BUREAU OF RECLAMATION

U.S. FISH & WILDLIFE SERVICE

Public Draft Workplan

Fiscal Year 2021 Obligation Plan for CVPIA Authorities

Central Valley Project, California
Interior Region 10 – California-Great Basin

U.S. Department of the Interior **February 2021**

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover Photos: 2020 channel realignment and juvenile rearing habitat restoration on Clear Creek near Redding, California. Before construction (top left); after construction (bottom right). (Reclamation/Derek Rupert - NCAO)

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Introduction

The Central Valley Project (CVP) is one of the Bureau of Reclamation's (Reclamation) largest and most important water projects, storing and delivering nearly 12 million acre-feet of water in support of California's farms, cities, wildlife refuges, and fish and wildlife. Reclamation serves these water supply needs through the balancing of competing statutory responsibilities. Reclamation's goal is to provide and enhance water and hydropower reliability for California communities, agriculture, fisheries, and wildlife refuges, in accordance with its statutory responsibilities, including compliance with Endangered Species Act (ESA) requirements for listed species within the project area.

This workplan describes Reclamation's Fiscal Year 2021 planned obligations using the authorities provided by the Central Valley Project Improvement Act (CVPIA), Title 34 of Public Law 102-575. This workplan builds upon and expands prior CVPIA workplans to cover activities using CVPIA authorities from both the Central Valley Project Restoration Fund (Restoration Fund) and other Federal appropriations. Through this workplan Reclamation identifies potential financial obligations to CVP water users and power customers and serves as a vehicle for continued discussion and feedback on program implementation from stakeholders and the public.

The ability to obligate funds consistent with this workplan will depend upon collections into the Restoration Fund, enactment of other Federal appropriations, and execution of contracts and agreements. Once obligated, funds become available for expenditure, which may span multiple years. CVP water users and power customers incur a reimbursable obligation only after Reclamation is invoiced and an expenditure recorded. Funds no longer required under contracts and agreements may be de-obligated and re-obligated on a similar or different authorized activity. Scopes of work, budgets, timelines, and priorities may change in the course of implementing programs. Reclamation will continue to use existing forums to communicate such deviations when identified.

Background

The 1992 passage of the CVPIA, in part, amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation. Section 3406 of the CVPIA authorized water operations, programs, and projects to support fish and wildlife. Section 3407 established the Central Valley Project Restoration Fund (Restoration Fund) for donations from any source and revenues provided through payments by CVP water and power customers for carrying out the fish and wildlife provisions of Title 34. Reclamation and the U.S. Fish and Wildlife Service (Service) jointly implement the CVPIA programs using the Restoration Fund. Reclamation and the Service coordinate CVPIA programs with the National Marine Fisheries Service (NMFS) and the State of California represented by the Department of Fish and Wildlife (CDFW) and Department of Water Resources (DWR).

Subsequent legislation and regulations continued to amend or augment authorizations of the CVP and relied upon many of the authorities added from the CVPIA, most notably on measures to address fish species. Examples include compliance with the Endangered Species Act (ESA) for the operation of the CVP, compliance with the State of California Water Quality Control Plan for the Bay Delta (State Water Resources Control Board Decision 1641, "D-1641"), the CalFed Bay-Delta Authorization Act (CalFed), Title 1 of Public Law 108-361, and the Water Infrastructure Improvements for the Nation (WIIN) Act, Subtitle J of Public Law 114-322, among others. Reclamation operates the CVP under Biological Opinions issued by the Service and NMFS and in coordination with DWR's operation of the State Water Project (SWP).

Section 3406 of the CVPIA authorizes programs and activities to support fish and wildlife. These authorities generally fall into the following areas:

- Fish Resource Area - Activities under section 3406(b) and (g) of the Act to improve the natural production of anadromous fish, address other adverse environmental impacts of the Central Valley Project, mitigate for fishery impacts associated with operations of the Tracy Pumping Plant, assist efforts to protect the waters of the Bay-Delta Estuary, and to help meet obligations under the Federal Endangered Species Act;
- Refuge Water Supply Program - Activities under section 3406(d) of the Act to provide firm water supplies of suitable quality to maintain and improve wetland habitat areas on units of the National Wildlife Refuge System in the Central Valley of California; on the Gray Lodge, Los Banos, Volta, North Grasslands, and Mendota state wildlife management areas; and on the Grasslands Resources Conservation District in the Central Valley of California; and
- Independent Programs -
    - Habitat Restoration Program (HRP) - Activities authorized under section 3406(b)(1) to mitigate the other adverse environmental impacts of the CVP on ESA-listed species other than anadromous fish,
    - San Joaquin River Restoration Program (SJRRP) - Use of the Restoration Fund authorized by Section 10009(b)(2) of Public Law 111-11 for activities to implement the Stipulation of Settlement for NRDC, et al. v. Rodgers, et al., (2006) and
    - Trinity River Restoration Program (TRRP) - Activities to implement the Trinity River flows under Section 3406(b)(23) and to complete the channel restoration actions under the other adverse environmental impacts of the CVP under 3406(b)(1).

Annually Reclamation prioritizes the Restoration Fund, subject to annual appropriations and current administration and Departmental focus, to the following areas:

1. Deliver Level 2 CVP water supplies to wildlife refuges
2. Long-Term Monitoring Data
3. Independent Programs/Incremental Level 4/Fisheries Habitat Improvement projects

Subsequent sections of this workplan summarize the activities in each of the aforementioned areas. Attachment 1 lists the planned obligations by Watershed and identifies CVPIA authorities. Attachment 2 introduces charters with more details on the use of the Restoration Fund and other appropriations.

Fish Resource Area

The Service listed Delta Smelt as threatened in 1993. NMFS listed winter-run Chinook salmon as threatened in 1989 and then updated to endangered in 1994; listed spring-run Chinook salmon as threatened in 1999; listed California Central Valley steelhead as threatened in 1998; and listed the southern Distinct Population Segment of Green Sturgeon as threatened in 2006. In 1999, the California State Water Resources Control Board issued D-1641 to adopt the 1995 Bay-Delta Plan, which imposed new obligations on both the CVP and SWP to protect water quality for beneficial uses, including fish and wildlife. Biological Opinions, beginning most significantly in 2009, set specific requirements for meeting the needs of listed salmon, steelhead, and sturgeon with a combination of restrictions on operations and mitigation requirements. In 2014, NMFS released a Recovery Plan for Central Valley salmon and steelhead that sets goals and prioritizes actions based on updated science.

In 2001, the Service refined actions from 1995 Working Papers[1] to release the Final Plan for the Anadromous Fish Restoration Program.[2] In 2015, the CVPIA established the SIT[3] to support formal Structured Decision Making (SDM) as an updated science-based framework to inform the use of the Restoration Fund on projects to improve anadromous fish. The SIT is a self-selected technical group made up of agency staff and stakeholders that follows the SDM process. The SIT works with local watershed groups and other local partners to advance the science for on-the-ground habitat and facility improvements in Central Valley watersheds.

The 2019 Proposed Action and Biological Opinions and the 2020 Long-Term Operations (LTO) Record of Decision (collectively, "LTO")[4] established a road map for operating the CVP for all statutory requirements, with a combination of flow, habitat, facility, hatchery, and science actions for meeting the needs of listed species. The adaptive elements for habitat and facility improvements under the LTO rely upon the CVPIA Program and SIT efforts. While not all of the actions under the LTO rely upon CVPIA authorities and not all of the CVPIA activities fall within the LTO, the integration approach provides a framework for understanding the scope of Reclamation's fisheries-related programs. This framework includes:

- Real-Time Operations – Data and analysis for decision-making on the day-to-day and seasonal operation of the CVP (e.g., Red Bluff Rotary Screw Trap, Enhanced Delta Smelt Monitoring "EDSM" Trawls);

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[1] U.S. Fish and Wildlife Service with assistance from the Anadromous Fish Restoration Program Core Group. 1995. Working Paper on Restoration Needs--Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California, Volume 3. https://www.fws.gov/lodi/anadromous_fish_restoration/documents/WorkingPaper_v3.pdf

[2] U.S. Fish and Wildlife Service with assistance from the Anadromous Fish Restoration Program Core Group under authority of the Central Valley Project Improvement Act. 2001. Final Restoration Plan For The Anadromous Fish Restoration Program, A plan To Increase Natural Production Of Anadromous Fish In The Central Valley Of California. https://www.fws.gov/lodi/anadromous_fish_restoration/documents/20010109%20Final%20Restoration%20Plan%20for%20the%20AFRP.pdf

[3] U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service. 2019. Science Integration Team and Science Coordinator. 2019 Priorities Technical Memorandum for FY2020. https://drive.google.com/file/d/1Ec3qn0Wk-PiygfZm-ZsdnYOUhdRl2sPd/view

[4] U.S. Bureau of Reclamation. 2019. Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. Draft Environmental Impact Statement. https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=41664

- Status and Trend Monitoring - Monitoring and analysis for assessing long-term changes in fish populations and the associated environmental and biological conditions (e.g., Bay Surveys and certain Delta trawls);
- Habitat and Facility Improvements - Improvements to the physical environment to support fish populations and reduce the adverse effects of infrastructure (e.g., gravel augmentation, rearing habitat, fish screens, Delta Cross Channel Gate retrofit);
- Intervention – Protections for species when hydrologic and environmental conditions cannot support the year classes through volitional movement and natural production, primarily drought and dry conditions (e.g., refugial and supplementation hatchery programs, trap and haul); and
- Special Studies - Actions to reduce uncertainty and improve the performance of real-time operations, status and trend monitoring, habitat and facility improvements, and intervention actions (e.g., Directed Outflow Project, Steelhead Juvenile Production Estimate).

In executing the appropriations provided by Congress for fisheries, Reclamation considered needs for operation of the CVP and Service programs; science-based information from the SIT, biological opinions, and recovery plans; and efficiency and effectiveness measures such as cost-share, local support, prior performance, and competition. Table 1 summarizes fisheries implementation expenditures using CVPIA authorities. Table 2 shows program management and administration costs.

Table 1. Fisheries Implementation Obligation Plan Using CVPIA Authorities

Categories	LTO-ESA	Non-Project	Total
Real-Time Operations	$19,020,059	$0	$19,020,059
Status and Trend	$17,484,229	$0	$17,484,229
Habitat and Facility	$44,249,163	$1,124,048	$45,373,211
Intervention	$8,841,741	$0	$8,841,741
Special Study	$16,442,112	$441,500	$16,883,612
Totals	$106,037,304	$1,565,548	$107,602,852

Table 2. Fish Resource Area Program Management and Administration

Office	Reclamation FTE	Reclamation Cost	USFWS FTE	USFWS Cost	Total FTE	Total Cost
Regional	1.5	$114,208	5.95	$639,692	7.45	$753,900
Lodi	-	-	7.33	$1,365,583	7.33	$1,365,583
Red Bluff	-	-	6.49	$883,156	6.49	$883,156
Bay-Delta	9.0	$2,422,449	2	$326,141	11.0	$2,748,590
Other	-	-	-	$52,547	-	$52,547
Overhead	-	$796,152	-	$1,274,176	-	$2,070,328
Total	10.5	$3,332,809	21.77	$4,541,295	32.27	$7,874,104

Table 3. Fish Resource Area Unfunded Needs: Identifies unfunded needs within FY2021, does not include long term Program needs or associated funding. If any action within the 2021 obligation plan is unable to be funded or delayed due to permitting, planning, etc., the charters below will be prioritized and funded.

Charter	Authority	Total
Habitat and Facility Improvements: Tracy Fish Facility Improvement Program	(b)(4)	$463,500
Special Studies: Central Valley Wide Salmonid Demographics	(g)	$1,500,000
Special Studies: Develop a Methodology for Rockwad Habitat	(g)	$120,000
Special Studies: SIT Critical Uncertainty Reduction	(g)	$960,000

Refuge Water Supply Program

The Refuge Water Supply Program (RWSP) includes all provisions under section 3406(d) of the CVPIA to provide firm water supplies of suitable quality to maintain and improve wetland habitat areas on units of the National Wildlife Refuge System in the Central Valley of California; on the Gray Lodge, Los Banos, Volta, North Grasslands, and Mendota state wildlife management areas; and on the Grassland Resources Conservation District in the Central Valley of California.

The Act specifies two water delivery responsibilities. Section 3406(d)(1) "Level 2" provides that the quantity and delivery schedules of water measured at the boundaries of each wetland habitat area shall be in accordance with Level 2 of the `Dependable Water Supply Needs' table for those habitat areas set forth in the Refuge Water Supply Report[5] and two-thirds of the water supply needed for full habitat development for those habitat areas identified in the San Joaquin Basin Action Plan/Kesterson Mitigation Action Plan Report[6]. Section 3406(d)(2) "Incremental Level 4" provides that the quantity and delivery schedules of water measured at the boundaries of each wetland habitat area shall be in accordance with Level 4 of the `Dependable Water Supply Needs' table for those habitat areas set forth in the Refuge Water Supply Report and the full water supply needed for full habitat development for those habitat areas identified in the San Joaquin Basin Action Plan/Kesterson Mitigation Action Plan Report, to be acquired through voluntary measures. A full Level 4 water supply (Level 2 plus Incremental Level 4) provides for optimum habitat management to support the enhancement of a broad range of species including targeted threatened and endangered species. Components of the RWSP include:

- Water Acquisition: purchase, exchange, and transfer for Incremental Level 4 water supplies;
- Conveyance: groundwater pumping and the conveying (wheeling) of surface sources for Level 2 and Incremental Level 4 water supplies; and
- Facility Construction and Acquisition: infrastructure improvements to enable the delivery of full Level 4 water supplies.

[5] U.S. Bureau of Reclamation. 1989. Report on Refuge Water Supply Investigations. Central Valley Hydrological Basin, California. United States Department of the Interior, Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.
[6] U.S. Bureau of Reclamation, U.S Fish and Wildlife Service, State of California, Department of Fish and Game. 1989. San Joaquin Basin Action Plan/Kesterson Mitigation Plan.
https://nrm.dfg.ca.gov/filehandler.ashx?documentid=133541

Priorities have been discussed throughout the year through an Inter-Agency Refuge Water Management Team (IRWMT). Reclamation and the Service hosted specific workshops with invitations to the IRWMT to discuss potential 2021 funding. Based on feedback, the RWSP funding prioritized Charters based on:

1. Program Administration;
2. Level 2 Water Conveyance;
3. Incremental Level 4 Water Acquisitions;
4. Facility Construction Projects; and
5. Unfunded needs.

Table 4. Refuge Water Supply Implementation: Summarizes the implementation of proposed 2021 projects

Program Components and Charters	**Restoration Fund**	**Supplemental Funds**	**Total**
Level 2 Water Supply			
Level 2 Refuge Water Conveyance	$16,880,801	-	$16,880,801
Subtotal	**$16,880,801**	**-**	**$16,880,801**
Incremental Level 4			
Inc. Level 4 Water Purchases and L2 Exchanges	$8,908,000	$5,797,000	$14,705,000
Inc. Level 4 Refuge Water Conveyance	$1,198,924	$2,100,000	$3,298,924
Subtotal	**$10,106,924**	**$7,897,000**	**$18,003,924**
Refuge Construction			
Biggs-West Gridley/Gray Lodge WA Project	$976,640	-	$976,640
East Bear Creek Pump Station Modifications Project	$1,500,000	-	$1,500,000
Sutter NWR Lift Station Project	$500,000	$2,153,000	$2,653,000
Pixley NWR Feasibility Study	-	$450,000	$450,000
Subtotal	**$2,976,640**	**$2,603,000**	**$5,579,640**
Grand Total	**$29,964,365**	**$10,500,000**	**$40,464,365**

Table 5. Refuge Water Supply Program Management: Summarizes Program Management and costs associated with administering the Refuge Water Supply Program

Office	**Reclamation FTE**	**Reclamation Cost**	**USFWS FTE**	**USFWS Cost**	**Total FTE**	**Total Cost**
Regional	1.5	$105,108	3.5	$331,583	5.0	$436,691
Bay-Delta	3.5	$454,539	-	-	3.5	$454,539
Other	-	-	-	$28,272	-	$28,272
Overhead	-	$156,047	-	$140,342	-	$296,392
Total	5.0	$715,694	3.5	$500,197	8.5	$1,215,894

Independent Programs

These programs generally have separate oversight and resources in addition to the Restoration Fund, and program-specific reporting and stakeholder coordination requirements.

Habitat Restoration Program

Reclamation and the Service manage the Habitat Restoration Program (HRP) jointly with the Central Valley Project Conservation Program (CVPCP) with the overall objective of improving conditions for impacted species and habitats, excluding fish. The CVPCP and HRP utilize a proposal solicitation process to fund and carry out conservation actions within the areas served by the Central Valley Project. At the beginning of each annual funding cycle, a Funding Opportunity Announcement (FOA) is posted on www.grants.gov with a solicitation period of approximately 120 days. Table 6 shows the funding for the HRP Charter.

Table 7 indicates the program management and administration funding for HRP. Historical projects and reports and contact information for more information are available at: http://www.usbr.gov/mp/cvpcp.

Table 6. Habitat Restoration Program Charters

Program Area	Restoration Fund	Total
HRP Protection and Habitat Restoration Projects	$1,096,832	$1,096,832
Total	**$1,096,832**	**$1,096,832**

Table 7. Habitat Restoration Program Management

Office	Reclamation FTE	Reclamation Cost	USFWS FTE	USFWS Cost	Total FTE	Total Cost
Regional	1	$161,504	1	$131,001	2.0	$292,505
Other	-	-	-	$11,673	-	$11,673
Overhead	-	$43,346	-	$55,643	-	$98,989
Total	1	$204,850	1	198,317	2.0	$403,168

San Joaquin River Restoration Program

The San Joaquin River Restoration Settlement Act (Title X, Subtitle A, Part I of Public Law 111-11), authorizes and directs implementation of the settlement in NRDC, et al., v. Rodgers, et al. Section 10007 of the Settlement Act finds and declares that the settlement satisfies and discharges all of the obligations of the Secretary contained in Section 3406(c)(1) of the CVPIA. Section 10009(b)(2) authorizes the use of the CVP Restoration Fund in an amount not to exceed $2,000,000 (October 2006 price levels) in any fiscal year. CVPIA funded activities for the SJRRP Charter is reflected in Table 8.

Table 8. San Joaquin River Restoration Program

Charter	Restoration Funds
SJRRP - Mendota Pool Bypass and Reach 2B Project	$2,000,000
Total	**$2,000,000**

*The SJRRP utilizes specific funding appropriated to the Program outside of the Restoration Fund. Those activities are not identified within this Work Plan.

Trinity River Restoration Program

The Trinity River Restoration Program (TRRP) was founded in 2000 based on three comprehensive foundational documents: the *Trinity River Flow Evaluation Final Report*[7]; the *Trinity River Environmental Impact Statement* [8]; and the *Trinity River Mainstem Fishery Restoration Record of Decision* [9]. These documents established a comprehensive science-based adaptive management program to restore the Trinity River's fishery resources. The Program's overarching goal is to restore anadromous fish populations to pre-dam levels. Activities that contribute to that end include mechanical channel rehabilitation, sediment management, instream flow releases, and watershed restoration. Table 9 shows the TRRP Charter.

Table 9. Trinity River Restoration Program

Charter	Restoration Funds	Other Appropriations	Total
CVP Restoration Fund TRRP Channel Restoration Projects	$1,500,000		$1,500,000
WRR Funding of TRRP Record of Decision Restoration Activities		$9,991,221	$9,991,221
Total	**$1,500,000**	**$9,991,221**	**$11,491,221**

[7] U.S. Fish and Wildlife Service. Arcata Fish and Wildlife Office, Hoopa Valley Tribe. (1999). Trinity River flow evaluation. Final report: a report to the Secretary, U.S. Department of the Interior. https://www.trrp.net/DataPort/doc.php?id=226

[8] U.S. Army Corps of Engineers. (2000). Upper Trinity River Basin, Trinity River, programmatic EIS: Environmental Impact Statement.

[9] U.S. Department of Interior. 2000. Record of decision, Trinity River mainstem fishery restoration final environmental impact statement/environmental impact report. https://www.trrp.net/DataPort/doc.php?id=227

Summary

Table 10 summarizes anticipated obligations on CVPIA authorities from the Restoration Fund and Other Appropriations, the water and power reimbursable exposure if and when expenditures occur, and the offsetting payments into the Restoration Fund.

Table 10. Total FY2021 Planned Obligations under CVPIA Authorities and Water and Power Reimbursability

Resource Area and Category	2021 Restoration	2021 Other	Total Obligation	Total Reimbursable
Fish	**$19,694,744**	**$87,908,108**	**$107,602,852**	**$41,024,523**
Habitat and Facility	$14,354,887	$31,018,324	$45,373,211	$22,981,082
Intervention	$0	$8,841,741	$8,841,741	$2,153,153
Real Time Operations	$1,444,055	$17,576,004	$19,020,059	$6,450,858
Special Studies	$2,472,302	$14,411,310	$16,883,612	$3,775,991
Status and Trend	$1,423,500	$16,060,729	$17,484,229	$5,663,440
Refuge	**$31,180,256**	**$10,500,000**	**$41,680,256**	**$18,755,002**
Level 2	$18,946,846	$1,845,840	$20,792,686	$18,755,002
Level 4	$12,233,411	$8,654,160	$20,887,571	$0
Independent	**$5,000,000**	**$9,991,221**	**$14,991,221**	**$11,718,081**
HRP	$1,500,000	$0	$1,500,000	$1,353,000
SJRRP	$2,000,000	$0	$2,000,000	$0
TRRP	$1,500,000	$9,991,221	$11,491,221	$10,365,081
Totals	**$55,875,000**	**$108,399,329**	**$164,274,329**	**$71,497,606**

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Attachment 1 – Fiscal Year 2021 Planned Obligations by Watershed and identifies CVPIA Authorities

Guardian Rock gravel augmentation - Clear Creek. Summer 2020. (Reclamation - Derek Rupert – NCAO)

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Resource Area, Category, and Watershed (* indicates LTO Related)	Description	Authority	2021 Restoration Funds	2021 Other Funds	Total 2021 Cost	Reimbursable Amount
Fish			**$19,694,744**	**$87,908,108**	**$107,602,852**	**$41,024,525**
Real Time Operations			**$1,444,055**	**$17,576,004**	**$19,020,059**	**$6,450,858**
Central Valley			**$1,444,055**	**$1,695,504**	**$3,139,559**	**$495,670**
FWS Modeling Labor	Program Staff Support	(g)	$164,024	$ -	$164,024	$ -
FWS Dedicated Yield	Program Staff Support	(b)(2)	$176,559	$ -	$176,559	$ 159,256
FWS CAMP Labor	Program Staff Support	(b)(15)	$678,133	$ -	$678,133	$ 254,300
BOR Modeling Labor	Program Staff Support	(g)	$206,368	$ 495,504	$701,872	$ -
BOR CAMP Labor	Program Staff Support	(b)(15)	$218,971		$218,971	$ 82,114
Central Valley Prediction and Assessment of Salmon	Description CVPAS for Central Valley Prediction and Assessment of Salmon, extends and improves the SacPAS real-time web database and fish forecasting tools to other river systems in the Central Valley.	(g)	$ -	$ 1,200,000	$1,200,000	$ -
Sacramento				**$5,827,208**	**$5,827,208**	**$ 2,185,203**
Coded Wire Tags for Late Fall Run Chinook Salmon Spring Run Surrogate tagging program	Annually purchase coded-wire tags for insertion into Coleman hatchery late-fall run Chinook salmon to serve as surrogates for spring-run Chinook salmon	(b)(15)	$ -	$ 103,040	$103,040	$ 38,640
Red Bluff Diversion Dam Rotary Screw Traps	Juvenile salmonid production monitoring in the Sacramento River at Red Bluff, Clear Creek adult and juvenile monitoring, and Battle Creek adult and juvenile monitoring. 2009 Biological Opinion actions carried over into 2019 LTO PA	(b)(15)	$ -	$3,430,168	$3,430,168	$ 1,286,313
Sacramento River Basin Salmonid Monitoring with Pacific States	Conduct annual Chinook Salmon spawning escapement surveys in the Sacramento River Basin (mainstem, Deer Creek, Antelope Creek, Mill Creek, Clear Creek, Battle Creek, Cottonwood Creek, Cow Creek, Bear Creek, and American River) to estimate the abundance and distribution of Chinook salmon spawners. Conduct effectiveness monitoring of salmonid habitat improvement projects in the Sacramento River basin.	(b)(15)	$ -	$ 2,294,000	$ 2,294,000	$ 860,250
Sacramento-San Joaquin				**$3,000,000**	**$3,000,000**	**$1,125,000**
Enhanced Delta Smelt Monitoring Program (EDSM)	Statistically based sampling program to determine absolute abundance of Delta Smelt, calibrate a Delta Smelt life cycle model and conduct real-time monitoring to minimize Delta Smelt entrainment	(b)(15)	$ -	$3,000,000	$3,000,000	$1,125,000
Delta				**$7,053,292**	**$7,053,292**	**$2,644,985**
Coordinated Enhanced Acoustic Tagging	Tagging of salmonids; coordination, operation and maintenance of Central Valley acoustic telemetry array; six-year steelhead study; telemetry data analysis and related web tools and databases.	(b)(15)		$3,142,518	$3,142,518	$ 1,178,444

Delta Juvenile Fish Monitoring Program	Monitor Bay-Delta fish community and other aquatic resources to support adaptive management.	(b)(15)	$ -	$3,910,774	$3,910,774	$ 1,466,540
Status and Trend			**$1,423,500**	**$16,060,729**	**$17,484,229**	**$5,663,440**
Central Valley			**$960,000**	**$8,126,987**	**$9,086,987**	**$2,889,474**
Data and Analytic Support	SIT support via data visualization & stewardship, and peer review management.	(g)	$ 260,000	$ 421,723	$681,723	$ -
Modeling	To manage, coordinate, plan and implement the CVPIA 3406(g) program.	(g)	$ 700,000	$ -	$700,000	$ -
Pacific States Marine Fisheries Commission Coleman-Nimbus Tagging	Continues the constant fractional marking program for Chinook Salmon from Coleman and Nimbus hatcheries. Tasks include the coded wire tagging and adipose fin clipping at the hatcheries, sampling the commercial and recreational catches for tagged and untagged salmon, reading tags, reading scales, and reporting results.	(b)(15)	$ -	$1,599,102	$1,599,102	$ 599,663
Science Support to Operate Continuous Tidal Flow and Turbidity Stations with USGS	Monitor Bay-Delta tidal flow, water quality and biogeochemical conditions in the Bay-Delta to support adaptive management of CVP operations and inform restoration activities	(b)(15)	$ -	$ 6,106,162	$6,106,162	$ 2,289,811
American			**$ 231,750**		**$231,750**	**$ 86,906**
American River Rotary Screw Trap project monitoring	Annual quantification of juvenile Chinook salmon production and the abundance of juvenile steelhead in the American River using rotary screw traps.	(b)(15)	$ 231,750	$ -	$231,750	$ 86,906
Stanislaus			**$ 231,750**	$ -	**$231,750**	**$ 86,906**
Stanislaus River Rotary Screw Trap project monitoring	Annual quantification of juvenile Chinook salmon production and the abundance of juvenile steelhead in the Stanislaus River using rotary screw traps.	(b)(15)	$ 231,750	$ -	$231,750	$ 86,906
Delta				**$7,933,742**	**$7,933,742**	**$2,600,153**
Environmental Monitoring Program with California Department of Water Resources	Conduct water quality and biological monitoring at fixed stations in accordance with Water Right Decision D-1641	(b)(15)	$ -	$2,700,000	$2,700,000	$ 1,012,500
Fish Monitoring with the California Department of Fish and Wildlife	Monitor Bay-Delta fish community and other aquatic resources to support adaptive management	(b)(15)	$ -	$4,233,742	$4,233,742	$ 1,587,653
Structured Decision-Making of Scientific Management in the Sacramento – San Joaquin Delta	The US Bureau of Reclamation (Reclamation) has a need to support the ongoing Structured Decision Making (SDM)	(g)	$ -	$ 1,000,000	$1,000,000	$ -
Habitat and Facility			**$14,354,887**	**$31,018,324**	**$45,373,211**	**$22,981,083**
Central Valley Wide			**$ 4,181,724**	**$1,752,824**	**$5,934,548**	**$4,354,223**
FWS Clear Creek Labor	Program Staff Support	(b)(12)	$562,253	$ -	$562,253	$ -

FWS AFRP Labor	Program Staff Support	(b)(1)	$ 2,960,326	$ -	$2,960,326	$ 2,670,214
BOR Fisheries Labor	Program Staff Support	(b)(1)	$659,145	$820,020	$1,479,165	$ 1,334,207
Gravel Labor	Program Staff Support	(b)(13)	$0	$418,323	$418,323	$ 156,871
BOR Yolo Bypass Labor	Program Staff Support	(b)(4)	$0	$514,481	$514,481	$ 192,930
American			**$ 1,000,000**	**$2,000,000**	**$3,000,000**	**$ 1,125,000**
American River Salmonid Habitat Restoration	Restore juvenile Chinook salmon and steelhead rearing habitat and enhance natural channel processes on the lower American River. Annual habitat improvement projects are planned for the next five years.	(b)(13)	$ 1,000,000	$2,000,000	$3,000,000	$ 1,125,000
Clear Creek			**$849,115**		**$849,115**	
Clear Creek Phase 3B Completion	SIT support via data visualization & stewardship, and peer review management.	(b)(12)	$ 200,000	$ -	$200,000	$ -
Clear Creek Gravel Injection	Place gravel into Clear Creek to provide spawning habitat for anadromous salmonids and to promote geomorphic processes that create habitat for all in-river fish life history stages.	(b)(12)	$ 329,600	$ -	$329,600	$ -
Clear Creek Stream Channel Restoration Phase 3C	This project completes the final phase of the 1999 Clear Creek Floodway Restoration Project conceptual plan. The project improves the stream channel, floodplains, and associated habitats of the Phase 3C site increasing spawning and rearing habitat for salmonids.	(b)(12)	$ 319,515	$ -	$319,515	$ -
Feather			**$1,124,048**		**$1,124,048**	**$150,497**
Feather River Sunset Pumps Sturgeon and Salmon Passage (Non-Project)	Removal of Sunset Pumps Facilities and Improvements to Sutter-Butte Main Canal	(b)(1)	$ 957,200	$ -	$957,200	$ -
Nelson Slough - Feather River/Sutter Bypass (Non-Project)	The proposed project will substantially increase available floodplain habitat in the lower Feather River corridor through Nelson Slough and contribute to improved quality of juvenile salmonids rearing habitat through increased production and availability of food resources.	(b)(1)	$ 166,848	$ -	$166,848	$ 150,497
Sacramento			**$7,200,000**	**$8,000,000**	**$15,200,000**	**$10,126,800**
Sacramento River – Improve Spawning Habitat Above Temperature Control Points	Includes Gravel Injection at Keswick Dam and instream gravel placement at downstream locations to the temperature control point.	(b)(13)	$800,000	$2,000,000	$2,800,000	$1,050,000
Sacramento River Salmonid Habitat Improvement - Keswick to Red Bluff	Implements the top priority habitat improvements along the Sacramento River between Keswick and Red Bluff.	(b)(13)	$ 2,000,000	$2,000,000	$4,000,000	$ 1,500,000
Sacramento River Salmonid Habitat Improvement - Red Bluff to Feather River	Implements top priority habitat improvements between Red Bluff and Feather River.	(b)(1)	$ 2,600,000	$2,000,000	$4,600,000	$ 4,149,200
Sacramento River – Tisdale Weir Sturgeon and Salmonid Passage	Reducing or eliminating opportunities for fish stranding in the stilling basin and Tisdale bypass.	(b)(1)	$ 1,800,000	$2,000,000	$3,800,000	$3,427,600

Stanislaus				**$ 800,000**	**$800,000**	**$ 300,000**
Stanislaus River Salmonid Spawning and Rearing Habitat Restoration	Steelhead and Chinook salmon spawning and rearing habitat restoration project on the Stanislaus River. Gravel injected at upper river locations in Goodwin Canyon.	(b)(13)	$ -	$ 800,000	$800,000	$ 300,000
Delta				**$18,465,500**	**$18,465,500**	**$6,924,563**
Head of Old River Scour Hole	Complete design for improvements to the Head of Old River Scour Hole to allow for improvement to survival rates of juvenile salmonids past Chips Island	(b)(4)	$ -	$2,500,000	$2,500,000	$ 937,500
Rock Slough Fish Screen	Improvements to Rock Slough fish screen.	(b)(5)	$ -	$ 650,000	$ 650,000	$ 243,750
Tracy Fish Facility Improvement Program	Annual Tracy Fish Facility Improvement Program (TFFIP)	(b)(4)	$ -	$727,500	$ 727,500	$ 272,813
Yolo Bypass Salmonid Habitat Restoration and fish passage	This is a project that stems from the 2009 NMFS Biological Opinion Reasonable and Prudent Alternative and it is a key action that NMFS has deemed necessary to allow the Coordinated Long-term Operation of the CVP and SWP without resulting in jeopardy of winter-run Chinook salmon and spring-run Chinook salmon or destruction or adverse modification to Critical Habitat. Also, Reclamation has recommitted to implementing the Yolo Bypass Salmonid Habitat Restoration and Fish Passage in the Reinitiation of Consultation of the Coordinated Long-term Operation of the CVP and SWP.	(b)(4)	$ -	$12,658,000	$12,658,000	$ 4,746,750
Yolo Bypass Salmonid Habitat Rec	As part of implementing the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project, Reclamation has adopted measures for recreation, subject to available appropriations, and as described in Attachment A of the Record of Decision. These measures are MM-REC-1 and MM-REC-3. Reclamation will implement mitigation that includes drainage improvement projects (MM-REC-3) in the northwest portion of the YBWA, specifically the entrance and parking Lot A	(b)(4)	$ -	$1,930,000	$1,930,000	$ 723,750
Intervention			$ -	**$8,841,741**	**$8,841,741**	**$2,153,153**
Sacramento			**$ -**	**$1,600,000**	**$1,600,000**	**$ -**
Battle Creek winter-run Chinook reintroduction and restoration project	This project furthers the introduction of winter-run Chinook into Battle Creek.	(b)(1)	$ -	$1,600,000	$1,600,000	$ -
Sacramento-San Joaquin				**$6,241,741**	**$6,241,741**	**$1,778,153**
Delta Smelt Supplementation Studies: Genetics and Tagging	The purpose of this agreement is to develop a supplementation strategy within one year of the issuance of the [USFWS] BiOp that will describe the capacity needed at hatchery facilities to accommodate the Delta Smelt production needed to meet genetic and other hatchery consideration with a goal of increasing production to a number and the life stages necessary to effectively augment the population.	(b)(4)	$ -	$ 2,000,000	$2,000,000	$ 750,000

FCCL Conservation Hatchery Operation for Delta Smelt Refuge Population Maintenance and Research Support	Continue maintaining a delta smelt refuge population under genetic management as a safeguard against species extinction in the wild. Conduct research with delta smelt and produce a supply of all life stages for research purposes.	(b)(4)	$ -	$2,741,741	$2,741,741	$ 1,028,153
Use of Cultured Delta Smelt in Field Studies	This project would investigate the options (barges, floating vessels, net pens, cages, near channel facilities, etc.) and associated feasibility of using cultured Delta Smelt to augment and facilitate investigation of mechanisms impacting the Delta Smelt population and subsequent recovery efforts	(b)(1) Other	$ -	$1,500,000	$1,500,000	$ -
Delta				**$1,000,000**	**$1,000,000**	**$ 375,000**
Facility Improvement for Delta Smelt Supplementation	The Tracy Aquaculture Facility will be outfitted to be able to culture juvenile Delta Smelt	(b)(4)	$ -	$1,000,000	$1,000,000	$ 375,000
Special Study			**$2,472,302**	**$14,411,310**	**$16,883,612**	**$3,775,991**
Central Valley			**$ 507,281**	**$ 312,890**	**$ 820,171**	**$ -**
Measuring the impact of removing predator contact points on juvenile salmon survival	Define predator contact points, then determine if predator contact points exist. Hypothesis: Can CVPIA management actions modify the contact point in a manner that increases juvenile salmonid survival?	(g)	$ 507,281	$ -	$507,281	$ -
Food Temperature Optimization Model for CVP	Develop and calibrate a salmonid habitat optimization model to inform CVP reservoir operations to balance water temperature and food resources downstream of CVP reservoirs.	(g)	$ -	$ 312,890	$312,890	$ -
American			**$180,200**		**$180,200**	**$ 67,575**
American River Juvenile Salmonid and Habitat Monitoring	This project links modeling and empirical data to evaluate how the existing and potential rearing habitat available in the lower American River (LAR) impacts the timing, size, and variation in out migration, carrying capacity, and population dynamics of LAR fall-run Chinook salmon.	(b)(15)	$180,200	$ -	$180,200	$ 67,575
Butte Creek			**$441,500**		**$441,500**	**$165,563**
Butte Sink and Sutter Bypass (Non-Project) - Evaluating the role(s) of the Butte Sink and Sutter Bypass for Butte Creek spring-run Chinook salmon and other Central Valley juvenile salmonid populations	This proposal will evaluate the growth benefits of the Sutter Bypass and compare survival between the Sacramento River and lower Butte Creek/Sutter Bypass area.	(b)(15)	$441,500	$ -	$441,500	$165,563

Sacramento			**$ 1,343,321**		**$1,343,321**	
Food for Fish	This proposal outlines coordinated science and management approach to re-integrate agricultural floodplain productivity into river ecosystems. The project boosts aquatic food webs and support recovery of abundant fish populations by subsidizing the food-poor river ecosystem with highly productive floodplain-derived food web resources grown in intentionally inundated winter rice fields, thereby improving juvenile salmonid foraging success in non-natal rearing habitats. Data produced by these actions will be used in the development of a food web and fish growth rate sub-module of the Science Integration Team's Salmon Decision Support Model.	(g)	$ 1,166,288	$ -	$1,166,288	$ -
Green Sturgeon Juvenile Investigation	Green Sturgeon juvenile rearing habitat investigation.	(g)	$ 177,033		$177,033	
Delta				**$14,098,420**	**$14,098,420**	**$3,542,853**
Bay-Delta Collaborative Science and Adaptive Management Study Program with Delta Stewardship Council	Collaborative for Science Adaptive Management Program (CSAMP) – Competitive Funding Opportunity	(b)(15)	$ -	$3,000,000	$3,000,000	$ -
Directed Outflow Project (DOP): Paired Habitat Sampling	The Directed Outflow Project (DOP) is a continuing collaborative effort among a dozen state, federal and non-governmental groups. The DOP will employ a focused spatial and temporal approach to evaluate mechanistic hypotheses directly related to the rationales provided for the summer Delta outflow action and Yolo Bypass Toe Drain action to benefit Delta Smelt, with direct relevance to the fall outflow action.	(b)(1) Other	$ -	$2,574,394	$2,574,394	$2,322,103
Drivers of Delta Smelt Health and Growth	This project will investigate the health, condition, and growth, salinity, and thermal history from fish otoliths with direct impact to subsequent recovery efforts and proposed management actions. This project is currently a primary investigator/contributor to the Directed Outflow Project (DOP).	(b)(15)	$ -	$ 850,000	$850,000	$ 318,750
Dual Operations Entrainment Study	This 3 to 5-yr study will help determine if reservoir releases can be managed to boost downstream zooplankton and benthic invertebrate ('fish food') production to offset effects of higher water temperature on salmonid growth and condition.	(g)	$ -	$2,600,000	$2,600,000	$ -
Eco Hydraulic Modeling with USACE	The USACE ERDC will provide technical and project management support to the USBR on ecohydraulics related to projects managed by the USBR Bay Delta Science Office. This work will include aspects development of project workflows and products to support ongoing projects related to: 1) Fremont weir notch and floodplain reconnection, 2) Fish movement evaluation through Shasta Reservoir, 3) Fish occupancy of newly constructed side channels and other habitats, and 4) Non–physical barrier evaluation and installation (coordinated with CADWR)	(g)	$ -	$ 256,804	$256,804	$ -

Predator Hot Spot Feasibility, Field Support and Analysis	The predator management project will support predation related studies and actions outlined in the 2019 Biological Opinion.	(b)(1)	$ -	$1,000,000	$1,000,000	$ 902,000
Sediment Supplementation Feasibility Study	Reclamation proposes to develop and implement a sediment supplementation feasibility study. The goal of this study will be to determine methods to reintroduce sediment in the Delta to increase turbidity which would provide better habitat conditions for all life stages of Delta Smelt, including increased cover for juveniles and feeding facilitation for larval smelt. This study will include, at minimum, consideration of sediment placement upstream of the Delta during low flow periods in the spring, summer and/or fall, followed by sediment remobilization following inundation during seasonal high flows. Reclamation will coordinate with the Service and other agencies to address necessary permitting for this study. Reclamation will coordinate with the Service on the design and findings of this study, including monitoring measures to assess its effectiveness and feasibility as a long-term management program, a method to phase implementation if required for permitting and other compliance needs.	(g)	$ -	$2,000,000	$2,000,000	$ -
Steelhead Lifecycle Monitoring Program	Upper Sacramento River and San Joaquin River *O. mykiss* population size and life-history composition census.	(g)	$ -	$1,817,222	$1,817,222	$ -
Refuge			**$31,180,257**	**$10,500,000**	**$41,680,257**	**$18,755,002**
Level 2			**$18,946,846**	**$1,845,840**	**$20,792,686**	**$18,755,002**
Refuge L2 Conveyance	Conveyance of surface water and groundwater pumping for refuges	(d)(1)	$ 16,880,801	$ -	$16,880,801	$15,226,483
FWS Refuge L2 Labor	Program Staff Support	(d)(1)	$160,108	$ -	$160,108	$ 144,417
BOR Refuges L2 Labor	Program Staff Support	(d)(1)	$315,609	$ -	$315,609	$ 284,679
East Bear Creek Pump Repair (67% L2)	Service agreements for O&M support services and design services for modifications to improve pump station performance	(d)(1)(5)	$ 1,005,000	$ -	$1,005,000	$ 906,510
Gray Lodge Construction (80% L2)	Project implementation or contract and construction management service for the Level 2 portion of conveyance to Gray Lodge	(d)(1)(5)	$ 195,328	$ -	$195,328	$ 176,186
Pixley National Wildlife Refuge Feasibility Study (37% L2)	Feasibility Study to provide level 2 portion of conveyance to Pixley NWR	(d)(1)(5)	$ -	$ 166,500	$166,500	$ 150,183
Sutter Construction (78% L2)	Sutter NWR lift station construction support services for the level 2 portion of conveyance to Sutter National Wildlife Area	(d)(1)(5)	$ 390,000	$1,679,340	$2,069,340	$ 1,866,545
Incremental Level 4			**$12,233,411**	**$8,654,160**	**$20,887,571**	**$0**
Refuge IL4 Water Acquisition	Incremental level 4 water purchases and level 2 exchanges	(d)(2)	$8,908,000	$5,797,000	$14,705,000	$ -
Refuge IL4 Conveyance	Conveyance of surface water and groundwater pumping for refuges	(d)(1)(2)	$ 1,198,924	$2,100,000	$3,298,924	$ -
FWS Refuge IL4 Labor	Program Staff Support	(d)(2)	$340,089	$ -	$340,089	$ -
BOR Refuges IL4 Labor	Program Staff Support	(d)(2)	$400,086	$ -	$400,086	$ -

East Bear Creek Pump Repair (33% IL4)	Service agreements for O&M support services and design services for modifications to improve pump station performance	(d)(2)(5)	$ 495,000	$ -	$495,000	$ -
Gray Lodge Construction (20% IL4)	Project implementation or contract and construction management service for the IL4 portion of conveyance to Gray Lodge	(d)(2)(5)	$ 781,312	$ -	$781,312	$ -
Pixley National Wildlife Refuge Feasibility Study (63% IL4))	Feasibility Study to provide IL4 portion of conveyance to Pixley NWR	(d)(2)(5)	$ -	$283,500	$283,500	$ -
Sutter Construction (22% IL4)	Sutter NWR lift station construction support services for the IL4 portion of conveyance to Sutter National Wildlife Area	(d)(2)(5)	$ 110,000	$473,660	$583,660	$ -
Independent			**$5,000,000**	**$9,991,221**	**$14,991,221**	**$11,718,010**
HRP			**$1,500,000**	**$ -**	**$1,500,000**	**$1,353,000**
Habitat Restoration Program (HRP)	Land Protection and Habitation Restoration Projects	(b)(1) other	$ 1,096,832	$ -	$1,096,832	$ 989,342
FWS HRP Labor	Program Staff Support	(b)(1) other	$198,317	$ -	$198,317	$ 178,882
BOR HRP Labor	Program Staff Support	(b)(1) other	$204,851	$ -	$204,851	$ 184,775
SJRRP			**$ 2,000,000**	$ -	**$ 2,000,000**	$ -
San Joaquin River Restoration Program	Construction of Mendota Pool bypass for flow routing and fish passage	(c)(1)	$ 2,000,000	$ -	$2,000,000	$ -
TRRP			**$ 1,500,000**	**$9,991,221**	**$11,491,221**	**$10,365,081**
Trinity River Restoration Program	Implementing the Record of Decision for the Trinity River Restoration Program including flows, gravel, monitoring, watershed restoration work, and related administration	(b)(1) Trinity	$ 1,500,000	$9,991,221	$11,491,221	$10,365,081

Attachment 2 – Fiscal Year 2021 Annual Obligation Plan Charters

Gray Lodge Wildlife Area.

