

# Review Plan for the Sacramento River, Yolo Bypass System, CA, Comprehensive Study



Source: USFWS Photo/Steve Martarano

U.S. Army Corps of Engineers – Sacramento District  
September 2024



STATE OF CALIFORNIA  
**CENTRAL VALLEY**  
FLOOD PROTECTION BOARD



CALIFORNIA DEPARTMENT OF  
**WATER RESOURCES**



## Comprehensive Study of the Sacramento River, Yolo Bypass System, CA

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# Comprehensive Study of the Sacramento River, Yolo Bypass System, CA

## Review Plan

September 2024

### 1. Project Summary

**Project Name:** Comprehensive Study of the Sacramento River, Yolo Bypass System, CA (Yolo Bypass Comprehensive Study)

**Location:** Yolo and Solano Counties, CA

**P2 Number:** 499690

**Decision and Environmental Compliance Document Type:** Feasibility Report. The study will follow the National Environmental Policy Act (NEPA) process by beginning with an environmental assessment, but there is a risk that an environmental impact statement may be required.

**Congressional Authorization Required:** Yes

**Project Purpose(s):** Flood Risk Management, Ecosystem Restoration

**Non-Federal Sponsor:** The Non-Federal Sponsors (NFS) for this study include the Sacramento Area Flood Control Agency (SAFCA) and the State of California, represented by the Central Valley Flood Protection Board (CVFPB) and supported by the California Department of Water Resources (DWR).

### **Points of Public Contact for Questions/Comments on Review Plan:**

**District:** Sacramento District

**District Contact:** Project Manager: 916-557-7054, Planning Lead: 916-296-0119, Engineering Technical Lead: 916-557-5121

**Major Subordinate Command (MSC):** South Pacific Division

**MSC Contact:** District Support Team Lead: 916-557-5159

**Review Management Organization (RMO):** Flood Risk Management -Planning Center of Expertise (FRM-PCX) in coordination with the Ecosystem Restoration – Planning Center of Expertise (ECO-PCX)

**RMO Contact:** FRM-PCX Deputy Director: 415-503-6852

### **Key Review Plan Dates**

Date of RMO Endorsement of Review Plan	5 June 2024
Date of MSC Approval of Review Plan	Pending
Date of IEPR Exclusion Approval	N/A
Has the Review Plan changed since RMO Endorsement	
Date of Last Review Plan Revision	
Date of Review Plan Web Posting	Pending

**Feasibility Study Milestone Schedule and Other Dates\***

	<b>Scheduled</b>	<b>Actual</b>
<b>Feasibility Cost Share Agreement Execution</b>	<b>25 Sep 2023</b>	<b>25 Sep 2023</b>
<b>Alternatives Milestone</b>	<b>10 May 2024</b>	<b>10 May 2024</b>
<b>Vertical Team Alignment Memorandum (VTAM)</b>	<b>6 Jun 2024</b>	<b>23 June 2024</b>
<b>VTAM Addendum</b>	<b>N/A</b>	<b>31 July 2024</b>
<b>Tentatively Selected Plan</b>	<b>11 Dec 2026</b>	
<b>Release Draft Report to Public</b>	<b>23 Feb 2027</b>	
<b>Agency Decision Milestone</b>	<b>23 Aug 2027</b>	
<b>Final Report Transmittal</b>	<b>20 Oct 2028</b>	
<b>State &amp; Agency Briefing</b>	<b>19 Dec 2028</b>	
<b>Chief's Report</b>	<b>21 Mar 2029</b>	

\*Note: The provided schedule for feasibility study review is tentative and will be revised based on decisions made in the VTAM and approval of a waiver for additional time beyond 3 years.

*Note that the milestone and review schedules reported are approximations, and the actual schedules may change based on available funding and execution of project work. Schedules of future reviews and milestones may be up to one year delayed in comparison to the schedule reported in this review plan. If the schedule changes significantly, this review plan will be updated to represent the updated dates.*

## **2. References**

CECW-P Study Specific Guidance for the Yolo Bypass Comprehensive Study, California, 18 October 2023

Engineer Regulation 1165-2-217 – Water Resources Policies and Authorities – Civil Works Review Policy, 1 May 2021.

Engineer Circular 1105-2-412 – Planning – Assuring Quality of Planning Models, 31 March 2011.

Planning Bulletin 2013-02, Subject: Assuring Quality of Planning Models (EC 1105-2-412), 31 March 2013.

Office of Management and Budget, Final Information Quality Bulletin for Peer Review, Federal Register Vol. 70, No. 10, January 14, 2005, pp 2664-267

The online the U.S. Army Corps of Engineers' (USACE) Planning Community Toolbox provides more review reference information at:

<https://planning.erdc.dren.mil/toolbox/current.cfm?Title=Peer%20Review&ThisPage=Peer&Side=No>.

## **3. Review Execution Plan**

As documented in the Yolo Bypass Study Specific Guidance, the Yolo Bypass System Comprehensive Study will include two levels of investigation and recommendations:

a) Development of initial recommendations for authorization and implementation. This will result in a feasibility-level document; and

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b) Identification of future actions by USACE and by others for the comprehensive management of the Yolo Bypass System (for example, as potential in situ pilot studies, comprehensive management coordination plans, future feasibility studies, or funding for continual coordination). Future actions and recommendations will be captured in either a separate volume or a chapter of the feasibility document.

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The table provides the schedules and costs for the anticipated reviews. Teams will also determine whether a site visit will be needed to support each review. The decisions about site visits are documented in the table. As the review plan is updated the team will note each review that has been completed.

**Table 1: Schedule and Costs of Reviews**

Product to undergo Review	Review Level	Site Visit	Start Date	End Date	Cost	Complete
Tuflow Model and FLO2D Models	District Quality Control (DQC) of written justification to request approval for use	No	7/31/2024	8/8/2024	\$2,500	No
Tuflow Model and FLO2D Models	Approval for use by H&H Agency Technical Review (ATR) reviewer and HH&C CoP lead	No	8/12/2024	8/29/2024	\$5,000	No
HEC-EFM	DQC of written justification to request approval for use	No	7/31/2024	8/8/2024	\$2,500	No
HEC-EFM	Certification for use by the ECO-PCX	No	8/12/2024	4/30/2025	\$20,000	No
Habitat Suitability Index (HSI) Model – California Vole	Approval for use by ECO-PCX	No	8/12/2024	4/30/2025	\$20,000	No
Chinook Salmon Habitat Quantification Tool or Yolo Bypass Salmon Benefits Model	Approval for use by ECO-PCX	No	8/12/2024	12/31/2025	\$50,000	No
Ecosystem Hydraulic Model setup and FWOP results (Tuflow)	DQC	No	5/15/2026	6/15/2026	\$5,000	No
Ecosystem Hydraulic Model setup and FWOP results (Tuflow)	Targeted ATR	No	6/16/2026	7/15/2026	\$10,000	No
FWOP FRM modeling and Results: Hydraulic Modeling, LifeSim Model, Total Risk, FDA model	DQC	No	5/15/2026	6/15/2026	\$30,000	No

