

Fall Creek Flush Model

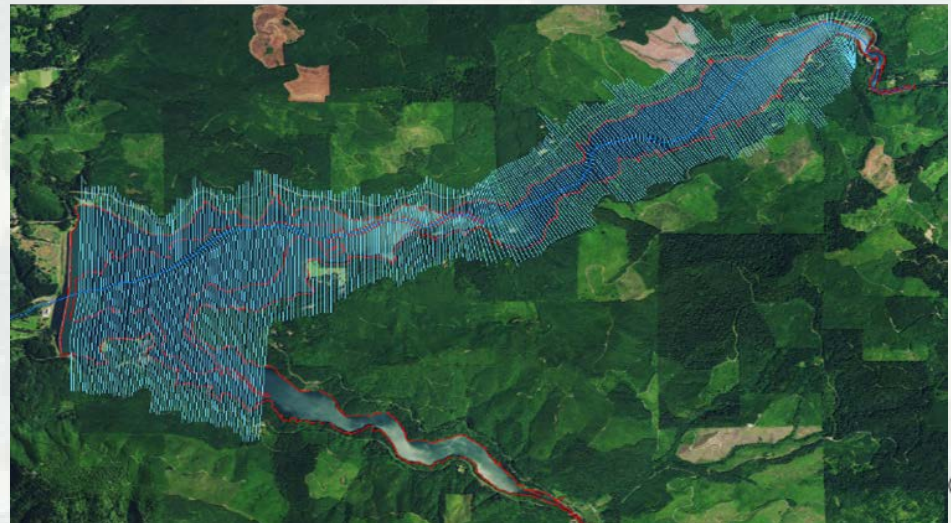
BLUF: NWP and HEC developed HEC-RAS sediment model of the only regular USACE reservoir flushing operation, calibrating the model to three years and adding new HEC-RAS features.

Objectives

- Calibrate a sediment model of the Fall Creek flush.

Approach

- Developed an HEC-RAS 5.0.3 model of three historic flushing events at Fall Creek, calibrating them to downstream concentration.
- Developed several different models utilizing different modeling approaches.



FY17 RSM IPR

Fall Creek Flush Model

District/Other USACE PDT Members

Jim Crain - NWP
Stanford Gibson - HEC
Ilya Poluektov – NWO
Jarrod Norton – NWP
Chris Nygaard – NWP