Description of Charter Information

Watershed: Reference to the watershed where the project is located.

Funding Years: Fiscal years covered by the Charter.

Priority: Ranking of the Charter within a specific CVPIA authority to provide an understanding of the relative importance of different efforts.

Partners: Listing of agencies and entities assisting in the planning and implementation of the Charter through the contribution of resources. Resources may include cost-share, in-lieu services, use of facilities, or other technical support during the development of a project.

Related Programs: List of related programs and activities supported by the Charter such as BDCP, RPA, Recovery Plans, CVJV, etc. to provide an understanding of the relationship between the proposed Charter and other efforts by Federal, State, and local entities.

Authority: Provision under the CVPIA supported by the Charter that will allow the government to undertake the action and determine the relevant reimbursement and cost-share requirements.

- **Authority**: One or more legislative provisions for the action and the relative contribution to the different provisions of the legislation.
- **Percentage**: Fraction of the total Charter costs attributable to the Authority.
- **Description**: Justification for why the Charter is allowable under the Authority and for the specific fraction, if applicable.

Metric(s): Anticipated accomplishments from successful completion.

Deliverables: Anticipated documentation and timeline for key activities under the Charter, typically public documents and reports that would be referenced by title.

- **Date**: The estimated year and month when the deliverable will be available.
- **Title**: The anticipated name or citation of the deliverable.

Narrative: A one or two paragraph(s) description of the Charter background, benefits, deliverables, additional information (e.g., cost basis), and changes since prior Charters, if any.

Data Management: Information on where reports and data for this Charter will be permanently housed and the relevant protocols for understanding the information.

Risks: Narrative or bulleted list of uncertainties and potential project management related issues that might change including, the scope, schedule, or budget.

Cost Estimate: Summary of costs by fiscal year and fund. The information in Resources Data automatically populates this table.

Fisheries Charters

2021 Annual Obligation Plan

CENTRAL VALLEY PROJECT IMPROVEMENT ACT
TITLE XXXIV OF PUBLIC LAW 102-575

American River

Special Study: American River Juvenile Salmonid and Habitat Monitoring

This project links modeling and empirical data to evaluate how the existing and potential rearing habitat available in the lower American River (LAR) impacts the timing, size, and variation in out migration, carrying capacity, and population dynamics of LAR fall-run Chinook salmon.

DCN: AFRP2109
Watershed: American River
Funding Years: 2019 - 2021
Priority: SIT FY2018 Tech Memo:
- Fall Chinook – American River, Improve/increase juvenile rearing habitat (floodplain)
- Winter Chinook – Create/improve juvenile rearing habitat in non-natal tributaries
Partners: Cramer Fish Sciences, Sacramento Water Forum, CBEC, Inc., CDFW
Related Programs: CVPIA (b)(13), CVPIA (b)(2)

Authority

Provision	Justification
(b)(15) CAMP	The modeling and data analysis of this project falls under the CAMP provision.

Metrics

Name	Value	Units	Comment
Abundance of recruits produced by spawning adults in restored habitats	1	number of fish	Task 3-4: Chinook Salmon otolith and genetic sample collection. Data and analyses from this task will improve future iterations of the SIT DSM model by quantifying how the production potential of habitat restoration actions applied in the LAR and how different life-history types of fall-run Chinook Salmon use rearing habitats in the LAR. These tasks will determine how spawning habitat restoration sites have enhanced juvenile production and how juvenile Chinook Salmon and steelhead utilize existing rearing habitat, DSM model information gaps.
DSM parameter estimates	1	N/A	Task 1: LAR SDM helps inform the broader CVPIA SIT and DSM process by improving the precision and accuracy of coefficients used in the SIT DSM and the life-cycle models for anadromous fishes upon which the DSM is based.

Name	Value	Units	Comment
Rearing habitat in the LAR	1	acres	Task 2: ESHE modeling. This task builds off a topographic survey and 2D hydraulic model that has been funded by USFWS, Water Forum, and SAFCA. Rearing habitat estimates can be calculated for steelhead and multiple run-timing groups of Chinook Salmon. This task will estimate current juvenile rearing capacity, a DSM model information gap.
Abundance of juvenile salmonids	1	number of fish	Task 4: Annual juvenile salmonid survey. Data generated from these surveys will provide abundance estimates of steelhead and juvenile chinook rearing in restored and unrestored habitats. These data will improve habitat-use estimates in the SIT DSM
Sediment volume	1	cubic yards	Task 6: Sediment budget modeling. This study would compare a 2017 digital elevation model (DEM) with a 2006 DEM to quantify the change over 11 years, resolving the average annual volume of sediment exported. Results from this study can be used to estimate restoration project lifespan and aid project prioritization in the SIT DSM. This task will determine how much sediment should be added to the river annually and the longevity of gravel augmentation projects, DSM model information gaps.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Dec. 2020	LAR SDM meeting (Task 1.1)
Dec. 2020	ESHE modeling final report (Task 2.1)
Dec. 2020	AFS symposium proceedings (6 manuscripts) (Task 3.2)
Jan. 2021	Year 3 otolith and genetic data report (Task 3.1)
Feb. 2021	AFS research symposium (Task 3.2)
Dec. 2022	Genetics and otolith data report
Dec. 2022	Juvenile rearing data report
Dec. 2022	Sediment budget report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Paul Cadrett, USFWS-Lodi
Project Technical Team(s):

	Name	Discipline	Contact Info
USFWS-Lodi	Paul Cadrett	Biologist	209-649-0898
CBEC	Chris Hammersmark	Biologist	916.668.5236
Water Forum	Lilly Allen	Project Manager	(916) 808-1997
Cramer Fish Sciences	Joe Merz	Biologist	jmerz@fishsciences.net
USBR-BDO	John Hannon	Biologist	916-414-2341

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360

Narrative

The SIT DSM model for fall-run Chinook, suggests the Lower American River (LAR) priority is increasing juvenile rearing habitat; however, the finer-scale LAR DSM model isn't as conclusive. Information gaps can be filled with studies extending and enhancing existing models. This charter outlines actions that will better characterize LAR rearing habitat use, resolve discrepancies between the SIT and LAR DSM models, and improve our understanding of Chinook habitat use in the LAR and delta.

The main Core Team priorities addressed in this charter are improving fall-run and winter-run Chinook salmon and steelhead juvenile rearing habitat.

- *Task 1- Application of the LAR DSM Model*
  The LAR DSM model will be refined to help prioritize decision making on the LAR, identifying future restoration locations and restoration project type to provide the greatest benefit toward the doubling goal.
- *Task 2- Habitat Modeling*
  We will quantify existing available habitat and the additional habitat required to reach the doubling goal, building on past efforts to model habitat requirements and a 2D hydrodynamic model.
- *Task 3- Otolith and Genetic Analysis*
  This task provides funds to complete, and extend, a study conducted from 2014-2016 using genetic samples and otoliths from adult and juvenile Chinook to assess reproductive success of adults utilizing restored habitats and analyze the effects of water management on outmigration timing and life history diversity.
- *Task 4- Juvenile Salmonid Monitoring*
  This task determines steelhead and fall-run Chinook salmon habitat use data within the LAR with emphasis on better understanding habitat restoration effects on salmonid rearing, growth, and survival.

- *Task 5- On-call Modeling*
  This task supports decision making processes with data and modeling analyses to quantify differences between alternatives. Analyses include: redd dewatering estimates, identification of stranding areas, monitoring and modeling temperature conditions under various release patterns.
- *Task 6- Sediment Budget Development*
  A sediment budget will estimate the average annual volume of material that is exported from the LAR, quantifying the annual sediment deficit and developing estimates of the longevity of gravel augmentation efforts.

Short-term objectives and anticipated outcome:

- Refinement and validation of existing LAR DSM, SIT DSM, and ESHE models
- Validated large-scale LAR DEM and 2D hydraulic/habitat suitability models
- Juvenile salmonid outmigration timing, growth, and life-history variants
- Enumeration of steelhead and Chinook rearing in restored and unrestored habitats
- Sediment budget and gravel augmentation project longevity estimate
- Improved tools and on-call analyses to support real-time management decision making

Genetic mark-recapture and otolith microchemistry (Task 3) provide a cost-effective means of acquiring high-quality data relative to standard monitoring techniques. Data include tracking natural production success from restored locations, determining life history diversity, straying, and the contribution of hatchery and wild adult Chinook salmon. Task 3 will be conducted in collaboration with CDFW and other interested stakeholders, increasing efficiency and subsequently reducing costs.

This charter aims to develop further a DSM tailored to the LAR and apply inference from that model in an ARM framework. This charter serves as a large-scale test case for the broader SIT DSM and ARM process, where information gained in the LAR will help improve applications in other watersheds. This charter will help fill key information gaps in current DSMs; refer to Metrics section for specifics. If this charter is not implemented, information gaps will remain that limit the extent to which resource agencies can make management decisions that maximize Chinook salmon production.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

ESHE model documentation (Task 2) will be submitted as supplemental material with the final report.

Genetic and otolith sample databases (Tasks 3 & 4) will be submitted to Center for Data Management upon project completion.

All field data from juvenile rearing studies associated with Task 5 will be submitted annually to the Center for Data Management. Associated data will help bolster DSM models (Task 1) and provide a means of ground-truthing model predictions (Task 2). Modeling outputs from Tasks 1, 2, 6, and 7 will leverage existing data from previous monitoring efforts to improve the efficiency and effectiveness of management actions. Data Contact: Paul Cadrett (paul_cadrett@fws.gov)

Risks

Risk	Likelihood	Impact
High flows	2	2
Not obtaining permits	1	3
Collaboration failure	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019	CVPRF	$1,155,400	$0	$1,155,400	$0
2019	S/LIK	$150,000	$0	$0	$150,000
2020[10]	CVPRF	$0	$0	$0	$0
2021	CVPRF	$180,200	$0	$180,200	$0

Total Cost: $1,485,600

10 The FY2019 funding amount of $1,155,400 included $180,200 which was the FY2020 allocated funding for this project.

Status and Trend: American River Rotary Screw Trap Monitoring

Annual quantification of juvenile Chinook salmon production and the abundance of juvenile steelhead in the American River using rotary screw traps.

DCN:	AFRP2129
Watering:	American River
Funding Years:	2017 - 2021
Priority:	SIT Critical Monitoring Need - Monitoring of juvenile salmon production on the American River provides fundamental data that are necessary to assess the biological response to habitat restoration activities in that CVP watershed.
Partners:	CDFW, Pacific States Marine Fisheries Commission
Related Programs:	CVPIA (b)(13), Structured Decision Making

Authority

Provision	Justification
(b)(15) CAMP	The data from this project is used for DSM calibration by the SIT. The data is also used by the fish agencies to track salmonid fish production performance measures.

Metrics

Name	Value	Units	Comment
Estimate of juvenile production in this watershed	1	Estimate of number of fish	The production or abundance of different life stages of juvenile salmon and steelhead are calculated on an annual basis based on monitoring data that are collected with rotary screw traps.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Annually	Annual American River rotary screw trap report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Donnie Ratcliff
Project Technical Team(s):

	Name	Discipline	Contact Info
USFWS-Lodi	Paul Cadrett	Biologist	209-649-0898

Project Management Team:

Team Position	Name	Discipline	Contact Info
USFWS-Lodi	Paul Cadrett	Biologist	209-649-0898

Narrative

The rotary screw trap monitoring activities in the American River supply data that are used to calibrate the SIT DSM and to assess the biological response to habitat management activities in those watersheds. As such, they can be used to infer, at a watershed-level scale, how habitat restoration activities are affecting the number of juvenile Chinook salmon and steelhead in that river.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data Contact: Paul Cadrett (paul_cadrett@fws.gov)

Risks

Risk	Likelihood	Impact
Low, unless funding distribution is delayed	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2017	CVPRF	$223,050	$0	$223,050
2018	CVPRF	$221,300	$0	$221,300
2019	CVPRF	$231,200	$0	$231,200
2020	CVPRF	$225,000	$0	$225,000
2021	CVPRF	$231,750	$0	$231,750
2022	CVPRF	$237,750	$0	$237,750
2023	CVPRF	$243,750	$0	$243,750
2024	CVPRF	$249,750	$0	$249,750
2025	CVPRF	$255,750	$0	$255,750
2026	CVPRF	$261,750	$0	$261,750
2027	CVPRF	$267,750	$0	$267,750

Total Cost: $2,648,800

Habitat and Facility Improvement: American River Salmonid Habitat Restoration

Restore juvenile Chinook salmon and steelhead rearing habitat and enhance natural channel processes on the lower American River. Annual habitat improvement projects are planned for the next five years.

DCN: 20BDAO015
Watershed: American River
Funding Years: 2017 - 2022
Priority: SIT Priority: Fall Chinook – 5 American River, Improve/increase juvenile rearing habitat (floodplain); Winter Chinook – 3 Create/Improve juvenile rearing habitat in non-natal tributaries
Partners: NMFS, Sacramento County, Sacramento Water Forum, SAFCA, USBR, CDFW, FWS
Related Programs: NMFS, AFRP, CDFW

Authority

Provision	Justification
3406 (b)(13) Gravel	Creates and enhances juvenile rearing habitat by placement of suitable sorted material into the river channel.

Metrics

Name	Value	Units	Comment
Large Chinook emigrants	24000	number of fish	Assumes 2 large Chinook supported per square meter of rearing habitat (SIT value)
Habitat created/improved	3	acres	Estimate that 3 acres of rearing habitat will be created/improved
Material moved	25000	cubic yards	Estimate that 25,000 cubic yards of material will be moved and 100 - 200 pieces of large wood added

Project Schedule

Date	Description
Nov. 2018	Habitat project completed - ~3 acres of new habitat
May. 2019	Aerial photos and shapefile of Chinook spawning locations
Sep. 2019	Effectiveness Monitoring Report
Nov. 2020	The cycle above repeats annually

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

	Name	Discipline	Contact Info
	John Hannon	Fish Biologist	jhannon@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	John Hannon, USBR	Fisheries and design	Phone: 916-414 2341 email: jhannon@usbr.gov
PMT Staff, Role: Federal Agency	Paul Cadrett, USFWS	Fisheries	Phone: 209-334-2968 email: paul_caudrett@fws.gov
PMT Staff, Role: Cooperative agreement recipient	Lilly Allen, Water Forum	Project manager and geologist	Phone: 916-808-1997 email: lallen@cityosacremento.org
PMT Staff, Role: Contractor	Chris Hammersmark, CBEC	Engineering	Phone: 916-668-5236 Email: c.hammersmark@cbecoeng.com
PMT Staff, Role: State Agency	Mike Healey, CDFW	Fisheries	Phone: email: mike.healey@wildlife.ca.gov
PMT Staff, Role: Federal Agency	Ruth Goodfield, NMFS	Restoration coordinator	Phone: 916-930-3716 email: ruth.goodfield@noaa.gov

Narrative

1. The project creates and enhances juvenile rearing habitat for Chinook salmon and steelhead by increasing floodplain and side channel habitat, incorporating new woody material, and adding coarse substrate. This is a continuation of annual restoration actions that started in 2008. The 2020 project location will be Ancil Hoffman, Lower Sailor, or El Manto. The project management team will determine the ultimate location each year following completion of the prior year (2019) project and synthesis of past monitoring results.
2. The project focus is on increasing juvenile rearing habitat on the floodplain of the American River, a SIT priority.
3. Specific activities include side channel and floodplain excavation, sorting of the excavated material, placement of the suitable sorted material into the river channel, and addition of woody material and boulders and monitoring the effectiveness of that work. A companion charter to this charter (American River Structured Decision Making) includes an additional monitoring component of the work.

4. The projects seek to increase the abundance and size of juvenile salmonids emigrating from the American River and ultimately result in a higher naturally produced salmonid return.
5. The 2018 project will be designed to produce approximately 24,000 large Chinook emigrants, based on the SIT value of 2 large Chinook/m**2, and also benefit juvenile steelhead habitat productivity.
6. Permits, within the complex permitting environment, have already been largely obtained through programmatic permits, so most of the funding supports on the ground restoration work.
7. The objective is to provide suitable rearing habitat adjacent to and downstream of spawning areas. Secondary benefits are encouragement of natural river processes through scaling of habitat to the flow regime.
8. Focus is habitat improvement.
9. If not implemented the successful collaboration with the diverse American River stakeholders would be jeopardized. Collaboration has been occurring through the Water Forum stakeholder meetings, Northern California Water Agency salmon plan meetings, American River FISH group, and American River Parkway Advisory committees. Sacrament Area Flood Control Agency provides approximately $100,000 cost share for the Paradise Beach juvenile rearing habitat project. The Water Forum contributes all of the time and resources their staff spends on the project.
10. No specific objections to the charter are known. Occasionally local interested parties have site-specific concerns relating to walking paths, dust, turbidity, perceived mining activity, or effects to boating features. These will be worked out as they occur on a one on one basis with the interested individuals.

Data Management

1. Project designs and as-built survey results will be included in a basis of design report prepared by cbec under contract with the Water Forum. The monitoring included in this charter includes riverwide aerial photography conducted during Chinook spawning in November and December. The photography provides for a river-wide redd count and enables the visible redds to be mapped in a GIS shapefile. It also provides a visual as-built view of the current year project and of changes that occur at other project sites and throughout the river through time. In addition, monitoring includes high priority effectiveness monitoring activities that contribute to the American River structured decision making.

   Effectiveness monitoring would also be achieved through a companion charter (American River SDM project).
2. CVPIA data management center to be utilized when available.
3. Relates to the objective of providing rearing habitat close to spawning habitat and helps determine project longevity at all sites to feed into back improving effectiveness of future habitat improvement designs.

4. Data will be housed at the Bureau of Reclamation Bay Delta Office, US Fish and Wildlife Service Stockton Office, and the Sacramento Water Forum office. Contact John Hannon at jhannon@usbr.gov for data.

Risks

Risk	Likelihood	Impact
Flows too high to work in river	1	3
Permits not obtained	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2018	CVPRF	$1,000,000	$1,000,000	$0
2019	CVPRF	$1,000,000	$1,000,000	$0
2020	CVPRF	$1,000,000	$1,000,000	$0
2021	CVPRF	$1,000,000	$1,000,000	$0
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	CVPRF	$1,000,000	$1,000,000	$0

Total Cost: $7,000,000

Butte Creek

Special Study: Butte Sink/Sutter Bypass - Evaluating the Role(s) of the Butte Sink and Sutter Bypass for Butte Creek Spring-Run Chinook Salmon and Other Central Valley Juvenile Salmonid Populations

This proposal will evaluate the growth benefits of the Sutter Bypass and compare survival between the Sacramento River and lower Butte Creek/Sutter Bypass area.

DCN:	AFRP2103
Watershed:	Butte Creek
Funding Years:	2019 - 2023
Priority:	SIT FY2020 Tech Memo - Increase access to juvenile rearing habitat in Sutter and Yolo Bypasses - Increase access to non-natal tributaries to open up habitat in Upper and Upper Mid Sacramento River, Aug-March The NMFS 2014 Recovery Plan for Central Valley Chinook Salmon and steelhead supports 'Implement projects to increase Butte Creek floodplain habitat availability to improve habitat conditions for juvenile rearing' Butte Creek Action ID 2.14
Partners:	DWR, Golden Gate Salmon Association, Metropolitan Water District, NMFS, UC-Davis, USFWS
Related Programs:	NMFS-RP

Authority

Provision	Justification
(b)(15) CAMP	These monitoring and evaluation tasks fall under the CAMP Provision

Metrics

Name	Value	Units	Comment
Evaluation of Survival	1	percentage of fish	Tagged Fish will be evaluated for percentage of survival.
Evaluation of Fish Growth	1	percentage of fish	Chinook will be evaluated for enhanced fish condition.
Food Web Productivity	1	metadata	Water samples collected for invertebrate diversity analysis.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Jun. 2021	Annual Report
Mar. 2023	Final Report
Jun. 2022	Annual Report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
Jim Early	USFWS-RBFO	530-736-0890
Matt Brown	USFWS-RBFO	530-762-1804
Derek Rupert	USBR-NCAO	530-247-8514
Elissa Buttermore	USBR-BDO	916-414-2416

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360
	Donnie Ratcliff	USFWS	916-862-0203

Narrative

This project was previously approved in the FY19 Annual Work Plan based on the FY19 Priorities of improve rearing habitat for winter-run Chinook salmon and improve survival for juveniles on Butte Creek. Both runs are being observed in the Sutter Bypass. Continuing the study has both short-term objective-specific monitoring elements by providing real time input on habitat condition, as well as long-term trend monitoring elements, as the project can be used to assess trends if/when habitat expansion occurs via a change in operations, restoration, etc. The FY20 Call for Project Proposals identifies in Table 2: Juvenile tributary survival as a Tier 1 Priority and juvenile river growth as a Tier 2 Priority. This project will continue to provide critical data to inform the Peterson 2014 DSM.

The Butte Creek spring-run Chinook salmon have been a relatively successful and stable population compared to other populations in the Central Valley. To date, there is little data to suggest the mechanism for this relative success. NOAA Fisheries designated Butte Creek and Sutter Bypass as a critical habitat for Central Valley spring-run Chinook salmon.

The purpose of this study is to quantify the benefits of the flooded Sutter Bypass and Butte Sink for juvenile Chinook salmon compared to adjacent main river channel habitats. Future management actions can utilize this information to maximize benefits to juvenile salmon and help enhance the abundance of Chinook salmon populations in the Central Valley. Consequently, it is crucial to first have a better understanding of what mechanisms and locations create high quality habitat for juvenile salmonids. To do this, we propose to address the following questions:

1. How does the hydrology of the lower Butte Creek (Butte Sink and Butte Slough) and the Sutter Bypass affect juvenile salmon?
2. What are the growth benefits of juvenile salmonids rearing in the lower Butte Creek and Sutter Bypass?
3. What runs of Salmon utilize the Sutter Bypass?

The NMFS 2014 Recovery Plan for Central Valley Chinook Salmon and Steelhead supports 'Implement projects to increase Butte Creek floodplain habitat availability to improve habitat conditions for juvenile rearing' Butte Creek Action ID 2.14.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.
Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

This project proposal supports overall FY20 SIT priorities by collecting and providing information for the DSM on fish survival, habitat availability, flow and temperature for Chinook salmon. Additionally, it addresses juvenile tributary survival, and the value of increasing perennially inundated juvenile habitat in the Sacramento River for all runs of Chinook salmon.

Data will be maintained and housed at UC Davis and reports submitted to USFWS at https://www.fws.gov/redbluff/afrp.html

Risks

Risk	Likelihood	Impact
Impacts to wild spring Chinook	2	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2019	CVPRF	$775,720	$0	$775,720
2020[11]	CVPRF	$17,925	$0	$ 17,925
2021	CVPRF	$441,500	$0	$441,500

Total Cost: $1,235,145

.11 The FY2019 funding amount of $775,720 included $388,169, which was the FY2020 allocated funding for this project. The $17,925 is additional FY20 funding to cover added genetic sampling, water sampling, and materials as part of the original agreement.

Central Valley Wide

Real Time Operations: Central Valley Prediction and Assessment of Salmon

Description CVPAS for Central Valley Prediction and Assessment of Salmon, extends and improves the SacPAS real-time web database and fish forecasting tools to other river systems in the Central Valley.

DCN: 21BDAO001
Watershed: Central Valley Wide
Funding Years: 2017 - 2021
Priority: High
Partners: University of Washington
Related Programs: Not applicable

Authority

Provision	Justification
3406(g)	Integrate models and output from water quality models into a web-accessible analysis and visualization system.

Metrics

Not applicable.

Project Schedule

Date	Description
2018	Established web page
2019-2024	Expand linked fish models
2019-2024	Expand analysis tools

Roles and Responsibilities

Project Sponsor: Reclamation
Project Manager: Elissa Buttermore
Project Technical Team(s):

Name	Discipline	Contact Info
Elissa Buttermore	Fish Biologist	ebuttermore@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Elissa Buttermore	Fish Biologist	ebuttermore@usbr.gov

Narrative

CVPAS for Central Valley Prediction and Assessment of Salmon, extends and improves the SacPAS real-time web database and fish forecasting tools to other river systems in the Central Valley. The goal is to integrate environmental/fish data, fish passage/survival models and output from water quality models into a web-accessible analysis and visualization system. The website provides support for regional integration and public access to Reclamation and ESA-mandated activities.

Data Management

A publicly accessible web site has been established at: http://www.cbr.washington.edu/sacramento/

Risks

Risk	Likelihood	Impact
Not applicable		

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$1,200,000	$1,200,000	$0
2022	CalFed	$410,000	$410,000	$0
2023	CalFed	$390,000	$390,000	$0

Total Cost: $2,000,000

Status and Trend Monitoring: Data & Analytic Support

SIT support via data visualization & stewardship, and peer review management.

DCN: AFRP2116
Watershed: Central Valley Wide
Funding Years: 2015 - 2023
Priority: CVIPA SIT data and analytic support
Partners: USFWS, USBR
Related Programs: CAMP

Authority

Provision	Justification
3046(g)	Support data and analytical needs related to the decision support model.

Metrics

Name	Value	Units	Comment
Peer Reviews	1	Completion	On-call to compile list of peer reviewers and to complete peer review of 2019 Fall Run DSM and 2020 Near Term Restoration Strategy in conjunction with Reclamation & USGS Science Integrity policies.
Data Visualization	1	metadata	Visualization/Presentation of DSM output per USGS & Reclamation
Data Management	1	Website	Organize, manage, and provide permanent access to all CVPIA data the contractor can get their hands on.

Project Schedule

Date	Description
Dec. 2017	Tech Memo Support description
Mar. 2018	Review of 2017 Technical Memorandum
Mar. 2018	Review of 2017 Fall Run DSM
Mar. 2018	Phase I - Contract Closeout Summary
Jun. 2019	Website with access to tools, data, and SIT meeting notes, as well as SIT related materials and meeting calendar
Dec. 2019	Annotated Outline of 2020 Near Term Restoration Strategy

Roles and Responsibilities

Project Sponsor: Heather Casillas, USBR
Project Manager: Michael Beakes USBR

Project Technical Team(s): Michael Beakes USBR, Rod Wittler USBR, Donnie Ratcliff USFWS, James Peterson USGS, Mike Urkov FlowWest

Name	Discipline	Contact Info
Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
Rod Wittler	Ph.D., PE	rjwittler@usbr.gov
Donnie Ratcliff	Fisheries	donald_ratcliff@fws.gov
James Peterson	Ph.D. SDM	jt.peterson@oregonstate.edu
Mike Urkov	Sr. Env. Planner	murkov@flowwest.com

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
PMT Data Steward	Rod Wittler	Ph.D., PE	rjwittler@usbr.gov
PMT Data Steward	Donnie Ratcliff	Fisheries	donald_ratcliff@fws.gov
Technical Lead	James Peterson	Ph.D. SDM	jt.peterson@oregonstate.edu
Technical Lead	Mike Urkov	Sr. Env. Planner	murkov@flowwest.com

Narrative

In 2008, an independent review of the anadromous fish related provisions of the Central Valley Project Improvement Act (CVPIA), recommended improving the science-based framework for decision making. The agencies jointly implementing the CVPIA, the U.S. Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (USFWS), selected the SDM process to address the recommendation and led a "Core Team" consisting of representatives from the USFWS, Reclamation, California Departments of Fish and Wildlife and Water Resources, and the U.S. National Marine Fisheries Service in developing an SDM framework as part of the Implementation Plan for the Fish Resource Area of the CVPIA (Implementation Plan, USFWS, 2014 Draft).

SDM provides a formal, documented, and open source process to develop quantifiable and measurable objectives and determine the best decision alternatives to meet those objectives using quantitative models. In the development of the Implementation Plan and the initial SDM framework, the agencies focused efforts on a limited number of decision models to represent potential hypotheses for how actions addressing limiting factors would improve natural production for Chinook salmon (of all races), steelhead, and sturgeon. The models provided reasonable results and a logical method for prioritizing limited resources. Sensitivity studies identified uncertainty in both the parameters and models where refinement could potentially improve the ability to determine the best decisions to maximize natural production.

The purpose of this charter is to support data and analytical needs related to SDM within the Fish Resource Area of the CVPIA. Support will take the form of data compiling, making data available, and using numerical tools to facilitate analysis of data related to fisheries performance, mitigation

actions, and habitat restoration. This charter will refine and further develop the quantitative modeling component of the SDM through a collaborative process with agencies (State, Federal, and Local) and stakeholders (non-government organizations, Federal and State Water Contractors, etc.). The resulting products will assist to prioritize funding actions to achieve the anadromous fish doubling goal of the CVPIA and management objectives.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server. Contractor visualizes, coordinates, and stewards data generated by the USGS via the DSM"s. Contractor will store all pertinent data on their own system and Reclamation will initiate efforts to transfer all data/meta data to a DOI system in 2020. The 3406(g) program (MP-700; Michael Wright) is the point of contact for maintaining the mirror of the contractor's data.

Risks

Risk	Likelihood	Impact
Peer Review	2	2
Visualization	1	2
Stewardship	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2015	CVPRF	$379,547	$379,547	$0
2016	CVPRF	$325,887	$325,887	$0
2017	CVPRF	$323,911	$323,911	$0
2018	CVPRF	$135,000	$135,000	$0
2018	WRR	$434,000	$434,000	$0
2019	CVPRF	$260,000	$260,000	$0
2019	WRR	$429,619	$429,619	$0
2020	CVPRF	$260,000	$260,000	$0
2020	WRR	$425,436	$425,436	$0
2021	CVPRF	$260,000	$260,000	$0
2021	Supplemental	$421,723	$421,723	$0
2022	CVPRF	$260,000	$260,000	$0
2022	WRR	$417,548	$417,548	$0
2023	CVPRF	$260,000	$260,000	$0
2023	WRR	$417,548	$417,548	$0

Total Cost: $5,010,219

Special Study: Food Temperature Optimization Model for CVP

Develop and calibrate a salmonid habitat optimization model to inform CVP reservoir operations to balance water temperature and food resources downstream of CVP reservoirs.

DCN: 20BDAO028
Watershed: Central Valley Wide
Funding Years: 2020-2023
Priority: High
Partners: University of California-Davis
Related Programs:

Authority

Provision	Justification
3406(g)(4)	Models Central Valley river carrying capacity

Metrics

Name	Value	Units	Comment
Habitat optimization model	1	Model	Model will be used to determine if reservoir food exports can be managed to reduce cold water pool depletion.
Manuscripts	2	Manuscript	Publication of results in peer-reviewed scientific journals

Project Schedule

Date	Description
4/2023	Complete monthly water quality sampling
4/2023	Complete benthic food web sampling
4/2023	Complete in-reservoir zooplankton sampling
4/2022	Document food web structure
4/2023	Determine salmonid growth rates
4/2023	Complete habitat optimization model
9/2023	Present results at science conference
9/2023	Submit manuscripts

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team position	Name	Discipline	Contact Info
Modeler-UC-Davis	Francisco Bellido Leiva	Modeler	fjbellidoleiva@ucdavis.edu
Modeler-Reclamation	Michael Beakes	Fish Biologist	mbeakes@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-UCD	Robert Lusardi	Professional researcher	ralusardi@ucdavis.edu
PMT Data Steward			

Narrative

The project includes an observational and a modeling component. The observational component will include: (i) longitudinal profiles of water quality, nutrients, food resources (phytoplankton, zooplankton, organic carbon) below three CVP reservoirs; (ii) longitudinal profiles of benthic food web and food dynamics including estimates of benthic algae biomass, fine particulate organic matter and benthic macroinvertebrate abundance; (iii) sampling zooplankton in three CVP reservoirs to determine from where and at what times of year zooplankton are exported to downstream areas; and (iv) use carbon and nitrogen isotopes to determine the contribution of reservoir and in-river food web constituents to salmonids and other higher order consumers. The modeling component of the study will consist of a habitat optimization model for winter-run Chinook that considers both temperature (egg incubation and rearing) and food (rearing) as related to the management of reservoir releases (discharge timing and magnitude) below Shasta Reservoir and with consideration of inter-annual run timing and return of winter-run Chinook. The model will be populated using data from the field sampling component of the study. The model will specifically look at tradeoffs between cold water releases and food subsidies to the Sacramento River during critical periods (and over a range of water years) and optimize habitat conditions for fish while also considering water management constraints associated with discharge releases.

Data Management

All data, modeling results and the optimization model code will be housed on Bay-Delta Office internal servers and published on the Environmental Data Initiative Data Portal.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Funding Source	Total	BOR	FWS	State or Local/In Kind
2020	CBD	$236,657	$236,657	$0	$0
2021	CBD	$65,890	$65,890	$0	$0
2021	Supplemental	$247,000	$247,000	$0	$0
2022	CBD	$341,341	$341,341	$0	$0
2023	CBD	$60,397	$60,397	$0	$0

Total Cost: $951,285

Special Studies: Measuring the Impact of Removing Predator Contact Points on Juvenile Salmon Survival

Define predator contact points, then determine if predator contact points exist. Hypothesis: Can CVPIA management actions modify the contact point in a manner that increases juvenile salmonid survival?

DCN:	AFRP2110
Watershed:	Central Valley Wide
Funding Years:	2018-2023
Priority:	SIT Priority: Fall Chinook – 4 Adaptively manage reduction/imp. predator contact point
Partners:	FWS, MWD, Natural Resource Scientists, NMFS, DAF Consultants, EBMUD
Related Programs:	CAMP, Interagency Ecological Program, NMFS, WIIN Act, AFRP, AFSP

Authority

Provision	Justification
3406(g)(4)	Measures needed to restore anadromous fisheries to optimum and sustainable levels in accordance with the restored carrying capacities of Central Valley rivers, streams, and riparian habitat

Metrics

Name	Value	Units	Comment
Reduced model uncertainty	1	Completion	Study will reduce SDM model uncertainty in determining what affects juvenile survival, focusing on 'Predator Contact Points' in association with setback levee on Bouldin Island.
number of contact points addressed	1	Number of improvements	Reclamation District No. 756 will be implementing a $9.5 million set-back levee on Bouldin Island in 2018. We plan on identifying contact points in the Mokelumne River and around Bouldin Island and Webb Tract
reach-scale juvenile survival	5	Percentage of fish	Increase in survival is predicted using the DSM parameter estimate for mortality per contact point (-0.0067). Assuming 5 contact points removed, we predict a 5/exp (-0.0067) = 5.0% increase in survival. Contact point restoration and post-restoration measures of juvenile survival will update the DSM parameter estimate.

Project Schedule

Date	Description
Dec. 2019	Year 1 data collection report
Dec. 2020	Baseline Monitoring
Dec. 2021	Year 3 data collection report
Dec. 2022	Contact Point Modification Report
Dec. 2023	Final Report

Roles and Responsibilities

Project Sponsor:
Project Manager: Cyril Michel
Project Technical Team(s):

Name	Discipline	Contact Info
Dave Forkel		DAF Consultants
Michelle Workman		EBMUD
J.D. Wikert		FWS
Mark Gard		FWS
Corey Phillis		MWD
Alison Collins		MWD
Russell Ryan		MWD
Steve Lindley		NMFS
Cyril Michel		NMFS
Andrew Hein		NMFS
Dave Vogel	Resource Scientists	River Lighting PMT

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Cyril Michel	Fisheries Biologist	NMFS
PMT Data Steward			
COR/GOR	Corey Phillis		

Narrative

A key uncertainty of the DSM is 'what affects juvenile salmonid survival.' Scientific disagreement exists regarding 1) what is a predator contact point and 2) can they be restored to increases survival? Our objective is to reduce these uncertainties with a replicated before-after control-impact experiment to measure changes in survival following restoration of predator contact points. Predation Event Recorders (PERs) will measure juvenile survival associated with DSM contact points. Contact points will then be removed or modified, and juvenile survival again measured to test whether restoring contact points can increase juvenile survival. There are 3 possible outcomes: 1) predation-events remain the same (or increase) at restored contact points, suggesting restoration has no effect; 2) predation-events decrease at restored contact points, but reach-scale survival does

not change, suggesting restoring contact points simply redistributes predators; or 3) predation-events decrease at restored contact points, suggesting restoring contact points can reduce predation. So results can be generalized to other regions the project locations include delta (Bouldin Is and Webb Tract) and riverine habitats (Mokelumne and Sac. Rivers).

FY19 activities include PER study in the delta associated with river lighting. FY20 activities may include lighted structure predation study in the upper Sacramento River near Redding, CA, pending additional funding.

Fall Chinook priority: adaptively manage reduction/improvement predator contact points. Winter-run PWT/SAIL: Reduce predation losses

Predation events will be estimated with PERs. Potential contact points and actions to restore, modify, or eliminate contact point will be identified (e.g., fill scour hole). We will identify 1 (Bouldin Is levee project) to six predator contact points, develop restoration actions and measures of survival post-restoration.

Biological objectives: increasing Abundance & Natural Productivity at Central Valley & Mokelumne River. Abundance metric: sum of all naturally-spawned juvenile abundance passing Chipps Island and the lowermost Mokelumne River RST. Natural Productivity: number of natural-origin juveniles per natural-origin adults passing Chipps Island and the lowermost Mokelumne River RST.

We predict each contact point improvement will increase juvenile survival by 1% based on DSM parameter estimates. Survival predictions will be updated following pre-restoration monitoring to reflect the measured predation-related mortality associated with 1) contact points in the DSM model inputs and 2) predator contact points identified by PER results. Predictions will be compared to measured changes in survival.

Project leverages a set-back levee restoration action on Bouldin Is.7. Implementation will reduce DSM uncertainty on the effect of contact points on survival.

Not implementing the charter means continued uncertainties in efficacy of restoring predator contact points to increase juvenile salmonid survival and missed opportunity for identifying beneficial fish impacts associated with levee setbacks in the Delta. There are no known stakeholder objections to this charter; landowner (MWD) is on PMT.

Data Management

The key uncertainty in the DSM is what affects juvenile survival. The objective of this charter is to reduce uncertainty in what affects juvenile survival by restoring contact points associated with predation-related mortality. The charter will measure the change in reach-specific survival following the restoration actions taken to reduce predator-related mortality associated with contact points. Predation will be measured with Predation Event Recorders before and after contact points are restored. Additional monitoring will measure changes to biotic (e.g., predator density) and abiotic features (e.g., depth, flow) following restoration of contact points. Biological responses to the project, measured as through-reach survival, are expected in the first outmigration season following the restoration actions on the contact points. Physical responses can be expected immediately after completion of restoration of the contact points.

Long-term monitoring of the project will utilize existing monitoring infrastructure. Rotary Screw Traps in the Mokelumne River and the Chipps Island trawl provide data to estimate Natural Productivity and Abundance objectives at the watershed and valley scale. Project scale monitoring can be achieved with acoustic or PIT tagged fish released upstream of the project areas. Full response to the project will be expected in one salmon generation. The magnitude of the proposed project is uncertain, but likely to be small. However, the intent of the project is to reduce this uncertainty and provide an estimate of how many contact points would need to be removed to achieve a detectable signal at the population level.

Data will be provided to CVPIA as GIS and/or Excel data and maintained in relational databases.

The performance metrics are described above. Each of these performance metrics are derived from the DSM or means objectives and will be integrated into the monitoring plan during Phase I of the charter when the PMT will develop the study design, sampling protocol and potential suite of restoration actions for likely contact points.

J.D. Wikert (FWS) can be contacted to provide data which will be stored on the Lodi FWO server, and/or forwarded to the Center for Data Management when that program becomes operational.

Risks

Risk	Likelihood	Impact
This project has a high likelihood of successful implementation because substantial planning will be done by the PMT during the first year of the study. During the first year of the charter, the PMT will develop a study design. The PMT will develop a list of contact points from data previously collected by NOAA SWFSC and others and identify the restoration actions that could be taken to eliminate or improve the contact points.	1	1
Inability to obtain permits. The project cannot be implemented without compliance with applicable environmental clearance and public notice requirements. This project has a high likelihood of success because it involves an already approved set-back levee on Bouldin Island that can be considered as one restoration action for the charter. For any work in the Mokelumne River, EBMUD has a programmatic EIR that could cover some of the potential restoration actions to selected contact points.	2	2
Landowner access permission. This project has a high likelihood of successful implementation (overall low risk) because it involves a willing landowner, MWD, to provide access to Delta river channels for project data collection/monitoring and access for potential restoration	1	1

Risk	Likelihood	Impact
actions to selected contact points. Likewise, in the Mokelumne River, EBMUD maintains positive working relationship with landowners and irrigators who routinely allow access for annual monitoring.		
Insufficient Funding. We anticipate substantial funding on cost share from project partners, as well as implementation funding from CVPIA. If these funds fail to materialize, the project is likely to be less successful.	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2018	CVPRF	$1,443,427	$642,733	$0	$800,694
2019	CVPRF	$732,380	$703,801	$0	$28,579
2019	WRR	$91,676	$91,676	$0	$0
2020	CVPRF	$1,397,741	$1,342,162	$0	$55,579
2021	CVPRF	$507,281	$507,281	$0	$0
2022	S/LIK	$405,656	$0	$0	$405,656
2023	Unfunded	$405,656	$0	$0	$405,656

Total Cost: $4,983,817

Status and Trend Monitoring: Modeling Program

To manage, coordinate, plan and implement the CVPIA 3406(g) program.

