FINAL
§10(a)1(A), ENHANCEMENT OF SPECIES PERMIT APPLICATION

for the

Reintroduction of Central Valley Spring-Run Chinook into the San Joaquin River

SAN JOAQUIN RIVER RESTORATION PROGRAM

Submitted by the U.S. Fish and Wildlife Service

In Cooperation with:
National Marine Fisheries Service
U.S. Bureau of Reclamation
California Department of Fish and Game

December 2011

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1. APPLICATION PURPOSE

This §*10(a)1(A), Enhancement of Species Permit Application for the Re-Introduction of Central Valley Spring-Run Chinook into the San Joaquin River* (application) proposes specific criteria, guidelines, and measures that the U.S. Fish and Wildlife Service (Service), and their sub-grantees will follow during the implementation of the proposed action.

Due to capacity restrictions of the on-line component of the application process (through the National Marine Fisheries Service's [NMFS] Authorization and Permits for Protected Species site) this application should be considered the Service's full application and the information included on the on-line site as summarized sections.

2. USE OF THE DOCUMENT

This document is intended to be used within the interagency process as set in the Program Management Plan (PMP). This document provides the overall framework underlying the implementation process to be facilitated through the Implementing Agencies and via the San Joaquin River Restoration Program (SJRRP). Additionally, this document is intended to be used in its entirety; meaning that the individual sections and appendices are not intended to stand alone. Using the document as a whole, rather than in part, provides the reader with the appropriate perspective in which to assess this application. We anticipate further technical discussion and refinement of specific components presented within this application—both through the upcoming National Environmental Policy Act (NEPA) process NMFS is undertaking for the reintroduction action, and through an annual adaptive process for program collection and reporting activities.

2.1 Consultation History

September 29, 2010, the Service submitted a §*10(a)1(A), Enhancement of Species Permit Application for the Re-Introduction of Central Valley Spring-Run Chinook into the San Joaquin River* to NMFS.

November 17, 2010, the Service received a 30-day Response letter from NMFS requesting additional clarification on two points of the application.

January 20, 2011, the Service sent NMFS a letter to clarify the Donor Stock Collection decision process and the finalized Hatchery and Genetic Management Plan (HGMP).

February 2011, NMFS released the §10(a)1(A) permit application for public comment from February 4 through March 7, 2001 and held public workshops in Chico, Fresno and Los Banos for the §10(a)1(A) permit application and the reintroduction process.

May 28, 2011, the Service received a letter from NMFS asking that we address the 113 public comments and the 4 NMFS comments that resulted from the public scoping period. This Revised Application addresses both the public comments and Implementing Agency discussions that have occurred since the original permit application was submitted on September 29, 2010.

November 4, 2011, the Service submits the *Revised §10(a)1(A), Enhancement of Species Permit Application for the Re-Introduction of Central Valley Spring-Run Chinook into the San Joaquin River* to NMFS.

December 2011, the Service revised the November 4, 2011, *§10(a)1(A), Enhancement of Species Permit Application for the Re-Introduction of Central Valley Spring-Run Chinook into the San Joaquin River* to NMFS to reflect changes in collection methods and donor sources.

3. INTRODUCTION

3.1 San Joaquin River Restoration Settlement

The SJRRP was formed to execute a legal settlement from the lawsuit, NRDC et al. v. Kirk Rodgers et al. In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging the renewal of long-term water service contracts between the United States and California's Central Valley Project Friant Division contractors. After years of litigation, the Settling Parties reached a Stipulation of Settlement Agreement (Settlement). The Settling Parties, including NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement, which was subsequently approved on October 23, 2006. The Settlement established two primary goals:

- Restoration Goal – To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River downstream of Friant Dam to the confluence with 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 to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

To achieve the Restoration Goal, the Settlement calls for a combination of channel and structural modifications along the San Joaquin River downstream of Friant Dam, releases of water from Friant Dam to the confluence of the Merced River, and the reintroduction of Chinook salmon (Chinook), *Oncorhynchus tshawytscha*. In response to the Settlement, the implementing agencies, consisting of the Service, Bureau of Reclamation (Reclamation), NMFS, California Department of Fish and Game (CDFG), and California Department of Water Resources (DWR) organized a Program Management Team (PMT) and associated Technical Work Groups to begin work implementing the Settlement. For additional information related to the Implementing Agency approach, the reader is referred to the PMP, available on the SJRRP Website at www.restoresjr.net.

The Settlement specified the roles and responsibilities for a Restoration Administrator (RA) who is supported by a Technical Advisory Committee. The SJRRP management structure integrates these resources to obtain timely input on technical issues related to the Restoration Goal.

Paragraph 14 of the Settlement indicates that the Restoration Goal shall include the reintroduction of spring-run and fall-run Chinook to the San Joaquin River between Friant Dam and the confluence of the Merced River. In addition, Paragraph 14 of the Settlement requires the Service to submit an Endangered Species Act (ESA) §10(a)1(A) permit application to the NMFS for the reintroduction of spring-run Chinook. The San Joaquin River Restoration Settlement Act (SJRRS Act; Public Law (PL) 111-11) indicates that spring-run Chinook shall be reintroduced into the San Joaquin River pursuant to §10(j) of the ESA, provided that the Secretary of Commerce "finds that a permit for the reintroduction of California Central Valley spring-run Chinook may be issued pursuant to §10(a)1(A) of the Endangered Species Act." This document fulfills the Paragraph 14 Settlement requirement that the Service submit a §10(a)1(A) enhancement of species permit application.

3.2 Project Overview

The overall objective of the proposed action (Reintroduction Program) is to collect and reintroduce multiple life stages of Central Valley ESU spring-run Chinook to develop a naturally-reproducing, self-sustaining population of spring-run Chinook in the San Joaquin River. The intent is to ultimately include the range of genetic and phenotypic characteristics identified in existing populations of the fish, and therefore increase the likelihood that the reintroduction of spring-run Chinook to the San Joaquin River will be successful.

Another clear objective within the proposed action is that these collections not have an adverse impact on the survival and recovery of the Central Valley ESU and/or of the populations within each potential source stream. Finally, in keeping with the requirements of PL111-11, no spring-run Chinook will be released to the San Joaquin River as part of the proposed action unless designated as an experimental population under section 10(j) of the Endangered Species Act.

As a result of consultation with the RA and technical deliberation within the Implementing Agencies, we are proposing a stepwise, iterative approach to implement the reintroduction. This approach would begin with collecting spring-run Chinook from the Feather River Fish Hatchery (FRFH) to use as donor stock. Ultimately, approval may be sought to diversify donor stock by utilizing spring-run Chinook from other streams, if and when the spring-run Chinook populations in those streams can sustain the collection of some fish for this purpose.

This application is for the collection of surplus Feather River Fish Hatchery (FRFH) spring run Chinook salmon which will be used for broodstock and direct river reintroductions for the SJRRP. The Service is requesting a 5 year permit be issued for this action. Future donor stock collections will depend on the status of Central Valley spring-run Chinook, the condition and status of anticipated San Joaquin River channel improvements and Conservation Facilities and would require an amendment to this permit or a subsequent permit application to NMFS.

Given the goal of the SJRRP to achieve a naturally-reproducing and self-sustaining spring-run Chinook population in the Restoration Area, several options have been considered in the development of this Application.

3.3 Project Location

The San Joaquin River from Friant Dam near the town of Friant, California, to the confluence of the Merced River is considered the Restoration Area for the purposes of the SJRRP. 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). See Figure 1 for a map of the project area. 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.

Sections of the 153 mile area are dry most of the year except during periods of agricultural or flood flows. The Restoration Area has been significantly altered by changes in land and water use over the past century. Several structures such as the Chowchilla Bypass, Mendota Dam, Sack Dam, Eastside Bypass, and many smaller private structures may impede fish movements through the system until the restoration of the San Joaquin River is completed.

The Service, in accordance with the Settlement, is proposing to reintroduce Central Valley spring-run Chinook to the San Joaquin River upstream of the mouth of the Merced River in the Central Valley of California (Merced, Madera, and Fresno counties).

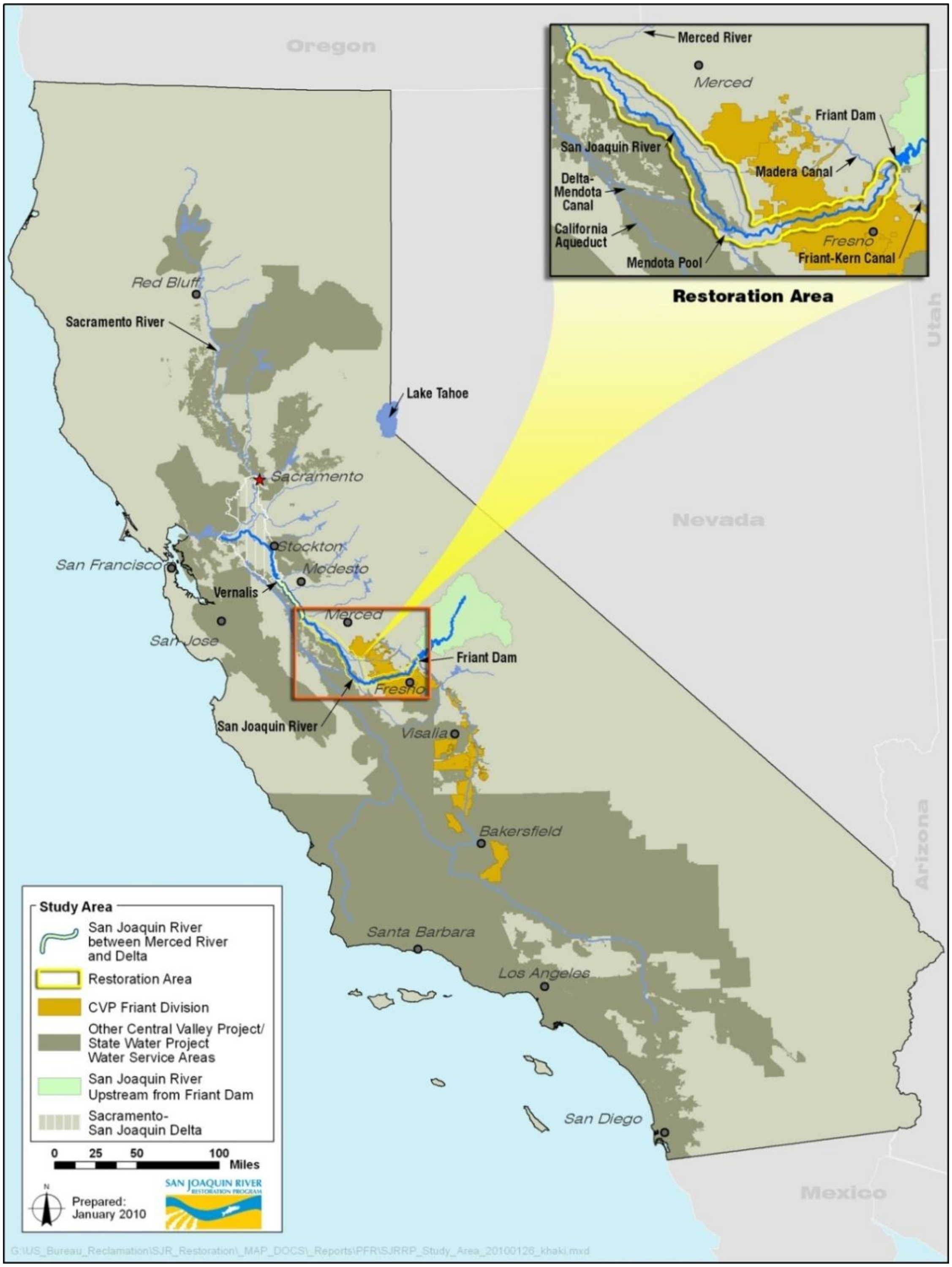

Figure 1. Project Location.

The Central Valley spring-run Chinook is listed as threatened under the Federal Endangered Species Act (ESA) and is listed as threatened under the California ESA (CESA). The Evolutionarily Significant Unit (ESU) includes all naturally spawned populations of spring-run Chinook in the Sacramento River and its tributaries in California, including the Feather River, as well as the Feather River Hatchery spring-run Chinook program (NOAA 2005). Critical habitat was established on September 2, 2005, and became effective on January 2, 2006 (NOAA 2005a). In accordance with the San Joaquin River Restoration Settlement Act (SJRRS Act) the fish reintroduced under the SJRRP would be considered an experimental population under §10(j) of the ESA.

4. CONSERVATION STRATEGY FOR THE SAN JOAQUIN RIVER SPRING-RUN CHINOOK

Historically, the Central Valley spring-run Chinook ESU spanned four ecoregions, known as Diversity Groups (Northern Sierra Nevada, Northwestern California, Basalt and Porous Lava, and Southern Sierra Nevada). Spring-run Chinook have been almost entirely extirpated from both the Basalt and Porous Lava region and the Southern Sierra Nevada region. The current lack of viable populations makes the Central Valley spring-run Chinook ESU vulnerable to catastrophic disturbance.

To be viable, an ESU needs a wide distribution of natural spawners sufficient to accomplish the following: avoid the loss of genetic and/or life history diversity during short-term losses in abundance that are expected parts of environmental cycles; fulfill key ecological functions that are attributable to the species, such as nutrient cycling and food web roles; and provide for long-term evolutionary adaptability to changing environmental conditions.

For the Central Valley spring–run Chinook ESU to achieve recovery, as outlined in the Recovery Plan, each Diversity Group must be represented, and population redundancy within the groups must be met to achieve Diversity Group recovery. Therefore, Diversity Group criteria include a minimum of two viable populations of spring-run Chinook within each of the four spring-run Chinook Diversity Groups. Viability of the ESU is also more likely if: 1) populations are geographically widespread but some are close enough together to facilitate connectivity; 2) populations do not all share common catastrophic risks; and 3) populations display diverse life-histories and phenotypes (McElhany et al. 2000).

Addressing the primary threats and risk factors for the ESU will require reintroducing populations to historic and currently unoccupied habitats. Candidate areas for reintroduction are identified and prioritized in the NMFS Recovery Plan. The spring-run of the San Joaquin River, within the Southern Sierra Nevada Diversity Group, is listed as a "primary" focus of recovery within the Recovery Plan.

The FMWG (and subgroups) collaborated on development of the three foundational technical documents: Stock Selection Strategy; San Joaquin River Salmon Conservation and Research Program (Conservation Program) Hatchery and Genetic Management Plan (HGMP); and Reintroduction Strategies documents. They comprise the initial framework of the Reintroduction Program within this application.

The foundational technical documents (Stock Selection, HGMP, and Reintroduction Strategy) identify the extant Central Valley spring-run stocks as the most appropriate stocks for reintroduction to achieve success in the San Joaquin River. This determination is based on the premise that the donor stocks should be selected from currently existing stocks inhabiting the Central Valley to maximize the likely success of local adaptation to the San Joaquin River, and that incorporating all of the existing genetic diversity found in the Central Valley spring-run stocks provides the most opportunity for successful establishment of a naturally reproducing, self-sustaining population of spring-run Chinook in the San Joaquin River. Therefore, populations that may be considered for future actions in the Reintroduction Program are the independent spring-run Chinook populations on Butte, Deer and Mill creeks, and the spring-run Chinook population in the Feather River, along with opportunistic collection of other spring-running Chinook from the Stanislaus, Mokelumne, and Yuba rivers and Battle and Clear creeks.

Studies mentioned in the various foundational technical documents are important aspects of the overall adaptive management planning process of the SJRRP. These studies will include monitoring that is essential for reporting requirements and meeting performance measures of this permitted activity; but also include research and further investigations necessary to improve the performance of underlying methodology, or assist in improving the efficacy of implementation within the overall adaptive management framework. It is important to recognize the segregation of these activities within the programmatic framework of this application.

We intend this application will serve as the official project description, effects and take analysis. However, the three foundational documents are attached as supporting technical documents and can provide additional explanation and clarity for overarching concepts recommended for the Reintroduction Program. Unless specifically prioritized and defined in this Application, we do not explicitly intend to include studies listed in the foundational technical documents as part of the project description. Beyond the data required to implement the donor stock collection planning process, and the monitoring and reporting necessary to ascertain programmatic performance during management of the conservation stock at the Conservation Facility or the experimental stock during and following reintroduction, we do not intend this application to include all aspects of additional research or restoration monitoring. These are part of the larger programmatic operations and the adaptive management of the experimental stock of spring-run Chinook and their habitat in the restored mainstem San Joaquin River, and should be captured in the further evolution of the SJRRP implementation.

5. PROJECT DESCRIPTION

5.1 Multiple Strategy Approach

To implement the Settlement, this Application outlines the process needed to evaluate and approve the collection, propagation, and reintroduction of spring-run Chinook into the San Joaquin River. It takes into consideration the NMFS Recovery Strategy for the species and the genetic needs for a robust reintroduced population (as discussed in the Stock Selection Strategy document), and the current condition of spring-run Chinook in potential donor areas.

Following consultation with the RA and technical deliberation within the interagency technical working groups, we are proposing multiple strategies to implement the reintroduction. More than one reintroduction method at a time would be implemented to maximize learning opportunities and the potential for success. Given the Restoration Goal of the SJRRP to achieve a naturally-reproducing and self-sustaining spring-run Chinook population in the Restoration Area, several options have been considered.

One option is the use of temporary propagation facilities (hatcheries). Propagation facilities can generally be classified as supplementation facilities or conservation facilities. Traditional supplementation facility models have a low likelihood of achieving the restoration goals without detrimental genetic impacts to the reintroduced population. Conservation facility models emphasize not only producing desired numbers of fish for release, but also reducing genetic and ecological impacts of release on wild fish (Flagg and Nash, 1999).

Another option is translocation-- moving fish directly from one stream for immediate release into the San Joaquin River. However with the exception of donor stock derived from the FRFH, it is probable that the numbers of donor fish needed to support in-river reintroductions (translocation) is too high to be currently supported by other potential donor populations. Although minimizing hatchery influence is genetically a desirable strategy, the translocation option must take into account the reality of population-level impacts to the donor streams (in this case, to a listed species).

The third option is to allow natural re-colonization following the time course of habitat restoration. However, allowing only natural re-colonization of the San Joaquin River is problematic for spring-run Chinook, given the lack of geographically proximal populations. For all intents and purposes, the population has been extirpated from the entire watershed (Yoshiasma et.al. 1998).

Based upon the evaluation of options above, the Service believes that the long-term goals of the program would be best met utilizing a multi-strategy approach–1) reintroduction of donor stock of various lifestages directly from donor streams into the San Joaquin River Restoration Area, if and when spring-run populations in potential donor streams can sustain the collection of fish for this purpose, and 2) reintroduction of cultured fish (Conservation Stock) at different lifestages originally collected from natural production donor stocks (also at various lifestages only when donor populations can sustain collection) to various San Joaquin River locations. However, due to the status of the species and the availability of potential donor stock, the Service believes that the use of FRFH donor stock for both direct translocation and the development of Conservation Stock is the most appropriate course of action at the present time due to concerns about the ability of spring-run populations from other potential stream sources to sustain fish collections.

Conservation Strategy Design Plan

It is anticipated that a portion of collected individuals will be used as broodstock for annual supplementation into the San Joaquin River from the Conservation Facility (or Interim Facility in years 1-3; 2012-2014). Reintroduction would be provided via direct releases of eggs and juveniles and/or Conservation Stock from the Facility. This includes the use of surplus eggs or juveniles obtained from the FRFH. The number of years and/or seasons that collecting would occur is dependent on the propagation needs and available supply of donor stock, however we propose to begin collections around April 30, 2012 and to continue through April 2017.

During the initial years (Years 1-3), the goal would be to collect sufficient numbers of broodstock, per broodyear, to provide a maximum of 100 unrelated gravid adult females and an equal number of fertile males for the Interim Facility. For example: during brood years 2012 to 2014 we would collect enough eggs/juveniles to produce 150-200 adults (100 pairs) from each broodyear. Therefore, we will have multiple age classes at the Facility (3 year olds, 2 year olds, 1 year olds, and current broodyear). These fish, produced from eggs and juveniles would be reared in the Interim Facility, and their offspring would be released to the San Joaquin River in sufficient numbers to meet the targets (see section 5.9 for release methods).

Assuming the survival rates and enhanced rearing conditions in the Facility, it is anticipated that 300-500 eggs or juveniles would be needed to produce 50-100 adult pairs in the facility. Therefore in years 4-5, based on the anticipated availability of the full Conservation Facility, the goal would be to propagate sufficient numbers of broodstock to provide up to 150-450 unrelated adults, per year for the subsequent years of the proposed action.

5.2 Collection Methods by Lifestage

To simultaneously maximize flexibility for collections (and therefore Reintroduction Program success), we are proposing to collect from multiple life stages. Donor stock collection of eggs and juveniles is proposed from the Feather River Fish Hatchery. The collection and processing methods, including genetic testing are described here, and are subject to an adaptive process.

5.2.1 Eggs—Feather River Fish Hatchery

Collection and Processing

Eggs would be obtained from the FRFH in association with the hatchery's standard procedures as outlined in the FRFH draft HGMP (DWR 2009). All eggs collected would be surplus, defined as eggs that are not needed to meet the production goals/targets of the FRFH (described below). Eggs are preferred for collection because of the ability to target genetically diverse individuals and collect spatial and temporal diversity, while maintaining low risk to the donor population. Furthermore, collection at this life stage provides greater survival to adulthood in a controlled environment when compared to rearing in the wild, thereby reducing population level impacts. Additionally, eggs provide the least amount of risk associated with disease transfer to the Restoration Area due to their ability to withstand disinfection and the fact that many pathogens are not vertically transmitted from parent to ova.

The FRFH offers the opportunity for a consistent source of eggs for the Conservation Program. The FRFH HGMP protocols (DWR 2009, or most current version) would be followed for the collection, fertilization and incubation of eggs at the FRFH, and for the testing of ovarian fluid and kidney/spleen for pathology testing. Eggs would be taken at the eyed stage for both broodstock and direct translocation. After following the specific mating scheme outlined in the FRFH draft HGMP (DWR 2009), a small number of eggs from a minimum of 50 crosses will be segregated for use by the Program. Due to space availability, the FRFH is unable to segregate all crosses, even in subdivided trays. Therefore, the maximum number of crosses segregated may change each year. A minimum of 50 crosses will be selected by FRFH personnel for segregation throughout the spawning season to maximize genetic diversity.

In accordance with their permit the FRFH will segregate a small number of eggs from individual crosses into sub-divided egg trays that the Program will later target for collections. Egg trays will be subdivided into four sections, each section would hold approximately 10-20 ounces (oz) of eggs, up to 80 oz. per tray. An equal number of eggs by weight will be segregated per cross. Once disease status and run timing are known (see criteria below), and once eggs have eyed, the Program will select eyed eggs from segregated lots up to the maximum allowed. This is the preferred method, since the Program will have the opportunity to select from individual preferred crosses. The Program will first randomly select eggs from preferred crosses for the broodstock program, then select eggs for direct translocation.

If the FRFH is unable to segregate enough green eggs for both broodstock and direct translocation from preferred crosses (see criteria below), then the Program would also select eyed eggs, up to the maximum allowed, from the FRFH spring-run egg trays. Since the FRFH does not have the space to segregate all crosses, two to three different crosses may be in one tray. Selecting eyed eggs using this method will reduce the number of available preferred crosses since a non-preferred cross (i.e. BKD or IHNV positive female parent) may be mixed with a preferred cross, thus requiring rejection of the entire tray. This will be a backup method that will only be used to collect eggs for direct translocation.

Individuals will be randomly selected from preferred crosses/trays for both broodstock and for direct translocation. Corresponding individual fish data will be collected for each cross; including Hallprint tag number, adipose fin status, head tag number, coded wire tag (CWT) number, gender, weight, fork length, ovarian fluid sample number, tissue sample number and corresponding genetic analysis data. These data will be used to select preferred crosses for the Program (for both broodstock and direct translocation) guided by the following criteria:

- Disease Status - Parents of juveniles test negative for major virulent pathogens and in particular, Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD).
- Genetic Variability – The collections accurately represent the genetic diversity of the donor population. Siblings should comprise less than 2 percent of the total collection [base on the goal of 50 crosses from unrelated individuals (i.e. non-siblings)].
- Run Timing – preferably two-generations of spring-run phenotype are identified using CWT data, parentage based tagging (PBT) or otolith microchemistry. Generation-one would be the spawning adults (i.e. parents of the eggs), and generation-two would be the parents of the spawning adults (i.e. grandparents of the eggs).
- Age of Maturing – Two year old males and females (based on length data) will comprise less than 5 percent of the parental crosses.

Hatchery versus wild origin (i.e. adipose fin status) by itself will not be a sole determining factor for selection; but rather, there must be a clear identification of a two-generation expression of a spring-run phenotype (i.e. adult migration during the spring). On the Feather River, run timing ancestry is most easily demonstrated in FRFH origin fish which possess a clear data trail from CWT and PBT data which is not associated with wild origin fish. Therefore, particularly in the near term, collections will be primarily comprised of hatchery origin fish unless run timing ancestry is identified in wild origin fish (i.e. by using otolith microchemistry (i.e. strontium isotopes)).

After fertilization, eggs would be disinfected with iodophore during water hardening and placed in compartmentalized hatching trays. Individual crosses would be kept separate at FRFH for approximately 30 days until corresponding genetic and coded wire tag data and pathogen data are compiled for selection criteria. This allows FRFH to determine whether annual production goals have been met. In the event production goals are not met, all proposed egg collections from FRFH for the Program will be terminated.

The FRFH in most years has met its production goal of two million spring-run Chinook smolts (personal communication with Anna Kastner, Hatchery Manager, October 13, 2011). To reach this target, the hatchery typically mates approximately 750 pairs to produce three million eggs (Figure 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 current 2011 spawning season at FRFH the number of surplus adults was particularly large. To date, 486 surplus adults (231 males and 255 females) have entered the hatchery (Table 1). Theoretically, these fish were capable of producing an additional one million eggs.

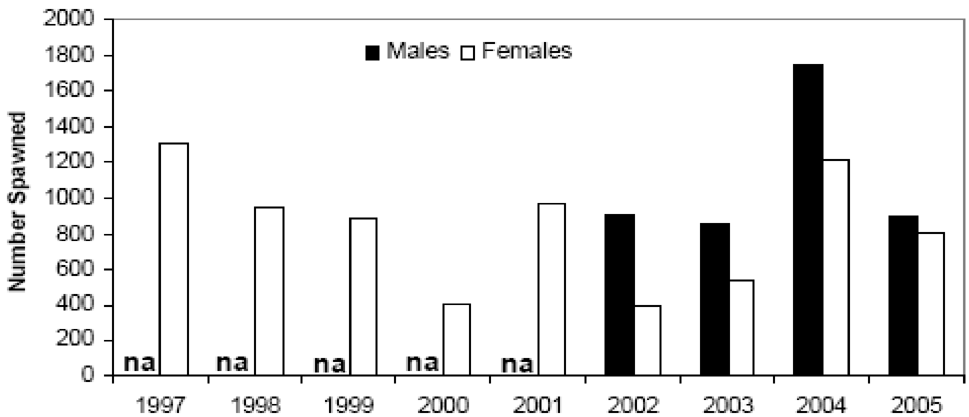

Figure 2. Number of spring-run Chinook adults spawned at the FRFH (Source: DWR 2009).

	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 1. Surplus Fish Observed at Feather River Fish Hatchery in Recent Years (based on personal communication with Anna Kastner, 10/13/11).

Transport

All eggs destined for direct translocation to the San Joaquin River or the quarantine facility will be transported when the eggs are the most shock resistant. All eggs transported to the quarantine facility will be hatched and transported to the San Joaquin River or Conservation Facility as fry or juveniles (following methods described in *Section 5.3.2 Juveniles—Feather River Fish Hatchery, subsection Transport*).

Eggs will be placed in a specialized shipping container (e.g. Styrofoam cooler) to reduce excessive movement and limit damage to the egg membrane. Eggs will be segregated in wet cheesecloth and securely tied, then placed in the shipping container, kept cool and moist using non-chlorinated ice, and transported in a dark environment. Ice will be in a separate compartment of the shipping container, so as not to be in direct contact with the eggs. The ideal temperature for transport is between 5 – 10^{o} C. A standard vehicle will be used to transport eggs.

Quarantine and Pathology

Health inspection data for IHNV and BKD are collected from ovarian fluid of returning adult females annually during spawning. Eggs destined for the Conservation Facility will first go to a quarantine facility (see *Sections 5.3 Quarantine and Pathology* and *5.4 Quarantine Facilities*) for health screening at which time eggs will hatch. After hatching, 60 individuals will be sacrificed for pathology testing, and upon health certification the remaining individuals will be transferred to the Conservation Facility for the captive rearing program (see *Section 5.8 Rearing Facilities*).

Most of the collected eggs will be reserved for direct translocation to the San Joaquin River. Eggs from IHNV and BKD negative females will be properly disinfected at FRFH and transported for direct translocation to the San Joaquin River for injection into the gravels, or streamside or in-stream incubation. Eggs for direct translocation will not be taken to the Conservation Facility.

5.2.2 Juveniles—Feather River Fish Hatchery

The FRFH offers the opportunity for a consistent source of juveniles for the Conservation Program. Juveniles would be produced on site from eggs as described in the FRFH HGMP (DWR 2009) and in the above section (see Section 5.2.1 Eggs—Feather River Fish Hatchery). All juveniles collected would be surplus, defined as fish that are not needed to meet the production goals/targets of the FRFH (as described in section 5.2.1 Eggs—Feather River Fish Hatchery).

Collection and Processing

Preferably, fish selected for the Reintroduction Program would be segregated as eggs in individual vertical egg incubator trays for hatching (see Section 5.2.1 Eggs – Feather River Fish Hatchery) and later transferred to a segregated raceway section for outdoor rearing at the main FRFH facility or at the nearby FRFH Annex facility. If the FRFH is unable to rear eggs to the juvenile stage, then individuals will be transferred to the Silverado Fisheries Base, as eggs, for rearing and quarantine. If the Program is unable to segregate fish during the egg lifestage, then the Program will collect spring-run juveniles from all available raceways. To capture the temporal and spacial diversity of the parents, random collections would occur guided by the number of fish in each raceway, the size of the fish, and the number of different families (i.e. crosses) in each raceway. Each concrete raceway section is 100 feet long x 10 feet wide x 2.5 feet deep, with a water flow rate of 3-5 cubic feet per second. When juveniles reach the appropriate length for transfer to the Conservation Facility, or for translocation to the San Joaquin River, the Program will follow the FRFH's standard procedures to corral and collect the juveniles. Once collected, the juveniles would be placed in buckets for further processing. Adipose-fin clipping and CWTs would be required for any juveniles reared in the facility and released into the San Joaquin River. Prior to collections, the Program will coordinate with FRFH staff and work closely with them during collections. The Program will follow FRFH standard procedures and practices. Coordination will occur with FRFH and will be done with close collaboration with hatchery staff, process and procedures.

Quarantine and Pathology

Between December and March, juveniles would be quarantined for the minimum 30-day health evaluation (see *Sections 5.3 Quarantine and Pathology* and *5.4 Quarantine Facilities*). After quarantine and pathology testing, juveniles would be transported to the Conservation Facility for use as broodstock or translocated to the San Joaquin River. For individuals translocated to the San Joaquin River, short- term confinement is required for sufficient imprinting, which may occur either in or alongside the San Joaquin River or at the Conservation Facility.

Transport

Any juveniles requiring transport, either to the Conservation facility or directly to the San Joaquin River, would be moved utilizing a 500-gallon transport tank and trailer. The tank would be filled with water from the FRFH (for transport from FRFH to Silverado, SJR, or Conservation Facility) or from the Silverado Fisheries Base (for transport from the Silverado Fisheries Base to SJR or the Conservation Facility) just prior to transport. Transport times would depend on the location, but may be as long as 4 hours. Before transferring fish, the water would be tempered to within two degrees Celsius of the water temperature at the receiving facility.

5.3 Quarantine and Pathology

The need for the Program to transfer out-of-basin fish to the Restoration Area and to the proposed Conservation Facility requires preventative measures to avoid introduction of infectious disease. Some fish pathogens found in California are capable of severely impacting wild fish populations and disease issues can, and have, threatened captive rearing programs (Kline 2010).

