NOVEMBER 2012

TITLE OF ENVIRONMENTAL REVIEW	Draft Environmental Assessment for Nonessential Experimental Population Designation and 4(d) Take Provisions for Reintroduction of Central Valley Spring-run Chinook Salmon to the San Joaquin River Below Friant Dam
RESPONSIBLE AGENCY AND CONTACT	Rhonda Reed National Marine Fisheries Service Protected Resources Division Central Valley Office 650 Capitol Mall, Suite 500 Sacramento, CA 95814
LOCATION OF PROPOSED ACTIVITIES	The San Joaquin River Restoration Area from Friant Dam to the confluence of the Merced River, and portions of the Central Valley.
PROPOSED ACTION	National Marine Fisheries Service (NMFS) proposes to designate the establishment of Central Valley spring-run Chinook salmon to the San Joaquin River above the confluence of the Merced River as a nonessential experimental population under section 10(j) of the Endangered Species Act (ESA). NMFS also is proposing the establishment of take provisions under section 4(d) of the ESA for the experimental population and for the spring-run Chinook salmon reintroduced on the San Joaquin River below the confluence of the Merced River.

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DEFINITIONS AND ACRONYMS

APCD	Air Pollution Control District
BMP	Best Management Practices
Broodstock	Fish derived directly from Donor Stock which are raised to maturity from eggs, juveniles, or unripe adults, and reared at the Conservation Facility. Offspring from the broodstock would eventually be released to the San Joaquin River.
DFG	California Department of Fish and Game
DFW	California Department of Fish and Wildlife
DWR	California Department of Water Resources
cfs	cubic feet per second
CO2	Carbon dioxide
CV	Central Valley
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
^{o}F	Degrees Fahrenheit
DO	dissolved oxygen
Donor Stock	Includes any individual Chinook collected at any life stage, from any particular donor source stream.
DSC Plan:	Donor Stock Collection Plan; The proposed formal request made to NMFS via USFWS for annual donor stock collection
EA	Environmental Assessment
Escapement	That portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.
ESA	Endangered Species Act
ESU	Ecological Significant nit

FMP	Fisheries Management Plan
FMWG	Fisheries Management Work Group
FRFH	Feather River Fish Hatchery
FWA	Friant Water Authority
Genotype	The genetic makeup, as distinguished from the physical appearance, of an organism or a group of organisms.
GHG	greenhouse gas
Holding	The act of fish such as spring-run Chinook of staying within a given watershed before spawning.
HGMP	Hatchery and Genetics Management Plan
Jack	fish that returns a year early
Metapopulation	Consists of a group of spatially separated populations of the same species which interact at some level
MtCO2e	Metric Tonne (1,000 kg) Carbon Dioxide Equivalent. The standard measurement of the amount of CO2 emissions.
NEP	Nonessential population
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NRDC	Natural Resources Defense Council
PEIS/R	Program Environmental Impact Statement/ Report
Phenotype	The set of observable characteristics of an individual resulting from the interaction of its genotype with the environment.
RM	river mile
RWQCB	Regional Water quality Control Board
SFB	San Francisco Air Basin
SJFH	San Joaquin Fish Hatchery
SJRRP	San Joaquin River Restoration Program

SJVAB	San Joaquin Valley Air Basin
Spawning	the mass of eggs deposited by fishes, amphibians, mollusks, crustaceans, etc.
Spawner	Sexually mature individual
Spring-run Chinook	Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha)*
sorption	Used in chemistry: the taking up and holding of one substance by another. sorption includes the processes of absorption and adsorption.
SVAB	Sacramento Valley Air Basin
SWP	State Water Project
TDS	total dissolved solids
TMDL	Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant. Pollutant sources are characterized as either point sources, or nonpoint sources.
USFWS	United States Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Program

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SECTION 1 PURPOSE AND NEED

1.1 Introduction

NOAA's National Marine Fisheries Service (NMFS) proposes to establish rules pursuant to sections 10(j) and 4(d) of the Endangered Species Act (ESA) (16 U.S. Code of Federal Regulations [USC] 1531 *et seq*.) to allow for the release of Central Valley spring-run Chinook salmon (spring-run Chinook) as an experimental population into the San Joaquin River as part of the San Joaquin River Restoration Program (SJRRP) spring-run Chinook reintroduction process, and to define the take prohibition exceptions to section 9 of the ESA for said reintroduced fish.

1.1.1 Background

Over the past two centuries, development of water resources transformed the San Joaquin River. Since the 1880s, large areas of valley floor were converted to agricultural production with irrigation activities that modified the natural flow patterns. With the construction of Friant Dam on the San Joaquin River and the completion of Friant-Kern Canal and Madera Canal the Friant Dam diverted San Joaquin River water supplies to over 1 million acres of highly productive farmland along the eastern portion of the San Joaquin Valley. Operation of the dam ceased flow for portions of the approximately 153 miles of the river, preventing access to salmon spawning and rearing habitat, and extirpating salmon runs in the San Joaquin River upstream from its confluence with the Merced River.

The Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) (Spring-run Chinook) Evolutionarily Significant Unit (ESU) is listed as threatened under the ESA. The ESU includes all naturally spawned populations of spring-run Chinook in the Sacramento River and its tributaries in California, as well as non-adipose clipped fish from the Feather River Hatchery spring-run Chinook program (70 FR 37160). Hatchery produced, adipose fin-clipped fish are not protected under this listing (70 FR 37204). Critical habitat was established on September 2, 2005, and became effective on January 2, 2006 (70 FR 52488). Figure 1-1, taken from the Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead (Draft Recovery Plan) (NMFS, 2009a) shows the current and historical distribution of spring-run Chinook and the established ESU. Note that all current spring-run Chinook watersheds are located in the Sacramento River basin.

1.1.2 Settlement and Statute

In 1988, a coalition of environmental and fishing groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging renewal of long-term water service contracts between the United States and Central Valley Project (CVP) Friant Division contractors. After more than 18 years of litigation of this lawsuit, known as *NRDC, et al., v. Kirk Rodgers, et al.*, a Settlement was reached (Settlement). On September 13, 2006, the Settling Parties, including

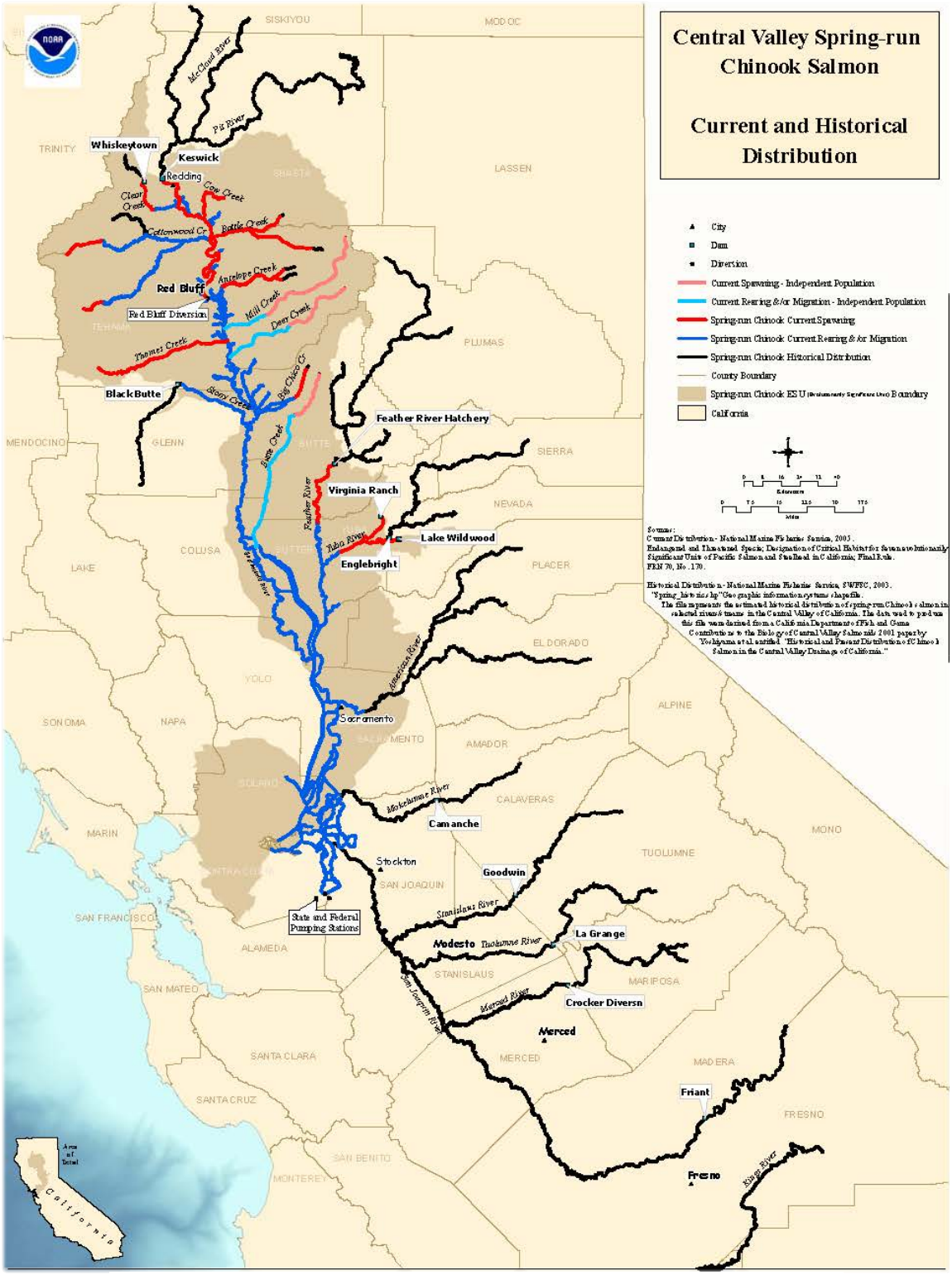


Figure 1-1. Current and Historical Distribution of Central Valley Spring-run Chinook Salmon (from Draft Recovery Plan [NMFS 2009a]).

NRDC, Friant Water Users Authority [now the Friant Water Authority], and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement, which was subsequently approved by the U.S. Eastern District Court of California on October 23,2006. Implementation of the Settlement is accomplished through the SJRRP.

The Implementing Agencies of the SJRRP are the Bureau of Reclamation (Reclamation) and Fish and Wildlife Service (USFWS) from the Department of Interior, the National Marine Fisheries Service (NMFS) from the Department of Commerce and, by Memorandum of Understanding, from the State of California, the Department of Fish and Game [now the Department of Fish and Wildlife (DFW)] and the Department of Water Resources (DWR).

The Settlement establishes two primary goals:

Restoration Goal – To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

Water Management Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim flows and Restoration Flows provided for in the Settlement.

Paragraph 14 of the Settlement states that the Restoration Goal "shall include the reintroduction of spring-run and fall-run Chinook salmon to the San Joaquin River between Friant Dam and the confluence of the Merced River." Because fall-run Chinook are not listed as threatened or endangered their reintroduction is not analyzed in this EA (see section 1.4.1).

The Federal Implementing Agencies are authorized to carry out the Settlement by the San Joaquin River Restoration Settlement Act (Restoration Act) (Pub. L. 111-11, 123 Stat. 1349 (2009)). This legislation also mandates that spring-run Chinook reintroduced into the San Joaquin River under the SJRRP shall be as an experimental population pursuant to section 10(j) of the ESA of 1973 (16 U.S.C. 1539(j)). The Restoration Act further requires NMFS to prepare a rule pursuant to 4(d) so that reintroduction will not impose more than "*de minimus*: water supply reductions, additional storage releases, or bypass flows on unwilling third parties." Consequently, in order to release spring-run Chinook into the wild under the SJRRP, NMFS is required to complete the rulemaking necessary to designate an experimental population for the San Joaquin River and promulgate 4(d) rules for that experimental population.

Section 10(j) and section 4(d) allow exemption to section 9 take prohibitions, when, for the conservation of the species, regulatory flexibility will allow greater likelihood of successful introduction and reduce landowner concerns. Adoption of regulations does not require reintroduction of the species. Physical activities to implement reintroduction requires permitting of specific actions as covered by sections 10(a)(1)(A) and 4(d).

The Environmental Assessment (EA) analyzes the effects of the actions necessary to fulfill certain requirements of the Restoration Act, and the Settlement – including an analysis of the potential effects of the establishment of the experimental population (section 10(j)) area, the release of spring-run Chinook to the San Joaquin River, and the potential effects to the ESU. As a threatened species the existing population of spring-run Chinook in the Sacramento River basin has specific existing take exemptions established under section 4(d) of the ESA and set forth in 50 CFR Part 223 (NOAA, Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs, 70 Fed. Reg. 37160 (June 28, 2005)). The EA also analyzes the potential effects of establishing new take exemptions under section 4(d) of the ESA for the reintroduced fish.

1.2 Endangered Species Act

1.2.1 NMFS Responsibilities for Management under the Endangered Species Act

When Congress enacted the ESA, it vested responsibilities for management of species listed as threatened and endangered to the Secretaries of the Interior and Commerce (Secretaries). Most of the ESA mandates require the Secretaries to manage species and listed populations through promulgation of protective regulations and establishment of prohibited acts; development and implementation oversight of recovery plans; management of listing determinations and subsequent management decision-making; review, approval, and oversight of applicant-requested program and permit approvals and hardship exemptions; and management of inter-agency consultations related to the conservation of listed species[1]. As an agency within the Department of Commerce, the NMFS is responsible for the management of ESA conservation programs related to marine and anadromous fish species (http://www.nmfs.noaa.gov/pr/laws/esa/)[2]

[1] Examples of Department of Commerce management responsibilities for listed species conservation can be found throughout the ESA, including the critical habitat program definition ("…those physical or biological features… (II) which may require special management considerations or protection…") (16 USC1532 (5)(A)(i)), the basis for listing determinations ("the Secretary shall implement a system to monitor effectively the status of all species…")(16 USC 1533 (b)(3)(C)(A)(iii)), and recovery planning (The Secretary shall develop and implement plans…for the conservation and survival of endangered species and threatened species…") (16 USC 1533 (f)(1)).

[2] The mission statement for the NMFS Southwest Region is to conserve, protect, and manage Pacific salmon, groundfish, halibut, and marine mammals and their habitats under the Endangered Species Act (ESA) and other federal laws (http://www.swr.noaa.gov/).

1.2.2 Statutory and Regulatory Framework To Be Followed

The June 2005 Federal Register notice (June 28, 2005, 70 FR 37160) presented the final listing determination for 16 ESUs of West Coast Salmon, which included Central Valley spring-run Chinook. In addition to determining the status of each salmon ESU (i.e., whether it was endangered or threatened) the Federal Register notice also included an announcement that the hatchery fish populations within the specific ESU would be included in the listing determinations for the ESU. NMFS further announced that it had amended the section 4(d) protective regulations for threatened salmonid ESUs to exclude listed hatchery fish marked by a clipped adipose fin from the ESA take prohibition; and simplified existing 4(d) protective regulations so that the same set of limits apply to all threatened salmonid ESUs (June 28, 2005, 70 FR 52488). Therefore, in the case of spring-run Chinook in the Sacramento River Basin, it was determined that the population was threatened, but those fish from the Feather River Hatchery marked by a clipped adipose fin would not be included in the ESA take prohibitions according to the amended section 4(d).

The ESA Section 4(d) leaves it to the Secretary of Commerce's (Secretary) discretion whether and to what extent to promulgate protective regulations for threatened species. Section 4(d) states that ''[w]henever a species is listed as a threatened species …, the Secretary shall issue such regulations as *he deems necessary and advisable* to provide for the conservation of such species [emphasis added]. ''The Secretary may … prohibit with respect to any threatened species any act prohibited under section 9(a)(1) … with respect to endangered species.'' This gives the Secretary flexibility under section 4(d) to tailor protective regulations that appropriately reflect the biological condition of each threatened ESU and the intended role of listed hatchery fish (June 28, 2005, 70 FR 37160).

For the purposes of this document, reintroduction is defined as the deliberate release of a species into the wild from captivity or relocated from other areas where the species still survives, in zones formerly inhabited by said species but from where it has disappeared for a number of reasons, , with the expectation that such a release will contribute to the re-establishment of a population or populations of the species.

Under the Settlement, reintroduction of spring-run Chinook in the San Joaquin River will occur as a process over a number of years. Implementation of the restoration actions planned in the Settlement are necessary to allow a reasonable expectation that a portion of those fish released into the river would complete their life cycle and contribute to future generations of the population. Reintroduction will begin with actions appropriate to existing habitat and to refining methods that would be used. Succeeding actions are expected to have more likely success as the habitat improvements and accompanying actions in the Settlement are implemented.

Individuals that are used to establish the experimental population may be collected from an existing donor population, provided their removal will not appreciably reduce the likelihood of the survival and recovery of the donor population, and provided appropriate permits are issued in accordance of section 10(a)(1)(A). Under section 10(a)(1)(A), Federal and non-Federal entities

may apply for permits from NMFS to take ESA-listed species under the jurisdiction of NMFS, if such taking is for scientific purposes or to enhance the propagation or survival of the affected species. Actions that may affect listed species are reviewed by NMFS through section 7 or section 10 of the ESA. Authorization for the collection of spring-run Chinook and issuance of 10(a)(1)(A) permits is a discretionary action of NMFS and is analyzed separately.

The approach for reintroduction will include use of a conservation hatchery facility to assist the establishment of the population (Reclamation and DWR, 2011). The USFWS submitted in December 2011 a 10(a)(1)(A) permit application for collection of broodstock from the Feather River Fish Hatchery (FRFH) for development of culturing techniques that could be used in the reintroduction of spring-run Chinook to the San Joaquin. This permit was approved by NMFS in October 2012. This permit allows a captive broodstock, but no release of these fish. Subject to additional permits these fish could be used as founding stock for release to the river.

Under section 10(j) of the ESA, 16 USC 1539(j), the Secretary can designate reintroduced populations established outside the species' current range, as "experimental" and criteria for the designation are identified. NMFS has not adopted guidance on establishing 10(j) rules. NMFS is preparing the proposed section 10(j) rule using USFWS guidance for CFR 50 17.80 to 17.83. The term "experimental population" means an introduced and/or designated population (including any off-spring arising solely therefrom) that has been so designated only when, and at such times as the population is wholly separate geographically from nonexperimental populations of the same species. Where part of an experimental population overlaps with natural populations of the same species on a particular occasion, but is wholly separate at other times, specimens of the experimental population will not be recognized as such while in the area of overlap. That is, experimental status will only be recognized outside the areas of overlap. The designation and release must further the conservation of the species. The designation and release must be done through rulemaking that identifies the location of the population, and must state whether the population is essential or nonessential to the continued existence of the species.

A population would be considered nonessential if the loss of the experimental population would not reduce the prospect for future survival of the species in the wild. The experimental population is designated as a threatened species regardless of the species' designation elsewhere in its range. For the purpose of section 7 interagency consultations, a nonessential experimental population is considered a candidate species and a conference opinion is utilized (unless it occurs in a National Wildlife Refuge or National Park, where it is treated as threatened). No critical habitat can be designated for nonessential populations, while critical habitat can be designated for those populations that are deemed to be essential. Section 7 applies to actions by Federal agencies, thus section 7 consultations are not required for activities by non-federal entities, or undertaken on private land unless they are authorized, funded, or carried out by a Federal agency.

1.3 Relationship of the Proposed Experimental Population to Recovery Efforts

The Draft Recovery Plan (NMFS 2009a) has the overarching aim of recovering the spring-run Chinook ESU so that it may warrant removal from the threatened species list. The recovery

strategies and actions proposed in the Draft Recovery Plan will protect and improve ecosystem functions and restore normative ecological processes to levels that support recovery of spring-run Chinook populations. The actions reflect direction identified in regional and local plans, recent modeling and research findings, and local expert input provided by the planning team members. Together, these strategies and actions call for maintaining high quality habitats and their productive capacity, improving ecosystem processes and habitats that are impaired, but are currently important to productive capacity, and habitat restoration through passive and active measures. The conceptual recovery strategy for the spring-run Chinook ESU incudes (1) securing extant populations by implementing key habitat restoration actions and (2) establishment of additional viable independent populations in the ESU. Introduction of the proposed experimental population of spring-run Chinook to the San Joaquin River repopulates the Southern-Sierra Nevada Diversity Group, and further support the recovery of the species.

1.3.1 Regulatory Issues That Are to be Addressed by Designation.

1.3.1.1 Proposed Designation will Further the Conservation of the Species

The Settlement establishes a framework for accomplishing the Restoration and Water Management goals that will require environmental review, design, and construction of projects over a multiple-year period. To achieve the Restoration Goal, the Settlement calls for a combination of channel and structural modifications, and habitat improvements along the San Joaquin River below Friant Dam, releases of water from Friant Dam to the confluence of the Merced River (referred to as Interim and Restoration flows), and the reintroduction of Chinook salmon. With these actions, the prognosis for spring-run Chinook populations to return is good (NMFS 2009a). The 10(j) designation and 4(d) rule will further the conservation of the species and will incorporate all reasonably feasible measures to avoid and minimize the impacts of any taking allowed, while also meeting the Restoration Act's commitment to only *de minimus* impacts to water supply reductions, additional storage releases, or bypass flows on unwilling third parties. Furthermore, NMFS will ensure, through the section 10 permitting authority and the section 7 consultation process, that the use of animals from any donor population for these reintroductions is not likely to jeopardize the continued existence of the species.

1.3.1.2 The Proposed Experimental Population is Nonessential

Under ESA section 10(j)(2)(B), before authorizing the release of any experimental population, NMFS, as the responsible agency, must determine whether or not such population is essential to the continued existence of the species. The existing ESU includes three independent wild, and one hatchery supported population. Genetic heterogeneity exists among the wild populations. Although current spring-run Chinook abundance trends are down in recent years, restoration activities on Clear Creek, Battle Creek, and Butte Creek have allowed persistent populations of spring-run Chinook to return. In 2006, the Butte Creek population abundance exceeded 10,000 adults. Early indicators in 2012 suggest a comparably large run will occur. In Battle Creek, spring-run Chinook returns reached the highest on record in 2012 at over 800 fish. Another factor to consider is that NMFS will use the section 10 permitting authority and the section 7

consultation process, to ensure that the use of fish from any donor population for this reintroduction is not likely to jeopardize the continued existence of the spring-run Chinook ESU and will further the conservation of the species. Given the existence of several extant populations and additional restoration actions underway on Butte Creek, and other watersheds, to benefit spring-run Chinook, the continued existence of the species is not dependent on a population on the San Joaquin River. Consequently, this experimental population will be designated as a nonessential experimental population (NEP).

1.4 Use of Previous Environmental Documentation for the Environmental Assessment

1.4.1 San Joaquin River Restoration Program Environmental Impact Statement/Report

Implementation of the restoration program for the San Joaquin River requires an analysis of the potential environmental effects under the National Environmental Policy Act and for program aspects and actors subject to state law, the California Environmental Quality Act. The SJRRP Program Environmental Impact Statement/Report (SJRRP PEIS/R) evaluated the potential direct, indirect, and cumulative impacts on the environment at a program level that could result from implementing the Settlement consistent with the Restoration Act (Reclamation and DWR 2011). Program level analysis of habitat and conveyance (channel improvement) projects and the reintroduction of "Chinook salmon"(Reclamation and DWR 2011), Although the Settlement established a priority for the reintroduction of spring-run Chinook the SJRRP PEIS/R analyzed the reintroduction of Chinook salmon which would include both fall-run and spring-run at the programmatic level. The SJRRP PEIS/R also analyzed, at a project level of detail, the potential direct, indirect, and cumulative impacts that could result from implementing certain aspects of the Settlement, including release, conveyance, and recapture of Interim and Restoration flows. In addition, the SJRRP PEIS/R included feasible mitigation measures to avoid, minimize, rectify, reduce, or compensate for significant adverse impacts.

As a programmatic document, the SJRRP PEIS/R provided information for use in the environmental analysis of the future site specific projects located within an area identified as the Restoration Study Area, an area that included lands above Friant Dam and north of the Merced River. An example of this information is the description of the existing conditions along the San Joaquin River. The SJRRP PEIS/R has a discussion of Biological Resources in two chapters, the first chapter for the fisheries in the region and the second covering vegetation and wildlife. In the chapter on fisheries, the SJRRP PEIS/R presented the existing conditions of all of the fisheries within the area to be restored as well as the conditions further downstream and upstream of the proposed Restoration Area where the SJRRP project will be done.

The analysis in the SJRRP PEIS/R for the most part describes the potential impacts to existing fish populations from the restoration program activities. However, the SJRRP PEIS/R included a discussion as to the possible use of fish stocks, taken from outside of the basin, and the use of hatchery stock and the development of broodstock at a hatchery facility located near Friant Dam.

The SJRRP PEIS/R also analyzed reintroduction of spring-run Chinook with regard to hybridization between spring-run Chinook and fall-run Chinook, competition between reintroduced spring-run Chinook and fall-run Chinook on the San Joaquin River tributaries, and disease entering the San Joaquin from use of out-of-basin spring-run Chinook stock. However, analysis of the potential effects of the reintroduction of spring-run Chinook to the San Joaquin River was considered only at the program level. As stated in the Draft SJRRP PEIS/R (and amended in the Final SJRRP PEIS/R):

> This Draft PEIS/R identifies potential system effects associated with reintroducing salmon. … Specific environmental effects related to the reintroduction of spring-run Chinook salmon would be addressed in the subsequent project-specific NEPA analysis, and possibly CEQA analysis, in compliance with an associated Special Rule authorizing the experimental population (Reclamation and DWR 2012).

Some information from the PEIS/R was incorporated by reference in this EA.

1.4.2 Fisheries Management Work Group Documents

The SJRRP Fisheries Management Plan (FMP) was created by the Fisheries Management Work Group (FMWG) to provide a roadmap to adaptively manage efforts to restore and maintain naturally reproducing and self-sustaining populations of Chinook salmon and other fish in the San Joaquin River between Friant Dam and the confluence with the Merced River (SJRRP 2009). The FMWG Genetics Subgroup developed a strategy for selection of donor stock for collection for the reintroduction of spring-run Chinook (Stock Selection Strategy SJRRP 2010). This document provided background information for development of this reintroduction strategy. The FMP and Stock Selection Strategy were used in developing possible alternatives.

1.4.3 Central Valley Spring-run Chinook Salmon and Steelhead in the Sacramento River Basin Background Report

The discussion of the Affected Environment (Section 3 of this EA) within the Restoration Study Area used sections from the SJRRP PEIS/R. Information for those areas outside of the Restoration Study Area was taken from either the Stock Selection Strategy (SJRRP 2010) or the Central Valley Spring-run Chinook Salmon and Steelhead Sacramento Basin Background Report (Sacramento Background Report) prepared by the DWR (DWR 2009).

The Stock Selection Strategy identified Clear Creek and Battle Creek as potential donor stock sources (see section 3.0 Action Area, below). However, the strategy document then focused on only four of the upper Sacramento River tributaries (i.e., Feather River, Deer Creek, Mill Creek, and Butte Creek). The Sacramento Background Report was used for description as to the existing conditions along Clear Creek and Battle Creek.

1.5 Purpose and Need Statement

The National Environmental Policy Act (NEPA) regulations require a statement of "the underlying purpose and need to which the agency is responding in proposing the alternatives, including the Proposed Action" (40 Code of Federal Regulations (CFR) 1502.13).

The purpose of the Proposed Action is to reintroduce spring-run Chinook into the San Joaquin River, by implementing the provisions of the Restoration Act, thereby fulfilling aspects of the Settlement, the Restoration Act, and elements of the Draft Recovery Plan. The ESA section 10(j) and 4(d) proposed rules allow for the reintroduction of spring-run Chinook, as an experimental population, into the San Joaquin River as part of the SJRRP as conditioned by the Restoration Act. The experimental population and the take provisions directly support the terms of the Settlement.

The need for the action is to restore and maintain fish populations in the mainstem San Joaquin River, including Chinook salmon, in order to implement the provisions of the Settlement as conditioned by the Restoration Act. The action also fulfills elements of the Draft Recovery Plan. To meet these goals, NMFS is proposing to release spring-run Chinook a species listed as threatened under the ESA into portions for the San Joaquin River that was part of its historic range and where the species does not currently exist. At the same time, the proposed 4(d) take provisions minimize the effect on certain otherwise lawful activities from the reintroduction of these fish. Further, the taking of fish must be done in such a way as to not jeopardize the already threatened source populations, while providing for a founding stock that is most likely to succeed in the reintroduction area.

1.6 Description of Action Area, Study Area, and Restoration Area

The following terms are used in this EA to describe where project related activities may occur. The Action Area of this EA (Figure 1-2) is the most inclusive area. The Action Area includes portions of the Sacramento River and San Joaquin River Basins, and the Sacramento-San Joaquin Delta (Delta). As proposed, watersheds within the Sacramento River Basin would be the source of donor stock and the San Joaquin Basin is the focal location of the reintroduction. However, some salmon may stray into accessible watersheds. Consequently the Action Area includes areas that salmon reintroduced into the San Joaquin River would use (i.e., the Delta) or may stray into.

The Sacramento River Basin supports the remaining extant spring-run Chinook populations. Sacramento River tributary watersheds that have runs include the Feather River, Yuba River, Deer Creek, Mill Creek, Butte Creek, Clear Creek and Battle Creek (SJRPP 2010). While there is a wild river spawning population, a component of the Feather River spring-run Chinook population is spawned at the FRFH.

Figure 1-2. Action Area: The action area that may be affected by the Proposed Action. For the area north of the Mokelumne River, the watersheds that could be affected would be inside of the Spring-run ESU boundaries established by ESA regulations. For the area south of the Mokelumne River, would consist of the areas established for the experimental population under 10(j) and Third Party 4(d) Provision area. See Figures 2-1 and 2-2 for boundary alternatives of the 10(j) and Third Party 4(d) Provision areas.