DCN:	21FHRP005
Watershed:	Central Valley Wide
Funding Years:	2015 - 2023
Priority:	1 - Developing models and tools for ecosystem and water operations in Central Valley region is a CVPIA priority identified by the CALFED Bay Delta Program, and recently WIIN act. This on-going program provides essential modeling supports for, including but not limited to, other CVPIA Programs. 17 different agencies including US FWS, CA FW, CA DWR utilize the models and tools developed and constantly updated by this CVPIA 3406 (g) program.
Partners:	FWS, USGS, CDFW, DWR
Related Programs:	CDFW, CVPCP, CVPIA b1, CVPIA b12, CVPIA b13, CVPIA b2, EWP, Interagency Ecological Program, NMFS, NMFS-RPAs, San Joaquin River Restoration Program, SWRCB, AFRP, BDCP, CALFED, California Drought Response, WIIN.

Authority

Provision	Justification
3406 (g)	These actions fall under the provision of Ecosystem and Water Operations Models.

Metrics

Name	Value	Units	Comment
Models and tools that supports ecosystem restoration and water operation decisions to reach the goal of fish doubling in the Central Valley region	1	number of models complete	Models and tools, developed by this program, vitally support CVPIA's meeting fish production and ecosystem restoration targets. The benefits of Ecosystem and Water Operation Modeling underlies with the core mission and vision of CVPIA. See more in the Program Priority Section.

Project Schedule

Date	Description
Sep. 2021	1 D Hydrodynamic Modeling
Sep. 2021	2 D Hydrodynamic Modeling
Sep. 2021	Water Quality Modeling
Sep. 2021	CalSim Modeling
Sep. 2021	SIT Fisheries Modeling Support
Sep. 2021	Temperature Modeling
Sep. 2021	Modeling Projects Management for FY21

Date	Description
Sep. 2021	Annual Work Plan for FY 2022
Sep. 2022	Annual Report for FY 2021

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager (presently acting Sadie Gill sgill@flowwest.com), CVPIA Science Coordinator (presently acting Mike Urkov, murkov@flowwest.com), and CVPIA Fish Resource Area Coordinator (Rodney Wittler rjwittler@usbr.gov).

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Jobaid Kabir
Project Technical Team(s):

Name	Discipline	Contact Info
Amanda Baker	USBR	
Cameron Koizumi	USBR	916-978-5086
Daniel Deeds	USBR	916-978-4467
Derya Sumer	USBR	916-979-2363
Eric Mork	USBR	916-978-5296
James Lu	USBR	916-978-5129
Junaid As-Salek	USBR	916-978-5099
Jun Wang	USBR	916-978-5189
Justin Thompson	USBR	916-978-5064
Kirk Nelson	USBR	916-978-5066
Michael Tansey	USBR	916-978-5197
Michael Wright	USBR	916-978-5009
Vanessa King	USBR	916-978-2760
Zackary Leady	USBR	916-978-5088
Rodney Wittler	USBR	916-978-5232

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Program Mgr	916-978-5360
Project Manager	Jobaid Kabir	USBR	916-978-5091

Narrative

The Ecosystem Modeling effort is a continuing program that began in 1994 to develop models and tools to evaluate effects of alternative water management strategies, to improve scientific understanding of ecosystems.

In 1994, a Task Order Agreement namely— Sharing of Costs Agreement for Mitigation Projects Improvements (SCAMPI) has been entered into by the State of California, and by the United States for cost-sharing to support implementation of environmental restoration measures under CVPIA.

All studies and investigations shall take into account and be fully consistent with the fish, wildlife, and habitat protection and restoration measures required by the CVPIA. The CVPIA 3406(g) lists 9 subject areas for study and investigation, including the following:

1. Related water quality conditions and improvement alternatives, including improved1temperature prediction capabilities as they relate to storage.
2. Development and use of base flows and channel maintenance flows to protect and restore natural channel and riparian habitat values.
3. Implementation of operational regimes at State and Federal facilities to increase springtime flow releases, retain additional floodwaters, and assist in restoring both upriver and downriver riparian habitats.
4. Measures needed to restore anadromous fisheries to optimum and sustainable levels in accordance with the restored carrying capacities of Central Valley rivers, streams, and riparian habitats

HEC-5Q, Temperature Regression model, Comprehensive San Joaquin Water Quality Model (SJRSIM), CalSim 3.0, CalSim II, CalLite II, ECOSIM-W, Fish Mortality model, InSALMO, Chinook salmon lifecycle Decision Support Models (DSM), C2VSIM,and HydroGeosphere models, are developed and being modified to incorporate recent changes in legislative requirements and water-environment.

Funding-
- CVPIA Restoration Funds
- Water & Related Resources
- In-kind 25% cost sharing by State Agencies

Benefits -
- Improved flow and water temperature
- Improved water quality
- Better management for anadromous fish species
- Better planning of water operations

Reclamation Program Lead is responsible for administration of the program and coordination of program activities, budget and work with Federal and State agencies with the following duties:

- Prepare SCAMPI contract, monitor the expenditure and in-kind support of the partner agencies.
- Develop PWS, objectives, and milestones of projects.
- Develop and maintain long term modeling plans and PMPs for modeling projects and update these regularly.
- Submit all CVPIA 3406 (g) requisition packages on time.
- Plan, and manage CVPIA 3406 (g) modeling budgets and schedules.
- Respond FOIA requests.
- Promote effective communications with all partner-agencies like FWS, DWR, CAFW,

NOAA, USGS, USACE, Municipal Utility Districts, with Reclamation modelers, Budget Analyst, CVPIA Administrators, Acquisition, Reclamation and DWR legal counselors, accountant

The Program is jointly implemented by the U.S. Fish and Wildlife Service (Service) and the Bureau of Reclamation (Reclamation). Program management and technical support are shared by both agencies, with the Reclamation primarily leading on program management as stated above and full technical support for modeling projects management and implementation.

Funding for the CVPIA 3406(g) maintains a core capability in support of a science-based approach for selecting CVPIA programs and projects.

Data Management

All modelling data and files will be kept in the Planning Division at Cottage Way Office, Sacramento. Information resulting from activities funded by this charter, including all program reports and any raw data, will be permanently housed at BOR's Interior Region 10, California Great Basin Office in Sacramento, and FWS's Pacific Southwest Regional Office in Sacramento.

Management of confidential data and response to FOIA requests will be handled according to DOI and Reclamation protocols.

The Project Management Team (PMT) Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the Science Integration Team (SIT) and the PMT per the 2021 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2021 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data produced by this project will be used in the development of a sub-module of the Science Integration Team's Salmon Decision Support Model(s). The Project Management Team Leader will coordinate with the CVPIA Science Coordinator on the development and submission of a SIT Decision Support Model (DSM) Modification Proposal (Using the standard proposal template), as well as ensure progress on completing the sub-module in cooperation with the Science Integration Team.

CVPIA 3406 (g) Pre- and Post-Project Monitoring Plans (as of June, 2020)

CVPIA (g) Warrants	Models	Pre- and Post-Project Monitoring Plans
(1) Comprehensive water budget of surface and groundwater supplies, considering all sources of inflow and outflow available over extended periods.	CalSim II, CalSim 3.0 CalLite, HGS, ANN, ECOSIM-W, C2VSIM and DSM2	Completion of CalSim 3.0 hydrology development, resolving of surface-water groundwater interaction issues. QAQC water budget/hydrology of upstream operations: American River and Stanislaus River at the minimum, extend to review of Eastside streams as they are applicable to CVP. Use CalSim II/3.0 inputs to identify CVP's supplies and obligations and analyze availability of excess water for additional environmental or water supply needs. Continue to work on CalSim 3 Tulare Lake representation to achieve a complete water budget picture to understand effects of SGMA on Reclamation's surface water supplies. DSM2 analysis of planning level scenarios were conducted and provided to FlowWest for further analysis. DSM2 modeling established and extended for BiOps 2019 and WIIN Act assessments conducted from FY18 to present. These assessments provide a dynamic visualization snapshot of the current state of the Delta with integrated forecasted operations for determining the net effect of Delta actions on fishery targets.
(2) Related water quality conditions, including temperature dynamics related to storage		Complete toolkit development for the recent 2019 version of HEC-5Q. DSM2 modeling proficiency for accessing EC is being pursued in partnership with DWR's Delta Group.
(3) Surface-ground and stream-wetland interactions	HydroGeoSphere, CVHGSM (Central Valley	Develop proficiency in simulating habitat availability using tools such as WUA, HEC-RAS for riverine habitats and

CVPIA (g) Warrants	Models	Pre- and Post-Project Monitoring Plans
	Hydro GeoSphere Model), C2VSIM	SCHISM, RMA2D for Bay-Delta habitats. S&T 1867 is working on producing temporary floodplain mapping of the CVP to provide habitat acreage numbers as model inputs for the CVPIA's DSM tools.
(4) Measures needed to restore anadromous fisheries to optimum and sustainable levels in accordance with the restored carrying capacities of Central Valley rivers, streams, and riparian habitats;	inSALMO	Work with BDO in identifying best tools, look into replacing SALMOD.
(5) Development and use of base flows and channel maintenance flows to protect and restore natural channel and riparian habitat values;	RHEM	Building expertise in HEC-RAS for determining water quality & habitat parameters on the Sacramento River Chinook Salmon Coarse Resolution Decision Support Model. (keep this the same?)
(6) Implementation of operational regimes at State and Federal facilities to increase springtime flow releases, retain additional floodwaters, and assist in restoring both upriver and downriver riparian habitats;	CalSim II, CalSim 3.0, CalLite and ECOSIM-W	Work with CVO and BDO on the implementation of the upstream actions (such as Shasta spring pulse, rice decomp shift, Keswick winter base flows, etc.) proposed in the ROC on LTO.
(7) Measures designed to reach sustainable harvest levels of resident and anadromous fish, including development and use of systems of tradeable harvest rights;	SIT DSM	Assisting CVPIA Science Integration Team (SIT) in using Chinook salmon lifecycle Decision Support Models (DSM), synthesizing data for DSM input, developing flow regimes for DSM Scenarios from CalSim II, CalSim 3, CalLite model outputs, developing temperature regimes using regression methods, and maintaining capacity to maintain and run R code base.
(8) Ecosystem modeling to identify opportunities to protect and restore wetland and upland habitats throughout the Central Valley;	inSALMO	Continue adaptation/ development of hydrologic, fish-population and water temperature models at varying spatial and temporal scales.

CVPIA (g) Warrants	Models	Pre- and Post-Project Monitoring Plans
(9) Measures to enhance the firm yield of existing Central Valley Project facilities, including improved management and operations, conjunctive use opportunities, development of off-stream storage, levee setbacks, and riparian restoration.	CalSim II, CalSim 3.0, CalLite and ECOSIM-W	Assisting and coordinating with partner agencies in modeling fish behavior, habitat, temperature, water flow, salinity and other water quality parameters. Tulare basin initial development, including draft WBA and DU delineations, ET and consumptive use datasets, and connectivity as implemented in WRESL code.

Risks

Risk	Likelihood	Impact
Adverse Stakeholders	1	3
Insufficient Field Data	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2015	CVPRF	$721,529	$613,400	$108,129	$0
2015	S/LIK	$944,573	$0	$0	$944,574
2016	CVPRF	$606,531	$519,575	$86,953	$0
2016	S/LIK	$972,911	$0	$0	$972,911
2017	CVPRF	$538,720	$511,688	$27,032	$0
2017	S/LIK	$793,332	$0	$0	$793,332
2018	CVPRF	$600,000	$499,977	$100,023	$0
2018	S/LIK	$832,999	$0	$0	$832,999
2019	CVPRF	$650,000	$549,978	$100,022	$0
2019	S/LIK	$832,998	$0	$0	$832,998
2020	CVPRF	$700,000	$700,000	$0	$0
2020	S/LIK	$832,999	$0	$0	$832,999
2021	CVPRF	$700,000	$700,000	$0	$0
2021	S/LIK	$832,999	$0	$0	$832,999
2022	CVPRF	$700,000	$700,000	$0	$0
2022	S/LIK	$832,999	$0	$0	$832,999

Total Cost: $12,092,590

Status and Trend Monitoring: Pacific States Marine Fisheries Commission Coleman-Nimbus Hatcheries

Continues the constant fractional marking program for Chinook Salmon from Coleman and Nimbus hatcheries. Tasks include the coded wire tagging and adipose fin clipping at the hatcheries, sampling the commercial and recreational catches for tagged and untagged salmon, reading tags, reading scales, and reporting results.

DCN: 20BDAO011
Watershed: Central Valley Wide
Funding Years: 2021 - 2025
Priority: High
Partners: Pacific States Marine Fisheries Commission
Related Programs: Ocean Salmon Project

Authority

Provision	Justification
3406 (b)(15)	Project monitors natural and hatchery salmon.

Metrics

Name	Value	Units	Comment
Proportion of hatchery and natural production	0	percentage of fish	Determines proportion of natural and hatchery produced Chinook in the fisheries, in the spawning escapement, and returning to the hatcheries.

Project Schedule

Date	Description
2/28/2021	Annual constant fractional marking report, fish tagged, and catch sampled
3/2022	Repeats annually
3/2023	
3/2024	
3/2025	

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov
Stan Allen	PSMFC	(503) 595-3114

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

Continues the constant fractional marking program for Chinook Salmon from Coleman and Nimbus hatcheries. Tasks include the coded wire tagging and adipose fin clipping at the hatcheries, sampling the commercial and recreational catches for tagged and untagged salmon, reading tags, reading scales, and reporting results.

The program marks 25% of about 12 million Chinook from Coleman Hatchery and 25% of about 4 million Chinook from Nimbus Hatchery. Also includes the adipose clipping of the juvenile steelhead (~425k fish/year) at Nimbus.

Data Management

Constant Fractional Marking data resides in the PSMFC maintained website at https://www.rmpc.org/

Risks

Risk	Likelihood	Impact
No fishery occurs due to low numbers of salmon	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR	$1,500,000	$1,500,000	$0
2021	WRR	$99,102	$99,102	$0
2021	Supplemental	$1,500,000	$1,500,000	$0
2022	WRR	$1,658,867	$1,658,867	$0
2023	WRR	$1,717,323	$1,717,323	$0
2024	WRR	$1,778,024	$1,778,024	$0

Total Cost: $8,253,316

Status and Trend: Science Support to Operate Continuous Tidal Flow and Turbidity Stations with USGS

Monitor Bay-Delta tidal flow, water quality and biogeochemical conditions in the Bay-Delta to support adaptive management of CVP operations and inform restoration activities.

DCN: 20BDAO020
Watershed: Central Valley Wide
Funding Years: 2020-2022
Priority: High
Partners: U.S. Geological Survey (USGS)
Related Programs: Environmental Monitoring Program (D-1641)

Authority

Provision	Justification
(b)(15)	Operation and maintenance of a network of continuous monitoring stations.

Metrics

Name	Value	Units	Comment
Continuous flow and water quality data	365	Days/year	Data provide basis calibrating and validating hydrodynamic and water quality models and for evaluating effects of conservation measures and restoration actions. Temperature data used for temperature offramps. Turbidity data used for real-time operations to protect delta smelt (turbidity bridge)

Project Schedule

Date	Description
January 1, 2020	Start of performance period
December 31, 2020-2022	Annual metadata reports for each continuous station
August 2020-Dec 2022	Monthly inter-regional flux estimates
December 2021	Memo on fish survey review recommendations
December 31, 2022	End of performance period

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
USGS-Flow	Cathy Ruhl	Hydrologist	cruhl@usgs.gov
USGS-Water quality	Brian Bergamaschi	Biogeochemist	bbergam@usgs.gov
USGS-Fish survey reviews	Fred Feyrer	Fish biologist	ffeyrer@usgs.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Erwin Van Nieuwenhuyse	Aquatic Scientist	evannieuwenhuyse@usbr.gov
PMT Data Steward	Cathy Ruhl	Hydrologist	cruhl@usgs.gov

Narrative

The principal objectives of this 3-year agreement are to continue operation and maintenance of a network of continuous monitoring stations that record tidal stage and velocity, specific conductance, water temperature, turbidity and other physical parameters as well as pH, dissolved oxygen, chlorophyll concentration, dissolved organic matter and other biogeochemical properties. Also included in the agreement are field sampling tasks designed to document inflow and fate of suspended solids. These data are used to document natural variability and responses to flow and non-flow conservation measures stipulated in the 2019 biological opinions on Reclamation's long-term operation of the CVP, management actions taken under CVPIA and other initiatives. Also included in this agreement is task to provide technical support for an independent review of fish surveys conducted by the California Department of Fish and Wildlife.

Data Management

All data are posted on National Water Information System and California Data Exchange web sites and can be viewed on Bay-Delta Live.

Risks

Risk	Likelihood	Impact
Very Low Risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CBD	$ 5,762,805	$ 5,762,805	$0
2021	CBD	$ 4,106,162	$ 4,106,162	$0
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	CBD	$ 6,289,347	$ 6,289,347	$0

Total Cost: $18,158,314

Clear Creek

Habitat and Facility Improvement: Clear Creek Gravel Injection

Place gravel into Clear Creek to provide spawning habitat for anadromous salmonids and to promote geomorphic processes that create habitat for all in-river fish life history stages.

DCN: AFRP2126
Watershed: Clear Creek
Funding Years: 2021 - 2025
Priority: SIT FY2020 Tech Memo:
- Maintain spawning habitat in the CVP streams
This project also addresses the legislative 3406(b)(12) priority.
Partners: CDWR, NPS, BLM, CDFW
Related Programs: NMFS-RP, NMFS-RPAs, CVPIA (b)(12), EWP

Authority

Provision	Justification
(b)(12)	Gravel augmentation creates spawning habitat as required by this section.

Metrics

Name	Value	Units	Comment
(b)(12): Spawning gravel placed annually (tons)	12000	tons	Approximate amount of gravel augmented annually, which will increase supply, promote alluvial processes, and is manageable within a season.
(b)(12): Area of spawning habitat	347308	square feet	The long-term goal is to produce and maintain usable spawning habitat greater than or equal to the amount available pre-Whiskeytown Dam construction (347,308 square feet above the George overlook).

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Title
Dec. 2021	Annual Project Completion Report
Dec. 2022	Annual Project Completion Report
Dec. 2023	Annual Project Completion Report
Dec. 2024	Annual Project Completion Report
Dec. 2025	Annual Project Completion Report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Derek Rupert, NCAO
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
Project Manager	Derek Rupert (USBR)	Fish Biologist	DRupert@usbr.gov, 570-419-2823
Team Member	Paul Zedonis (USBR)	Division Chief	PZedonis@usbr.gov
Team Member	Charlie Chamberlain (USFWS)	Fish Biologist	charles_chamberlain@fws.gov
Team Member	Matt Brown (USFWS)	Sup. Fish Biologist	matt_brown@fws.gov
Team Member	Mike Memeo (DWR)	Fish Biologist	mike.memeo@water.ca.gov
Team Member	Tricia Bratcher (CDFW)	Enviro. Scientist	patricia.bratcher@wildlife.ca.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Derek Rupert	Fish Biologist	DRupert@usbr.gov, 570-419-2823
PMT Data Steward	Derek Rupert	Fish Biologist	DRupert@usbr.gov, 570-419-2823
Project Co-lead	Charlie Chamberlain	Fish Biologist	charles_chamberlain@fws.gov

Narrative

The CVPIA (b)(12) program has a long-standing responsibility to augment gravel in Clear Creek to replace desirable sediment fractions blocked by the presence and operation of Whiskeytown Reservoir and historic gravel mining. Clear Creek gravel augmentations are consistent with the 2019 Biological Opinion for Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. The gravel augmentation project provides spawning habitat for ESA listed Spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*), and the other anadromous fishes of Clear Creek. The gravel program is identified in NMFS' Recovery Plan for these listed species (NMFS 2014). This program also benefits Clear Creek's Fall- and Late Fall-run Chinook Salmon. These gravel augmentations support three SIT priorities: 1) maintain spawning habitat in CVP streams, 2) Increasing perennially inundated juvenile Chinook Salmon habitat (Sacramento River watershed upstream of the American R. confluence), and 3) Increase seasonally inundated juvenile Chinook Salmon habitat at 2-yr frequency (Sacramento River watershed upstream of the American R. confluence).

From 1996 to 2019, approximately 185,000 tons of coarse gravel have been placed into Clear Creek. FWS (Red Bluff) annually monitors the amount of spawning habitat for all Clear Creek runs of Chinook Salmon and steelhead. The project also helps to restore sediment transport processes, such as coarse bedload transport continuity, alternating bar riffle sequences, and sediment deposition on floodplain surfaces (floodplain habitat enhancement). Flow events transport gravel downstream, and injections of gravel help restore and maintain balance. Desirable river channel floodway processes are critically dependent on sediment transport and support long-term fish habitat formation and riparian community development. System wide gravel routing has not yet been achieved. However, augmented gravels are approaching gravel routing between most of the frequently used augmentation sites.

The Clear Creek Restoration Program (3406(b)(12) evaluates the amount of spawning habitat using Potential Spawning Habitat Mapping (PSAM) and Spawning Habitat Use (SHU) data collected by USFWS. SHU maps and quantifies all habitat actually used or disturbed during spawning in reaches used by Fall-run Chinook Salmon. PSAM maps and quantifies areas that meet spawning habitat criteria of depth, velocity, and substrate for steelhead and three runs of Chinook Salmon (Spring-run, Fall-run, and Late Fall-run). Overall trends in spawning area can be detected with these methods as well as changes on reach and site-specific scales.

In 2018, the PSAM surveys showed record high spawning habitat in 5 of the 8 monitored gravel augmentation sites on Clear Creek (2010 to present; USFWS unpublished data). Both Chinook and steelhead spawn in augmented gravel at increasingly higher rates (USFWS unpublished data).

The Clear Creek Technical Team is exploring ways to address the needs of the Decision Support Model (DSM), including consideration of metrics we believe important to Clear Creek and northern Sacramento salmonid populations that aren't necessarily captured in the current structure of the DSM.

FY2021, FY2022, FY2023, FY2024, and FY2025 represents projected costs to augment up to 12,000 tons of gravel into Clear Creek.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Compliance and effectiveness monitoring for the project are conducted as part of the (b)12 Clear Creek Adaptive Management Monitoring Charter which funds FWS Red Bluff Office, and includes fishery, habitat, and geomorphic components. There are short- and long-term aspects of each of these components. Short-term, Objective Specific (STOS) monitoring will include repeat topological surveys of the gravel projects as they change over time, and documentation of spawning use during

year-round spawning ground surveys. While the first physical and biological responses of the project will be detected with these methods, they are also long-running monitoring programs that inform Long-Term Trend monitoring (LTT). Most of our monitoring efforts are spatially explicit and suitable for analysis on multiple scales:

Watershed Scale: Longitudinal topographic surveys, LiDAR; bedload transport and sediment budget; annual adult salmonid population estimates; annual juvenile production estimates; annual juvenile productivity estimates (juvenile production / adult escapement); InSALMO modeled outmigrants per year; temperature monitoring system of loggers.

Spawning-reach Scale: Topographical change, especially estimating volumes of gravel moving in and out of project sites; salmonid spawning habitat suitability mapping salmonid spawning habitat use; redd distribution surveys; salmonid use of supplemental gravel.

Meso- and Micro-habitat Scale: Spawning gravel evaluation: sediment size; juvenile habitat use studies compare salmonid densities between: restored and control reaches, physical habitat treatments, habitat types, types or presence of riparian vegetation; macro-invertebrate studies comparing gravel restoration types in treated and control areas.

STOS monitoring quantitative predictions of the expected outcomes of the gravel additions include 1) a 5% increase in PSAM in the year following gravel addition, 2) Based on previous observation we expect an increase of 16% Spawning Habitat Use per year following gravel mobilization, 3) The percent of redds in injection gravel in the upper reaches of Clear Creek increases roughly 5% per year. Note, we expect some of these relationships to be asymptotic, eventually reaching some yet-to-be-determined maximum levels.

LTT monitoring quantitative predictions include 1) an increase in PSAM to pre-dam conditions, 2) sustained increase in Spawning Habitat Use to a carrying capacity value which has yet to be determined, 3) an increase in tons per year until the system has been recharged with sediment. 4) the size distribution of gravel in spawning areas will converge on the size distribution preferred by salmonids. Another important metric for LTT monitoring is the number of juveniles produced per female salmonid.

The Clear Creek Technical Team has discussed metrics to study to see how our monitoring may help inform the DSM process. The DSM in its current state does not identify spawning gravel as a primary limiting factor for Chinook Salmon and steelhead in Central Valley streams. Our information may help support or modify this initial conclusion of the DSM. Additional factors or data sources we have considered following up on include gravel size specifications, outmigrants per year from InSALMO model, Potential Spawning Area Mapping, watershed-wide bulk sediment sampling, macro-invertebrate abundance and species richness and Juvenile Habitat Use.

Risks

Risk	Likelihood	Impact
Funding reductions	1	2
High fuel costs	2	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$329,600	$329,600	$0
2022	CVPRF	$339,500	$339,500	$0
2023	CVPRF	$349,400	$349,400	$0
2024	CVPRF	$359,300	$359,300	$0
2025	CVPRF	$369,200	$369,200	$0
2026	CVPRF	$369,200	$369,200	$0
2027	CVPRF	$369,200	$369,200	$0

Total Cost: $2,185,400

Habitat and Facility Improvement: Clear Creek Phase 3B Completion

SIT support via data visualization & stewardship, and peer review management.

DCN: AFRP2127
Watershed: Clear Creek
Funding Years: 2019-2022
Priority: This project addresses the legislative 3406(b)(12) priority
Partners: CDWR, NMFS, NPS, NRCS, Point Blue Conservation Science, Western Shasta Resource Conservation District, BLM, CDFW
Related Programs: NMFS-RPAs, CALFED, NMFS-RP

Authority

Provision	Justification
(b)(12) Clear Creek	CVPIA PL 102-575 directs the secretary to direct actions under specific (b)(12).

Metrics

Name	Value	Units	Comment
(b)(12): Stream Channel restored (miles)	2	miles	CPAR goal was 2 miles for the entire program based on the length of the first stream channel restoration project proposal in 1999. Subsequent projects and those currently under consideration could exceed metric value
Permit requirement	2	completion	Address commitments made to Corps and BLM as the public landowner regarding the mass balance of riparian and wetland loss/creation over the Lower Clear Creek Floodway Rehabilitation effort. This project will complete floodplain work that was left unfunded at the time of construction of Phase 3B.

Project Schedule

Date	Description
FY 2019	Wetland Inventory completed.
FY 2020	Set up project management team (a CCTT sub-group) and decide on project priorities/goals.
FY 2021	Design and permitting. A contract (via competitive bid) will be established to design and engineer a plan for implementing the key components selected by the CCTT. This contract will also incorporate any NEPA and permit applications needed to complete the work.

Date	Description
FY 2021	Construction and implementation. A contract (via competitive bid) will be established to implement the designed plans and CCTT selected components. This contract will include year-1 of re-vegetation irrigation and an as-build data package.
FY 2022	Irrigation and final clean up. A contract (via competitive bid [may be inclusive of Construction and Implementation Contract above]) will be established to complete the second (and final) year of revegetation irrigation and to clear up any remnant project infrastructure. This contract will also include a final project completion report.

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Derek Rupert, NCAO
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
Project Manager	Derek Rupert (USBR)	Fish Biologist	DRupert@usbr.gov, 570-419-2823
Team Member	Paul Zedonis (USBR)	Division Chief	PZedonis@usbr.gov
Team Member	Charlie Chamberlain (USFWS)	Fish Biologist	charles_chamberlain@fws.gov
Team Member	Matt Brown (USFWS)	Sup. Fish Biologist	matt_brown@fws.gov
Team Member	Mike Memeo (DWR)	Fish Biologist	mike.memeo@water.ca.gov
Team Member	Tricia Bratcher (CDFW)	Enviro. Scientist	patricia.bratcher@wildlife.ca.gov
Team Member	Leana Wiessberg (BLM)	Forester	lweissberg@blm.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Derek Rupert	Fish Biologist	DRupert@usbr.gov, 570-419-2823
PMT Data Steward	Derek Rupert	Fish Biologist	DRupert@usbr.gov, 570-419-2823
Project Co-lead	Charlie Chamberlain	Fish Biologist	charles_chamberlain@fws.gov

Narrative

Initial construction portions of the Lower Clear Creek Phase 3B Restoration project were completed in the late 2000's. Final floodplain modifications, wetland, and riparian replanting efforts for the site were to be funded by the State of California, but a portion of those tasks were not completed due to the California Bond Crisis (2008). The purpose of this charter is to finish restoration at the Phase 3B Restoration site and realize the complete benefits of a fully constructed site. Additionally, in discussions regarding other Lower Clear Creek Floodway Restoration Project phases, the Army Corps of Engineers (Corps) has expressed concern regarding the balance of wetland and riparian loss and creation over the 20-year multiple phase period of the lower Clear Creek Floodway Restoration Program, of which Phase 3C is the final remaining piece (scheduled for 2020 construction). The Corps wants a final accounting of the loss/creation balance. This Phase 3B Completion project provides an opportunity to address the Corps' concerns regarding the balance of wetlands. This project is critical for meeting the commitments CVPIA has made to permitting agencies and the landowner (BLM). These commitments will also improve floodplain habitats for salmon and terrestrial species by creating additional floodplain habitat (riparian, wetland), reducing fragmentation between earlier revegetated section of the floodplain, and further augmenting spawning habitat.

The Phase 3B Completion project supports CVPIA goals and 2019 SIT priorities. Clear Creek stream restoration was individually called out in the CVPIA, under section b(12), and Phase 3B in an integral part of this large effort. Phase 3B completion project supports three SIT priorities: 1) Increasing seasonally inundated juvenile Chinook Salmon habitat, 2) Increase perennially inundated juvenile Chinook Salmon habitat, and 3) maintain spawning habitat in CVP streams.

The first steps to the Phase 3B Completion project began in 2019, with an inventory of the current site conditions (e.g. wetlands delineation and site evaluations). From this preliminary information, the Clear Creek Technical Team will prioritize and select key aspects of the Phase 3B site to address. Known issues include, wetlands creation, road decommissioning, road re-routing, revegetation, site clean-up, and poor floodplain performance.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Information for the charter including relevant protocols for understanding the information, will be permanently housed at Northern California Area Office of Reclamation and the Red Bluff Fish and Wildlife Office of the Service.

Short-term Objective Specific Monitoring: At the Phase 3B site, STOS monitoring will evaluate the projects performance in meeting the CCTT selected key components. This could include wetlands performance evaluations, revegetation performance, floodplain inundation levels, juvenile fish habitat creation, and aesthetic resource evaluations, among others.

Long-term Trend Monitoring: At the Phase 3B site, LTT monitoring will continue to access the overall performance of the LCCFRP. This includes (but in not limited to) adult salmonid escapement levels, salmonid spawning assessments, juvenile production, egg-to-fry survival assessments, geomorphic evaluations, avian response, and habitat assessments.

Risks

Risk	Likelihood	Impact
Floodway wetland inventory identifies wetland creation needs that exceed available budget.	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019[12]	CVPRF	$35,000	$35,000	$0	$0
2020	CVPRF	$0	$0	$0	$0
2021	CVPRF	$200,000	$200,000	$0	$0
2022	S/LIK	$75,000	$0	$0	$75,000
2023	Unfunded	$75,000	$0	$0	$0

Total Cost: $385,000

12 No funds spent in FY 18 or FY 20. This charter supersedes the previous charters.

Habitat and Facility Improvement: Clear Creek Stream Channel Restoration Phase 3C

This project completes the final phase of the 1999 Clear Creek Floodway Restoration Project conceptual plan. The project improves the stream channel, floodplains, and associated habitats of the Phase 3C site increasing spawning and rearing habitat for salmonids.

DCN: AFRP2128
Watershed: Clear Creek
Funding Years: 2016 - 2023
Priority: This project addresses the legislative 3406(b)(12) priority
Partners: BLM, CDFW, DWR, FWS
Related Programs: Clear Creek Technical Task Force

Authority

Provision	Justification
(b)(12) Clear Creek Restoration	CVPIA PL 102-575 directs the secretary to direct actions under specific (b)(12). This is last phase that will complete the requirements under 3406(b)(12).

Metrics

Name	Value	Units	Comment
Wetland and riparian planting and maintenance	12.4	acres	
Upland seeding and mulching	29.8	acres	

Project Schedule

Date	Description
Dec. 2020	Quarterly updates to Phase 3C Project Management Team and CCTT
Sep. 2023	Final Reports - fish, riparian, geomorphic

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Sean Frische – CCAO FOO
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
Project Manager	Sean Frische (USBR)	Civil Engineer	sfrische@usbr.gov

Team Member	Derek Rupert (USBR)	Fish Biologist	DRupert@usbr.gov
Team Member	Robert Hilldale (USBR)	Hydraulic Engineer	rhilldale@usbr.gov
Team Member	Charles Chamberlain (USFWS)	Fish Biologist	charles_chamberlain@fws.gov
Team Member	Tricia Bratcher (CDFW)	Fish Biologist	patricia.bratcher@wildlife.ca.gov
Team Member	Doug Kleinsmith (USBR)	Natural Res. Specialist	dkleinsmith@usbr.gov
Team Member	Leana Weissberg (BLM)	Forester	lweissberg@blm.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Manager	Sean Frische (USBR)	Civil Engineer	sfrische@usbr.gov
PMT Data Steward	Sean Frische (USBR)	Civil Engineer	sfrische@usbr.gov
Project Co-lead	Charlie Chamberlain	Fish Biologist	charles_chamberlain@fws.gov
Project Co-lead	Derek Rupert	Fish Biologist	DRupert@usbr.gov

Narrative

Phase 3C is the final phase of a 2-mile multi-phase restoration plan described in the Conceptual Plan (M&T 1999) and Clear Creek Technical and Design Document (M&T 1999). Phase 3C will create floodplain and stream channels in the lowest part of this 2-mile reach.

The project includes elements to enhance riverine and riparian functions, and aquatic habitats. Channel re-alignment will return the main channel to its historic alignment, lengthen the main channel, increase sinuosity, and establish a more complex channel with suitable stream bed materials for spawning. Channel split features will increase shoreline area for fry habitat. Additional channels and alcoves will be built to inundate at 200 cfs to expand fish rearing habitat at frequent flows. An off-channel pond with adjacent seasonal wetlands will increase habitat diversity and create off-channel rearing habitat. The project will expand seasonal wetlands, increase and enhance riparian, emergent, and wetland vegetation, and create floodplain surfaces which are at suitable elevations to increase natural recruitment of cottonwoods.

The design incorporates Beaver Dam Analogues (BDA's) to mimic the natural form and function of beaver dams, where surfaces are wetted through increased backwatering. Each BDA allows juvenile fish to migrate downstream through the structures. Organic materials used to initiate the structure will break down over time. There are numerous beavers in the project area and the structure may be maintained and repaired by natural beaver colonization. In the absence of maintenance by the existing beaver population, annual maintenance (~1 day/year) is required. If BDA's are not

maintained, the earthen bases of the BDAs and the pond control structure will retain water in the ponds and fish passage between the ponds, but water levels will be lower, and less area of the pond will have adequate depth to meet temperature targets.

Approximately 2 acres of lowered floodplain are incorporated into the 90% design. These surfaces will be lowered approximately 1–5 ft to create floodplain surfaces which are inundated at flows between 200 and 1,000 cfs. Lowered floodplain areas will increase the connectivity between floodplain surfaces and the active channel. Increased floodplain conductivity will increase natural cottonwood recruitment, increase habitat complexity, provide rearing habitat, and create velocity refugia for salmonids and other aquatic species across a broad range of flows greater than base flow. These lowered areas may naturally develop additional scour channels, maintaining a complex network of channels and floodplain surfaces that are activated over a range of flows.

Some of the plant materials included in the 90% revegetation design were selected to be installed and established with minimal post-project irrigation. Riparian and emergent plantings were intended to be installed into substrates that are in contact with the summer and fall late season groundwater capillary fringe. Soil moisture and shallow groundwater were intended to be the main water available to those plantings; because of this, plantings must be done correctly at the specified depths to be successful. Pole cuttings must be installed directly into visible groundwater to survive with minimal irrigation.

Without irrigation, it can be expected that there will be areas of high survival and areas with little or no survival. The 90% revegetation strategy relies heavily on nursery-grown plants, and one revegetation goal is to establish healthy and vigorously growing plants. To accomplish this goal, irrigation is often necessary to protect vulnerable plantings from installation and thermal stress. Thermal stress may be the result of low ambient moisture, lack of precipitation, and high temperatures that exist during summer conditions when projects are constructed and in subsequent summers before tree/shrub canopies can be established.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Information for the charter including relevant protocols for understanding the information will be permanently housed at Northern California Area Office of Reclamation and the Red Bluff Fish and Wildlife Office of the Service.

Habitat modeling of existing and proposed condition will be compared to assess the benefit of Phase 3C – primarily to juvenile salmonid rearing, but also to spawning. In SALMO will be utilized to make a model-based prediction of the production difference between existing and proposed

conditions. Coordination will also occur to asses model comparisons based on the coarse resolution model of the Decision Support Model (DSM) being used to evaluate restoration metrics on the much broader scale. In SALMO and DSM results will be assessed for differences in the two approaches.

Risks

Risk	Likelihood	Impact
Cost estimate higher than expected	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2016	CVPRF	$187,723	$187,723	$0
2017	CVPRF	$4,842,358	$4,344,528	$497,830
2018	CVPRF	$610,955	$510,955	$100,000
2019	CVPRF	$194,741	$194,741	$0
2020	CVPRF	$980,901	$980,901	$0
2021	CVPRF	$319,515	$319,515	$0
2022	CVPRF	$220,978	$220,978	$0
2023	CVPRF	$211,978	$211,978	$0

Total Cost: $7,569,149

Delta

Special Studies: Bay-Delta Collaborative Science and Adaptive Management Study Program with Delta Stewardship Council

Collaborative for Science Adaptive Management Program (CSAMP)- Competitive Funding Opportunity

DCN: 20BDAO027
Watershed: Delta
Funding Years: 2020-2024
Priority: SIT knowledge gaps. Science Action Agenda implementation
Partners: Delta Stewardship Council
Related Programs:

Authority

Provision	Justification
Provision 3046 (g)	This project will assist in understanding and monitoring the effects of fishery and water management actions in the Delta on Endangered Species Act (ESA)-listed species population dynamics to inform prevention of the extinction of listed fish species and provide information for use in recovery efforts.

Metrics

Name	Value	Units	Comment
Research	1	Metadata	

Project Schedule

Date	Description
September 2020-June 2024	Task 1. Semiannual Meeting with Reclamation staff to identify status of each task.
Within 30 days of completion of reviews	Task 2. Delta Lead Scientist's funding recommendations based on the final review panel's evaluations.
Within 30 days of completion of reviews	Task 2. Final report compiling reviewer evaluations and scores.
Within 90 days of proposal awards	Task 3. Fact Sheets
Semiannually 2021-2024	Task 4. Reporting on subaward progress, obligations, and expenditures.

Roles and Responsibilities

Project Sponsor: USBR, DSC
Project Manager: Michael Beakes
Project Technical Team(s): Louise Conrad DSC, Dylan Stern DSC

Name	Discipline	Contact Info
Michael Beakes	PhD - Fish Biologist	mbeakes@usbr.gov
Louise Conrad	Ecology	Louise.Conrad@deltacouncil.ca.gov
Dylan Stern	Env. Sci.	Dylan.Stern@deltacouncil.ca.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Michael Beakes	Ph.D. Biology	mbeakes@usbr.gov
PMT Data Steward	Louise Conrad	Ecology	Louise.Conrad@deltacouncil.ca.gov
PMT Data Steward	Dylan Stern	Env. Sci.	Dylan.Stern@deltacouncil.ca.gov

Narrative

The purpose of this Performance Work Statement (Work Statement) is to describe collaboration between Reclamation and the Delta Stewardship Council (COUNCIL), Delta Science Program (DSP), to cooperatively leverage state and federal science efforts that enhance and accelerate critical science related to water operations, fish management, and adaptive management in the Bay-Delta and Sacramento River. The Delta Science Program was established to develop scientific information and synthesis for the state of scientific knowledge on issues critical for managing the Bay-Delta system. The DSP undertook a collaborative scoping process, which Reclamation participated in, to define near-term science activities and described these in their Science Action Agenda (SAA). This process was open and transparent to ensure the recommendations were unbiased, relevant, authoritative, and integrated across state and federal agencies. Reclamation is a participant in the Delta Plan Interagency Implementation Committee (statutorily established in the Delta Reform Act of 2009), the Collaborative Science and Adaptive Management Program (CSAMP), several structured decision-making processes in the larger Bay-Delta watershed, including the Delta, and other collaborative science and adaptive management venues. Additionally, Reclamation is a participant in the Sacramento River Science Partnership, which is an agency and stakeholder collaborative supporting structured decision-making processes and uncertainty reduction through science studies in the upper Sacramento River. Using these kinds of collaborative deliberation and decision forums and their outputs to identify priority objectives, Reclamation will provide funding to the Delta Stewardship Council for coordinated services to solicit, review, and manage a number of near-term science studies consistent with the Science Action Agenda and Sacramento River Science Partnership.

Data Management

Data emerging from this project will be housed at BOR Bay-Delta office internal servers and with project partners.

Risks

Risk	Likelihood	Impact
Implementation	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2020	Supplemental	$6,964,983	$3,500,000	$0	$3,464,983
2021	Supplemental	$3,000,000	$3,000,000	$0	$0

Total Cost: $9,964,98

Real Time Operations: Coordinated Enhanced Acoustic Telemetry Program

Tagging of salmonids; coordination, operation and maintenance of Central Valley acoustic telemetry array; six-year steelhead study; telemetry data analysis and related web tools and databases.

