



# **Floodplains Reimagined: Scenario Development Ad Hoc Group Meeting**

# Agenda / Presentation Overview

- **Project Schedule / Timeline**
  - Where we are now and where we are going
- **Scenario Development Process**
- **Model Development**
- **Baseline Model Results**
  - Colusa and Butte Basins
- **Scenario Development**
  - Suite of potential actions
  - Preliminary model results to aid in screening potential actions
- **In-River Opportunities Analysis**

# Scenario Development Needs

- 3/30 Ad Hoc Outcomes Needed: feedback on pre-screening of key actions
- 4/18 AC & 4/26 SC Outcomes Needed: feedback on refined key actions and habitat suitability results
- 5/TBD AC & 5/24 SC Outcomes Needed: feedback and approval of action groupings

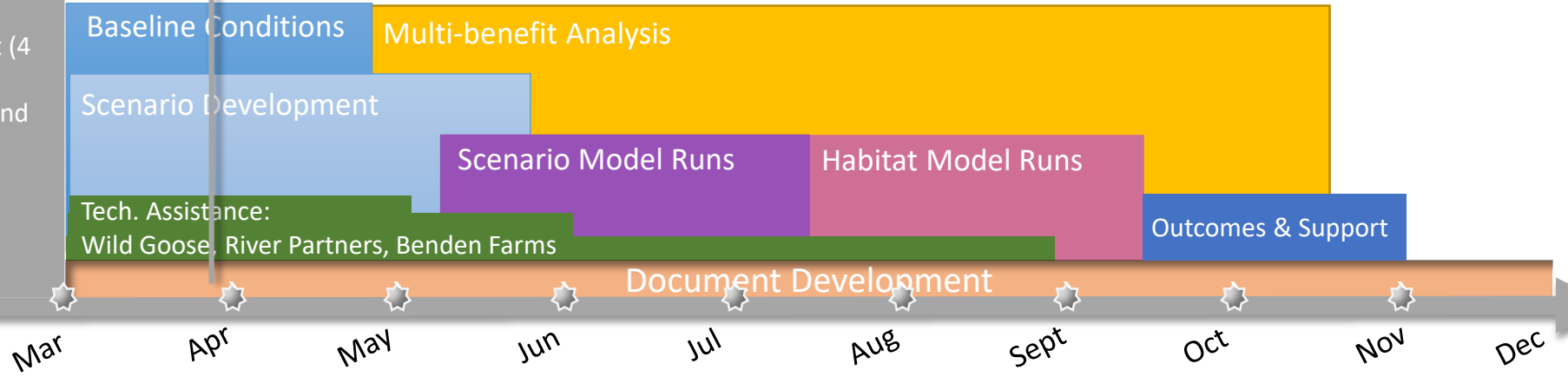
Steering Committee								
3/22	4/26	5/24	6/28	7/26	8/23	9/27	10/25	11/22
<ul style="list-style-type: none"> <li>• Opp &amp; Constraints Break Out Groups</li> <li>• Salmon Suitability</li> <li>• DU Scope of Work</li> </ul>	<ul style="list-style-type: none"> <li>• Scenario Dev Update</li> <li>• Habitat Suitability Outcomes</li> <li>• DU Scope of Work</li> </ul>	<ul style="list-style-type: none"> <li>• Scenario Dev Update</li> <li>• Salmon Productivity</li> <li>• Managed Lands Metrics</li> </ul>						

Advisory Committee								
3/22	4/18	5/TBD	6/9	8/11	10/13			
	<ul style="list-style-type: none"> <li>• Scenario Dev Update</li> <li>• Habitat Suitability Outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• Scenario Dev Update</li> <li>• Salmon Productivity</li> <li>• Managed Lands Metrics</li> </ul>						

We are Here

--Scenario Development Ad Hoc, 3/30  
 --Managed Lands Ad Hoc, 4/TBD

- ### Discussed To-Date
- Priorities & Objectives
  - Preliminary Scenario Development (4 types of actions)
  - Implementation Strategies: Risks and Solutions
  - Habitat Suitability Criteria Development (Birds/Salmon)
  - Baseline Conditions



Feasibility: Is there potential for species benefit but more information is needed?

Next Phase of Development

# Scenario Development Process

## Develop Potential Actions

- Stakeholder/Landowner input (...4<sup>th</sup> action type added)
- Technical team input

## Pre-Screen Potential Actions (we are here)

- Test the hydrologic feasibility of key actions (...where is the water and for how long)

## Develop Potential Grouping of Actions

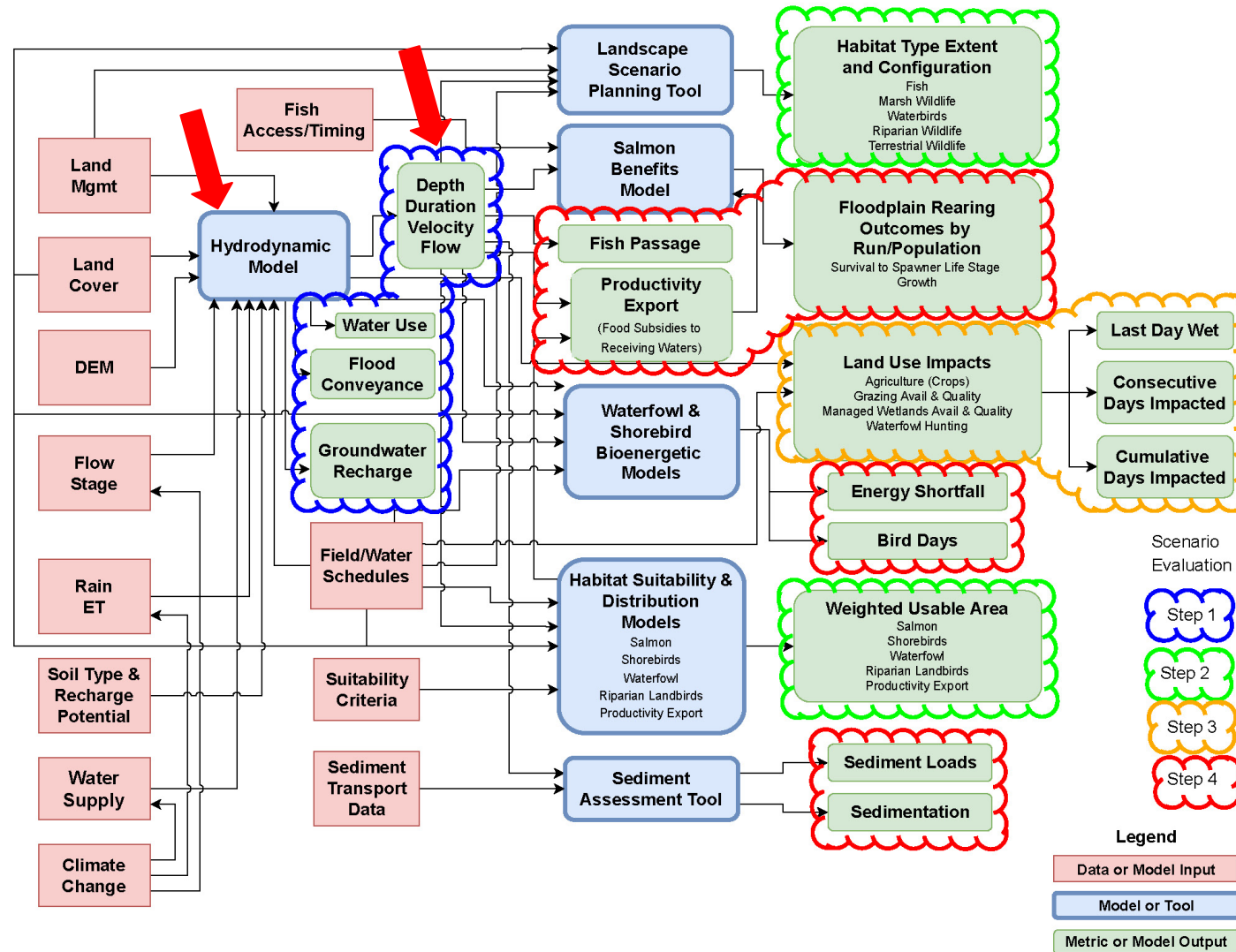
- Combine actions (...and share out at upcoming AC meetings)
- Test scenarios globally (...and identify hydrologic opportunities and constraints)
- Refine scenarios

## Evaluate Scenarios

- Evaluate relative changes (scenario vs baseline)
- Perform multi-benefit analysis
- Assess landowner willingness



# Small Part of Larger Process / Tool Set



# Scenario Development Process

## Develop Potential Actions

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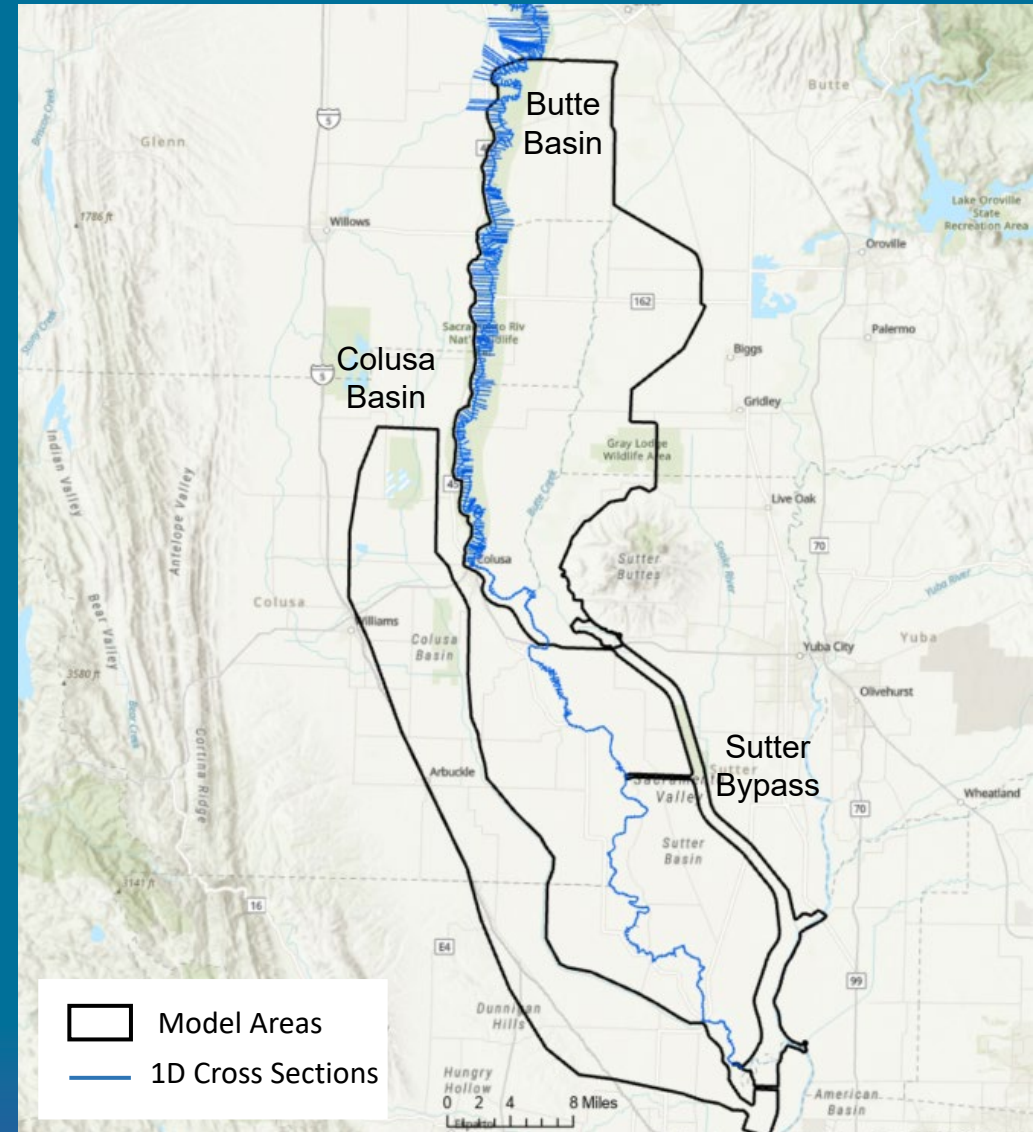
# Hydrodynamic Modeling Basics

## What are Hydrodynamic Models

- Computer program that simulates the conveyance of water across the landscape – rivers, floodplains, rice fields etc.
- Computations based on laws of physics and typically driven (boundary conditions) by historic measurements or estimated flows (gages)

## Model Domains

- Colusa Basin, Butte Basin, Sutter Bypass
- Butte Basin and Colusa Basin modeling approach and technical methodologies based on a foundation of work developed for the Sutter Bypass Management Plan
- Water management is based on typical inundation footprints/schedules



# Hydrodynamic Model Calibration – Optimization for Accuracy

## What is Calibration?

- Tuning of model parameters to ensure model results are an accurate representation of reality comparing to historic conditions

## Mainstem Sacramento River Calibration

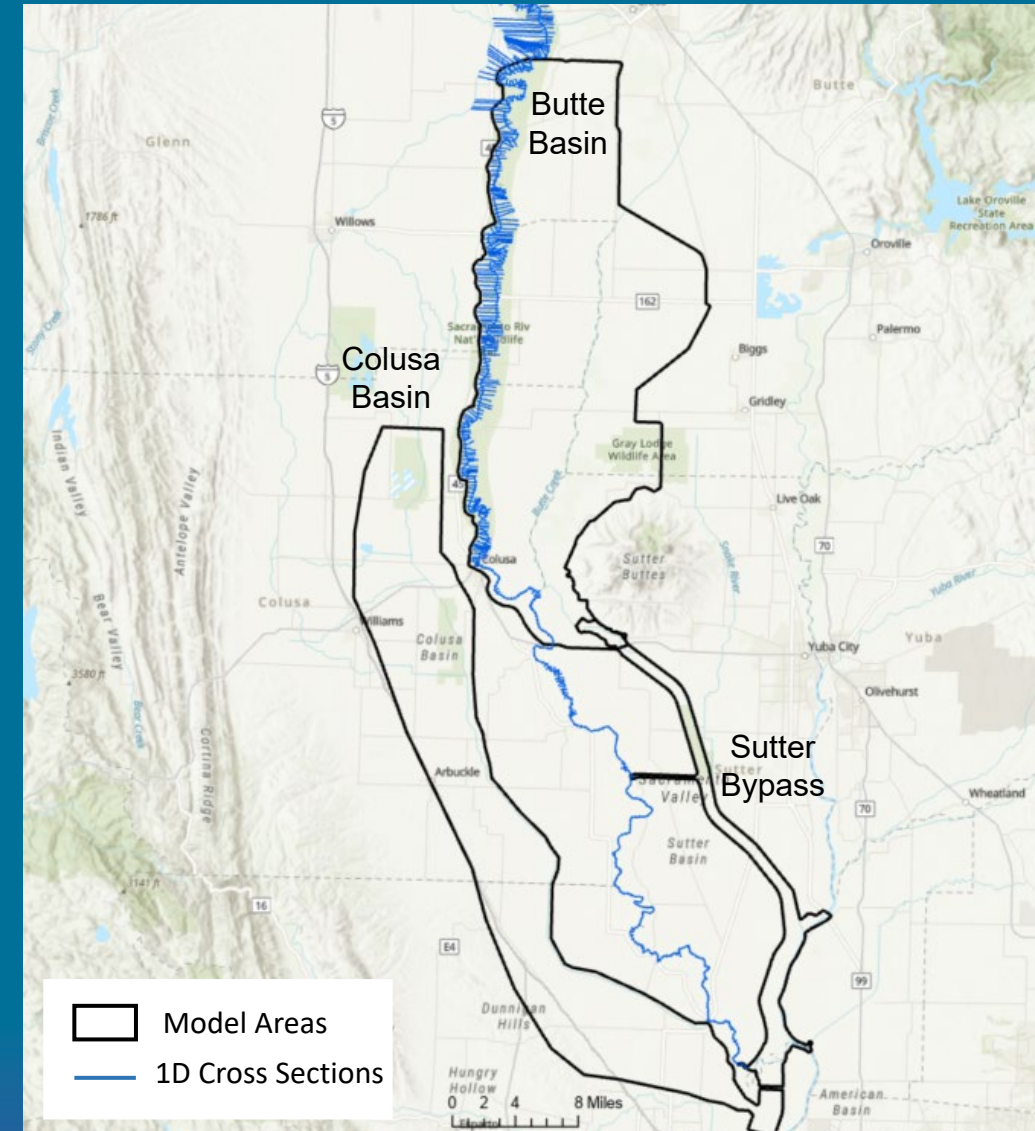
- Mainstem Sacramento River and Overflows
- 1997, 1998, 2006, 2019

## Butte Basin Interior Calibration

- 2019 water year
- Field Management

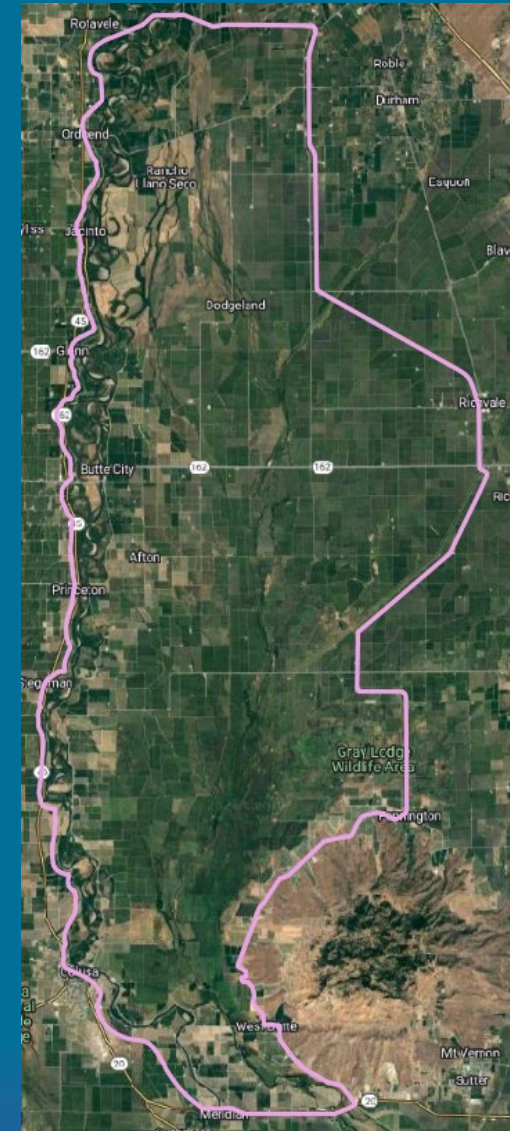
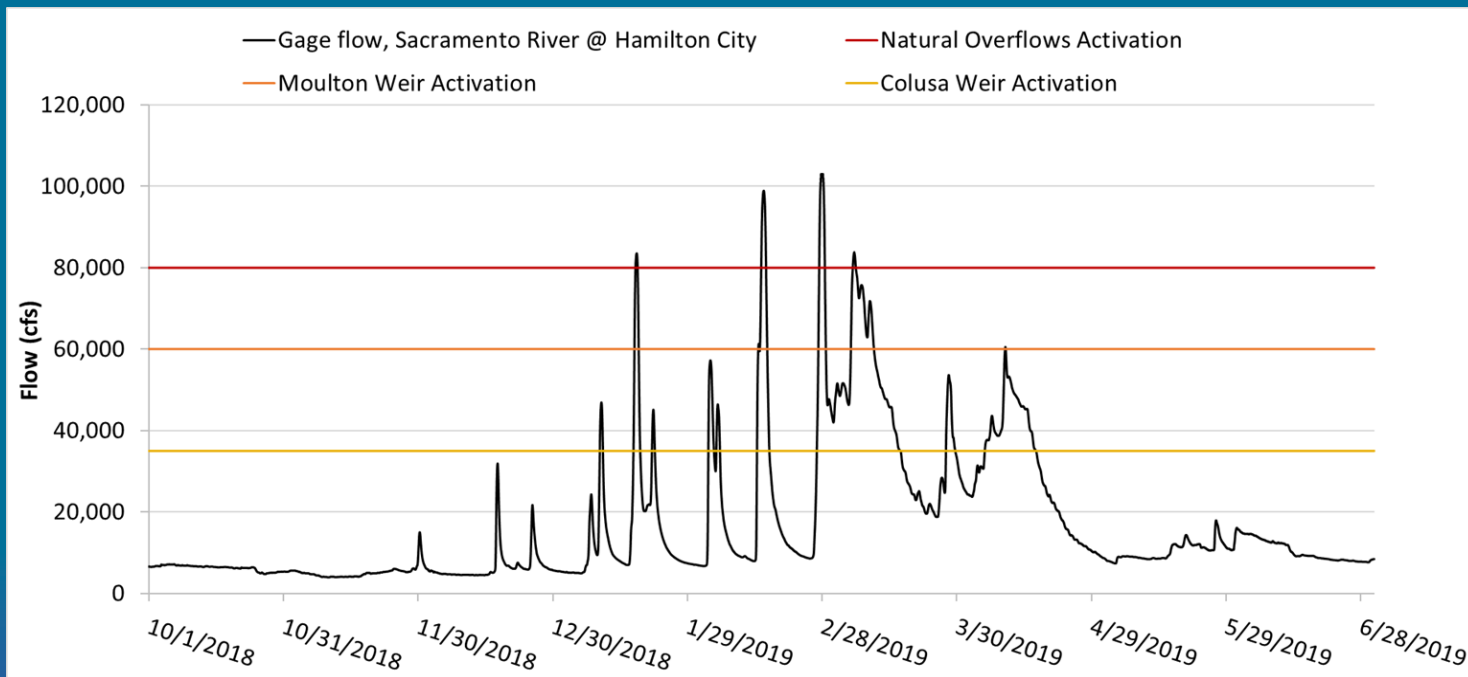
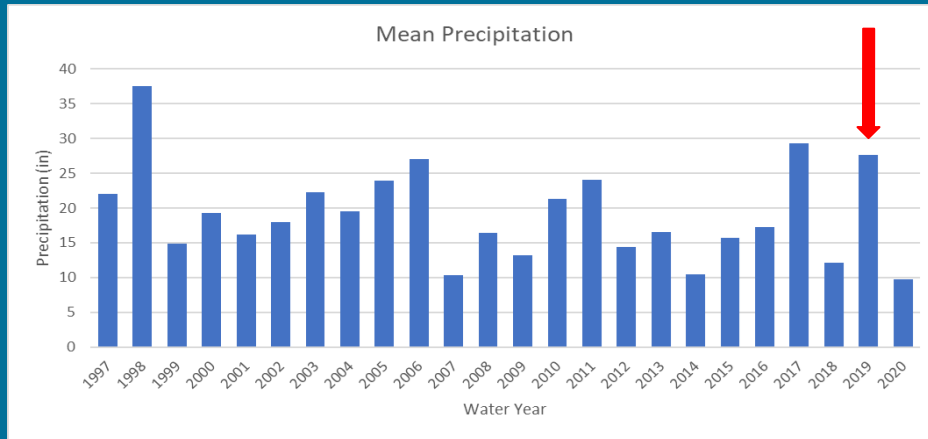
## Colusa Basin Calibration

