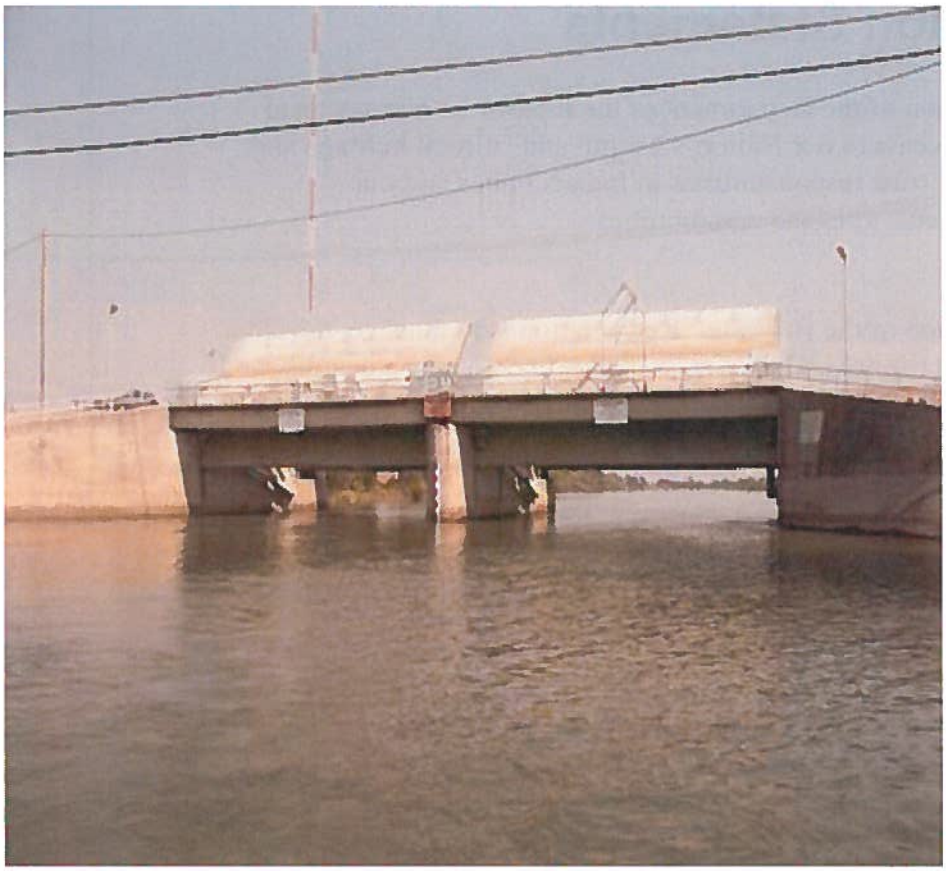
EBMUD-182

RECLAMATION

Managing Water in the West

Delta Cross Channel Temporary Closure Multi-Year Study

FINAL ENVIRONMENTAL ASSESSMENT



U.S. Department of the Interior
Bureau of Reclamation

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Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

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.

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List of Acronyms and Abbreviations

AFRP	Anadromous Fish Restoration Program
Calfish	California Cooperative Anadromous Fish and Habitat Data Program
CESA	California Endangered Species Act
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWT	Coded Wire Tag
D-1641	State Water Resources Control Board Decision 1641
DFG	California Department of Fish and Game
DOSS	Delta Operations for Salmon and Sturgeon
DPS	Distinct Population Segment
DSM2	Delta Simulation Model II
DSWG	Delta Smelt Working Group
DWR	California Department of Water Resources
EA	Environmental Assessment
EBMUD	East Bay Municipal Utility District
ESA	Federal Endangered Species Act
ESU	Evolutionarily Significant Unit
Hatchery	Mokelumne River Hatchery
JSA Partnership	Mokelumne Joint Settlement Agreement Partnership Steering Committee
LMR	Lower Mokelumne River
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
Operation BO	Biological Opinion on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project
ROD	Record of Decision
USFWS	United States Fish and Wildlife Service

1.0 Introduction and Background

The lower Mokelumne River (LMR) produces a substantial Chinook salmon return in most years and significantly contributes to the Central Valley salmon population and associated commercial and sport fisheries. The LMR also supports a significant population of federally threatened Central Valley steelhead and is designated critical habitat for this species. Over the past several years there has been a significant decline and slow recovery in the abundance of returning fall-run Chinook salmon throughout the Central Valley. Natural production of Chinook salmon in the LMR has been significantly impacted due to the reduced escapement. One factor that has been identified as contributing to low returns in the LMR is straying to other rivers, particularly the lower American River.

1.1 Anadromous Fish Restoration Program's Doubling Goal

Central Valley Project Improvement Act (CVPIA) Section 3406(b)(1) identifies a goal for the Anadromous Fish Restoration Program (AFRP), which is to "develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991." The AFRP is a component of a broader program within the CVPIA, which supports provisions for fish and wildlife habitat restoration. The CVPIA program prepared a programmatic environmental impact statement (USBR 1999) and Record of Decision (ROD) (USBR 2001) in accordance with the National Environmental Policy Act (NEPA). The objectives for the AFRP can be found in the Final Restoration Plan for the Anadromous Fish Restoration Program (USFWS 2001). The Restoration Plan identified the operation of the Delta Cross Channel (DCC) and the need to evaluate opportunities to provide modified operations and a new or improved control structure for the DCC and Georgiana Slough or other methods at those locations to assist in the successful migration of anadromous salmonids as a high priority (USFWS 2001; Sacramento-San Joaquin Delta Evaluation 5).

The AFRP adult salmon doubling goal for all Central Valley fall-run Chinook salmon is 750,000 fish. The AFRP's natural production doubling goal target for all Central Valley fall-run Chinook salmon is 750,000 fish (USFWS 2001). In 2008, 412 fall-run Chinook salmon returned to the LMR and 2,233 Chinook salmon returned in 2009 (DOI 2010).

