

# Rating Review Tool

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

Grant Gilron, Education Specialist



# USER POLL!

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**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)*





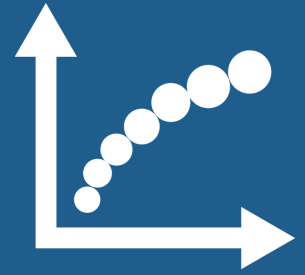
# AGENDA

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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?
- Overview of Rating curve types
  - Descriptive Equations now supported!
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- Review of Blended Ratings
- Question and Answers



# User Interface Tour



- From Springboard

A screenshot of the AQUARIUS Time-Series web application interface. The interface is divided into a left sidebar and a main content area. The sidebar contains the 'Locations' section with a search bar and a list of location folders. The main content area features a top navigation bar with several icons, a breadcrumb trail, and a table of data series. A red arrow points from the 'training01-complete' breadcrumb to the corresponding row in the table. A red box highlights the selected row in the table.

**AQUARIUS**  
Time-Series

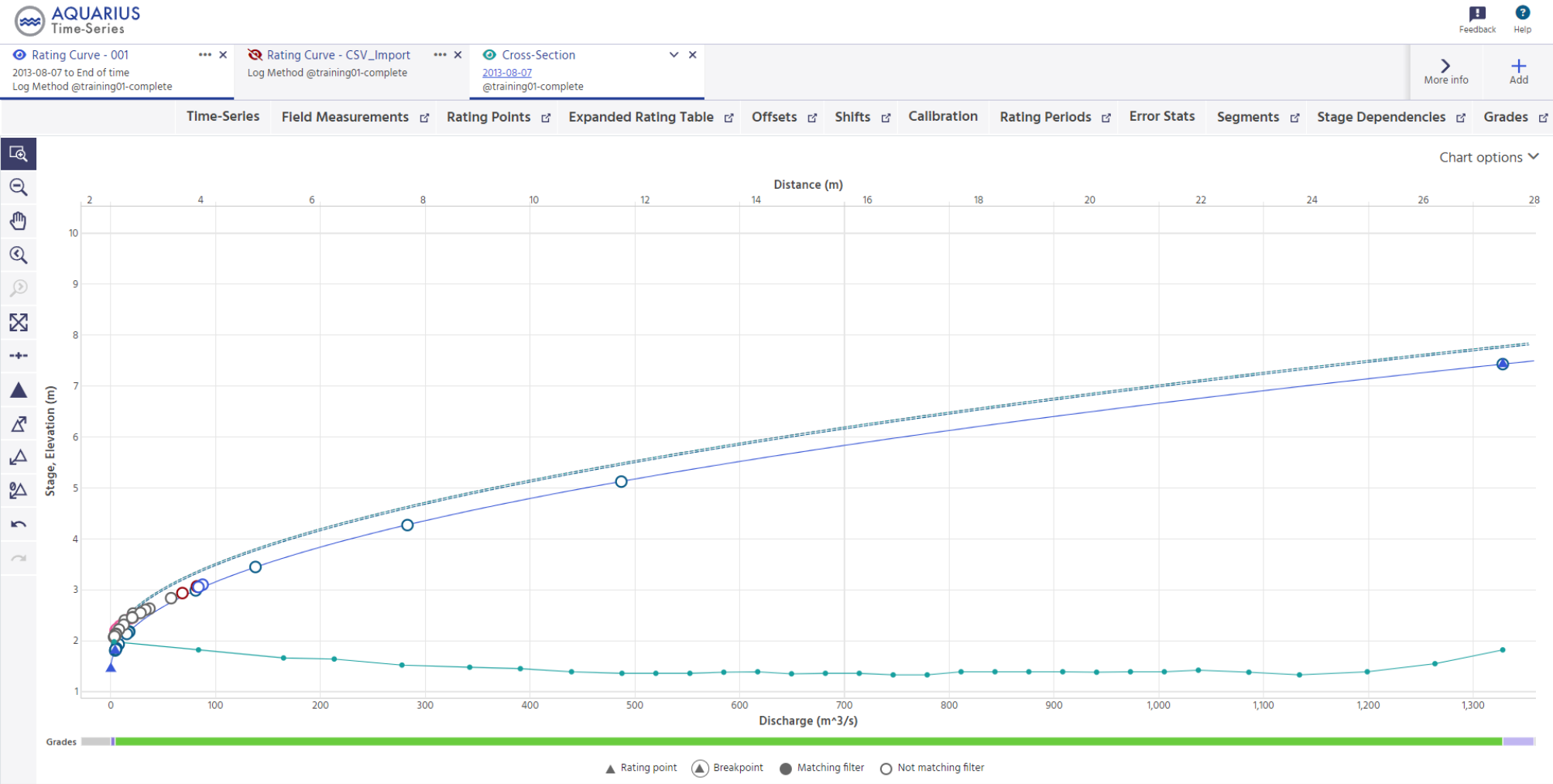
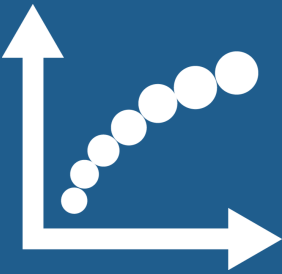
training01-complete

Time-Series & Rating Models | Visits | Sensors & Gauges | Thresholds

		Location	Parame...	Label	Period
<input type="checkbox"/>	≡	training01-...	Air Temp	Logger	
<input type="checkbox"/>	≡	training01-...	Discharge	Working	
<input type="checkbox"/>	≡	training01-complete	Stage	Working	2023-06-23 09:53
<input checked="" type="checkbox"/>	≡	training01-complete	Stage-Discharge	Log Method	2023-
<input type="checkbox"/>	≡	training01-complete	Discharge	Daily Mean	Daily   Mean
<input type="checkbox"/>	≡	training01-complete	Discharge Total	Daily Totals	Daily   T



# User Interface Tour



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

Expanded Rating Table [↗](#) Offsets [↗](#) Shifts [↗](#) Calibration [↗](#) Rating Periods [↗](#) Error Stats [↗](#) Segments [↗](#) Stage Dependencies [↗](#) Grades [↗](#)

### Time-Series

Preview time-series data derived from this rating model.

Input time-series

Select an input time-series ▼

### Field Measurements

**i** All checked measurements will be recorded as "used" for curve development when saved. If you do not want to record any of those measurements as "used" uncheck them before saving. ✕

Date range  Control Condition  Stage

Show only:

... Actions [Color scheme](#) [+ Time-series](#) [Export table](#)

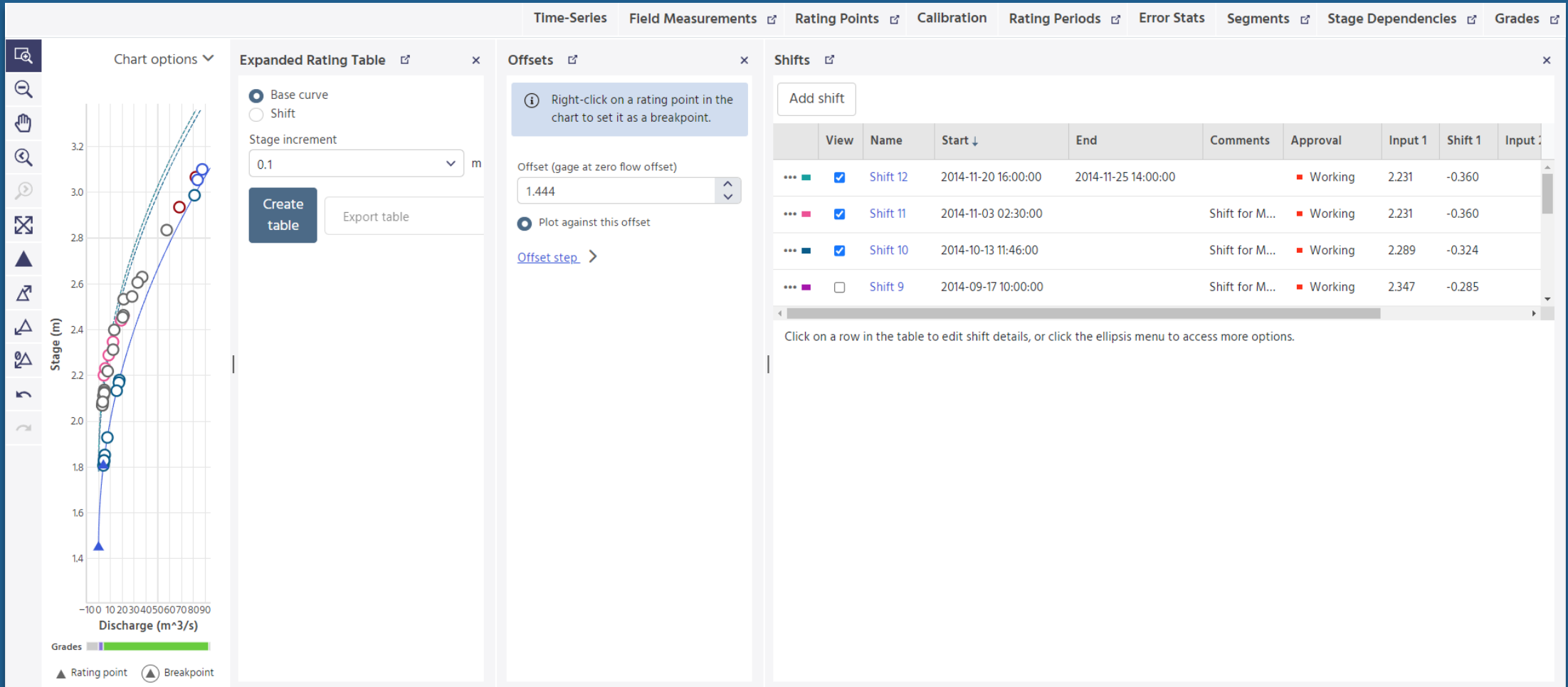
<input type="checkbox"/> Use	Chart view	Timestamp ↓	Stage m	Discharge m <sup>3</sup> /s	ID
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-10-01 11:40:00</a>	2.085	3.51	578
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-09-14 10:45:00</a>	2.124	4.81	577
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-09-01 13:26:00</a>	2.070	3.12	576
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-08-18 14:33:00</a>	2.085	3.57	575
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-07-30 11:17:00</a>	2.128	4.76	574
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2015-07-16 10:56:00</a>	2.070	3.17	573