Stakeholders and Partners

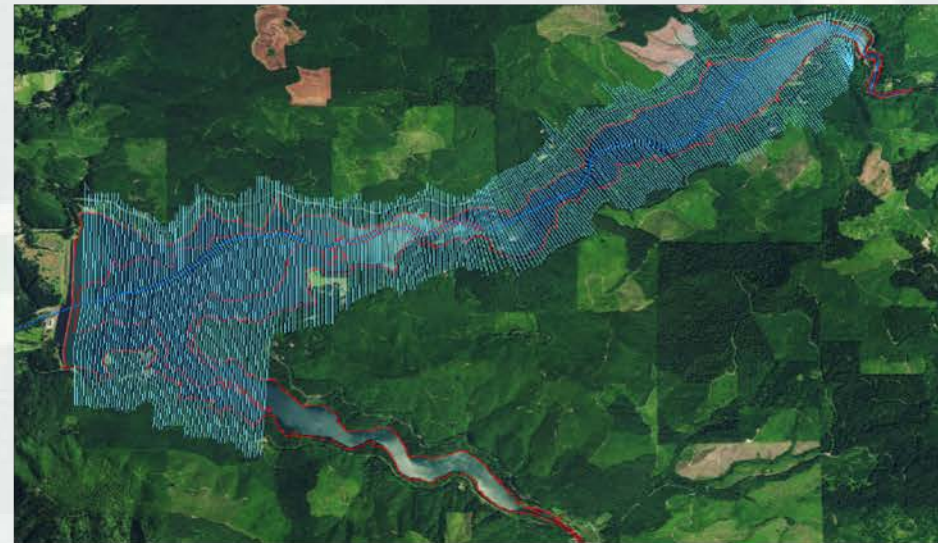
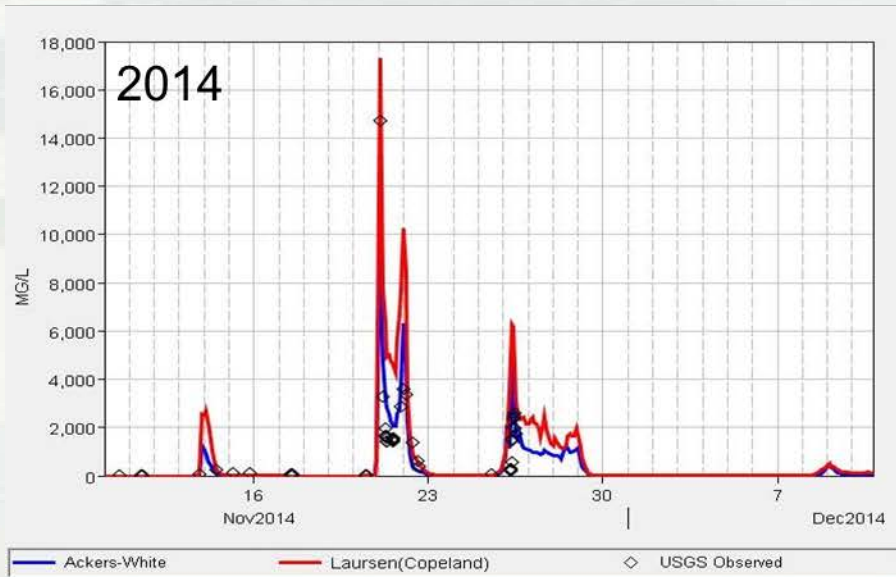
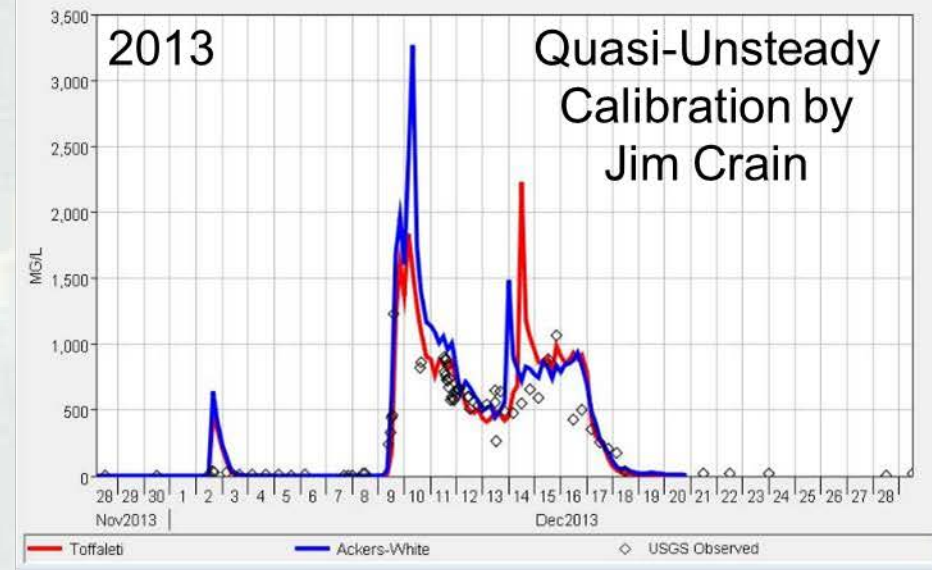
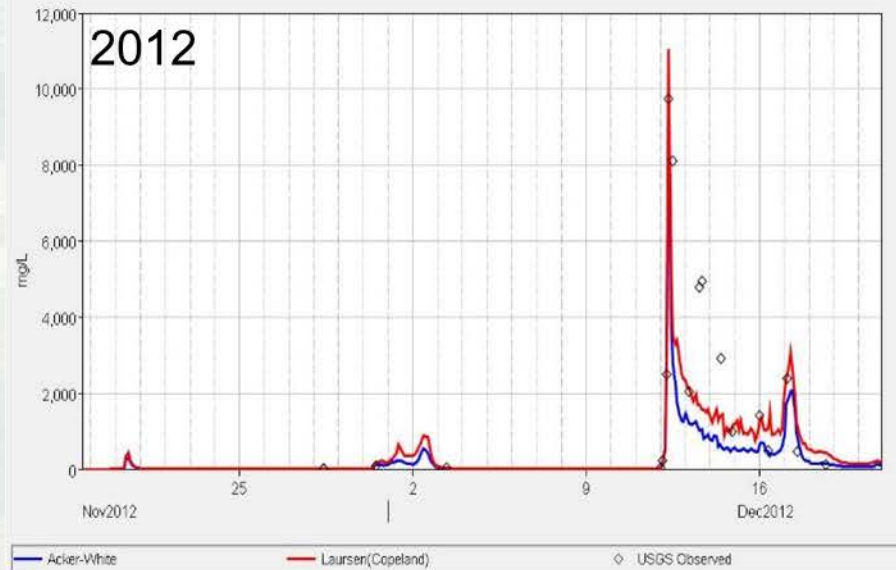
Greg Taylor, NWP
USGS

