

FY17 RSM IPR

# Fall Creek Flush Model

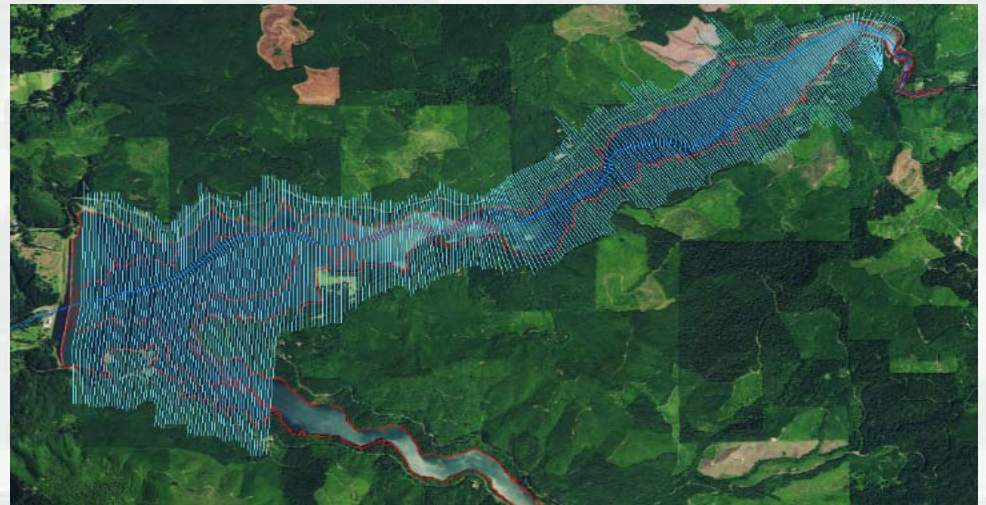
**BLUF:** NWP and HEC developed HEC-RAS sediment model of the only regular USACE reservoir flushing operation, calibrating the model to three years and adding new HEC-RAS features.