### Rating Points

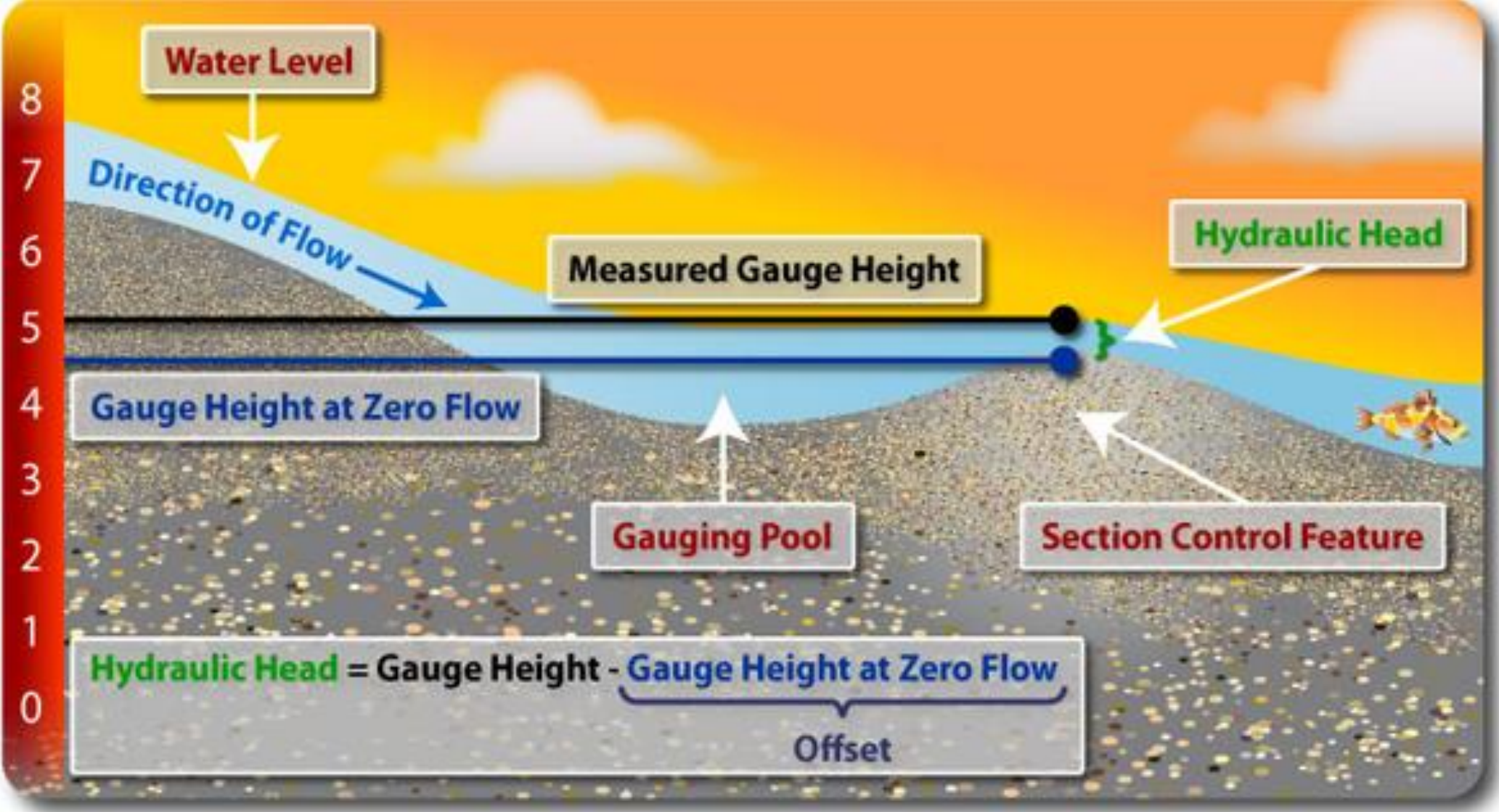
	Stage m	Discharge m <sup>3</sup> /s	Offset m	Slope	Equation
... ▲	1.450	0.001	1.444		
... ▲	1.807	4.08	1.444	2.026	$X = 31.696 * (Y - 1.444)^{2.026}$
... ▲	7.431	1330	1.444	2.065	$X = 32.980 * (Y - 1.444)^{2.065}$
... ▲	10.161	2890	1.444	2.065	$X = 32.981 * (Y - 1.444)^{2.065}$



