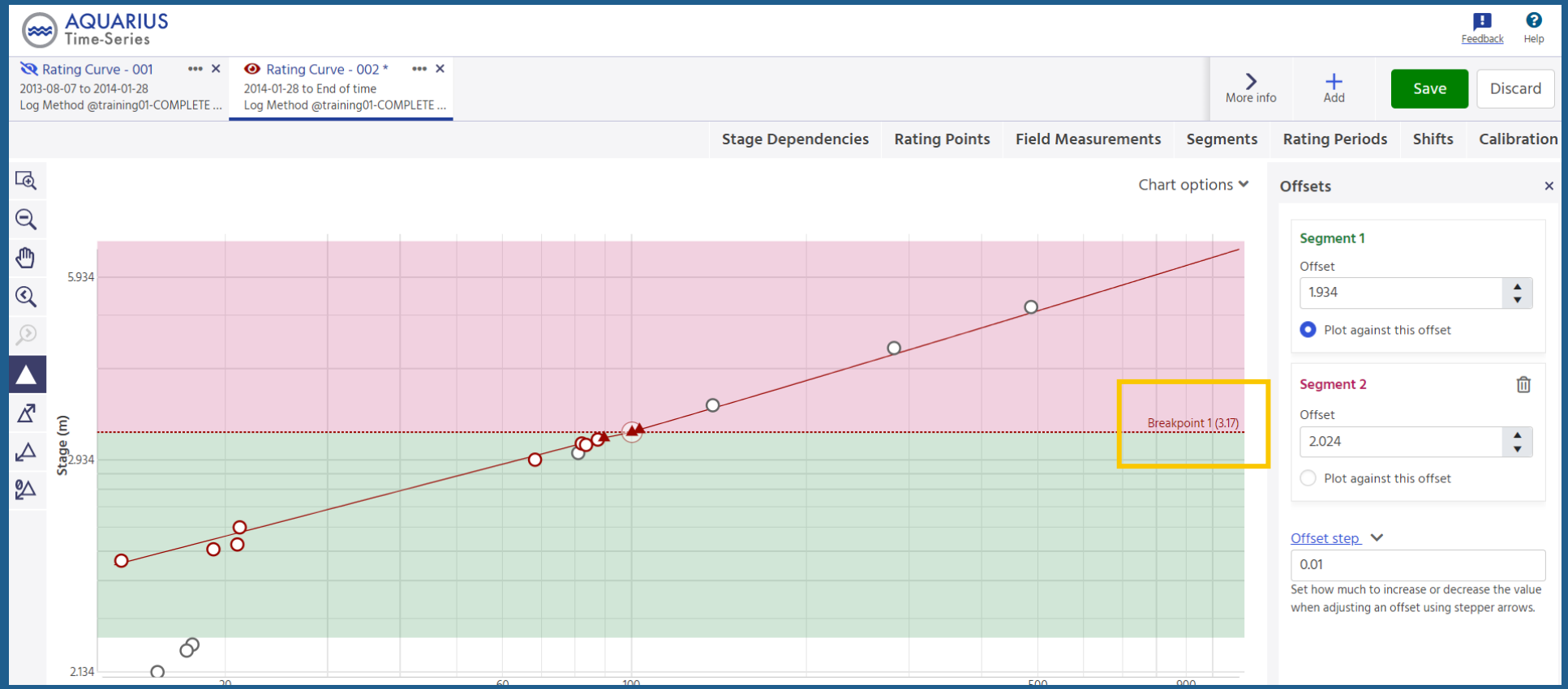
Compound Curve

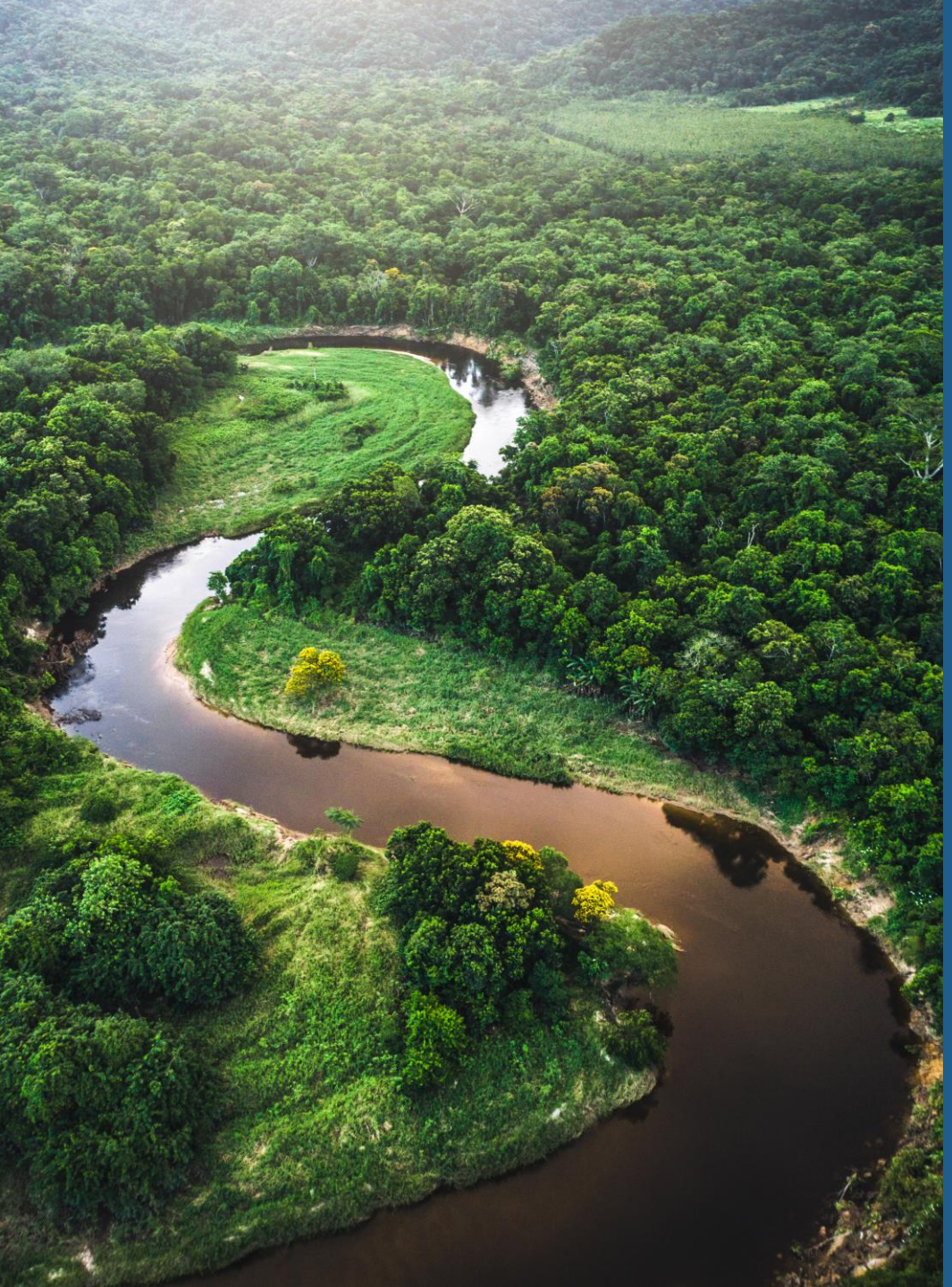
AQUATIC Informatics



Compound Curves

- Add additional rating points and set them as breakpoints





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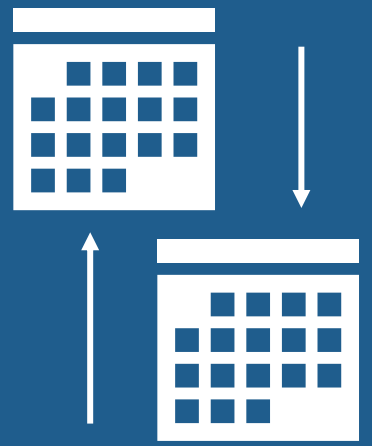
What are “Blended Ratings”?

- Overlap two rating periods
- Shown in the rating period pane
- Input data ⟶ output data value is computed as the pro-rated combination of the outputs from the two ratings

- T1 = 100% R1
- T2 = 50% R1 + 50% R2
- T3 = 100% R2



Example

If the blend period for ratings R1 and R2 is from times ts to te and we are computing a value at time t within the blend:

- Proration p = (t - ts) / (te - ts) ts < t < te
- Output v = [(1-p) * R1] + [p * R2]

THANKS!

ANY QUESTIONS OR COMMENTS?

AQUATIC INFORMATICS
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