California Department of Water Resources

Cosumnes River Multi-Benefit Floodplain Restoration Pilot Study Summary

June 2025

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Acronyms and Abbreviations

DWR	California Department of Water Resources
EcoFIP	Ecological Floodplain Inundation Potential
FAU	floodplain analysis units
HAR	height-above-river
SRA	shaded riverine aquatic
WSE	water surface elevation
WY	water year

1. Introduction and Study Approach

This Cosumnes River Multi-Benefit Floodplain Restoration Pilot Study Summary (Summary) illustrates potential opportunities for multi-benefit projects along the Cosumnes River using an innovative toolset that can evaluate and prioritize opportunities at the reach and project scales. For example:

- The Ecological Floodplain Inundation Potential (EcoFIP) analysis described here provides a process for developing and prioritizing multi-benefit projects that reduce flood risk and improve floodplain activation, ecological functions, and groundwater recharge on the Cosumnes River and Deer Creek.
- Study results described here show that floodplain restoration projects could improve the function of the regional flood management system, groundwater recharge, and floodplain ecosystems.
- Analyses described here identify opportunities and critical next steps for advancing and implementing multi-benefit projects in the Cosumnes River watershed.
- Subsequent efforts can build on this analysis and work toward project feasibility and implementation.

In 2023, the California Department of Water Resources (DWR) initiated the Cosumnes River Multi-benefit Floodplain Restoration Pilot Study (Cosumnes River Pilot Study) to evaluate conceptual floodplain restoration opportunities that could improve function of the regional flood management system, groundwater recharge, and floodplain ecosystems. The Cosumnes River Pilot Study focused on the stretch of the Cosumnes River and Deer Creek running from Michigan Bar to Highway 99 in Sacramento County (Figure 1), although areas downstream of Highway 99 were considered during the development of potential concepts (Chapter 3).

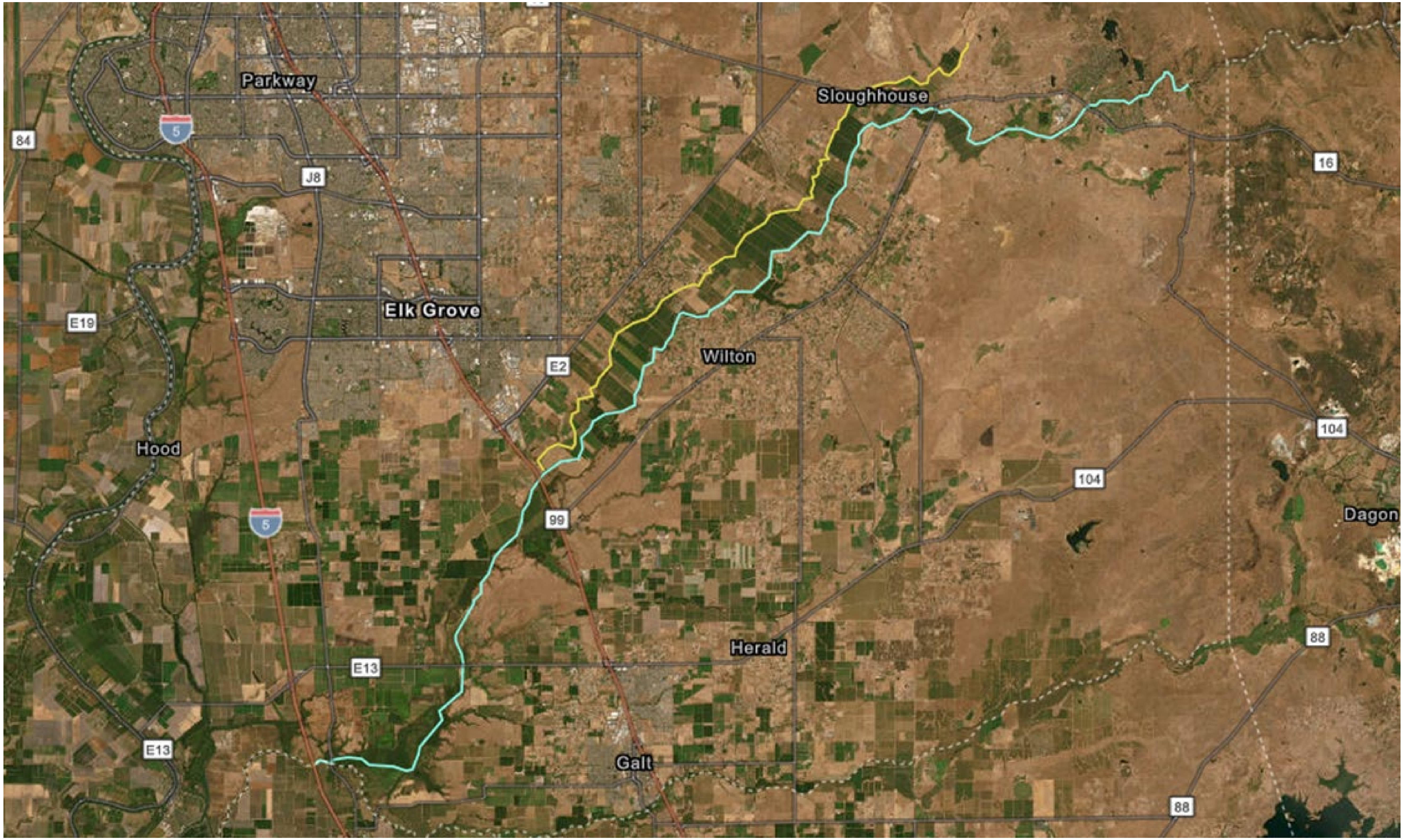
To identify and prioritize physical opportunities for multi-benefit floodplain restoration, DWR's EcoFIP decision support toolset (Chapter 6) was employed at the following levels of analysis:

- Tier 1: Large-scale Inundation Potential
- Tier 2: Multi-objective Site Identification, Analysis, and Prioritization
- Tier 3: Conceptual Designs

In addition to the standard EcoFIP analysis that has been used in other Multi-benefit Floodplain Restoration Pilot Studies (refer to URLs list in Chapter 9), the Cosumnes River Pilot Study incorporates groundwater modeling to simulate the interaction between surface water and groundwater for potential concepts. The Cosumnes River Pilot Study used hydrologic modeling to represent historical hydrology at the subbasin level and for ungauged areas, providing a more holistic representation of the watershed under observed storm conditions. Additional hydraulic analyses were conducted to estimate changes in flood stage with the implementation of conceptual designs in the pilot study area.

These elements, in conjunction with the development of future climate change scenarios, allow for improved evaluation of potential impacts on floodplain inundation, flood risk, groundwater recharge, and suitable habitat over time.

Figure 1. Aerial View of Cosumnes River and Deer Creek



Notes: The blue line denotes the location of the Cosumnes River and the yellow line outlines Deer Creek.

During the study, regional collaboration ensured potential concepts were formulated and designed with local objectives in mind, and helped focus EcoFIP analysis on areas that might have greater potential for project implementation. The following entities shared thoughts, feedback, and valuable input throughout the process (Photo 1):

- Omochumne-Hartnell Water District
- Reclamation District 800
- Cosumnes Coalition
- Sloughhouse Resource Conservation District
- Sacramento Valley Conservancy
- Sacramento Central Groundwater Authority
- Sacramento County
- The Freshwater Trust
- Wackman Consulting
- Wilton Rancheria
- The Nature Conservancy
- Conservation Fund
- Other local landowners and entities

Photo 1. Pilot Study Team and Local Entities During a Site Visit on November 14, 2023

2. Background

Over the last two centuries, the Cosumnes River has evolved from a natural channel configuration to a more constrained and engineered system. After gold was discovered at Michigan Bar in 1849, people from all over the world came to the area, laid claim to indigenous land, and began to develop the floodplains adjacent to Cosumnes River and Deer Creek for agricultural and livestock use. Shortly after, a dam was built to provide a reliable water supply for downstream agricultural lands. However, this dam was completely swept away by flooding in 1851 and 1852. In the following years, flood events were common occurrences along the Cosumnes River.

Like many of the rivers with their headwaters in the Sierra Nevada mountain range in northern California, hydraulic gold mining operations in the mid-1800s led to the accumulation of significant amounts of sediment that are still present in portions of the system. The growth of agriculture and development along the Cosumnes River led to the construction of levees to protect crops and surrounding communities from floods. Many of these levees were originally not engineered and constructed using native material and accumulated sediment. Furthermore, levees were typically built directly adjacent to the Cosumnes River to maximize the amount of land used for agricultural production, thereby disconnecting and eliminating historical floodplain habitat.

Despite several attempts to construct a major dam over the years, the Cosumnes River is the only remaining unregulated river flowing out of the western side of the Sierra Nevada. These factors, in conjunction with limited funding for repairs and improvements to levee systems over time, have made areas adjacent to Cosumnes River particularly susceptible to flooding.

Over the last few decades, large storm events have led to significant flooding in the lower Cosumnes watershed. In 1997, flows on the Cosumnes River reached roughly 90,000 cubic feet per second (cfs)—the highest flow on record—after a series of winter storms. This resulted in 24 levee breaches and widespread flooding in the region. Twenty years later, the Central Valley experienced its wettest seasons ever, causing multiple flood events for areas around the Cosumnes River. And more recently in January of 2023, a landfalling atmospheric river led to several levee breaks along the Cosumnes River, causing Highway 99 and much of the surrounding area to flood (Photo 2).

Photo 2. Franklin Boulevard in Elk Grove is flooded by the Cosumnes River

Photo taken January 13, 2017. Photo Credit: DWR.

In addition to increased flood vulnerability, groundwater levels in the Cosumnes subbasin have declined steadily over the last few decades. This has resulted in a disconnect between the aquifer and surface flows along certain portions of the Cosumnes River. This disconnect threatens groundwater-dependent ecosystems because portions of the Cosumnes River and surrounding area can become entirely dry during summer months, particularly during periods of extended drought. Furthermore, groundwater is a primary source of water for the region; continued groundwater level decline poses a risk to agricultural and municipal uses.

In addition to the importance of a sustainable groundwater system, intact and functional floodplains are vital for reducing flood risk, promoting groundwater recharge, and maintaining the health of wetlands and riparian habitats and the species that inhabit them. The Cosumnes River and surrounding areas are home to an array of wildlife consisting of over 250 bird species, upward of 40 fish species, and nearly 230 plant species

(California Department of Fish and Wildlife 2025). While over 50,000 acres of habitat and agricultural land are protected in lower Cosumnes River near its confluence with the Sacramento-San Joaquin Delta at the Cosumnes River Preserve (Cosumnes River Preserve 2025), efforts to restore floodplains along the leveed portions of Cosumnes River and areas adjacent to Deer Creek can promote recovery of natural riverine processes, create additional habitat, improve groundwater recharge, and reduce flood risk in the region (Photo 3).