# Additional Panes: Expanded Rating Table, Offsets and Shifts

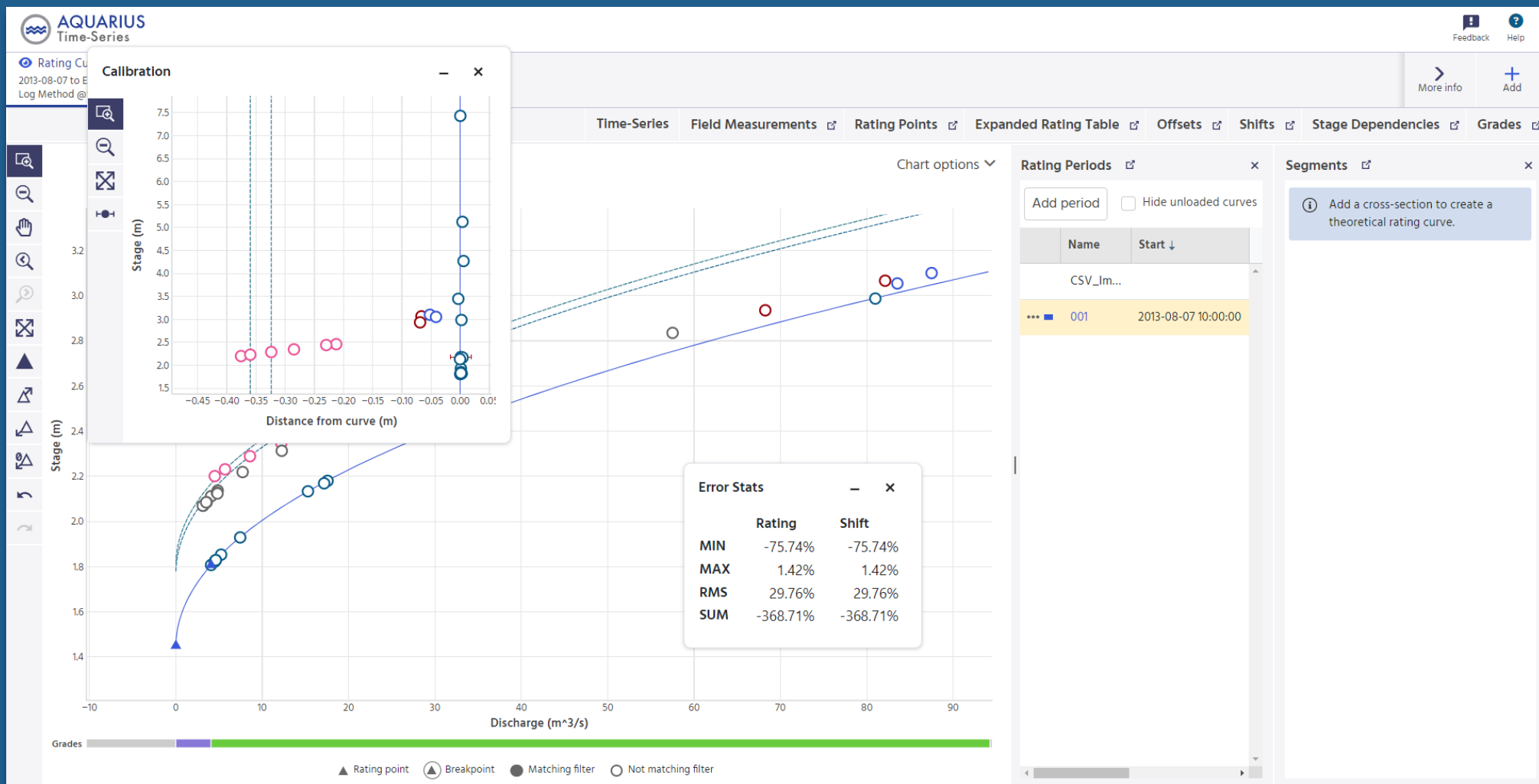


# What is an Offset again???

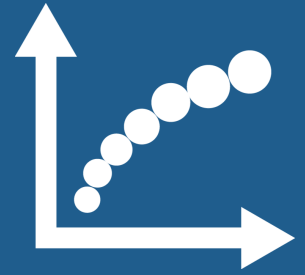




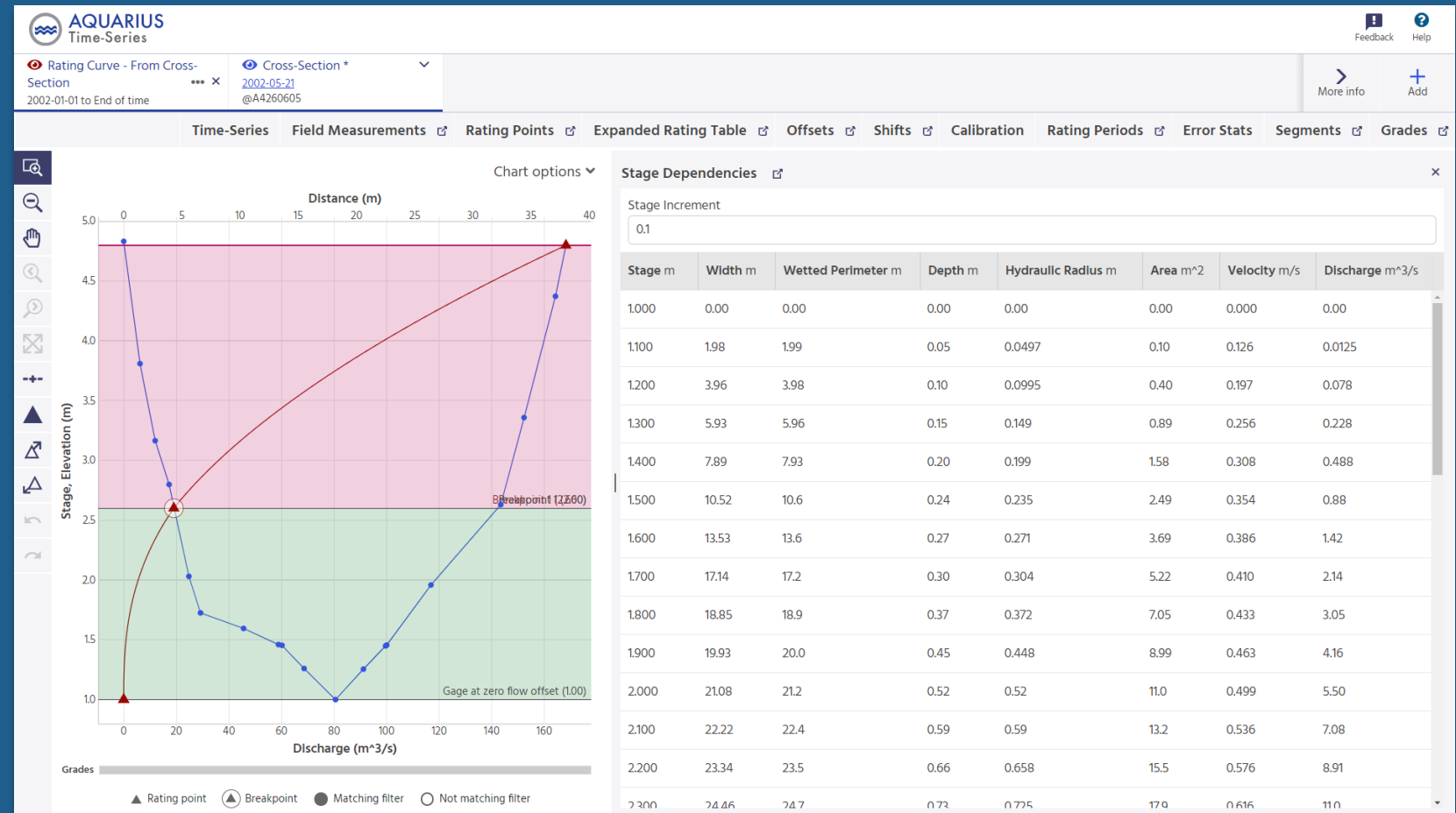
# Additional Panes: Calibration, Error Stats, Rating Periods...



# 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?

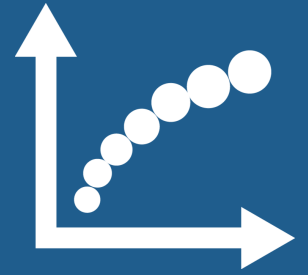


Chart options ▾

Field Measurements

- Show tooltips
- Show measurements
- Show unused measurements
- Show measurements not matching filter
- Show measurement marker labels

Axis Configuration

- Linear
- Log Log

Shift Curves

- Show target shift curve(s)
- Show reference shift curve(s)





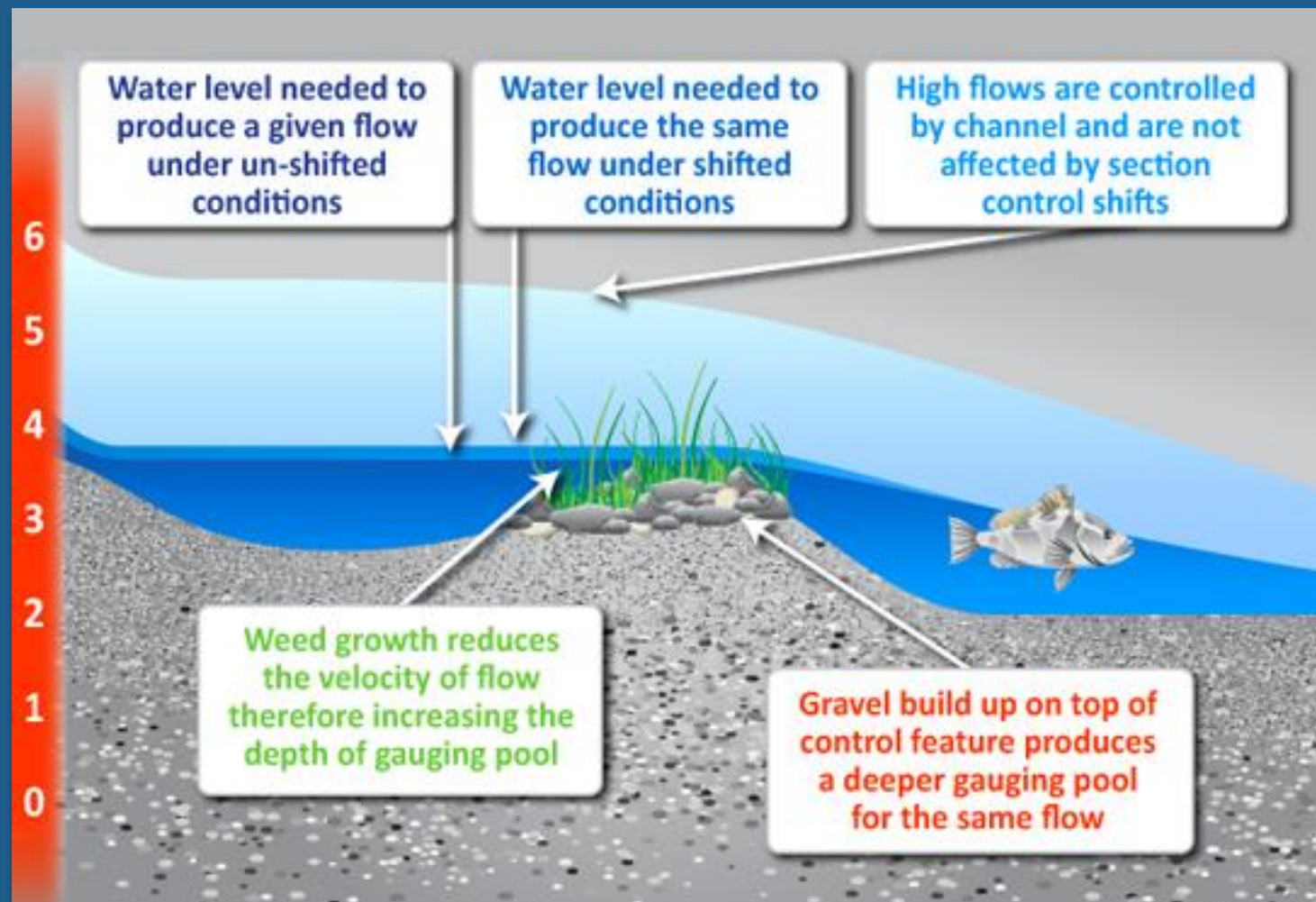
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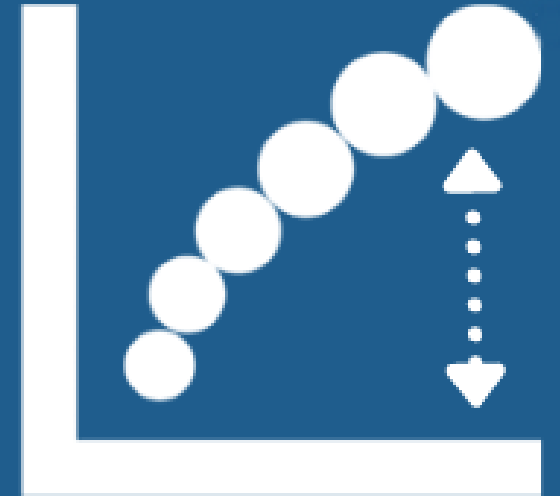
# What is a Shift?