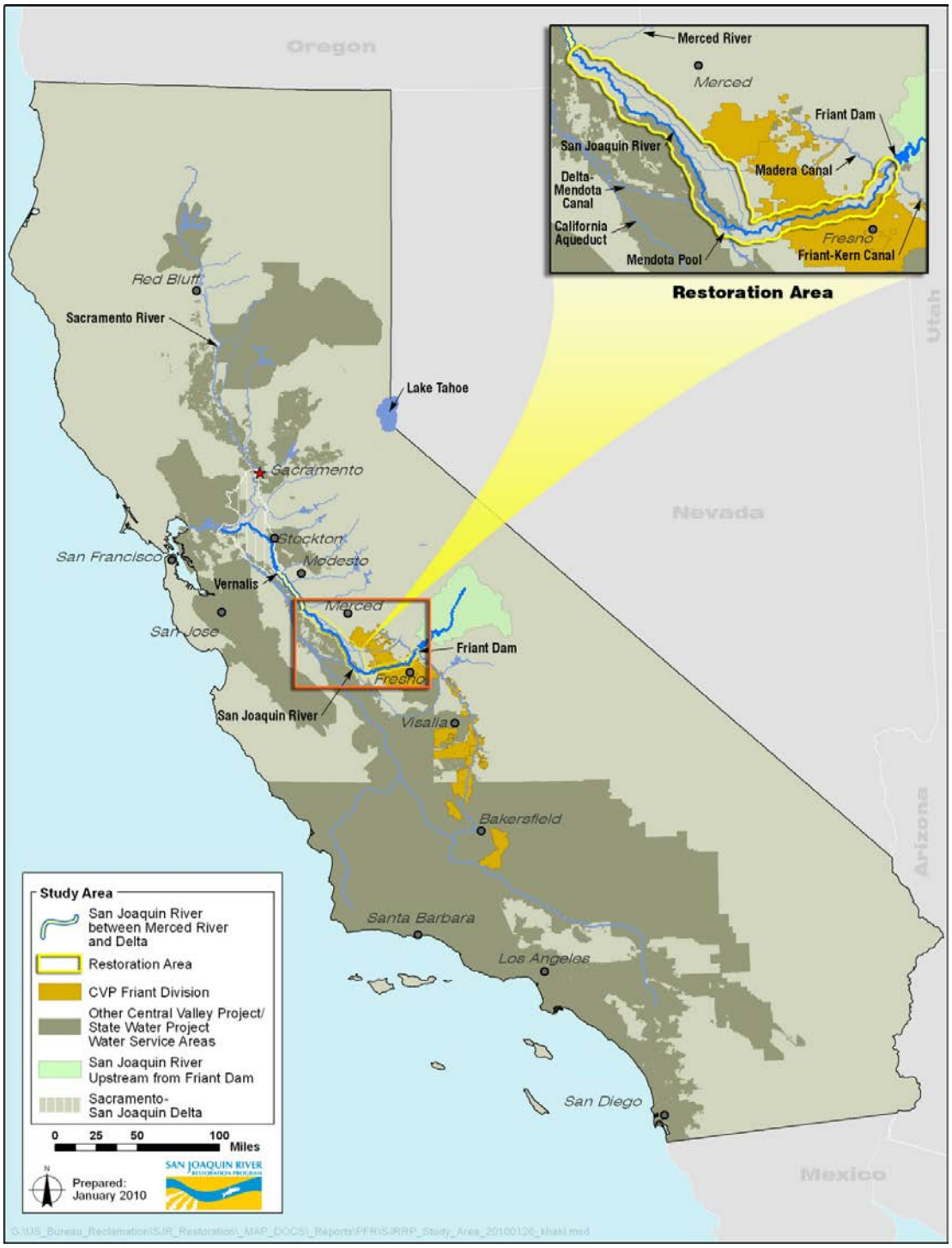
The SJRRP PEIS/R describes the San Joaquin River and surrounding area using two terms: Study Area and Restoration Area. The Study Area of the SJRRP consists of the San Joaquin River, the Delta and those portions of the CVP that are served by the Friant Division (Figure 1-3). The San Joaquin River from Friant Dam near the town of Friant, California, to the confluence of the Merced River is identified in the SJPPR PEIS/R as the Restoration Area since it is within this area that the SJRRP projects will occur (Figure 1-4). San Joaquin River conditions including riparian vegetation, geomorphology, and channel morphology are highly variable throughout the Restoration Area. The Restoration Area is about 153 miles long, and includes an extensive flood control bypass system (bypass system). The bypass system consists of a series of dams, bifurcation structures, flood channels, levees, and portions of the main river channel; and is managed to maintain flood-conveyance capacity. The basic features of the bypass system include: Fresno Slough (also known as James Bypass), the Chowchilla Bypass and Bifurcation Structure, and the Eastside and Mariposa Bypasses.

The Delta is a region where two of California's largest rivers meet. Freshwater from the Sacramento and San Joaquin rivers mingles with saltwater from the Pacific Ocean, creating the West Coast's largest estuary. It is composed of 57 leveed island tracts and 700 miles of sloughs and winding channels (DWR 2012). The Delta to the Pacific Ocean is considered part of the Action Area since waters, and to some extent fish populations, from the Sacramento and San Joaquin rivers can interact. The Pacific Ocean is not included in the analysis of this EA as the effects are expected to be nominal as a result of the comparative number of fish likely to be produced through the reintroduction and the extent of the proposed rule would not apply to the ocean.

1.7 Scoping

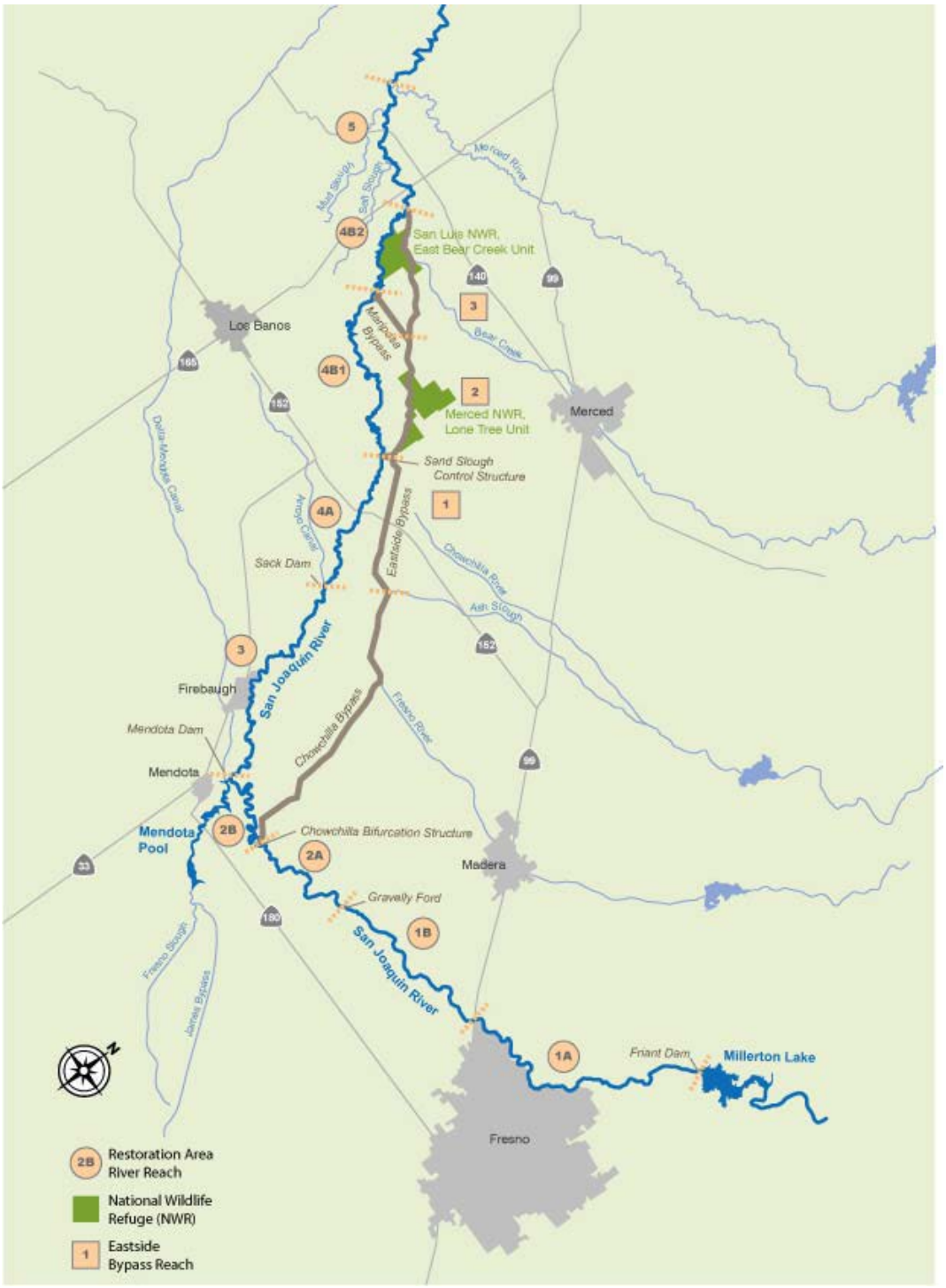
April 21, 2010 in the Federal Register: Publication of Notice of Intent to Prepare an Environmental Assessment and Conduct San Joaquin River Chinook Salmon Scoping Meeting announced that NMFS was going to prepare an EA to analyze the potential impacts of the proposed reintroduction of spring-run Chinook to the mainstem of the San Joaquin River. The Notice of Intent also included announcement of time and location of scoping meeting for the proposed document. As part of the scoping process the following events occurred:

- On April 28, 2010, scoping meeting on proposed EA held in Fresno, California.
- On November 15, 2010, NMFS sent 10 NEPA notification letters to federally recognized tribes in accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, to inform them that NMFS had begun planning for the preparation of an environmental assessment and public scoping process regarding the permitting and rule-making for reintroduction of spring-run Chinook to the San Joaquin River and to request comment.
- On November 15, 2010, NMFS sent 74 letters to non-federally recognized tribes requesting them to comment and/or participate in the public scoping process as interested parties.



Source: Reclamation and DWR 2012

Figure 1-3 San Joaquin Restoration Plan Study Area



Source: Reclamation and DWR 2012

Figure 1-4 San Joaquin River Restoration Area

- On February 2011, NMFS released the section 10(a)(1)(A) permit application for public comment from February 4, through March 7, 2011, and held public workshops in Chico on February 3, Fresno on February 7, and Los Banos, on February 8, for the section10(a)(1)(A) permit application. Although the permit was a separate action questions on the reintroduction and the experimental population process were raised and addressed.
- On April 7, 2011, NMFS met with the Southern Sierra Miwuk Tribe to discuss the spring-run Chinook reintroduction process.
- On May 17, 2011, SJRRP Fisheries Technical Feed Back Group Meeting was held at 2800 Cottage Way, Sacramento, CA. Public meeting at which the 10(a)(1)(A) permitting process and the 10(j) rule process were discussed.
- On November 1, 2011, SJRRP Restoration Goal Technical Feedback Group Meeting was held in Fresno, California. Public meeting at which the 10(a)(1)(A) permit process and the 10(j) rule process were discussed.
- On January 20, 2012, SJRRP Fisheries Technical Feed Back Group Meeting was held at 2800 Cottage Way, Sacramento, CA. Public meeting at which the 10(j) rule process was discussed.
- On March 2012, Focus Group meetings with State Water Contractors and flood management interests.

Of the 84 letters sent to federally and non-federally recognized tribes and a presentation made to the Southern Sierra Miwuk Tribe, one response was received in support of the plan to restore salmon, and no specific tribal interests were expressed regarding reintroduction. There are no tribal treaty or fishing rights affected by the proposed action. As a result, no further discussion of tribal interests will be part of this document.

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SECTION 2 PROPOSED ACTION AND ALTERNATIVES

The Proposed Action is the reintroduction of spring-run Chinook to the San Joaquin River. As part of the action the reintroduced population will have the designation of an experimental population pursuant to section 10(j) and take provisions in accordance to section 4(d) of the ESA. This action will allow implementation of the provisions of the Settlement as conditioned by the Restoration Act, thereby fulfilling the Settlement, the Restoration Act requirements, and elements of the Draft Recovery Plan.

As discussed in Section 1, the reintroduction of spring-run Chinook is a long-term process that will require many years of collecting, propagating, and releasing of salmon into the San Joaquin River. This reintroduction is being implemented as part of the SJRRP. Modifications to the conveyance structures and habitat conditions are being led by other agencies and are in progress. It is expected that, over time, habitat conditions will improve and there will be an increase in the potential success of the reintroduced salmon. However, habitat conditions are not currently consistently beneficial for salmon in all reaches of the San Joaquin River. Also, over the course of the reintroduction process, potential donor population abundance may vary widely on an annual basis in response to a variety of conditions. Consequently, the reintroduction process will be implemented in such a way that the collection of spring-run Chinook in any given year considers both the condition of potential donor populations and the likely success of reintroduced spring-run Chinook, given the status of the habitat.

The objectives of the Proposed Action are as follows:

1. Identification of the optimal source stock(s) that is most likely to result in the successful reintroduction of spring-run Chinook to the San Joaquin River.
2. Designation of a nonessential experimental population (NEP) for spring-run Chinook within the San Joaquin River using section 10(j) of the ESA.
3. Promulgation of take exemption measures using section 4(d) of the ESA for the conservation of the species, and to ensure that spring-run Chinook reintroduced to the San Joaquin River will not impose more than *de minimus* water supply reductions, additional storage releases, or bypass flows on unwilling third parties, as defined under Restoration Act section 10011(c)(1), due to such reintroduction.

2.1 Alternatives to Be Analyzed

2.1.1 No Action Alternative

Under the No Action Alternative the channel and habitat improvements proposed in the SJRRP would be carried out. However, there would be no collection of donor stock, no 10(j) designation of an experimental population, and spring-run Chinook would not be reintroduced intentionally to the San Joaquin River. Furthermore, there would be no take exemptions established within the San Joaquin River basin under a 4(d) rule, nor for persons or entities diverting or receiving water pursuant to applicable State and Federal laws. Any actions related to spring-run Chinook in the

San Joaquin River and associated tributaries and waterways would remain under the existing 4(d) rule for the Central Valley Spring-run Chinook Salmon ESU (50 CFR 223.203; 70 FR 37160).

The presence of some spring-running Chinook salmon on the Stanislaus and Tuolumne rivers indicates that re-colonization could occur on the San Joaquin River when conditions are favorable, but the process would likely be very long and would not achieve the Restoration Goal of the Settlement in a timely manner. Under the No Action Alternative, the existing 4(d) rule would apply to any strays entering the San Joaquin River and any natural colonization of the San Joaquin River.

2.1.2 Action Alternative Development

The development of Alternatives to the Proposed Action requires that each of the ESA parts of the Proposed Action are individually identifiable alternatives independent of the other parts, and may be implemented independently or in combination, with no change in the effect on the environment. This means that for the reintroduction of spring-run Chinook, the analysis is for the donor stock (i.e., Stock Source) alternatives, and the 10(j) and the 4(d) rule provisions. It should be noted that the alternatives being developed are for the reintroduction of spring-run Chinook. Even if spring-run Chinook are not reintroduced fall-run Chinook will be reintroduced, whether by natural recolonization or planting. Because of fall-run Chinook's status as a non-threatened or endangered species, and pervious analysis done in the PEIS/R, the reintroduction of fall-run Chinook was not fully analyzed in this EA. However, there is general information as to the location of fall-run Chinook population in the San Joaquin River basin in Section 3, Affected Environment. The potential effects of fall-run Chinook reentering the San Joaquin River upstream of the confluence of the Merced River are discussed in Section 4, Environmental Consequences.

Alternatives for the section 10(j) and 4(d) rule provisions include the extent of the nonessential experimental population designation area (NEP Area Alternatives) and the length of time the rules would be enforced (Duration Alternatives).

In addition to the Stock Source and the 10(j) and 4(d) rule provisions alternatives, described below, the EA is required to consider the No Action Alternative. Under the No Action Alternative, the SJRRP projects proposed to improve the habitat, flows, and water management would be carried out; however, the experimental population would not be established and the existing 4(d) rule (50 CFR 223.203, 70 FR 37160) pertaining to the Central Valley spring-run Chinook ESU would remain in force.

2.1.3 Common Activities

During the development of Alternatives it was found that there were a number of activities that would be common to each of the potential NEP Area Alternatives and Stock Source Alternatives. These common activities are discussed below.

2.1.3.1 Activities Common to Source Stock Alternatives

The physical activities required to collect, transport and propagate donor stock are expected to be the same regardless of the particular stock being collected. This analysis will address impacts associated with removing fish from a population, but the specific analysis of the impact of particular collection methods will be addressed in the analysis necessary for the proposed issuance of the 10(a)(1)(A) permit for that collection activity. In addition to the collection and transplantation methods, the following assumptions are common to all of the Alternatives, with the exception of the No Action Alternative.

- SJRRP Settlement is implemented including the reintroduction of Spring-run Chinook.
- Take of donor stock issued under section 10(a)(1)(A) will consider source population condition and San Joaquin River habitat condition.
- Implementing Agencies are responsible for success of the SJRRP.
- DFW coordination with NMFS on fishing regulations to accommodate the reintroduction.
- A conservation hatchery facility for propagation of spring-run Chinook will be utilized to minimize the number of individuals taken from existing populations.
- Release of spring-run Chinook would be from conservation hatchery facility broodstock, or from direct transfer of fish at appropriate life stages..
- Voluntary actions and partnerships that contribute to the conservation of the species will be encouraged.
- The San Joaquin experimental population's nonessential versus essential designation will be considered as part of the spring-run Chinook ESU five year periodic status review.

2.1.3.2 Activities Common to Section 10(j) and Section 4(d) Rule Alternatives

The Restoration Act requires NMFS establish a 4(d) rule governing incidental take of reintroduced spring-run Chinook that also ensures minimal impact from reintroduction to specific third party water users. Congressional intent is clearly stated that the effect of the reintroduction shall not incur additional liabilities to specific facilities that already affect spring-run Chinook of the ESU. This 4(d) rule is considered by NMFS only in light of the need to reintroduce spring-run Chinook to fulfill the Settlement and to further recovery of the species. It must apply to the ESU in a way to account for, and to discount the incidental take of individuals generated by the reintroduction to the San Joaquin River as a result of diverting or receiving water pursuant to Federal and State water rights.

The Restoration Act directs NMFS to apply the provisions of ESA section 10(j) for the reintroduction of spring-run Chinook to the San Joaquin River. Congressional intent for the inclusion of section 10(j) in the ESA is to allow for a less restrictive regulatory condition for reintroduction of ESA listed species, specifically to reduce local resistance to such reintroductions. The mechanism for reducing the regulatory burden is to develop specific

provisions regarding take that will apply to the experimental population, and their progeny, under the authority of section 4(d). In practice these provisions are broadly applicable, such that section 9 take prohibitions do not apply to take that occurs incidental to otherwise lawful activities.

ESA section 10(j) requires that an experimental population be geographically isolated from other populations of the species, so as to be distinguishable for the purposes of applicable take prohibitions.

For the purposes of this EA, the analysis of the section 10(j) and section 4(d) rule alternatives assumes the following common conditions:

- There will be a source of spring-run Chinook for the reintroduction.
- The experimental population will have a designated area.
- Within the experimental population designated area, direct take will be prohibited. This will include:
    - Angling
    - Take due to negligent actions
    - Take that occurs pursuant to an otherwise illegal activity.
- Provisions of the 4(d) rule will apply equally to hatchery adipose fin-clipped fish and intact fish.
- Within the experimental population's designated area, take exemptions will include:
    - Exemption for take incurred incidental to otherwise lawful activities
    - Take for scientific, research, or enhancement purposes, provided that it is permitted through a designated process
    - Take that may be allowed under a Fishery Management and Evaluation Plan developed by the State of California and approved by NMFS. This may include angling at a later time.
- In the area between the current designated boundary of the Central Valley spring-run Chinook salmon ESU and the designated experimental population, provisions under 4(d) will exempt take by specific third party water users of spring-run Chinook originating from the San Joaquin River. Take authorizations from the other provisions of the existing 4(d) rule for spring-run Chinook continue to apply to these populations (research, rescue, etc., see 50 CFR 223.203, 70 FR 37160).
- Other state and federal regulations that protect water quality, riparian habitat, other ESA listed species, and other environmental conditions will incidentally afford some protection of reintroduced spring-run Chinook from certain classes of harm, as defined in ESA section 9. The NEP will not change requirements applicable to other laws and regulations that are protective of the environment. In complement to the above and in addition to the proposed 4(d) rule, protective measures including programs for strategic screening and participation in habitat conservation programs will be implemented in conjunction with SJRRP activities and are intended to provide net benefit to reintroduction.

2.2 Stock Source Alternatives

For the reintroduction and establishment of a spring-run Chinook salmon population into the San Joaquin River, the SJRRP FMWG was tasked with identifying the potential donor stock sources. The FMWG Genetics subgroup developed a strategy for selection of donor stock for collection for the reintroduction of spring-run Chinook (SJRRP 2010). Only spring-run Chinook from the Central Valley ESU are considered for reintroduction as an experimental population. Populations of spring-run Chinook remain in Deer, Mill, and Butte creeks. Another spring-run Chinook population occurs in the wild on the Feather River below Oroville Dam; individuals from this population also are spawned at the FRFH. Spring-running salmon populations are re-establishing on Clear and Battle creeks (Newton and Brown 2004) and other dependent populations occur in the Sacramento River Basin (Lindley et al. 2004). The FMWG also identified the existence of periodic spring running adult salmon from the Stanislaus and Mokelumne rivers.

The primary goal of donor stock selection is to identify the stock(s) with the highest likelihood of establishing a self-sustaining, naturally reproducing population in the San Joaquin River Restoration Area (San Joaquin River between Friant Dam and the confluence with the Merced River). The development of the Stock Source Alternatives for analysis in this EA has to weigh the potential risk to the existing spring-run Chinook population being used as donor stock against the benefit of reintroduction of spring-run Chinook in the San Joaquin River.

A key component to identifying the "best" stock(s) is conducting genetic analyses of extant populations to ascertain the genetic integrity of all potential source populations. Measurement indices that are useful for analysis of potential donor stock(s) include, but are not limited to: effective population size, genetic comparisons to historic population in the upper San Joaquin River (if feasible); within population genetic diversity and inbreeding coefficient levels; among population genetic diversity; and hatchery influence. Optimum characteristics for the chosen donor population sources include:

- Be of local or regional origin (Central Valley)
- Have life history (behavioral and physiological) characteristics that fit conditions expected to occur on the San Joaquin River, thereby maximizing the probability of successful reintroduction
- Large effective population size
- High within-population genetic diversity with low inbreeding coefficients
- Adequate representation of overall ESU genetic diversity

The independent spring-run Chinook populations on Deer, Mill, and Butte creeks and in the Feather River may be the best candidate populations for this program, having relatively large effective population size or unique genetic profiles.

In developing donor stock alternatives and the subsequent analysis the following aspects were considered: genetic diversity, current population size, availability of donor stock, and compatibility of life history characteristics to anticipated restored Restoration Area conditions. Only spring-run Chinook populations from the Central Valley spring-run Chinook salmon ESU were considered because they experience habitat conditions most similar to expected conditions in the Restoration Area and to maintain the integrity of the common gene pool of the ESU.

Based on the Stock Selection Strategy (SJRRP 2010) the following Stock Source Alternatives are analyzed in this EA.

All Donor Stock Sources Alternative (Preferred Alternative): Under the All Donor Stock Source Alternative collection of donor stock would come, over time, from all of the identified donor stock watersheds: the Feather River, Deer and Mill Creeks, and Butte Creek. Under this Alternative there could also be opportunistic collecting of spring-run Chinook salmon in other watersheds (i.e., Clear and Battle creeks). This Alternative provides for the widest range of genetic variation in the reintroduced population and the highest likelihood of success. However, as described earlier, current habitat conditions in the Restoration Area are not consistently suitable to support salmon. Additionally, the recent review of spring-run Chinook ESU status (NMFS 2011) identified wild spring-run Chinook abundance as being a declining trend (NMFS 2011). Also, the conservation hatchery facility is not yet fully functional. Therefore the analysis of the All Donor Stock Sources Alternative will consist of an analysis of a phased collection of donor stock.

FRFH is a consistent source of spring-run Chinook. The facility may plan for sufficient production to allow individuals to be collected with no effect on the population or the ESU. Individuals will be collected at a life history stage that is most appropriate. For example, broodstock collections may be best done at the egg stage but direct release may be more successful with juvenile fish. Initially, when channel and habitat improvements are in development, collections for direct release to the San Joaquin River would rely on FRFH eggs and juveniles. Broodstock development would also rely on FRFH eggs unless wild populations were sufficiently abundant to support collection of individuals whose genetics could be integrated into the broodstock program, guided by a NMFS approved Hatchery and Genetics Management Plan. Over time it is anticipated that the proportional representation of FRFH genotypes will be balanced with genotypes from other donor sources. Over time, broodstock at the conservation hatchery facility will produce juveniles that will be released to the river in sufficient numbers to enable, in combination with SJRRP channel and habitat improvements, the return of sufficient adults to complete their life cycle. Ultimately, the fish will establish a naturally self-sustaining population of spring-run Chinook, and the conservation hatchery contribution will be phased out. All collections of donor stock will require the application for and approval of section 10(a)(1)(A) permit(s), and associated NEPA and section 7 review.

Discussion of both the phased introduction and use of all the donor stocks will include potential impacts to existing fish populations in the San Joaquin River and the donor stock populations and to achieving the goal of a naturally self-sustaining San Joaquin River population.

Feather River Fish Hatchery (FRFH) Source Only Alternative: During the entire enhancement period the only donor-stock collected will be spring-run Chinook from the FRFH. In contrast to the All Donor Source Stock Alternative, analysis of the FRFH Source Only Alternative includes not going forward with collection of any donor stock outside of the FRFH.

Single Source Alternative: Under the Single Source Alternative, collection of donor stock would come from wild fish from only one of the independent donor stock watersheds: the Feather River, Deer and Mill Creeks, or Butte Creek. While Deer and Mill Creeks would be used as potential donor stock sources in combination with other stock sources in the All Donor Stock Source Alternative, the potential effect on their smaller population as the single source rules them out for consideration under this Alternative. Feather River spring-run Chinook have been heavily influenced by FRFH practices for spring and fall-run Chinook. Unlike carefully managed collection of spring-run Chinook from known hatchery crosses, it would be difficult to collect known spring-run Chinook from Feather River wild fish without additional handling and genetic testing and rejection of unsuitable fish. The spring-run Chinook population in Butte Creek is considered persistent and viable and is one of the most productive spring-run Chinook streams in the California Central Valley (NMFS 2009b). Therefore, the Single Source Alterative analyzes the effect of using Butte Creek as the single source of donor stock.

2.3 Section 10(j) Rule Alternatives.

2.3.1 10(j) Area Alternatives

Area 1 Alternative: Under this Alternative, the nonessential experimental population area (NEP area) would be established under the 10j of the ESA as shown on Figure 2-1. The area consists of the San Joaquin River south of Mossdale County Park, which is near the city of Manteca, to Friant Dam in Fresno County. If viewed that the mainstem of San Joaquin River forms the spine of the NEP area, the eastern side of the NEP area would include the San Joaquin River's main tributaries, the Stanislaus River to Goodwin Dam, the Tuolumne River to the La Grange Dam, and Merced River to Merced Falls Dam, their associated watersheds and any other eastern watersheds that feed directly into the San Joaquin River.

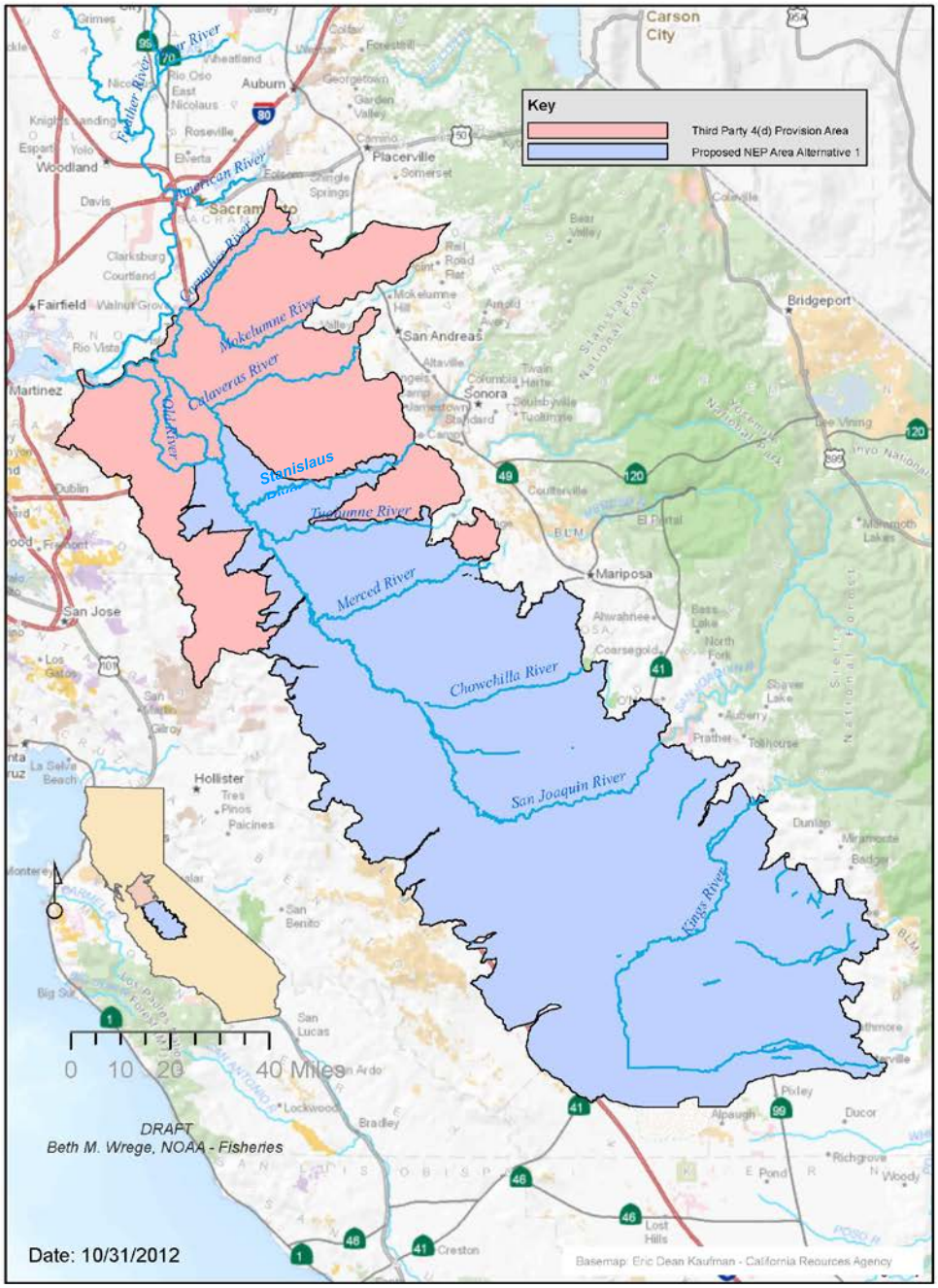


Figure 2-1. 10(j) Area Alternative 1 Based on HUC map for San Joaquin River

Note: A hydrologic unit code (HUC) is a map of a hydrological feature, therefore the map shows watershed for each stream or river. Not all of these water sources would support fish.

To the west of the San Joaquin River, Del Puerto Creek, Orestimba Creek, Los Banos Creek and numerous unnamed watersheds feeding into the San Joaquin River would also be included in the NEP area. There are a number of unnamed man-made conveyances used for the irrigation of the surrounding agricultural lands. While not natural waterways, salmon have been known to use canals so these would also be included. Lastly, in high water years, water from the Kings River may flow northward into the San Joaquin River using both natural and man-made conveyances such as Fresno Slough and James Bypass. During these periods of high water flows when the Kings River is connected to the San Joaquin River, the Kings River and its associated watersheds up to Pine Flat Dam would also be considered to be within the NEP area.

Additionally, outside the experimental population's geographic designation and outside of the current ESU of the species (including portions of the San Joaquin River downstream of Mossdale County Park and in the Delta) the rule pursuant to section 4(d) of the ESA would exempt take of Central Valley spring-run Chinook that originate from the San Joaquin River as follows:

a. Take will be authorized for otherwise lawful activities relating to diverting or receiving water pursuant to applicable State and Federal laws, so that the reintroduction will not impose more than *de minimus* water supply reductions, additional storage releases, or bypass flows on unwilling third parties due to such reintroduction. For the purpose of the rule, the term ''third party'' means persons or entities not parties to the Settlement diverting or receiving water pursuant to applicable State and Federal laws and include Central Valley Project (CVP) contractors outside of the Friant Division of the CVP and the State Water Project (SWP).
b. Take will be authorized of spring-run Chinook at the CVP and SWP projects in the South Delta that originates from the San Joaquin River, including fish from the NEP experimental area. NMFS will annually determine by January 15 of each year the share of take at the CVP and SWP facilities that originates from the San Joaquin River. This determination will provide a methodology for deducting San Joaquin River origin spring-run Chinook salmon from the operational triggers and incidental statements associated with any biological opinion that is in effect at the time for operations of the CVP and SWP facilities.

Area Alternative 2 (Preferred Alternative): Under the Area Alternative 2, the NEP area would include the Restoration Area of the San Joaquin River (Figure 2-2), from Friant Dam to upstream of the confluence of the Merced River and the drainage of the Kings River as the geographic boundary for the experimental population designation. Provisions for the exemption of take within the NEP are described under the Common Activities.