Photo 3. Cosumnes River Downstream of the Dillard Road Bridge

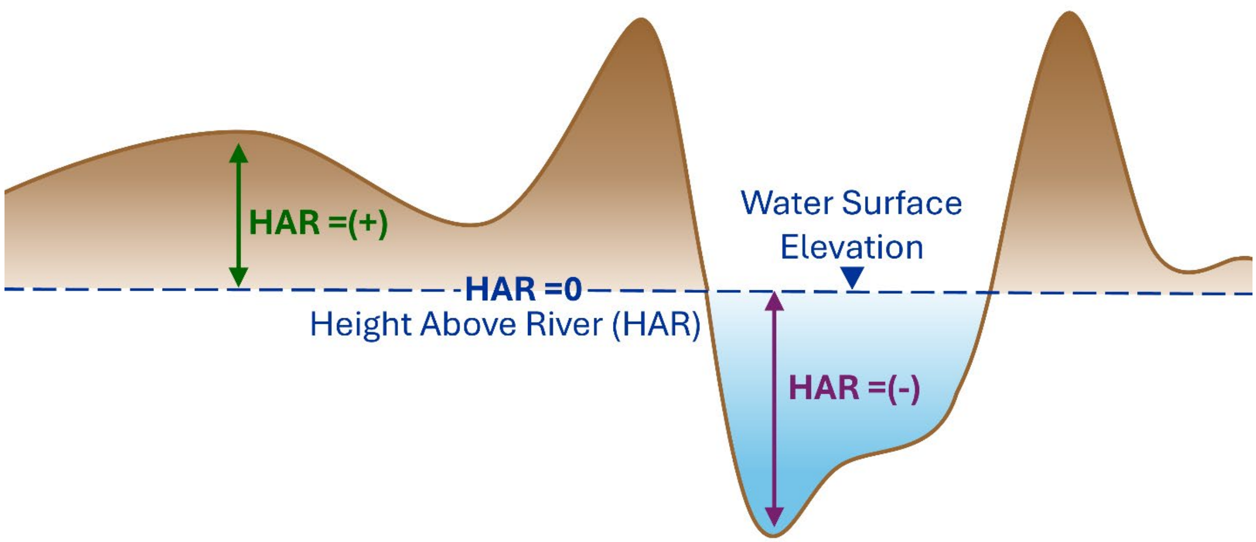
Photo taken November 14, 2023 by the study team.

3. Tier 1 Analysis—Large-Scale Inundation Potential

This chapter discusses the EcoFIP Tier 1 analysis (Chapter 1) which evaluates the physical opportunities for floodplain inundation based on existing and potentially altered (e.g., no levees) terrain.

For the Cosumnes River Pilot Study, a two-dimensional hydraulic model developed by DWR in 2023 was used. Updates to this hydraulic model include incorporation of bathymetry for the Cosumnes River collected by DWR in the winter of 2023. First, the updated model was simulated for a range of flows that have historically occurred on the Cosumnes River and its tributaries. Next, outputs from the hydraulic model were used in EcoFIP analysis to identify the extents of connected and disconnected inundated areas in the study area (Figure 2).

Figure 2. Height-above-river Projection Relative to a Given Water Surface Elevation



Note: WSE = water surface elevation

Finally, and expanding on hydraulic modeling results, height-above-river (HAR) maps (Figure 3) and potential activation flow maps (Figure 4) were generated to identify opportunities for floodplain reconnection.

HAR maps (Figure 3) identify the height of the existing terrain relative to the water surface elevation (WSE) at a particular flow. These maps help researchers understand the elevation of adjacent floodplains relative to a specific river flow elevation to quickly screen locations that may be suitable for floodplain reconnection. Figure 3 shows example analysis results for the Cosumnes River based on flow at Michigan Bar (i.e., the location of long-standing U.S. Geological Survey stream gage 11335000). The example Tier 1 analysis results illustrate the HAR at 6,000 cfs on the Cosumnes River. Areas with a negative HAR represent terrain that is lower than projected WSE and could be feasible areas to increase inundated floodplain areas if obstacles to flow (for example, levees) were removed or set back. In the example analysis the floodplain between the Cosumnes River and Deer Creek and the lower Cosumnes River have terrain that is below the projected WSE when flow in the Cosumnes River is 6,000 cfs.

Figure 3. Example Height-above-river Map for Cosumnes River at 6,000 cfs

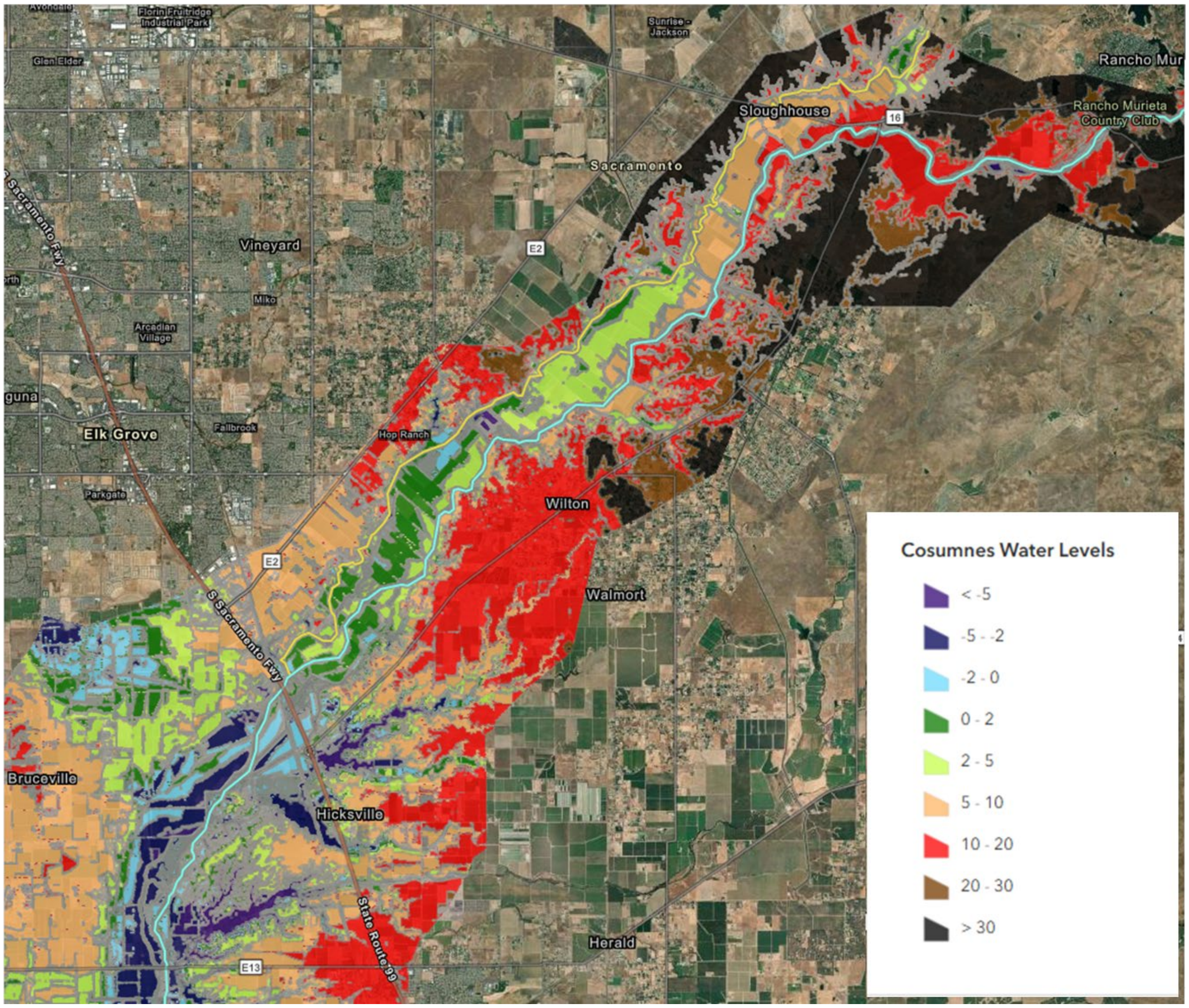
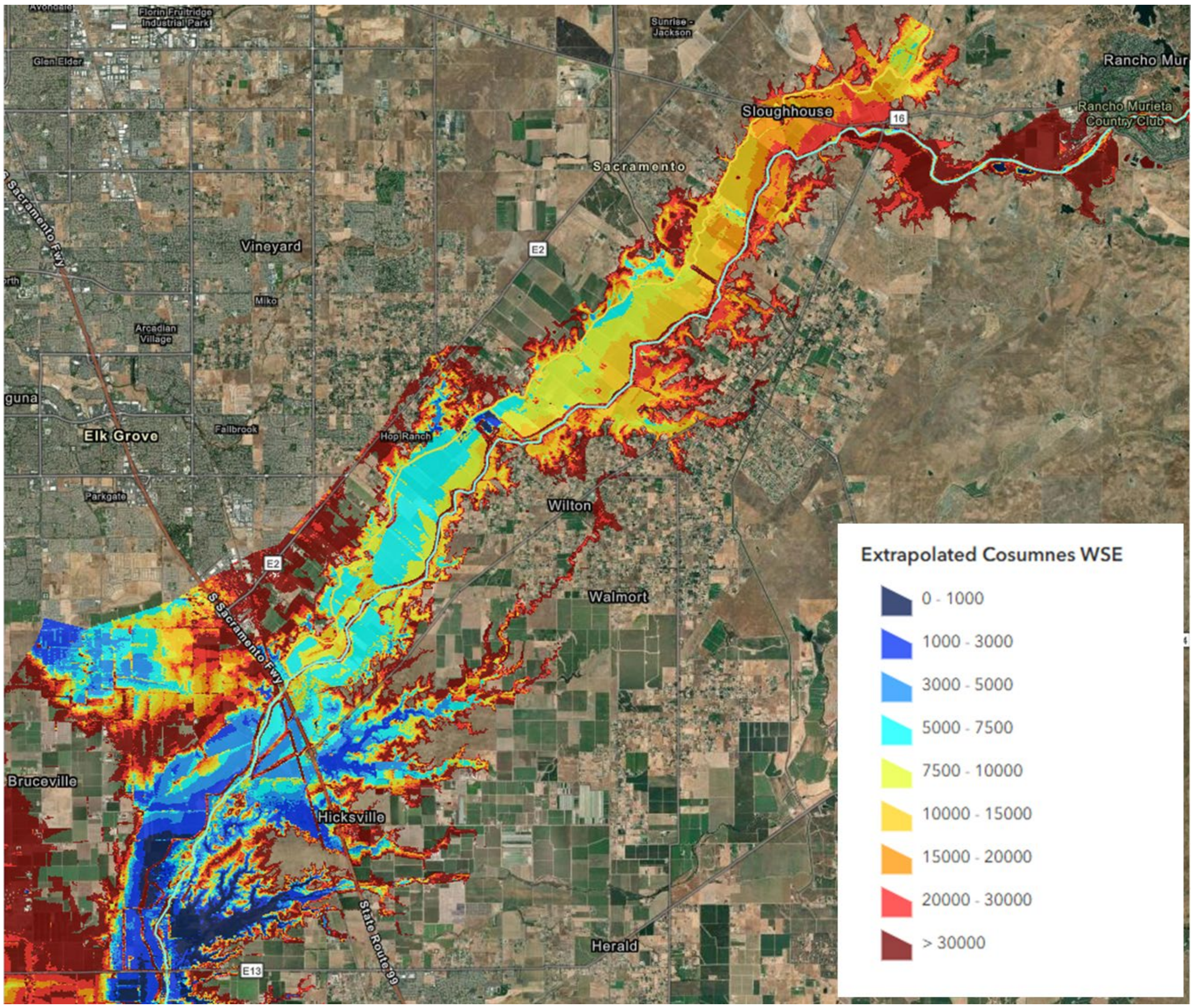


Figure 4 shows an example potential floodplain activation flow map developed from extrapolated WSE results (beyond the extent of existing levees or banks). These are similar to HAR maps, but instead of referencing an elevation relative to the river, the flow in the river that generates a potential inundation extent is displayed. Rather than indicating that the floodplain will activate at a particular flow under current conditions, a potential activation flow map approximates the magnitude of flow that could inundate the floodplain if barriers (for example, levees) were removed. A potential floodplain activation flow map is useful for understanding the magnitude of flow that would potentially inundate Cosumnes River or Deer Creek floodplain.