- 2019 water year
- Field Management

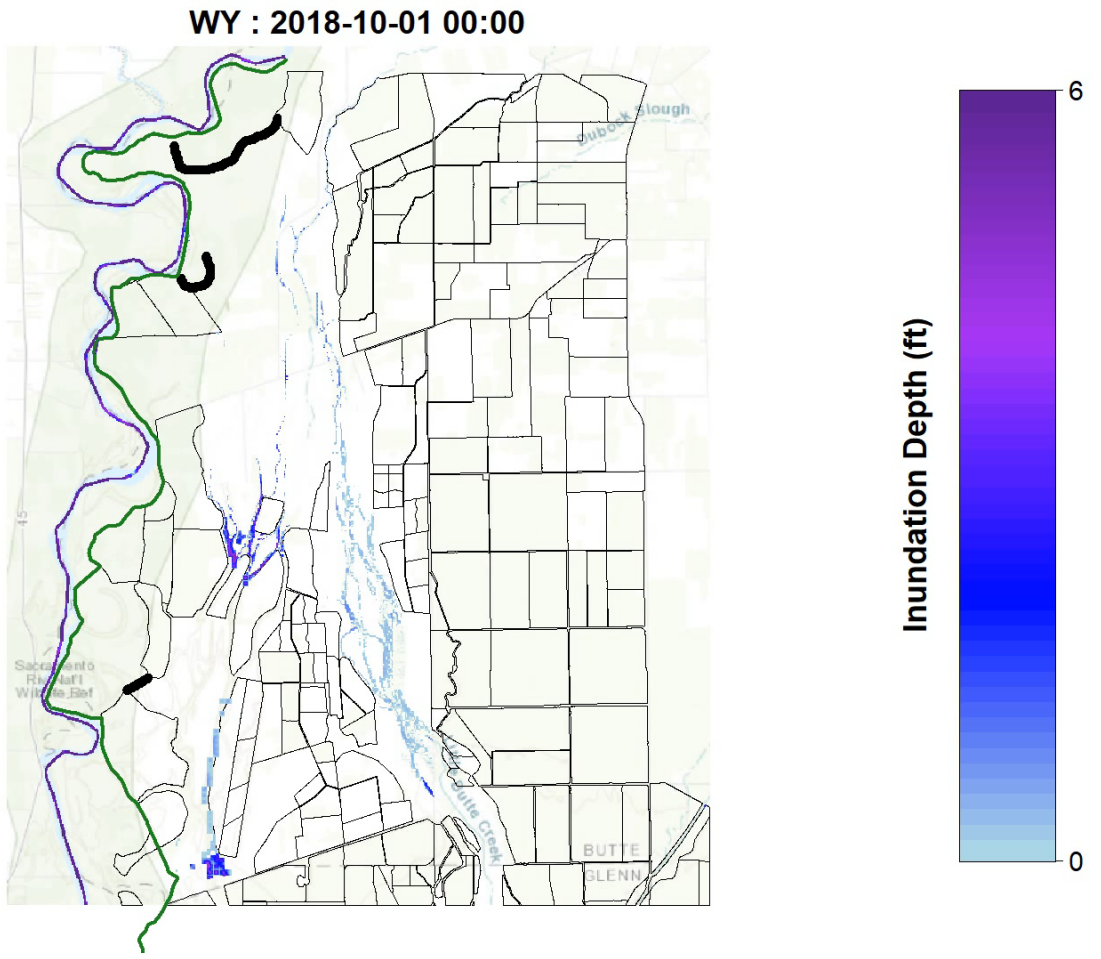
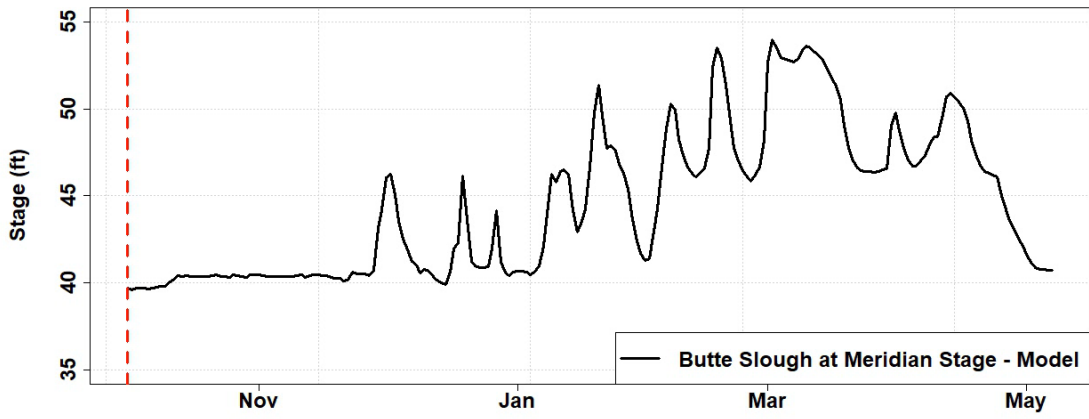
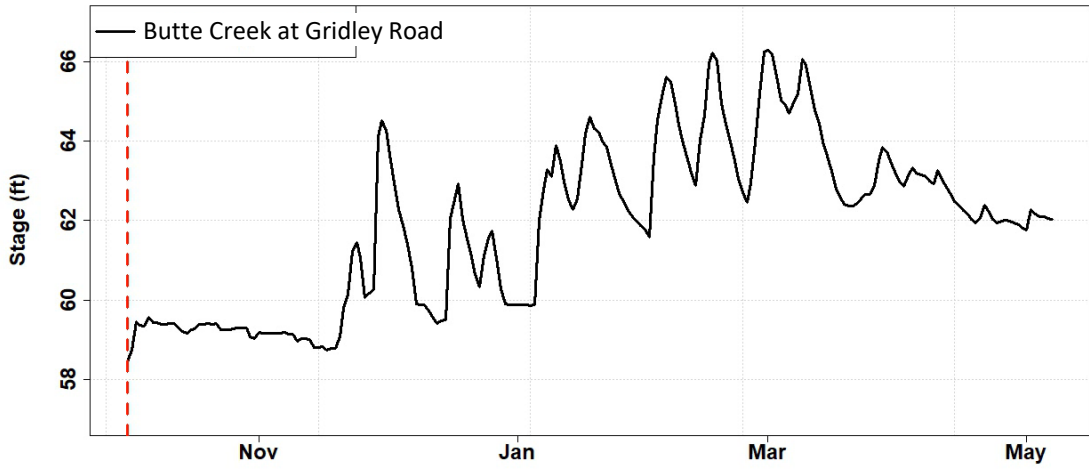




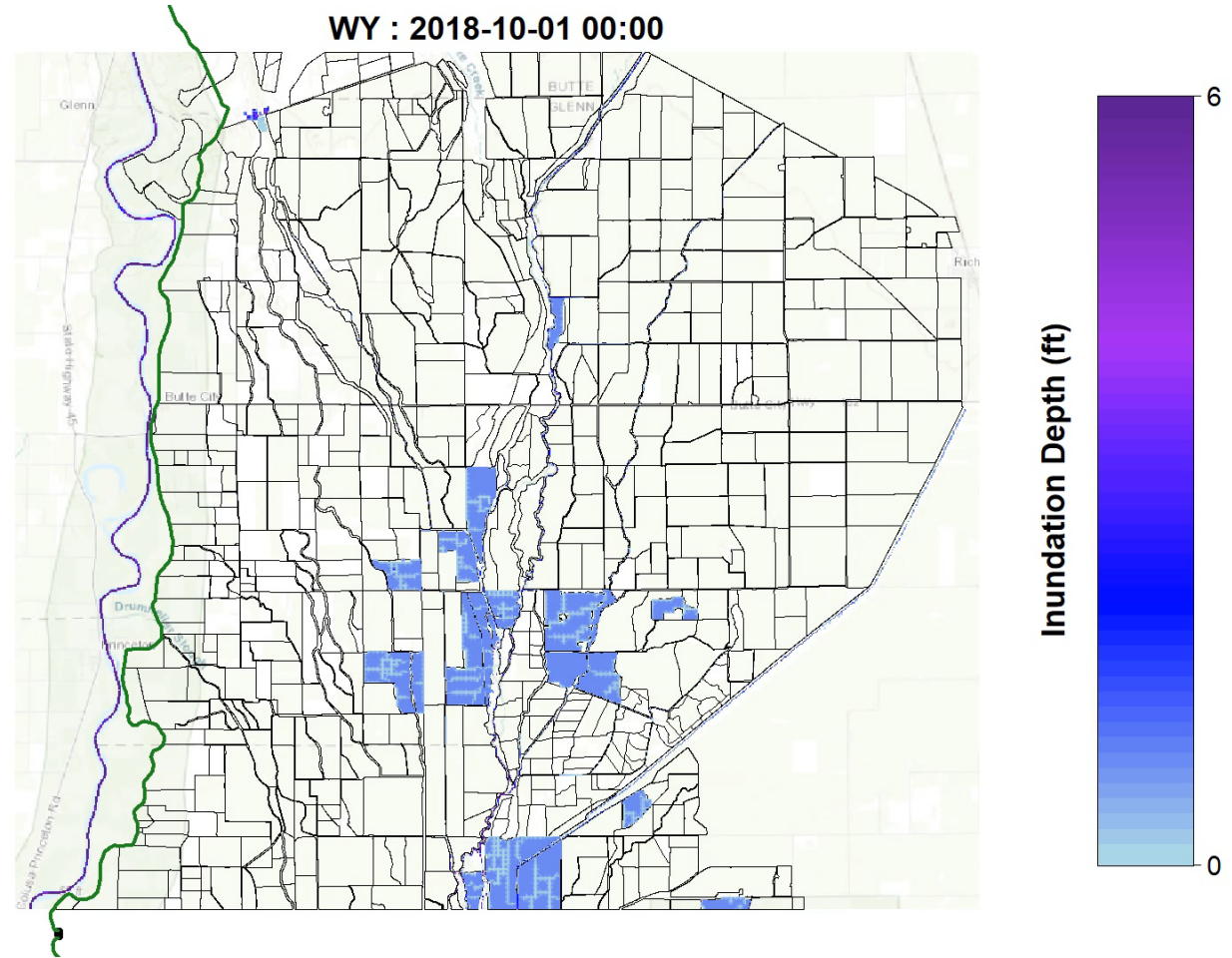
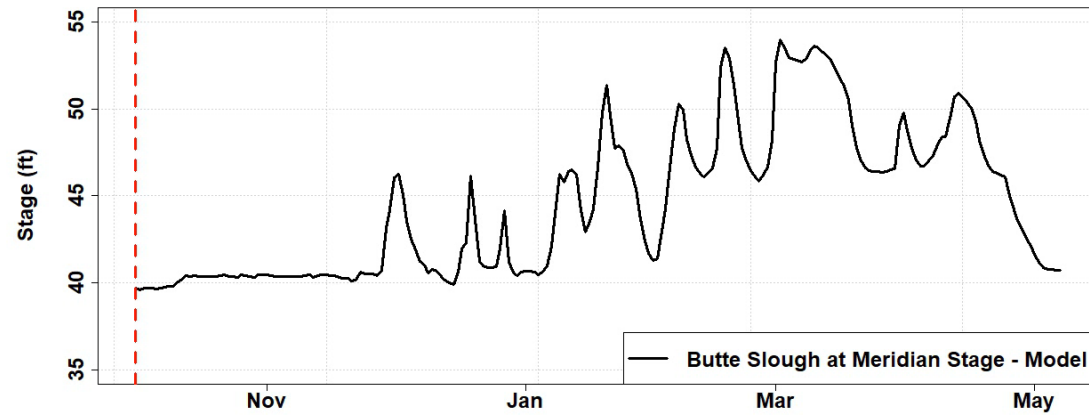
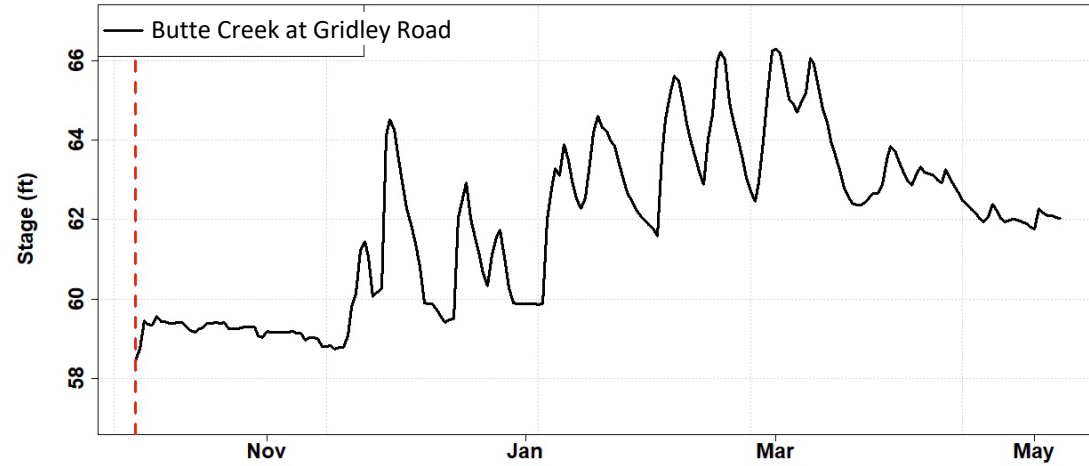
# 2019 Water Year – Great for Inundation Evaluation



# Baseline Model Results – Butte Upper Region

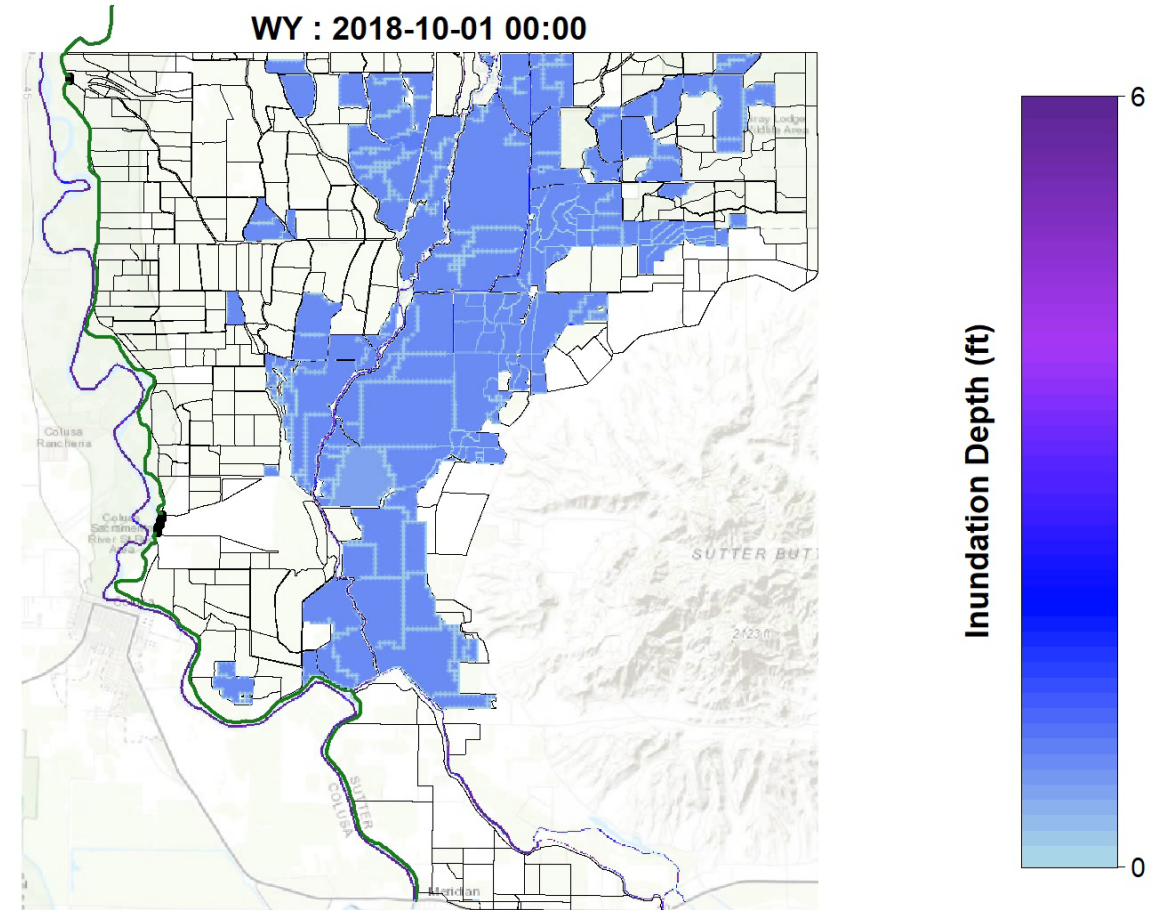
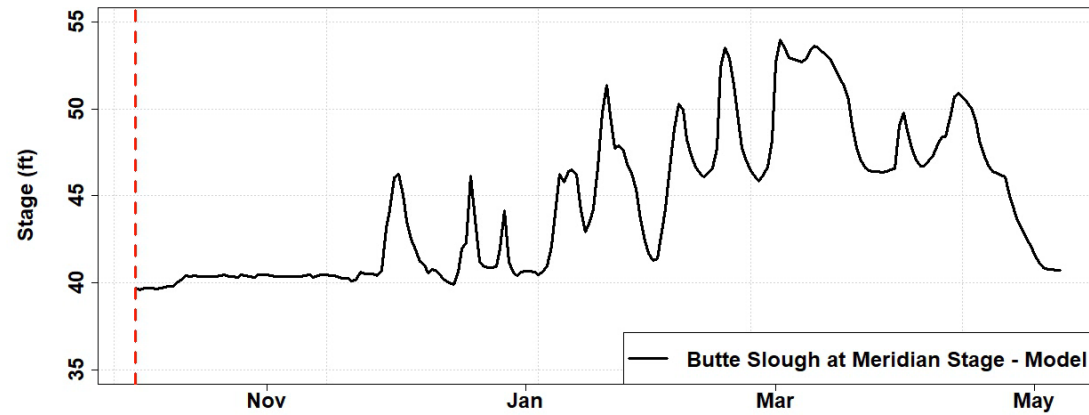
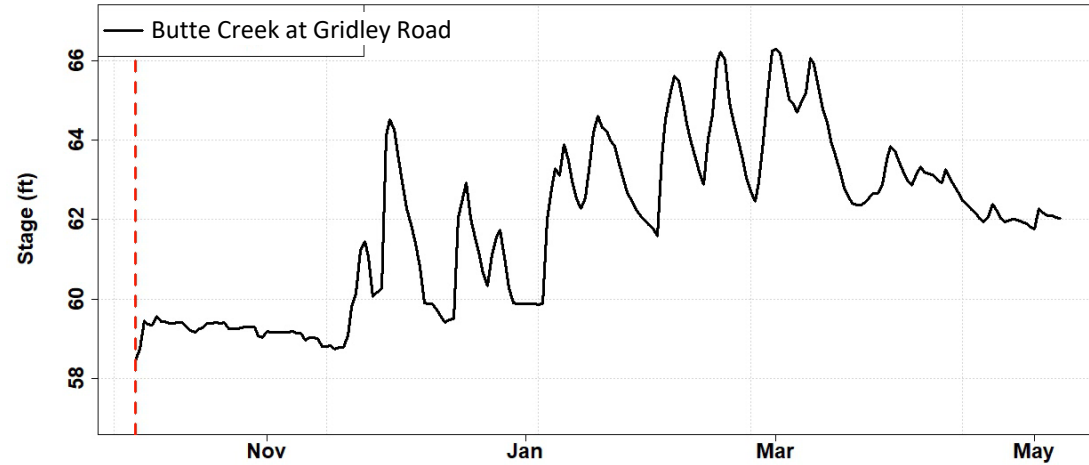


