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Hydraulics | Hydrology | Geomorphology | Design

Floodplains Reimagined

Hydrodynamics Ad Hoc Meeting
April 21, 2022

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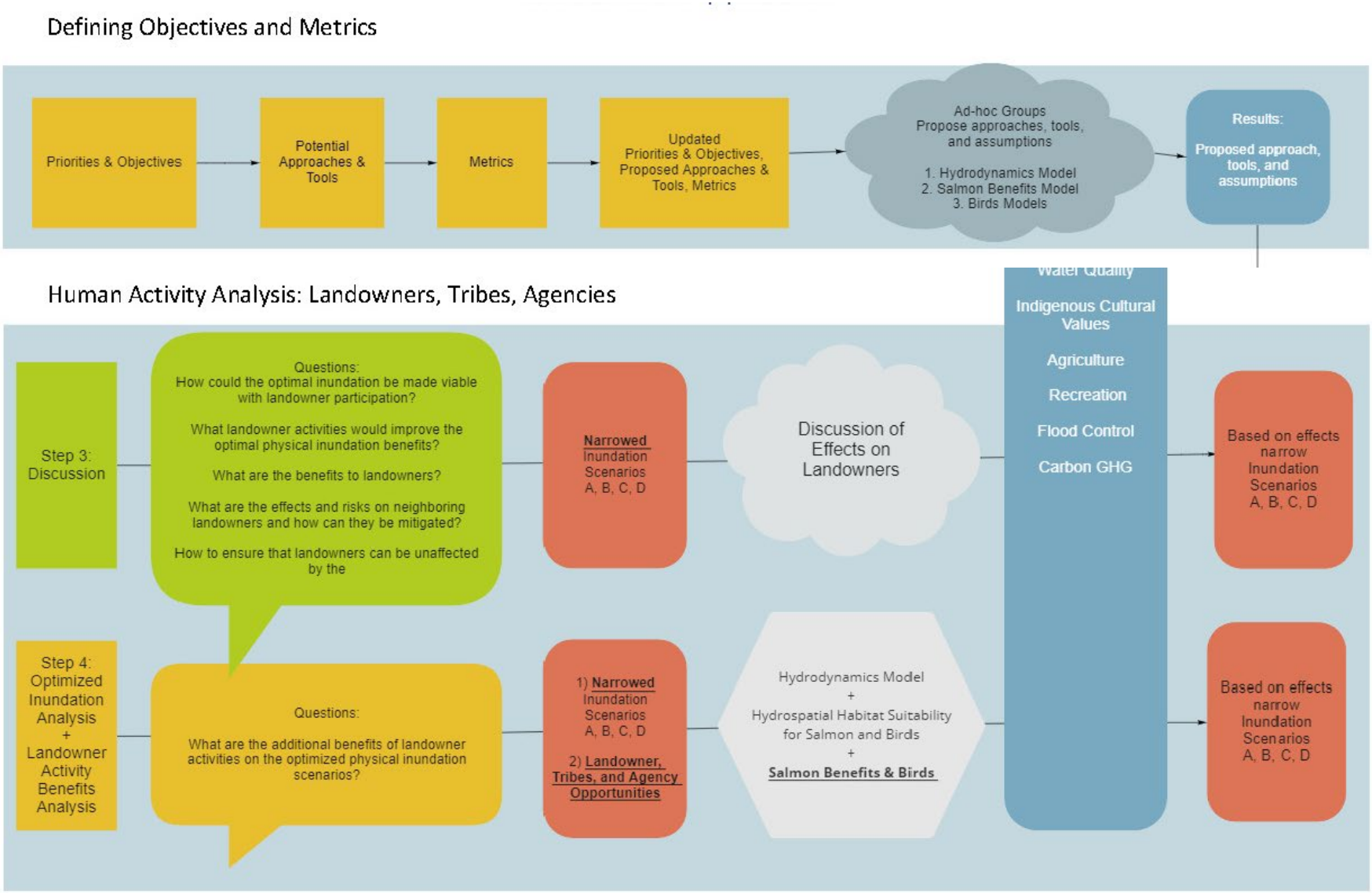
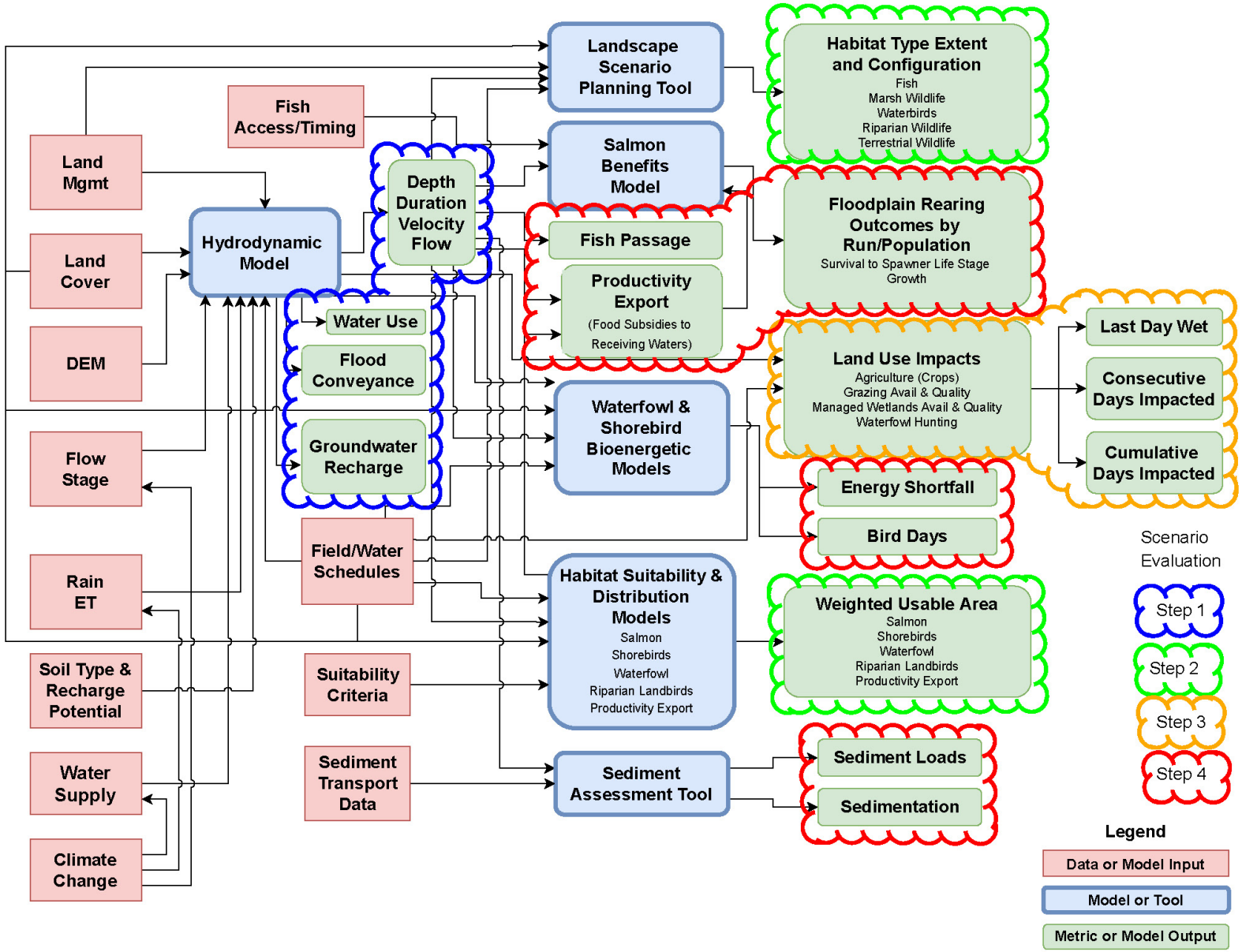
Environmentally sustainable solutions for the water resources industry