The example Tier 1 analysis results illustrate the floodplain activation potential for flows ranging from 0 cfs to over 30,000 cfs. Flow ranges are color coded in Figure 4 and, as expected, floodplain inundation increases as flows increase. Like the HAR example, the floodplain between the Cosumnes River and Deer Creek and the lower Cosumnes River have lower terrain and the potential to inundate at flows less than 7,500 cfs.

Figure 4. Example Floodplain Activation Map for the Cosumnes River for a Range of Potential Flow Rates (cfs)



4. Tier 2 Analysis—Multi-Objective Site Identification, Analysis, and Prioritization

This chapter discusses the EcoFIP Tier 2 analysis (Chapter 4) which quantifies potential benefits of floodplain inundation at more refined scales. The chapter summarizes the methodology and shows example analysis results. EcoFIP Tier 2 analysis evaluates an inundated area at a range of flows to a defined spatial extent of interest (for example, land parcels, river miles, a grid, or similar). This information is helpful for identifying areas that have the potential to provide a range of benefits, as well as for prioritizing locations for development of conceptual designs.

For the Cosumnes River Pilot Study, inundated area results were evaluated for two types of spatial extents, and are defined here as floodplain analysis units (FAUs): parcel boundaries and a 10-acre grid. Modeling results were analyzed for a 31-year period of record from water years (WYs) 1993 to 2023. Figure 5 shows the average number of days per water year an area could be inundated based on existing topography for each 10-acre grid. Figure 5 shows average number of days per water year in color-coded ranges from 0 to over 28 days. The more days of inundation the more likely there will be benefits for habitat and recharge. There is high potential for increased days of floodplain inundation in lower Cosumnes River and in specific locations along the river corridor with lower topography, such as former gravel mines.

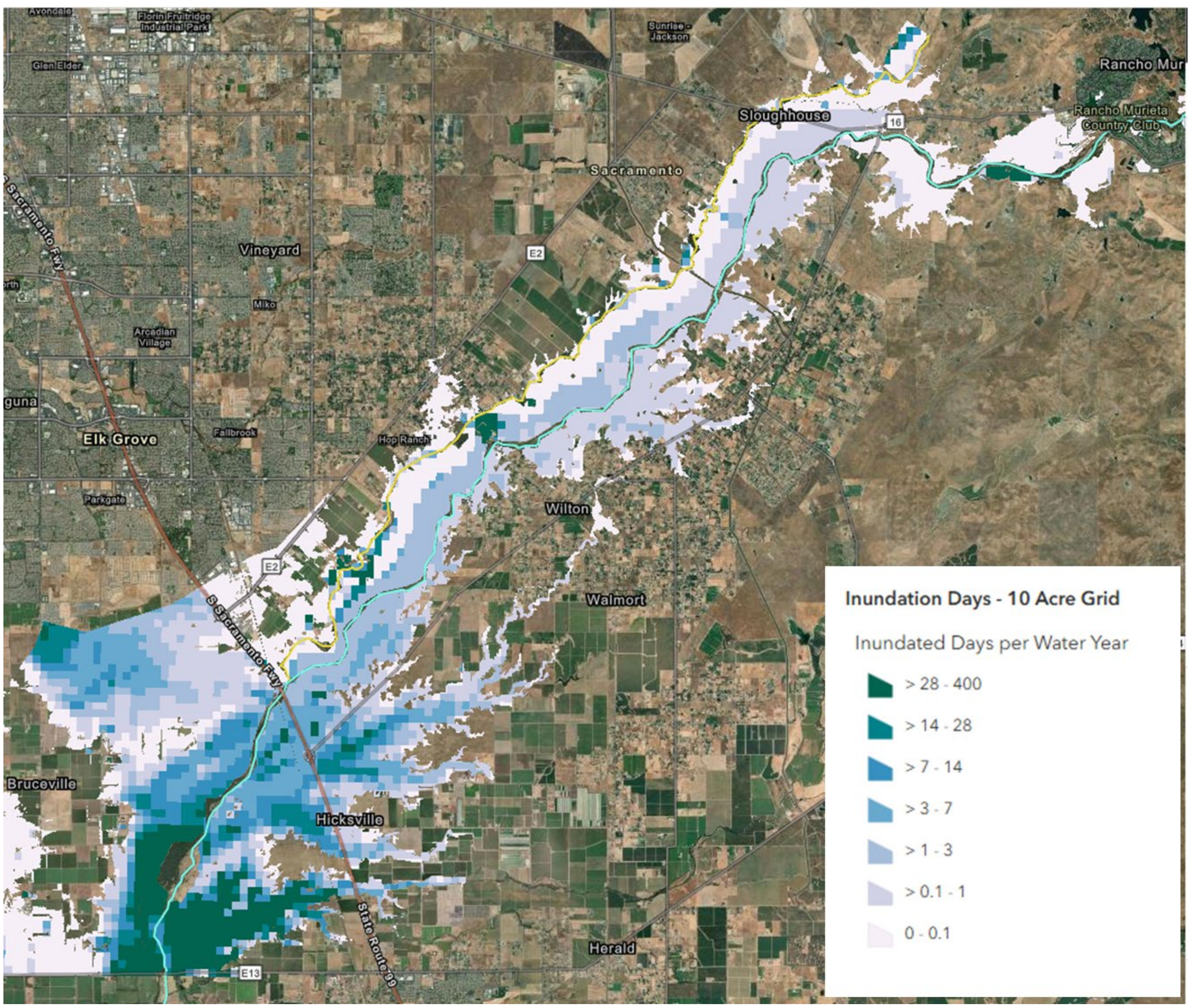
The following metrics were also used to quantify potential concept benefits for an average water year.

- **Flood risk—**Inundated area and WSE were used to evaluate potential flood risk.
- **Recharge—**Annual recharge rates were estimated in acre-feet per acre of FAU (that is, the average depth of potential recharge per water year for a particular FAU). The recharge rate was defined as the saturated infiltration rate of recharge through the upper layers of soil.

- **Habitat suitability (salmonid rearing)—**The acre-days of suitable habitat for an average water year and the acre-days normalized by FAU area are calculated resulting in days of suitable habitat by parcel or 10-acre grid cell. Habitat suitability is intended to describe the amount of habitat available within an area of interest for a given flow rate or on a given day.

These metrics were used to identify multi-benefit floodplain restoration opportunities and to select locations for floodplain restoration concept development.

Figure 5. Potential Inundated Days per Water Year for a Portion of the Cosumnes River Watershed



5. Tier 3—Conceptual Designs

This chapter discusses the EcoFIP Tier 3 analysis for which conceptual designs are developed and benefits quantified. This chapter describes the methodology and summarizes example conceptual designs for projects in the Cosumnes River watershed, including a levee setback project and a gravel pit near Wilton as rendered from the analysis.

The conceptual design process leverages information about hydrology, geomorphology, biology, land use, and community knowledge along the Cosumnes River to identify and evaluate opportunities to improve flood protection, increase groundwater recharge, and enhance habitat.

Through this process, high-level conceptual designs were developed via modeling scenarios that modify levees, lower floodplains, and alter existing Cosumnes River topography. Ultimately, this process seeks to identify potential concepts that could provide multiple benefits.

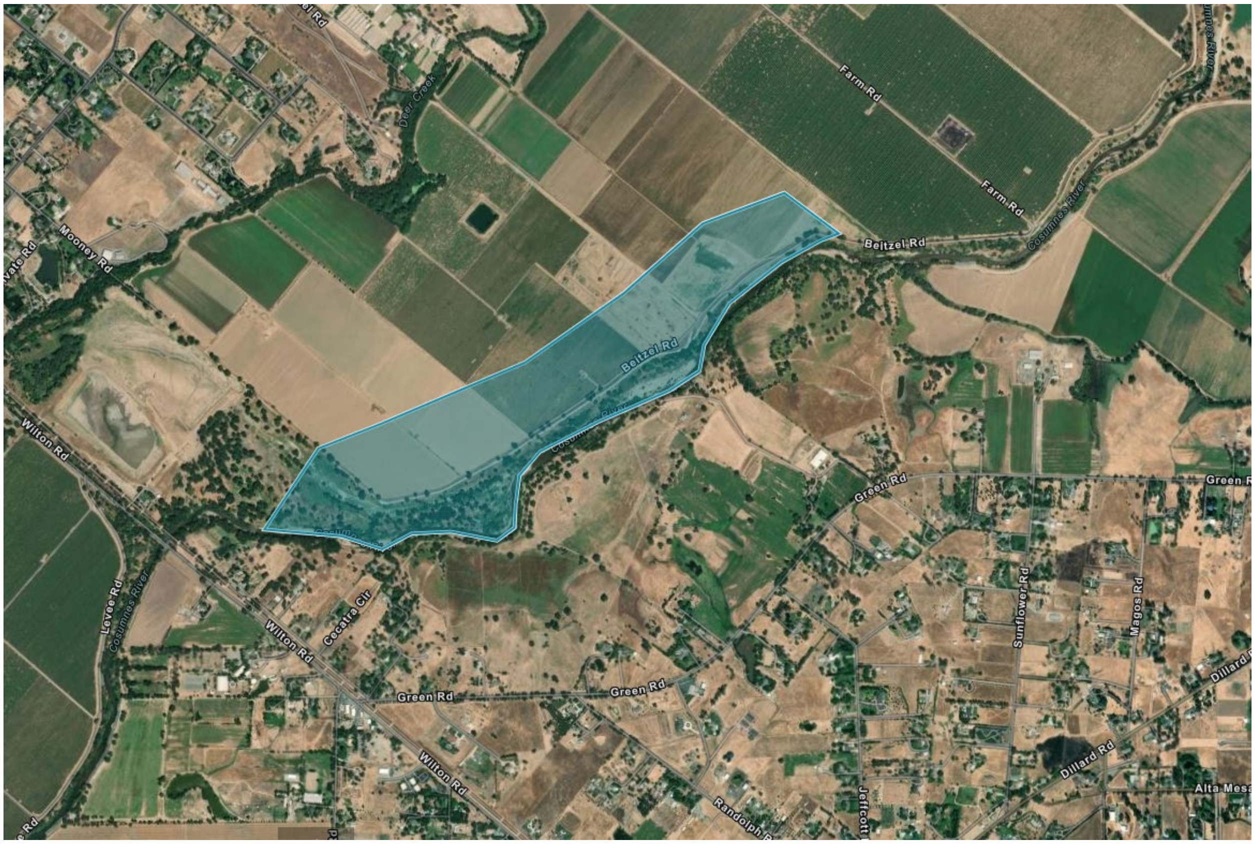
Many conceptual designs were developed through the Cosumnes River Pilot Study to illustrate potential benefits of a variety of floodplain restoration actions in the watershed; the following maps and figures highlight a subset of these conceptual designs and compare them to current-day conditions.

Design concepts do not reflect landowner willingness or approval, nor do they represent any agency commitment to pursue projects toward implementation.

5.1 Levee Setback Concept

Figure 6 shows the area considered for a conceptual levee setback; this area is currently used for agricultural production. Based on analysis results, a levee setback in this area would provide additional room for the Cosumnes River to meander and would reduce stress on the levee system. In the without concept condition, these agricultural land could still become inundated during large weather events when flows overtop the banks of Deer Creek.