# Baseline Model Results – Butte Middle Region



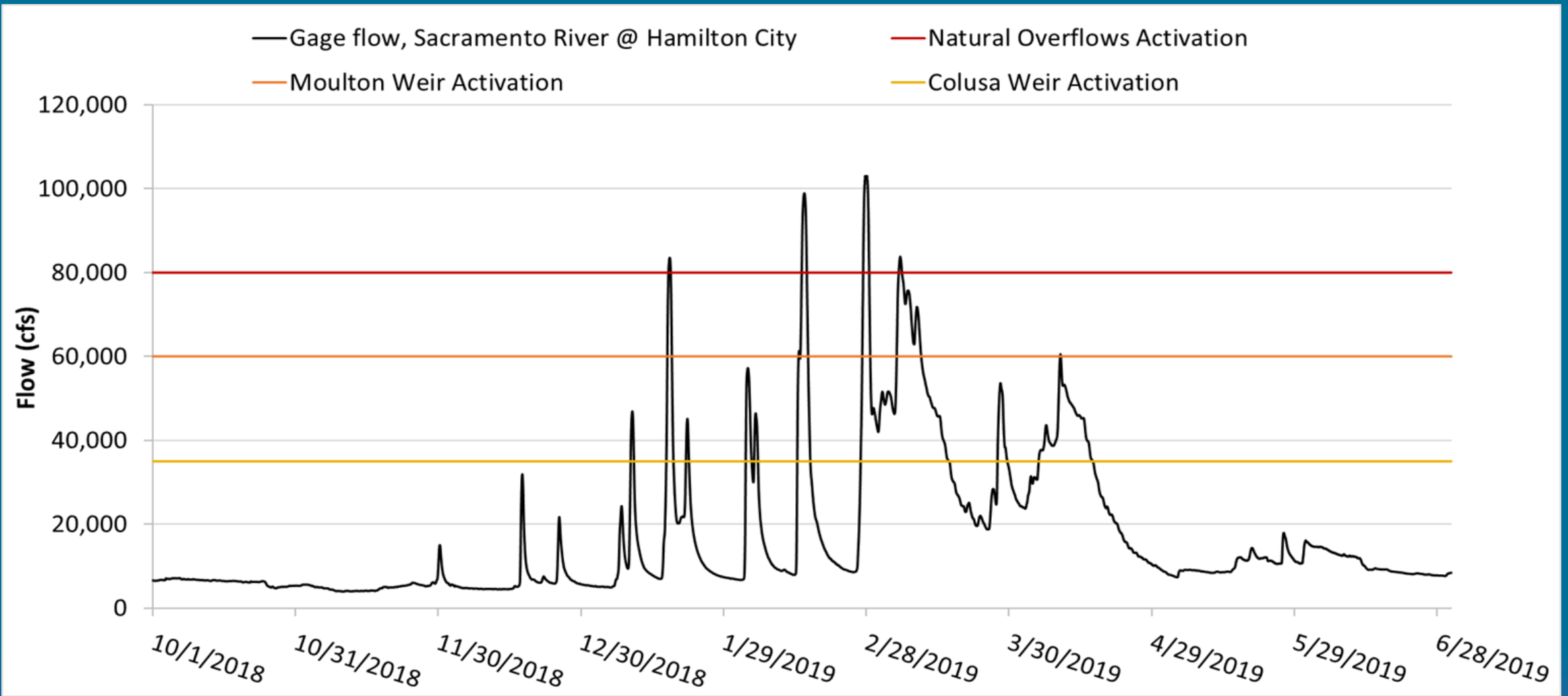


# Baseline Model Results – Butte Lower Region

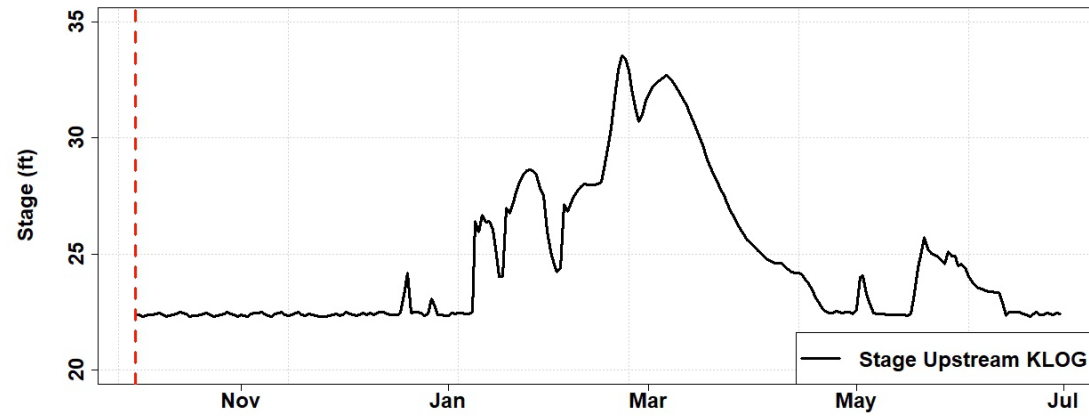
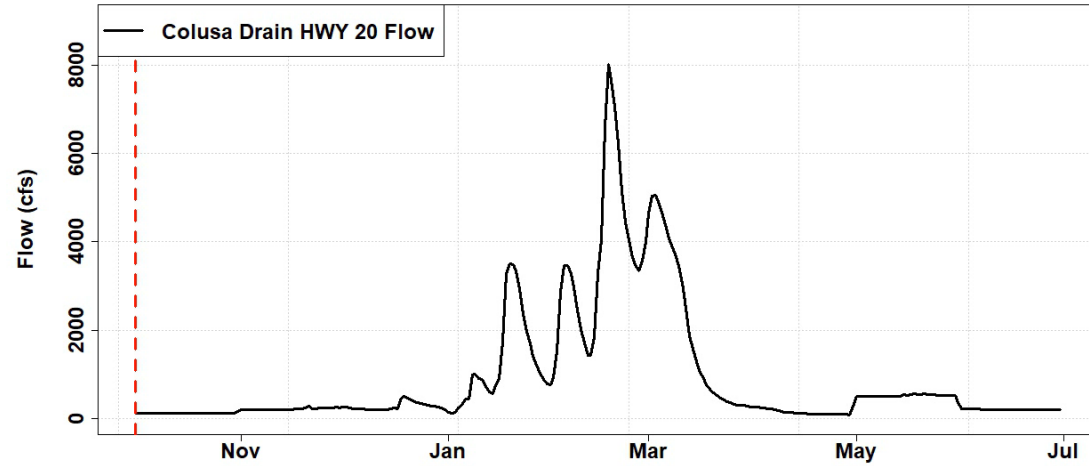




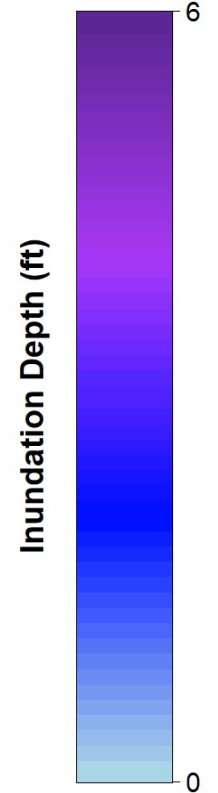
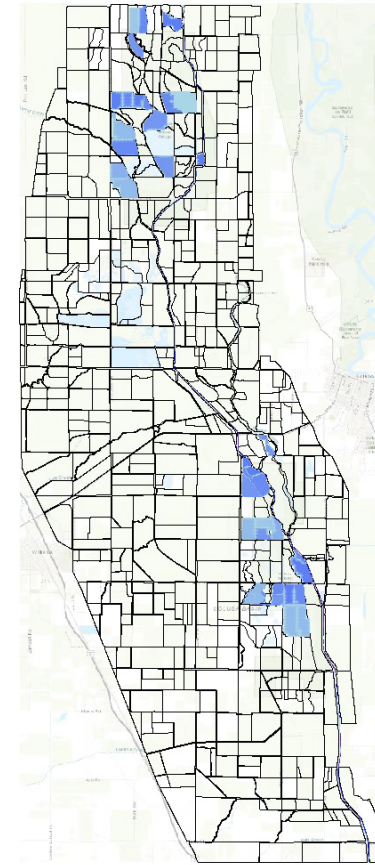
# Baseline Model Results – Butte & Colusa Basin 2019



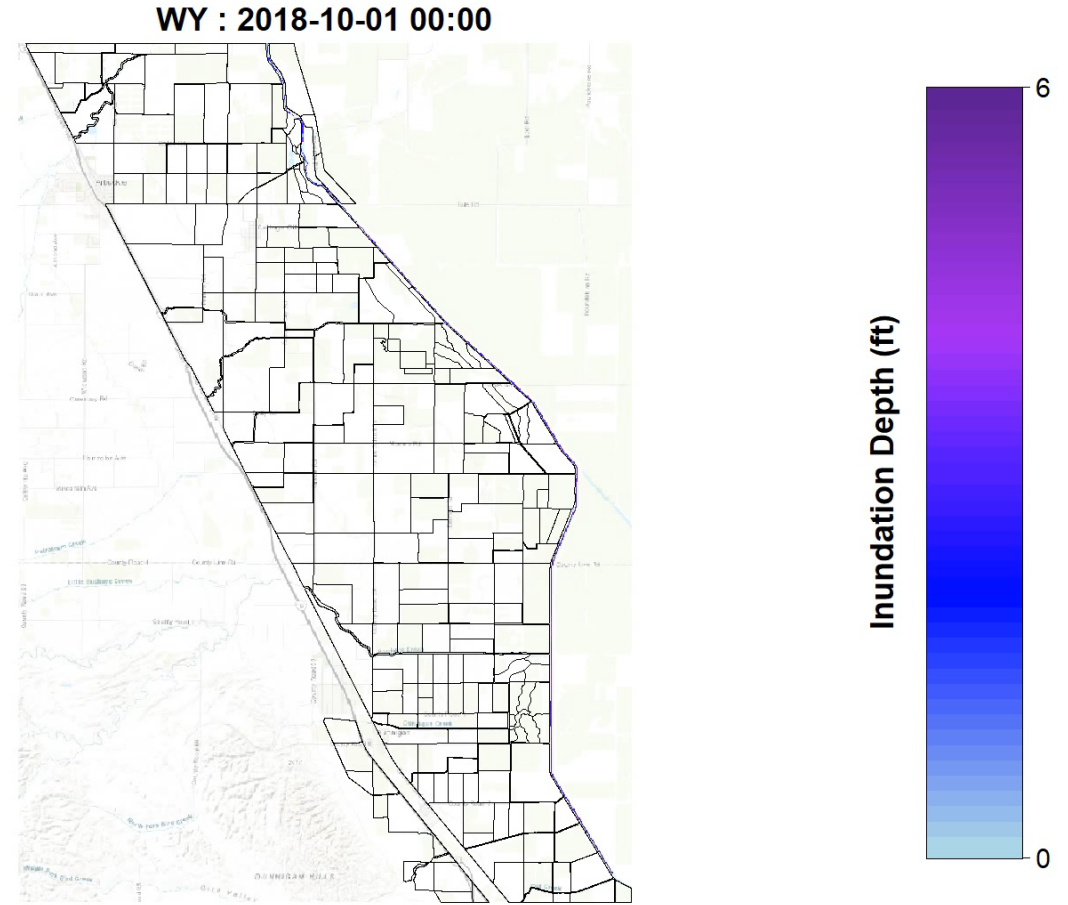
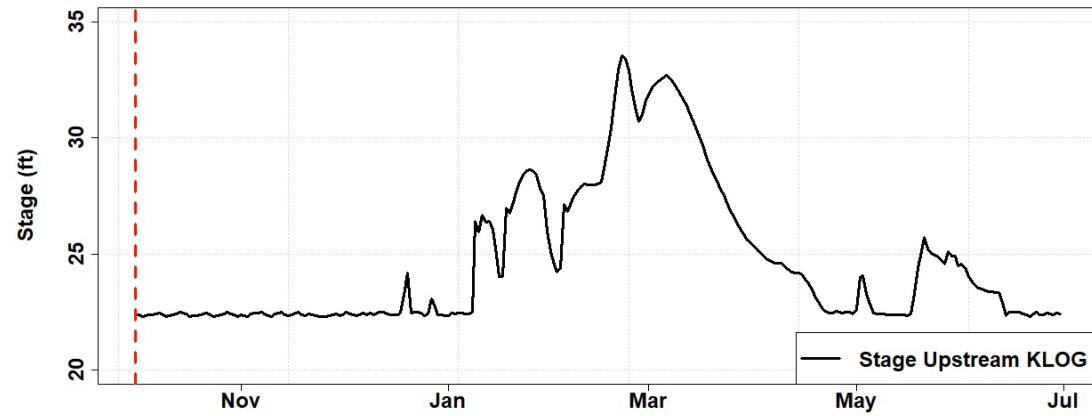
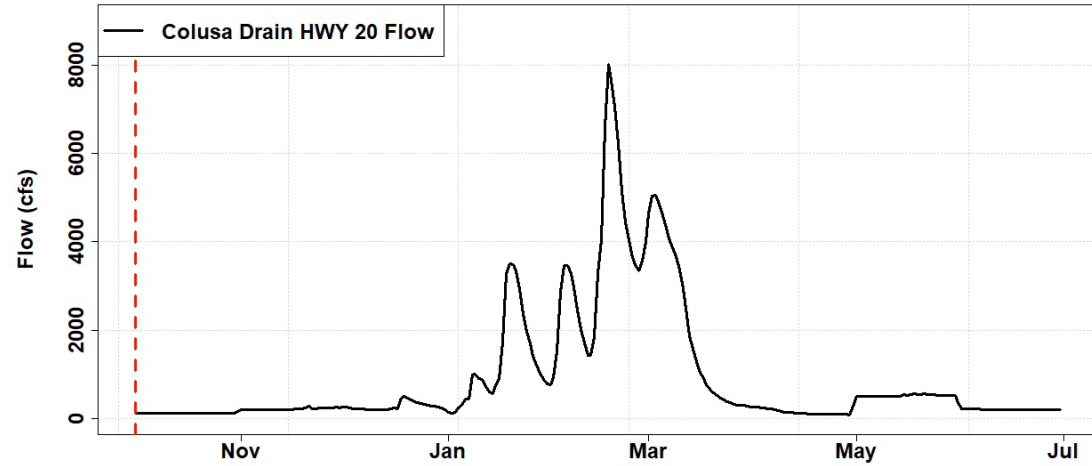
# Baseline Model Results - Colusa Upper Region



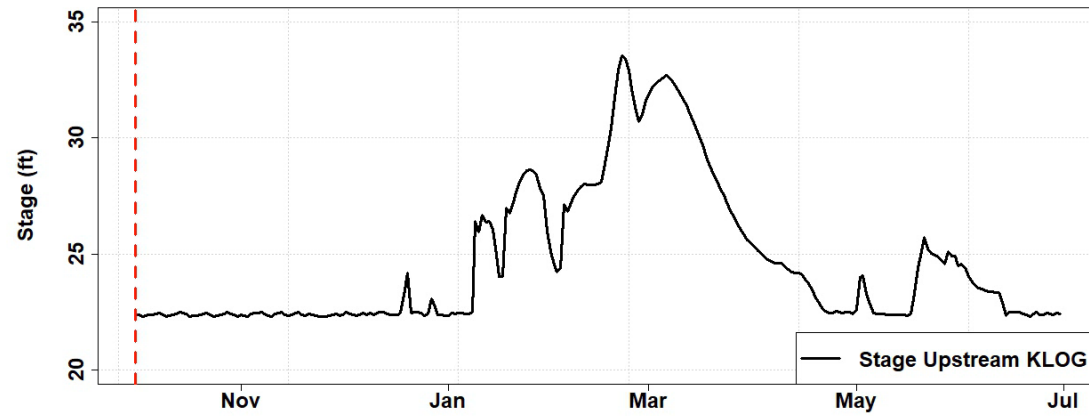
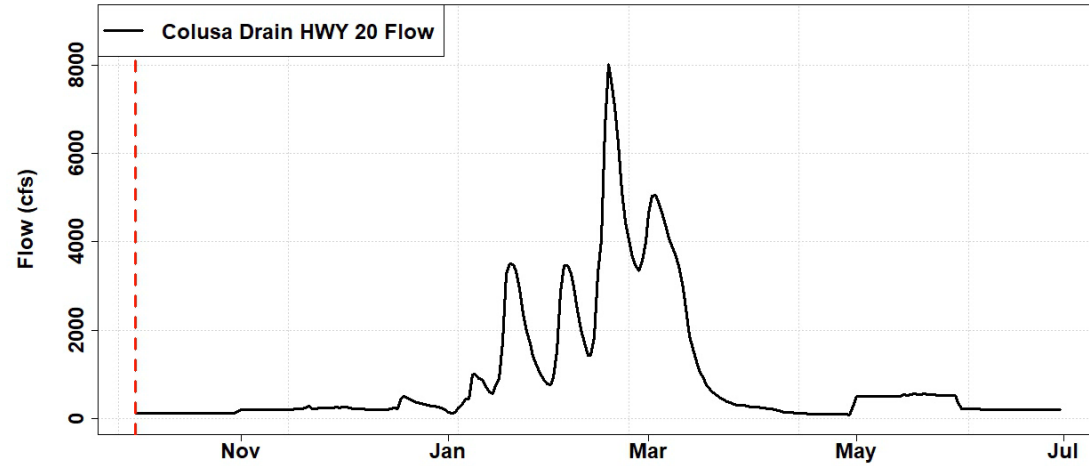
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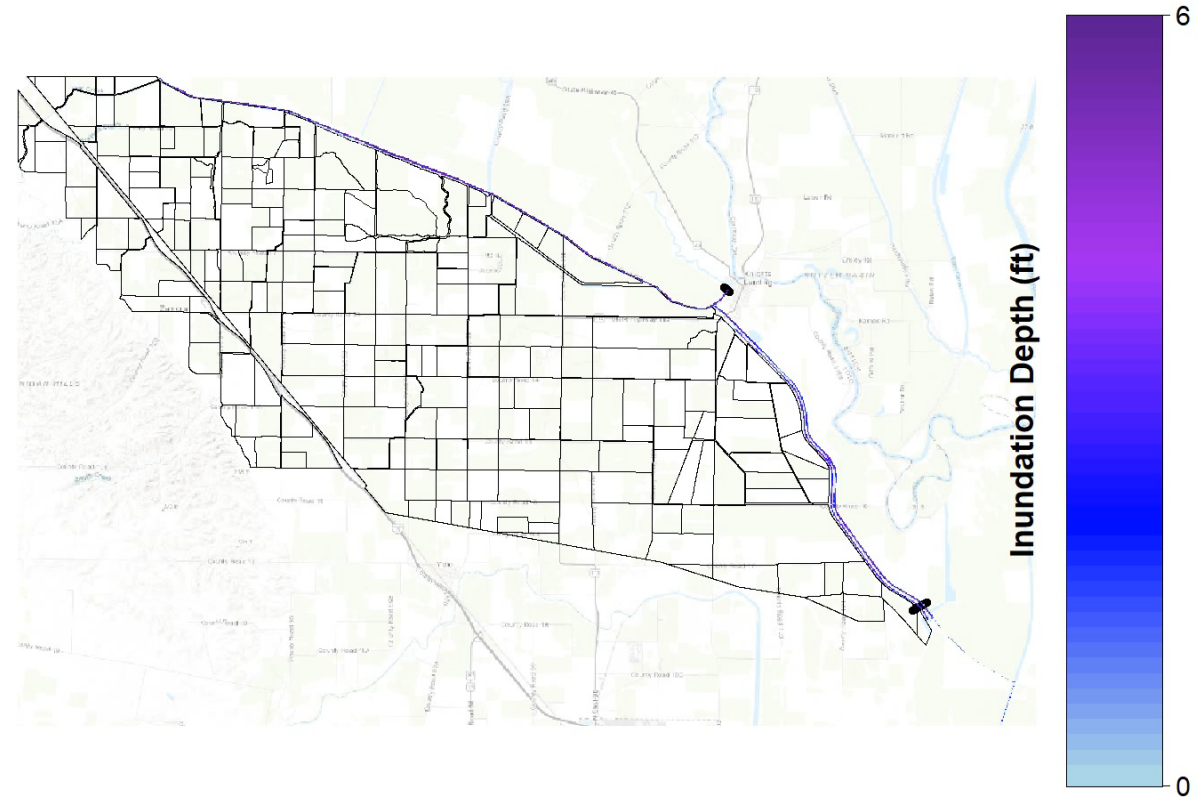
# Baseline Model Results – Colusa Middle Region



# Baseline Model Results – Colusa Lower Region



WY : 2018-10-01 00:00



# Scenario Development – Suite of Possible Actions

## Types

- River Connections
  - Notch overflow and flood weirs
  - Modify outfall gates
  - Modify existing or add new diversions
  - With or without fish screens
- Floodplain Infrastructure
- Land Management
- Habitat Restoration