Fish in hatcheries are particularly susceptible to disease due to high fish densities and the added stressors of the hatchery environment. The Conservation Facility lies in close proximity to the San Joaquin Fish Hatchery, a major producer of rainbow trout for regional recreational fishing. This requires strict bio-security measures to prevent disease transfer between the facilities. The three pathogens of highest concern are IHNV, BKD and *Myxobolus cerebralis* [Whirling Disease (WD)]. Transfer of a virulent pathogen to the trout hatchery or Conservation Facility such as IHNV, which is commonly found in wild Chinook, could result in the need to destroy the entire fish inventory for facility disinfection.

Therefore, fish health inspections of the highest degree are necessary before all fish transfers. These inspections include quarantining fish to investigate all instances of moribund and dead animals in an attempt to immediately identify the cause of the problem. All eggs or fish collections from a given lot will be destroyed when these pathogens are identified during health assessment to prevent introduction of pathogens to the Conservation Facility or the San Joaquin River.

Risk assessments for fish transfers will be conducted and based on the FWS Aquatic Health Policy (713 FW 5). Fish health assessments will be conducted through the CDFG Fish Health Lab (Rancho Cordova, CA) and based on procedures described in the American Fisheries Society blue book: *Suggested procedures for the detection and identification of certain finfish and shellfish pathogens* (AFS-FHS 2010).

A fish health assessment is performed by sacrificing and analyzing a sufficient number of fish from a given lot to provide a 95 percent confidence level that at least one infected fish will be collected. The health assessment and necropsy is conducted on fish that are 40 mm in length or greater and is based on the assumption that the prevalence of the pathogens in the population is 5 percent or greater (i.e. assumed pathogen prevalence level (APPL) of 5 percent).

The general process for fish health assessment involves first transferring eyed eggs or juveniles to a quarantine facility, whose water supply is free from virulent fish pathogens (see *Section 5.5 Quarantine Facilities* for further details). For eyed eggs, this would typically occur sometime in mid-October and for juveniles would occur sometime between November and April of each year. After all fish or eggs from a similar group or lot have entered quarantine and have hatched and reached a minimum size of 40 mm, approximately 60 fish will be sacrificed for pathogen testing which takes approximately 30 days. In cases where fish from the same lot enter quarantine over a period of time, pathogen testing begins after the last fish from the lot enters quarantine. After fish health clearance has been received, “cleared fish” may be transferred to the Conservation Facility, or to the San Joaquin River for direct release.

5.4 Quarantine Facilities

The CDFG Silverado Fisheries Base is the standard quarantine facility for all fish transfers. All eggs and fish going to the Conservation Facility, and all juveniles for direct translocation will be sent to the Silverado Fisheries Base for quarantine and pathology. However, if the Silverado Fish Base is unable to receive the collections (i.e., temperatures not conducive), then collections will either stay at the FRHF and be quarantined onsite at the FRFH Annex Facility or be transferred to the Center for Aquatic Biology and Aquaculture (CABA) facility located on the UC Davis Campus (Davis, CA) as a backup system for quarantine. The Program will work with CDFG Pathology to determine which backup quarantine facility is appropriate for use. If sufficient quarantine cannot be provided by any of the backup facilities or another appropriate site, then proposed fish collections will be terminated.

Quarantine facilities may also be used for short term holding and potentially longer-term holding, if the need arises. Under such circumstances, 6ft, 10ft, or 16ft circular fiberglass culture tanks would be made available at the facilities for that specific purpose.

Silverado Fisheries Base

CDFG operates the Silverado Fisheries Base (Yountville, CA) for the purpose of juvenile fish and egg quarantine. All fish and egg transfers to the Conservation Facility and for direct transfer to the San Joaquin River will first require quarantine and fish health inspection. The Silverado has a capacity for hatching and rearing 100,000 Chinook eggs and juveniles to approximately 5 grams; however, fewer salmon may be reared to a larger size. Typically, salmon can be housed at the facility between mid-November through mid-May of each year. CDFG is currently working to extend this holding period by installing appropriate water refrigeration systems.

Center for Aquatic Biology and Aquaculture

The Reintroduction Program intends to use the CABA facility located on the UC Davis Campus (Davis, CA) as a backup system for quarantine. CABA's fish culture tanks utilize a secure source of well water which is generally considered free of fish pathogens. CABA has a capacity for hatching a minimum of 40,000 Chinook eggs at one time and is capable of rearing them to approximately 5 grams.

Feather River Fish Hatchery Annex

The Program intends to use the Feather River Fish Hatchery Annex located on the FRFH grounds, when feasible. The FRFH Annex uses about 12 cfs of well water (whereas the main FRFH uses river water), all raceways are 100-ft long and 10-feet wide. The FRFH Annex is part of the FRFH operations, and is located downstream from the FRFH on the west side of the Thermalito Afterbay. The FRFH Annex provides additional rearing capacity for 2.5 million fingerling salmon. The operation of the FRFH Annex is covered under the FRFH HGMP.

5.5 Donor Stock Collection Numbers

The annual maximum collection targets representing the maximum numbers the Reintroduction Program could collect in any given year are displayed in Table 2. The maximum collection targets are needed by NMFS to permit the proposed project but also enable the Reintroduction Program to achieve its goals concerning lifestage variability, genetic diversity, and facility capacity. Working within these maximum numbers also provides the flexibility for the Reintroduction Program to adaptively manage collections, which will be reflected in the annual Donor Stock Collection (DSC) Plan submitted to NMFS for annual incidental take approval and DFG for concurrence. That is, the maximum number the Program could collect in any given year.

To determine a maximum number of individuals that could be collected as donor stock, the capacity of the Conservation Facility was used as a threshold. In years 1-3, the Interim Facility capacity will be 100-200 individual adults (50-100 adult pairs), per broodyear. Upon completion of the full scale Conservation Facility (around year 4), the capacity will increase to 300-900 individual adults (150-450 adult pairs) per broodyear.

The Reintroduction Program is targeting the collection of 80,000 eyed eggs for direct translocation into the San Joaquin River as this number of eggs and resulting outmigrating juveniles would be expected to result in a returning adult population of about 10 pairs (see Appendix B, Table 2). It is recognized that early returns of adult may not reach this goal until river restoration efforts and removal or modification of migration barriers have been achieved. However, it is anticipated that this number of eggs and resulting juveniles will provide returning adults for the program to assess the river's condition and further identify any constraints to restoring spring-run Chinook to the San Joaquin River pursuant to the Settlement.

During Years 1-3 as a primary source of donor stock, we are proposing a maximum annual collection of 80,560 eyed eggs ("surplus eggs" see section 5.2.1 for definition) from the FRFH (80,000 for translocation and 560 for broodstock development). Alternatively, we may utilize juveniles produced at the FRFH which have been determined to meet donor stock criteria. The number of juveniles which we may collect is based on the number of fish an equivalent number of eggs would produce at that age. For example on average, 80,000 eyed eggs would produce about 54,400 fingerling juveniles (based on an average 32 percent mortality from eyed to fingerling stage, Cavallo et al 2009).

During years four and five a maximum annual collection of 82,760 eyed eggs would be collected from the FRFH (80,000 for translocation and 2,760 for broodstock). Again, we may elect to utilize FRFH juvenile fish instead of eggs (see Table 2 below)

Collection Type	Collection Source	Targeted Lifestage	Disposition Location	Max Years 1-3	Max Years 4-
Primary	Feather River Fish Hatchery	Juveniles	Conservation Facility	560	2,760
	Feather River Fish Hatchery	Eyed Eggs	Conservation Facility	560	2,760
	Feather River Fish Hatchery	Juveniles	Translocation to SJR	54,400 @ fingerling	54,400 @ fingerling
	Feather River Fish Hatchery	Eyed Eggs	Translocation to SJR	80,000	80,000

Table 2. Maximum collection targets by year, location, lifestage and disposition.

5.6 Donor Stock Collection Planning and Reporting

As a condition of the §10(a)1(A) permit, an annual report on the status of collections and summary of the coming years proposed collection will be submitted to NMFS and CDFG. *Appendix A* outlines the annual decision making process and the information to be contained in the Donor Stock Collection Plan (DSC Plan).

Other considerations may also arise through further monitoring and research. These include: recovery criteria, new understanding about genetics and improved understanding regarding survivability of donor stock. In addition, we need to be sure about donor stock disposition with respect to the Conservation Facility's operational status and/or habitat conditions in the mainstem San Joaquin River for reintroduced individuals.

The Service will develop two reporting documents each year to be submitted to NMFS and CDFG.

1) **DSC Plan**. Annual DSC Plans will be developed by a multi-agency technical team to describe the collection plan for each year. This document will be developed prior to any collections and will include all the expected collection actions for the year. The annual DSC Plan will be submitted to NMFS and CDFG for approval.

2) **Year-End Report**. A year-end report will be developed by December 31 of each year. This document will summarize any differences between the anticipated actions and what occurred, and any adaptive processes under review.

Donor Stock Collection Criteria

The donor stock collection planning and implementation will be driven by interagency collaboration and based on real time information. The criteria below will evaluate FRFH donor stock each year and the number of individuals targeted by life stage:

- Facility status and capacity available to rear broodstock;
- Resources available to collect donor stock;
- Donor stream status and population viability;
- San Joaquin River instream conditions for reintroductions;
- Genetic considerations

See *Appendix A* for a template of what would be contained in the annual plan.

5.7 Rearing Facilities

The Conservation Facility (and Interim Facility in the early years), will be used as the primary rearing facility for broodstock. However, in the event the currently proposed Interim Facility is unavailable for holding fish (e.g. CEQA permitting is not complete, lack of sufficient flow, etc.), the contingency plan is to: 1) focus on the direct transfers to the San Joaquin River (as described elsewhere in this document) without use of the Interim Facility; 2) utilize the Center for Aquatic Biology Aquaculture facility at University of California at Davis or; 3) allow fish to remain at the Feather River Fish Hatchery facilities (as described in *Section 5.4 Quarantine Facilities*) in accordance to their permitted authority. These decisions would be based on conditions on the ground at the time and agreement between the State and Federal Fisheries Agencies. Fish would remain at the alternative facilities until conditions improve at the Interim Facility or until conditions become unsuitable at the alternative facilities. If the latter occurs, fish would be transferred in an appropriate manner to the San Joaquin River for reintroduction (as described elsewhere in this document). Prior to temporarily utilizing any of these facilities for rearing and propagation of spring-run Chinook we would ensure that this is consistent with State and Federal Regulations.

5.7.1 Conservation Facility

The Interim Facility will be located on the grounds of the CDFG San Joaquin Fish Hatchery (SJFH) until 2014, when the construction of the permanent Conservation Facility is expected to be completed on the SJFH property. The full scale Conservation Facility would be located along the San Joaquin River adjacent to the SJFH in Friant, California about 20 miles northeast of Fresno (Fresno County) and one mile downstream of Friant Dam.

Individuals may be brought into either facility relatively briefly and released; while others would be reared to adulthood. These adults would either be spawned upon reaching sexual maturity after 2-5 years, or be released to the river to spawn naturally. Salmon resulting from eggs and juveniles planted directly into the San Joaquin River should begin returning as adults in 2015. Likewise, initial Conservation Facility broodstock should reach adulthood by 2015. The adult offspring of these fish would be expected to return to the San Joaquin River and the Conservation Facility in 2019.

For the short-term (Years 1-3; 2012-2014), the goal of the Conservation Facility Program would be to collect sufficient numbers of broodstock to provide a minimum of 50 and a maximum of 100 unrelated gravid adult females (and an equal number of fertile males), per broodyear, for the Conservation Facility. These fish, produced from donor stock eggs and juveniles, would be the first broodstock reared in the Interim Facility and their offspring would be released to the San Joaquin River.

In Year 4 and beyond (2015-2017), based on genetic considerations, the goal would be to propagate sufficient numbers of broodstock annually to provide a minimum of 150 and a maximum of 450 unrelated gravid adult females (and an equal number of fertile males) from each donor population. The permanent Conservation Facility will be designed to accommodate the maximum broodstock size of 900 fish per broodyear.

Some of the source stock may be reared for a shorter period of time in the Conservation Facility and released directly to the San Joaquin River as juveniles, provided habitat restoration activities have restored suitable conditions in the San Joaquin River. However, since in-stream survival to adulthood in the wild is less, relative to hatcheries, additional eggs and juveniles would be required for direct release to the "wild."

Incubation and rearing operations would occur at an Interim Facility until 2014, at which time operations would transition to the full-scale Conservation Facility. Eggs and juveniles collected from the FRFH would be transported to the Facility, after quarantine and pathology testing, and reared under controlled hatchery conditions to sufficient age and size to improve their probability of survival to reproduction. Each year, a portion of this production would be withheld in the hatchery to provide the source for the next generation of broodstock.

The first introductions from the hatchery-reared, adult broodstock are expected to occur in 2015. This is the preferred near-term strategy to attain numeric fish goals until such time that the Conservation Program completes habitat restoration to provide sufficient in-river survival rates. All hatchery juveniles would be adipose fin-clipped and coded wire tagged prior to release; therefore releases from the Conservation Facility would be 100 percent marked. The broodstock would be genotyped for parental-based tagging, and would be intraperitoneal Passive Integrated Transponder (PIT) tagged for tracking and identification in the hatchery.

The Conservation Facility's funding source, physical design and operation are described below.

Funding

The State of California is anticipating funding for the capital budget for the Conservation Facility and the O&M costs would be covered by the Bureau of Reclamation. The proposed estimate for the capital improvement costs for the Conservation Facility is $14.64 million. The State has an approved budget allocating the funding and spending authority. Immediate funding is secure but owing to past bond sale challenges and an uncertain economy, the current status could change.

Physical Infrastructure

The small-scale, Interim Facility would be located on the grounds of SJFH and be operational until the full-scale Conservation Facility is constructed. The Interim Facility holding tanks would include twelve 3-foot diameter circular tanks, three 6-foot diameter circular tanks, three 16-foot diameter circular tanks, and two 20-foot diameter circular tanks. It would be designed to spawn about 50-100 adult salmon annually. Interim facility incubators would include two, 12-tray vertical flow incubators (Marisource®, Fife, WA); two deep matrix incubators (ARED, Inc., Wrangell, Alaska); and one moist air Incubator (ARED, Inc., Wrangell, Alaska).

The full-scale Conservation Facility is anticipated to be operational in 2014, at which time both facilities would be integrated together. Additional facilities for the Conservation Facility would include three 20-foot by 5-foot high circular tanks for holding, quarantine and acclimation of all wild fish entering the hatchery. Eight 12-tray vertical egg incubators would be obtained as well. A pre-engineered metal shell spawning shed, equipped with spawning tables, egg processing equipment and associated plumbing, would be installed.

Rearing facilities would be organized into three main areas: fry production, smolt production, and captive rearing. Fry production would occur in the main hatchery building and involve rearing fish from the unfed fry stage to about 3 grams each (in 72 small, circular culture tanks measuring 3 feet in diameter by 30 inches high with a volume of 106 gallons). Smolt production of fish from 3 grams to 7.5 grams, and yearling production from 7.5 grams to 75 grams, would occur outdoors in the exterior hatchery area. Twenty, 16-foot diameter tanks would be used for smolt production.

Captive rearing of fish for adult production from yearlings (75 grams) to adults (greater than 1 kilogram) also would occur outdoors in the exterior hatchery area using four banks of culture tanks, with one 30-foot tank and three 20-foot tanks in each bank. All outdoor tanks would be equipped with automatic feeders, include netted or solid-roof bird enclosures, and feature a flow-through water system. A 3-foot wide volitional release channel would be installed between fish culture tanks to be used both for volitional release and transporting fish to the adjacent spawning shed.

Water Source and Discharge

Water for the Conservation Facility would be supplied from Millerton Lake, located at the base of Friant Dam. The water supply would be micro-screened (with a minimum pore size of 80 microns to reduce pathogen loads) and aerated. The water supply (for egg incubation, hatching and early rearing) would be further treated with ultraviolet filtration. The existing CDFG SJFH uses the same water source, and has successfully hatched and raised trout at the site since 1955 due to favorable water temperature and water quality conditions.

The source water for the hatchery is a continuous 35 cubic foot per second (cfs) supply gravity-fed directly from Friant Dam. 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.

The temperature of the water in each pipeline varies throughout the year, and valves are used to control the flows to create favorable temperature conditions at the hatchery. Temperatures are typically maintained between 45-55ºF (7.2-12.8ºC) throughout the year, occasionally dipping as low as 42ºF (5.6ºC) or peaking as high as 58ºF (14.4ºC). Hatchery water and the adjacent river water are of the same origin and fairly similar in quality and temperature; however, the temperatures of the hatchery water are moderated due to the ability to adjust water temperatures at the mixing valves located at the Fishwater Release Hydropower Plant.

The water flowing from the Hydropower Plant is delivered to a 44-inch diameter pipeline for delivery to the fish hatchery (about 1 mile from the dam). The pipeline has been calculated to have the capacity to convey an additional 30 cfs to the hatchery. Planning is currently in progress to convey a portion of the unused capacity to the Conservation Facility, therefore water flow is anticipated to be equally as reliable.

The Conservation Facility would have a separate discharge from the existing hatchery and would operate under an independent National Pollutant Discharge Elimination System (NPDES) permit. Effluent from the hatchery building and bottom drains from fish culture tanks would be directed via gravity flow to micro-screen drum filters. Filtered water would be directed to a common discharge point on the river. Sludge from drum filters would be directed to a drying pond for disposal. Existing settling ponds would be lined, refurbished, and used for additional effluent treatment as required.

Because of the high flow rates intended at the hatchery to provide sufficient flushing and to provide optimal conditions, temperature increase in the San Joaquin River from Conservation Facility effluent water is anticipated to be minimal and would remain within the guidelines provided by the Regional Water Quality Control Board.

Spawning

All male and female broodstock would be examined weekly during the spawning season to determine readiness for spawning. Mating pairs would be determined according to molecular relatedness estimates, as described in the draft HGMP, with consideration given to increasing genetic diversity and effective population size, and decreasing inbreeding and outbreeding depression.

Eggs from the female would be divided into five groups and each group would be fertilized by a different male. Each male would be used with five different females. Fish to be spawned would be euthanized by pneumatic knife inserted into the spinal cord posterior to the head. The ventral wall of the abdominal cavity of each female Chinook would be slit open and eggs allowed to freely flow into a metal spawning pan (Leitritz and Lewis 1976). Sperm from males would then be expressed into the pan by stroking the vent area.

The flaccid eggs would be put into incubation trays. Eggs and fry from each cross would be kept separately until the swim-up stage to allow for evaluation of the success of the cross. As available, and as governed by the recommendations of the hatchery and river monitoring technical teams, precocious males and jacks would be used to ensure representation of alternative life history strategies.

Egg Incubation

Each vertical flow incubator (consisting of 12 trays) would be operated at the manufacturer's recommended flow rate of 30-60 gallons per minute, depending on the loading density. Loading densities would not exceed 8,000 eggs per tray, although egg tray capacity is 10,000 eggs. Individual family lots would be segregated into three or four sections per egg tray using segregation dividers (providing segregation for up to 48 parental crosses). Opaque side panels would be added to the incubators to produce a darkened environment for incubation. All egg incubation would occur in darkened conditions.

Deep matrix incubators are hatch boxes that provide a substrate (i.e., plastic rings) for hatching to mimic in-river conditions by requiring "emergence." The units would be single pass through flow systems, and would be operated at the manufacturer's recommended flow rate. Each unit has a recommended loading rate of 200,000 salmon eggs.

Each egg tray would hold 2,700 eggs, with a total capacity of almost 600,000 eggs per unit. The unit would recirculate 40 gallons of filtered water, with 5 gallons of water replaced daily. Filtration would consist of 1 and 50 micron particle filters, a 10 micron carbon filter and ultraviolet sterilization.

Moist air incubation produces a fine mist for incubation to inhibit fungal growth. The moist air incubator would have 220 individual egg trays to allow isolation and tracking of individual parental crosses. The moist air unit would incubate green eggs through the eyed stage in a dark environment, after which the eggs would be transferred to deep matrix or vertical tray incubators for hatching.

The deep matrix incubators and the vertical tray incubators would utilize ambient water temperatures, anticipated to be between 45-55^{o}F. As the moist air incubator would allow for temperature control, hatching temperatures would be based on the objectives of the Conservation Program, and may include: mimicking San Joaquin River temperatures, slowing or speeding egg development, and/or utilizing temperature to produce thermal marks on otoliths. Dissolved oxygen levels would be maintained near saturation. Eggs would be monitored twice daily, and dead eggs would be removed. Siltation is not anticipated to be a problem because the water supply comes from Lake Millerton (i.e., the reservoir would allow sediments to settle out before reaching the hatchery intake).

Rearing

The rearing facility would utilize circular rearing tanks. Circular rearing tanks have been shown to have several advantages over plug-flow raceway designs, and are the design of choice for many salmon captive rearing programs. The benefits of circular tanks include the following:

- the ability to adjust water velocities to target optimal swimming speeds for salmonids, which has been shown to improve growth rates, feed efficiency, oxygen utilization, swimming performance and stamina, and to reduce aggression;
- the ability to self-clean, allowing improved water quality and minimizing human to fish contact;

- improved waste management characteristics;
- the ability to efficiently and evenly add supplemental oxygen; and
- easily modified for water recirculation, if needed.

Three-foot circular tanks (106 gallons) would be used for early feeding and for juvenile segregations, and would be monitored for early mortality. After about 2 weeks, family groups would be combined in larger circular holding tanks. Sixteen-foot circular tanks would be used for rearing fish up to age 2, and 20-foot tanks would be used for rearing fish from age 2 until maturity. During captivity, tank flushing rates would be less than one turnover per hour and the maximum allowable fish density index would be 0.15 $lb/ft^3/in$, as proposed by Banks (1994) and Ewing and Ewing (1995) for spring-run Chinook.

The Conservation Facility would utilize high quality slow sinking salmon feed from a reputable fish feed manufacturer. Dietary protein and energy levels may vary in order to modulate fish growth rates according to The Conservation Program requirements. Feeding charts would be used to guide the number of feedings and feed amount per day (by percent body weight).

Live feeds and other natural feeds would be investigated, with the goal of mimicking natural conditions. Feed conversion efficiencies would vary depending on the feed type, feed rate, and the age of the fish. Automated feeders would be used and feeding regimes and timing would attempt to mimic natural conditions, particularly for smolt production.

Growth rates would be modulated by manipulating the feed rate and/or the energy density and protein content of the feed. Growth of captive reared fish would be modulated to minimize precocity. Growth during smolt production would be modulated to meet the Conservation Program goals for release size, release timing and strategies for avoiding possible impacts to the wild population.

Fish health would be monitored by CDFG pathologists. Treatment methods prescribed by fish pathologists for disease outbreaks and treatment protocols would be carried out by hatchery staff. Depending on the nature of an outbreak, treatment methods may vary. However, chemical treatments for external pathogens may include the use of salt, $KMnO_4$, formalin or hydrogen peroxide (as allowed by the hatchery discharge permit). Bacterial infections could include the use of oxytetracycline, florfenicol or other approved antibiotic.

All treatment would follow veterinary guidance and would be used and monitored according to NPDES wastewater discharge requirements. Diagnostic procedures for pathogen detection would follow American Fisheries Society professional standards, as described in the American Fisheries Society Bluebook (Thoesen 2007).

Tagging

The entire population of captive reared broodstock would be genotyped for parental based tagging. A small fin clip would be collected from spawned fish and either dried on blotter paper or stored in ethanol. In the lab, the fish would be genotyped, and this information stored in a parent database. When suspected offspring are sampled subsequently, they too would be genotyped, their parents located in the database and the stock and cohort of origin recorded.

All ESA-listed Central Valley salmonids tissue samples would be preserved as voucher specimens and sent to: Dr. Robert Titus, California Department of Fish and Game, Tissue Archive Lab, 1875 Alpine Avenue Suite F, Sacramento, California 95814, (916) 227-6844. Preservation protocol would be confirmed with the appropriate contact person.

Broodstock reared at the Conservation Facility also would be tagged using PIT tags and Visual Implant (VI) tags after reaching a minimum length of 55 mm (Harvey 1987). Sterilized PIT tags would be injected into the peritoneum using an implant gun or syringe-style implanter. PIT tags would be used for monitoring individual fish throughout captivity. Sterilized VI tags would be inserted into the clear tissue behind the eye using a sterilized syringe. VI tags would be used as a "duplicate" tag, since fish may expel PIT tags.

Prior to spawning, adult fish would be tagged intra-muscularly with Petersen disc tags for easy visual identification (Harvey 1987). The tag would consist of two plastic buttons that are held to the sides of the fish by a stainless steel pin passed through the muscle tissue beneath the dorsal fin. The discs would be colored or marked with letters or numbers. Adult fish would be anesthetized during all tagging activities using MS-222, CO_2, or Tricaine-S. The dosage of the anesthetics would be adjusted to avoid fish mortality.

All hatchery juveniles would be adipose fin clipped and coded wire tagged prior to release (Harvey 1987). Coded wire tags are small (less than 1 mm) lengths of wire implanted into the snout of each juvenile fish using specialized automated equipment. The tags (visually indicated by the removed adipose fin) would allow fish to be identified as belonging to a particular Conservation Facility cohort when it is either captured as an adult (commercial or sport fishery harvest), or when it returns to the San Joaquin River to spawn and the carcass is recovered. Some adipose fin clips would be used for additional genetic analysis.

5.8 Reintroduction & Experimental Stock Release

The third component of our proposed action includes the release of donor stock and/or conservation stock to the mainstem of the San Joaquin River.

The prospective elements of the §10(j) ruling include direction by the permitting agency to provide coverage for all collected donor stock (and their progeny) through to release into the San Joaquin River—at which time the §10(j) experimental designation is expected to be in effect. Therefore, we anticipate activities associated with release to be categorized into two broad categories.

1) Fish Relocation—"cleared fish" (at different lifestages) will be available *from the Conservation Facility* and transported for either direct release and/or exposure and acclimation at in-stream facilities (incubators or cages) into different areas of the river (see Reintroduction Strategies document, and below); and
2) Fish Translocation—"cleared fish" (at different lifestages) may be directly introduced *from a donor stream source* to the San Joaquin River. This is from riverine donor source (or associated holding facility) to riverine San Joaquin River habitat (including direct release and/or in-stream facilities).

In regulatory terms, "cleared fish" relocation refers to transport of covered individuals from one facility to another, all under the proposed §10(a)1(A) provisions pursuant to this application. Fish translocation involves transport of fish for eventual direct release to the San Joaquin River. Reintroduction into in-stream or streamside facilities would entail either relocation or translocation, depending on the fish source. Upon completion of transfer to riverine habitat (direct release or in-stream facility), the experimental §10(j) designation would commence.

5.8.1 Adaptive Management of the Reintroduction

The Reintroduction Strategy document will guide future adaptive management methods for reintroduction of our donor source stock and progeny. The adaptive management process is discussed in the *Fisheries Management Plan* (SJRRP 2010) which emphasizes "learning by doing," and ideally follows a technically rigorous process. That process includes: articulating what is known about the ecological dynamics of the system; predictive (quantitative, where possible) modeling to relate management actions to expected outcomes; monitoring, assessment and reporting of observed results; followed by successive reiterations of the entire process—revisiting our revised understanding through adaptive actions and further observations, etc.

A number of monitoring tools are necessary to evaluate the reintroduction strategies employed. Genetic evaluation and other methods will be used to evaluate the relative fitness and success of fish from the different stocks at various life stages following the reintroduction, and these evaluations will inform progress in the reintroduction effort. A monitoring framework that includes static sites, which will remain identical throughout the term of the SJRRP, for collecting biological data and genetic samples (e.g., fin clips), would allow identification of individuals and their biological status (e.g. growth, weight, condition factor). This pedigree information and biological information can be combined with genetic study of adaptive traits to demonstrate selection for specific traits and local adaptation to the San Joaquin's environment.

5.8.2 Direct Releases

This activity includes transport of various lifestages ("cleared fish" relocation and translocation) for direct reintroduction to the San Joaquin River. For all such transport activities (regardless of destination), proper protocol must be followed to minimize stress and mortality. Transport of spring-run Chinook eggs, juveniles or adults from the Conservation Facility to the San Joaquin River for release/reintroduction would occur as described above for donor stock collections, by lifestage.

Transport water would be tempered to within 2^{o} C of the river location receiving the fish before transferring fish. When possible, fish would be moved in and out of the transport truck using a water filled vessel and without netting to minimize stress and loss of slime. In particular, fish would be transferred to and from transport tanks using "in-water" purse-style stretchers that hold both fish and water (i.e., water-to-water transfer). Direct netting of fish would be minimized to the greatest extent possible to reduce injury and fish stress. When possible, releases would occur at night to minimize predation. Juvenile and adult fish would be transported to the release site using the following general guidelines (Carmichael et al. 2001):

- reduce the number of stressors;
- reduce the severity of stressors;
- minimize the duration of stressors;
- minimize plasma ion disturbances; and
- minimize increases in metabolic rate.

Up to 250,000 spring-run Chinook eggs per year may be reintroduced to the San Joaquin River, the source of which could be the Conservation Facility or directly from translocated fish collected in the donor streams. Upon arrival at the release site, eggs would be tempered to the receiving water by increasing the egg temperature 1ºC per hour until matching the receiving water temperature. Eggs then would be reintroduced to the San Joaquin River as described below using streamside incubators, instream incubation boxes, or egg injection into the gravel. Timing of egg releases would occur in direct correspondence to their availability from the Conservation Facility, typically from August 20 through November 10.

Preferred release sites would be near the hatchery and predicted spawning ground; however, releases may occur much farther downstream to avoid migratory hazards and predator conditioning, and transport time may be as long as 2 hours.

San Joaquin River egg or juvenile spring-run Chinook release locations may include, although are not limited to, the following locations:

- Conservation Facility, RM 254.2
- Lost Lake Park, RM 264.5
- Ball Ranch Access Point RM 262.2
- San Joaquin River Ecological Reserve, Willow Unit, RM 260.6
- Fort Washington Access Point, RM 257
- Vulcan Access Point/Rank Island RM 258.5
- Sycamore Island, RM 253.3

- Scout Island, RM 250
- Highway 99 Bridge Crossing, RM 243.2
- San Joaquin River Ecological Reserve, Millburn Unit, RM 247.2
- Bifurcation Structure Access Point, RM 216.1
- Mendota Pool Access Point, RM 205
- Sack Dam, RM 182
- Firebaugh, RM 195
- San Luis Wildlife Area, RM 147.2
- Highway 165 Bridge, RM 132.9
- Highway 140 Bridge, RM 125.1
- Hills Ferry Barrier, RM 118.2

5.8.3 Reintroduction Methods

Depending on the lifestage targeted for each reintroduction, several direct or indirect methods are proposed. These methods were chosen to allow the best chance of survival for each lifestage and will be monitored to addresses additional unforeseen factors and improvements that may be needed. All fish (eggs and juveniles) will be quarantined based on DFG's Fish Health Assessment recommendations (see *Section 5.3 Quarantine and Pathology*). After fulfilling pathology/quarantine requirements, fish collected for direct translocation to the San Joaquin River may be held at the Conservation Facility or in net pens in the river (to facilitate imprinting, tagging/marking, etc.) before release. Eggs for direct translocation will not be sent to a quarantine facility. Health inspection data for IHNV and BKD are collected from ovarian fluid of returning adult females annually during spawning. Eggs from IHNV and BKD negative females will be properly disinfected at FRFH and transported for direct translocation to the San Joaquin River. Eggs for direct translocation will not be taken to the Conservation Facility.

Direct Release

Egg injection into the gravel

This method would involve injecting eyed eggs into the gravel using a hydraulic redd pump/egg injector (ARED, Inc., Wrangell, Alaska (http://www.ared.net)) to simulate incubation in a natural redd within the gravel. Egg injection would occur in areas of the river with suitable spawning habitat characterized by appropriate water depth, velocity, and substrate, and low sedimentation. Egg injection sites also would be selected to be adjacent to areas with appropriate water depth, velocity, and substrate, and cover characteristics to promote fry growth and survival. A simulated redd would be prepared by first inserting a water pump pipe into the gravel and pumping water through to remove fine material, as would occur with natural salmonid spawning, prior to egg injection. Fine sediments would be "pumped" out to improve permeability. About 50 eggs would then be poured into the open top of the pipe and pumped into the gravel along with the stream water from the pump. The site would then be left alone for the eggs to incubate and fry to emerge naturally. If the reintroduction of eggs would occur entirely using the hydraulic redd pump/egg injector, the activity would occur in about 4,000 locations.