Additionally, outside the experimental population's geographic designation and outside of the current ESU of the species (including portions of the San Joaquin River downstream of the Merced Confluence, tributaries to the San Joaquin River and in the Delta) the rule pursuant to section 4(d) of the ESA would exempt take of spring-run Chinook as follows:

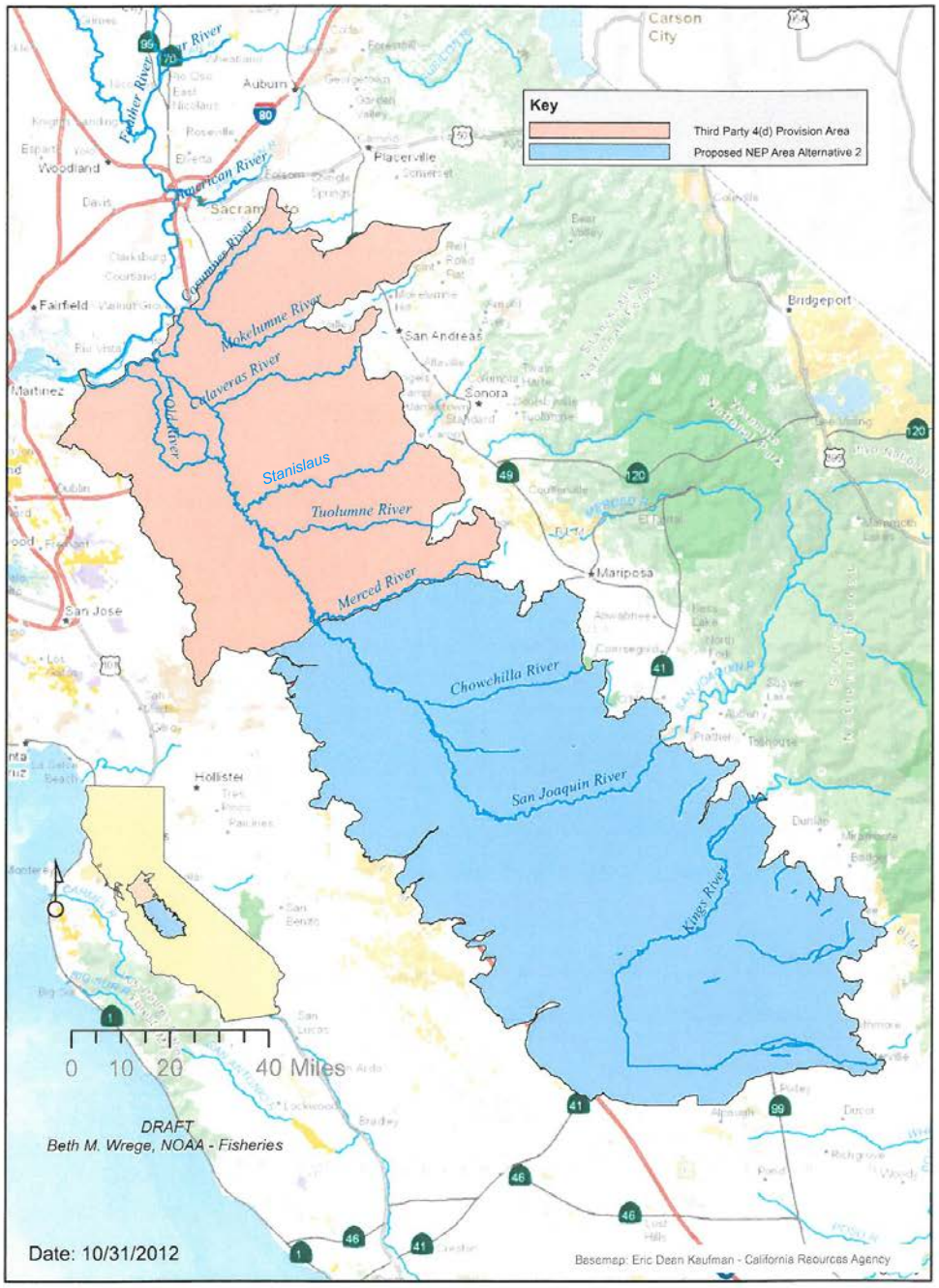


Figure 2-2 10(j) Area Alternative 2. HUC map for San Joaquin River south to the Merced River and the King River drainage would be the NEP area.

a. Take will be exempted for spring-run Chinook originating in the San Joaquin River within the Merced River, the Tuolumne River, and the Stanislaus River for otherwise lawful activities relating to diverting or receiving water pursuant to applicable State and Federal laws, so that the reintroduction will not impose more than *de minimus* water supply reductions, additional storage releases, or bypass flows on unwilling third parties due to such reintroduction. For the purpose of the rule, the term ''third party'' means persons or entities not parties to the Settlement diverting or receiving water pursuant to applicable State and Federal laws and include CVP contractors outside of the Friant Division of the CVP and the SWP.

b. Take will be authorized of spring-run Chinook at the CVP and SWP projects in the South Delta that originates from the San Joaquin River, including fish from the NEP experimental area. NMFS will annually determine by January 15 of each year the share of take at the CVP and SWP facilities that originates from the San Joaquin River. This determination will provide a methodology for deducting San Joaquin River origin spring-run Chinook salmon from the operational triggers and incidental statements associated with any biological opinion that is in effect at the time for operations of the CVP and SWP facilities.

2.3.2 10(j) Duration Alternatives

10(j) Duration Alternative 1: Under the Duration Alternative 1, the 10(j) experimental population designation will be in effect until December 31, 2025. This alternative is based on the assumption that the Restoration Goal is achieved and that achieving Restoration Flows and habitat improvements will provide for re-establishment of a natural, self-sustaining salmon population. Paragraph 20(a) of the Settlement identifies that in 2025 certain terms of the Settlement, including Restoration Flows, may be revised through a court process. The Restoration Act (section 10011(e)(1)) requires the Secretary to forebear on section 18 of the Federal Power Act (16 U.S.C. 811) prescriptions in Federal Energy Regulatory Commission proceedings on the Merced, Tuolumne, and Stanislaus rivers until 2025. The Restoration Act (section 10011(d)(1)) also requires a report to Congress in 2024 on status of the reintroduction. These three terms, singularly or in combination, could alter conditions for spring-run Chinook and the basis for the NEP designation in 2025.

10(j) Duration Alternative 2 (Preferred Alternative): Under the Duration Alternative 2, the 10(j) experimental population designation would remain in effect unless NMFS makes a determination that the level of protection afforded by the NEP no longer ensures protection and provides for conservation of the species. While there would be a formal review of the essential or nonessential status of the experimental population during future reviews of the status of the species that will occur every five years, as a whole there would no formal review regarding the maintenance of the experimental population itself. Any future proposed changes to the rule would be made through the federal rule-making process.

2.4 Alternatives Considered and Eliminated from Further Consideration

2.4.1 Stock Source Alternatives

Spring Stray Alternative: Under the Spring Stray Alternative, donor stock collection would occur through opportunistic collecting of early spring-running Chinook salmon adult strays on the Yuba, Stanislaus, and Mokelumne rivers and on Battle and Clear creeks. Current data indicates that the numbers of stray spring-running Chinook would not be large enough to establish a population on the San Joaquin River (Maslin *et al*. 1997, Snider 2001). Therefore, it is unlikely that enough fish could successfully be collected under this Alternative to meet the goal of restoring spring-run Chinook to the San Joaquin River. Additionally, collecting fish from the small developing runs on Clear and Battle creeks could prevent full establishment of these runs. Because it is likely that this alternative would not meet the goals of restoring spring-run Chinook to the San Joaquin River it has been eliminated from further consideration.

2.4.2 Section 10(j) Rule Alternatives.

2.4.2.1 10(j) Area Alternative 3

Under the Area Alternative 3, the NEP area would include only the Restoration Area of the San Joaquin River, from Friant Dam to the confluence of the Merced River as the geographic boundary for the experimental population designation. Under this alternative, the Kings River drainage would not be included. This alternative was rejected because unlike Area Alternative 2, during those years in which connectivity occurs between the San Joaquin River basin and the Kings River, any spring-run Chinook would not be considered part of the NEP, therefore it would be possible that third parties would be subject to ESA regulations under normal, legal activities in these areas. Therefore this Alternative does not give regulatory relief to third parties as intended in the Settlement and the Restoration Act.

2.4.2.2 10(j) Area Alternative 4

Under the Area Alternative 4, the NEP area would include only the main steam of the San Joaquin River from Friant Dam to Mossdale County Park as the geographic boundary for the experimental population designation. This alternative would exclude tributaries and the other waterways associated with the mainstem San Joaquin River. This alternative was not deemed to be reasonable, because Chinook salmon naturally exhibit some low levels of straying to non-natal streams, hence this NEP designation would not provide the regulatory relief to third parties that is intended in the Settlement and the Act.

2.4.2.3 10(j) Area Alternative 5

Under the Area Alternative 5, the NEP area would include, in addition to the NEP area designated in Area Alternative 1, the San Joaquin River north of Mossdale County Park. This

alternative was rejected because Delta juvenile salmonid monitoring indicates that existing spring-run Chinook are likely to occur downstream of Mossdale, and according to the section 10(j an experimental population is any population authorized by the Secretary for release, but only when, and at such times as, the population is wholly separate geographically from nonexperimental populations of the same species, i.e., isolated from other existing populations of the species. Individuals of the experimental populations will not be recognized as such while in the area of overlap with nonexperimental populations. That is, experimental status will only be recognized outside the areas of overlap. Since the area north of Mossdale County Park is likely to overlap the existing population this area, by law, cannot be included in the NEP area.

2.4.2.4 10(j) Duration Alternative 3

Under the Duration Alternative 3 the NEP would be monitored and the designation would be renewed and revised every five years in tandem with the status of the species review of the CV spring-run Chinook salmon ESU. This alternative time period was rejected because it has limited certainty for the human environment and does not fulfill the intent of the Restoration Act.

To summarize, Table 2-1 shows the matrix of Stock Source Alternatives and the 10(j) and 4(d) Rule Alternatives that are considered for analysis in the EA. Those alternatives that have been eliminated from further consideration are shaded.

Table 2-1 Alternatives Considered by Type (Blue Column) read left to right. Shaded alternatives were not analyzed.

No Action	Existing 4(d) take exemptions for spring-run Chinook would apply to strays and natural colonization. No new rules created				
Stock Source Alternatives	All Donors Stock Sources	Feather River Source Only	Single Source	Spring Stray	
10(j) Area Alternatives	**Area 1** Friant Dam to Mossdale; up major tributaries to first major anadromous barrier; including appurtenant drainages and conveyance (HUC's) and including Kings River drainage. Within the NEP area, incidental take allowed as a result of otherwise lawful activity. Directed take, including adipose-clipped fish, must be under permit or within California fishing regulations. 4(d) take exemptions apply to third party water activities between NEP area and designated ESU boundary at the CVP and SWP export facilities for reintroduced spring-run Chinook.	**Area 2** (*Preferred Alternative*) Restoration area south of the confluence with the Merced River to first major anadromous barrier; including appurtenant drainages and conveyance (HUC's) and including Kings River drainage. Take provisions within the NEP area are the same as Area Alternative 1. 4(d) take exemptions apply to spring-run Chinook for third party water activities on the San Joaquin River and tributaries between NEP area and Mossdale County Park and at the CVP and SWP export facilities.	**Area 3** Restoration area only excluding Kings River drainage.	**Area 4**: Mainstem only, from Friant Dam to Mossdale.	**Area 5** Area of Alternative 1 plus San Joaquin River north of Mossdale.
10(j) Duration Alternatives	**Duration 1** In effect through 2025	**Duration 2** (*Preferred Alternative*)No expiration	**Duration 3** Renewable with each 5 year spring-run Chinook status review		

SECTION 3 AFFECTED ENVIRONMENT

3.1 Introduction

The following section first presents a current status of spring-run Chinook within the project action area. The surrounding environment affected by this project, and thereby evaluated in this EA, includes portions of the Sacramento River (i.e., Deer, Mill, and Butte creeks) and the Feather River. Portions of the San Joaquin River which make up the proposed Restoration Area include the following tributaries: the Merced, the Stanislaus, the Tuolumne, and Mokelumne rivers. Also included are portions of the Delta. Finally, a description of additional fish species currently present in these areas, along with the current environmental conditions that affect spring-run Chinook in these locations, is provided below.

3.2 Central Valley Spring-run Chinook Salmon

3.2.1 Life History

Spring-run Chinook generally leave the ocean and enter the Sacramento River from March to July as immature fish. Lindley *et al*. (2007) indicate that adult spring-run Chinook enter native tributaries from the Sacramento River primarily between mid-April and mid-June. Typically, spring-run Chinook utilize mid-to high-elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering while conserving energy and allowing their gonadal tissue to mature (Yoshiyama *et al*. 1998).

Spring-run Chinook spawning occurs between late August and early October depending on water temperatures (NMFS 2002). Between 56 and 87 percent of adult spring-run Chinook that enter the Sacramento River basin to spawn are 3 years old (Calkins *et al.* 1940, Fisher 1994). The eggs are deposited in the gravel, where incubation, hatching, and emergence occur. The emergence of spring-run Chinook fry occurs from November to March, depending again on water temperatures (DFW 1998). Spring-run Chinook exhibit both of the freshwater life history types (i.e., stream-type and ocean-type) described by Healey (1991). The stream-type spring-run Chinook reside in freshwater for a year or more following emergence, and the ocean-type Chinook migrate to the ocean within their first year (DWR 2009). The fry use shallow, nearshore areas with slow current and good cover (DFW 1998). Higher elevation streams such as Mill and Deer creeks generally have a higher proportion of spring-run Chinook exhibiting the stream-type life history (DWR 2009). These juveniles spend 9 to 10 months in their natal streams and up to 18 months in freshwater (USFWS 1995, DFW 1998). In lower elevation streams such as Butte Creek, the juveniles exhibit more of an oceantype life history with a higher proportion of the production leaving the tributaries from December to February (DFW 2000). These young of the year (YOY) may rear in the bypasses, the lower Sacramento River, and the Delta until ready to enter the ocean (DWR 2009). DFG conducted a life history investigation on Butte Creek from 1995 to 2003 and found that spring-run that emigrated from the creek as yearlings contributed greatly to the ocean harvest rate, suggesting that yearlings survive at higher rates than YOY (DFG 2004b). In general, spring-run Chinook spend between 1 and 4 years in the ocean before returning to spawn (Myers *et al.* 1998).

3.2.2 Historical Distribution

Historically spring-run Chinook were the second most abundant salmon run in the Central Valley (CDFW 1998). These fish occupied the upper and middle reaches (1,000 to 6,000 feet) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The Central Valley Technical Review Team estimated that historically there were 18 or 19 independent populations of spring-run Chinook along with a number of dependent populations, all within four distinct geographic regions (diversity groups) (Lindley *et al.* 2004). Of these 18 populations, only 3 wild populations (Mill, Deer, and Butte creeks on the upper Sacramento River) currently exist (Draft Recovery Plan 2009a). In addition to these three extant populations, there are other tributaries within the Sacramento River that are known to contain populations of spring-run Chinook, such as the Feather River (Draft Recovery Plan 2009a). However, these populations all have low abundance, and/or are heavily influenced by hatchery origin spring-run fish from the Feather River hatchery (Draft Recovery Plan 2009a). The Central Valley drainage as a whole is estimated to have supported spring-run Chinook runs as large as 600,000 fish between the late 1880s and 1940s (DFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River alone (Fry 1961). Construction of other low elevation dams in the foothills of the Sierra Nevada on the American, Mokelumne, Stanislaus, Tuolumne, and Merced rivers, is thought to have extirpated spring-run Chinook from these watersheds of the San Joaquin River. Observations in the last decade suggest that perhaps a naturally occurring population may exist in the Stanislaus and Tuolumne rivers (Franks 2012). Naturally-spawning populations of spring-run Chinook currently are restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and the Yuba River (DFG 1998).

3.2.3 Current Distribution

Much of the historical habitat of spring-run Chinook is currently blocked by dams (DWR Background Report 2009). On the Feather River, only 35 km (22 miles) of habitat on the mainstem below Oroville Dam remains, and there is no spatial or temporal separation between spring-run and fall-run Chinook (Schick *et al.* 2005). This has resulted in the hybridization of the two runs from in-river spawning and past hatchery operations (Yoshiyama *et al.* 2001). However, an early-returning population persists within both the Feather and Yuba rivers, and is supported by FRFH operations (Yoshiyama *et al.* 2001, DWR 2007, Lindley *et al.* 2007).

3.2.4 Viable Population Summary for Spring-run Chinook

3.2.4.1 Abundance

From 2001 to 2005, the spring-run Chinook ESU has experienced a trend of increasing abundance in some natural populations, most dramatically in the Butte Creek population (Good *et al.* 2005). The non-adipose clipped FRFH spring-run Chinook has been included in the ESU

based on its genetic linkage to the natural population and the potential development of a conservation strategy for the hatchery program. In contrast to the first half of the decade, the next 5 years (2006 to 2010) of adult returns indicate that population abundance declined from the peaks seen in the 5 years prior for the entire Sacramento River basin. The recent declines in abundance place the Mill and Deer creek populations in the high extinction risk category due to the rate of decline and, in the case of Deer Creek, also the level of escapement. Butte Creek has sufficient abundance to retain its low extinction risk classification, but the rate of population decline in the past several years is nearly sufficient to classify it as a high extinction risk based on this trend (Lindley *et al.* 2007).

3.2.4.2 Productivity

The geometric mean for the extant Butte, Deer, and Mill creek spring-run Chinook populations between 2001 and 2005 ranged from 491 to 4,513 fish, indicating increasing productivity over the short-term (Good *et al.* 2005). The productivity of the Feather and Yuba river populations and contribution to the spring-run Chinook ESU currently is unknown (Good *et al.* 2005).

3.2.4.3 Diversity

The spring-run Chinook ESU is comprised of two genetic complexes. Analysis of natural and hatchery spring-run Chinook stocks in the Central Valley indicates that the northern Sierra Nevada diversity group spring-run Chinook populations of Mill, Deer, and Butte creeks, have retained their genetic integrity, as opposed to the genetic integrity of the Feather River population, which has been somewhat compromised. Genetic analysis of FRFH spring-run Chinook shows evidence of hybridization between spring-run and fall-run hatchery stocks, and Feather River spring-run Chinook that have strayed into the Yuba River appear to have introgressed with the fall-run Chinook also inhabiting the river. Additionally, the diversity of the spring-run Chinook ESU has been further reduced with the loss of the San Joaquin River basin spring-run Chinook population.

In the Central Valley, spring-run Chinook are genetically distinct from fall-run Chinook. A few individual fish, however, may exhibit migration patterns that differ from the norm. Phenotypic behaviors are behaviors that normally are driven by genetic background, but that are performed by individuals that do not have that normal genetic background. Adult Chinook that are observed migrating in streams where a sustaining population of spring-run Chinook is not known to exist, at times of the year typical of spring-run Chinook migration, are called phenotypic spring running Chinook. Phenotypic spring running Chinook that have been observed on the San Joaquin River tributaries could be: 1) Chinook of an unknown genotype that show behaviors typical of spring-run Chinook; 2) from genetically distinct spring-run Chinook parentage, but have strayed from their home streams; or 3) genetically fall-run Chinook that behave like spring-run Chinook. Hatchery practices can influence salmon genetics and straying rates.

3.3 Donor Action Areas

3.3.1 Sacramento River Tributaries

The proposed Donor Stock Alternatives could take eggs or fish from the Sacramento River tributaries for use in the San Joaquin River. Therefore, the following sections describe the existing conditions present on the following tributaries: the Feather River and FRFH, and Deer, Mill, Butte, Clear, and Battle creeks. It should be noted that there is a great deal of variability as to the amount of information available for each of the tributaries. Some watersheds have more than 50 years of information whereas others have approximately 20 years plus there are differences in what information is available that describe the characteristics of each watershed. Furthermore, any removal of eggs or fish from these sources would require subsequent NEPA and permit action pursuant to section 10(a)(1)(a) of the ESA.

3.3.1.1 Feather River

The Feather River is a major tributary to the Sacramento River located at the north end of the western slope of the Sierra Nevada, with a watershed encompassing 5,900 square miles (FERC 2007, NMFS 2009b). The upper Feather River watershed above Oroville Dam is approximately 3,600 square miles and has four tributaries, the North, South, Middle, and West Forks. Downstream of Oroville Dam, the watershed includes the drainage of the Yuba and Bear rivers, and the Feather River eventually meets the Sacramento River (NMFS 2009b). Figure 3-1 shows the lower Feather River watershed and the locations of the FRFH.

Spring-run Chinook are spawned artificially in the FRFH, and also spawn naturally in the river during late September to late October (Reynolds et al. 1993, Yoshiyama 2001) downstream from the Fish Barrier dam approximately eight miles to the Thermalito Afterbay Outlet (NMFS 2009b).

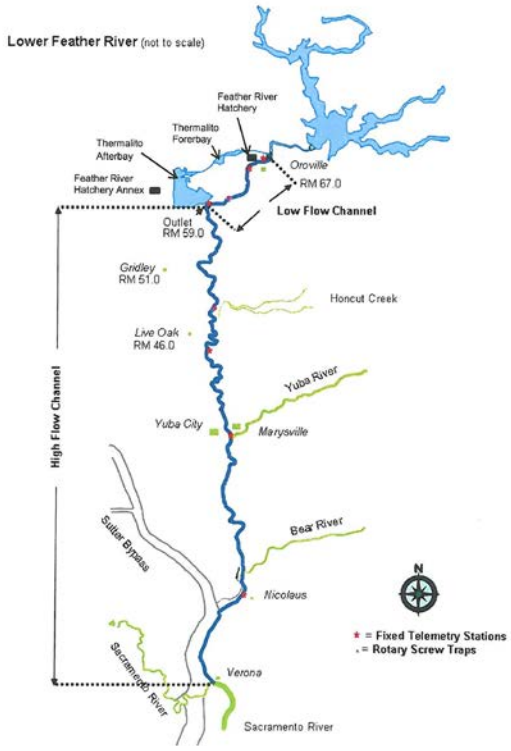


Figure 3-1 Lower Feather River

In most years the FRFH has met its production goal of two million spring-run Chinook smolts. To reach this target, the hatchery typically mates approximately 750 pairs to produce three million eggs (Figure 3-2). Once the production goal has been met, spring-run Chinook typically continue to enter the hatchery. In past years, these "surplus" fish have either been released back to the river, euthanized (designated as "killed, not spawned"), or allowed to die on site (designated as "Died in Tank"). The "Died in Tank" adults died while waiting to be spawned, or were allowed to die over time once production goals were met.

The number of the "surplus" fish varies from year to year. During the 2011 spawning season at FRFH the number of surplus adults was particularly large. The number of fish included 486 surplus adults (231 males and 255 females) that entered the hatchery (Table 3-1). Theoretically, these fish were capable of producing an additional one million eggs.

In June of 2012 California Hatchery Scientific Review Group proposed a policy that all fish produced at California Hatcheries would have a purpose (i.e., no surplus) (California HSRG 2012) this policy has been approved by DFW, USFWS and NMFS. Although there will be no "surplus" fish, under the revised operational policies for FRFH use of fish for restoration purposes in the San Joaquin River is an approved production use.

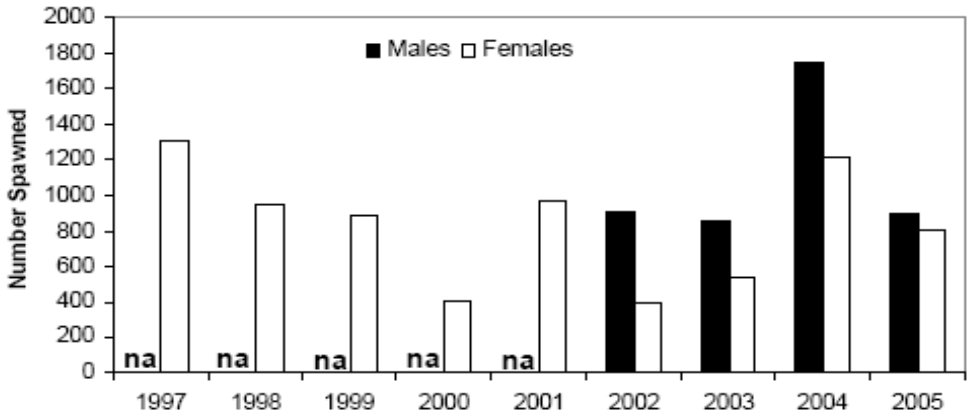


Figure 3-2. Number of spring-run Chinook adults spawned at the FRFH (Source: DWR 2009 as sited in the SJRRP 2010).

	Female	Male	Jack	Died in Tank
2011	255	231	No data	No data
2010	154	23	6	256
2009	0	2	34	76
2008	47, unknown gender		No data	240

Table 3-1. Surplus Fish Observed at Feather River Fish Hatchery in Recent Years (Anna Kastner, cited in 10(a)(1)(A) permit).

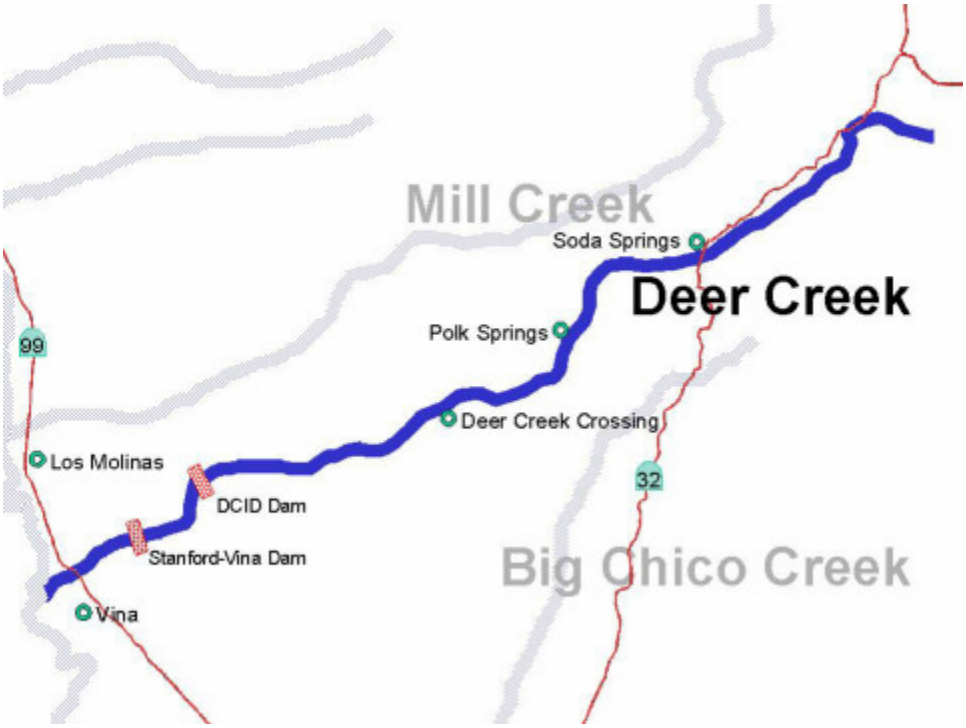
Between 1967 and 2008, the highest annual hatchery spring-run Chinook escapement was 8,662, occurring in 2003 (DFW 2009 as cite in SJRRP 2010). Between 1986 and 2007, the average number of spring-run Chinook returning to the FRFH was 3,992, compared to an average of 12,888 spring-run Chinook returning to the entire Sacramento River Basin (NMFS 2009b), and an average of 1,700 fish before the construction of Oroville Dam (Reynolds *et. al.* 1993, Yoshiyama 2001). More recently, FRFH spring-run Chinook escapement from 2005 through 2008 was 1,774, 2,061, 2,674, and 1,418; respectively (DFW 2009, NMFS 2009b). The increase in numbers since the completion of the dam (1968) is attributed to the consistent supply of cold water to both the hatchery and the Low Flow Channel and the contribution of hatchery fish (Reynolds et. al. 1993, Yoshiyama et. al. 2001).

3.3.1.2 Deer Creek

Deer Creek is an eastside tributary to the upper Sacramento River. Deer Creek is 60 miles long and its watershed drains 200 square miles (USFWS 1995). Deer Creek originates on the northern slopes of Butte Mountain at an elevation of approximately 7,320 feet. It initially flows through meadows and dense forests and then descends rapidly through a steep rock canyon into the Sacramento Valley. Deer Creek flows for 11 miles across the Sacramento Valley floor, entering the Sacramento River at River Mile (RM) 220 (Figures 3-3 and 3-4). Along with Butte Creek and Mill Creek, Deer Creek is recognized as supporting genetically distinct, self-sustaining populations of spring-run Chinook (DFG, 2008). The Mill and Deer creek populations appear

genetically similar to each other compared to the other extant spring-run Chinook populations in the Central Valley and likely function together demographically as a metapopulation.

Spring-run Chinook have been documented migrating upstream on Deer Creek from March through early July. Migrations usually end during the peak of the irrigation season when flows are insufficient to pass adults and water temperatures begin to approach lethal limits low in the watershed.



Source USFWS Anadromous Fish Restoration Program, 2011

Figure 3-3 Spring-run habitat in Deer Creek.

Table 3-2 shows annual escapement estimates for Deer Creek spring-run Chinook. For the Central Valley Project Improvement Act (CVPIA) doubling period 1967-1991, the average spawning escapement of spring-run Chinook in Deer Creek was 1,300 (USFWS 1995). From 1991 to 2011 the average is only 1,024 (DFG, 2012).

Table 3-2 Annual Escapement Estimates for Deer Creek

Year	Count	Year	Count	Year	Count
1963	2,302	1980	1,500	1997	466
1964	2,874	1981	-	1998	1,879
1965	-	1982	1,500	1999	1,591
1966	-	1983	500	2000	637
1967	-	1984	0	2001	1,622
1968	-	1985	301	2002	2,195
1969	-	1986	543	2003	2,759

Year	Count	Year	Count	Year	Count
1970	2,000	1987	200	2004	804
1971	1,500	1988	371	2005	2,239
1972	400	1989	84	2006	2,432
1973	2,000	1990	496	2007	644
1974	3,500	1991	479	2008	140
1975	8,500	1992	209	2009	213
1976	-	1993	259	2010	262
1977	340	1994	485	2011	271
1978	1,200	1995	1,295		
1979	-	1996	614		

Source: DFG 2012

3.3.1.3 Mill Creek

Mill Creek is a major tributary of the Sacramento River, flowing from the southern slopes of Mount Lassen and entering the Sacramento River at RM 230. The stream originates at an elevation of approximately 8,200 feet and descends to 200 feet at its confluence with the Sacramento River. Mill Creek originates from springs in Lassen Volcanic National Park (LVNP) and initially flows through meadows and dense forests. It descends rapidly through a steep canyon, and then flows eight miles across the Sacramento Valley floor. Its total length is approximately 58 miles. Nearly the entire mainstem habitat is utilized and/or available to spring-run Chinook (Figure 3-4). The Mill Creek watershed encompasses 134 square miles. During the irrigation season (mid-spring to fall), three dams on the lower eight miles of the stream divert most of the natural flow, particularly during dry years. Adult spring-run Chinook have been observed migrating in Mill Creek as early as February. A 10-year study from 1953 to 1964 (DFG 1966 as cited in SJRRP 2010) has documented the majority of upstream migration into Mill Creek as occurring between mid-April and the end of June.

Based on observations of spring-run Chinook adults holding and/or spawning, the known range of this habitat extends a distance of approximately 48 miles from near the Little Mill Creek confluence (C. Harvey 1996, personal communications, as cited in SJRRP 2010) upstream to within one-half mile of the LVNP boundary (personal observation of adult holding, as cited in SJRRP 2010). Suitable spawning habitat on the mainstem of Mill Creek extends to near Morgan Hot Springs (approximately three miles downstream of LVNP), although salmon have been reported spawning in "Middle Creek" (1990 communication with Luke Mason, former caretaker at Hanna Ranch as cited in SJRRP 2010), a small tributary located approximately two miles downstream of the park boundary.