# Scenario Development – Suite of Possible Actions

## Types

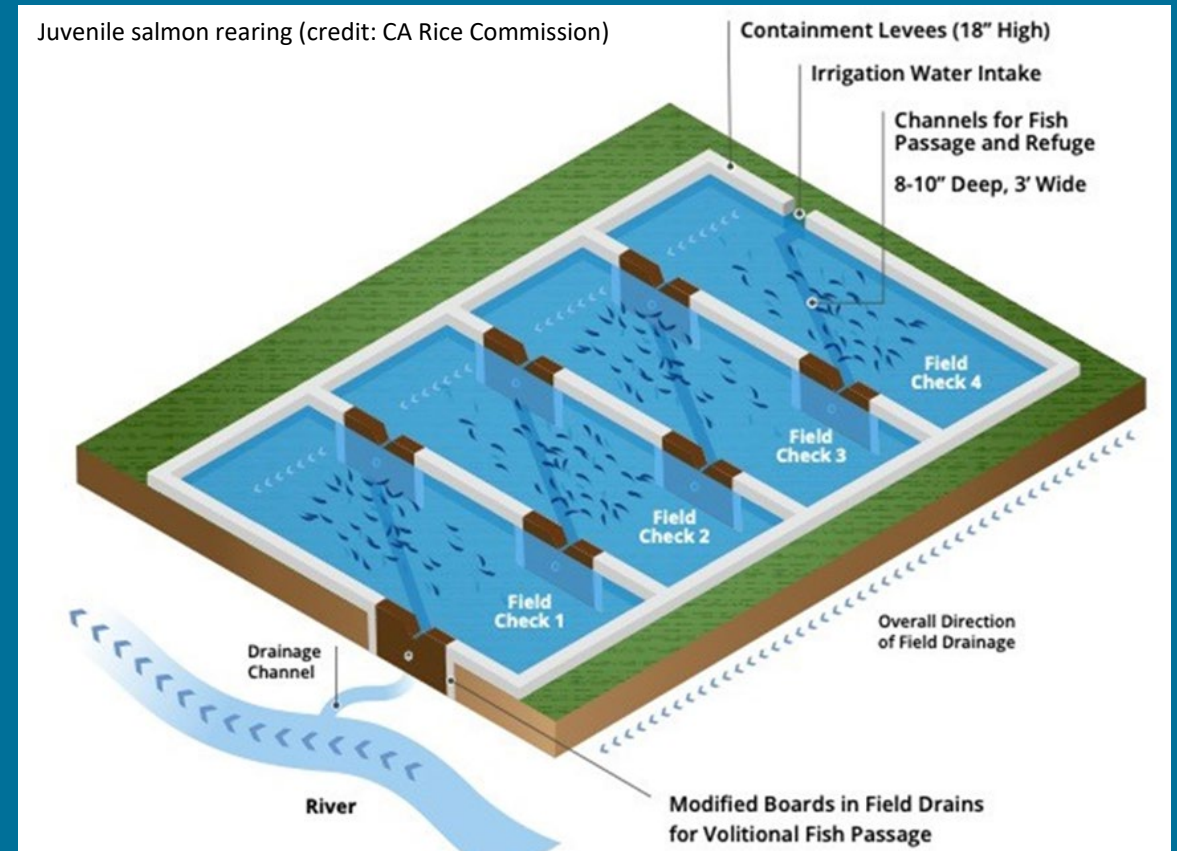
- River Connections
- Floodplain Infrastructure
  - Modify water management
  - Improve fish passage
- Land Management
- Habitat Restoration



# Scenario Development – Suite of Possible Actions

## Types

- River Connections
- Floodplain Infrastructure
- Land Management
  - Manage water on the field unit
    - Juvenile salmon rearing & fish food
    - Bird habitat
    - Groundwater recharge
  - Fish friendly passage
  - Fish screens
- Habitat Restoration





# Scenario Development – Suite of Possible Actions

## Types

- River Connections
- Floodplain Infrastructure
- Land Management
- Habitat Restoration
  - Juvenile rearing
  - Reduce stranding
  - Riparian restoration



Willow Bend Preserve (credit: this study)



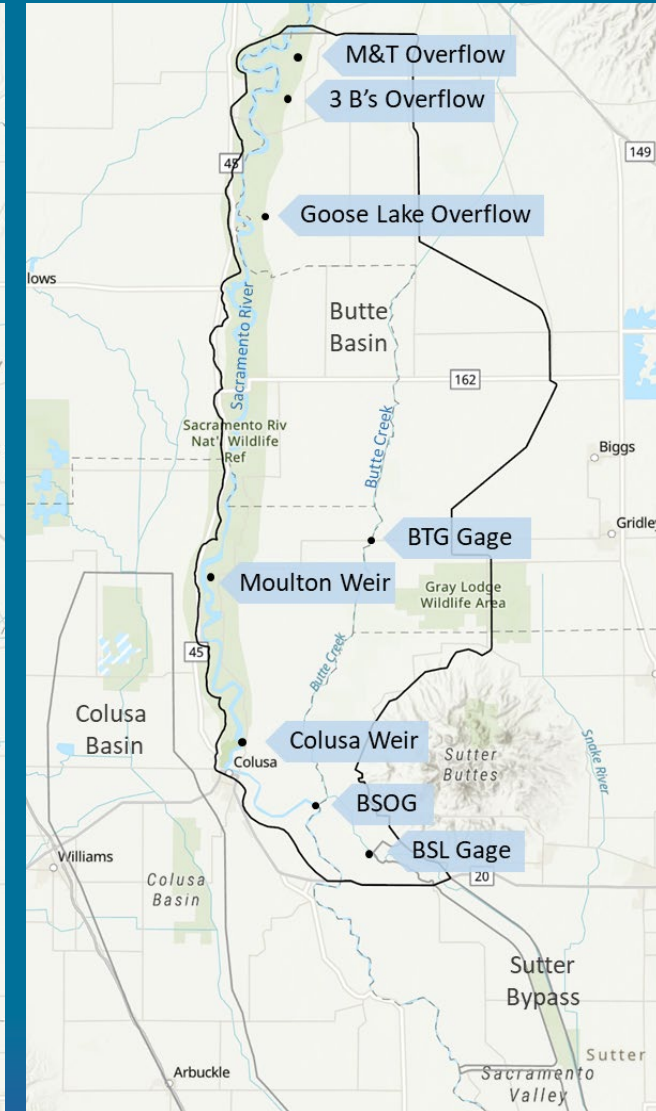
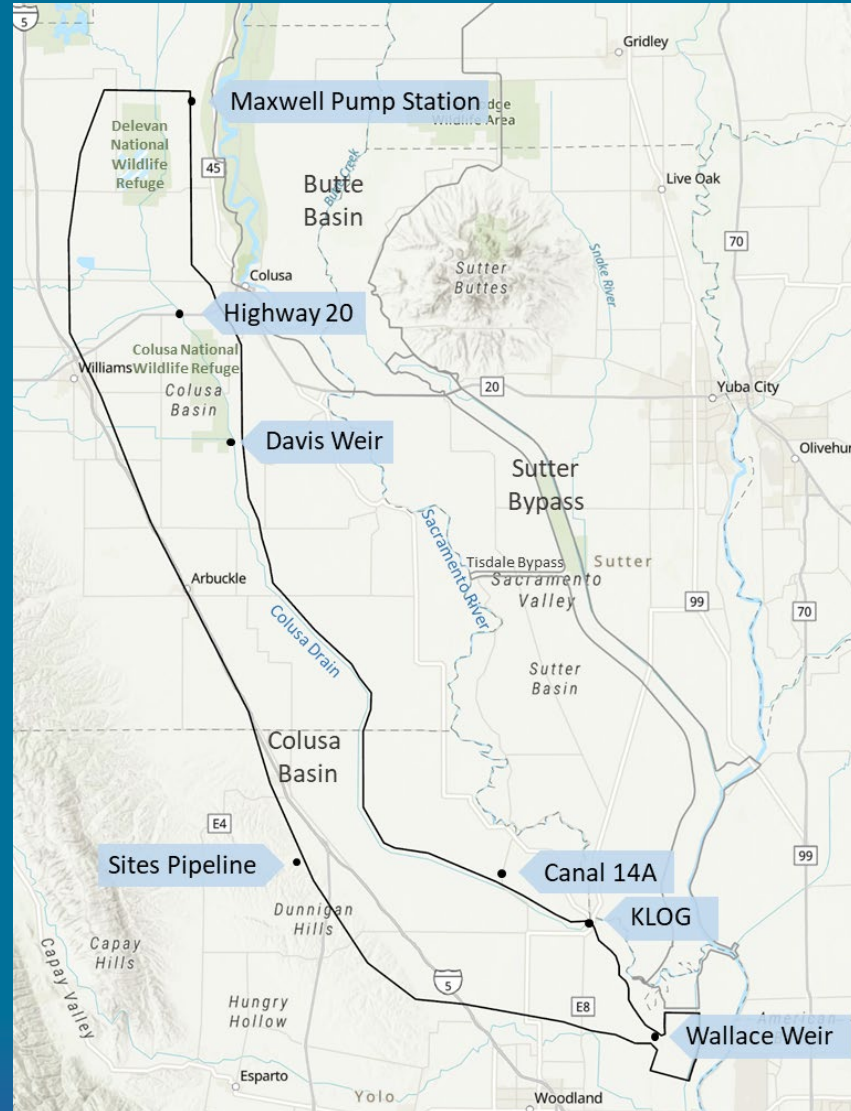
# Scenario Development – Suite of Possible Actions

## Actions are Preliminary!!!

- Actions require willingness
- Actions require evaluation
  - Are they feasible?
  - Are they beneficial?
  - Do they impact existing uses?
  - Do they impact other projects?

## Actions to be Discussed Today

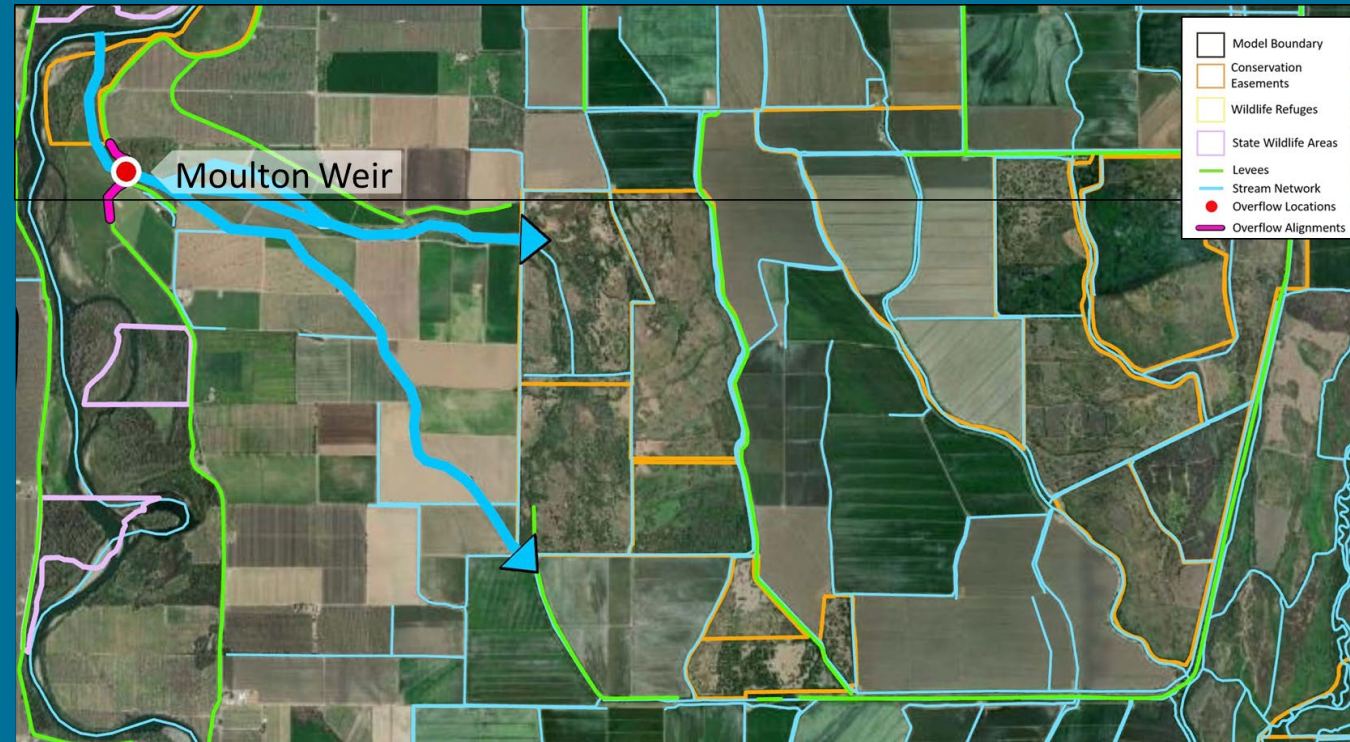
- River Connections
  - Moulton & Colusa Weir Notch
- Floodplain Infrastructure
  - Wallace Weir
- Habitat Restoration



# Butte Basin – Moulton Weir Notch Action

## Description

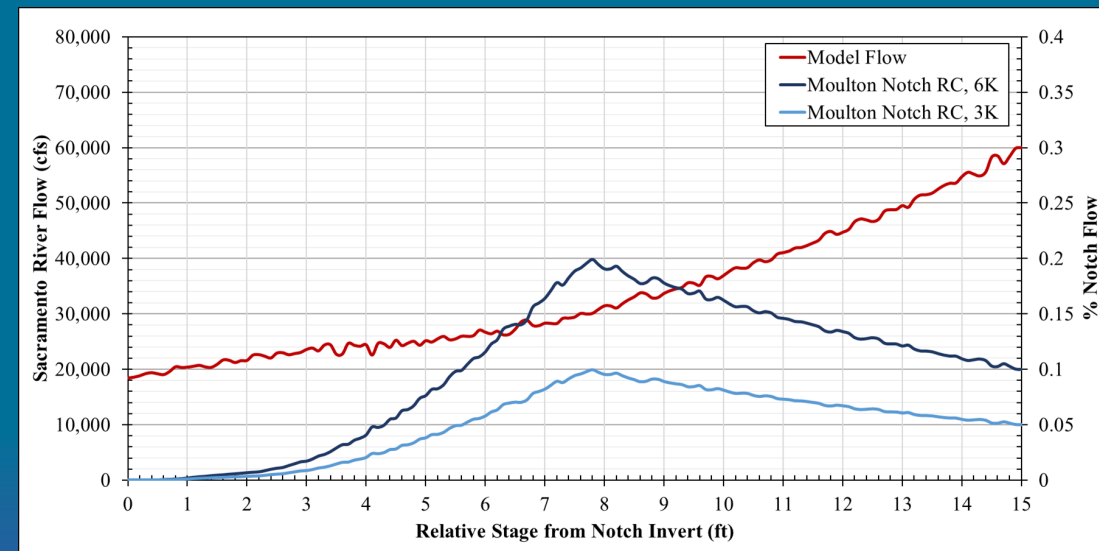
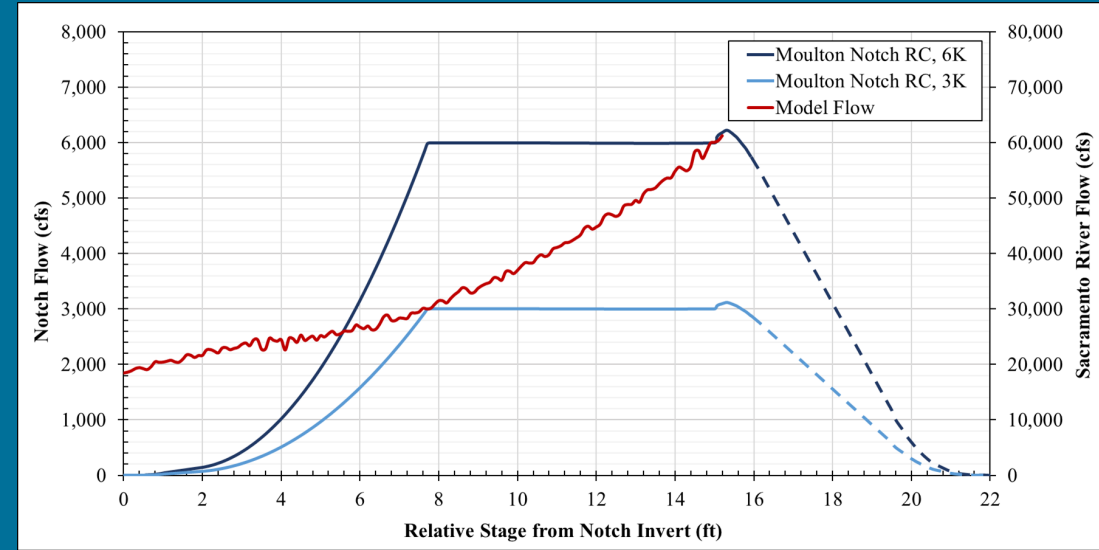
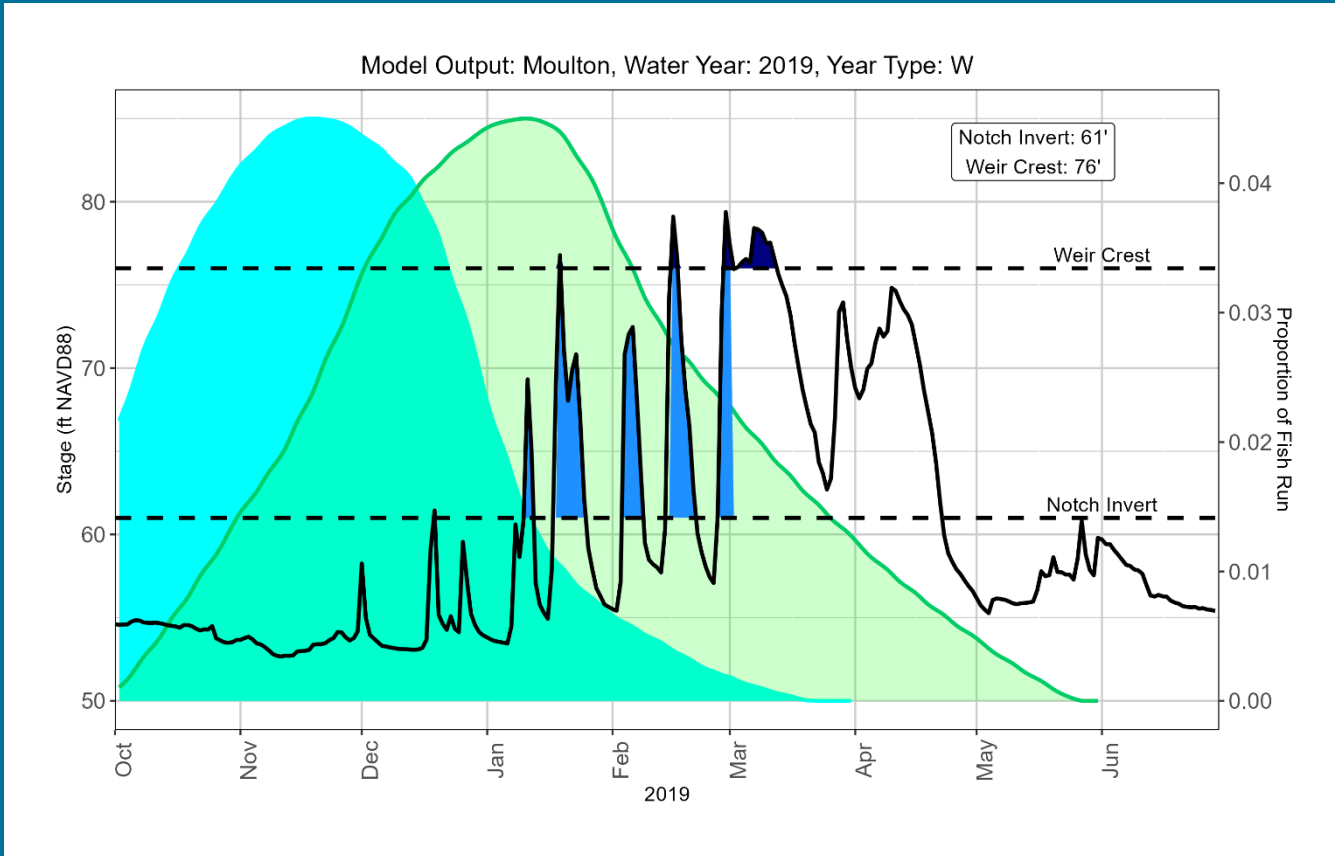
- Existing weir:
  - Overtops at 60,000 cfs and 76 ft
- Operable notch:
  - Operational window: 11/1 to 3/1
  - River stage range: 61 ft to 76 ft
  - River flow range: 18000 cfs to 60000 cfs
  - Notch flows: max rates of 3000 cfs and 6000 cfs
- Operable notch features:
  - Inlet: grade 3800 ft channel
  - Outlet: regrade overflow channels



## Question

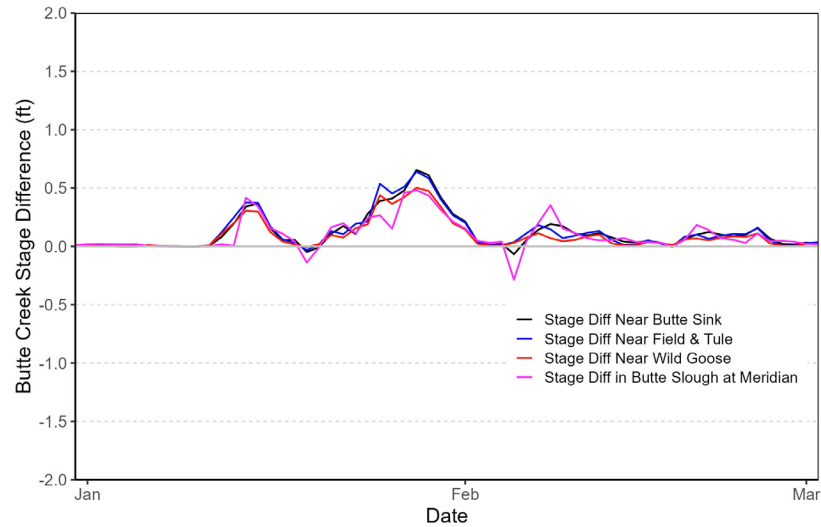
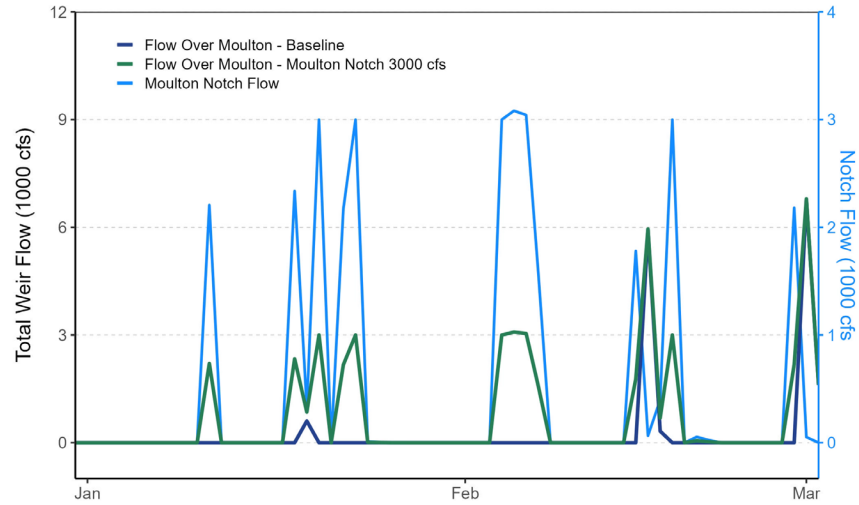
- What flow rate should be carried forward?