Figure 6. Levee Setback Concept Design Area with High Potential for Multiple Benefits

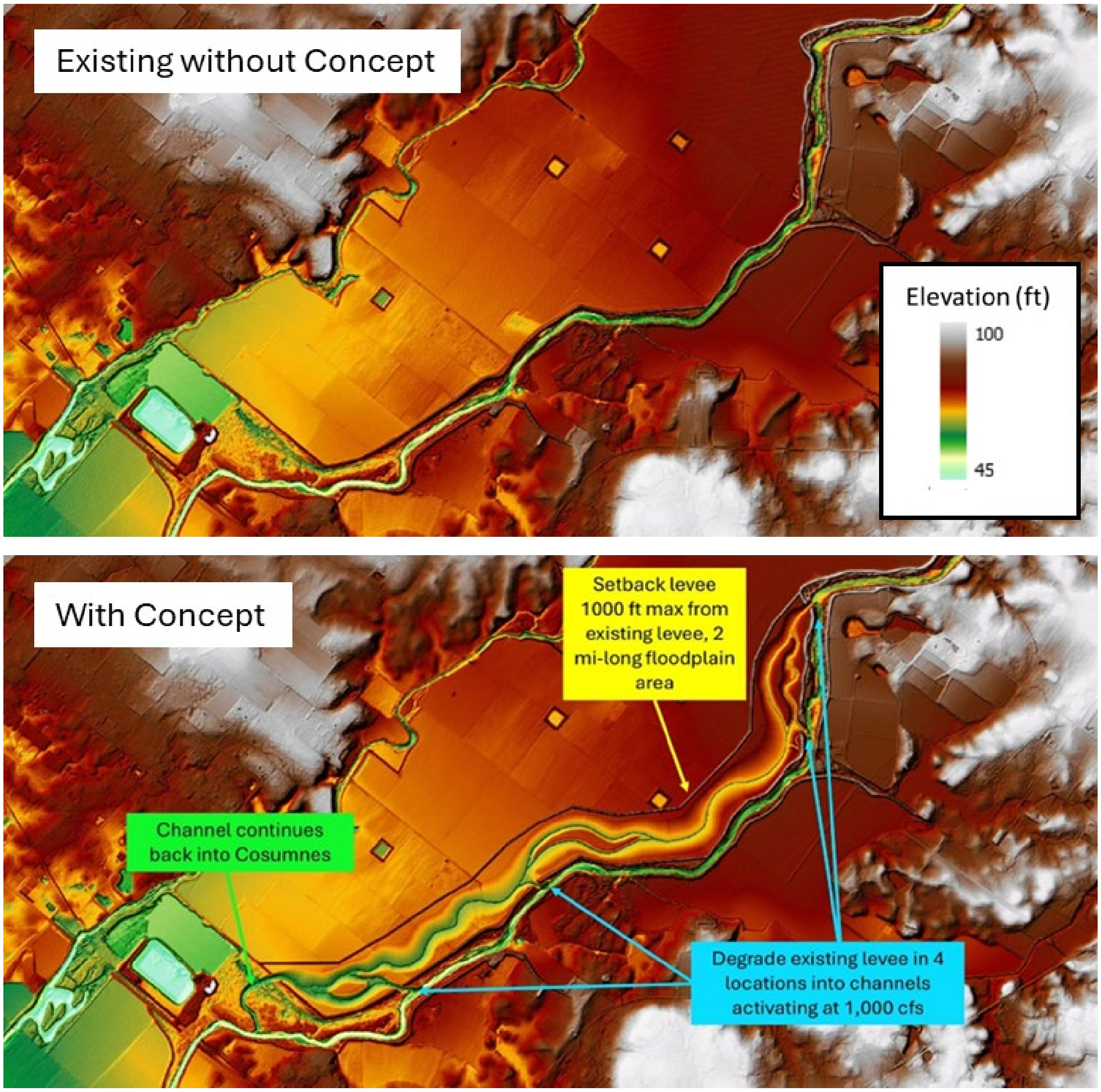


The conceptual levee setback was designed to provide the following:

- **Flood protection—**Conceptual design reduces WSEs and associated stress on the Cosumnes River levee system.
- **Groundwater recharge—**Conceptual design increases inundation duration through side channels that activate and remain inundated at lower flows.
- **Habitat—**Conceptual design increases fish rearing habitat through an additional side channel and improves riparian, shaded riverine aquatic (SRA), and other floodplain-dependent ecosystems.

Figure 7 shows area topography with and without the conceptual levee setback.

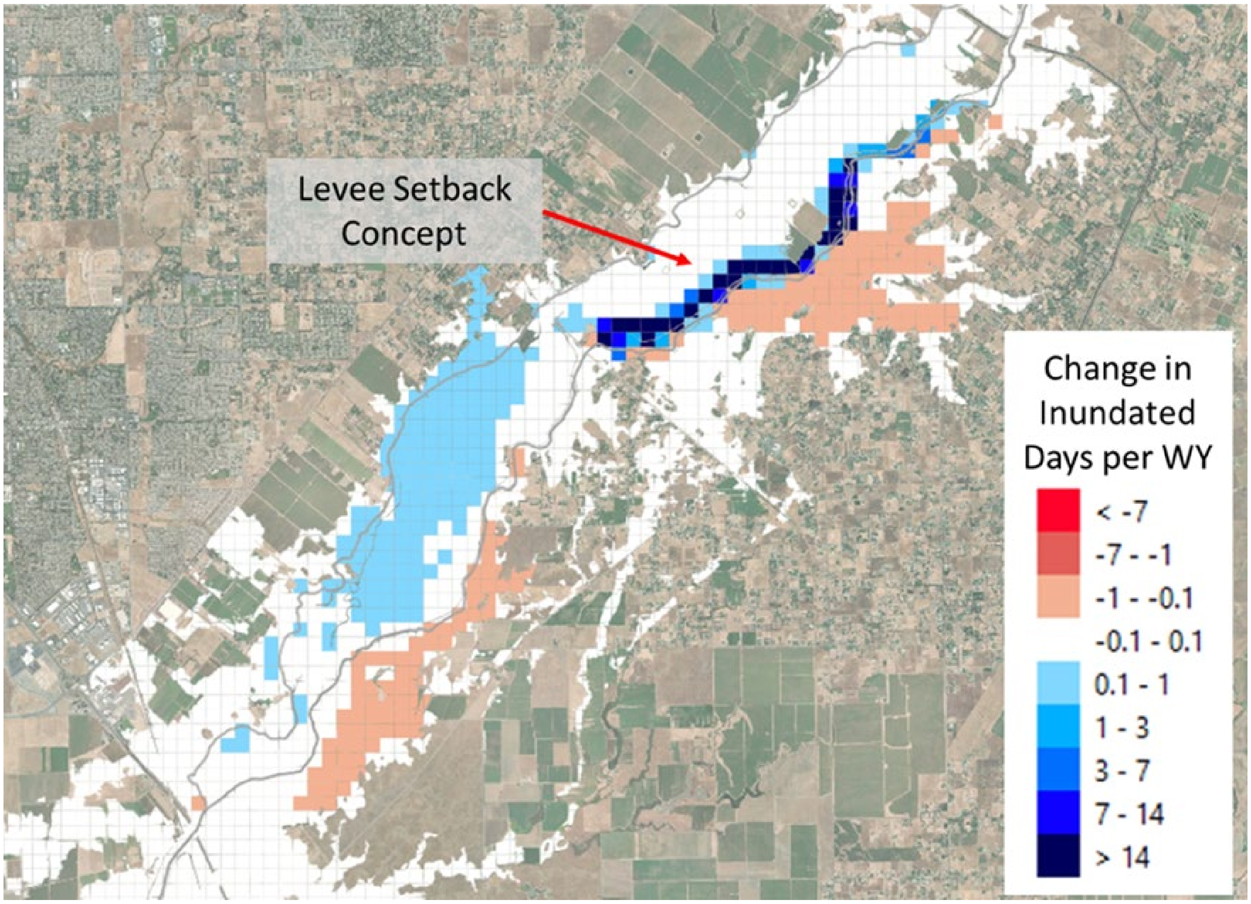
Figure 7. Topography With and Without Conceptual Levee Setback



5.1.1 Results

The conceptual levee setback design results in increased frequency and duration of floodplain inundation in the project area (Figure 8). This increased inundation provides new opportunities for flood risk reduction, groundwater recharge, and habitat. As expected, modeling for this concept showed inundation increased in the setback area and decreases in the levee-protected area south of the project area.

Figure 8. Change in Days with Floodplain Inundation per Water Year



5.1.2 Flood Risk

To evaluate the levee setback concept's flood risk reduction potential, with- and without-project conditions were evaluated for a 75,000 cfs flow on the Cosumnes River. Modeling results show the levee setback concept significantly reduced potential depth of flooding (Figure 9) and removed many structures from the potentially inundated area (Figure 10).

Figure 9. Change in Water Surface Elevation with Levee Setback Concept for Example Flood Event at 75,000 cfs