Source USFWS Anadromous Fish Restoration Program, 2011

Figure 3-4. Spring-run Chinook habitat in Mill Creek

Table 3-3 shows annual escapement estimates for Mill Creek spring-run Chinook (DFG, 2011). For the CVPIA doubling period 1967-1991, the average spawning escapement of spring-run Chinook in Mill Creek is 800 (USFWS 1995). From 1991 to 2011 the average is 632 (DFG 2012).

Table 3-3 Annual Escapement Estimates for Mill Creek

Year	Count	Year	Count	Year	Count
1960	2,368	1978	925	1996	253
1961	1,245	1979	-	1997	202
1962	1,692	1980	500	1998	424
1963	1,315	1981		1999	560
1964	1,539	1982	700	2000	544
1965		1983	-	2001	1,100
1966	-	1984	191	2002	1,594
1967	-	1985	121	2003	1,426
1968	-	1986	291	2004	998
1969	-	1987	90	2005	1,150
1970	1,500	1988	572	2006	1,002
1971	1,000	1989	563	2007	920
1972	500	1990	844	2008	362
1973	1,700	1991	319	2009	220
1974	1,500	1992	237	2010	482

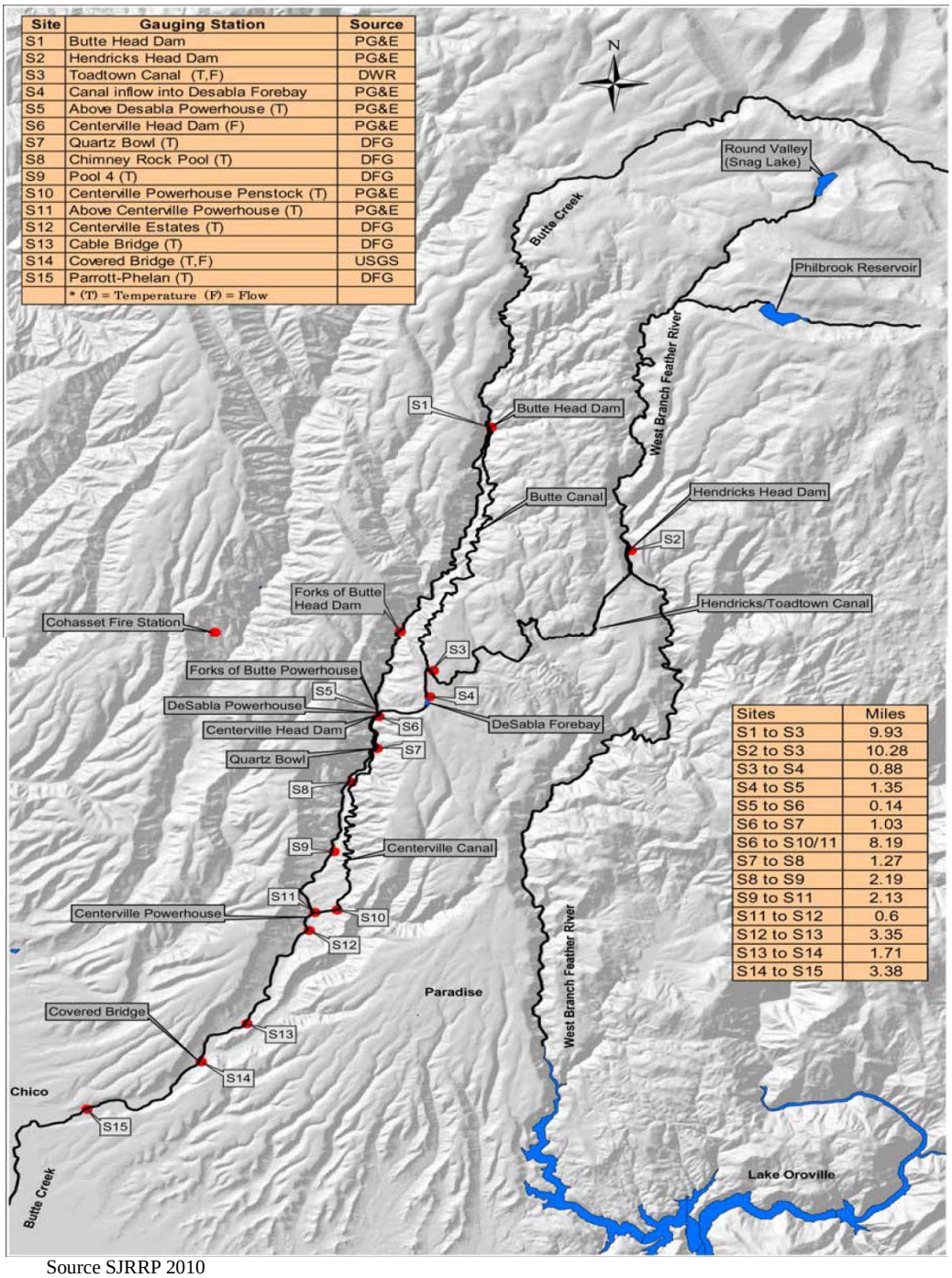
Year	Count	Year	Count	Year	Count
1975	3,500	1993	61	2011	366
1976	-	1994	723		
1977	460	1995	320		

Source: DFG 2012

3.3.1.4 Butte Creek

The spring-run Chinook in Butte Creek are considered persistent and viable and the creek is one of the most productive spring-run Chinook streams in the California Central Valley (NMFS 2009b). Lindley *et al.*, (2007) indicated that the Butte Creek population is at a low risk of extinction due to the population size, general increases in production, and low hatchery influence. Butte Creek is one of only three streams to sustain a genetically distinct and viably independent population of spring-run Chinook (NMFS 2009b). According to Moyle *et al.*, (2008 as cited in SJRRP, 2010) there is a high likelihood of spring-run Chinook going extinct in the next 50-100 years due to the vulnerability of a catastrophic event and due to the narrow physiological tolerances in the summer, where an increase in temperature due to climate change may drastically reduce survival. Population numbers have increased within the last two decades, and large pre-spawn mortalities have occurred on a few years (Williams 2006 as cited in SJRRP 2010). The pre-spawn mortalities were due to a high number of fish concentrated in limited holding pools with high water temperatures, resulting in an outbreak of diseases (SJRRP 2010).

The entire available holding and spawning area for Butte Creek spring-run Chinook is below 931 feet elevation, due to a 15-foot waterfall barrier known as the Quartz Bowl Falls. Butte Creek spring-run Chinook adults migrate into Butte Creek from February through June, with the peak in mid-April. Adult migration is frequently impaired by low flows and high water temperatures in June, and adult spring-run Chinook that have not migrated above State Highway 99 by mid-June have a lower likelihood of surviving to spawn.



Source SJRRP 2010

Figure 3-5 Reaches of Butte Creek and West Branch of the Feather River controlled by Pacific Gas and Electric Company affecting Butte Creek spring-run Chinook, including temperature and flow gage locations and distances

The data below is based on DFW escapement estimates for the years 1954 – 2011. The approximate averages for the last thirty, twenty, and ten years are 3,472; 4,953; and 5,000, respectively.

Table 3-4. Butte Creek spring-run Chinook Spawning Escapement Estimates for the Period 1954 through 2011

Year	Run Size	Year	Run Size	Year	Run Size	Year	Run Size		
1954	830	1969	830	1984	23	1999	3679*		
1955	400	1970	285	1985	254	2000	4118*		
1956	3000	1971	470	1986	1371		Snorkel	Prespawn Mortality	Spawn
1957	2195	1972	150	1987	14	2001	9605	193	18312**
1958	1100	1973	300	1988	1300	2002	8785	3431	12597
1959	500	1974	150	1989	1300*	2003	4398	11231	6063
1960	8700	1975	650	1990	100*	2004	7390	418	10221
1961	3100	1976	46	1991	100*	2005	10625		
1962	1750	1977	100	1992	730*	2006	4579	244	6303
1963	6100	1978	128	1993	650*	2007	4943	638	6220
1964	600	1979	10	1994	474*	2008	3935		
1965	1000	1980	226	1995	7500*	2009	2059		
1966	80	1981	250	1996	1413*	2010	1160		
1967	180	1982	534	1997	635*	2011	2130		
1968	280	1983	50	1998	20212*				

Source: SJRRP 2012

* Surveys prior to 1989 used various methods with varying precision. Snorkel surveys implemented since 1989 are thought to significantly underestimate the actual population size and should only be used as an index. Spawning surveys results for 2001 – 2006 were generated by a modified Schaefer Model carcass survey.

** Number as reported for 2001 (22,744) in error (Ward *et al.* 2004).

τ Preliminary data (DFG 2012)

3.3.1.5 Clear Creek

Clear Creek is approximately 18.1 miles long between the confluence with the Sacramento River and Whiskeytown Dam. Whiskeytown Dam is a total barrier to salmonid migration in Clear Creek (Figure 3-6). The elevation for this reach drops from 1,000 feet to 400 feet above mean sea level (Newton and Brown 2004). USFWS identified two predominant stream channel types in Clear Creek. The upper reaches from Whiskeytown Dam down to Clear Creek Road Bridge (RM 8.5) have steep canyon walls with falls, high-gradient riffles, and deep pools. Below Clear Creek Road Bridge, the stream channel widens into an alluvial reach with a much lower gradient.

Since 2001, the Dedicated Project Yield Program—authorized by Section 3406(b)2 of the CVPIA— has provided additional water year-round to increase streamflow. The increased flows and resulting lower water temperatures improve passage, holding, spawning, and rearing

conditions for both spring-run Chinook and California Central Valley steelhead (steelhead) (*O. mykiss*) (Giovannetti and Brown 2007, as cited in SJRRP 2010).

Source: USFWS Anadromous Fish Restoration Program, 2011

Figure 3-6. Clear Creek

The data below are based on DFW escapement estimates for the years 1993 – 2011. Given that yearly surveys have only occurred since 1999, the yearly average was determined from that year. From 1999 to present the average annual escapement is approximately 71.

Lindley *et al.* (2004) classified this population as a dependent population, and thus it is not expected to exceed the low-risk population size threshold of 2500 fish (i.e., annual spawning run size of about 833 fish). The status review of the ESU (NMFS 2011) states that the spring-run Chinook population in Clear Creek has been increasing.

Table 3-5 Annual Escapement Estimates for Clear Creek

Year	Count	Year	Count
1993	1	2003	25
1994	0	2004	98
1995	2	2005	69
1996		2006	77
1997		2007	194
1998	47	2008	200

Year	Count	Year	Count
1999	35	2009	120
2000	9	2010	21
2001	0	2011	8
2002	66		

Source: DFG 2012

3.3.1.6 Battle Creek

Battle Creek is an east-side tributary of the Sacramento River that drains from the southern Cascade Range, with attributes similar to tributaries upstream of Shasta Dam (Kier Associates 1999, Lindley *et al.* 2007). Large snowfields and spring-fed creeks maintain streamflow until late summer in both the North and South Forks of Battle Creek, providing suitable holding and spawning water temperatures. Spring-run Chinook and steelhead can access approximately 14 miles of spawning and holding habitat in the North Fork and approximately 18 miles in the South Fork (Kier Associates 1999, as cited in SJRRP 2010) (Figure 3-7). The North Fork has high-gradient stream segments, similar to those in Mill and Deer creeks, upstream of Eagle Canyon Dam and elevations over 2,000 feet occur above North Fork Battle Creek Feeder Dam. On the South Fork, similar high-gradient stream segments exist upstream of Inskip Dam; elevations over 2,000 feet occur upstream of the South Dam (Kier Associates 1999).

Source: USFWS Anadromous Fish Restoration Program, 2011

Figure 3-7 Battle Creek

The data below is based on DFW spring-run Chinook escapement estimates for the years 1995 – 2011. From 1995 to present the average annual escapement is approximately 141.

Table 3-6 Annual Escapement Estimates for Battle Creek

Year	Count	Year	Count
1995	66	2004	90
1996	35	2005	73
1997	107	2006	221
1998	178	2007	291
1999	73	2008	105
2000	78	2009	194
2001	111	2010	172
2002	222	2011	157
2003	221		

Source: DFG 2012

3.3.2 San Joaquin River Tributaries

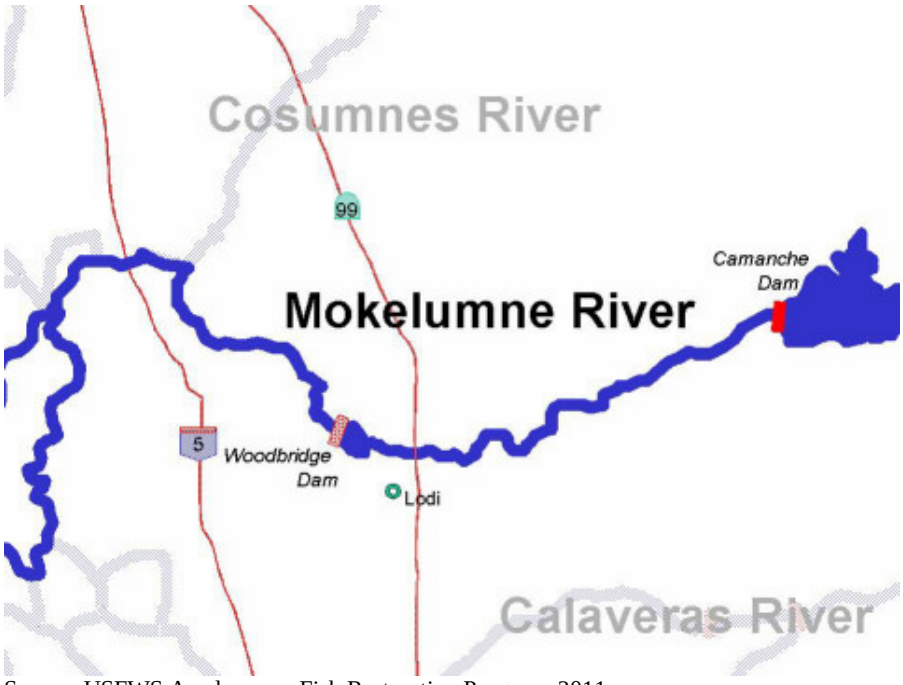
Three additional watersheds in the east Sacramento-San Joaquin Delta or San Joaquin River basin have reports of phenotypic spring-running Chinook. These are the Mokelumne River, an eastside tributary to the Sacramento-San Joaquin Delta, the Stanislaus River and Tuolumne River both tributaries to the San Joaquin River. As mentioned the Stanislaus and Tuolumne Rivers are within the study area established by the SJRRP PEIS/EIR but that discussion of these rivers did not include details of the spring-running Chinook.

3.3.2.1 Mokelumne River

The lower Mokelumne River is considered an eastside tributary to the Sacramento-San Joaquin River Delta. Its confluence with the San Joaquin River is within the legal Delta boundaries. Flows in the Mokelumne River are regulated by a Joint Settlement Agreement (JSA) under Federal Energy Regulatory Commission License (EBMUD et.al 2008).

Camanche Dam is on RM 64 and is the upper limit to anadromy on the Mokelumne River (Figure 3-8). Camanche Dam blocks approximately 80 percent of historical Chinook spawning habitat (DFG 1991 as cited in SJRRP 2010). There are approximately 10 miles of spawning habitat downstream of Camanche Dam available for salmonid spawning, and holding habitat is limited to a few large pools in the first river mile below Camanche Dam.

Year round video monitoring on the Mokelumne River began in 2001. Since that time it has become clear that adult spring-running Chinook are ascending the Mokelumne from April through June on an irregular basis, in addition to the well-established population of fall-run Chinook (escapement from August/September through January). Low numbers of spring-running fish have passed video monitoring at Woodbridge Dam between April and June (SJRRP 2010).



Source: USFWS Anadromous Fish Restoration Program, 2011

Figure 3-8 Mokelumne River

Limited adult spring-run Chinook holding opportunities exist on the Mokelumne River. There are few large pools in the uppermost reach just below Camanche Dam. No assessments of holding or spawning have been conducted and there are no anecdotal reports of these adult fish persisting through the summer months.

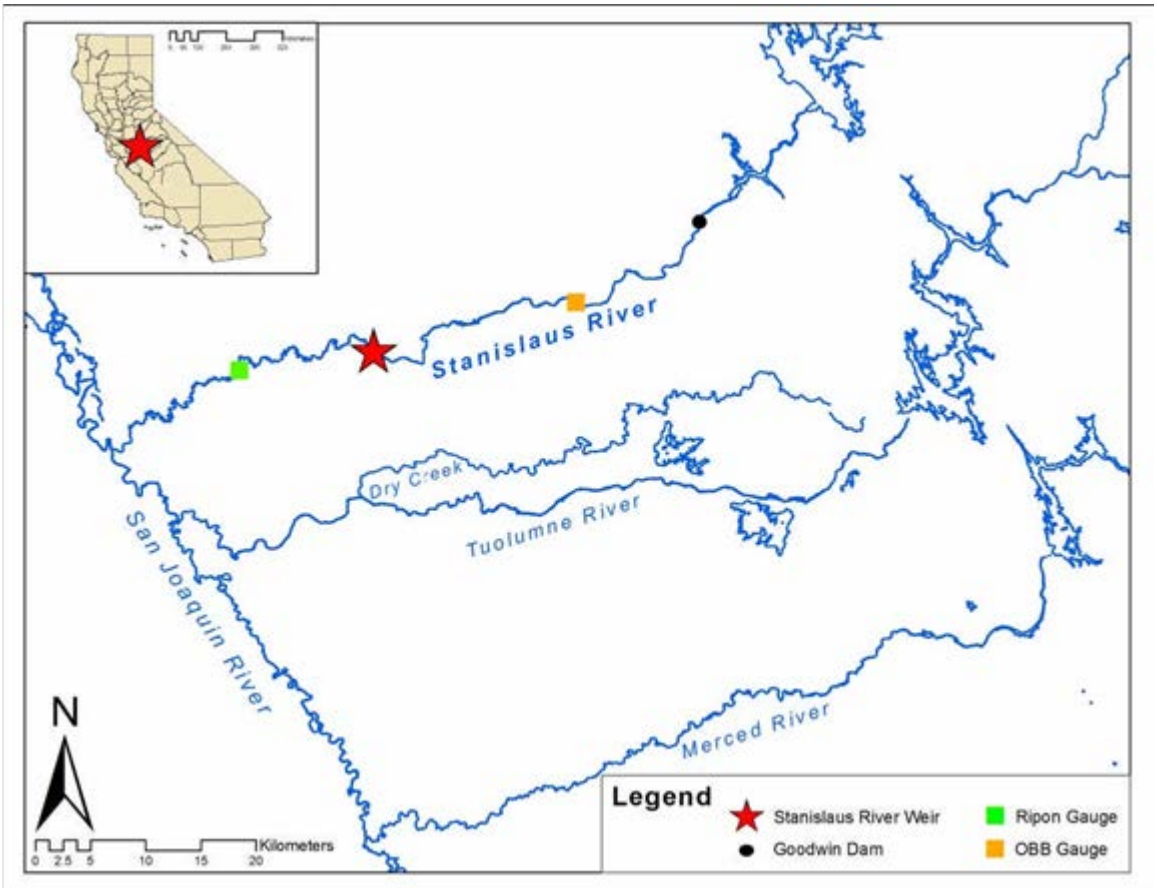
Phenotypic spring-run Chinook on the Mokelumne River have numbered as high as 114 in the spring of 2002 between April and July, with 4 adipose clipped fish observed (Workman 2002). Ninety-seven were observed in 2003 between March and July, with 21 adipose clipped fish observed (Workman 2003). The importance of adipose fin clipped fish is that the clipped fins indicate that these fish are of hatchery origin, not wild populations. None were observed in 2004, and in 2005, 2006, and 2007 when limitations in video monitoring due to construction led to carcass survey data for escapement estimates, and no estimate of phenotypic spring-run Chinook were attempted (Workman 2004, 2005, 2006, Workman and Rible 2007, Workman *et al.* 2008).

3.3.2.2 Stanislaus River

The Stanislaus River is one of three major tributaries to the San Joaquin River (Figure 3-9). It is snow fed and its headwaters begin at an elevation of approximately 12,000 ft. Like all San Joaquin River tributaries, multiple dams are located on the upper Stanislaus River. Historically, various life history types of Chinook inhabited the Stanislaus River, including fall-, late fall-, and spring-run Chinook (Reynolds *et al.* 1993). Currently, upstream migration for anadromous fish ends at Goodwin Dam RM 59. Historically, upstream migration and spawning occurred well into the Stanislaus River's three forks, but miles of spawning and rearing habitat were made inaccessible due to dam construction (Fry 1961).

In 2002, a resistance board weir was installed on the Stanislaus River to assess escapement numbers and timing of Chinook salmon and steelhead. In 2003 the weir was improved with the addition of a Vaki RiverWatcher infrared camera. The weir has been operated ever year, with the exception of 2008. Phenotypic spring-running Chinook have been observed passing the weir on the Stanislaus River in April and June (Anderson *et al.* 2007).

Chinook have been reported in the Stanislaus River during the summer months. Snorkel surveys (Kennedy and Cannon 2005) conducted between October 2002 to October 2004 identified adults in June 2003 and June 2004 between Goodwin Dam and Lovers Leap. Snorkel surveys also observed Chinook fry in December 2003 at Goodwin Dam, Two Mile Bar, and Knights Ferry, which indicates spawning occurring in September. This is earlier than when fall-run Chinook salmon would be spawning in the river. In 2000 DFW (unpublished data) seined a deep pool at Buttonbush Recreation Area on five occasions between June 29 to August 25, and captured 28 Chinook salmon. Of these, eight were adipose fin-clipped and five had coded wire tags. All coded wire tagged fish originated from the FRFH. Table 3-7 shows the number of adult Chinook migrating upstream on the Stanislaus River for the months February through June.



Source SJRRP, 2010

Figure 3-9 Tributaries of the San Joaquin River: the Stanislaus, the Tuolumne, and the Merced Rivers

Table 3-7 Weir Counts of Adult Chinook migrating upstream on the Stanislaus River

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
February	2	0	0	11	11	Weir not operated	0	0	0	3
March	Weir pulled	Weir pulled	Weir pulled	0	0		10	0 (weir pulled)	0	1
April				0	0		1		Weir removed due to flow increase per NMFS B.O.)	Weir removed due to flow increases per NMFS B.O.)
May				5	5					
June				7	6					

Source: NMFS, 2012

3.3.2.3 Tuolumne River

Yoshiyama, et al. (2001) reported that spring and fall salmon runs historically used the Tuolumne River. Clavey Falls (10 to 15 ft. high), at the confluence of the Clavey River, may have obstructed the salmon at certain flows, but spring-run Chinook in some numbers undoubtedly ascended the mainstem a considerable distance. The spring-run Chinook were most likely stopped by the formidable Preston Falls four miles above Early Intake Dam near the boundary of Yosemite National Park (about 50 mi. upstream of New Don Pedro Dam), which would have been the upstream limit of native fish distribution.

While Yoshiyama stated in 1993 that currently only the fall-run Chinook salmon use the Tuolumne River, Yoshiyama cites Reynolds and others that a late fall run may also be present based mainly on the occurrence of juveniles in the river during the summer and on observations of occasional spawning in later months (Yoshiyama et al. 2001).

In addition, there have been reports of adult Chinook in the Tuolumne River in the spring months of April and May. However, the origin of these animals remains unknown. There is limited information as to whether these fish represent a typical occurrence or an anomaly. Future monitoring is required to make a determination whether these fish are spring-run Chinook. Table 3-8 shows the number of adult Chinook that migrated upstream on the Tuolumne River between February and June for the years 2009 to 2012.

While there are questions regarding these possible spring-run of Chinook and whether they are strays or a population, NEPA requires Federal Agencies to take a “hard look” at such information. The potential presence of a population of spring-running Chinook on the Stanislaus River /or the Tuolumne River needs to be considered as part of the determination of the area for the NEP.

Table 3-8 Weir counts of Adult Chinook migrating upstream on the Tuolumne River

	2009	2010	2011	2012
February	15	0	6	4 (weir)
March	3	6	15	8 (weir)
April	0 (weir removed April 15)	0	19	18 (weir)
May	no data	0	13	6 (weir removed May 9)
June	no data	0	nothing through June 4	2 (weir)

Source: NMFS 2012

3.4 Reintroduction Area

3.4.1 San Joaquin River Basin

The EA incorporates by reference information contained in SJRRP EIS/EIR regarding existing habitat descriptions and habitat conditions in the San Joaquin River and the associated Restoration Area Study Area.

3.4.2 San Joaquin River from Friant Dam to Merced River

This section summarizes aspects of the current aquatic habitat found in the five reaches (i.e., river segments) of the Restoration Area and the Restoration Area bypasses (see Figure 1-4). The Restoration Area encompasses the San Joaquin River from Friant Dam downstream to the confluence with the Merced River. Information presented in this section is compiled from the PEIS/R.

- **Aquatic Habitat**

Aquatic habitat conditions vary spatially and temporally throughout the San Joaquin River Restoration Area, and the flood bypasses because of differences in habitat availability and connectivity, water quantity and quality, channel morphology, and predation risks. Throughout the area, physical barriers, reaches with poor water quality, or little to no surface flow, and the presence of false migration pathways have reduced habitat connectivity for anadromous and resident native fishes.

- Structural Migration Impediments

Several structures in the Restoration Area are impediments to both upstream and downstream fish movement including the following:

- The seasonally deployed weir located at Hills Ferry (Hills Ferry Barrier), just upstream from the confluence with the Merced River, to direct migrating adult salmonids into the Merced River and prevent them from entering the San Joaquin River. The Hills Ferry Barrier has been operated by DFW since 1992.
- Eastside Bypass drop structure near its confluence with the San Joaquin River.

- Mariposa Bypass drop structure near its confluence with the San Joaquin River.
- San Joaquin River Headgate Structure at the Sand Slough Control Structure.
- Sack Dam, a low head diversion dam for Arroyo Canal.
- Mendota Dam, delivery point of the Delta Mendota Canal and diversion point for several irrigation canals and pumps.
- Radial gates and control structure on the Chowchilla Bypass Bifurcation Structure.
- At least one earthen diversion dam just downstream from Gravelly Ford.
- Friant Dam, primary storage dam on the San Joaquin River and upper limit of potential salmonid migration.

- **Non-Structural Migration Impediments**

In addition to physical barriers, false migration pathways may impede fish movement in the Restoration Area. False migration pathways lead fish away from habitats that would support reproduction, survival, and growth. False pathways also affect both upstream and downstream fish movement. During upstream movement, flow may attract fish into drains and bypasses that do not provide habitat because spawning substrate or cover, food availability, water temperatures, DO concentrations, salinity, and other environmental conditions are unsuitable. The San Joaquin River also has an extensive system of bypasses and canals that divert and carry water around the mainstem San Joaquin River channel. Bypasses may not have environmental conditions that support movement of fish to downstream habitat, especially if flow entering the bypass becomes discontinuous and fish are stranded. Canals generally do not provide habitat that can sustain populations of most fish species, and frequently end in irrigated agricultural fields.

Potential false pathways created by the bypass and canal systems are Salt Slough, Mud Slough, Bear Creek, Ash Slough, Berenda Slough, Dry Creek, Fresno River, Lone Willow Slough, James Bypass, Mariposa Bypass, Eastside Bypass, Arroyo Canal, Main Canal, other canals, and Little Dry Creek. Gravel mining ponds in Reach 1 may also be minor false pathways that can confuse downstream and upstream migrating fish and delay migration.

Most aquatic habitat in the bypasses is temporary, and its duration depends on flood flows. The bypasses are largely devoid of aquatic and riparian habitat because of hydraulic conveyance maintenance efforts (McBain and Trush 2002, as cited in Reclamation and DWR, 2011). Portions of the Eastside Bypass near Merced National Wildlife Refuge are reportedly wet year-round, but it is unknown whether these areas support fish. Although the bypasses provide very little perennial aquatic habitat, fish and other aquatic species may be present in the bypasses during wet conditions, including high-flow periods when a portion of the San Joaquin River flow is routed into the bypass system.

Many changes have occurred to channel morphology in the Restoration Area, with the most pronounced as follows:

• **Reach 1** – In-channel and floodplain pits and exposed gravel bars and floodplains created by instream gravel mining in Reach 1 have impeded coarse sediment routing, reduced native fish habitat, increased river water temperatures, and increased habitat for nonnative species. As has been demonstrated on the Tuolumne River, these pits provide habitat conducive to nonnative predatory fish species such as largemouth and smallmouth bass (EA Engineering 1991, as cited in Reclamation and DWR 2011). Gravel pits have also converted what was historically lotic habitat to lentic habitat, which may provide habitat for Sacramento pikeminnow and other predatory fishes. In addition, riparian encroachment has occurred, channels have been incised, mobilization of bed material is less frequent, and possible filling of gravel interstices with fine sediment has likely occurred.

• **Reaches 2 Through 5** – Habitat conditions for fish in Reaches 2 through 5 have been substantially modified by levee/dike construction, agricultural encroachment, and water diversions. These changes have reduced the quantity of floodplain habitat, as well as reducing main channel habitat complexity and the quantity and quality of off-channel habitat in these reaches. Much of this floodplain habitat has been isolated from the river by dikes and levees, and the remaining floodplain habitat is rarely inundated under current hydrologic conditions. There are projects proposed in the SJRRP to improve habitat conditions and to support flows that would permit juvenile rearing and adult/juvenile migration.

Important factors and processes affecting aquatic habitat throughout the Restoration Area, including channel migration and avulsion, spawning gravels and sedimentation, habitat heterogeneity, river flow, and benthic macroinvertebrates and algal communities are described in more detail below.

Channel Migration and Avulsion. In the past, channel migration and avulsion were critical processes for creating and maintaining habitat for salmonids and many native fish species, as well as for riparian regeneration and recruiting large woody debris into the channel. Agricultural conversion has reduced the amount of floodplains, and levees and dikes have further isolated historical floodplains from the channel. Additionally, bank protection along channel margins and the reduced flow regime have stabilized the channel, reduced bank erosion, reduced lateral migration, and greatly reduced the processes that create complex side channels and high-flow scour channels. Undercut banks, riparian vegetation, and recruitment of large woody debris have all been reduced or eliminated as a consequence of channel stabilization, and the corresponding habitat benefits realized by these processes have been largely eliminated. Reduced channel migration has eliminated off-channel habitats, reduced complex side channels, and reduced instream habitat complexity for native fish species. The loss of undercut banks and large woody debris reduces cover and velocity refuge for salmonids and many other native fish species, increasing exposure to predation and high flows. The loss of riparian vegetation recruitment may contribute to increased stream temperatures, and reduced complexity during the now rare periods of floodplain inundation. Current conditions have minimized and mostly eliminated meander migration and oxbow creation, which can facilate the creation of spawning areas.

Spawning Gravels and Sedimentation. The discussion within the SJRRP PEIS/R notes that Friant Dam has eliminated sediment supply from the upper watershed to the San Joaquin River downstream from the dam. Small particles on the bed surface, such as gravels less than 32 millimeters (mm), have likely been mobilized and deposited downstream since dam construction. The larger particles that were not mobilized remained to form an armor layer, protecting smaller gravels from being exposed to mobilization. The formation of an armor layer and blocked sediment supply has likely reduced the amount of suitable spawning habitat in Reach 1 relative to historical conditions. Although spawning gravel in the Restoration Area is no longer used by anadromous salmonids, it may still provide spawning habitat for other gravel-nesting fish species, including resident rainbow trout and lamprey species.

Several historical and recent estimates of salmonid spawning gravel quantity have been made in the Restoration Area (Table 3-9).