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Product to undergo Review	Review Level	Site Visit	Start Date	End Date	Cost	Complete
FWOP FRM modeling and Results: Hydraulic Modeling, LifeSim Model, Total Risk, FDA model	Targeted ATR	No	6/16/2026	7/15/2026	\$25,000	No
Habitat modeling setup and FWOP results	District Quality Control (DQC)	No	5/15/2026	6/15/2026	\$10,000	No
Habitat modeling setup and FWOP results	Targeted ATR	No	6/16/2026	7/15/2026	\$10,000	No
Draft Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	DQC	No	1/11/2027	2/9/2027	\$65,000	No
Draft Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	ATR	No	2/23/2027	4/20/2027	\$80,000	No
Draft Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	IEPR	No	2/23/2027	5/25/2027	\$180,000 <sup>1</sup>	No
Draft Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	Policy and Legal Compliance Review	No	2/23/2027	4/20/2027	N/A	No
Final Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	DQC	No	4/3/2028	5/1/2028	\$30,000	No
Final Feasibility (includes Comprehensive Management Plan) Report and NEPA/CEQA	ATR	No	5/31/2028	7/26/2028	\$40,000	No

<sup>1</sup> IEPR Cost includes an estimated \$150,000 in contract cost at 100% federal expense. Additional \$30,000 for FRM-PCX and Institute for Water Resources (IWR) to scope and execute the contract, cost shared 50% federal/ 50% nonfederal.

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Product to undergo Review	Review Level	Site Visit	Start Date	End Date	Cost	Complete
Final Feasibility Report and NEPA/CEQA	Policy and Legal Compliance Review	No	10/23/2028	12/22/2028	N/A	No



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Table 2 identifies the specific expertise and role required for the members of each review team. The table identifies the technical disciplines and expertise required for members of review teams. In most cases the team members will be senior professionals in their respective fields. In general, the technical disciplines identified for a DQC team will be needed for an ATR team. **Each ATR team member will be certified to conduct ATR by their community of practice.** The table is set up to concisely identify common types of expertise that may be applicable to one or more of the reviews needed for a study.

**Table 2: Review Teams - Disciplines and Expertise**

Discipline / Role	Expertise	DQC	ATR	IEPR
DQC Team Lead	Extensive experience preparing Civil Works decision documents and leading DQC. The lead may serve as a DQC reviewer for a specific discipline (planning, economics, environmental, etc.).	Yes	No	No
ATR Team Lead	Professional with extensive experience preparing Civil Works decision documents and conducting ATR. Skills to manage a virtual team through an ATR. The lead may serve on the ATR team for a specific discipline (such as planning, economics, or environmental work).	No	Yes	No
IEPR Manager	Planner with extensive knowledge of IEPR policy and procedures and contract management and oversight skills.	No	No	Yes
Planning	Skilled water resources planner knowledgeable in complex planning investigations, multipurpose studies (expertise with primary purposes of flood risk management and aquatic ecosystem restoration required; experience with secondary purposes/benefit categories of recreation and water supply preferred), and the application of USACE SMART (Specific, Measurable, Attainable, Risk Informed, Timely) Planning principles to problem solving.	Yes	Yes	No
Economics	Experience with applying theory, methods and tools used in the economic evaluation of flood risk management water resources projects.	Yes	Yes	Yes
Life Safety	Experience with applying theory, methods and tools used in the life safety evaluation of flood risk management water resources projects.	Yes	Yes	Yes
Environmental Resources	Experience with environmental evaluation and compliance requirements, national environmental laws and statutes, applicable Executive Orders, other planning requirements, and aquatic ecosystem restoration. Multiple reviewers may be required based on review capabilities/expertise for each model.	Yes	Yes	Yes
Fisheries	Experience in fish biology and restoration	Yes	Yes	No

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Discipline / Role	Expertise	DQC	ATR	IEPR
Cultural Resources	Experience with cultural resource survey methods, area of potential effects, National Historic Preservation Act Section 106, and state and federal laws pertaining to American Indian Tribes.	Yes	Yes	No
Hydrology	Engineer with experience applying hydrologic principles and technical tools to project planning, design, construction, and operation.	Yes	Yes	Yes
Hydraulic Engineering	Engineer with experience applying hydraulic engineering principles and analytic tools, including sediment transport/geomorphology, to project planning, design, construction, and operation.	Yes	Yes	Yes
Cost Engineering	Experience using cost estimation software; working knowledge of water resource project construction; capable of making professional determinations using experience.	Yes	Yes	No
Civil Design	Experience in the design of and plans for various ecosystem restoration features and flood risk management features including structural, non-structural and nature-based.	Yes	Yes	Yes
Levee Safety	Expertise in levee safety analysis to ensure consistent and appropriate analysis and identification of associated risks and project performance analysis.	Yes	Yes	Yes
Geotechnical Engineering	The reviewer should have recent experience in the USACE design requirements. This person should also have experience in investigating existing subsurface conditions and materials; determining their physical/mechanical and chemical properties that are relevant to the project considered, assessing risks posed by site conditions; designing earthworks and structure foundations; and monitoring site conditions, earthwork and foundation construction. To the extent available, the reviewer should have experience with seismic considerations.	Yes	Yes	Yes
Landscape Architecture	Reviewer should be licensed senior level landscape architect with experience in ecosystem, re-vegetation, and wetland/creek restoration large scale/system wide projects	Yes	Yes	No
Geographic Information Systems	Experience in Geographic Information Systems including geographic data calculations supporting the study * ATR for this discipline is not necessary	Yes	No*	No
Hazardous, Toxic and Radioactive Waste (HTRW)	Experience in HTRW with a focus on natural occurring mercury. *ATR not necessary because study will not propose HTRW remediation.	Yes	No*	No

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Discipline / Role	Expertise	DQC	ATR	IEPR
Operations	Experience in operation of existing and proposed features within the study area. *ATR for this discipline is not necessary in the feasibility stage since designs are conceptual and subject to minor changes based upon final engineering designs during PED.	Yes	No*	No
Construction	Experience in construction of existing and proposed features within the study area. *ATR for this discipline is not necessary in the feasibility stage since designs are conceptual and subject to minor changes based upon final engineering designs during PED.	Yes	No*	No
Structural Engineering	Experience in the design of structures such as reinforced concrete hydraulic structures, bridges and hydraulic control gates.	Yes	Yes	No
Real Estate	Experience with developing Real Estate Plans is critical for this study. Also, experience in real estate fee/easement acquisition, residential/business relocations, and facility and utility relocations for Civil Works Federally Cost Shared projects is essential.	Yes	Yes	No
Climate Preparedness and Resilience	A member of the Climate Preparedness and Resiliency Community of Practice knowledgeable of inland hydrology and coastal hydraulics related climate change assessment policy and practice, including sea level change analysis.	Yes	Yes	Yes
Risk and Uncertainty	Expertise in multi-discipline flood risk analysis to ensure consistent and appropriate identification, analysis, and written communication of risk and uncertainty.	Yes	Yes	No

#### **4. Documentation of Reviews**

**Documentation of DQC.** Quality Control will be performed continuously. A specific certification of DQC completion will be prepared at the base conditions (existing and future), draft and final report stages. Documentation of DQC will follow the District Quality Control Manual and the MSC Quality Management Plan. DrChecks will be used for documentation of DQC comments. An example DQC Certification statement is provided in ER 1165-2-217, Appendix D. Documentation of completed DQC, to include the DQC checklist, will be provided to the MSC, RMO and the ATR Team leader. The ATR team will examine DQC records and comment in the ATR report on the adequacy of the DQC effort.