Juvenile Releases

Juveniles are expected to be available for release into the San Joaquin River at various ages and sizes from the FRFH and Conservation Facility. Juveniles may be released over the same temporal window as collection or availability occurs, or placed in temporary holding pens for imprinting and additionally for acclimation prior to release into the San Joaquin River. Release sites would be selected to provide appropriate water depth, velocity, substrate, and cover characteristics to promote juvenile growth and survival. The use of temporary holding pens would allow the juveniles to acclimate before release, and thereby reduce the risk of predation (Fisheries Foundation 2009). Juvenile salmon outmigrate in groups, which may reduce mortality due to predation. Temporarily holding juveniles and releasing them in a series of groups may more closely resemble natural densities experienced during rearing and outmigration and increase their survivorship.

Finally, if smolt-sized juveniles from the FRFH are released in the Restoration Area, holding the fish in pens temporarily may increase the likelihood that they imprint on the San Joaquin River and return to the Restoration Area to spawn as adults. Juvenile salmon learn odors associated with their home stream before seaward migration and use these odor memories for homing as adults (Dittman 1995). Numerous studies from the Pacific Northwest point to the value in developing olfactory cues for juvenile salmonids released outside of their natal streams, to improve homing to the river of release (Slatick et al 1988).

Indirect Release

Streamside Incubators

This method would entail using portable incubators erected alongside the San Joaquin River. The incubators would be Whitlock-Vibert (WV) boxes (Federation of Flyfishers, Livingston, Montana; www.fedflyfishers.org) contained in 5-gallon buckets or large tubs. The WV boxes would be plastic and measure 6in x 2in x 4in (www.kawanobooks.com/html/En/e083.html). Fifty eyed eggs would be placed in one of two chambers in the box. Once they hatch, fry would exit the egg chamber through slots and enter a rearing chamber. Fry would be released into the river immediately upon absorption of their yolk sac and swim through slots in the outer sides of the boxes. Release would occur volitionally onsite, or fry would be transported to specific locations for release. Release sites would be selected so as to provide appropriate water depth, velocity, and substrate, and cover characteristics to promote fry growth and survival. This method essentially involves piping a river water source, using gravity, through an incubator of incubating eggs. The water is piped into the bottom of the incubator and allowed to flow out the top. Sites would be selected to provide the best conditions to successfully incubate the eggs. If the re-introduction of eggs would occur entirely using streamside incubators, up to 8000 WV boxes may be required. These would be housed in 5-gallon buckets (2 WV boxes per bucket) or 534 large tubs (15 WV boxes per tub).

Instream Incubators

This method would involve incubating freshly fertilized or eyed eggs contained in wire or plastic boxes directly in the stream gravel of the San Joaquin River. Incubators would be buried in the streambed in a likely spawning area with appropriate water depth, velocity, and substrate, and low sedimentation. Sites also would be selected adjacent to areas with appropriate water depth, velocity, and substrate, and cover characteristics to promote fry growth and survival. WV boxes may be used as described above, except that they would be buried in the stream gravel and fry would complete their swim through the stream gravel. Additionally, an incubator design described by Donaghy and Verspoor (2000) may be used. Their design is an about 7-inch square box that includes lidded trays for holding eggs, a basket for retaining the trays, and a lidded frame for securing the basket in the streambed. This incubator would accommodate 4,000 eggs, and as with the Whitlock-Vibert boxes, would allow eggs to mature within the streambed and the fry to emerge naturally. If the reintroduction of eggs would occur entirely using instream incubators, 8000 WV boxes or 100 incubators of the type described by Donaghy and Verspoor (2000) would be required.

5.8.4 Reintroduction Timeline

With the acceptance of the Settlement by the Court in October 2006, work immediately began on planning needed to implement the SJRRP consistent with the NEPA and the California Environmental Quality Act (CEQA). During the drafting of the Settlement, it was assumed that legislation would be quickly forthcoming. However, the legislation (SJRRS Act) was not signed until March 2009, which then authorized the implementation of the Settlement. As a result, progress on channel improvements has been delayed past that which was anticipated and scheduled within the context of the Settlement.

To fully achieve the Restoration Goal, a combination of channel and structural improvements along the San Joaquin River below Friant Dam and releases of additional water from Friant Dam to the confluence of the Merced River will be required. The near-term channel and structural improvements are outlined in Paragraph 11(a) of the Settlement. The near-term release of additional water from Friant Dam is outlined in Paragraph 15 of the Settlement. However, realizing that quality fish habitat must be present to optimize the success of the proposed action, the implementing agencies have also considered the current habitat conditions of the San Joaquin River in light of the Settlement timeline.

The anticipated short residency time of spring-run during the initial introduction and the several year lag prior to the initial adult returns provide greater flexibility in the completion of the restoration activities, despite delays in implementing channel improvements.

Furthermore, prior to the completion of stream restoration activities, the various habitat components required by different life history stages of salmonids are generally available in the upper mainstem San Joaquin River, although it is not yet clear if the extent and quality of existing habitat is sufficient to support long-term population needs. There are still holding pools below Friant Dam suitable for adult spring-run Chinook; moderate quantities of salmonid spawning habitat still remain in Reach 1A; and the river channel in Reach 1 seems capable of providing instream rearing habitat for juvenile salmonids in certain months. Furthermore, the interim releases can provide adequate flow and temperatures in the upper reaches. The increase in flows in certain reaches could enhance dispersal and germination of riparian vegetation in the absence of restoration efforts, via natural colonization. Even if the amount and quality of existing habitat is initially inadequate to achieve the long-term objectives, the amount and quality of existing habitat seem sufficient to at least initiate the process of restoring salmonid populations (McBain and Trush 2002).

5.8.5 Settlement Paragraph 11(a), Phase 1 Improvements

Mendota Pool Bypass and Reach 2B Channel Improvements Project

- Creation of bypass channel around Mendota Pool to ensure conveyance of at least 4,500 cfs from Reach 2B to Reach 3. (Requires completion of a structure capable of directing flow down the bypass and allowing deliveries of San Joaquin River water into Mendota Pool when necessary.)
- Channel capacity modifications (incorporating new floodplain and riparian habitat) to ensure conveyance of at least 4,500 cfs in reach 2B between Chowchilla Bifurcation Structure and new Mendota Pool bypass channel.

The actions described in Paragraph 11(a)(1) and 11(a)(2) have been combined because of their related functions, the project planning has begun and construction is estimated to start in 2013, and be completed in 2015.

Reach 4B, Eastside Bypass and Mariposa Bypass Low Flow Channel and Structural Improvements Project

- Modifications in San Joaquin River channel capacity, if necessary, to ensure 475 cfs through Reach 4B.
- Modifications at Reach 4B headgate on the San Joaquin River channel for fish passage and to enable flow routing of between 500 cfs and 4,500 cfs into Reach 4B.
- Sand Slough modifications to ensure fish passage.
- Modifications to structures in the Eastside and Mariposa Bypass channels to the extent needed to provide anadromous passage on an interim basis until completion of Phase 2 improvements.
- Modifications in the Eastside and Mariposa Bypass channels to establish a suitable low flow channel (if Secretary, in consultation with RA, determines necessary).

Work on combined projects 3, 4, 5, 8, and 9 began in September 2009; construction is anticipated to start in 2013 and be completed in 2015.

Arroyo Canal Fish Screen and Sack Dam Fish Passage Improvements Project

- Screening of Arroyo Canal water diversion upstream of Sack Dam to prevent entrainment of anadromous fish.
- Modifications at Sack Dam for fish passage.

Planning began in 2009, and construction is anticipated to start in 2012 and be completed in 2014.

Salt and Mud Slough Seasonal Barriers

- Modifications to enable deployment of seasonal barriers to prevent adult anadromous fish from entering false migration pathway in the area of Salt and Mud Sloughs.

Planning is anticipated to begin for this project in early 2012, with construction estimated to start and be completed in 2014

Additional Actions Identified in the draft Fisheries Management Plan (SJRRP 2010)

- Minimize in-river harvest, unlawful take, and disturbance;
- Augment and clean gravel to improve spawning habitats;
- Construct settling basins to reduce sedimentation;
- Restore floodplain habitat;
- Create off-channel Chinook rearing areas; and
- Increase invertebrate production.

Planning and construction timelines have not been established for these actions.

Interim Flows

Paragraph 15 of the Settlement calls for a program of Interim Flows that includes releases of additional water from Friant Dam to start no later than October 1, 2009, and continue until full Restoration Flows begin. The purpose of the Interim Flows is to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture and reuse to facilitate the larger project planning.

Paragraph 14 of the Settlement identifies that the Restoration Goal of the Settlement shall include the reintroduction of spring run and fall run Chinook salmon to the San Joaquin River between Friant Darn and the confluence with the Merced River by December 31, 2012. Given the schedule for fish reintroduction outlined in the Settlement, the implementation of interim flows, the channel improvements and the biology of salmon, the following timeline for the reintroduction of Chinook salmon is anticipated.

2012 – 2017

Initial reintroduction encompasses direct in-river Chinook releases, the use of an Interim Facility, and the construction and operation of a full scale Conservation Facility. In the Reintroduction and Interim population phases (Meade 2007, 2008), genetic pedigree analyses (parentage based tagging, Anderson and Garza 2005) and well-designed propagation experiments will/should be conducted to evaluate which reintroduction methods are/will have the greatest success in returning adult spawners. Monitoring of the effectiveness of artificial propagation and management actions on the demographics of the natural re-establishing populations is essential for adaptive management. This population will require monitoring during all periods of the restoration program to ensure that the planned level of segregation/integration of hatchery fish is occurring.

2017 - 2022

During this time period, strategies with the greatest success should be continued. It is anticipated that San Joaquin River spring-run Chinook returns will be high enough so collection of fish from source stocks will not be necessary. The Conservation Facility will also start ramping down hatchery operations during this time.

2022– 2040

The settlement calls for salmon populations to be self-sustaining on the San Joaquin River between Friant Dam and Merced River by December 2025. It is anticipated that the Conservation Facility will be phased out during the beginning of this period; however, the research component of the Conservation facility will be ongoing. The Conservation Facility may be brought back online in certain circumstances, such as but not limited to, during periods of low returns, low water year types, and rescue operations.

5.8.6 Trap and Haul

In the early years of the Reintroduction Program, it is anticipated that a number of major passage impediments will still be in place in the Restoration Area. In order to meet the Settlement mandated reintroduction date, December 31, 2012, there may be a need to utilize trap and haul procedures to move reintroduced fish through the river system. This would require moving juveniles downstream of structures, or unscreened diversions/bypasses, and may require moving returning adults upstream around passage barriers, including structural or biological barriers, (e.g., temperature or DO migration barriers). The locations of these impediments may vary both temporally and spatially as they are subject to river conditions and flows, as well as depend on the state of proposed restoration projects.

For out migrating juveniles, one method to assist with trap and haul operations may be to utilize holding pens as described above (in the *Experimental Stock Release/Reintroduction, Juvenile Releases section*). Holding pens serve to both acclimate, and also allow imprinting of fish. If transporting significant distances, fish would be put into pens in more than one location in the river to increase the likelihood that they are able to imprint successfully. It is anticipated that both the holding pens and trap and haul may be used in conjunction.

Fish would be collected from the holding pens in the San Joaquin River and transferred to a transport tank. The tank would be filled with stream water immediately prior to transport using a portable, screened pump. The transport water would be oxygenated using bottled oxygen with oxygen stones and/or impellor driven aerators. Dissolved oxygen levels would be monitored and maintained near saturation during transport. When necessary, transport water would be supplemented with sodium chloride to provide a physiologically isotonic concentration to minimize ionic disturbances. When possible, fish would be moved in and out of the transport tank using a water filled vessel (i.e., water to water transfer) and without netting to minimize stress and loss of slime. Transport times may be as long as 4 hours. Water would be tempered to two degrees Celsius of the receiving water at the release location before transferring fish.

The same general guidelines used to minimize impacts during the collection and relocation or translocation of fish from the donor and conservation stocks to the Conservation Facility and/or San Joaquin River can be utilized to minimize impacts of Trap and Haul Procedures.

6. EXISTING CONDITIONS

6.1 Current Conditions by Reach

The San Joaquin River from Friant Dam to the confluence of the Merced River (Restoration Area) is approximately 153 miles long, and includes an extensive flood control bypass system (bypass system). The Restoration Area has been significantly altered by changes in land and water use over the past century. During flood flows there is connectivity from Friant Dam to the Merced River and ultimately to the Delta by way of the bypass system. This connectivity occurs on average every 2.5 years. While most the San Joaquin River channel will have water in it during these conditions, Reach 4B remains dry, as water is routed around this river section and into the Eastside Bypass.

Five river reaches have been defined to address the great variation in river characteristics throughout the Restoration Area. Table 3 describes the various attributes of the 5 river reaches.

Reach	Substrate	Geo-morphology	Water present/ source	Land use	Vegetation	Other impacts
1A	Gravel	Incised	Yes/ Friant	Gravel mining/ Ag	Invasive woody spp.	Sediment limited
1B	Gravel	narrow/ levees	Yes/ Friant	Gravel mining/ Ag	narrow riparian zone; Invasive woody spp.	Sediment limited
2A	sand	narrow/ levees	No/ Intermittent/ Delta Mendota Canal	Ag	sparse; grassland; non-native	seepage loss; ground water overdrafting; backwater effects
2B	sand	sandy channel/ levees	No/ Intermittent/ Mendota pool	Ag	narrow riparian zone; native	limited conveyance; perennial
3	sand	narrow/ canals	Yes/ DMC	Ag/ urban	narrow riparian zone	flow diverted to Arroyo canal
4A	sand	narrow canals	No/	Ag	sparse	lowest ratio of vegetation to river in the entire Restoration Area
4B1	sand	poorly defined	No/ water by passed	Ag	dense vegetation	Dry for >40 years except Ag water return
4B2	sand	wider floodplains	Yes	Ag	vast area natural vegetation	Ag water returns
5	sand	side channels/ levees/ floodplain	Yes	public ownership/ wildlife habitat	large expanses of grassland and woody riparian veg.	Extensive bypass system

Table 3. Reach Specific Restoration Area Conditions

Reach 1 begins at Friant Dam and continues approximately 37 miles downstream to Gravelly Ford. This reach conveys continuous flows through an incised, gravel-bedded channel. Reach 1 typically has a moderate slope, and is confined by periodic bluffs and terraces. The reach is divided into two subreaches: 1A and 1B. Reach 1A, which extends down to State Route (SR) 99, supports continuous riparian vegetation except where the channel has been disrupted by gravel mining and other development. Reach 1A also contains potential holding pool habitat that would support adult spring-run holding, and the majority of available spawning habitat. Reach 1B continues from SR 99 to Gravelly Ford where it is more narrowly confined by levees. Reach 1 has been extensively mined for instream gravel and is sediment limited. Gravel mining and agriculture are the primary land uses in Reach 1B.

Reach 1 is the only reach that contains potential holding pool habitat to support adult spring run holding from late spring through the summer. Draft data compiled by California Department of Fish and Game (Matt Bigelow, pers. comm. 09/01/2011 email to Michelle Workman) delineated holding pool criteria and area available for suitable adult holding. Preliminary estimates suggest that there is enough holding habitat (based on temperature, depth, velocity and cover) to support 120,000-360,000 adult fish. At this time, holding pool habitat does not appear to be a limiting factor in the San Joaquin River.

Reach 2 starts at Gravelly Ford, extends downstream to Mendota Dam, and is a meandering, low-gradient channel. During most months of the year, the Reach 2 channel is dry with the exception of flood release conditions from Gravelly Ford to Mendota Dam. Mendota Pool is formed by the Mendota Dam at the confluence of the San Joaquin River and Fresno Slough. The primary source of water to the Mendota Pool is conveyed from the Delta through the Delta-Mendota Canal (DMC).

Reach 2 is subdivided at the Chowchilla Bypass Bifurcation Structure into two subreaches, Reach 2A and Reach 2B, which have confining levees protecting adjacent agricultural land. Reach 2A and Reach 2B are intermittent and sand-bedded. Reach 2A is subject to extensive seepage losses and accumulates sand due to backwater effects of the Chowchilla Bypass Bifurcation Structure and the low gradient of the reach. Riparian vegetation in Reach 2A is sparse or absent due to the usually dry conditions of the river and groundwater overdrafting (McBain and Trush 2002). Reach 2A vegetation has abundant grassland/pasture and large stands of nonnative plants (Moise and Hendrickson 2002). Reach 2B has a sandy channel with limited conveyance capacity and a thin strip of riparian vegetation, primarily native species, which borders the channel. A portion of Reach 2B is perennial because of the backwater of Mendota Pool.

Reach 3 extends from Mendota Dam at the upstream end to Sack Dam at the downstream end and receives continuous flows from the DMC. At Sack Dam, flow releases are diverted into the Arroyo Canal. The river is confined by local dikes and canals on both banks. The sandy channel meanders through a predominantly agricultural area, except where the City of Firebaugh borders the river’s west bank. The river at this location has a low stage but is perennial and supports a narrow riparian corridor along the edge of the river channel.

Reach 4, located between Sack Dam and the confluence with Bear Creek and the Eastside Bypass, is sand-bedded and usually dewatered because of the diversion at Sack Dam. The upstream portion of Reach 4 is bounded by canals and local dikes down to the confluence with the Mariposa Bypass at the San Luis National Wildlife Refuge. Levees that begin at the Mariposa Bypass continue downstream on both banks (McBain and Trush 2002). Reach 4 is subdivided into three distinct subreaches: 4A, 4B1, and 4B2.

Reach 4A, from Sack Dam to the Sand Slough Control Structure, is confined within a narrow channel. This subreach is dry in most months with any existing flows being diverted at Sack Dam. The floodplain of Reach 4A is broad, with levees set back from the active channel. The subreach is sparsely vegetated, with a thin and discontinuous band of vegetation along the channel margin. This subreach has the fewest functioning stream habitat types and the lowest ratio of natural vegetation per river mile in the Restoration Area.

Reach 4B1 extends from the Sand Slough Control Structure to the confluence with the Mariposa Bypass. All flows reaching the Sand Slough Control Structure are diverted to the bypass system. Because of this, Reach 4B has been perennially dry for > 40 years, except when agricultural return flows are put through the channel, leaving standing water in many locations. As a result, the Reach 4B1 channel is poorly defined with dense vegetation and other fill material. The riparian corridor upstream of the Mariposa Bypass is narrow, but nearly unbroken.

Reach 4B2 begins at the confluence of the Mariposa Bypass, where flood flows in the bypass system rejoin the mainstem of the San Joaquin River, and extend to the confluence of the Eastside Bypass. Reach 4B2 contains wider floodplains than upstream reaches and vast areas of natural vegetation.

Reach 5 extends from the confluence of the Eastside Bypass downstream to the Merced River confluence. Reach 5 is perennial because it receives varying amounts of agricultural return flows from Mud and Salt sloughs. Reach 5 is more sinuous than other reaches and contains oxbows, side channels, and remnant channels (McBain and Trush 2002). Reach 5 is bounded on the west by levees downstream to the Salt Slough confluence and on the right bank to the Merced River confluence. Reach 5 has a broad floodplain; however, levees generally dissociate the floodplain from the mainstem San Joaquin River (McBain and Trush 2002). Less agricultural land conversion has occurred in Reach 5, with a majority of the land held in public ownership and managed for wildlife habitat.

The bypass system consists of a series of dams, bifurcation structures, flood channels, levees, and portions of the main river channel. The bypass system is managed to maintain flood-conveyance capacity. Descriptions of primary components of the bypass system follow:

Fresno Slough, also known as James Bypass, conveys flood flows regulated by Pine Flat Dam from the Kings River system in the Tulare Basin to Mendota Pool. Under current flood flow operations, Kings River flows take precedence for channel capacity in the system, so when Kings River flows enter Mendota Pool at least some portion of Friant releases must be routed down the Chowchilla Bypass to make space for the Kings River flows in the downstream reaches (reaches 3-5).

The Chowchilla Bifurcation Structure, at the head of Reach 2B, regulates the flow split between the San Joaquin River and the Chowchilla Bypass. The Chowchilla Bypass extends to the confluence of Ash Slough, and is approximately 22 miles long, leveed, and 600 to 700 feet wide. Sand deposits are dredged from the bypass, as needed, and vegetation is periodically removed from the channel. The Chowchilla Bypass contains a number of bridge crossings, road crossings and drop structures that may inhibit successful fish passage. In order for flow connection from the lower Chowchilla Bypass through the Eastside Bypass system, an approximate 2,000 cfs needs to enter at the head of the Chowchilla Bypass. In general flows less than 2000 cfs will not connect due to channel losses along the length of the Chowchilla Bypass.

The Eastside Bypass bypasses 32.5 miles of river and extends from the confluence of Ash Slough and Chowchilla Bypass to the confluence with the San Joaquin River at the head of Reach 5 and is subdivided into three reaches. Eastside Bypass Reach 1 extends from Ash Slough to the Sand Slough Bypass confluence and receives flows from the Chowchilla River at RM 136. Eastside Bypass Reach 2 extends from Sand Slough Bypass to the head of the Mariposa Bypass at RM 147.2. Eastside Bypass Reach 3 extends from the head of the Mariposa Bypass to the head of Reach 5, at RM 168.5 and receives flows from Deadman, Owens, and Bear creeks. There is a bifurcation structure at the junction of the Eastside Bypass and the Mariposa Bypass. Flood flow operations call for the water to be released down the Mariposa Bypass first, then the Eastside Bypass reach 3, but elevationally water must inundate the Eastside Bypass reach 3 to attain an elevation that will then send it down the Mariposa Bypass. The Eastside Bypass contains a number of bridge crossings, road crossings, drop structures, sloughs and side channels that may inhibit fish passage both upstream and downstream.

6.2 Riparian Habitat

Previous vegetation surveys were conducted on the San Joaquin River by Jones and Stokes Associates, Inc. (1998), Science Applications International Corporation (SAIC 2002) and California Department of Water Resources (Moise and Hendrickson 2002). A summary of the current acreages of various riparian vegetation types by Reach is shown in Table 4.

Category	Vegetation type	Reach								
		1A	1B	2A	2B	3	4A	4B	5	Total
Riparian forest	Cottonwood riparian forest	167	79	31	48	441	16	32	41	855
	Cottonwood riparian forest, low density	27	114	41	1	23	4	4	0	214
	Willow riparian forest	205	119	43	112	116	65	508	590	1758
	Willow riparian forest, low density	28	0	4	6	8	14	118	308	486
	Mixed riparian forest	400	260	0	0	0	6	0	32	698
	Mixed riparian forest, low density	56	19	2	0	0	0	0	17	94
	Valley oak riparian forest	265	0	0	0	0	0	23	46	334
Riparian scrub	Willow scrub	216	113	76	38	190	38	119	73	863
	Willow scrub, low density	74	32	124	15	41	10	13	10	319
	Riparian scrub (non-willow)	47	48	126	87	61	61	58	81	569
	Elderberry savanna	2	0	3	63	0	0	0	0	68
Invasive Exotics	Exotic tree	55	22	9	0	0	0	0	12	98
	Giant reed	3	4	6	0	0	0	0	0	13
Wetland	Wetland	233	5	11	64	16	41	290	336	996
Other	Grassland	2582	300	491	226	174	201	2730	3969	10673
	Agriculture	1915	3167	4554	2047	5361	2702	4189	1445	25380
	Disturbed	2244	381	184	259	743	372	658	182	5023
	Urban	365	0	0	0	623	0	0	0	988
Total		8884	4663	5705	2966	7797	3530	8742	7142	49429

Table 4. Area of vegetation types (in acres) in 1998 (adapted from Moise and Hendrickson 2002).

Reach 1A presently supports nearly continuous riparian vegetation, except where the channel has been disrupted by instream aggregate removal and aggregate pits (JSA and MEI 1998). In Reach

1B, mature vegetation is scarce; which may be due to extensive removal of riparian vegetation for floodway clearing from 1968 through 1970 (JSA 1998). These two reaches (1A and 1B) currently provide potential spawning and rearing habitat for salmonids.

In Reach 2, agricultural grading has eliminated much of the floodplain, and the remaining riparian zone is confined between levees and bordered by agricultural lands. Riparian vegetation in the upper 10 miles of Reach 2A is sparse or nearly absent. The lower few miles of Reach 2B support narrow, patchy, but nearly continuous vegetation where backwater forms upstream of Mendota Pool. Reach 3 is similar, in that most of the floodplain has been agriculturally graded and leveled, however, nearly continuous riparian vegetation of various widths occurs on at least one side of the channel within this reach (JSA and MEI 1998). Reach 4A is only sparsely vegetated, with a very thin band of vegetation along the channel margin. Several narrow bands and patches of willow scrub and marsh vegetation occur (JSA and MEI 1998). Reach 4B upstream of the Mariposa Bypass supports a nearly unbroken, dense, but narrow corridor of willow scrub or young mixed riparian vegetation on most of the reach, with occasional large gaps in the canopy. In Reach 5, the San Joaquin River is surrounded by upland grassland with some woody riparian vegetation within the floodplain. The floodplain and basin are generally disassociated from the mainstem of the river due to levees.

6.3 Aquatic Habitat

Recent surveys have provided estimates of the quantity of spawning gravel in the upper San Joaquin River. In 1996, Cain (1997) estimated a total of 303,000 ft^2 of spawning gravel between Friant Dam (RM 267) and Gravelly Ford (RM 229) (Table 5). In 2000, Jones and Stokes Associates, Inc. (JSA and Mussetter 2002) and Entrix (in McBain and Trush 2002) delineated spawning areas and estimated 773,000 ft^2 of spawning habitat available between Friant Dam and Skaggs Bridge (RM 234). In spring 2002, a second survey was conducted to map suitable spawning gravel in the reach from the Friant Dam to Highway 99 (RM 243) (Stillwater Sciences in McBain and Trush 2002). Over 357,000 ft^2 of suitable spawning gravel was delineated, of which approximately 281,400 ft^2 of suitable spawning gravel occurred between Friant Dam and Lanes Bridge.

Source	Date of survey	Extent of survey	Estimate (ft^2)
Cain 1997	1996	Friant Dam to Gravelly Ford	303,000
Jones and Stokes Assoc./Entrix, cited in McBain and Trush 2002	2001	Friant Dam to Skaggs Bridge	773,000[a]
Stillwater Sciences, cited in McBain and Trush 2002	2002	Friant Dam to Highway 99 Bridge	357,000[b]

[a] included gravel beyond the base flow channel (e.g., on point bars, etc.), probable over-estimate
[b] incorporated hydraulic suitability at potential spawning baseflows

Table 5. Summary of salmonids spawning habitat estimates on the upper San Joaquin River (adapted from McBain and Trush 2002).

7. EFFECTS ANALYSIS AND PROPOSED CONSERVATION MEASURES

7.1 Effects of Donor Stock Collection

Individual-Level Effects

The life-history stage selected for broodstock and translocation from the FRFH would vary based on several factors, including: the status of the donor population, the potential impact to the donor population for the particular choice of lifestage and method utilized, the accessibility of each life-stage, stipulations of collection permits, and guidance from the adaptive management process. Final collection targets would depend on broodstock availability and guidance from the NMFS and CDFG through the annual donor stock collection planning process.

Feather River Fish Hatchery Egg Collection

Adult spring-run Chinook are currently spawned onsite at the FRFH to meet existing hatchery production goals and targets. Surplus fertilized eggs and juveniles would be collected for the Reintroduction Program. This collection technique would require the sacrifice of adult salmon and the artificial incubation of the fertilized eggs and the artificial rearing of juveniles.

After fertilization, the eggs are unlikely to be disturbed until the eyed-egg stage when they would be addled (bounced) to separate the live and dead eggs. It is unlikely that the jostling of the embryos could elicit a “shock” response because the embryos are fairly resistant to jostling by this stage of development (Billard and Jensen 1996, ADFG 2010). The protocols set forth in the HGMP for the FRFH spring-run Chinook (DWR 2009) would be followed to minimize any additional adverse effects.

To reduce disease and egg mortality, iodine would be flushed through the incubators on a daily basis. During times that increased mortality may be anticipated, fish health would be monitored by CDFG Fish Health Laboratory personnel and diagnostic procedures for pathogen detection would follow American Fisheries Society professional standards as described in Thoesen (1994). Appropriate treatments would be recommended or prescribed by a CDFG Fish Pathologist/Veterinarian and follow-up examinations would be performed as needed (Cavallo et al. 2009). The use of these protocols has resulted in a 72 percent survival to hatching rate, with survival rates reaching 85 percent in recent years (Cavallo et al. 2009).

Preferably, juveniles selected for the Reintroduction Program would be segregated as eggs in individual vertical egg incubator trays for hatching and later transferred to a segregated raceway section for outdoor rearing at the main FRFH facility or at the nearby FRFH Annex facility. If the Program is unable to segregate fish during the egg lifestage, then the Program will collect spring-run juveniles from all available raceways. When juveniles reach the appropriate length for transfer to the Conservation Facility, or for translocation to the San Joaquin River, the Program will follow the FRFH's standard procedures to corral and collect the juveniles. Once collected, the juveniles would be placed in buckets for further processing. Adipose-fin clipping and CWTs would be required for any juveniles reared in the facility and released into the San Joaquin River.

Quarantine and Pathology

Eggs destined for the Conservation Facility will first be quarantined. After hatching, 60 individuals will be sacrificed for pathology testing, and upon health certification the remaining individuals will be transferred to the Conservation Facility for the captive rearing program (see *Section 5.8 Rearing Facilities*). For direct translocation to the San Joaquin River, eggs from IHNV and BKD negative females will be properly disinfected at FRFH and transported for direct translocation to the San Joaquin River for injection into the gravels, or streamside or in-stream incubation.

Between December and March, juveniles raised at the FRFH would be quarantined on-site for the minimum 30 day health evaluation (see *Sections 5.3 Quarantine and Pathology* and *5.4 Quarantine Facilities*). If fish cannot be quarantined on-site, then the fish will be sent to another quarantine facility (e.g. Silverado Fisheries Base). Sixty individuals will be sacrificed for pathology testing, however these 60 fish may be fall run as they would have experienced similar conditions in the rearing facility. After quarantine and pathology testing, juveniles would be transported to the Conservation Facility or the San Joaquin River for translocation. For individuals translocated to the San Joaquin River, short term confinement is required for sufficient imprinting, which may occur either in or alongside the San Joaquin River or at the Conservation Facility.

The transport of eggs or juveniles between FRFH and the San Joaquin River Conservation facilities or release site on the San Joaquin River is not expected to result in more than a 1 percent decrease in survival of eggs or juveniles (Sharpe et al 1998, Schreck et al 2006, Achord et al 1996).

Transport Effects—Eggs

Possible adverse effects to the collected eggs could occur in the transport process, including ionic and respiratory disturbance of the egg membrane, the spread of disease to other eggs, injury due to jostling, or death if the membrane is ruptured or punctured (ADFG 2010, Thedinga et al. 2005). To minimize these effects, eggs would be placed in a specialized shipping container to reduce excessive movement and limit damage to the egg membrane. An iodine bath would be administered during transport to disinfect eggs and to limit the spread of disease to other embryos. The eggs would also be disinfected again upon arrival to the rearing facility or prior to being placed in the river.

Transport Effects—Juveniles

The transfer and holding of fish could cause adverse effects to juveniles including, stress, injury and mortality. Juveniles can easily become stressed if the ionic balance, pH, dissolved oxygen concentration, or the water temperature in the transfer tank differs greatly from the source water (NMFS 2003). Also, a high stocking density of juvenile salmonids could elicit a stress response (increased cortisol levels) in individual fish, leading to reduced fitness, vulnerability to additional stressors, and possible mortality (Barton et al. 1980).