## 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

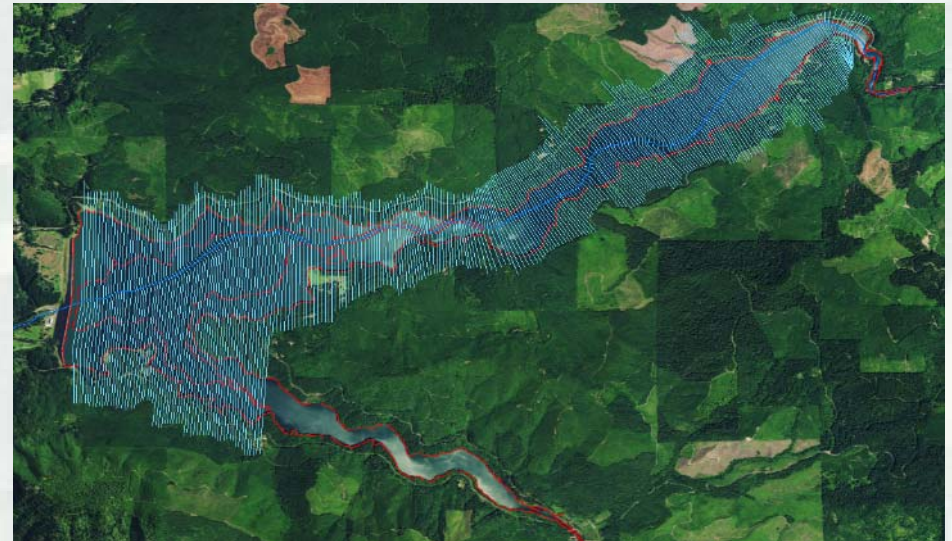
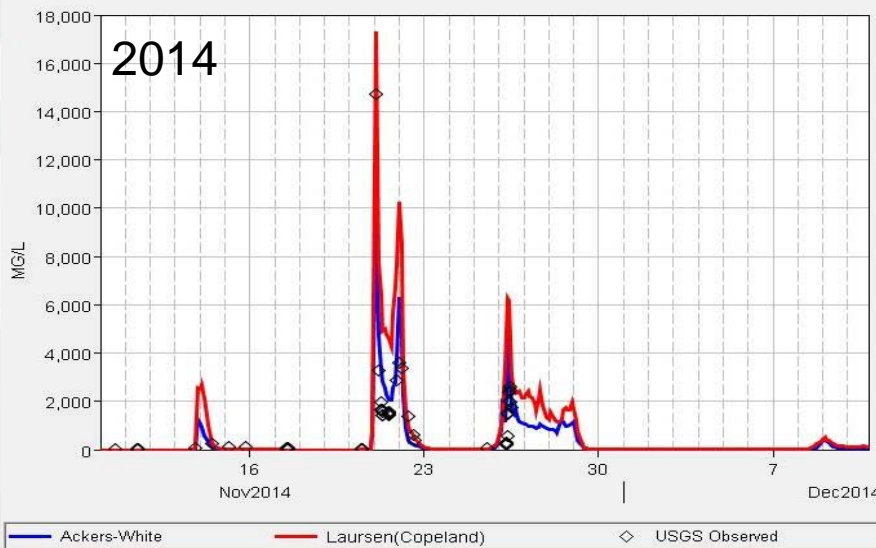
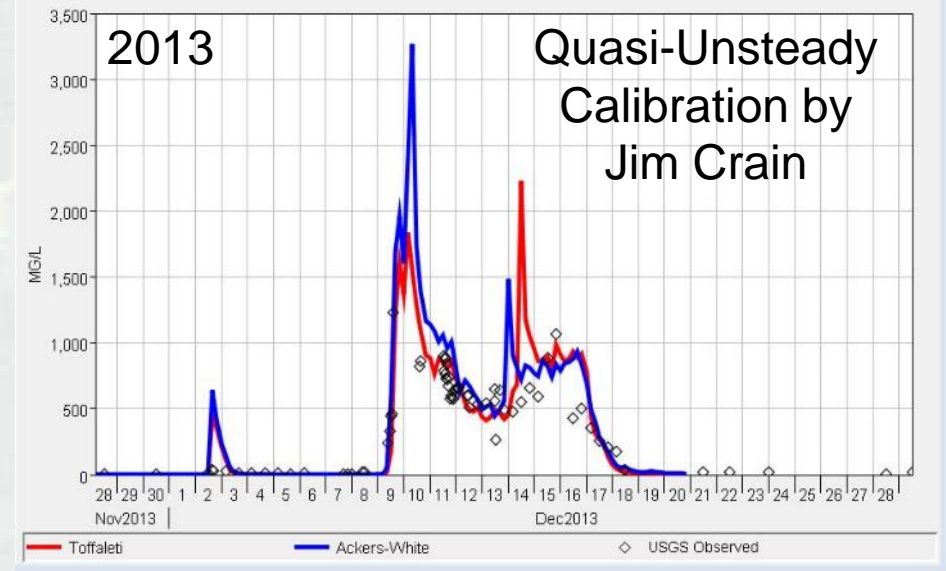
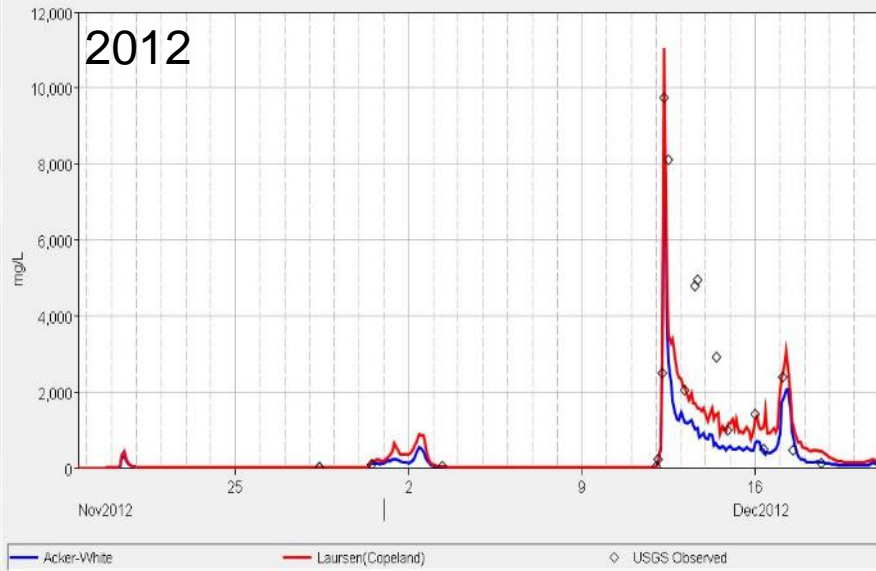
#### **Leveraging/Collaborative Opportunities**

