CFF Detention Basin Feasibility Study

Flood Control Zone 2A
Advisory Committee

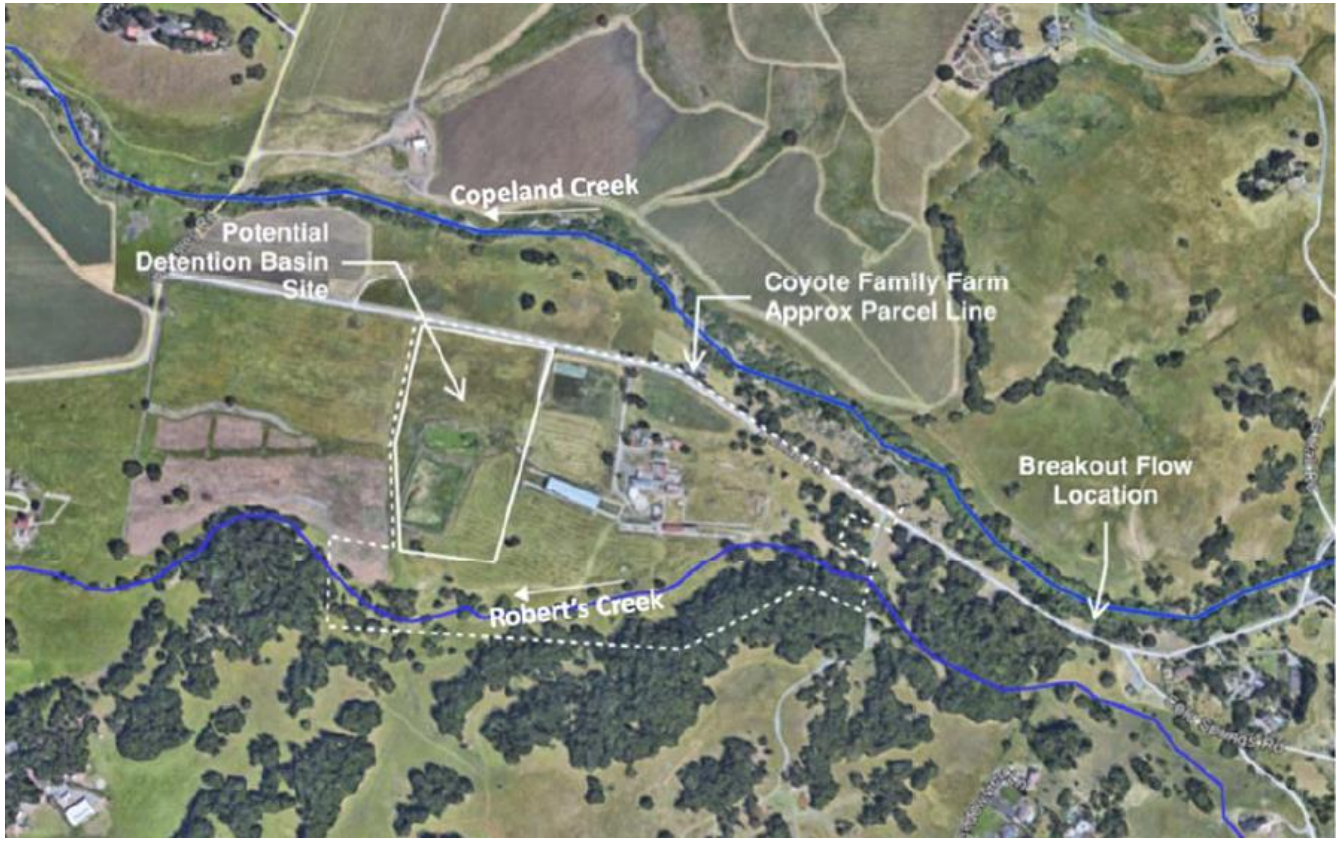
October 28, 2020

Sonoma Water

PRUNUSKE CHATHAM, IN

Feasibility Study

- Design a detention basin downstream of primary avulsion site
- Located within a minimally utilized 12-acre area
- Goal – reduce flooding in Penngrove, Petaluma, and Rohnert Park
- Primary Objective – capture all of the Copeland Creek breakout flows that flow through CFF
- Secondary Objective – capture a portion of peak flows from Robert's Creek



Model Comparison to 2017 Flood

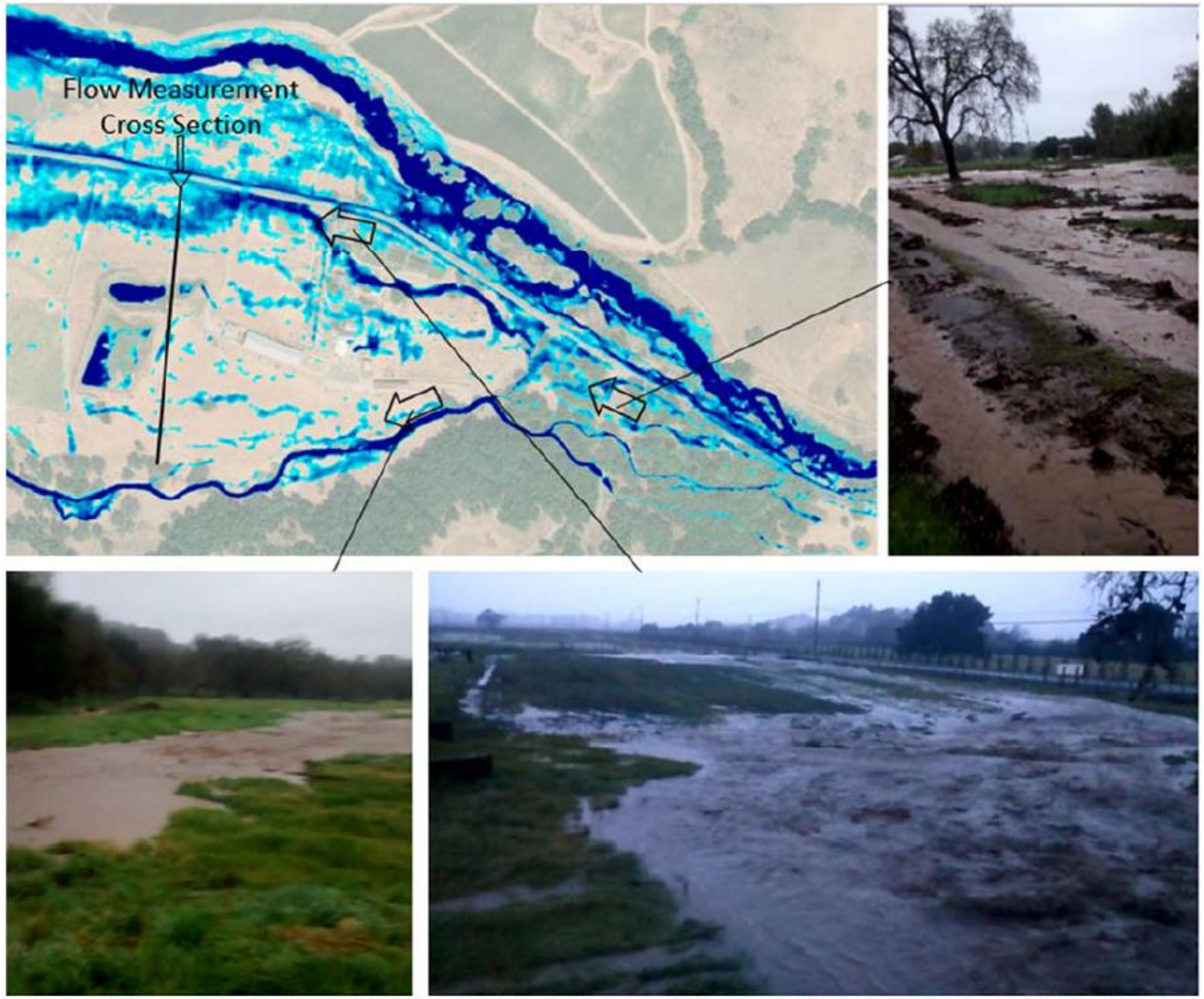


Figure 8. Existing condition hydraulic model results compared to photos taken during the Jan 8th, 2017 flood. (Photos taken by the landowner Alex Perotti)

Ex Conditions

- 1st Objective – Capture 100% of Copeland Creek avulsion flows through property
  - ~200 cfs ~19 acre-feet
- 2nd Objective – Roberts Creek Flows
  - ~200 cfs reduction seems achievable
  - ~10 acre feet

Target Detention = 29 acre-feet

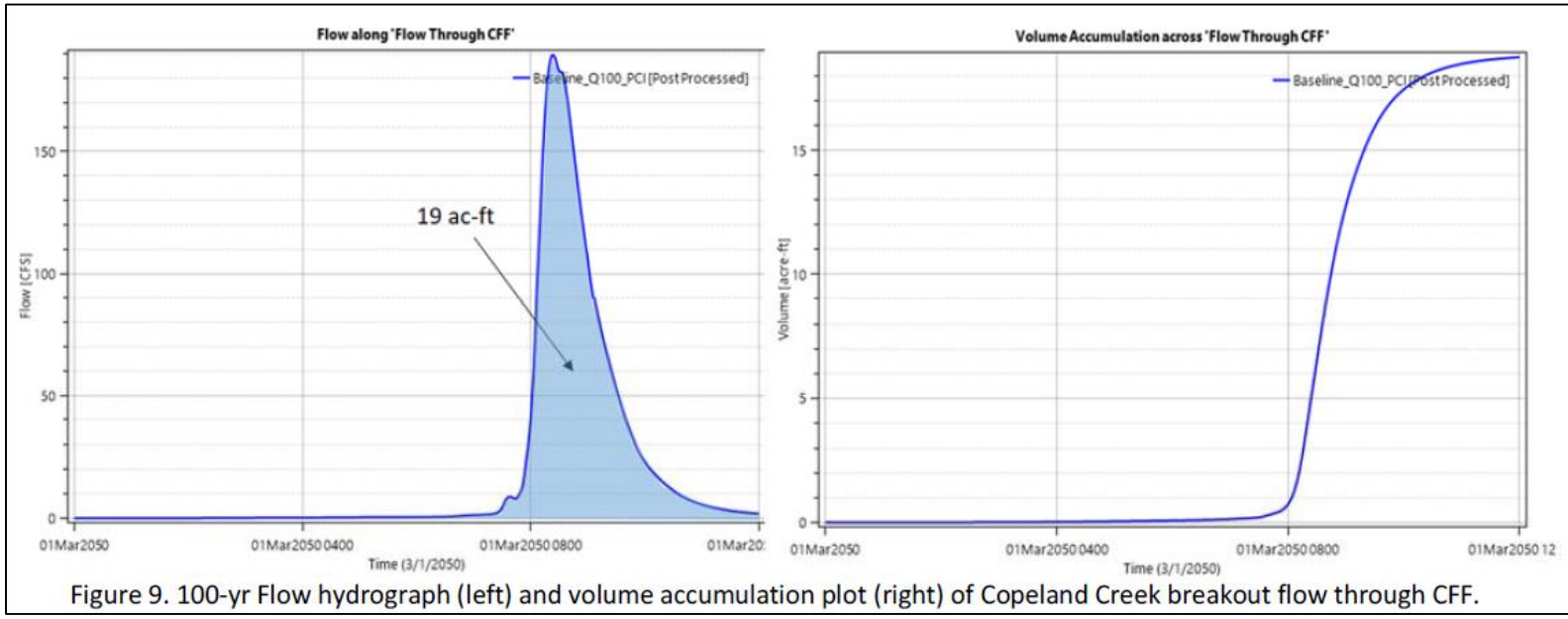


Figure 9. 100-yr Flow hydrograph (left) and volume accumulation plot (right) of Copeland Creek breakout flow through CFF.