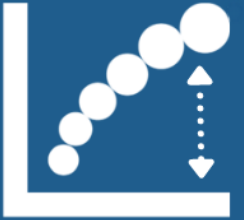
# What is a Shift?

- 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

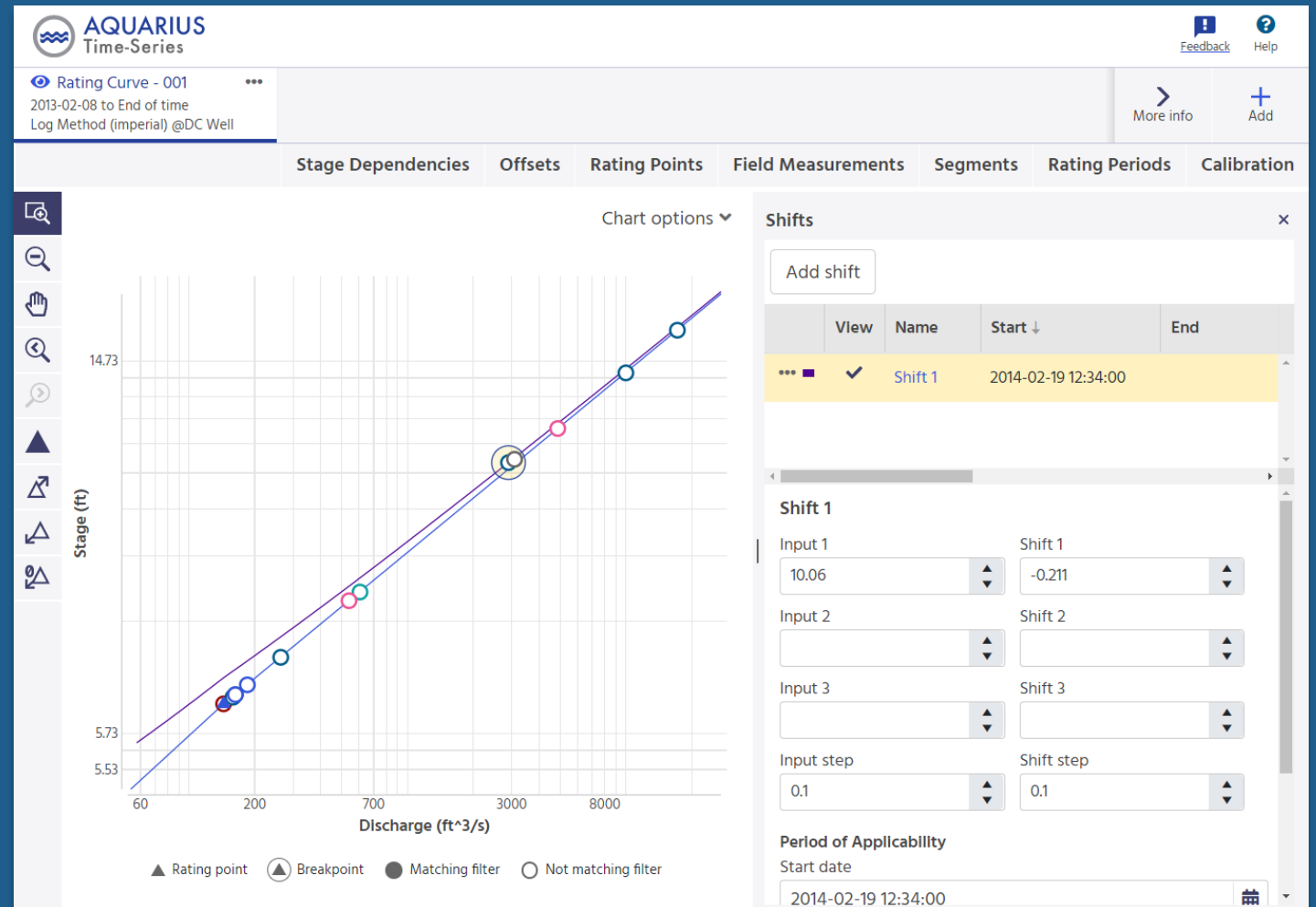
Shift



# 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!



The screenshot displays the AQUARIUS software interface. The main window is titled "Calibration" and shows a graph of Stage (m) versus Discharge (m<sup>3</sup>/s). The graph has a logarithmic x-axis with major ticks at 4, 9, 50, 100, and 600. The y-axis ranges from 2.8 to 4.8. A blue line represents the rating curve, and several blue circles represent data points. One data point at approximately (0.5, 4.27) is highlighted with a red circle and labeled "Create new shift".

Below the main graph is a "Grades" section with a horizontal bar. At the bottom, there is a legend: ▲ Rating point, ● Breakpoint, ● Matching filter, ○ Not matching filter.

On the right side, the "Shifts" pane is open. It has an "Add shift" button at the top. Below it is a table with columns: View, Name, Start ↓, and End. The table contains one entry: Shift 1, with a start date of 2021-08-07 12:40:00. Below the table, the configuration for "Shift 1" is shown:

Input	Value	Shift	Value
Input 1	4.27	Shift 1	0.006
Input 2		Shift 2	
Input 3		Shift 3	
Input step	0.1	Shift step	0.1

At the bottom of the Shifts pane, there is a "Period of Applicability" section with a "Start date" field.





# 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

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- 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).

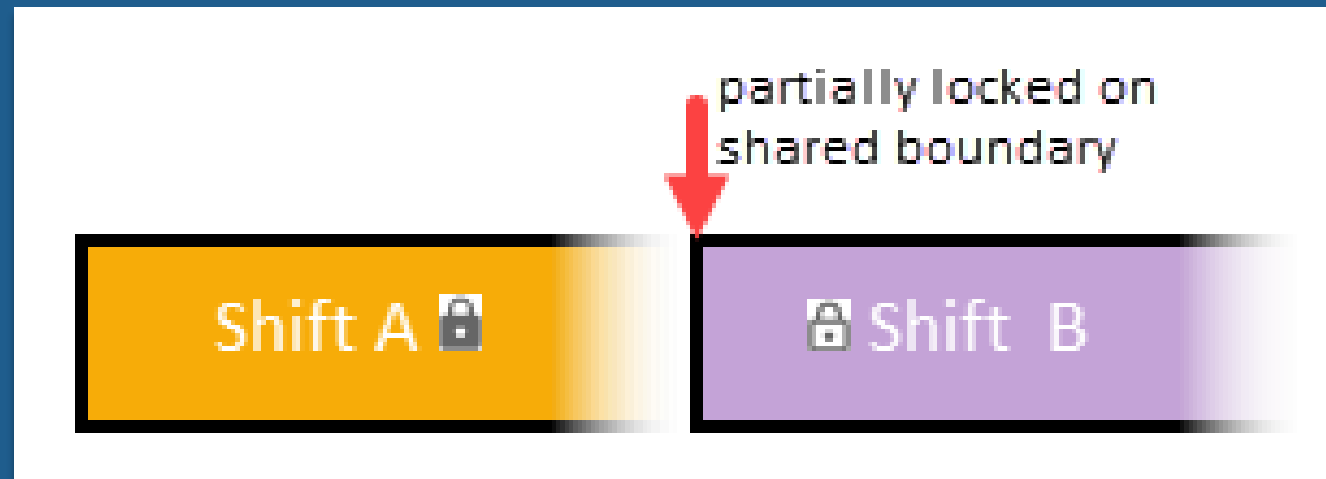


# Rules for Shifts: Partially Locked



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.