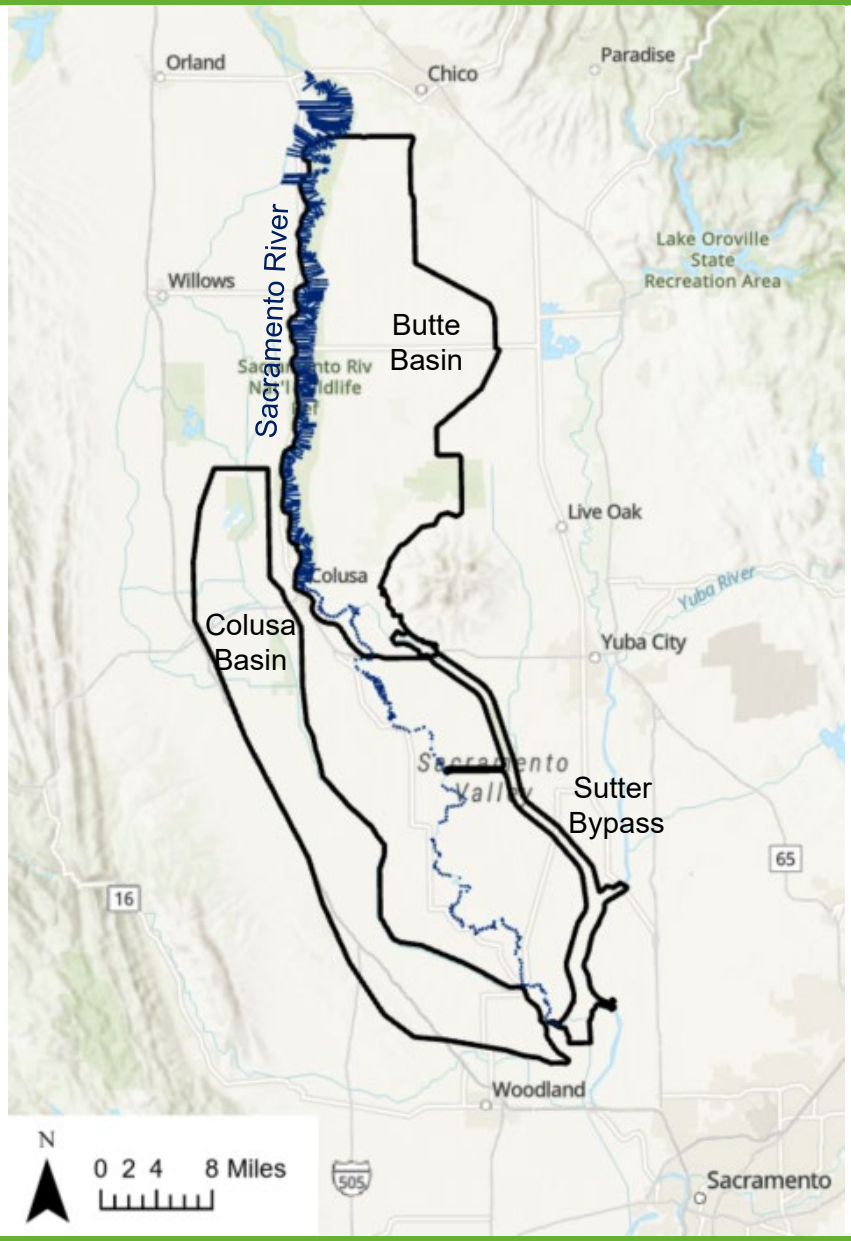
Evaluation Approach



Tools and Metrics Flow Chart



Hydrodynamic Model Description



1D (channel) and 2D (floodplain) linked hydrodynamic models

Models predict depth and velocity in grid cells with sizes ranging from 25 – 400 feet

Depth and velocity info supports habitat quantification, ecological modeling, and other assessments (water use, conveyance, recharge)

Simulating 1997 to 2018, October to June

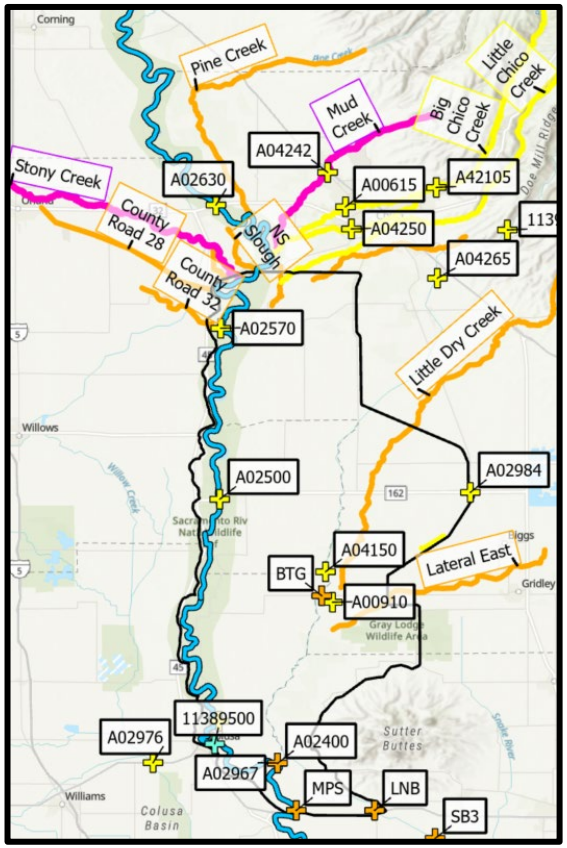
Butte model overlaps with Sutter Bypass model

Model drivers/data needs

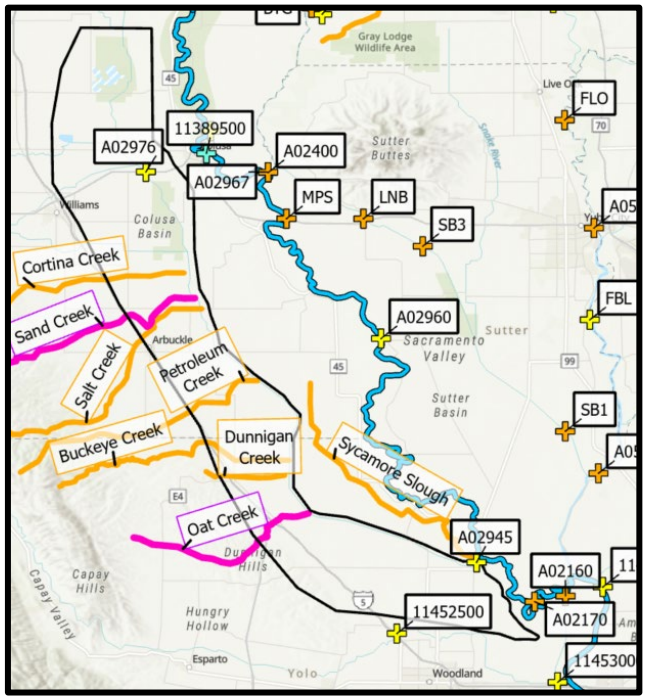
- Flows into the model domain
- Topography
- Water infrastructure
- Field/wetland management