Leveraging/Collaborative Opportunities

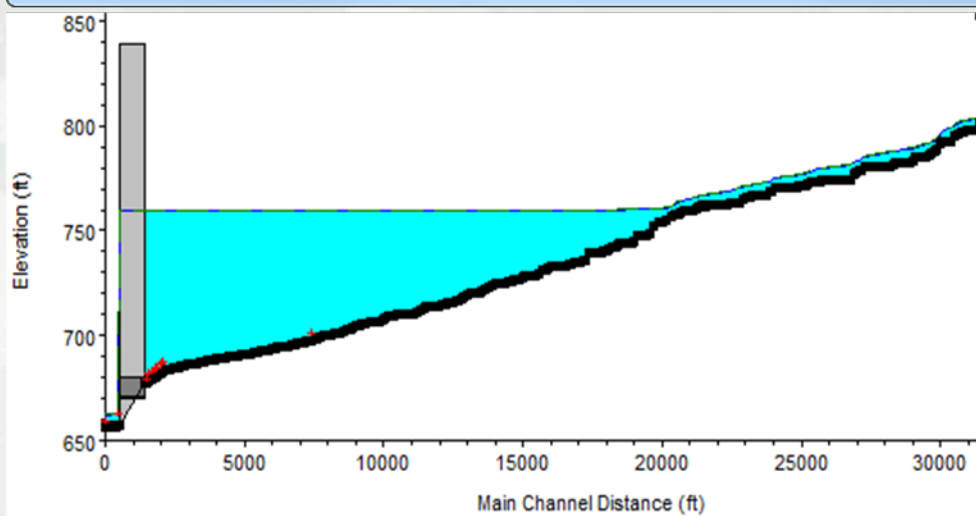
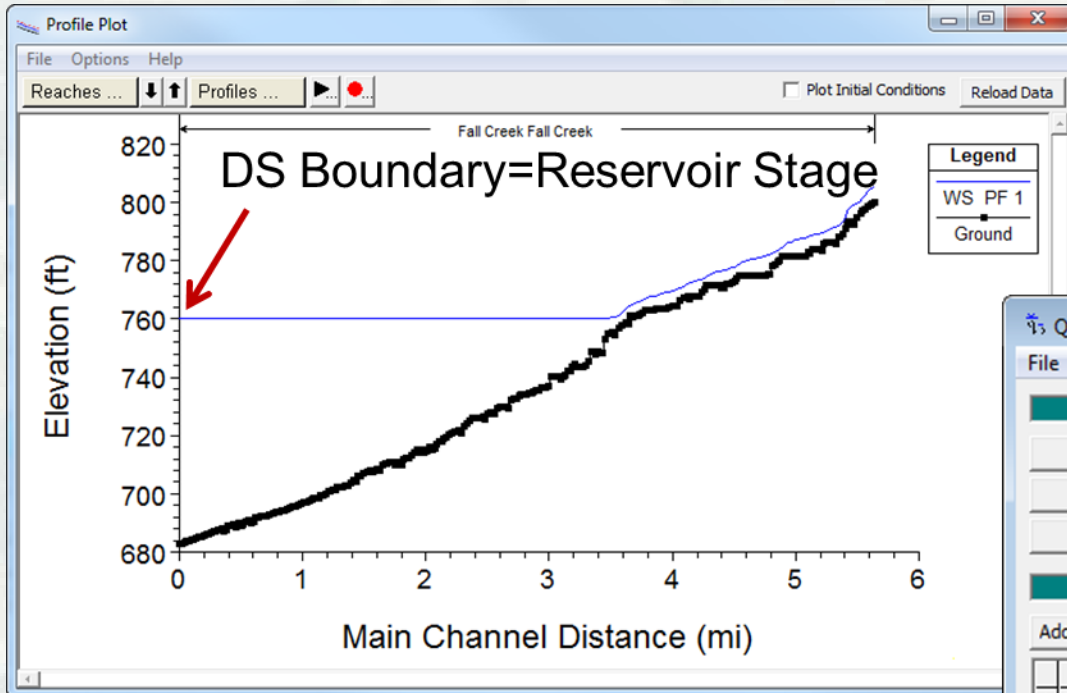
Leveraging development of HEC-RAS from the
Flood and Coastal R&D Program