DCN: 20BDAO031
Watershed: Delta
Funding Years: 2018-2024
Priority: High
Partners: FWS, NMFS, DFW, UCSC, UCD, DWR, USGS, DSC
Related Programs: EATSM, SAIL, ITAG, CAT array

Authority

Provision	Justification
3406 (b)(15)	Fish monitoring for fish and wildlife resources in the Central Valley

Metrics

Name	Value	Units	Comment
Fish Survival		%	
Route entrainment		%	
Travel time		days	

Project Schedules

Date	Description
October 2019	Coordinate tag-training at CNFH and organize tagging workshops
December 31, 2019	Draft Study plans (results and analyses plans).
2019	Develop mark-recapture statistical models for real- time survival and routing estimates
October 2020	Prepare tagging equipment for tagging of wild fish at RBDD
May 31, 2020	Final Study plans (results and analyses plans)
March 2020	Plan and implant 500 AT into LSNFH hatchery winter-run at CNFH
March 2020	Plan and implant 1,000 AT into CNFH hatchery fish at CNFH
October 2021	Prepare tagging equipment for tagging of wild fish at RBDD
March 2021	Plan and implant 500 AT into LSNFH hatchery winter-run at CNFH
November to June 2021	Manage and tag wild fish at RBDD, provide data to ERDDAP
March 2021	Plan and implant 1,000 AT into CNFH hatchery fish at CNFH
Spring 2021	Tagging, release, fish health evaluation of six-year steelhead study continuation
October 2022	Prepare tagging equipment for tagging of wild fish at RBDD
December 2022	Analysis and synthesis
March 2022	Plan and implant 500 AT into LSNFH hatchery winter-run at CNFH

Date	Description
March 2023	Plan and implant 500 AT into LSNFH hatchery winter-run at CNFH
November to June 2023	Manage and tag wild fish at RBDD, provide data to ERDDAP
Spring 2022	Tagging, release, fish health evaluation of six-year steelhead study continuation
Fall 2022	Data Management, Modeling Analysis for six-year steelhead study continuation
Spring 2023	Tagging, release, fish health evaluation of six-year steelhead study continuation
Fall 2023	Data Management, Modeling Analysis for six-year steelhead study continuation
2023	multi-state survival model
December 2023	Analysis and synthesis
Spring 2024	Tagging, release, fish health evaluation of six-year steelhead study continuation
Fall 2024	Data Management, Modeling Analysis for six-year steelhead study continuation
Spring 2025	Report, presentation for six-year steelhead study continuation
December 2017 to August 2024	Deploy and service field monitoring acoustic telemetry stations
December 2017 to June 2024	Analysis and synthesis to support production and development of new metrics for understanding the survival, distribution, and entrainment of juvenile salmonid along the Sacramento River and its floodways, as well as, the Bay-Delta
January 2018 through June 2024	Implant, transport, and release acoustically tagged juvenile ESA-listed wild and hatchery juvenile salmonids (annually)
November to June 2022	Manage and tag wild fish at RBDD, provide data to ERDDAP
2020 to 2024	Survival, travel time, routing predictions based on historical late fall-run Chinook salmon data
2020 to 2024	R Shiny Application maintenance for visualizing predictions on web applications
December 2024	Analysis and synthesis
2019-2024	Project management and coordination

Roles and Responsibilities

Reclamation – Provide funding and serve as GOTR, COR, IATR.

University of California - Santa Cruz (UCSC) Principal Investigator (PI) and staff will deploy the receivers, collect wild fish, tag fish, enter the data and organize the receivers, equipment and gear. UCSC staff will also be responsible for the data analysis and assisting with reports.

USFWS will undertake several tasks as part of the six-year study. Services include (1) fish tagging, (2) Fish transport, (3) fish release, (4) Fish Health Evaluation, (5) Project Management, (6) Data Management consistent with the ITAG approach, (7) modeling and analysis, and (8) reporting.

The USGS (Cook, WA) will develop the statistical models used to generate real-time estimates of survival and migration routing. These models will be constructed to run automatically and will be provided to Reclamation and National Marine Fisheries Service, who will be responsible for posting real-time updates to project websites.

The USGS has performed a number of analyses to understand how route-specific travel time, survival, and migration routing of late-fall Chinook salmon vary in response to daily river flows. USGS will use these existing statistical models to predict daily route-specific survival, routing, and travel time of juvenile salmonids in the Delta given daily inflows to the Delta (Perry et al. inrevision). These models will be coded in the R open source computer programming language.

Predictions from these models represent our expectations based on historical data, and will provide a baseline against which to compare in-season estimates. Under this task, USGS will develop source code needed to generate predictions from the statistical models using real-time environmental data such as river flow of the Sacramento River at Freeport.

For visualizing output from predictive models, USGS will develop an interactive web-based application in R known as a "Shiny App" (https://shiny.rstudio.com/). The Shiny App will provide a front-end dashboard for viewing model predictions. The USGS will develop the Shiny App for the predictive models develop in Task 2 and provide the Shiny App to Reclamation and NMFS for posting on project websites.

The USGS and NMFS will develop survival models that identify how continually changing environmental conditions (e.g., tidal flows) are integrated to influence survival of fish through the Delta by using cumulative hazard modeling (USGS) and functional regression (NMFS). The USGS will extend a Bayesian survival model that jointly estimates reach-specific travel time and survival as a function of daily covariates at the time each individual enters a given reach (Perry et al. in revision). This model posits that survival and travel time depends only on the conditions when a fish enters a reach, not on variation in conditions during an individual's migration through the reach. The extension to this model will using a cumulative hazard approach that explicitly accounts for varying conditions experienced by each individual over its travel time through a given reach. This approach will employ a piecewise constant hazard function that assumes the rate of mortality is constant given the environmental conditions experienced during a given time increment (either 15-minute or daily). NMFS will use a different technique (functional regression) to examine how time-integrated environmental conditions affect survival (Hein in prep).

In addition to new telemetry data collected under this agreement and under the hybrid CWT-AT trawl efficiency study, numerous telemetry data sets from past years exist. The USGS will select the most appropriate telemetry data sets for retrospective analysis, given the goals outlined here.

SWFSC will manage the deployment of 139 autonomous JSATS receivers at 82 locations. SWFSC will manage field staff and complete management of data and delivery of data to website(s). SWFSC will manage and coordinated support for studies utilizing Vemco 69kHz receivers also, and this type of receiver will be deployed at 12 of the 82 sites. SWFSC will organize these receiver's data and make them available via web application. SWFSC will provide public release of data through their Environmental Research Division's Data Access Program (ERDDAP) website. SWFSC will plan and participate in tagging operations. SWFSC will perform the analyses, report creation, publication

writing, and presentations primarily related to juvenile salmonid survival, and perform several retrospective, multi-year analyses of the telemetry data collected during this project. SWFSC will test and manage the deployment of receivers, the data and delivery of data to their websites.

Narrative

These monitoring efforts can provide critical information on juvenile salmonid distribution and survival, which inform biologists and managers interpretations of the exposure and intensity of CVP and SWP water operation risks on tagged populations in Central Valley rivers and the Bay- Delta. Understanding salmon survival and migration dynamics in the Delta and its tributaries is critical to the recovery of ESA-listed species, and sport and commercial fisheries management.

For example, estimating the population size of endangered Sacramento River Winter-run Chinook (SRWRC) as they enter and exit the Delta is considered critical for informing Delta water management actions (Interagency Ecological Program (IEP) SAG 2013). "The use of real-time acoustic receivers that immediately transmit acoustic tagged (AT) fish detections needs to be included in the expanded network" (Johnson et al., in press). Tracking the fate of individual tagged fish will be accomplished with AT and used to develop estimates of survival and movement for other non-AT fish also part of that group. Population level sampling programs will use survival estimates generated by AT and applied to other mass marked (coded wire tagging) groups to develop improved capture efficiency for these sampling programs.
Objectives:

- Deploy and service field monitoring acoustic telemetry stations at locations important to fish and water management.
- Implant, transport, and release acoustically tagged juvenile ESA-listed wild and hatchery juvenile salmonids.
- Analysis and synthesis to support production and development of new metrics for understanding the survival, distribution, and entrainment of juvenile salmonid along the Sacramento River and its floodways, as well as, the Bay-Delta.

<u>Six-Year Steelhead Study Continuation</u>
Reclamation's Proposed Action for ROC on LTO Section 4.10.5.12.3 Additional Measures includes a *San Joaquin Basin Steelhead Telemetry Study* -- Continuation of the 6-Year Steelhead telemetry study for the migration and survival of San Joaquin Origin Central Valley Steelhead.

This investigation involves undertaking experiments utilizing acoustically-tagged salmonids to confirm proportional causes of mortality due to flows, exports, and other project and non-project adverse effects on steelhead smelt out-migrating from the San Joaquin Basin and through the southern Delta. This study is to coincide with different periods of operations and focus on clipped hatchery steelhead (*Oncorhynchus mykiss*). The period of interest is between February 15 and June 15, which coincides with a majority of *O. mykiss* outmigration from the Stanislaus River and recoveries of steelhead smolts in the Mossdale fish monitoring efforts. This period is to include changes in CVP/SWP operations that include reductions in exports, reductions in reverse flows in Old and Middle rivers (OMR), and San Joaquin River pulse flows to assess the influence of flow and exports on juvenile steelhead survival.

This study is designed to evaluate juvenile steelhead route selection at channel divergences in the south Delta and along the mainstem San Joaquin River, and how these behaviors influence survival in specific reaches and through the Delta to Chipps Island.

Data Management

1. Web-accessible reporting status of real-time receivers.
2. Real-time data available through ERDDAP data server, updated daily
3. Web-accessible real-time receiver data available in open data format
4. Web-accessible summary database of deployment of receivers.
5. Data quality assurance of no more than 2 days of downtime before site visit to reestablish real time operations.

Real time data analysis and reporting will be accomplished via tag coordination with members of the coordinated telemetry program (Tag Coordinator: Arnold Ammann, NMFS-SWFSC). This study will be a demonstration of this program being spearheaded by the Interagency Telemetry Advisory Group (USBR POC: Josh Israel, Elissa Buttermore, USFWS POC: Donnie Ratcliff, Bill Poytress) where real time visualization, forecasts, and data downloads are available (https://calfishtrack.github.io/real-time/index.html). This will allow for data on project status, real time detection through the Sacramento River, Delta, and Bay; and multiple estimates of Delta survival, route entrainment, and detection probability.

Risks

Risk	Likelihood	Impact
COVID-19	5	8

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	WRR	$580,518	$580,518	$0
2021	Supplemental	$2,562,000	$2,562,000	$0
2022	CalFed	$3,855,309	$3,855,309	$0
2023	CalFed	$3,979,229	$3,979,229	$0
2024	CalFed	$4,022,182	$4,022,182	$0

Total Cost: $14,999,238

Real Time Operations: Delta Juvenile Fish Monitoring Program

Monitor Bay-Delta fish community and other aquatic resources to support adaptive management.

DCN: 20BDAO006
Watershed: Delta
Funding Years: 2020-2022
Priority: High
Partners: U.S. Fish and Wildlife Service (USFWS)
Related Programs: Enhanced Delta Smelt Monitoring Program (EDSM)

Authority

Provision	Justification
3406(b)(15)	Improve fish and environmental monitoring

Metrics

Name	Value	Units	Comment
Trawls, beach seining	~7500	Samples/year	Provide data on relative abundance, run timing, distribution and composition of juvenile salmon and other fish
Weekly data summary report	52	Number/year	Submitted to DOSS and other groups for operational decision making
Technical report	1	Report/year	Report on Liberty Island fish community and associated habitat conditions
Newsletter articles	1	Number/year	Article summarize trawl data for each year
Manuscripts	1	Number/year	Manuscripts suitable for publication in peer-reviewed journal

Project Schedule

Date	Description
January 1, 2020	Start of performance periods
February 1, 2021	Liberty Island report
March 2022	Manuscript-synthesis
April 2022	Report on electrofishing-beach seine task
December 31, 2022	End of performance period

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
Technical lead	Brian Mahardja	Fish Biologist	brian_mahardja@fws.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-USFWS	Jeff McLain	Project Leader	jeffrey_mclain@fws.gov

Narrative

The principal objectives of this 3-year agreement are threefold: (i) to continue baseline fish surveys in the context of a broader effort to improve fish and environmental monitoring in the Bay-Delta; (ii) to coordinate baseline fish survey sampling with parallel sampling activities designed to test alternative sampling methods and approaches; and (iii) to actively participate in efforts to improve and better integrate Bay-Delta fish monitoring activities for management and scientific purposes

Under this agreement, USFWS will continue to monitor the relative abundance of fish and other aquatic resources in the Bay-Delta. It will also conduct formal reviews of the individual activities that make up this monitoring program and provide expertise for synthesis efforts. The monitoring activities conducted under this agreement will include: (i) Kodiak and Midwater trawling for juvenile salmon and steelhead (Sacramento Trawl, Mossdale Trawl and Chipps Island Trawl; (ii) beach seining for juvenile salmonids and resident fishes; (iii) real-time monitoring to inform water operations (Delta Operations for Salmon and Sturgeon team); (iv) Liberty Island fish sampling; and (v) boat electrofishing at nearshore locations.

Data Management

All data are posted on the USFWS Lodi Office web site.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CBD	$3,412,785	$3,412,785	$0
2021	CBD	$1,410,774	$1,410,774	$0
2021	Supplemental	$2,500,000	$2,500,000	$0
2022	CBD	$3,666,970	$3,666,970	$0

Total Cost: $10,990,499

Special Study: Directed Outflow Project (DOP): Paired Habitat Sampling

Evaluate mechanistic hypotheses directly related to the rationales provided for the summer Delta outflow action and Yolo Bypass Toe Drain action to benefit Delta Smelt, with direct relevance to the fall outflow action.

DCN: 20BDAO013
Watershed: Delta
Funding Years: 9/18/2018 - 6/30/2022
Priority: High
Partners: FWS, CDFW, UC Davis, ICF
Related Programs: Interagency Ecological Program

Authority

Provision	Justification
3406(b)(1) Other	Evaluation of Yolo Bypass Toe Drain and the flow outfall action delta smelt.

Metrics

Name	Value	Units	Comment
Outflow Alteration Effects Analysis	0	metadata	Requests and plans for water management actions related to augmentation of Delta outflow have proceeded and are expected to proceed in the future.

Project Schedule

Date	Description
Feb 1 of following year	Annual oral or poster presentations
Nov 15 of following year	Annual DOP Technical Report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR
Project Management Team: USBR/USFWS/USGS
Project Technical Team(s): USBR/USFWS/USGS

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
PMT Data Steward	TBD		
Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov

Narrative

The Directed Outflow Project (DOP) is a continuing collaborative effort among a dozen state, federal and non-governmental groups. The DOP will employ a focused spatial and temporal approach to evaluate mechanistic hypotheses directly related to the rationales provided for the summer Delta outflow action and Yolo Bypass Toe Drain action to benefit Delta Smelt, with direct relevance to the fall outflow action. Paired data collections (same location and time) of abiotic and biotic habitat constituents to test specific hypotheses will assist in avoiding prior shortcomings of using data collected for different studies/hypotheses and/or across variable spatial/temporal scales (as discussed in MAST [2015] and elsewhere). Sampling will occur during the Delta Smelt juvenile rearing-stage, a period known to be associated with the location of the low salinity zone (LSZ). Results should strengthen our understanding of the mechanisms and drivers impacting Delta Smelt vital rates and associated habitat features with a focus on outflow conditions. Results should assist in evaluating the benefit and feasibility of future flow augmentation actions for managers and decision makers. Results from this and other related studies will inform evaluations on which particular outflow-related action or group of actions provides the most benefit for Delta Smelt. Requests and plans for water management actions related to augmentation of Delta outflow have proceeded and are expected to proceed in the future. However, there is uncertainty and disagreement regarding the mechanistic relationship of Delta outflow during the rearing period to Delta Smelt vital rates and habitat, and the hypothesized benefit of outflow alteration for Delta Smelt. Delta outflow has experienced reductions in recent years, coinciding with the collapse of the Delta Smelt. Reduced outflow has been linked to reductions in habitat suitability in Suisun Bay and Marsh and movement of the LSZ to the Confluence of the Sacramento-San Joaquin River where little connection to shallow open water habitats exists.
The DOP's main objective will be to evaluate the hypothesized benefit of outflow alteration for Delta Smelt and its habitat in coordination with all stakeholder groups. The following process and product related sub-objectives will facilitate progression toward this evaluation objective.

- Test mechanistic hypotheses addressing the rationale behind outflow-based actions to benefit Delta Smelt.
- Concurrently sample fish and measure abiotic/biotic habitat conditions at each randomly selected location along the salinity and habitat gradient of the north to western Delta along the Sacramento River during the summer and fall.
- Compare collected fish and habitat measures in relation to research hypotheses.
- Produce a summary report with conclusions, recommendations on outflow management, and recommendations for future research.

Data Management

Data will be disseminated from collaborating DOP investigators to Reclamation and made stored/made available in formats consistent with federal data policies (e.g., Open Data Executive Order 13642). When data becomes available it will be shared with IEP for posting and additional storage on the Interim IEP Data and Metadata Access online portal. It will also be accessible through the USBR's Bay Delta Office's website under the Project, Activities, Documents web page. Synthesis, analysis and recommendations may occur informally through briefings and presentations as opposed to solely formal reports. The DOP anticipates the IEP, CSAMP and/or CAMT would represent the target audience for interim presentations and reports.

Risks

Risk Type	Likelihood	Impact
Equipment failure	Low-Mod	Variable but low due to redundancies

Cost Estimate

Year	Fund	Total	BOR	FWS
2018	WRR	$1,021,128	$1,021,128	$0
2019	WRR	$2,421,325	$2,421,325	$0
2020	WRR – Supplemental	$2,466,542	$2,466,542	$0
2021	Supplemental	$2,574,394	$2,574,394	$0

Total Cost: $8,483,389

Special Study: Drivers of Delta Smelt Health and Growth

This project will investigate the health, condition, and growth, salinity, and thermal history from fish otoliths with direct impact to subsequent recovery efforts and proposed management actions. This project is currently a primary investigator/contributor to the Directed Outflow Project (DOP).

DCN: 20BDAO005
Watershed: Delta
Funding Years: 9/16/2017 - 10/31/2022
Priority: High
Partners: UC Davis
Related Programs: NA

Authority

Provision	Justification
3406(b)(15)	This project's monitoring and evaluation fall under the CAMP Provision.

Metrics

Name	Value	Units	Comment
Processed Delta Smelt	0	Number of fish	Process up to approximately 500 fish per year from Federal and state monitoring surveys to investigate the health, condition, and growth, salinity, and thermal history of each fish.

Project Schedule

Date	Description
Mar.	Semi-annual performance and financial report
Sep.	Semi-annual performance and financial report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR
Project Management Team: USBR/USFWS/USGS
Project Technical Team(s): USBR/USFWS/USGS

Team Position	Name	Discipline	Contact Info
Project Management Reclamation	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
Project Management Reclamation	Swee Teh	Animal Health	sjteh@ucdavis.edu
PMT Data Steward	TBD		

Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
	Swee Teh	Animal Health	sjteh@ucdavis.edu

Narrative

Operation of the Central Valley Project (CVP) has been identified as a potential cause of reductions in the quantity and quality of habitat for Delta Smelt (*Hypomesus transpacificus*) and other native fish populations in the Sacramento-San Joaquin Delta-San Francisco Bay estuary (Bay-Delta). Other factors affecting smelt habitat include drought, contaminants and food supply. Recent studies indicate considerable regional variation in the prevalence of contaminant effects and food shortage effects as well as possible interactions with drought. Surveys, conducted by the California Department of Fish and Wildlife (CDFW); included the Spring Kodiak Trawl (SKT) focused on adults, the summer townet survey (STN) focused on early juveniles and the Fall Midwater Trawl (FMWT), which targets juveniles and sub-adults, as well as the USFWS Enhanced Delta Smelt Monitoring Program (EDSM). To evaluate the effect of CVP actions on the smelt population, it is essential that as much data about the health, growth, diet, movement, and reproductive and habitat history of captured and cultured fish be gathered. This kind of information is essential to developing and quantifying performance measures for the Fall and Summer outflow actions as well as to improving overall understanding of the factors regulating Delta Smelt production. The Recipient will perform measures and analyses related to the health, growth, diet, and movement, reproductive and habitat history of captured and cultured Delta Smelt (or a suitable surrogate) captured by surveys that include the EDSM, SKT, STN, FMWT and others during 2017 and 2018 as well as on cryogenically-preserved smelt collected by these surveys in previous years. The main objective of the project is to develop and quantify performance measures for the Fall and Summer outflow actions as well as to improving overall understanding of the factors regulating Delta Smelt production.

Data Management

Data will be disseminated from collaborating investigators to Reclamation and made stored/made available in formats consistent with federal data policies (e.g., Open Data Executive Order 13642). When data becomes available it will be shared with IEP for posting and additional storage on the Interim IEP Data and Metadata Access online portal. Reporting on this data will be accessible through the USBR's Bay Delta Office's website under the Project, Activities, Documents web page. Synthesis, analysis and recommendations may occur informally through briefings and presentations as opposed to solely formal reports.

Risks

Risk Type	Likelihood	Impact
Equipment failure	Low	Variable but low due to redundancies and type of equipment

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CalFed	$850,000	$850,000	$0
2021	CalFed	$850,000	$850,000	$0
2022	CalFed	$850,000	$850,000	$0

Total Cost: $2,550,000

Special Study: Eco Hydraulic Modeling with USACE

Development of project workflows and products to support ongoing projects related to: 1) Fremont weir notch and floodplain reconnection, 2) Fish movement evaluation through Shasta Reservoir, 3) Fish occupancy of newly constructed side channels and other habitats, and 4) Non–physical barrier evaluation and installation (coordinated with CADWR)

DCN: 21BDAO002
Watershed: Delta
Funding Years: 2019-2024
Priority:
Partners: USACE
Related Programs: WIIN Act

Authority

Provision	Justification
3406 (g)	Modeling that supports CVPIA and LTO habitat action.

Metrics

Name	Value	Units	Comment
Analysis for Fish Movement	0	metadata	The USACE ERDC will provide technical and project management support to the USBR on the subject of ecohydraulics related to projects managed by the USBR Bay Delta Science Office

Project Schedule

Date	Description
9/30/2020	Annual Report
9/30/2024	Annual Report
9/30/2021	Annual Report
9/30/2023	Annual Report
9/30/2022	Annual Report
9/30/2024	Final Report

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
Joshua Israel, PhD	Chief, Science Division	U.S. Bureau of Reclamation 801 I Street, Suite 140 Sacramento, CA 95814-2536 Phone: 916-414-2405
John Hannon	Fisheries Biologist	U.S. Bureau of Reclamation 801 I Street, Suite 140 Sacramento, CA 95814-2536 jhannon@usbr.gov Phone: 916-414-2413
Manny Bahia	Senior Water Resources Engineer	DWR Division of Environmental Services 3500 Industrial Blvd #131 West Sacramento, CA 95691 Phone: 916-376-9835

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

The USACE ERDC will provide technical and project management support to the USBR on the subject of ecohydraulics related to projects managed by the USBR Bay Delta Science Office. This work will include aspects development of project workflows and products to support ongoing projects including:

1. Fremont weir notch and floodplain reconnection. This project will involve participating in the Fisheries Engineering Technical Team and with the USBR Denver Technical Services Center to develop requirements for simulating fish entrainment at the Fremont Weir notch. Typical task include assisting with CFD model development, and running fish movement simulations (ELAM). The scope of the simulations and the types of behaviors simulated will be jointly decided with input from the FETT and others as directed by USBR. The aim of the work will be to help understand and refine the best notch design to maximize the notch benefits to fish.

2. Fish movement evaluation through Shasta Reservoir. This project will involve developing a hydrodynamics simulation of Shasta Reservoir with the USBR Technical Services Center and simulating juvenile salmon movement through the reservoir using a fish movement model (ELAM). Existing telemetry data will be used to calibrate and validate the movement model. The aim will be

to assist with the reintroduction of salmon above Lake Shasta. Upstream movement of adult fish as part of this project may also be included.

3. Fish occupancy of newly constructed side channels and other habitats. This project will involve using existing or developing new hydrodynamic simulations of the Sacramento River and some of the newly constructed or to be constructed side channels. The hydrodynamic models will be coupled to a habitat selection model developed on the Stanislaus River based on the ELAM. Existing fish habitat occupancy data will be used to guide calibration and validation of the model. The aim of the work will be to develop a rearing model for salmon in the Sacramento River that can be applied for the USBR, USACE and others.

4. Non–physical barrier evaluation and installation (coordinated with CA-DWR). This project will involve simulating the hydrodynamics and fish movement associated with nonphysical barriers in the lower Sacramento River. Significant leveraging with ongoing USACE and DWR work on this subject will occur.

Data Management

Data will be housed with USACE and USBR via hard drive.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR	$252,294	$252,294	$0
2021	WRR	$256,804	$256,804	$0
2022	WRR	$271,647	$271,647	$0
2023	WRR	$276,315	$276,315	$0
2024	WRR	$281,077	$281,077	$0

Total Cost: $1,338,137

Status and Trend: Environmental Monitoring Program with the California Department of Water Resources

Conduct water quality and biological monitoring at fixed stations in accordance with Water Right Decision D-1641.

DCN: 20BDAO008
Watershed: Delta
Funding Years: 2020-2022
Priority: High
Partners: California Department of Water Resources
Related Programs:

Authority

Provision	Justification
3406(b)(15)	Conducts water quality and biological monitoring

Metrics

Name	Value	Units	Comment
Continuous water quality data	365	Days/year	Water temperature, electrical conductivity, pH, dissolved oxygen, turbidity and fluorescence
Monthly discrete water quality data	12	Months/year	Suspended solids, turbidity, nutrients, chlorophyll concentration
Monthly biological data	12	Months/year	Phytoplankton, zooplankton, clams and other benthic invertebrates

Project Schedule

Date	Description
January 1, 2020	Start of performance period
February 2021-2023	Annual status and trends summary reports
December 2021	EMP review completed
December 31, 2022	End of performance period

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation-California Department of Water Resources
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team position	Name	Discipline	Contact Info
EMP lead	Ted Flynn	Biogeochemist	Theodore.Flynn@water.ca.gov

'Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-DWR	Sarah Lesmeister	Branch chief	Sarah.Lesmeister@water.ca.gov
PMT Data Steward			

Narrative

The Environmental Monitoring Program (EMP) is a requirement of Water Right Decision D-1641 and is designed to provide data documenting the status and trends of environmental conditions in the Sacramento-San Joaquin Delta and Suisun, San Pablo and North bays. The principal objectives of the EMP are to: (i) conduct monthly discrete water quality monitoring at 24 sites including water temperature, specific conductance, pH, turbidity, dissolved oxygen, alkalinity, chlorophyll concentration, chloride, silica, dissolved orthophosphate-P, total phosphorus, dissolved ammonium-N, dissolved nitrate-nitrite-N, organic nitrogen, and total and volatile suspended solids concentration at 24 fixed station; (ii) conduct monthly discrete monitoring of phytoplankton density and taxonomic composition (15 sites), zooplankton density and taxonomic composition (22 sites), and benthos density and taxonomic composition (10 sites); operate nine fixed continuous water quality monitoring stations to document water and air temperature, solar radiation, specific conductance, pH, dissolved oxygen, fluorescence, and turbidity.

The EMP will involve data management, data analyses, quality assurance, quality control and communicate findings to stakeholders (scientists, managers, public) to further understanding of the estuarine ecology and provide useful information for the management and conservation of the upper San Francisco Estuary.

The Recipient (DWR) will produce static and interactive annual reports on the California Estuary portal to meet water rights Decision D-1641 requirements. The Recipient will also produce a 3-year report per D-1641 requirements. The Recipient will produce oral and/or poster presentations at various scientific venues including, Inter-agency Ecological Program workshop, Bay-Delta Science Conference, and similar settings. The Recipient will produce articles for the IEP Newsletter summarizing status and trends observed by the EMP

Data Management

All data are posted on California Data Exchange Center (CDEC) and the Water Quality Monitoring Council web portals. They are also published via the Environmental Data Initiative (EDI) web site.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State /Local In Kind
2020	CBD	$6,000,000	$2,700,000	$0	$3,300,000
2021	CBD	$6,000,000	$2,700,000	$0	$3,300,000
2022	CBD	$6,000,000	$2,700,000	$0	$3,300,000

Total Cost: $18,000,000

Intervention: Facility Improvement for Delta Smelt Supplementation

The Tracy Aquaculture Facility will be outfitted to be able to culture juvenile Delta Smelt.

DCN: 21BDAO005
Watershed: Delta
Funding Years: FY2021-TBD
Priority: TBD
Partners:
Related Programs: CASS

Authority

Provision	Justification
(b)(4)	Mitigate for fishery impacts associated with operations of the Tracy Pumping Plant.

Metrics

Name	Value	Units	Comment
Fish Capacity		Number of Fish	Final number of fish and life stage is still to be determined.

Project Schedule

Date	Description
Jan. 2021	Tank installations
Aug. 2023	Transfer of first ~21,000 fish.

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
Rene Reyes	Supervisory Fish Biologist	Tracy Fish Collection Facility
Brandon Wu	Fish Biologist	Tracy Fish Collection Facility
Christopher Hart	Fish Biologist	Tracy Fish Collection Facility

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Andrew Schultz	Fish Biologist	

Narrative

The 2019 Biop calls for supplementation of 125,000 Delta Smelt by 2023 and current production only occurs at the UC Davis Fish Culture and Conservation Laboratory (FCCL). The FCCL has a capacity to hold only 50,000 adults for supplementation but could produce more if additional space to move later life stages off the facility became available. The Tracy Aquaculture Facility (TAF) within the Tracy Fish Collection Facility is located close enough to make transfers of fish feasible, but the special requirements for successful culture of delta smelt will require additional staffing and modifications to the existing infrastructure.

The modifications would accommodate the water quality and water temperature needs of Delta Smelt. The TAF will be reconfigured into multiple rows of recirculating aquaculture systems. Each individual recirculating aquaculture system will incorporate a chilled water system for temperature control, a UV system for water sterilization, and appropriate filters to prevent biocontamination. In addition, a canopy would be installed above all outdoor tanks. Several whole system improvements are planned as well. The raw Delta water UV system will be installed, an emergency generator will be purchased and brought online, and a VFD type pump will be added to protein fractionator. Once installed several other repairs will be made to the AIR Sep, sump pumps, and Ozone machines

Data Management

Transfers of fish from FCCL or LSNFH would be recorded and reported within the CASS supplementation program annually. A chain of custody form will document the transfer of fish from and to their respective agencies. The chain of custody form will contain the number of fish, age of fish, and all other pertinent information. While the chain of custody form will be archived, the data from the form will be entered into a spreadsheet or database and made available upon request.

Risks

Risk	Likelihood	Impact
Modifications not completed within anticipated schedule	2	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$1,000,000	$1,000,000	$0

Total Cost: $1,000,000

Status and Trend: Fish Monitoring with the California Department of Fish and Wildlife

Monitor Bay-Delta fish community and other aquatic resources to support adaptive management.

DCN: 20BDAO035
Watershed: Delta
Funding Years: 2020-2022
Priority: High
Partners: California Department of Fish and Wildlife
Related Programs:

Authority

Provision	Justification
3406(b)(15)	Monitor Bay-Delta fish community and other aquatic resources to support adaptive management.

Metrics

Name	Value	Units	Comment
Relative fish abundance	12	Months/year	Status and trends of delta smelt and other fish species
Zooplankton density	12	Months/year	Status and trends of zooplankton and other fish food organisms

Project Schedule

Date	Description
2020-202	Data are posted on CDFW web site (https://wildlife.ca.gov/Conservation/Delta)
September 2020	Survey Plan for Fall Mid-Water Trawl survey completed
December 2020	Survey plans for Summer Townet, 20-mm, Spring-Kodiak Trawl, Bay Study and Smelt Larval surveys completed
December 2020	Retrofit of the New Alosa
July 2021	Station reduction proposal
July 2021	Retrofit of the Hypomesis
July 2020-2022	Annual Spring Kodiak Trawl memo
September 2020-2022	Annual 20 mm survey index memo
September 2020-2022	Annual Summer Tow Net index memo
December 2020-2022	Annual status and trends report/article
January 2021-2022	Annual ESA 'take' reports to NMFS/USFWS
June 2021-3022	Final reports-results of fish survey reviews

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation-California Department of Water Resources
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team position	Name	Discipline	Contact Info
Technical team lead	Jim Hobbs	Fish biologist	James.Hobbs@wildlife.ca.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-CDFW	Stephanie Fong	Program Manager	Sarah.Lesmeister@water.ca.gov
PMT Data Steward			

Narrative

The principal objectives of this 3-year agreement are threefold: (i) to continue IEP baseline fish surveys in the context of a broader effort to improve fish and environmental monitoring in the Bay-Delta; (ii) to coordinate baseline fish survey sampling with parallel sampling activities designed to test alternative sampling methods and approaches; and (iii) to actively participate in efforts to improve and better integrate Bay-Delta fish monitoring activities for management and scientific purposes.

Under this agreement, CDFW will continue to monitor the relative abundance of fish and other aquatic resources in the Bay-Delta. It will also conduct formal reviews of the individual surveys that make up this monitoring program and provide expertise for synthesis efforts. The surveys include the Fall Midwater Trawl, Summer Townet, Bay Study (estuarine and marine fish, shrimp and zooplankton abundance and distribution), 20-mm, Smelt Larval and Spring Kodiak Trawl. Other activities include estimating adult sturgeon population size, juvenile salmon rotatory screw trap monitoring at Knight's Landing and the Mossdale Spring Trawl.

Data Management

All data are posted on the CDFW web site: https://wildlife.ca.gov/Conservation/Delta

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2020	CBD	$8,220,858	$4,110,429	$0	$4,110,429
2021	CBD	$8,467,484	$4,233,742	$0	$4,233,742
2022	CBD	$8,721,508	$4,360,754	$0	$4,360,754

Total Cost: $19,409,850

Habitat and Facility Improvement: Head of Old River Scour Hole

Complete design for improvements to the Head of Old River Scour Hole to allow for improvement to survival rates of juvenile salmonids past Chips Island.

DCN: 20BDAO018
Watershed: Delta
Funding Years: 2021-2027
Priority: Medium
Partners: None
Related Programs: LTO Non-Flow Actions

Authority

Provision	Justification
Sections 3406(b)(4)	Mitigate for fishery impacts associated with operations of the Tracy Pumping Plant.

Metrics

Name	Value	Units	Comment
Head of Old River Scour Hole (HORS) Improvement Design	1	HORS Design	This project will complete the designs and cost estimates for a future construction project that will improve the scour hole thereby removing an area of high predation of salmonids traveling up the San Juaquin River from traditional spawning grounds in the South Delta
HORS Improvement Construction	1	HORS Improvements	This project will complete a construction project that will improve the scour hole thereby removing an area of high predation of salmonids traveling up the San Juaquin River from traditional spawning grounds in the South Delta

Project Schedule

Date	Description
July 2021	Technical Team Membership identified
September 2021	Identification of previous studies/efforts that may be leveraged in the alternative development process
February 2022	Identification of alternatives
August 2022	15% Design and Cost Estimate (appraisal-level) for all alternatives
November 2022	Analysis of alternatives considering designs, cost estimates, and expected benefits
January 2023	30% Design and Cost Estimate of proposed action
June 2024	60% Design and Cost Estimate of proposed action

Date	Description
July 2024	Initiate the environmental compliance process for proposed action, and identify ESA consultation and NEPA timelines
January 2025	90% Design and Cost Estimate of proposed action
June 2025	Develop solicitation documents for the proposed action
October 2025	Select contractor(s) and begin implementation of proposed action
January 2026- Dec 2027	Proceed with construction activities
January 2028	Develop monitoring plan to understand effectiveness of the Project

Roles and Responsibilities

Project Sponsor:
Project Manager: Colin Maloney
Project Technical Team(s):

Name	Discipline	Contact Info
Colin Maloney	Civil Engineer	cmaoney@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Colin Maloney, USBR	Civil Engineering	Phone: 916-414-2442 Email: cmaloney@usbr.gov
PMT Data Steward			

Narrative

To prevent erosion of the northern bank of the San Juaquin River just north of the junction with the Old River rip rap was placed along a section of shoreline. While the rip rap successfully prevented the erosion of the riverbank there, it did not mediate the forces of the river around this turn and he San Juaquin's River's force scoured out the riverbed creating a large depression.

This scour hole has been identified as an area of abnormally high predation of juvenile Steelhead Trout by electronic fish surveillance conducted by NMFS. The results of this work are presented in, "Fish Predation on a Landscape Scale" published by Michel, et al. in 2019.

The predatory fish use the depth of the scour hole to hide and ambush the juvenile Steelhead with success significantly higher than along the flat-bottomed areas of the San Juaquin River, as demonstrated in the Michel Study. It is believed that the depth of the scour hole gives introduced predatory fish a unique hunting ground which results in high levels of Steelhead mortality that would be reduced be removing this depression in the riverbed.

This scour hole is in the path of salmonids traveling up the San Juaquin River from traditional spawning grounds in the South Delta. At the head of the Old River a rock barrier is maintained to prevent the migration of Juvenile Steelhead Trout and fall-run Chinook salmonids up the Old River where the water would take them to the Central Valley Project (CVP) and State Water Project (SWP)

pumping facilities where there is a high probability these fish would become entrained. While juvenile Steelhead Trout have two migratory patterns. One Anadromous, where after being born in the freshwater of the Delta travel to the sea only to return to the Delta in order to spawn. The other where they spend their entire lives in the Delta. In both cases the juvenile salmonids path passes the scour hole where they encounter high mortality rates.

Data Management

All data will be stored on Reclamation servers.

Risks

Risk	Likelihood	Impact
Project Time Overrun	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$2,500,000	$2,500,000	$0
2022	CalFed	$1,100,000	$1,100,000	$0
2023	CalFed	$1,100,000	$1,100,000	$0
2024	CalFed	$12,000,000	$12,000,000	$0
2025	CalFed	$12,000,000	$12,000,000	$0
2026	CalFed	$12,000,000	$12,000,000	$0
2027	CalFed	$11,000,000	$11,000,000	$0

Total Cost: $51,700,000

Special Study: Predator Hot Spot Feasibility, Field Support, and Analysis

The predator management project will support predation related studies and actions outlined in the 2019 Biological Opinion.

DCN: 21BDAO012
Classification: Improvement
Watershed: Delta
Funding Years: 2022 – 2027
Priority: High
Partners: CDFW, DWR
Related Programs: USBR-TFCF predator removals; DWR Enhanced Predatory Fish Removal and Relocation Study
Project Type: Performance Monitoring

Authority

Provision	Justification
3406(b)(1) other	Addresses actions that support efforts to achieve natural production goals.

Metrics

Name	Value	Units	Comment
Identification of predator hotspots throughout Delta	Presence / Absence	Binary by location	Identification of areas best suited for removal project(s)
Quantification of predator density	Density	Fish/m^3	Understanding of magnitude of predator presence
Prediction of predator removal effect	Method		Identification of a successful method to complete action(s)
Calculation of predator removal success	Index		Measure the success of the undertaken action(s)

Project Schedule

Date	Description
2022 – 2023	Identify hotspots and successful predator removal action(s), collect and interpret data
2023 – 2024	Develop removal action predictions
2024 – 2027	Measure and observe predator removal action(s)
March, annually	Semi-annual performance and financial report
September, annually	Semi-annual performance and financial report
2027	Final Report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR
Project Management Team: USBR/CDFW/DWR
Project Technical Team(s): USBR/CDFW/DWR

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Suzanne Manugian	Fish Biologist	smanugian@usbr.gov
PMT Data Steward	Suzanne Manugian	Fish Biologist	smanugian@usbr.gov
Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
Technical Team	Rene Reyes	Supervisory TFCF Fish Biologist/Biological Resources Section	rreyes@usbr.gov
Technical Team	TBD		

Narrative

The Sacramento-San Joaquin Delta (Delta) has been highly modified by human behavior (DSC 2013; Wiens et al. 2016; Grossman 2016) including biological, physical, and chemical environmental changes. Native fish species (Chinook salmon, steelhead, Delta smelt, and longfin smelt) are in decline due to compounded effects of habitat changes and introduced predators (Grossman et al. 2013). There is evidence both within the Delta and in other locations worldwide to support positive selectivity for juvenile salmonids by predators because they are energy-rich, handled easily, and may be potentially naïve to invasive predators (Hartman and Brandt 1995; Johnson and Martinez 2000; Johnson et al. 2002; Kuehne and Olden 2012; Lepak et al. 2012; Grossman et al. 2013).

Predation occurrence can be dependent on a suite of local factors, some of which include alternative prey presence and density, prey size, structures in the environment, hydrology, and bathymetry. Localized, intense predation occurs consistently in areas referred to as hot spots (Gingras 1997; Michel 2010; Buchanan et al. 2013; San Joaquin River Group 2013). Within the Sacramento-San Joaquin Delta there are many identified hot spots such as man-made structures, scour holes, and bodies of deep water like forebays. There are also identified hot spots at both the State (SWP) and Federal (CVP) Delta pumping facilities.

Projects that fall under this Charter are consistent with Reclamation's Final Biological Assessment (October 2019) and the NMFS Biological Opinion (October 2019) and will support any of the predation-related actions in either Biological Opinion. Outlined conservation measure actions may include, but are not limited to: improvements to Tracy and Skinner Delta Fish Facilities assessment of Lower San Joaquin River habitat for predator hot spots, and assessment of Head of Old River scour hole to plan localized predator reduction, and identification.

Results are expected to provide direct benefits to listed species (CCV steelhead, WR Chinook salmon, SR Chinook salmon, and Delta Smelt) which may include increased juvenile survival,

improved conditions for all life stages, and improved Delta salvage facility efficiency by reducing salmonid mortality.

Data Management

Data will be stored and made available in formats consistent with state and federal data policies (e.g., Open Data Executive Order 13642). When data become available, they will be shared with all members of the project management team via a Microsoft Teams channel for joint, collaborative, concurrent access to data and documents. It will also be accessible through the USBR's Bay Delta Office's website under the "Project, Activities, Documents" web page.

Risks

Risk	Likelihood	Impact
Agency (State, Federal, and local) involvement	1	2
Inability to sample / take action(s)	3	3
Technical analyses complications	1	3
Schedule conflicts / complications	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$1,000,000	$1,000,000	$0
2022	Supplemental	$5,000,000	$5,000,000	$0

Total Cost: $6,000,000

Status and Trend: Structured Decision-Making of Scientific Management in the Sacramento – San Joaquin Delta

The US Bureau of Reclamation (Reclamation) has a need to support the ongoing Structured Decision Making (SDM).

DCN: 21BDAO004
Watershed: Delta
Funding Years: 2019-2021
Priority: Implementation of SDM for guiding BiOp actions
Partners: Delta Science Program, NMFS, CDWR, CDFW, FWS, Metropolitan Water District, East Bay Municipal Utility District
Related Programs: CVPIA

Authority

Provision	Justification
3406 (g)	Support for structured decision making and the decision support model.

Metrics

Name	Value	Units	Comment
SDM facilitation	1	metadata	The study will test how to best link various agency management action portfolios and improve conditions for listed species through monitoring and evaluation of effects from Reclamation actions

Project Schedule

Date	Description
March, September	Semi-annual Reports
Completion of each version of the SDM Model	Executive Summaries
September 30, 2021	Structured Decision-Making Management
September 30, 2021	Structured Decision-Making Team Coordination
September 30, 2021	Structured Decision-Making Communication and Outreach

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: Michael Beakes
Project Technical Team(s): Ben Geske

Name	Discipline	Contact Info
Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
Ben Geske	P.E.	ben.geske@deltacouncil.ca.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
PMT Data Steward	Ben Geske	P.E.	ben.geske@deltacouncil.ca.gov

Narrative

The US Bureau of Reclamation (Reclamation) has requested support of the ongoing Structured Decision Making (SDM) pilot study for the Delta Stewardship Council (Council). This Delta SDM pilot study is designed to assess key fishery, water, chemical, and economical drivers in the Sacramento-San Joaquin Delta. It is also intended to be used as a tool, by varying and diverse Federal and state agencies, stakeholders, and local public interests, to facilitate transparent scientific evaluation of alternative scenarios related to the fishery and water management actions based on the best available information. The pilot study will test how to best link various agency management action portfolios and improve conditions for listed species under the ESA. Example of efforts to improve conditions for ESA listed species will involve reducing predation and water quality stresses, enhancing rearing and migrating conditions, and providing habitat to improve overall species survivability and fecundity. Additionally, it will be used by these varying and diverse interest to evaluate and prioritize investments in data collection and model refinement to narrow key uncertainties that would prevent evaluation of desired outcomes under various management scenarios. The process will incorporate a wide range of expert opinions and highlight scientific uncertainties. It may also establish quantifiable metrics that can guide monitoring efforts. Public agencies have been undertaking structured decision making to improve stakeholder engagement, quantification of biological risks and benefits, and improve decision making as part of CVPIA since 2015. This project will be integrated into the broader decision support modeling and efforts to accelerate decisions, benefit water and fish management, and expand the specificity of these tools.