**Documentation of ATR.** DrChecks will be used to document all ATR comments, responses, and resolutions. Comments should be limited to those needed to ensure product adequacy. All members of the ATR team will use the four-part comment structure (see ER 1165-2-217, Section 5). If a concern cannot be resolved by the ATR team and PDT, it will be elevated to the vertical team to resolve using the issue resolution process in ER 1165-2-217, Section 5.9. Unresolved concerns will be closed in DrChecks by noting the concern has been elevated. ATR documentation will include an assessment by the ATR team of the effectiveness of DQC. The ATR Lead will prepare a Statement of Technical Review (see ER 1165-2-217, Section 5.11, and Appendix D), for the draft and final reports, certifying that review issues have been resolved or elevated. ATR will be certified when all concerns are resolved or referred to the vertical team and the ATR documentation is complete.

**Documentation of IEPR.** The Outside Eligible Organization will submit a final Review Report no later than 60 days after the end of the draft report public comment period. USACE shall consider all recommendations in the final Review Report and prepare a written response for all recommendations. The final decision document will summarize the Review Report and USACE response and will be posted on the internet.

**Documentation of Model Review.** Planning models require compliance with EC 1105-2-412. Models developed by the Corps of Engineers are certified and models developed by others are approved. Certifications or approvals may be specific to a single study, a regional application or for nationwide application. Completion of a model review is documented in a memorandum from the Director of a Planning Center of Expertise and should accompany reporting packages for study decisions.

#### **5. Supporting Information**

**Study Background.** The Yolo Bypass System is located in northern California, west of the City of Sacramento, and is a feature of the Sacramento River Flood Control Project, which was authorized for construction in Section 2 of the Flood Control Act of March 1917 (chapter 144). The Sacramento River Basin is California's largest, key watershed, and it is integral to a water system that serves the most populous state in the Nation and the fifth-largest economy in the

world. The basin also encompasses the City of Sacramento, a critical metropolitan area with one of the highest residual flood risks in the Nation.

For more than a century, federal, state, and local governments and stakeholders have worked continuously to develop water resource management solutions, particularly regarding flooding, to protect life and property in the region. Local interests constructed levees in the area for flood protection as early as the 1860s with Congress later authorizing construction of the Sacramento River Flood Control Project as a flood risk management feature. Residential communities, industry, commercial business, and agriculture has thrived in the region ever since. However, management of the shared water resources in the Yolo Bypass vicinity across these multiple water users present critical challenges requiring a comprehensive approach to meet the present and future needs.

Climate change is forecast to result in increasingly dramatic swings between catastrophic flooding and mega droughts within the Sacramento River Basin. While formulating for the primary purposes of flood risk management and aquatic ecosystem restoration, this comprehensive study seeks to understand the water resources problems within the Yolo Bypass vicinity and recommend opportunities to solve them in a wholistic manner to provide benefits under the project categories of flood risk management, ecosystem restoration, recreation, and water supply.

**Study Authority.** The Comprehensive Study was authorized in Section 209 of the Water Resources Development Act of 2020, included in Part 2, Division AA of the Consolidated Appropriations Act of 2021 (Pub. L. No. 116-260, Part 2 Div. AA, §209, 134 Stat. 2615, 2681-2682 (2020)) which states:

*“The Secretary shall conduct a comprehensive study of the Sacramento River in the vicinity of the Yolo Bypass System, California, to identify actions to be undertaken by the Secretary for the comprehensive management of the Yolo Bypass System for the purposes of flood risk management, ecosystem restoration, water supply, hydropower, and recreation.”*

*“In conducting the comprehensive study under subsection (a), the Secretary may develop a recommendation to Congress for-- (A) the construction of a water resources development project; (B) the structural or operational modification of an existing water resources development project; (C) additional monitoring of, or adaptive management measures to carry out with respect to, existing water resources development projects, to respond to changing hydrologic and climatic conditions; or (D) geographic areas within the Yolo Bypass System for additional study by the Secretary.”*

**Study Area.** The Yolo Bypass is a 40-mile-long federal flood management project situated between the Fremont Weir in the north and the Sacramento-San Joaquin Delta in the south. The Yolo Bypass plays a critical role in protecting the region from flooding and is also central to a significant agricultural economy, a critical water supply delivery system, and an ecosystem of national significance. Levees are along the entire eastern extent of the bypass, and along the

northern portion of the western extent (see Figure 2). The southern bypass on the western side is delineated by high ground.

The Yolo Bypass System is operated and maintained by local levee and reclamation districts and the California Department of Water Resources (DWR). These maintenance activities are inspected and monitored by DWR, USACE, and the Central Valley Flood Protection Board (CVFPB) to ensure compliance with federal and state regulations. It conveys flood flows from the Sacramento River by allowing flood flow to enter the bypass through the Fremont and Sacramento Weirs, flooding existing lands currently in agriculture, and public and private wetlands. Upstream of the Yolo Bypass, Sacramento River Basin watershed flows are managed through multiple reservoirs, gates, weirs, and bypasses.