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



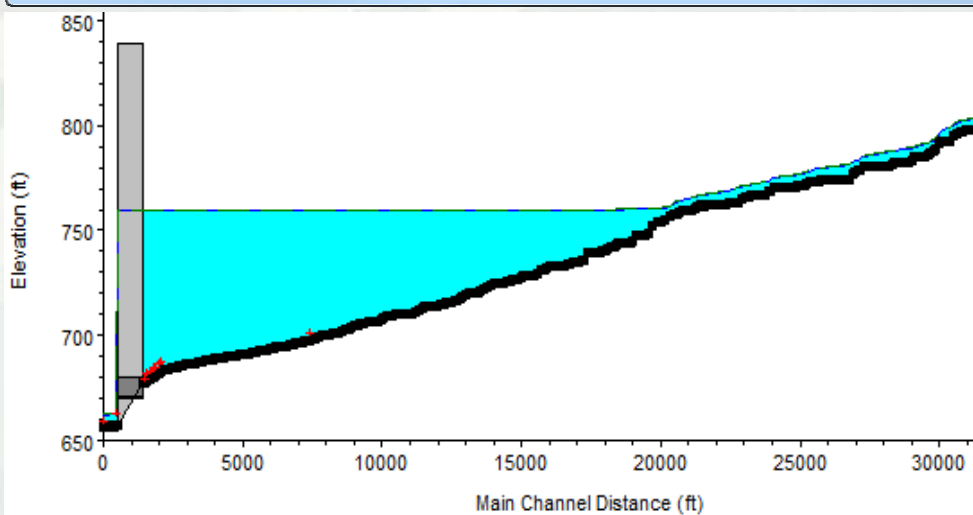
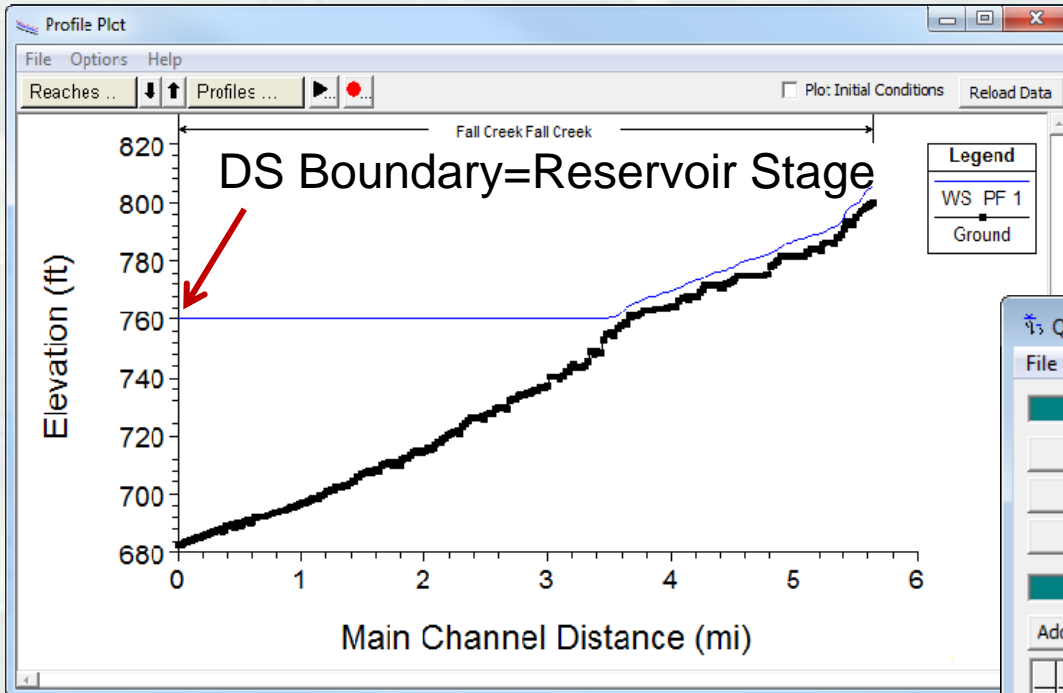
# FY17 RSM IPR: Fall Creek Flush Model