1.2 Salmonid Migration Straying

Straying is the phenomenon where fishes born in a particular river system return as adults to a different river system to reproduce. Based on coded wire tag (CWT) recoveries in 2008 and 2009, straying rates of LMR origin Chinook salmon appeared to be significant with more salmon returning to the lower American River and Nimbus Hatchery than the LMR and Mokelumne River Hatchery (Hatchery). Additionally, straying in 2008 and 2009 may have resulted in the Hatchery not meeting its production goals (9,000,000 eggs). In 2008 and 2009, only 261,969 and 2,158,000 salmon smolts were produced at the Hatchery, respectively.

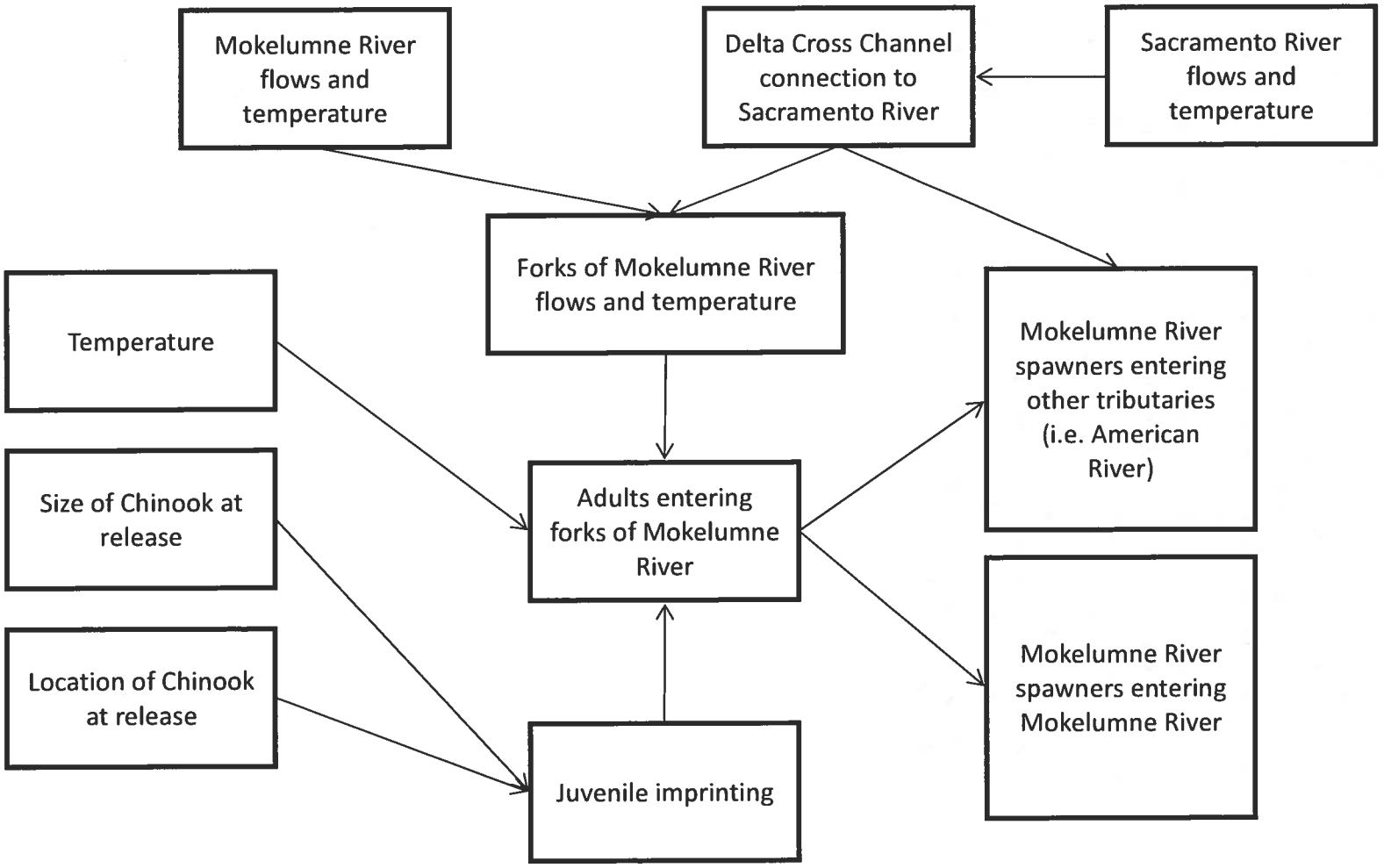
The high rate of straying along with the significant decrease of the Central Valley fall-run Chinook salmon stock left the LMR short of its AFRP doubling goal target of 9,300 fish. The average fall-run Chinook salmon estimated production for the period 1992-2009 (doubling goal base period is 1967-1991) is just below the doubling goal on the LMR (8,176 fish). Battle, Butte, and Clear creeks are the only Central Valley watersheds that currently meet their doubling goals and the LMR is currently the only other watershed near its doubling goal. By reducing straying and consequently increasing returns of LMR origin fish to the LMR, the AFRP doubling goal may have a higher likelihood of being achieved.

The management of straying rates is important to ensure adequate supplies of spawners for salmon production and the Hatchery. Natural spawning facilitates locally adapted stocks of Central Valley fall-run Chinook salmon and Central Valley steelhead. The reduction of straying rates will be important for achieving goals for both the Mokelumne and Nimbus hatchery genetics management plans.

The Mokelumne Joint Settlement Agreement Partnership Steering Committee (JSA Partnership) oversees the management of the lower Mokelumne River. The partnership consists of representatives from the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (DFG), National Marine Fisheries Service (NMFS) and East Bay Municipal Utility District (EBMUD). Reducing straying to other river systems has been identified by the JSA Partnership and NMFS as one of the key parameters that may be positively impacted by enacting or requesting temporary changes to specific DCC operations. By limiting the straying of fish reared on the LMR, the JSA Partnership and NMFS hypothesize that the population of spawning fish on the LMR should increase in numbers. In the long-term, limiting straying should increase the overall annual number of spawning fish and may lead to a more sustainable population of fish that return year after year to the Mokelumne River system.