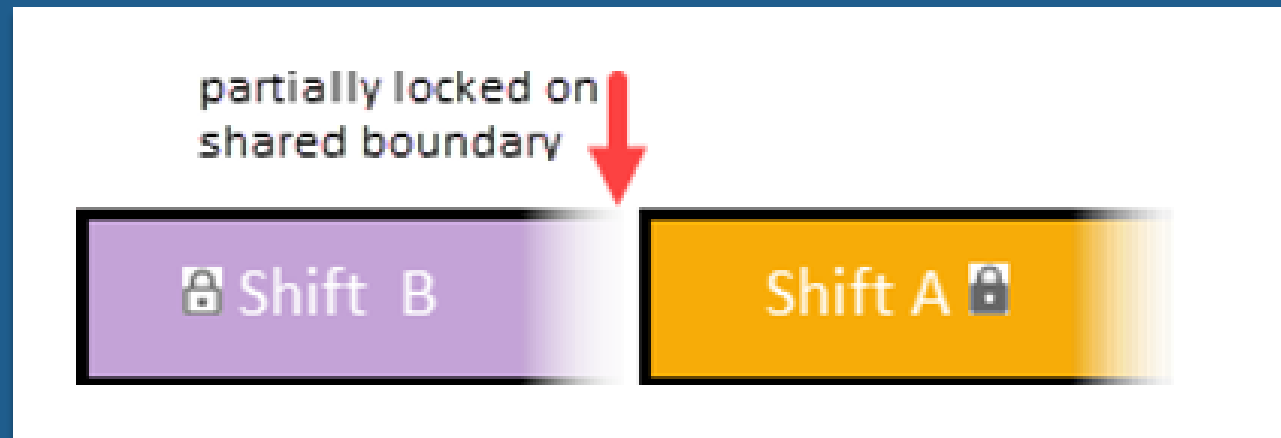


# Rules for Shifts: Partially Locked



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?

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## 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!



Rating Curve - 10.1  
2022-01-14 to End of time  
STGQ @01010000

Field Measurements | Rating Points | Expanded Rating Table | Offsets | Calibration | Rating Periods | Error Stats | Segments | Stage Dependencies | Grades

Chart options

Time-Series

Preview time-series data derived from this rating model.

Input time-series  
Gage height.ft@01010000

Preview output

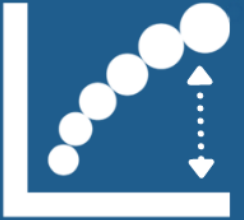
Shifts

Add shift

	View	Name	Start ↓	End	Comments	Approval
...	<input checked="" type="checkbox"/>	Shift 4	2021-09-02 07:15:00			Approved
...	<input checked="" type="checkbox"/>	Shift 3	2014-04-30 20:30:00	2014-09-01 00:00:00		Approved
...	<input checked="" type="checkbox"/>	Shift 2	2014-02-10 18:15:00	2014-02-15 00:00:00		Approved
...	<input checked="" type="checkbox"/>	Shift 1	2013-11-01 14:21:26	2014-01-15 00:00:00		Working

Click on a row in the table to edit shift details, or click the ellipsis menu to access more options.

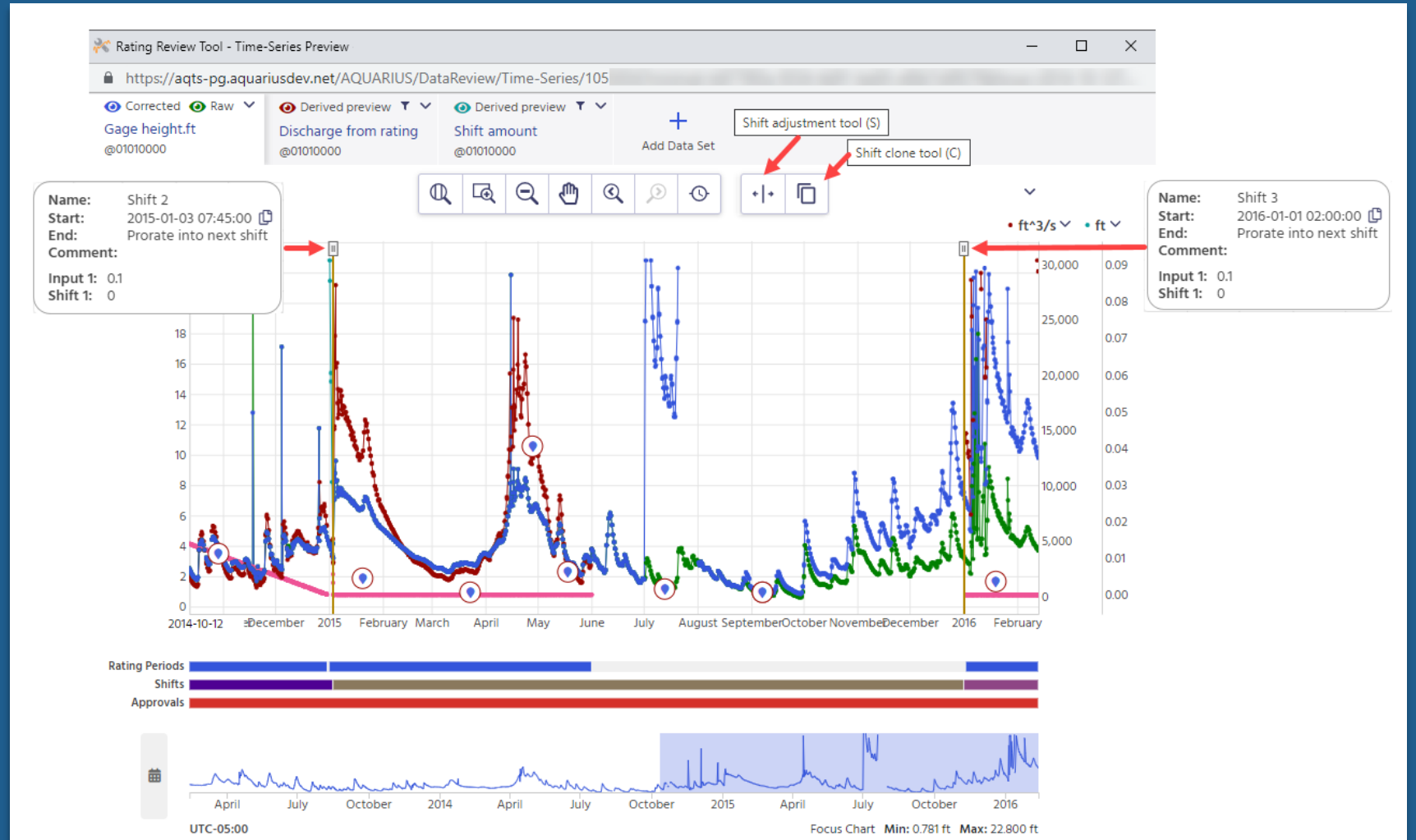




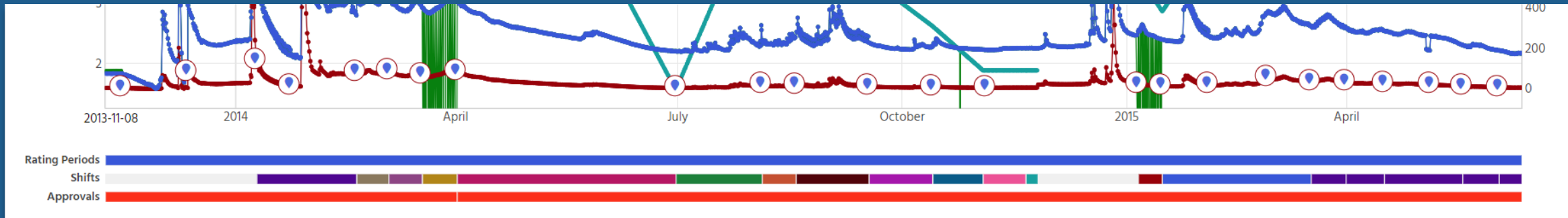
# Edit shifts from the Time-Series Preview!

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 (within approved period)

Partially locked (shift partially overlaps a locked region)