Flow and Stage Data

Butte Basin



Colusa Basin

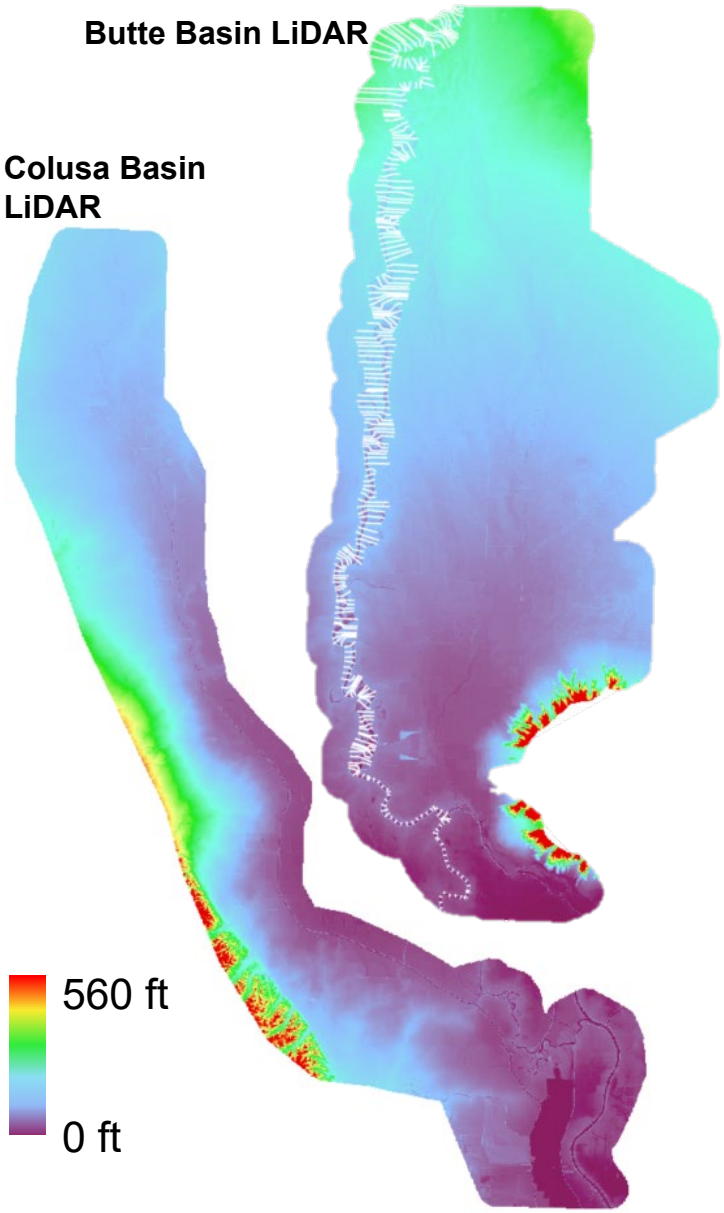


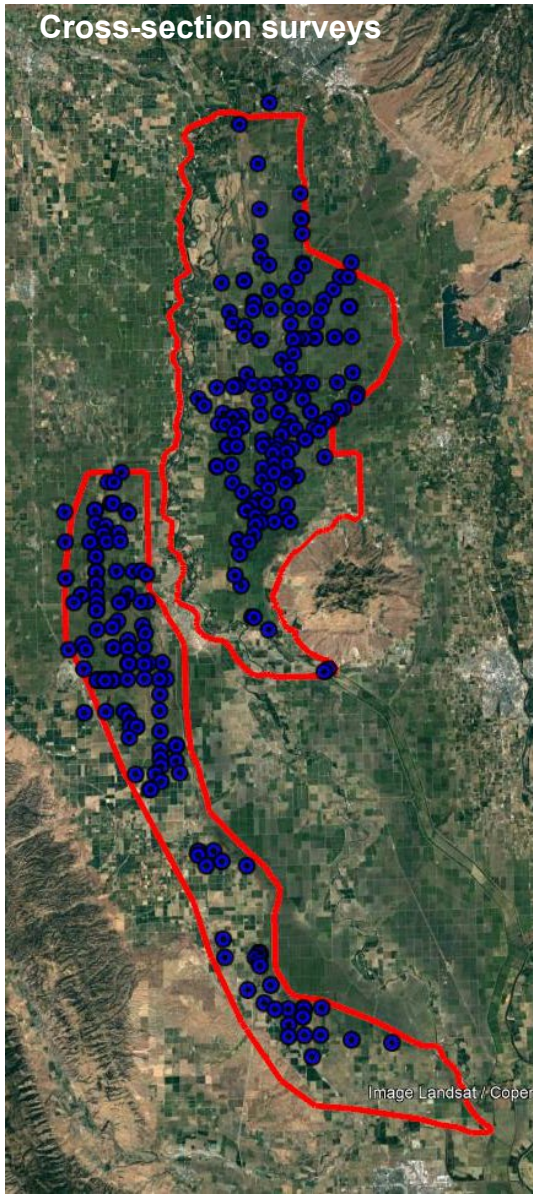
- Flows into the model are derived from the available gaging network
- For ungaged tributaries to the Colusa Basin, rainfall-runoff modeling is used to estimate inflows
- Stage data from the gaging network are used for model calibration

Flow Gage
Stage
Stage and Flow

Tributary from 2017 CVFED model (Steady Flow)
Tributary from 2017 CVFED model (Unsteady Flow)
Tributary not included 2017 CVFED model

Model Topography

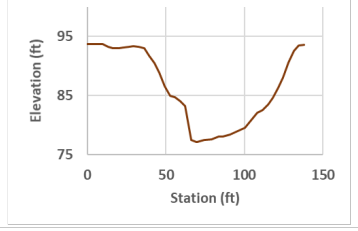


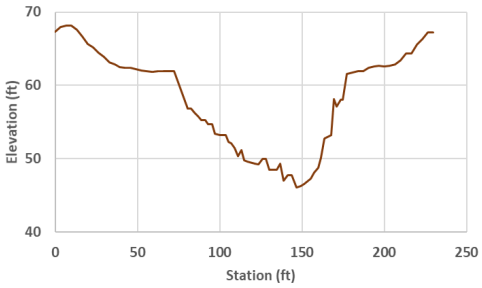


Topography Sources

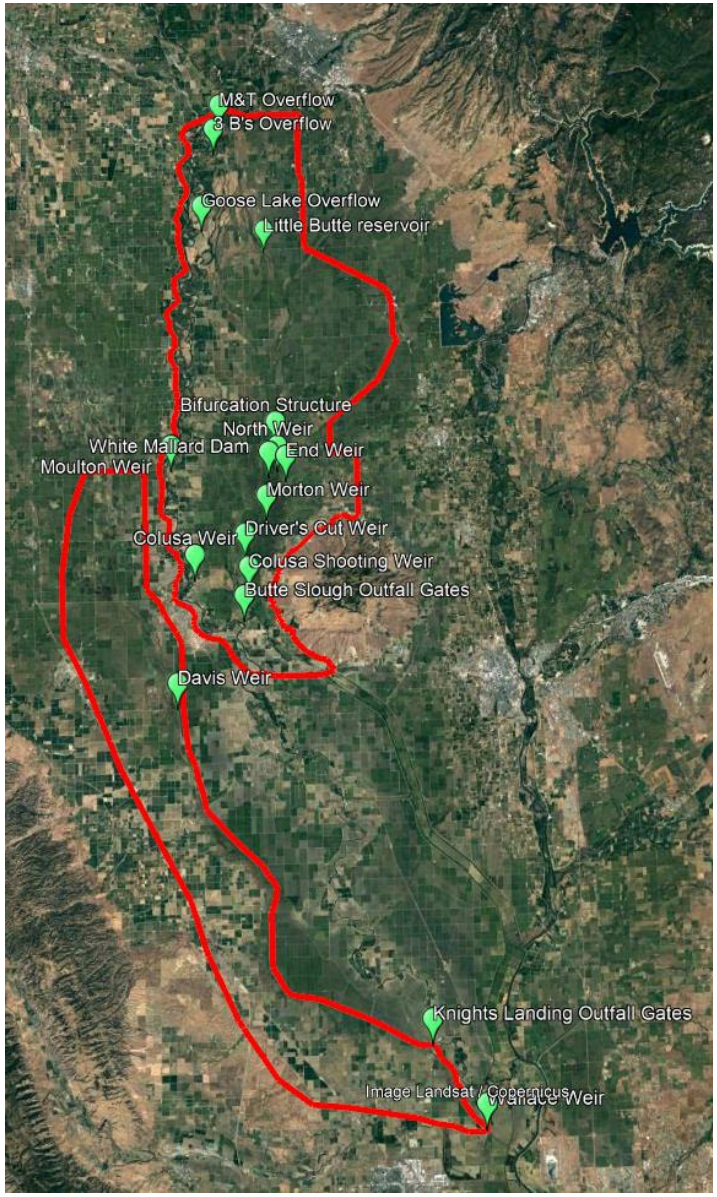
- 2008 CVFED and 2018/19 USGS LiDAR
- On-the-ground surveys of channels where LiDAR data insufficient
- 1D cross-sections from CVFED
- Merged to create a seamless DEM

