

Table 1. Proposed Conservation Measures Contributing to Improving Viable Salmonid Population (VSP) Parameters for the Central Valley Spring-Run ESU

Biological Objectives	Proposed Conservation Measures	Attributes of Viability			
		Abundance	Population Growth Rate	Spatial Structure	Diversity
<p>Objective ECSY1.1: Provide hydrodynamic conditions that support the movement of larval and juvenile life stages of covered fish species to downstream rearing habitats.</p>	<p>WOCM1: North Delta Facilities Operations and Bypass Flows. WOCM2: Fremont Weir Operations. WOCM3: Deep Water Ship Channel Bypass Weir Operations. WOCM4: Sutter and Steamboat Slough Flows. WOCM5: Delta Cross Channel Gate Operations. WOCM6: Rio Vista Flow Requirements. WOCM7: Three Mile Slough Gate Operations. WOCM8: Two Gate Operations – Old River and Connection Slough. WOCM9: Delta Outflow. WOCM11: Montezuma Slough Salinity Control Gate. WOCM12: South Delta Diversions. WOCM13: Old and Middle River Flows.</p>	<p>X</p> <p>(reduced exposure to predation, improved food availability)</p>	<p>X</p> <p>(increased survival of juveniles could increase the spawning population and productivity)</p>	<p>X</p> <p>(flows distribute juveniles to downstream habitats and allow smolts to use multiple migration downstream pathways)</p>	
<p>Objective ECSY1.2: Provide hydrodynamic conditions that support the movement of adult life stages of covered fish species to upstream spawning habitats.</p>	<p>WOCM1: North Delta Facilities Operations and Bypass Flows. WOCM2: Fremont Weir Operations. WOCM6: Rio Vista Flow Requirements. WOCM9: Delta Outflow.</p>		<p>X</p> <p>(increased abundance of adults passing to spawning habitats could increase the spawning population and productivity)</p>		

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<p>Objective ECSY1.3: Provide a range of salinity conditions that support habitat and food production for covered fish species.</p>	<p>WOCM1: North Delta Facilities Operations and Bypass Flows. WOCM5: Delta Cross Channel Gate Operations. WOCM6: Rio Vista Flow Requirements. WOCM7: Three Mile Slough Gate Operations. WOCM8: Two Gate Operations – Old River and Connection Slough. WOCM9: Delta Outflow. WOCM10: Suisun Bay and Western Delta Salinity Conditions. WOCM11: Montezuma Slough Salinity Control Gate. WOCM12: South Delta Diversions. WOCM14: Delta Salinity Standards. FIMA1.1. Restore a mosaic of __ to __ acres of freshwater intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Yolo Bypass/Cache Slough Complex ROA. FIMA1.2: Restore a mosaic of __ to __ acres of freshwater intertidal marsh, shallow subtidal aquatic, and transitional habitat within the Cosumnes/Mokelumne ROA. FIMA1.3: Restore a mosaic of __ to __ acres of intertidal marsh and shallow subtidal aquatic habitat within the West Delta ROA. FIMA1.4: Restore a mosaic of __ to __ acres of intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the South Delta ROA. FIMA1.5: Restore a mosaic of __ to __ acres of intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the East Delta Restoration Opportunity Area. BIMA1.1 Restore a mosaic of __ to __ acres of brackish intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Suisun Marsh Restoration Opportunity Area.</p>	<p>X</p> <p>(increased food abundance reduces mortality of juveniles)</p>	<p>X</p> <p>(increased survival of juveniles could increase the spawning population and productivity)</p>	<p>X</p> <p>(providing a range of salinity conditions distributes individuals according to life stage needs)</p>	

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<p>Objective ECSY2.1: Over the term of the BDCP, increase the abundance of zooplankton species that provide food and support food production for covered fish species in Delta waterways.</p>	<p>FLOO1.1: Modify the Fremont Weir and the Yolo Bypass to provide for a higher frequency and duration of inundation. FLOO2.1: Create and operate a new flood bypass in the Yolo Bypass/Cache Slough Complex ROA to restore seasonally inundated floodplain habitat. WOCM2: Fremont Weir Operations. WOCM3: Deep Water Ship Channel Bypass Weir Operations. FIMA1.1. Restore a mosaic of __ to __ acres of freshwater intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Yolo Bypass/Cache Slough Complex ROA. FIMA1.3: Restore a mosaic of __ to __ acres of intertidal marsh and shallow subtidal aquatic habitat within the West Delta ROA. BIMA1.1 Restore a mosaic of __ to __ acres of brackish intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Suisun Marsh ROA. CHMA1.1. Support development and implementation of levee construction and maintenance designs that incorporate aquatic, intertidal marsh, and riparian habitat features. CHMA1.2. Provide for the establishment of native riparian woody vegetation and emergent vegetation on BDCP constructed levees. CHMA1.3: Enhance channel margin habitats along __ to __ miles of Steamboat and Sutter Sloughs to improve habitat conditions for covered fish species. RIPA1.1. Restore between __ and __ acres of riparian forest and scrub communities as a component of restored floodplain, freshwater intertidal marsh, and channel margin habitats.</p>	<p>X</p> <p>(increased food abundance reduces mortality of juveniles and increases growth rates)</p>	<p>X</p> <p>(increased abundance of adults passing to spawning habitats could increase the spawning population and population growth)</p>	<p>X</p> <p>(increasing food availability throughout north Delta improves distribution of juveniles)</p>	