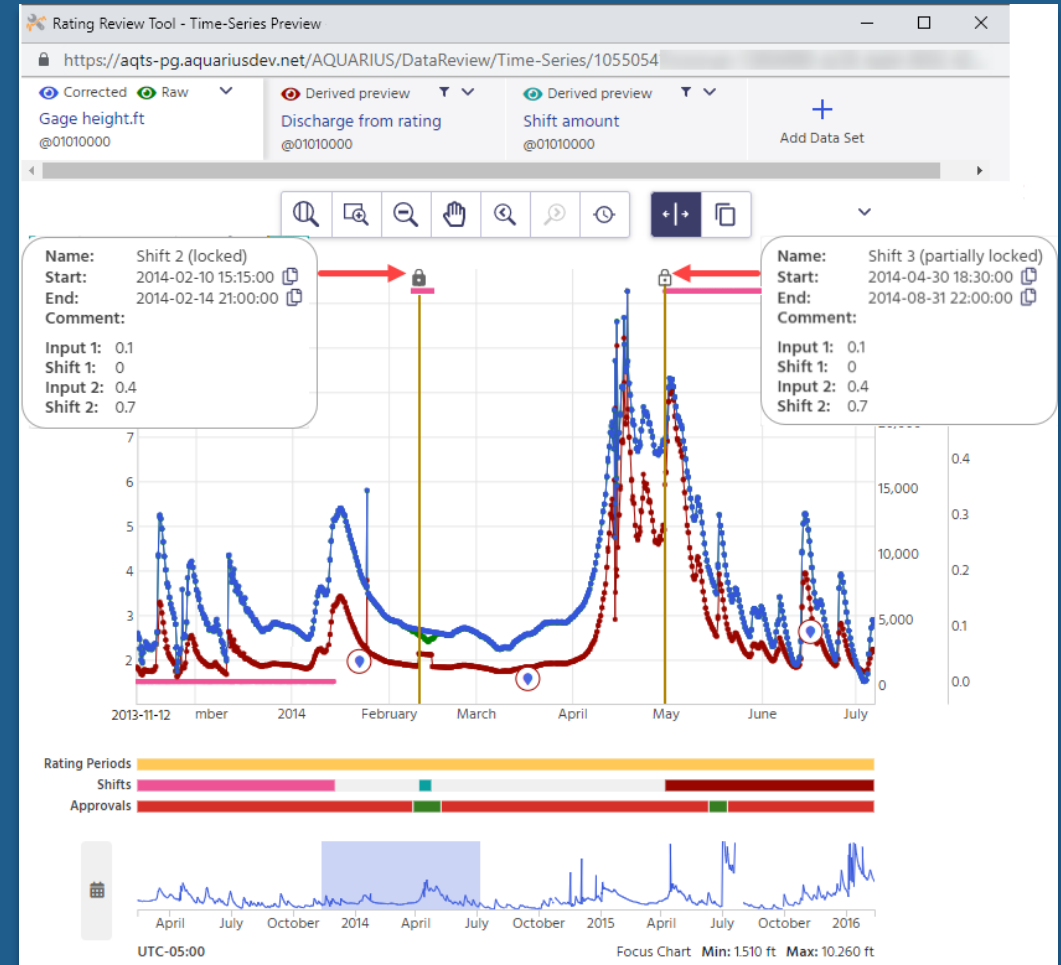
Partially locked (preceding shift is prorated and fully locked)



# 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.

### Clone Rating Curve

Rating Curve 001 will be cloned as 001 (copy).

Rating Curve name \*

Clone with Rating Curve

Offsets and breakpoints

Measurement settings

Shifts

- Shift 3 2021-04-22
- Shift 2 2015-01-21 (partially locked)
- Shift 1 2013-01-19 (locked)

Comments



## 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:



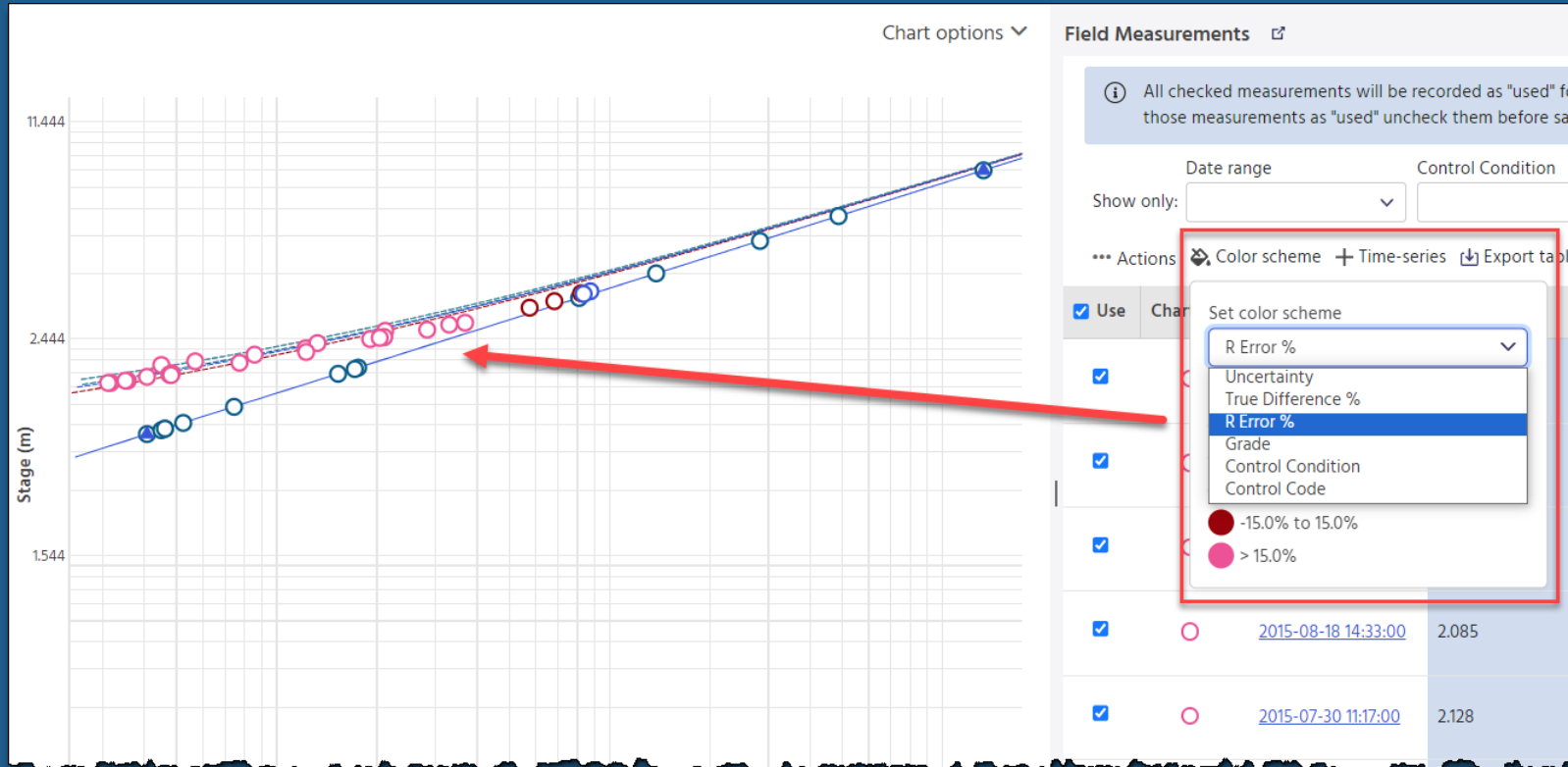
Start dates were set to today's date for these cloned shifts because they were locked or partially locked:  
2013-01-19 01:45:00 to End of time



*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

Base curve  
 Shift

Gage height increment  
0.1 ft

Create table Export table

Export in table format  
Export in column format

Gage height ft	Discharge ft <sup>3</sup> /s										Difference in Discharge per 1 ft
	.4	.5	.6	.7	.8	.9					
0					95.63	131.42	173.07	220.64			
1	274.17	333.71	399.28	470.93	548.67	632.54	722.57	818.77	921.18	1029.8	870.52
2	1144.7	1265.8	1393.3	1527.0	1667.0	1813.4	1966.2	2125.3	2290.7	2462.6	1496.2
3	2640.9	2825.6	3016.8	3214.4	3418.5	3629.0	3846.0	4069.5	4299.6	4536.1	2138.3
4	4779.2	5028.8	5285.0	5547.7	5817.0	6092.8	6375.3	6664.4	6960.0	7262.3	2792.0
5	7571.2	7886.7	8208.9	8537.7	8873.1	9215.2	9564.0	9919.5	10282	10650	3441.3
6	11013	11381	11756	12137	12524	12917	13317	13722	14133	14550	3961.1
7	14974	15403	15838	16280	16727	17181	17641	18106	18578	19056	4566.0
8	19540	20029	20525	21027	21535	22049	22569	23095	23628	24166	5170.5
9	24710	25260	25817	26379	26947	27522	28102	28689	29281	29880	5774.4
10	30484	31095									



# Expanded Rating Table: Column Format



```
expanded-rating-table-Test-001.txt - Notepad
File Edit Format View Help
# Location: 01010000 St. John River at Ninemile Bridge, Maine
# Date processed: 2023-04-11 13:18:39 UTC-07:00 by admin
# Rating: Test-001
# Created: 2022-04-12 21:47:40 UTC-05:00
# Created by: admin
# Updated: 2023-03-27 13:31:51 UTC-05:00
# Updated by: admin
#
#
# Periods of Applicability
# ID Start Date (UTC-05:00) End Date (UTC-05:00) Approval Comments
# 1441947:001 2013-06-06 05:00:00 2014-12-31 05:00:00 Working
# 1441947:001 2015-01-01 05:00:00 2015-06-01 05:00:00 Working Test
# 1441947:001 2016-01-02 05:00:00 2016-06-01 05:00:00 Working
# 1441947:001 2017-01-02 05:00:00 2017-06-01 05:00:00 Working
# 1441947:001 2018-01-02 04:00:00 End of time Working
#
#
# Expanded Rating Table: 001
#
# Gage height (ft) Discharge (ft^3/s)
0.600 95.63
0.700 131.42
0.800 173.07
0.900 220.64
1.000 274.17 i-001
1.100 333.71
1.200 399.28
1.300 470.93
1.400 548.67
1.500 632.54
1.600 722.57
1.700 818.77
1.800 921.18
1.900 1029.8
Ln 1, Col 1 80% Windows (CRLF) UTF-8
```

## 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

The screenshot displays the 'Field Measurements' application interface and the resulting Excel spreadsheet. The application interface shows a table with columns for Use, Chart view, Timestamp, Gage height ft, Discharge ft<sup>3</sup>/s, ID, Method, Grade, Uncertainty, and Comments. The 'Export table' button is highlighted in red. Below, the Excel spreadsheet shows the same data exported into a table with columns A through K.