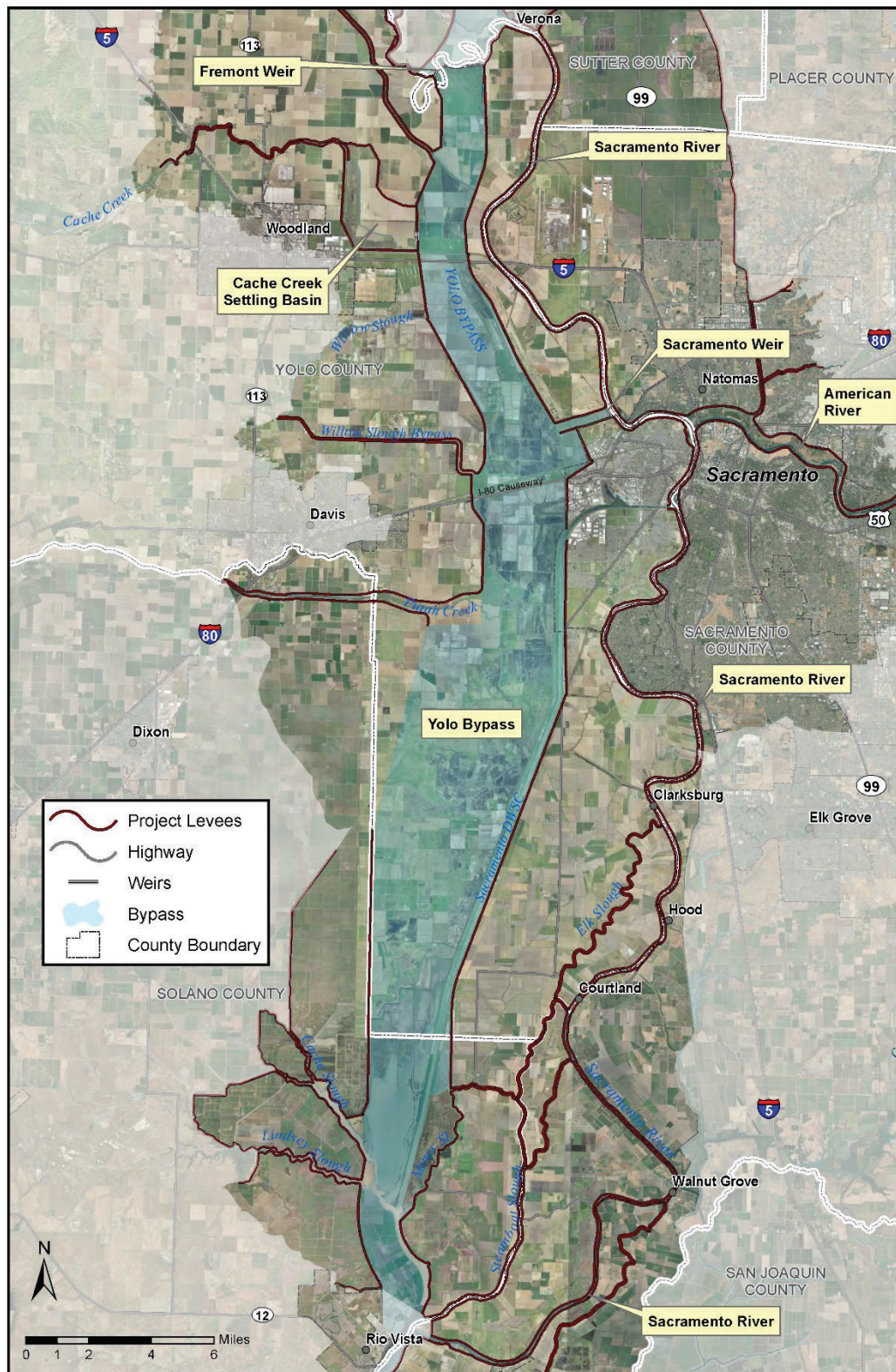
## Study Area Maps

Figure 1 – Sacramento River Watershed Map





Figure 2 – Study Area Map



Datum: NAD 83  
 Projection: CA (Teale) Albers  
 Units: Feet  
 Date Saved: 9/6/2024

# YOLO BYPASS AND VICINITY Sacramento River Flood Control System





**Problems.** The problems, or existing undesirable conditions, identified within the study area are based on information gathered from past reports, related studies underway within the vicinity, and from study scoping efforts. The separable problems identified for this study include the following:

- A risk of flooding threatens public safety, property, and critical infrastructure throughout the study area with significant consequences, including Sacramento and West Sacramento.
- Impaired natural hydro-geomorphic processes and land-use changes have removed, fragmented, degraded native aquatic, wetland, and riparian habitats, reducing their function and value, and the abundance, distribution, and diversity of native species.
- Restricted fish passage along the bypass system greatly reduces accessibility of native fish (including salmonid) habitat and causes stranding.
- Means of entry constrained for Tribes to access culturally important land.
- Drought threatens municipal and agricultural water supply reliability.
- Naturally occurring methylmercury enters the Yolo Bypass and contributes to water-quality problems in the Delta.
- Lack of shaded riparian vegetation increases water temperatures in waterways of the Yolo Bypass and creates poor water quality conditions for freshwater habitat.

Problems that may be best addressed in Comprehensive Management of Yolo Bypass include:

- Lack of funding is increasing deferred maintenance of features.
- Challenges completing regulatory applications disrupts operation and maintenance of features.
- Increasing demands on the bypass challenges long-term sustainability for multiple purposes.
- The bypass has evolved to serve more uses but not in a comprehensive way.

**Opportunities.** The opportunities, or future desirable conditions, include:

- Improve socio-economic conditions through FRM improvements in the study area.
- Improve riparian and aquatic habitats and ecosystem functions in conjunction with FRM features.
- Integrate with other Tribal, Federal, State, and local initiatives.

- Enhance public awareness about residual flood risk and improve preparedness.
- Include associated multi-benefit features such as recreation access opportunities, water quality improvements, and water supply resiliency.
- Create native plant palettes that reflect plants that were traditional to tribal ancestral territories.

Opportunities that may be best addressed in Comprehensive Management Plan:

- Collaborate with local, State, Tribes, and Federal agencies to develop streamlined regulatory permitting pathways to support operations and maintenance activities.
- Synchronize divergent strategies for the bypass for sustainable system management.

**Objectives.** The planning objectives represent desired positive changes in the study area in the future with project conditions. Each of the planning objectives apply to the study area for a 50-year period of analysis. The following planning objectives identified for this study include:

**Objective 1:** Reduce flood risks to life safety, property, and critical infrastructure within the Yolo Bypass vicinity.

**Objective 2:** Restore ecological functions of riparian and wetland habitats to a less degraded state within the Yolo Bypass, prioritizing incorporation of native and culturally significant vegetation to the maximum extent practicable.

**Objective 3:** Enhance fish ecology by improving access to floodplain habitat and reducing stranding in the Yolo Bypass.

**Objective 5:** Increase sustainability and resiliency of the FRM System and its associated agricultural, riverine, and floodplain habitat within the Yolo Bypass.

**Objective 6:** Improve quality of recreation/education opportunities within the Yolo Bypass.

**Constraints.** The following constraints were identified for this study:

- Cannot cause unacceptable and unmitigable impacts to ESA listed species.
- Federal cost share cannot be applied to AER features for existing mitigation requirements.
- Comply with applicable Federal laws, policies, and regulations.

**Future Without Project Conditions.** Current and future flood risk within the study area is likely to pose a threat to human life. Flood risk in the upper reaches of the Yolo Bypass area is related to the capacity of the existing system to manage flood events from inundating high consequence urban areas and related to levee performance associated with through and under seepage, levee erosion, levee stability, levee overtopping and encroachment of the levees. Climate change is expected to increase flood risk and the impacts of flooding within the study area. Environmental resources are expected to continue to be stressed due to development and FRM in the study area. Changes in flood frequency due to climate change may impact the ability to accurately predict when floodplains are active (i.e. inundated) in order to design effective aquatic habitat restoration sites. Riparian vegetation is dependent upon the elevation of the local water table and inundation frequency. Additionally, available public land or willing landowners for ecosystem restoration sites may be limited within the study area, creating challenges to identify viable ER locations.