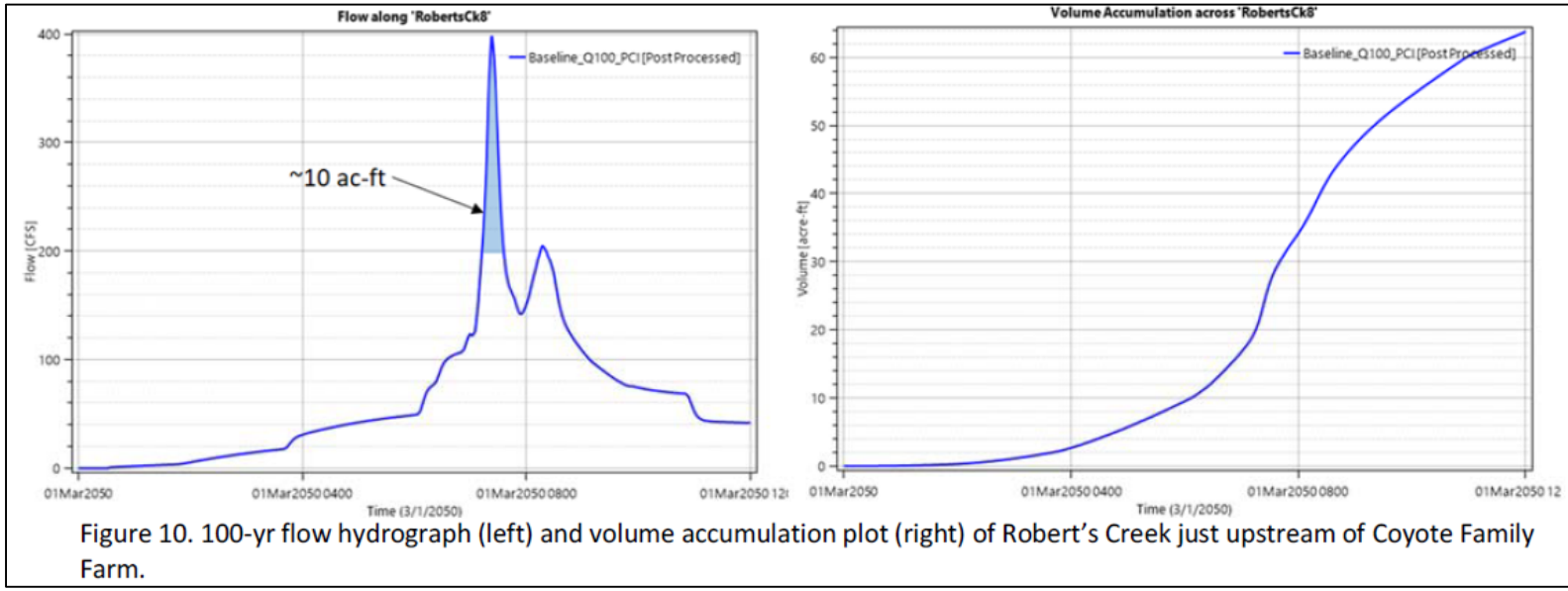


Figure 10. 100-yr flow hydrograph (left) and volume accumulation plot (right) of Robert's Creek just upstream of Coyote Family Farm.

Preferred Conceptual Alternative

- Design Elements
  - Minimizes excavation below ex ground surface to limit impacts to GW
  - Embankment heights similar to ex heights
  - Maintain existing northern pond with perennial water
  - Maintain southern pond wetland area and include potential enhancements
  - Native trees/shrubs
  - Comply with SoCo design guidance for dams/reservoirs

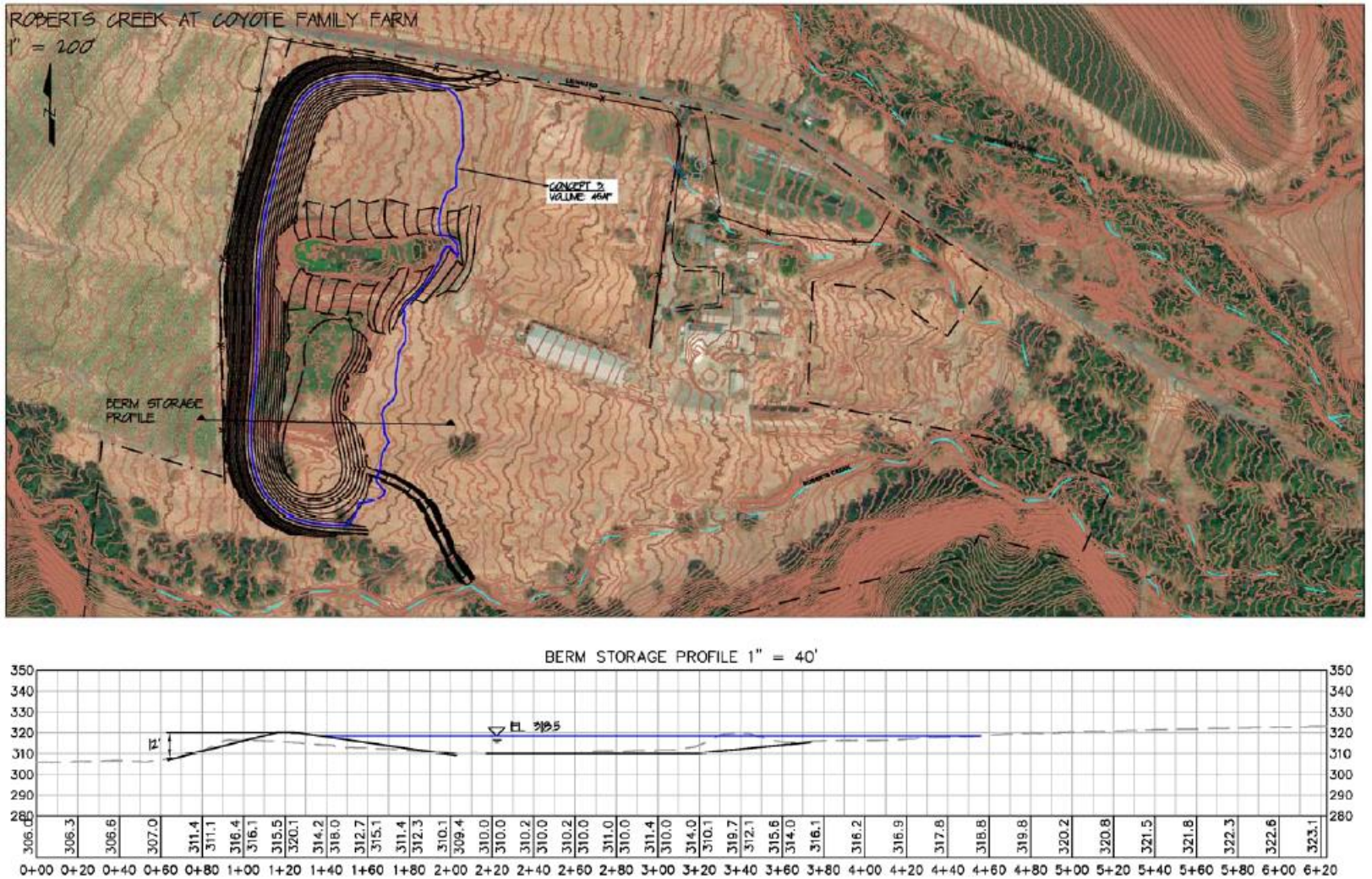


Figure 16. Detention basin Concept Design.

Preferred Conceptual Alternative

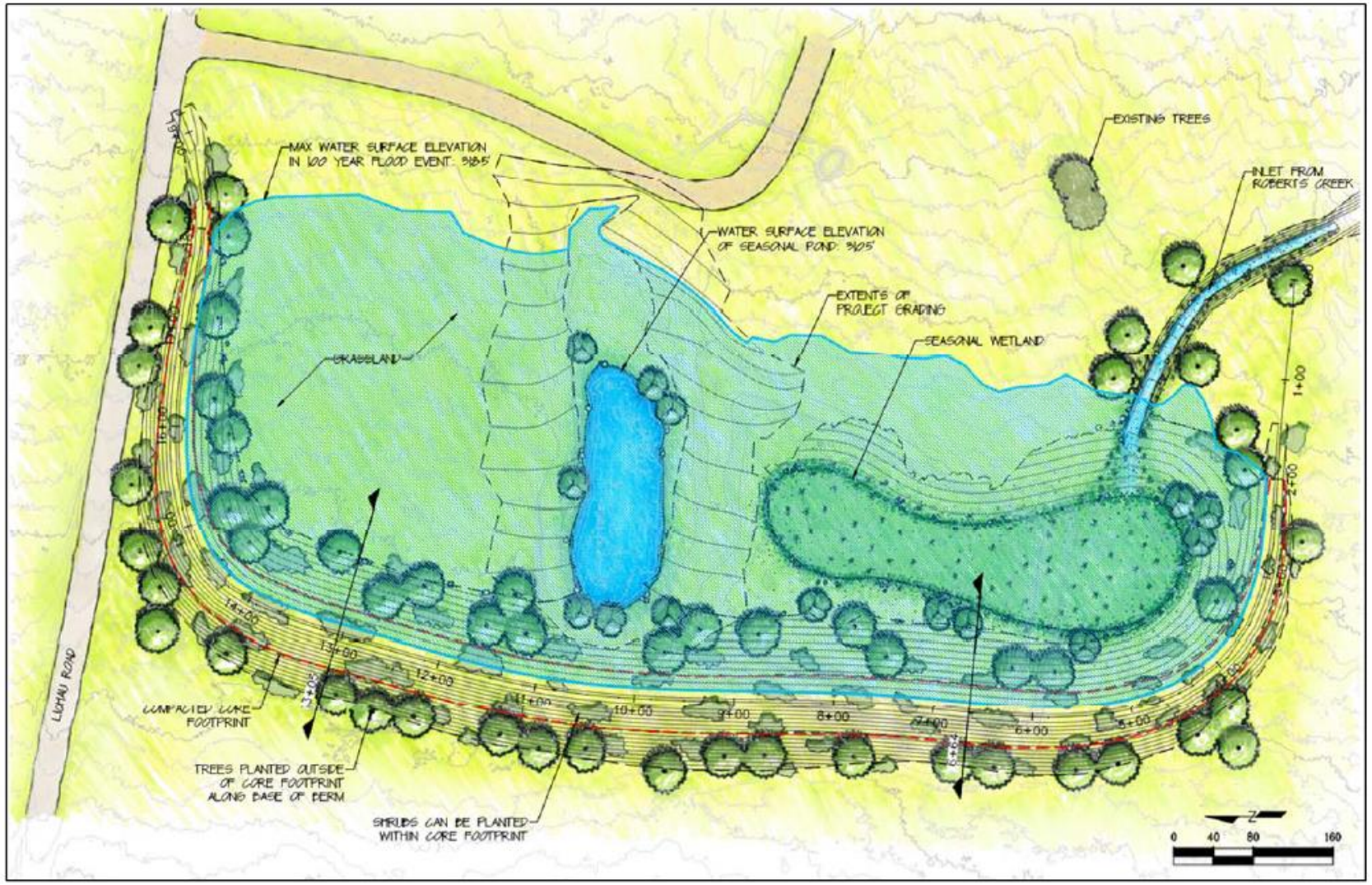


Figure 17. Plan view rendering of Concept Design.