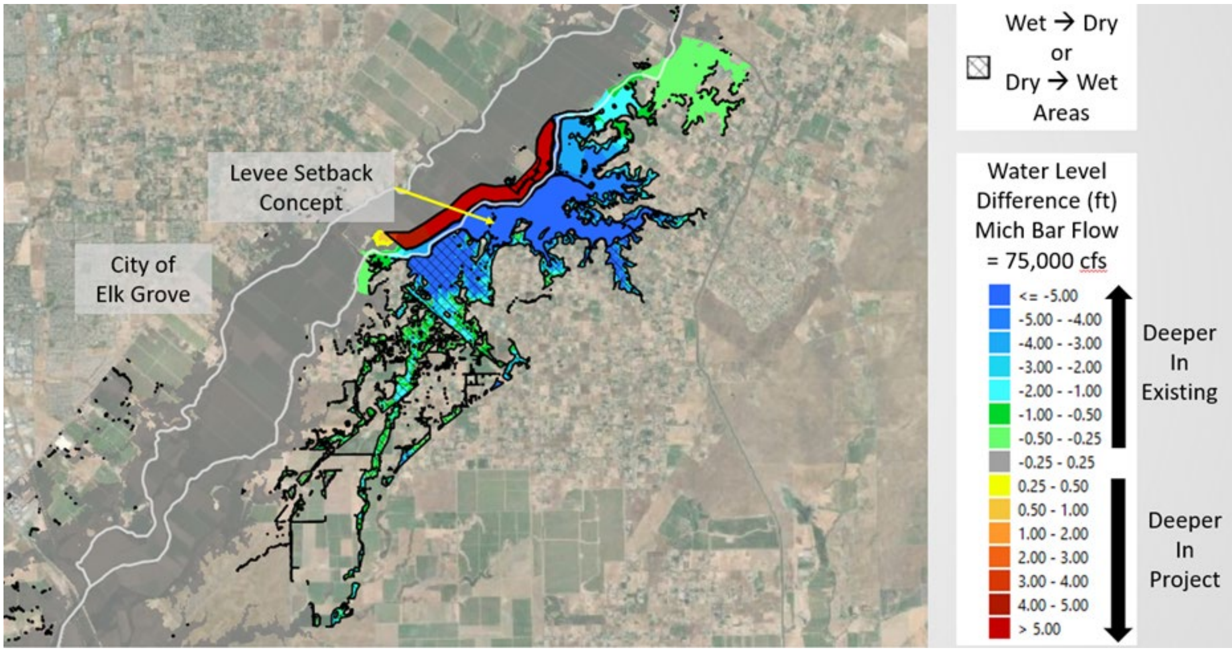
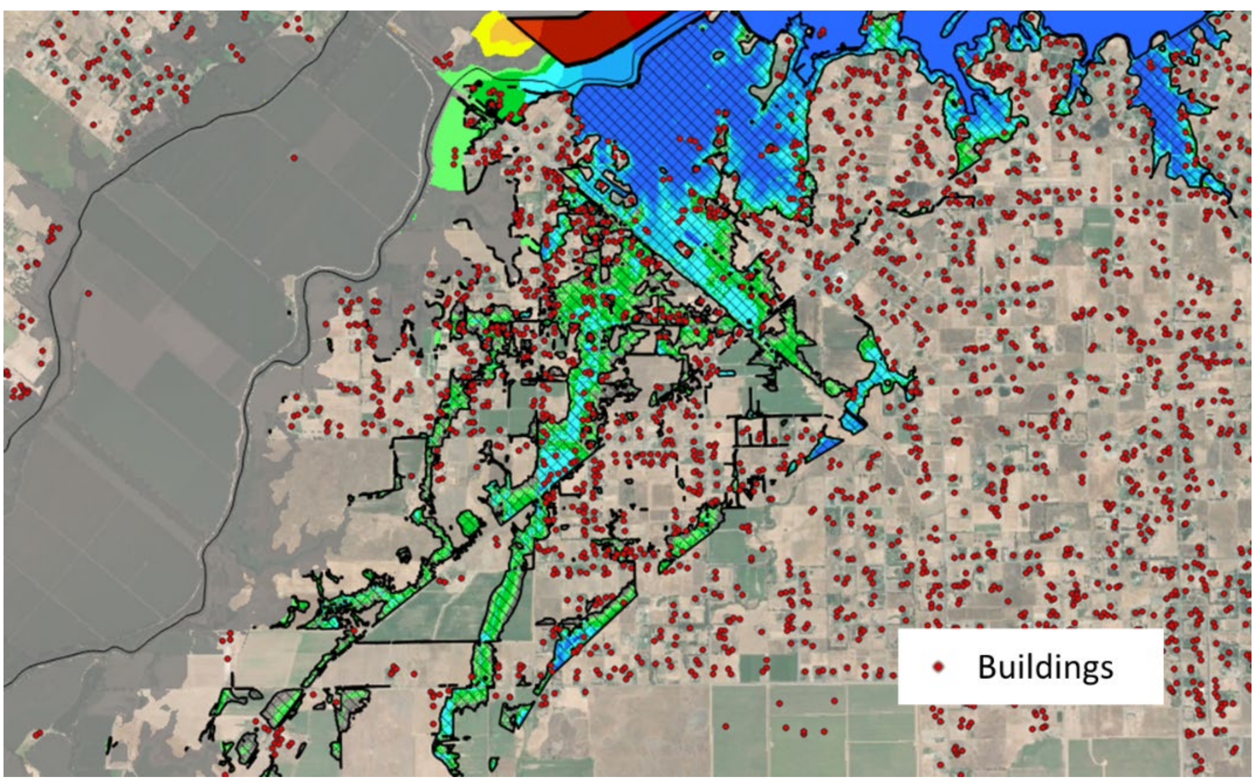


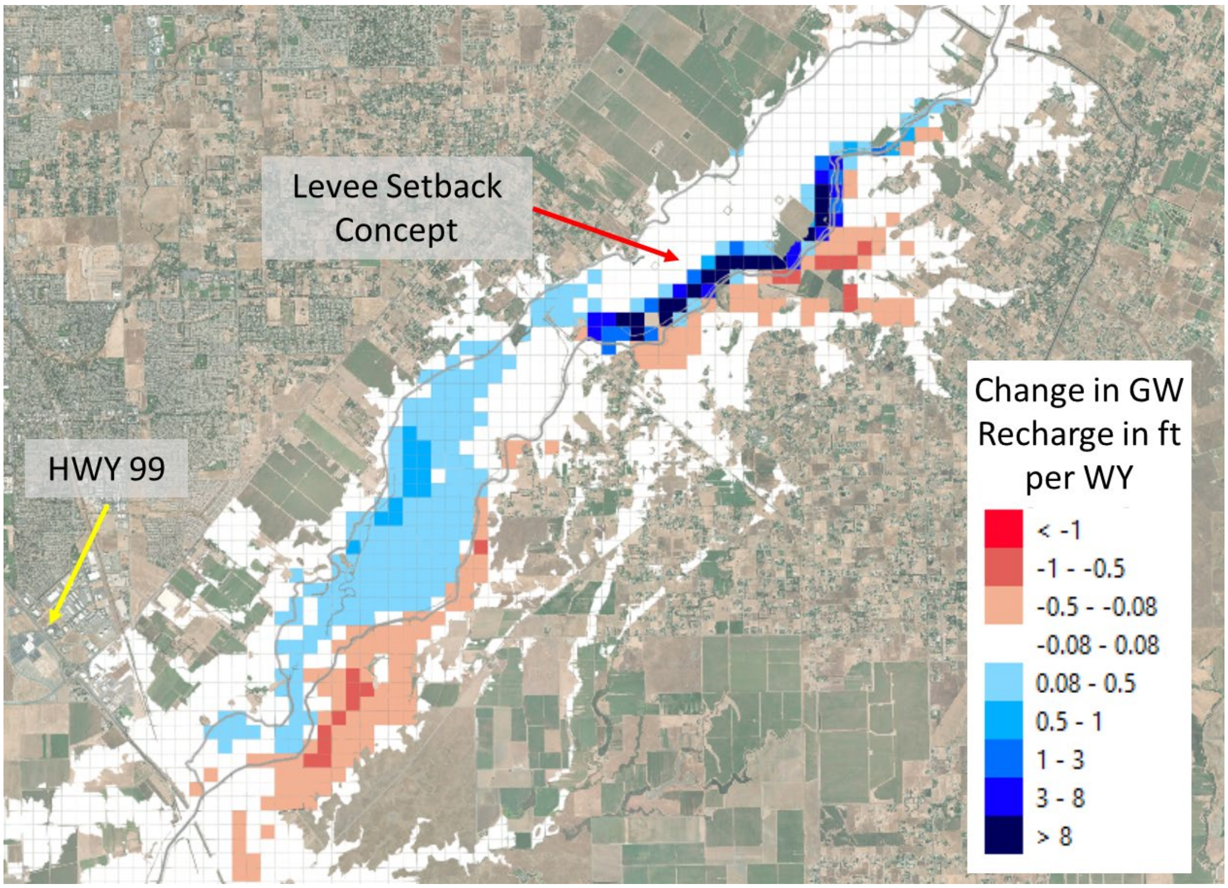
Figure 10. Structures Removed from Potentially Inundated Area with Levee Setback Concept when Cosumnes River is Flowing at 75,000 cfs



5.1.3 Groundwater Recharge

The levee setback concept would significantly increase groundwater recharge in the project area due to increased frequency of inundation. Figure 11 illustrates the anticipated change in groundwater recharge per water year due to the project concept.

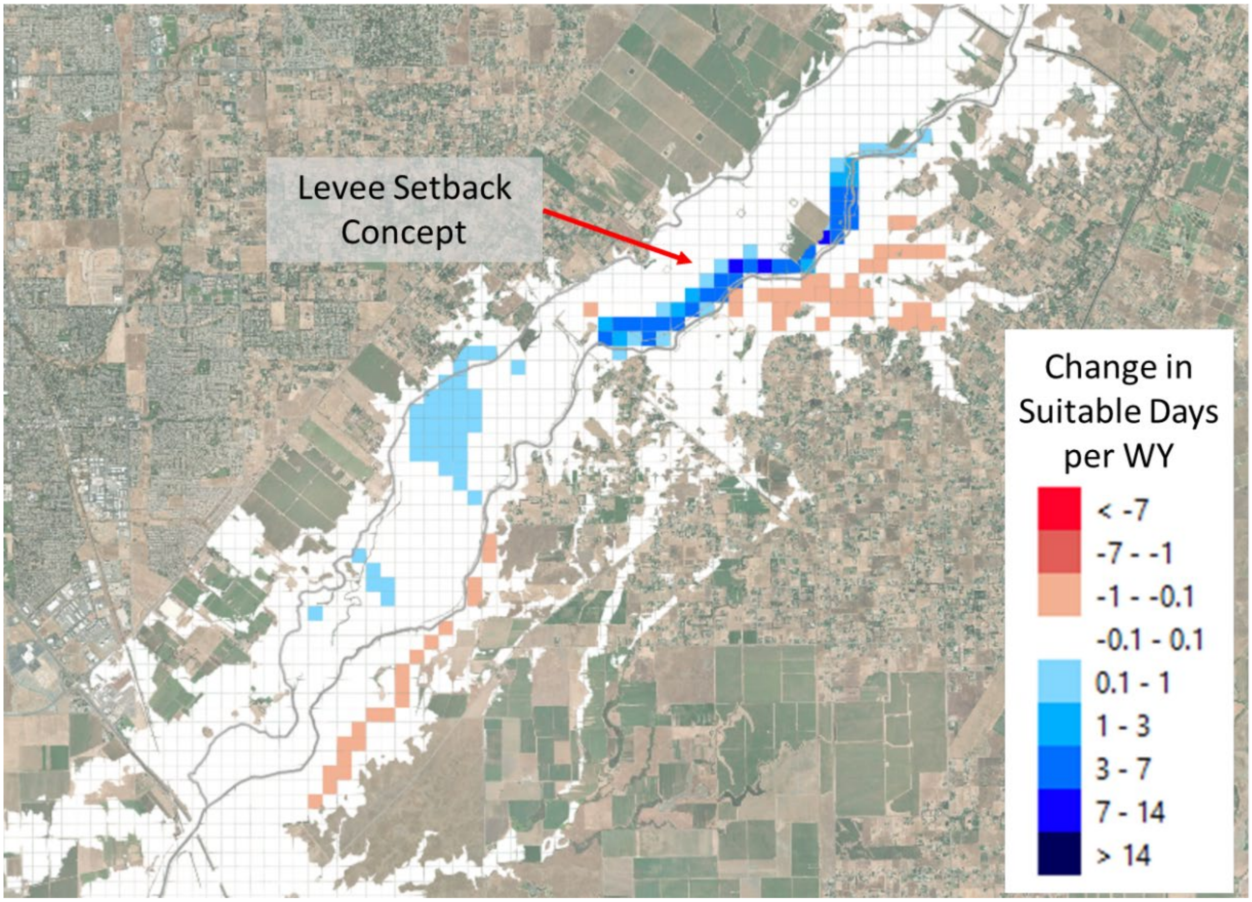
Figure 11. Anticipated Change in Groundwater Recharge per Water Year with Levee Setback Concept



5.1.4 Habitat Suitability

The levee setback concept could increase the number of days suitable for salmonid rearing in the project area due to increased frequency of floodplain inundation generating conditions needed for rearing. Figure 12 illustrates the anticipated change in suitable habitat days per water year if the conceptual project was in place.

Figure 12. Anticipated Change in Suitable Habitat Days per Water Year with Levee Setback Concept



5.2 Hanford Gravel Pit Concept

The Hanford gravel pit conceptual project consists of two low-elevation pits, with the lower of the two pits being completely inaccessible to Cosumnes River water except during extreme weather events. Figure 13 shows the conceptual pit location.