**Types of Measures/Alternatives Being Considered.** This study will develop an array of alternatives formulated to meet the study objectives using a feasibility-level approach. The feasibility-level approach will formulate alternative plans that focus on priority purposes of flood risk management and aquatic ecosystem restoration and may enhance or optimize for secondary purposes identified by the non-Federal sponsors, the Yolo Bypass-Cache Slough Partnership, in the study authority, and documented in the study specific guidance. Measures and alternatives not included in the feasibility-level plan formulation process may be recommended for follow-on or future-phased feasibility studies or for incorporation into the comprehensive-level recommendations.

Alternatives may include measures such as setback levees, nature-based elements, structure raising, wetlands protection and restoration through a variety of means such as changes to soil hydrology, vegetation plantings, increasing floodplain connectivity, and creating opportunities for improved fish passage.

**Estimated Cost/Range of Costs.** Costs of alternatives are unknown at this time but given the size of the area and problem complexity, costs are anticipated to potentially total over \$200 million for the recommended plan.

## **6. Models to be Used in the Study**

EC 1105-2-412 mandates the use of certified or approved models for all planning activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. Planning models are any models and analytical tools used to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision making. In compliance with CECW-P Memorandum Subject: Model Coordination for Civil Works Planning Studies dated 28 July 2023, the district has assessed the experience and capability of the PDT

members running the certified and approved models and determined the discipline lead for each model has the necessary expertise and experience appropriate for the level of the study. The district has also assessed that the DQC reviewers have the experience and capability necessary to perform quality reviews for each model identified.

Model certification is generally required to be renewed at least every 7 years. It is likely that certification of many of the models to be used in this study will be re-evaluated during course of this study. The PDT will coordinate with the associated Planning Center of Expertise to confirm that all models used are certified. If any of the models is not recertified, the PDT will coordinate with the PCX for potential one-time-model use approval or will evaluate whether a different model is more appropriate for use. Should any additional models be used for this study, this review plan will be updated to document their use and approval status.

The following planning models may be used to develop the decision document:

**Table 3: Planning Models**

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Certification / Approval</b>
HEC-FDA 2.0	Flood Damage Reduction Analysis (HEC-FDA) software developed by USACE Hydrologic Engineering Center (CEIWR-HEC) provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of flood risk management plans. Per coordination with the vertical team and the FRM-PCX, version 2.0 will be used for this study, pending certification. Using version 2.0 from the beginning will allow consistent economic damage modeling throughout the study and will avoid the possibility of having to convert versions during the study process which will likely impact budget and schedule.	TBD – Certification expected by early FY2025  It is anticipated that FDA 2.0 will be certified prior to the use in the study and, if not, the PDT will work with the FRM-PCX to justify and document any decision prior to use FDA 2.0 prior to certification.

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Certification / Approval</b>
Risk Management Center (RMC)-TotalRisk	TotalRisk is a quantitative risk analysis software used to enhance and expedite risk assessments within the Flood Risk Management, Planning, and Dam and Levee Safety communities of practice. It performs risk analysis from user defined hazard, system response, and consequence functions. It can generate various aspects of risk including Total, Incremental, Failure, Non-Failure, and Background.	TBD – Certification expected by early FY2025
RECONS 2.0	Regional Economic System (RECONS) is a USACE-certified regional economic modeling tool. It is designed to provide estimates of regional economic impacts and contributions associated with Corps projects, programs, and infrastructure. Regional economic impacts and contributions are measured as economic output, jobs, income, and value added.	Recertified September 2019
RMC-LifeSim 2.0	RMC-LifeSim is a USACE certified software designed to help study teams better understand the consequences of a flood event. RMC-LifeSim is a spatially distributed, dynamic simulation system for estimating potential life loss and economic damages from flood hazards. RMC-LifeSim will be used to evaluate the life safety risk to the study without project and determine incremental risk for structural components of selected plan.	Certified 2021
CAFRE 2.1	California Agricultural Flood Risk Estimation (CAFRE) is an agricultural flood damage estimation model for the greater California Central Valley.	Regional Certification May 2020

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Certification / Approval</b>
IWR -Planning Suite 2.0.9	This software assists with the formulation and comparison of alternative plans, including Cost Effectiveness/Incremental Cost Analysis. IWR-Planning Suite can assist with plan formulation by combining solutions to planning problems and calculating the additive effects of each combination, or "plan." The software can assist with plan comparison by conducting cost effectiveness and incremental cost analyses, identifying the plans which are the best financial investments and displaying the effects of each on a range of decision variables. This software is anticipated to be utilized to develop the National Ecosystem Restoration plan.	Certified May 2018
HSI – Black Shouldered Kite	The black shouldered kite HSI is used as part of the habitat evaluation procedures (HEP) methodology to calculate habitat value. The black shouldered kite HSI will be used to model and evaluate grassland habitat.	Approved for Regional Use, 2018
HSI – Red-Winged Blackbird	The Red-Winged Blackbird HSI is used as part of the HEP methodology to calculate habitat value. The Red-Winged Blackbird HSI will be used to model and evaluate tidally influenced estuarine and palustrine wetland habitats at the southern extent of the study area.	Approved for Regional Use, 2018
HSI – Great Blue Heron	The Great Blue Heron HSI is used as part of the HEP methodology to calculate habitat value. The Great Blue Heron HSI will be used to model and evaluate freshwater wetland habitats including lacustrine, riverine, estuarine, and palustrine wetlands.	Approved for Regional Use, 2018

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Certification / Approval</b>
HSI – Riparian Songbird	The riparian songbird HSI is used as part of the HEP methodology to calculate habitat value. The riparian songbird HSI will be used to model and evaluate riparian shrub and shaded riverine aquatic habitat.	Approved for Regional Use, 2023
HSI – Riparian Forest	The riparian forest HSI is used as part of the HEP methodology to calculate habitat value. This HSI will be used to model and evaluate riparian forest and shaded riverine aquatic habitat.	Approved for Regional Use, 2023
HSI – Northern Pintail (Gulf Coast Wintering)	The Northern Pintail HSI is used as part of the HEP methodology to calculate habitat value. The Northern Pintail HSI will be used to model and evaluate flooded agriculture habitat.	Approved for Regional Use, 2018
HSI – California Vole	The California Vole HSI is used as part of the HEP methodology to calculate habitat value. The California Vole HSI will be used to model and evaluate fallowed agriculture habitat.	Model not certified, model requires review and approval by ECO-PCX; expected January 2026
Net Emissions Analysis Tool (NEAT)	The NEAT tool is used to determine impacts to air quality based on emissions from construction equipment for NEPA/CEQA analysis, determination of carbon sequestration benefits from habitat enhancement projects, and calculate the Social Costs of Greenhouse Gas to support the environmental justice analysis component.	Certified for National Use, 2023