The purpose of the charter is for generating a collaborative decision support tool to inform prioritization of fish and water management and science investments by public agencies that is credible, relevant, and has broad stakeholder endorsement in the Sacramento-San Joaquin Delta (Delta). The Delta Science Program (DSP) (acting under the administrative umbrella of the Council) will be the implementing entity of this agreement. The DSP, through outreach and direct communication, will help improve transparency and collaboration between decision-makers, as well as other stakeholders in the Delta, who may contribute to and benefit from a decision-making framework. The DSP helps put science-based decision making as the focus of the SDM framework.

Data Management

The Delta Science Program (DSP) will provide a tool for QA/QC of any related SDM materials as part of this process. The DSP will act as a liaison between all parties. Communication between

Reclamation and all other stakeholders will be coordinated and documented to ensure that the process is moving along efficiently to ensure adaptive management throughout the entire effort. An executive summary about the SDM process and each version of the model. A Summary Report about the results and key findings from each version of the model. This should also include lessons learned, ideas for improving the process, and a recommendation to proceed to subsequent SDM version or not

Risks

Risk	Likelihood	Impact
Agency (State, Federal, and local) involvement	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	Supplemental	$160,000	$160,000	$0
2021	Supplemental	$1,000,000	$1,000,000	$0

Total Cost: $1,160,000

Special Study: Steelhead Lifecycle Monitoring Program

Upper Sacramento River and San Joaquin River *O. mykiss* population size and life-history composition census.

DCN: 21BDAO010
Watershed: Delta
Funding Years: 2019-2024
Priority: BA Proposed Action Chapter 4 section 4.10.5.12.3 Steelhead Conservation Measures
Partners: CDFW, USGS, NMFS, FWS, Cramer Fish Sciences, FishBio
Related Programs: WIIN Act

Authority

Provision	Justification
3046 (g)	These actions fall under the provision of Ecosystem and Water Operations Models.

Metrics

Name	Value	Units	Comment
Progress update and current study results in an annual report	4	Number of reports	Annual progress report for years 1-4
Final report on steelhead population status and life-history composition	1	Number of reports	Final report and recommendations in year 5
Raw data	1	NA	Raw data generated from *O. mykiss* monitoring and research

Project Schedule

Date	Description
2020-2021	Permitting, data collection, initial project reports
2021-2022	Data collection and reporting
2022-2023	Data collection and reporting, integration with CVPIA and Delta SDM
2023-2024	Final analysis and report, integration with CVPIA and Delta SDM

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: Michael Beakes
Project Technical Team(s): Michael Beakes USBR, Jim Peterson USGS, Steve Tsao CDFW, Contractor/s TBD

Name	Discipline	Contact Info
Michael Beakes	PhD - Fish Biologist	mbeakes@usbr.gov
Jim Peterson	PhD – Structured Decision Making	jt.peterson@oregonstate.edu
Steve Tsao	Fish Biologist	steve.tsao@wildlife.ca.gov
Contractor/s	Fish Biologists	TBD
Contractor/s	Fish Biologists	TBD

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Michael Beakes	PhD - Fish Biologist	mbeakes@usbr.gov
Technical Team	Jim Peterson	PhD – Structured Decision Making	jt.peterson@oregonstate.edu
Technical Team	Steve Tsao	Fish Biologist	steve.tsao@wildlife.ca.gov
Technical Team	Contractor/s	Fish Biologists	TBD
Technical Team	Contractor/s	Fish Biologists	TBD

Narrative

California Central Valley *O. mykiss* are distributed throughout most watersheds but often in low abundance, particularly in San Joaquin tributaries (Williams et al. 2016). The species can adopt a broad range of life-history strategies ranging from anadromous (steelhead) to freshwater residents (Rainbow trout). While there is a genetic basis for life-history expression (Pearse et al. 2014), resident *O. mykiss* can produce offspring that adopt an anadromous life-history and anadromous steelhead can produce freshwater residents (Zimmerman et al. 2009).

There are a variety of genetic and environmental factors that influence population dynamics and life-history variation in *O. mykiss* (Kendall et al. 2015). Past research has emphasized that growth and survival in freshwater, survival during migration and at sea, asymptotic sizes achievable in freshwater, and genetic makeup are likely key factors in determining life-history expression and adaptation (Satterthwaite et al. 2009, 2010, Pearse et al. 2014, Kendall et al. 2015). This charter will build on past research while focusing on evaluating how CVP operations impact population dynamics and the expression and evolution of *O. mykiss* life histories.

Studies emerging from this charter will address concerns of SIT members regarding the lack of information and high degree of uncertainty about how to enhance or encourage anadromous life history in steelhead by providing high-priority data and parameter estimates listed in tables 13, 16,

and 19 of the SIT Technical Memorandum on FY20 CVPIA Priorities. In addition, this charter will meet requirements outlined in Chapter 4 section 4.10.5.12.3 of the Proposed Action and coordinated long-term operations of the CVP and SWP by aiding the San Joaquin Basin Steelhead Collaborative and providing a Steelhead Life-Cycle Monitoring Program foundation. It is anticipated that this charter and associated studies will span five years, fill critical knowledge gaps, and generate testable hypotheses related to *O. mykiss* life-history variation and CVP operations that can be evaluated by the CVPIA SIT. Year one will be used to develop a full study plan, develop contracts, and acquire permits. Studies will be implemented, and preliminary analyses will be conducted in years two through four. Final analysis and management recommendations will be completed in year five.

Data Management

Data from this charter's studies will be stored on external hard drives and internal servers with the Bureau of Reclamation and project partners.

Risks

Risk	Likelihood	Impact
Non-lethal, incidental take of winter-run Chinook	2	1
Permit acquisition	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR	$1,340,942.72	$1,340,943	$0
2021	WRR	$428,222	$428,222	$0
2021	Supplemental	$1,389,000	$1,389,000	$0
2022	WRR	$1,812,731	$1,812,732	$0
2023	WRR	$525,013	$525,013	$0
2024	WRR	$582,826	$582,826	$0

Total Cost: $6,078,735

Habitat and Facility Improvement: Tracy Fish Facility Improvement Program

Annual Tracy Fish Facility Improvement Program (TFFIP)

DCN: 21FHRP004
Classification: Research, Infrastructure Improvement
Location: Delta
Funding Years: 2020 - 2022
Benefits Start Year: 2020
Priority: 1 - Program Priority Comments: CVPIA (b)(4) metrics coincide with OCAP Biological Opinions
Partners: Collaborative research partners, DWR and CalF&W.
Related Programs: Crosscut with CVPIA (b)(1).

Authority

Provision	Justification
3406(b)(4)	Develop and implement a program to mitigate for fishery impacts associated with operations of the Tracy Pumping Plant.

Metrics

Name	Value	Units	Comment
Completion of RPAs			

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Title
Dec. 2020	Accomplishments Report
Jan. 2021	Annual Report
EOFY	Reports from individual subprojects funded by this project. (see attached "Tracy Volume Series Report Status")

Roles and Responsibilities

Project Sponsor:
Project Manager: J. Carl Dealy
Project Technical Team(s):

Name	Discipline	Contact Info
Rene Reyes	Supervisory Biologist	Tracy Office
Zachery Sutphin	Biologist	USBR-TSC
Connie Svoboda	Hydrologist	USBR-TSC

Name	Discipline	Contact Info
(Currently Vacant) Chief	Operation & Maintenance Division	Tracy Office
Duane Stroup	Deputy Area Manager	South-Central California Area Office

Project Management Team

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

This action consists of program administration and management support for the Tracy Fish Collection Facility Improvement Program. The program is implemented through an interdisciplinary approach; competitive process for soliciting proposals; integration with the CVP Conservation Program; protection, restoration, and enhancement of federally listed species and habitats affected by the CVP. Management includes program support, environmental compliance, scientific review and publication, peer review management, management of all collaborative processes as well as web site management. Administrative support is primarily oversight on all funded projects, coordination with the Tracy Technical Team and may also include acquisitions as needed.

Implementation during FY 2020 & FY2021 includes:

FY 2021 Projects Tracy Fish Facility Improvement Program emphasis is similar to FY 2018, in order is as follows: 1) Predator Evaluations, particularly related to Fish Release Sites; 2) Predator removal methods; 3) Whole Facility Evaluation using two mark and recapture methods. Much of the work will involve collaborations with other federal and State agencies. Result will be published to the Tracy Research Website http://www.usbr.gov/mp/TFFIP.

Ancillary to the core research efforts identified above is the Tracy Fish Collection Facility (TFCF) bathymetric survey. The data from the survey will be used for the FY2020-22 CO2 mathematical modeling and other predator control investigations. We have also established a reconnaissance team to explore automated fish counting.

Data Management

Data will be retained by the Tracy Fish Facility Improvement Program, SCCAO-Tracy. Finalized Study Plans, Tracy Series Reports, Tracy Technical Bulletins, Hydraulic Laboratory Technical Memos are maintained at Tracy Research Website http://www.usbr.gov/mp/tffip. Annual work plans and CVPIA program-level reports are maintained MPRO.

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Risks

Risk	Likelihood	Impact
No Data.		

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2020	WRR	$710,000	$710,000	$0	$0
2020	CVPRF	$426,000	$426,000	$0	$0
2021	Unfunded	$463,500	$463,500	$0	$0
2021	WRR	$727,500	$727,500	$0	$0
2022	S/LIK	$463,500	$0	$0	$463,500
2022	WRR	$772,500	$772,500	$0	
2022	CVPRF	$463,500	$463,500	$0	
2023	CVPRF	$2,910,500	$2,910,500	$0	$0
2023	Unfunded	$3,374,000	$0	$0	$0
2023	S/LIK	$426,000	$0	$0	$426,000
2024	CVPRF	$1,895,000	$1,895,000	$0	$0
2024	S/LIK	$426,000	$0	$0	$426,000
2024	Unfunded	$2,321,000	$0	$0	$0
2025	CVPRF	$1,895,000	$1,895,000	$0	$0
2025	Unfunded	$2,321,000	$0	$0	$0
2025	S/LIK	$426,000	$0	$0	$426,000
2026	CVPRF	$1,895,000	$1,895,000	$0	$0
2026	Unfunded	$2,321,000	$0	$0	$0
2026	S/LIK	$426,000	$0	$0	$426,000
2027	CVPRF	$1,895,000	$1,895,000	$0	$0
2027	Unfunded	$2,321,000	$0	$0	$0
2027	S/LIK	$426,000	$0	$0	$426,000

Total Cost: $29,305,000

Habitat and Facility Improvements: Yolo Bypass Salmonid Habitat Recreation Mitigation

As part of implementing the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project, Reclamation has adopted measures for recreation, subject to available appropriations, and as described in Attachment A of the Record of Decision. These measures are MM-REC-1 and MM-REC-3. Reclamation will implement mitigation that includes drainage improvement projects (MM-REC-3) in the northwest portion of the YBWA, specifically the entrance and parking Lot A

DCN: 21BDAO006
Watershed: Delta
Funding Years: FY21 or FY22
Priority:
Partners: California Department of Fish and Wildlife (CDFW); California Department of Water Resources (DWR)
Related Programs: 2019 NMFS Biological Opinion

Authority

Provision	Justification
3406(b)(4)	Mitigate for fishery impacts associated with operations of the Tracy Pumping Plant.

Metrics

Name	Value	Units	Comment
YBWA Parking Lot A	N/A	N/A	Access during inundation

Project Schedule

Date	Description
Fall 2020	Planning and environmental compliance
Spring 2021	Design
2021 or 2022	Construction

Roles and Responsibilities

Project Sponsor: USBR/DWR/CDFW
Project Manager: Ben Nelson
Project Technical Team(s):

	Name	Discipline	Contact Info
DWR Project Manager	Manny Bahia		
CDFW	TBD		

Narrative

The Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project contributes to the improvement of juvenile rearing habitat by increasing access and acreage of floodplain habitat. Inundation of floodplain habitat has effects to recreation in the Yolo Bypass, specifically the Yolo Bypass Wildlife Area (YBWA), managed by CDFW. In the ROD, Reclamation adopted measures for recreation, including drainage improvement projects (MM-REC-3) in the northwest portion of the YBWA, specifically the entrance and parking Lot A, subject to available appropriations, and up to a total of $2 million.

Recreation mitigation at the YBWA could involve a financial assistance agreement with the state of California, through CDFW or DWR.

Data Management

N/A

Risks

Risk	Likelihood	Impact
Construction timing with the overall project	1	1
Awarding agreement for construction	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
FY21	Supplemental	$1,930,000	$1,930,000	$0
FY22	CalFed	$50,000	$50,000	$0

Total Cost: $1,980,000

Habitat and Facility Improvement: Yolo Bypass Salmonid Habitat Restoration and Fish Passage

Action under Re-initiation of Consultation of the Coordinated Long-term Operation of the CVP and SWP.

DCN: 20BDAO002
Watershed: Delta
Funding Years: FY19-FY25
Priority: High
Partners: California Department of Water Resources (DWR)
Related Programs: 2019 NMFS Biological Opinion

Authority

Provision	Justification
3406(b)(4)	Under the project, more juvenile Chinook salmon avoid interior Delta entrainment associated with the Tracy Pumping Plant (TPP). The Project would minimize impacts from the TPP and improve juvenile migration and survival.

Metrics

Name	Value	Units	Comment
Floodplain enhancement	17,000-20,000+	Acres	Increase juvenile rearing habitat
Adult fish passage	-	-	
Juvenile migration	-	-	

Project Schedule

Date	Description
December 10, 2018	Biological Assessment
April 29, 2019	U.S. Fish and Wildlife Service Biological Opinion
May 10, 2019	National Marine Fisheries Service Biological Opinion
June 7, 2019	Final Environmental Impact Statement/Environmental Impact Report
September 19, 2019	Record of Decision
May 2020	35% Design
November 2020*	60% Design
February 2021*	90% Design
April 2021*	Final Design
Summer 2022*	Construction

* Planned dates

Roles and Responsibilities

Project Sponsor: USBR/DWR
Project Manager: Ben Nelson
Project Technical Team(s):

	Name	Discipline	Contact Info
DWR Project Manager	Manny Bahia		
DWR Environmental Lead	Analisa Martinez		
DWR Fisheries Lead	Josh Martinez		

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

The Project seeks to achieve the objectives of Action I.6.1 and I. 7 as an obligation under Section 7 of the federal Endangered Species Act, 16 U.S.C. s 1531, et seq. The California Department of Water Resources (DWR) and Reclamation are the lead state and federal agencies in the preparation of the environmental impact statement/environmental impact report (EIS/EIR) for the Project, which fulfills the requirements of both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

The Project contributes to the improvement of adult fish passage and juvenile rearing habitat with a goal of increasing populations of listed salmonids and sturgeon by improving connectivity within the Yolo Bypass and between the Yolo Bypass and the Sacramento River and increasing access and acreage of floodplain habitat. The Project will address factors limiting fish populations in the lower Sacramento River basin, such as food web and migratory delays and stranding.

Under the Project, more juvenile Chinook salmon would enter the Delta near Rio Vista from the Yolo Bypass as opposed to the Sacramento River, which will mitigate fishery impacts (ie interior Delta entrainment, juvenile mortality) associated with the Tracy Pumping Plant (TPP). Juvenile salmonids that avoid the interior Delta and the pumps have greater success on their migration out to the ocean. Incidental take at the pumps would be reduced and population increases would lead to increases in authorized take. Therefore, the Project would minimize impacts from the TPP and improve juvenile migration and survival relative to current conditions with fish entrained at the pumps.

The Reinitiation of Consultation (ROC) on L TO provides updated Endangered Species Act compliance for the operations of the Central Valley Project and State Water Project. One of CVP's major impacts on fisheries is fisheries impacts at the TPP. The TPP entrains fish, causing injury and mortality of out-migrating salmonid juveniles. One way that Reclamation has identified in the ROC on L TO to mitigate for these effects is to create additional rearing habitat in the Yolo Bypass. This

non-flow action to create additional rearing habitat will increase the survival of juvenile salmonids upstream of the TPP, so that the net population effect of the CVP operations is mitigated for. The Yolo Bypass Project is part of the proposed action for the ROC on LTO, which is the ESA consultation on operations of TPP and the rest of the CVP.

Data Management

Reclamation will manage data in coordination with DWR.

Risks

Risk	Likelihood	Impact
Easement negotiations	2	2
Construction by 2022	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019	Supplemental WRR/CalFed	$34,498,502	$34,498,502	$0	$0
2020	Supplemental WRR/CalFed	$6,578,460	$6,578,460	$0	$0
2021	WRR	$288,000	$288,000	$0	$0
2021	CalFed	$7,400,000	$7,400,000	$0	$0
2021	Supplemental	$4,970,000	$4,970,000	$0	$0
2022	State Cost Share	$10,000,000	$0	$0	$10,000,000
2022	CalFed	$5,000,000	$5,000,000	$0	$0
2022	Unfunded	$4,000,000	$4,000,000	$0	$0
2023	State Cost Share	$15,000,000	$0	$0	$15,000,000
2023	CalFed	$5,000,000	$5,000,000	$0	$0
2023	Unfunded	$1,000,000	$1,000,000	$0	$0
2024	State Cost Share	$31,000,000	$0	$0	$31,000,000
2024	CalFed	$723,038	$723,038	$0	$0
2025	State Cost Share	$10,000,000	$0	$0	$10,000,000
2026	State Cost Share	$10,000,000	$0	$0	$10,000,000

Total Cost: $152,000,000

Feather River

Habitat and Facility: Feather River: Sunset Pumps Sturgeon and Salmon Passage

Removal of Sunset Pumps Facilities and Improvements to Sutter-Butte Main Canal

DCN:	AFRP2104
Watershed:	Feather River
Funding Years:	2019 - 2024
Priority:	SIT FY2020 Tech Memo: - Increase access to Chinook juvenile rearing habitat in Sutter and Yolo Bypasses - Improve Green Sturgeon Passage at Tisdale, Fremont Weir and Sunset Pumps.
Partners:	NMFS, Sutter Extension Water District, CDFW, CDWR
Related Programs:	CDFW, CDWR

Authority

Provision	Justification
(b)(1)	This project addresses anadromous fish population goal

Metrics

Name	Value	Units	Comment
Habitat	28	miles	Access to this habitat will be increased.
Barrier Removal	1	# improv.	One barrier will be removed.
Green Sturgeon	1	# fish	See explanation in narrative.
Chinook Salmon	1	# fish	See explanation in narrative.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Dec. 2020	Feasibility Study; Design Plans
Dec. 2020	Annual Reports
Dec. 2021	Permits; Monitoring Reports
Dec. 2023	Initial Construction Actions

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
Paul Cadrett	USFWS	209-334-2968
Amanda Ott	CDWR	
Lynn Phillips	SEWD	
Colin Purdy	CDFW	
Tracy McReynolds	CDFW	
Tanya Sheva	CDFW	
Ruth Goodfield	NMFS	

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360
	Rod Wittler	USBR-CVPIA	916-262-3670

Narrative

This project is ongoing and directly addresses the 2020 SIT priority for green sturgeon of improve passage at Tisdale, Fremont Weir, and Sunset pumps.

Quantitative prediction of expected outcome: Green Sturgeon: The number of females to successfully spawn is expected to increase by 100% (from 4 to 8). Average female has 142,000 eggs so an additional 568,000 green sturgeon eggs are expected to be produced per year.

Chinook Salmon (spring- and fall-run combined): Pre-spawning mortality is expected to drop off by 50% from the average observed from the carcass surveys (from 20% to 10%). The 10% more spawning from an escapement of 48,000 is 4,800 male and female salmon, or 2,400 females x ~5,000 eggs/female = 12,000,000 additional salmon eggs are expected to be produced per year.

The Sunset Pumps dam (i.e., boulder weir) is operated by Sutter Extension Water District (SEWD) and spans the Feather River near Live Oak, California. It is a well-known, long-standing impediment to fish passage, most notably for spring-run Chinook salmon and green sturgeon. In addition to causing migratory delays to spring- and fall-run Chinook salmon adults and green sturgeon, acoustic tag data suggests that disorientation and predation near Sunset Pumps may decrease the survival of out-migrating juvenile Chinook salmon and steelhead. This multi-year project would entirely remove the Sunset Pumps facility (i.e., dam and pumps) from the Feather River, which is the best solution for long-term improvement of fish passage and access to 28 miles of habitat as well as overall ecosystem function. In exchange, the capacity of the Sutter-Butte Main Canal would be increased, thereby maintaining SEWD's water supply.

Planning for this project has been ongoing since late 2014, with project management, modeling, and initial design and alternatives analyses facilitated or conducted by CDWR, USFWS, and SEWD staff. CDWR has established a SharePoint site to assist with project coordination. Initial modeling tasks addressing both the dam removal and canal modifications have been completed. A hydraulic model has been developed to provide an initial evaluation of sediment volume upstream of the dam, identify existing and post-project channel profiles, and determine effect on upstream diversions. Additionally, an analysis completed by GEI Consultants (contracted by SEWD) has conceptual-level recommendations that involve improving approximately 7.4 miles of canal. CVPIA funds are especially needed to complete planning, design, and permitting, and initiate monitoring and preliminary construction actions. Most of the construction and implementation costs are expected to be funded through large matching grants from the California Department of Fish and Wildlife Proposition 1 Restoration Fund and the Northern Sacramento Valley Integrated Regional Water Management Plan, which require significant matching funds and also that projects are 'shovel-ready' with designs and permits in hand. Implementation funding is also being pursued through the DWR Agricultural Water Use Efficiency, DWR IRWM, and DWR Water-Energy grant programs.

The project addresses AFRP Final Restoration Plan/CPAR evaluation E5, 'Identify and remove physical and water quality barriers that impede access for white sturgeon and green sturgeon to spawning habitat or facilitate passage around these barriers' and Working Paper (V. 3) limiting factor 3 for sturgeon in the Feather River, 'Barriers that prevent or slow the migration of sturgeon to spawning habitat.' The project is supported by NMFS's 2014 recovery plan for Central Valley salmonids, specifically Recovery Action FER-2.13, 'Modify Sunset Pumps to provide unimpeded upstream passage of adult steelhead and Chinook salmon (and sturgeon) and to minimize predation of juveniles moving downstream.'

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Short-term monitoring will include as-built surveys (depth and water velocity) of the river channel following facility and weir removal. Pre- (and post-) project monitoring of juvenile salmonids would occur using acoustic tagging as part of this project, with the objective of quantifying changes in survival of outmigrants through the Sunset Pumps reach before and after facility removal. Short- and long-term monitoring also will be addressed through CDWR's existing fisheries monitoring program, which includes adult sturgeon tagging and tracking, roving surveys done with ARIS cameras, larval surveys, and egg mat studies; Chinook salmon carcass surveys; steelhead redd surveys; and rotary screw trapping of juvenile salmonid outmigrants. Sampling sites located upstream and downstream of Sunset Pumps are included in many of these surveys. The objective

would be to quantify changes in the proportion and timing of adult migration and spawning in the reaches above Sunset Pumps. Chinook salmon and steelhead timing and return rates to the Feather River Hatchery also are tracked and could be used to assess the effectiveness of this project. The RSTs could be used to detect changes in juvenile production.

Risks

Risk	Likelihood	Impact
This project has a high likelihood of successful implementation (overall low risk) because multiple agencies, local water districts, and the facility owner (SEWD) support it. The project management team includes project managers Mark Gard (USFWS), Amanda Ott (CDWR), and Lynn Phillips (SEWD); and technical experts Mark Gard (USFWS), Colin Purdy (CDFW), Tracy McReynolds (CDFW), Tanya Sheya (CDFW), and Ruth Goodfield (NMFS).	1	1
Full implementation will cost about $21M and is expected to be funded through CDFW Prop 1 funds, the Northern Central Valley IRWMP, or the DWR Agricultural Water Use Efficiency, DWR IRWM, and DWR Water-Energy grant programs. Probability of funding is high (i.e., risk is low) because with the initial CVPIA funding, cost share and 'shovel-ready' requirements of these programs will be met.	1	1
The project has a high cost, necessitating phased implementation. Potential adverse impacts related to e.g. flood control or sediment transport are expected to be minimal, and modeling should allow adjustment to the design or phasing of implementation to accommodate any concerns and result in overall low risk.	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019	CVPRF	$2,138,000	$0	$2,138,000	$0
2019	S/LIK	$95,000	$0	$0	$95,000
2020[13]	CVPRF	$0	$0	$0	$0
2020	S/LIK	$95,000	$0	$0	$95,000
2021	CVPRF	$957,200	$0	$957,200	$0
2021	S/LIK	$95,000	$0	$0	$95,000
2022	S/LIK	$6,000,000	$0	$0	$6,000,000
2023	S/LIK	$6,000,000	$0	$0	$6,000,000
2024	S/LIK	$6,000,000	$0	$0	$6,000,000

Total Cost: $21,380,200

[13] The FY2019 funding amount of $2,138,000 included $957,200, which was the FY2020 allocated funding for this project.

Habitat and Facility Improvement: Nelson Slough - Feather River/Sutter Bypass

Nelson Slough Floodplain Habitat. The proposed project will substantially increase available floodplain habitat in the lower Feather River corridor through Nelson Slough and contribute to improved quality of juvenile salmonids rearing habitat through increased production and availability of food resources.

DCN:	20FHRP007
Watershed:	Feather River
Funding Years:	2020 - 2023
Priority:	SIT FY2020 Tech Memo: All Chinook Runs - Increase access to juvenile rearing habitat in Sutter and Yolo Bypasses. An Action Priority 1 in the Recovery Plan for Winter and Spring-run Chinook salmon and Steelhead is to restore and maintain riparian and floodplain ecosystems along both banks of the Sacramento River to provide a diversity of habitat types including riparian forest, gravel bars and bare cut banks, shady vegetated banks, side channels, and sheltered wetlands, such as sloughs and oxbow lakes.
Partners:	CDFW, USFWS
Related Programs:	CVPIA b1, NMFS-RP

Authority

Provision	Justification
(b)(1)	Improves natural production (rearing) of anadromous fish in Central Valley rivers.

Metrics

Name	Value	Units	Comment
Floodplain Enhancement	3,000	acres	

Deliverables

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Dec. 2021	Nelson Slough Salmonid Floodplain Habitat Improvement Feasibility Study

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager:
Project Technical Team(s):

	Name	Discipline	Contact Info
	Paul Cadrett	USFWS	
	Tanya Shea	CDFW	
	Jason Kindopp	DWR	

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360

Narrative

The proposed project completes a feasibility study to develop and evaluate potential restoration actions at the Nelson Slough Wildlife Area to increase the frequency with which floodplain habitat is inundated in the Sutter Bypass.

The project would be located on CDFW property at the confluence of the lower Feather River corridor and the Sutter Bypass near Nelson Slough.

The project could include lowering and widening an existing slough within setback levees in the lower Feather River corridor downstream of Highway 99 and tying this into the Sutter Bypass; creating multiple swales within the area; and/or lowering the floodplain terrace. This would allow Feather River basin water to flow into the Sutter Bypass with much greater frequency than under current conditions, thereby connecting remnant floodplain in the lower Feather River corridor with existing floodplain in the Sutter Bypass. The project could increase floodplain habitat available to Feather, Yuba, and Bear River salmonids by 3,000 to 5,000 acres. Additional floodplain inundation resulting from this project could provide rearing benefits to Sacramento River origin juvenile winter and spring-run Chinook salmon, juvenile Butte Creek spring-run Chinook salmon in the Sutter Bypass as well as to Feather River basin spring-run Chinook salmon. Currently, River Partners has been awarded funds through the Wildlife Conservation Board to conduct native riparian plantings at this site. These two efforts could be coupled together to further enhance the existing and newly created floodplain habitat.

The Peterson, Coarse Resolution model Report, 2014 (DSM) suggests that supporting juvenile Chinook size at emigration can be beneficial to the outcome of a greater number of returning adults. Post project monitoring may help improve or validate the hypothesis of the DSM.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

All Study related documents will be stored on the U.S. Fish and Wildlife Service Red Bluff and Lodi FWO Websites at: https://www.fws.gov/redbluff/afrp.html
https://www.fws.gov/lodi/anadromous_fish_restoration/afrp_documents.htm

Risks

Risk	Likelihood	Impact
Land Ownership, Permission and Access	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2020	CVPRF	$265,000	$0	$265,000	$0
2021	CVPRF	$166,848	$0	$166,848	$0
2022	S/LIK	$2,120,000	$0	$0	$2,120,000
2023	Unfunded	$2,120,000	$0	$0	$2,120,000

Total Cost: $4,671,848

Sacramento River

Intervention: Battle Creek Winter-Run Chinook Reintroduction and Restoration Project

This project furthers the introduction of winter-run Chinook into Battle Creek.

DCN: 21BDAO007
Watershed: Sacramento River
Funding Years: 2021 - 2031
Priority: Medium
Partners: USFWS, CDFW, NMFS
Related Programs: CVPIA

Authority

Provision	Justification
3406 (b)(1)	

Metrics

Name	Value	Units	Comment
Adult winter-run	500	number of fish	Initial goal for returning adults.

Project Schedule

Date	Description
10/30/2021	First year accomplishment report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: John Hannon
Project Technical Team(s): Winter-run Chinook reintroduction team

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	John Hannon	Fish Biologist	jhannon@usbr.gov
PMT Data Steward	John Hannon	Fish Biologist	jhannon@usbr.gov

Narrative

The project furthers the reintroduction of winter-run Chinook into Battle Creek in furtherance of the recovery plan goal of providing winter-run Chinook spawning populations in additional locations. The LTO PA states that Reclamation will provide $1.4 million per year over 10 years to accelerate reintroduction on winter-run and the Battle Creek restoration project. Acceleration actions will be developed within the reintroduction team. The goal of this project is to accelerate progress towards establishing a self-sustaining population of winter-run Chinook in Battle Creek. The work under this charter should complement ongoing actions to restore Battle Creek and reintroduce winter-run.

See Battle Creek LTO non-flow action charter for more detail if needed.

Data Management

USBR Bay Delta Office, USFWS Red Bluff Office, and then CVPIA data repository when that is developed.

Risks

Risk	Likelihood	Impact
Battle Creek water not cool enough for winter-run eggs	2	2
Hydropower facility modifications not completed	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	WRR	$100,000	$100,000	$0
2021	Supplemental	$1,500,000	$1,500,000	$0
2022	WRR	$1,600,000	$1,600,000	$0
2023	WRR	$1,600,000	$1,600,000	$0
2024	WRR	$1,600,000	$1,600,000	$0

Total Cost: $6,400,000

Real Time Operations: Coded Wire Tags for Late-Fall Run Chinook Salmon Spring-Run Surrogate Tagging Program

Annually purchase coded-wire tags for insertion into Coleman hatchery late-fall run Chinook salmon to serve as surrogates for spring-run Chinook salmon.

DCN: 21BDAO008
Watershed: Sacramento River
Funding Years: 2020-2024
Priority: High
Partners: U.S. Fish and Wildlife Service
Related Programs: N/A

Authority

Provision	Justification
3406(b)(15)	Monitoring of hatchery generated fishes.

Metrics

Name	Value	Units	Comment
Decimal coded wire tags	1.12	Million	Agency code 05 (FWS)

Project Schedule

Date	Description
4/1/2020	Tags delivered to Coleman National Fish Hatchery
4/1/2021	Tags delivered to Coleman National Fish Hatchery
4/1/2022	Tags delivered to Coleman National Fish Hatchery
4/1/2023	Tags delivered to Coleman National Fish Hatchery
4/1/2024	Tags delivered to Coleman National Fish Hatchery

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s): N/A

Team position	Name	Discipline	Contact Info

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-FWS	Kevin Niemela	Program manager	kevin_niemela@fws.gov
PMT Data Steward			

Narrative

Reclamation operates the Central Valley Project (CVP), which includes a pumping facility and a fish collection facility in the southern Sacramento-San Joaquin Delta. Operation of the pumping plant is conditioned in part by a biological opinion issued by the National Marine Fisheries Service to protect listed salmonid populations. Among the listed populations are wild spring run Chinook salmon produced in tributaries of the Sacramento River. There is an annual program in place to tag and mark late-fall hatchery fish that are used as surrogates for spring run salmon. Capture of these surrogate fish at the fish collection facilities acts as a trigger for pumping restrictions.

Data Management

All data, modeling results and the optimization model code will be housed on Bay-Delta Office internal servers and published on the Environmental Data Initiative Data Portal.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CBD	$103,040	$103,040	$0
2021	CBD	$103,040	$103,040	$0
2022	CBD	$103,040	$103,040	$0
2023	CBD	$103,040	$103,040	$0
2024	CBD	$103,040	$103,040	$0

Total Cost: $515,200

Special Studies: Food for Fish - Reintegrating Floodplain Food Web Productivity into the River Aquatic Ecosystem

This proposal outlines coordinated science and management approach to re-integrate agricultural floodplain productivity into river ecosystems. The project boosts aquatic food webs and support recovery of abundant fish populations by subsidizing the food-poor river ecosystem with highly productive floodplain-derived food web resources grown in intentionally inundated winter rice fields, thereby improving juvenile salmonid foraging success in non-natal rearing habitats. Data produced by these actions will be used in the development of a food web and fish growth rate sub-module of the Science Integration Team's Salmon Decision Support Model.

DCN:	AFRP2134
Watershed:	Sacramento River
Funding Years:	2019-2021
Priority:	SIT FY2018 Tech Memo: Create/improve juvenile rearing habitat in non-natal tributaries; Sacramento Mainstem, Improve/increase juvenile Chinook rearing habitat; Sacramento River below Red Bluff, increase juvenile rearing habitat SIT FY2020 Tech Memo: Adaptively manage juvenile habitat restoration to allow the evaluation of the effect of habitat restoration on wild juvenile Chinook Salmon survival in the Sacramento River
Partners:	California Trout, River Garden Farms, RD 108, Northern California Water Association, UC Davis Center for Watershed sciences, San Luis & Delta-Mendota Water Authority, CVPIA, California Rice Commission, Trout Unlimited.
Related Programs:	CVPIA, NMFS-RPAs

Authority

Provision	Justification
3406 (g)	DSM Sub-module

Metrics

Name	Value	Units	Comment
Water diverted to managed floodplains	40,000	Acre-feet	Determined by each District's water rights permit.
Managed floodplain duration	1,200,000	Wetted-acre/days	Measure of the residence time that floodplain area enrolled in the program remains inundated and actively producing food web resources.
Food web contribution	330	Grams Dry Carbon Zooplankton/ Acre foot of	Volume floodplain water exported (AF) * zooplankton biomass density (grams dry carbon) = trophic subsidy delivered to augment in-river food webs.

Name	Value	Units	Comment
		floodplain water exported	
Integration, coordination and transfer of data to CVPIA		N/A	Project data steward will meet with CVPIA data manager and coordinate the transfer of data to the SIT in compliance with Data Guidance.
Sub-module of the Decision Support Model		N/A	Develop a sub-module of the SIT Decision Support Model that calculates habitat-specific fish growth rates based on access to aquatic food web resources.

Project Schedule

Date	Description
	Year 1: FY 2019
Jan. 2020	Estimates of food web resources (Zooplankton, phytoplankton and nutrients) delivered to river ecosystem to benefit juvenile fish to the SIT from 2018/19 field season.
Sept. 2020	Annual technical documentation report describing monitoring results for the flood up-drain event(s).
Feb. 2020	Proposal to SIT for incorporation of results into DSM.
	Year 2-3: FY 2020-2021
December 31, 2022	Science Integration Team (SIT) coordination and monitoring integration with other CVPIA and valley-wide research and monitoring programs.
September 30, 2020	Complete remaining monitoring sample processing and data analysis.
December 31, 2020	2019/20 Annual Technical Report preparation.
December 31, 2020	2020/21 field season preparation - experimental design and planning, contracting and coordination with water/ag partners, procurements, field site preparation, etc.
April 15, 2021	20/21 field study implementation – landscape scale flooding/monitoring, floodplain lab study and long-term data collection.
September 30, 2021	2020/21 monitoring sample processing, and data analysis.
December 31, 2021	2020/2021 Annual Technical Report preparation from Pilot field work.
December 31, 2021	2021/22 field season preparation - experimental design and planning, contracting and coordination with water/ag partners, procurements, field site preparation, etc.
April 15, 2022	2021/22 field study implementation – landscape scale flooding/monitoring, floodplain lab study and long-term data collection.
September 30, 2022	2021/22 monitoring sample processing and data analysis

Date	Description
December 31, 2022	2021/2022 Annual Technical Report preparation.
December 31, 2022	Final report preparations, invoicing and project close out.
December 31, 2021	2020/2021 Annual Technical Report preparation from Pilot field work.

Roles and Responsibilities

Project Leader: Jacob Katz, CalTrout
Project Manager: Ian Smith, USBR; Jacob Katz, CalTrout
Project Technical Team(s):

Name	Discipline	Contact Info
David Guy		NCWA
Rod Wittler		USBR
Josh Israel		USBR
Donnie Ratcliff		USFWS
Paul Butner		CRC
Jon Rubin		Westlands
Griffin Hill		SLDMWA
Ted Sommer		DWR
Kris Tjernell		DWR
Brian Ellrott		NMFS
Jeff McCreary		DU
Collin Purdy		CDFW
Carson Jeffres		UC Davis
Andrew Ryppel		UC Davis
Alison Collins		MWD
Chuck Hanson		SWC

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Jacob Katz	Fisheries Biologist	CalTrout
Project Management Team Lead	Ian Smith	Fisheries Biologist	USBR
PMT Data Steward	Jacob Montgomery	Fisheries Biologist	Cal Trout

Narrative

Conceptual model:

1. Extremely high rates of invertebrate production relevant for rearing juvenile salmonids are generated in seasonally hydrologically-activated floodplains with relatively long-duration water residence times.

2. The Central Valley floodplains have been extensively re-contoured for efficient, rapid drainage with 95% of Central Valley floodplains converted to other uses, primarily to agriculture, and hydrologically divorced from fish bearing stream channels by levees.
3. Hydrologic isolation of river channel from floodplains has turned rivers into food-scarce environments detrimentally affecting native fish populations and abundance.
4. Hydrologically reconnecting managed agricultural floodplains with river channels will augment in-river food web resources to the benefit of juvenile salmonids and other native fishes where these resources enter the Sacramento River *(i.e.,* greatly improve habitat quality -foraging success- in non-natal rearing habitats)

Hundreds of thousands of acres of rice ground in the Sacramento Valley are flooded in fall and early winter to aid in rice stubble decomposition (decomp). While these fields are inundated, they produce physical conditions similar to the natural floodplain wetlands which once produced the food resources that supported the Sacramento Valley's pre-development populations of waterfowl and native fish. Under current agricultural practices, very little decomp water containing floodplain-derived "fish food" resources drains back to the river. However, if management practices are altered to actively drain floodplain waters back to the river there is potential to export these critically important floodplain-derived food web resources to the river where they may augment the aquatic ecosystem's depleted food webs and help recover endangered fish populations.

Year 1 (2018/2019) of this project pilots this action on 6,500 acres of farmland owned by a single Reclamation District – RD 108. Growth benefits for juvenile salmonids caged in the river at the outfall location of pumped floodplain waters will be experimentally determined. The project will attempt three flood and drainage cycles but the number of flood-drain cycles will be dependent on river flows, water diversion restrictions and pumping capabilities of RD 108.

Years 2 and 3 builds on this effort by expanding this practice both in geographic space and (expanding to Sutter Mutual and other water districts) and by refining practices which facilitate multiple flood-drain cycles per season. Increasing the number of locations and the frequency of connection between "dry-side" managed floodplain resources and "wet-side" rearing fish populations will improve habitat quality and foraging success of juvenile salmonids in non-natal rearing habitats. Data collected from multiple years of landscape scale inundation actions will be compiled and shared with the Science Integration Team to inform and develop a sub-module of the Decision Support Tool.

This research is coordinating with these on-going research projects:

Development of baseline data for fish growth and lower trophic production on the Sutter Bypass
– Research conducted by the University of California Santa Cruz, the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, University of California Davis, Center for Watershed Sciences Watershed Sciences. Project funding from the State Water Contractors and California Department of Water Resources. The purpose of this project was to quantify the growth benefits of the Butte Sink and Sutter Bypass, compared to adjacent main river channel habitats, for Butte Creek juvenile

Chinook Salmon and other CCV Chinook Salmon populations that could potentially access the floodplain.

Paired Salmon Release Study and Agriculture Practice Standard Development Project – CalTrout is a science partner in this California Rice Commission lead, and NRCS funded project which is developing management practices for the rearing of salmon in "wet side" agricultural floodplains located within the flood bypass system. While the Fish Food project focuses on augmenting food web resources derived from managed inundation of farm fields and wetland habitats on the "dry side" of the levees into the river ecosystem where fish can access managed floodplain habitat.

Schedule

Oct – Dec 2018: Initiate coordination with the Science Integration Team and begin transfer of existing data to CVPIA Chinook Salmon Coarse Resolution Model and other Decision Support Tools will begin in September 2018 and continue for length of the contract.

Oct 2018 – May 2019: Field work, research, data collection and monitoring for pilot year. Due to the seasonal nature of floodplain research–which can only be conducted during the wet season when rivers rise and inundate floodplains, water is available for diversion, temperatures are within the thermal tolerances of salmon, and salmon are migrating through the Sacramento River corridor–fieldwork for this project must take place between Nov 1, and March 30th. Substantial preparation such as experimental design, grower outreach and flood and drainage coordination and installation of instrumentation is necessary in advance of field work.

June – Dec 2019: Monitoring sample processing, data analysis and coordination with the Science Integration Team and annual report preparation. Experimental design for next field season commences in June.

Oct 2019 – May 2020: Field work, research, data collection and monitoring for Year 2. Multiple inundation/drain cycles with RD 108, pilot-test with an additional district. Floodplain Lab experiments.

June – Dec 2020: Monitoring sample processing, data analysis, coordination with the Science Integration Team and annual report preparation. Experimental design for next field season commences in June.

Oct 2020 – May 2021: Field work, research, data collection and monitoring for Year 3. Multiple inundation/drain cycles with RD 108, large single cycle with an additional district. Floodplain Lab experiments. Coordination with the Science Integration Team and annual/final report preparation.

June – Dec 2021 - Monitoring sample processing, data analysis, coordination with the Science Integration Team and annual/final report preparation.