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<p>Objective ECSY3.1: Manage the distribution and abundance of established non-native invasive species in the Delta to reduce non-native species predation on and competition with covered fish species.</p>	<p>OSCM14: Increase the Harvest of Non-Native Predatory Fish to Decrease their Abundance. WOCM1: North Delta Facilities Construction, Preferential Operation, and Bypass Flows. WOCM5: Delta Cross Channel Gate Operations. WOCM6: Rio Vista Flow Requirements. WOCM7: Three Mile Slough Gate Operations. WOCM8: Two Gate Operations – Old River and Connection Slough. WOCM9: Delta Outflow. WOCM10: Suisun Bay and Western Delta Salinity Conditions. WOCM11: Montezuma Slough Salinity Control Gate. WOCM14: Delta Salinity Standards.</p>	<p>X (reduced exposure to predation and resource depletion via competition)</p>	<p>X (increased survival of juveniles could increase the spawning population and productivity)</p>		
<p>Objective ECSY3.2: Manage the distribution and abundance of established non-native invasive species in the Delta to rehabilitate aquatic ecosystem processes.</p>	<p>OSCM13: Remove Non-Native Submerged and Floating Aquatic Vegetation from Delta Waterways. OSCM14: Increase the Harvest of Non-Native Predatory Fish to Decrease their Abundance. WOCM1: North Delta Facilities Construction, Preferential Operation, and Bypass Flows. WOCM5: Delta Cross Channel Gate Operations. WOCM6: Rio Vista Flow Requirements. WOCM7: Three Mile Slough Gate Operations. WOCM8: Two Gate Operations – Old River and Connection Slough. WOCM9: Delta Outflow. WOCM10: Suisun Bay and Western Delta Salinity Conditions. WOCM11: Montezuma Slough Salinity Control Gate. WOCM14: Delta Salinity Standards.</p>	<p>X (Reduced predation by non-native predators and increased habitat and possibly food resources from removal of non-native aquatic vegetation)</p>	<p>X (Increased habitat for juveniles reduces competition for resources and reduced predation by non-natives increases survival, could increase the spawning population and productivity)</p>	<p>X (Increased habitat availability throughout the Delta would expand spatial extent of juveniles)</p>	

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<p>Objective ECSY3.3: Minimize the likelihood for future invasions and establishment of non-native species into the Delta's aquatic ecosystem.</p>	<p>OSCM9: Reduce the Risk of Future Introductions of Non-Native Aquatic Organisms from Commercial Watercraft. OSCM10: Reduce the Risk for Future Introductions of Non-Native Aquatic Organisms from Recreational Watercraft. OSCM11: Provide for Rapid Detection of and Response to New Introductions of Non-Native Species into Delta Waterways. OSCM12: Reduce the Risk for Establishment of Zebra Mussel and Quagga Mussel in Delta Waterways.</p>	<p>X (Reduced future predators and competitors for food and habitat)</p>	<p>X (Increased habitat and food could increase the spawning population and productivity)</p>	<p>X (Increased habitat availability throughout the Delta would expand spatial extent of juveniles)</p>	
<p>Objective ECSY4.1: Contribute to managing the load of contaminants of concern that enter the Delta in wastewater treatment plant discharges to levels in conformance with existing and future water quality standards to reduce their effects on and biological uptake by covered fish species.</p>	<p>OSCM1: Reduce the Load of Ammonia in Effluent Discharged from the Sacramento Regional County Sanitation District into the Sacramento River if Warranted Based on Research. OSCM2: Reduce the Load of Endocrine Disrupting Compounds in Effluent Discharged from Wastewater Treatment Plants into Delta Waterways if Warranted Based on Research.</p>	<p>X (Reduced lethal effects from toxics)</p>	<p>X (Reduced lethal and sublethal effects could increase the spawning population and productivity)</p>	<p>X (Increased habitat throughout the Delta due to fewer impaired waterways)</p>	
<p>Objective ECSY4.2: Contribute to managing the load of contaminants of concern that enter the Delta from urban sources to levels in conformance with existing and future water quality standards to reduce their adverse effects on and biological uptake by covered fish species.</p>	<p>OSCM5: Reduce the Loads of Toxic Contaminants in Stormwater Pollution and Urban Runoff by Working with Existing Efforts in the Delta.</p>	<p>X (Reduced lethal effects from toxics)</p>	<p>X (Reduced lethal and sublethal effects could increase the spawning population and productivity)</p>	<p>X (Increased habitat throughout the Delta due to fewer impaired waterways)</p>	