# Butte Basin – Moulton Weir Notch Action

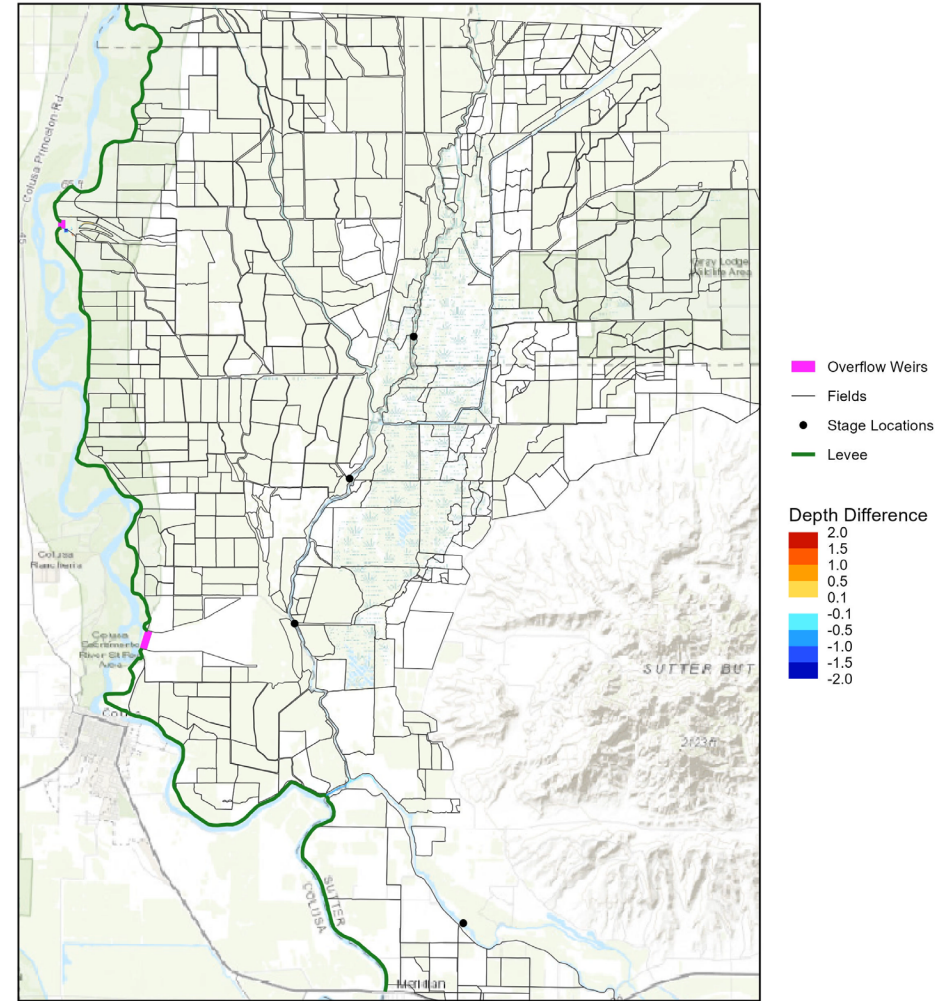




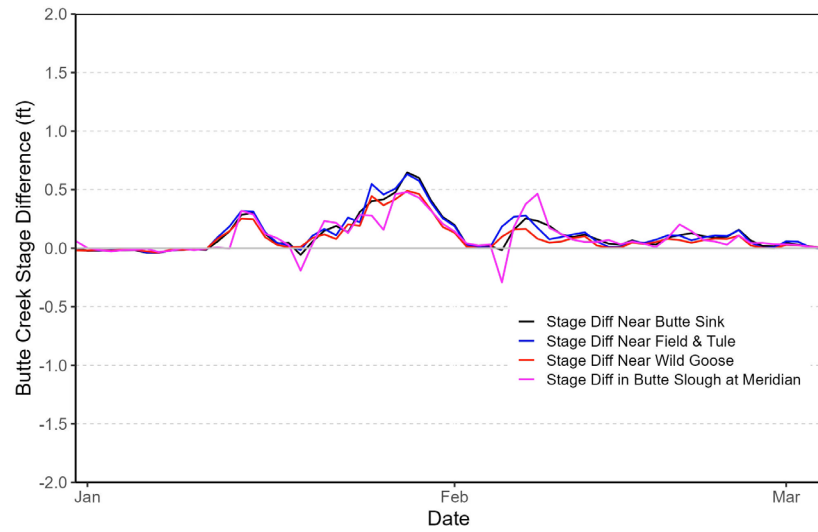
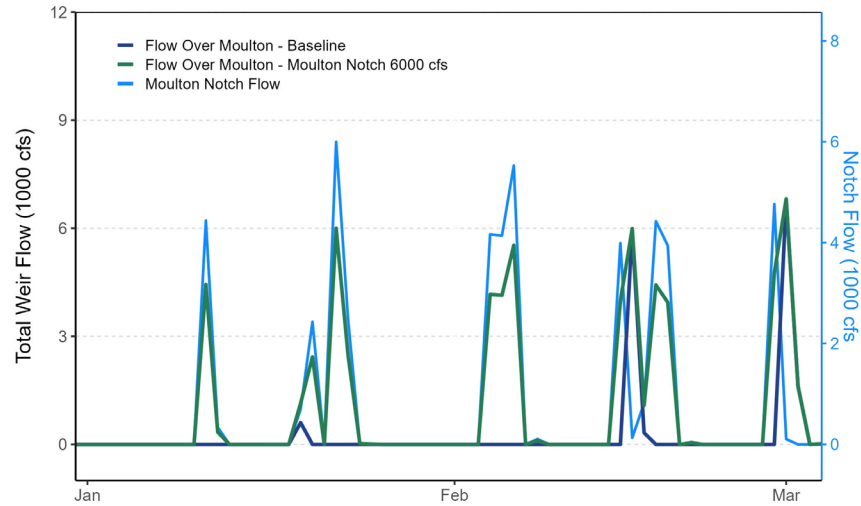
# Butte Basin – Moulton Weir Notch 3000 cfs Action



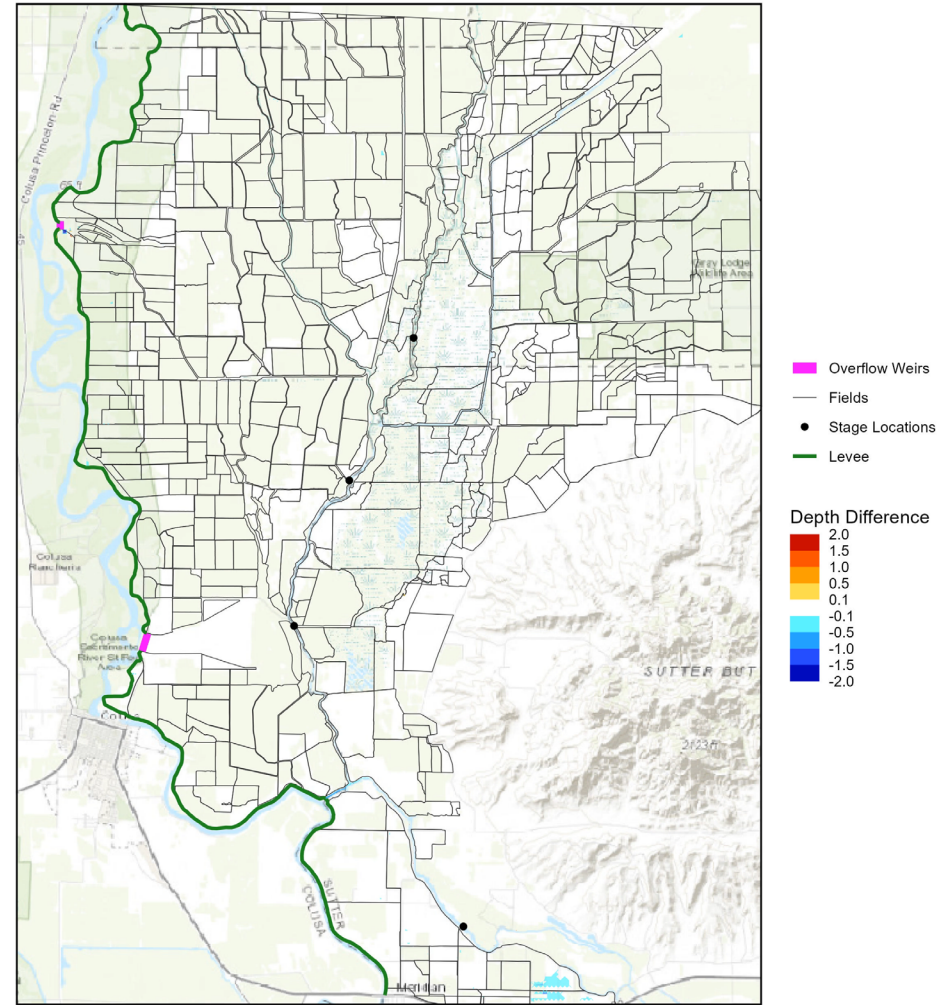
Moulton Notch 3000 cfs Effect on Water Depth  
WY 2019: 2018-12-31 00:00



# Butte Basin – Moulton Weir Notch 6000 cfs Action



Moulton Notch 6000 cfs Effect on Water Depth  
WY 2019: 2018-12-31 00:00





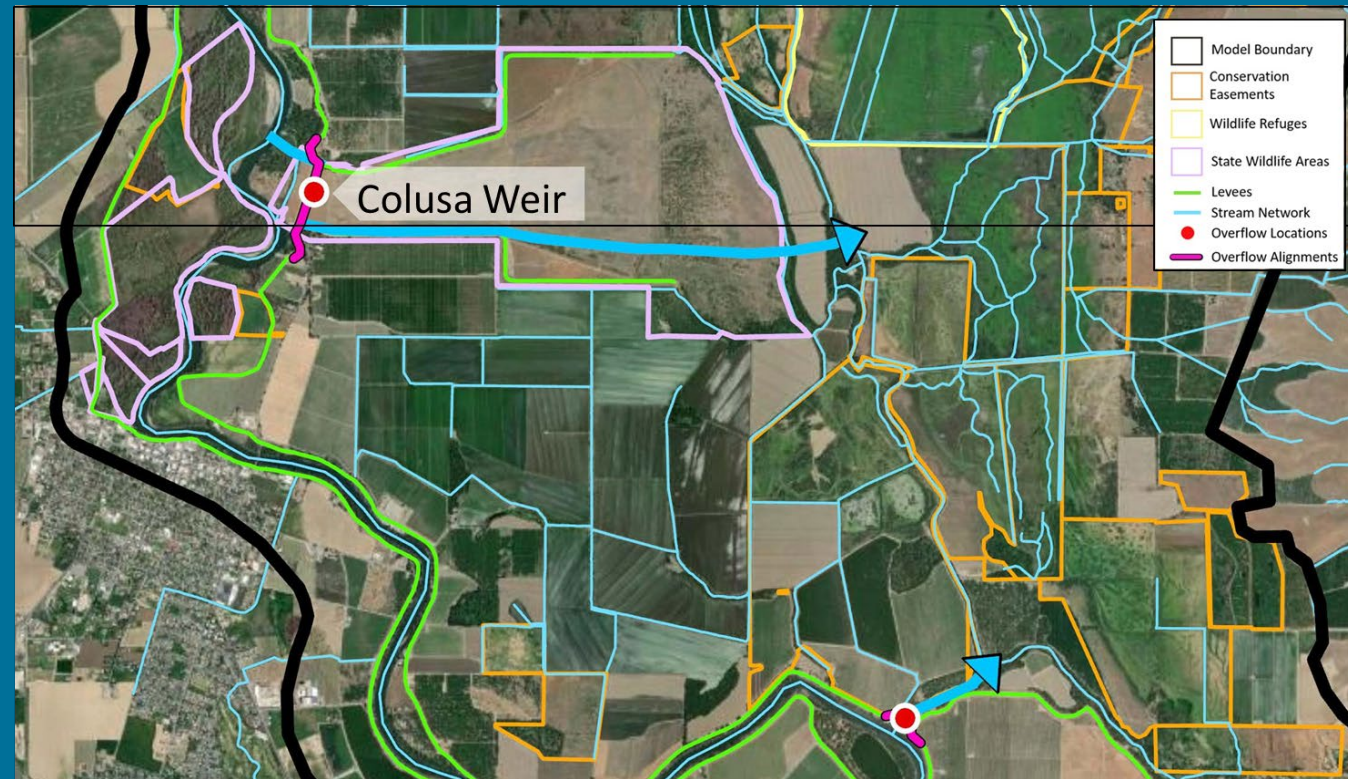
# Butte Basin – Colusa Weir Notch Action

## Description

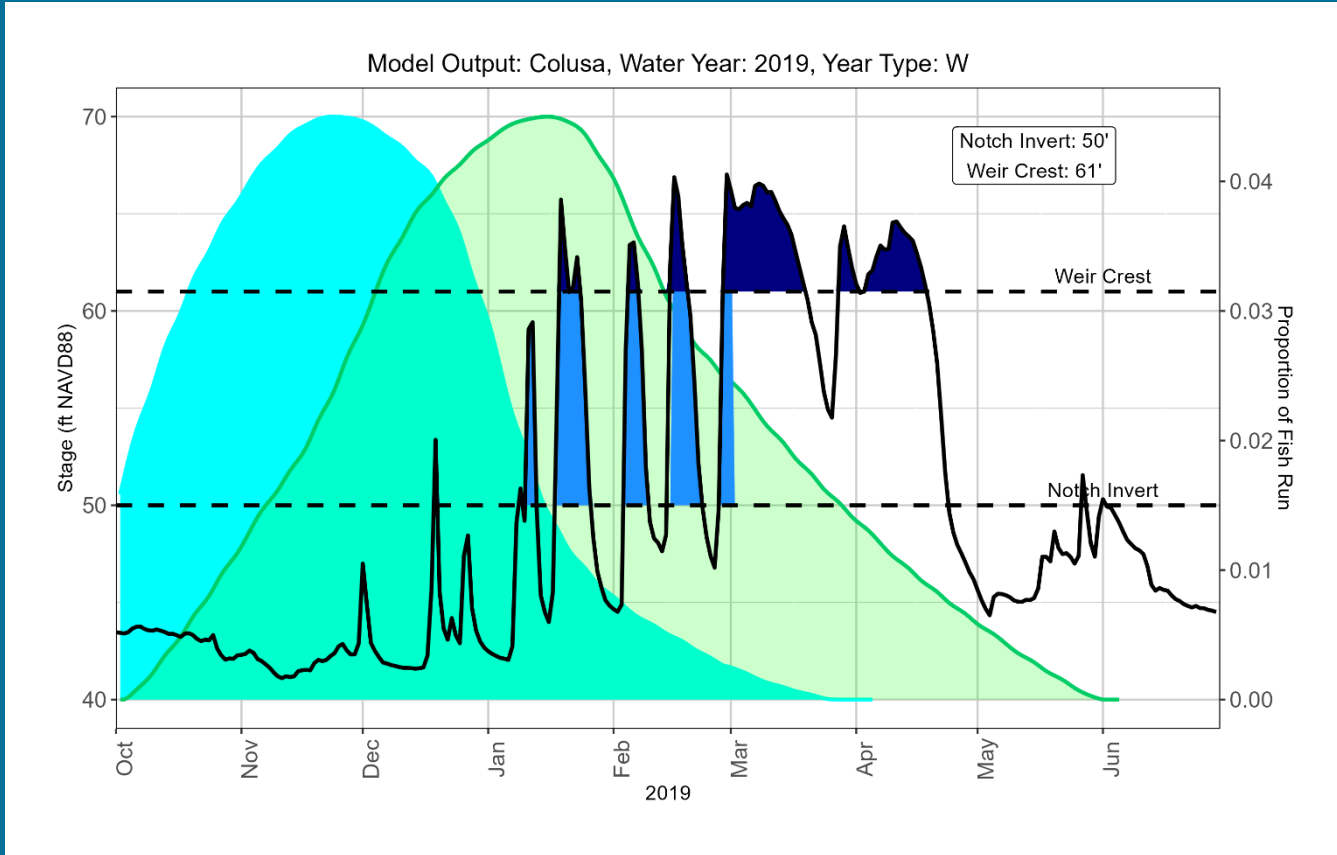
- Existing weir:
  - Overtops at 30,000 cfs and 61 ft
- Operable notch:
  - Operational window: 11/1 to 3/1
  - River stage range: 50 ft to 61 ft
  - River flow range: 16000 cfs to 30000 cfs
  - Notch flows: max rates of 3000 cfs and 6000 cfs
- Operable notch features:
  - Inlet: regrade 1300 ft oxbows
  - Outlet: grade 15000 ft channel

## Question

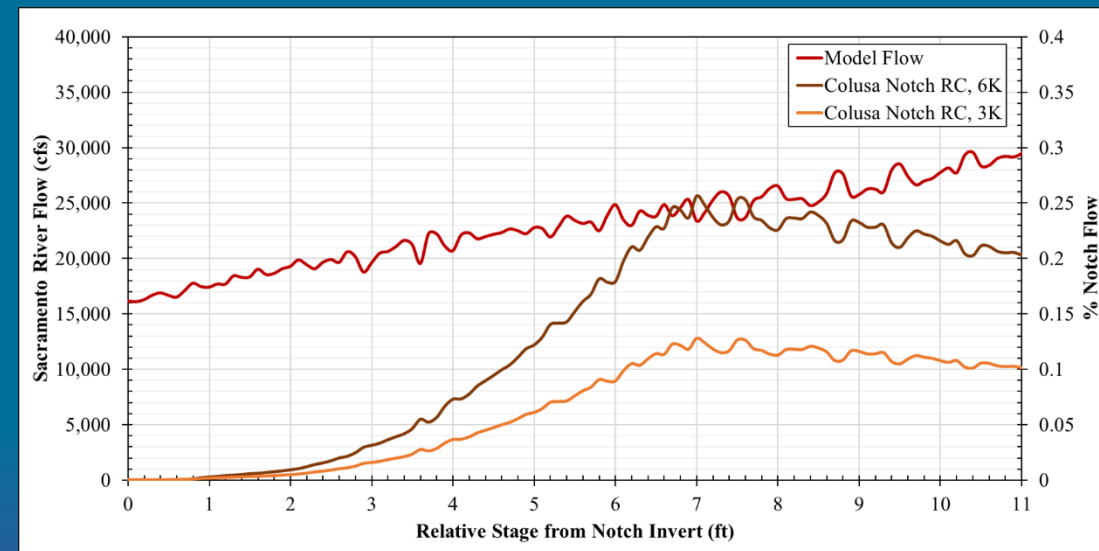
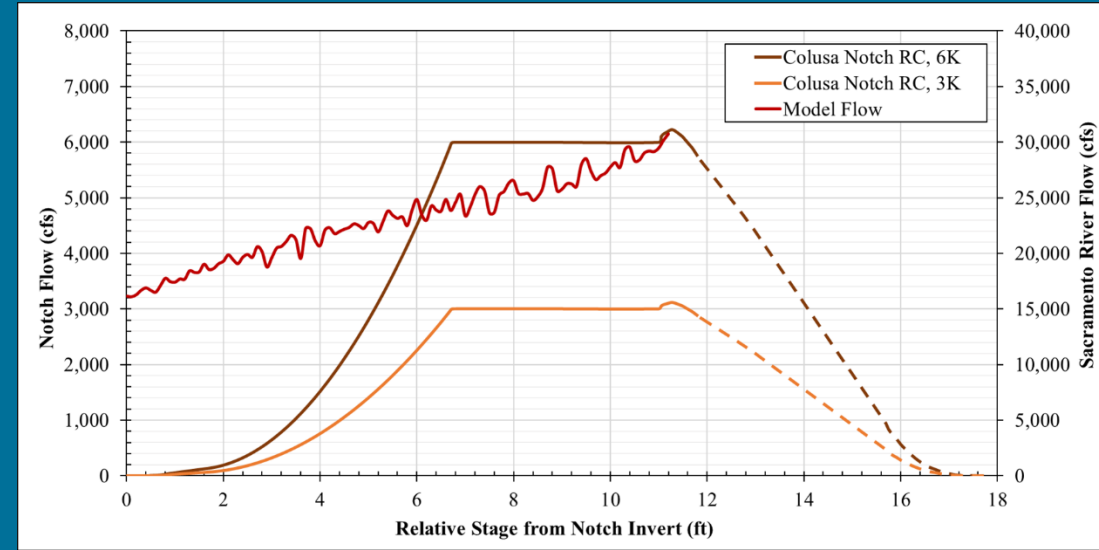
- What flow rate should be carried forward?