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Certification / Approval</b>
Fish Habitat and Assessment Simulation Tool (FHA <sup>1</sup> )	FHA is used to assess between pre and post habitat conditions for riverine life stages of anadromous fish for actions including adverse impact and habitat restorations (enhancements). The model is applicable to Chinook, steelhead, and green sturgeon in sections and tributaries of the Sacramento River.	Certified by ECO-PCX for regional use within the Sacramento and San Joaquin River watershed on March 20, 2024.
Chinook Salmon Habitat Quantification Tool <sup>1</sup>	The Chinook salmon Habitat Quantification Tool draws from restoration research and practice to establish a science-based framework for quantifying floodplain habitat for rearing juvenile Chinook salmon. The tool was developed by the San Francisco Estuary Institute, American Rivers, UC Berkeley, and Stillwater Sciences	Model not certified, model requires review and approval by ECO-PCX; expected January 2026.
Yolo Bypass Salmon Benefits Model <sup>1</sup>	The Yolo Bypass Salmon Benefits Model simulates and tracks key stages of Chinook salmon life history. It was developed for the Yolo Bypass Salmonid Habitat Restoration and Fish Passage.	Model not certified, model requires review and approval by ECO-PCX; expected January 2026.
HEC-EFM	The Ecosystem Functions Model (HEC-EFM) is used to determine ecosystem responses to changes in the flow regime of a river or connected wetland. HEC-EFM uses HSI model output in concert with HEC flow data to calculate and display existing ecologic conditions, identify potential restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem.	Certification expired 2022; based on coordination with HEC and by ECO-PCX, PDT is pursuing one-time use model recertification to conclude in January 2025. HEC-EFM recertified by ECO-PCX on August 21, 2024.

<sup>1</sup>Only one of these two models will be used by the study. Model certification will only be pursued for the final selected model. An additional model is needed to quantify benefits to salmonids from flooded agricultural land. The FHA model does not currently work for floodplain habitats, so an additional model is needed for the study.



EC 1105-2-412 does not cover engineering models used in planning. The responsible use of well-known and proven USACE developed and commercial engineering software will continue. The professional practice of documenting the application of the software and modeling results will be followed. The USACE Scientific and Engineering Technology Initiative has identified many engineering models as preferred or acceptable for use in studies. These models should be used when appropriate. For example, HH&C models need to comply with the requirements of HH&C CoP Enterprise Standard 08101. Models that are not HH&C CoP preferred will undergo the approval process described in HH&C CoP Enterprise Standard 08101 which will involve early ATR involvement.

These engineering models may be used to develop the decision document:

**Table 4: Engineering Models**

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Approval Status</b>
HEC- RAS 6.3.1 or greater if released.	The HEC's River Analysis System (RAS) is a hydraulic model that will be used to evaluate the water surface elevation and velocity of water within the river and floodplain for the feasibility study area. This information will be used to assess potential future damages and likely benefits of the final array of alternatives in order to compare and select an alternative.	USACE HH&C CoP preferred model
Tuflow	Tuflow is a hydraulic model software package that is used to simulate open channel hydraulics. An existing Tuflow model of the complex network of irrigation channels within the yolo bypass may be used to support evaluation of fish passage for frequent flow events. This model would not be used to evaluate flood conditions for flood risk assessments.	USACE HH&C CoP allowed for use.

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Approval Status</b>
FLO2D	FLO2D is a hydraulic model software package that is used to simulate 1D and 2D open channel hydraulics. The model was utilized to simulate levee breaches for HEC-FDA models and LifeSim models used for the State of California's Central Valley Flood Protection Plan. The Yolo Bypass study will use existing simulations, new simulations will not be conducted using FLO2D for the study.	USACE HH&C CoP allowed for use.
HEC-HMS 4.10 or greater if released.	A HEC-HMS (hydrologic) model was previously developed to determine rainfall-runoff for ungauged portions of the Sacramento River Basin. The model was used in the Central Valley Hydrology Study (CVHS) conducted by the State of California and USACE which received a DQC and ATR certificate under the 2018 interim study. This model will be used to develop hydrology for a 0.1% AEP event.	USACE H&H CoP preferred model
Abbreviated Risk Analysis, Cost Schedule Risk Analysis	Cost risk analyses identify the amount of contingency that must be added to a project cost estimate and define the high-risk drivers. The analyses will include a narrative identifying the risks or uncertainties. During the alternatives evaluation, the District will assist the cost engineer in defining confidence/risk levels associated with the project features within the abbreviated risk analysis. For the Class 3 estimate, an evaluation of risks will be performed using Crystal Ball Cost Schedule Risk Analysis for construction costs over \$40 M or the Abbreviated Risk Analysis for projects under \$40 M.	Civil Works Cost Engineering Mandatory Center of Expertise (MCX)

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Approval Status</b>
MII	MII is the second generation of the Micro-Computer Aided Cost Estimating System. It is a detailed cost estimating software application.	Cost Engineering Approved
Crystal Ball	This model will be used to account for risk and uncertainty of alternatives and the recommended plan.	Enterprise
GeoStudio 2021.4 (11.3.0.23668)	The integrated GeoStudio software is a software product for geotechnical modeling & analysis. GeoStudio analyzes both simple and complex slope stability problems for a variety of slip surface shapes, pore-water pressure conditions, soil properties, and loading conditions as well as simulates groundwater flow in porous media under saturated and unsaturated transient hydraulic conditions. Finally, GeoStudio provides finite element software capabilities for modelling stress and deformation in soil and structures ranging from simple linear elastic simulations to soil-structure interaction problems with nonlinear material models.	Standard of practice.

<b>Model Name and Version</b>	<b>Brief Model Description and How It Will Be Used in the Study</b>	<b>Approval Status</b>
HEC-ResSim v. 3.2	The model includes a representation of the physical features and operational rules of the reservoir system. Physical features include the capacity of the reservoirs and outlets to store and release water. Given a set of inflows and initial conditions, the model simulates reservoir operation and routes releases through the defined channel network. This model was used in the Central Valley Hydrology Study (CVHS) conducted by the State of California and USACE which received a DQC and ATR certificate under the 2018 interim study. This model will be used to develop hydrology for a 0.1% AEP event.	USACE H&H CoP preferred model
IPAST v. 2.2.0.16	IPAST processes modeled HEC-ResSim and HEC-RAS data and creates unregulated flow (volume) frequency curves and unregulated-to-regulated flow transforms. IPAST will be used to update the unregulated-to-regulated transform to include additional existing condition design flood water surface profiles.	USACE H&H CoP allowed for SPK projects. Written justification for use in the Yolo Comprehensive study will be prepared and undergo ATR in accordance with HH&C CoP Enterprise Standard 08101.