Table3-9 Summary of Anadromous Salmonid Spawning Habitat Estimates in Reach 1 of Restoration Area

Source	Survey Year	Extent of Survey	Estimated Total	Estimated Suitable (square feet)
Clark (1942)	1942	Highway 41 to Kerckhoff Powerhouse	417,000	266,800[1]
Fry and Hughes (1958)	1943	Gravelly Ford to Friant Dam	1,000,000[2]	None
Ehlers, pers. com. (in Cain 1997)	1957	Gravelly Ford to Friant Dam	2,600,000	1,820,000[3]
Cain (1997)	1996	Gravelly Ford to Friant Dam	303,000	None
Jones and Stokes Assoc./Entrix (in McBain and Trush 2002)	2001	Friant Dam to Skaggs Bridge	773,000[4]	408,000[4 5]
Stillwater Sciences (in McBain and Trush 2002)	2002	Friant Dam to Highway 99 Bridge	357,000[6]	281,400[1 6]

Notes:

[1] Spawning habitat between Highway 41 and Friant Dam

[2] Estimated at 350 cfs; therefore, incorporated hydraulic suitability

[3] Seventy percent of 2,600,000 square feet was suitable; presumed criterion was quality (limit of fine sediment in gravel)

[4] Included gravel beyond the baseflow channel (e.g., on point bars); probable over-estimate

[5] Based on portion of spawning gravel with less than 40 percent fines (ocular estimate)

[6] Incorporated hydraulic suitability at potential spawning baseflows

Key:

cfs = cubic feet per second

pers. com. = personal communication

In addition to altering spawning gravel dynamics, the presence of Friant Dam has likely changed sedimentation rates in areas outside the main river channel, such as floodplains and side channels. Reduced frequencies of overbank flow, combined with reduced suspended sediment concentrations, may serve to extend the life span of off-channel habitats. The extent to which this is offset by any increase in sediment loading from agricultural runoff is difficult to determine because of a lack of data. Reduced sediment loading may have had particularly significant effects

on oxbow lakes, which are disconnected from the mainstem and thus may only aggrade (fill in) during the largest, most infrequent overbank flow events. Reduced bedload under postdam conditions may be less likely to generate closed off-channel habitat areas (oxbow lakes and sloughs). In addition to locally affecting meander migration rates, gravel bar dynamics can also regulate the connectivity of off-channel habitat to the mainstem, and thus alter its quality for fish and other aquatic species.

3.4.3 San Joaquin River Tributaries

Aquatic habitat and fish presently found in the three main San Joaquin River tributaries, the Merced, Tuolumne, and Stanislaus rivers, are discussed below.

- **Aquatic Habitat**

The Merced River is accessible to anadromous fish for the first 51 river miles upstream from the San Joaquin River confluence, with access terminating at Crocker-Huffman Dam (USFWS 2001, as cited in Reclamation and DWR 2011). Most anadromous fish spawning occurs within a few miles of the dam. Aquatic habitats in the Tuolumne River downstream from LaGrange Dam are influenced by several factors, many of them related to former gold mining activities and gravel mining (McBain and Trush 2000, as cited in Reclamation and DWR 2011). In the Stanislaus River, fall-run Chinook spawn in a 23-mile stretch of the Stanislaus downstream from Goodwin Dam, but most spawning occurs in the first 10 miles below the dam. Anadromous fish populations on all three tributaries are affected by flow and water temperatures, particularly during dry and critical water year types (Mesick 2009 and 2010, as cited in Reclamation and DWR 2011).

3.4.4 Sacramento-San Joaquin Delta

The aquatic habitat and fish presently found in the Delta are discussed below.

- **Aquatic Habitat**

The historical Sacramento-San Joaquin Delta consisted of low-lying islands and marshes that flooded during high spring flows. More than 95 percent of the original tidal marshes have been leveed and filled, resulting in loss of aquatic habitat (USGS 2007, as cited in Reclamation and DWR 2011). The current Delta consists of islands, generally below sea level, surrounded by levees to keep out water. Inflow of freshwater into the Delta has been substantially reduced by water diversions, mostly to support agriculture. Dredging and other physical changes have altered water flow patterns and salinity (USGS 2007, as cited in Reclamation and DWR 2011). Nonnative species are changing the Delta's ecology by altering its food webs. All of these changes have had substantial effects on the Delta's biological resources, including marked declines in the abundance of many native fish and invertebrate species (Greiner *et al.* 2007, as cited in Reclamation and DWR 2011).

3.5 Fish Species within the San Joaquin River Basin

Fish assemblages currently found in the San Joaquin River are the result of substantial changes to the physical environment, combined with more than a century of nonnative species introductions. Areas where unique and highly endemic fish assemblages once occurred are now inhabited by assemblages composed primarily of introduced species. Primary environmental conditions that currently influence native fish species abundance and distribution (and frequently favor nonnative species) include the following:

- Highly altered flow regimes and substantial flow reductions
- Substantial reductions in the frequency, magnitude, and duration of floodplain inundation
- Isolation of floodplains from the river channel resulting from channelization and levee construction
- Changes in sediment supply and transport
- Habitat fragmentation caused by physical barriers
- Creation of false migration pathways by flow diversions
- Reduced quantity and quality of riparian habitat, including increased prevalence of invasive exotic vegetation
- Degraded water quality
- Dewatered stream reaches

Of the approximately 21 native fish species historically present in the San Joaquin River, at least 8 are now uncommon, rare, or extinct, and an entire fish assemblage – the deep bodied fish assemblage (e.g., Sacramento splittail, Sacramento blackfish) has been largely replaced by nonnative warm-water fish species (e.g., carp, catfish) (Moyle 2002a, as cited in Reclamation and DWR 2011). Warm-water fish assemblages, comprised many nonnative species such as black bass species and sunfish species, appear better adapted to current, disturbed habitat conditions than native assemblages. However, habitat conditions in Reach 1 (slightly higher gradient, cooler water temperatures, and higher water velocities) seem to have restricted many introduced species from colonizing Reach 1. The occurrence of fish species within the Restoration Area listed by reach is presented in Table 3-10.

Table 3-10 Native and Non-native Fish Species found in the San Joaquin River Basin

Species	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	San Joaquin River & Tributaries Merced River to Mossdale
bigscale logperch (*Percina macrolepida*)						X
black bass species						X
black bullhead (*Ameiurus nebulosus*)						X

Species	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	San Joaquin River & Tributaries Merced River to Mossdale
black crappie (*Pomoxis nigromaculatus*)	x	x	X		x	x
bluegill (*Lepomis macrochirus*)	x	x	X		x	x
brown bullhead (*Ameiurus nebulosus*)	x	x	X		x	
California roach (*Hesperoleucus symmetricus*)						x
channel catfish (*Ictalurus punctatus*)	x	x	X		x	x
common carp (*Cyprinus carpio*)	x	x	X		x	x
fall-run Chinook salmon (*Oncorhynchus tshawytscha*)						x
spring-run Chinook salmon (*Oncorhynchus tshawytscha*)						?
fathead minnow (*Pimephales promelas*)						x
golden shiner (*Notemigonus crysoleucas*)	x	x	X		x	x
goldfish (*Carassius auratus*)	x	x	X		x	x
green sturgeon (*Acipenser medirostris*)						x
green sunfish (*Lepomis cyanellus*)	x	x	X		x	x
hardhead (*Mylopharodon conocephalus*)						x
hitch (*Lavinia exilicauda*)		x	X		x	x
inland silverside (*Menidia beryllina*)			X	x	x	x
kokanee (*Oncorhynchus nerka*)	x	x	X		x	
lamprey species	x					x
largemouth bass (*Micropterus salmoides*)	x	x	X		x	x
longfin smelt (*Spirinchus thaleichthys*)						x
Pacific lamprey (*Lampetra tridentate*)						x
Pacific staghorn sculpin (*Leptocottus armatus*)						x
prickly sculpin (*Cottus asper*)			X		x	x
pumpkinseed (*Lepomis gibbosus*)					x	
red shiner (*Cyprinella lutrensis*)			X		x	x

Species	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	San Joaquin River & Tributaries Merced River to Mossdale
redear sunfish (*Lepomis microlophus*)	x	x	X		x	x
river lamprey (*Lampetra ayresii*)						x
Sacramento blackfish (*Orthodon microlepidotus*)			X		x	x
Sacramento Perch (*Archoplites interruptus*)						x
Sacramento pikeminnow (*Ptychocheilus grandis*)	x				x	x
Sacramento splittail (*Pogonichthys macrolepidotus*)					x	x
Sacramento sucker (*Catostomus occidentalis*)	x				x	x
sculpin species	x					
smallmouth bass (*Micropterus dolomieu*)						x
spotted bass (*Micropterus punctulatus*)	x	x	X		x	
Starry flounder (*Platichthys stellatus*)						x
steelhead (rainbow trout) (*Oncorhynchus mykiss*)	x					x
striped bass (*Morone saxatilis*)						x
threadfin shad (*Dorosoma petenense*)						x
threespine stickleback (*Gasterosteus aculeatus*)	x					x
tule perch (*Hysterocarpus traskii*)			X		x	x
warmouth (*Lepomis gulosus*)						x
western mosquitofish (*Gambusia affinis*)	x	x	X		X	x
white catfish (*Ameiurus catus*)						x
white crappie (*Pomoxis annularis*)		x	X		X	x
white sturgeon (*Acipenser transmontanus*)						x

Native Species
Nonnative Species

1 Compiled from Reclamation and DWR 2011

In addition, fall-run Chinook inhabit the Merced, Tuolumne, and Stanislaus rivers, and are supported in part by hatchery stock in the Merced River. The average annual spawning escapement (1952 through 2005) for the three major San Joaquin River tributaries was an estimated 19,100 adults. Since 1952, fall-run Chinook populations in the San Joaquin River basin have fluctuated widely, with a distinct periodicity that generally corresponds to periods of drought and wet conditions. Escapement estimates in 2006 and 2007 indicate another period of severe declines, presumably unrelated to drought, with a near record low escapement in 2007 (DFG 2008, as cited in Reclamation and DWR 2011). As discussed in the Section 3.3.2, there are data that supports the possibility of spring-run Chinook in the Mokelumne, Tuolumne and Stanislaus Rivers.

Nonnative species predominate the fish assemblage within the San Joaquin River and its tributaries. Moyle and Light (1996, as cited in Reclamation and DWR 2011) suggested that nonnative piscivorous fish are most likely to alter fish assemblages. Largemouth bass are documented predators of outmigrating juvenile anadromous salmonids (TID/MID 1992, as cited in Reclamation and DWR 2011). They may also play the role of keystone predator (i.e., species that may increase biodiversity by preventing any one species from becoming dominant) in many aquatic environments because of broad environmental tolerances and their ability to forage on a wide variety of prey under many conditions. Smallmouth bass may primarily affect hardhead through competition for food resources, and may prey on juvenile cyprinids. Striped bass may be an important predator on immature life stages of river lamprey and Sacramento splittail. Inland silversides may feed on eggs and larvae of Sacramento splittail and other fish species in floodplain spawning areas. Native species expected to be the most sensitive to predation by nonnative predators include juvenile hardhead and Sacramento splittail.

3.5.1 Federally Listed Fish Species

California Central Valley steelhead are still present in low numbers in the Tuolumne, Stanislaus, and the Merced river systems below the major dams (McEwan 2001, Zimmerman *et al.* 2008, as cited in Reclamation and DWR 2011), but escapement estimates are not available.

Several researchers have speculated that green sturgeon spawn within the San Joaquin River system. Numerous juvenile and larval sturgeon have been collected on the lower San Joaquin River, but these fish are believed to have entered the system from the Sacramento River through the lower Mokelumne River, Georgiana Slough, or the Three Mile Slough. DFW concluded "based on movement of other fishes in the Delta, young green sturgeon found in the lower San Joaquin could easily, and most likely, come from the known spawning population in the Sacramento River" (DFG 2002 in Gruber, J. J., *et al.* 2012, as cited in Reclamation and DWR 2011).

Gruber, *et al.* (2012) states that DFG Sturgeon Report Card data indicates six green sturgeon were caught within the San Joaquin River upstream of Stockton, five of which were caught in March and April. Although the data indicates the presence of a limited number of green sturgeon, it is possible that some fish go unreported (e.g., poaching) or a proportion of the 143 reported white

sturgeon may be misidentified. It remains unknown how and to what extent green sturgeon use the San Joaquin River. However, their reported presence coincides with the spawning migration of the Southern Distinct Population Segment of green sturgeon within the Sacramento River.

3.5.2 Predation and Disease

Predation is another threat to the spring-run Chinook salmon ESU, especially in the lower Feather River, the Sacramento River, and in the Delta where there are high densities of nonnative (e.g., striped bass, smallmouth bass and largemouth bass) and native fish species (e.g., pikeminnow) that prey on outmigrating salmon (NMFS 2011). Changes in predator success due to increased abundance and vulnerability of prey may occur at newly constructed or altered diversion intakes or passage structures. Many predatory fish may be more successful at locations where prey fish are artificially concentrated or stressed, such as at dams or salvage and hatchery release sites (Buchanan *et al.* 1981, Pickard *et al.* 1982, as cited in Reclamation and DWR, 2011). High predation rates are known to occur below small dams, such as the Red Bluff Diversion Dam (RBDD) in the Sacramento River and Sack Dam in the Restoration Area. As fish pass over small dams, they are subject to conditions that may disorient them, making them highly susceptible to predation by fish or birds. In addition, deep pool habitats tend to form immediately downstream from such dams, such as within the Restoration Area, creating conditions that promote congregation of Sacramento pikeminnow, striped bass, and other predators. Tucker *et al.* (1998 as cited in Reclamation and DWR 2011) showed high rates of predation by Sacramento pikeminnow and striped bass on juvenile salmon below the Red Bluff Diversion Dam on the Sacramento River.

Although not specifically mentioned in the SJRRP PEIS/R, naturally occurring pathogens may also pose a threat to the spring-run Chinook salmon ESU, because artificially propagated spring-run Chinook salmon are susceptible to disease outbreaks such as the Infectious Hematopoietic Necrosis Virus and Bacterial Kidney Disease (NMFS 2011). No disease outbreaks at the Feather River Fish Hatchery affecting spring-run Chinook salmon have occurred between 2006 and 2011 (NMFS 2011).

3.6 Other Environmental Conditions of the San Joaquin Basin

Other environmental conditions of the San Joaquin Basin are described below. These conditions include recreational boating and fishing, commercial fishing, hatchery facilities, land use, water quality, water temperature, suspended sediment and turbidity. Portions of these discussions have been taken from the SJRRP PEIS/R. The SJRRP includes restoration actions that will address some of the conditions described here.

3.6.1 San Joaquin River Recreation

The PEIS/R describes the settings of recreation, as they pertain to implementation of the Settlement. The PEIS/R therefore contains discussion regarding all of the recreational facilities. The following is summary of recreational opportunities a presentation of those resources related to fishing and other river related activities.

Water from the San Joaquin River is heavily managed and is extensively distributed to benefit a variety of users. Recreation is possible in the river and adjacent to the river in some areas. However, with such extensive modification of the river's flows, some reaches are dry at most times, and only limited recreation opportunities are available. The following text briefly describes recreation uses occurring within the five project reaches of the San Joaquin River located downstream from Millerton Lake.

Recreational activities within the San Joaquin River portion of the Restoration Area include fishing, boating, nature interpretation and education, trail use, camping, hunting, picnicking, and wildlife viewing/nature observation. Fishing and boating are activities that are most directly flow-dependent, with the availability and quality of these activities closely tied to the frequency, timing, and volume of river flows. The other activities mentioned below are flow-independent but are often associated with boating and fishing, and may be enhanced by more frequent river flows.

Most of the recreation use on the river within the Restoration Area occurs in Reach 1 because this reach provides publicly accessible lands, public river access, consistent flows, and several developed facilities. Reach 2 is almost entirely dry except during high flow events, and Reaches 2 and 3 contain few public lands and have little public river access. The exceptions are the Mendota Pool, at the downstream end of Reach 2, which contains water year-round and is accessible to the public via a county park, and a gravel boat ramp and small city park on the upstream portion of Reach 3. Other use of the river or riverbed in these reaches is assumed to be by adjacent private landowners and possibly other local residents, and may include fishing, hunting, and off-highway vehicle use. Reach 4 (also generally dry) and Reach 5 include public lands that offer hunting and fishing.

Recreational Boating

A range of boating opportunities is possible in Reach 1 (SJRPCT 2010a, as cited in Reclamation and DWR 2011). The river, side channels, and old mining lakes provide flat-water boating opportunities. The *San Joaquin River Parkway Master Plan* (SJRC 2000, as cited in Reclamation and DWR 2011) describes the river as a public "canoe trail" for nonmotorized boating. The river has minimal riffles and a few small rapids at Lost Lake Park (American Whitewater Association 2007a, as cited in Reclamation and DWR 2011) but is generally slow enough that constant paddling is required (SJRC 2000, as cited in Reclamation and DWR 2011). According to American Whitewater, the river from Friant Dam to Skaggs Bridge Park is "the safest introduction to river paddling in the Fresno area" during summer low flows and "the closest whitewater to Fresno" during high flows. Some boating hazards are present and include riparian vegetation that overhangs the river and mining causeways and culverts (American Whitewater Association 2007a, as cited in Reclamation and DWR, 2011).

Two Stanislaus County parks provide the only developed recreation access to this segment of the San Joaquin River. The Las Palmas Fishing Access, a few miles east of the town of Patterson, is a 3-acre park providing a concrete boat ramp and day use facilities (Stanislaus County 2009a, as

cited in Reclamation and DWR 2011). Laird Park, 2 miles east of the town of Grayson, is a 97-acre "community park" providing river access and day use facilities (Stanislaus County 2009b, as cited in Reclamation and DWR 2011).

The San Joaquin River NWR is located along the San Joaquin River between the Tuolumne and Stanislaus rivers, two major tributaries to the San Joaquin River. The refuge boundaries encompass over 7,000 acres of riparian woodlands, wetlands, and grasslands. Although the refuge is primarily undeveloped, a wildlife viewing platform has been constructed at one location at a favored location for viewing geese and other waterbirds (USFWS 2006, as cited in Reclamation and DWR 2011).

The West Hilmar Wildlife Area, on the west bank of the river a few miles downstream of the Merced River confluence, is a 340-acre State wildlife area, with no facilities and accessible only by boat (DFG 2009, as cited in Reclamation and DWR 2011). The last river access before the San Joaquin River enters the Delta is Mossdale County Park (San Joaquin County) located in the City of Lathrop which provides boating access.

Not on the San Joaquin River, but in the vicinity, California Department of State Parks (State Parks) manages two small developed park units, each less than 75 acres, on the bank of the lower Merced River in Merced County. George J. Hatfield State Recreation Area (SRA) is near the confluence with the San Joaquin River and McConnell SRA is approximately 18 miles upstream from the confluence with the San Joaquin River. Both parks provide access to the Merced River for boating, fishing, swimming, picnicking, and hiking on short trails. McConnell SRA also offers family and group camping.

Farther north, the Turlock Lake SRA furnishes camping, boating, and day use facilities at the 3,500-acre Turlock Lake and the adjacent Tuolumne River, on the eastern edge of the valley in Stanislaus County. Caswell Memorial State Park is located along the Stanislaus River in San Joaquin County, approximately 5 miles upstream from the confluence with the San Joaquin River. This 258-acre park offers opportunities for fishing and swimming in the Stanislaus River and camping facilities and nature trails through the park's riparian oak woodland.

Lastly, as the river enters the Delta there is Mossdale County Park located in the City of Lathrop which provides boating access.

Recreational Fishing

Fishing occurs primarily in Reaches 1 and 5, which have year-round flow, and the portion of Salt Slough located in the San Luis National Wildlife Refuge (NWR) (USFWS 2010, as cited in Reclamation and DWR 2011). Current California sportfishing regulations prohibit salmon fishing on the San Joaquin River from Friant Dam to Mossdale. Reach 1 is planted throughout the year with rainbow trout from DFW's San Joaquin Fish Hatchery (SJFH) located downstream from Friant Dam and is fished year-round, primarily by local anglers (Shaffer 2005 as cited in Reclamation and DWR 2011). Public fishing access exists along the river in Reach 1(Table 3-11)

and fishing occurs in the adjacent Lost Lake, a borrow pit created during the construction of Friant Dam (City of Fresno 2007a, as cited in Reclamation and DWR 2011), and other similar pits created by gravel mining. Most of the native fish species that were present in the San Joaquin River before construction of the dam are now uncommon, rare, or extinct and have been largely replaced by warm water nonnative fish species, such as sunfish, crappie, bluegill, striped bass, largemouth bass, smallmouth bass, and catfish. Salmon have been extirpated from the mainstem San Joaquin River primarily because of a lack of continuous flow in the San Joaquin River upstream from the Merced River (FWUA and NRDC 2003, as cited in Reclamation and DWR, 2011).

Table 3-11 Existing Parks and Public Lands in the San Joaquin River Parkway – Reach 1

Recreation Facility/ Park Unit	Owner[1]	Area(acres)	Primary Recreation Opportunities					
			Fishing	Boat Access to River	Outdoor	Trails/Trail Access	Camping	Picnicking
Camp Pashayan	DFW, SJRPCT	32[2]	X	X		X		X
Coke Hallowell Center for River	SJRPCT	20			X	X		
Fort Washington Beach	Private	NA	X	X			X	X
Friant Cove	SJRC	6	X	X				X
Jensen River Ranch	SJRC	167				X		X
Lost Lake Park	City of Fresno	305	X	X	X	X	X	X
San Joaquin River Ecological	DFW	800[2]			X			
Scout Island	City of Fresno	85		X	X		X	
Sycamore Island Ranch	SJRPCT	350	X	X		X		X
Wildwood Native Park	SJRPCT	22	X	X		X		
Willow Lodge (adjacent to Willow Unit of San Joaquin River	DFW	88			X	X		
Woodward Regional Park	City of Fresno	300				X		X

Notes:

1 Management of several of the parks is by an entity other than the owner, in some cases with the park owner. The SJRC owns and manages 2,541 acres in total, much of which is managed for conservation and future low-impact recreation. In addition, on land owned by the Conservancy, Islewood Golf Course is operated by a private entity. In addition to the properties providing the recreation opportunities in the table, DFW also owns and operates the San Joaquin Hatchery, below Friant Dam, where the public can view and feed trout in the hatchery raceways.

2 The ecological reserve is composed of several widely dispersed units in the parkway, which in total equal 800 acres; access is by special permit only (DFG 2007).

Key:

DFW = California Department of Fish and Wildlife

NA = not applicable

SJRPCT = San Joaquin River Parkway and Conservation Trust

SJRC= San Joaquin River Conservancy

3.6.2 Commercial Fishing

Commercial fishing of Chinook and other salmon occurs off the coast of northern and central California, when open. The Central Valley Chinook salmon that are targeted by this fishery are fall-run Chinook. There also is an important recreational fishery for Chinook salmon in the ocean as well as in the inland waters, although more restrictive regulations apply in anadromous spawning areas to protect this important life stage. Current regulations on both the recreational and commercial fisheries include restrictions of time, place, and gear that are intended to reduce the take of ESA listed salmonids.

3.6.3 Hatchery Facilities

As part of the restoration process eggs or juveniles will be collected for use as broodstock or direct release. The pathogen and quarantine procedures for transporting eggs from one watershed to another watershed may require holding at the DFW holding facility. After any quarantine the collected eggs or juveniles will need a place to be held, prior to release or held until ready for breeding.

As part of its 10(a)(1)(A) permit application the USFWS proposed the Silverado holding facility and CABA as locations to be used to quarantine the juveniles/eggs collected at FRFH. While future 10(a)(1)(A) may identify other locations, these quarantine facilities and the hatchery facilities below are the likely facilities that would be used for restoration activities.

Silverado is located in Napa County, California, near Yountville. Silverado takes its water from Rector Reservoir on Rector Creek, a tributary of the Napa River. Silverado is permitted 1.6 million gallons of water per day. Unlike most of the hatcheries run by DFW, Silverado does not have a National Pollutant Discharge Elimination System (NPDES) permit because the quantity of fish produced is less than the biomass limit or flow limit that would require an NPDES permit for a cold-water concentrated aquatic animal production facility (NMFS 2012).

The CABA was established to provide support to University of California Davis researchers in addressing problems associated with California's cultured and wild aquatic biological resources.

The CABA consist of two facilities. The first is a five-acre facility that has numerous tanks and tank systems that are available both inside and outside. Tank sizes range from small 2 ft. diameter tanks to a 24 ft. diameter tank. The second is the Putah Creek facility consisting of two buildings for inside work with an office trailer and tool room. This facility has mainly large diameter tank systems (7 ft. to 20 ft. diameter) suitable for large species of fish or for use in mesocosm studies. CABA also has on site an array of four artificial streams. There is research and student training space for a wide range of programs in aquatic vertebrate and invertebrate ecology, reproduction, behavior, nutrition, genetics, endocrinology, disease and pathology, aquaculture engineering, aquatic toxicology, and general aquatic biology (NMFS 2012).

Both CABA facilities receive well water at 63 to 66°F throughout the year. The Putah Creek facility has an additional source of ground water that varies in temperature from 50 to 68°F during the year (CABA, 2012). The university has all the appropriate water use and discharge permits (NMFS 2012).

As part of the Proposed Action, the collection of spring-run Chinook eggs or juveniles to be used for broodstock will need a place to be held. In order to provide the necessary facilities for these eggs or juveniles to be held, an existing Interim Facility will first be used, followed by an additional, larger Conservation Hatchery Facility that will be constructed by DFW later.

As described in the recreational fishing section, the DFW operates the SJFH for raising trout. It is located approximately one mile downstream of Friant Dam. This location also as an existing ""Interim Facility" that will be used for restoration (see below). Water for the hatchery is a continuous 35 cfs supply gravity-fed directly from Friant Dam, and then aerated at the hatchery. The existing SJFH has used this water source to successfully hatch and raise trout at the site since 1955 due to favorable water temperature and water quality conditions (NMFS 2012).

Prior to reaching the hatchery, the water passes through the Fishwater Release Hydropower Plant, which is owned by the Orange Cove Irrigation District. The flows are delivered to the power plant through two different pipelines: a 24-inch diameter pipeline from two Friant Dam penstocks, and a 30-inch diameter pipeline that takes water from the Friant Kern Canal penstock near the left dam abutment. DFW is currently in negotiations with Reclamation to secure additional water for the Conservation Hatchery Facility. Once additional water is secured, the water supply is anticipated to be equally as reliable as the SJFH (NMFS 2012).

The small-scale, Interim Facility is located on the grounds of SJFH and will be operational until the full-scale Conservation Hatchery Facility is constructed. The full-scale Conservation Hatchery Facility is anticipated to be operational in 2014, at which time both facilities would be integrated together. Construction funding for the Interim Facility and the long-term Conservation Hatchery Facility is provided by the State of California. The DFW started to build the Interim Facility in 2010 and has been expanding and testing the system since then. Planning and permitting activities for the full-scale Conservation Hatchery Facility are in process with DFW as the lead agency.

3.6.4 Land Use

The following summarizes the land use and agricultural resources within the Restoration Area of the SJRRP and is taken from the Environmental Setting section of Chapter 16 (Land Use and Agricultural Resources) of the SJRRP PEIS/R. While there are other land uses adjacent to the San Joaquin River it is the potential use of river water by agriculture that could affect the riverine system. The SJRRP PEIS/R contains detailed information regarding land use along the five reaches of the San Joaquin River (Figure 1-3) including the amounts of land under Williamson Act contracts, the acreages for the various categories of farm land. This information is incorporated by reference. This EA does not include a discussion of the land uses and

agricultural resources associated with the possible donor stock collection sites since the effects of collecting donor stock, including specific information as to the land uses surrounding the collection sites is analyzed during the section 10(a)(1)(A) permit process.

- **Agricultural and Other Land Uses**

Within the Restoration Area the SJRRP PEIS/R identified where restoration actions could affect existing land uses or agricultural resources. In addition, the SJRRP PEIS/R included a discussion of forest lands within the Restoration Area.

Most of the land in the Restoration Area is privately owned. The primary land uses are open space and agriculture. Urban land uses (e.g., residential, commercial, industrial) account for only a small percentage of land use along the San Joaquin River. This type of use is associated primarily with the small communities located near the river between Friant Dam and the confluence with the Merced River.

As described in the *San Joaquin River Restoration Study Background Report* (FWUA and NRDC 2002, as cited in Reclamation and DWR 2011), land ownership data were compiled from Reclamation and DWR's database (2001). Data depicting lands managed by the San Joaquin River Parkway and Conservation Tract (SJRPCT) were provided by GreenInfo Network (2002). Data provided by the SJRPCT also were reviewed. As a historic navigable river, the bed of the San Joaquin River is subject to the jurisdiction of the California State Lands Commission.

The State of California holds the fee ownership in the river bed between the two ordinary low water marks in Reach 1A (State Lands Commission 1992, as cited in Reclamation and DWR 2011). Data from the 1989 to 1992 State Lands Boundary Survey located the State's fee title (low water) and Public Trust Easement (high water) claims, and were used as a basis for defining property boundaries from Friant Dam to Herndon on both sides of the river. The 1989 to 1992 State Lands Commission surveys did not go downstream from Reach 1A. However, the California State Lands Commission initiated work in the fall of 2010 to develop an administrative decision on the ordinary low and high water marks in the remaining reaches of the Restoration Area. Land between the ordinary high water marks is subject to a Public Trust Easement. A lease is required for projects on State-owned lands under the jurisdiction of the California State Lands Commission. Land ownership was separated into two broad classifications: public and private. Public lands were classified as Federal lands, State Lands Commission public trust and fee title lands, other State and county lands, and lands owned by the SJRPCT.

In the Restoration Area, public lands are located in the jurisdictions of the following Federal, State, and local agencies, respectively: USFWS, USACE, and Reclamation; DWR and State Parks; and Fresno, Madera, and Merced counties, and the cities of Fresno and Firebaugh. Available land use management plans, comprehensive plans, and general plans adopted by jurisdictions in the Restoration Area were reviewed to identify existing and future land uses. These plans are described in the Regulatory Setting section of the SJRRP PEIS/R.

The Restoration Area occupies approximately 72,581 acres along the San Joaquin River (Table 3-12). Land uses within the Restoration Area were identified, inventoried, and placed into the following broad land use categories: agricultural, open space, and urban. Table 3-12 shows the approximate acreages for each land use category along the San Joaquin River, by reach, and for the bypass areas.

Table 3-12. Acreage of Land Uses Along San Joaquin River in Restoration Area[1]

River Reach	Land Use (acres)[2]			
	Agricultural	**Open Space**	**Urban**	**Total**
Reach 1	7,216 (46**%**)	5,195 (33%)	3,419 (22%)	15,830
Reach 2	9,107 (99%)	37 (<1%)	28 (<1%)	9,172
Reach 3	7,218 (90%)	606 (8%)	231 (3%)	8,055
Reach 4	14,439 (100%)	0 (0%)	0 (0%)	14,439
Reach 5	5,461 (100%)	0 (0%)	0 (0%)	5,461
Bypass Areas	16,306 (83%)	0 (0%)	3,317 (17%)	19,623
Total	**59,747 (82%)**	**5,838 (8%)**	**6,996 (10%)**	**72,581**

Source: SJRRP PEIS/R

Notes:

[1] The width of the Restoration Area includes an area approximately 1,500 feet from the river centerline outward from both banks, for a total width of approximately 3,000 feet.

[2] Acreage numbers have been rounded to the nearest acre.

Key:

% = percent

< = less than

While the SJRRP PEIS/R includes information for each of the reaches this EA is including only the additional information for Reach 1. The Interim Facility and subsequent conservation hatcheries are in Reach 1 and much of the activities associated with reintroduction would occur within this Reach. Approximately 1,636 acres of Reach 1 of the Restoration Area are in the City of Fresno. Reach 1 also includes the town of Friant, as well as the unincorporated communities of Rolling Hills, Herndon, and Biola. The approximate acreage of land uses, as inventoried in Reach 1, is approximately 15,832 acres (see Table 3-9). The primary land use category of Reach 1 is agriculture (60 percent), followed by open space (28 percent), and urban land uses (12 percent). Approximately 93.8 percent of lands found in Reach 1 are privately owned.

Reach 1 is divided into two subreaches. Reach 1A flows to the north of Fresno and also passes near the communities of Friant and Rolling Hills and two trailer parks located adjacent to the Yosemite Freeway Bridge. Between Friant Dam and the SR 99 bridge that crosses the San Joaquin River, several roads parallel the river in this subreach, and six bridges (North Fork Road Bridge, Yosemite Freeway Bridge, West Nees Bridge, and three unnamed bridges) cross the river.