Cross-section surveys





Primary Water Infrastructure



Sacramento River overflows

- M&T, 3Bs, Goose Lake
- Moulton Weir
- Colusa Weir

Outfalls to Sacramento River

- Butte Slough Outfall Gates
- Knights Landing Outfall Gates

Butte Sink wetlands

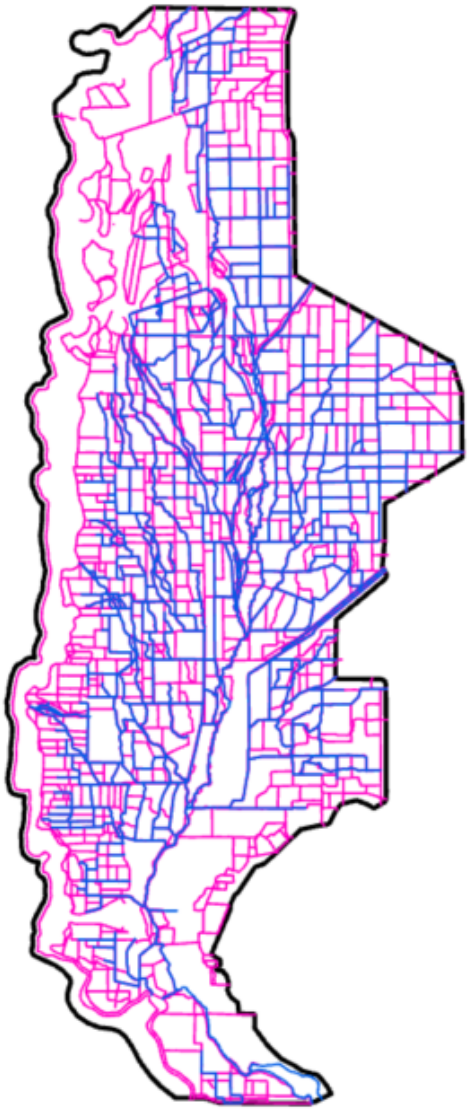
- Bifurcation Structure
- White Mallard Dam
- Five Points Dam
- North, End, Morton, Driver's Cut, and Colusa Shooting Weirs/Outfalls

Colusa Drain

- Davis Weir
- Wallace Weir

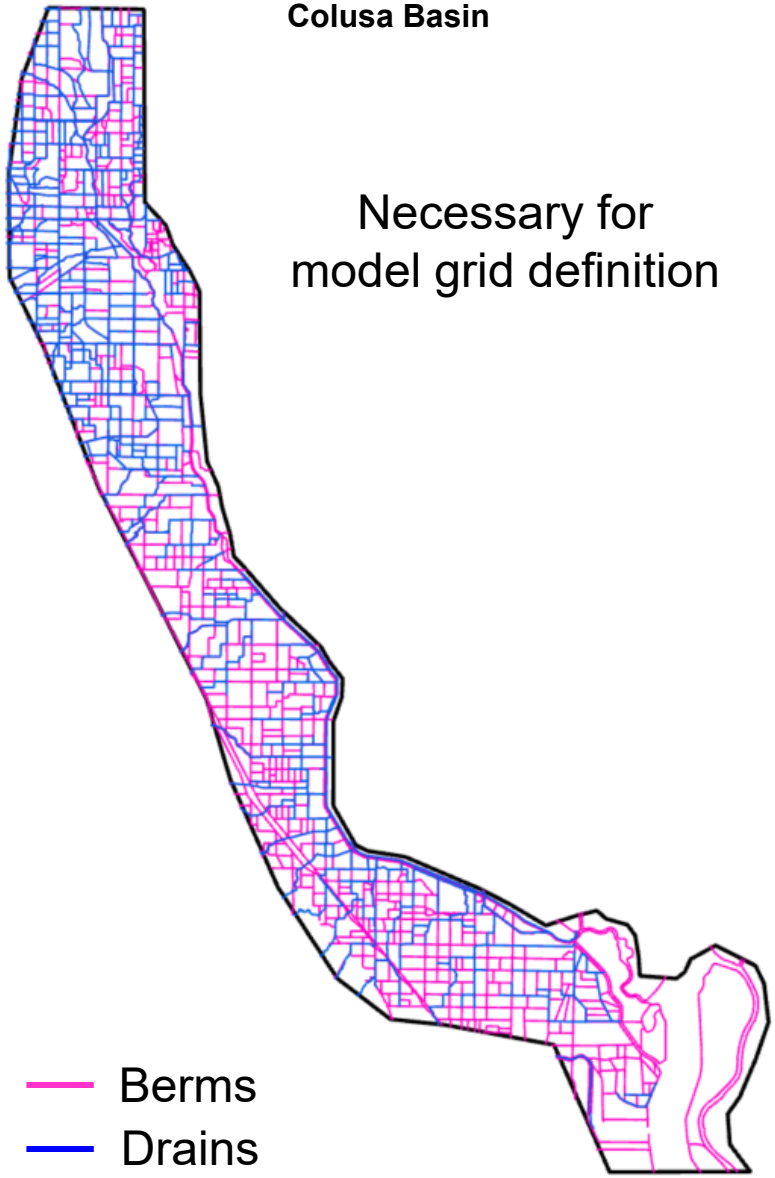
Field Berm and Drain Network

Butte Basin



Example Areas

Colusa Basin



Necessary for model grid definition

Berms

Drains

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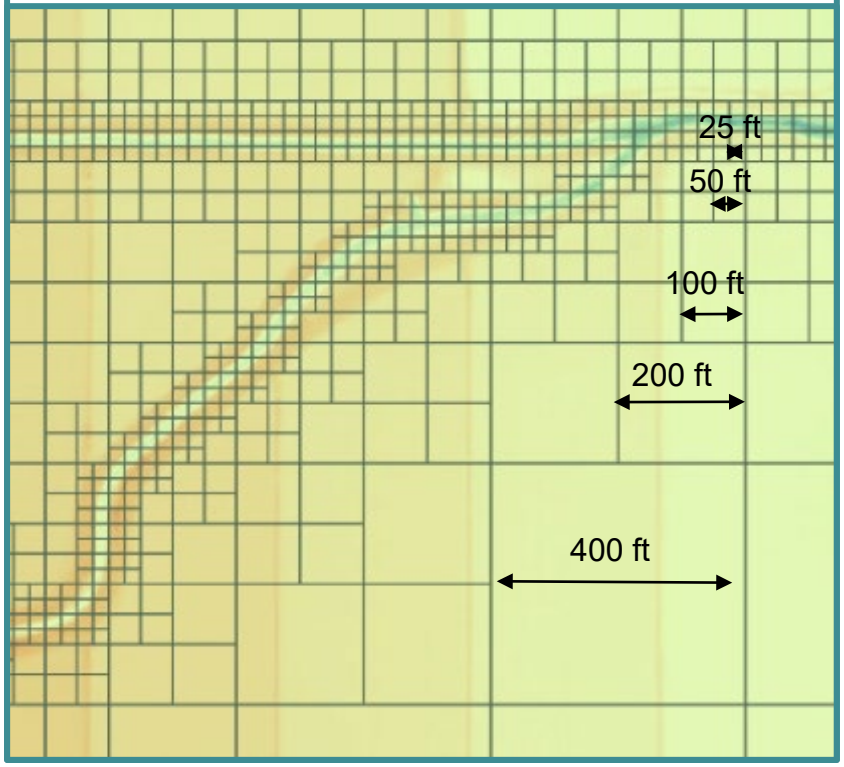
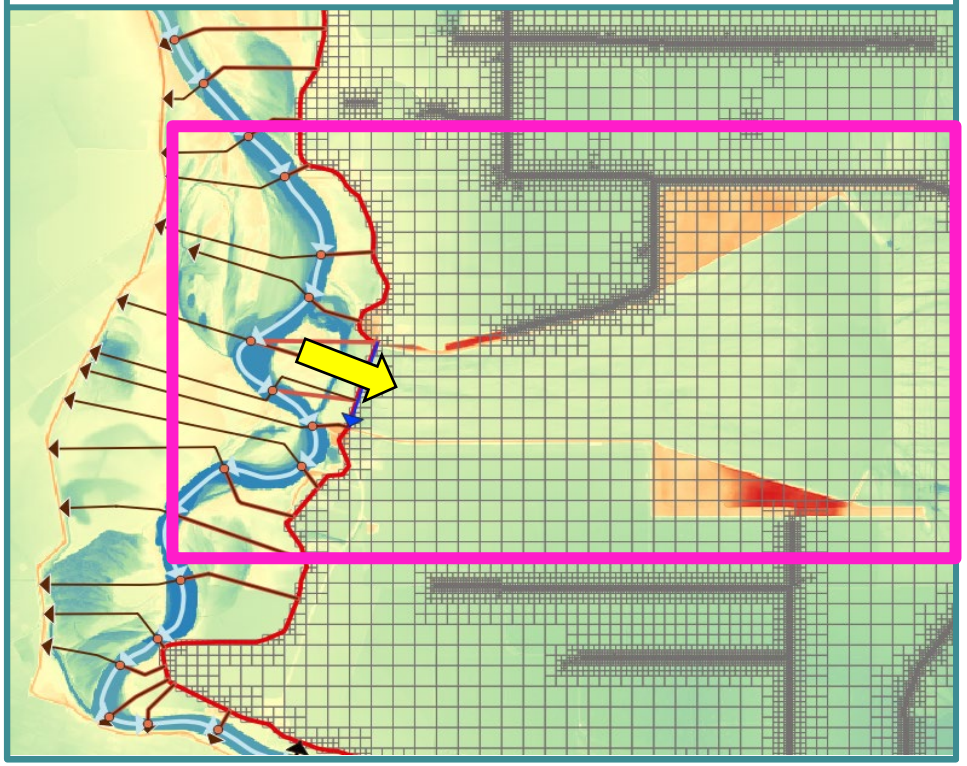
Model Grid