To minimize the potential effects of transporting juveniles, transfer protocols would be followed that would monitor and maintain dissolved oxygen and isotonic water concentrations, temper the water temperature to within two degrees Celsius of the receiving facility, and maintain an appropriate stocking density. The maximum allowable density index would be 0.15 $lb/ft^3/in$ as proposed by Banks (1994) Ewing and Ewing (1995) for spring-run Chinook.

Ecosystem (Indirect) Effects

Marine Derived Nutrients and Carbon Availability

It is widely accepted that marine derived nutrients (via adult salmon carcasses) are vital for the growth of juvenile salmonids (Bilby et al. 1998, Bilby et al. 1996). Removal of broodstock from donor streams may limit the number of returning adults and thus decrease the availability of marine derived nutrients and carbon in the stream system. However, the broodstock collected from the donor streams would be limited to a number that would not have an adverse impact on the population (see *Donor Stock Collection: Population level effects* section). There should be virtually no impact of broodstock collection on the marine derived nutrients or carbon availability in the donor stream systems.

Population Level Effects

One federally-listed population would be directly affected by the Reintroduction Program, the Feather River Hatchery production. Eggs and juveniles that would be collected are considered surplus, and therefore not part of the effective population and in turn have no effect on the donor populations.

Climate Change

Spring-run Chinook are particularly vulnerable to climate change because adults migrate during spring runoff periods, and reside in freshwater for the summer before spawning in the fall. Climate projections suggest that temperatures throughout both the Sacramento and San Joaquin basins may increase steadily during the 21st century. High altitude basins like the San Joaquin exhibited less decrease in spring runoff than lower elevation watersheds such as the Sacramento. From a life history perspective, spring-run Chinook use the spring run off period to migrate into freshwater to reach holding habitat. While climate change will translate into warmer summer temperatures overall, the projected lower decrease in spring runoff in the San Joaquin River could translate into maintenance of suitable migratory conditions to holding habitat in the San Joaquin Basin below Friant Dam.

7.2. Effects of Conservation Stock Rearing

Individual-Level Effects

Incubation and rearing operations would occur at an Interim Facility until 2014, at which time operations would transition to the full-scale Conservation Facility. All activities and minimization measures mentioned in the subsections below would be implemented at both the interim and full-scale Conservation Facilities.

Egg and Juvenile Introduction into the Facility

It is possible that various pathogens from the donor stocks could be introduced to the rearing facility and cause disease in the other introduced stocks. To minimize this risk, all out-of-basin eggs and fish brought into the facility will be quarantined and 60 individuals sacrificed for pathology testing. The Conservation Facility would also implement specific fish health maintenance and sanitation procedures similar to those used at the FRFH (Cavallo et al. 2009).

Incubation

After disinfection, eggs would be placed in incubation trays, which may jostle the eggs and elicit a "shock" response. If eggs are water-hardened they have not reached their most sensitive stage (gastrulation) and remain slightly resistant to disturbance and "shock" (Jensen and Alderdice 1983). Similarly, the jostling or heavy movement of eggs in the eyed-stage is unlikely to result in mortality, as the embryos are fairly resistant to disturbance by this stage of development (Billard and Jensen 1996, ADFG 2010). However, care would be taken to ensure that the eggs are moved only when necessary and would follow the FRFH HGMP (DWR 2009).

Once hatched, eggs incubated in the deep matrix boxes would volitionally swim from the incubator into a holding tank, whereas the eggs in the vertical tray incubators would require hand transfer into a holding tank. The latter would require further handling, which could elicit stress or induce injury (NMFS 2003). The adverse effects of handling would be minimized by using water-to-water transfer rather than direct netting to reduce injury and stress, and further minimized by following the FRFH HGMP protocols (DWR 2009). Once fish enter the holding tanks, they would remain there for the duration of their rearing.

Rearing

Juveniles would either be reared from eggs or directly introduced to the facility as juvenile broodstock. Donor stock juveniles (non-FRFH stock) would be transported to a quarantine facility (e.g. Silverado Fish Base) for a 30 day quarantine period, after which 60 individuals will be sacrificed for pathology testing. Upon fish health certification fish would be transported to the Conservation Facility. Fish will be transported from the transport trucks into the holding tanks. The potential adverse effects to the juveniles during the transfer process are similar for the fry (see *Incubation* subsection above), and the effects would be minimized following the same protocols.

The biggest threat to the broodstock in the rearing facilities is exposure to diseases and other pathogens. To minimize the likelihood of infections, all fish would be monitored by CDFG pathologists, and treatment methods and protocols prescribed for disease outbreaks would be implemented.

Depending on the cause of an outbreak, treatment methods may vary. Chemical treatments for external pathogens may include the use of salt, $KMnO_4$, formalin or hydrogen peroxide, and bacterial infections may require the use of oxytetracycline, florfenicol or other approved antibiotics. All treatment would follow veterinary guidance. Sanitation procedures would be implemented, and include the following:

- All cleaning equipment and nets would be disinfected in iodine-based disinfectant prior to use and separate cleaning instruments would be kept for each culture tank.
- Routine pathology health assessments would be carried out to maintain the health of all hatchery stocks. Fish would be monitored daily for behavior and physical abnormalities. Fish exhibiting abnormal behavior would be screened for pathogens. Sick fish would be promptly examined by the California Department of Fish and Game State Fish Health Lab.
- Feeding practices would be continuously monitored to avoid uneaten feed at the bottom of the rearing tanks and feed would be stored according to manufacturer recommendations to avoid fish health problems related to mycotoxins and rancidity, and feed would be used within the time recommended by the manufacturer.
- Water flushing rate would be maintained at a minimum of one turnover per hour and rotational water velocities would be elevated daily to improve water quality and tank sanitation.
- Sidewall viewing windows would be installed on all large tanks for increased fish health and tank sanitation monitoring.
- Dead or dying fish would be removed promptly from each rearing tank and necropsied. Dying fish would be humanely euthanized immediately after removal from rearing tank.
- The water supply would be micro-screened with a minimum pore size of 80 microns to reduce pathogen loads, and the water supply for early rearing would be further treated with ultraviolet filtration.
- Weekly prophylactic salt flushes would be administered throughout the duration of captive broodstock holding.

A high stocking density of juveniles could elicit a stress response (increased cortisol levels) in individual fish, leading to reduced fitness, lower growth rates, a vulnerability to additional stressors and possible mortality (Barton et al. 1980). To minimize density induced effects, the maximum-allowable-density index would be 0.15 $lb/ft^3/in$, as proposed by Ewing and Ewing (1995) and Banks (1994) for spring-run Chinook.

Human-induced disturbance could also invoke a stress response in rearing juveniles. To reduce the likelihood of this effect, human-fish contact would be minimized and culture tanks would be cleaned no more than once per month, unless required by sanitary conditions. Additionally, flushing rates would be maintained at a minimum of one turnover per hour to reduce stress and disease potential. The tanks would be designed with the ability to self-clean, allowing improved water quality and minimized human to fish contact.

To avoid any adverse effects of water quality on the fish, specific parameters would be monitored. Dissolved oxygen levels would be generally maintained between 80-100 percent saturation and not allowed to drop below 70 percent saturation. Studies indicate the benefits of high dissolved oxygen levels in fish culture (Westers 2001). Both total suspended solids (Timmons and Ebeling 2007) and carbon dioxide levels would be maintained at or below 10 mg/L (Piper et al. 1982).

There is growing concern that reared fish could exhibit hatchery induced selection due to rearing conditions. The use of natural rearing methods is a relatively new phenomenon (Flagg and Nash 1999), but the Conservation Facility Program would institute natural rearing techniques to provide the most promise for increasing the reproductive fitness of fish for the Conservation Program. The methods to be employed include the following:

- Promote development of body camouflage coloration in juvenile fish by creating more natural environments in hatchery rearing vessels, for example, overhead cover, and in-stream structures and substrates.
- Condition young fish to orient to the bottom rather than the surface of the rearing vessel by using appropriately positioned feed delivery systems.
- Exercise young fish by altering water-flow velocities in rearing vessels to enhance their ability to escape predators (the ability to adjust water velocities to target optimal swimming speeds for salmonids has been shown to improve growth rates, feed efficiency, oxygen utilization, swimming performance and stamina, and to reduce aggression).

Tagging, Marking, Measuring of Juveniles During Rearing

Reared juveniles would be measured and weighed, marked with adipose fin-clips, Coded Wire Tags (CWT), Visual Implant and PIT tags, and tissue would be collected for genetic analysis. All measuring and marking activities would require netting, removal and handling. Such activities could induce stress or result in the removal of beneficial mucous lining, scale loss, or cause damage to fins (Gadomski et al. 1994, NMFS 2003). To minimize the likelihood of such effects, anesthesia would be administered to juveniles during measuring and weighing activities and PIT tag implantation. Dosage and administration would follow protocols outlined in the FRFH HGMP (DWR 2009). An automated system that is quick and efficient would be used for adipose-fin clipping and CWT implantation. All processed fish would be allowed to recover before returning to the rearing tanks. Although physical damage from tag implementation is likely, the stress associated with the injury may subside after 12 hours (Gadomski et al. 1994). It should be noted however that Dare (2003), found less than 1 percent mortality had occurred in Chinook salmon 10 days after being PIT tagged.

Alternative Incubation Methods

If the Interim Facility or Conservation Facility is unable to house additional donor stock eggs from collected adults, or it is not appropriate to do so, alternative methods to facility incubation are proposed. In such cases, in-stream incubator boxes, streamside incubators, or egg planting options would be utilized (see *Donor Stock Release/Reintroduction section, Eggs subsection* for specific details).

Instream Incubation Boxes

The instream incubation box method involves incubating eggs in flow-through containers buried in the stream bed. There is a risk that the water temperature and velocity in the stream could be too high and cause egg damage or mortality. In some cases, the boxes may fill with fine sediment, which could suffocate incubating eggs. However, this is largely dependent on the specific stream conditions, and instream incubation boxes would not be used where sedimentation poses a risk. As in natural redds, there is also risk of disease and fungus outbreaks. Whitlock-Vibert slotted boxes would likely be used, which would facilitate the examination and removal of dead eggs to minimize the likelihood of pathogen outbreaks.

Streamside Incubators

Streamside incubators would be erected along the stream banks and filled with freshly fertilized or eyed eggs. Similar to instream incubation, there is a risk that the stream water temperature could be too high or water quality could be poor and cause egg damage or mortality. However, there is little risk of sedimentation because the box would be placed on the bank rather than in-river. Vandalism and tampering could occur, so placement of the boxes in less accessible areas would generally be required.

Venditti et al. 2000 reported a 78-90 percent hatching rate from eyed eggs placed in stream side or in-stream rearing boxes on the Salmon River in 1999 and 2000. These methods appear to compare well with natural stream production in which only 30 percent or less of eggs hatch and survive to emergence (Healey, M. C. 1991).

Egg Planting

Eggs would be injected into suitable spawning habitat to simulate natural incubation. The process of injecting the eggs into the gravels may cause damage or "shock" to the embryo. For eggs injected into the gravels, fine sediments may limit permeability and suffocate eggs. Similar to other stream incubation methods, temperature and water quality are concerns. However, these would be natural conditions and could not be altered. To minimize the likelihood of these effects, egg injection would not occur until the eggs were fairly resistant to "shock" (at the eyed egg stage), and the gravels would be thoroughly "pumped" with an injector to remove the fine sediments before egg planting. Risk of vandalism and tampering would be low because the planted redds are rather inconspicuous.

Population-Level Effects

Survival Rates

Although there is inherent risk and likelihood of mortality associated with hatchery rearing, the survival rates are significantly higher in a rearing facility than under natural conditions. Following the FRFH HGMP (DWR 2009), the FRFH has had a 72 percent survival to hatching rate for their facility, with survival rates reaching 85 percent in recent years. Survival rates under natural conditions usually do not exceed 40 percent (EA 1992). The use of instream incubation, streamside incubation and egg planting may result in higher survival rates as well, but no research has been conducted to date.

Catastrophic Events

There is inherent risk of catastrophic events or disasters occurring during rearing facility operations, and such events could have devastating consequences for the broodstock. Such events could range from water shortages to electrical outages.

Water deliveries have been very reliable in the existing adjacent trout hatchery which receives water from the same major supply line as the interim and Conservation facilities. In the past 55 years, there was one major interruption to water flow that occurred in 1992 when a work crew accidentally ruptured the main line. For the Conservation Facility, the water delivery system would be gravity fed, thereby reducing risk of interruption to flow by eliminating the use of electric pumps that are susceptible to failure by power outages. In addition, each tank would contain a water monitoring and alarm system that would alert culturists to low dissolved oxygen levels, interruption to water flow, high or low water temperatures, or high or low water levels. The monitoring system would be integrated with a backup oxygen system that would trigger a solenoid for the supply of gaseous oxygen from compressed oxygen cylinders in the event of low oxygen conditions.

Flooding occurred at least once in recent history, when in 1997 the trout hatchery raceways were inundated by floodwater due to high river flows. At that time, many fish from the trout hatchery escaped to the adjacent San Joaquin River. In the event of future flooding, it is likely that fish from both facilities would again be released to the river. In a case such as this, it is unlikely that it would result in 100 percent mortality (since fish would be able to escape to the San Joaquin River), but depending on the time of occurrence and stage of development, fish may be less likely to survive in the mainstem river. Measures would be taken to prevent fish loss during a flood event by netting the tops of fish tanks.

7.3 Experimental Stock

The goal of the Conservation Program is to restore naturally reproducing, viable spring and fall-run Chinook populations, and so its success is marked by the ability to ultimately phase out hatchery production of fish. This will reduce the negative influences that continued hatchery supplementation can have on the re-established spring- and fall run Chinook populations. Modification of spring-run Chinook hatchery production should be determined by an adaptive management approach given the likely uncertainty of initial restoration phases. Genetic accommodation of the natural population, quantitative natural population targets (e.g. effective population (N_e), census size, genetic diversity), and other community and ecosystem indicators of reintroduction success will be derived and periodically evaluated to phase out hatchery production. Hatchery production phase out is further detailed in the draft HGMP (Appendix 9.4). Additionally, uncertainties such as local habitat change, climate change, and others, should be given consideration in phase out determinations.

Density-dependent mechanisms contribute to predator avoidance, feeding behavior, migration patterns, and survival in juvenile salmonids, so care needs to be taken to translocate enough individuals to minimize alteration of natural behaviors and to achieve a detectable level of adult returns from the effort.

Individual-Level Effects

Transport to San Joaquin River

Several life stages of fish would either be transported from the Interim or Conservation Facilities or transported directly from the Feather River Hatchery to the San Joaquin River. Disease transmission could occur since equipment would be shared from these different sources. To minimize the introduction of pathogens, transport tanks, containers and equipment would be properly disinfected (e.g. iodophore) prior to use and between sources.

The transport of various life stages has different risks and effects. Possible adverse effects to eggs include: ionic and respiratory disturbance of the egg membrane, injury due to jostling, or death if the membrane is ruptured or punctured (ADFG 2010, Thedinga et al. 2005). To minimize these effects, eggs would be placed in a specialized shipping container to reduce excessive movement and limit damage to the egg membrane. The eggs would not be transported until they are fairly resistant to "shock," at the eyed-egg stage. For juveniles, the transferring process could cause stress, injury and mortality.

Juveniles can easily become stressed if the ionic balance, pH, dissolved oxygen concentration or the water temperature in the transfer tank differs greatly from the source water (NMFS 2003). Also, a high stocking density of juvenile salmonids could elicit a stress response (increased cortisol levels) in individual fish, leading to reduced fitness, vulnerability to additional stressors and possible mortality (Barton et al. 1980). To minimize the potential effects of transporting of juveniles, transfer protocols would be followed that would monitor and maintain dissolved oxygen and isotonic water concentrations, temper the water temperature to within two degrees Celsius of the receiving stream, and maintain an appropriate stocking density.

Effects of Release

The reintroduction of fish collected from spring-run donor populations for direct release into the San Joaquin in the near-term has some challenges. Specifically, river restoration projects are not anticipated to be completed until 2016, yet salmon reintroduction would begin in 2012.

Eggs would be introduced into the San Joaquin River either in in-stream or streamside incubation boxes or by egg planting in the river gravels. Juveniles could be either directly released or placed in temporary holding cages for imprinting prior to release.

Eggs

The effects of incubating eggs outside of the rearing facility are discussed in *Donor Stock Rearing: Individual-level effects* section, *Alternative rearing methods* subsection. There are few ways to minimize the effects, as they are largely affected by stream conditions. However, acclimation stress could be minimized, and eggs would be tempered to the receiving water by increasing the egg temperature 1 ºC per hour until matching the receiving water temperature.

Incubating in-stream or streamside would allow for imprinting opportunities and information on egg survival in the San Joaquin River, which would inform decisions for future stocking and provide estimates of survival during natural spawning events.

Juveniles

Direct release of juveniles collected from donor stocks into the San Joaquin River could be achieved on the same schedule as they are collected. This would simulate the same temporal distribution of rearing and outmigration observed by the donor source. Holding pens could be used for one to two hours to allow the fish to acclimate prior to release to reduce the risk of predation (Fisheries Foundation 2009). Additionally, holding pens could be used to cue fish to different reaches of the river by simulating downstream migration. Slatik et al (1988) showed sequential exposure imprinting techniques that significantly improved homing to release location. Since all passage improvements to the river may not be complete by the time reintroduction is mandated, this staggered holding pen approach may be one option to move fish through the river system and move them around passage impediments while improving imprinting. One disadvantage may be releasing too few fish at a given time, disrupting densities and schooling behaviors. The transportation and release of fish as they are collected on a daily or weekly basis also increases the frequency and logistics in transporting and releasing fish to the San Joaquin River.

An alternative to direct release into the San Joaquin River is to temporarily hold juveniles in a net pen with recirculating San Joaquin River water to assist with imprinting, acclimation, and natural schooling behaviors. Quinn et al (1989) linked homing to changes in thyroid hormone levels during smoltification and the onset of migration in salmonids. The temporary use of holding pens may provide time during the smolting process for fish to imprint on the San Joaquin River and maximize their likelihood of successfully navigating back to their reintroduced location to spawn. Smolt survival studies with juvenile salmon from the Feather River and Merced River hatcheries that released smolts with coded-wire-tags near Mossdale and Dos Reis in the San Joaquin River Delta indicate that the out-of-basin juvenile salmon returned at low rates to the San Joaquin Basin compared to the Merced River Hatchery smolts. Only a mean of 37 percent of the FRFH smolts returned to the San Joaquin Basin from 1995 to 2000 compared to 83 percent of the Merced River Hatchery smolts from 1998 to 2000 (DFG CWT database, methods described in Mesick et al. 2009). Smolts released at Mossdale probably only spent about 2 days before they encountered Sacramento River flows via the Mokelumne River.

It is possible that by holding juveniles in pens in the Restoration Area for several days, imprinting and adult returns to the Restoration Area would be improved. In addition, keeping juveniles in holding pens for at least one to two hours allows the fish to acclimate prior to release and reduces the risk of predation (Fisheries Foundation 2009). The use of temporary holding cages would also allow collection of juveniles from donor stocks over a period of time until a group of fish have been amassed and released together. Juvenile salmon outmigrate in groups, which are thought to occur primarily to reduce mortality due to predation. Temporarily holding fish and releasing them in a series of groups may therefore more closely resemble the densities experienced during rearing and outmigration and increase their survivorship.

Predation

The initial reintroduced juvenile spring-run Chinook will likely benefit from a period of depressed predation because of the current conditions in the San Joaquin River. The periodic reduction and elimination of flow in some reaches of the restored mainstem of the San Joaquin River should limit the establishment of large piscivore predators within those reaches. This would likely be a temporary situation, and would not extend beyond those reaches that have until recently been without consistent flows of water. In addition, fish that are ultimately released culminating any trap and haul effort would be released at a number of different locations over time to limit the establishment of large piscivore predators within the areas of release.

Further evaluation of the size, location, and potential for predation within the pools and at the in-river gravel excavation sites in the Restoration Area is anticipated. The acoustic telemetry study with fall-run juveniles completed in the spring of 2011 is currently being evaluated and will provide further insight into the current predation risks in the San Joaquin River. Subsequent studies will further evaluate this issue.

The restoration of channel structures and fish barriers will be key in limiting the number of predator pools. This challenge will be thoroughly considered in the design of the structural modifications.

If the timing of outmigrating juveniles from the San Joaquin River matches those of the outmigrating fall-run juveniles from the San Joaquin River tributaries (Merced, Stanislaus, etc.), the high prey density may induce a 'swamping' effect on the predators, thus enhancing the likelihood of higher individual survival.

To minimize predation under current conditions, the use of the Interim and Restoration flow scheduling could provide pulse flows to displace non-native predatory fishes in the Restoration Area and also increase water turbidity during juvenile downstream migration to reduce detection and predation by pisciviorous fishes.

Habitat Conditions

Restoration of the mainstem of the San Joaquin River is anticipated to begin several years following the introduction of fish. Before restoration is completed, the in-stream conditions may limit the growth potential and the survival rates of the introduced eggs and juveniles.

The water temperature modeling has not been completed, but it is likely that in the summer months the stream temperatures may reach lethal limits, especially with the lack of a riparian zone to shade the stream. If adequate pools and in-stream cover are available, they could serve as refugia from the high summer temperatures. However, it is unknown how many pools may be available. The flows during these warmer months may also be limited and are based on the releases from Friant Dam. If the flows are inadequate, they would create limiting reaches that are impassible by both adults migrating upstream and juveniles emigrating downstream. The limited flows may also create low dissolved oxygen concentration conditions which would also be problematic for juveniles.

Food Availability

Food availability is a concern in the San Joaquin River. The flows are anticipated to be rather high during the winter and spring months which would result in inundation of floodplain habitat; a rich source of food for juvenile salmonids. However, it is unclear if the seasonal spates (flood pulses) would inundate these floodplains for long enough to supply this food source.

Food availability in Reach 1 is considered of high importance as this reach is expected to support most life-history stages of Chinook for the greatest period of time. Food conditions in Reaches 2 through 5 are considered to be of moderate importance to accommodate other life-history requirements, though likely for a shorter temporal period.

Species composition of invertebrates affects prey availability for juvenile salmonids (i.e., some invertebrate taxa are highly vulnerable to salmonid predation while others are not). The current state of invertebrate production and conditions for growth and development are unknown. It will be necessary to evaluate and monitor food conditions, growth, and development to provide a measure of what effect in-river conditions may have on the fishery and measure SJRRP restoration success. Although the food availability within the San Joaquin River is not fully understood, it is anticipated that the hydraulic and digital terrain models used to evaluate relationships between flow and floodplain inundation will be updated.

Water Quality

The upper San Joaquin River has been, and will continue within the foreseeable future to be, greatly influenced by the surrounding agriculture. A certain amount of agricultural waste water will likely influence the water chemistry of the San Joaquin River during the time that salmon are occupying the river. To meet the SJRRP Restoration Goal, water quality should meet minimum standards for protection of aquatic resources. Because of the lack of information on the effects of many water quality constituents on Chinook and other fishes, the water quality objectives for beneficial uses defined by the Central Valley Regional Water Quality Control Board (Regional Board) are used to establish water-quality goals. The main beneficial uses for the enhancement of fisheries resources within the Restoration Area are: (1) cold, freshwater habitat, (2) migration of aquatic organisms, and (3) spawning, reproduction, and early development.

The temperature objectives are based on a CDFG proposal to assess temperature impairment (DFG 2007b), U.S. Environmental Protection Agency (EPA) guidelines (EPA 2003), and a report on temperature impacts on fall-run Chinook and steelhead (Rich and Associates 2007).

Water-quality objectives are “the limits or levels of water quality constituents or characteristics established for the reasonable protection of beneficial uses of the water or the prevention of a nuisance in a specific area” (California Water Code Section 13050(h)). Water-quality standards consist of the designated beneficial uses and water quality objectives set forth by the State Water Resources Control Board (SWRCB) and the Regional Board and are contained in the Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin (Basin Plan). For the San Joaquin River system, including the Restoration Area, the SWRCB has set a goal to be free from toxic substances in surface water (CVRWQCB 1998). Selenium, dissolved oxygen, and ammonia objectives are based on the Regional Board and SWRCB standards described above. Additional water quality criteria are defined in Exhibit A and B of the Fisheries Management Plan (FMP 2010).

Water quality objectives are listed below. The recommended objectives should be treated as preliminary recommendations, recognizing they will very likely be revised as more is learned about the habitat needs and the response of reintroduced fish populations to flows and other physical factors.

- Water temperatures for spring-run Chinook adult migrants should be less than 68 °F in Reaches 3, 4, and 5 during March and April, and less than 64°F in Reaches 1 and 2 during May and June (Exhibit A, Table A-1).
- Water temperatures for spring-run Chinook adult holding should be less than 59°F in holding areas between April and September (Exhibit A, Table A-1).
- Water temperatures for spring-run Chinook spawners should be less than 57°F in spawning areas during August, September, and October (Exhibit A, Table A-1).
- Water temperatures for spring-run Chinook incubation and emergence should be less than 55°F in spawning areas between August and December (Exhibit A, Table A-1).
- Water temperatures for spring-run Chinook juveniles should be less than 64°F in the Restoration Area when juveniles are present (Exhibit A, Table A-1).

- Selenium levels should not exceed 0.020 milligrams per liter (mg/L) or a 4-day average of 0.005 mg/L in the Restoration Area (Exhibit B, Table B-3).
- DO concentrations should not be less than 6.0 mg/L when Chinook are present (Exhibit B, Table B-3).
- Total ammonia nitrogen should not exceed a 30-day average of 2.43 milligrams nitrogen per liter (mg N/L) when juvenile Chinook are present or exceed a 1-hour average of 5.62 mg N/L when adult Chinook are present (Exhibit B, Table B 9).

The current water quality monitoring throughout the Restoration Area, includes real-time telemetry with continuous measurements of physical conditions, including flow, depth, temperature, specific conductance (salinity), pH, dissolved oxygen, turbidity, and chlorophyll. The data is averaged every 15 minutes and reported to the California Data Exchange Center. In addition, bacteria, trace elements and pesticides sampling is also conducted in accordance with the Interim Flow Water Quality Monitoring Plan (SJRRP 2010a).

Increasing flows in the San Joaquin River from Friant Dam to the Merced River and downstream reaches has the potential to improve water quality conditions under various hydrologic conditions in some reaches of the river. Opportunities to improve water quality in the San Joaquin River will be identified and evaluated to the extent that they are consistent with actions that address the Restoration and Water Management goals.

Restoration Schedule

The schedule for the channel and structural improvements is outlined in Paragraph 11(a) of the Settlement. The implementing agencies are weighing the current habitat conditions of the San Joaquin River in light of the Settlement timeline. The anticipated short residency time of spring-run during the initial introduction and the several year lag prior to the initial adult returns provide greater flexibility in the completion of the restoration activities.

Prior to the completion of restoration activities, the various habitat components required by different life history stages of salmonids are generally available in the upper mainstem San Joaquin River, although it is not yet clear if the extent and quality of existing habitat is sufficient to support long-term population needs. There are holding pools below Friant Dam suitable for adult spring-run Chinook; moderate quantities of salmonid spawning habitat still remain in Reach 1A; and the river channel in Reach 1 seems capable of providing instream rearing habitat for juvenile salmonids in certain months. Furthermore, the Interim Flow releases can continue to provide adequate flow and temperatures in the upper reaches. The increase in flows in certain reaches could enhance dispersal and germination of riparian vegetation in the absence of restoration efforts, via natural colonization. Even if the amount and quality of existing habitat is inadequate to achieve the long-term objectives, the amount and quality of existing habitat seems adequate to initiate the process of restoring salmonid populations (McBain and Trush 2002).

Spring-run Chinook are required, per the Settlement, to be reintroduced into the Restoration Area by December 31, 2012, which is prior to the completion of the first and second phases of channel and habitat improvements. The first phase of channel and habitat improvements is scheduled to be completed by December 31, 2013. These improvements include: (1) creating a bypass channel around Mendota Pool; (2) modifying channels in Reaches 2B and 4B to increase flow capacity; (3) modifying Eastside and Mariposa bypasses to create a low-flow channel; (4) modifying Reach 4B headgate and Sand Slough control structures to provide fish passage and convey flows up to 4,500 cfs into Reach 4B; (5) installing screens at the Arroyo Canal Water Diversion; (6) providing fish passage at Sack Dam; (7) modifying Eastside Bypass structures and Mariposa Bypass structures to provide fish passage; and (8) installing seasonal barriers at Salt and Mud sloughs (SJRRP 2010).

The second phase of improvements is scheduled for completion by December 31, 2016. These Phase 2 improvements include: (1) restoration of Chinook spawning habitat; (2) actions to minimize in-river harvest, unlawful take, and disturbance, and (3) targeted studies of potential problems (e.g., entrainment at Chowchilla Bifurcation Structure and impacts of in-river mining pits) (SJRRP 2010).

Before the Phase 1 and Phase 2 improvements have been made, fish passage barriers, entrainment, and in-stream conditions likely will limit the survival of eggs and juvenile fish, particularly in the reaches that are upstream from the planned improvement sites. It is anticipated that the FMWG will consider the level of completion of the planned channel and habitat improvements when determining the best location, timing, and number of fish and/or eggs to be reintroduced into the Restoration Area. In addition, monitoring will be conducted to determine whether passage is blocked by inadequate flow or unimproved flow control structures. If these targeted studies indicate that fish passage is impaired, trap-and-haul operations would be implemented to move the salmon to suitable habitats (SJRRP 2010).

Several of the planned studies have begun prior to the reintroduction, for instance, the first juvenile survival and acoustic telemetry study was conducted in the spring of 2011 using fall-run Chinook and the spawning gravel study (egg survival) was implemented in the fall of 2011.

Trap and Haul

It is anticipated that a number of major passage impediments will still be in place in the Restoration Area in the first years of the reintroduction. Likewise, returning adults would encounter these structural and biological barriers and would also require collection and transport upstream, thus encountering similar stressors and adverse effects as the adults collected in the donor streams. Early reintroductions would be maintained in cages and under the control of agency personnel during movement (which may include sequential *in-situ* residence periods along the stream course at locations chosen to test survival and provide limited selection pressure specific to the San Joaquin River while imprinting the smolts).

The transport of juveniles and adults would follow optimal handling protocols to minimize the adverse impacts of these actions. The transport water would be oxygenated using bottled oxygen with aerators, and dissolved oxygen levels would be monitored and maintained near saturation during transport. When possible, fish would be moved in and out of the transport truck using a water filled vessel (i.e., water to water transfer) and without netting to minimize stress and loss of mucous lining. Adult fish would be transferred to and from transport tanks using purse-style stretchers that hold both fish and water (i.e., water-to-water transfer).

Ecosystem (Indirect) Effects

Marine Derived Nutrients and Carbon Availability

The reintroduction of Chinook to the San Joaquin River will likely result in adults returning and carcass deposition. It is widely accepted that marine derived nutrients (via adult salmon carcasses) are vital for the growth of juvenile salmonids (Bilby et al. 1998, Bilby et al. 1996). Bilby et al. (1998) found increased densities, body weight and improved condition factor of juvenile salmonids in stream reaches where salmon carcasses were added. Therefore, the presence of carcasses in the San Joaquin River would increase the availability of marine derived nutrients and carbon in the stream system and thus have a positive effect on rearing juveniles, possibly increasing the weight and condition factor of the fish, which may positively influence their survival rates.

Introduction of invasive Species or Pathogens

Reintroduction efforts could increase the potential for invasive species, such as New Zealand mud snail (*Potamopyrgus antipodarum*) and freshwater asian clam (*Corbicula fluminea)* to be transferred from one stream system to another (for a full list of potential non-target species, which could be transferred see Appendix D). Transfer of invasive species could occur in a number of ways, including nets and other equipment not appropriately decontaminated prior to use. All equipment will be properly cleaned and decontaminated to reduce the spread of invasive species and pathogens.

Population-Level Effects

The reintroduced spring-run Chinook (i.e., experimental stock) in the mainstem San Joaquin River would also be a population affected by the proposed action. This stock does not yet exist, so no detailed review is possible at this time.