## Classic Quasi-Unsteady Calibration



# FY17 RSM IPR: Fall Creek Flush Model

## New Feature: Internal Quasi Dam



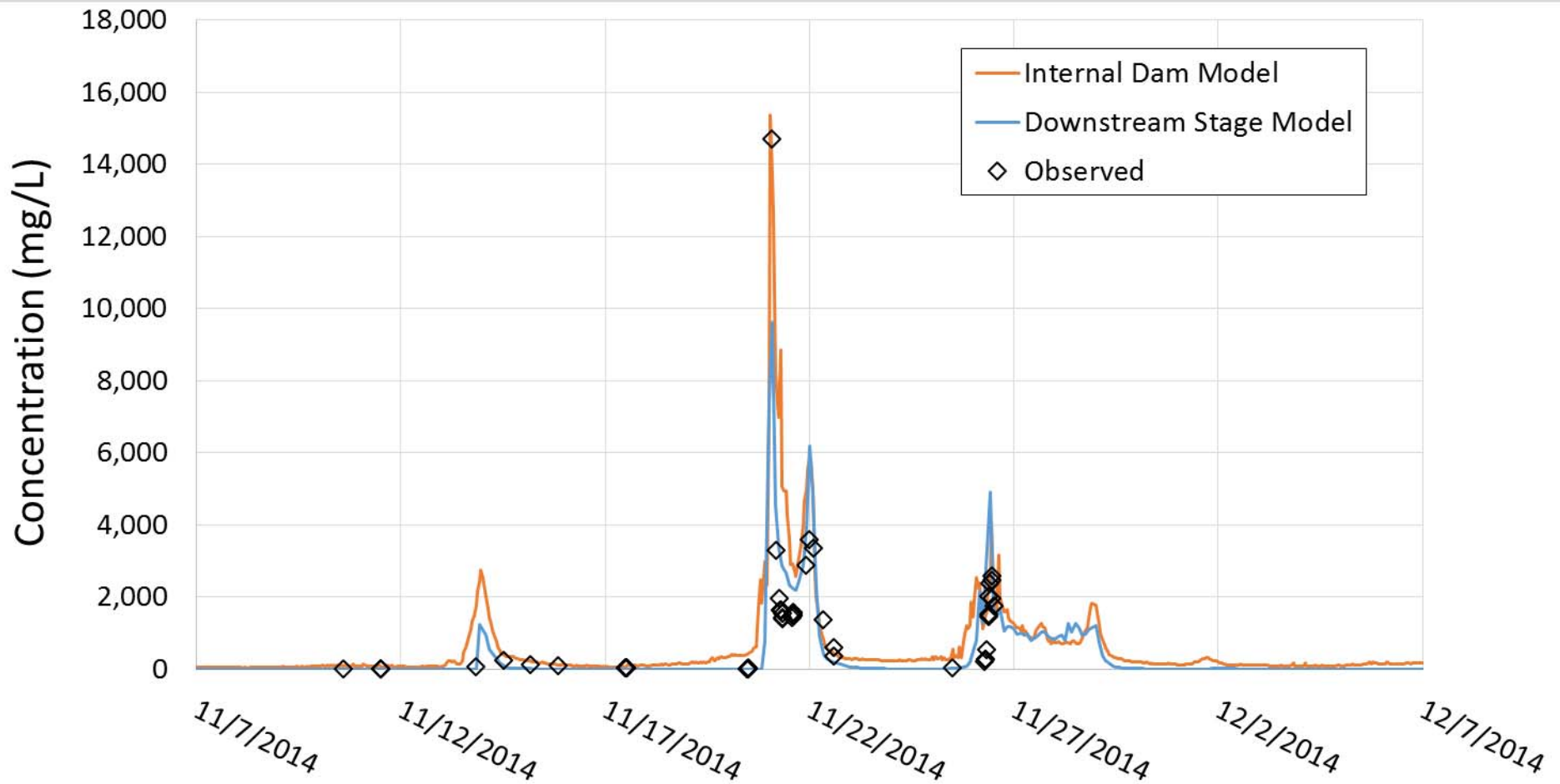
Quasi Unsteady Flow Editor window showing Boundary Condition Types and a table of boundary conditions. The "Internal Stage BC" option is highlighted in red in the Boundary Condition Types section, and the corresponding row in the table is highlighted in blue.