There are several factors that can influence straying, including, but not limited to, tributary flow operations, Delta water management operations (including operation of the DCC), temperature and planting practices for hatchery fingerlings and smolts (Figure 1).

Figure 1. Conceptual model of biological and physical processes that may influence adult fall run Chinook salmon escapement to the Mokelumne River.



1.3 Delta Cross Channel Gate Operations

The DCC is located on the Sacramento River near Walnut Grove, California. The DCC connects to Snodgrass Slough, which in turn connects to the Mokelumne River. The DCC is operated with a set of radial gates, which can be opened to allow water movement between the two systems. The DCC gates are generally open from June through October to convey water to the Central Valley Project (CVP) and State Water Project (SWP) pumps through the central Delta while simultaneously meeting the water quality standards contained in State Water Resources Control Board (SWRCB) Decision 1641 (D-1641). Additionally, as part of Action IV.1.2 included in the NMFS Biological Opinion on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project (Operation BO; NMFS 2009), closures of the DCC from October 1 through November 30 are required when fish monitoring indicates that juvenile salmonids are entering the Delta in excess of certain trigger criteria and D-1641 water quality criteria are met (Table 1). Additional closures are required between December 1 and January 31 when fish monitoring indicates that juvenile salmonids are entering the Delta in excess of certain trigger criteria as part of the NMFS Operation BO.

Table 1. Operation of the DCC under State Water Board Decision 1641 and the NMFS BO during October and November.

D-1641		NMFS BiOp		
Date	Action	Date	VI. Action Triggers	Action Responses
November 1-January 30	DCC gates may be closed for up to a total of 45 days.	October 1-November 30	Water quality criteria per D-1641 are met and either the the KLCI or SCI is greater than 5 fish per day	Within 24 hours, close the DCC gates and keep closed until the catch index is less than 3 fish per day at both the Knights Landing and Sacramento monitoring sites.
			Water quality criteria per D-1641 are met, niether Knights Landing Catch Index or the Sacramento Catch Index are greater than 3 fish per day but less than or equal to 5 fish per day	Within 24 hours of trigger, DCC gates are closed. Gates will remain closed for 3 days
			The KLCI or SCI triggers are met but water quality critera are not met per D-1641 crtieria	DOSS reviews monitoring data and makes recommendation to NMFS and WOMT per procedutes in Action IV.5

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When the DCC is in the open position, water flows from the Sacramento River into the South and North Forks of the Mokelumne River towards the SWP and CVP export pumps. These Delta distributaries of the Mokelumne River are the key upstream migratory pathway for fall-run Chinook salmon and Central Valley steelhead returning to the LMR to spawn. Based on the volume of water transferred through the DCC and Mokelumne forks, the olfactory cue from the Mokelumne River can be diminished due to Sacramento River flows diverted through the DCC.

DCC operations have been identified as a factor in Delta hydrodynamics that could affect fish behavior and survival. Anadromous fish species may be influenced under current operating guidelines. One of the effects is related to upstream migration delays and timing. With the gates open, there is a clear pathway for salmon migrating upstream into the LMR to 'stray' into the Sacramento River system. When the gates are closed, the connection between the Sacramento and Mokelumne systems is a more circuitous route and the majority of water entering the eastern Delta north of the San Joaquin River comes from fall attraction flow pulses on the Mokelumne River and San Joaquin River tributaries. During the Mokelumne River fall attraction flow pulse, stronger migratory cues in the Delta forks of the Mokelumne River enters the eastern Delta, which is likely to increase attraction of LMR reared fish and encourage these fish to migrate back to their natal river. Therefore, it is hypothesized that temporarily closing the DCC during a portion of October would strengthen migration cues for migratory fish, including Chinook salmon, and would increase fidelity of LMR salmonids to their river of origin. A closed DCC would block a main connection between the Mokelumne and Sacramento Rivers, separating waters from the Sacramento and Mokelumne rivers. A separate effect that may occur when the DCC is open in the late fall is outmigrating juvenile winter-run and spring-run Chinook salmon may leave the Sacramento River mainstem channel and enter into the interior Delta via the open DCC. Studies have demonstrated that juvenile salmonids entrained into the interior Delta via the DCC or Georgiana Slough have lower survival than along other migratory routes (Perry et al 2010; Newman and Brandes 2010).

A confounding effect, however, is that when the DCC is closed, flows from the Sacramento River to the lower San Joaquin River increase (either through Georgiana Slough, Three-mile Slough or in a reverse direction up the lower San Joaquin River). This can affect the ability to meet water quality standards (as discussed in Section 4.2). These Sacramento River flows can also dilute migratory cues; result in a weakened net San Joaquin River flow (wetter years) or a stronger net reverse flow (drier years) in the lower San Joaquin River; and increase salinity in the lower San Joaquin River. Under net reverse flow conditions, Mokelumne River water can move into the South Delta. Hydrodynamic models, such as the Delta Simulation Model II (DSM2) can be used to determine the difference in Mokelumne River water in the lower Mokelumne River, lower San Joaquin River and South Delta with and without DCC closures. This information can help establish the spatial and temporal extent of various effects, and to separate flow pulse effects from DCC closure effects.

1.4 Previous Delta Cross Channel Seasonal Temporary Closures

In 2010 the JSA Partnership requested a ten day DCC gate closure and was granted a two day (48 hour) closure from October 13th – October 15th, 2010. The gate closure was coordinated with a pulse flow that was timed to draw Chinook salmon into the LMR. The salmon return improved on the LMR in 2010 with a total of 7,196 fall-run Chinook salmon returning. Preliminary return data indicates straying was reduced by 50% but was still significant, with over 25% of LMR origin Chinook salmon returning to the lower American River. To date it appears that the actions taken (pulse flows and/or DCC closure) have not resulted in attracting non-LMR origin salmon into the Mokelumne River. In 2009 and 2010 approximately 15% of the Chinook salmon returning to the LMR (natural and hatchery) were non-LMR origin fish. As additional data from other Central Valley rivers and hatcheries becomes available it will be analyzed to refine the estimates of stray rates. In 2011, the JSA Partnership requested and was granted a ten day closure from October 4 – October 14, 2011. Preliminary results from CWT returns to all Central Valley streams in 2011 found that approximately 7% of LMR hatchery fish strayed to other rivers, and straying of these fish to the lower American River was reduced compared to previous years.