Preferred Conceptual Alternative

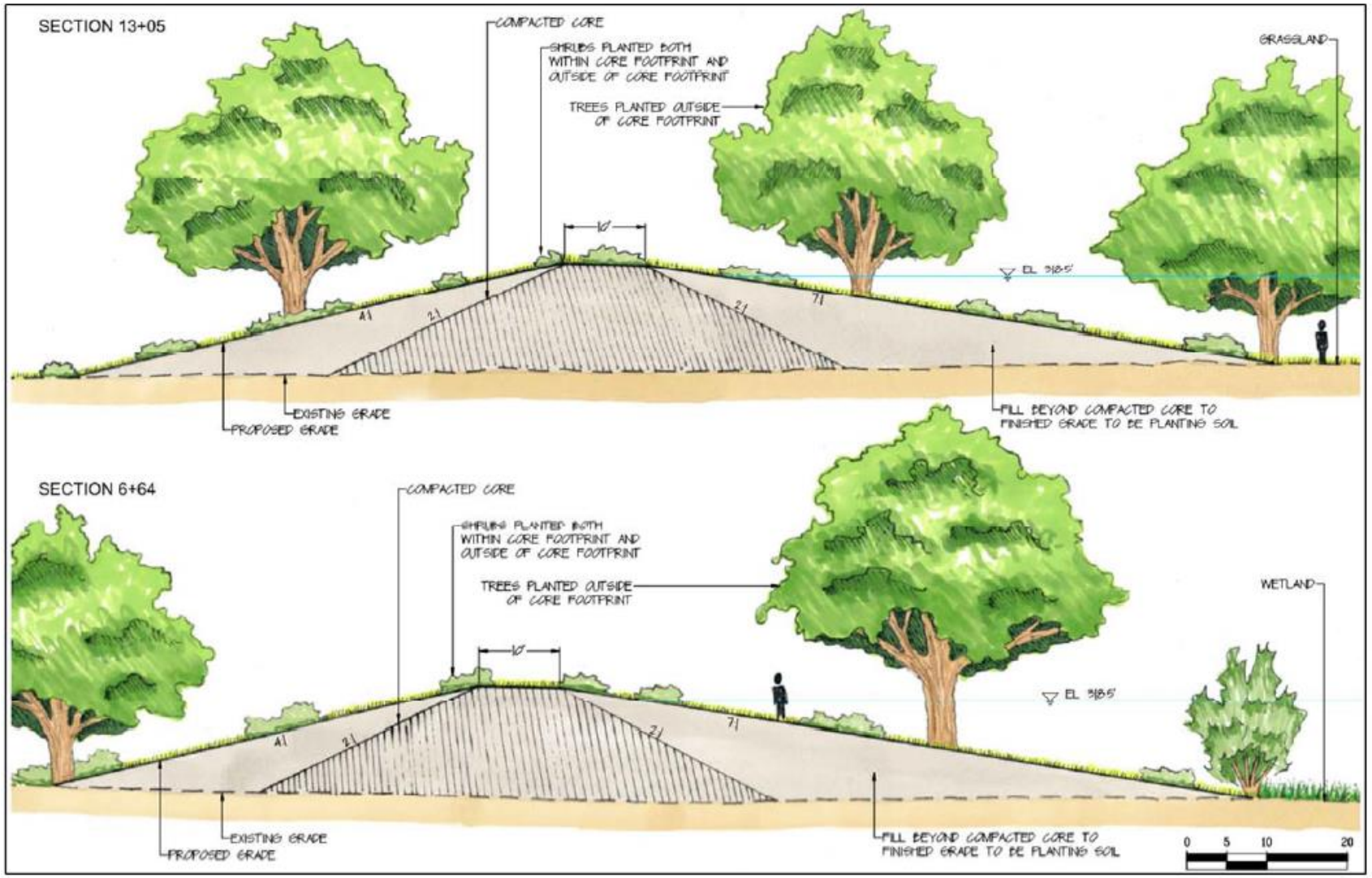


Figure 18.Cross-sectional rendering of Concept Design.

Post-Project Results

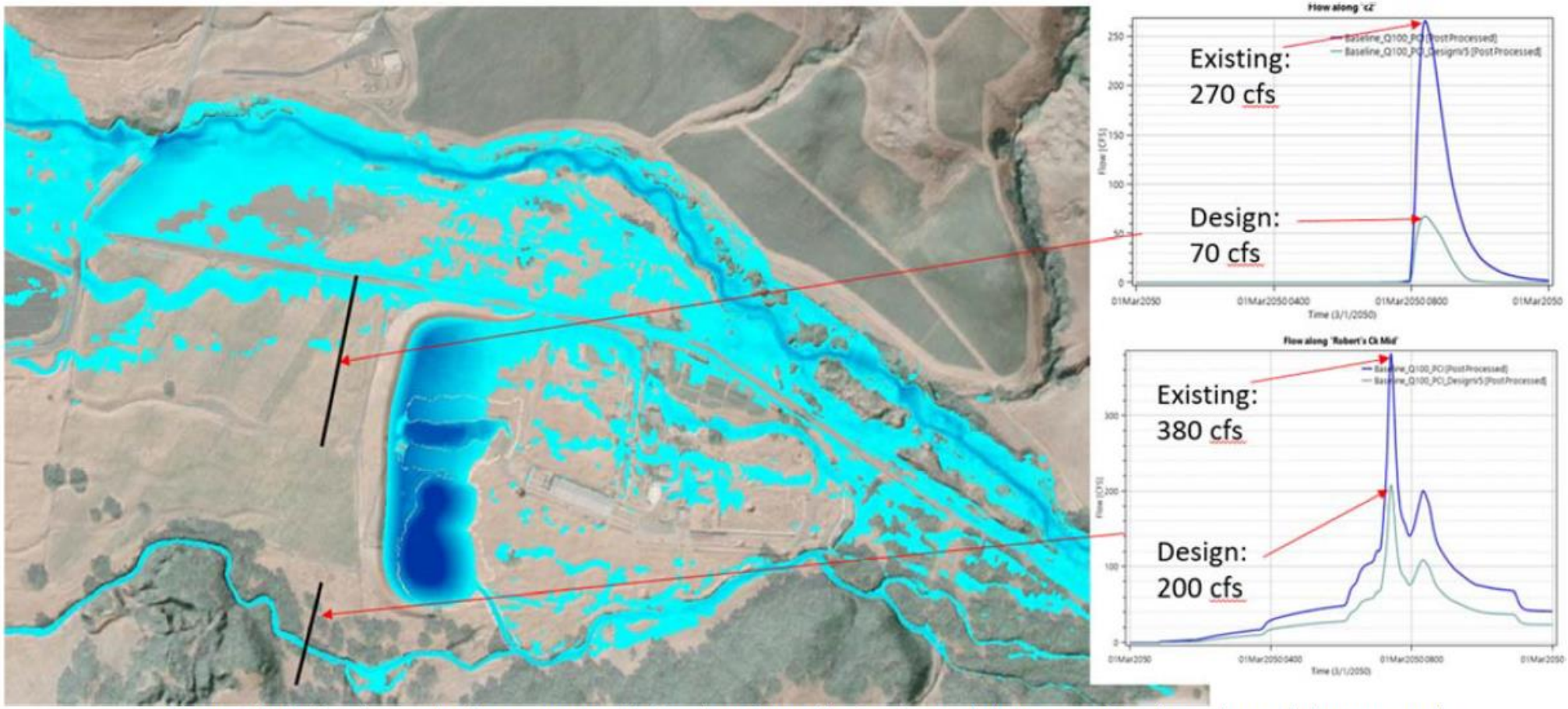


Figure 19. Hydraulic results from concept design showing reduction in peak flow rates just downslope of the proposed detention basin from Copeland Creek overflow as well as in Robert's Creek.

- Downtown Penngrove could see 9% reduction in Q100

Visual Rendering & Summary

- Meets primary objective of capturing 100% of Copeland avulsion flows
- Also meets secondary objective and capable of capturing a portion of Roberts Creek peak flows
- Provides flood benefit to Penngrove and Petaluma River
- Also provides additional benefits of groundwater recharge and wetland enhancement
- Minimal visual impacts
- Additional storage available if desired

Figure 22. View of Coyote Family Farm from Lichau Road under existing conditions (top) and artist's rendering of the Concept Design's proposed conditions after maturation of a robust native revegetation plan (bottom).