"Nested" model grid to provide refinement locally where needed
Large grid cells in flat areas

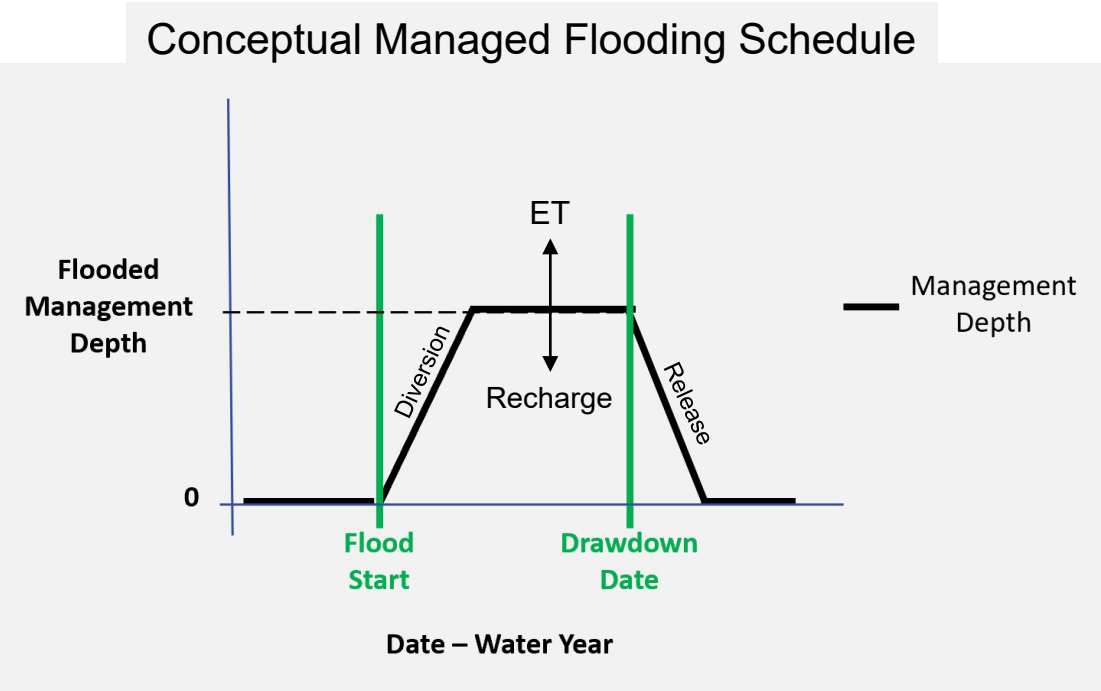
Quadtree Grid Refinement
400 ft cells for open area and
25 ft cells along the streams and canals



Colusa Weir 1D/2D Connection
Sacramento River in 1D
laterally spills into 2D floodplain



Field-Scale Water Management



Water Use

Groundwater recharge

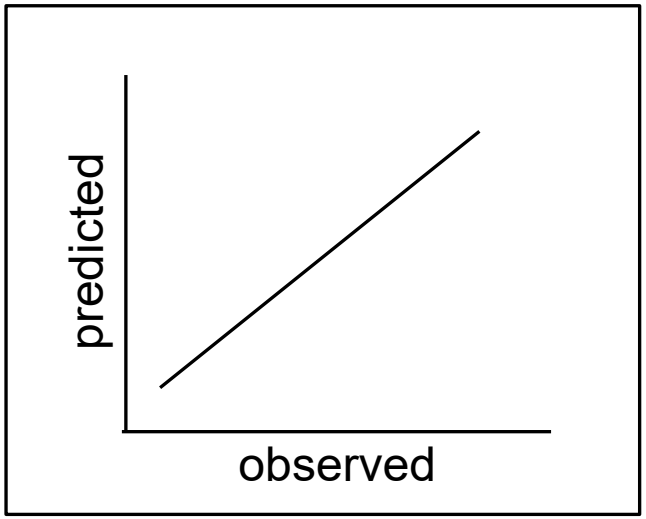
- Field and wetland flood-up and drawdown modeled with simplified methods; too many small structures to model all details
- Managed depths maintained by moving water directly from main channels and canals to fields and wetlands; allowed to drain with operated weir
- Using generalized schedules for flood-up and drawdown for different land-uses
- Change in approach from Sutter Bypass model

Model Calibration Approach

Measured data are used to calibrate model parameters

Calibration data and information

- Gage measurements of stage and discharge within the model domain
- High-water marks from historical floods
- Inundation extents from satellite imagery
- Results from CVFPP modeling



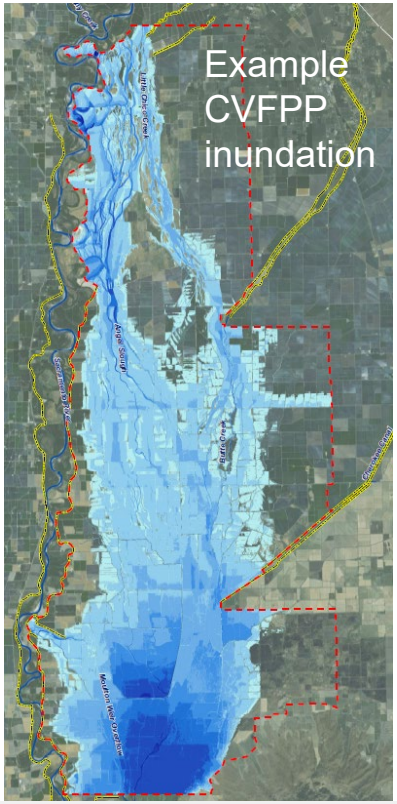
Calibration process

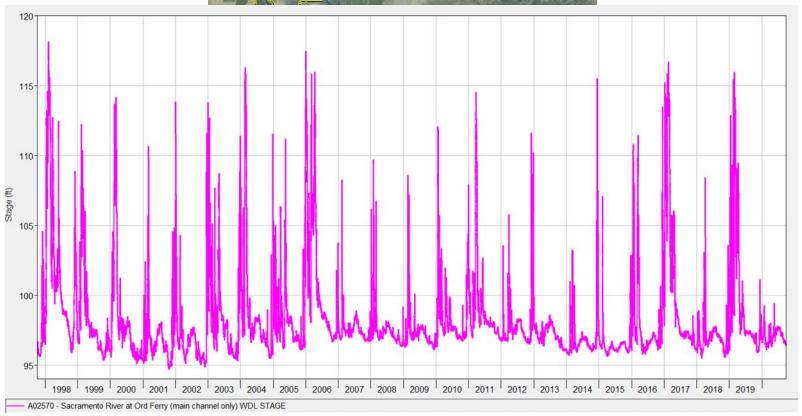
- Model parameters and settings are adjusted within reasonable ranges to optimize agreement with measured data
- Model is then tested against a reserved validation dataset (e.g. certain years)