However, the San Joaquin was once home to the largest run of spring-run Chinook in the Central Valley. Spring-run persisted in large numbers below Friant Dam for years until the flows were curtailed and the river was disconnected. This supports the premise that spring-run can persist over time in a connected San Joaquin River.

A primary goal of the Settlement is to develop a naturally reproducing and self-sustaining population of Chinook in the main stem of the San Joaquin River. The Settlement gives preference to spring-run because of the historic populations that used to exist. The restoration hydrographs in the Settlement are also intended to benefit spring-run.

The Service and Implementing Agencies are working to address challenges to survival through studies during the interim flow period. This will help inform decisions we make during reintroduction efforts. We are currently conducting and proposing studies during interim flows to better refine true survival for juvenile salmonids through the Restoration Area, and egg survival studies. Studies are planned to assess the effects of a trap and haul program on salmon survival. Studies would also address areas that represent potential losses due to predation among other issues. We are also proposing to collect predator population information to use as a management tool. Since the Donor Stock Collection Plan will be assessed annually we will have the opportunity to incorporate any new information in the annual request each year.

Hybridization—Run Separation within the San Joaquin

The Service and other Resource agencies recognize the risk of fall and spring run hybridization in the San Joaquin River. The Fish Management Plan recommends installation of a separation weir as an implementation action for the Program. Several studies are currently under way, utilizing the interim flows to assess potential holding pool and spawning habitat conditions and will provide information that will aid in identifying the appropriate placement of the separation weir. The risk of hybridization between the runs can be reduced through the operation of a separation weir below the spring run spawning habitat. However, historically both spring-run and fall-run Chinook spawned in the San Joaquin River, with spring run being the larger and more successful run.

Potential Donor Stock Hybridization within the San Joaquin

Currently there are no plans to segregate natural spawning between different donor spring-run stocks in the San Joaquin River. The Program recognizes that spring-run donor stocks may mix on the spawning grounds, which may add to the genetic diversity of the reintroduced population, and could provide better local adaptation through genetic diversity; as populations with low genetic diversity are generally at a higher risk of extinction. The Program will plan to monitor the genetics of the successful stocks to document actual outcomes. However, this will not be an issue early in the reintroduction effort as all reintroduced fish will be obtained from the FRFH.

Outmigration Effects

The reintroduced salmon occupying the lower reaches of the San Joaquin River, where populations of salmon of the San Joaquin/Sacramento River system are currently present, will experience the same effects as those already existing populations. This includes effects in the lower San Joaquin River, the Sacramento/San Joaquin Delta, San Francisco Bay and the marine habitat off the central coast of California.

7.4 Critical Habitat

The final ruling for Central Valley spring-run Chinook critical habitat was published February 2, 2005 (50 **CFR** Part 226), and includes much of the Sacramento River Valley, its tributaries and the Sacramento-San Joaquin River Delta. After recovery and threshold criteria have been established, the Program may request in the subsequent permits to collect donor stock from Mill Creek, Deer Creek and Butte Creek, all of which are within critical habitat units and sub-areas. The locations proposed for reintroduction of fish are not within critical habitat. Central Valley Chinook critical habitat is also considered critical habitat for Central Valley steelhead (*O. mykiss*).

The proposed action, as described, will not destroy or adversely modify any designated critical habitat.

7.5 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined by NMFS as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate. "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities. "Necessary" means habitat required to support a sustainable fishery and a healthy ecosystem. "Spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle. The proposed effort would not have adverse effects on any Chinook EFH.

7.6 Evolutionarily Significant Unit

An evolutionarily significant unit, or ESU, of Pacific salmon is considered to be a "distinct population segment" and thus a "species" under the Endangered Species Act. There are established two criteria for ESUs: 1) the population must show substantial reproductive isolation; and 2) there must be an important component of the evolutionary legacy of the species as a whole.

It is anticipated that the Conservation Program would expand the range and distribution of the ESU with the addition of a self-sustaining natural San Joaquin River population. The addition of these fish would increase the number of key populations within the ESU that could buffer the risk of extinction from environmental fluctuations, stochastic events and human, land and water use impacts.

8. STATUS OF THE SPECIES

8.1. General Life History of Chinook

Chinook exhibit two generalized freshwater life history types (Healey 1991). "Stream-type" Chinook, enter freshwater months before spawning and reside in freshwater for a year or more following emergence, whereas "Ocean-type" Chinook spawn soon after entering freshwater and migrate to the ocean as fry or parr within their first year. Adequate instream flows and cool water temperatures are more critical for the survival of Chinook exhibiting a stream-type life history due to over-summering by adults and/or juveniles.

Chinook typically mature between 2 and 6 years of age (Myers et al. 1998). Freshwater entry and spawning timing generally are thought to be related to local water temperature and flow regimes. Runs are designated on the basis of adult migration timing. However, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and the actual time of spawning (Myers et al. 1998). Both winter-run and spring-run exhibit a "Stream-type" life history and tend to enter freshwater as immature fish, migrate far upriver, and delay spawning for weeks or months. Fall-run exhibit an "Ocean-type" life history and enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

During their upstream migration, adult Chinook require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows are necessary to allow adult passage to upstream holding habitat. The preferred temperature range for upstream migration is 38ºF to 56ºF (Bell 1991, CDFG 1998). Boles (1988) recommends water temperatures below 65ºF for adult Chinook migration, and Lindley et al. (2004) report that adult migration is blocked when temperatures reach 70ºF, and that fish can become stressed as temperatures approach 70ºF.

Information on the migration rates of adult Chinook in freshwater is scant and primarily comes from the Columbia River basin, where information regarding migration behavior is needed to assess the effects of dams on travel times and passage (Matter and Sanford 2003). Keefer et al. (2004) found migration rates of Chinook ranging from about 10 kilometers (km) per day to greater than 35 km per day and to be primarily correlated with date, and secondarily with discharge, year, and reach, in the Columbia River basin. Matter and Sanford (2003) documented migration rates of adult Chinook ranging from 29 to 32 km per day in the Snake River. Adult Chinook inserted with sonic tags and tracked throughout the Delta and lower Sacramento and San Joaquin rivers were observed exhibiting substantial upstream and downstream movement in a random fashion, for several days at a time, while migrating upstream (CALFED 2001). Adult salmonids migrating upstream are assumed to make greater use of pool and mid-channel habitat than channel margins (Stillwater Sciences 2004), particularly larger salmon such as Chinook, as described by Hughes (2004). Adults are thought to exhibit crepuscular behavior during their upstream migrations, meaning that they are primarily active during twilight hours. Recent hydroacoustic monitoring conducted by LGL Environmental Research Associates showed peak upstream movement of adult spring-run in lower Mill Creek, a tributary to the Sacramento River, occurring in the 4-hour period before sunrise and again after sunset.

Spawning Chinook require clean, loose gravel in swift, relatively shallow riffles or along the margins of deeper runs, and suitable water temperatures, depths, and velocities for redd construction and adequate oxygenation of incubating eggs. Chinook spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995). The range of water depths and velocities in spawning beds that Chinook find acceptable is very broad. The upper preferred water temperature for spawning Chinook is 55ºF to 57ºF (Chambers 1956, Smith 1973, Bjornn and Reiser 1991, and Snider 2001).

Incubating eggs are vulnerable to adverse effects from floods, siltation, desiccation, disease, predation, poor gravel percolation, and poor water quality. Studies of Chinook egg survival to hatching conducted by Shelton (1995) indicated 87 percent of fry emerged successfully from large gravel with adequate subgravel flow. The optimal water temperature for egg incubation ranges from 41ºF to 56ºF [44ºF to 54ºF (Rich 1997), 46ºF to 56ºF (NMFS 1997), and 41ºF to 55.4ºF (Moyle 2002)]. A significant reduction in egg viability occurs at water temperatures above 57.5ºF and total embryo mortality can occur at temperatures above 62ºF (NMFS 1997). Alderdice and Velsen (1978) found that the upper and lower temperatures resulting in 50 percent pre-hatch mortality were 61ºF and 37ºF, respectively, when the incubation temperature was held constant. As water temperatures increase, the rate of embryo malformations also increases, as well as the susceptibility to fungus and bacterial infestations. The length of development for Chinook embryos is dependent on the ambient water temperature surrounding the egg pocket in the redd. Colder water necessitates longer development times as metabolic processes are slowed. Within the appropriate water temperature range for embryo incubation, embryos hatch in 40 to 60 days, and the alevins (yolk-sac fry) remain in the gravel for an additional 4 to 6 weeks before emerging from the gravel.

During the 4 to 6 week period when alevins remain in the gravel, they utilize their yolk-sac to nourish their bodies. As their yolk-sac is depleted, fry begin to emerge from the gravel to begin exogenous feeding in their natal stream. Fry typically range from 25 mm to 40 mm at this stage. Upon emergence, fry swim or are displaced downstream (Healey 1991). The post-emergent fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris, and begin feeding on zooplankton, small insects, and other micro-crustaceans. Some fry may take up residence in their natal stream for several weeks to a year or more, while others are displaced downstream by the stream's current. Once started downstream, fry may continue downstream to the estuary and rear, or may take up residence in river reaches farther downstream for a period of time ranging from weeks to a year (Healey 1991). Fry then seek nearshore habitats containing riparian vegetation and associated substrates important for providing aquatic and terrestrial invertebrates, predator avoidance, and slower velocities for resting (NMFS 1996). The benefits of shallow water habitats for salmonid rearing have been found to be more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer et al. 2001).

When juvenile Chinook reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energy expenditures (Healey 1991). Catches of juvenile salmon in the Sacramento River near West Sacramento exhibited larger-sized juveniles captured in the main channel and smaller-sized fry along the margins (USFWS 1997). When the channel of the river is greater than 9 to 10 feet in depth, juvenile salmon tend to inhabit the surface waters (Healey 1982). Migration cues, such as increasing turbidity from runoff, increased flows, changes in day length, or intraspecific competition from other fish in their natal streams, may spur outmigration of juveniles when they have reached the appropriate stage of maturation (Kjelson et al. 1982, Brandes and McLain 2001).

As fish begin their emigration, they are displaced by the river's current downstream of their natal reaches. Similar to adult movement, juvenile salmonid downstream movement is crepuscular. The daily migration of juveniles passing Red Bluff Diversion Dam (RBDD) is highest in the 4-hour period prior to sunrise (Martin et al. 2001). Juvenile Chinook migration rates vary considerably, presumably depending on the physiological stage of the juvenile and hydrologic conditions. Kjelson et al. (1982) found Chinook fry to travel as fast as 30 km per day in the Sacramento River, and Sommer et al. (2001) found travel rates ranging from about 0.5 miles up to more than 6 miles per day in the Yolo Bypass. As Chinook begin the smoltification stage, they prefer to rear further downstream where ambient salinity is up to 1.5 to 2.5 parts per thousand (Healey 1980, Levy and Northcote 1981).

Fry and parr may rear within riverine or estuarine habitats of the Sacramento River, San Joaquin River, the Delta, and their tributaries (Maslin et al. 1997, Snider 2001). Within the Delta, juvenile Chinook forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels, and sloughs (McDonald 1960, Dunford 1975, Meyer 1979, Healey 1980). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson et al. 1982, Sommer et al. 2001, MacFarlane and Norton 2002). Shallow water habitats are more productive than the main river channels, supporting higher growth rates, partially due to higher prey consumption rates, as well as favorable environmental temperatures (Sommer et al. 2001). Optimal water temperatures for the growth of juvenile Chinook in the Delta are between 54ºF to 57ºF (Brett 1952). In Suisun and San Pablo Bays, water temperatures reach 54ºF by February in a typical year. Other portions of the Delta (i.e., South Delta and Central Delta) can reach 70ºF by February in a dry year. However, cooler temperatures are usually the norm until after the spring-runoff has ended.

Within the estuarine habitat, juvenile Chinook movements are dictated by the tidal cycles, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levings 1982, Levy and Northcote 1982, Levings et al. 1986, Healey 1991). As juvenile Chinook increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tides into shallow water habitats to feed (Allen and Hassler 1986). In Suisun Marsh, Moyle et al. (1989) reported that Chinook fry tend to remain close to the banks and vegetation, near protective cover, and in dead-end tidal channels. Kjelson et al. (1982) reported that juvenile Chinook demonstrated a diel migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. During the night, juveniles were distributed randomly in the water column, but would school up during the day into the upper 3 meters of the water column. Available data indicate that juvenile Chinook use Suisun Marsh extensively both as a migratory pathway and rearing area as they move downstream to the Pacific Ocean. Juvenile Chinook were found to spend about 40 days migrating through the Delta to the mouth of San Francisco Bay and grew little in length or weight until they reached the Gulf of the Farallones (MacFarlane and Norton 2001). Based on the mainly ocean-type life history observed (i.e., fall-run Chinook), MacFarlane and Norton (2001) concluded that unlike other salmonid populations in the Pacific Northwest, Central Valley Chinook show little estuarine dependence and may benefit from expedited ocean entry.

8.2. Central Valley Spring-Run Chinook ESU

Historically, spring-run 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). Because of alterations to the system, the upper San Joaquin River, from Friant Dam downstream to the confluence with the Merced River, no longer supports spring-run Chinook. The last documented run of spring-run Chinook in the upper San Joaquin River, consisting of only 36 individuals, was observed in 1950 (Warner 1991). Since the 1950s, the remaining Chinook in the San Joaquin basin consist only of fall-run populations found in major tributaries to the lower San Joaquin River.

8.3. Spring-Run Exhibit a Stream-Type Life History

Adults enter freshwater in the spring, hold over the summer, spawn in the fall, and the juveniles typically spend a year or more in freshwater before emigrating. Adult spring-run leave the ocean to begin their upstream migration in late January and early February (CDFG 1998) and enter the Sacramento River between March and September, primarily in May and June (table 4-4; Yoshiyama et al. 1998, Moyle 2002). Lindley et al. (2007) indicate adult spring-run enter tributaries from the Sacramento River primarily between mid-April and mid-June. Typically, spring-run 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). Reclamation reports that spring-run holding in upper watershed locations prefer water temperatures below 60ºF, although salmon can tolerate temperatures up to 65ºF before they experience an increased susceptibility to disease.

Spring-run spawning occurs between September and October depending on water temperatures. Between 56 and 87 percent of adult spring-run that enter the Sacramento River basin to spawn are 3 years old (Calkins et al. 1940, Fisher 1994).

Spring-run fry emerge from the gravel from November to March (Moyle 2002) and the emigration timing is highly variable, as they may migrate downstream as young-of-the-year (YOY) or as juveniles or yearlings. The modal size of fry migrants at about 40 mm between December and April in Mill, Butte, and Deer creeks reflects a prolonged emergence of fry from the gravel (Lindley et al. 2007). Studies in Butte Creek (Ward et al. 2002, 2003; McReynolds et al. 2005) found the majority of spring-run migrants to be fry occurring primarily from December through February; and that these movements appeared to be influenced by flow. Small numbers of spring-run remained in Butte Creek to rear and migrated as yearlings later in the spring. Juvenile emigration patterns in Mill and Deer creeks are very similar to patterns observed in Butte Creek, with the exception that Mill and Deer Creek juveniles typically exhibit a later YOY migration and an earlier yearling migration (Lindley et al. 2007).

Once juveniles emerge from the gravel, they seek areas of shallow water and low velocities while they finish absorbing the yolk sac and transition to exogenous feeding (Moyle 2002). Many also will disperse downstream during high-flow events. As is the case in other salmonids, there is a shift in microhabitat use by juveniles to deeper, faster water as they grow larger. Microhabitat use can be influenced by the presence of predators, which can force fish to select areas of heavy cover and suppress foraging in open areas (Moyle 2002). The emigration period for spring-run Chinook extends from November to early May, with up to 69 percent of the young of the year fish outmigrating through the lower Sacramento River and Delta during this period (CDFG 1998). Spring-run juveniles have been observed rearing in the lower reaches of non-natal tributaries and intermittent streams in the Sacramento Valley during the winter months (Maslin et al. 1997, Snider 2001). Peak movement of juvenile spring-run in the Sacramento River at Knights Landing occurs in December, and again in March and April. However, juveniles also are observed between November and the end of May (Snider and Titus 2000). Based on the available information, the emigration timing of spring-run appears highly variable (CDFG 1998). Some fish may begin emigrating soon after emergence from the gravel, whereas others over summer and emigrate as yearlings with the onset of intense fall storms (CDFG 1998).

Historically, spring-run were the second most abundant salmon run in the Central Valley (CDFG 1998). The Central Valley drainage as a whole is estimated to have supported spring-run runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 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 Sierras on the American, Mokelumne, Stanislaus, Tuolumne, and Merced Rivers extirpated spring-run from these watersheds. Naturally-spawning populations of spring-run 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 Yuba River (CDFG 1998).

On the Feather River, significant numbers of spring-run, as identified by run timing, return to the FRFH. From 1986 to 2007, the average number of spring-run returning to the FRFH was 3,992, compared to an average of 12,888 spring-run returning to the entire Sacramento River Basin. However, CWT information from these hatchery returns indicates substantial introgression has occurred between spring-run and fall-run populations within the Feather River system due to hatchery practices. Because Chinook have not always been temporally separated in the hatchery, spring-run and fall-run have been spawned together, thus compromising the genetic integrity of the spring-run and early fall-run stocks. The number of naturally spawning spring-run Chinook in the Feather River has been estimated only periodically since the 1960s, with estimates ranging from 2 fish in 1978 to 2,908 in 1964. However, the genetic integrity of this population is questionable because of the significant temporal and spatial overlap between spawning populations of spring-run and fall-run (Good et al. 2005).

The spring-run ESU has displayed broad fluctuations in adult abundance, ranging from 1,403 in 1993 to 25,890 in 1982 (CDFG 2007, PFMC 2004, CDFG 2004, Yoshiyama 1998, GrandTab 2009). Sacramento River tributary populations in Mill, Deer, and Butte creeks are probably the best trend indicators for the spring-run ESU as a whole because these streams contain the primary independent populations within the ESU. Escapement numbers are dominated by Butte Creek returns, which have averaged over 7,000 fish between 1995 and 2007. During this same period, adult returns on Mill Creek have averaged 778 fish, and 1,463 fish on Deer Creek. Although recent trends are positive, annual abundance estimates display a high level of fluctuation, and the overall number of spring-run remains well below estimates of historic abundance. Additionally, in 2002 and 2003, mean water temperatures in Butte Creek exceeded 21ºC for 10 or more days in July (Williams 2006). These persistent high water temperatures, coupled with high fish densities, precipitated an outbreak of columnaris disease (*Flexibacter columnaris*) and ichthyophthiriasis (*Ichthyophthirius multifiis*) in the adult spring-run over-summering in Butte Creek. In 2002, this contributed to the pre-spawning mortality of about 20 to 30 percent of the adults. In 2003, about 65 percent of the adults succumbed, resulting in a loss of an estimated 11,231 adult spring-run in Butte Creek.

The Butte, Deer, and Mill Creek populations of spring-run are in the Northern Sierra Nevada diversity group. Lindley et al. (2007) indicated that spring-run populations in Butte and Deer creeks had a low risk of extinction in Butte and Deer Creek, according to their Population-level Viability Assessment (PVA) model and the other population viability criteria (i.e., population size, population decline, catastrophic events, and hatchery influence). The Mill Creek population of spring-run Chinook is at moderate extinction risk according to the PVA model, but appears to satisfy the other viability criteria for low-risk status. However, the spring-run ESU fails to meet the "representation and redundancy rule," since the Northern Sierra Nevada is the only diversity group in the spring-run ESU that contains demonstrably viable populations out of at least 3 diversity groups that historically contained them. Independent populations of spring-run only occur within the Northern Sierra Nevada diversity group. The Northwestern California diversity group contains a few ephemeral populations of spring-run that are likely dependent on the Northern Sierra Nevada populations for their continued existence. The spring-run populations that historically occurred in the Basalt and Porous Lava, and Southern Sierra Nevada, diversity groups have been extirpated. Over the long term, the three remaining independent populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the spring-run populations in the Deer, Mill, and Butte Creek watersheds due to their close proximity to each other. One large event could eliminate all three populations.

The Central Valley Project Improvement Act (CVPIA), implemented in 1992, requires that fish and wildlife get equal consideration with other demands for water allocations derived from the CVP. From the CVPIA arose several programs that have benefited listed salmonids: the Anadromous Fish Restoration Program (AFRP), the Anadromous Fish Screen Program (AFSP), and the Water Acquisition Program (WAP). The AFRP is engaged in monitoring, education, and restoration projects geared toward recovery of all anadromous fish species residing in the Central Valley. Restoration projects funded through the AFRP include fish passage, fish screening, riparian easement and land acquisition, development of watershed planning groups, instream and riparian habitat improvement, and gravel replenishment. The AFSP combines Federal funding with State and private funds to prioritize and construct fish screens on major water diversions mainly in the upper Sacramento River. The goal of the WAP is to acquire water supplies to meet the habitat restoration and enhancement goals of the CVPIA and to improve the DOI's ability to meet regulatory water quality requirements. Water has been used successfully to improve fish habitat for spring-run by maintaining or increasing instream flows in Butte and Mill creeks and the San Joaquin River at critical times.

For spring-run, the construction of high dams for hydropower, flood control, and water supply resulted in the loss of vast amounts of upstream habitat (i.e., about 80 percent, or a minimum linear estimate of over 1,000 stream miles), and often resulted in precipitous declines in affected salmonid populations. For example, the completion of Friant Dam in 1947 has been linked with the extirpation of spring-run in the San Joaquin River upstream of the Merced River within just a few years. The reduced populations that remain below Central Valley dams are forced to spawn in lower elevation tailwater habitats of the mainstem rivers and tributaries that were previously not used for this purpose. This habitat is entirely dependent on managing reservoir releases to maintain cool water temperatures suitable for spawning, and/or rearing of salmonids. This requirement has been difficult to achieve in all water year types and for all life stages of affected salmonid species. Spring-run have also been negatively affected by the production of hatchery fish associated with the mitigation for the habitat lost to dam construction (e.g., from genetic impacts, increased competition, exposure to novel diseases, etc.).

Land-use activities such as road construction, urban development, logging, mining, agriculture, and recreation are pervasive and have significantly altered fish habitat quantity and quality for Chinook through alteration of streambank and channel morphology; alteration of ambient water temperatures; degradation of water quality; elimination of spawning and rearing habitat; fragmentation of available habitats; elimination of downstream recruitment of LWD; and removal of riparian vegetation resulting in increased streambank erosion. Human-induced habitat changes, such as: alteration of natural flow regimes; installation of bank revetment; and building structures such as dams, bridges, water diversions, piers, and wharves, often provide conditions that both disorient juvenile salmonids and attract predators. Harvest activities, ocean productivity, and drought conditions provide added stressors to listed salmonid populations. In contrast, various ecosystem restoration activities have contributed to improved conditions for listed salmonids (e.g., various fish screens). However, some important restoration activities have not yet been implemented and benefits to listed salmonids have been less than anticipated.

Current natural production estimates, relative to historic baselines and AFRP production targets for spring-run Chinook are presented in Table 6 and Figure 4. These are derived from the Comprehensive Assessment and Monitoring Program (CAMP); Assessment of Anadromous Fish Production in the Central Valley of California between 1992 and 2008 (2009).

Chinook group	**1967-1991 average production**	**1992-2008 average production**	**AFRP fish production target**	**Percent change in average production 1967-1991 vs. 1992-2008**
Spring-run	34,374	15,446	68,000	- 55%

Table 6. Summary statistics of the average natural production of spring-run of adult Chinook from the Central Valley, 1967-2008. (CAMP, 2009)

The graph in Figure 4 show the watershed's AFRP production target, estimated annual natural production of Chinook between 1992 and 2008, and average natural production of Chinook between 1967 and 1991 (CAMP, 2009). Table 7, identifies the percent changes over that time and the number of years in which AFRP goals were exceeded.

Watershed/Run	Number of years the AFRP production target was exceeded /number of years monitoring occurred since 1991	Change in average production between the 1967-1991 and 1992-2008 time periods
Butte Creek spring-run	14/17	+ 976%**
Deer Creek spring-run	0/17	- 29%
Mill Creek spring-run	0/17	- 40%
Sacramento River spring-run	0/16	- 97%**

Table 7 Overall assessment of changes in natural production of spring-run adult Chinook from the Central Valley, 1967-2008.; ** P values <0.05 reflect a statistically significant change (CAMP, 2009).

All Central Valley spring-run Chinook ESU are federally-listed as threatened, and of the potential donor stocks considered, only one (Butte Creek) has exceeded the AFRP goal (CAMP 2009), but this may be a result of anomalously low population numbers used for the 1967 through 1991 mean baseline. The three genotypic spring-run donor sources (Butte, Deer, and Mill creeks) have all shown declines since 2005 (CAMP 2009).

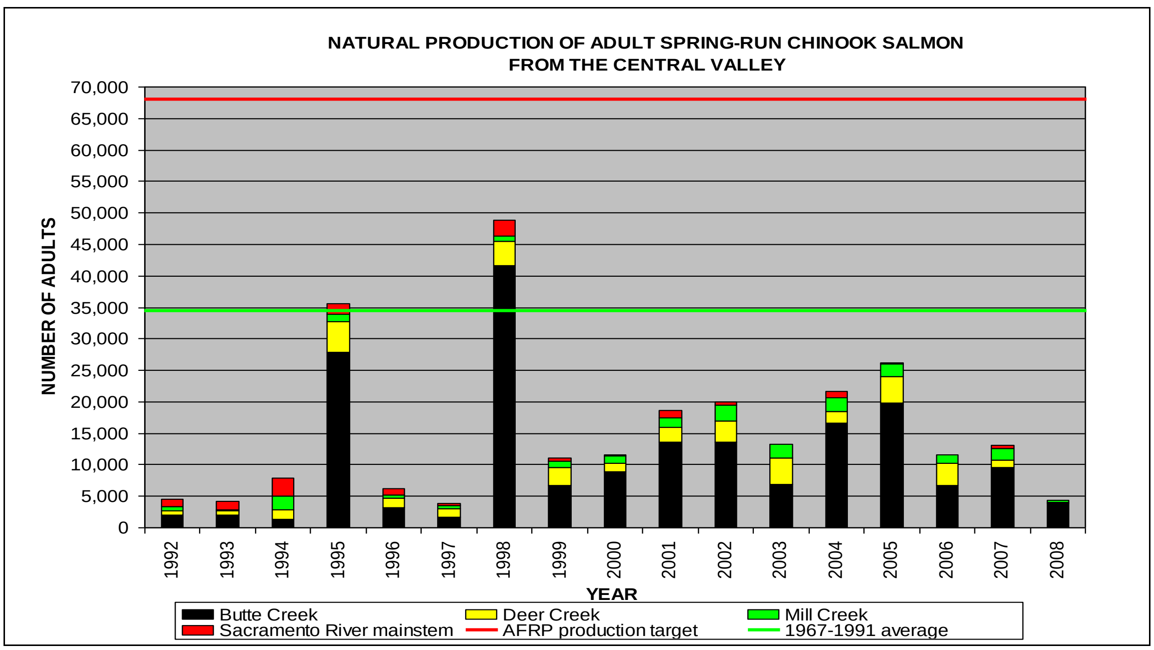

Figure 4. Estimated natural production of adult spring-run Chinook from the Central Valley, 1992-2008. Annual estimates reflect the combined contributions from Butte Creek, Deer Creek, Mill Creek, and the Sacramento River mainstem. The AFRP spring-run Chinook production target is 68,000 Chinook, and the 1967-1991 baseline average is 34,374 Chinook. (CAMP, 2009)

9. DIRECT AND INCIDENTAL TAKE

For purposes of defining the relevant project activities, we are segregating affected individuals (or populations) into three distinct categories: Donor Stock, Conservation Stock, and Experimental Stock.

Donor Stock refers to the individuals actually collected from their native (or currently resident) stream source. In permit terms, we reference these numbers to their donor population. All fish collected and managed as part of this proposed activity will be recognized as Conservation Stock for the entire duration while in the possession of the responsible parties for each specified activity. For example, transport during relocation and during residence in the Conservation Facility (during the pre-emergence phase for eggs). Once fish are introduced to the San Joaquin River proper (at the moment that fish are no longer in possession of the responsible personnel during direct release activities), these fish transition to Experimental Stock, under the anticipated §10J designation. All eggs located streamside or in-stream are considered part of the Experimental Stock, though they technically remain in the possession of responsible entities.

The proposed action would result in both direct and incidental take to the donor stock populations and losses to the Conservation Stock. Donor Stock direct take consists of all collections (one for one numeric debits to the donor population). Donor stock (population) incidental take consists of effects to the remnant populations from collection activities. Transport and rearing activities also involve mortality to the Conservation Stock incidental to the Conservation program activity.

Total direct and indirect take of donor stock was calculated by using the sum of the maximum collection number for each lifestage and watershed.

9.1 Direct Take of Donor Stock

Direct take would result from the capture of donor stock and the removal of the donor stock from the FRFH. Direct take would affect those fish or eggs that were captured, collected and fish that will be used for pathology. Those numbers would vary year to year depending on the allowable quotas set for each year's collection and outlined in the annual DSC Plan and would not exceed the annual maximum collection targets presented in Table 2 (page 17).

9.2 Incidental Take to Donor Population from Collection

Incidental take to the donor population would be considered that associated with collection activities and would include harassing, injuring, or killing any spring-run Chinook during the permitted collection activities. Incidental direct take would include any take that occurred during the actual collection or capture activities, e.g., any mortality or injury that may occur to individual fish during the capture process or eggs during collection (see Effects Analysis for a description of possible causes). Incidental indirect take would also result from the collection activities, but would occur at a later time as a result of the proposed activity (e.g., fungal infection caused by removal of protective slime), and will by definition be unobserved.

The Service anticipates that tangible numeric figures for indirect take of donor stock may be difficult to fully ascertain. The small size of eggs and juvenile fish inherently make mortality detection difficult within a hatchery or within in-stream rearing facilities.

All take incidental to the activities covered under this permit will be avoided and minimized based on the mitigation measures outlined in the Project Description and Effects Analysis, above.

9.3 Conservation Stock Losses and Facility Performance Measures

Losses at the Conservation Facility are anticipated to be similar to other CDFG hatcheries currently in operation. Using current literature searches and local experts, the Service has projected mortalities for various activities associated with the management and rearing of the Conservation Stock. Appendix B presents the effect details for various project activities. The program will maintain performance standards deemed necessary by the permitting agency for mortality rates of captured donor stock and broodstock of a species under the current conservation status (threatened under the ESA).

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11. PERSONAL COMMUNICATION

J. Hannon, USBR. August 25, 2010

Colleen Harvey-Arrison, CDFG. April 28, 2010

C. Mesick, USFWS. September 15, 2010

John Rueth USFWS August 9, 2011

Anna Kastner- CDFG Hatchery Manager, October 13, 2011

12. APPENDIX A – DONOR STOCK COLLECTION PLAN

12.1 Donor Stock Collection Annual Decision Process

A suite of collection methods across life stages are proposed subject to permit approval and an adaptive process that includes assessment of current population conditions, habitat characteristics, fish distribution, and spawning phenology. The donor stock collection decision process will be an interagency process, and will receive technical input from technical teams, such as the FMWG. The objective of this process is to adaptively manage annual collections to assure no detrimental effects to the viability of donor stream populations. In addition, this process will ensure that specific collection locations and methods will follow best available practices to minimize take within the umbrella of the Collection Program.

The technical team will use real time information for planning and implementation. This information will include, but not be limited to: population status, life stage(s) present, physical availability of donor stock, ease of capture method and its associated impact to individual (stress, injury, survival), Conservation Program status, benefits to the Conservation Program, and other pertinent information. Potential impacts to donor populations will be assessed based on, but not limited to: induces stress on non-targets, negative effects from habitat disturbance, absolute numbers taken from donor populations, and the genetic implications for each method utilized. Other considerations may arise through further monitoring and research, and these may influence future planning.

This information, along with further data made available from genetic studies, monitoring and method refinement (based in part as learning follows implementation of this reintroduction) will be critical to inform the specific details for future collections within refined stock selection strategies.

In addition, the interagency team will consider any updated numeric guidelines provided by NMFS to determine allowable collection limits with respect to current population.