	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



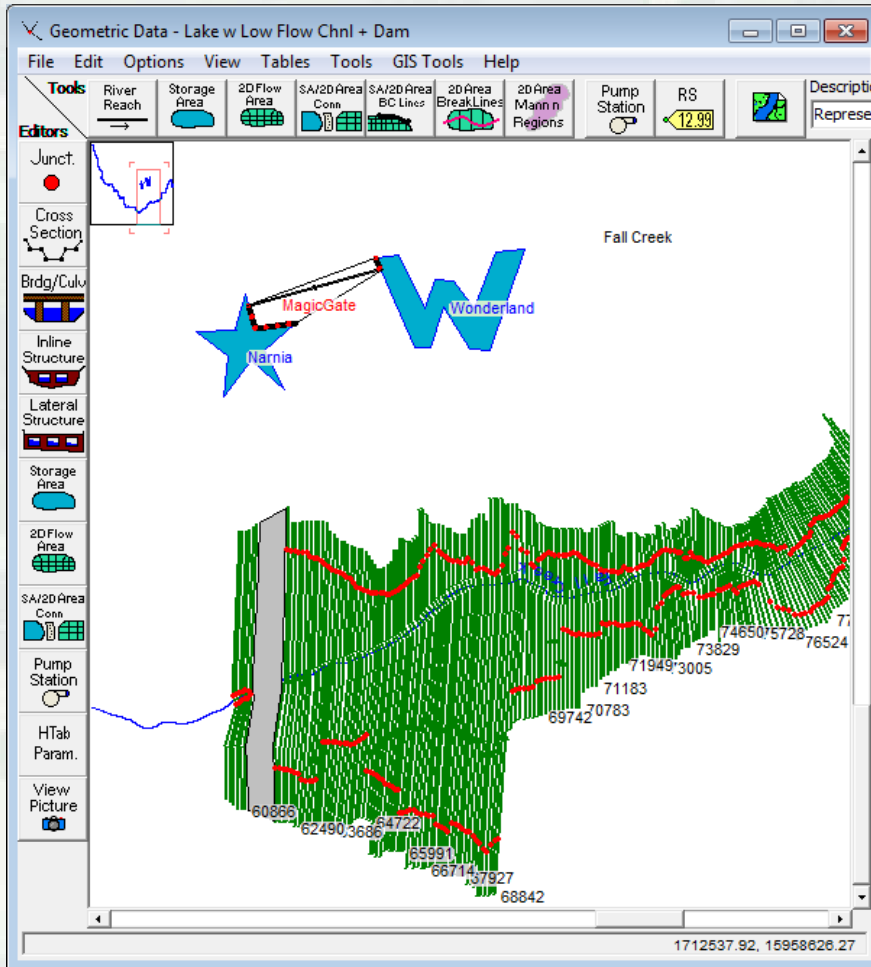
## FY17 RSM IPR: Fall Creek Flush Model

# New Feature: Internal Quasi Dam



## FY17 RSM IPR: Fall Creek Flush Model

# 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



## FY17 RSM IPR: Fall Creek Flush Model

# 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



## FY16 RSM IPR

District, Title

### **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.





## FY17 RSM IPR

District, Title

### **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.