Use	Chart view	Timestamp	Gage height ft	Discharge ft <sup>3</sup> /s	ID	Method	Grade	Uncertainty	Comments
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2022-10-01 11:29:30</a>		0.00		None			
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2022-06-20 16:44:30</a>		51.0		Volumetric			
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2022-06-20 11:30:00</a>	5.433	0.00		None	500 - FAIR QUALITY		
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2021-08-02 12:29:30</a>	0.750	158		Mid-section	4 - PARTIAL	6.00	Discharge comment
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2021-08-02 12:29:30</a>	0.840	211		Mid-section	15 - POOR	10.00	
<input type="checkbox"/>	<input type="radio"/>	<a href="#">2020-10-05 01:30:00</a>	1.800	0.07	TestId	Volumetric	70 -	6.00	

A	B	C	D	E	F	G	H	I	J	K
1	Use	Timestamp	Gage height (ft)	Discharge (ft <sup>3</sup> /s)	ID	Method	Grade	Uncertainty	Comments	Control Code
2	FALSE	2022-10-01 11:29:30		0						
3	FALSE	2022-06-20 16:44:30		51.01007414						
4	FALSE	2022-06-20 11:30:00	5.433333333	0		500 - FAIR QUALITY				
5	FALSE	2021-08-02 12:29:30	0.75	158		4 - PARTIAL		6	Discharge comment	Section Control
6	FALSE	2021-08-02 12:29:30	0.84	211		15 - POOR		10		Section Control
7	FALSE	2020-10-05 01:30:00	1.8	0.068804423	TestId	70 - Excellent		6		Section Control
8	FALSE	2020-10-05 01:15:00	0.67	128		70 - Excellent		1		Section Control
9	FALSE	2020-10-05 00:30:00	1.85	1012						Section Control
10	FALSE	2018-10-27 10:20:00	6.3	93.8	412				5 SECOND OSS MEASURE DOWN RECONSTRUCTED LATER. NOT USED FOR CORREC	





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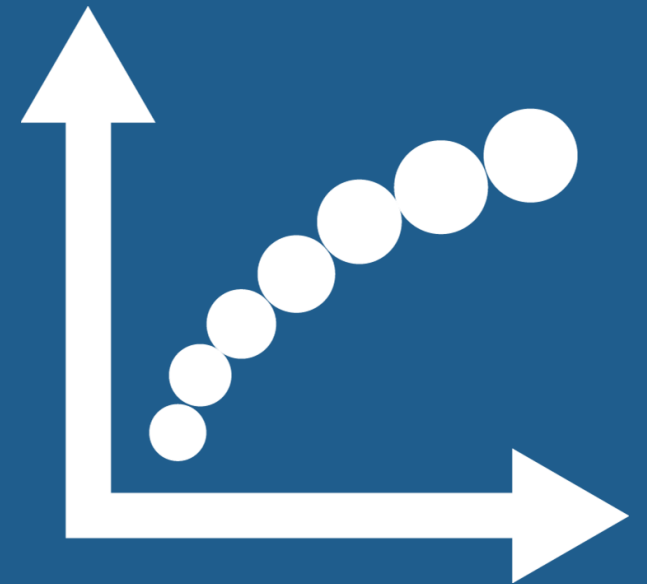
# Rating Review Tool – Types of Curves

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

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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



Rating Curve - Descriptive  
Equation Example  
Descriptive Equation Example @trainin...

More info Add

Time-Series Field Measurements Expanded Rating Table Offsets Shifts Calibration Rating Periods Error Stats Segments Stage Dependencies Grades

Chart options

Rating Points

Enter a descriptive equation below to change the resulting curve. To edit the equation, select the edit curve tool.  
Example: "y = 0.65 \* pow(x, 1.6) + 6.32"

Equation

```
if (x <= -1) {  
  y = double.NaN;  
} else if (x <= 0) {  
  y = 0 - 0.2 * (x - (-1)) + 0.171429 * Math.Pow((x - (-1)), 2) + 0.0285714 *  
  Math.Pow((x - (-1)), 3);  
} else if (x <= 0.02) {  
  y = 0 + 0.228571 * (x - (0)) + 8.57143 * Math.Pow((x - (0)), 2) + 0 *  
  Math.Pow((x - (0)), 3);  
} else if (x <= 0.04) {  
  y = 0.008 + 0.571429 * (x - (0.02)) + 6.42857 * Math.Pow((x - (0.02)),  
  2) + 0 * Math.Pow((x - (0.02)), 3);  
} else if (x <= 0.08) {  
  y = 0.022 + 0.828571 * (x - (0.04)) + 4.28571 * Math.Pow((x - (0.04)), 2)  
  + 0 * Math.Pow((x - (0.04)), 3);  
}
```

Preview

Stage (m)

Discharge (m<sup>3</sup>/s)

Grades

Rating point Breakpoint Matching filter Not matching filter





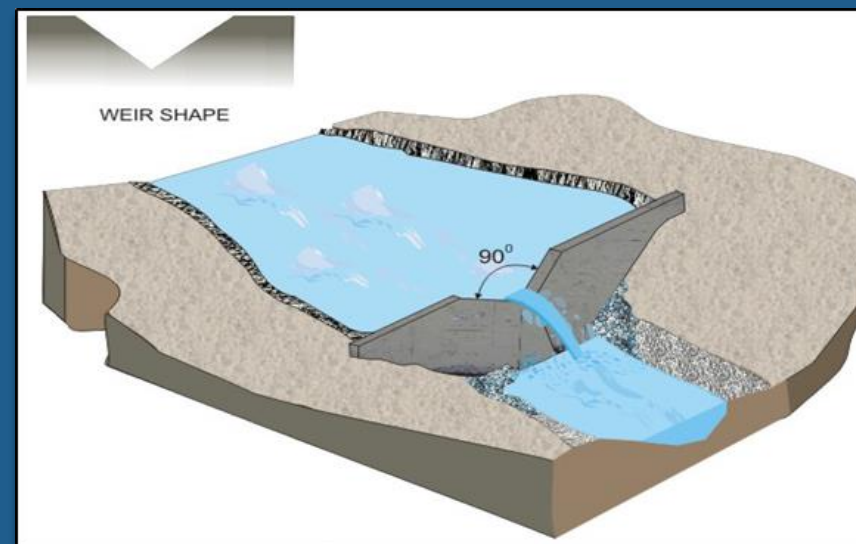
# AGENDA

---

- A brief tour of the user interface
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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

## New Rating Curve

Rating Curve name \*

Rating Curve type \*

Structure type \*

- Triangular Notch Weir (BS ISO 1438-2017)
- Triangular Notch Weir (BS ISO 1438-2017)**
- Rectangular Notch Weir (BS ISO 1438-2017)
- Compound Weir (BS ISO 1438-2017)
- Rectangular Flume (BS ISO 4359-2022)
- Trapezoidal Flume (BS ISO 4359-2022)

Create Cancel



# 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  $k_s$

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

# 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.)

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





# 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)

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





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# Create a Rating from a Cross-Section!?



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

**AQUARIUS Time-Series** 2002-05-21 A4260605 - Marne Creek (Weir) New Activity

**Cross-Section Survey** Delete Save

2002-05-21 14:30 (UTC+00:00) Collapse All

**Description**

**Cross-Section Profile**

**View in Rating Review Tool**

**Add Point**

Point Order *	Distance (m) *	Elevation (m) *	Depth (m)	Comments
---------------	----------------	-----------------	-----------	----------



# 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  $(\frac{2}{3} g)^{0.5}$



# VIDEO: Thompson River





## Natural river geometry example...

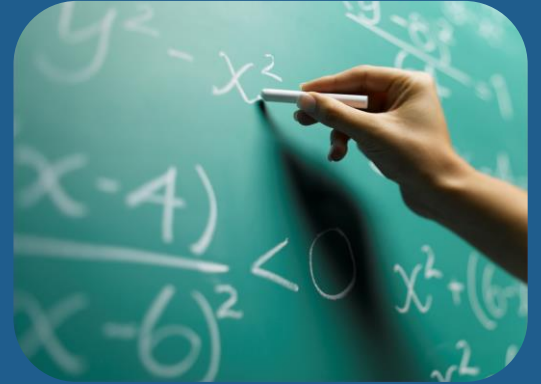
Thompson River at Spence's Bridge

AQUATIC  
Inver 202

channel slope (S) approximately 0.002 (google maps)  
roughness (n) approximately 0.045 (MSP 2329)  
velocity Coefficient =  $5\sqrt{0.5n} = 0.9928$



# 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:
$Q = 27.10896 * (1.77 - 1.37)^{2.18959}$	$Q = 27.10896 * (7.62 - 1.37)^{2.18959}$
$Q = 3.646 \text{ m}^3/\text{s}$	$Q = 1498.869 \text{ m}^3/\text{s}$