In a separate but related action, EBMUD has implemented pulse flows on the LMR by releasing water from Camanche Reservoir coordinated with the temporary closure of the DCC in October. While in October 2011 approximately 90,000 acre feet were released (pulses 800-1,800 cfs); the actual volume of water potentially available over the next five years for pulse flows will be dependent on water year type and fall precipitation. These pulse flows are generally greater than those prescribed in their Federal Energy Regulatory Commission and State Water Resource Control Board (SWRCB) Joint Settlement Agreement (JSA) as part of the Settlement Agreement's Adaptive Management Program. The JSA Partnership determines the volume of water based on the JSA's Adaptive Management Program. Based on last year's action, flows during October could range between 800 – 1,800 cfs over the next five years.

In another separate but related action, the JSA Partnership will continue to implement a fish monitoring study to evaluate the benefits of the pulse flow and DCC closures. The JSA Partnership anticipates continuing these fish monitoring studies and analyses over the next five year period coincident with this proposed action. DFG implements these field activities and coordinates reporting activities. Appendix A includes a description of the DFG fish monitoring study plan.

2.0 Purpose and Need for Action

Of the total number of LMR origin Chinook salmon returning to Central Valley tributaries, over 50% strayed into the lower American River during the 2008 and 2009 spawning seasons. Reducing straying of LMR fall-run Chinook salmon to other river systems has been identified by the JSA Partnership and NMFS as one of the key parameters that may be impacted positively by implementing changes to DCC operations. By limiting the straying of fish reared on the LMR, the JSA Partnership and NMFS hypothesize that the proportion of LMR spawning fish will increase. In the long-term, limiting straying should increase the overall annual number of spawning fish and may lead to a more sustainable population of fish that annually return to the LMR. It is hypothesized that having the DCC closed during a portion of October would strengthen migration cues for migratory fish, including Chinook salmon. The purpose of the proposed action is to evaluate the effects of short term modifications to DCC gate operations annually in the fall over a five-year period on reduction of LMR fall-run Chinook salmon straying. Additionally, the AFRP Final Restoration Plan identified this evaluation as a high priority to improve the successful migration of anadromous salmonids (USFWS 2001; Sacramento-San Joaquin Delta Evaluation 5).

3.0 Alternatives

3.1 No Action Alternative

Under the No Action Alternative, Reclamation would not implement the proposed study of temporary closures of the DCC annually in the fall over five years for the purposes of evaluating effects on LMR Chinook salmon straying. Under the No Action Alternative, Reclamation would operate the DCC during October in accordance with the State Water Resources Control Board Decision 1641 (D-1641) and NMFS Operation BO Action IV.1.2. Regardless of pulse flow releases from Camanche Dam, DCC closure would be modified only to reduce direct and indirect mortality of emigrating juvenile salmonids and green sturgeon as prescribed in NMFS Operation BO Action IV.1.2.

3.2 Proposed Action

During 2012 through 2016, Reclamation proposes closing the DCC for up to 10 days during the first half of October. The duration of the closure in each year would be determined by evaluating in-season DSM2-QUAL water quality modeling to ensure compliance with D-1641 water quality standards and

minimization of potential adverse impacts to water supply (Table 2). Reclamation and California Department of Water Resources (DWR) would not need to modify their upstream reservoir releases to accommodate the proposed action or for improvement of Delta water quality conditions. During the study period if water quality has the potential to exceed concern levels, the proposed action would not be undertaken. If unanticipated impacts to water management capabilities are reported in the vicinity due to the proposed action, Reclamation will modify the duration of the closure as appropriate. If delta smelt or longfin smelt monitoring suggests an increased risk of entrainment of these species into the lower San Joaquin River, the proposed action would not be undertaken.

Reclamation would coordinate closing the DCC gates with EBMUD's anticipated series of pulse flows on the LMR in October. EBMUD's pulse flow schedule is unknown until the LMRP finalizes their annual flow plan based on annual hydrology. This coordinated water operation is intended to reduce straying to other river systems and therefore further improve returns of LMR origin Chinook salmon to the LMR beyond those observed with a fall pulse flow and no closure of the DCC.

DWR models Mokelumne River and Delta flows, Delta salinity levels, and the potential impacts to CVP and SWP water supplies based on the proposed DCC gate closure using their DSM2 model. The DSM2-QUAL model uses Delta inflow, exports, barrier operations, tide forecasts, in-Delta water use, and initial Delta water quality conditions to model salinity conditions at multiple locations. The model simulates 21 days of forecasted conditions based on ten days of these historical data. The primary water quality sampling locations used for decisions regarding DCC management are Jersey Point, Bethel, Holland Cut, and Bacon Island, which are monitored and used for modeling electrical conductivity (EC; umhos/cm). The actual timing and duration of the DCC gate closure will consider tides, wind, barometric pressure, existing water quality, and Delta inflow on hydrodynamics. Model results will be reviewed with the CALFED Operations Team and NMFS Operation BO's Delta Operations for Salmon and Sturgeon (DOSS) Group, and the proposed action will be coordinated through the Water Operations Management Team. Additionally, these teams will review delta smelt and longfin smelt distributional information to determine if the proposed action may cause entrainment of these species into the lower San Joaquin River. Using these real-time data sources, annual closures would be scheduled between 0 and 10 days in accordance with the proposed water quality concern level targets in Table 2.