Figure 13. Conceptual Location of Hanford Gravel Pit between Cosumnes River and Deer Creek

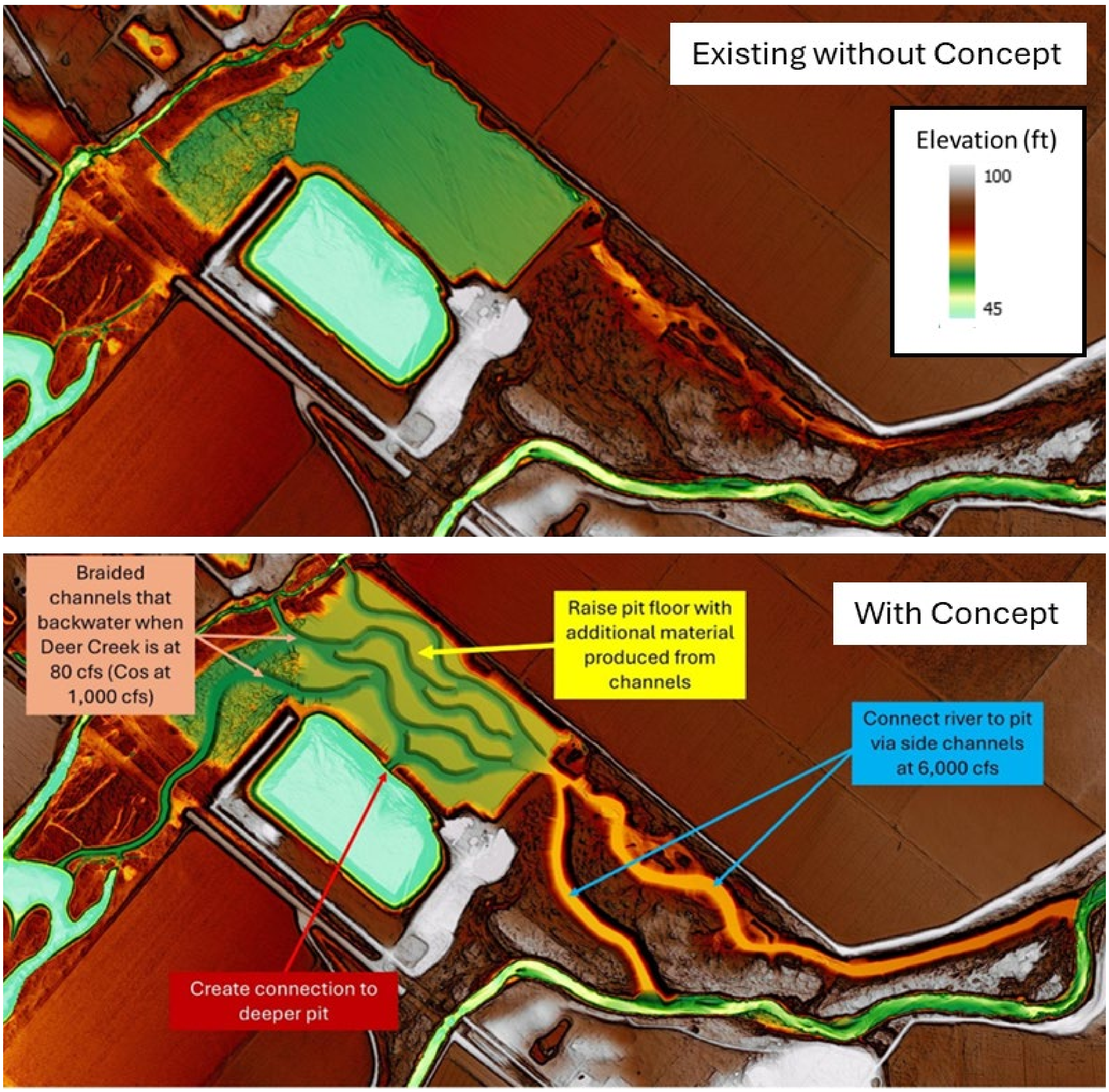
There are two unmanaged channels that activate from the Cosumnes River during extreme weather events, and there is a berm along the southeast edge of one of the pits that was breached in 2023. The concept design was developed with the goal of more frequently and intentionally inundating the channels and gravel pit. The Hanford gravel pit concept could provide the following:

- **Flood Risk Reduction—**Conceptual design diverts flows from Cosumnes River to Deer Creek during large floods, reducing stress on Cosumnes River levees.
- **Groundwater Recharge—**Conceptual design increases connectivity from the Cosumnes River through an enhanced side channel and floodplain, providing greater opportunities to store water on site for recharge.

- **Habitat—**Conceptual design provides braided floodplain habitat with increased connectivity to the Cosumnes River and riparian recruitment opportunities. Design would also improve riparian, SRA, and other floodplain-dependent ecosystems.

Figure 14 shows the area topography both with and without the Hanford gravel pit concept.

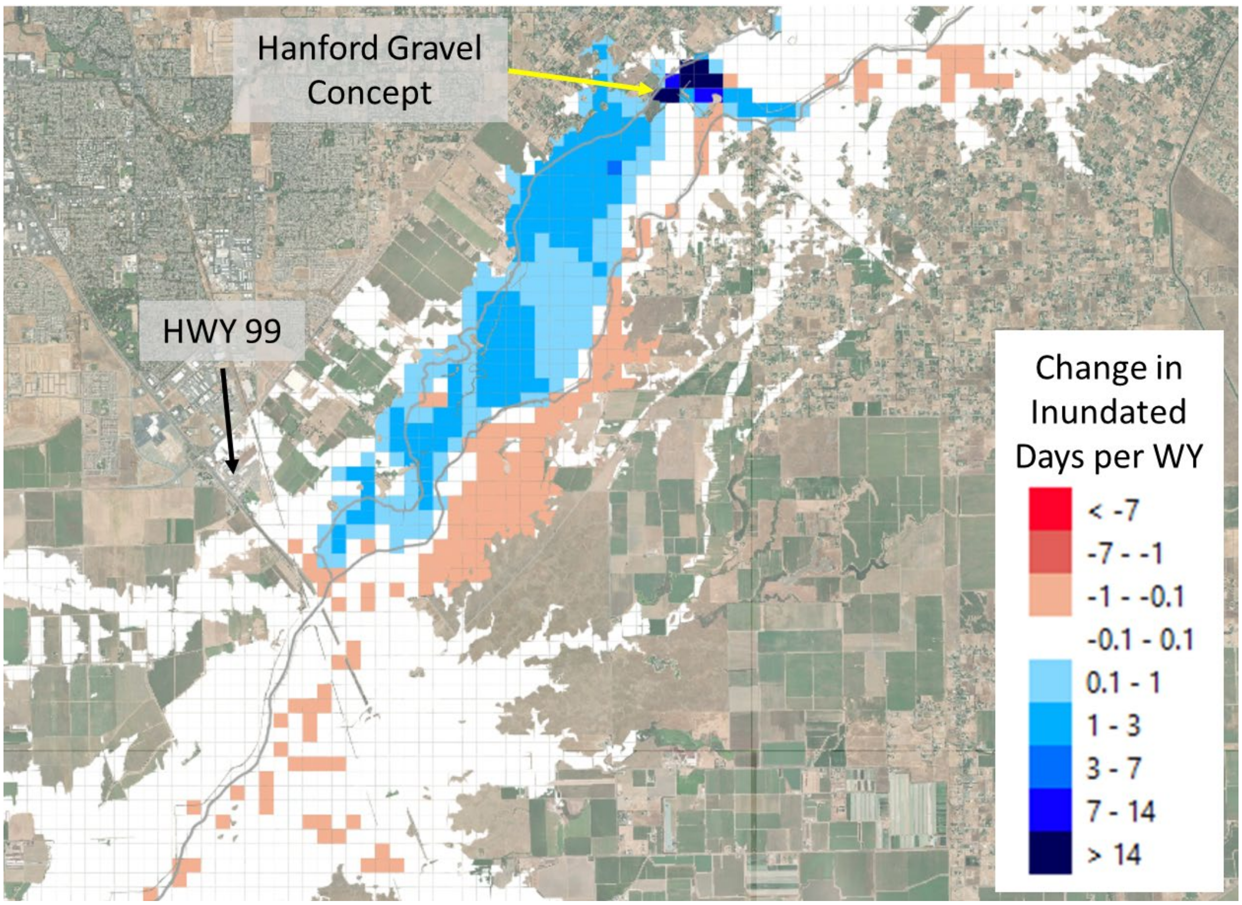
Figure 14. Topography With and Without Hanford Gravel Pit Concept



5.2.1 Results

Modeling shows that the Hanford gravel pit concept results in increased frequency and duration of floodplain inundation in the project area (Figure 15). This increased inundation would provide new opportunities for flood risk reduction, groundwater recharge, and habitat. As expected, inundation increased in the gravel pit area and downstream.

Figure 15. Change in Days with Floodplain Inundation per Water Year with Hanford Gravel Pit Concept



5.2.1.1 Flood Risk

To evaluate the Hanford gravel pit's potential for flood risk reduction, both with- and without-project conditions were evaluated for a 75,000 cfs flow on the Cosumnes River. Modeling results showed the Hanford gravel pit concept reduced potential depth of flooding by about 1 foot around the project area (Figure 16) and removed many structures from the potentially inundated area (Figure 17).

Figure 16. Change in Water Surface Elevation with Hanford Gravel Pit Concept for Example Flood Event of 75,000 cfs