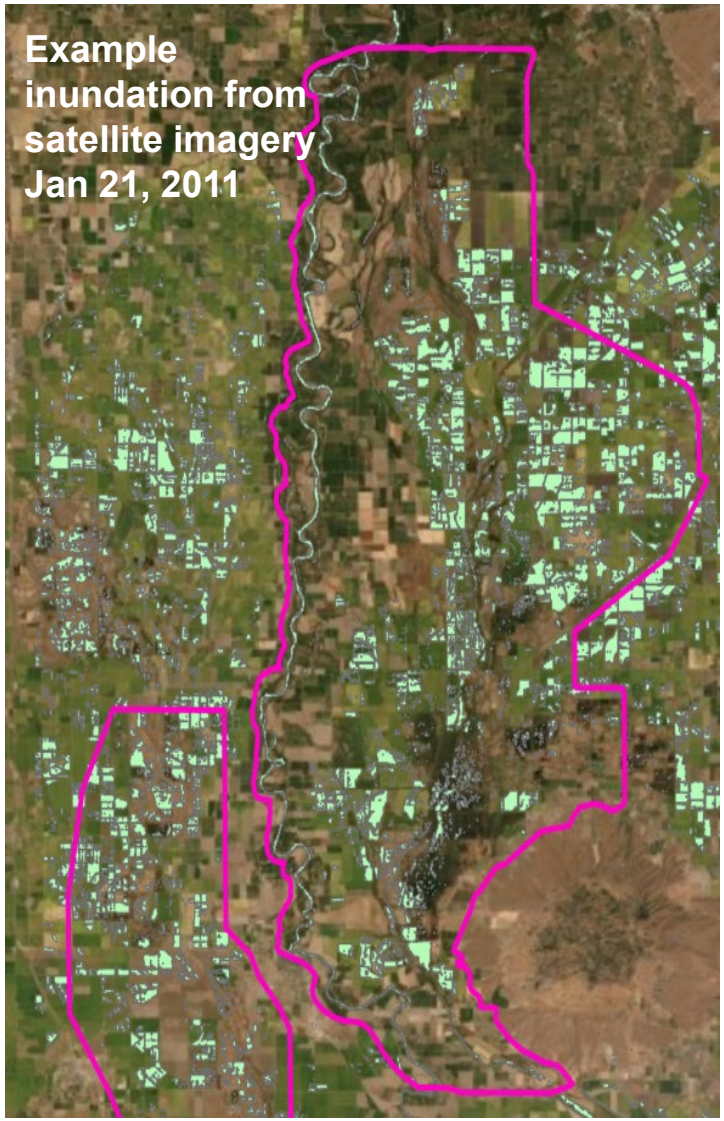
Calibration parameters

- Surface roughness
- Structures and breaklines

Model Calibration Example Datasets

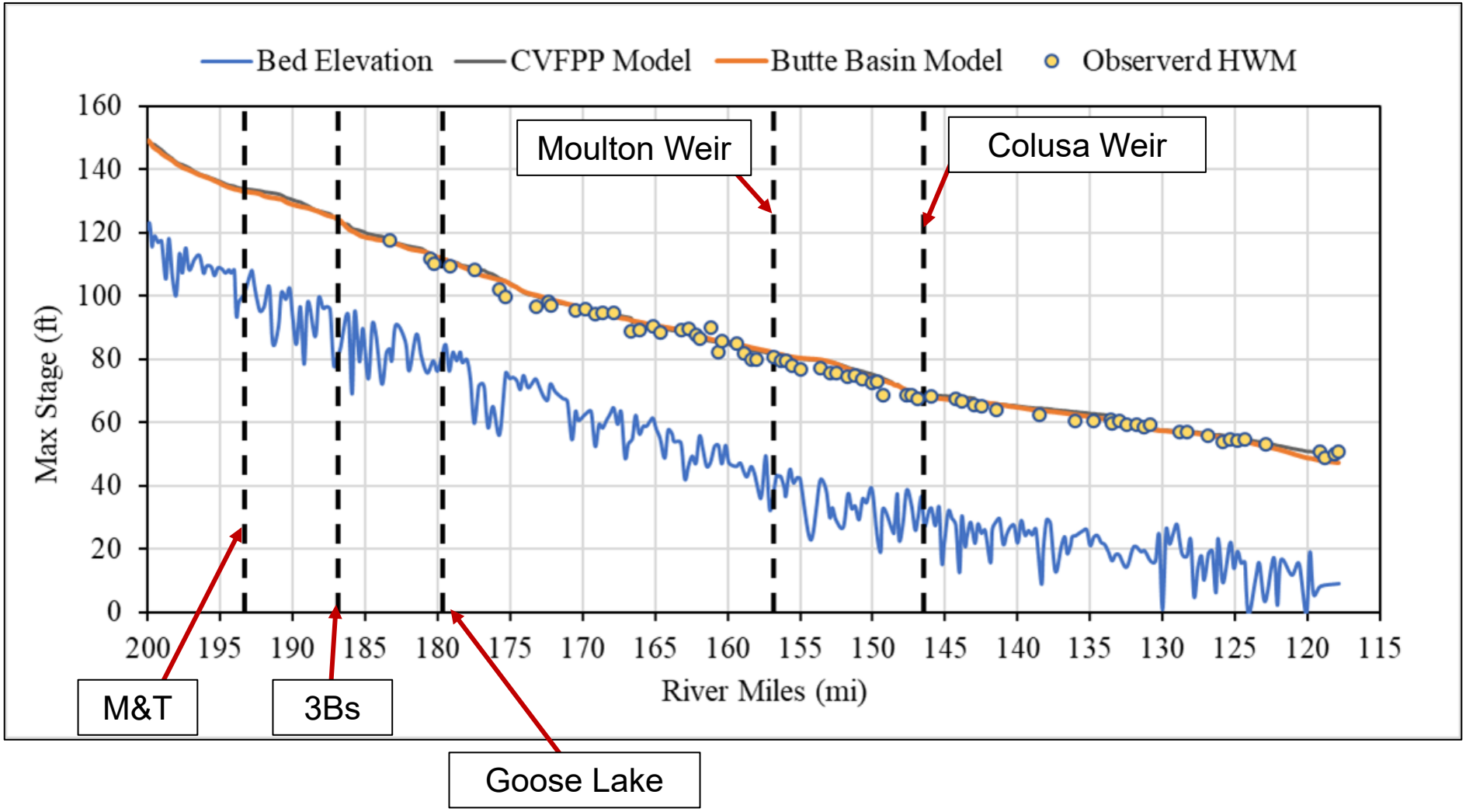




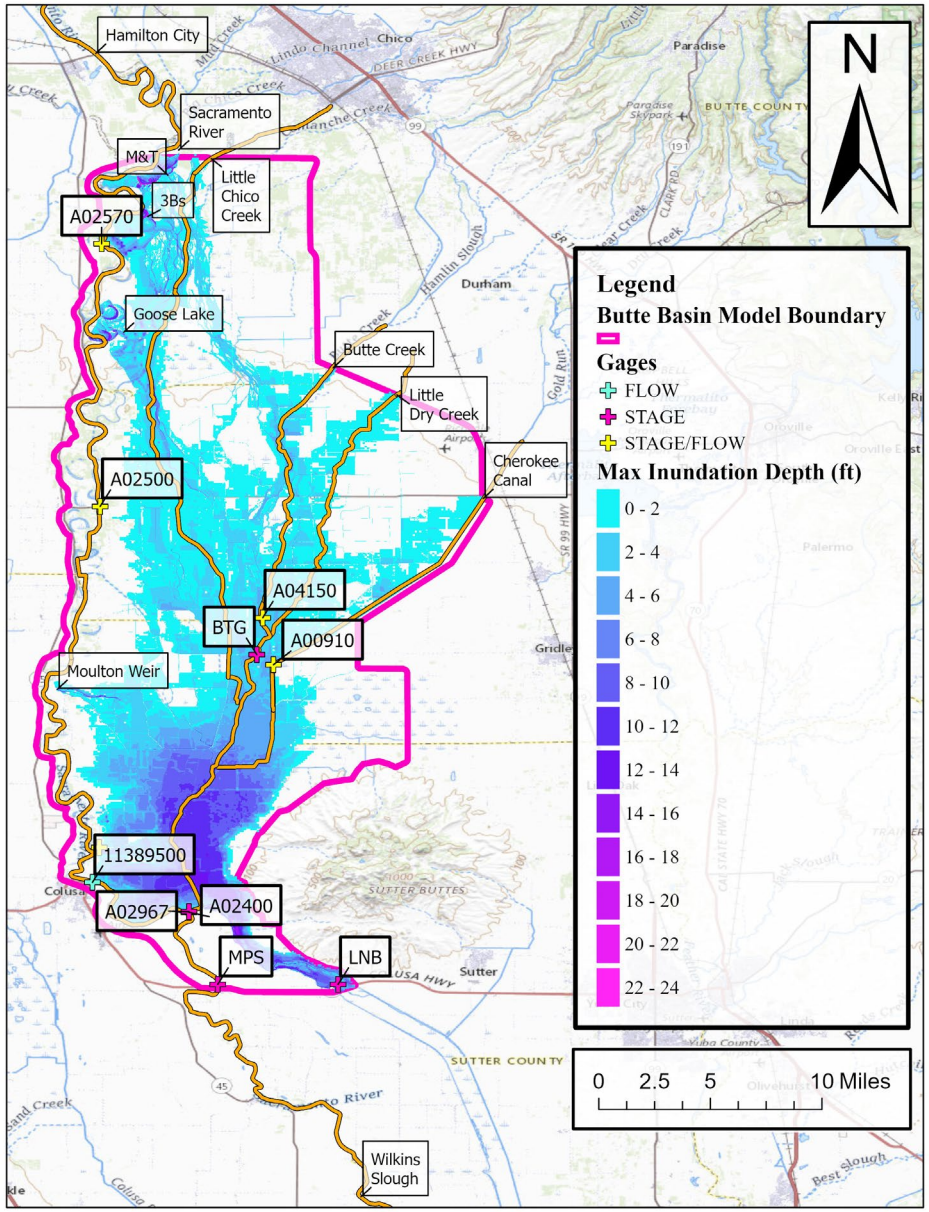


Sacramento River Stage Calibration – 2006 flood

133,000 cfs peak at Hamilton City



Butte Basin Inundation – 2006 flood