Table 2. Proposed DCC operational changes (modified from NMFS BO Action VI.1.2)

Date	VI. Action Triggers	Action Responses
October 1-November 30	Water quality criteria per D-1641 are met and either the Knights Landing Catch Index or Sacramento Catch Index is greater than 5 fish per day	Within 24 hours, close the DCC gates and keep closed until the catch index is less than 3 fish per day at both the Knights Landing and Sacramento monitoring sites.
	Water quality criteria per D-1641 are met, neither Knights Landing Catch Index or the Sacramento Catch Index are greater than 3 fish per day but less than or equal to 5 fish per day	Within 24 hours of trigger, DCC gates are closed. Gates will remain closed for 3 days
	Water quality criteria per D-1641 are met, real-time DSM2[1] modeling shows water quality concern level targets are not exceeded during 28 day period following DCC closure and there is no observed deterioration of interior Delta water quality.	Within 24 hours of start of LMR attraction flow release, close the DCC gates for up to 10 days (dependent upon continuity of favorable water quality conditions).
	Water quality criteria per D-1641 are met, real-time DSM2[1] modeling shows water quality concern level targets are not exceeded during 14 day period following DCC closure and there is no observed deterioration of interior Delta water quality.	Within 24 hours of start of LMR attraction flow release, close the DCC gates for up to 5 days (dependent upon continuity of favorable water quality conditions).
	Water quality criteria per D-1641 are met, real time DSM2 modeling shows water quality concern level targets are exceeded during 14 day period following DCC closure.	No closure of DCC gates
	The KLCI or SCI triggers are met but water quality criteria are not met per D-1641 criteria	DOSS reviews monitoring data and makes recommendation to NMFS and WOMT per procedures in Action IV.5

1. Real time DSM2 modeling will occur within 7 days of the DCC closure

Water quality concern level targets (DSM2 simulated EC)[2]	
Jersey Point	1700 umhos/cm
Bethel Island	1000 umhos/cm
Holland Cut	1000 umhos/cm
Bacon Island	800 umhos/cm

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section discusses the affected environment and environmental consequences of the proposed action. The proposed action would not affect the following resources: groundwater, geology and soils, vegetation and wildlife, air quality, power, cultural resources, Indian trust assets, socioeconomics, environmental justice, climate change, aesthetics, noise, hazardous and toxic waste, and transportation. Therefore, these resource categories are not analyzed in further detail.

4.1 Fisheries

4.1.1 Affected Environment

For the purposes of this assessment, "special-status species" are defined as species of management concern to State and Federal resource agencies, and include those species that are listed as endangered, threatened, or candidate for listing under the Federal Endangered Species Act (ESA). A list of special status species potentially occurring in the project area was obtained from USFWS (Appendix B).

This assessment includes: an inventory of regionally occurring special-status species, and a complete inventory of special-status species with the potential to occur within the project area (Table 3). The project area encompasses: the mainstem Sacramento River from Walnut Grove to its confluence with the San Joaquin River, DCC manmade channel, Mokelumne River, mainstem San Joaquin River to its confluence with the Sacramento River, and the San Francisco Bay-Delta south of the San Joaquin River to its southern tidal boundary. This fish inventory is based on a review of pertinent literature and California Cooperative Anadromous Fish and Habitat Data Program (CalFish). The list of regionally occurring special-status fish species was evaluated to determine which of these species have the potential to occur in the project area during or temporally proximal to the proposed action. Results from the inventory indicate that the project area supports the following special-status fish species: including Central Valley fall-run Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, delta smelt, longfin smelt, North American green sturgeon, and California Central Valley steelhead.

Table 3. List of special status species. SC=Species of Concern, SE=State Endangered, FE=Federal Endangered, ST=State Threatened, FT=Federal Threatened, SSC=State Species of Concern, FC=Federal candidate species.

Scientific Name	Common Name	State	Federal
Fish Species		Status	
Oncorhynchus tshawytscha	Central Valley fall-run Chinook Salmon	-	SC
Oncorhynchus tshawytscha	Sacramento River winter-run Chinook Salmon	SE	FE
Oncorhynchus tshawytscha	Central Valley spring-run Chinook Salmon	ST	FT
Hypomesus transpacificus	Delta smelt	SE	FT
Spirinchus thaleichthys	Longfin smelt	ST	FC
Acipenser medirostris	North American green sturgeon (southern DPS)	SSC	FT
Oncorhynchus mykiss	California Central Valley steelhead DPS	-	FT

Central Valley Fall-run Chinook Evolutionarily Significant Unit (ESU) (*Oncorhynchus tshawytscha*)

Federal Status: Species of Concern. Established by NMFS
California Endangered Species Act (CESA) Status: N/A

Central Valley fall-run Chinook salmon are philopatric semelparous fish species staying in or returning to their birthplace and reproducing only once in their lifetime. Fall-run Chinook salmon typically emigrate in the spring of their first year and spend two to four years in the ocean before returning to their natal stream to spawn. The annual adult fall-run Chinook salmon migration through the Bay-Delta as they return to spawning tributaries is affected by temperature, dissolved oxygen, and flows.

On the Mokelumne River, the adult fall-run Chinook salmon escapement migration begins by mid-October, peaks in late October and early November, and tapers off by late November (Del Real and Saldate 2011). Spawning generally occurs shortly after migration, primarily in late October through January. The salmon eggs incubate and hatch in the gravel between October and April, depending on time of spawning and water temperature. The fry begin to emerge from the gravel starting in January and continue through April. Most juvenile Chinook salmon in the Mokelumne River have left the spawning areas by June of their first year. These juveniles move downstream and continue rearing as they pass the vicinity of Chipps Island. No critical habitat has been designated for fall-run Chinook salmon. Fall-run Chinook salmon are present in the project area during the project period of early October.