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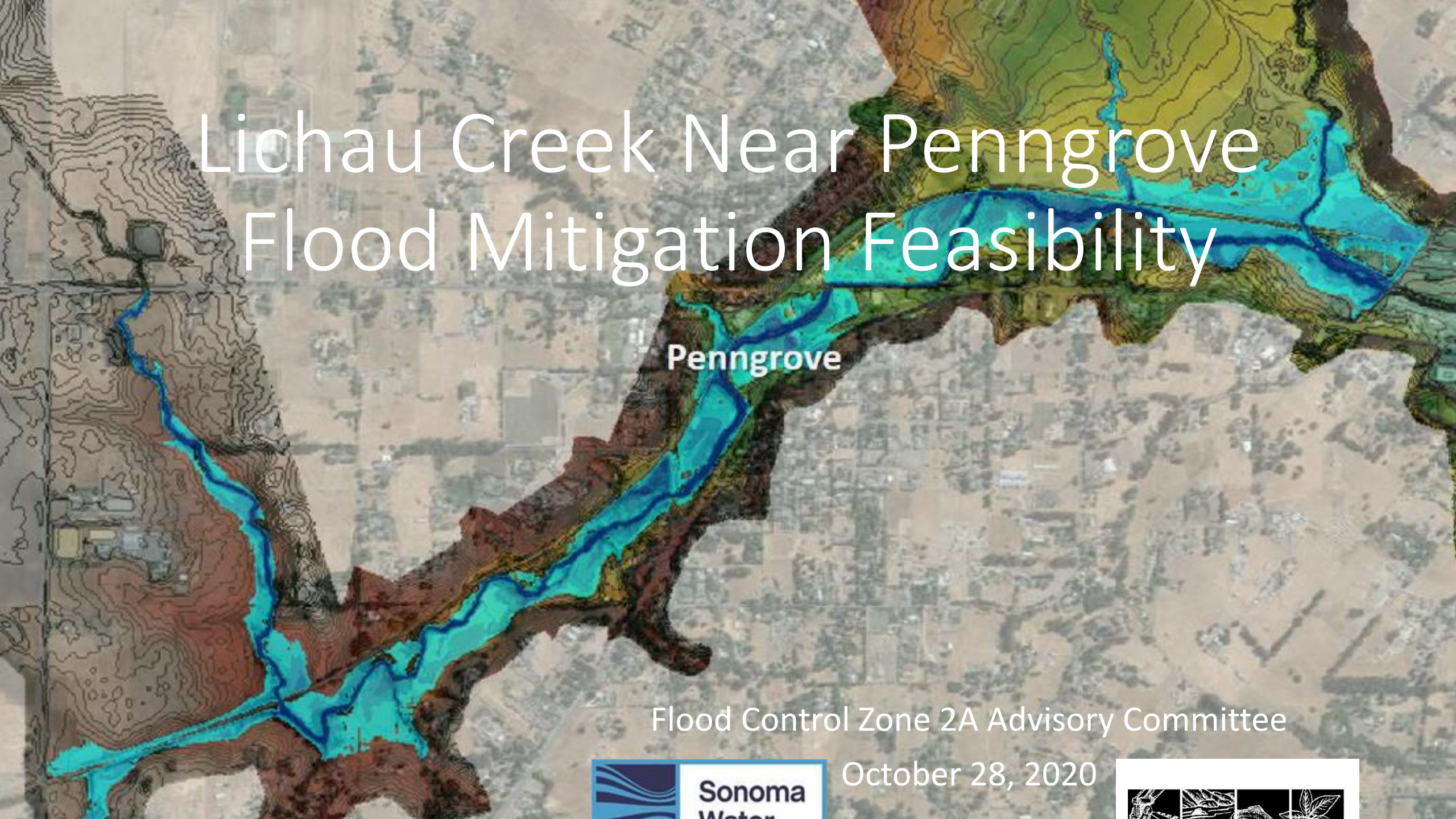
Lichau Creek Near Penngrove Flood Mitigation Feasibility



Flood Control Zone 2A Advisory Committee

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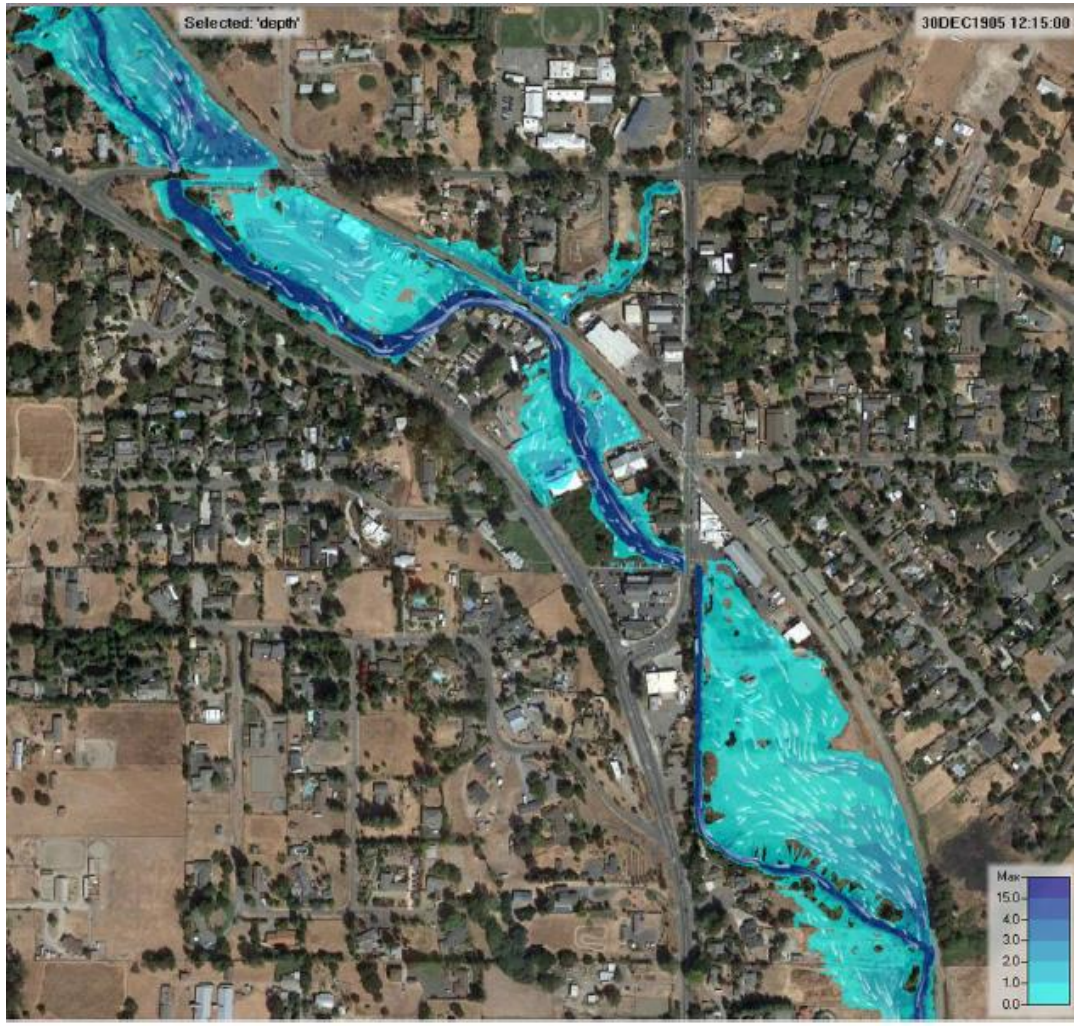
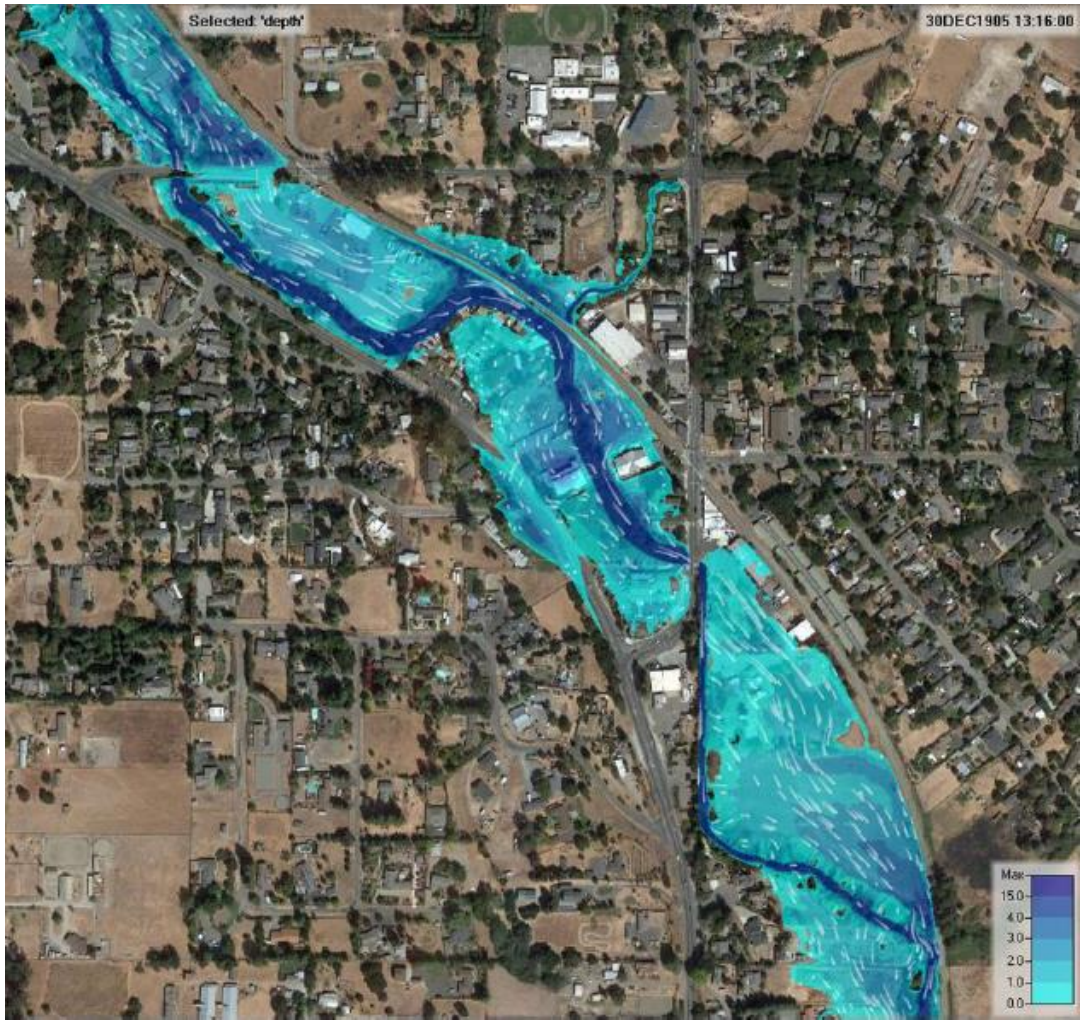
Existing Conditions Modeling

5-10yr Event (1,050 cfs)