The primary nonurban land uses along the remaining areas of Reach 1A are gravel mining, agriculture, and recreation/open space. Several active gravel quarries, and related roads and other infrastructure, are located adjacent to the river. Agricultural land uses include vineyards, annual crops, and orchards.

In addition to mining and agriculture, several recreation areas are located in Reach 1A. The San Joaquin River Parkway extends upstream from, and includes, the Millerton Lake SRA and areas along both river banks of this subreach. The parkway includes multiple recreation sites and use areas, including Lost Lake Park, an approximately 273-acre recreation area along 1.8 miles of the southern bank, Fort Washington Beach, Sycamore Island Ranch, and Camp Pashayan, among others. Three private golf courses (Riverbend Golf Club, Fig Garden Golf Club, and San Joaquin Country Club) and one public golf course (Riverside Golf Course) are present in this subreach. Multiple ponds are also located in this reach. These ponds were created in abandoned mining gravel pits and are now stocked with game fish.

- **Forest Land**

Forest land is defined as native tree cover greater than 10 percent that allows for management of timber, aesthetics, fish and wildlife, recreation, and other public benefits (California Public Resources Code Section 12220(g)). Natural forest and woodland vegetation types in the study area typically have greater than 10 percent cover by native trees (SJRRP PEIS/R, 2010 Appendix L, "Biological Resources – Vegetation and Wildlife"). Forest land in the Restoration Area consists of riparian forest that has been classified into four major types based on the dominant species: cottonwood riparian forest, willow riparian forest, mixed riparian forest, and valley oak riparian forest. As shown in Table 3-13, forest lands total approximately 4,320 acres in the Restoration Area.

Table 3-13 Habitats and Acreage of Forest Land in the Restoration Area

Habitat Type	**Habitat Acreage[1]**						
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Bypasses**	**Total**
Cottonwood Riparian Forest	386 (37%)	120 (12%)	452 (43%)	56 (5%)	29 (3%)	-- (0%)	1,043
Willow Riparian Forest	345 (16%)	163 (8%)	124 (6%)	777 (36%)	755 (35%)	2 (<1%)	2,166
Mixed Riparian Forest	783 (99%)	2 (<1%)	-- (0%)	6 (<1%)	1 (<1%)	-- (0%)	792
Valley Oak Riparian Forest	265 (41%)	-- (0%)	-- (0%)	23 (7%)	35 (11%)	-- (0%)	323
Total	**1,779 (41%)**	**285 (7%)**	**576 (13%)**	**862 (20%)**	**820 (19%)**	**-- (0%)**	**4,324**

Source: DWR 2002 in SJRRP PEIS/R
Note:
1 Acreage numbers have been rounded to the nearest acre.
Key:
% = percent
< = less than

Table 3-13 shows those lands formally identified as the forest types present within the Restoration Area. These lands consist of habitats associated with river systems and are not considered traditional sources of timber production.

3.6.5 Water Quality

The discussion of water quality in the Restoration Area is from the Draft PEIS/R. It should be noted that one of the actions that will result from the SJRRP is that the restoration of flows to the Restoration Area may result in changes to water quality. Any potential changes are addressed in the Draft PEIS/R, and would occur whether the Proposed Action occurs or not.

Water quality in various segments of the San Joaquin River below Friant Dam is degraded because of low flow, and discharges from agricultural areas and wastewater treatment plants. The current triennial review of the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan) is anticipated to provide the regulatory guidance for Total Maximum Daily Load (TMDL) standards at locations along the San Joaquin River (Central Valley RWQCB 2009b).

Water quality in Reach 1 is influenced by releases from Friant Dam, with minor contributions from agricultural and urban return flows. Water quality data collected from the San Joaquin River below Friant Dam demonstrate the generally high quality of water released at Friant Dam from Millerton Lake to Reach 1. Temperatures of San Joaquin River water releases to Reach 1 are dependent on the cold-water volume available at Millerton Lake (Reclamation 2007). The reach from Gravelly Ford to the Mendota Pool (Reach 2) is frequently dry, except during flood releases at Friant Dam, because water released at Friant Dam is diverted upstream to satisfy water right agreements, or the water percolates to groundwater.

During the irrigation season, water released at Mendota Dam to Reach 3 generally has higher concentrations of total dissolved solids (TDS) than water in the upper reaches of the San Joaquin River. Increased electrical conductivity (salinity) and concentrations of total suspended solids demonstrate the effect of Delta contributions to San Joaquin River flows. Water temperatures below Mendota Dam are dependent on water temperatures of inflow from the Delta Mendota Canal and, occasionally, the Kings River system via James Bypass (Reclamation 2007).

Water quality criteria applicable to some beneficial uses are not currently met within Reaches 3 and 4.

The Central Valley RWQCB is currently developing a Proposed Basin Plan Amendment to establish new salinity and boron water quality objectives in the lower San Joaquin River upstream from Vernalis, and a TMDL to implement the salinity and boron water quality objectives (Central Valley RWQCB 2009c). In addition to these water quality impairments, a TMDL and Basin Plan Amendment for organic enrichment and low dissolved oxygen (DO) in the Stockton Deepwater Ship Channel portion of the San Joaquin River were adopted. However, the Central Valley RWQCB has not adopted TMDL for DO for the entire San Joaquin River Basin.

Water quality in the Delta is highly variable temporally (timing) and spatially (location) and is a function of complex circulation patterns that are affected by inflows, pumping for Delta agricultural operations and exports, operation of flow control structures, and tidal action.

3.6.5.1 Water Temperature

Most fish maintain body temperatures that closely match their environment (Brown and Moyle 1993, as cited in Reclamation and DWR 2011). As a result, water temperature has a strong influence on almost every fish life-history stage, including metabolism, growth and development, timing of life-history events, and susceptibility to disease. These effects may vary depending on a fish's prior thermal history (i.e., acclimation). Reduced growth, reduced reproductive success, inhibited movement, and mortality of fish can occur when water temperature exceeds the metabolic tolerance of a particular life stage (Hughes et al. 1978, Bjornn and Reiser 1991, as cited in Reclamation and DWR 2011).

In the San Joaquin River, water temperature is primarily a concern for native fish that thrive in cooler water, such as salmon, steelhead, and rainbow trout (Bjornn and Reiser 1991, as cited in Reclamation and DWR 2011), and for those species that require cooler water for specific life stages (Moyle 2002a as cited in Reclamation and DWR 2011). Summer water temperatures in many Central Valley streams regularly exceed 77°F (Moyle 2002a as cited in Reclamation and DWR 2011). Sustained periods of increased water temperature can impact behavioral and biological functions of all fish in the San Joaquin River system, including special status species and others that are relatively tolerant of warm temperatures.

3.6.5.2 Suspended Sediment and Turbidity

Suspended sediments such as clay, silt, organic matter, plankton and other microscopic organisms cause turbidity in water that can interfere with photosynthetic primary productivity, water temperature, dissolved oxygen (DO), and fish feeding habits. Turbidity generally reduces the efficiency of piscivorous (fish-eating) and planktivorous (plankton-eating) fish in finding and capturing their prey (Henley et al. 2000 as cited in Reclamation and DWR 2011). Higher turbidity may occasionally favor the survival of young fish by protecting them from predators (Burton 1985, Van Oosten 1945 as cited in Reclamation and DWR 2011) at the expense of reduced growth rates for sight-feeding fish (Newcombe and MacDonald 1991, Newcombe and Jensen 1996 as cited in Reclamation and DWR 2011).

The San Joaquin River downstream from Reach 5 has physical habitat and water quality conditions similar to those found in Reach 5, with increased flows provided by major tributaries, including the Merced, Tuolumne, Stanislaus, and Calaveras rivers. Water management in the San Joaquin River focuses on diversion of water out of streams and rivers into canals for agricultural use, with some of the applied water returned as agricultural drainage (Brown and May 2006, as cited in Reclamation and DWR 2011). Flood control levees closely border much of the river but are set back in places, creating some off-channel aquatic habitat areas when inundated.

3.6.6 Air Quality

- **Air Basins for Sacramento River and San Joaquin River**

This section provides a description of the air basins in which the Proposed Action are located and a summary table of the Attainment Status within the air basin. Description of individual pollutants and the regulatory setting are found in the SJRRP PEIS/R and are incorporated by reference.

The Proposed Action is located within the Sacramento Valley Air Basin (SVAB) and San Joaquin Valley Air Basin (SJVAB). The watersheds for the potential donor stocks – Feather River, Deer, Mill, Butte, Clear, and Battle Creeks – are within the SVAB. Lastly, the Mokelumne River and the Restoration Area, which includes the San Joaquin River tributaries the Stanislaus, Tuolumne, and Merced Rivers, are within the SJVAB under the jurisdiction of the San Joaquin Valley Air Pollution Control District (APCD).

The SVAB consists of northern portion of the Central Valley of California. The SVAB contains all or part of 11 counties (Shasta, Tehama, Butte, Glenn, Colusa, Yuba, Sutter, Yolo, Placer, Sacramento, and eastern Solano). The basin is ringed by tall mountains with the Coast Range to the west, Cascade Range to the north, the Sierra Nevada to the east. Seasonally the winters in the SVAB are cool and wet with the summers being hot and dry.

The SJRRP Area is located in Fresno, Madera, and Merced counties, which are part of SJVAB. The SJVAB also comprises all of Kings, San Joaquin, Stanislaus, and Tulare counties and the valley portion of Kern County, including the Friant Division. The SJVAB occupies the southern half of the Central Valley. The SJVAB is a well-defined climatic region with distinct topographic features on three sides. The Coast Range is located on the western border of the SJVAB. The Tehachapi Mountains are located on the south side of the SJVAB. The Sierra Nevada forms the eastern border of the SJVAB. The northernmost portion of the SJVAB is San Joaquin County. No topographic feature delineates the northern edge of the basin. The SJVAB can be considered a “bowl” open only to the north and connected to the SVAB and San Francisco Air Basin.

Like the SVAB, the inland Mediterranean climate type of the SJVAB is characterized by hot, dry summers and cool, rainy winters. Table 3-14 summarizes the Attainment Status Designations for the counties of the two air basins.

3.6.7 Climate Change

- **Climate Change and Greenhouse Gas Emissions**

Chapter 7 of the SJRRP PEIS/R describes the environmental setting for climate change and greenhouse gas (GHG) emissions. The discussion of climate change and the potential impacts of the program alternatives on climate change encompasses the San Joaquin River from Friant Dam to the Merced River (the Restoration Area), the San Joaquin River from the Merced River to the Sacramento-San Joaquin Delta, and the Sacramento-San Joaquin Delta.

Scientific evidence suggests that many climatic conditions are already changing and will continue to change in the future. Therefore, expected future climate changes that have the potential to affect implementation and performance of the SJRRP were also considered in the SJRRP PEIS/R. These included changes in snowpack and the timing and magnitude of snowmelt runoff and flood flows, which would in turn influence storage, delivery, and release actions. Furthermore, sea level rise could affect San Francisco Bay and conditions in the Sacramento-San Joaquin Delta. However, the considerations in the SJRRP PEIS/R where associated with future CVP/SWP operations.

The affected environment for climate change analysis is global, with State and local implications. The SJRRP PEIS/R discussion provided a background overview of global climate change (which has been incorporated by reference), and climate trends and associated impacts at the global and State levels are then described, followed by an overview of GHG emissions sources in California and in SJVAB.

- **Global Climate Trends and Associated Impacts**

The rate of increase in global average surface temperature over the last hundred years has not been consistent; the last three decades have warmed at a much faster rate – on average 0.32°F per decade. Eleven of the 12 years from 1995 to 2006, rank among the warmest years in the instrumental record of global average surface temperature (going back to 1850) (IPCC 2007a, as cited in Reclamation 2011).

During the same period over which this increased global warming has occurred, many other changes have occurred in other natural systems. Sea levels have risen on average 1.8 mm/year; precipitation patterns throughout the world have shifted, with some areas becoming wetter and other drier; tropical cyclone activity in the North Atlantic has increased; peak runoff timing of many glacial and snow-fed rivers has shifted earlier; as well as numerous other observed conditions. Though it is difficult to prove a definitive cause and effect relationship between global warming and other observed changes to natural systems, there is high confidence in the scientific community that these changes are a direct result of increased global temperatures (IPCC 2007a, as cited in Reclamation and DWR 2011).

- California Climate Trends and Associated Impacts

Maximum (daytime) and minimum (nighttime) temperatures are increasing almost everywhere in California but at different rates. The annual minimum temperature averaged over all of California has increased 0.33°F per decade during the period 1920 to 2003, while the average annual maximum temperature has increased 0.1°F per decade (Moser et al. 2009, as cited in Reclamation and DWR 2011).

With respect to California's water resources, the most significant impacts of global warming have been changes to the water cycle and sea level rise. Over the past century, the precipitation mix between snow and rain has shifted in favor of more rainfall and less snow (Mote et al. 2005,

Table 3-14 Summary of Attainment Status Designations for the Sacramento Valley, San Joaquin Valley and Bay Area Air Basins

Pollutant	**Averaging Time**	**Attainment Status**
Ozone	1-hour	Nonattainment- Severe: San Joaquin Valley, Serious: Yolo, Sacramento, Sutter Counties Moderate: Butte, Colusa, Yuba, Glenn, Tehama, and Shasta Counties
	8-hour	–
Carbon Monoxide (CO)	1-hour	Attainment: Fresno, Stanislaus, San Joaquin, Sacramento, Napa, Yolo, Sutter, Butte Counties Unclassified: Madera, Merced, Yuba, Colusa, Glenn, Tehama, and Shasta Counties
	8-hour	
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	-
	1-hour	Attainment
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	-
	24-hour	Attainment
	3-hour	-
	1-hour	Attainment
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	Nonattainment
	24-hour	
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	Nonattainment: San Joaquin Valley, Sacramento, Butte, and Napa Counties. Attainment: Sutter, Yuba, Colusa, and Shasta Counties. Unclassified: Yolo, Glenn, and Tehama Counties
	24-hour	-
Lead	30-day Average	Attainment
	Calendar Quarter	-
Sulfates	24-hour	Attainment
Hydrogen Sulfide	1-hour	Unclassified
Vinyl Chloride	24-hour	Unclassified/ Attainment
Visibility Reducing Particle Matter	8-hour	Unclassified

Sources: ARB 2012, (SJVAPCD 2008b; ARB 2008c, 2008d; EPA 2008c) In PEIS/R 2011

Knowles 2006, as cited in Reclamation and DWR 2011) and snow pack in the Sierra Nevada is melting earlier in the spring (Kapnick and Hall 2009, as cited in Reclamation and DWR 2011). The average early spring snowpack in the Sierra Nevada has decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage (DWR 2008, as cited in Reclamation and DWR 2011). These changes have significant implications for future water supply, flooding occurrences, aquatic ecosystems, energy generation, and recreation throughout the state. During the same period, sea levels along California's coast rose seven inches (DWR 2008, as cited in Reclamation and DWR 2011). Sea level rise associated with global warming will continue to threaten coastal lands and infrastructure, increase flooding at the mouths of rivers, place additional stress on levees in the Sacramento-San Joaquin Delta, and will intensify the difficulty of managing the Sacramento-San Joaquin Delta as the heart of the state's water supply system.

These trends in California's water supply could impact the SJRRP by further straining the scarce resources needed to implement appropriately-timed Restoration Flows, while balancing the need to irrigate cropland and supply drinking water to large numbers of Californians. Increased surface temperatures may affect stream quality for fish and their prey, changing the biological conditions under which the SJRRP operates. In addition, increased frequency and severity of flood events could negatively or positively impact fragile or restored areas such as gravel bars and riparian habitat by either breaking down gravel bars in one area and building up in another.

- **Greenhouse Gas Emissions Sources and Inventory**

Human activities contribute to climate in many ways, but primarily by causing changes in the atmospheric concentrations of GHGs and aerosols. The largest anthropogenic contribution to climate change is the burning of fossil fuels, which releases CO2 and other GHGs to the atmosphere. Since the start of the industrial era (about 1750), the use of fossil fuels has increased through activities such as transportation, building heating and cooling, and the manufacture of cement and other goods. Land use changes, such as wide-scale deforestation, the use of fertilizers, and draining of wetlands also contribute to GHG emissions worldwide. The rate of increase in GHG concentrations has increased during the last century, with an increase of 70 percent between 1970 and 2004 alone (IPCC 2007a, as cited in Reclamation and DWR 2011). During this period, the two largest sectors of GHG emissions were the energy supply (with an increase of over 145 percent) and transportation (with a growth of over 120 percent) sectors. The slowest growth during the 1970 to 2004 period was in the agricultural sector with 27 percent growth and the residential/commercial buildings sector at 26 percent (IPCC 2007b, as cited in Reclamation and DWR 2011).

California is the 12th to 16th largest emitter of CO2 in the world (CEC 2006, as cited in Reclamation and DWR 2011). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (CEC 2006, as cited in Reclamation and DWR 2011). California produced 484 million gross metric tons (mt) of CO2 equivalent in 2004. Combustion of fossil fuel in the transportation sector was the single largest source of California's GHG emissions in 2004, accounting for 35 percent of total GHG emissions in the State (CEC 2006, as cited in Reclamation and DWR 2011). This sector was followed by the electric power sector (including both in-State and out-of-State sources) (22 percent) and the industrial sector (21 percent) (CEC 2006, as cited in Reclamation and DWR 2011). No GHG emissions inventory has been conducted for the SJVAB at this time.

SECTION 4 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

The environmental consequences of this action are related to potential impacts to salmonid populations within the Central Valley (Sacramento and San Joaquin river basins) and how an experimental population of spring run Chinook may affect aquatic species and human activities along the San Joaquin River and its tributaries. The proposed action does not involve construction, changes in water diversions or flows in the Sacramento or San Joaquin river basins, or other physical changes to the environment beyond those associated with the collection of donor stock and their eventual release to the San Joaquin River. Changes in San Joaquin River flows and related projects are evaluated in the SJRRP PEIS/R.

The analysis of the environmental consequences is organized starting with the No Action Alternative, and is followed with an analysis of the proposed Action Alternatives. The donor stock alternatives analyze the effects of collecting spring-run Chinook within the Sacramento River Basin for transfer to the San Joaquin River Basin. The effects of placing spring-run Chinook into the San Joaquin River Basin are analyzed in each of the Area Alternatives. The two Duration alternatives will be discussed separately following the discussion of the Area Alternatives.

NO ACTION ALTERNATIVE ANALYSIS

4.2 No Action Alternative

Under this alternative the channel and habitat improvements proposed in the SJRRP would be carried out and fall-run Chinook would be reintroduced. However, there would be no collection of listed spring-run Chinook donor stock, no 10(j) designation of an experimental population, and spring-run Chinook would not be reintroduced intentionally to the San Joaquin River. Without the experimental population designation, there would be no special take exemptions established within the San Joaquin River basin, generally, nor for persons or entities diverting or receiving water pursuant to applicable State and Federal laws.

The No Action Alternative would result in no impact to the existing spring-run Chinook populations of the Sacramento River since there would be no collection of donor stock. There would be no on-going effort to restore the spring-run Chinook population to the San Joaquin River, which is an important element of the spring-run Chinook recovery plan and the Settlement. Since the terms of the Settlement, including requirements laid out in the Restoration Act, call for the restoration of the spring-run Chinook to a naturally self-sustaining level by 2025, this goal would not be fulfilled under the No Action Alternative.

While restoration of flows to the San Joaquin River make it possible that spring-run Chinook could potentially recolonize the San Joaquin River naturally, there is no evidence that such a volunteer population could meet either the terms of the Settlement or spring-run Chinook recovery objectives. Further, without the establishment of the NEP area and associated take exemptions, any spring-run

Chinook that did enter the San Joaquin River Basin would be protected under the existing ESA rules, potentially creating an unintended impact from the Settlement.

This impact would occur because persons or entities diverting or receiving water pursuant to applicable State and Federal laws could be impacted with ESA permitting requirements, since the current ESU 4(d) rule would apply for spring-run Chinook that naturally recolonize. There would likely be additional administrative and regulatory burdens to both individuals and the agencies as regulatory actions are taken on a case-by-case basis for actions that may adversely affect spring-run Chinook.

4.2.1 Federally Listed Species

4.2.1.1 Central Valley Spring-run Chinook Salmon

Under the No Action Alternative spring-run Chinook would not be released into the San Joaquin River as part of the SJRRP. A population of spring-run Chinook could only be re-established by volitional recolonization, after sufficient completion of SJRRP Restoration Goal actions such as modifications to conveyance structures and habitat conditions. Implementation actions to reintroduce spring-run Chinook to the Southern Sierra Nevada diversity group would need to be implemented in the Merced, Tuolumne, Stanislaus, or Mokelumne rivers in order to achieve the Draft Recovery Plan (NMFS, 2009a) objective of restoring two viable populations to this diversity group. With this alternative there would be no collection of fish from existing threatened donor stock populations, so there would be no potential impact from taking individuals from the populations. However, the limitation on re-establishing spring-run Chinook on the mainstem San Joaquin River through natural recolonization or on other tributaries would delay or prevent recovery of the species.

4.2.1.2 California Central Valley Steelhead

California Central Valley steelhead (steelhead) occurs throughout the San Joaquin River basin, including its tributaries to the confluence with the Merced River (NMFS 2009). Under the No Action Alternative it is assumed that the SJRRP would proceed with restoration activities related to implementing restoration flows and removing barriers to fish migration. These actions would allow for the passage of fall-run Chinook and steelhead that already occur in the San Joaquin River basin.

Since these two species' habitat and food requirements are similar, any improvements made to the San Joaquin River such as those proposed in the SJRRP would also help increase steelhead distribution and abundance by enhancing habitat and food supply for most life stages. Please see the PEIS/R for further information on habitat improvements. Steelhead is federally listed as a threatened species. Therefore, steelhead already have regulations related to their protection, which are not altered by any of the alternatives, including the No Action Alternative.

The No Action Alternative would be beneficial to steelhead as an additional 153 miles of river and riparian habitat would become available for the species under the SJRRP. During salmon spawning, steelhead are known to eat loose salmon eggs. So as fall-run, and potentially eventually spring-run,

Chinook reestablish within the San Joaquin River, these eggs and salmon carcasses would provide additional nutrients to the local food web.

4.2.1.3 Southern DPS of Green Sturgeon

As noted in Section 3, there is an increased likelihood that green sturgeon is present in the San Joaquin River. If that is the case, like steelhead, green sturgeon are federally listed as threatened and have regulations related to their protection, which are not altered by the any of the alternatives including the No Action. The No Action alternative would be beneficial to green sturgeon as an additional 153 miles of river and riparian habitat would become available for the species over time.

4.2.2 Fish

The No Action Alternative does not fulfill requirements of the Settlement for the reintroduction of spring-run Chinook nor the conditions for that reintroduction specified in the Restoration Act, section 10011 (b)

Under the No Action Alternative, no eggs or juvenile spring-run Chinook would be collected. However, the improvement projects of the SJRRP could be carried out; therefore, existing barriers to salmon migration could be removed as part of the SJRRP. While it is expected that under improved conditions, some spring-run Chinook would find their way into the San Joaquin River, it is likely that there would be no large scale change from the existing fish populations, based on comparison of fish assemblages in the Merced, Tuolumne, and Stanislaus rivers (SJRRP PEIS/R 2012).

4.2.3 Recreation

Fishing

Under the No Action Alternative, the habitat improvements would occur; therefore, it is likely that with improved habitat, fish species that are currently present would increase and there would be a general increase in fishing opportunities and boating related activities. In addition, fall-run Chinook and steelhead could also gain access to the San Joaquin River above the Merced River. Current fishing regulations prohibit salmon fishing in the San Joaquin River upstream of Mossdale County Park. While DFW has had fishing regulations in place for the existing fish present in the San Joaquin River above the Merced River, as well as for salmon, there has been little reason to enforce any regulations for anadromous fish such as fall-run Chinook and steelhead without a connection to the sea. Even with enforcement of regulations for fall-run Chinook and steelhead, under the No Action Alternative, there would be less than significant impacts to recreational opportunities. There would be no change in the recreational fishery for Chinook salmon in the ocean as well as in the inland waters.

The reintroduction of fall-run Chinook salmon to the San Joaquin River would eliminate current trout planting in the San Joaquin River per FGC policy. While fishing for other species of fish would continue, the opportunity to fish for planted trout would end. This would occur with the reintroduction of fall-run Chinook salmon under the SJRRP, regardless of whether spring-run Chinook are reintroduced. Consequently, mitigation to offset any impacts is being implemented as a measure under the SJRRP

PEIS/R (REC-4), so there will be no impact to recreational fishing as a result of the No Action Alternative.

Boating

Under the No Action Alternative the improvements made to the San Joaquin River by the SJRRP would improve water flows thereby improving recreational boating opportunities.

4.2.4 Commercial Fishing

Under the No Action Alternative no eggs or fish would be collected from spring-run Chinook stocks and transported to the San Joaquin River. Commercial fishing of Chinook and other salmon off the coast of northern and central California would continue. The establishment of harvest rates for these fish would continue. There would be no contribution to the fishery of salmon produced from the Proposed Action. However, implementation of the SJRRP is expected to restore habitat and connectivity which will allow existing fall-run Chinook to access suitable spawning areas near Friant Dam, which may provide a small increase in salmon available to the fishery.

Current regulations for both recreational and commercial fisheries include restrictions of time, place, and gear that are intended to reduce the take of ESA listed and non-listed salmonids. These would remain unchanged.

4.2.5 Land Use

Under the no action alternative current land use activities could continue. With the SJRRP habitat improvements it is likely that spring-run Chinook and steelhead eventually would use the upper reaches of the San Joaquin River. As these fish are federally listed any take would be subject to the provisions of the 4(d) rules established under 70 FR 37160. There would be no regulatory relief for any taking of any naturally occurring spring-run Chinook.

4.2.6 Hatchery Facilities

Absent reintroduction of spring-run Chinook, the DFW Interim Facility could be used to support existing hatchery operations or activities related to the re-establishment of fall-run Chinook under the SJRRP. Although dependent upon the ultimate buildout and design, the conservation hatchery facility could serve the reintroduction for fall-run Chinook under the SJRRP, even if the spring-run Chinook reintroduction did not occur. Production actions at the FRFH would not change under the No Action Alternative, and the hatchery would not plan to produce fish for the SJRRP. Therefore, there would be no change to either the FRFH or the SJFH operations or the environment.

4.2.7 Water quality

Under the No Action Alternative there would be no changes to the current operations of the FRFH or the SJFH. Therefore there would be no change to water quality to either the Feather River or the San Joaquin River and no impact on water quality from this alternative.

4.2.8 Air Quality

Under the No Action Alternative spring-run Chinook donor stock would not be collected or transported to the San Joaquin River or used as broodstock at the conservation hatchery facility. Therefore under the No Action Alternative there would be no air emissions from vehicles used in collection and transportation any emissions related to the operation of the conservation hatchery are dependent on ultimate buildout and design of the facility. Without new emissions there would be no impacts to air quality.

4.2.9 Climate Change

Under the No Action Alternative there would be no change in greenhouse gas emissions. Therefore there would be no impact on climate change.

ACTION ALTERNATIVES ANALYSIS

The purpose of the Proposed Action is the reintroduction of spring-run Chinook to the San Joaquin River, with regulations that meet the requirements of the Restoration Act. In all Action Alternatives, this entails the collection, transport, and release of fish for the reintroduction, and development of regulations pursuant to ESA sections 10(j) and 4(d).

4.3 Proposed Action/Reintroduction of Spring-run Chinook

All of the Donor Stock Alternatives have as common activities the collection of spring-run Chinook used in the reintroduction effort and the transportation to a conservation hatchery facility or to the release point on the San Joaquin River. All of the environmental consequences related to the Donor Stock Alternatives are the same, except for the potential impact on spring-run Chinook. In this section, the potential impact of reintroduction of spring-run Chinook is analyzed and the potential effect of each different Donor Stock Alternative will be analyzed in section 4.4.

4.3.1 Federally Listed Species

4.3.1.1 Central Valley Spring-run Chinook salmon

Use of a conservation hatchery facility is proposed for the initial population development for reintroduction. Collections of donor stock will be used to produce broodstock in the conservation hatchery facility. As the broodstock mature, their eggs or young may be placed directly into the San Joaquin River, or retained in the conservation hatchery facility as broodstock. Individual spring-run Chinook would continue to be added to the broodstock from either the FRFH or wild populations.

Conservation Best Management Practices, as outlined in a NMFS approved Hatchery and Genetics Management Plan (HGMP) that is developed for the conservation hatchery facility would be used to make the appropriate crosses of available stocks. The Proposed Action could have a beneficial impact to the species by increasing the understanding of handling, transport and broodstock culture methods. The Proposed Action also could have a beneficial impact on spring-run Chinook by restoring a population to the Southern Sierra Nevada diversity group, to further the Draft Recovery Plan objectives for the species.

Spring-run Chinook reintroduced to the San Joaquin River will be imprinted on the San Joaquin River as their natal stream or through an imprinting procedure. Any fish produced through natural spawning in the San Joaquin River would also be imprinted to the river. It is possible that members of the reintroduced spring-run Chinook could stray into the Sacramento River or tributaries to the San Joaquin River. This is expected to be within natural straying rates. Because all donor stocks are from the Sacramento River populations, those strays would contribute, in a small way, to the abundance of those runs. Over time, evolutionary forces could favor certain genetic patterns in the reintroduction population that may be different from their Sacramento River ancestors. A natural level of straying to non-natal watersheds may enhance the species diversity and contribute to species recovery.

The collection of broodstock, fish, or eggs from wild populations from Clear, Butte, Deer, Mill, or Battle creeks would require additional evaluation pursuant to NEPA and ESA. Prior to any collection from the Feather River, or FRFH spring-run Chinook populations, an analysis would need to be completed to determine if the collection of fish would jeopardize the continued existence of the species. The use of a conservation hatchery facility will minimize the number of individuals collected from wild sources or from the FRFH. The facility's operations in accordance with the HGMP will ensure genetic diversity and minimal domestication effects.

Existing conditions on the San Joaquin River place a number of stressors on any potential reintroduction effort. These include water flows and the other physical conditions on the San Joaquin River. Increased water flows have been implemented through the Interim Flow Study, and while there is greater understanding as to how to manage the flows on the San Joaquin River, present channel capacity and seepage issues constrain flow levels below Restoration Flow levels. Physical constraints on the San Joaquin River such as road crossings, small dams, and flood control structures also provide barriers to migration and additional stressors on returning adults or outmigration juveniles. The SJRRP includes a variety of projects to improve the physical conditions of the San Joaquin River, as described in the SJRRP PEIS/R. Until the suite of projects analyzed is constructed, the physical environment, aside from water flows, will remain unchanged. Habitat and passage conditions are expected to improve over time as these projects are completed. Consequently, the likely survival of spring-run Chinook released to the San Joaquin River will be low initially, but will improve as habitat and conveyance projects are implemented. Even if expected survival in the river is low, the use of a conservation hatchery facility will prevent excessive collection from wild stocks, while providing larger numbers of individuals to offset losses.

The Restoration Act requires spring-run Chinook cannot be reintroduced to the San Joaquin River unless NMFS completes special rules to exempt these fish from particular classes of take, pursuant to section 10(j) and 4(d) of the ESA. Such rules typically afford a lesser level of protection for the species than is

provided through ESA section 9 take prohibitions. If these rules were applied to existing threatened or endangered populations, the impact to those populations could potentially be significant. In the case of a population reestablished in historical range of the species, but where it no longer exists, there would be no adverse impact, because any fish produced from the reintroduction would be above and beyond abundance and productivity of the existing population. A reestablished population would also increase the spatial diversity for the species, providing greater resilience and a higher likelihood for survival and recovery of the species. This would be a beneficial impact to spring-run Chinook. These take exemptions will allow the reintroduction of spring-run Chinook to have minimal impact on the regulatory environment and will provide sufficient protection for spring-run Chinook so as to not adversely impact the ESU but instead will benefit the ESU because of greater numbers and distribution and increased genetic diversity.