Classic Quasi-Unsteady Calibration



New Feature: Internal Quasi Dam



Quasi Unsteady Flow Editor

File Help

Boundary Condition Types

Flow Series Lateral Flow Series Uniform Lateral Flow

Normal Depth Stage Series Rating Curve

T.S. Gate Openings **Internal Stage BC**

Select Location for Boundary Condition

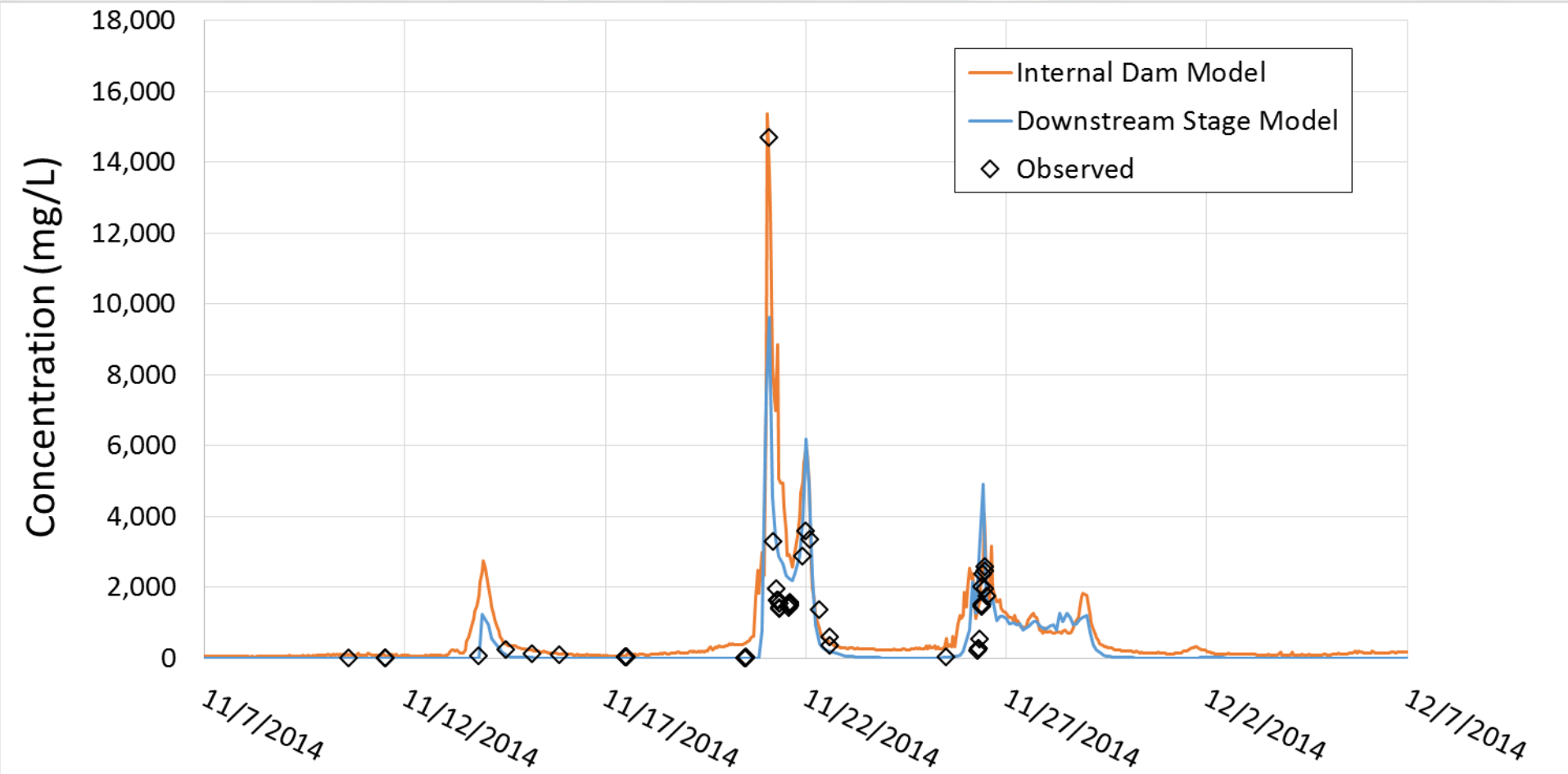
Add Flow Change Location(s) Delete Current Row