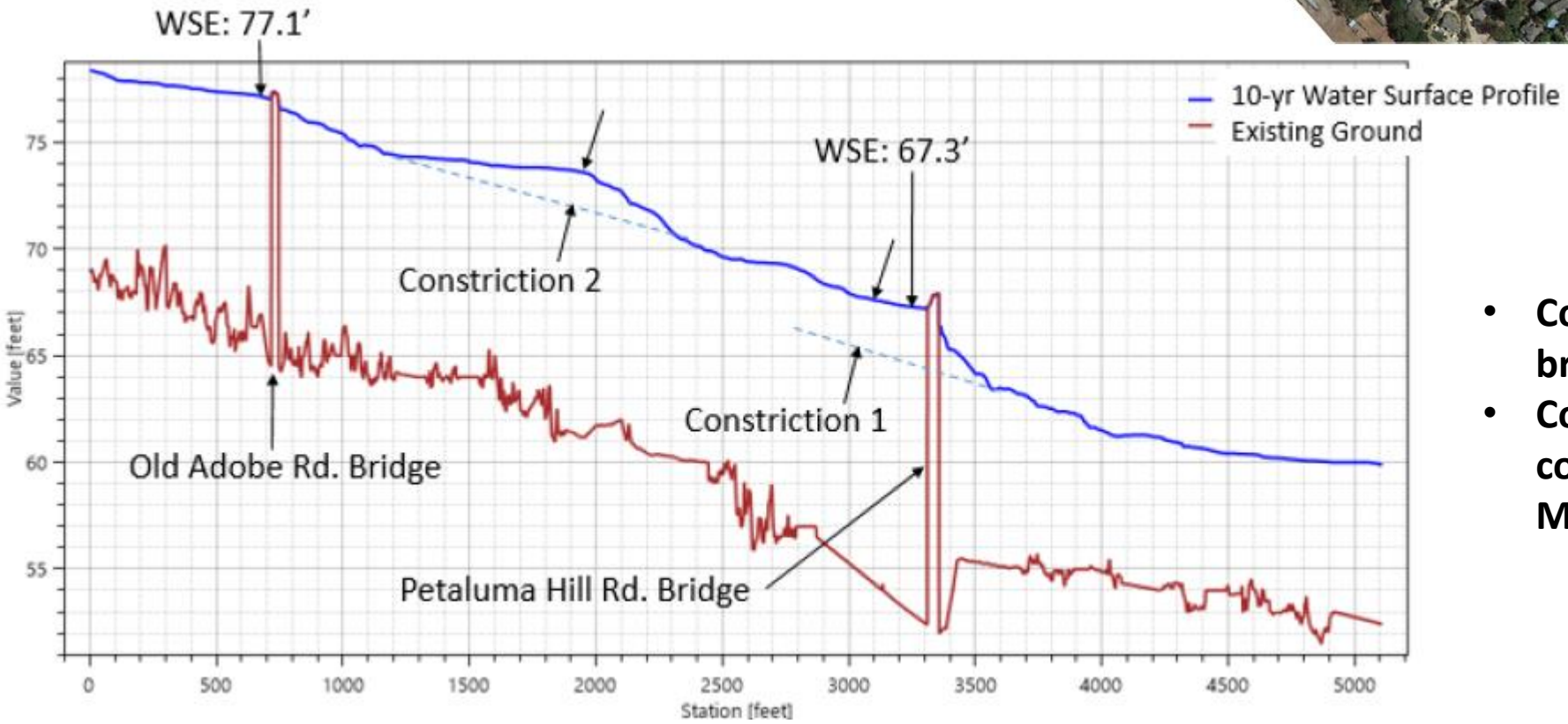
FEMA 10yr Event (1,480 cfs)



For context, flows overtop Old Adobe Rd at ~650 cfs and begin to flood V-Dolan yard.

Existing Conditions Modeling

"Although flooding in Penngrove's location is somewhat inevitable, it does appear that channel constrictions within the downtown area may be causing elevated water surface during high flows." (PCI, 2020)



- **Constriction 1 – Petaluma Hill Rd bridge**
- **Constriction 2 – Where channel is constrained between SMART and Mobile Home Park**

Bridge Sediment Removal Alternative (1a)

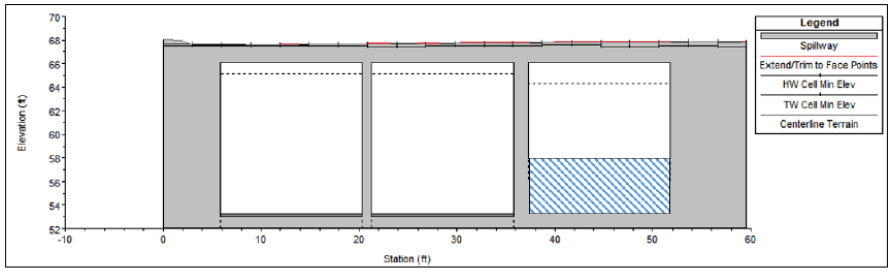


Figure 18. Image of HECRAS geometry for the Petaluma Hill Rd bridge showing sediment that was removed in the right bay (hatched area) for the Bridge Sediment Alternative model run.

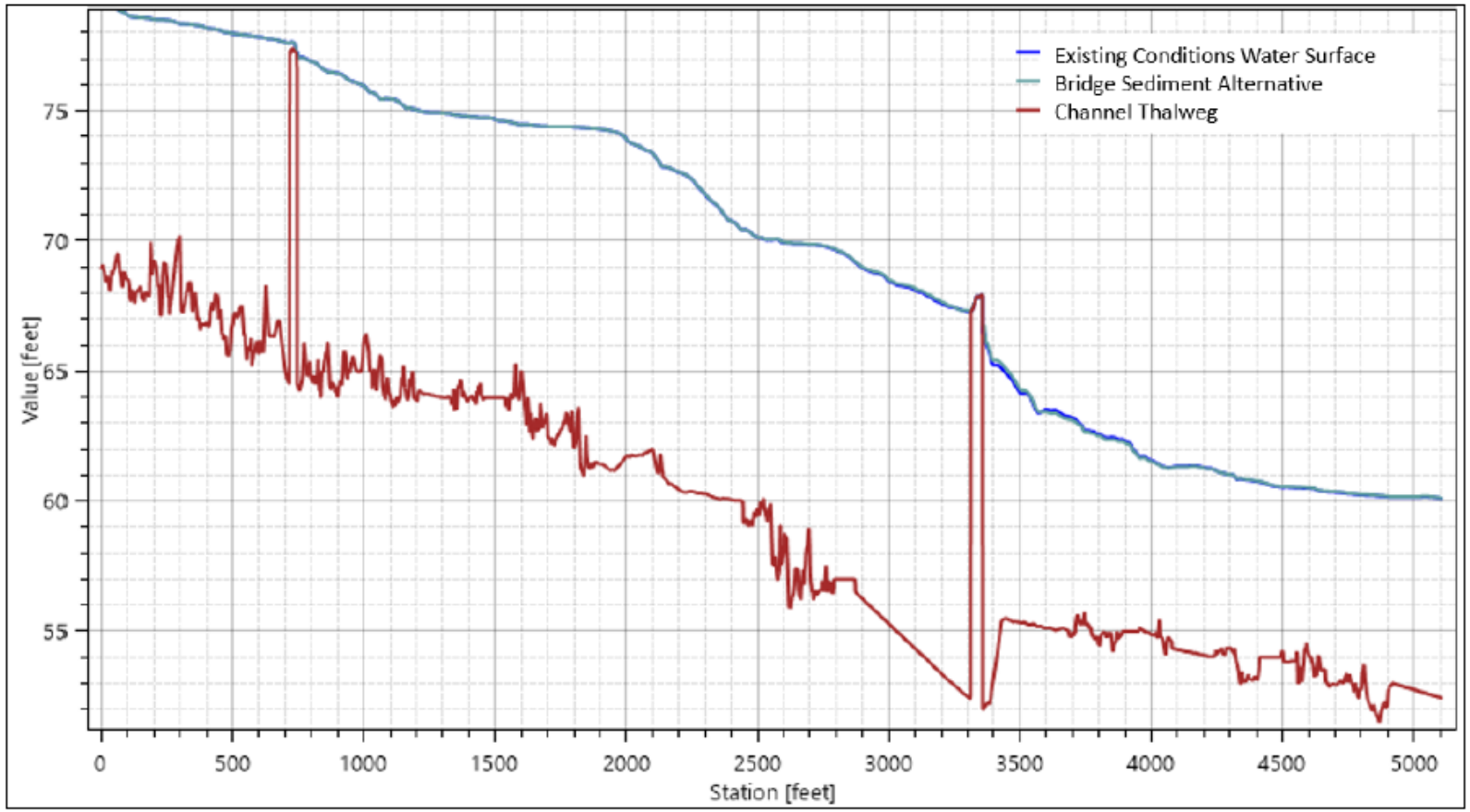


Figure 19. 10-yr storm WSEL plot comparing Existing Conditions with the Bridge Sediment Alternative. Note that existing and Bridge Sediment Alternative WSELs are essentially the same throughout the project reach.

Channel Widening Alternative (1b)

Figure 20. Bank Widening Alternative. Grey outlines indicate extent of channel widening. White line shows location of cross section in Figure 21.

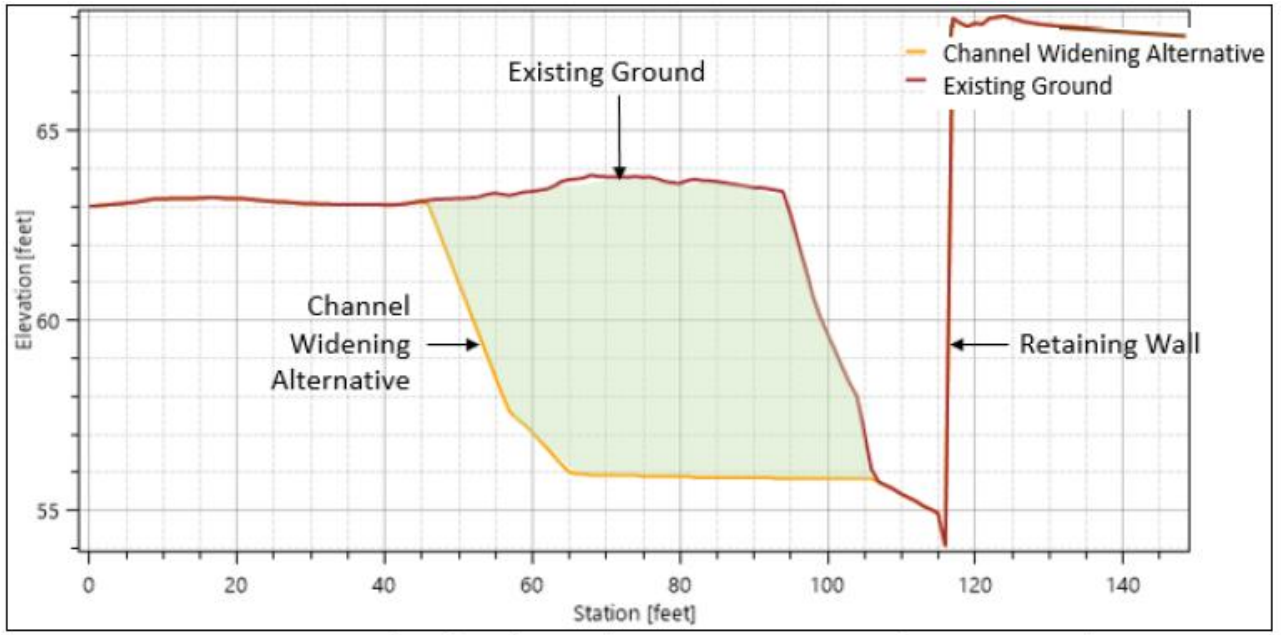


Figure 21. Cross section of Bank Widening Alternative. See Figure 20 for cross section location.