The reintroduction of spring-run Chinook will require collection of some individuals from existing populations, but the FRFH has the ability to plan for and produce sufficient stock to allow for collection without impacting any existing stocks. Therefore the collection of spring-run Chinook for reintroduction could be done with no impact to the species' abundance. However, at a population level, the manner of selecting particular populations as donor stock has the potential for different impacts on spring-run Chinook, for genetic considerations and the abundance of individual populations, depending on the donor stock collection strategy. These potential impacts to spring-run Chinook are analyzed below in sections 4.4.1 through 4.4.3

The Restoration Act requires that NMFS report to Congress on the success of the reintroduction in 2024. The ESA requires that NMFS conduct a status review every five years for all listed species under its responsibility. These requirements will ensure that NMFS is tracking the status of the reintroduced spring-run Chinook population and will develop information to assess the effectiveness of this rule, and if necessary, will trigger revision to the regulation through the rulemaking process. This will ensure that the reintroduction of spring-run Chinook to the San Joaquin River is providing for the conservation of the species as expected, and that the population is not essential to the continued survival of the species. These conditions are further assurance that the Proposed Action will have no impact on spring-run Chinook.

4.3.1.2 California Central Valley Steelhead

Steelhead occurs throughout the San Joaquin River basin, including its tributaries downstream of the confluence with the Merced River (NMFS 2009). Spring-run Chinook and steelhead historically coexisted in both the Sacramento and San Joaquin River watersheds, and their habitat and food requirements are similar. Both species are sensitive to habitat degradation, increases in stream temperatures, and fish passage barriers (NMFS 2009).

Since these two species' habitat and food requirements are similar, any improvements made to the San Joaquin River such as those proposed in the SJRRP would also help increase steelhead distribution and abundance by enhancing habitat and food supply for most life stages. Please see the PEIS/R for further information on habitat improvements. Steelhead is federally listed as a threatened species. Therefore,

steelhead already have regulations related to their protection, which are not altered by the Proposed Action.

During salmon spawning, steelhead are known to eat loose salmon eggs. Once salmon are reestablished, these eggs and salmon carcasses would provide addition nutrients to the local food web. The proposed reintroductions of spring-run Chinook and subsequent reestablishment of fall-run Chinook could have a beneficial impact on steelhead within the San Joaquin River.

4.3.1.3 Southern DPS of Green Sturgeon

As noted in Section 3, it is likely that green sturgeon is present in the San Joaquin River. If that is the case, like steelhead, green sturgeon are federally listed as threatened, and have regulations related to their protection, which would not be altered by any of the proposed alternatives. Within the Sacramento River basin, fall-run Chinook, spring-run Chinook, and green sturgeon coexist. There is no evidence to suggest that these species would not also coexist in the San Joaquin River. Thus, the proposed reintroduction of spring-run Chinook would not impact green sturgeon that may be within the San Joaquin River.

4.3.2 Fish

The potential effects of reintroduction of spring-run Chinook on existing San Joaquin River fish species were assessed by evaluating the potential for reintroduced spring-run Chinook to cause changes in the way these species interact with their environment and with other species. These impacts were primarily considered in the Restoration Area and the San Joaquin River downstream from the Merced River confluence to the Sacramento San Joaquin Delta. The potential impacts that may affect biological interactions in the three major San Joaquin River tributaries (Merced, Tuolumne, and Stanislaus rivers) were also assessed for the Chinook salmon and steelhead populations that exist in those rivers.

A number of native fish species along with the spring-run Chinook were extirpated from the upper reaches of the San Joaquin River. With the return of flows and restoration of habitat it is anticipated that in subsequent years fish would again use the San Joaquin River. The reintroduction of spring-run Chinook is not expected to change the balance of fish populations in the San Joaquin River basin, such as shifting to a higher percentage of predatory fish. A return of spring-run Chinook would bring nutrients to the river that will enhance the aquatic food web, and consequently could improve food availability for all fish species. Thus, the reintroduction of spring-run Chinook would have no impact or a beneficial impact, on fish assemblages in the San Joaquin River.

Hybridization. The spawning periods of spring-run and fall-run Chinook in the Central Valley typically overlap during October, during which hybridization between reintroduced spring-run Chinook and San Joaquin River basin fall-run Chinook could occur in the Restoration Area. At present, there is no specific information on how salmon will use the spawning areas below Friant Dam. The SJRRP includes the potential for continued operation of temporary fish barrier(s) to seasonally restrict access by fall-run Chinook to the San Joaquin River in the Restoration Area to prevent hybridization with spring-run Chinook, if necessary (Reclamation and DWR 2012). Therefore, should hybridization become an issue in

the future, the SJRRP includes mechanisms to prevent hybridization, and therefore there will be no impact.

Predation. The assessment in the SJRRP PEIS/R of predation-related impacts evaluated the potential for the SJRRP to modify environmental conditions that could increase or decrease the vulnerability of special-status fishes, particularly egg, larval, and juvenile life stages, to predation by piscivorous fish. Fish assemblages on the tributary rivers to the San Joaquin River are similar to those found in the Restoration Area, except that Chinook salmon and steelhead are absent from the Restoration Area. The reintroduction of spring-run Chinook is not expected to change these assemblages, so predation rates would not be changed. The reintroduction of Chinook salmon, regardless of the run, will bring marine-derived nutrients into the system which would increase productivity of all aquatic species, with no expectation that it would differentially affect predatory species. Thus there would be no impact on predation due to the reintroduction of spring-run Chinook.

Competition. Potential fisheries impacts related to competition were assessed by evaluating the potential that the habitat improvements made by the SJRRP could increase or decrease competitive interactions among the representative fish species. The assessment in the SJRRP PEIS/R was qualitative, based on potential changes in competition that could result from altered distribution, abundance, and behavior of all fishes in the San Joaquin River, as well as potential changes in other environmental conditions such as habitat quantity and quality, food resources, and water temperature that can affect competitive interactions. Water diversions that alter the abundance or proportion of nonnative fish species relative to native species may also increase the potential for competition in aquatic systems.

Some nonnative fish species have habitat requirements that overlap with those of native special-status species. Nonnative species may be more aggressive and territorial than native species and result in the exclusion of native species from their habitats. Many nonnative species, such as green sunfish, also tolerate very high water temperatures and are better able than native fishes to persist in water with low DO, high turbidity, and pollutants (Moyle 2002a, as cited in Reclamation and DWR 2011). Green sunfish are among the nonnative species that currently occur at relatively high abundance in the Restoration Area (DFG 2007, as cited in Reclamation DWR 2011).

The predicted flow increases in the San Joaquin River from the Merced River confluence to the Delta resulting from the release of both Interim and Restoration flows would increase the amount of in stream habitat available to the representative species, and could reduce interspecific (between species) and intraspecific (within species) competition, especially during spring, when modeled flow increases are largest and migrating juvenile fall-run Chinook and steelhead are most abundant in this section of the river. Therefore based on the findings of the SJRRP PEIS/R the potential impacts from either an increase or a decrease in competition are not significant, and would not be changed by the reintroduction of spring-run Chinook.

Disease. Potential fisheries impacts resulting from disease were assessed by evaluating the potential impacts of the Proposed Action on environmental conditions that could increase or decrease the incidence and impacts of disease on the representative fish species.

The assessment was qualitative, based on potential changes in disease transmission vectors, virulence, and fish susceptibility that could result from altered distribution, abundance, and behavior of all fishes in the San Joaquin River. This assessment was also based on potential changes in other environmental conditions, such as habitat quantity and quality, pollutants, and water temperature that can affect disease transmission and the impacts of disease on the representative fish species.

The improved aquatic habitat conditions created through the implementation of the SJRRP would provide access to the Restoration Area by fishes currently restricted to downstream portions of the San Joaquin River, including San Joaquin River basin fall-run Chinook and steelhead. Restored habitat connectivity could increase the potential for disease transmission among formerly isolated populations, including the hatchery-supplemented resident rainbow trout in Reach 1 of the Restoration Area, and the Central Valley steelhead that occupy the lower San Joaquin River and tributaries. The parasite *Myxobolus cerebralis*, which causes whirling disease in salmonids, including rainbow trout, steelhead, and Chinook salmon, poses a risk to salmonid populations in the San Joaquin River. This parasite relies on tubifex worms (Tubifex tubifex) as an intermediate host (Bergersen and Anderson 1997, cited in Reclamation and DWR 2011), and is a concern for the San Joaquin River because there is a tubifex worm farm located in Reach 1A (Jones and Stokes 2002, cited in Reclamation and DWR 2011). However, the tubifex worm farm has been at its current location for more than 20 years and in that time no incidents of parasitic transmission has been recorded in the rainbow trout found in the area of the farm. Therefore, the potential for the transmission of this disease is considered low and the potential impacts not significant to either the current fish populations or to the proposed reintroduced spring-run Chinook.

Since spring-run Chinook must be translocated from outside of the San Joaquin River basin, there is the potential for eggs or fish being translocated into the San Joaquin River to increase the potential for disease transmission. Translocation of eggs or fish would be subject to section 10(a)(1)(A) permitting, which will require disease mitigation. Also the 10(a)(1)(A) issued in 2012 includes HGMP protocols for disease management. Therefore there will be no disease impacts from the Proposed Action.

4.3.3 Recreation

Fishing

The SJRRP PEIS/R includes analysis of recreational fishing impacts that is relevant to the impacts analyzed in this EA and is incorporated by reference. The SJRRP PEIS/R identified potential impacts to recreational opportunities associated with the construction projects and improved water flows. Some of these did not have any impacts or generated beneficial effects. In addition to the construction projects the SJRRP PEIS/R also identified that the reintroduction of either spring-run or fall-run Chinook could have a potentially significant impact to recreational opportunities related to angling opportunities due to cessation of stocking of rainbow trout by DFW in Reach 1 and the implementation of new fishing restrictions. While fishing for other species of fish would continue, the opportunity to fish for planted trout would end. This would occur with the reintroduction of fall-run Chinook salmon under the SJRRP, regardless of whether spring-run Chinook are reintroduced. Consequently, mitigation to offset any impacts is being implemented as a measure under the SJRRP PEIS/R (REC-4) that would reduce these

potential impacts to a less than significant level, so there will be no impact to recreational fishing as a result of the Proposed Action.

The reintroduction of spring-run Chinook *per se* does not change recreational fishing regulations. These are controlled by California Fish and Game Commission (FGC). The proposed rule would accommodate take considerations associated with regulated fishing when fishing regulations are developed. Currently DFW has harvest protective measures benefiting spring-run Chinook. These include seasonal constraints on sport and commercial fisheries south of Point Arena. Most Central Valley salmon bearing streams, including the San Joaquin River are subject to regulation to protect Chinook salmon during spawning. California fishing regulations in anadromous waters typically include bag and seasonal restrictions to protect anadromous salmonids, but fishing is not prohibited.

In addition, the State has listed spring-run Chinook under the California Endangered Species Act (CESA), and has thus established specific in-river fishing regulations and no-retention prohibitions designed to protect this ESU (e.g., fishing method restrictions, gear restrictions, bait limitations, seasonal closures, and zero bag limits), particularly in primary tributaries such as Deer, Big Chico, Mill, and Butte Creeks, which support spring-run Chinook.

Boating

The reintroduction of spring-run Chinook would not have any impact on boating opportunities on the San Joaquin River. The improvements to water flows that would benefit the reintroduction will also benefit boaters, by providing additional locations where they can use their boats.

4.3.4 Commercial Fishing

There are no significant adverse impacts to commercial fishing from the reintroduction of spring-run Chinook. Spring-run Chinook is a small percentage of the commercial harvest. Collections from donor stocks will have no impact because of the small number collected.

Under this alternative, the placement of spring-run Chinook in the San Joaquin River would not have an immediate impact on the commercial fishing of Chinook and other salmon. Harvest rates would still be established and would in the short-term limit the take of spring-run Chinook based on ESU conditions. Likewise, in the short-term there would be no change to management of the recreational salmon fishery, which is currently closed to angling on the San Joaquin River. However, implementation of the SJRRP is expected to restore habitat and connectivity which will allow existing fall-run Chinook to access suitable spawning areas near Friant Dam, which may provide a small increase in salmon available to the ocean fishery. In the long-term, with the restoration of spring-run and fall-run Chinook it is possible that the increased size of Chinook salmon runs would translate to improved commercial fishing.

Therefore, there would be no short-term significant adverse impacts to commercial fishing. In the long-term there are potential beneficial impacts to commercial fishing.

4.3.5 Land Use

Agricultural Resources and Forestry

The Restoration Act requires that reintroduction of spring-run Chinook to the San Joaquin River shall be done only pursuant to section 10(j) of the ESA with special provisions under ESA section 4(d). Within the NEP area, NMFS's proposed 4(d) rule would provide coverage for take that occurs incidental to otherwise lawful activities. To the extent the 4(d) rule applies outside of the NEP, the rule protects agricultural and forestry resources by ensuring no more than de minimus: water supply reductions, additional storage releases or bypass flows on unwilling third parties. These take exemptions will allow the reintroduction of spring-run Chinook to have little to no impact on agricultural and forestry activities.

Future donor stock could be collected from rivers and tributaries that cross a variety of landscapes from valley floor to steep mountain canyons. The specific collection locations will be identified in the individual 10(a)(1)(A) permits that are required. The proposed action creates no obligation for access to private property. Any collecting sites which would require crossing privately held land, would require voluntary access permission from private landowners. As noted, the individual 10(a)(1)(A) permits would need to identify collection locations and would need to also identify specific measures to reduce environmental impacts. Should collection activities occur either on private lands, or access to collecting areas crosses private land, the 10(a)(1)(A) permit would include the requirement that permission of the land owners and a discussion of what is required to access the collecting area and identification of any environmental effects. Having permission to access private land, prior to the issuance of the 10(a)(1)(A) will reduce potential impacts to a non-significant level.

4.3.6 Water Quality

The operations of any of the Sacramento River Basin hatcheries would not change with the reintroduction of spring-run Chinook to the San Joaquin River and would remain subject to current waste water discharge permits. Collection of eggs or juveniles would be subject to analysis of water quality during the 10(a)(1)(A) permitting process, therefore the proposed collection of eggs would not affect the water quality within the Sacramento River Basin.

With the exception of occasional low dissolved oxygen levels in the discharge from the SJFH, there are no water quality issues along Reach 1 of the San Joaquin River where the Interim Facility is located and the subsequent conservation hatchery facility will be located. As discussed in the 2010 Hatchery and Stocking Program EIR/EIS (Hatchery EIR/EIS) prepared for all of DFW's hatchery operations, the discharge of lowest DO level detected of 6.4 mg/L is not optimal for coldwater fish conditions, but is not a significant impact (ICF Jones & Stokes 2010). The analyses of the Hatchery EIR/EIS are incorporated by reference into this document. Operations of the subsequent conservation hatchery facility would require discharge permits that require monitoring and reporting to assure that discharged water would not

impact water quality of the San Joaquin River. The discharge permit conditions established for the hatchery activities would require that discharges from either facility will not adversely affect ambient water quality. Any variance in the discharge from those levels established by the permit would have to be addressed by the hatcheries and confirmed by the State of California Regional Water Quality Control Board. Therefore, this alternative would not have a significant effect on water quality.

4.3.7 Air Quality

This analysis considers the potential impact of the general activities related to the reintroduction of spring-run Chinook on air quality. The specific details of collection, handling and transportation, and the potential impacts on spring-run Chinook will be specified and analyzed in the 10(a)(1)(A) permit process.

The reintroduction of spring–run Chinook would generate air emissions from vehicles used to collect and transport fish (or eggs) and from operation of the Interim Facility and later the conservation hatchery facility. Existing facilities would be used until the conservation hatchery is built by the State of California, for which a separate environmental analysis would be done. The operational emissions associated with the reintroduction process would be emissions from electrical power generation, which are anticipated to be less than significant. Other operational emissions would air emissions from vehicles used to collect and transport fish (or eggs), first to a holding area, then to the conservation hatchery facility. However, given that there would only be a small number of trips (i.e. less than 100 trips per year) to collect and transport the collected fish or eggs the resulting emissions would have no significant impacts to air quality.

4.3.8 Climate Change

Mandatory GHG Reporting Rule

On September 22, 2009, EPA released its final Greenhouse Gas Reporting Rule (Reporting Rule). The Reporting Rule is a response to the fiscal year (FY) 2008 Consolidated Appropriations Act (House of Representatives 2764; Public Law 110-161), that required EPA to develop "… mandatory reporting of GHGs above appropriate thresholds in all sectors of the economy…." The Reporting Rule would apply to most entities that emit 25,000 mtCO2e (metric tonne CO2 emissions) or more per year. Starting in 2010, facility owners are required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. The Reporting Rule would also mandate recordkeeping and administrative requirements in order for EPA to verify annual GHG emissions reports. As shown in Table 4-3, the amount of CO2 generated by the transportation of fish over a five-year term would be approximately 5/10ths of one percent of the yearly reporting level of 25,000 mtCO2e. Even adding the CO2 emitted by electrical generation used in the operations of the hatcheries would not bring the amount of greenhouse gas emitted near the yearly threshold. Since the emissions of GHGs for the Proposed Action would be substantially lower than the 25,000 mtCO2e reporting threshold, the impacts to Climate Change from GHG emissions of the Proposed Action would be less than significant.

The analysis of potential cumulative impacts from Climate Change to the area of the Proposed Action is presented in Section 5 Cumulative Impacts.

Table 4-3 Calculated CO2 emissions for transportation of fish between various locations

Trip	mtCO2e per trip	Number of trips per year	Total mtCO2e per year	Total mtCO2e for 5 years
FRFH to Silverado	0.178	48	8.583	42.913
Silverado to SJFH	0.271	48	13.030	65.152
FRFH to SJFH	0.311	4	1.242	6.212
Total	0.760	100	32.451	114.277
Percentage of 25,000 mtCO2e threshold			0.13%	0.46%

Calculation based on the following: Mileage (determined by Google Maps):
FRFH to Silverado Fisheries Base = 137 miles:
Silverado Fisheries Base to SJFH = 208 miles
FRRH to SJFH = 238 miles
CO2 emissions 10180 grams per gallon of diesel fuel (source EPA 2011)
Fuel usage mile/gallon: 7. 8 (personal com. Scott Hamelberg, Coleman National Fish Hatchery Complex 2012)

DONOR STOCK ALTERNATIVES ANALYSIS

4.4 Donor Stock Alternatives Introduction

The specific actions of collection of broodstock, fish, or eggs from wild populations from Clear, Butte, Deer, Mill, or Battle creeks would require additional evaluation pursuant to NEPA and ESA, including issuance of 10(a)(1)(A) permits. Prior to any collection from the Feather River, or FRFH spring-run Chinook populations, an analysis would need to be completed to determine if the collection of fish would jeopardize the continued existence of the species. The use of a conservation hatchery facility will minimize the number of individuals collected from wild sources or from the FRFH. The facility's operations in accordance with the HGMP will ensure genetic diversity and minimal domestication effects. The below analysis is a general analysis of the potential sources of donor stock. Detailed analysis of future 10(a)(1)(A) permits for collection of the source stocks would need to be conducted prior to issuance of any 10(a)(1)(A) permits.

The environmental consequences of the Donor Stock alternatives on all resources except Central Valley spring-run Chinook salmon are the same as the impacts described above for the reintroduction of spring-run Chinook/proposed action. The impacts to Central Valley spring-run Chinook salmon are analyzed below. Please refer to the analysis of the reintroduction of spring-run Chinook/proposed action for impacts to the other resources.

The environmental consequences of any of the Donor Stock alternatives are the same for all resource areas as for reintroduction of spring-run Chinook, except in the resource area of Federally Listed Species, Central Valley spring-run Chinook salmon. These are described here.

4.4.1 All Source Donor Stock Alternative (preferred alternative)

Central Valley Spring-run Chinook Salmon

Under this Alternative, collections would be made from the range of existing spring-run Chinook populations. This provides for the greatest genetic diversity for the founding stock, and consequently the greatest likelihood for successful reintroduction.

Under the All Source Donor Alternative, FRFH would plan to produce sufficient fish to allow for eggs or juveniles to be consistently collected, providing a consistent source of fish for broodstock or direct release with no impact on the source population. The proportion of FRFH eggs or juveniles is expected to decline as broodstock from the other sources develops. Stock would be collected from other sources such as Deer, Mill, Butte, Clear and Battle Creeks or the Feather River, depending on the conditions and population status of each run. This means that in some years fish might be collected from all the locations (for example: 10 fish from Mill Creek, 5 fish from Deer, 50 from Butte and so on). In other years, collections may be made from only one source. The specifics of these collections will be managed through section 10(a)(1)(A) permitting. The use of the conservation hatchery facilities will multiply the number of fish that could be introduced into the San Joaquin River while minimizing the number required from wild donor stocks. Any request to collect stock from any donor source will require submission and approval of a 10(a)(1)(A) permit and subsequent environmental impact analysis and ESA section 7 consultation. During the initial phase the San Joaquin River habitat conditions will also improve for salmon as habitat projects are completed. While early population levels are expected to be small, with improved habitat, the fish generated and released from the broodstock or released directly to the river will have an increased likelihood of survival.

Using a conservative approach where fish from donor stock would only be collected when a hatchery has planned to have sufficient stock available (as would be the case at the FRFH), or when the removal of a limited number of individuals from a donor stock population can be shown not to result in a negative impact to existing spring-run Chinook, beneficial impacts from this approach would result in providing genetic diversity to the San Joaquin spring-run Chinook population. This would furthermore increase the likelihood for successful reintroduction of spring-run Chinook. It is anticipated that collection of fish would cease when sufficiently diverse broodstock is established.

The All Donor Stock Source Alternative would have a beneficial impact on spring-run Chinook salmon by providing the highest probability of success of the reintroduction owing to high genetic diversity in the founding stock. This beneficial impact is based on the premise that collections will be made under a 10(a)(1)(A) permit.

4.4.2 Feather River Hatchery Only Donor Stock Source Alternative

Central Valley Spring-run Chinook Salmon

Under the Feather River Hatchery Only Donor Stock Source Alternative, collection of donor stock would come only from the FRFH. The hatchery would plan to produce sufficient fish to allow for fish for the SJRRP. This alternative would provide a consistent source of fish for reintroduction to the San Joaquin River without adversely affecting the threatened donor populations. These fish from the FRFH will not detract from any of the populations, including the FRFH target numbers, and will still provide fish for the reintroduction process. Until the habitat improvement projects are completed, in river survival is expected to be low, except in wet years. Any survival for these fish would have a net gain for the species. Using fish that have been purposefully designated for the SJRRP would allow for the SJRRP to satisfy the Settlement, without negatively impacting the donor population, but also providing recovery actions for spring-run Chinook.

As discussed in the Stock Selection Strategy (SJRRP 2010), the long-term use of FRFH stock could result in fish which have genetic traits of both spring-run and fall-run Chinook. In other fisheries where only hatchery fish have been used there has been a reduction in the genetic vigor. Genetic analysis of FRFH spring-run Chinook has shown evidence of hybridization between spring-run and fall-run hatchery stocks. The FRFH is addressing these problems, but the use of FRFH stock could result in fish being reintroduced to the San Joaquin River with genetics of both spring-run and fall-run Chinook. It is uncertain if this combination of parental stock would be successful in the San Joaquin River. The use of FRFH stock would offer limited genetic diversity as a founding stock of spring-run Chinook. Conditions in a restored San Joaquin River will be different than the Feather River would, particularly with expected warmer temperatures.

The use of FRFH fish only would have no significant adverse impacts to the other spring-run Chinook populations. It is not the preferred alternative, because these fish may have compromised genetics for spring-run Chinook, and lower overall genetic diversity.

4.4.3 Single Source Alternative

Central Valley Spring-run Chinook Salmon

Under this Alternative, fish would be collected from just one of the non-hatchery influenced watersheds. Based on the analysis presented in the Stock Selection Strategy, Butte Creek is only population that currently has sufficient abundance and productivity to be considered as a single source.

However, even with the strongest population run, Butte Creek stocks are threatened and are in a trend of decline (NMFS 2011). For the development of broodstock, the Stock Selection Strategy proposed the representation of 50 males and 50 females in the collection. The likely effect to the Butte Creek population resulting from removal of this number of fish, in some years would have no appreciable effect on the population, but in other years this would be a major reduction in the population. Table 3-4 shows

that the removal of 100 fish in 2010 would have been more than 8.5 percent of the returning population. In contrast, in 2006 it would represent less than 1/100,000 or 0.01 percent of the population. Collection of fish at other life stages (e.g. juveniles) could reduce this impact, but in some years the effect could still be significant. The Stock Selection Strategy specifically outlines that a genetic compliment of all runs should ultimately be used for reintroduction to the San Joaquin River. The Stock Selection Strategy approach is that with greater genetic diversity there is a higher likelihood for the reintroduced fish to adapt to the San Joaquin River, and thus a more probable success in the reintroduction (SJRRP 2010). Using only Butte Creek fish, like the use of only FRFH fish, does not provide the genetic diversity for the best chance for reintroduction to be successful. Unlike FRFH only alternative, using a single source from a wild stock would be a less reliable source of fish because of natural fluctuations in abundance. This alternative has potential negative effects on the threatened donor population and variable availability of donor stock.

NEP AREA ALTERNATIVES ANALYSIS

4.5 Area Alternative 1

For this alternative the NEP area includes the majority of the San Joaquin River basin including the main stem of the San Joaquin River from below Friant dam to Mossdale Park, the Merced River below the Merced Falls, the Tuolumne River below the La Grange Dam and the Stanislaus River below the Goodwin Dam (Figure 2-1). Within the NEP area, take exemptions for spring-run Chinook would cover all take that occurs in the course of otherwise lawful activities. Direct take is prohibited. Take for research and scientific purposes may be permitted. Adipose fin-clipped fish are included in the limited take prohibitions.

Outside of the NEP area on the San Joaquin River and its tributaries from the confluence of the Merced River to Mossdale County Park, take of Central Valley spring-run Chinook salmon would be exempted for third parties engaged in otherwise lawful activities relating to diverting or receiving water pursuant to applicable State and Federal laws, so that the reintroduction will not impose more than *de minimus*: water supply reductions, additional storage releases, or bypass flows on unwilling third parties. For the CVP and SWP facilities in the south Delta take would be exempted for spring-run Chinook reintroduced to the San Joaquin River. The calculation to discount the contribution of these fish to existing Incidental Take authorization for spring-run Chinook would be defined by NMFS in an annual technical memorandum.

4.5.1 Federally Listed Species

4.5.1.1 Central Valley Spring-run Chinook Salmon

The environmental consequences of implementing Area Alternative 1 on spring-run Chinook are the same as for the reintroduction of spring-run Chinook described in section 4.3.1.1.1, except that these fish reintroduced to the San Joaquin River would have less protection from take as identified by the ESA section 4(d) provisions described in the proposed rule than under the existing 4(d) rule. Within the Restoration Area and associated waterways, the take exemptions for spring-run Chinook would be

reduced from current protections already afforded, and spring-run Chinook could be incidentally taken as a result of otherwise lawful activities. This could encompass a variety of activities otherwise classified as "harm", and direct losses such as entrainment at authorized water diversions. This broad regulatory exemption could be a negative impact on spring-run Chinook. For extant populations of spring-run Chinook, these conditions would be considered an adverse impact. For the proposed reintroduced population, these fish would not otherwise exist, at the numbers proposed, in the near future without implementation of the SJRRP and the Proposed Action. The authorization for collection of fish from donor populations would be done with the awareness that some of the fish collected would die, and that some of the fish released to the river would also die, and the permits would be conditioned appropriately. Use of a conservation hatchery facility will allow the production of fish to be released to the river at a level that accounts for potential losses from the allowed incidental take, and that provides for sufficient survival to re-establish a naturally self-sustaining population. Any fish lost to these relaxed regulatory conditions associated with the reintroduction would not otherwise exist to contribute to the species.

Under the existing 4(d) rule, within the ESU hatchery produced adipose fin-clipped fish are not protected (70 FR 37204) because the purpose of these hatcheries is mitigating production lost to fisheries by dams and other water projects. Contrasted to other hatcheries the fish produced in the conservation hatchery facility are produced for reintroduction. Conservation hatchery facility produced adipose fin-clipped fish would be included within the 4(d) provisions associated with the NEP area and would receive some addition level of protection.

At the time spring-run Chinook was listed as a threatened species, (see 70 FR 37160) available evidence suggested spring-run Chinook did not occur in the San Joaquin River Basin. Based on this rationale the NEP area could be implemented to include tributaries to the San Joaquin River. However, recent observations indicate that spring-running Chinook are present in the tributaries. At this time, it is not clear as to their origin, but if assumed to be spring-run Chinook, then inclusion of the tributaries in the NEP designation is not valid (50 CFR 17.80). The spring-running Chinook now in the tributaries could have protection from take under the existing 4(d) rule even if they are not within in the boundaries of the ESU. The status quo for the area south of designated ESU has been identified as not having a spring-run Chinook population since it was extirpated years ago. As such, there has been no enforcement and only recent monitoring of these rivers at times when spring-run Chinook may occur.

If these spring-running Chinook salmon are in fact genetically Central Valley spring-run Chinook of wild origin, take of these fish would be covered by the existing 4(d) provisions for the ESU. Under this alternative the take exemptions for spring-run Chinook would be reduced from current protections already afforded, and would exempt take that occurred as a result of any otherwise legal activity. This broad regulatory exemption could be a negative impact on spring-run Chinook.

However, the presence of spring-run Chinook in the tributaries would conflict with the geographic criteria for establishing the NEP.

4.5.1.2 California Central Valley Steelhead

Steelhead occurs throughout the San Joaquin River basin, including its tributaries downstream of the confluence with the Merced River (NMFS 2009). Spring-run Chinook and steelhead historically coexisted in both the Sacramento and San Joaquin River watersheds, and their habitat and food requirements are similar. Both species are sensitive to habitat degradation, increases in stream temperatures, and fish passage barriers (NMFS 2009).

Since these two species' habitat and food requirements are similar, any improvements made to the San Joaquin River such as those proposed in the SJRRP would also help increase steelhead distribution and abundance by enhancing habitat and food supply for most life stages. Please see the PEIS/R for further information on habitat improvements. Steelhead is federally listed as a threatened species. Therefore, steelhead already has regulations related to their protection, which are not altered by the Proposed Action.

During salmon spawning, steelhead are known to eat loose salmon eggs. Once salmon are reestablished, these eggs and salmon carcasses would provide addition nutrients to the local food web. The proposed reintroductions of spring-run Chinook and subsequent reestablishment of fall-run Chinook could have a beneficial impact on steelhead within the San Joaquin River.

4.5.1.3 Southern DPS of Green Sturgeon

As noted in Section 3, it is likely that green sturgeon are present in the San Joaquin River. If that is the case, like steelhead, green sturgeon are federally listed as threatened and have regulations related to their protection, which would not be altered by any of the alternatives. Within the Sacramento River basin fall-run Chinook, spring-run Chinook, and green sturgeon coexist. There is no evidence to suggest that these species would not also coexist in the San Joaquin River. Thus, the proposed reintroduction of spring-run Chinook would not impact green sturgeon that may be within the San Joaquin River.

4.5.2 Fish

The potential effects of reintroduction of spring-run Chinook on existing San Joaquin River fish species were assessed by evaluating the potential for Area Alternative 1 to cause changes in the way these species interact with their environment and with other species. These impacts were primarily considered in the Restoration Area and the San Joaquin River downstream from the Merced River confluence to the Sacramento San Joaquin Delta. The potential impacts that may affect biological interactions in the three major San Joaquin River tributaries (Merced, Tuolumne, and Stanislaus rivers) were also assessed for the Chinook salmon and steelhead populations that exist in those rivers.