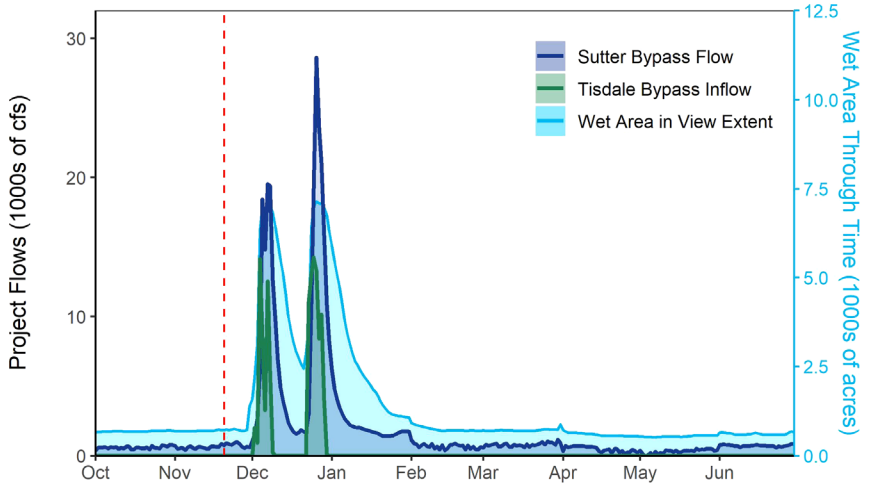
Preliminary result: not fully calibrated

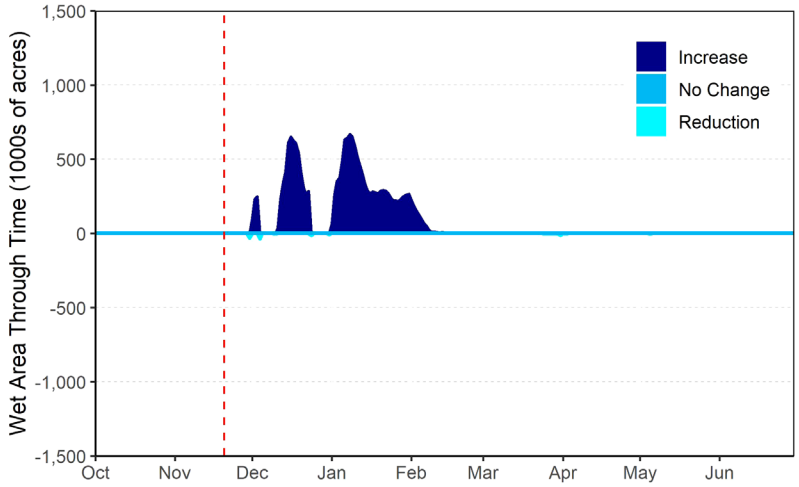
Shown as example of the type of product the hydrodynamic will provide for habitat quantification and other resource assessments

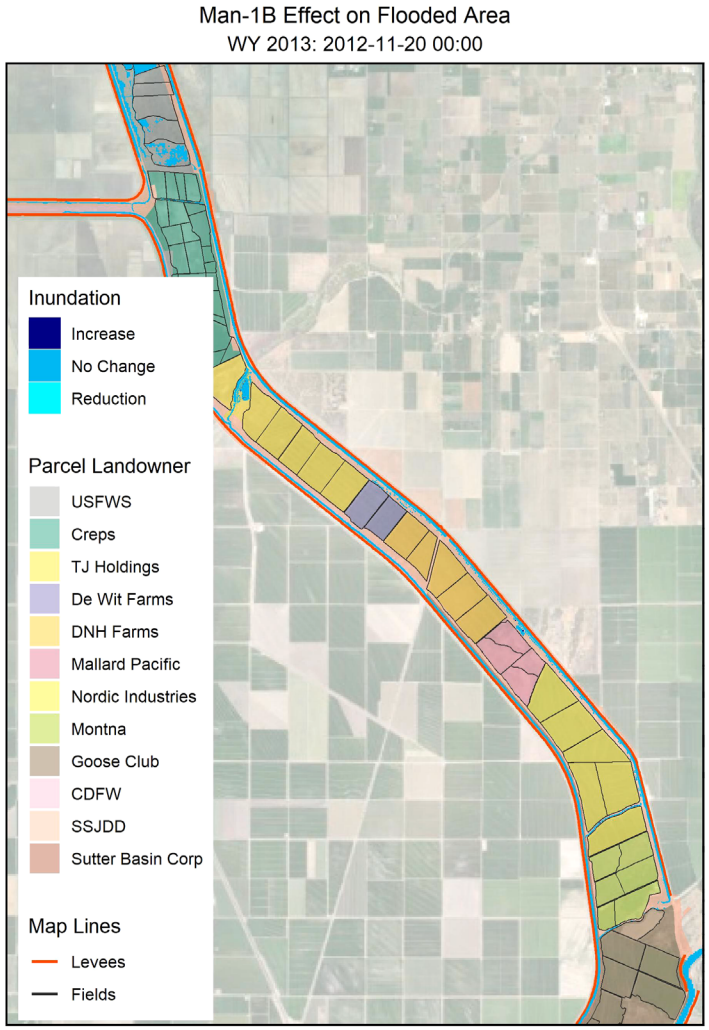
Inundation extent, depth, duration, and velocity for existing/baseline and project conditions