Year 1 – Pilot Year - (Oct 2018- Dec 2019)
During Year 1 this project will pilot the inundation of approximately 6,500 acres of rice fields between October and March. Fields will be actively drained directly to the Sacramento River through the Rough and Ready pumping plant. The Rough and Ready pumping facility has several levels of water export pumping capacity. For baseline conditions, a single 80cfs pump can be used. And during flood conditions or for higher discharge rates, the facility has 3 x 210cfs pumps. All these pumps can be run individually or together in various combinations for a range of export discharge rates of 80-720cfs. 5,000 acre-feet of agricultural floodplain water can be drained in 3-20 days, depending on water stages on the floodplain and in the river. River diversions will occur at the screened Wilkins Slough and Emery Poundstone pumping plants equipped with state of-the-art positive barrier fish screens and will be used for all diversions to ensure that no salmonids or other fish are entrained into the diversion and discharged into the flooded rice fields. The project will attempt three flood and drainage cycles but the number of flood-drain cycles is dependent on river flows, water diversion restrictions and pumping capabilities of RD 108.

Data will be collected on water quality, zooplankton density, and juvenile Chinook salmon growth rate at regular intervals during each flooding cycle. Temperature and dissolved oxygen data loggers recording at 15-minute intervals will be deployed and downloaded throughout the sampling period. Conductivity will be measured using a portable EC meter. Baseline river zooplankton density will be determined by sampling in the Sacramento River upstream of the floodplain drainage point source. Drainage water will be sampled at the Rough and Ready pump directly before it enters the river. Effected river samples will be taken at the point of discharge and at two sites downstream of the initial sample. In order to directly measure habitat specific growth rates, measure the effect of agricultural floodplain water export on fish growth and to compare growth rates of fish experiencing natural river conditions to those experiencing fish food-augmented conditions, hatchery-origin juvenile Chinook salmon will be confined in enclosures upstream and downstream of the Rough and Ready pumping station. Each site will have three cages each containing 10 hatchery-origin juvenile fall run Chinook salmon. Every fish will be PIT tagged. Fish length, weight, and body condition will be recorded weekly. Flow through the Rough and Ready pumping station will be recorded by RD 108 and used, in conjunction with physical and biological metrics, to determine total food web subsidy to the river by this management action.

Years 2 and 3 (Jan 2020- Dec 2021)
In Years 2 and 3, the project will work to use lessons learned from the pilot year to grow the number of acres inundated, the number of reclamation districts (districts) participating and refine management practices to facilitate conducting multiple flood/drain cycles per season.

In Year 2 the project will work to conduct three flood/drain cycles on at least 5,000 acres at RD 108 for a total 15,000 inundated acres drained. We will also begin work with Sutter Mutual Water district. In Year 3, the project plans to continue three flood/drain cycles on at least 5,000 acres at RD 108 as well as 5,000 at Sutter Mutual or another district for a total of 20,000 inundated acres drained in year 3. At the conclusion of Year 3, the project seeks to have drained approximately 40,000 acres of intentionally inundated floodplain to the Sacramento River.

exporting. An estimated 330 grams of dry zooplankton carbon is exported to the river food web per acre foot of floodplain water pumped into the River.

Other Districts in the Sacramento Valley with existing managed agricultural floodplains include but are not limited to RD 70, RD 1660, RD 1000, RD 1001, RD 2047 among others. Pending water rights limitations, infrastructure constraints and unforeseen management impediments, each year the project will increase the number of locations of fish food delivery, the frequency of fish food deliveries throughout the outmigration/rearing season, and the total volume of fish food deliveries to the lower Sacramento River system to increase fish foraging success, growth rate, and survival.

Representative managed wetlands within each participating District, along with a longitudinal transect of river sites bracketing floodplain fish food export point sources will be monitored weekly throughout the field season. Water temperature, conductivity, dissolved oxygen, pH, turbidity, chlorophyll-a concentration, weather, biogeochemical constituent (e.g., nitrogen, phosphorus, and dissolved carbon), and zooplankton community assemblage and abundance data will be collected and recorded weekly throughout the field season. Temperature and dissolved oxygen loggers will be deployed at each District's fish food delivery point source, collecting data at 15-minute intervals throughout the field season. Biogeochemical samples will be subcontracted out for analysis (e.g., EcoAnalysts, Inc.). Zooplankton sample analysis will be conducted after the field season at the UC Davis Center for Watershed Sciences. Hatchery-origin juvenile Chinook salmon will be caged in the river upstream and downstream of fish food export point sources to compare baseline and managed agricultural floodplain-augmented fish diets and growth rates. Wild fish will also be sampled weekly upstream and downstream of fish food export point sources during export management actions to confirm wild fish use of these resources.

Concurrently, a managed floodplain laboratory will be constructed at River Garden Farms in Knights Landing, CA and will be used to scientifically investigate drivers, mechanisms, and outcomes of managed floodplain fish food production through controlled, replicated experiments. Specific topics to be studied include but are not limited to: effects of water residence time on zooplankton density, effects of fish food export practices on waterfowl and shorebird populations, effects of fish presence on managed floodplain methane efflux.

Integration with Related Long-Term Monitoring Programs

This project will assist in the integration of monitoring efforts among the major entities devoted to winter and spring salmon population monitoring and conservation and collaborate with the Science Integration team to use compiled data to develop a sub-module in the Decision Support Model. Traditionally salmonid populations have been monitored by state and federal agencies with screw traps along the outmigration corridor. As rearing habitat and food availability increasingly become incorporated into the suite of conservation management strategies, a more comprehensive monitoring program is required. UC Davis researchers at the Center for Watershed Sciences the Department of Water Resources and California Rice Commission have already begun to sample rearing habitat in the Butte Sink and the Yolo and Sutter Bypasses when they are flooded. We will incorporate water quality, zooplankton, and

wild fish sampling data into their reporting schema to create a centralized location for data storage and transparency. Additionally, baseline data before major conservation actions to improve access to rearing habitat are enacted will be critical for determining salmon population response to those conservation actions.

In Years 2 and 3, the project will continue to monitor the three major confluences of floodplain drainage and the lower Sacramento River. Major confluences include, but are not limited to the Colusa Drain, lower Butte Creek in Sutter Bypass, and Auburn Ravine Cross Canal. Each location will be monitored weekly for water quality and zooplankton density in similar transect experimental design used in Year 1. Baseline river zooplankton density will be determined by sampling in the Sacramento River upstream of the floodplain confluence. Floodplain water will be sampled directly before it enters the river. River samples will be taken at the confluence and at least one site downstream of the initial sample.

Representative floodplain farm fields and/or wetlands within each floodplain foodshed will also be monitored weekly throughout the winter-spring wet season. These sites were established in 2016 and continuous monitoring will generate the long-term data set needed to assess baseline conditions from which to gauge the magnitude of ecosystem response after restoration and management actions. Additional "foodshed" confluences of interest may expand to include the Butte Slough Outfall Gates and various Reclamation District discharge locations.

CalTrout's Data Steward will coordinate with external partners and the CVPIA Data Manager on the transmission of long-term monitoring, fish food export and other pertinent data defined by the SIT and the PMT per the new Data Guidance.

CVPIA Objectives: The project may contribute to improved growth rates and survival of salmonids and other native fish populations rearing in the Sacramento River through improved food web productivity and increased availability and density of food web resources.

This project will divert winter river flows to create inundated wetland habitat and facilitate productive floodplain food webs that can then be discharged into the Sacramento River where they will then be available for consumption by juvenile salmonids and other fish.
The overall propose of this project is to determine how increased availability of food resources in the Sacramento River contributes to improved rearing habitat for listed salmonids and other resident and migratory fish.

In the Central Valley of California, approximately 3360 km of state and federal levees (Inamine et al. 2010), along with local flood protection projects, have cut off approximately 95% of historical floodplain wetlands from their river channels. Recent state-wide analysis of the conservation status of freshwater fishes have concluded that lack of floodplain and other off channel habitat is an important contributor to widespread decline of many fish species (Moyle et al. 2011, Katz et al. 2013). In the Central Valley, studies have shown that, when inundated by flood waters, floodplains are generally warmer due to increased surface area and residence time compared to the relatively cool and swift river channel (Ahearn et al. 2006, Grosholz and Gallo 2006). Elevated phytoplankton growth in floodplain habitats provides food resources for grazing zooplankton and other invertebrates, which ultimately become food resources for fishes

(Sommer et al. 2001b, Miller-Solger et al. 2002, Ahearn et al. 2006, Grosholz and Gallo 2006, Jeffres et al. 2008). Due to the limited amount of floodplain habitats remaining within the levee footprint, there has been much focus on how the flood bypasses - which still hydrologically connect to river channels during high flow events - may be modified to better mimic historical shallow flooding patterns that once sustained aquatic food webs and were important drivers of fish and wildlife abundance in the Sacramento Valley.

Recent research has shown that agricultural fields in the Yolo Bypass and the Sutter Bypass can also provide a productive food web and abundant food resources for juvenile salmonids when intentionally flooded using existing irrigation infrastructure. The overall rapid growth and robust body condition of the salmon in these studies demonstrates that winter flooding of bypass agriculture fields during the non-growing season can provide high quality habitat for rearing juvenile Chinook salmon in all water years. These results suggest that changes to agricultural management and infrastructure that increase the frequency and extend the inundation duration of bypass flood events could allow bypass agriculture fields to serve as large-scale surrogates for floodplain wetlands (Katz et al. 2017).

Another potential opportunity for aquatic food web production in the Sacramento Valley is the approximately 500,000 acres of rice ground that lies on historical low-elevation floodplains that are now on the "dry-side" of flood protection levees. Over the last three decades, rice growers in the Sacramento Valley have adopted and continued to refine farm practices that provide wetland habitat for waterfowl and shorebirds on winter-flooded rice fields that remain in active agricultural production during summer (Eadie et al. 2008, Elphick 2008, Elphick et al. 2010, Strum et al. 2013). One of these practices, which occurs on approximately 300,000 acres of rice ground in the Sacramento Valley annually, is the shallow flooding of rice fields after harvest in fall to aid in rice stubble decomposition. This managed inundation produces conditions similar to natural floodplain wetlands (i.e., surrogate floodplains), and has had positive, landscape-level effects on native waterfowl populations including recent all-time high counts of wetland bird species (Elphick et al. 2010).

Current farm practices keep decomp water on fields where it percolates into the ground or evaporates. Unfortunately for fish, very little of this decomp water, which the 2017 Fish Food project pilot year showed are rich in zooplankton and other invertebrates (i.e., fish food), returns back to the river. The Fish Food project is focused on reintegrating the natural winter productivity of these managed, "dry-side" floodplain farm fields with the river aquatic food web where it can support salmonid and other fish populations.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and

the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data produced by this project will be used in the development of a sub-module of the Science Integration Team's Salmon Decision Support Model(s). The Project Management Team Leader will coordinate with the CVPIA Science Coordinator on the development and submission of a SIT DSM Modification Proposal (Using the standard proposal template), as well as ensure progress on completing the sub-module in cooperation with the Science Integration Team.

Field data will be recorded on data sheets or directly to a laptop computer and transferred into a computer database. Field data, analyses, and reports will be stored and backed-up on a CalTrout server.

Risks

Risk	Likelihood	Impact
Operating under existing water rights; project qualifies for a Notice of Exemption under CEQA with RD 108 acting as the lead agency.	I	1
Time delay on grant agreement development, review and execution for funding for Years 2 and 3: Our ability to perform work, supply large amounts of water and contract/coordinate with sub-contractors is dependent on being able to develop, review and execute grant agreements and make funding available. Given past experiences, there is a risk that the development, review and approval (Secretary) may cause significant delay in agreement execution and funding availability and may result in needing to alter the schedule or extend project timelines.	1	4
Operating in a dynamic environment: inundating/draining large amounts of farm acres and conducting in-field monitoring and research in a historic floodplain presents uncertainty based on weather, climate and flood conditions. In some cases, flood or drought years may delay work or limit our ability to meet objectives on the number of acres inundated, amount of fish food augmented or types of data collected. We have taken preventative steps including strategically selecting field sites, moving operations outside of flood bypasses, etc. to minimize this risk.	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019	CVPRF	$997,775	$881,973	$0	$0
2019	S/LIK	$0	$0	$0	$115,802
2020	CVPRF	$1,186,140	$1,083,775	$0	$0
2020	S/LIK	$0	$0	$0	$102,365
2021	CVPRF	$1,378,512	$1,166,288	$0	$0
2021	S/LIK	$0	$0	$0	$212,224

Total Cost: $3,562,427

Special Studies: Green Sturgeon Juvenile Investigation

Green Sturgeon Juvenile Rearing Habitat Investigation

DCN: AFRP2118
Watershed: Sacramento River
Funding Years: 2018 - 2021
Priority: This project supplies the SIT with data for the Sturgeon DSM per Table 17 of the SIT FY2020 Tech Memo.
Partners: NMFS, USACE, USBR
Related Programs: CVPIA (b)(1), NMFS, NMFS-RPA

Authority

Provision	Justification
3406(g)	This research meets the Ecosystem and Water System Operations Models of this provision.

Metrics

Name	Value	Units	Comment
Habitat Assessment	160	miles	Determine, in given water year, number of linear river miles of the Sacramento River utilized as rearing habitat for Green Sturgeon juveniles based on temperature and flow operations from Shasta/Keswick dams under in situ annual temperature management plan.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Sep. 2019	Annual Report
Sep. 2020	Annual Report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
Josh Gruber	USFWS-RBFO	

Name	Discipline	Contact Info
Matt Brown	USFWS-RBFO	
Bill Poytress	USFWS-RBFO	
Derek Rupert	USBR-NCAO	

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360

Narrative

Sacramento River flow and temperature management influences the quantity and quality of sturgeon juvenile rearing habitat in the Sacramento River. This information is critical input to the CVPIA SIT Green Sturgeon DSM effort. This project corresponds with the FY 2020 SIT Core Team specific priority for Green Sturgeon of "adaptively managing flows, habitats, and/or temperature to increase juvenile recruitment". The information derived from this project will assist in adaptively managing annual temperature management plans for Shasta/CVPIA water resources with respect to the biological needs of winter-run Chinook Salmon (NMFS 2009 OCAP BO RPA) and Green Sturgeon. The project is collaborative in-nature and in execution and evaluates multiple listed species.

Sacramento River flow and temperature management influences the quantity and quality of sturgeon juvenile rearing habitat in the Sacramento River. This information is critical input to the CVPIA SIT Green Sturgeon DSM effort. This project corresponds with the FY 2020 SIT Core Team specific priority for Green Sturgeon of "adaptively managing flows, habitats, and/or temperature to increase juvenile recruitment". The information derived from this project will assist in adaptively managing annual temperature management plans for Shasta/CVPIA water resources with respect to the biological needs of winter-run Chinook Salmon (NMFS 2009 OCAP BO RPA) and Green Sturgeon. The project is collaborative in-nature and in execution and evaluates multiple listed species.

The effects of flow and temperature management operations of the Central Valley Project, most directly Shasta and Keswick dams, are currently biologically focused at conserving Endangered winter-run Chinook salmon. Current water resource management operations have impacts to Threatened Green Sturgeon who cohabitate in the upper Sacramento River temporally and spatially during their spawning and juvenile rearing periods. The water temperature needs for salmon spawning, egg incubation and hatching are generally lower than for Green Sturgeon. We hypothesize that, dependent upon annual water year type and resultant storage capacity, temperature and flow management for winter Chinook may result in benefits or negative impacts to the quantity and quality of spawning and rearing habitat of Green Sturgeon in the Sacramento River. A recent publication by Hamda et al. (2019) has modeled the impacts of temperature management for winter-run on Green Sturgeon. Data from this project will be used to validate modeling results and either support or allow for recalibration on model parameters. Our working hypothesis is therefore as follows:

Ho = Water resource management (via flow and temperature manipulation) focused on winter-run Chinook salmon has no effect on the quantity of Green Sturgeon spawning and/or juvenile rearing habitat.
Ha = Water resource management (via flow and temperature manipulation) focused on winter-run Chinook salmon does affect the quantity of Green Sturgeon spawning and/or juvenile rearing habitat.

Funding of this Charter in FY2020 and beyond would continue and expand upon work already funded and in progress to allow greater assessment via quantification of juvenile rearing habitat in terms of linear miles of the Sacramento River based on physical data collection efforts (e.g., flow and temperature monitoring coupled with juvenile habitat occupancy using telemetry). Quantification of juvenile sturgeon rearing habitat has been noted as a significant data gap in the SIT team Decision Support Model that is currently being developed for Green Sturgeon. This project fits well within the multiple CVPIA SIT FY2020 monitoring priorities of evaluating juvenile sturgeon habitat use, fish routing and the effect of temperature and flow operations of CVP facilities on this species as well as winter-run (multi-species benefits).

NMFS (2015) 5-Year Review of the Southern Distinct Population Segment of the North American Green Sturgeon indicated the juvenile life-history stage is one of the least understand phases of this species. Efforts to learn about how annual Sacramento River flow and temperature management (i.e., annual temperature management plan) affect the quantity and quality of juvenile rearing habitat in the Sacramento River are greatly desired by NMFS, USFWS, and USBR. Without this research, it is impossible to evaluate the potential effects of flow and temperature management (e.g., for winter-run Chinook salmon) and diversion operations on the availability of rearing habitat for Green Sturgeon.

This research could allow for assessment of potential habitat restoration efforts to directly benefit Green Sturgeon and potentially optimize water resource allocation for winter Chinook in an adaptive management framework. This research could result in having the required baseline information to make progress toward achieving the CVPIA doubling goal for this species. This would occur by knowing what habitat exists and is utilized by Green Sturgeon and how other rivers (e.g., the Feather or Yuba) may or may not have similar habitat which could then be used to determine feasibility of various restoration actions (e.g., flow/temp management strategies or habitat restoration activities) to achieve greater population numbers. This work could also aid in filling data gaps required to assist with Recovery or delisting of Green Sturgeon from the Endangered Species Act.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and

the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data produced by this project will be used in the development of a sub-module of the Science Integration Team's Salmon Decision Support Model(s). The Project Management Team Leader will coordinate with the CVPIA Science Coordinator on the development and submission of a SIT DSM Modification Proposal (Using the standard proposal template), as well as ensure progress on completing the sub-module in cooperation with the Science Integration Team.

Telemetry and physical habitat data (temp. flow, velocity, depth, and substrate composition) generated by this project will be coordinated with USACE modeling staff to produce habitat use models. Information developed by this charter will be stored at the USFWS Red Bluff Fish & Wildlife Office and reports posted to the office website: http://www.fws.gov/redbluff/

Risks

Risk	Likelihood	Impact
Attaining research permits	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2018	CVPRF	$147,832	$0	$147,832	$0
2019	CVPRF	$348,645	$0	$348,645	$0
2020[14]	CVPRF	$0	$0	$0	$0
2021	CVPRF	$177,033	$0	$177,033	$0
2021	S/LIK	$212,224	$0	$0	$212,224

Total Cost: $885,734

14 The FY2019 funding amount of $348,645 included $174,823, which was the FY2020 allocated funding for this project

Real Time Operations: Red Bluff Diversion Dam Rotary Screw Traps

Juvenile salmonid production monitoring in the Sacramento River at Red Bluff, Clear Creek adult and juvenile monitoring, and Battle Creek adult and juvenile monitoring. 2009 Biological Opinion actions carried over into 2019 LTO PA

DCN: 20BDAO023
Watershed: Sacramento River
Funding Years: 06/02/2020 – 05/31/2025
Priority: High
Partners: USFWS
Related Programs: NMFS-BO, LTO PA

Authority

Provision	Justification
(b)(15) CAMP	The data is used to track salmonid fish production.

Metrics

Name	Value	Units	Comment
Report from each activity	8 of them	report	Annual update reports and regular in-season updates for Red Bluff RST and winter-run carcass survey

Project Schedule

Date	Description
Annual	The escapement and juvenile production monitoring activities occur annually and repeat annually

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s): see below

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov
Matt Brown		
Charlie Chamberlain		
Jim Earley		
Kevin Niemala		

Project Management Team: Same as above

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

The juvenile production monitoring at Red Bluff is used to determine when ESA listed species are migrating down the Sacramento River, helps set the winter-run take level for the Delta pumps each year, and determines the effectiveness of operations at Shasta at maintaining salmonid survival in the upper Sac River. The Clear Creek monitoring helps determine effectiveness of water operations in Clear Creek/Whiskeytown and of Clear Creek restoration actions. Battle Creek monitoring helps with evaluation of Battle Creek restoration project and Coleman Hatchery operations.

River and Task

Task Project Title

Sacramento River

Activity 01 Red Bluff Diversion Dam Site Rotary-Screw Trap Juvenile Production Monitoring

Activity 02 Upper Sacramento River Winter Chinook Salmon Carcass Escapement Survey

Clear Creek

Activity 03 Operation of Segregation Weir in Clear Creek

Activity 04 Adult Spring Chinook Escapement Monitoring in Clear Creek

Activity 05 Juvenile Spring-run and Steelhead Production Monitoring in Clear Creek (RST's)

Activity 06 Adult Steelhead and Late-fall Chinook Escapement Monitoring in Clear Creek

Battle Creek

Activity 07 Juvenile Production Monitoring in Battle Creek (RST's)

Activity 08 Adult Salmonid Escapement Monitoring in Battle Creek

Data Management

USFWS Red Bluff Field Office maintains the data.

Risks

Risk	Likelihood	Impact
Insufficient staffing to complete activities	1	3

Cost Estimate:

Year	Fund	Total	BOR	FWS
2020	WRR	$3,311,786	$3,311,786	$0
2021	WRR	$10,168	$10,168	$0
2021	Supplemental	$3,420,000	$3,420,000	$0
2022	WRR	$3,557,693	$3,557,693	$0
2023	WRR	$3,643,553	$3,643,553	$0

Total Cost: $13,943,200

Real Time Operations: Sacramento River Basin Salmonid Monitoring with Pacific States

Conduct annual Chinook Salmon spawning escapement surveys in the Sacramento River Basin (mainstem, Deer Creek, Antelope Creek, Mill Creek, Clear Creek, Battle Creek, Cottonwood Creek, Cow Creek, Bear Creek, and American River) to estimate the abundance and distribution of Chinook salmon spawners. Conduct effectiveness monitoring of salmonid habitat improvement projects in the Sacramento River basin.

DCN:	20BDAO025
Watershed:	Sacramento River
Funding Years:	2021 - 2025
Priority:	Priority Comment: The monitoring activities of this agreement are part of the Reasonable and Prudent Actions (RPA) described by National Marine Fisheries Service in the biological opinion (BiOp) on long-term operations of the CVP and California State Water Project (SWP). To maintain CVP operations, Reclamation must ensure these activities occur in order to comply with the Endangered Species Act.
Partners:	Pacific States Marine Fisheries Commission
Related Programs:	NMFS-RPAs

Authority

Provision	Justification
(b)(15) CAMP	This project conducts effectiveness monitoring of salmonid habitat improvement projects.

Metrics

Name	Value	Units	Comment
Spawner Abundance	0	Number of fish	The primary objective of this project is to continue to determine the annual abundance and distribution of adult Chinook salmon returning to spawn in the Sacramento River Basin and to assess effectiveness of restoration actions.

Project Schedule

Date	Description
3/31/2021	Semi-Annual Performance Report and Financial Report
9/30/2021	Annual Survey Reports
9/30/2021	Semi-Annual Performance Report and Financial Report
	Above cycle repeats annually

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov

Project Management Team:
John Hannon
Stan Allen

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

The monitoring activities of this agreement are part of the Reasonable and Prudent Actions (RPA) described by National Marine Fisheries Service in the biological opinion (BiOp) on long-term operations of the CVP and California State Water Project (SWP). To maintain CVP operations, Reclamation must ensure these activities occur in order to comply with the Endangered Species Act and carried the activities over into the project description of the 2019 BA.

The primary objective of this project is to continue to determine the annual abundance and distribution of adult Chinook salmon returning to spawn in the Sacramento River Basin and to assess effectiveness of restoration actions. The escapement surveys for winter-run and spring-run Chinook in the Sacramento River, Clear Creek, Mill Creek, Deer Creek, and Battle Creek is included in the Proposed Action for the 2019 water operations BA. The restoration effectiveness monitoring task is a CVPIA funded activity.

Data Management

Data emerging from this project will be housed at the USBR Bay-Delta Office internal servers and uploaded to CalFish (https://www.calfish.org/)

Risks

Risk	Likelihood	Impact
Covid makes field work difficult	1	2
Staff unavailable	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR	$1,150,000	$1,150,000	$0
2021	Supplemental	$2,294,000	$2,294,000	$0
2022	WRR	$1,280,000	$1,280,000	$0
2023	WRR	$1,300,000	$1,300,000	$0

Total Cost: $6,024,000

Habitat and Facility Improvement: Sacramento River - Improve Spawning Habitat above Temperature Control Points

Includes Gravel Injection at Keswick Dam and instream gravel placement at downstream locations to the temperature control point.

DCN:	AFRP2114
Location:	Sacramento River
Funding Years:	2017 - 2021
Priority:	SIT FY2018 Tech Memo: Winter Chinook – Upper Sacramento River above temperature control points, increase spawning habitat
Partners:	Chico State Enterprises, ACID, Glenn Colusa Irrigation District, Sacramento River Forum
Related Programs:	CVPIA (b)(13), Structured Decision Making

Authority

Provision	Justification
(b)(13)	Develop and implement a continuing program for the purpose of restoring and replenishing, as needed, spawning gravel lost due to the construction and operation of Central Valley Project dams, bank protection projects, and other actions that have reduced the availability of spawning gravel and rearing habitat in the Upper Sacramento River from Keswick Dam to Red Bluff Diversion Dam.

Metrics

Name	Value	Units	Comment
Gravel injected or placed	20000	cubic yards	Volume can be adjusted to meet what the core team feels is reasonable. Injection is about $37/cubic yard (@1.5 ton/yard), and placement is around $42/cubic yard. Includes purchase, placement, and oversight.
Spawning Distribution	100	percentage of fish	Percent of fish spawning upstream of temperature compliance point
Survival	30	percentage of fish	Survival from egg to juvenile passage at Red Bluff

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Sep. 2018	Injected and placed gravel
Sep. 2019	Injected and placed gravel
Sep. 2020	Injected and placed gravel
Sep. 2021	Injected and placed gravel
Sep. 2022	Injected and placed gravel

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: John Hannon
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Lead	John Hannon	Biologist	916-206-4187

Project Management Team:

Team Position	Name	Discipline	Contact Info
	Jim Early	Biologist	USFWS – Red Bluff
	Paul Zedonis	Biologist	USBR – NCAO
	Ruth Goodfield	Biologist	NMFS - SWSC

Narrative

1. The project includes Gravel Injection at Keswick Dam and instream gravel placement at downstream locations to the temperature control point. The primary downstream sites are Market Street adjacent to the ACID water intake facility, the Redding Riffle area near the Sundial Bridge, and the South Cypress riffle. Market Street placement will help replenish gravel between that point and Turtle Bay area. South Cypress placement will help replenish the area on down to the general downstream area of winter Chinook spawning and the temperature compliance point.
2. Core team priority = increase spawning habitat in the Sacramento River above temperature control points.
3. Keswick Dam site includes injection via end dumping gravel off the side of the Keswick office parking lot. Expected quantity = 20,000 tons.
4. Market Street site is an in-river gravel placement on the south side of the river downstream of the ACID dam. Expected quantity = 15,000 tons.
5. Redding Riffle site is an in-river gravel placement on the south side of the river upstream of the Sundial Bridge. Expected quantity = 10,000 tons.

6. South Cypress is and in-river gravel placement south of the Cypress Avenue Bridge. Expected quantity = 20,000 tons.
7. Requested funding could implement at three of these sites. This project has a flexible funding amount depending on the desire of the core team. Higher funding = more gravel, lower funding = less gravel, no funding = no gravel.
8. Addresses maintaining or increasing egg to fry survival by providing habitat in the reach of the river with the coolest water during winter-run spawning.
9. The predicted outcome of maintaining spawning habitat in areas nearest Keswick Dam is maintained or improved egg to fry survival for winter Chinook at a given temperature regime, particularly in the dryer years with insufficient cold water pool storage, in comparison with letting the habitat degrade. Effects of the high flows in 2017 on habitat are yet to be fully assessed, but the injection site at Keswick Dam is devoid of gravel as of summer 2017. Permits are largely in place, so most of the cost goes directly to gravel placed into the river and the oversight of that activity.
10. Gravel placement is cost-effective as minimal design is required, so most of cost goes into implementation. Permits are mostly in place. Will be additionally evaluating bringing the gravel removed from the dual-purpose canal adjacent to RBDD.
11. Contributes to the fundamental objective of providing spawning habitat in up-river areas and fits in conjunction with projects focusing on juvenile rearing habitat.
12. Focused on implementation.
13. Stakeholders feel that this activity needs to be implemented each year. The need likely varies by year with varying annual hydrology. It's useful to maintain a stockpile at the Keswick injection site so that when mobilization flows occur the material is there to replace the coarse material blocked by the dam. Reclamation is contributing a gravel budget study started in FY18 through the Re-initiation of Consultation on Long-Term Water Operations.
14. No known stakeholder objections. Site-specific issues are addressed in the collaboration that goes into implementation.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2022 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

1. In-river placement documented via aerial photography. Spawning distribution is monitored via roughly weekly aerial redd surveys during winter-run spawning (May through August) and less frequent surveys the rest of the year for the other runs. Underwater videography or acoustics will attempt to document spawning in deep water areas of the canyon reach. Gravel movement monitored via aerial photography after gravel mobilizing flow events.
2. Data management center yet to come.

3. Performance metrics = % of population spawning upstream of temperature compliance point and % of population estimated to be using placed gravel. Annual egg to Red Bluff survival is estimated by carcass surveys, hatchery fecundity data, and Red Bluff screw trap passage estimates.
4. Data maintained by USBR and USFWS project managers and will be disseminated in annual reports.

Risks

Risk	Likelihood	Impact
Permits not obtained	1	3
Truck falls into river; parking lot falls into river	1	3
Damage to ACID facilities	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2018	CVPRF	$800,000	$800,000	$0
2019	CVPRF	$0[15]	$0	$0
2020	CVPRF	$1,600,000	$1,600,000	$0
2021	CVPRF	$800,000	$800,000	$0
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	CVPRF	$5,935,550	$5,935,550	$0

Total Cost: $11,135,550

[15] FY2019 AWP allocation of $800,000 was unable to be obligated in FY2019 so funding was shifted to FY2020

Habitat and Facility Improvement: Sacramento River Tisdale Weir Sturgeon and Salmonid Passage

Reducing or eliminating opportunities for fish stranding in the stilling basin and Tisdale bypass.

DCN: AFRP2106
Watershed: Sacramento River
Funding Years: 2019 - 2021
Priority: SIT FY2020 Tech Memo: - All Chinook Runs: Increase access to juvenile rearing habitat in Sutter and Yolo Bypasses.
Partners: CDFW, CDWR, NMFS, USBR, USFWS
Related Programs: CDFW, NMFS-RP

Authority

Provision	Justification
(b)(1)	This action addresses adverse environmental impacts by reducing the stranding of fish.

Metrics

Name	Value	Units	Comment
Fish stranded	0	percentage of fish blocked	Reducing adult and juvenile stranding of SCS, WCS, sturgeon and lamprey by improving access to the Sutter Bypass West Borrow Canal and to the Sacramento River.
Passage Barrier Improved	1	number of actions	
Juvenile rearing habitat created	20,000	square feet	Juvenile habitat created in Tisdale Bypass

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Title
Sep. 2023	Final Report
Sep. 2020	Feasibility Study
Sep. 2021	Designs and Permits
Sep. 2022	Implementation and Construction

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager:
Project Technical Team(s):

	Name	Discipline	Contact Info
Lead Fish Biologist	Derek Rupert	USBR-NCAO	530-247-8514
	Jim Early	USFWS-RBFO	

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Sponsor	Heather Casillas	CVPIA Prgm Mgr	916-978-5360

Narrative

This project was previously approved in the FY19 Annual Work Plan Charter to address adult stranding in the stilling basin immediately below the weir on the downstream side through fish passage and juvenile stranding and floodplain enhancement in the bypass.

The Tisdale Weir was identified as a FY18 priority for fall and spring Chinook salmon. Improving fish passage at Tisdale Weir would also improve the viability of the green sturgeon population. An FY18 priority is to 'Adaptively manage reduction/improvement predator contact points,' such as stranding in bypasses. Fall Chinook salmon are a positive SIT/PWT integrated priority through Multi-taxa benefit, Benefits T and E species and Contributes to model/information gaps as identified in table 14 of the SIT Tech memo for FY18.

The Tisdale Weir Multi-Benefit Flood Project has two elements; Element 1 addresses adult fish passage and Element 2 addresses juvenile fish stranding and habitat enhancement and connectivity. Element 1 has been moving forward and this proposal seeks to provide funding for Element 2, so that both elements are working together to accomplish the overall project objectives.

Isolated pools occur in the Tisdale Bypass for a period of time after flows recede. Stranding potential is the greatest between Tisdale Weir and the Reclamation Road Bridge. The Tisdale Bypass between the Reclamation Road Bridge and the Sutter Bypass has a low-flow channel on each side of the Bypass that connects to the West Borrow Canal of the Sutter Bypass. However, the potential stranding areas closest to the weir are not connected to these low-flow channels. Element 2 seeks connectivity from pools to channels.

Reducing or eliminating opportunities for fish to be stranded in the stilling basin and throughout the bypass would reduce the potential for take of protected species including winter-run Chinook. Green sturgeon will benefit by FY18 and FY20 SIT priority 'Reducing illegal harvest (poaching) of adults,' by eliminating stranding sites below the weir. Green sturgeon also have a positive SIT/PWT integrated priority of Progress towards numeric goals and Benefit of T and E species.

The project addresses AFRP Final Restoration Plan E15 for Butte Creek, 'Evaluate juvenile and adult Chinook salmon stranding in Sutter Bypass and behind Tisdale, Moulton, and Colusa weirs during periods of receding flows on the upper mainstem Sacramento River. p65' The project also supports NMFS's 2014 recovery plan for Central Valley salmonids, specifically Recovery Action SAR-1.12, 'In an adaptive management context, implement short- and long-term solutions to minimize the loss of adult Chinook salmon and steelhead in the Yolo bypass, and Colusa and Sutter-Butte basins p158.'

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Field data such as fish passage or count data, and data used for habitat assessment or hydrologic modeling will be recorded on data sheets or directly to a laptop computer, and later transcribed into a computer database or spreadsheet program. These data as well as model runs, project designs, permits, and reports will be stored on a computer hard drive and backed up on an agency or consulting firm server. Copies will be made available to CVPIA.

Risks

Risk	Likelihood	Impact
This project has a high likelihood of successful implementation (overall low risk) because it is supported by CDFW. The project does have a high cost, necessitating phased implementation.	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2019	CVPRF	$1,510,000	$0	$1,510,000	$0
2019	S/LIK	$2,140,000	$0	$0	$2,140,000
2020[16]	CVPRF	$0	$0	$0	$0
2020	S/LIK	$5,000,000	$0	$0	$5,000,000
2021	CVPRF	$1,800,000	$0	$1,800,000	$0
2021	Supplemental	$2,000,000	$0	$2,000,000	$0
2022	CVPRF	$2,000,000	$0	$2,000,000	$0

Total Cost: $14,450,000

[16] The FY2019 funding amount of $1,510,000 included $1,060,000, which was the FY2020 allocated funding for this project.

Habitat and Facility Improvement: Sacramento River Salmonid Habitat Improvement – Keswick to Red Bluff

Implements the top priority habitat improvements along the Sacramento River between Keswick and Red Bluff.

DCN: 20FHRP004
Watershed: Sacramento River
Funding Years: 2019 – 2025
Priority: SIT FY2020 Tech Memo
Partners: City of Anderson, CA, City of Red Bluff, City of Redding, CSU Chico, Glenn Colusa Irrigation District, CDFW, CDWR, Golden Gate Salmon Association, Pacific States Marine Fisheries Commission, RD 108, River Partners, Sacramento River Forum, Trout Unlimited, USBR, USFS, USFWS, Western Shasta Resource Conservation District
Related Programs:

Authority

Provision	Justification
3406 (b)(13) Gravel	Projects are side channel enhancement and creation and floodplain expansion.

Metrics

Name	Value	Units	Comment
Shea Adult Chinook	1105	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Shea Juvenile Chinook	189800	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Kapusta 1B Juvenile Chinook	81561	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Kapusta Island Juvenile Chinook	130827	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Battle Creek Levee Juvenile Chinook	112500	Number of fish	Add a zero to the end of the fish number. Territory estimates consistent with SIT salmon lifecycle model inputs
Anderson River Park Juvenile Chinook	331710	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Reading Island Phase II	386380	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
South Cypress Juvenile Chinook	386250	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs

Name	Value	Units	Comment
South Cypress Adult Chinook	1287	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
East Sand Slough Juvenile Chinook	532500	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs

Project Schedule

Date	Description
5/15/2020 12:00:00 AM	Anderson River Park completed
5/15/2020 12:00:00 AM	South Cypress side channel completed if USBR approves bridge
5/15/2020 12:00:00 AM	Reading Island side channel completed
5/15/2021 12:00:00 AM	Shea Side Channel completed
5/15/2021 12:00:00 AM	East Sand Slough completed
5/15/2022 12:00:00 AM	Kapusta sites completed

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov
Jim Earley		
Mike Berry		

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

1. Implements prioritized juvenile rearing habitat improvements in the Keswick to Red Bluff reach of the river. Projects are side channel enhancement and creation and floodplain expansion.
2. Addresses these SIT priorities:
    a. Increase perennially inundated juvenile habitat, Sacramento River above the American River confluence;
    b. Increase seasonally inundated juvenile habitat at 2 yr freq, Sacramento River above American River confluence.

3. Detailed descriptions of the projects including the specific types of proposed management actions. Chinook potential from territory estimates consistent with SIT salmon lifecycle model inputs

Top Priority

Site	Cost Est	Type	Rearing acres	Spawning acres	Total Juveniles	Adult Chinook
Shea Island	$2,660,000	side channel	2.5	1.7	189,800	1,105
Kapusta 1B	$575,000	side channel	1.1		81,561	
Kapusta Isand	$1,000,000	side channel	1.7		130,827	
Battle Creek Levee	$796,800	floodplain	15.0		1,125,000	
Anderson RP Ph 1-3	$1,781,900	side channel	4.4		331,710	
Reading Island Ph	$721,584	side channel	5.2		386,380	
South Cypres	$1,522,640	side channel	1.4	1.4	105,068	910
East Sand Slough	$1,484,000	side channel	7.1		532,500	

Tier 2

Site	Type	Rearing acres	Spawning acres	Total Juveniles	Adult Chinook
Wyndham	connecting a pond	1.42		106,763	
Tobiasson Island	side channels	1.56		117,270	
I-5	side channel	0.36	3.00	27,114	1950
Dog Island	side channel	1.22		91,511	

Tier 3

Site	Type	Rearing acres	Spawning acres	Total Juveniles	Adult Chinook
Cow Creek	side channel	1.17		88,122	
China Garden	side channel	1.13		84,732	
Battle Creek	floodplain	50.00		3,750,000	
Jellys Ferry	side channel	2.26		169,465	

4. What biological objectives and specific performance metrics (at the Central Valley and/or watershed scale) does the project proposal address? What local (within-watershed) performance metrics do the project proposals address? Adds new juvenile rearing habitat in the Upper Sacramento River to increase productivity and ultimately increase adult production.

5. Prediction of project outcome (Quantitative temporal prediction of expected project outcome. Best if made in terms of means objectives, i.e. short-term objective specific monitoring measures physical/biological response to management action.). See the potential fish number in number 2.

6. How the project proposal is cost-effective relative to its complexity, regulatory environment, and potential ecological and community benefits. Are the proposed costs substantiated? Does the majority of funding support on-the-ground restoration? All the funding goes towards the high priority projects selected by the upper Sacramento River Restoration Interagency Advisory Technical Group. Prioritized based on biological benefit, engineering feasibility, and cost effectiveness.
7. How does the project proposal fit within the ARM process and DSM model? What fundamental objective does it contribute to? (Peterson, Coarse Resolution Model Report, 2014) What means objective(s) does the project proposal implement/test? (Peterson, Coarse Resolution Model Report, 2014). Increases Chinook production based on DSM priority actions.
8. If the project proposal is focused primarily on science or monitoring, how will the results inform the DSMs or reduce uncertainty in decision-making? N/A
9. What are the impacts of not doing the project proposal? Explain collaboration with or among stakeholders and agency partners in development and/or implementation of this project proposal. Interagency group and stakeholders have been working on these projects over past four years. Impact would be loss in momentum and reduced potential to double anadromous fish production.
10. Are there stakeholder objections to the project proposal as described? If so, what are these and how are they addressed? None I'm aware of.

Data Management

Associated data housed by USBR Bay Delta Office and available on request.

Risks

Risk	Likelihood	Impact
Landowner agreements not reached	1	3
Permits not obtained	2	2
New habitat washed out	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CVPRF	$4,114,450	$4,114,450	$0
2020	WRR	$1,000,000	$1,000,000	$0
2021	CVPRF	$2,000,000	$2,000,000	$0
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	CVPRF	$5,935,550	$5,935,550	$0

Total Cost: $15,050,000

Habitat and Facility Improvement: Sacramento River Salmonid Habitat Improvement – Red Bluff to Feather River

Implements top priority habitat improvements between Red Bluff and Feather River.

DCN: 20FHRP005
Watershed: Sacramento River
Funding Years: 10/01/2019 12:00 AM – 9/30/2024 12:00 AM
Priority: High
Partners: City of Red Bluff, CSU Chico, Glenn Colusa Irrigation District, CDFW, CDWR, Golden Gate Salmon Association, Pacific States Marine Fisheries Commission, RD 108, River Garden Farms, River Partners, Sacramento River Forum, Trout Unlimited
Related Programs: CDWR, NMFS

Authority

Provision	Justification
3406 (b)(1) AFRP	

Metrics

Name	Value	Units	Comment
La Barranca juvenile Chinook	350839	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
McClure juvenile Chinook	250808	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Foster juvenile Chinook	196579	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Mooney juvenile Chinook	59313	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Blethen juvenile Chinook	194322	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Altube juvenile Chinook	111847	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Flynn juvenile Chinook	67786	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Blackberry juvenile Chinook	176243	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Oklahoma juvenile Chinook	128183	Number of fish	Territory estimates consistent with SIT salmon lifecycle model inputs
Rearing Habitat	3	Acres	2.68 acres is the average habitat value of all the projects listed here. Range = 0.79 – 4.68 acres.

Project Schedule

Date	Description
10/1/2021 12:00 AM	First site permitted and ready to construct
3/1/2022 12:00 AM	Additional sites depend on level of funding allocated
3/1/2022 12:00 AM	First site constructed

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info
John Hannon	Fish Biologist	jhannon@usbr.gov
Jim Early		
Mike Berry		

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead			
PMT Data Steward			

Narrative

1. Salmon habitat improvement projects in the middle SIT reach of Sacramento River – Red Bluff to Feather River. Types are side channel habitat improvement and creation, floodplain expansion, and rock revetment removal.
2. Addresses these SIT priorities:
   Increase perennially inundated juvenile habitat, Sacramento River above the American River confluence.
   Increase seasonally inundated juvenile habitat at 2 yr freq, Sacramento River above American River confluence.
   Adaptively manage juvenile habitat restoration to allow the evaluation of the effect of habitat restoration on wild juvenile Chinook salmon survival in the Sacramento River.
3. Detailed descriptions of the projects including the specific types of proposed management actions. All of these are side channel projects at sites of historic channels now cut off from flows at the most habitat limiting low flow levels. Activities are excavation of material to create perennial rearing habitat and additions of woody material and boulders where appropriate. Incrementally inundated floodplain habitat will be incorporated at sites where opportunity arises. Projections of fish numbers are territory estimates consistent with SIT salmon lifecycle model inputs.