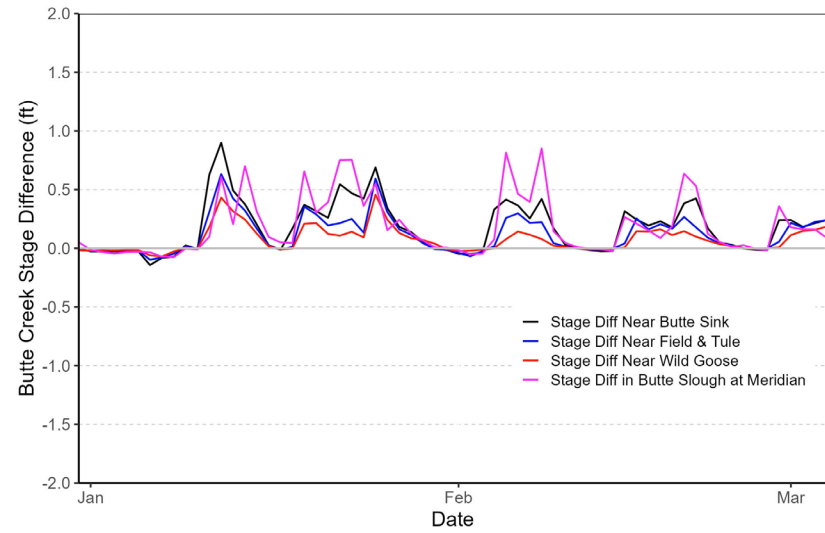
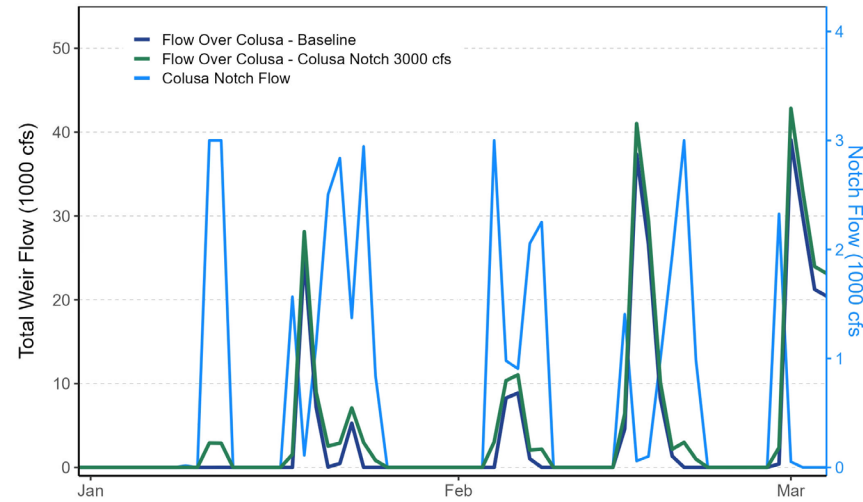
# Butte Basin – Colusa Weir Notch Action



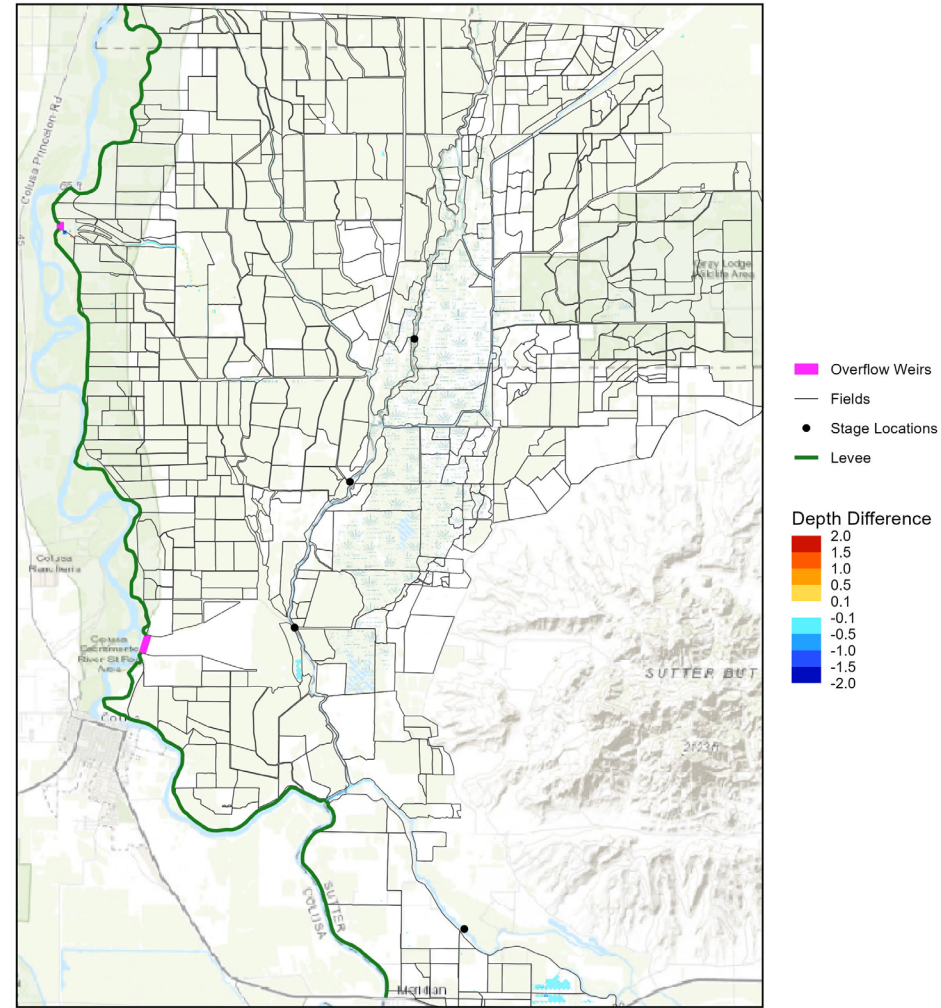
■ Notch Active: Open Nov 1 to Mar 1   
 ■ Weir Overtopping   
 ■ Winter Run   
 ■ Fall/Spring Run



# Butte Basin – Colusa Weir Notch 3000 cfs Action



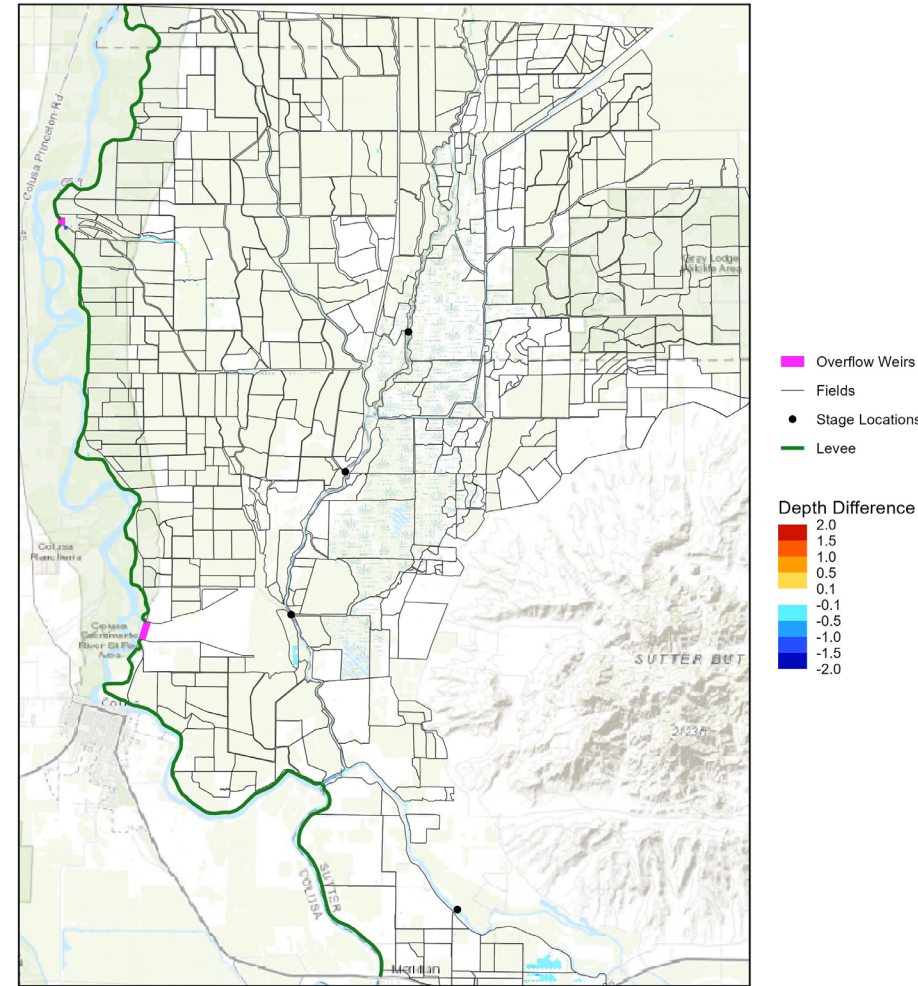
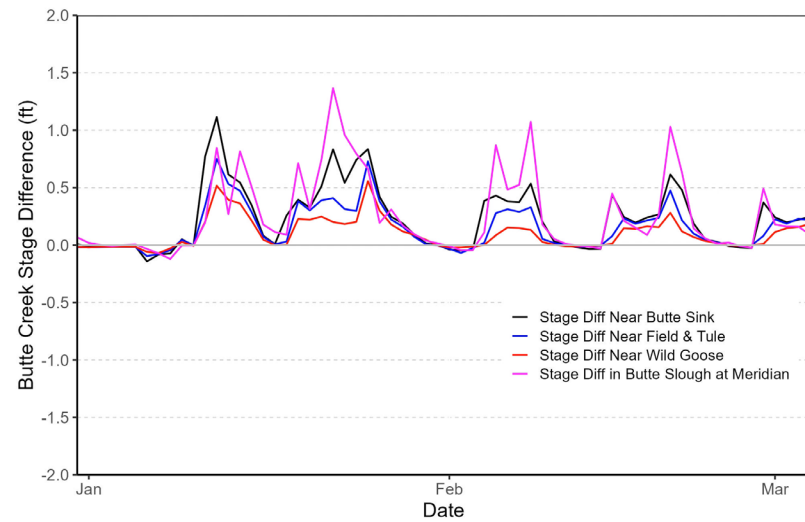
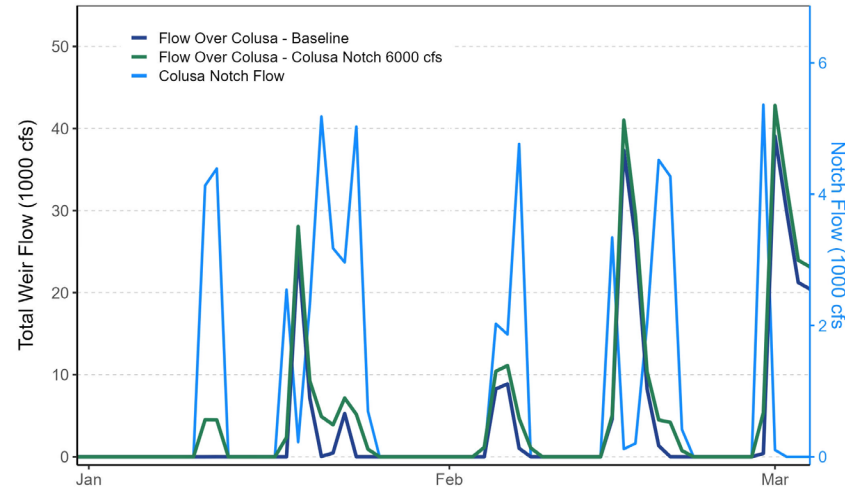
Colusa Notch 3000 cfs Effect on Water Depth  
WY 2019: 2018-12-31 00:00



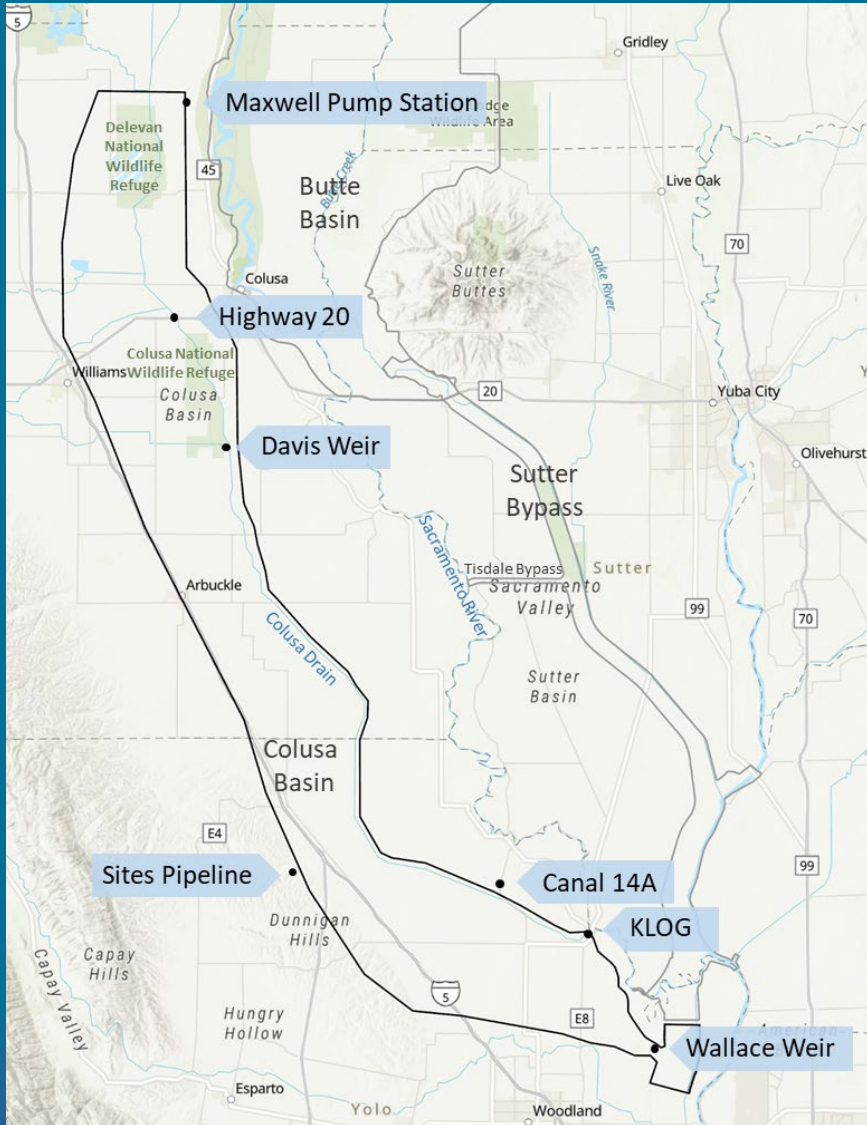


# Butte Basin – Colusa Weir Notch 6000 cfs Action

Colusa Notch 6000 cfs Effect on Water Depth  
WY 2019: 2018-12-31 00:00



# Colusa Basin – Wallace Weir Water Level Management Action



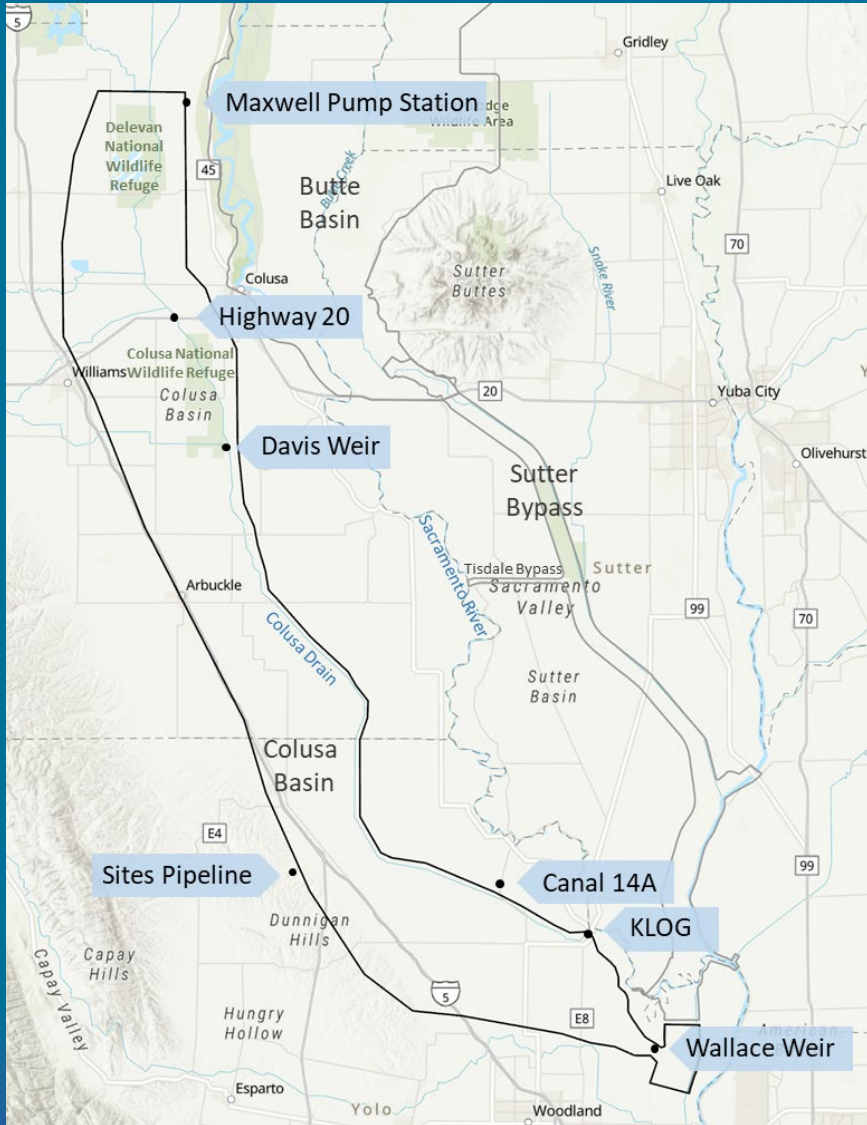
## Description

- Reoperate Wallace Weir and KLOG to maintain a higher management level in the Colusa Drain
- There are multiple potential locations for water additions or Sacramento River connections to the Colusa Drain

## Questions

- Is it physically possible to accommodate volitional ingress/egress on the adjoining floodplain if juvenile salmon were introduced to the basin?
- Should juvenile salmon access into Colusa Basin be considered?

# Colusa Basin – Wallace Weir Water Level Management Action



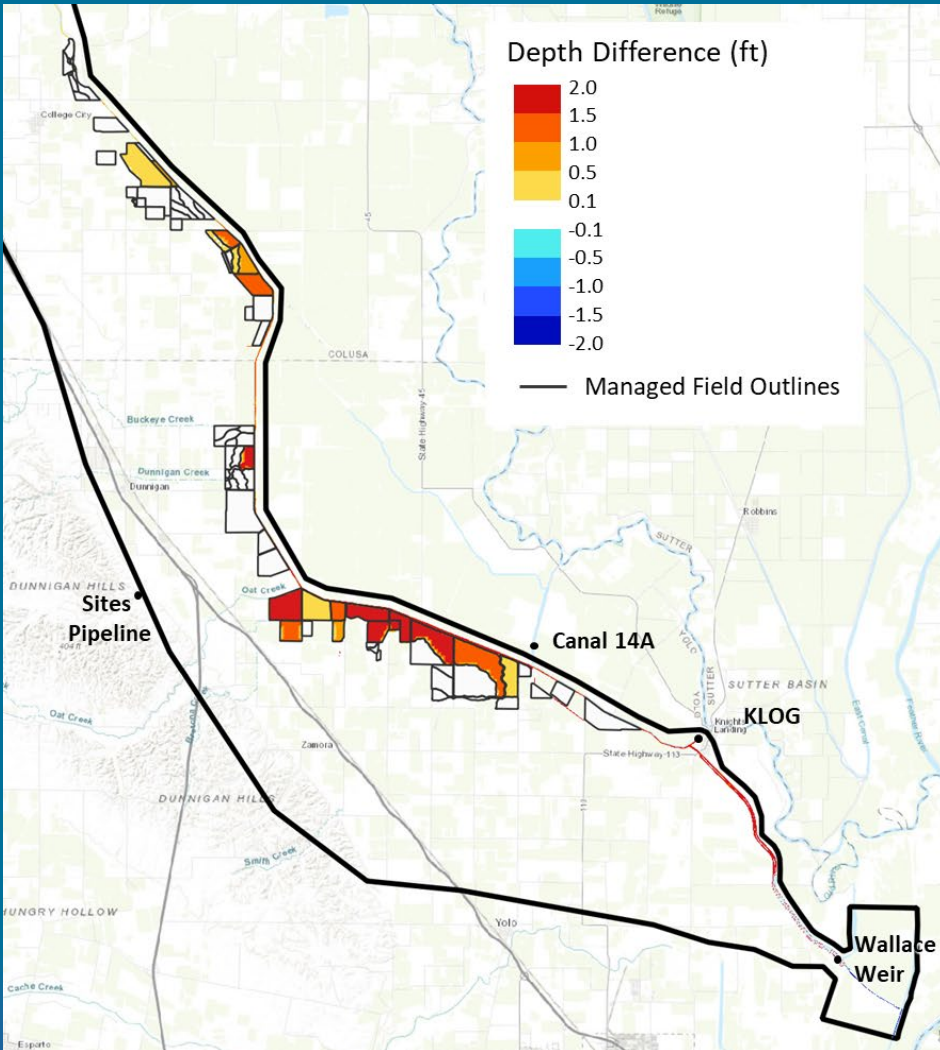
## Description

- Wallace Weir Baseline:
  - Four constant flows: 1000, 2000, 3000, and 4000 cfs
  - Operate Wallace Weir to maintain a current management level of **22.4 ft** at KLOG
- Wallace Weir Action:
  - Four constant flows: 1000, 2000, 3000, and 4000 cfs
  - Operate Wallace Weir to maintain a higher management level of **27.75 ft** upstream of Wallace Weir
- Analysis:
  - Compare the depths in the inundation area along the drain between the two management levels for each flow
  - Identify when managed wetlands would experience berm overtopping events to allow for juvenile salmon access
  - Note: there is subsidence in the lower half of the basin with subsidence of 1-1.5 ft in the last 15 years