Sacramento River Winter-run Chinook Salmon ESU (*Oncorhynchus tshawytscha*)

Federal Status: Endangered. Established by NMFS in 2005
State Status: Endangered. Established by CDFG in 1989

There are no winter-run Chinook salmon in the Mokelumne River. Adult winter-run Chinook salmon emigrate up the Sacramento River in the winter and spring to spawn below Shasta Dam. The salmon eggs incubate and hatch in the gravel during late spring and early summer. Rearing juveniles start migrating from the river in the summer and enter the Delta during November. A review of fifteen years (1997-2011) of Knights Landing rotary screw trap data found that no more than 0.01% of the winter-run passing this location annually occurred in October and November combined. In December, juvenile winter-run Chinook salmon do enter the Delta and between 0 and 3.9% of the winter-run passing Knights Landing annually migrated past Knights Landing in December. The portion of the project area within designated critical habitat for winter-run Chinook salmon includes the mainstem Sacramento River from Walnut Grove to its confluence with the San Joaquin River.

Central Valley Spring-run Chinook Salmon ESU (*Oncorhynchus tshawytscha*)

Federal Status: Threatened. Established by NMFS in 2005
State Status: Threatened. Established by CDFG in 1999

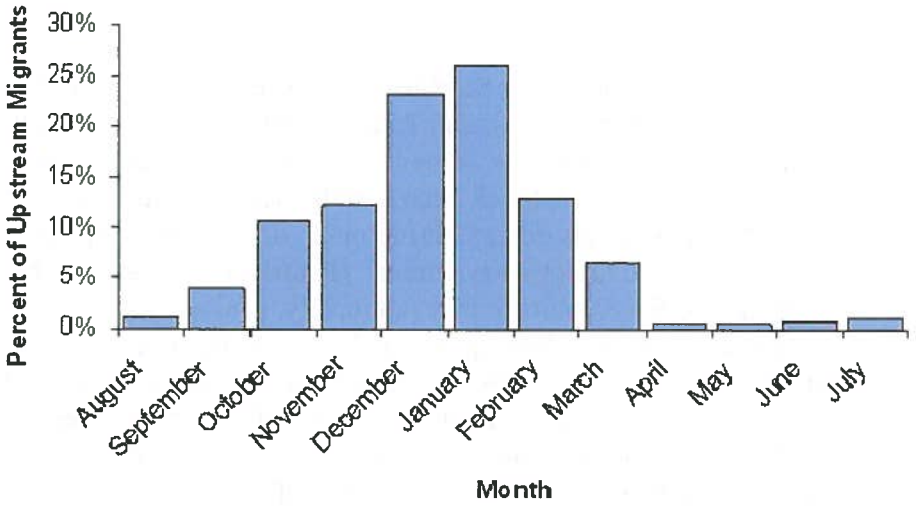
Spring-run Chinook salmon have been observed passing the Woodbridge video monitoring site between April and June, although no spring-run Chinook salmon population exists on the Mokelumne River. Adult spring-run Chinook salmon emigrate through the Delta in the late spring then oversummer in a limited number of Sacramento and Feather River tributaries in coldwater holding habitats. Spawners build redds in late summer, and the eggs incubate and hatch in the gravel during the winter and early spring. Juveniles emigrate as smolts during the spring, but also rear in natal tributaries before emigrating as yearlings during early rainstorms the following fall. A review of fifteen years (1997-2011) of Knights Landing rotary screw trap data found that 0.01% of juvenile spring-run passing this location annually occurs in October and November combined. In December, juvenile spring-run passing this location do enter the Delta and between 0.0 and 10.6% of the spring-run passing Knights Landing annually migrated past Knights Landing in December. The portion of the project area within designated critical habitat for spring-run Chinook salmon includes the mainstem Sacramento River from Walnut Grove to its confluence with the San Joaquin River and the DCC.

California Central Valley Steelhead Distinct Population Segment (DPS) (*Oncorhynchus mykiss*)

Federal Status: Threatened. Established by NMFS in 2006
State Status: N/A

California Central Valley Steelhead, as currently defined, is the anadromous form of rainbow trout (McEwan and Jackson 1996). However, steelhead life history can be quite variable, with some individuals or populations reverting to residency when flow conditions block access to the ocean. Adult migration from the ocean to spawning grounds occurs during much of the year, with peak migration occurring in the fall or early winter. Historically, migration through the Sacramento River mainstem began in July, peaked at the end of September, and continued through February or March. Currently, California Central Valley steelhead are mostly 'winter steelhead', mature in the ocean and arrive on the spawning grounds nearly ready to spawn. Hatchery steelhead, which are marked with a clipped adipose fin, are not considered part of the DPS, wild naturally-produced fish are considered part of the DPS. Adult California Central Valley steelhead are observed to migrate into the Mokelumne River during the project period (Figure 2; J. Setka, EBMUD, personal communication), and presumably are also migrating into the Sacramento River. Steelhead are believed to spawn soon after reaching spawning habitats with optimal temperature and flow conditions. Eggs incubate during the winter and fry emerge from the gravel in later winter and spring. Juveniles spend from one to three years rearing in stream prior to outmigrating. Outmigration of steelhead occurs during the winter and spring during seasonally high flows caused by stormy conditions or releases. The portion of the project area within designated critical habitat for California Central Valley steelhead includes the Sacramento River from Walnut Grove to its confluence with the San Joaquin River, Mokelumne River, mainstem San Joaquin River to its confluence with the Sacramento River, and the San Francisco Bay-Delta south of the San Joaquin River to its southern tidal boundary.

Figure 2. Proportion of adult steelhead moving upstream past Woodbridge Irrigation District Dam by month, 1997-2005; 2010



Southern DPS of North American Green sturgeon (*Acipenser medirostris*)

Federal Status: Threatened. Established by NMFS in 2006
State Status: Species of Concern. Established by NMFS in 1995

Green sturgeon spawning habitat is not documented on the Mokelumne or San Joaquin rivers. Green sturgeon are found in the lower reaches of large rivers from British Columbia south to the Sacramento River, the estuaries of these rivers, and the Pacific Ocean. In the Central Valley, late spring spawning habitat extends up the Sacramento River to the confluence of Battle Creek and Feather River to the low flow channel. Green sturgeon are an anadromous species migrating from the ocean to their natal freshwater streams as adults between March and July to spawn when river temperatures are within 45°F and 57°F. Females are broadcast spawners that produce 60,000–140,000 eggs in swift water that are then fertilized externally. Eggs hatch in about eight days at 55°F. Juveniles generally migrate downstream during the summer and fall, and reside in freshwater and brackish estuaries until one to three years of age. They migrate and grow in nearshore coastal waters and natal and non-natal estuaries before returning to first spawn at approximately 13 to 17 years of age. Environmental factors most likely to reduce survival and production of green sturgeon are high water temperatures, water quality, and competition and predation with nonnative species. Management factors most likely to reduce survival and production are barriers to migration and flow modification. The project area is within the designated critical habitat for green sturgeon. Juvenile and adult green sturgeon may outmigrate during the period proximate or during the project period of early October.