Channel Widening Alternative (1b)

FEMA 10yr Event (1,480 cfs)

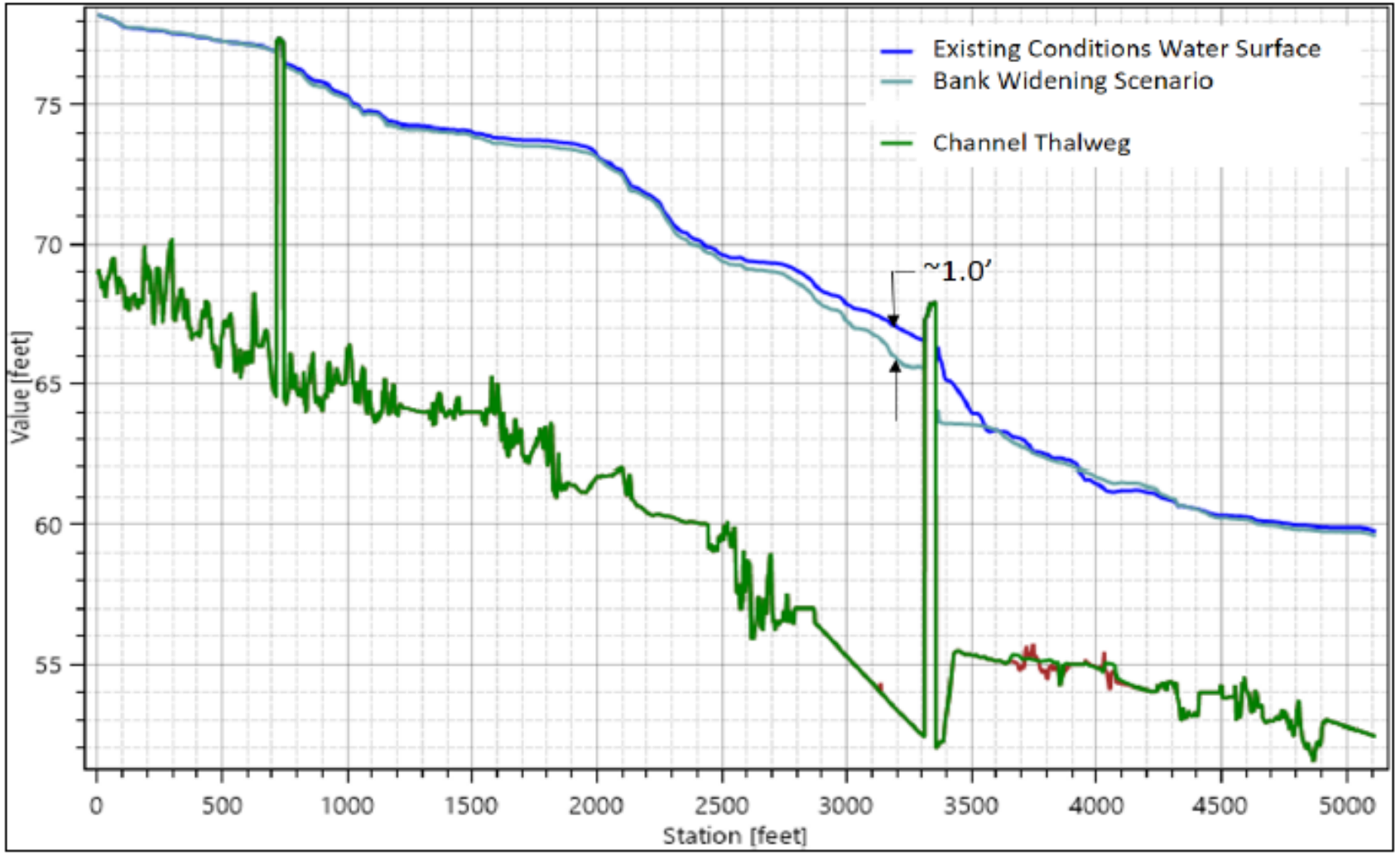


Figure 22. 10-yr storm WSEL plot for Existing Conditions and the Bank Widening Alternative.

Floodplain Bench Alternative (2)

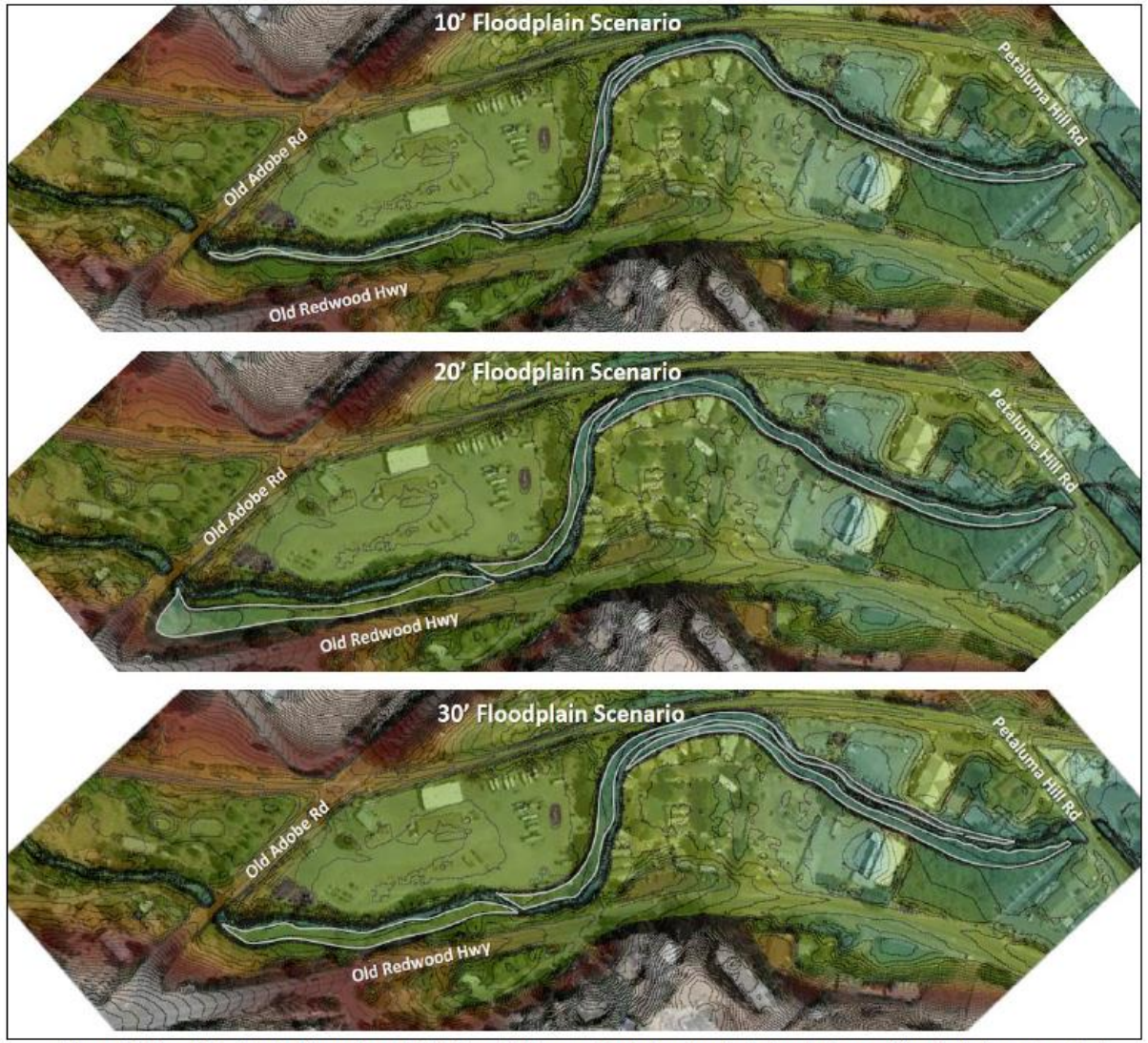


Figure 23. Floodplain Bench Alternatives (10', 20', and 30', respectively from top to bottom). Grey outlines indicate outer extent of floodplains modelled for each alternative.

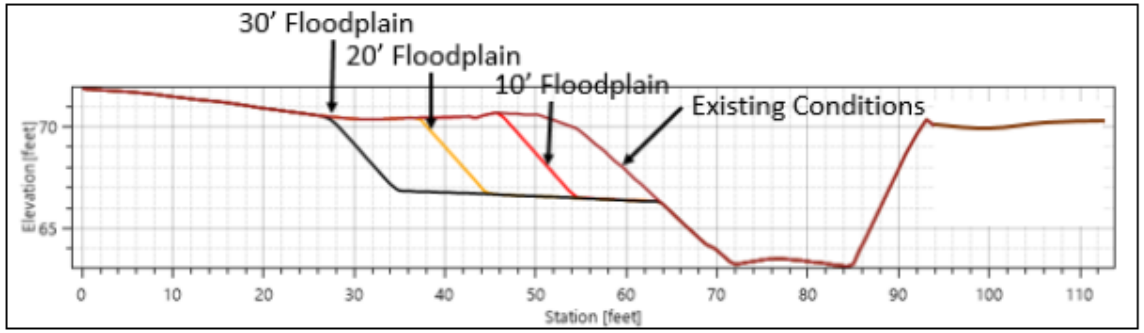


Figure 24. Typical cross section showing the three different floodplain bench alternatives.