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Objective ECSY4.3: Contribute to managing the load of methyl mercury entering the Delta from in-Delta and upstream sources to levels in conformance with existing and future water quality standards to reduce adverse effects of methyl mercury on and biological uptake by covered fish species.	OSCM3: Reduce the Load of Methylmercury Entering Delta Waterways.	X (Reduced lethal effects from toxics)	X (Reduced lethal and sublethal effects could increase the spawning population and productivity)	X (Increased habitat throughout the Delta due to fewer impaired waterways)	
Objective ECSY4.3 Contribute to managing the load of contaminants of concern entering the Delta from in-Delta and upstream sources from agricultural practices to reduce their adverse effects on and biological uptake by covered fish species.	OSCM4: Reduce the Load of Pesticides and Herbicides Entering Delta Waterways from In-Delta Sources that are Believed to be Toxic to Covered Fish Species.	X (Reduced lethal effects from toxics)	X (Reduced lethal and sublethal effects could increase the spawning population and productivity)	X (Increased habitat throughout the Delta due to fewer impaired waterways)	
Objective ECSY4.4: Coordinate efforts to detect and respond to toxic events in the Delta.	OSCM6: Provide for Rapid Detection of and Response to Toxic Contaminant Events that could Affect Covered Fish Species.	X (Reduced lethal effects from toxics)	X (Reduced lethal and sublethal effects could increase the spawning population and productivity)	X (Increased habitat throughout the Delta due to fewer impaired waterways)	

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<p>Objective ECSY5.1: Provide the hydrodynamic and salinity and other water quality conditions within the Delta that support the effective movement of all life stages of covered fish species between spawning, larval, juvenile, and adult habitat areas.</p>	<p>WOCM1: North Delta Facilities Operations and Bypass Flows. WOCM2: Fremont Weir Operations. WOCM3: Deep Water Ship Channel Bypass Weir Operations. WOCM4: Sutter and Steamboat Slough Flows. WOCM5: Delta Cross Channel Gate Operations. WOCM6: Rio Vista Flow Requirements. WOCM7: Three Mile Slough Gate Operations. WOCM8: Two Gate Operations – Old River and Connection Slough. WOCM9: Delta Outflow. WOCM10: Suisun Bay and Western Delta Salinity Conditions. WOCM11: Montezuma Slough Salinity Control Gate. WOCM12: South Delta Diversions. WOCM13: Old and Middle River Flows. WOCM14: Delta Salinity Standards.</p>	<p>X</p> <p>(reduced exposure to predation, improved food availability)</p>	<p>X</p> <p>(increased survival of juveniles and reduced stranding and straying could increase the spawning population and productivity)</p>	<p>X</p> <p>(flows distribute juveniles to downstream habitats and allow smolts and adults to use multiple migration pathways downstream and upstream, respectively)</p>	