## 7. Factors Affecting Level and Scope of Review

All planning products are subject to the conduct and completion of District Quality Control and Agency Technical Review. A smaller sub-set of products may be subject to Independent External Peer Review and/or Safety Assurance Review. Information in this section helps in the scoping of reviews through the considerations of various potential risks.

### Objectives of the Reviews

The objective of the reviews is to perform a critical analysis of the intended outcome of alternative plans with particular attention to key technical considerations, associated risks likely to be encountered during the study and/or in later phases of the project, and to ensure compliance with all applicable policies, guidance, and laws. The FRM-PCX will be asked to facilitate conducting the Agency Technical Reviews.

### Assessing the Need for IEPR

#### Mandatory IEPR Triggers

- Has the Chief of Engineers determined the project is controversial? **No**
- Has the Governor of an affected state requested an IEPR? **No**
- Is the cost of the project more than \$200 million? **To be determined, but likely.**

#### Discretionary IEPR

- Has the head of another Federal agency requested an IEPR? **No**

#### Potential IEPR Exclusion

- Is the project cost greater than \$200 million? **To be determined, but likely;** and
- Does the project have an Environmental Impact Statement? **To be determined.**

### Assessing Other Risk Considerations

- Will the study likely be challenging? If so, describe how? **Yes, the study seeks to balance multiple, competing uses of land and waterways within the Yolo Bypass vicinity.**
- Provide a preliminary assessment of where the project risks are likely to occur and assess the magnitude of those risks. **Potential project risks include:**
  - Lack of landowners willing to sell real estate needed for aquatic ecosystem restoration (AER) portions of the project could delay construction due to re-design or reformulation. The NFS can only use condemnation to acquire real estate for compensatory mitigation if there are no other options available. Condemnation is not an option for real estate needed for AER. Failure to acquire real estate would lead to re-designs and could impact the benefit-cost ratio of the project from increased real estate and design costs. (High risk schedule impact)
  - Use of existing Tule Canal aquatic ecosystem restoration designs could lead to study delays (e.g., to the TSP decision) due to lack of stakeholder buy-in. The California Department of Water Resources (DWR) and other organizations have preliminary designs for restoring parts of the Tule Canal. For example, the Conaway Preservation Group and Reclamation District 108 have created preliminary designs for restoring the middle portion of the Tule Canal. However, the PDT risks lack of buy-in and support from stakeholders/regulators if these designs are used. (High risk schedule impact and performance impact)
  - If significant impacts to environmental justice communities, Threatened and Endangered species and habitat, and air quality cannot be mitigated to less than significant, an environmental impact statement may be required instead of an environmental assessment. Based on prior studies, there is a likely chance that at least air quality impacts will be significant. The study area is either in non-attainment or maintenance for several criteria pollutants. Based on prior construction projects, any extensive concrete work such as widening the Fremont Weir by two miles, will have significant impacts on air quality. Sequencing to avoid

impacts is not usually possible due to the nature of concrete work. (High risk schedule impact)

- Risk of inaccurate description of the FWOP conditions due to the exclusion of current configuration of the Sacramento Weir and current Folsom Dam operations if using DWR stage frequency curves. Risk of changing the stage frequency curves late in the study would require reformulation and analysis due to all plans based upon assumption of FWOP conditions. The most likely project benefits would not be accurately depicted if current configuration and operation of the Sacramento Weir and Folsom Dam are excluded from analysis. (High risk schedule impact)
  - Risk is a delayed TSP with potential reanalysis if the decision-makers are unwilling to accept the uncertainty of 10-year-old fragility curves created by NFS. Geotechnical SMEs must perform new fragility curve analysis, economist must perform new LifeSim analysis and FDA analysis for all alternative plans and FWOP. The alternative plans and FWOP involve extensive number of reaches, which must each be analyzed in turn. The timing of the risk being potentially realized is at TSP. (High risk schedule impact)
- Is the project likely to be justified by life safety or is the study or project likely to involve significant life safety issues? Briefly describe the life risk, including the District Chief of Engineering's assessment as to whether there is a significant threat to human life associated with aspects of the study or failure of the project or proposed projects. **Yes, the District's Chief of Engineering assessment is failure of levees in the study area could result in significant life loss. The study will evaluate measures that may involve new levees or improvements to existing levees. Some measures may increase or decrease stage frequency along existing levees. By signing this review plan, the Chief of Engineering agrees with this assessment, fulfilling the requirement of ER 1165-2-217. Levee safety will be considered over the course of the study and during the DQC and ATR review process and will include an Independent External Peer Review (IEPR).**
  - Is the information in the decision document or anticipated project design likely to be based on novel methods, involve innovative materials or techniques, present complex challenges for interpretation, contain precedent-setting methods or models, or present conclusions that are likely to change prevailing practices? If so, how? **Yes, the comprehensive study seeks to incorporate novel methods of presenting the calculation of benefits resulting from the concurrent implementation of multiple land use opportunities with a large geographic area. Concepts such as creating access to active rice production fields for juvenile ESA-listed salmonid rearing are novel and of interest as part of this comprehensive study.**
  - Does the project design require redundancy, resiliency, and/or robustness, unique construction sequencing, or a reduced or overlapping design/construction schedule? If so, how? **Yes, the project will address redundancy, resiliency and robustness as required by guidance. The project design has yet to be developed, but an objective of the study is to seek opportunities for climate change resiliency through methods such as habitat type**

redundancy and connectivity across the landscape. The evaluation of flood risk management measures will also account for sea level change and inland climate change per guidance (evaluation of inland climate change will follow guidance for qualitative assessments). The Feasibility Study may include recommendations for sequencing of construction based on allowing time to realize hydrologic changes necessary for future phase success. The Comprehensive Study may include recommendations for future feasibility studies, in situ pilot studies, collaborative operation and maintenance plans, and other topics relative to the Yolo Bypass System.

- Is the project expected to have more than negligible adverse impacts on scarce or unique tribal, cultural, or historic resources? If so, what are the anticipated impacts? **The project design has yet to be developed, but an objective of the study is to seek opportunities for incorporation of benefits to Tribal and cultural resources. The Yolo Bypass is a component of the Sacramento River Flood Control Plan, a historically significant system of water management infrastructure completed between 1911 and 1961. Levee units within the bypass may be contributing elements of this historic property and adversely effected by any project that involves levee modification or removal. Given the proximity of the bypass to the Sacramento River and its tributaries, it is also possible that scarce or unique buried cultural resources (pre-contact Native American or historic era) could be impacted during ground disturbing activities. Adverse effects to significant cultural and historic resources would be avoided to the extent feasible or minimized and mitigated through compliance with Section 106 of the National Historic Preservation Act.**
- Is the project expected to have substantial adverse impacts on fish and wildlife species and their habitat prior to the implementation of mitigation measures? If so, describe the impacts? **The project design has yet to be developed, but an objective of the study is to seek opportunities for improvements to fish and wildlife species' habitats. Sequencing which improves or restores habitat prior to habitat impacts will reduce the need for implementation of mitigation measures.**
- Is the project expected to have, before mitigation measures, more than a negligible adverse impact on an endangered or threatened species or their designated critical habitat? If so, what are the anticipated impacts? **The project design has yet to be developed, but an objective of the study is to seek opportunities for improvements to ESA-listed fish species' habitat to include removal of passage barriers and increased access to rearing habitat. The locations of high value habitat for ESA listed terrestrial species is known, therefore, impacts to these areas could be avoided. Opportunities to improve habitat and habitat connectivity for these ESA listed terrestrial species will also be explored.**

## 8. Risk Informed Decisions on Level and Scope of Review

**Targeted ATR.** Targeted ATR will be conducted for major modeling tasks associated with describing the future without project conditions as described in Table 1.