- Focused in Penngrove center reach

Floodplain Bench Alternative (2)

FEMA 10yr Event (1,480 cfs)

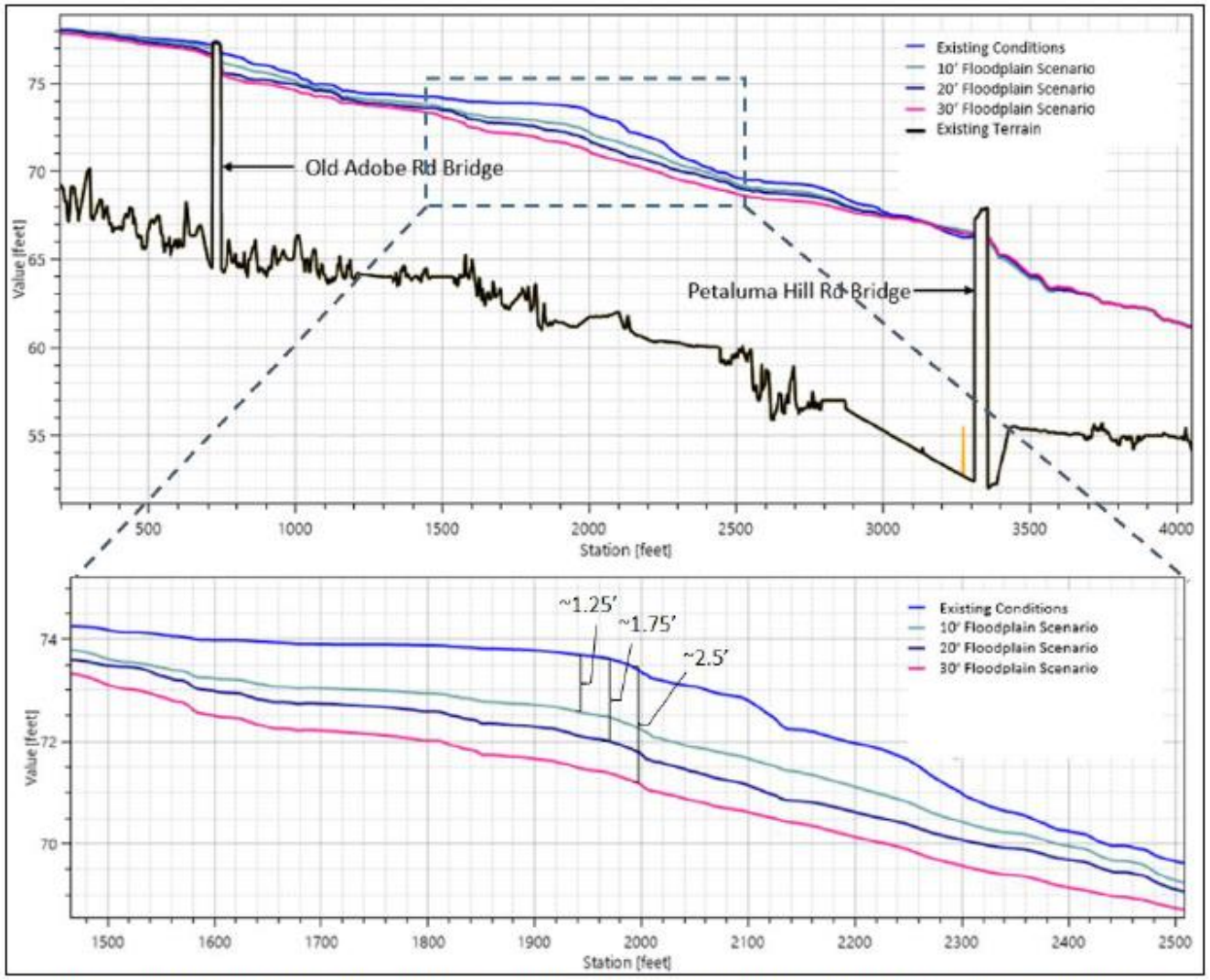
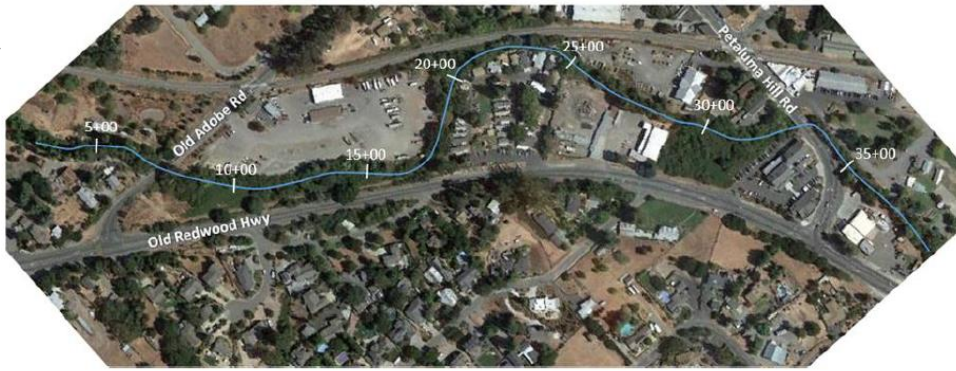


Figure 25. 10-yr storm WSEL plots comparing Existing Conditions with the 10', 20', and 30' floodplain alternatives.



- **Benefits disappear ~300 ft upstream of Petaluma Hill Rd**
- **Due to constriction downstream of bridge that creates a backwater that propagates through the bridge**

Lowered Floodplain Alternative (3a)

- Floodplains lowered to begin flooding at ~2yr event
- Objective – to slow and hold a greater volume of water on floodplains
- Unexpected Result – this alternative actually <u>increased</u> 10-year flood peaks in Penngrove

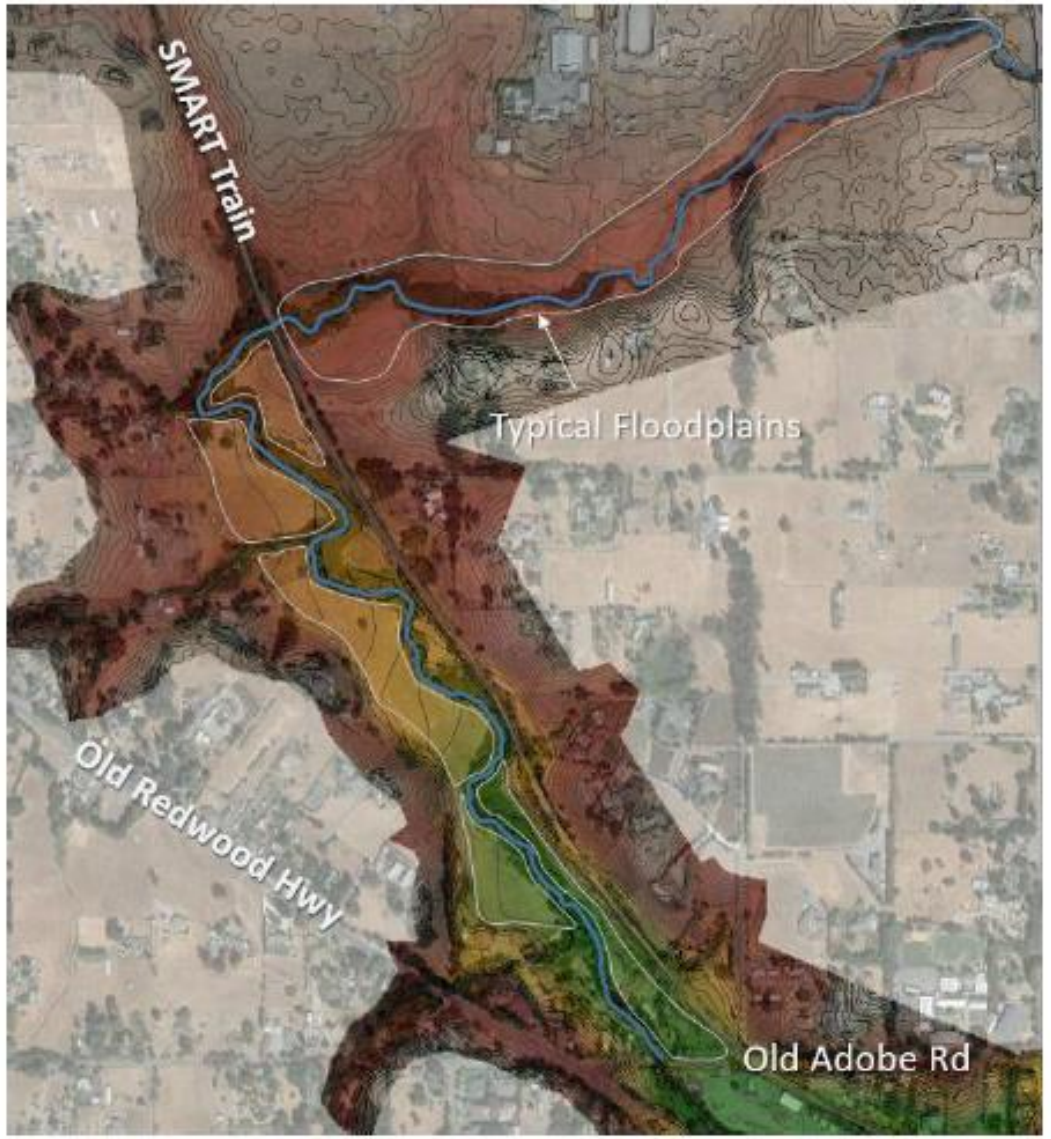


Figure 29. Floodplain Alternative. Grey outlines indicate outer extent of floodplains lowered and modelled.

Detention Basins Alternative (3b)

- Two alternative analyzed
  - Max Detention Alternative included 10 open fields utilized to full extent Select Basin Alternative looked at a subset of two promising basins
  - Storage is 90 acre-feet & 31 acre-feet