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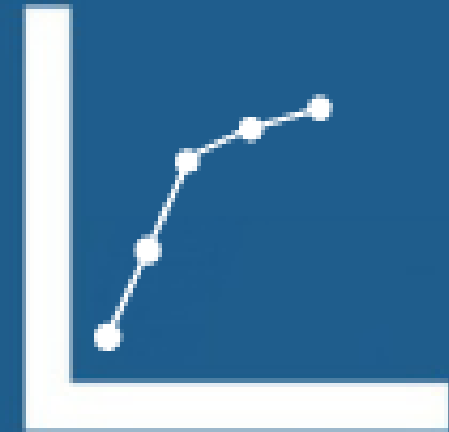


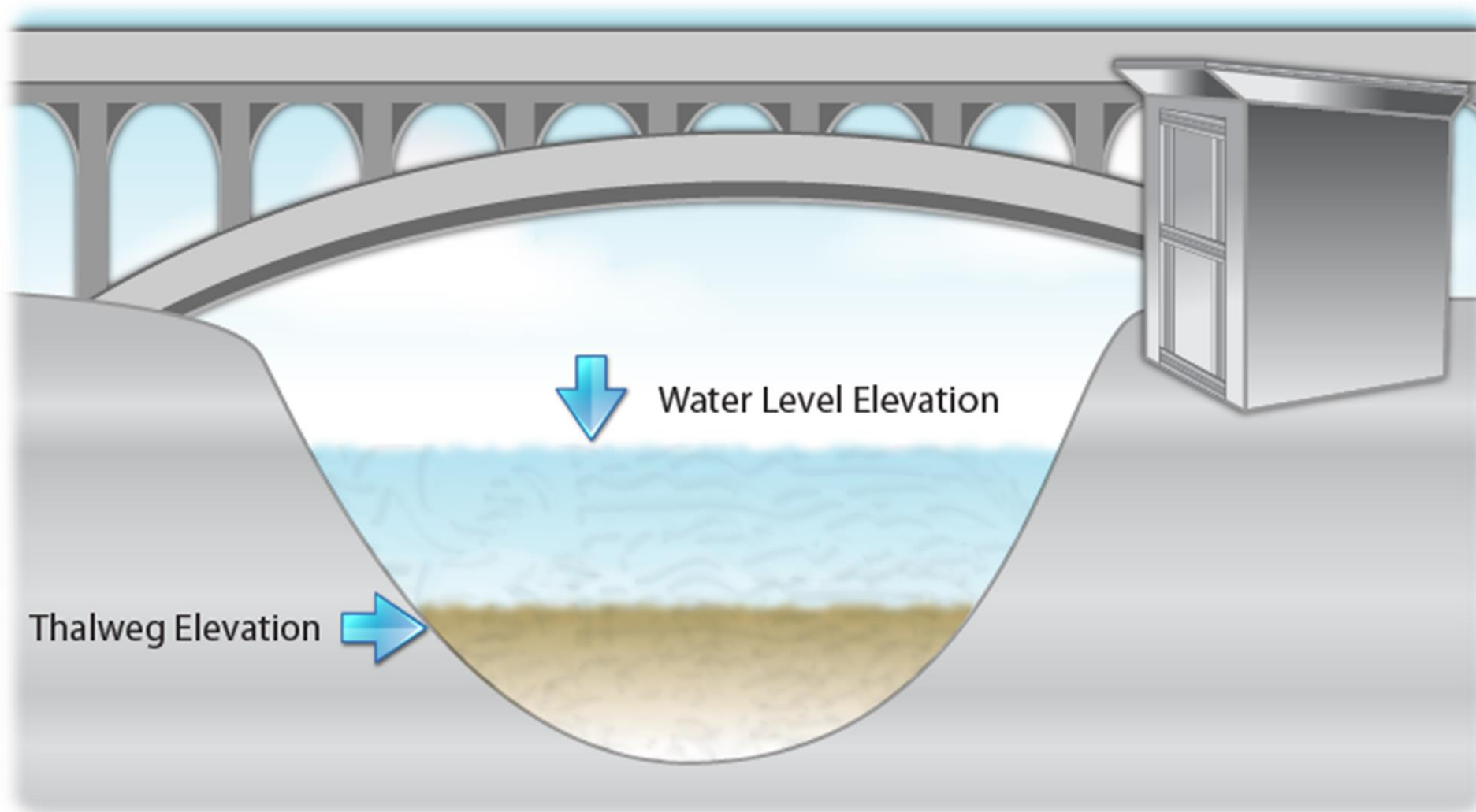
# What is a Compound Curve?

---

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

Compound  
Curve

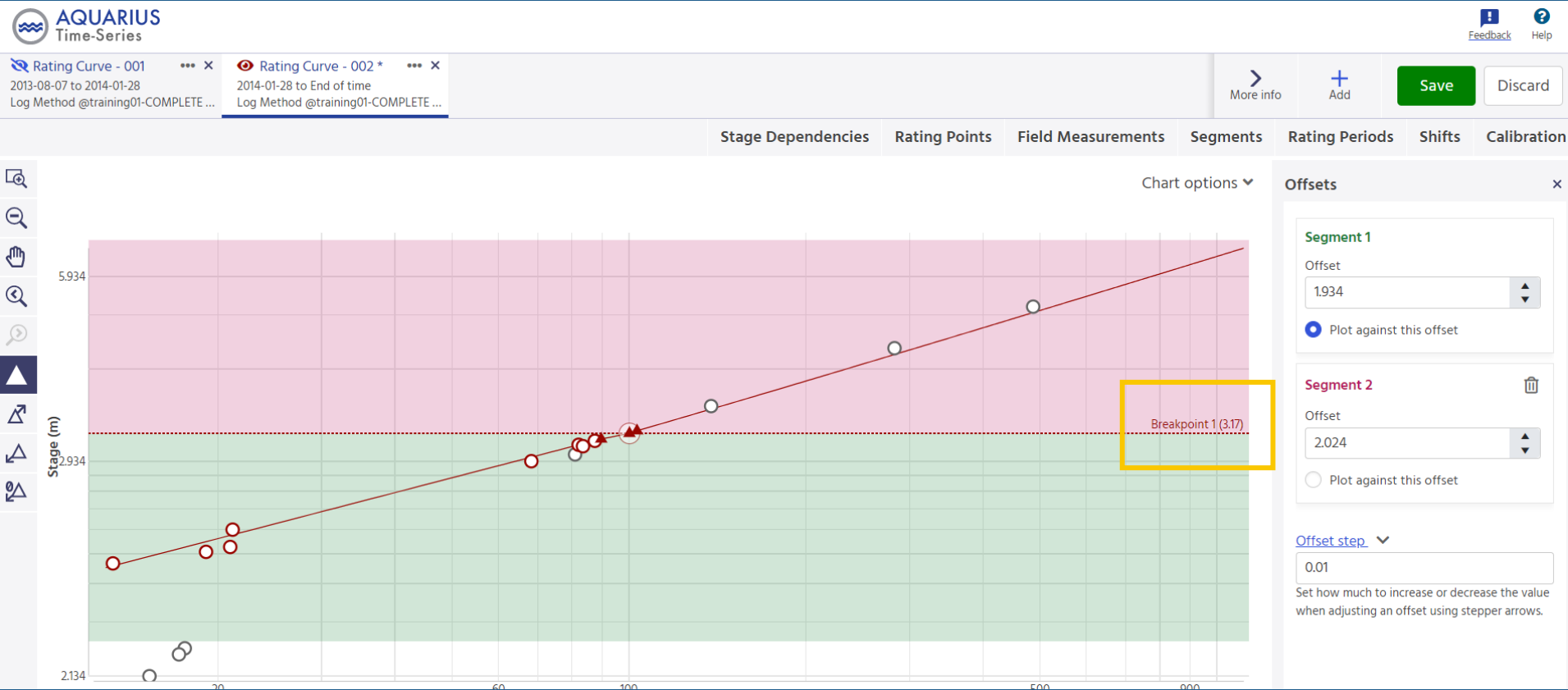






# Compound Curves

- Add additional rating points and set them as breakpoints





# AGENDA

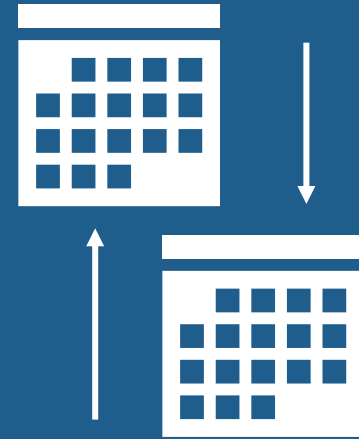
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# What are “Blended Ratings”?

- Overlap two rating periods
- Shown in the rating period pane
- Input data  $\longrightarrow$  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  $t_s$  to  $t_e$  and we are computing a value at time  $t$  within the blend:

- Proration  $p = (t - t_s) / (t_e - t_s)$   $t_s < t < t_e$
- Output  $v = [(1-p) * R1] + [p * R2]$



# THANKS!

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## ANY QUESTIONS OR COMMENTS?

AQUATIC INFORMATICS

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