Tier 1

Project	Rearing acres	Juvenile
Mooney	0.79	59,313
Blethen Island	2.59	194,342
Blackberry Island	2.35	176,243

Tier 2

Project	Rearing acres	Juvenile
La Barranca	4.68	350,839
Oklahoma Island	1.71	128,183
McClure Creek	3.34	250,808
Foster Island	2.62	196,579

Tier 3

Project	Rearing acres	Juvenile
Altube Island	1.49	111,847
Flynn Unit	0.90	67,786

4. What biological objectives and specific performance metrics (at the Central Valley and/or watershed scale) does the project proposal address? What local (within-watershed) performance metrics do the project proposals address? Increases juvenile rearing habitat productivity in the middle Sacramento River reach to move closer to the CVPIA doubling goal.
5. Prediction of project outcome (Quantitative temporal prediction of expected project outcome. Best if made in terms of means objectives, i.e. short-term objective specific monitoring measures physical/biological response to management action.) See #3 above for Chinook habitat potential.
6. How the project proposal is cost-effective relative to its complexity, regulatory environment, and potential ecological and community benefits. Are the proposed costs substantiated? Does the majority of funding support on-the-ground restoration?
7. How does the project proposal fit within the ARM process and DSM model? What fundamental objective does it contribute to? (Peterson, Coarse Resolution Model Report, 2014) What means objective(s) does the project proposal implement/test? (Peterson, Coarse Resolution Model Report, 2014) Increases Chinook Salmon production in Sac River.
8. If the project proposal is focused primarily on science or monitoring, how will the results inform the DSMs or reduce uncertainty in decision-making? N/A
9. What are the impacts of not doing the project proposal? Explain collaboration with or among stakeholders and agency partners in development and/or implementation of this project proposal. The group just last year expanded the focus, based on SIT priorities, to working in this reach of the river. Coordination has occurred within the interagency group and needs to be expanded to the local communities and counties close to the projects.

10. Are there stakeholder objections to the project proposal as described? If so, what are these and how are they addressed? None I'm aware of and any conflicts will be addressed by the appropriate restoration team members as they arise.

Data Management

Data housed at USBR Bay Delta Office and CVPIA master database.

Risks

Risk	Likelihood	Impact
Lack of landowner agreements	2	2
Unable to get permits	2	2

Cost Estimate

Year	Funding	Total	BOR	FWS
2020	CVPRF	$3,950,000	$3,950,000	$0
2020	WRR	$1,000,000	$1,000,000	$0
2021	CVPRF	$2,600,000	$2,600,000	$0
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	CVPRF	$2,000,000	$2,000,000	$0

Total Cost: $11,550,000.00

Sacramento River-San Joaquin River

Intervention: Delta Smelt Supplementation Studies: Genetics and Tagging

Tagging and monitoring program for supplementation of Delta Smelt.

DCN: 21BDAO003
Watershed: Sacramento-San Joaquin
Funding Years: 9/11/20 - 10/1/23
Priority: High
Partners: USFWS/UCD
Related Programs: NA

Authority

Provision	Justification
3406(b)(4)	Other CVP Impacts

Metrics

Name	Value	Units	Comment
GT-seq panels	1+	# of panels	
New markers	1+	# of markers	

Project Schedule

Date	Description
10/1/2023	Final Report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR/USFWS
Project Management Team: USBR/USFWS
Project Technical Team(s): USBR/USFWS/UCD

Team Position	Name	Discipline	Contact Info
Project Management Reclamation	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
Project Management USFWS	Evan Carson	Genetics	evan_carson@fws.gov
PMT Data Steward	TBD		
Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
	Evan Carson	Genetics	evan_carson@fws.gov
	Tien-Chieh Hung	Aquaculture	thung@ucdavis.edu

Narrative

The purpose of this Agreement is to fund the USFWS to: (1) develop novel genetic markers for a GT-seq panel and update baselines for Delta Smelt for genetic monitoring under the Supplementation Program for Delta Smelt; (2) develop an alternative breeding design and spawning method necessary to meet the 2019 BiOp twin-mandate to upscale captive propagation for supplementation and simultaneously conserve genetic diversity of delta smelt; (3) develop a SOP for VIE tagging under the monitoring program for supplementation of Delta Smelt.

Data Management

Data will be stored and made available in formats consistent with state and federal data policies (e.g., Open Data Executive Order 13642). When appropriate it will also be accessible through the USBR's Bay Delta Office's website under the Project, Activities, Documents web page. Synthesis, analysis and recommendations may occur informally through briefings and presentations as opposed to solely formal reports.

Risks

Risk Type	Likelihood	Impact
General	Low due to nature of the research	Low

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$2,000,000	$2,000,000	$0
2022	WRR	$650,830	$650,830	$0
2023	WRR	$722,729	$722,729	$0

Total Cost: $3,373,559

Real-Time Operations: Enhanced Delta Smelt Monitoring Program (EDSM)

Statistically-based sampling program to determine absolute abundance of Delta Smelt, calibrate a Delta Smelt life cycle model and conduct real-time monitoring to minimize Delta Smelt entrainment

DCN: 20BDAO022
Watershed: Sacramento-San Joaquin
Funding Years: 2021-2024
Priority: High
Partners: U.S. Fish and Wildlife Service (USFWS)
Related Programs: Delta Juvenile Fish Monitoring Program (DJFMP)

Authority

Provision	Justification
3406(b)(15)	Documents fish response to Reclamation actions under CVPIA and other activities

Metrics

Name	Value	Units	Comment
Kodiak trawls (December-March)	~6400	Samples/year	Estimates absolute abundance of adult Delta Smelt and provides early warning detection to reduce entrainment probability
20 mm sampling (April-November)	~1100	Samples/year	Estimates abundance of larval and juvenile Delta Smelt and vulnerability to entrainment.
Weekly catch data	52	Reports/year	Weekly catch report includes number and location of captured Delta Smelt and other species of concern
Data base	1	Access data base	Data base containing all data collected under this agreement

Project Schedule

Date	Description
April 1, 2021	Start of performance period
April 2021-March 2024	Weekly catch summaries
March 2024	Final report
March 31, 2024	End of performance period

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Erwin Van Nieuwenhuyse
Project Technical Team(s):

Team Position	Name	Discipline	Contact Info
Technical lead	Jonathan Speegle	Fish Biologist	jonathan_speegle@fws.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead-Reclamation	Erwin Van Nieuwenhuyse	Aquatic scientist	evannieuwenhuyse@usbr.gov
Project Management Team Lead-USFWS	Jeff McLain	Project Leader	jeffrey_mclain@fws.gov
PMT Data Steward			

Narrative

Long term, fixed station monitoring surveys conducted over the last several decades by the California Department of Fish and Wildlife provide an invaluable record of the Bay-Delta fish community and the distribution of Delta Smelt and other individual fish populations. These data cannot be used to estimate absolute abundance of the total Delta Smelt population or the proportion of the total population at risk of entrainment. The EDSM is designed to fill these important data gaps. EDSM data are collected using a stratified randomized sampling design that enables calculation of absolute abundance and the proportion of the population subject to entrainment. These data are also used for real-time management of Old and Middle River flows to reduce the probability of entrainment. Finally, EDSM data are used to calibrate and validate the USFWS Delta Smelt Life Cycle Model which is used to compare flow and non-flow management action scenarios.

Under this agreement, USFWS will continue to conduct daily Kodiak trawl sampling during December through March to determine the abundance of adult Delta smelt and the proportion subject to entrainment. USFWS will also continue to conduct daily 20-mm surveys during April-November to estimate the abundance and vulnerability to entrainment of larval and juvenile Delta Smelt. All data will continue to be made available on the Lodi office web site and will be summarized in weekly reports.

Data Management

All data are posted on the USFWS Lodi Office web site.

Risks

Risk	Likelihood	Impact
Very low risk	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$3,000,000	$3,000,000	$0
2022	WRR	$2,575,000	$2,575,000	$0
2023	WRR	$2,622,500	$2,622,500	$0

Total Cost: $8,167,500

Intervention: FCCL Conservation Hatchery Operation for Delta Smelt Refuge Population Maintenance and Research Support

Continue maintaining a delta smelt refuge population under genetic management as a safeguard against species extinction in the wild. Conduct research with delta smelt and produce a supply of all life stages for research purposes.

DCN: 20BDAO010
Watershed: Sacramento-San Joaquin
Funding Years: 2/29/2020 – 2/29/2025
Priority: High
Partners: UC Davis
Related Programs: NA

Authority

Provision	Justification
3406(b)(4)	

Metrics

Name	Value	Units	Comment
Refugial population maintained	0	Genetic diversity	The primary objective of the FCCL is to maintain a refugial population of Delta Smelt with a level of genetic diversity that is reflective of the wild population
Provide fish for experiments	0	Number of fish provided	The secondary objective of the FCCL is to provide Delta Smelt to agencies and researchers for experiments, including experimental releases.

Project Schedule

Date	Description
Mar.	Semi-annual performance and financial report
Sep.	Semi-annual performance and financial report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR/UCD
Project Management Team: USBR/UCD
Project Technical Team(s): USBR/UCD

Team Position	Name	Discipline	Contact Info
Project Management Reclamation Lead	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
Project Management UCD Lead	Tien-Chieh Hung	FCCL Director	thung@ucdavis.edu
PMT Data Steward	TBD		
Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
	Tien-Chieh Hung	FCCL Director	thung@ucdavis.edu
	Mandi Finger	GVL Director	ajfinger@ucdavis.edu
	TBD		

Narrative

Due to a discernible decline in delta smelt population abundance indices, a refuge population for this endangered species was created and is maintained at the University of California, Davis (UC Davis) Fish Conservation and Culture Laboratory (FCCL). This refuge population program was founded in 2007 with the collaboration with U.S. Bureau of Reclamation (USBR) and the Genomic Variation Lab (GVL) at UC Davis. The FCCL successfully developed culture techniques for delta smelt and with the help of the GVL provides a sustained breeding program of about 500 individuals, or 250 pair crosses, annually. Each year about 200,000 larvae are produced via genetically-informed crosses to assure high family representation and retention as the fish grow to maturity and complete their yearly life cycle. The USBR continues to support the program after the termination of first agreement in 2015. Currently the FCCL is producing and maintaining the 12th generation of delta smelt on site as a safeguard against the possibility of population-loss.

In addition to the refuge population program, the FCCL works closely with U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife (CDFW), the Interagency Ecology Program, California Department of Water Resources (DWR), and researchers at UC Davis to conduct various research projects to understand the causes of population decline and provide much-needed data that informs ongoing habitat restoration efforts under Endangered Species Act. Given the endangered status of the fish and the protections this status provides, the work at the FCCL not only benefits conservation efforts but also broader efforts pertaining to the Delta ecosystem and answer questions that are needed for the coming reintroduction and species supplementation plan and decision making.

The FCCL is now applying for the support for the next five-year operation. For the new agreement, the FCCL will be putting more effort on serving as a conservation hatchery to provide more fish for research and educational purposes and potential experimental release or mesocosm studies of delta smelt. The FCCL is so far the only place that is capable of conducting mass production of delta smelt for research purposes. The goal is to expand the fish production capacity to 50,000 sub-adult delta smelt in addition to the needs of refuge population and other research projects. By doing so, we are expecting to hire four more fish care staff and increase some costs of operational supplies. The deliverable should include delta smelt of all life stages, presentations in science conferences, publications in peer-reviewed journals, and semi-annual progress reports.

Data Management

All the daily operation records and observations will be documented on daily log sheet and organized into electronic format monthly. The paper-based log will be stored on site for at least five years, and the electronic data will be preserved on local hard drives with regular backup in cloud storage on Box. All the reports, publications, and abstracts will be organized and submitted to USFWS and CDFW per requests on the permits.

Risks

Risk Type	Likelihood	Impact
Equipment failure	Low due to recent upgrades	Variable but low due to redundancies
Disease	High	Variable but manageable under most circumstances
Lack of available wild brood stock	Low-Moderate as number needed is low	High potential

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR – Supplemental/CalFed	$2,445,829	$2,445,829	$0
2021	CalFed	$2,741,741	$2,741,741	$0
2022	CalFed	$2,841,545	$2,841,545	$0
2023	CalFed	$2,945,733	$2,945,733	$0
2024	CalFed	$3,054,627	$3,054,627	$0

Total Cost: $14,029,474

Intervention: Use of Cultured Delta Smelt in Field Studies

This project would investigate the options (barges, floating vessels, net pens, cages, near channel facilities, etc.) and associated feasibility of using cultured Delta Smelt to augment and facilitate investigation of mechanisms impacting the Delta Smelt population and subsequent recovery efforts.

DCN: 20BDAO032
Watershed: Sacramento-San Joaquin
Funding Years: 12/29/2020 - 12/29/2025
Priority: High
Partners: USFWS. USGS
Related Programs: NA

Authority

Provision	Justification
3406(b)(1) Other	Other CVP Impacts

Metrics

Name	Value	Units	Comment
Delta Smelt survival	0-100	percent	
Delta Smelt health	index		
Delta Smelt growth	Continuous	/time period	

Project Schedule

Date	Description
Mar.	Semi-annual performance and financial report
Sep.	Semi-annual performance and financial report
12/29/2025	Final Report

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: USBR
Project Management Team: USBR/USFWS/USGS
Project Technical Team(s): USBR/USFWS/USGS

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Andrew Schultz	Fish Biologist	aschultz@usbr.gov
PMT Data Steward	TBD		
Technical Team	Andrew Schultz	Fish Biologist	aschultz@usbr.gov

Narrative

The positive relationship of freshwater flows to populations of various SFE-Delta fish species and their habitat has been clearly demonstrated for some taxa (Stevens and Miller 1983; Kimmerer 2002; Feyrer et al. 2006; Perry et al. 2018). Previous work shows that Delta Smelt physical habitat increases during the fall when outflow, indexed as X2, is located seaward of the freshwater region of the Sacramento-San Joaquin Delta (Feyrer et al. 2007; Feyrer et al. 2011; Bever et al. 2016). However, several authors have found no to a weak relationship between Delta Smelt and freshwater outflow/X2 (Stevens and Miller 1983; Moyle et al. 1992; Jassby et al. 1995; Kimmerer 2002; Bennett 2005; Mac Nally et al. 2010; Thomson et al. 2010; Miller et al. 2012) and fall X2 has not been found to be an important predictor of Delta Smelt population growth rate (Thomson et al. 2010; Maunder and Deriso 2011). This has led to uncertainty among fisheries and water resources managers.

Regardless, outflow-related management actions to benefit Delta Smelt are currently in place or proposed (USFWS 2008; CNRA 2016; Frantzich et al. 2018; Schultz et al. 2018). Action 4 (Fall X2 Action) of the Delta Smelt Biological Opinion (USFWS 2008) currently requires Delta outflow be maintained at an average X2 no greater than 74 km for September and October following wet years and 81km following above normal years. While uncertainty remains as to how these actions may affect certain habitat factors for Delta Smelt, the prevailing hypothesis is that summer and fall habitat conditions are improved for juvenile Delta Smelt when X2 moves seaward (USBR 2012; Brown et al. 2014), especially when X2 overlaps the Suisun Bay-Marsh area of the Delta. It is predicted that lower water temperatures, harmful algal constituents, nonnative competitor and predator abundance, and increased habitat area, turbidity and prey density/biomass will facilitate an increase in Delta Smelt catch density, health, growth, and survival within Suisun Bay and Marsh and at levels greater than other regions. Several ongoing agency projects are seeking to assist in evaluating several of these predictions using data from ongoing surveys. However, catch rates of Delta Smelt can be very low and leads to difficulty or inability to evaluate outflow and environmental conditions to Delta Smelt metrics. It is anticipated that construction and use of mesocosms or other designs for holding Delta Smelt for experimentation purposes will assist Reclamation in testing hypotheses critical to understanding how Delta smelt are affected by environmental conditions and CVP and SWP water operations. It is also anticipated it will also assist with the release of propagated Delta Smelt as soon as 2022.

Data Management

Data will be stored and made available in formats consistent with state and federal data policies (e.g., Open Data Executive Order 13642). When data becomes available it will be shared with IEP for posting and additional storage on the Interim IEP Data and Metadata Access online portal. It will also be accessible through the USBR's Bay Delta Office's website under the Project, Activities, Documents web page. Synthesis, analysis and recommendations may occur informally through briefings and presentations as opposed to solely formal reports. The DOP anticipates the IEP, CSAMP and/or CAMT would represent the target audience for interim presentations and reports.

Risks

Risk Type	Likelihood	Impact
Equipment failure	Low-Mod	Variable but low due to redundancies
Disease	High	Variable but manageable under most circumstances
Vandalism	Low	Variable but high potential

Cost Estimate

Year	Funding Source	Total	BOR	FWS
2021	Supplemental	$1,500,000	$1,500,000	$0
2022	WRR	$900,000	$900,000	$0
2023	WRR	$700,000	$700,000	$0
2024	WRR	$700,000	$700,000	$0
2025	WRR	$700,000	$700,000	$0

Total Cost: $4,500,000

Stanislaus River

Status and Trend: Stanislaus River Rotary Screw Trap Monitoring

Annual quantification of juvenile Chinook salmon production and the abundance of juvenile steelhead in the Stanislaus River using rotary screw traps.

DCN:	AFRP2131
Watershed:	Stanislaus River
Funding Years:	2017 - 2021
Priority:	SIT Critical Monitoring Need - Monitoring of juvenile salmon production on the Stanislaus River provides fundamental data that are necessary to assess the biological response to habitat restoration activities in that CVP watershed.
Partners:	CDFW, Pacific States Marine Fisheries Commission
Related Programs:	CVPIA (b)(13), Structured Decision Making

Authority

Provision	Justification
(b)(15) CAMP	The data from this project is used for DSM calibration by the SIT. The data is also used by the fish agencies to track salmonid fish production performance measures.

Metrics

Name	Value	Units	Comment
Estimate of juvenile production in this watershed	1	Estimate of number of fish	The production or abundance of different life stages of juvenile salmon and steelhead are calculated on an annual basis based on monitoring data that are collected with rotary screw traps.

Project Schedule

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Description
Annually	Annual Stanislaus River rotary screw trap report

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Donnie Ratcliff
Project Technical Team(s):

	Name	Discipline	Contact Info
USFWS-Lodi	Paul Cadrett	Biologist	209-649-0898

Project Management Team:

Team Position	Name	Discipline	Contact Info
USFWS-Lodi	Paul Cadrett	Biologist	209-649-0898

Narrative

The rotary screw trap monitoring activities in the Stanislaus River supply data that are used to calibrate the SIT DSM and to assess the biological response to habitat management activities in those watersheds. As such, they can be used to infer, at a watershed-level scale, how habitat restoration activities are affecting the number of juvenile Chinook salmon and steelhead in that river.

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data Contact: Paul Cadrett (paul_cadrett@fws.gov)

Risks

Risk	Likelihood	Impact
Low, unless funding distribution is delayed	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2017	CVPRF	$223,050	$0	$223,050
2018	CVPRF	$221,300	$0	$221,300
2019	CVPRF	$231,200	$0	$231,200
2020	CVPRF	$225,000	$0	$225,000
2021	CVPRF	$231,750	$0	$231,750

Total Cost: $1,132,300

Habitat and Facility Improvement: Stanislaus River Salmonid Spawning and Rearing Habitat Restoration

Steelhead and Chinook salmon spawning and rearing habitat restoration project on the Stanislaus River. Gravel injected at upper river locations in Goodwin Canyon.

DCN: 20BDAO017
Watershed: Stanislaus River
Funding Years: Ongoing
Priority: SIT FY2020 Tech Memo: Maintain spawning habitat in the CVP streams
Partners: Sean Smith Construction, ACOE, OID, SSJID, CDFW, DWR
Related Programs: FWS ARP, CVPIA

Authority

Provision	Justification
(b)(13)	Gravel injection project in Goodwin Canyon

Metrics

Name	Value	Units	Comment
b13: Stanislaus R: percentage of spawning salmonids using placed gravel	25	percent	Also, 2009 RPA action for steelhead
b13: Stanislaus R; Spawning gravel placed annually (tons)	5000	tons	Annual value listed in 2019 PA
Juvenile Rearing Habitat	8000	cubic yards	Provide alluvial habitat complexity in Goodwin Canyon
Large juvenile produced	16000	number of fish	Number of large juvenile Chinook at Goodwin Canyon

Project Schedule

Date	Description
2019-2020	Structural engineer bridge inspection and final report – completed
2020	ACOE realty license – completed
2020	Temporary entry permits: OID, SSJIID, ACOE - completed
2020	ESA Section 7 Permit - completed
2020	SHPO
2020	404 Permit
2020	401 Permit
2025	Gravel monitoring report
2020	Contract awarded
May 2020-2024	Gravel sorting and other construction preparation begins
July-Sept 2020-2024	Gravel Placement

Roles and Responsibilities

Affiliation	Name	Discipline	Contact Info
Reclamation	Elissa Buttermore	COR, Project Manager	ebuttermore@usbr.gov
Reclamation	John Hannon	Habitat Restoration Specialist	
Reclamation	Luke Davis	Permit Specialist	
	Contractor	gravel placement	

Narrative

Spawning and rearing habitat restoration in the Stanislaus are RPMs in Reclamation's proposed action. Juvenile rearing habitat is the core team priority in the Stanislaus River along with spawning for spring-run Chinook.

SIT priorities for Stanislaus River include juvenile rearing habitat for fall-run Chinook and spring-run spawning habitat. The gravel addition at Goodwin Canyon provides downstream gravel bars and other alluvial features to enhance rearing habitat in the canyon where the river water is cooler than in the downstream reaches with more rearing habitat available. The over-summering Chinook salmon occur primarily in the Goodwin Canyon down through Two Mile Bar area to roughly Knights Ferry depending on the year.

The predicted outcome is increased juvenile rearing habitat resulting in higher fry to smolt survival and ultimately higher adult production in the Stanislaus River.
Funding would be used for the on-the-ground work for gravel placement, gravel sorting and addition. The targeted locations take advantage of the coolest water temperatures and are in areas with minimal predation risk to rearing salmonids in comparison with the outmigration corridor through the lower river and delta.
Impacts of not doing are no change in habitat condition and potentially degradation in a high flow year as existing coarse substrate is washed downstream. Proposed gravel placement locations are largely devoid of gravel after high flows in 2017.

No known stakeholder objections. Any objections will be dealt with on a site-specific basis as the project proceeds.

Data Management

1. Reclamation conducts annual redd mapping at project sites and CDFW conducts weekly river-wide redd counts and escapement survey. Additional juvenile habitat use monitoring would be added comparing pre and post fish densities at the site and at control sites in conjunction with other habitat projects on the river. Long term trend monitoring is via the rotary screw traps at Caswell and Oakdale and the adult escapement surveys. The scale of projects is such that detecting population change attributable to projects will be difficult.
2. Center for data management to be determined—potentially use EDI

3. Performance metrics are from the SDM fall-run model assumptions for juvenile rearing habitat capacity (2, 7, and 18 fish/m**2 for large, medium, and small fish respectively).
4. Data maintained by USBR project managers and will be disseminated in annual reports.

Risks

Risk	Likelihood	Impact
Not acquiring permits in time	2	10
Damage to bridge and access issues.	2	9
COVID	3	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Supplemental	$800,000	$800,000	$0
2022	Unfunded	$500,000	$500,000	$0
2023	Unfunded	$600,000	$600,000	$0
2024	Unfunded	$600,000	$600,000	$0

Total Cost: $2,500,000

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Refuge Water Supply Program Charters

2021 Annual Obligation Plan

CENTRAL VALLEY PROJECT IMPROVEMENT ACT
TITLE XXXIV OF PUBLIC LAW 102-575

Refuge: Refuge Water Acquisition Program

Incremental Level 4 Water Purchases and Level 2 Exchanges

DCN: 21RWSP002
Watershed: Central Valley Wide
Funding Years: 2021 - 2023
Priority: 5 - 'The RWSP's funding priorities are: 1) Labor & overhead (Administrative and Technical); 2) Conveyance of 100% Level 2 water; 3) Acquisition and conveyance of IL4; 4) Facilities construction – ongoing needs
Partners: GWD, CDFW, FWS
Related Programs: No Data.

Authority

Provision	Justification
(d)(2) Refuge Acquisition IL4	Acquires water to increase incremental level 4 water supplies.

Metrics

Name	Value	Units	Comment
d2 Refuge: Inc L4 Water Acquisition, including Replacement Water	0	acre-feet	

Project Schedule

Date	Title
Oct. 2021	Incremental Level 4 Water

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Heather Casillas
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Linda Colella	Water Acquisition Specialist	lcolella@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Leader	Linda Colella	Water Acquisition Specialist	lcolella@usbr.gov

Narrative

Purchase surface and ground water from various sources and enter into uneven exchange agreements for refuge Level 2 to increase IL4 supplies.

Data Management

Water contract records are maintained in the Bureau of Reclamation's Resources Management Division. Incremental Level 4 delivery and losses data is maintained in the Bureau of Reclamation's Resources Management Division.

Risks

Risk	Likelihood	Impact
Water Not Available for Purchase	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$8,908,000	$8,908,000	$0
2021	Supplemental	$5,797,000	$5,797,000	$0
2022	CVPRF	$8,200,000	$8,200,000	$0
2023	CVPRF	$8,200,000	$8,200,000	$0
2024	CVPRF	$8,200,000	$8,200,000	$0
2025	CVPRF	$8,200,000	$8,200,000	$0
2026	CVPRF	$8,200,000	$8,200,000	$0
2027	CVPRF	$8,200,000	$8,200,000	$0

Total Cost: $63,905,000

Refuge: Incremental Level 4 Refuge Water Conveyance

Conveyance of surface water and groundwater pumping for refuges

DCN: 21RWSP001
Watershed: Central Valley wide
Funding Years: 2020 - 2023
Benefits Start Year: 2021
Priority: 3 - Refuge Water Supply Program - Priority Ranking Numbers & Definitions:
1) Administration (RWSP staff and technical support);
2) Level 2 conveyance (L2) water conveyance and facilities construction;
3) Incremental Level 4 (IL4) acquisitions and conveyance; and
4) Unfunded needs.
Partners: CDFW, FWS, GWD
Related Programs: No Data.

Authority

Provision	Justification
(d)(2) Refuge Acquisition IL4	Conveyance of Level 4 refuge water to CVPIA refuges.

Metrics

Name	Value	Units	Comment
Conveyance: Inc L4 Refuge Water Conveyance (annual)	22,500	acre-feet	Inc L4 Water with no Conveyance Cost to RWSP for WY2021
Conveyance: Inc L4 Refuge Water Conveyance (annual)	50,650	acre-feet	Inc L4 Surface Water Conveyance for WY2021
Conveyance: Inc L4 Refuge Water Conveyance (annual)	2,000	acre-feet	Inc L4 Groundwater Pumping for WY2021

Project Schedule

Date	Title
Mar. 2021	Conveyance of Incremental Level 4 Water Supplies

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Sonya Nechanicky
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Sonya Nechanicky	CVPIA Refuge Water Supply Program Specialist	(916)41-5114 ptaber@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov

Project Management Team:

	Name	Discipline	Contact Info
Project Management Team Leader	Sonya Nechanicky	CVPIA Refuge Water Supply Program Specialist	(916)41-5114 ptaber@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov

Narrative

Conveyance of Incremental (Inc.) Level 4 refuge water supplies to CVPIA refuges. This includes annually acquired surface water, purchased permanent surface water, and pumped groundwater.

The conveyance of Incremental Level 4 (IL4) surface water supplies requires conveyance contracts with a number of conveying entities. Due to the geographical location of the refuges, direct delivery of water to a refuge boundary from Reclamation conveyance facilities can only be achieved for two of the 19 refuges. The remaining refuges receiving surface water deliveries require up to 3 conveying entities (including Reclamation facilities) for water to reach their boundaries. For the purpose of this charter, the primary conveyor represents the contracted conveyor conveying the initial diversion of refuge water supplies. In most cases, this water is then delivered to another conveying entity (secondary conveyor) with facilities in closer proximity to specific refuges. In some instances, the secondary conveyor completes the conveyance, delivering water to the refuge boundary. In other instances, a third conveying entity (tertiary conveyor) is necessary to complete refuge water conveyance due to the distances between certain refuges and available conveyance facilities. The secondary conveyor moves refuge water into the tertiary conveyor's system for final delivery to refuge boundaries.

-- FY21 represents projected costs to convey Incremental Level 4 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2021 (March 1, 2021, thru February 28, 2022).
-- FY22 represents projected costs to convey Incremental Level 4 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2022 (March 1, 2022, thru February 28, 2023).
--FY23 represents projected costs to convey Incremental Level 4 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2023 (March 1, 2023, thru February 28, 2024)

Incremental Level 4 metrics (acre-feet estimates), both surface and ground water, for FY2021-2023 were developed with data available as of 6/2020.

Data Management

Contract and agreement records are maintained in the Bureau of Reclamation's Acquisitions Division and Resources Division. Delivery data is maintained on the Bureau of Reclamation's computer network server. Flow data for Gray Lodge Wildlife Area surface water is available on the internet at https://www.usbr.gov/mp/glwa/index.php.

Risks

Risk	Likelihood	Impact
Conveyance contractor default	1	3
Unfavorable hydrology	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$1,198,924	$1,198,924	$0
2021	Supplemental	$2,100,000	$2,100,000	$0
2022	CVPRF	$2,393,806	$2,393,806	$0
2023	CVPRF	$2,661,748	$2,661,748	$0
2024	CVPRF	$2,661,748	$2,661,748	$0
2025	CVPRF	$2,661,748	$2,661,748	$0
2026	CVPRF	$2,661,748	$2,661,748	$0
2027	CVPRF	$2,661,748	$2,661,748	$0

Total Cost: $19,001,470

Refuge: Level 2 Refuge Water Conveyance (FY2021)

Conveyance of surface water and groundwater pumping for refuges

DCN: 21RWSP003
Watershed: Central Valley Wide
Funding Years: 2020 - 2023
Priority: 2 - Refuge Water Supply Program - Priority Ranking Numbers & Definitions:
1) Administration (RWSP staff and technical support);
2) Level 2 (L2) water conveyance and facilities construction;
3) Incremental Level 4 (IL4) Acquisitions and conveyance; and
4) Unfunded needs.
Partners: CDFW, FWS, GWD
Related Programs: No Data.

Authority

Provision	Justification
(d)(1) Refuge Conveyance L2	Conveyance of Level 2 refuge water supplies to CVPIA refuges.

Metrics

Name	Value	Units	Comment
Conveyance: L2 Refuge Water Convey (annual)	330,383	acre-feet	L2 Surface Water Conveyance for WY2021
Conveyance: L2 Refuge Water Convey (annual)	55,836	acre-feet	L2 Water from Diverse Sources at no Cost to RWSP for WY2021
Conveyance: L2 Refuge Water Convey (annual)	16,232	acre-feet	L2 Groundwater Pumping for WY2021

Project Schedule

Date	Title
Mar. 2021	Level 2 Water Conveyance to CVPIA Refuges

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Sonya Nechanicky
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Sonya Nechanicky	CVPIA Refuge Water Supply Program Specialist	(916)41-5114 ptaber@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov

Project Management Team:

	Name	Discipline	Contact Info
Project Management Team Leader	Sonya Nechanicky	CVPIA Refuge Water Supply Program Specialist	(916)41-5114 ptaber@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov

Narrative

Conveyance of Level 2 (L2) refuge water supplies to CVPIA refuges. This includes CVP surface water and water from diverse sources such as groundwater, mitigation water, water rights water, riparian rights water, and accretion water. The conveyance budget for FY2021 includes some assumptions to reduce the potential for over-estimations. For example, instead of using full L2 quantities for NOD conveyance cost estimates, an average of L2 deliveries for 2-3 recent years (excluding critically dry years) is used. Early in FY2021, the conveyance budget will be refined and recalculated. If the revised budget need is less than the allocated budget amount, the CVPIA Program Administrator and Refuge Water Supply Program (RWSP) team will be informed to allow for a determination where the unneeded funds can be used to benefit other RWSP activities or CVPIA Program needs.

The conveyance of surface water supplies requires conveyance contracts with a number of conveying entities. Due to the geographical location of the refuges, direct delivery of water to a refuge boundary from Reclamation conveyance facilities can only be achieved for two of the 19 refuges. The remaining refuges receiving surface water deliveries require up to 3 conveying entities (including Reclamation facilities) for water to reach their boundaries. For the purpose of this charter, the primary conveyor represents the contracted conveyor conveying the initial diversion of refuge water supplies. In most cases, this water is then delivered to another conveying entity (secondary conveyor) with facilities in closer proximity to specific refuges. In some instances, the secondary conveyor completes the conveyance, delivering water to the refuge boundary. In other instances, a third conveying entity (tertiary conveyor) is necessary to complete refuge water conveyance due to the distances between certain refuges and available conveyance facilities. When a

tertiary conveyor is utilized, the secondary conveyor moves refuge water into the tertiary conveyor's system for final delivery to refuge boundaries.

-- FY21 represents projected costs to convey full L2 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2021 (March 1, 2021, thru February 28, 2022).
-- FY22 represents projected costs to convey full L2 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2022 (March 1, 2022, thru February 28, 2023).
- FY23 represents projected costs to convey full L2 water supplies to those CVPIA refuges with sufficient external conveyance capacity in Contract Water Year 2023 (March 1, 2023, thru February 28, 2024).

A factor of 3% increase was applied to all FY2021 conveyance estimates to arrive at an estimate for FY2022, repeating the process for FY2023 estimates, to meet the out-year planning estimates for the work plans, providing an adjustment to account for future rate increases. However, once each of those years moves up into the position of being the "next fiscal year" with an assigned Proposed President's Budget, the Refuge Water Conveyance budget is reanalyzed, refined, and recalculated, incorporating upcoming-year rate estimates based on the then-prevailing rates for all conveyance contracts, applying the same process as described earlier above, again narrowing the budget closer to expected conditions.

There are no "fixed" conveyance costs for any of the 19 CVPIA refuges. Overall conveyance costs may vary according to hydrology; for example, in a critically dry year where refuges full L2 allocations are reduced by 25%, there may be a reduction in L2 conveyance costs as a result of delivering fewer L2 supplies. All current conveyance agreements contain provisions allowing for rate increases or include a rate escalator.

Data Management

Contract and agreement records are maintained in the Bureau of Reclamation's Acquisitions Division and Resources Division. Delivery data is maintained on the Bureau of Reclamation's compute network server. Flow data for Gray Lodge Wildlife Area surface water is available on the internet at: http://www.usbr.gov/mp/glwa/index.php

Risks

Risk	Likelihood	Impact
Unfavorable hydrology	1	2
Conveyance contractor default	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS	State/Local In Kind
2021	CVPRF	$16,880,801	$15,950,793	$930,008	$0
2021	S/LIK	$170,000	$0	$0	$170,000
2022	CVPRF	$14,717,853	$13,908,266	$809,482	$0
2022	S/KIK	$145,000	$0	$0	$170,000
2023	CVPRF	$14,717,748	$13,908,266	$809,482	$0
2024	CVPRF	$14,717,748	$13,908,266	$809,482	$0
2025	CVPRF	$14,717,748	$13,908,266	$809,482	$0
2026	CVPRF	$14,717,748	$13,908,266	$809,482	$0
2027	CVPRF	$14,717,748	$13,908,266	$809,482	$0

Total Cost: $105,502,394

Refuge: East Bear Creek Pump Repair

Station Modifications Project and Service agreement for O&M support services

DCN: 21RWSP005
Watershed: Bear Creek
Location: San Luis NWR Complex, South of Delta Refuges and Wildlife Areas
Funding Years: 2019 - 2021
Benefits Start Year: 2020
Priority: High
Partners: FWS

Authority

Provision	Percentage
(d)(5)-(1) Refuge Facility L2	Construction of conveyance facility 67.0%
(d)(5)-(2) Refuge Facility IL4	Construction of conveyance facility 33.0%

Metrics

Name	Value	Units	Comment
Full Level 4 water delivery capacity.	13290	acre-feet	Amount of water required for optimum wetland management, subject to water supply availability.

Project Schedule

Date	Title
Oct. 2018	Service Agreement - FY19 (MP-410 and Tracey Office)
Feb. 2019	A/E design contract executed
Sep. 2019	A/E design contract deliverables completed/ being modifications
Oct. 2019	Service Agreement - FY20 (MP-410 and Tracey Office)
2020	Service Agreement (CGB-250 and Tracy Office)
2021	Service Agreement (CGB-250 and Tracy Office)
2022	Construction and Service Agreement (CGB-250 and Tracy Office)
2023	Construction and Service Agreement (CGB-250 and Tracy Office)

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Pam Taber
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Pam Taber	CVPIA Program Analyst	(916)41-5114 ptaber@usbr.gov
	Jesse Castro	Electrical/Mechanical Engineering Branch Chief	916-799-3502 jcastro@usbr.gov

Project Management Team:

	Name	Discipline	Contact Info
Project Management Team Leader	Pam Taber	CVPIA Program Analyst	(916)413-5114 ptaber@usbr.gov
Construction Design	Jesse Castro	Electrical/Mechanical Engineering Branch Chief	(916)799-3502 jcastro@usbr.gov
Construction Design	Joshua Fender	Civil Engineer	(916)978-5314
Tracy Fish Facility	David Tsao	Fish Facility Branch Chief	(209)597-1356

Narrative

The East Bear Creek Pump Station is the only facility available to divert water from Bear Creek for this San Luis Wildlife Refuge East Bear Creek Unit's wetlands. Therefore, it is critical to keep the facility fully operational throughout the year, addressing any electrical and mechanical issues quickly. Since the completion of the pump station in 2009, it has been plagued by mechanical and electrical issues. Funding is needed to:

1. Enter into a service agreement with Reclamation's Tracey Office to provide O&M (electrical and mechanical) services for the East Bear Creek pump station.
2. Enter into an service agreement with a CGB-250 to help assess and prioritize needed design and operational changes to the pump station to minimize unscheduled pump shutdowns.
3. Purchase materials for implementation of identified design and operational modifications to improve pump station performance (e.g., new valves, pumps, controls, electronics, etc.).
4. Enter into a service agreement with Reclamation's Engineering and Design Division (MP-200) to provide QA/QC technical review support of design and operational modifications.

Data Management

Data and reports will be maintained within Reclamation's Resources Management Division, Program Management Branch (MP-410).

Risks

Risk	Likelihood	Impact
Pump Plant failure - inability to pump water	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CVPRF	$205,755	$205,755	$0
2021	CVPRF	$1,500,000	$1,500,000	$0
2022	CVPRF	$6,600,000	$6,600,000	$0
2023	CVPRF	$100,000	$100,000	$0
2024	CVPRF	$100,000	$100,000	$0
2026	CVPRF	$100,000	$100,000	$0
2027	CVPRF	$100,000	$100,000	$0

Total Cost: $8,705,755

Refuge: Biggs-West Gridley/Gray Lodge Construction

Biggs-West Gridley/Gray Lodge Wildlife Area Project implementation or contract and construction management service

DCN: 21RWSP004
Watershed: Feather River
Funding Years: 2017 - 2023
Priority: High
Partners: Ducks Unlimited, FWS, Gray Lodge, BWDWD, CDFW
Related Programs: CVPIA (b)(2)

Authority

Provision	Justification
(d)(5)-(1) Refuge Facility L2	Construction of conveyance facilities-80.0%
(d)(5)-(2) Refuge Facility IL4	Construction of conveyance facilities-20.0%

Metrics

Name	Value	Units	Comment
Full Level 4 Delivery Capacity	44000	acre-feet	Amount of water required for optimum management of wetlands, subject to water supply availability.

Project Schedule

Date	Title
Oct. 2018	FY19 Service Agreement (MP-410 and MPCO)
Oct. 2019	FY20 Service Agreement (MP-410 and MPCO)
Oct. 2020	FY21 Service Agreement (MP-410 and MPCO)
Oct. 2021	FY22 Service Agreement (MP-410 and MPCO)
Oct. 2022	FY23 Service Agreement (MP-410 and MPCO)
May 2023	Construction complete

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Pam Taber
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Pam Taber	CVPIA Program Analyst	(916)41-5114 ptaber@usbr.gov
Construction Management	Sean Frische	Civil Engineer	(916)537-7312 sfrische@usbr.gov

Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov
Construction Management Lead	Vincent Thompson	Ducks Unlimited Civil Engineer	(916)852-2000 vthompson@ducks.org
Biologist	Virginia Gets	Ducks Unlimited	(916)798-1973 vgetz@duck.org
Biologist	John Ranlett	Ducks Unlimited	jranlett@ducks.org

Project Management Team:

	Name	Discipline	Contact Info
Construction Management Lead	Vincent Thompson	Ducks Unlimited Civil Engineer	(916)852-2000 vthompson@ducks.org
Construction Management	Sean Frische	Civil Engineer	(916)537-7312 sfrische@usbr.gov
District General Manager	Eugene Massa	Biggs-West Gridley	(530)846-3317 janderson@bwgwater.com

Narrative

This charter is for Reclamation's Mid-Pacific Construction Office (MPCO) construction contract and management support services to be provided to Ducks Unlimited for the implementation of the Gray Lodge Wildlife Area Water Supply Project (formally known as the Biggs-West Gridley Water District (BWGWD) Conveyance Improvement Project). The project includes improvements to the BWGWD water conveyance system to increase system capacity and accommodate deliveries of full Level 4 water supplies to the Gray Lodge WA, a CVPIA refuge. This Project builds upon previous phases of BWGWD conveyance improvements completed between 2013-15 and funded by Reclamation.

The resulting MPCO Service Agreement will be for contract management and construction management services to monitor the project construction activities. MPCO personnel will be on site to help coordinate construction work, verify that work is constructed per the design and specifications, monitor schedules and budgets, attend weekly project management meetings, provide construction/engineering support as needed, and prepare written daily and weekly construction update reports. BWGWD was awarded a grant from the California Natural Resources Agency (CNRA) to implement the construction Project. BWGWD is working with Ducks Unlimited, a RWSP NGO partner, to perform the construction work. MPCO will be supporting Ducks Unlimited who is the construction contract administrator for this project. The total CNRA (state) contribution to this project is $52,458,449.

Data Management

Project notes, data (daily updates and weekly reports) and reports will be maintained by Reclamation's Construction Office (MPCO) and Reclamation's Resources Management Division, Program Management Branch (MP-410).