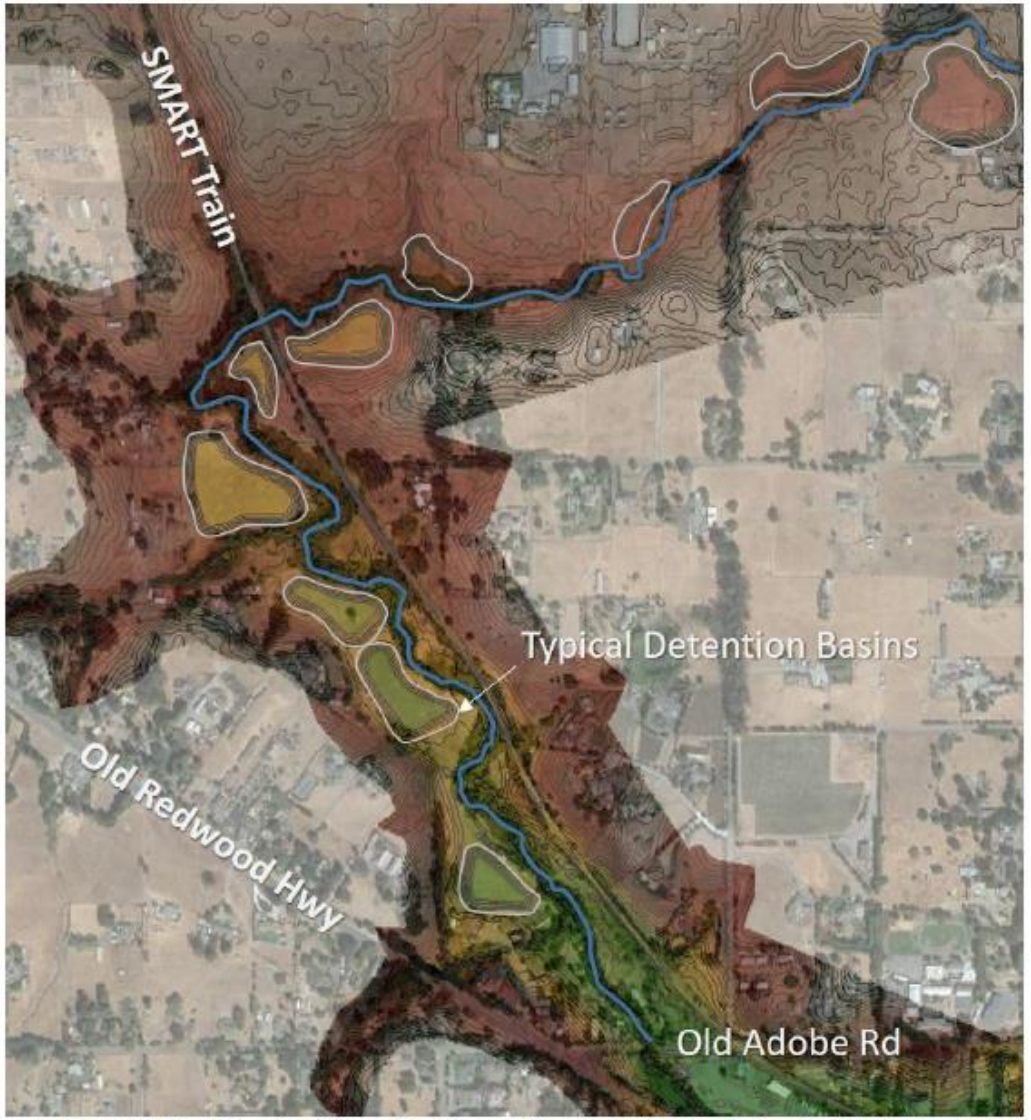


Figure 31. Max Detention Alternative. Grey outlines indicate extent of each detention basin.

Combined Alternatives

- 20’ Floodplain Alternative + Bank Widening Alternative

- 20’ Floodplain Alternative + Bank Widening Alternative + Max Detention Basin Alternative

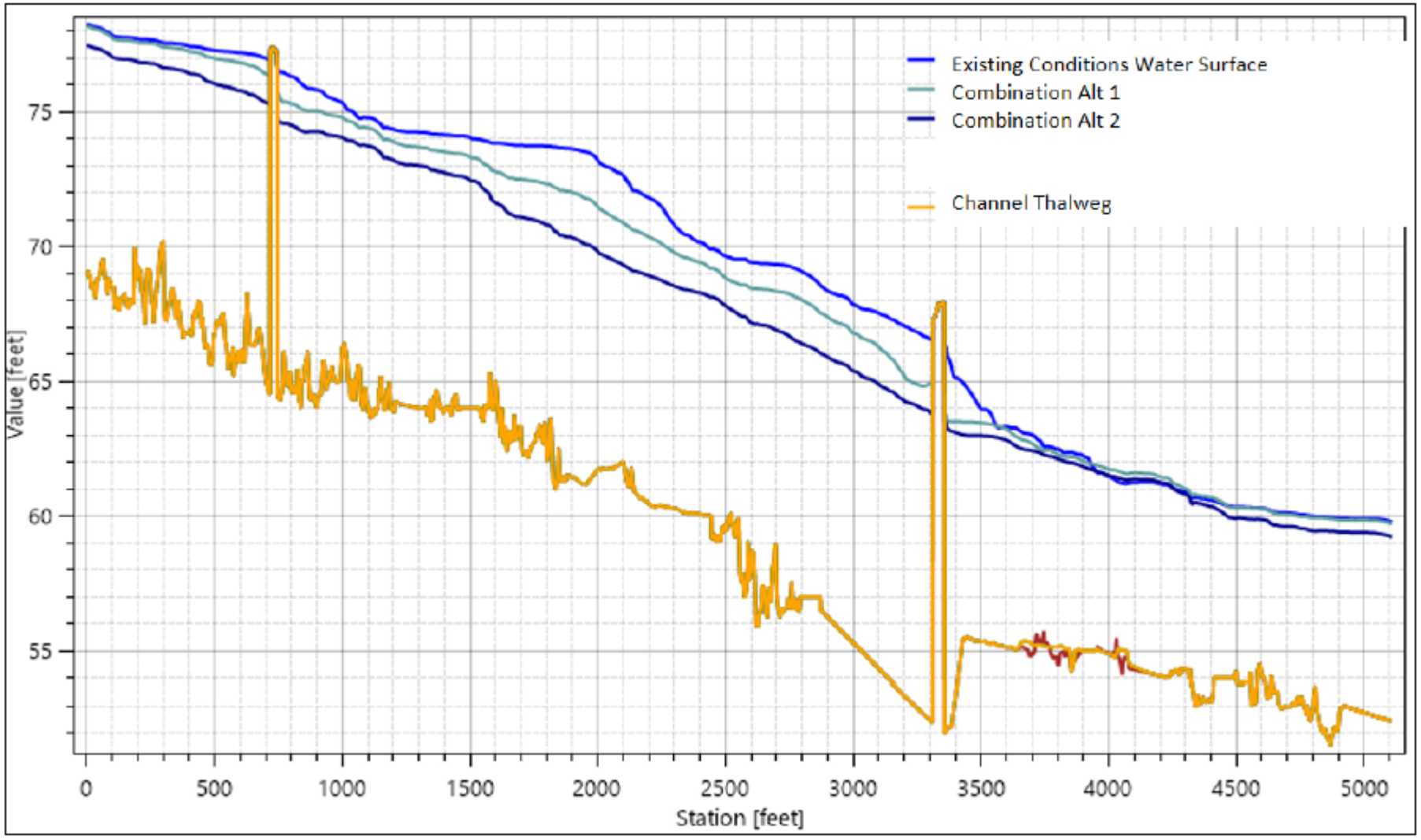


Figure 37. Water surface profiles for the 10-yr storm event through Penngrove showing model results for Existing Conditions and the two Combination Alternatives.

Combined Alternatives

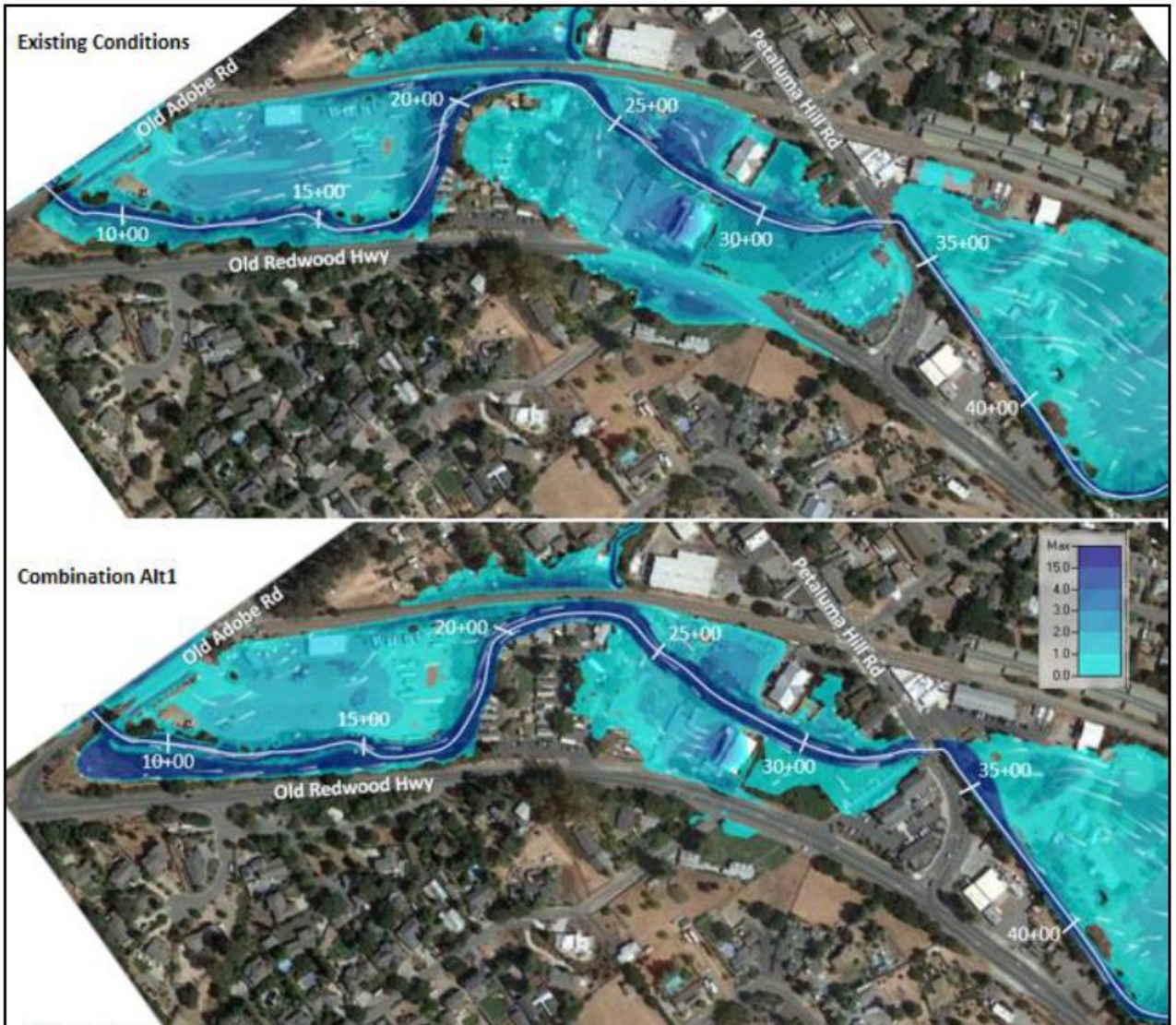


Figure 38. Water depths and flooding extents during the 10-yr storm for Existing Conditions and the two Combined Alternatives in downtown Penngrove.

- 1,480 cfs under Existing Conditions
- 2,160 cfs under Alt 1 and Alt 2 to produce same flood depths
- Effectively, a flood depth that would have occurred every 10 years would only occur every 100 years

Summary Findings & Costs

- Securing 10-yr flood reduction benefits will require multiple projects
- Channel capacity needs to be expanded (Bank Widening and Floodplain Benches)
- To largely eliminate 10-yr flooding, upstream detention is required
- Large-scale detention projects will be longer term and more challenging
- Outreach and community discussions needed to advance projects

Table 2. Planning level construction cost estimate for project alternatives

Alternative	Planning Level Construction Cost
Bank Widening Alt:	$350K-$650K
20' Floodplain Bench Alt:	$2M-$4M
Max Detention Alt:	$21M-$39M
Select Basin Alt:	$7M-$13M

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