Upon reviewing the available information, the team will confer and make a formal recommendation to the Service SJRRP Program Manager for stock selection for that year. The SJRRP Program Manager, or designated staff, will compile the information provided into an annual Donor Stock Collection Plan (DSC Plan), which will be submitted to NMFS and DFG in the form of a formal request for approval.

12.2 Donor Stock Collection Plan

The annual DSC Plan will be developed by a multi-agency technical team and will describe and evaluate the entire year's field activities, which include, at a minimum: the project impact to stocks, take totals, the full collection request (specific numbers, by lifestages, by collection method, by donor source), and the proposed annual timing for reporting the collection methods. Collection requests will include the rationale and justification for the specified numbers, sources, lifestages, and collection methods.

The DSC Plan will also include a summary of data evaluated by the interagency team, summaries of the group's deliberation from development to recommendations, and the Service's rationale underlying the conditions of the permit and the FMWG technical recommendations through the permitting guidelines established through the 10(j) ruling. In addition, the DSC Plan will include any additional information requested by NMFS or CDFG.

The DSC Plan will be submitted to NFMS and DFG for approval. Since the Program is utilizing a multi-strategy approach, an interim/subsequent DSC Plan may be necessary at times to includes request not submitted in the original plan, or to change requests based on real time information.

12.3 Details of Donor Stock Collection Plan

The sections below describe and list the information the Program anticipates NMFS or CDFG will require being included in the DSC Plan. It is anticipated that the DSC Plan will include the following: collection targets (as a total, by donor stream, and by life stage), collection methods, collection locations, transportation methods, disposition of fish, and monitoring plan. Additional information may be included during the development of this document or if deemed necessary by State or Federal fishery jurisdictional agencies.

12.4 Collection Targets

The initial basis for collection targets will be the numbers presented in Table 2 (section 5.5). These numbers may be modified on an annual basis based on opportunities and/or constraints at various collection points, hatchery limitations, etc.

12.5 Collection Method(s)

Collection protocols will be developed prior to collections and included in the DSC Plan. Collection methods may be implemented differently in each donor stream, or within each donor stream, and those differences will be clearly identified and included in the collection protocols. The DSC Plan will only contain collection protocols the Program anticipates using that year. Collection protocols may change or be refined in future DSC Plans as data, from future studies and monitoring, is made available. It is anticipated that the collection protocols will include detailed information on the following:

- Capture methods and gear that will be used.
- All samples and measurements that will be taken.
- Disposition of tissues (if tissue samples are taken).
- How species will be handled, including any anesthesia to be used.
- Measures to minimize effects to species.
- How species will be cared for after capture.
- Indirect mortality, percentage of indirect mortality expected due to action.
- Effects of research on the behavior and physiology of the fish, including probability of mortalities.

- Emergency Contingency Plans.

Collection protocols may include additional information as deemed necessary by the Program or by State or Federal fishery jurisdictional agencies. During the course of collection, the Program will monitor and report the progress of collection activities to the Service.

12.6 Collection Location(s)

Collection locations will be identified by coordinating with fishery agency staff and managers who work on the donor systems. These locations will be included in the DSC Plan. It is anticipated that NMFS will require the following information:

- Describe location(s) of collection, and what collection method will be used.
- Fill out "Take Location #1 Description," for each take location. See Table 11-1.
- Fill out "Detailed Take Table, Location #1," for each take location. See Table 11-2.
- Map of collection locations

Table 11.1. Take Location Table

Take Location #1 Description	
State/Territory:	
Basin (4th Field HUC):	
Begin Mile:	
End Mile:	
Township, Range, Section, Latitude, Longitude, UTM Northing, and UTM Easting:	
Location Description:	

Table 11.2 Detailed Take Table

Detailed Take Table												
SPECIES	LISTING UNIT/STOCK	PRODUCTION/ORIGIN	LIFESTAGE	SEX	EXPECTED TAKE	INDIRECT MORTALITY	TAKE ACTION	OBSERVE/COLLECT METHOD	PROCEDURES	RUN	BEGIN DATE	END DATE

12.7 Contingency Planning

Central to our reintroduction strategy is recognition that our plans (e.g. logistics, monitoring) will need to evolve as we implement and learn from our actions. We will rely on continued guidance from our technical team to make decisions to accommodate unforeseen circumstances. Here we outline some scenarios (not exhaustive) that have been formulated to build in flexibility to our reintroduction strategy to accommodate these possibilities.

12.7.1 Availability of Donor Stock

The Genetic Subcommittee Group recommends the use of multiple Chinook salmon spring-run stocks from the Sacramento River basin to re-establish a population on the San Joaquin River. Since spring-run salmon are listed as 'threatened' under the federal and state endangered species act, removing individuals from their native populations may cause demographic impacts to populations already at low abundances. We will rely on guidance from NMFS to determine the demographic parameters necessary for a putative donor stock to be used in our reintroduction program. These conditions may be satisfied in some, but not all years. As such, the specific donor stock(s) (or life stages) used in a given year will vary as a function of their availability. In future years, we aim to have information on the specific stock(s) or combination of stocks that successfully establish in the restoration area which may also influence our stock selection for future broodstock or releases into the river. The Service recognizes that collection of donor stock from other than the Feather River Hatchery would require the development of a new permit application.

12.7.2 Condition of River

Some of the restoration actions associated with the Settlement will not be fully implemented prior to reintroduction of fish to the San Joaquin River in 2012. An assessment will be made regarding the likelihood of survival for introduced fish below Friant Dam. In the event that the river is not deemed hospitable by the technical team (Fisheries Management Work Group), alternate release locations (or release of fall-run fish) may be considered. This may involve trucking fish below areas that are deemed to be high risk to fish (to below barriers) or to downstream locations with temperatures or flows conducive to survival.

In some drier years, flows in the river may be limited and create challenges to fish migration and/or holding. In these cases, efforts may be made to trap and haul migrating adults upstream to more favorable spawning or holding habitat including the Conservation Facility.

12.7.3 Mortality of In-River Spawners (Adult Rescues)

Once spring-run Chinook salmon return and spawn in-river (putatively a small initial population), efforts will be made to minimize prespawn mortality. If temperatures during the summer months are above physiological tolerance for adults or if fish health is determined to be compromised, these in-river adults may be retrieved from the river and brought in to the Conservation Facility to spawn.

12.7.4 No Spring-Run Return

In the event that the abundance of spring-run fish to the San Joaquin River does not reach sustainable levels after several generations of reintroduction efforts, Program efforts may shift to establishing viable fall-run Chinook salmon populations (fall-run ESU included in Settlement).

All efforts would be made to determine the cause(s) of mortality that are preventing the success of spring-run recruitment to the restoration area. If the technical team (Fisheries Management Work Group) determines that the stressors may not apply to the successful establishment of fall-run (determined by the apparent success of fall-run), then the reintroduction efforts may shift focus to fall-run populations.

12.7.5 Availability of Conservation Facility

The Conservation Facility will be initiated in phases. While the Program works to construct the full-scale conservation facility, an interim facility will be developed for practice captive rearing of non- ESA listed Chinook prior to working with spring-run Chinook in 2012 and be used to initiate spring-run Chinook captive rearing. The interim facility will be operated between 2012-2014, during the construction of the full-scale conservation facility. In the event that the interim facility development is delayed, other facilities, such as UC Davis may be used temporarily to hatch and captive rear fish for one to two years. Fish at UC Davis would be held at the Center for Aquatic Biology and Aquaculture. Once facility development is complete, the fish would be transferred and temporarily quarantined at the interim facility.

12.7.6 Mortality of Hatchery Brood (Cohort Failure)

Hatchery protocols minimize the spread of disease and several detailed procedures are outlined on how the hatchery anticipates reducing these risks. However, to the extent possible or feasible, we may consider rearing some individuals at an alternate facility in the event that failure of a(n) entire broodyear(s) occurs at the primary facility. This strategy has its tradeoffs. Not only can this be costly to maintain, but other conservation hatchery programs that have employed this back-up strategy have had difficulty in raising fish at the same developmental rate as the primary hatchery. This has limited the usefulness of the surrogate broodstock for use in the primary hatchery. Alternatively, in years where entire broodyears fail, juvenile spring-run Chinook salmon from the Feather River hatchery could be released in-river in the relevant year to defray the impacts of the failed brood(s).

12.7.7 Flood Conditions as it Relates to Hatchery Brood

Flooding occurred at least once in recent history at the proposed hatchery grounds when in 1997 San Joaquin State Trout Hatchery was inundated by floodwater. At that time, many fish from the trout hatchery escaped to the adjacent San Joaquin River. However, approximately 20 percent of the trout remained in the uncovered raceways throughout the flood. In the event of future flooding, it is possible that fish from both facilities will again be released to the river. Measures will be taken to prevent fish loss during a flood event by netting the tops of fish tanks to prevent escape.

12.7.8 Funding

All of the restoration activities related to the reintroduction strategy require funds to implement. This includes funding for hatchery operations and all monitoring related activities. All primary responsibilities necessary to achieve the Settlement goals are contingent on funding availability (allocation). This poses the greatest challenge in anticipating what components of the reintroduction strategy, and fisheries management plan will be implemented.

13. APPENDIX B - DIRECT AND INCIDENTAL TAKE

The tables presented below represent the maximum direct take that may occur during all annual activities required for donor stock collection. Again, these represent population level losses to the donor source population, but it is emphasized that this permit is for the use of "surplus" eggs or juveniles only and will not represent a loss in production to the donor population (i.e. the FRFH)

Additionally, we have provided loss estimates that the permitting agency may use for reference purposes associated with the Conservation Stock and Experimental Stock reintroduction of the Reintroduction Program. Conservation Stock losses will include losses to the donor stock individuals while in possession of the collecting party (collection, handling, tagging, genetic testing and transport during relocation or translocation), pathology, and losses to their progeny during Conservation Facility operation. Experimental Stock losses will vary according to the life stage released, but will involve losses to individuals following reintroduction and/or placement of the individuals at stream-side or in-stream facilities (i.e., infrastructure other than the Conservation Facility).

Collection - Direct Take of Donor Stock

As described in the *Project Description*, of the permit donor stock individuals will be collected the FRFH . Individuals of varying life stages will be collected from the donor sources and used for conservation stock rearing, remote-site egg collection, or direct transplant into the San Joaquin River (translocation). Table 1 below summarizes the maximum numbers to be collected at each location and life stage. Table 2 summarizes the maximum percent of mortality/take due to collection method, handling, transport, quarantine, and rearing fish stock to various life stages.

Collection Type	Collection Source	Targeted Lifestage	Disposition Location	Max Years 1-3	Max Years 4-
Primary	Feather River Fish Hatchery	Juveniles	Conservation Facility	560	2,760
	Feather River Fish Hatchery	Eyed Eggs	Conservation Facility	560	2,760
	Feather River Fish Hatchery	Juveniles	Translocation to SJR	54,400 @ fingerling	54,400 @ fingerling
	Feather River Fish Hatchery	Eyed Eggs	Translocation to SJR	80,000	80,000

Table 1. Maximum collection targets by year, location, lifestage and disposition.

Table 2 Donor Stock Collections								
Source	Lifestage	Number collected	Collection method	Reason for loss	Expected mortality-based in percent	Number of fish lost/taken	References	Number remaining
FRFH	eggs	Max.: 80,000 eyed eggs*. For translocation to SJR	Surplus eggs from about 20 adult females at the FRFH, based on average of 4,000 eggs per female	Collections from FRFH	N/A	N/A	Losses would be associated with existing operations under FRFH HGMP	80,000
				Transport to San Joaquin River	1%	800	Schreck et al. 2006	79,200
				Eyed to emergence. In San Joaquin River Start of Sec 10j rule	35%***	27,720	Percent mortality extrapolated from several sources***	51,480
				Fry to smolt	97%	49,935.6	Carl Mesick** pers. com. 9/15/10	1,544.4

				Smolt survival to returning adult	97.5% 99.91% 98.7%	1,505.79 1,543 1,524.3	Carl Mesick** pers. com. 9/15/10 (Stanislaus River) Carl Mesick pers. com. 9/15/10 (Merced River) Average of Stanislaus and Merced	38.61 1.4 20.1
FRFH	egg	Max 560 (years 1-3) or 2,760 (years 4-5) for Conservation Facility	Surplus eggs from FRFH	Collections of eggs from FRFH	N/A	N/A	Losses would be associated with existing operations under FRFH HGMP	560 (year 1-3) 2,760 (year 4-5)
				Transport (to quarantine and from quarantine)	1%	5.6 (year 1-3) 27.6 (year 4-5)	Schreck et al. 2006	554.4 (year 1-3) 2,732.4 (year 4-5)
				Eyed to fingerling	32%	177.4 (year 1-3) 874.4 (year 4-5)	Cavallo et al 2009	377 (year 1-3) 1,858 (year 4-5)

				Pathology	100% of the 60 fish required for pathology	60	AFS-FHS 2010; per comm. Mark Adkinson	317 (year 1-3) 1,798 (year 4-5)
				Fingerling to smolt in conservation facility	22%	69.7 (year 1-3) 395.6 (year 4-5)	Cavallo et al 2009	247.3 (year 1-3) 1,402.4 (year 4-5)
				Smolt to adult in conservation facility	50%	123.6 (year 1-3) 701.2 (year 4-5)	Pollard and Flagg 2004	123.6 (year 1-3) 701.2 (year 4-5)
FRFH	juveniles	54,400 juveniles based on average mortality to 80,000 eggs in hatchery conditions. For translocation	Surplus juveniles from FRFH	Collections from FRFH	N/A	N/A	Losses would be associated with existing operations under FRFH HGMP	54,000
				Transport (to and from quarantine)	1%	544	Schreck et al. 2006	53,856
				Pathology	100% of the 60 fish required for pathology	60	AFS-FHS 2010; per comm. Mark Adkinson	53,796

		to SJR		Placed in in-stream facility and released Fry to smolt in river Start of Sec 10j rule	97%	52,182.1	Carl Mesick** pers. com. 9/15/10	1,613.9
				Smolt to returning adult	97.5% 99.91% 98.7%	1,573.5 1,612.4 1,592.9	Carl Mesick** pers. com. 9/15/10 (Stanislaus River) Carl Mesick pers. com. 9/15/10 (Merced River) Average of Stanislaus and Merced	40.3 1.5 21
FRFH	juveniles	Max 560 (years 1-3) or 2,760 (years 4-5) for Conservation Facility	Surplus juveniles from FRFH	Collections of juveniles	N/A	N/A	Losses would be associated with existing operations under FRFH HGMP	560 (year 1-3) 2,760 (year 4-5)
				Transport (to quarantine and from quarantine)	1%	5.6 (year 1-3) 27.6 (year 4-5)	Schreck et al. 2006	554.4 (year 1-3) 2,732.4 (year 4-5)

				Pathology	100% of the 60 fish required for pathology	60	AFS-FHS 2010; per comm. Mark Adkinson	494.4 (year 1-3) 2,672.4 (year 4-5)
				Fingerling to smolt in conservation facility	22%	108.8 (year 1-3) 587.9 (year 4-5)	Cavallo et al 2009	385.6 (year 1-3) 2,084.5 (year 4-5)
				Smolt to adult in conservation facility	50%	192.8 (year 1-3) 1042.2 (year 4-5)	Pollard and Flagg 2004	192.8 (year 1-3) 1042.2 (year 4-5)

*Assumes all 80, 000 eyed eggs are raised to juveniles for release or are released as eggs to the San Joaquin River.

**Assumes similar mortality on the San Joaquin River as the low end survival rate for fish released on the Stanislaus River

***

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Justification of Mortality Estimates for Incidental Take Table

Egg Collection

Feather River Fish Hatchery Collections

Collections of eyed eggs from Feather River Fish Hatchery (FRFH) should result in minimal to no mortality following established protocols developed in the by their respective Hatchery and Genetics Management Plans.

Egg Transportation

One percent mortality was assigned to Transportation effects, it is anticipated that this is conservative estimate of loss. Transport may consist of two trips: from donor system to quarantine facility and from quarantine facility to the conservation facility or San Joaquin River.

Juvenile Collection

Feather River Fish Hatchery Collections

Collections of juveniles from Feather River Fish Hatchery (FRFH) should result in minimal to no mortality following established protocols developed in the FRFH Hatchery and Genetics Management Plan.

Transport of Donor Stock Juveniles

Handling and transport procedures have an associated mortality of less than one percent based on Shreck et al (2006). In these cases, one percent mortality was assigned to that activity to create a more conservative estimate of loss. Transport would consist of two trips: from donor system to quarantine facility (Silverado Fisheries Base in Yountville, California) and from quarantine facility to the Conservation Facility or San Joaquin River.

Quarantine and Pathology

All donor stock juveniles are subject to quarantine and pathology protocols as outlined in Section 5.3 of the Application and would be held in quarantine for a minimum of 30 days. A maximum of 60 juveniles would be utilized for pathology per collection group as determined by CDFG pathologists.

Rearing

While in the Conservation Facility/Interim Facility eggs and juveniles will be reared according to the HGMP and would have similar results as stated in Cavallo et al 2009 and Pollard and Flagg 2004. Instream rearing mortality was based on personal communications with Carl Mesick (9/15/10).

If eggs cannot be collected from FRFH and therefore hatch while at FRFH, we would collect them as juveniles and would lose egg collections for that season. Eggs reared at the FRFH would be reared as stated in the FRFH HGMP (Cavallo et al 2009).

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PERSONAL COMMUNICATIONS

Carl Mesick, 9/14/10: Summary of trap and haul methods form winter-run Chinook, Word document included in 9/14/10 email.

Carl Mesick, 9/15/10: Juvenile salmon survival rates in 9/15/10 email.

14. APPENDIX C- INVASIVE SPECIES

Non-Targets That May Potentially Be Moved/Introduced
Vertebrates: Non-indigenous fish (20 species), bull frog (*Rana catesbeiana*), northern water snake (*Nerodia sipedon*), and red-eared slider turtle (*Trachemys scripta*).
Invertebrates: New Zealand mudsnail (*Polamophyrgus antipodarum*), zebra mussel (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), and freshwater asian clam (*Corbicula fluminea*), crawdads *Procambarus clarkii* and *Orconectes rusticus*, mitten crab (*Eriocheir sinensis*), Siberian prawn (*Exopalaemon modestus*), exotic zooplankton spp.
Plants: <u>Aquatic:</u> Canadian waterweed (*Elodea canadensis and E. nuttallii*), Brazilian waterweed (*Egeria densa*), curly pondweed (*Potamogeton crispis*), hydrilla or waterthyme (*Hydrilla verticillata*), water hyacinth (*Eichhornia crassipes*), Eurasian watermilfoil or parrot's feather (*Myriophyllum* spicatum), floating primrose-willow or water primrose (*Ludwigia spp.*), lens-podded white-top (*Cardaria* chalepensis) and harmful algae such as *Didymosphenia geminata*. <u>Terrestrial:</u> yellow starthistle (*Centaurea solstitialis*), Himalayan blackberry (*Rubus discolor*), tree-of-heaven (*Ailanthus altissima*), perennial pepperweed (*Lepidium latifolium*), yellow flag iris (*Iris pseudacorus*), Scotch broom (*Cytisus scoparius*), Spanish broom (*Spartium junceum*), pampas grass (*Cortaderia selloana*), medusa-head (*Taeniatherum caput-medusae*), leafy spurge (*Euphoribia esula*), black locust (*Robinia pseudoacacia*), purple loosestrife (*Lythrum salicaria*), giant arundo (*Arundo donax*), salt cedar or tamarisk (*Tamarix spp.*), Italian thistle (*Carduus pycnocephalus*), Canada thistle (*Cirsium arvense*), tansy ragwort (*Senecio jacobaea*), spotted knapweed (*Centaurea maculosa*) and red sesbania (*Sesbania punicea*).
Other Biologics (pathogens, parasites, etc.): Various fish diseases and parasites including but not limited to: furunculosis (*Aeromonas salmonicida*), *Ambiphyra*, *Ceratomyxa shasta*, *Dactylogyridiasis spp.*, *Epistylis*, columnaris (*Flavobacterium columnare*), *gyrodactylus spp.*, *Hexamita spp.*, costia (*Ichthyobodo spp.*), (*Ichthyophthirius multifiliis*), anchor worm (*Lernea* spp.) whirling disease (*Myxobolus cerebralis*), *Nanophyetus salmincola*, *Pseudomonas spp.*, bacterial kidney disease (*Renibacterium salmoninarum*), rosette agent (*Sphaerothecum destruens*), *Trichodina*, cestodes, enteric redmouth disease (*Yersinia ruckeri*), various fungi, and infectious hematopoietic necrosis virus (IHNV)

15. APPENDIX D—RESPONSE TO COMMENTS

15.1 Introduction

In February 2010, the National Marine Fisheries Service (NMFS) circulated the Fish and Wildlife Service's (Service) §*10(a)1(A), Enhancement of Species Permit Application for the Reintroduction of Central Valley Spring-Run Chinook into the San Joaquin River* (Application), dated September 29, 2010. The purpose of the Application is to gain approval from NMFs to engage in the collection, propagation and reintroduction of spring-run Chinook. The Application has a planning horizon beyond this initial permit request.

15.2 Comment Period

The 30-day public comment period for the Application began on February 4, 2011. During the comment period the Application was available for review through the Federal Register and on the NMFS website. Additionally NMFS held public workshops in Chico, Los Banos, and Fresno, California during the public comment period. The Service presented an outline of the Application during the public workshops and NMFS followed with a presentation on their rule making processes (§4d and §10J) for the SJRRP.

Written comments were submitted by the public organizations, individuals, and by NMFS itself. The Service received copies of the written comment on May 28, 2011. The comments, along with the responses from the Service in collaboration with NMFS, California Department of Fish and Game and the Bureau of Reclamation, are presented in the table below.

15.3 Response to Comments Table

Item	Comments	Response
1	Under NEPA the agencies must consider alternatives to the proposed action. One good alternative for fish is to have a river with water. The salmon will colonize it just fine.	NEPA and CEQA are the responsibility of the governmental agency which has discretionary authority over a project. In this instance NMFS has discretionary authority over the issuance of the §10(a)1(A) permit so NMFS is responsible for the NEPA and will develop alternatives through that process.
2	The stocks targeted for transfer have pathogens that kill dogs that eat of them.	The California Department of fish and game has developed fish health screening criteria that the SJRRP will follow during implementation. These draft criteria include quarantine procedures and testing for bacteria, viruses and parasites prior to the transfer of any fish from or to the San Joaquin Basin.
3	If you want a good salmon run on the San Joaquin River, you will need a permanent hatchery.	A requirement of the Settlement and one of the primary goals of the SJRRP is to achieve a naturally-reproducing and self-sustaining spring-run Chinook population in the Restoration Area. A permanent propagation facility could not meet this requirement or goal.
4	Prove that you can fix the habitat and then reintroduce the fish. Your mandate calls for fish in 2012 and water flows to support them in 2014.	The Settlement calls for full Restoration Flows to begin in 2014 however, Interim Flows began in 2009 and will continue until full Restoration Flows can occur.
5	The one person who is an authority on Mill and Deer Creek's Spring-Run was never consulted by your interagency team of experts.	In the process of preparing the background information for the Application, the Service contacted Ms. Colleen Harvey- Arrison with CDF&G who is very knowledgeable on both Mill and Deer creeks. Many of Ms. Harvey-Arrison's annual reports of Deer and Mill creek monitoring have been included in the development of the technical documents to support the Application. The Service can not speculate as to who the commenter believes is the "one person."
6	These fish are at risk of extinction; your scheme will guarantee it. Is this a legitimate taking?	This comment addresses an action specific to the NMFS therefore the response will be prepared by the NMFS.
7	Rhonda Reed of NOAA/NMFS stands by her public comment: "above all, there is a clear mandate that works to reintroduce salmon in the San Joaquin and cannot harm existing populations elsewhere". I will hold her and her agency to that standard.	This comment addresses an action specific to the NMFS therefore the response will be prepared by the NMFS.
8	15% of Mill Creek spawners is a big number and will certainly harm the population.	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
9	How do you address the Delta survival of these fish?	Through the current protections that already exist for the San Joaquin River fishery in the NMFS Long-term Central Valley Project Operations Criteria and Plan biological opinion.
10	How do you guarantee the separation of spring-run and fall-run in such a confined area at 800 feet elevation below the Friant Dam or is your scheme content with hybridization?	The Fish Management Plan identifies the placement of a separation weir as an implementation action for the program. Current studies underway during Interim Flows are assessing holding pool and spawning habitat capacity and location and will provide information on the appropriate placement of this separation weir.
11	This proposed implementation of the Settlement would have a materially severe effect on our wild Mill Creek spring-run Chinook and therefore should not be considered for use in this project.	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.

12	Why are there no CEQA or NEPA documents with the Enhancement of Species Permit Application? How can you have a Permit Application prior to the preparation of a NEPA document?	NEPA and CEQA are the responsibility of the governmental agency which has discretionary authority over a project. In this instance NMFS has discretionary authority over the issuance of the §10(a)1(A) permit so NMFS is responsible for the NEPA. The CDFG is currently working on their needs for the CEQA.
13	It is disturbing that the "Reintroduction Strategies" has only a draft outline and is not available for public review at this time. These documents should be included in your permit process.	The three foundational technical documents (Stock Selection Strategy, Hatchery and Genetic Management Plan, and Reintroduction Strategy) were used as the framework for the project description presented in the §10(a)1(A) permit application. The §10(a)1(A) application is a stand-alone document and does not tier off of the foundational technical documents.
14	The current fish population is well below any level that could even conceivably justify any "donation or taking" of our wild Mill Creek spring-run Chinook.	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
15	The Draft Stock Selection Strategy, 2010 should also be completed prior to any decision being made regarding this important topic.	The three foundational technical documents (Stock Selection Strategy, Hatchery and Genetic Management Plan, and Reintroduction Strategy) were used as the framework for the project description presented in the §10(a)1(A) permit application. The §10(a)1(A) application is a stand-alone document and does not tier off of the foundational technical documents.
16	How will late arriving spring-run Chinook be separated from early arriving fall-run?	Operations of Hills Ferry barrier and the placement of a separation weir will be used to address hybridization.
17	How will the donor stocks be protected from hybridization?	Hybridization between fall-run and spring-run will be addressed through the placement of a separation weir and the continued operation of Hills Ferry Barrier. These devices will continue to be evaluated during Interim Flow periods. Currently there are no plans to segregate natural spawning between different donor spring-run stocks. The Service recognizes that spring-run may mix on the spawning grounds and that would add to the genetic diversity of the reintroduced population, and may provide better local adaptation through genetic diversity.
18	What measures are being proposed to ensure that the reintroduced San Joaquin salmon will survive in the Delta?	Measures to ensure survival in the Delta are provided through the current protections that already exist for the San Joaquin River fishery in the NMFS Long-term Central Valley Project Operations Criteria and Plan biological opinion.
19	Have any studies been performed to determine the potential impacts from climate change on the proposal?	Not specifically, however, studies to evaluate the current conditions, modeling analysis and scientific literature searches on species needs are all occurring. Climate change is an aspect of both NEPA and CEQA and will be part of those environmental analyses for the reintroduction. Although no specific studies focused on climate change are planned at this time, studies addressing the effects of climate change on this project may be conducted in the future.
20	When will habitat restoration of proposed spring-run Chinook habitat be completed?	The date of habitat restoration completion within the entire Restoration Area is currently unknown.

21	Has a survey been completed to ascertain if adequate spawning gravel exists in the river bed?	Several recent surveys have provided estimates of the quantity of spawning gravel within the Restoration Area of the San Joaquin River. In 1996, Cain (1997) estimated the amount of spawning gravel between Friant Dam and Gravelly Ford. In 2000, Jones and Stokes Associates, Inc. and Entrix (in McBain and Trush 2002) delineated spawning areas and estimated the spawning habitat available between Friant Dam and Skaggs Bridge. In spring 2002, a second survey was conducted to map suitable spawning gravel in the reach from the Friant Dam to Highway 99 (Stillwater Sciences in McBain and Trush 2002). See the 'Existing Conditions' section for new and clarifying text regarding gravel surveys.
22	Has funding been secured for continual gravel supplementation, even after full restoration has been completed? How much shaded riparian habitat is being proposed?	Future planning and environmental work necessary for improvements to habitat, including gravel supplementation, is ongoing and will continue to occur. Concern over funding for future needs is speculative and not considered in the context of addressing the technical merits of channel improvements and salmonid reintroduction.
23	How will interfacing with humans be minimized when the proposed spawning area is in a flat exposed area?	There is a need to estimate how harassment, harm or poaching may impact the distribution, abundance and the health of spring-run Chinook spawning and holding in the upper Reaches. The lands adjacent to the spawning reaches are primarily San Joaquin River Parkway parcels, held under public ownership. Although the river is not accessible from all the Parkway lands, there will likely be some interaction. The best methods to minimize the interactions and limit the disturbance to spring-run adults are currently being evaluated.
24	Mill Creek's spring-run Chinook population has declined from historic runs above 2,500 to such low levels that even 400 fish are now deemed a "good" year. But putting "good" in context, geneticists would quickly define a spawning population of such small size as one in imminent danger of extinction. Consequently the taking of even 1% of Mill Creek's fish for the San Joaquin experiment would be highly irresponsible—much less the potential taking of up to 15% as stipulated in the current plan.	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
25	The current San Joaquin plan mandates reintroducing salmon prior to reestablishing appropriate water flows and other conditions critical for salmon survival. Any fish introduced under these circumstances will inevitably experience extremely high mortality rates. It would be totally unacceptable to expose Mill Creek's already threatened stock to this risk.	Initial reintroduction efforts will focus on development of a captive broodstock. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.The fish authorized for collection under this permit would be used to develop the captive broodstock and would be held in the captive rearing program and used to develop progeny that would be released in out years when progress has been made in the channel modifications mandated by the Settlement.
26	Mill Creek's wild spring-run Salmon have adapted over the millennia to entering Mill Creek in the spring, passing immediately through the low elevation valley floor and climbing to their spawning grounds at altitudes ranging from 2,500 feet to 5,400 feet. The yearlong cold, spring fed water, abetted by protective canyon walls and forest-shaded watershed, enables the fish to hold throughout the summer, spawning	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.

	in the fall. The fact that virtually the entire spawning area is within the road less Ishi Wilderness area also protects from poaching and/or other human disturbances. Mill Creek's fish are genetically unsuited for survival in the San Joaquin's diametrically opposite environment, where the fish will be unable to climb higher than 800 feet in search of cold water, where there will be few if any shaded pools in which to hold over the summer, and where road access will expose them to poaching and other human/suburban hazards.	
27	Hybridization: Existing conditions in the lower San Joaquin watershed will lead to swift hybridization of Spring and fall-run Chinook due to overlapping spawning grounds. On Mill Creek, thermal conditions create an impenetrable natural barrier between Spring and Fall Run fish. Fall-run fish spawn immediately upon entering Mill Creek, at elevations below 800 feet. Mill Creek's spring-run fish spawn only at altitudes above 1,200 feet, and mainly above 2,500 feet. This guarantees lack of interaction between the two species.	Hybridization risk will be addressed through operations of the Hills Ferry barrier and operation of a separation weir in the spawning/holding habitat. Please note that historically both spring-run and fall-run spawned on the San Joaquin River before Friant Dam was constructed, with spring-run being the larger and more successful run.
28	There are no CEQA or NEPA documents with the enhancement of species permit application.	Normally no, but in this case NMFS and CDFG are currently working through the NEPA and CEQA processes that might be needed for the entire reintroduction.
29	The granting of an Enhancement of Species Permit Application for this project will have an adverse impact to any endangered species.	NMFS has jurisdiction over spring-run Chinook and will evaluate the Application for affect to the individuals and the population.
30	The "Reintroduction Strategies" contains only a draft outline and is not available for public review at this time.	Draft documents are internal documents and not available for public comment. However, all necessary portions of the Reintroduction Strategies document have been incorporated into the Application itself. The Reintroduction Strategies document was completed February 2011.
31	The 2010 Draft Stock Selection Strategy should be completed prior or any final decision being made regarding this topic.	The Stock Selection Strategy document is one of three foundational technical documents which were the frame work for the development of the project description in the Application. The Stock Selection Strategy document was in draft form when the September 29, 2010, Application was submitted to NMFS, however, it was finalized in November 2010.
32	There are no protections for the donor stocks regarding hybridization	Hybridization risk will be addressed through operations of the Hills Ferry barrier and operation of a separation weir in the spawning/holding habitat. Please note that historically both spring-run and fall-run spawned on the San Joaquin River before Friant Dam was constructed, with spring-run being the larger and more successful run.
33	There are no protections to ensure that the reintroduced San Joaquin salmon will survive the Delta	Protections include the current protections that already exist for the San Joaquin River fishery in the NMFS Long-term Central Valley Project Operations Criteria and Plan biological opinion.