	River	Reach	RS	Boundary Condition Type
1	Fall Creek	Fall Creek	91653	Flow Series
2	Fall Creek	Fall Creek	61503	Internal Stage BC
3	Fall Creek	Fall Creek	60394	Normal Depth

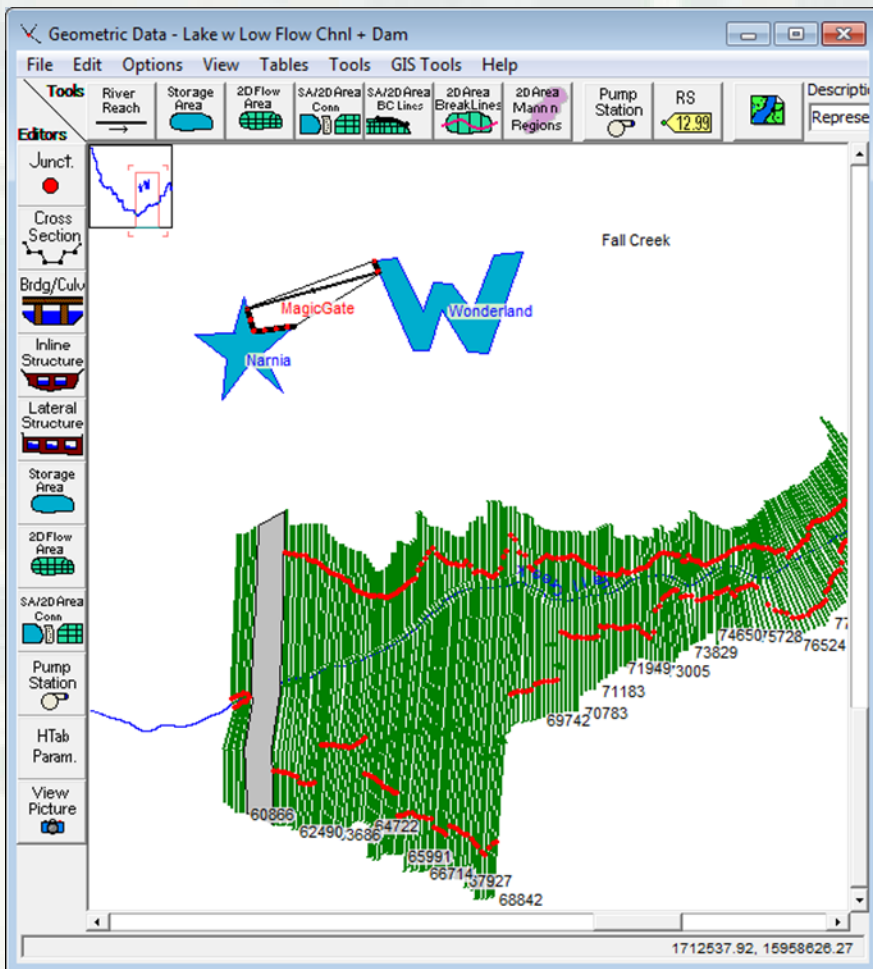
Set Temperature ... Histogram Generator...