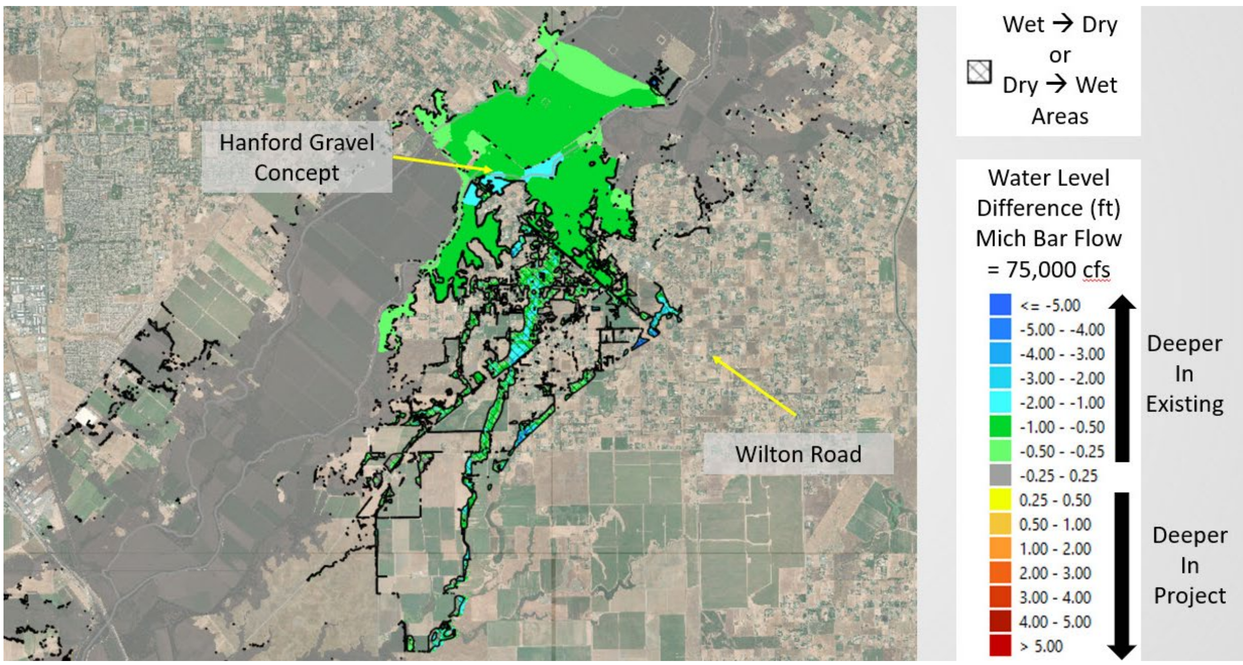
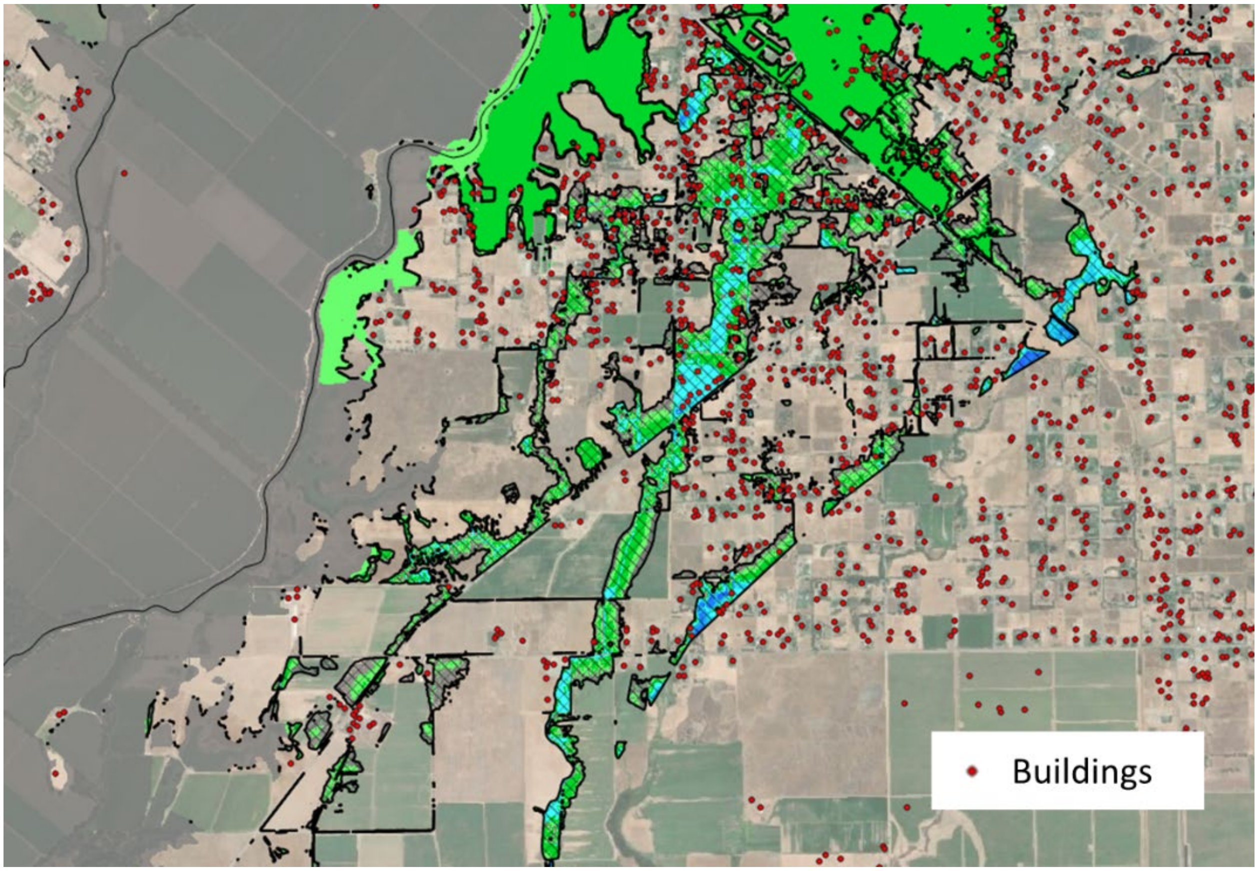


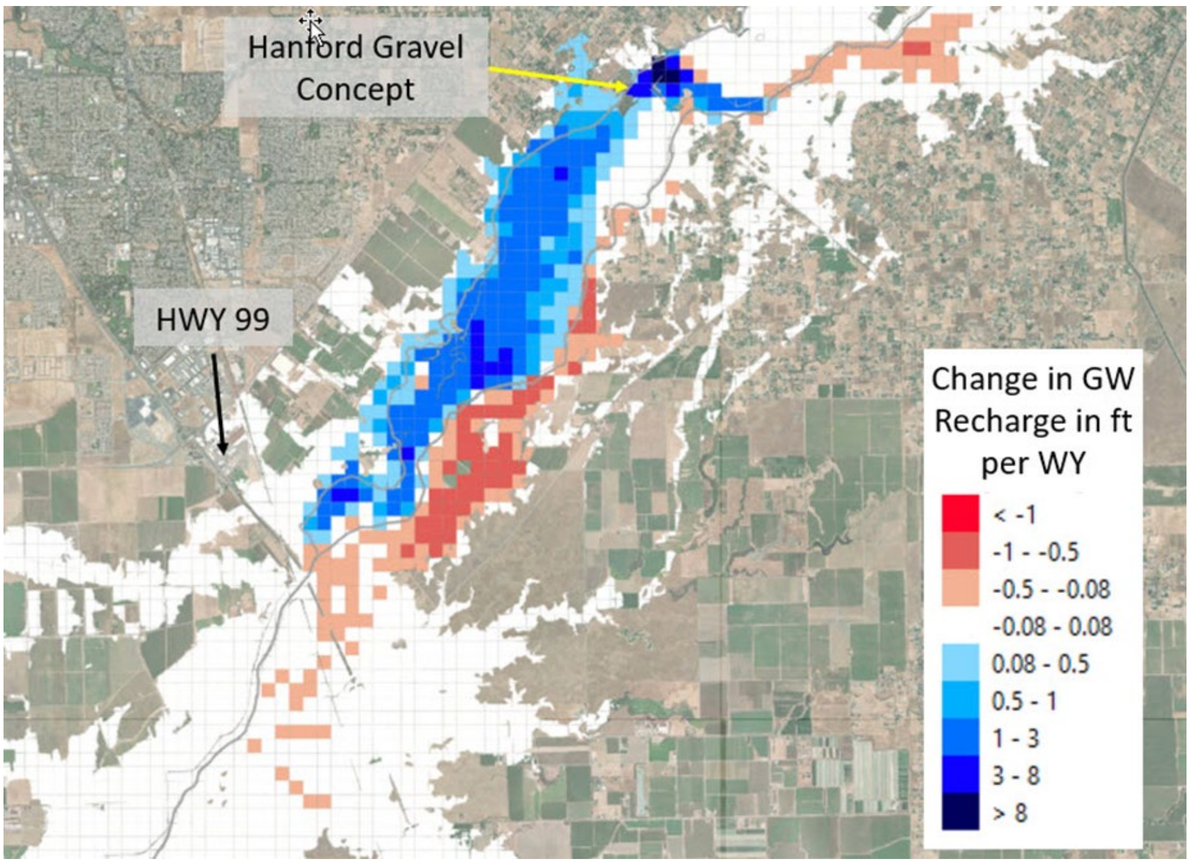
Figure 17. Structures Removed from Potentially Inundated Area with Hanford Gravel Pit Concept when Cosumnes River Flow is 75.000 cfs.



5.2.2 Groundwater Recharge

Modeling results show that the Hanford gravel pit concept would increase groundwater recharge in the project area due to increased frequency of inundation. Figure 18 illustrates the anticipated change in groundwater recharge per water year due to the project concept.

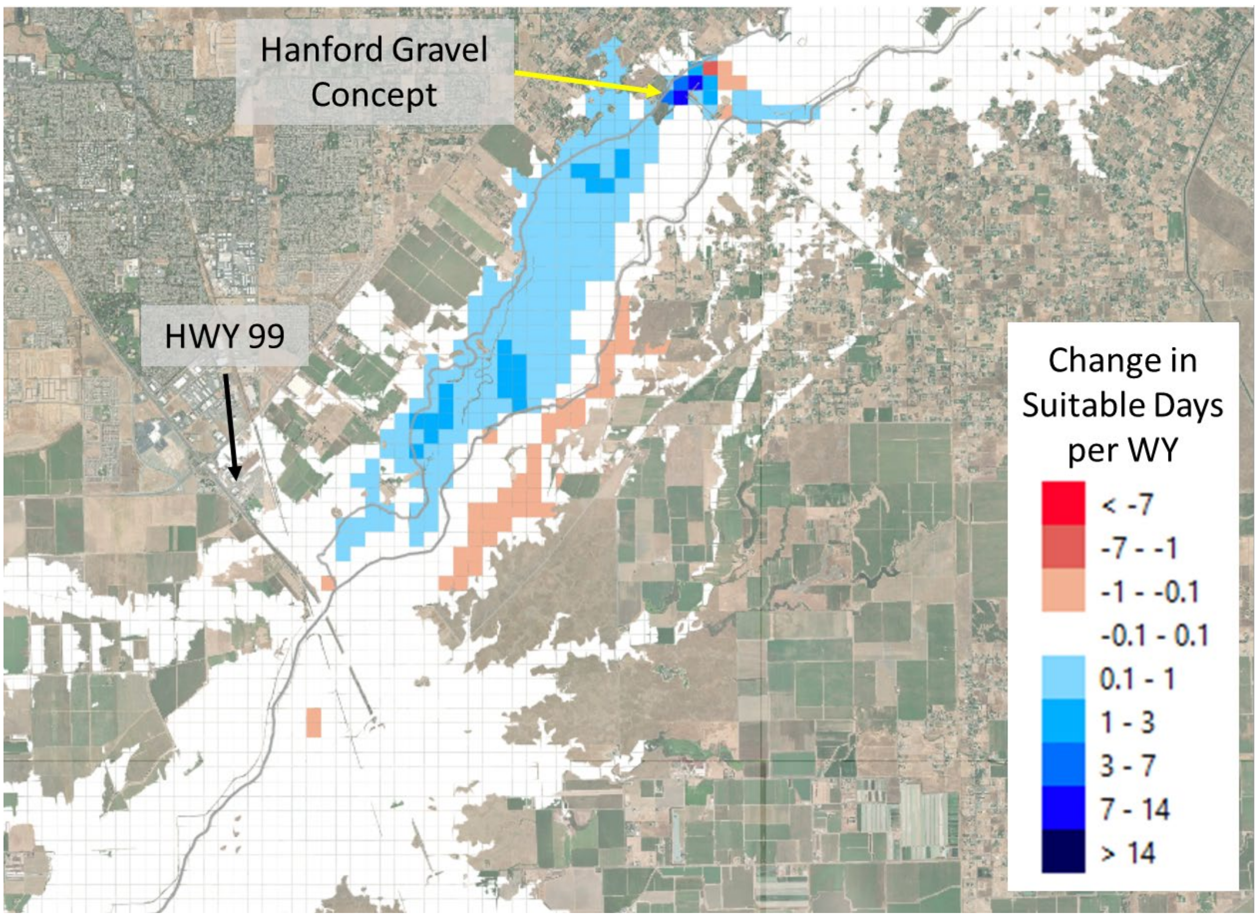
Figure 18. Change in Groundwater Recharge per Water Year with Hanford Gravel Pit Concept



5.2.3 Habitat Suitability

Modeling results show that the Hanford gravel pit concept would increase the number of days suitable for floodplain habitat with increased connectivity to the Cosumnes River and riparian recruitment opportunities in the project area due to increased frequency of floodplain inundation. Figure 19 illustrates the anticipated change in suitable habitat days per water year due to the project concept.