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<p>Objective ECSY5.2: Contribute to the availability of well-distributed restored floodplain, riparian, tidal marsh, and shallow subtidal aquatic habitats to support increased distribution of covered species and improved connectivity among covered species habitats within and adjacent to the BDCP planning area.</p>	<p>FLOO1.1: Modify the Fremont Weir and the Yolo Bypass to provide for a higher frequency and duration of inundation. FLOO2.1: Create and operate a new flood bypass in the Yolo Bypass/Cache Slough Complex ROA to restore seasonally inundated floodplain habitat. FIMA1.1. Restore a mosaic of __ to __ acres of freshwater intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Yolo Bypass/Cache Slough Complex ROA. FIMA1.3: Restore a mosaic of __ to __ acres of intertidal marsh and shallow subtidal aquatic habitat within the West Delta ROA. BIMA1.1 Restore a mosaic of __ to __ acres of brackish intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Suisun Marsh ROA. CHMA1.1. Support development and implementation of levee construction and maintenance designs that incorporate aquatic, intertidal marsh, and riparian habitat features. CHMA1.2. Provide for the establishment of native riparian woody vegetation and emergent vegetation on BDCP constructed levees. CHMA1.3: Enhance channel margin habitats along __ to __ miles of Steamboat and Sutter Sloughs to improve habitat conditions for covered fish species. RIPA1.1. Restore between __ and __ acres of riparian forest and scrub communities as a component of restored floodplain, freshwater intertidal marsh, and channel margin habitats.</p>	<p>X</p> <p>(Improved availability of high quality habitat would reduce competition and predation)</p>	<p>X</p> <p>(Reduced competition and predation could increase the spawning population and productivity)</p>	<p>X</p> <p>(Improved connectivity would increase the spatial extent in the Delta)</p>	
<p>Objective NACO1.1: Increase the frequency that floodplain habitat within the Yolo Bypass is inundated for at least 45 consecutive days to approximately percent of years based on current hydrology.</p>	<p>WOCM2: Fremont Weir Operations. FLOO1.1: Modify and operate the Fremont Weir to increase the frequency that the Yolo Bypass floodplain is inundated.</p>	<p>X</p> <p>(Increased access to floodplain habitat increases growth rate leading to high survival)</p>	<p>X</p> <p>(Higher survival could lead to an increase in the spawning population and productivity)</p>		

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<p>Objective NACO1.2: Provide for the inundation of at least [redacted] acres of historical floodplain surfaces that have been disconnected from river channels to provide habitat and ecosystem functions that support of covered species.</p>	<p>FLOO2.1: Create and operate a new flood bypass in the Yolo Bypass/Cache Slough Complex ROA to restore seasonally inundated floodplain habitat. WOCM3: Deep Water Ship Channel Bypass Weir Operations. FLOO2.2: Restore floodplain habitat along ___ miles of the San Joaquin River from Vernalis to Mossdale. FLOO2.3: Restore floodplain habitat along ___ miles of the San Joaquin River from Mossdale to French Camp Slough. FLOO2.4: Restore between ___ and ___ acres of inundated floodplain habitat in the South Delta Restoration Opportunity Area.</p>	<p>X</p> <p>(Increased access to floodplain habitat increases growth rate leading to high survival)</p>	<p>X</p> <p>(Higher survival could lead to an increase in the spawning population and productivity)</p>		
<p>Objective NACO1.3: Restore, manage, and protect at least ___ acres of freshwater tidal marsh in the Delta that provides habitat and ecosystem functions in support of covered species.</p>	<p>FIMA1.1: Restore a mosaic of [redacted] to [redacted] acres of freshwater intertidal marsh, shallow subtidal, and transitional grassland habitat within the Yolo Bypass/Cache Slough Complex Restoration Opportunity Area. FIMA1.2: Restore a mosaic of [redacted] to [redacted] acres of freshwater intertidal marsh, shallow subtidal aquatic, and transitional habitat within the Cosumnes/Mokelumne Restoration Opportunity Area. FIMA1.3: Restore a mosaic of [redacted] to [redacted] acres of intertidal marsh and shallow subtidal aquatic habitat within the West Delta Restoration Opportunity Area. FIMA1.4: Restore a mosaic of [redacted] to [redacted] acres of intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the South Delta Conservation Opportunity Area. FIMA1.5: Restore a mosaic of [redacted] to [redacted] acres of intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the East Delta Restoration Opportunity Area.</p>	<p>X</p> <p>(Tidal marsh restoration would increase food supply, increasing growth and survival; also, tidal marsh restoration could provide refuge from non-native predators)</p>	<p>X</p> <p>(Higher survival could lead to an increase in the spawning population and productivity)</p>		

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<p>Objective NACO1.4: Restore, manage, and protect [redacted] acres of brackish tidal marsh in Suisun Marsh/Bay to provide habitat and ecosystem functions in support of covered species.</p>	<p>BIMA1.1: Restore a mosaic of [redacted] to [redacted] acres of brackish intertidal marsh, shallow subtidal aquatic, and transitional grassland habitat within the Suisun Marsh Restoration Opportunity Area.</p>	<p>X</p> <p>(Brackish marsh restoration would increase food supply, increasing growth and survival; also, tidal marsh restoration could provide refuge from non-native predators)</p>	<p>X</p> <p>(Higher survival could lead to an increase in the spawning population and productivity)</p>		
<p>Objective NACO1.6: Restore at least [redacted] acres of riparian forest and scrub within the Delta to provide habitat and ecological functions in support of covered species.</p>	<p>CHMA1.1: Support development and implementation of levee construction and maintenance designs that incorporate aquatic and riparian habitat features. CHMA1.2: Design levees constructed under the BDCP to incorporate design features that support and enhance covered species habitats. CHMA1.3: Enhance channel margin habitats along [redacted] to [redacted] miles of Steamboat and Sutter Sloughs to improve habitat conditions for covered fish species. OSCM22: Establish No Wake Boating Zones in Delta Waterways to Protect Sensitive Covered Species Shoreline Habitat.</p>	<p>X</p> <p>(Increased shaded riverine and channel margin would provide productivity inputs and improve survival)</p>	<p>X</p> <p>(Higher survival could lead to an increase in the spawning population and productivity)</p>		