Delta Smelt (*Hypomesus transpacificus*)

Federal Status: Threatened. Established by USFWS in 1993
State Status: Endangered. Established by CDFG in 2010

Delta smelt are endemic to the Sacramento-San Joaquin Estuary from Suisun Bay eastward though the Delta. The majority of their life span occurs within the interface of saltwater and freshwater (Moyle 2002). Delta smelt are euryhaline species that can survive in freshwater and estuarine waters reaching approximately 14 parts per thousand. Adults can reach 5 to 7.5 cm standard length and migrate upstream from the estuarine waters associated with the mixing zone and disperse widely into river channels and tidally influenced backwater sloughs to stage shortly before spawning. Delta smelt spawning microhabitat is unknown, but occurs in freshwater reaches of the Bay-Delta estuary (Bennett 2005). The project area is within the designated critical habitat for Delta smelt. Delta smelt are not anticipated to be present in the project area during the proposed temporary closure period. However, delta smelt can be affected by water quality changes; measures to avoid such impacts are discussed in Section 4.1.2.

Longfin Smelt (*Spirinchus thaleichthys*)

Federal status: Candidate species. Established by USFWS in 2012
State status: State Threatened. Established by DFG in 2009

Longfin smelt is a pelagic (lives in open water) estuarine fish that typically measures 3.5 to 4.3 inches standard length and is found in California's bay, estuary, and nearshore coastal environments. The San Francisco Estuary and the Delta supports the largest longfin smelt population in California. Longfin smelt habitat in the project region includes slightly upstream from Rio Vista (on the Sacramento River in the Delta) including the Cache Slough region and Medford Island (on the San Joaquin River in the Delta) through Suisun Bay and Suisun Marsh. Longfin smelt spend their adult life in bays, estuaries, and nearshore coastal areas, and migrate into freshwater rivers to spawn. Longfin smelt are not anticipated to be present in the project area during the proposed temporary closure period.

4.1.2 Environmental Consequences

The impacts to fisheries are expected to be beneficial as the short-term impacts would be to direct the adult escapement of LMR fall-run Chinook salmon and California Central Valley steelhead back to their natal river. The proposed action would also reduce outmigrating juvenile salmon exposure to alternate routes into the south Delta. Also, a reduction in straying by these species to other river systems may reduce competition for spawning habitat on other tributaries of the Bay-Delta.

Because the area is very infrequently occupied by listed juvenile salmonids in the early fall, and the proposed action is anticipated to have a beneficial effect on LMR adult fall-run Chinook salmon by reducing straying, the proposed action would have a beneficial effect on fall-run Chinook salmon. The NMFS Operation BO (NMFS 2009) requires closure of the DCC for winter-run and spring-run salmon protection as early as October 1 for up to three days. The proposed action was designed to avoid negatively impacting water quality, and thus it is not likely that DCC operations for spring-run and winter-run Chinook salmon protection would be negatively impacted. Spring-run and winter-run Chinook salmon are not likely to be adversely impacted by the proposed action.

Juvenile steelhead are not likely to be outmigrating during the project period or proximate period (early October). Therefore, California Central Valley steelhead are not likely to be adversely impacted by the proposed action. Monitoring as part of the 2011 pulse flow monitoring study by DFG did not encounter adult California Central Valley steelhead during their field sampling. Therefore, no adverse effects on adult steelhead are anticipated.

While green sturgeon may occupy the Delta year round, temporary closure of the DCC would not likely negatively impact green sturgeon because historically no juvenile green sturgeon have been observed near the DCC and closure of the manmade DCC would emulate historic natural conditions. Delta smelt and longfin smelt are not anticipated to be in the project area during the time of the proposed closure, but delta smelt and longfin smelt distributions will be reviewed annually to avoid entrainment into the lower San Joaquin River. Additionally, Reclamation has committed to open the DCC gates if water quality monitoring indicates potential exceedance of water quality standards during the proposed action. This would avoid potential impacts to water quality and eliminate potential adverse effects on fisheries from the proposed temporary closure of the DCC.

4.2 Water Supply and Water Quality

4.2.1 Affected Environment

The current volume of water exports from the CVP and SWP during the period of the year in which the action is proposed to occur is 15 to 20 thousand acre-feet (TAF) per day. For water quality purposes, the DCC has been operated in accordance with D-1641 since 2000. Since that time, the DCC has been closed during October and November in a number of years for fish and water quality experiments and fish protection (Table 4). During the 2008 fish, hydrodynamic, and water quality USGS and DWR experiments, closure of the DCC for experimentation was suspended twice due to water quality concerns in November and December.

Table 4. Number of days during the Fall when the DCC has been closed.

				Experimental purpose for closure?		
	Oct	Nov	Dec	Oct	Nov	Dec
2000	31	8	4	Yes	Yes	No
2001	21	8	27	Yes	No	No
2002	3	1	22	Yes	No	No
2003	0	0	31	No	No	No
2004	0	0	25	No	No	Yes
2005	0	4	28	No	No	No
2006	1	0	16	No	No	No
2007	0	0	17	No	No	No
2008	0	17	18	No	Yes	Yes
2009	4	11	18	Yes	No	No
2010	3	4	31	Yes	No	No
2011	10	0	31	Yes	No	No
Average	6	4	22			

4.2.2 Environmental Consequences

The proposed action is within the range of historical operation of the Central Valley Project (CVP), as the opening and closing of the gates to manipulate flows in the eastern Delta is the primary function of the DCC. In addition, D-1641 and the NMFS Operation BO include language that encourages Reclamation to participate in hydrodynamic, water quality, and fishery experiments, which may have benefit to special status species. These experiments have occurred during the October period in six out of the last twelve years. Also as specified in the NMFS Operation BO, Reclamation has in the past coordinated proposed temporary DCC closures with the DOSS Group and will continue to do so over the five-year study period. Because fall water quality may be important to Delta smelt, Reclamation will also coordinate experimental closures of the DCC with the Delta Smelt Working group (DSWG).