New Feature: Internal Quasi Dam



New Feature: The Unsteady Model with “Rules”



Rule Operations

Description: Attempts to roughly simulate a guide curve based on historic pool elevations. This rule set tries to pass the historical observed flow. However, the desired flow is scaled based on how far above or below the historical observed pool elevation the model elevation is at the cross

Gate Parameters

	Location	Open Rate (ft/min)	Close Rate (ft/min)	Max Opening	Min Opening	Initial Opening
1	Regulating	0.1	0.1	10	0.1	0.1

Summary of Variable Initializations:

	User Variable	Description	Initial Value
1			

Rule Operations

row	Operation	True	False
1	! Get the observed lake elevation	2	2
2	'ObsLakeElev' = Storage Area Connections:Gate.Opening(MagicGate,...	3	3
3	! Get the lake elevation computed in the RAS model	4	4
4	'SimLakeElev' = Cross Sections:WS Elevation(Fall Creek,Fall Creek,61...	5	5
5	! Get the observed outflow from the Dam. The outflow timeseries is ...	6	6
6	'ObsDamOutflow' = Storage Areas:Net Inflow(Narnia,Value at current...	7	7
7	! Calculate a proposed gate flow adjustment scaled to the degree of ...	8	8
8	! The constant cfs value was a rough guess. Adjustment encouraged.	9	9
9	! A lower value produces less oscillations while too low a value will no...	10	10
10	'PropGateFlowAdj' = (('SimLakeElev') - ('ObsLakeElev')) * (100)	11	11
11	! Add the proposed gate flow adjustment to the desired gate flow to ...	12	12
12	'PropGateFlow' = 'ObsDamOutflow' + 'PropGateFlowAdj'	13	13
13	Gate.Flow (Desired) = 'PropGateFlow'	0	0

Enter/Edit Rule Operations...

OK

Cancel



New Feature: The Unsteady Model with “Rules”

HEC-RAS Finished Computations

Write Geometry Information
Layer: Complete

Geometry Processor
River: Fall Creek RS: 60394
Reach: Fall Creek Node Type: Cross Section
IB Curve:

Unsteady Flow Simulation
Simulation:
Time: 2112.0000 31DEC2013 00:00:00 Iteration (1D): 0 Iteration (2D):
Writing Profiles 700

Post Process
River: Fall Creek RS: 91653
Reach: Fall Creek Node Type: Cross Section
Profile: 30DEC2013 1800
Simulation: 353/353

Computation Messages

Computations Summary

Computation Task	Time(hh:mm:ss)
Completing Geometry	<1
Preprocessing Geometry(64)	1
Unsteady Flow Computations with Sediment(64)	163:20:38
Writing to DSS(64)	<1
Post-Processing(64)	21
Complete Process	163:21:02

Pause Take Snapshot of Results Close



What is working? Ups? Success?

The quasi-unsteady models. Good calibration for all three flushing events.

What is not working? Downs? Issues?

Unsteady sediment in steep slopes and rapid drawdown → 5 day run time
→ 1D Finite Volume and Variable Time Step Features will improve the unsteady performance.



How is this project benefiting the USACE and Nation

The Fall Creek model can help evaluate future flush alternatives and demonstrates the viability of predictive 1D models of reservoir flushing events.

As the USACE imagines future sustainable sediment management alternatives (including flushing operations), a model of our only regular flush demonstrates the sort of predictive analyses that could support these alternatives.

Software developments to HEC-RAS targeted to improve flushing analysis will improve USACE predictions of proposed, sustainable, sediment solutions.