Significant post-processing to compute various metrics of interest

Example Application – Sutter/Tisdale







Baseline Considerations

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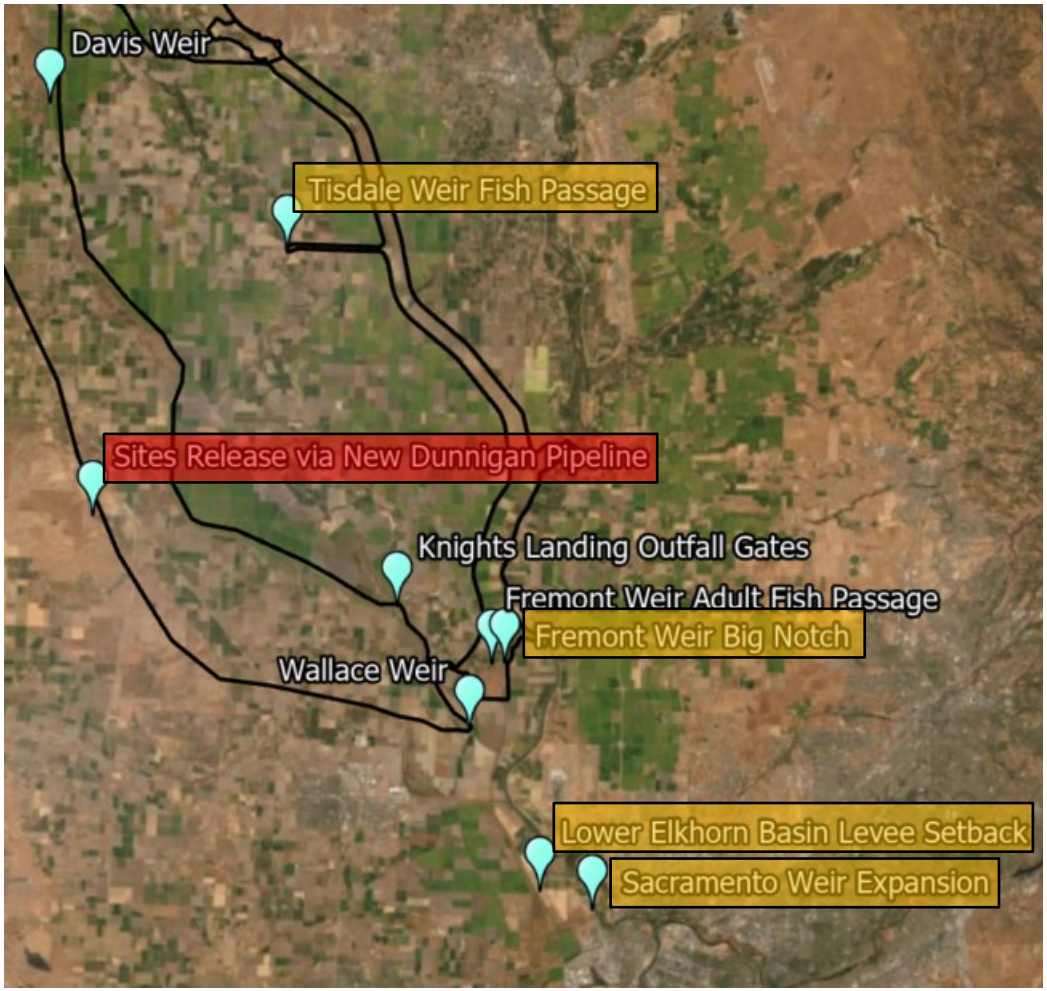
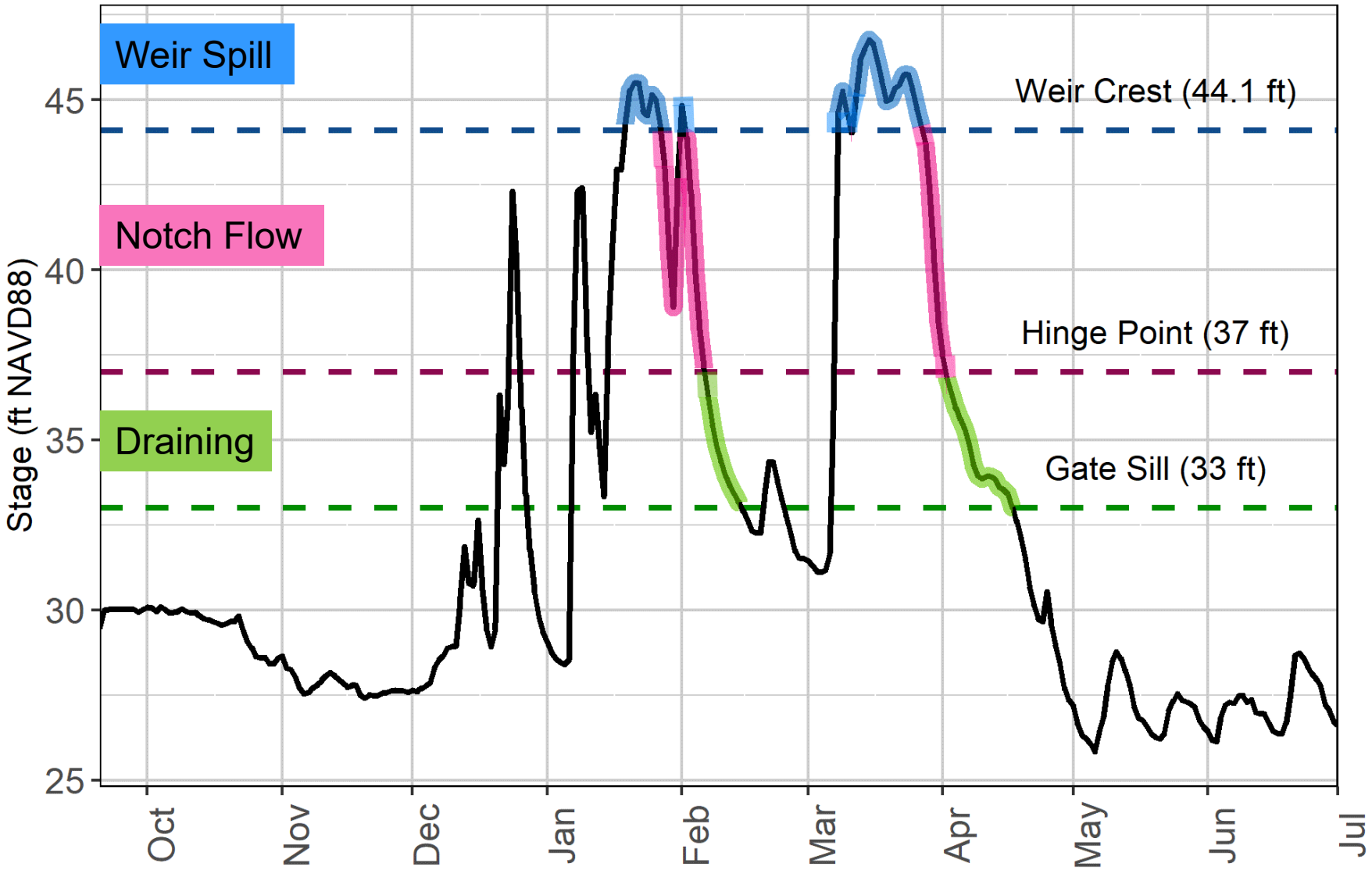


Baseline Considerations

Project	Existing	Near-Term	Future	Notes
Sites Reservoir			X	RDEIR released 11/2021
M&T Overflow	X			
3B's Overflow	X			
Goose Lake Overflow	X			
Moulton Weir	X			
Colusa Weir	X			
Butte Slough Outfall Gates Rehab			X	Addendum/NOD filed 8/2020
Tisdale Weir Rehab and Fish Passage		X		EIR certified/NOD filed 10/2021
Davis Weir	X			
Knights Landing Outfall Gates Rehab	X			Construction completed 2015
Fremont Weir Adult Fish Passage	X			Construction completed 2018
Fremont Weir Big Notch		X		Construction in progress
Wallace Weir Fish Rescue Facility	X			Construction completed 2018
Lower Elkhorn Basin Levee Setback		X		Construction in progress
Sacramento Weir Expansion		X		Construction in progress

Tisdale Weir Rehab Operations



Fremont Weir AFP & BNP Operations