A number of native fish species along with the spring-run Chinook were extirpated from the upper reaches of the San Joaquin River. With the return of flows and restoration of habitat it is anticipated that in subsequent years fish would again use the San Joaquin River. The reintroduction of spring-run Chinook is not expected to change the balance of fish populations in the San Joaquin River basin, such as shifting to a higher percentage of predatory fish. A return of spring-run Chinook would bring nutrients to

the river that will enhance the aquatic food web, and consequently could improve food availability for all fish species. Thus, the reintroduction of spring-run Chinook would have no impact or a beneficial impact, on fish assemblages in the San Joaquin River.

Hybridization. The spawning periods of spring-run and fall-run Chinook in the Central Valley typically overlap during October, during which hybridization between reintroduced spring-run Chinook and San Joaquin River basin fall-run Chinook could occur in the Restoration Area. At present, there is no specific information on how salmon will use the spawning areas below Friant Dam. The SJRRP includes the potential for continued operation of temporary fish barrier(s) seasonally restrict access by fall-run Chinook to the San Joaquin River in the Restoration Area to prevent hybridization with spring-run Chinook, if necessary (Reclamation and DWR 2012). Therefore, should hybridization become an issue in the future, the SJRRP includes mechanisms to prevent hybridization, and therefore there will be no impact.

Predation. The assessment in the SJRRP PEIS/R of predation-related impacts evaluated the potential for the SJRRP to modify environmental conditions that could increase or decrease the vulnerability of special-status fishes, particularly egg, larval, and juvenile life stages, to predation by piscivorous fish, which found that the impact was less than significant. Fish assemblages on the tributary rivers to the San Joaquin River are similar to those found in the Restoration Area, except that Chinook salmon and steelhead are absent from the Restoration Area. The reintroduction of spring-run Chinook is not expected to change these assemblages, so predation rates would not be changed. The reintroduction of Chinook salmon, regardless of the run, will bring marine-derived nutrients into the system which would increase productivity of all aquatic species, with no expectation that it would differentially affect predatory species. Thus there would be no impact on predation due to the reintroduction of spring-run Chinook.

Competition. Potential fisheries impacts related to competition were assessed by evaluating the potential that the habitat improvements made by the SJRRP could increase or decrease competitive interactions among the representative fish species. The assessment in the SJRRP PEIS/R was qualitative, based on potential changes in competition that could result from altered distribution, abundance, and behavior of all fishes in the San Joaquin River, as well as potential changes in other environmental conditions such as habitat quantity and quality, food resources, and water temperature that can affect competitive interactions. Water diversions that alter the abundance or proportion of nonnative fish species relative to native species may also increase the potential for competition in aquatic systems.

Some nonnative fish species have habitat requirements that overlap with those of native special-status species. Nonnative species may be more aggressive and territorial than native species and result in the exclusion of native species from their habitats. Many nonnative species, such as green sunfish, also tolerate very high water temperatures and are better able than native fishes to persist in water with low DO, high turbidity, and pollutants (Moyle 2002a, as cited in Reclamation and DWR 2011). Green sunfish are among the nonnative species that currently occur at relatively high abundance in the Restoration Area (DFG 2007, as cited in Reclamation and DWR 2011).

The predicted flow increases in the San Joaquin River from the Merced River confluence to the Delta resulting from the release of both Interim and Restoration flows would increase the amount of in stream habitat available to the representative species, and could reduce interspecific (between species) and intraspecific (within species) competition, especially during spring, when modeled flow increases are largest and migrating juvenile fall-run Chinook and steelhead are most abundant in this section of the river. Therefore based on the findings of the SJRRP PEIS/R the potential impacts from either an increase or a decrease in competition are not significant, and would not be changed by the reintroduction of spring-run Chinook.

Disease. Potential fisheries impacts resulting from disease were assessed by evaluating the potential impacts of this this alternative on environmental conditions that could increase or decrease the incidence and impacts of disease on the representative fish species.

The assessment was qualitative, based on potential changes in disease transmission vectors, virulence, and fish susceptibility that could result from altered distribution, abundance, and behavior of all fishes in the San Joaquin River. This assessment was also based on potential changes in other environmental conditions, such as habitat quantity and quality, pollutants, and water temperature that can affect disease transmission and the impacts of disease on the representative fish species.

The improved aquatic habitat conditions created through the implementation of the SJRRP would provide access to the Restoration Area by fishes currently restricted to downstream portions of the San Joaquin River, including San Joaquin River basin fall-run Chinook and steelhead. Restored habitat connectivity could increase the potential for disease transmission among formerly isolated populations, including the hatchery-supplemented resident rainbow trout in Reach 1 of the Restoration Area, and the Central Valley steelhead that occupy the lower San Joaquin River and tributaries. The parasite *Myxobolus cerebralis*, which causes whirling disease in salmonids, including rainbow trout, steelhead, and Chinook salmon, poses a risk to salmonid populations in the San Joaquin River. This parasite relies on tubifex worms (Tubifex tubifex) as an intermediate host (Bergersen and Anderson 1997, cited in Reclamation and DWR 2011), and is a concern for the San Joaquin River because there is a tubifex worm farm located in Reach 1A (Jones and Stokes 2002, cited in Reclamation and DWR 2011). However, the tubifex worm farm has been at its current location for more than 20 years and in that time no incidents of parasitic transmission has been recorded in the rainbow trout found in the area of the farm. Therefore, the potential for the transmission of this disease is considered low and the potential impacts not significant to either the current fish populations or to the proposed reintroduced spring-run Chinook.

Since spring-run Chinook must be translocated from outside of the San Joaquin River basin, there is the potential for eggs or fish being translocated into the San Joaquin River to increase the potential for disease transmission. Translocation of eggs or fish would be subject to section 10(a)(1)(A) permitting, which will require disease mitigation. Also the 10(a)(1)(A) issued in 2012 includes HCMP protocols for disease management. Given the methodology of quarantining any eggs and fish prior to locating the eggs or fish into the San Joaquin River, the potential effects related to the introduction of disease to the existing populations on the San Joaquin River would be no greater than the existing conditions. Therefore there will be minimal potential for disease transmission from the Proposed Action.

4.5.2.1 Fisheries: San Joaquin River Tributaries (Merced, Tuolumne, and Stanislaus Rivers)

The Merced, Tuolumne, and Stanislaus rivers are the three main tributaries to the lower San Joaquin River. Each tributary supports populations of fall-run Chinook and Central Valley steelhead. In addition, recent observations on the Tuolumne and the Stanislaus have reported the presence of spring-running Chinook.

Hybridization. Reintroduction of spring-run Chinook is a high-priority restoration action, and its implementation potentially could result in interspecific hybridization with San Joaquin River fall-run Chinook. The spawning periods of spring-run and fall-run Chinook in the Central Valley typically overlap during October, during which hybridization between reintroduced spring-run and San Joaquin River basin fall-run Chinook could occur in the Merced, Tuolumne, and Stanislaus rivers. However, spring-run Chinook reintroduced to the San Joaquin River would be imprinted to the San Joaquin River to minimize straying to other waterways, so the potential for hybridization between fall-run- and spring-run Chinook on San Joaquin River tributaries would be less or no different than what already occurs between fall-run and spring-running Chinook in these rivers. Therefore this alternative would have no impact on hybridization in the tributaries.

Competition. The potential for increased competition for Chinook spawning habitat in the Merced, Tuolumne, and Stanislaus rivers could occur following reintroduction of spring-run and fall-run Chinook to the upper San Joaquin River. This impact was assessed by evaluating the potential for reintroduced spring-run Chinook to stray into the Merced, Tuolumne, or Stanislaus rivers and superimpose their redds (i.e., nests) on those of fall-run Chinook during spawning. The assessment of potential impacts because of redd superimposition was conducted only for the existing population of San Joaquin River basin fall-run Chinook.

Redd superimposition occurs when spawning fish construct new redds on top of preexisting redds such that the eggs in the preexisting redd are either destroyed or buried under fine sediment that prevents most of the fry from emerging. Redd superimposition by fall-run Chinook has been reported in the Tuolumne River (TID/MID 1991) and in the Stanislaus River (Mesick 2001, as cited in Reclamation and DWR 2011). However, it is unlikely that superimposition of fall-run Chinook redds by reintroduced spring-run Chinook would occur in the Merced, Tuolumne, or Stanislaus rivers because spring-run Chinook spawn before most fall-run, and the peak spawning periods of the two runs have a short duration overlap. Similarly the reverse could occur where fall-run would superimpose on spring-run Chinook redds. However, the levels of superimposition in other natural streams where spawning occurs, in the Sacramento Basin, has been found to be low (H. Brown pers. comm. 2012). Furthermore, recent research on fall-run Chinook indicates that redd superimposition is currently unlikely to limit adult Chinook recruitment in these San Joaquin River tributaries because many more fry are produced at high densities of spawners than can be sustained by the available rearing habitat (Mesick and Marston 2007, as cited in Reclamation and DWR 2011). Therefore, there will be no impact on Chinook salmon competition for spawning areas as a result of implementing this alternative.

Disease. Reintroduced spring-run Chinook, may include or be supplemented by fish from an out-of-basin hatchery. These fish could stray into the Merced, Tuolumne, and Stanislaus rivers and increase the potential for the introduction and spread of hatchery-borne disease into San Joaquin River basin Chinook populations. However, given the methodology of quarantining any eggs and fish prior to locating the eggs or fish into the San Joaquin, the potential effects related to the introduction of disease to the existing populations on the Merced, Tuolumne, and Stanislaus rivers would not be significant.

4.5.3 Recreational Fishing

The impacts to recreational fishing would be the same as the impacts described for the reintroduction of spring-run Chinook/proposed action in section 4.3.3. There are no impacts to recreational fishing from the implementation of any of the Area Alternatives.

4.5.4 Commercial Fishing

The impacts to commercial fishing would be the same as the impacts described for the reintroduction of spring-run Chinook/proposed action in section 4.3.3. Under the Area Alternative 1 there would be no short-term impacts to commercial fishing and in the long-term there are potential beneficial impacts.

4.5.5 Hatchery Facilities

The impacts to hatchery facilities from the implementation of Area Alternative 1 would be the same as the impacts described for the reintroduction of spring-run Chinook/proposed action in section 4.3.5.

4.5.6 Land Use

If NEP Area Alternative 1 is implemented, all legal activities that would result in incidental take would be included in the take exemption for spring-run Chinook within the Restoration Area and also on the San Joaquin River and its tributaries between the confluence with the Merced River and Mossdale Landing. Agricultural and forestry activities that could incidentally affect spring-run Chinook would be exempted from ESA section 9 take prohibitions. Thus there would be no impact on agricultural resources and forestry as a result of the Proposed Action.

Delta pump operations would not be effected by the reintroduction of spring-run Chinook to the San Joaquin River. As outlined in the Restoration Act, reintroduction is required to have a *de minimus* effect upon Third Parties diverting or receiving water pursuant to applicable state and federal laws, which includes the Delta pumping facilities. The proposed rules include language to exempt these activities from take of spring-run Chinook that originate from the San Joaquin River. This can be achieved by identifying San Joaquin River spring-run Chinook proportional contribution to take at the pumping facilities, relative to the take of spring-run Chinook from other watersheds, and excluding that amount from spring-run Chinook incidental take allowances established for Sacramento Valley origin fish. The method of these calculations will be identified each year by NMFS in a technical memorandum, issued by January 15th. This approach is similar to, and will be integrated with, incidental take calculations that

have been applied to minimize take of other fish populations at the export facilities. Consequently the reintroduction will not add a regulatory burden to that process. Information for that calculation of proportionate take attributable to the reintroduction will be available. Additionally, until spring-run Chinook begin reproducing in the wild, all fish released into the San Joaquin River will be marked or identifiable. This will allow for several years of data on fish definitively from the reintroduction to inform methods for the calculation. Therefore, the implementation of Area Alternative 1 have would de minimus or no impact on Third Parties and their water use activities because of the reintroduction of spring-run Chinook.

However, steelhead is listed as a threatened species under the ESA. Steelhead already occurs in the San Joaquin River tributaries and areas downstream of the confluence of the San Joaquin River and the Merced River, and outside of the designated boundary of the Central Valley spring-run Chinook salmon ESU. Actions that likely would cause take of spring-run Chinook in this area also likely would cause take of steelhead. There would be no change in the ESA regulatory environment for actions that may affect steelhead, thus the 4(d) provisions of the NEP designation have limited effect, in this area, on potentially regulated entities because of the presence of steelhead. However, these 4(d) provisions will ensure that the reintroduction of spring-run, alone, will have minimal impact on the specified water management actions.

4.5.7 Water Quality

Under Area Alternative 1, the impacts on water quality would be the same as the impacts described for the reintroduction of spring-run Chinook salmon/proposed action in section 4.3.7. This alternative would not have a significant effect on water quality.

4.5.8 Air Quality and Climate Change

The air quality and climate change impacts of Area Alternative 1 would only relate to the activities implemented for the reintroduction of spring-run Chinook, and would be the same as the impacts described for the reintroduction of spring-run Chinook/proposed action described in 4.3.8. The resulting emissions would have no significant impacts to air quality or climate change.

4.6 Area Alternative 2 (preferred alternative)

Under Area Alternative 2, the NEP area includes the main stem of the San Joaquin River from below Friant dam to the confluence of the Merced River (See Figure 2-2). Within the NEP area, take exemptions for spring-run Chinook would cover all take that occurs in the course of otherwise lawful activities. Direct take is prohibited. Take for research and scientific purposes would be allowed subject to permit requirements. Adipose fin-clipped fish are included in the limited take prohibitions.

Outside of the NEP area on the San Joaquin River and its tributaries from the confluence of the Merced River to Mossdale County Park, take of Central Valley spring-run Chinook salmon would be exempted for third parties engaged in otherwise lawful activities relating to diverting or receiving water pursuant to

applicable State and Federal laws, so that the reintroduction will not impose more than *de minimus*: water supply reductions, additional storage releases, or bypass flows on unwilling third parties. For the CVP and SWP facilities in the south Delta take would be exempted for spring-run Chinook reintroduced to the San Joaquin River. The calculation to discount the contribution of these fish to existing Incidental Take authorization for spring-run Chinook would be defined by NMFS in an annual technical memorandum, as described under section 4.5.6, above.

This alternative would ensure that the experimental population designation in the San Joaquin basin will be wholly separate geographically from the remaining spring-run Chinook populations found within the Sacramento Basin and the potential spring-run Chinook populations of the Stanislaus, the Tuolumne, and the Merced Rivers, while affording the ESA regulatory relief envisioned in the Restoration Act. This area meets the wholly separate criteria of ESA section 10(j) as defined by FWS guidelines.

4.6.1 Federally Listed Species

4.6.1.1 Central Valley Spring-run Chinook Salmon

The environmental consequences of implementing Area Alternative 2 on spring-run Chinook are the same as the impacts of the reintroduction of spring-run Chinook/proposed action described in section 4.3.1.1, except that the area of the experimental population would be separate from the other potential populations that may be in the San Joaquin River tributaries. Spring-run Chinook that may already occur in the tributaries would not be covered by the ESA take provisions within the NEP area for take incidental to all otherwise legal activities. However, the take provisions exempting Third Party activities relating to the providing or diverting of water would cover incidental take of wild produced spring-run Chinook in the tributaries. This exemption covers a limited range of activities, and these activities are already subject to ESA regulations as they apply to take for steelhead. In these areas, the habitat and life history requirements for steelhead and spring-run Chinook are similar, consequently it is expected that these take exemptions associated with the reintroduction of spring-run Chinook to the San Joaquin River would have nominal to no impact on any existing or reintroduced spring-run Chinook in the San Joaquin River tributaries.

It is likely that some reintroduced spring-run Chinook would stray into the tributaries. It is expected that straying would be within natural straying rates. Such movement would provide a normal level of genetic exchange and would not negatively affect any existing spring-run Chinook populations.

4.6.1.2 Central Valley Steelhead

Although the area of the NEP and Third Party 4(d) provisions would differ under Area Alternative 2, the impacts related to steelhead would be the same as impacts of the reintroduction of spring-run Chinook/proposed action. See discussion section 4.3.1.2 for impacts related to Central Valley steelhead as a result of this alternative.

4.6.1.3 Southern DPS of Green Sturgeon

Although the area of the NEP and 4(d) provisions would differ under Area Alternative 2, the impacts related to green sturgeon would be the same as impacts of the reintroduction of spring-run Chinook/proposed action. See discussion section 4.3.3 for impacts related to green sturgeon as a result of this alternative.

4.6.2 Fish

Although the area of the NEP and 4(d) provisions would differ under Area Alternative 2, the impacts related to fisheries would be the same as impacts of the reintroduction of spring-run Chinook./proposed action. See discussion section 4.3.2 for impacts related to fisheries as a result of this alternative**.**

4.6.3 Recreational Fishing

Although the area of the NEP and 4(d) provisions would differ under Area Alternative 2, the impacts related to recreational fishing would be the same as impacts of the reintroduction of spring-run Chinook/proposed action. See discussion section 4.3.3 for impacts related to fisheries as a result of this alternative.

4.6.4 Commercial Fishing

Although the area of the NEP and 4(d) provisions would differ under Area Alternative 2, the impacts related to commercial fishing would be the same as impacts of the reintroduction of spring-run Chinook/proposed action. See discussion section 4.3.4 for impacts related to commercial fishing Central Valley steelhead as a result of this alternative.

4.6.5 Hatchery Facilities

The impacts to hatchery facilities from the implementation of Area Alternative 2 would be the same as impacts of the reintroduction of spring-run Chinook./proposed action. discussed in section 4.3.5.

4.6.6 Land Use

If NEP Area Alternative 2 is implemented, fewer activities would be included in the take exemption for spring-run Chinook between the confluence with the Merced River and Mossdale Landing. However,

steelhead is listed as threatened under the ESA and already occurs in this area. Actions that likely would cause take of spring-run Chinook also likely would cause take of steelhead. Hence there would be no change in the ESA regulatory environment for land use actions not included in the "Third Party" definition because such actions are already regulated by NMFS because of the presence of steelhead in the area between the proposed NEP and the spring-run Chinook ESU. However, the 4(d) provisions will ensure that the reintroduction of spring-run, alone, will have minimal impact on the specified water management actions.

Delta pump operations would not be effected by the reintroduction of spring-run Chinook to the San Joaquin River. As outlined in the Restoration Act, reintroduction is required to have a *de minimus* effect upon third party water users which includes the Delta pumping facilities. The proposed rules include language to exempt these activities from take of spring-run Chinook that originate from the San Joaquin River. This can be achieved by identifying San Joaquin River spring-run Chinook proportional contribution to take, relative to the take of spring-run Chinook from other watersheds. The method of these calculations will be identified each year by NMFS in a technical memorandum, issued by January 15th. This approach is similar to, and will be integrated with, incidental take calculations that have been applied to minimize take at the export facilities for other fish populations. Consequently the program will not add a regulatory burden to that process. The SJRRP will monitor reintroduced spring-run Chinook as part of the program. Information for that calculation of proportionate take attributable to the reintroduction will be available. Additionally, until spring-run Chinook begin reproducing in the wild, all fish released will be marked or identifiable. This will allow for several years of data on fish definitively from the reintroduction to inform methods for the calculation. Therefore, the implementation of Area Alternative 1would de minimus or no impact on Third Parties and their water use activities.

4.6.7 Water Quality

The impacts related to water quality under Area Alternative 2 be the same as impacts of the reintroduction of spring-run Chinook./proposed action. See discussion section 4.3.7 for impacts related to water quality as a result of this alternative.

4.6.8 Air Quality

The impacts related to air quality under Area Alternative 2 would remain as be the same as impacts of the reintroduction of spring-run Chinook./proposed action. See discussion section 4.3.8 for impacts related to air quality as a result of this alternative.

4.6.9 Climate Change

The impacts related to climate change under Area Alternative 2 be the same as impacts of the reintroduction of spring-run Chinook/proposed action. See discussion section 4.3.9 for impacts related to climate change as a result of this alternative.

DURATION ALTERNATIVE ANALYSIS

4.7 Duration Alternative 1

Under this alternative, the 10(j) experimental population designation would be in effect through 2025; that is to say, the experimental population designation would sunset unless alternative rules are made. The environmental consequences of this alternative on all resources except Land Use are the same as the impacts described above for the reintroduction of spring-run Chinook/proposed action. The impacts to Land Use are analyzed below. Please refer to the analysis of the reintroduction of spring-run Chinook/proposed action for impacts to the other resources.

4.7.1 Land Use

If the NEP designation sunsets in 2025, the take provisions for spring-run Chinook in the San Joaquin River would likely revert to the provisions set forth in the existing 4(d) rule established for the ESU. The provisions under the ESU rule are more restrictive than the associated take provisions that would be established for the NEP or the *de minimus* provisions established for the area between the NEP area and the designated boundary of the ESU. Activities permitted under the NEP and *de minimus* provisions exempt take for more activities that may affect spring-run Chinook than what is permitted under the current ESU rule. If the NEP ends in 2025 and spring-run Chinook is still listed, individuals within the Restoration Area could be subjected to increased regulations. However, the Restoration Act provision that the reintroduction will not impose more than *de minimus*: water supply reductions, additional storage releases, or bypass flows on unwilling third parties due to such reintroduction, does not sunset. With the sun setting of the NEP there is at minimum regulatory uncertainty whether new regulations would need to be adopted to meet the conditions of the Restoration Act. This would trigger an additional regulatory burden on the public for NMFS to prepare replacement regulations. Additionally, this would create an uncertain business environment for agricultural and forestry activities. The actual consequences of this alternative are difficult to quantify, but from a qualitative analysis this alternative could result in a negative impact to the human environment.

4.8 Duration Alternative 2 (preferred alternative)

Under the 10(j) Duration Alternative 2 there would be no pre-determined end to the experimental population designation. Therefore the selected 4(d) rule for spring-run Chinook within the NEP area would remain unless NMFS undertakes the rulemaking process to remove or otherwise modify the duration of the experimental population designation. This would only be done if and when warranted. The status of the essential or non-essential designation of the experimental population would be considered every five years during the status review of the species. The environmental consequences of this alternative on all resources except Land Use are the same as the impacts described above for the reintroduction of spring-run Chinook/proposed action. The impacts to Land Use are analyzed below. Please refer to the analysis of the reintroduction of spring-run Chinook/proposed action for impacts to the other resources.

4.8.1 Land Use

There are similar regulatory issues with Duration Alternative 2 not establishing an end point for the experimental population designation as Duration Alternative 1 set end point. In the case of closing the designation there is the possibility of having regulatory gaps which is not the case with Duration Alternative 2.

The major difference between Duration Alternative 1 and Duration Alternative 2 is that while the determination of the population's status would occur during the preparation of the 2024 Report to Congress, the existing designation of the NEP would not sunset automatically in 2025. This means that regardless of the findings presented to Congress there would be regulatory continuity. Therefore there would be no significant adverse impacts.

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SECTION 5 CUMULATIVE IMPACTS

NEPA defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts were identified for the SJRRP in the PEIS/R. However, cumulative negative impacts from NMFS' proposed designation of the NEP (via the proposed 10(j) and 4(d) Rules) and associated boundaries, would be minor, if at all measurable, on spring run Chinook salmon and not likely measurable on any other resource, with the exception of a less than significant impact to Recreational Opportunities. Cumulative positive environmental effects are likely, owing to development and implementation of cooperative and comprehensive conservation measures to support the ongoing release, reintroduction, and reestablishment of a self-sustaining population of spring-run Chinook in the San Joaquin River.

Impacts on the environment are included in the resource analyses in Section 4 Environmental Consequences. For example, the establishment of the NEP furthers the goals established by the Settlement. The NEP, SJRRP restoration projects, and other activities such as construction of the conservation hatchery facility and future 10(a)(1)(A) permits would work in concert with other ongoing recovery and reintroduction efforts for spring-run Chinook and would enhance NMFS' flexibility and discretion in managing listed Central Valley salmon within the whole of the Central Valley. Monitoring of the 10(a)(1)(A) permits and special handling for scientific or salvage and rescue purposes under the existing 4(d) permitting protocol and adaptive management components of the FMP or San Joaquin River Conservation Hatchery HGMP, for example, would help ensure that the affected spring-run Chinook is adequately protected. Therefore, the incremental and cumulative impacts to spring-run Chinook would not be significant.

Cumulatively, the NEP designation would be consistent with the goals and objectives of the numerous ongoing restoration activities in the NEP area. The area in which the NEP is to be established has been degraded in terms of fish habitat and access for salmon to spawning areas from past actions, most importantly, by the direct, indirect, and cumulative impacts from dam development and water withdrawals. The establishment of the proposed NEP and 4(d) rules is the result of long-term negotiations between the stakeholders in the region and the Settlement process. The NEP along with the establishment of take exemptions for both the area within the NEP and the area between the NEP and the south Delta may result in greater numbers of San Joaquin River spring-run Chinook being taken than under the more restrictive exemptions that apply to the existing ESU. These allowances represent conditions necessary to obtain support of the local stakeholders to allow Congressional authorization to implement the Settlement. The flow and habitat improvements to be implemented by the SJRRP represent the best opportunity to have spring-run Chinook reintroduced to the San Joaquin River. With the successful reintroduction to the San Joaquin River, combined with ongoing recovery actions, there is an increased likelihood of recovery for the species as a whole.

In addition to recovery planning, Federal agencies must consult with NMFS under section 7 of the ESA on any action that is likely to adversely affect listed species under NMFS jurisdiction, including spring-run Chinook salmon. Non-federal actions that may result in "take" of ESA listed species as defined

through section 9 or 4(d) are required to obtain appropriate authorization to avoid violation of the law. Reintroduction of ESA listed species to an area where they do not currently occur could add to the regulatory requirements for Federal and non-federal actions. However, the proposed NEP designation provides substantial regulatory relief from section 9 take prohibitions, hence cumulative effects of the reintroduction as a NEP on present and future activities will be negligible. Also, when a NEP is in effect, the section 7(a)(2) consultation requirement would be suspended, but the section 7(a)(4) conference requirement would remain in effect. A conference between a Federal agency and the NMFS consists of informal discussions concerning an action that is likely to jeopardize the continued existence of the proposed species or result in the destruction or adverse modification of the proposed critical habitat at issue. The occurrence of conferences under the proposed action are likely to be limited, hence the cumulative effect of the reintroduction as a NEP on regulatory requirements for present and future activities will be negligible.

In the long-term, however, the designation may result in net benefits to listed spring-run Chinook if conservation measures supporting reintroduction are successfully developed and implemented during the established NEP period. Incidental take of spring-run Chinook that would continue under the NEP designation would be consistent with Congressional intent for section 10(j) of the ESA to foster improved habitat and abundance conditions in the long-term while ongoing, lawful landowner activities are occurring concurrent to the NEP designation.

As discussed, the cumulative impacts of the SJRRP were identified in the PEIS/R. However, there is one specific impact discussion that is reproduced herein. That discussion is the analysis of Climate Change and the possible impacts of Climate Change on the fish population of the Proposed Action.

Climate change is predicted to bring profound changes to California's natural environment. Hayhoe et al. (2004 as cited in Reclamation 2011) describe the results of four climate change models: compared with 1960–1991, by 2070–2099 statewide average annual temperatures will 36°F–42°F higher, average annual precipitation will be reduced by >3.9 inches, sea level will have risen 7.5–16.1 inches, snowpack will have declined by 29%–89%, and change in annual inflow to reservoirs will decline by >20%. (One model predicted slight increases in precipitation, snowpack, and reservoir inflow.)

Changes in vegetation are also predicted (e.g., substantial decreases in the extent of alpine/subalpine forest, evergreen conifer forest, mixed evergreen woodland, and shrubland; and increases in mixed evergreen forest and grassland (Hayhoe et al. 2004 as cited in Reclamation 2011). Climate change is likely to cumulatively affect native fishes and amphibians by increasing water temperatures (hence reducing dissolved oxygen), reducing stream flows, and increasing the likelihood of drought-related fires. A rise in sea level would lead to increasing rates of erosion, sedimentation, flooding, and inundation of low-lying coastal ecosystems. With reductions in snowmelt runoff, peak flows may come earlier as rainfall contributes more, which could affect species such as Central Valley spring-run Chinook that have evolved their life history based on predictable runoff patterns (Williams 2006, as cited in Reclamation and DWR 2011). An example of this potential vulnerability is the Butte Creek population of spring-run Chinook. Butte Creek is at a lower elevation than the sources of the San Joaquin River. With reduced snowpack owing to climate change, the potential resulting flows would be at temperatures that would reduce the viability of reproduction and there are no upstream reservoirs that could store water at cooler

temperatures. Increasing temperatures also may increase metabolic needs of fish predators and increase predation (Lindley et al. 2007, Thompson, et al. In press.). Moyle et al. (2008 as cited in Reclamation and DWR 2011) qualitatively assessed the potential for climate-related impacts on California's native salmonids (Table 5-1). Their analysis indicated that the majority of taxa (18 of 29, 62%) were vulnerable in all or most of the watersheds inhabited; no taxon was invulnerable to climate change.

The PEIS/R for the SJRRP found that the Restoration Program would not have significant cumulative greenhouse gas emissions. As part of the overall program, the potential greenhouse gas emission for establishment of the NEP would be minimal. There is the potential that climate changes would increase pressures on fish habitat from warming trends. However, the reintroduction of spring-run Chinook to the San Joaquin River may have a beneficial effect to the species. Waters of the San Joaquin River start at higher elevations than those of the Sacramento River. Therefore, it is possible that even with reduced snow pack, the waters generated would be cooler for longer periods than the Sacramento Branch of the Central Valley. It is possible that the reintroduced population may represent a potential refugia for the ESU (Reclamation and DWR 2011).

The establishment of the experimental population and other SJRRP projects would work in concert with other ongoing recovery and reintroduction efforts and would enhance NMFS' flexibility and discretion in managing listed Central Valley salmon conservation. Monitoring and adaptive management would help ensure that the experimental population of spring-run Chinook is adequately protected and supported by restoration actions implemented through the SJRRP.

Because of the practices identified in the HGMP, which include methods and monitoring to protect the genetic integrity and to minimize hatchery influence, there will be no cumulative adverse impacts if experimental population salmon naturally stray at normal levels to natal streams of existing spring-run Chinook populations.

Table 5-1. Qualitative Assessment of California Salmonids' Vulnerability to Climate Change

Vulnerability	**Taxon**
Vulnerable in all watersheds inhabited	Klamath Mountains Province summer steelhead[SSC]; northern California coastal summer steelhead[FT, SSC]; central California coast steelhead[FT]; south-central California coast steelhead[FT, SSC]; southern steelhead[FE, SSC]; upper Klamath–Trinity Rivers spring-run Chinook salmon[SSC]; Central Valley late fall–run Chinook salmon[SC, SSC]; Sacramento winter-run Chinook salmon[FE, SE]; Central Valley spring-run Chinook salmon[FT, ST]; southern Oregon– northern California coastal Coho salmon[FT, ST]; central California coast Coho salmon[FE, SE]; McCloud River redband trout[SSC]; Eagle Lake rainbow trout[SSC]; Lahontan cutthroat trout[FT]
Vulnerable in most watersheds inhabited (possible refuges present)	Central Valley steelhead[FT]; upper Klamath–Trinity Rivers fall-run Chinook salmon; California coast Chinook salmon[FT]; Goose Lake redband trout[SC]; coastal cutthroat trout[SSC]
Vulnerable in portions of watershed inhabited (e.g., headwaters and lowermost reaches of coastal streams)	Northern California coastal winter steelhead[FT]; Central Valley fall-run Chinook salmon[SC]; California golden trout[SC, SSC]; Little Kern golden trout[FT]; Kern River rainbow trout[SC, SSC]; Paiute cutthroat trout[FT]; mountain whitefish
Low vulnerability due to location, cold water sources, or active management	Klamath Mountains Province winter steelhead; resident coastal rainbow trout; southern Oregon–northern California coastal Chinook salmon
Not vulnerable to significant population loss due to climate change	None

Notes:
FE = endangered (federal).
FT = threatened (federal).
SE = endangered (state).
ST = threatened (state).
SC = species of concern (federal).
SSC = species of special concern (state).

Source: Moyle et al. 2008 (as cited in Reclamation and DWR 2011).

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