Figure 19. Change in Suitable Habitat Days per Water Year with Hanford Gravel Pit Concept



6. Further Groundwater Analysis Integration

This chapter describes additional analysis that was conducted for the study to integrate EcoFIP with an existing local groundwater model.

During analysis, the EcoFIP decision support toolset recharge rate is typically represented by the soil zone hydraulic conductivity until the unsaturated zone is filled. By adding aerial electromagnetic data and a groundwater model, the Cosumnes River Pilot Study offers further insight into site-specific and regional groundwater recharge conditions, leading to improved assumptions for groundwater recharge and a better understanding of benefits that individual concepts may provide.

For this study, enhanced groundwater data were incorporated into the EcoFIP toolset as follows:

- The Tier 2 analysis unsaturated recharge potential was represented by the minimum of hydrological soil group hydraulic conductivity and the hydraulic conductivity from the adding aerial electromagnetic data.
- The Tier 2 analysis saturated recharge potential was represented by the 30-day average recharge estimate following an approach previously applied in the basin (Maples at al. 2020). In this approach, a three-dimensional partial saturation flow model was applied with varying locations of recharge sites to develop a statistical relationship for predicting recharge rates based on the unsaturated zone conductivity and depth to groundwater.
- For Tier 3 analysis, the groundwater model helped to identify the impact of floodplain recharge on the system, with improved resolution of stream-aquifer exchanges, lateral groundwater flow, pumping, evapotranspiration, and more. As a result, conceptual designs could be simulated in the groundwater model using the extent and elevation of inundation to better quantify recharge benefits.

The existing groundwater model, a MODFLOW-NWT model, was adapted to use the WSE and inundated area output from the U.S. Army Corps of Engineers Hydrologic Engineering Center's River Analysis System (HEC-RAS) model for each concept to represent the change in river and floodplain inundation (U.S. Geological Survey 2022). The inundation data inform the surface water stage, the wetted area, and the saturated soil thickness applied to the surface boundary condition for each floodplain or river cell in MODFLOW-NWT. These adapted models were run for the period of available data (from 2000 to 2022) to evaluate impacts on the water budget locally and regionally, on groundwater levels, and on stream-aquifer exchange as compared to the existing grade scenario.

Results of groundwater modeling confirmed that recharge occurring with the project concepts (Section 5.1 and Section 5.2) increases groundwater storage and baseflow locally (i.e., near the project site) and lead to elevated groundwater levels (Photo 4).

Photo 4. Fields Flooded from Heavy Storms near the Cosumnes River in Wilton, California

Photo taken January 11, 2023. Photo Credit: DWR.

7. Climate Change Considerations

This chapter describes how flows on the Cosumnes River may change due to climate change.

Initially, a hydrologic model was developed to characterize the conversion of precipitation to streamflow in the Cosumnes watershed to represent future climate change scenarios. The hydrologic model simulated the timing and quantity of surface and groundwater based on elevation, land cover, soil, meteorological, and reservoir data inputs. This allowed for a representation of existing hydrologic conditions and provided an improved understanding of how streamflow, floodplain inundation, and other metrics assessed through EcoFIP analysis might change under a range of future conditions.

After the hydrologic model was developed, climate change scenarios were developed, leveraging DWR's *Climate Action Plan Phase 2: Climate Change Analysis Guidance* on the decision-scaling method, to stress test the Cosumnes system under a range of changes in temperature, average precipitation, and extreme precipitation (California Department of Water Resources 2018).

Current climate forecasts anticipate that temperatures will increase by roughly 2 degrees Celsius (°C) by 2050. Extreme precipitation is expected to increase alongside rising temperatures; however, specific trends in average precipitation are uncertain. To account for the uncertainty and variability in these considerations, 30 climate change scenarios were formulated that span the following ranges:

- Temperature: 0 to +5°C
- Average precipitation: -25% to +25%
- Extreme precipitation: 0%, +7%, and +14% per °C

Ultimately, projected changes in 2-year daily flows (Figure 20) and 100-year daily flows (Figure 21) for Cosumnes River indicate that flood risk is likely to increase as the climate continues to warm. For 2-year daily flows, median increases of just below 30% are noted for these locations. This means that the metrics associated with floodplain inundation are likely to increase under future conditions. Furthermore, 100-year daily flows indicate a median increase of 22% and 31% for the Cosumnes River at Michigan Bar and Deer Creek, respectively. These projected changes indicate that flood events are likely to worsen significantly under future conditions. Improvements to the existing flood management system and capitalizing on opportunities that promote beneficial floodplain inundation may help address these concerns.

Figure 20. Projected Changes in Daily 2-year Stream flows with Different Changes in Precipitation and Temperature

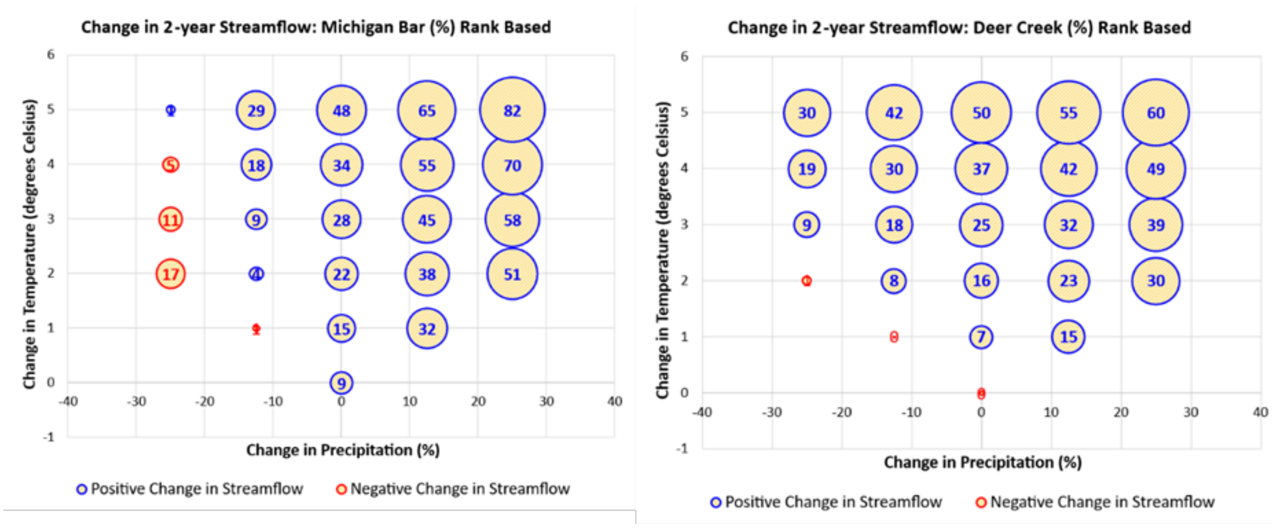
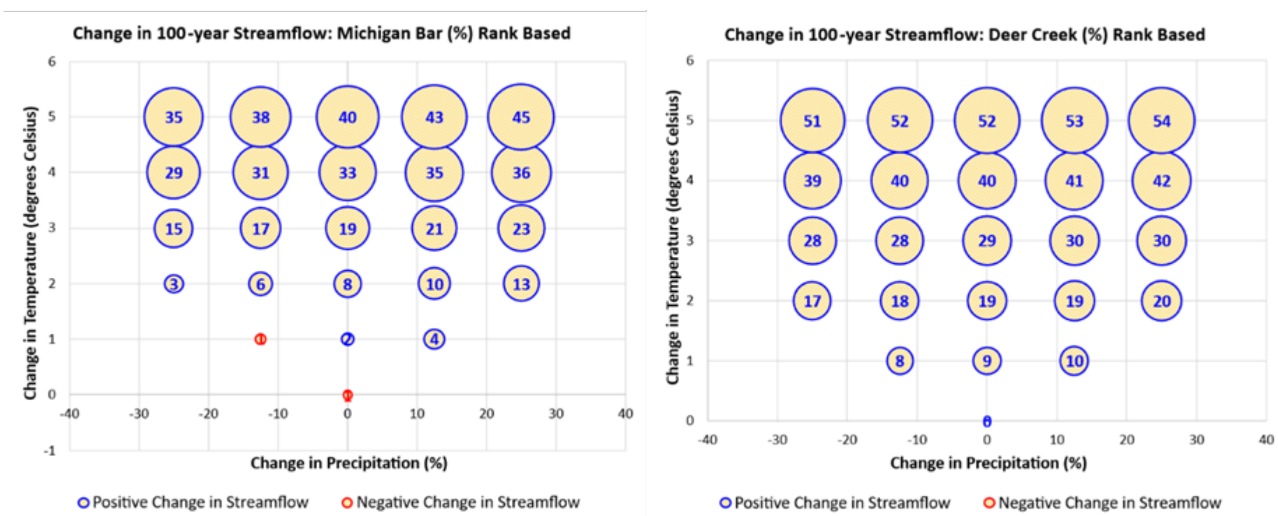


Figure 21. Projected Changes in Daily 100-year Stream Flows with Different Changes in Precipitation and Temperature



8. Path Forward

The EcoFIP analysis described in this Summary provides a process for developing and prioritizing multi-benefit projects that reduce flood risk and improve floodplain activation, ecological functions, and groundwater recharge on the Cosumnes River and Deer Creek. Subsequent efforts can build on this analysis and work toward project feasibility and implementation. Many local efforts are already using these study findings as follows:

- Sacramento County and the Omochumne-Hartnell Water District seek to leverage federal funding
- Sacramento County and the Cosumnes River Working Group are advancing multi-benefit concept development and implementation
- Omochumne-Hartnell Water District is expanding current on-farm recharge projects
- Wilton Rancheria is planning and implementing multi-benefit projects near the Hanford gravel pit site

Other next steps for this Cosumnes River Pilot Study could include the following:

- Evaluating of systemwide flood risk reduction benefits resulting from the multi-benefit concepts (Section 5.1 and Section 5.2)
- Developing feasibility studies for implementation of multi-benefit concept projects

Additional funding is needed to complete these analyses, but these are critical next steps for advancing and implementing multi-benefit projects in the Cosumnes watershed.

9. Helpful Web Links

California Department of Fish and Wildlife: Cosumnes River Ecological Preserve
https://wildlife.ca.gov/Lands/Places-to-Visit/Cosumnes-River-ER#:~:text=More%20than%20250%20bird%20species,and%20yellow%20and%20Wilson's%20warblers

Cosumnes River Preserve: About the Preserve
https://www.cosumnes.org/about-the-preserve/

Ecological Floodplain Inundation Potential (EcoFIP) decision support toolset:
https://storymaps.arcgis.com/stories/f899bf3c36a2403d9e0bd3c70dc2dfc5#n-KprdzB

Multi-benefit Floodplain Restoration Pilot Studies:
https://storymaps.arcgis.com/stories/f899bf3c36a2403d9e0bd3c70dc2dfc5

10. References

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Maples, Stephen R., Laura Foglia, Graham E. Fogg, and Reed M. Maxwell. 2020. "Sensitivity of hydrologic and geologic parameters on recharge processes in a highly heterogeneous, semi-confined aquifer system." *Hydrology and Earth System Sciences* 24(5):2438–2456. https://hess.copernicus.org/articles/24/2437/2020/

U.S. Geological Survey. 2022. Website: MODFLOW-NWT: A Newton Formulation for MODFLOW-2005. https://www.usgs.gov/software/modflow-nwt-a-newton-formulation-modflow-2005