34	There are no studies of which I am aware that demonstrate if adequate spawning gravel or shaded riparian habitat exists.	Several recent surveys have provided estimates of the quantity of spawning gravel in the upper San Joaquin River. In 1996, Cain (1997) estimated the amount of spawning gravel between Friant Dam and Gravelly Ford. In 2000, Jones and Stokes Associates, Inc. and Entrix (in McBain and Trush 2002) delineated spawning areas and estimated the spawning habitat available between Friant Dam and Skaggs Bridge. In spring 2002, a second survey was conducted to map suitable spawning gravel in the reach from the Friant Dam to Highway 99 (Stillwater Sciences in McBain and Trush 2002). Recent vegetation surveys were conducted on the San Joaquin River by Jones and Stokes Associates, Inc. (1998), Science Applications International Corporation (SAIC 2002) and California Department of Water Resources (Moise and Hendrickson 2002). See the 'Existing Conditions' section for new and clarifying text regarding gravel and riparian surveys.
35	No document that I have seen give me a level of comfort of when spring-run Chinook habitat restoration will be complete	Studies are on-going to better understand the habitat restoration needed for the Restoration Area, specifically habitat restoration that will support the reintroduction and development of a naturally producing, self-sustaining Chinook population.
36	I am aware of no studies that compare and contrast the differences in the physical, biological, and chemical make ups of these two, very different, systems regarding habitat for the spring-run Chinook.	The physical and biological similarities are discussed in detail in the Stock Selection Strategies Document, under Environmental Conditions. No chemical analyses in the donor streams have been conducted aside from water quality monitoring in the San Joaquin River.
37	The permit application fails to include a provision that ensures the reintroduction of spring-run Chinook to the San Joaquin River will have no adverse impacts to CVP contract allocations.	This comment addresses an action specific to the NMFS therefore the response will be prepared by the NMFS.
38	FWS and NMFS must ensure that the SJRRP's impact on donor populations will not result in adverse impacts to CVP operations.	This comment addresses an action specific to the NMFS therefore the response will be prepared by the NMFS.
39	Inadequate Habitat: Currently, the program is not being implemented in the sequence or on the schedule that was foreseen in 2006 when the stipulated settlement was crafted. At the time, it was believed that the necessary infrastructure would be in place to reintroduce fish and release full Restoration Flows down the San Joaquin River by 2014, a schedule as discussed below that is no longer achievable. As a result, the issuance of the §10(a)(1)(A) Permit for the salmon reintroduction program with the goal of spring-run Chinook reintroduced to the San Joaquin River by December 21, 2012, is far in advance of (a) the establishment of Restoration Flows and (b) necessary structural and channel improvement, both of which are critical to providing habitat conditions and the full restoration flow hydrographs essential for the successful reintroduction of spring-run Chinook to the San Joaquin River.	The schedule for the channel and structural improvements is outlined in Paragraph 11(a) of the Settlement. The implementing agencies are evaluating the current habitat conditions of the San Joaquin River as well as the Settlement timeline. The anticipated short residency time of spring-run during the initial reintroduction and the several year lag prior to the initial adult returns provide greater flexibility in the completion of the restoration activities. The amount and quality of existing habitat may be sufficient to initiate the process of restoring salmonid populations.

40	Currently, the Bureau of Reclamation (Reclamation) is conducting the interim flow program described in paragraph 15 of the stipulated settlement, the purpose of which is to collect data regarding flows, temperatures, fish needs, seepage losses, and recirculation, recapture and reuse of water in advance of full Restoration Flows. Restoration Flows are scheduled to commence no later than January 1, 2014. However, the scheduled Restoration Flows will not be achievable in the time period contemplated for salmon reintroduction due to the requirements on Reclamation to first mitigate adverse impacts on third parties, including damage from levee and groundwater seepage, complete necessary channel capacity improvements, or install screens and other fish protection measures – none of which have occurred or are likely to timely occur due to a lack of funding.	Chapter 19(b) of the Settlement states, "The Secretary, with cooperation of the other Parties, shall provide appropriate opportunities for input from third parties who have an interest in measures to be undertaken pursuant to this Settlement, and for coordination with third parties who own or control facilities or property affected by implementation of such measures. Further, the Secretary, with cooperation of the other Parties, shall provide appropriate opportunities for public participation regarding implementation of this Settlement." In May 2007, Reclamation prepared and provided for public distribution the Public Involvement/Public Outreach Plan (PIP). The PIP outlines the public involvement process for sharing SJRRP information and identifies target audiences, including signatories to the Third Party Memorandum of Understanding (MOU), dated February 26, 2007. The PIP further identifies mechanisms to inform the public and stakeholders about information. These mechanisms include briefings, workshops, reach-by-reach coordination meetings, stakeholder subgroups, websites, publication, e-mail, media, and other public involvement opportunities. The SJRRP will continue to operate in accordance with the Settlement, the Third Party MOU, and the PIP, as appropriate, to disseminate information to the Exchange Contractors and the RMC as well as other interest groups, stakeholders, elected officials, landowners, and the general public.
41	i. Pursuant to both the stipulated settlement and the San Joaquin River Settlement Act, restoration of the San Joaquin River must not have a material adverse impact on any third parties. Specifically with regards to Interim Flows, the Secretary is required to mitigate impacts on adjacent and downstream water users and landowners under section 10004(d)(2) of the San Joaquin River Settlement Act and to reduce Interim Flows to the extent necessary to address impacts to third parties caused by seepage under section 10004(h)(3). Growers within the Service area of the Exchange Contractors experienced serious damage to crops and the levee system from seepage that resulted from the first year's Interim Flows, even though Interim Flows was limited to only 10 to 25% of the full flow ultimately planned. Such damage has neither been addressed adequately nor mitigated by Reclamation. Before continuing with the Interim Flows, Reclamation must complete plans and work needed to mitigate against this type of damages from the flow program.	The comment provided is beyond the scope of the action analyzed in the permit application. Reclamation is coordinating with landowners and stakeholders to avoid potential downstream impacts associated with Interim Flows by releasing flows consistent with the current channel capacities and making real-time adjustments as necessary. Interim Flows will be reduced and seepage projects would be implemented, as needed, to address material seepage impacts as identified through groundwater monitoring and the Seepage and Conveyance Technical Feedback Group, which consists of landowners, stakeholders, agencies, and interested parties.
42	Section 10004(h)(2)(B) of the San Joaquin River Settlement Act: the Secretary is prohibited from releasing flows that exceed existing downstream channel capacities. For example, existing channel capacity is zero in Reach 4B. Current channel capacity in Reach 4A, without causing seepage impacts, is only 500 cfs. All necessary channel modifications to address capacity identified as Phase 1 improvements in paragraph 11(a) of the stipulated settlement and contemplated to be completed by December 31, 2013, are significantly behind schedule. All are in the planning/permitting stage with no established planning and construction timelines.	Statements related to channel capacities and seepage are beyond the scope of the analysis that would be performed to prepare and submit a sufficient permit application for the reintroduction of Chinook to the San Joaquin River. Activities related to channel capacity improvements and groundwater elevation concerns are being addressed through the larger SJRRP projects, including site-specific channel improvement projects identified in the Settlement, and through information gathered from the Seepage and Conveyance Technical Feedback Group, landowner coordination, and regular monitoring efforts along the San Joaquin River. Reclamation will continue to coordinate with landowners, stakeholders, agencies, and the Settling Parties to develop timelines and implement the project.

43	Successful reintroduction of spring-run Chinook to the San Joaquin River cannot be achieved if the reintroduction occurs years in advance of necessary in-river, near-river, and facilities/infrastructural improvements to provide quality fish habitat, a concern also raised by the Service in the Permit Application at page 43. Habitat conditions in reaches of the San Joaquin River are severely degraded. To achieve the restoration goal, a combination of channel and structural improvements, described in paragraph 11 of the stipulated settlement, along the San Joaquin River below Friant Dam are required. "Phase 1" improvements, listed in paragraph 11(a), are to be completed no later than December 31, 2013 and "Phase 2" improvements, listed in paragraph 11(b), are to be completed no later than December 31, 2016. On page 43, the Permit Application acknowledges that these projects have been delayed beyond that which was anticipated within the context of the Settlement. The just released Reintroduction Strategy for spring-run Chinook dated February 2011 also raises this significant concern stating that the Phase 1 projects scheduled for completion by December 31, 2013 are still in the planning permitting stages and are considered significantly behind schedule with no established planning and construction timelines. The reintroduction of spring-run Chinook in advance of necessary restoration projects on the San Joaquin River calls into question whether the restoration goal of the SJRRP, as described in the Permit Application can be successfully accomplished.	Paragraph 14(a) of the Settlement states "The Secretary, through the Fish and Wildlife Service (Service), and in consultation with the Secretary of Commerce, the Department of Fish and Game (CDFG), and the Restoration Administrator, shall ensure that spring and fall-run Chinook are reintroduced at the earliest practical date after commencement of sufficient flows and the issuance of all necessary permits." Reclamation, CDFG, Service, and NMFS will continue to coordinate on aspects of salmon reintroduction to ensure meeting habitat and flow requirements for fish survival in the San Joaquin River. Further, Sec. 10011(c)(3) of Public Law (PL) 111-11 explains that the 4(d) rule issued "shall provide 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." Reclamation is coordinating and will continue to coordinate with third parties to meet this need. PL 111-11, Sec. 1004(g)(3) also says "The Secretary shall reduce Interim Flows to the extent necessary to address any material adverse impacts to third parties from groundwater seepage caused by such flows that the Secretary identifies based on the monitoring program of the Secretary." Reclamation is currently undertaking efforts to identify and manage potential groundwater concerns with adjacent landowners, as stipulated in PL 111-11 and will continue to monitor and address these concerns. Planning and environmental work necessary for the construction of channel capacity improvements and the installation of fish screens is ongoing and will continue to occur. Concern over lack of funding is speculative and not considered in the context of addressing the technical merits of channel improvements and salmonid reintroduction.
44	Reintroduction of spring-run Chinook to the existing system would be deadly to the fish. In addition to the poor habitat conditions described above, due to the existing flow limitations and flow paths relative to the Mendota Pool, these fish will become entrained in the diversions in the Mendota Pool. When spring interim pulse fish flushing flows occur starting in May, existing flow limitations come into play. With current capacity limitations, Interim Flows are limited to about 1300 cfs into the Mendota Pool and only about 50 cfs out of the Mendota Pool and into river Reach 4A. To the extent that out migrating juvenile salmon follow the flow, then at least 96% of these fish will be entrained in the 3000 cfs of total irrigation diversions drawing from the Mendota Pool. Internal flow issues in the Mendota Pool will cause the take percentage to be higher. The settlement envisioned construction of the Mendota Pool Bypass, the Reach 2B improvements, and the Arroyo Canal Fish Screens projects to solve and mitigate this specific issue at a cost estimated at $225 million by Reclamation. The Exchange Contractors estimates indicate the costs will be significantly more than the Reclamation estimate.	Investigations for the needs of fish to successfully meet the goals of the Settlement and the timeline are currently being planned and implemented. Concern over lack of funding is speculative and not considered in the context of addressing the technical merits of channel improvements and salmonid reintroduction.

47	Inadequate Funding: Most significantly, the current lack of assured and adequate funding for the SJRRP will prevent the achievement of the program's goals. When the San Joaquin River Settlement Act was enacted in 2009, four sources of funds were identified to provide some of the monies needed to carry out the Restoration Program amounting to hundreds of millions of dollars for the necessary channel and structural improvements; to operate the salmon reintroduction program; to prevent damage (via flooding and seepage) to downstream lands and infrastructure (such as those owned by the Exchange Contractors); and to accomplish the goal of "reducing or avoiding an adverse water supply impact"" to Friant water users. However, absent additional appropriations, only $88 million is currently available until October 1, 2019 from the federal government (due to "Pago" rules). In light of President Obama's announced freeze on discretionary spending for the next five years, the funding issue appears to be highly problematic. Moreover, it is believed that some $40 million has already been spent by the Federal implementing agencies. The remaining funds, over the next 8 years, are grossly inadequate to carry out the fishery and restoration program that was envisioned at the time of the enactment of the Act.	Concern over lack of funding is speculative and not considered in the context of addressing the technical merits of channel improvements and salmonid reintroduction.

48	Inadequate Environmental Review: Ad hoc environmental review that improperly "piecemeal"" or "segments" review of individual programs without a consideration of the larger SJRRP will result in unnecessary planning delays, uninformed decision-making and deprives the public and stakeholders of the opportunity to meaningfully comment on the SJRRP. The Settlement and the San Joaquin River Settlement Act specifically state that the Secretary must comply with National Environmental Policy Act (NEPA) and other laws and the Settlement provides in paragraph 28 that the Secretary is to "expeditiously complete applicable environmental documentation and consultations as may be necessary to effectuate the purposes of this Settlement." To date, no Programmatic Environmental Impact Statement (PEIS) has been issued to review the SJRRP initiated by the stipulated settlement. From the outset, Reclamation has claimed that it would prepare a PEIS prior to project specific NEPA documents. A large-scale program such as the SJRRP, which is composed of many individual but interconnected programs that have a significant cumulative impact on each other and the program as a whole, compels programmatic review prior to project specific review. With the Interim Flows, Reclamation has released Environmental Assessments (EA) with a Finding of No Significant Impact (FONSI) for each of the first two years of the Interim Flow program. However, each year represent an integral and necessary part of the overall restoration on flows and the water management agreement of the SJRRP and are not separable or of utility in and of themselves, despite Reclamation's contentions to the contrary. Such segmenting of annual Interim Flows is inappropriate and improper under NEPA. Moreover, the EA/FONSI's done to date for the annual Interim Flows willfully ignore the fact that a PEIS is being prepared by Reclamation for the entirety of the SJRRP and fail to address and provide mitigation measures for current and future damage to land and levees from seepage. Similarly, a project-specific environmental assessment of the reintroduction of spring-run Chinook to the San Joaquin River is expected to be released by NMFS. It remains to be seen to what degree the environmental review performed by NMFS is coordinated with the PEIS in preparation by Reclamation. However, it is not proper to contend that the permitting for the spring-run Chinook is an action independent of the SJRRP or that it has "independent utility." We expect a unit feed approach to the entire restoration program. Finalization of the PEIS/PEIR is essential so that the public and interested parties will have an opportunity to comment on the overall restoration program and the alternatives to restoring flows to the San Joaquin River. By failing to develop an integrated and comprehensive approach to restoration, the public and stakeholders are being deprived of the opportunity to consider and comment on the proposed SJRRP.	NEPA analysis shall be performed by NMFS for the approval of the actions identified in the permit application for the reintroduction of Chinook to the San Joaquin River. The San Joaquin River Restoration Draft Programmatic Environmental Impact Statement/Report (PEIS/R) was released for public comment and review on April 11, 2011, with the comment period closing on September 21, 2011. The PEIS/R includes a programmatic analysis of the implementation of the SJRRP, as called for in the Settlement and Act. This programmatic analysis outlines the broad environmental impacts that could occur as a result of the reintroduction of Chinook. The NEPA analysis that will be performed by NMFS, based on their approval of the actions identified in the permit application submitted by USFWS, will identify specific impacts that would occur as a result of this action and will tier off or incorporate by reference the information provided in the PEIS/R related to reintroduction actions. As specified in previous responses to comments for WY 2010, 2011, and 2012 Interim Flows, these actions constitute a complete project under NEPA because they have independent utility and provide useful information on flows, temperatures, fish needs, seepage losses, shallow groundwater conditions, recirculation, recapture, and reuse conditions, channel capacity, and levee stability regardless of the future implementation of actions called for in the Settlement and the Act. These data are useful independent of the SJRRP, particularly with respect to understanding the flood management system and seepage. While WY 2010, 2011, and 2012 Interim Flows is one of the first several steps in implementing the SJRRP, they can be implemented successfully in meeting their purpose and need without any prior or subsequent SJRRP activities.

50	Due Process Concerns: The public participation procedures utilized by NMFS for the review of the USFWS §10(a)(1)(A) Permit Application potentially raise due process concerns. Paragraph 14(a) of the stipulated settlement required the USFWS to submit the Permit Application by September 30, 2010. However, at the time the 10(a) (1) (A) Permit Application was finalized on September 29, 2010, the three foundational documents that comprise the initial technical framework for the Permit Application's project description (the Stock Selection Strategy, the Hatchery and Genetic Management Plan and the Reintroduction Strategies document) were all in draft form. The Permit Application acknowledged that "some discrepancies may exist between draft documents and our application." Subsequently, the Stock Selection Strategy document was finalized in November 2010 and the Hatchery and Genetic Management Plan was finalized on December 17, 2010. However, the Reintroduction Strategies document remained in draft form for all but a few days of the comment period making a complete and informed assessment of the technical underpinning of thee §10(a)(1)(A) Permit Application difficult. A final Reintroduction Strategies document dated February 2011 was placed on the restoresjr.net website, but not the NMFS website, sometime between March 2 and 4, 2011, a few days before the comment period deadline of March 7, 20011. The URL for the document seems to indicate that it was finalized on February 28, 2011. To enable thorough and well-informed comments from the public on the Permit Application, NMFS should have postponed review and comments on the Permit Application pending finalization and release of all foundational technical documents. Moreover, NMFS issued the "Notice of receipt for application for a new scientific research and enhancement permit, notice of public meetings, and request for comment" regarding USFWS §10(a)((1)(A) Permit Application on February 4, 2011 ((Federal Register vol. 76, no. 24). Due to the short review period for such a comprehensive and technical program encompassing numerous background documents and citations to scientific studies, there was insufficient time to thoroughly review the Permit Application in detail. As a result of these concerns, the Exchange Contractors and RMC reserve the right to make additional comments to the SJRRP, in particular to the reintroduction of spring-run Chinook to the SJR, as more information from the implementing agencies becomes available and the SJRRP progresses.	The need for adaptive management for the SJRRP, and for fish reintroduction, is clear, we also have worked diligently to produce the 'well thought out strategy' the commenter describes as necessary. This strategy is evident in the supporting documents (Stock Selection, Reintroduction Strategy and HGMP) developed along with this permit. The SJRRP does provide the avenue for peer review. Both the Restoration Technical Feedback Group and Fisheries Technical Feedback Group are convened by the program to solicit technical input and review by scientists outside the program. This comment addresses an action specific to the NMFS therefore the comment will be addressed by the NMFS.

51	The donor fish collection efforts as well as the reintroduction program are proposed to be guided by an adaptive management approach. While necessary to a degree, it is no substitute for a well thought out initial strategy. An undertaking as large as the SJRRP should not be rushed by arbitrary deadlines. The product of such a rushed effort is the sacrifice of science to the avoidance of confronting an unrealistic schedule. This approach could lead to a never ending cycle of studies and costly enhancement attempts while realistically it may never be possible to establish a self-sustaining population of spring-run Chinook in the San Joaquin River. The long list of uncertainties identified throughout all of the documents and the known extreme variability affecting survival (see page 5-12 of Fisheries Management Plan) attest to this concern. We believe that the use of a quantitative life cycle model rather than only a qualitative model as now proposed would allow the question of biological feasibility of the program to be assessed and periodically updated. Additionally, we recommend the establishment of an independent scientific review process whereby objective scientific assessment can be made of some of the tough issues that the vested parties may be reluctant to address. A similar process has been very effective on the Columbia River system. This is a particularly strong need in this effort where the program was dictated by secret negotiations that compel a course of action without the benefit of scientific peer review, environmental analysis, feasibility studies or public participation.	The need for adaptive management for the SJRRP, and for fish reintroduction, is clear, we also have worked diligently to produce the 'well thought out strategy' you describe as necessary. This strategy is evident in the supporting documents (Stock Selection, Reintroduction Strategy and HGMP) developed along with this permit. The SJRRP does provide the avenue for peer review. Both the Restoration Technical Feedback Group and Fisheries Technical Feedback Group are convened by the program to solicit technical input and review by scientists outside the program.
53	Whether the application was applied for in good faith; (50 CFR § 222.308(c)(1)), whether permit, if granted and exercised, will not operate to the disadvantage of the endangered species; (50 CFR § 222.308(c)(2)), • Whether the permit would be consistent with the purposes and policy set forth in section 2 of the Act; (50 CFR § 222.308(c)(3)), Whether the permit would further a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the endangered species, taking into account the benefits anticipated to be derived on behalf of the endangered species; (50 CFR §222.308(c(4)), • The status of the population of the requested species and the effect of the proposed action on the population, both direct and indirect; (50 CFR§ 222.308(c)(5)), whether alternative non-endangered species or population stocks can and should be used; 50 CFR§ 222.308(c)(7)), Whether the expertise, facilities, or other recourses available to the applicant appear adequate to successfully accomplish the objectives stated in the application; and (50 CFR §222.308(c)(11)), Opinions or views of scientists or other persons or organizations knowledgeable about the species which is the subject of the application or of other matters germane to the application. (50 CFR § 222.308(c)(12)).	50 CFR § 222.308 states, "The Assistant Administrator may issue permits for scientific purposes or for the enhancement of the propagation or survival of the affected endangered or threatened species in accordance with the regulations in parts 222, 223, and 224 of this chapter and under such terms and conditions as the Assistant Administrator may prescribe, authorizing the taking, importation, or other acts otherwise prohibited by section 9 of the Act." The sub-sections the commenter has highlighted are part of the issuance criteria for NMFS to evaluate.

54	As noted above as a general overall comment concerning due process concerns, the short review period provided for such a comprehensive and technical program encompassing numerous background documents and citations to scientific studies provided insufficient time to thoroughly review the Permit Application in detail. In addition, the finalization of foundational technical documents after the 10(a)1(A) Permit Application itself was finalized, most recently the Reintroduction Strategies document, made a complete and informed assessment of the technical underpinning of the 10(a)1(A) Permit Application difficult. Again, review and comments on the Permit Application should have been postponed pending finalization and release of all foundational technical documents in order to provide a meaningful opportunity to consider the program as a whole.	The foundational technical documents (Stock Selection Strategy, HGMP and Reintroduction Strategy) set the framework for the proposed action in the Application. However, the Application is a stand-alone document so the finalization of the founding technical documents was not needed before the Application was submitted.
55	As discussed above as an overall comment, the issuance of the §10(a)1(A) Permit for the salmon reintroduction program with the goal of spring-run Chinook to be reintroduced to the San Joaquin River by December 31, 2012, is far in advance of (a) the establishment of Restoration Flows and (b) necessary structural and channel improvements, both of which are critical to the San Joaquin River. The Fisheries Management Plan (FMP) identifies biological targets such as fry/juvenile/adult salmon survival, minimum juvenile growth rates, and minimum annual production. Whether these targets can be successfully met will in large part depend on the implementation of appropriate habitat improvements, structural modifications, and restoration measures in the San Joaquin River to support salmon survival and growth before reintroduction of spring-run Chinook, as discussed on pages 63-65 of the Permit Application. Such a serious disregard for the habitat necessary to sustain the experimental population within the San Joaquin calls into question the objectives concerning the SJRRP as described in the Permit Application, as well as whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application, and each of the other issues raised in the regulations highlighted in the bullets above. The Exchange Contractors recommend that the reintroduction of spring-run Chinook be coordinated with priority mitigation, habitat and structural improvement work that has to be completed. We recognize that there could be value in collecting a smaller number of fish for study purposes in the San Joaquin River, for example to estimate downstream migration behavior and survival, but to go beyond that at this time would be an unwarranted taking of individuals from a listed population that is already at high risk of extinction.	Investigations for the needs of fish to successfully meet the goals of the Settlement and the timeline are currently being planned and implemented. Concern over lack of funding is speculative and not considered in the context of addressing the technical merits of channel improvements and salmonid reintroduction. Additional new and clarifying language has been added to the Application which discusses existing conditions and habitat evaluations.
56	The Permit Application and HGMP discuss a range of initial in-stream conditions that may limit growth potential and survival rates of introduced eggs and juveniles such as contaminant levels, temperature levels and food availability in the early years of the reintroduction program. However, the Permit Application does not provide details concerning actions to address these issues other than to say that intense restoration work several years after the introductions begin will include establishment of floodplain habitat, creation of in-stream cover, providing shaded streamside riparian habitat and minimizing the limiting reaches.	Several evaluations of the existing habitat conditions and studies are on-going and will continue to provide updated information. Additional new and clarifying language has been added to the Application in the Effects Analysis section.

57	The Permit Application does not acknowledge and sufficiently address the potentially significant impact of predation on juvenile spring-run Chinook survival, in particular predation by bass and other nonnative piscivorous species, in both the lower and upper stretches of the San Joaquin River. It also does not address the actions off the SJRRP Interim Flows in establishing the presence of bass near the Hills Ferry Barrier. There are reports of a substantially increased population in the area of the Hills Ferry Barrier and no measures have been identified to address this predation. Further, bass will migrate to the upper San Joaquin River with similar impacts. Again, the Permit Application and supporting documents fail to address this significant problem.	We are currently conducting and proposing studies during Interim Flow Periods to better refine true survival for juvenile salmonids through the Restoration Area. These studies also address what we believe are the areas that represent potential losses due to predation. The incidental take associated with this Project will be assessed and reported annually, thus allowing the opportunity to incorporate any new information in the request submitted to NMFS for review each year.
58	On pages 46 through 47 and 65 through 66, the Permit Application discusses the possibility of using a trap and haul program to move reintroduced spring-run Chinook around passage impediments still in place in the restoration area in the early years of the program, but does not address the impact of implementing the trap and haul program on projected or assumed spring-run Chinook survival rates.	Studies are planned to assess the effects of a trap and haul program on spring-run Chinook survival.
59	Although we have not had time to adequately assess the current status (extinction risk) of the donor stock, we are aware that returns of adult spring-run Chinook to the Sacramento River system have declined in recent years. Taking additional fish from these at-risk stocks and placing them into the San Joaquin River system, where they assuredly would suffer extremely high mortality, makes little sense under these conditions. If the donor stocks were in healthier condition and the San Joaquin River system habitat considerably improved, it might make sense to initiate the reintroduction effort, but that is not the current situation.	The reintroduction of spring-run Chinook is part of a legal settlement. The Service is the lead agency on the reintroduction as dictated in the Settlement and has responsibility to make a good faith effort to restore Chinook (giving priority to spring-run) to the San Joaquin River. Additionally the Service, as a natural resource agency, has responsibility to not harm existing populations of spring-run Chinook in the process of implementing the Settlement. The Application addresses the necessity of using viability criteria to evaluate any and all potential donor stock collections annually and to submit the request to NMFS for approval.
60	The very fact that the Sacramento spring-run Chinook returns have been so variable over the last couple of decades highlights two additional concerns. First, the Sacramento River Basin stocks have not recovered enough to allow fish to be removed on a yearly basis. This is important because the reintroduction program would likely fail in the long term to establish a self-sustaining run if donor fish were not available every year for the next couple of decades. Second, the fact that the Sacramento spring-run Chinook do not appear to be recovering very fast raises the question of why one would expect the same fish to do any better in the much more highly degraded San Joaquin River.	The Conservation Facility is proposed as the basis for the initial population development for reintroduction. Initial collections of donor stock will be used to produce a broodstock in the Conservation Facility. If collections could only be made opportunistically, those individuals would continue to be added to the broodstock and Conservation Best Management Practices, as outlined in the HGMP for the San Joaquin River, would be used to make the appropriate crosses of available stocks.

61	Donor stock from which the experimental spring-run Chinook for the San Joaquin River will be sourced from drainage systems includes Feather River, Butte Creek and Deer/Mill creeks (preferred alternative chosen by the Genetics Subcommittee of the SJRRP). Out of these, the Feather River spring-run Chinook population appears to be significantly hybridized with fall-run Chinook (FRC), as evidenced by the high level of introgression with FRC genes, and acknowledged in the HGMP. It is also unclear whether the practices recently adopted by the Feather River Fish Hatchery (FRFH) to reduce hybridization between spring-run and fall-run Chinook are having any measurable benefits. Recent genetic analyses (Garza et al. 2008) suggest that Feather River spring-run Chinook are heavily introgressed with FRFH genes and essentially are not genotypically distinguishable as spring-run fish in the way that Butte and Mill/Deer Creek salmon are. Furthermore, the Feather River spring-run stock consists of both hatchery-spawned and naturally-spawned salmon. In contrast, the Butte Creek and Deer/Mill Creek populations show little evidence of introgression and apparently no hatchery influence. As noted in the Stock Selection Strategy document dated November 2010, the genetic risks posed by the Feather River fish due to hatchery fish influence and hybridization of FRFH with spring-run Chinook, prompted the Technical Advisory Committee (TAC) of the San Joaquin Protected Resources Division River Restoration Program to recommend against the use of the Feather River Hatchery stock or any other hatchery origin stock for use in reintroduction (Meade 20007). However, the SJRRP still included the Feather River stock in the preferred alternative (along with Butte and Mill/Deer Creek stocks). The rationale that the Genetics Subcommittee provided for using Feather River spring-run Chinook as part of the donor stock includes the fact that this stock appears to retain remnants of the phenotype and ancestry of the Feather River spring-run, and that through careful management of the broodstock, it may be possible to preserve some component of the ancestral Central Valley spring-run genomic variation.	Feather River Spring-Run stock has the highest genetic diversity of the three primary runs discussed in the foundation technical documents. However, this stock is known to have been affected by hybridization with fall-run Chinook at the Feather River Hatchery (Garza et al. 2008) and hybridization is ongoing (M. Lacy, pers. comm.). It is also likely that hybridization occurs in the spawning grounds of the lower Feather River. So, at least some of the additional genetic diversity seen in the Feather River stock is likely due to the addition of fall-run genes. It is also important to point out that, while this may be unfavorable for the maintenance of phenotypic differentiation, it also reduces the risk of inbreeding in a reintroduction project and the consequent reduction in fitness from inbreeding depression. The Application has been developed both to address the genetic goals, but also ensure consideration for feasibility of donor stock collections. The genetic integrity goal is valid, but the realities of the donor stock status must be taken into account when developing each annual Donor Stock Collection Plan.