Risks

Risk	Likelihood	Impact
Cost estimates and budget	1	2
Lack of Construction Office resources/expertise	1	2

Cost Estimate

Year	Fund	Total	BOR	SIK
2013	CVPRF	$29,438,990	$29,438,990	$0
2017	State Prop 1	$52,458,449	$0	$52,458,449
2018	CVPRF	$29,420	$29,420	$0
2019	CVPRF	$135,785	$135,785	$0
2020	CVPRF	$945,490	$945,490	$0
2021	CVPRF	$976,640	$976,640	$0
2022	CVPRF	$976,640	$976,640	$0
2023	CVPRF	$488,320	$488,320	$0

Total Cost: $85,449,734

Refuge: Pixley National Wildlife Refuge

Develop water supply conveyance alternatives to address water constraints at the Pixley NWR.

DCN: 21RWSP007
Watershed: San Joaquin
Funding Years: 2021
Benefits Start Year: 2022
Priority: High
Partners: FWS

Authority

Provision	Percentage
(d)(1)(5) Refuge Facility L2	Construction of conveyance facility 37%
(d)(2)(5) Refuge Facility IL4	Construction of conveyance facility 63%

Metrics

Name	Value	Units	Comment
Full Level 4 water delivery capacity.	6,000	acre-feet	Amount of water required for optimum wetland management, subject to water supply availability.

Project Schedule

Date	Title
June 2021	Study award
June 2022	Final report

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Pam Taber

Project Management Team:

	Name	Discipline	Contact Info
	Pam Taber	CVPIA Program Analyst	(916)413-5114 ptaber@usbr.gov
	Dale Garrison	Refuge Program Specialist	916)414-6728 dale_garrison@fws.gov

Narrative

Pixley National Wildlife Refuge is a 6,939-acre refuge that was established in 1959 to provide wetland habitat for migratory waterfowl and shorebirds. However, no adequate water supply was provided that could sustain the proposed wetland habitat. The refuge currently relies on groundwater and is unable to receive Full Level 4 water delivery. As a result, a water supply conveyance study will be contracted by an engineering design consultant to identify potential conveyance options to provide a reliable and long-term supply of full Level 4 water (L2 and IL4). The study is expected to:

1. Develop potential water supply and conveyance alternatives for agency consideration.
2. Compare and prioritize the most promising alternatives.
3. Develop conceptual designs.
4. Preparing planning level construction cost estimates.
5. Identify possible operational concerns associated with priority alternatives.

Based on the study outcomes Reclamation will issue an A/E design contract to begin design work on the selected conveyance alternative(s). The timeline for measurable benefits of the project depends on the alternatives identified and selected for design, design activities, environmental compliance and permitting activities, and implementation funding.

Data Management

Data and reports will be maintained within Reclamation's Bay-Delta Area Office.

Risks

Risk	Likelihood	Impact
Inability for refuge to receive full Level 4 water.	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$450,000	$450,000	$0

Total Cost: $450,000

Refuge: Sutter Construction

Sutter NWR Lift Station Construction Project

DCN: 21RWSP006
Watershed: Sacramento River
Funding Years: 2017 - 2020
Priority: High
Partners: Ducks Unlimited, FWS, CDFW, CDWR
Related Programs: CVPIA b2

Authority

Provision	Justification
(d)(5)-(1) Refuge Facility L2	Construction of conveyance facility-78.0%
(d)(5)-(2) Refuge Facility IL4	Construction of conveyance facility-22.0%

Metrics

Name	Value	Units	Comment
Full Level 4 water delivery capacity.	30000	acre-feet	Amount of water required for optimum management of wetlands, subject to water supply availability.

Project Schedule

Date	Title
Oct. 2018	FY19 Service Agreement (CGB410 and CGBCO)
Oct. 2019	FY20 Service Agreement (CGB410 and CGBCO)
Oct. 2020	FY21 Service Agreement (CGB410 and CGBCO)
Oct. 2021	FY22 Service Agreement (CGB410 and CGBCO)
Oct. 2022	Construction completion

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation
Project Manager: Pam Taber
Project Technical Team(s):

	Name	Discipline	Contact Info
Project Management Team Leader	Pam Taber	CVPIA Program Analyst	(916)41-5114 ptaber@usbr.gov
Construction Management	Sean Frische	Civil Engineer	(916)537-7312 sfrische@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov

	Name	Discipline	Contact Info
Construction Management	Vincent Thompson	Ducks Unlimited Civil Engineer	(916)852-2000 vthompson@ducks.org
Biologist	Virginia Gets	Ducks Unlimited	(916)798-1973 vgetz@duck.org
Biologist	John Ranlett	Ducks Unlimited	jranlett@ducks.org

Project Management Team:

	Name	Discipline	Contact Info
Project Management Team Leader	Pam Taber	CVPIA Program Analyst	(916)41-5114 ptaber@usbr.gov
Construction Management	Sean Frische	Civil Engineer	(916)537-7312 sfrische@usbr.gov
Refuge Program Specialist	Dale Garrison	FWS	916-414-6758 dale_garrison@fws.gov
Construction Management	Vincent Thompson	Ducks Unlimited Civil Engineer	(916)852-2000 vthompson@ducks.org
Biologist	Virginia Gets	Ducks Unlimited	(916)798-1973 vgetz@duck.org
Biologist	John Ranlett	Ducks Unlimited	jranlett@ducks.org

Narrative

The Sutter NWR Lift Station Project is identified as part of the preferred alternative in the Sutter NWR Conveyance Study (Study), which was completed January 2015. The Lift Station is being designed with the capacity to provide the Refuge's full Level 4 water supply (30,000 AF) and will be a key component for long-term conveyance solutions identified in the Study. Project design and permitting were completed in the spring of 2020. The Lift Station will be equipped with state-of-the-art cylindrical fish screens. Project construction is expected to start in 2021, however, actual start date is subject to environmental compliance and permitting activities being complete. Ducks Unlimited, a RWSP NGO partner, was awarded a grant from the California Natural Resources Agency (CNRA) to implement the construction Project. The total CNRA (state) contribution to this project is $5,927,167.

Reclamation has committed to providing construction contract and management services to Ducks Unlimited for project implementation. These services will be provided by Reclamation's California Great Basin Construction Office (CGBCO) in Willows, CA. CGB-410 will enter into annual service agreements with CGBCO for these support services.

Reclamation has also committed to providing continued engineering design support during bidding and construction of the project. These services will be provided by Reclamation's Mid-Pacific design division (CGB-200) as Engineer of Record. CGB-410 will enter into annual service agreements with CGB-200 for these support services.

Finally, Reclamation has committed to reimbursing Ducks Unlimited for Project implementation expenses not reimbursable under the CNRA grant. This will be reimbursed under a Federal

Financial Assistance agreement between FWS and Ducks Unlimited (funds for this agreement were obligated in FY18).

Data Management

Project information will be maintained within Reclamation's Resources Management Division, Program Management Branch (CGB-410).

Risks

Risk	Likelihood	Impact
Lack of Construction Office resources/expertise	1	2
Cost estimate and budget	1	2

Cost Estimate

Year	Fund	Total	BOR	SIK
2017	State Prop 1	$5,927,167	$0	$5,927,167
2017	CVPRF	$396,456	$396,456	$0
2018	CVPRF	$341,850	$341,850	$0
2019	CVPRF	$599,875	$599,875	$0
2020	CVPRF	$519,565	$519,565	$0
2021	CVPRF	$652,790	$652,790	$0
2021	Supplemental	$2,222,130	$2,222,130	$0
2022	CVPRF	$577,790	$577,790	$0

Total Cost: $11,237,623

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Independent Programs Charters

2021 Annual Obligation Plan

CENTRAL VALLEY PROJECT IMPROVEMENT ACT
TITLE XXXIV OF PUBLIC LAW 102-575

Habitat and Facility Improvement: Trinity River Restoration Program (TRRP)

Channel Restoration Projects. Implementation of a river restoration project (Chapman Ranch Phase B) using CVPIA funding.

DCN: 21INDP001
Watershed: Trinity River
Funding Years: 2020 - 2021
Priority: 1 - 2000 Record of Decision
Partners: BLM, CDFW, DWR, Hoopa Tribe, NMFS, USFS, Yurok Tribe
Related Programs: No Data.

Authority

Provision	Justification
(b)(21) Trinity River Restoration Program	

Metrics

Name	Value	Units	Comment
Increase in channel length	2.4	miles	New channel edge length created at base flow including realigned main channel and side channels
Riparian habitat planting	16.49	acres	Area of new willow-cottonwood forest created
Beaver dam analogs	6	BDAs	Low cost wood structures to emulate beaver dams, creating topographic and temperature heterogeneity in side channel habitat and increasing groundwater elevation in associated floodplain
Increase in presmolt habitat area at summer baseflow (450cfs)	85	percent	Change in weighted usable area for chinook salmon.
Increase in presmolt habitat in 1.5 yr flow event (6,000 cfs)	288	Percent	Change in weighted usable area for chinook salmon

Project Schedule

See Trinity River Restoration Program Annual Progress Report.

Roles and Responsibilities

Project Sponsor:
Project Manager:
Project Technical Team(s):

Name	Discipline	Contact Info

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Leader			
PMT Data Steward			

Narrative

The Chapman Ranch Phase B channel rehabilitation project is situated near the top end of the Junction City Valley reach of the Trinity River. This is the broadest valley in the restoration reach of the Trinity and is where it has the highest potential to display the attributes of an alluvial river. However, it also was the location of some of the most intense hydraulic mining (followed by dredge mining) in California. The combination of mine-derived sedimentation compounded by flow regulation due to the TRD have resulted in dramatic channel simplification. The Chapman Ranch area has a narrow, straight channel with a very thin riparian corridor surrounded by mine tailings and terraces of mine sediment. A previous project built in 2019 (Chapman Ranch Phase A) created a series of three meanders which increased bank length and provided alcove and side channel habitat, as well as a several fold increase in floodplain area. Chapman Ranch Phase B will create additional floodplain habitat but focuses on creation of a complex of high and low flow side channels. The project seeks to accomplish the goals of increasing the availability of anadromous fish habitat above winter base flow for all life stages, increase available floodplain and favorable conditions for riparian vegetation, increase wetland habitat off-channel salmonid rearing habitat, and increase the geomorphic complexity of the river in this reach.

Data Management

Information will be retained in the TRRP Office.

Risks

Risk	**Likelihood**	**Impact**
No data		

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$1,500,000	$1,500,000	$0
2022	CVPRF	$1,500,000	$1,500,000	$0
2023	CVPRF	$1,500,000	$1,500,000	$0
2024	CVPRF	$1,500,000	$1,500,000	$0
2025	CVPRF	$1,500,000	$1,500,000	$0
2026	CVPRF	$1,500,000	$1,500,000	$0
2027	CVPRF	$1,500,000	$1,500,000	$0

Total Cost: $10,500,000

Real Time Operations: Trinity River Restoration Program (TRRP) Record Of Decision (ROD) Restoration Actions

Implementing the Record of Decision for the Trinity River Restoration Program including flows, gravel, monitoring, watershed restoration work, and related administration.

DCN: 21INDP002
Watershed: Trinity River
Funding Years: 2021
Priority: 1 - 2000 Record of Decision
Partners: Yurok Tribe, Hoopa Valley Tribe, CDFW, DWR, USFWS, USFS, NMFS, Trinity County
Related Programs: No Data.

Authority

Provision	Justification
(b)(21)	These are actions required by the Act for restoration actions on the Trinity River.

Metrics

Name	Value	Units	Comment
No Data			

Project Schedule

Date	Description
No Data	

Roles and Responsibilities

Project Sponsor: Heather Casillas
Project Manager: Mike Dixon
Project Technical Team(s):

Name	Discipline	Contact Info
Mike Dixon	Exec. Director	mdixon@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Leader	Mike Dixon	Exec. Director	mdixon@usbr.gov
PMT Data Steward	Eric Peterson		epeterson@usbr.gov

Narrative

The Trinity River Restoration Program funds a comprehensive internal and external program of work. The following list encompasses the scope of the TRRP funded by WRR under CVPIA (b)(23) authority.

TRRP Office Operations and Support Tasks - Includes building lease, fleet vehicles, Annual Report editing (TSC), Meeting notetaker contract.

TRRP Admin Personnel – Executive Director, Secretary, Grants Specialist, Indian Self Determination Specialist

TMC - This task funds agency, Hoopa Valley Tribe and Yurok Tribe participation in the Trinity Management Council (TMC), the decision-making body of the TRRP.

Technical Assistance - Technical work group participation, hydrograph development, policy review, TRRP Refinements participation

Implementation - On the ground activities such as habitat restoration, gravel augmentation, and watershed restoration. Charter using (b)(1) authority is strictly for on the ground activities. This Charter using (b)(23) authority includes administrative costs associated with implementation.

Implementation Personnel - Implementation Branch Chief, civil engineer, outreach coordinator, civil engineering technicians (2), natural resource specialist

Miscellaneous – TSC agreement for FEMA flood compliance modeling, temporary access agreements for restoration projects

Planning - Two contracts: NEPA support, Geophysical support services; interagency agreement for BLM NEPA review

Design & Support Services - Development and review of restoration designs
Construction (Non (b)(1)) - This Charter using (b)(23) authority includes administrative costs associated with construction related to implementation.

Watershed Implementation Grants - Grant(s) for tributary restoration work to government and NGO applicants

TRRP Science Personnel - Science Branch Chief, data steward, physical scientist, fish biologist, natural resource specialist
Science Program Support - Salary for program Riparian Ecologist employed by Hoopa Valley Tribe

Status & Trend Monitoring

1. Redd Distribution
2. Outmigrant monitoring
3. Stream Gaging

4. Chinook CWT
5. Chinook Run Size Estimation
6. Tribal Harvest Monitoring
7. Fall Run Scale Age
8. Sport Harvest/Trinity Creel Survey

Effectiveness Monitoring

Channel Rehab Effectiveness Monitoring - Field surveys and re-modeling of restoration sites to assess performance over time

Hatchery

Run size estimation - Operation of Junction City Weir, hatchery monitoring

Data Management

Information will be retained in the TRRP Office in addition in compliance with the CVPIA Data Guidance. Following peer review, publications, reports, and data packages will be published at www.trrp.net/dataport.

Risks

Risk	Likelihood	Impact
No Data		

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	WRR	$9,991,221	$9,991,221	$0
2021	WRR	$9,991,221	$9,991,221	$0
2022	WRR	$9,991,221	$9,991,221	$0
2023	WRR	$9,991,221	$9,991,221	$0
2024	WRR	$9,991,221	$9,991,221	$0
2025	WRR	$9,991,221	$9,991,221	$0
2026	WRR	$9,991,221	$9,991,221	$0
2027	WRR	$9,991,221	$9,991,221	$0

Total Cost: $79,929,768

Habitat and Facility Improvement: San Joaquin River Restoration Program

Mendota Pool Bypass and Reach 2B Project. Construction of Mendota Pool Bypass for flow routing and fish passage

DCN: 21INDP003
Watershed: San Joaquin
Funding Years: 2020 - 2024
Priority: 1 - All CVPIA Restoration Funds will be applied to this project. Additional funding will come from other sources.
Partners: USFWS, CDFW, DWR
Related Programs: San Joaquin River Restoration Program

Authority

Provision	Justification
SJRRP (PL111-11) & 3406(c)(1)	Pursuant to 111-11 up to $2 million of CVPIA restoration funds will be set aside for the San Joaquin River Restoration Program.

Metrics

Name	Value	Units	Comment
			Restore and maintain fish populations

Project Schedule

Date	Description
9/30/2024	Report on acquisition of land and construction of Mendota Pool fish screen. Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Roles and Responsibilities

	Name	Discipline	Contact Info
Project Management Team	Jessica Andrieux	Natural Resource Specialist	916-978-5461, jandrieux@usbr.gov
Project Management Team	Towns Burgess	SJRRP Lead Fish Biologist	916-978-5446, oburgess@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Manager	Don Portz	SJRRP Program Manager	916-978-5464, dportz@usbr.gov

Narrative

The San Joaquin River Restoration Program (Program) has identified entrainment as a limiting factor for accomplishing spring-run Chinook salmon population goals in the Program's Fisheries Framework: Spring-run and Fall-run Chinook Salmon (2018). Conditions necessary for reestablishment of spring-run and fall-run Chinook salmon in the San Joaquin River must include volitional fish passage, sufficient flows to manage temperatures in the river, and basic habitat needs. To accomplish this goal, the Funding Constrained Framework for Implementation (2018) specifies in Stage 1 of the restoration, which extends from federal fiscal year (FY) 2017 through 2024, that construction of the Mendota Pool Bypass and fish screen are priorities. In order to protect emigrating juvenile Chinook salmon from water deliveries that would be diverted from the San Joaquin River to Mendota Pool (2.5 miles northeast of Mendota, California), a fish screen is being designed for installation at the head of the Compact Bypass near the Mendota Pool Control Structure (Record of Decision for San Joaquin River Restoration Program's Mendota Pool Bypass and Reach 2B Improvements Project 2016). The fish screen will separate emigrating juvenile salmon from water diverted into Mendota Pool and return the fish to the Compact Bypass, where they can continue their downstream migration. The Compact Bypass is planned to be operated for Exchange Contractor diversions in summer months in highly infrequent dry years or during flood flow deliveries. The current 30% design for the fish screen is a paired vee screen, capable of passing 2,000 cfs, and designed to NMFS fish screen criteria for approach, sweeping, and bypass entrance velocities (NMFS 2008).

Fiscal year 2021 funds will be directed toward the acquisition of a realty holding by BB Limited Corporation. Parcels held by BB Limited Corporation are the footprint for the Mendota Pool Compact Bypass and Fish Screen and are necessary to begin design and construction of water conveyance and fish protection structures. The overall cost of the complete Mendota Pool Bypass, Fish Screen, and Reach 2B Levees Project is estimated to cost $336 million under the 2018 Funding Constrained Framework for Implementation projection. This project is part of the San Joaquin River Restoration Program actions to implement the 2006 Stipulation of Settlement in Natural Resources Defense Council, et al. v. Kirk Rodgers, et al.

For more information, please visit the San Joaquin River Restoration Program website www.restoresjr.net.

Data Management

Data will be retained by the San Joaquin River Restoration Program office in Mid-Pacific Region.

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Pre-project and Post-Project Monitoring Plans

Monitoring plans will follow guidance established for the Program and described in the Fisheries Framework: Spring-run and Fall-run Chinook Salmon (2018) and will be coordinated with the CVPIA Data Manager, CVPIA Fish Resource Area Coordinator, and others as described in the Deliverables and Data Management sections.

Risks

Risk	Likelihood	Impact
Potential delays in construction contracts due to land acquisition negotiations	2	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2009 – 2019	CVPRF	$20,000,000	$20,000,000	$0
2020	CVPRF	$2,000,000	$2,000,000	$0
2021	CVPRF	$2,000,000	$2,000,000	$0
2022	CVPRF	$2,000,000	$2,000,000	$0
2023	CVPRF	$2,000,000	$2,000,000	$0
2024	CVPRF	$2,000,000	$2,000,000	$0
2025	CVPRF	$2,000,000	$2,000,000	$0
2026	CVPRF	$2,000,000	$2,000,000	$0
2027	CVPRF	$2,000,000	$2,000,000	$0

Total Cost: $36,000,000

Habitat and Facility Improvement: Habitat Restoration Program (HRP)

Land Protection and Habitat Restoration Projects

DCN: 21INDP004
Watershed: Central Valley Wide
Funding Years: 2021 - 2023
Priority: 1 - Program Priority
Partners: River Partners, Santa Clara Valley Open Space Authority, Sierra Foothill Conservancy, Center for Natural Lands Management, California Rangeland Trust, The Nature Conservancy, Bureau of Land Management, U.S. Fish and Wildlife Service National Wildlife Refuges
Related Programs: Central Valley Project Conservation Program

Authority

Provision	Justification
HRP (b)(1) - other	Restores and improves habitat as stated in this section.

Metrics

Name	Value	Units	Comment
Number of acres of habitat restored for SWRCB Decision 1641	TBD	acres	Acres restored through habitat restoration actions for D-1641
Number of acres of habitat protected	TBD	acres	Acres protected through fee title acquisition and/or conservation easement actions
Number of acres of habitat restored	TBD	acres	Acres restored through habitat restoration actions
Number of acres of habitat protected for SWRCB Decision 1641	TBD	acres	Acres protected through fee title acquisition or conservation easement actions for D-1641
Increases in population numbers from restoration actions	TBD	number of improvements	These actions will contribute towards recovery criteria goals.
Increases in various habitat types per acre	TBD	acres	Improvements in quantity of habitat types per acre from habitat restoration activities.
Number of Recovery Actions	TBD	number of actions	These actions will contribute toward recovery criteria goals.

Project Schedule

Date	Description
September 2022	Protection actions completed
September 2022	Restoration actions completed
September 2022	Captive propagation and reintroduction actions completed

Roles and Responsibilities

Project Sponsor: Bureau of Reclamation, CGB-150; US Fish and Wildlife Service, Sacramento Fish and Wildlife Office
Project Manager: BOR Daniel Strait, USFWS Madeline Drake
Project Technical Team(s): HRP Grants Technical Team

HRP Technical Team	Name	Discipline	Contact Info
US Fish and Wildlife Service	Madeline Drake	Fish and Wildlife Biologist	916-414-6685 madeline_drake@fws.gov
Bureau of Reclamation	Daniel Strait	Natural Resources Specialist	916-978-5052 dstrait@usbr.gov
Bureau of Reclamation	Ned Gruenhagen	Wildlife Biologist	559-262-0343 ngruenhagen@usbr.gov
US Fish and Wildlife Service	Josh Hull	Fish and Wildlife Biologist	916-414-6742 josh_hull@fws.gov
Bureau of Reclamation	Jamie Griffin	Natural Resources Specialist	916-573-9060 jgriffin@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Leader	BOR - Anastasia Leigh USFWS - Donald Ratcliff	Regional Environmental Officer Central Valley Supervisor	aleigh@usbr.gov donald_ratcliff@fws.gov
PMT Data Steward	Daniel Strait	Natural Resources Specialist	dstrait@usbr.gov

Narrative

Improvement activities will include land protection and habitat restoration projects to conserve CVP-impacted listed species and habitats, and species captive propagation and reintroduction projects to facilitate species recovery. Land protection includes the purchase and permanent protection of lands in fee title or conservation easement that support populations of endangered, threatened, and other species of concern. Habitat restoration involves the re-establishment of native vegetation and other habitat components to degraded lands that historically supported CVP-

impacted listed species whose populations are present nearby. Species captive propagation and reintroduction projects are those where individuals of listed plants or animals are captured, bred in captivity, and their progeny returned to the wild to increase population numbers. All funded projects are designed to meet specific recovery criteria in U.S. Fish and Wildlife Service species recovery plans. Of project funds available each year, 50% will be targeted toward land protection.

Data Management

Information for this Charter, including all project files, will be permanently housed at BOR's California-Great Basin Regional Office in Sacramento, and FWS's California-Great Basin Regional Office in Sacramento. Additional information may be found at the HRP/CVPCP website at http://www.usbr.gov/mp/cvpcp/.

Risks

Risk	Likelihood	Impact
No risks are anticipated.	1	1

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$1,096,832	$806,110	$290,722
2022	CVPRF	$1,123,659	$569,446	$554,213
2023	CVPRF	$1,500,000	$750,000	$750,000
2024	CVPRF	$1,500,000	$750,000	$750,000
2025	CVPRF	$1,500,000	$750,000	$750,000
2026	CVPRF	$1,500,000	$750,000	$750,000
2027	CVPRF	$1,500,000	$750,000	$750,000

Total Cost: $9,720,491

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Unfunded Charters

2021 Annual Obligation Plan

CENTRAL VALLEY PROJECT IMPROVEMENT ACT
TITLE XXXIV OF PUBLIC LAW 102-575

Special Studies: Central Valley Wild Salmonid Demographics

This study will fill critical knowledge gaps by designing a monitoring network and associated statistical models to estimate the key demographic parameters in the Science Integration Team's (SIT) decision support model.

DCN: 21FHRP001
Watershed: Upper Sacramento Tributaries
Funding Years: 2020 - 2025
Priority: Science Integration Team's (SIT) high-priority demographic parameters
Partners: USBR, USFWS, USGS
Related Programs: CVPIA, LTO

Authority

Provision	Justification
CVPIA 3046(g)(4)	Directly informs ecosystem and water system operations models related to measures needed to restore anadromous fisheries to optimum and sustainable levels in accordance with the restored carrying capacities of Central Valley rivers, streams, and riparian habitats.

Metrics

Name	Value	Units	Comment
Demographic parameters	1	metadata	Instream rearing survival
Demographic parameters	1	metadata	Instream growth rates
Demographic parameters	1	metadata	Salmonid territory size
Demographic parameters	1	metadata	Instream movement and outmigration timing

Project Schedule

Date	Description
2021	Study planning, permitting, pilot study, efficiency trials,
2022	Study implementation, data acquisition
2023	Study implementation, data acquisition, analyses and reporting, Decision Support Model (DSM) integration
2024	Study implementation, data acquisition, analyses and reporting, DSM integration
2025	Final analyses, synthesis, reporting, DSM integration

Roles and Responsibilities

Project Sponsor: USBR
Project Manager: Michael Beakes USBR
Project Technical Team(s): Michael Beakes USBR, Rod Wittler USBR, Bryan Matthias USFWS, Russell Perry USGS, Jim Peterson USGS-OSU, Adam Duarte USGS-OSU, Mike Urkov FlowWest

Name	Discipline	Contact Info
Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
Rod Wittler	Ph.D., PE	rjwittler@usbr.gov
Bryan Matthias	Ph.D. Fisheries	bryan_matthias@fws.gov
Russell Perry	Ph.D. Fisheries	rperry@usgs.gov
James Peterson	Ph.D. Fisheries	jt.peterson@oregonstate.edu
Adam Duarte	Ph.D. Fisheries	adam.duarte@oregonstate.edu
Mike Urkov	Sr. Env. Planner	murkov@flowwest.com

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	Michael Beakes	Ph.D. Biologist	mbeakes@usbr.gov
PMT Data Steward	Rod Wittler	Ph.D., PE	rjwittler@usbr.gov
Technical Lead	Bryan Matthias	Fisheries	bryan_matthias@fws.gov
Technical Lead	Russell Perry	Ph.D. Fisheries	rperry@usgs.gov
Technical Lead	James Peterson	Ph.D. SDM	jt.peterson@oregonstate.edu
Technical Lead	Adam Duarte	Ph.D. Fisheries	adam.duarte@oregonstate.edu
PMT Data Steward	Mike Urkov	Sr. Env. Planner	murkov@flowwest.com

Narrative

The SIT Monitoring Subgroup Memo "Juvenile Chinook Salmon Demographic Parameters Needs" highlighted critical uncertainties about demographic parameters informing the SIT's DSM. The most influential factor affecting SIT's evaluation of Chinook Salmon restoration strategies was survival of wild juvenile Chinook salmon, and the second most influential factor was growth. Lastly, the SIT identified the need to evaluate the movement rule sets used by the DSM. Because empirical estimates of growth, movement, and survival of wild juvenile Chinook salmon are non-existent, this charter will support studies that design, initiate, and implement a PIT-tag monitoring program to fill these critical knowledge gaps.

Studies emerging from this charter will focus on the overarching goal of estimating tributary-level survival, growth transition, and movement probabilities to directly estimate the key demographic parameters in SIT's DSM. These studies will likely require the installation of PIT tag arrays in these natal tributaries (particularly in the downstream sections before fish exit to the mainstem Sacramento River and Delta) and along the migratory corridor. Data from PIT tag arrays should be supplemented with seining surveys, particularly at locations that are not amenable to the installation of PIT tag arrays. These studies will require field crews to check adult escapees for PIT tags during

spawning surveys. The data from the PIT tag readers will provide information on movement and survival, data from fish captures during seining efforts will provide information on growth, habitat use, survival, and movement that can be integrated with the data from the PIT tag readers, and data from spawning ground surveys will provide information needed to estimate in-ocean and delta survival. The studies and corresponding surveys should be conducted using the appropriate AFS standardized methods and the proper statistical design and estimator to allow the unbiased estimation. Examples of proper estimators include (multistrata) Cormack-Jolly-Seber (survival, growth, movement) and (multistrata) recapture-resight-recovery models (survival, growth, movement). Importantly, these estimators allow for the separate estimation of movement and survival which is indistinguishable when using estimators such as the traditional Cormack-Jolly-Seber model. Furthermore, these estimators allow for the estimation of transition probabilities among fish size classes (rather than estimating growth as a continuous curve), which matches the structure of the SIT's models. Finally, these estimators allow survival, movement, and growth to be related to environmental factors in the way that is needed to inform efforts by the SIT.

Data Management

Data from this charter's studies will be stored on external hard drives and internal servers with the Bureau of Reclamation and project partners.

Risks

Risk	Likelihood	Impact
Non-lethal, incidental take of ESA-listed salmonids	2	1
Permit acquisition	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	Unfunded	$1,500,000	$1,500,000	$0
2022	Unfunded	$1,500,000	$1,500,000	$0
2023	Unfunded	$1,500,000	$1,500,000	$0
2024	Unfunded	$1,500,000	$1,500,000	$0
2025	Unfunded	$1,500,000	$1,500,000	$0

Total Cost: $7,500,000.00

Special Studies: Develop a Methodology for Rockwad Habitat Design

Establishes a simplified design procedure for rockwad habitat through hydrodynamic modeling, physical experiments, and fish behavior algorithms. Full installation of rockwad habitat design planned in future charter.

DCN:	21FHRP002
Watershed:	Upper Sacramento Tributaries
Funding Years:	2020 - 2022
Priority:	Science Integration Team (SIT) 1 - Increase perennially inundated juvenile habitat, Sacramento River above the American River confluence; increase seasonally inundated habitat at 2-yr. frequency, Sacramento River above American River confluence; increase rearing habitat in Central Delta, Delta; increase perennially inundated juvenile habitat
Partners:	CGB, TSC, USACE, USFWS
Related Programs:	(b)(13)

Authority

Provision	Justification
60% - CVPIA 3046(g)(4)	Studies emerging from this charter will directly inform ecosystem and water system operations models related to measures needed to restore anadromous fisheries to optimum and sustainable levels in accordance with the restored carrying capacities of Central Valley rivers, streams, and riparian habitats. Partially funded by S&T program.
40% - Science & Technology Program (USBR-R&D)	Funded as part of the R&D – S&T program in FY19. Partially funded by CVPIA Restoration Fund.

Metrics

Name	Value	Units	Comment
Rockwad Design Guidelines	0	N/A	To be established with hydrodynamic modeling and fish behavior algorithms
Juvenile Rearing Habitat	0	acres	To be determined with hydrodynamic modeling and fish behavior algorithms

Project Schedule

Date	Description
Mar. 2021	Hydrodynamic Modeling Plan
Sep. 2022	Progress Report
Sep. 2023	Technical Memorandum of Design Procedures

Roles and Responsibilities

Project Sponsor: Heather Casillas - USBR
Project Manager: Rodney J. Wittler - USBR
Project Technical Team(s): Jenna Paul USBR, Rod Wittler USBR, Yong Lai USBR-TSC, David L. Smith USACE

Role	Name	Discipline	Contact Info
Project Lead	Jenna Paul	Civil Engineer	jpaul@usbr.gov
Project Coordinator	Rod Wittler	Civil Engineer	rjwittler@usbr.gov

Project Management Team:

Team Position	Name	Discipline	Contact Info
Project Lead	Jenna Paul	Civil Engineer	jpaul@usbr.gov
PMT Data Steward	Jenna Paul	Civil Engineer	jpaul@usbr.gov
Project Coordinator	Rod Wittler	Civil Engineer	rjwittler@usbr.gov
Fish Behavioralist	David L. Smith	Civil Engineer/Biologist	David.L.Smith@erdc.dren.mil
Numerical Modeler	Yong Lai	Civil Engineer	ylai@usbr.gov

Narrative

1. This project develops a design method for creating juvenile habitat using rockwads. A rockwad is a tree trunk (with root cluster) anchored to a large boulder. The boulder and root mass provide velocity and predator refugia, allowing juveniles to safely rest and eat during their emigration. Key elements in the design process include hydrodynamic simulations, physical models, and fish behavior algorithms. Full implementation of a rockwad design planned in a future charter.

2. Increase perennially inundated juvenile habitat, Sacramento River above the American River confluence. The proposed design method is also applicable on other rivers.

3. A prototype rockwad will be graphically rendered in AutoCAD Civil 3D. USACE will construct the prototype and place it in a large flume, where the velocity field can be evaluated. Two- and three-dimensional numerical models will be used to simulate the hydraulic conditions around the prototype within the geometry of the flume. The physical modeling will provide calibration and validation data for both models. The two- and three-dimensional models include Sedimentation and River Hydraulics—Two-Dimensional (SRH-2D) and Unsteady and Unstructured Reynolds Averaged Navier-Stokes (U2RANS), respectively. As 3D modeling is impractical on the reach scale, a simplifying relationship will be developed between the SRH-2D and U2RANS models.

   The hydrodynamic model results will be imported into the Eulerian- Lagrangian Agent Method (ELAM) tool to evaluate fish behavior around the rockwad. Following the physical and numerical results of a single rockwad, SRH-2D models will be developed along a study reach with several alternative rockwad placement patterns. These models will be evaluated with ELAM to identify the most successful rockwad quantity, sizes, and arrangements as indicated by the fish behavior algorithm.

4. Increases juvenile habitat in the Sacramento River, San Joaquin River, and Delta system by providing a new design methodology.

5. The product of this charter will be a technical memorandum describing a simplified design procedure for rockwad habitat. We predict that the availability of this design document will increase the construction of rockwad habitats in the Sacramento River, San Joaquin River, and Delta System. In the long term, we predict that these projects will lead to a more continuous sequence of velocity and predator refugia, and as a result, the size and survival rates of out-migrating juveniles will increase.

6. The majority of the funding for this project will support physical and numerical modeling tasks. While the physical experiments are a main cost driver, they benefit the project by ensuring that the models produce results consistent with field conditions. This project is intended as an investment, as the resulting technical memorandum will provide a streamlined approach for future habitat work. Cost-saving opportunities include: funding from Reclamation's Science and Technology Program and choosing a study reach based on the availability of bathymetric data.

7. The fundamental objective of this project is to increase the availability of habitat for out-migrating juveniles. This design approach is intended to reduce mortality from disease (stress), predation, and inadequate feeding opportunities. Methods will be tested using the fish behavior algorithms to verify that proposed rockwads are utilized by juveniles.

8. This project will provide estimates of velocity and predator habitat along a study reach. In a future charter, the rockwad habitat design will be implemented, and monitoring data will be available to import into DSM.

9. This project is fundamental to reducing the mortality rate of out-migrating juveniles. If not implemented, the shortage of velocity and predator refugia will continue to limit the success of juvenile emigration.

10. Supported by the SRSC's and the Upper Sacramento River Interagency Team.

Data Management

1. The objective of this research is to develop a method for increasing velocity and predator habitat with the anticipated result of increasing juvenile out-migration success. Expected findings include the amount of habitat area provided by a single rockwad, as well as design recommendations for placement patterns to achieve optimum habitat gain. Full implementation of the resulting rockwad design is planned in a future charter. Long-term pre- and post-project monitoring plans will be presented in that charter.

2. The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

   Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate

with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.
Hydrodynamic models, AutoCAD drawings, and progress reports will be archived in the Design and Construction Branch of the Interior Region 10 – California-Great Basin (CGB) office. Fish behavior models and physical model results will be archived by the USACE's Engineer Research and Development Center (ERDC). Design procedures will be published in a technical memorandum available on USBR internet site.

Data produced by this project may be used in the development of a sub-module of the Science Integration Team's Salmon Decision Support Model(s). The Project Management Team Leader will coordinate with the CVPIA Science Coordinator on the development and submission of a SIT DSM Modification Proposal (using the standard proposal template), as well as ensure progress on completing the sub-module in cooperation with the Science Integration Team.

Risks

Risk	Likelihood	Impact
3D Rendering of rockwad not compatible with hydrodynamic model	2	2
Inter-agency collaboration challenges	1	2

Cost Estimate

Year	Fund	Total	BOR	FWS
2020	CVPRF	$290,000	$290,000	$0
2020	S&T	$19,000	$19,000	$0
2021	CVPRF	$120,000	$120,000	$0
2021	S&T	$96,000	$96,000	$0
2022	CVPRF	$90,000	$90,000	$0
2022	S&T	$110,000	$110,000	$0
2023	S&T	$25,000	$25,000	$0

Total Cost: $750,000

Status and Trend: SIT Critical Uncertainty Reduction

Improves habitat availability estimates for CVPIA rivers to improve structured decision-making fish model results and enhances progress towards meeting CVPIA goals by identifying the most beneficial projects.

DCN:	21FHRP003
Classification:	Reconnaissance
Location:	Central Valley Wide
Funding Years:	2021 – 2024
Benefits Start Year:	2022
Priority:	SIT FY2020 Tech Memo: The 2020 Near-Term Restoration Strategy (page 37) states that the SIT places a high priority on improving the estimates of existing habitat areas used as inputs to the lifecycle models. This project conducts data collection, modeling, and analysis required to improve estimates of existing habitat area and makes recommendations about changes to the habitat data, the lifecycle model code, or both, that would improve the way habitat estimates are used.
Partners:	FWS, CDFW, DWR, CBEC, American Rivers, Trout Unlimited
Related Programs:	Salmon Resiliency Strategy

Authority

Provision	Percentage
3406(g)	100.0%

Metrics

Name	Value	Units	Comment
American River	Zero 1	Calibration Factor, Updated habitat est.	New habitat model runs using existing information for rearing habitat and complete substrate mapping for spawning habitat. A goal is to address the uncertainty and eliminate need for a calibration factor in the model.
Yuba River	Zero 1	Calibration Factor, Updated habitat est.	New habitat model runs using existing information. A goal is to address the uncertainty and eliminate need for a calibration factor in the model.
Lower-mid Sacramento River	Zero 1	Calibration Factor, Updated habitat est.	New habitat model runs using existing information. A goal is to address the uncertainty and eliminate need for a calibration factor in the model.
Upper Sacramento River	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.

Name	Value	Units	Comment
Habitat Change Estimation	2	Estimates for spawning and rearing change	Habitat change estimation to integrate how habitat changes over time in the SDM.
Clear Creek	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.
Upper-mid Sacramento River	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.
Feather River	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.
Battle Creek	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.
Stanislaus River	Zero 1	Calibration Factor, Updated habitat est.	New and existing data (LiDAR/Bathymetry/Cover/Substrate) and update hydraulic model in areas of change.
Lower San Joaquin River	Zero 1	Calibration Factor, Updated habitat est.	New data (LiDAR/Bathymetry/Cover/Substrate) and new hydraulic model needed.

Deliverables

Deliverables in all years of this project will be coordinated with the CVPIA Data Manager, CVPIA Science Coordinator, and CVPIA Fish Resource Area Coordinator.

Date	Title
Dec. 2022	American River habitat quantified and reported
Dec. 2022	Yuba River habitat quantified and reported
Dec. 2022	Lower-mid Sacramento River habitat quantified and reported
Dec. 2022	Spawning and Rearing Habitat Change estimated and reported
Dec. 2022	Upper Sacramento River habitat quantified and reported
Dec. 2023	Clear Creek habitat quantified and reported
Dec. 2023	Upper-mid Sacramento River habitat quantified and reported
Dec. 2024	Feather River habitat quantified and reported
Dec. 2024	Battle Creek habitat quantified and reported
Dec. 2024	Stanislaus River habitat quantified and reported
Dec. 2025	Lower San Joaquin River habitat quantified and reported

Project Management Team

Team Position	Name	Discipline	Contact Info
Project Management Team Lead	John Hannon	Habitat Restoration	jhannon@usbr.gov
PMT Data Steward	Mark Tompkins	Data Management	Mtompkins@flowwest.com
	Chris Hammersmark		
	Rod Wittler		
	Cesar Blanco		
	Matt Brown		
	Derek Rupert		
	Rene Henery		
	Lisa Hunt		
	Mark Gard		
	Mike Memeo		

Narrative

The ten watersheds identified in the near term restoration strategy have been prioritized by the habitat subgroup into Stage 1 (have existing hydraulic models and just need new model runs with updated habitat suitability criteria and need substrate for American R.) Stage 2 (high priority and need new habitat data and hydraulic models developed), Stage 3 (second priority and need new habitat data and hydraulic models), and Stage 4 (lower priority and need new habitat data and hydraulic models). Priorities are based on the age of habitat input quantification data currently used in the DSM, the quality of the modeling used, the relative area of impact of the watershed or reach, and the ease of updating the habitat input (i.e. availability of data and tools).

Stage 1 - New Model Runs Only:
American River
Yuba River
Lower Mid Sacramento River

Stage 2: New Data and Model Runs:
Upper Sacramento River
Clear Creek
Upper Mid Sacramento River

Stage 3: New Data and Model Runs:
Feather River
Battle Creek
Stanislaus River

Stage 4: New Data and Model Runs:
Lower San Joaquin River

The scope of work for this effort includes the following:

1. Finalize prioritization of watersheds for new habitat inputs (including considering watersheds not in Near Term Restoration Strategy prioritization)
2. Evaluate full census vs. random sample.
3. Acquire and test available hydraulic models and habitat suitability criteria
4. Collect new physical data (LiDAR, aerial imagery + cover mapping, and substrate mapping), as needed
    a. Topo-bathy LiDAR
    b. Substrate mapping (still partial census)
    c. On-the ground sampling / verification
5. Conduct new hydraulic modeling, as needed
6. Conduct new habitat modeling (suitability-based binary rather than suitability curves and weighted usable areas) with new hydraulic modeling
7. Conduct field verification of actual habitat use to validate model inputs
8. Format habitat model outputs for use in lifecycle models
9. Evaluate inundation duration component of rearing habitat input and use in model and recommend improvements
10. Evaluate potential integration of floodplain food production subsidy to adjacent model reaches and recommend use in lifecycle model
11. Evaluate implications of improved spatial resolution of habitat data and recommend additional uses (for CVPIA DSM and other tools)

There are no known stakeholder objections to the project proposal

Data Management

The PMT Data Steward will coordinate with external partners and biannually with the CVPIA Data Manager on the transmission of long-term monitoring and other pertinent data defined by the SIT and the PMT per the 2020 Data Guidance.

Field data will be recorded on data sheets or directly into a recording device/computer and transferred into a computer spreadsheet or database. The PMT Data Steward will coordinate with the CVPIA Data Manager on the transmission of relevant and pertinent data defined by the SIT and the PMT per the 2020 Data Guidance. Field data, analyses, and reports will be stored and backed up on a PMT computer/server.

Data produced by this project will be used in the development of the Science Integration Team's Salmon Decision Support Model(s). The Project Management Team Leader will coordinate with the CVPIA Science Coordinator on the development and submission of a SIT DSM Modification Proposal (Using the standard proposal template), as well as ensure progress on completing the sub-module in cooperation with the Science Integration Team.

Risks

Risk	Likelihood	Impact
Site access for substrate characterization	1	2
Site access for field verification / validation of habitat use	1	1
No improvement in DSM model	1	3

Cost Estimate

Year	Fund	Total	BOR	FWS
2021	CVPRF	$960,000	$960,000	$0
2022	CVPRF	$1,040,000	$1,040,000	$0
2023	CVPRF	$1,125,000	$1,125,000	$0
2024	CVPRF	$358,000	$358,000	$0

Total Cost: $3,483,000