Reclamation will also coordinate experimental DCC closures with potentially affected parties, including the CALFED Operations Group, to ensure that operations of Delta drinking water suppliers are not affected. DCC operational changes can affect water quality even without violations of D-1641 standards, and Reclamation and DWR will use DSM2 modeling and real-time monitoring of water quality conditions to ensure that the changes to Delta water quality from DCC experimental closures do not cause adverse operational effects.

The timing of the proposed action coincides with the most favorable tidal cycle. The operational criteria included as part of the proposed action are designed so

that potential impacts to water quality would be de minimis, as the limited closure of the DCC would be timed based on existing conditions in each October so that no water quality objectives would be exceeded. Also, Reclamation will coordinate with DWR to model salinity at several locations (Table 2) and will adapt the duration of the proposed action if the proposed action's Delta water quality concern level criterion are exceeded in modeling runs completed prior to and during the proposed action period.

The status of salinity intrusion in turn may influence water supply, as mandatory export reductions are required when certain salinity parameters are exceeded. Therefore the impacts on salinity and water supply are linked. The proposed water quality concern level targets are designed to avoid reductions in water exports. If unanticipated impacts to water management capabilities are reported in the vicinity due to the proposed action, Reclamation will modify the duration of the closure as appropriate. The temporary nature of the closure (up to 10 days) and the commitment by Reclamation to open the DCC if water quality modeling or monitoring indicates compliance points are approaching concern levels, would avoid and minimize potential impacts to water supply from the proposed action. Reclamation and DWR will review new DSM2 modeling approximately half way through the proposed closure and earlier if unexpected water quality conditions are observed. Additionally, fall pulse flows from the San Joaquin River tributaries will be coordinated in close proximity to the timing of the proposed action to improve water quality conditions in the South Delta, therefore the proposed action would not result in adverse effects on water quality. Therefore, the proposed action would have a less than significant impact on water supply and water quality.

4.3 Recreation

4.3.1 Affected Environment

The DCC is approximately 12 to 15 feet deep, while the Sacramento River channel is deeper (approximately 26 feet). The DCC is shallower than the main channel and forms a "lip" in the eastern channel edge where the DCC begins. The DCC allows transit of low-overhead clearance boats when the gates are open, providing a shortcut between two waterway systems. Without this shortcut, a boater must travel the entire distance of Georgiana Slough and back upstream the entire distance of the North Fork of the Mokelumne River (or vice versa), adding several miles to the trip. One marina and two boat docks are located in the vicinity of the project area.

Common boating activities in the Delta are cruising, sailing, windsurfing, kiteboarding, canoeing, kayaking, picnicking, swimming, fishing, sightseeing, camping, waterskiing, wakeboarding, and using personal watercraft. The summer months (Memorial Day to Labor Day) are the peak times for most boating activities in the Delta, with the Fourth of July typically the single highest peak use

event of the year, followed by other summer weekends and special event days (Bay Delta Conservation Plan 2012).

4.3.2 Environmental Consequences

While closure of the DCC could potentially impact boaters by causing them to detour around the closure, the proposed action would occur outside of the peak recreation season, and would only occur for a maximum of ten days. Reclamation will release information to the press regarding details of the closure each fall prior to implementing the closure to ensure public awareness. Therefore, the proposed action would have less than significant impacts on recreation resources.

4.4 Cumulative Impacts

When considered with the impacts of other past, present and reasonably forseeable projects in the project area, the proposed action would not significantly contribute to cumulative impacts on any resource category. The proposed action is anticipated to have beneficial impacts on fisheries, including special status species.

5.0 Consultation and Coordination

Reclamation has engaged EBMUD, DFG, USFWS, NMFS, and DWR in a number of meetings to plan previous closures and these agencies will be engaged in planning for the proposed multi-year study. An administrative draft of this EA was circulated to these agencies for comment in June 2012.

5.1 Endangered Species Act

Reclamation completed informal consultation on the proposed action with the USFWS and NMFS in accordance with Section 7(a)(2) of the ESA (Appendix B). Reclamation has received concurrence from USFWS and NMFS with the determination that the proposed action is not likely to adversely affect listed species or their designated critical habitats.

5.2 Magnuson-Stevens Fishery Conservation and Management Act

The action area has been identified as Essential Fish Habitat (EFH)for Pacific salmon in Amendment 14 of the pacific Salmon Fishery Management Pan pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). NMFS determined that the measures included in the proposed action regarding decision making for the proposed temporary closure of the DCC gates

would avoid potential adverse effects to EFH, and thus provided no additional Conservation Recommendations in accordance with MSA.

5.3 Fish and Wildlife Coordination Act

NMFS and USFWS provided no additional recommendations on the proposed action in accordance with the Fish and Wildlife Coordination Act.

5.4 National Historic Preservation Act

The proposed undertaking by Reclamation to have the DCC gates closed during a portion of October to conduct a multi-year study of the subsequent effects on the return of LMR Chinook salmon to the Mokelumne River Hatchery has no potential to cause effect to historic properties pursuant to 36 CFR Part 800.3(a)(1).

5.5 Public Review

A public draft of this EA was posted for public review and comment from August 8, 2012 to August 23, 2012. Comments received from Contra Costa Water District on the public draft EA have been incorporated into this final EA. A press release was issued by the Bureau of Reclamation's Mid-Pacific Regional Public Affairs Office concurrent with the posting of this Final EA.

6.0 List of Preparers

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