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RIPA1: Restore at least ___ acres of riparian forest and scrub within the Delta to provide habitat and ecological functions in support of covered species.	RIPA1. 1: Restore between [] and [] acres of riparian forest and scrub communities as a component of restored floodplain, freshwater intertidal marsh, and channel margin habitats.	X (Increased shaded riverine habitat would provide productivity inputs and improve survival)	X (Higher survival could lead to an increase in the spawning population and productivity)		
Objective GECF1.1: Reduce the risk of entrainment of covered fish species at non-project diversions.	OSCM21: Screen, Remove, Relocate, Consolidate, Modify and/or Alter Timing of Non-Project Diversions to Reduce Entrainment of Covered Fish Species at within the Delta.	X (Reduced entrainment mortality would lead to higher survival)	X (Higher survival could lead to an increase in the spawning population and productivity)		
Objective GECF1.2: Reduce the risk of entrainment of covered fish species at the Banks Pumping Plant and the Jones Pumping Plant.	WOCM1: North Delta Facilities Construction, Preferential Operation, and Bypass Flows. WOCM12: South Delta Diversions.	X (Reduced entrainment mortality would lead to higher survival)	X (Higher survival could lead to an increase in the spawning population and productivity)		

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Objective GECF1.3: Reduce the risk of entrainment of covered fish species into the SWP and CVP north Delta diversion intakes in the BDCP long-term implementation period.	WOCM1: North Delta Facilities Construction, Preferential Operation, and Bypass Flows.	X (Reduced entrainment mortality would lead to higher survival)	X (Higher survival could lead to an increase in the spawning population and productivity)		
Objective GECF1.4: Contribute towards reducing the risk for dissolved oxygen sags in Delta and Suisun Marsh waterways that could result in mortality of covered fish species.	OSCM7: Maintain Dissolved Oxygen Levels for Covered Fish Species in the Stockton Deep Water Ship Channel during Periods when Covered Fish Species are Present. OSCM8: Improve the Quality of Water Discharged from Managed Seasonal Wetlands into Suisun Bay and Delta Waterways to Prevent Dissolved Oxygen Sags.	X (Higher dissolved oxygen levels would reduce mortality and would lead to higher survival)	X (Higher survival could lead to an increase in the spawning population and productivity)		
Objective GECF1.5: Minimize the adverse effects of harvest on covered fish species.	OSCM16: Reduce Illegal Harvest of Chinook Salmon, Central Valley Steelhead, Green Sturgeon, and White Sturgeon in the Delta. OSCM17: Reduce Adverse Effects of Harvest on Sacramento Splittail Abundance. OSCM19: Reduce Losses of Wild Stocks of Chinook Salmon to Commercial Fishing and Recreational Fishing through a Mark-Select Fishery.	X (Reduced harvest would increase survival)	X (Higher survival could lead to an increase in the spawning population and productivity)	X? Reduced harvest would help ensure all 3 populations persist, but would not likely increase spatial structure	X? Reduced harvest would help ensure all 3 populations persist, but would not likely increase diversity

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GECF2.1: Improve the fitness of wild populations of Chinook salmon and steelhead by managing salmonid hatcheries to minimize their adverse effects on wild populations.	OSCM18: Develop and Implement Hatchery and Genetic Management Plans to Minimize the Potential for Genetic and Ecological Impacts of Hatchery Reared Salmonids on Wild Salmonid Stocks.	X (Improved genetic integrity of wild fish and reduced competition with hatchery fish, which could lead to higher survival)	X Higher survival could lead to an increase in the spawning population and productivity)		
GECF2.2: Reduce the risk for the extinction of delta smelt and the extirpation of longfin smelt by maintaining and expanding existing artificial propagation programs for preserving the genetic diversity of delta smelt and longfin smelt populations and contributing to their abundance and distribution within the planning area.	OSCM20: Establish New and Expand Existing Conservation Propagation Programs for Delta and Longfin Smelt.				