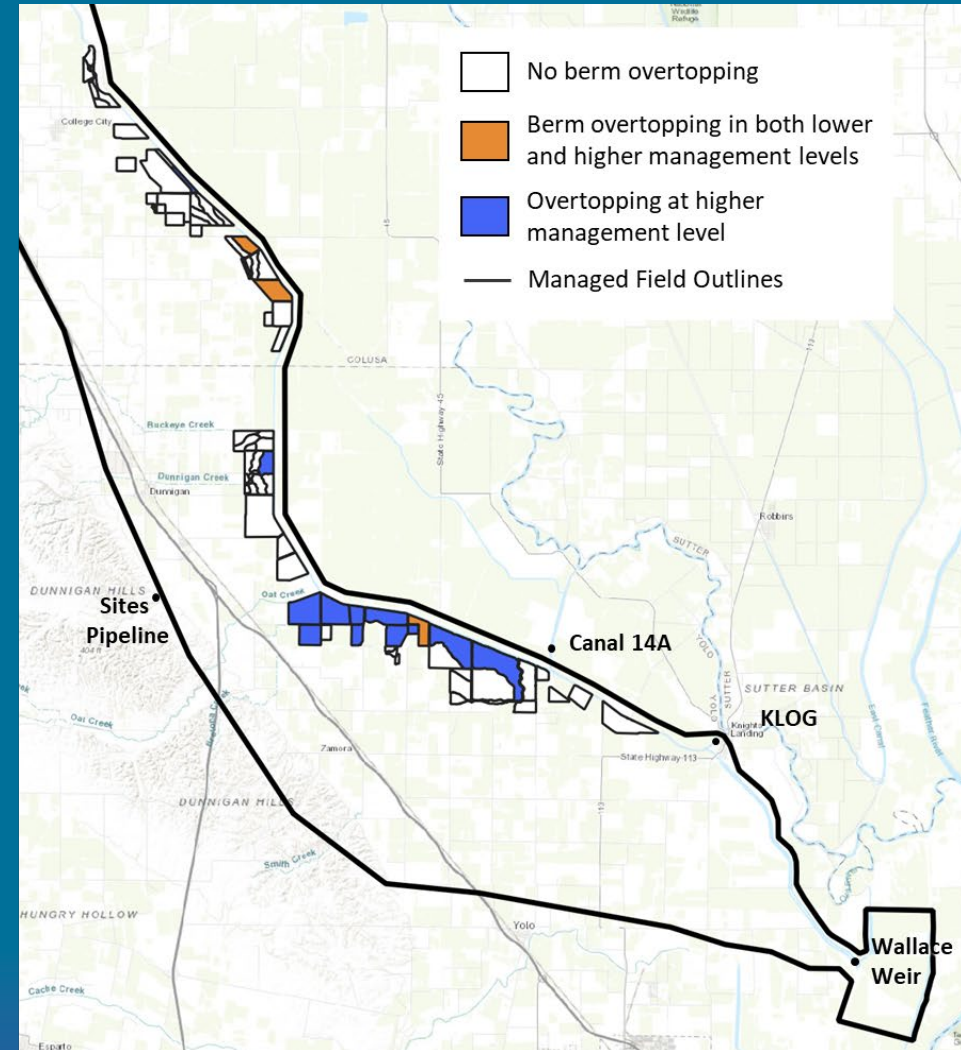


# Colusa Basin Action Evaluation – 1000 cfs

## Action – Baseline

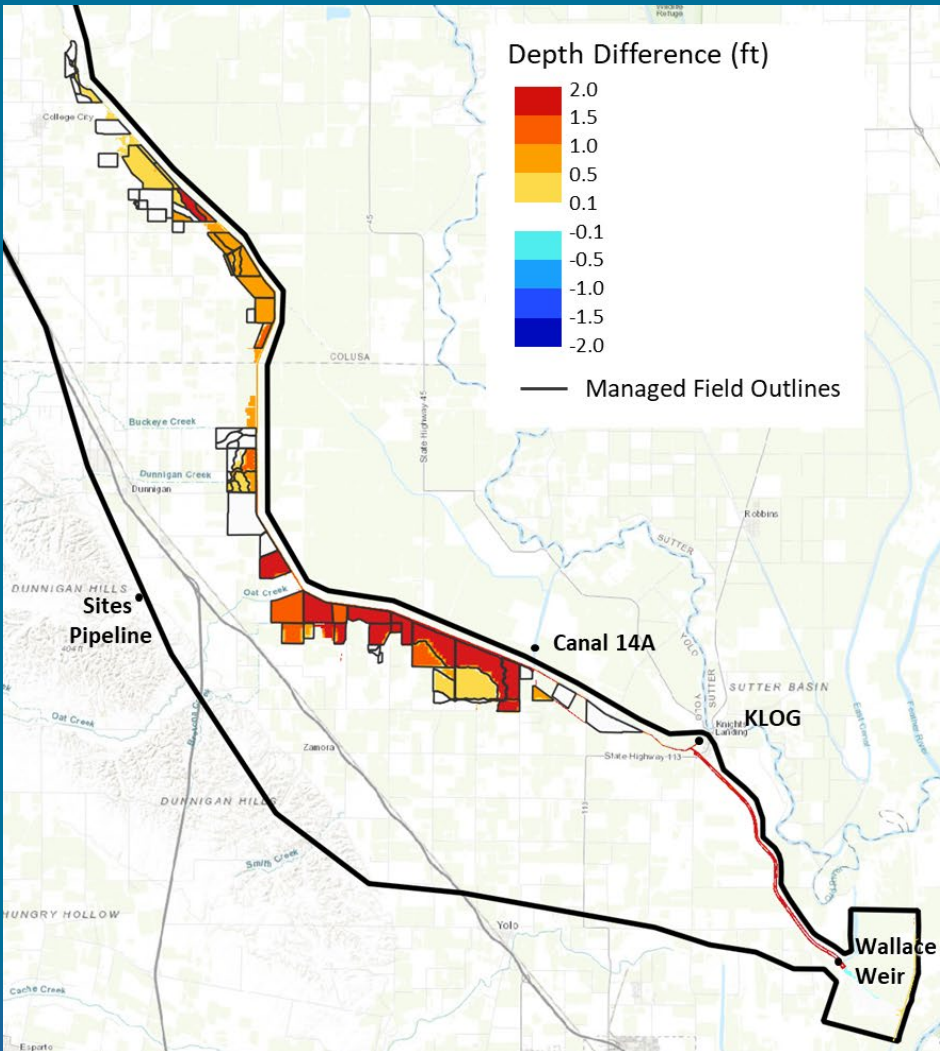


## Managed Wetland Berm Overtopping

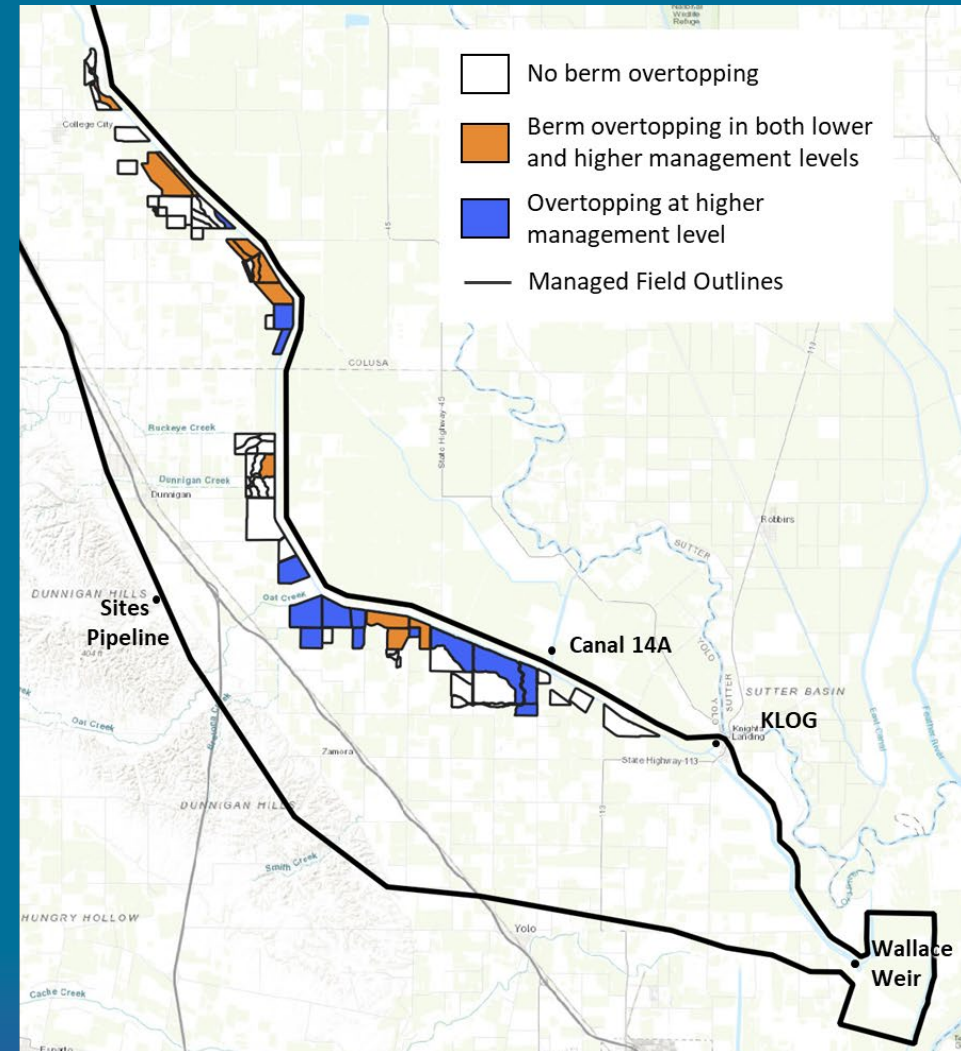


# Colusa Basin Action Evaluation – 2000 cfs

## Action – Baseline



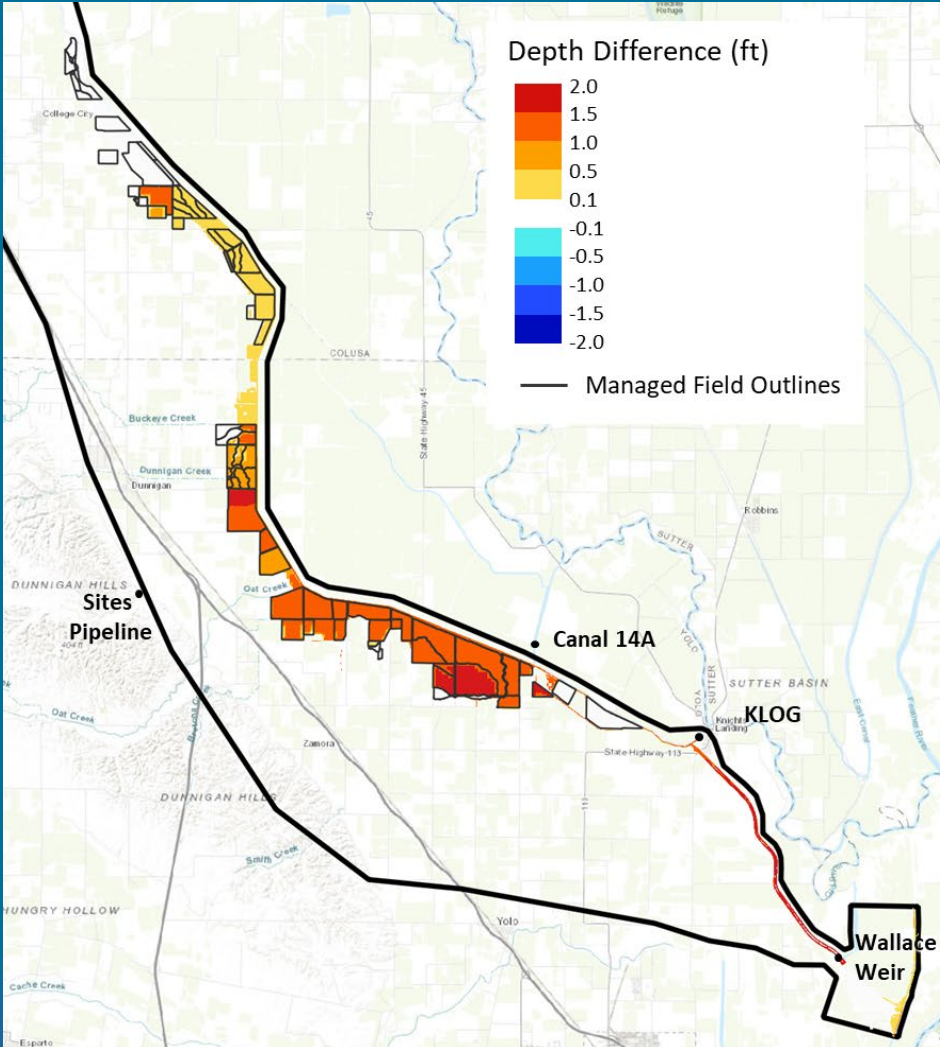
## Managed Wetland Berm Overtopping



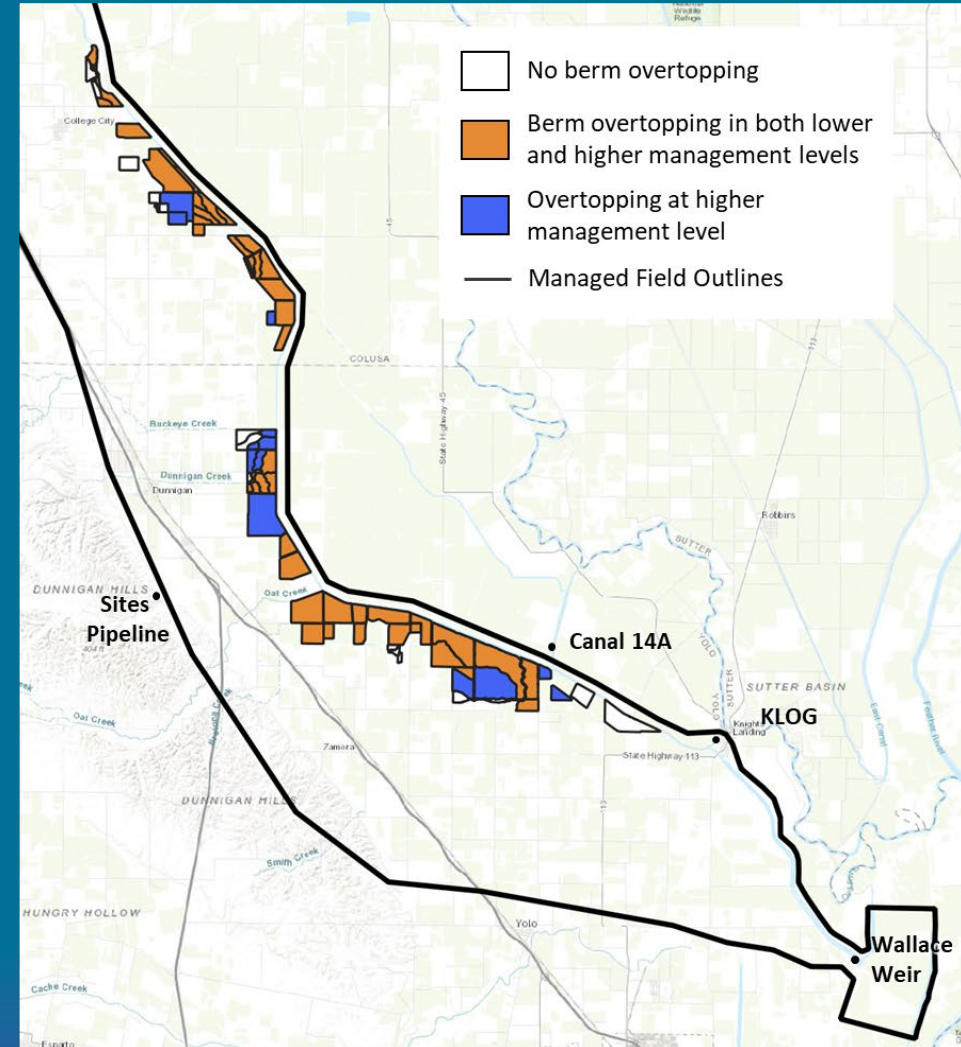


# Colusa Basin Action Evaluation – 3000 cfs

## Action – Baseline

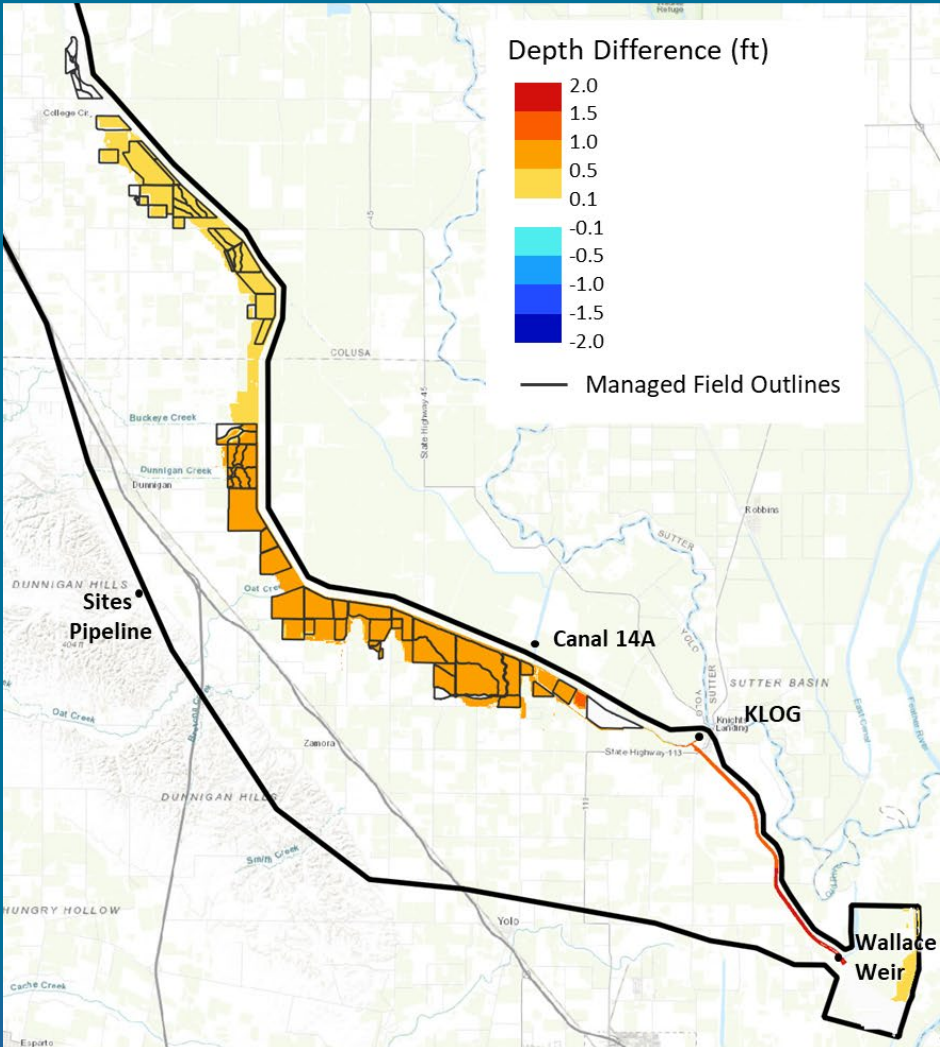


## Managed Wetland Berm Overtopping

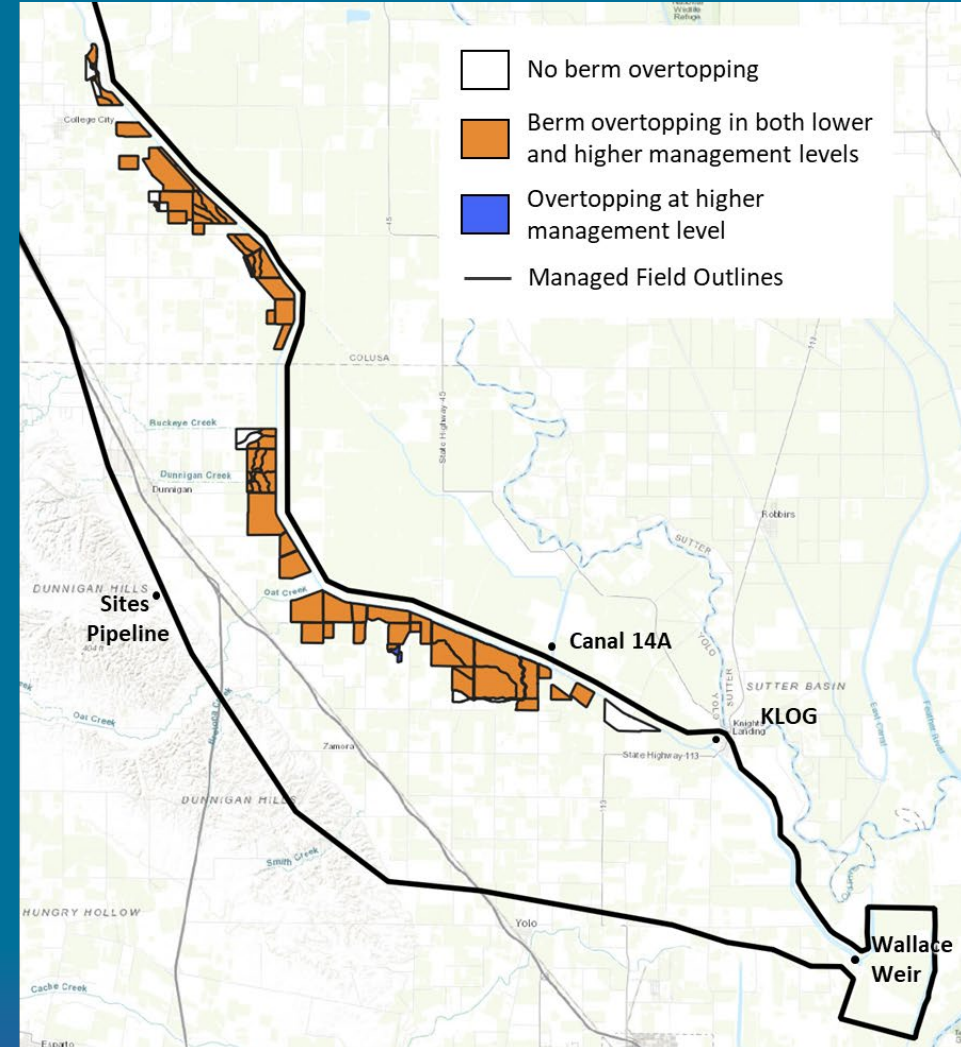


# Colusa Basin Action Evaluation – 4000 cfs

## Action – Baseline



## Managed Wetland Berm Overtopping



# Habitat Restoration – In-River Opportunities Analysis

## Scope of Stranding Hazard Identification

- Identify and prioritize juvenile salmon stranding hazards
  - Collect and analyze aerial imagery
  - Use EcoFIP (floodplain inundation potential) modeling framework to identify stranding areas and verify with aerial imagery

## Questions

- Should restoration actions be conceptualized for prioritized stranding hazards?
- Should restoration actions be conceptualized on private property (...the Benden Farms Technical Assistance will consider restoration actions west of Moulton Weir)?