**IEPR Decision.** ER 1165-2-216 describes the study conditions for which conducting IEPR is mandatory. The mandatory conditions are:

- if the Chief has determined the project to be controversial;
- if the Governor has requested an IEPR; or
- if the cost of the project is expected to be more than \$200 million.

Due to the wide range of stakeholders with varied interests, this study could be controversial because it is unlikely than any one plan or recommendation could satisfy the goals of each group. The Governor has not explicitly requested an IEPR. This project recommended could potentially exceed \$200 million.

Given the complex, large-scale nature of the comprehensive study, notable regional interest in the management of the Yolo Bypass, potential for recommendation of innovative use of water resources, the District has decided to conduct IEPR.

**Safety Assurance Review.** Safety Assurance Reviews are managed outside of the USACE and are conducted on design and construction products for hurricane, storm and flood risk management projects, or other projects where existing and potential hazards pose a significant threat to human life. In some cases, significant life safety considerations may be relevant to planning decisions. These cases may warrant the development of relevant charge questions for consideration during reviews such as ATR or IEPR. In addition, if the characteristics of the recommended plan warrant a Safety Assurance Review, a panel will be convened to review the design and construction activities on a regular schedule before construction begins and until construction activities are completed.

**Decision on Safety Assurance Review.** Based on the current scope and scale of the study, it is assumed that a Safety Assurance Review may be required; however, there is insufficient detail at this time to make a final determination. The decision will be made upon initiating PED as to whether a Safety Assurance Review will be conducted.

## **9. Policy and Legal Compliance Review**

Policy and legal compliance review of draft and final planning decision documents is delegated to the MSC (see Director's Policy Memorandum 2019-01).

### **(i) Policy Review.**

The policy review team is identified through the collaboration of the MSC Chief of Planning and Policy and the USACE Headquarters Chief of the Office of Water Project Review. The makeup of the Policy Review team will be drawn from USACE Headquarters, the MSC, the Planning Centers of Expertise, and other review resources as needed.

- The Policy Review Team will be invited to participate in key meetings during the development of decision documents as well as SMART Planning Milestone meetings. These



engagements may include In-Progress Reviews, Issue Resolution Conferences, or other vertical team meetings plus the milestone events.

- The input from the Policy Review team should be documented in a Memorandum for the Record (MFR) produced for each engagement with the team. The MFR should be distributed to all meeting participants.
- Teams may choose to capture some of the policy review input in a risk register if appropriate. These items should be highlighted at future meetings until the issues are resolved. Any key decisions on how to address risk or other considerations should be documented in an MFR.

## **(ii) Legal Review.**

Representatives from the Office of Counsel will be assigned to participate in reviews. Members may participate from the District, MSC, and Headquarters. The MSC Chief of Planning and Policy will coordinate membership and participation with the office chiefs.

- In some cases, legal review input may be captured in the MFR for the particular meeting or milestone. In other cases, a separate legal memorandum may be used to document the input from the Office of Counsel.

Each participating Office of Counsel will determine how to document legal review input.

## **10. Public Comment**

This Review Plan will be posted on the District's website. Public comments on the scope of reviews, technical disciplines involved, schedules and other considerations may be submitted to the District for consideration. If the comments result in a change to the Review Plan, an updated plan will be posted on the District's website.

## **11. Documents Distributed Outside the Government**

For information distributed for review to non-governmental organizations, the following disclaimer shall be placed on documents:

***"This information is distributed solely for the purpose of pre-dissemination review under applicable information quality guidelines. It has not been formally disseminated by USACE. It does not represent and should not be construed to represent any agency determination or policy."***

## 12. District Concurrence

We the undersigned concur in the review plan, dated 30 September 2024, for the Comprehensive Study of the Sacramento River, Yolo Bypass System, CA.

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ALICIA KIRCHNER  
Sacramento District Planning Chief

2024-09-30

Date



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MARK DEROCCHI  
Sacramento District Engineering Chief

                      
Date

## **Appendix A - Brief Description of Each Type of Review**

This section describes each level of review to be conducted. Based upon the factors discussed in Section 1, this study will undergo the following types of reviews:

**District Quality Control.** All decision documents and accompanying components will undergo DQC. This internal review covers basic science and engineering work products. It fulfills the project quality requirements of the Project Management Plan. The DQC team will read all reports and appendices. The review must evaluate the correct application of methods, validity of assumptions, adequacy of basic data, correctness of calculations (error-free), completeness of documentation, and compliance with guidance and standards. Districts are required to check all computations and graphics by having the reviewer place a highlight (e.g., place a “red dot”) on each annotation and/or number indicating concurrence with the correctness of the information shown.

**Agency Technical Review.** ATR will be performed by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. These teams will be comprised of certified USACE personnel. The ATR team lead will be from outside the home MSC.

**Independent External Peer Review.** IEPR is required for this decision document. This is the most independent level of review and is applied in cases that meet criteria where the risk and magnitude of the project are such that a critical examination by a qualified team outside of USACE is warranted. Certain criteria dictate mandatory performance of IEPR and other considerations may lead to a discretionary decision to perform IEPR. For this study, a risk-informed decision has been made that IEPR is appropriate. The information in Section 1 – Factors Affecting the Scope of Review – informed the decision to conduct IEPR.

**Cost Engineering Review.** All decision documents will be coordinated with the Cost Engineering MCX. The MCX assisted in determining the expertise needed on the ATR teams. The MCX will provide the Cost Engineering certification. The RMO is responsible for coordinating with the MCX for the reviews. These reviews occur as part of ATR.

**Model Review and Approval/Certification.** The use of certified or approved planning models for all planning work is required to ensure the models are technically and theoretically sound, compliant with policy, computationally accurate, and based on reasonable assumptions. Engineering models must comply with standards set by the appropriate Engineering Community of Practice.

**Policy and Legal Compliance Review.** These reviews culminate in determinations that report recommendations and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the home MSC Commander.

**Public Review.** The District will post the Review Plan and approval memo on the District's internet site. Public comment on the adequacy of the Review Plan will be accepted and considered. Additional public review will occur when the report and environmental compliance document(s) are released for public and agency comment.