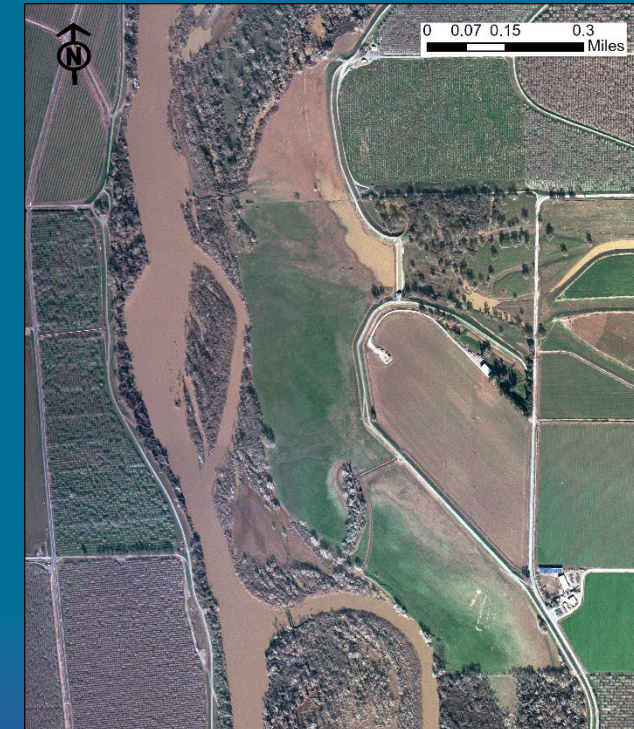
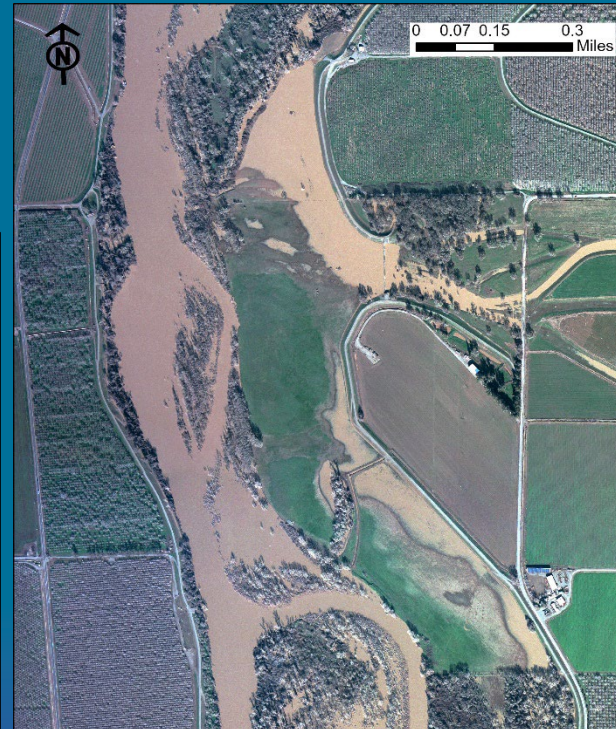
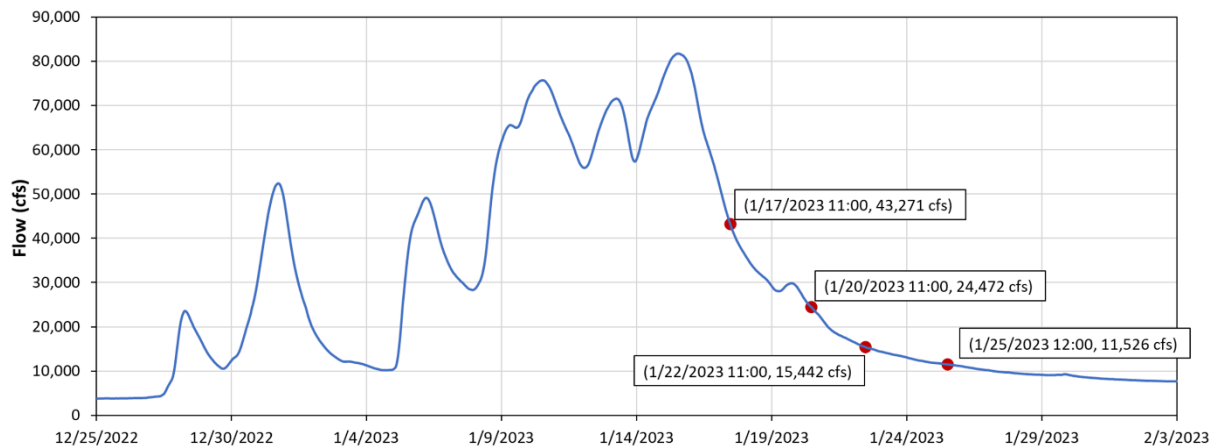


# Habitat Restoration – Stranding Hazard Analysis

## Aerial Imagery

- Images taken between Hamilton City and Colusa
- Four dates during a flood recession, January 17-25, 2023
- Images combined and orthorectified for spatial analysis

Sacramento River at Ord Ferry, CDEC (ORD)





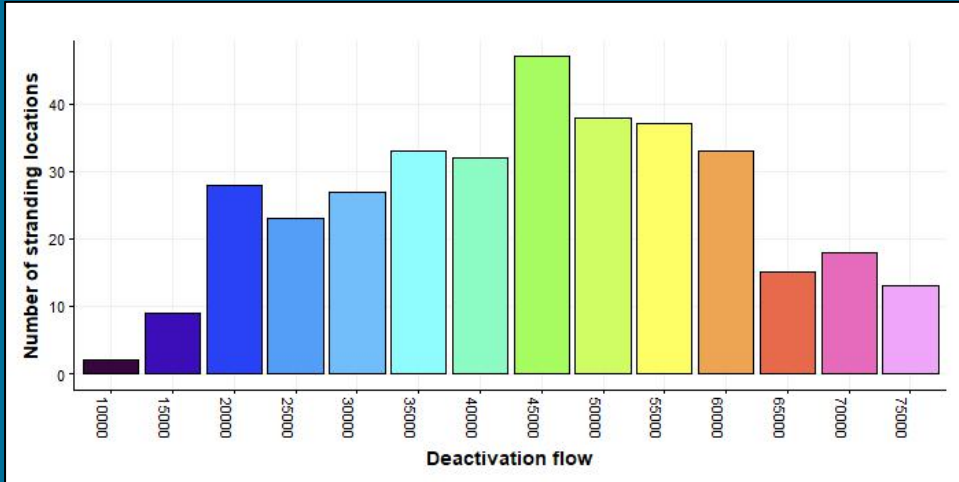
# Habitat Restoration – Stranding Hazard Analysis

- Use 1D hydraulic model outputs to calculate floodplain inundation at stepped flowrates
- Track connected and disconnected areas of inundation to identify stranding pools using EcoFIP analysis tool
- Stranding pools grouped by deactivation flow (between 10,000 – 80,000 cfs) and quantified by:
  - Surface area (acres)
  - Volume (acre-ft)
  - Proximity to the main channel (ft)
  - Limiting infiltration rate (in/hr)
- Pools screened with size limitations
  - 0.5 acre minimum surface area
  - 0.5 ft minimum depth

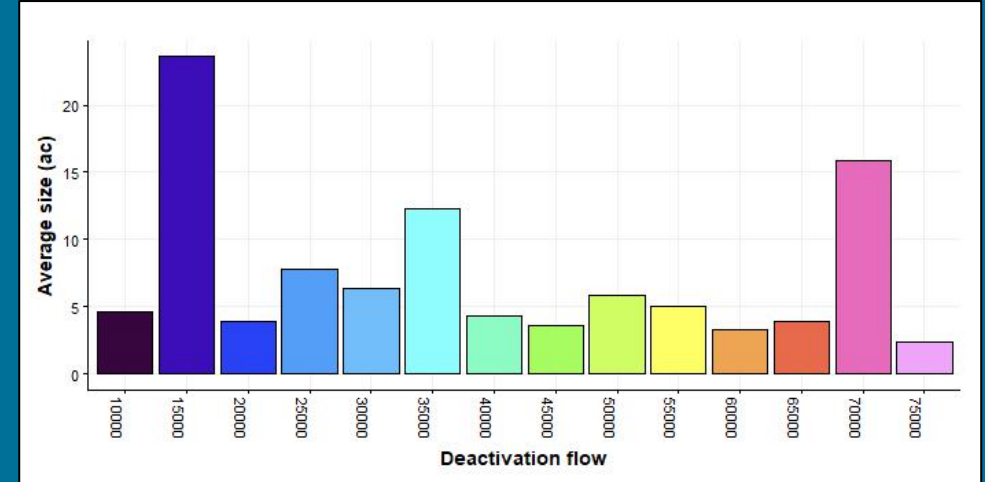


# Habitat Restoration – Stranding Hazard Analysis

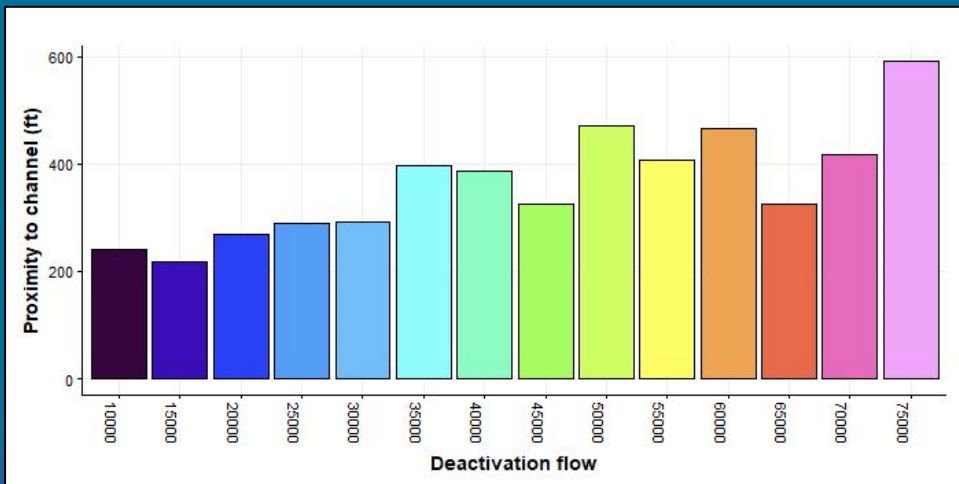
## Number of Pools



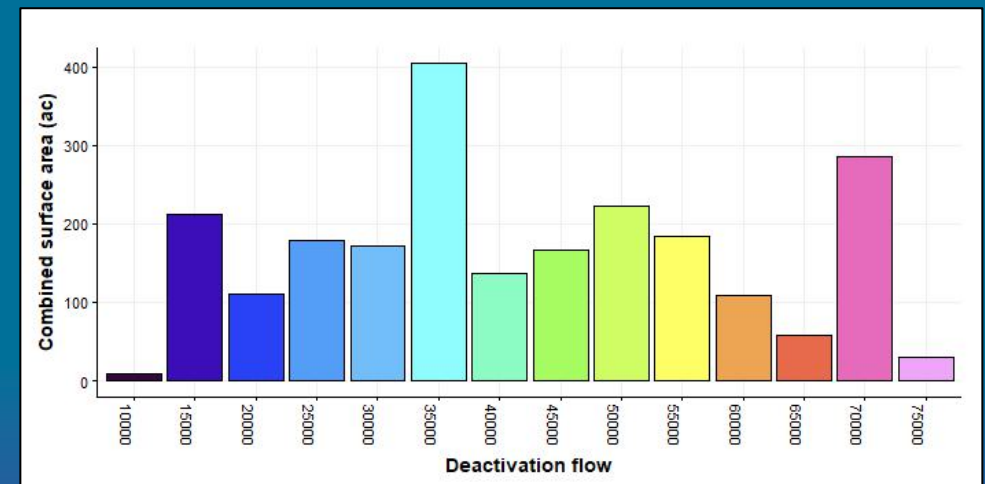
## Average Size



## Proximity to Main Channel



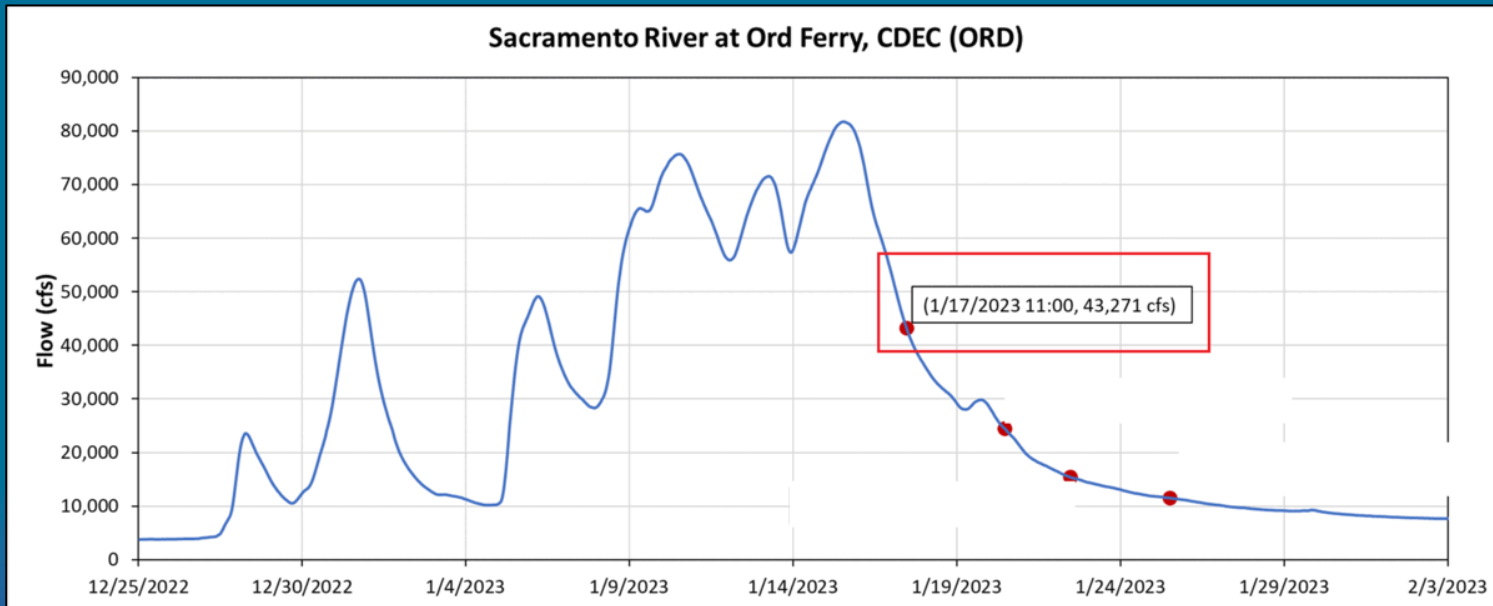
## Total Combined Size





# Habitat Restoration – Stranding Hazard Analysis

## Packer Lake



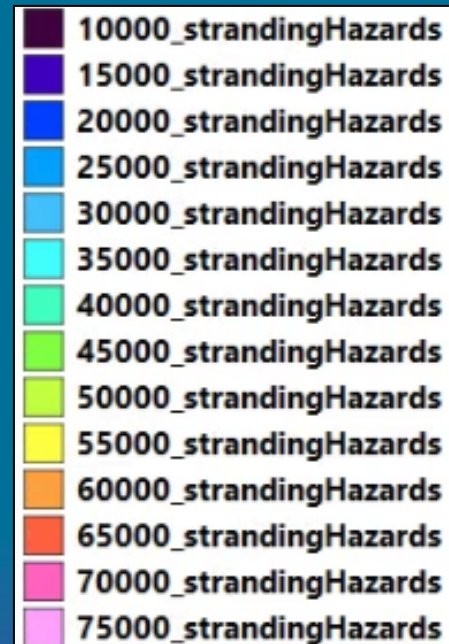
# Habitat Restoration – Stranding Hazard Analysis

## Packer Lake

Colored areas, no outline = modeled channel inundation

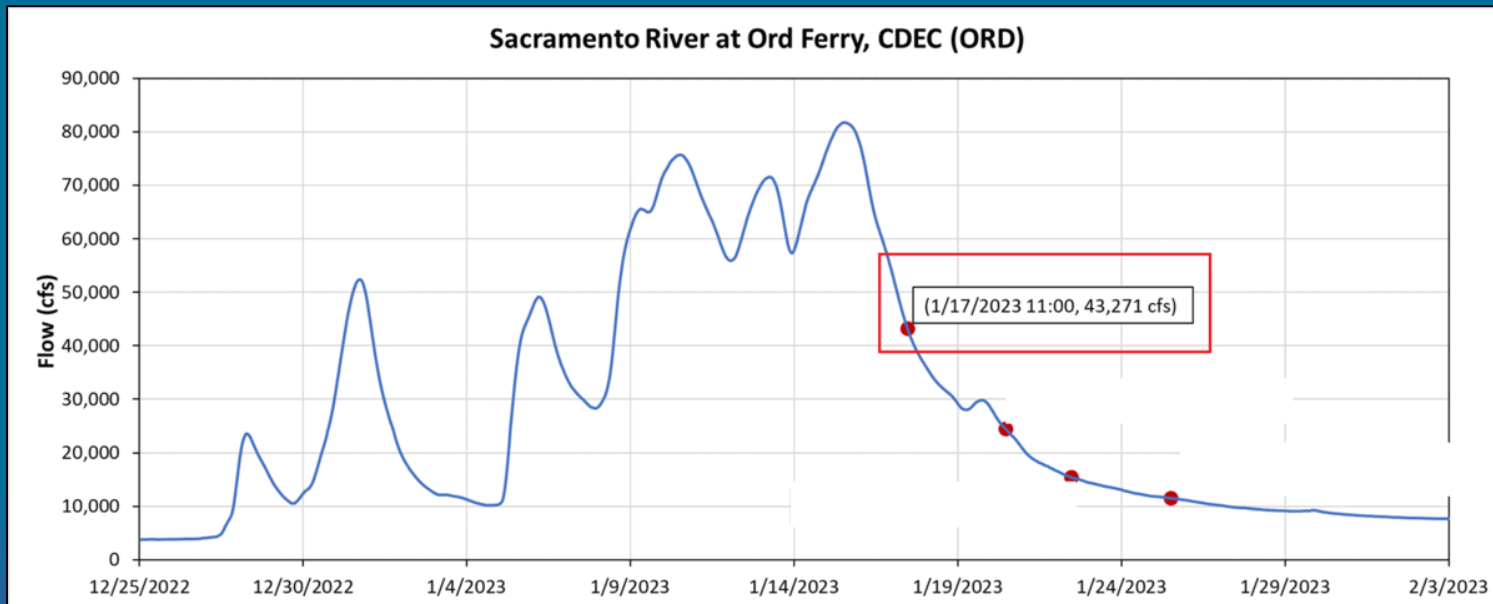
Outlined colored areas = identified stranding hazard locations

Packer Lake abandoned oxbows disconnect from the main channel at 35,000 cfs



# Habitat Restoration – Stranding Hazard Analysis

## Eddy Lake





# Habitat Restoration – Stranding Hazard Analysis

## Eddy Lake

Colored areas, no outline = modeled channel inundation

Outlined colored areas = identified stranding hazard locations

Large abandoned oxbows disconnect from the main channel at 70,000 cfs (pink) and 25,000 cfs (blue)

Pink stranding pools extend beyond current analysis extent