62	However, the Genetics Subcommittee acknowledges in the HGMP that there is no reasonable way to predict the outcome in terms of genetic variation and diversity. Overall, given the substantial degree of uncertainty and risk involved with hybridization and hatchery influence in Feather River fish, we recommend that the HGMP further consider the pros and cons of excluding this population from the donor stock. This may include conducting more studies on bloodstock selection before reintroducing spring-run Chinook in the San Joaquin River. Further, the Permit Application and underlying foundational documents do not adequately address the impacts on the assumptions and targets of the reintroduction program of a scenario in which the FRFH is the only or primary source of donor stock.	Feather River Spring-Run stock has the highest genetic diversity of the three primary runs discussed in the foundation technical documents. However, this stock is known to have been affected by hybridization with fall-run Chinook at the Feather River Hatchery (Garza et al. 2008) and hybridization is ongoing (M. Lacy, pers. comm.). It is also likely that hybridization occurs in the spawning grounds of the lower Feather River. So, at least some of the additional genetic diversity seen in the Feather River stock is likely due to the addition of fall-run genes. It is also important to point out that, while this may be unfavorable for the maintenance of phenotypic differentiation, it also reduces the risk of inbreeding in a reintroduction project and the consequent reduction in fitness from inbreeding depression. Each of the three spring-run lineages has biological characteristics that might be favorable for a successful reintroduction project and each also has unfavorable characteristics. The Application has been developed both to address the genetic goals, but also ensure consideration for feasibility of donor stock collections. The genetic integrity goal is valid, but the realities of the donor stock status must be taken into account when developing each annual Donor Stock Collection Plan.
63	As identified in Permit Application, the Conservation Program's target for the experimental population of spring-run Chinook is a minimum annual return of 500 adults by 2019. Although the basis for this target is not identified in the Permit Application, support for the numbers is presented in the Recommendations on Restoring spring-run Chinook to the Upper San Joaquin River (Recommendations Report) prepared by the San Joaquin River Restoration Program Technical Advisory Committee (Meade 2007).	The minimum annual return of 500 adults was developed from the Lindley population criteria. However, the goal of the Conservation Program is to meet the Restoration Goal as stated in the Settlement (naturally producing and self-sustaining population).
64	Discussion presented in the Recommendation Report indicates that the Technical Advisory Committee is aware that an annual run size of greater than 500 adults, perhaps at least 2,500 adults, may be necessary for a viable self-sustaining population. Our reading of the Recommendation Report is that the minimum population size is based on work related to identifying extinction risk of existing salmonid populations and may not be directly related to the minimum population size necessary to provide a viable (self-sustaining) salmonid population for a restoration (i.e., reintroduction) project. We agree with this general concern and further suggest that the 2012-2019 reintroduction period target of 500 adult spawners annually based on one or more of the criteria used to assess the risk of extinction is likely to be too low to provide for a viable salmon population for the following reasons:	The minimum annual return of 500 adults was developed from the Lindley population criteria. However, the goal of the Conservation Program is to meet the Restoration Goal as stated in the Settlement (naturally producing and self-sustaining population).
65	a. Total population size per generation (N) i s not the annual run size, but is approximated by multiplying the annual run size by the generation length, which for Chinook is assumed to be 3 (Allendorf et al. 1997). Using this calculation, the annual run size to satisfy the 2,500 total population criterion should be approximately 830 (2,500 divided by 3).	Allendorf and Lindley's definition of population size as pertaining to generation of 3 years is correctly stated on page 98 of the September 29, 2010, Application. However, Appendix A, and the criteria used to determine donor stock availability has been reconsidered in the Revised Application.

66	b. Conversely, calculating the total population size per generation based on a target annual run size off 500 yields an estimated total population size (NN) of 1,500 ((500 times 3). Using this single criterion would suggest that the population would be at a very high risk of extinction.	Allendorf and Lindley have two population criteria: one based on population size of 2,500 fish over 3 generations and the other based on a minimum of 500 spawners in a given year. There is no basis in either Allendorf or Lindley to change the population criterion to either 500 or 5,000 from 2,500 fish. Furthermore, the example analysis correctly suggests that for fall 2009 escapement estimates, Mill, Deer, and the Feather River Hatchery population all were at a high risk of extinction. The example analysis indicated that in the example given, stock collections would have been proposed for Butte Creek if collections were to have been made in 2010. The level of collection would have been developed using the Donor Stock Collection Plan approach. Appendix A, and the criteria used to determine donor stock availability. have been reconsidered in the Revised Application.
67	c. Similarly, using the calculated total population size per generation (N) based on the 5000 fish target (N = 1,500) and the assumed Ne/NN ratio of 0.2 would provide an estimate of the effective population size per generation (Ne) of 300 (1,500 times 0.2). Using this single criterion would suggest that a population with an effective population size of 3000 would be at a very high risk of extinction.	Allendorf and Lindley have two population criteria: one based on population size of 2,500 fish over 3 generations and the other based on a minimum of 500 spawners in a given year. There is no basis in either Allendorf or Lindley to change the population criterion to either 500 or 5,000 from 2,500 fish. Furthermore, the example analysis correctly suggests that for fall 2009 escapement estimates, Mill, Deer, and the Feather River Hatchery population all were at a high risk of extinction. The example analysis indicated that in the example given, stock collections would have been proposed for Butte Creek if collections were to have been made in 2010. The level of collection would have been developed using the Donor Stock Collection Plan approach. Appendix A, and the criteria used to determine donor stock availability, have been reconsidered in the Revised Application.
68	In summary, the 2012-20019 Reintroduction Period target of 500 adult Chinook annually seems to be based on criteria used to estimate extinction risk (using genetic concerns) that may not be entirely applicable to a reintroduction project. Even if the assumptions underlying the criteria used to identify the target value are valid, the actual target itself may be too low to provide a truly viable population of spring-run Chinook in the San Joaquin River. We recommend that NMFS, USFWS and the Technical Advisory Committee reconsider these assumptions and means for arriving at the target number of adults.	Several interagency technical teams are working to study and evaluate the needs for successful reintroduction.

69	Of the various anadromous salmonid races, spring-run Chinook are probably the most sensitive to environmental modification. They have the most demanding requirements for cool water for all of their life history stages from adult migration, extended pre--spawn holding, spawning, egg incubation, rearing, and outmigration. This is why they historically were confined to higher elevation reaches above about 1500 ft. (NMFS 1998). So, the notion of trying to reintroduce the most environmentally sensitive salmon to the highly altered San Joaquin River appears far-fetched. In general, it would seem highly unlikely to expect a transplanted out-of-basin spring-run Chinook stock to develop into a viable population in the much-altered San Joaquin River even assuming that many of the poor habitat conditions could be improved.	One of the Settlement goals is to develop a naturally reproducing and self-sustaining population of Chinook in the San Joaquin River from Friant Dam to the Merced River. The Settlement also gives preference to spring-run Chinook due to their historical population numbers in the San Joaquin River. The agreed upon restoration hydrographs in the Settlement are also intended to benefit spring-run. Please note that historically, the San Joaquin River had the largest run of spring-run in the system and that run continued in large numbers after Friant Dam was completed.
70	For the reintroduction program to be successful, it must lead to the establishment of a viable self-sustaining population over the long term. Self-sustainability clearly is the goal of the reintroduction program as identified in the stipulated settlement and other program documents. And yet we have not seen in any of the documents a real assessment of the biological feasibility of establishing a sustainable population of spring-run Chinook in the San Joaquin River. The numerous documents highlight uncertainties and challenges associated with the program but only treat them as things to study and address in the future under the "adaptive management" umbrella.	Investigations for the needs of fish to successfully meet the goals of the Settlement and the timeline are currently being planned and implemented.
71	In searching for some notion of whether the reintroduction program would be successful, none of the reports directly address the question of whether the program would be biologically feasible (i.e. sustainable runs). There is much mention of how reintroduction would not be successful now under existing conditions (of course that's why the fish became extirpated), and some optimistic views that it might work if all the major problems were corrected, but does not indicate any prognosis for conditions with the new "Restoration Flows" plus the various structural and channel modifications projects prescribed in the settlement and NMFS recovery plan. Absent a rational strategy, we have an experimental program that will likely cost in excess of $1 billion with little guarantee that it will be successful.	Investigations for the needs of fish to successfully meet the goals of the Settlement and the timeline are currently being planned and implemented.
72	In order to produce a viable population, regardless of the population size, the total survival rate from egg to returning adult spawner must exceed that necessary to replace the parent population in the long term. All of the documents seem to avoid this topic. The discussion of likely survival rates is only briefly discussed on pages 12-13 in the Permit Application. These rates are extremely optimistic and likely unrealistic. Even using the indicated rates, the total survival rate from egg to returned adult (0.0004) is not enough to achieve sustainability (1:1 return ratio)). Our comments on the specific life stage survival estimates cited in the Application are presented below.	Survival studies on eggs and juveniles are currently being planned and conducted that will improve the accuracy of these estimates. The survival estimates presented in the Application represent the best available science at the time it was submitted.

73	Egg-to-fry: The report cites 40% as the estimated survival rate from deposited egg to emergent fry. Yet on page 60 of the Permit Application, it is cited that "survival rates under natural conditions usually do not exceed 40%." So the average expected survival rate would have to be something less than 40%. There is little discussion to support this estimate except to note that it was obtained from studies done on the Tuolumne River under optimal water temperature conditions. There is no discussion of how conditions might differ in the expected spawning area of the San Joaquin River. However, a brief review of existing maximum daily water temperatures recorded 1.5 miles below Friant Dam revealed that temperatures are often suboptimal and sometimes critical for both Chinook spawning and incubation life stages. Implementation of the Restoration Flow schedule may improve conditions somewhat, but still would leave frequent periods of suboptimal conditions. Therefore, the 40% egg-to-fry survival rate cited in the Permit Application is likely an overestimate for application to the San Joaquin River. Furthermore, this estimate does not include any consideration of the anticipated warmer conditions associated with climate change, which would make temperature conditions even worse. Although climate warming impacts are discussed generally in several of the program documents (e.g. Lindley et al. 2007), the expected consequences specific to the success or failure of the reintroduction of spring-run Chinook to the San Joaquin River is not revealed. An accounting of the anticipated warming conditions should be included in the modeling efforts used to project future population growth in the restored spring Chinook runs to the San Joaquin River.	The estimate is based on the best available science from the San Joaquin River Basin. The estimate of 40% egg to emergent survival rates is based on the assumption that the spawning habitat will be enhanced in the Restoration Area to provide optimum survival rates. Adding clean gravel to construct spawning beds in the Project Area is a high priority action. The observed egg survival rate in newly placed gravel should be about 70% during the first few years and then decline to about 40% over time, so the estimate of 40% that was used in the application is conservative.
75	b. Fry-to-smolt: A 5% rate is quoted for fry to migratory smolt. It is difficult to assess this rate because the definition of what is migratory smolt versus a dispersing parr is necessarily vague. Nevertheless, while the rate seems to be supported with references, the applicability to the San Joaquin River is questionable given that migratory conditions in the San Joaquin River are likely much worse than those in the stream(s) from which the rate estimate was derived. Although there are plans to study and address many of the rearing and migratory problems (e.g. predation) in the lower SJR, there certainly will be realistic limits of what can be done in such an altered environment. The likelihood of extremely high predation rates from the known populations of nonnative fish species (e.g. striped, largemouth, and smallmouth bass) occurring in the lower San Joaquin River is especially of concern. Effectively controlling populations of such predatory fish has always been a challenge for fish management agencies.	The fry-to-smolt and the smolt-to-adult survival rates are based on rotary screw trap catch data of naturally produced fall-run Chinook from the Stanislaus River at Oakdale (fry estimates) and Caswell State Park (smolt out-migrant estimates) collected by Cramer Fish Sciences. The preliminary trap efficiency models were developed by Dr. Alan Hubbard, Professor of Biostatistics at UC Berkeley. The smolt-to-adult survival estimates are based on the CDFG GrandTab escapement estimates for the Stanislaus River. The Stanislaus River data were used for three reasons: 1) the data represents the survival of naturally produced fish; 2) the Stanislaus River is similar to the San Joaquin River in terms of gravel mining degradation and high water temperatures in the lower reaches during late spring; 3) the Stanislaus River smolts must migrate through the Delta as would San Joaquin River smolts. The Stanislaus River estimates are useful because they indicate that if fish are transferred directly from donor streams, collection numbers would need to be high, supporting the recommendation for rearing broodstock in the planned Conservation Facility.

76	c. Smolt-to-adult: The cited 2.5% rate for smolt-to-adult survival is simply unrealistically high for sub yearling Chinook smolts even for a river system in good shape. The Permit Application contains no source citation for this rate other than a personal communication, so it was not possible to check the actual data. Although we did not have time to assemble and present alternative data in this comment submittal, our previous reviews of smolt-to-adult survival data for ocean-type Chinook suggest rates that rarely exceed 11.0% and usually average about 0.5%. The Permit Application, in apparent support of their 2.5% rate, cites a reference for the Snake River that indicates a range of 1-5%. However, these rates were taken out of context and are clearly not applicable to the San Joaquin River. Snake River spring Chinook smolts are yearlings, which are much larger than the sub yearling smolts that typify Central Valley spring Chinook smolts. Smaller smolts naturally have lower survival rates.	The fry-to-smolt and the smolt-to-adult survival rates are based on rotary screw trap catch data of naturally produced fall-run Chinook from the Stanislaus River at Oakdale (fry estimates) and Caswell State Park (smolt out-migrant estimates) collected by Cramer Fish Sciences. The preliminary trap efficiency models were developed by Dr. Alan Hubbard, Professor of Biostatistics at UC Berkeley. The smolt-to-adult survival estimates are based on the CDFG GrandTab escapement estimates for the Stanislaus River. The Stanislaus River data were used for three reasons: 1) the data represents the survival of naturally produced fish; 2) the Stanislaus River is similar to the San Joaquin River in terms of gravel mining degradation and high water temperatures in the lower reaches during late spring; 3) the Stanislaus River smolts must migrate through the Delta as would San Joaquin River smolts. The Stanislaus River estimates are useful because they indicate that if fish are transferred directly from donor streams, collection numbers would need to be high, supporting the recommendation for rearing broodstock in the planned Conservation Facility.
77	Applying the life cycle survival rates (0.4 x 0.05 x 0.025 = 0.0004) presented in the Application to the stated (elsewhere) fecundity of 500 eggs/female curiously results in exactly a 1:1 adult return ratio. This raises suspicion that the survival rates were not derived from a sound review of the scientific data but rather arbitrarily selected to give the desired answer. We note too that the fecundity assumption of 500 eggs/female was not supported by references and that a more realistic number is closer to 400 eggs/female (DWR 2003).	We assumed a mean number of 4,200 eggs per spring-run female, which is based on Central Valley data (CDFG 2008; CDFG 1998a) as cited in the Application. In order to reach 500 adult returns in the San Joaquin River, we needed to determine how many individuals of each life stage would be needed for that minimum target of 500 adults. We used the survival estimates provided in the text (with accompanying references), in order to calculate the numbers of individuals at each lifestage for that target.

78	Another factor that was not considered regarding the feasibility of both the reintroduction program and the broodstock collection program is the widely varying natural survival occurring from year-to-year on all Chinook life stages. Some of these variability factors are described on page 5.112 of the draft FMP. These include ((1) up to a 40-fold variability in smolt production from the river systems; (2) a 25-fold range in smolt survival as they pass through the Delta; and (3) a 2.4-fold range in marine survival. In addition, the factors that cause these high rates of variability, such as ocean conditions and droughts, are widely cyclical. Attesting to the cumulative effect of this cyclical variability is the history of run sizes and escapements of Chinook in Central Valley river systems observed since the 1960s. The cyclical nature of these runs is depicted graphically in Figures 2, 3, and 5 in the San Joaquin River Technical Advisory Committee's 2007 report on Recommended Goals, Stocks, and Reintroduction Strategies. Differences in the peaks and valleys are approximately 20-fold for fall-run Chinook, 440-fold for winter-run Chinook, and 20-fold for spring-run Chinook. The important message seen in these cyclical patterns is that they will have a tremendous influence in determining the success or failure of the San Joaquin River spring-run Chinook reintroduction effort. The program to date has not appropriately taken this into account. In the Recommendation Report cited above, Figure 1 shows a potential population growth trajectory with fluctuations for the reintroduced spring-run Chinook out to and beyond year 2040. The graph indicates very minimal variability and basically an increasing trend line. While this may represent a hopeful outcome of the reintroduction program, it certainly is not very realistic in light of the natural cyclical variability that undoubtedly will continue to affect all Chinook stocks in the Central Valley. Consideration of such wide variability provides yet another question mark to the biological feasibility of the reintroduction program. Accounting for this variability can and should be incorporated into a stochastic quantitative life cycle model that would provide a more realistic projection of fish population growth in future years.	The recommended number of fish to be reintroduced into the Restoration Area is based on the minimum number required to sustain a viable population. The Service recognizes the regulatory and biological constraints associated with the reintroduction of a listed species and the Application compares the ideal numbers with what is realistic. The San Joaquin River Restoration Program (SJRRP) will provide habitat conditions suitable for survival and passage that result in the opportunity for a self-sustaining, naturally producing population to develop. The SJRRP is planning to use the Ecosystem Diagnosis and Treatment model in combination with other models and information to predict fish population trends and adapt the process to achieve the SJRRP goals.
79	In light of the above concerns we suggest that the program authors provide a more thorough and accurate account of expected life stage survival rates for spring-run Chinook reintroduced into the San Joaquin River. Furthermore, we recommend that the reintroduction program develop a quantitative life cycle model using realistic life stage survival estimates to address the biological feasibility question. This should provide a good means upon which to measure program success and progress. It could be used in conjunction with the Ecosystem Diagnostic and Treatment (EDT) model that is currently being used to help identify limiting factors and prioritize future actions.	The recommended number of fish to be reintroduced into the Restoration Area is based on the minimum number required to sustain a viable population. The Service recognizes the regulatory and biological constraints associated with the reintroduction of a listed species and the Application compares the ideal numbers with what is realistic. The San Joaquin River Restoration Program (SJRRP) will provide habitat conditions suitable for survival and passage that result in the opportunity for a self-sustaining, naturally producing population to develop. The SJRRP is planning to use the Ecosystem Diagnosis and Treatment model in combination with other models and information to predict fish population trends and adapt the process to achieve the SJRRP goals.

80	The Conservation Facility (i.e., fish hatcheries, both interim and final) will operate under a National Pollution Discharge Elimination System (NPDES) permit. Conservation Facility effluent will be micro-screened and returned to the San Joaquin River. The NPDES permitting process and analyses required by the Regional Water Quality Control Board (RWQCB) during the application processing phase must be protective of San Joaquin River water quality and quantity.	We agree that the water quality in the San Joaquin River watershed must be protective for several reasons including to facilitate meeting the Restoration Goal and protection of wildlife and their habitats.
81	Finally, NMFS regulation 50 C.F.R. § 222.308(b) provides a list of the information required in a §10(a)1(A) permit, some of which appear to be missing from the USFWS Permit Application. • 50 C.F.R. § 222.308(b) (5) (iii)) requires as part of a description of the proposed acts, a copy of the formal research proposal or contract if one has been prepared. A finalized Reintroduction Strategies document, which "details the elements of reintroduction and the management of fish and their progeny in the mainstream of the" SJR, should have been released prior to putting the §10(a)1(A) Permit Application out for public comment. • The Permit Application does not provide the names, qualifications and information concerning the persons or entity which will capture or otherwise take the animals or who will supervise such actions as required by 50 C.F.R. § 222.3008(b) (6) (vi)-(vii). • The Permit Application does not provide all the information required concerning the qualifications and experience of the staff at facilities at which the fish will be maintained; does not provide a written certification from a licensed veterinarian or expert regarding the adequacy of the transport and maintenance of the fish; and does not provide information concerning the availability in the future of such an expert as required by 50 C.F.R. § 222.3088(b) (8) (v-vi)). • The Permit Application does not provide the information required in 50 C.F.R. §222.3008(b) (11) regarding the past experience and practices of the applicant concerning endangered species and/or the species affected by the application. • Finally, the Permit Application appears to be lacking the applicant certification required by 50 C.F.R. § 222.3308(b) (12).	The on-line application process was not well suited for the needs of this project. NMFS advised the Service to enter summary information into the on-line program as appropriate and to submit a complete project description and effects analysis to them directly.
82	The HGMP, a foundational document for the §10(a)(1)(A) Permit Application, is a technical document that provides guidance on the management and operation of the Conservation Facility that will be used to propagate spring-run Chinook as part of the reintroduction effort on the San Joaquin River. The basis for establishing the Conservation Facility and thus the HGMP, is the recognition that natural re-colonization alone is not sufficient to achieve the goal of establishing a self-sustaining population of spring-run Chinook in the San Joaquin River. NMFS evaluates Hatchery and Genetic Management Plans for threatened anadromous fish under the criteria provided in 550 C.F.R. § 2223.203(b) (55).	Additional new and clarifying language has been added to the Application; see the Section titled Conservation Strategy for the San Joaquin River Spring-Run Chinook.

83	The Hatchery and Genetic Management Plan (HGMP) and decisions made under this plan will be guided by the adaptive management strategy described in the Fisheries Management Plan FMP, which recognizes and plans for the myriad sources of uncertainty associated with a project as large and complex as the SJRRP. As such, the HGMP recognizes that all plans for the development and operation of the Conservation Facility would be subject to revision based on this adaptive management approach. Paragraph 19 (b) of the stipulated settlement requires the Secretary to engage with the Exchange Contractors and RMC in a more in-depth manner than through the public process required by regulation. As such, the Exchange Contractors and RMC must be notified in the event of any substantial revisions to the HGMP and must be provided the opportunity to review such revised plans as they become available so that we may better understand how proposed changes to the HGMP may affect water system operations, water supply and land use on the San Joaquin River.	Chapter 19(b) of the Settlement states, "The Secretary, with cooperation of the other Parties, shall provide appropriate opportunities for input from third parties who have an interest in measures to be undertaken pursuant to this Settlement, and for coordination with third parties who own or control facilities or property affected by implementation of such measures. Further, the Secretary, with cooperation of the other Parties, shall provide appropriate opportunities for public participation regarding implementation of this Settlement." In May 2007, Reclamation prepared and provided for public distribution the Public Involvement/Public Outreach Plan (PIP). The PIP outlines the public involvement process for sharing San Joaquin River Restoration Program (SJRRP) information and identifies target audiences, including signatories to the Third Party Memorandum of Understanding (MOU), dated February 26, 2007. The PIP further identifies mechanisms to inform the public and stakeholders about information. These mechanisms include briefings, workshops, reach-by-reach coordination meetings, stakeholder subgroups, websites, publication, e-mail, media, and other public involvement opportunities. The SJRRP will continue to operate in accordance with the Settlement, the Third Party MOU, and the PIP, as appropriate, to disseminate information to the Exchange Contractors and the RMC as well as other interest groups, stakeholders, elected officials, landowners, and the general public.
84	The HGMP Program timeline (Figure ES.1. page viii) has several milestones, commencing with submission of permit applications in September 2010, and ending in 2025 with the planned phase-out of the Conservation Facility pending establishment of self-sustaining spring-run Chinook populations in the San Joaquin River. NMFS must set forth a plan that addresses delays in meeting these milestones and disclose the effect the delays would have on the Program's ability to meet its specific goals, especially within the proposed timeline. For example, what measures are specifically built into the Program's timeline to accommodate for any delays in getting the appropriate permits, in procuring funding or the unavailability of the required level of funding for the conservation facilities, and various uncertainties associated with the salmon bloodstock collection, rearing and reintroduction components (mentioned within the body of thee HGMP) that could potentially delay the overall Program's timeline?	There are no measures specifically built into the Program. Any delays that may develop due to funding, permitting, or construction, and would result in conditions which would not support successful reintroduction, will be taken into account before reintroduction continues.
85	NMFS must also clarify what are the ramifications of any delays in the Program's proposed timeline on water system operations on the San Joaquin River. For example, the HGMP states that if the return target of 500 "wild" spring-run Chinook is not met in 2019 or any year thereafter, the monitoring data will be reviewed and restoration strategies assessed to recommend refinements in management actions to improve returns. What types of revisions and refinements in proposed management action could be prescribed that would potentially affect water system operations and water supply and land use on the SJR?	This comment addresses an action specific to the NMFS therefore the response will be prepared by the NMFS.

86	A breakdown of the long--term operational and monitoring costs and sources of funding for the full-scale Conservation Facility is provided. What is the approximate capital cost of this facility? What are the sources of funding? Further, what are the prospects for successfully procuring this funding in a timely manner, so that the full-scale Conservation Facility may begin its operations as proposed in the summer of 2014?	Paragraph 14(a) of the Settlement states "The Secretary, through the FWS, and in consultation with the Secretary of Commerce, the CDFG, and the Restoration Administrator, shall ensure that spring and fall-run Chinook are reintroduced at the earliest practical date after commencement of sufficient flows and the issuance of all necessary permits." Reclamation, CDFG, FWS, and NMFS will continue to coordinate on aspects of salmon reintroduction to ensure meeting habitat and flow requirements for fish survival in the San Joaquin River. Further, Sec. 10011(c)(3) of Public Law (PL) 111-11 explains that the 4(d) rule issued "shall provide 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." Reclamation is coordinating and will continue to coordinate with third parties to meet this need. PL 111-11, Sec. 1004(g)(3) also says "The Secretary shall reduce Interim Flows to the extent necessary to address any material adverse impacts to third parties from groundwater seepage caused by such flows that the Secretary identifies based on the monitoring program of the Secretary." Reclamation is currently undertaking efforts to identify and manage potential groundwater concerns with adjacent landowners, as stipulated in PL 111-11 and will continue to monitor and address these concerns. Planning and environmental work necessary for the construction of channel capacity improvements and the installation of fish screens is ongoing and will continue to occur. Concern over lack of funding is speculative and not considered in the context of addressing the technical merits of channel improvements and salmon reintroduction.
87	It appears that the operational and monitoring (O&M) funds currently available to the State are insufficient to support the full-scale Conservation Facility, and that cost sharing is being explored between California Department of Fish and Game (CDFG) and others to procure the appropriate level of funding. Has CDFG identified alternate strategies for procuring O&M funds in case the cost sharing measure proves to be unsuccessful for any reason?	The State of California is anticipating funding for the capital budget for the Conservation Facility and the O&M costs to be covered by the Bureau of Reclamation.

88	In the discussion on pages 73-74 regarding the total number of broodstock to be collected from each source population, it was stated that collection goals are based on the number of fish necessary to capture the genetic diversity of the source stocks. Further, it was stated that all three populations (Feather River, Butte Creek, Deer/Mill Creek populations) should be used in roughly equal proportion, as using one population at a much higher level than the other would overwhelm the genetic diversity in the other smaller populations. The HGMP fails to properly consider the consequences if the Feather River populations is the only one available for sourcing broodstock at the time of collection? As previously discussed, the Feather River spring-run population has significant levels of hybridization with fall-run Chinook and also likely consists of both hatchery-spawned and naturally-spawned fish which could prove problematic for adhering to the goal of maintaining the genetic integrity of spring-run Chinook stock and inclusion of non-hatchery fish in the broodstock, especially if the Feather River population is the only one from which the broodstock could be sourced.	Feather River spring-run stock has the highest genetic diversity of the three primary runs discussed in the foundation technical documents. However, this stock is known to have been affected by hybridization with fall-run Chinook at the Feather River Hatchery (Garza et al. 2008) and hybridization is ongoing (M. Lacy, pers. comm.). It is also likely that hybridization occurs in the spawning grounds of the lower Feather River. So, at least some of the additional genetic diversity seen in the Feather River stock is likely due to the addition of fall-run genes. It is also important to point out that, while this may be unfavorable for the maintenance of phenotypic differentiation, it also reduces the risk of inbreeding in a reintroduction project and the consequent reduction in fitness from inbreeding depression. Each of the three spring-run lineages has biological characteristics that might be favorable for a successful reintroduction project and each also has unfavorable characteristics. The Application has been developed both to address the genetic goals, but also ensure consideration for feasibility of donor stock collections. The genetic integrity goal is valid, but the realities of the donor stock status must be taken into account when developing each annual Donor Stock Collection Plan.
89	The Conservation Facility program has planned several studies to fill data gaps that will help better inform the program on salmon conservation, reintroduction strategies. Some of these planned studies will be conducted in off-site laboratories, and others in-situ in the San Joaquin River. Four out of these ten listed studies will be conducted in the San Joaquin River (Acoustic Telemetry, Juvenile Predation, Egg Survival, and Juvenile Migration Survival). What are the implications of these studies on the water system operations, water supply and land use in the San Joaquin River during the course of these studies?	Effects to the existing water system operations, water supply and land use along the San Joaquin River, is not anticipated during the course of these studies. These studies will be implemented in accordance with all applicable environmental regulations including NEPA.
90	That the well-being of "donor stocks" be placed above that of the experimental populations in the San Joaquin River. Deer Creek is home to the last pure strains of wild spring-run Chinook and contains confirmed functional spring-run habitat that has not been used to capacity for some time. The salmon's stability should not be jeopardized to establish an experimental population in experimental habitat. We recommend that fish from hatchery systems be used until the system is functionally supporting all life stages of spring-run salmon and then only when Deer Creek stocks can sustain the loss of donor fish should these fish be introduced into the program.	The Service has the responsibility to and will thoroughly investigate potential stock sources to ensure our activities do not have a significant negative impact to the donor stock populations. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
91	That life stages and methods of collection/transportation be best fitted to each system with practical elements such as access, weather, and timing be given full consideration before any recommendation is made. Deer Creek is largely a rugged and remote watershed and needs to be considered on an individual basis. Previous attempts at collection and transportation of fish from outside watersheds should be referenced when making decisions.	The Service agrees it is important that all potential donor stock populations be evaluated annually, and that the criteria are sound before developing the annual Donor Stock Collection Plan. These elements are included in the Application. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.

92	That local landowners, agencies, and conservation groups be included in the decision making process that affects their watershed and be kept apprised of the proceedings throughout the duration of the project. These groups are by far the most familiar with the Deer Creek watershed and have strong working relationships. It is critical to the success of this project and to any other projects in the watershed that you utilize this local knowledge and expertise.	The Service agrees it is critical to the success and evolution of the SJRRP that everyone with a stake be involved if they choose to be. Therefore the Service and the SJRRP is continuing to do outreach to the local stakeholders and are participating in discussions to gather input and disseminate information as the process moves forward. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
93	While it appears that Mill and Deer Creek fish are effectively treated as one population for donor requirements, it is unclear whether or not they will be evaluated for having stocks stable enough to sustain donor losses on an individual or group basis. For example, if the minimum population is determined to be 500 fish for a number of years to be considered eligible to donate fish, these minimums need to be met for each creek rather than for both combined.	Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
94	That collection and distribution of donor fish be done in such a way that it minimizes or eliminates the waste of fish and funds. That donor fish and/or their offspring be released into a system that has adequate flows and habitat to facilitate their migration, spawning, and the rearing of juveniles. Until the system has met these requirements, wild stocks should not be used.	Any plans to use wild stocks of Chinook will incorporate risk assessment and appropriate mitigating measures to maximize survival and success.
95	Proposed quota criteria and collection methods are not protective enough of the donor stock since two of the primary proposed donor spring-run populations (Butte Creek and Mill/Deer Creek Complex) are within a federally Threatened ESU and, along with the third primary donor population (Feather River Hatchery), have recently declined to high risk of extinction.	If granted, the §10(a)1(A) permit will be held by the Service, and thus the responsibility to provide NMFS with assurance that the process proposed in the Application is adequate to determine donor stock populations are not negatively impacted. Also, the Interagency technical workgroups are made up of experts from the Service, NMFS, CDFG, Reclamation and DWR as well as local experts. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
96	Existing conditions in the San Joaquin River Restoration Area and areas downstream will not support the experimental population, and, until restoration is completed, even the proposed transport, culture, and release methods will not compensate for inadequate existing conditions.	The schedule for the channel and structural improvements are outlined in Paragraph 11(a) of the Settlement. The implementing agencies are evaluating the current habitat conditions of the San Joaquin River as well as the Settlement timeline. The anticipated short residency time of spring-run during the initial reintroduction and the several year lag prior to the initial adult returns provide greater flexibility in the completion of the restoration activities. The amount and quality of existing habitat may be sufficient to initiate the process of restoring salmonid populations.
97	Non-native predators, extant in the SJR, will predate juveniles from the experimental population and their progeny—the SJRRP should consider identifying/quantifying predators and implementing predator control strategies before introducing eggs and juvenile spring-run fish.	Further evaluation of the size, location, and potential for predation within the pools and at the in-river gravel excavation sites in the Restoration Area is anticipated. The acoustic telemetry study with fall-run juveniles completed in the spring of 2011, is currently being evaluated and will provide further insight into the current predation risks in the San Joaquin River. Subsequent studies will further evaluate this issue.

98	Predation on juvenile salmonids, including the experimental population and their progeny, can be exacerbated by poor existing conditions in the San Joaquin River. If not predated prior to exiting the Restoration Area, juveniles from the experimental population and their progeny will be susceptible to high rates of predation in the lower San Joaquin River and Delta.	Further evaluation of the size, location, and potential for predation within the pools and at the in-river gravel excavation sites in the Restoration Area is anticipated. The acoustic telemetry study with fall-run juveniles completed in the spring of 2011, is currently being evaluated and will provide further insight into the current predation risks in the San Joaquin River. Subsequent studies will further evaluate this issue. The restoration of channel structures and fish barriers will be key in limiting the number of predator pools. This challenge will be thoroughly considered in the design of the structural modifications. If the timing of out-migrating juveniles from the San Joaquin River matches those of the out-migrating fall-run juveniles from the San Joaquin River tributaries (Merced, Stanislaus, etc.), this may induce a 'swamping' effect on the predators with a high prey density, thus enhancing the likelihood of higher individual survival.
99	Expected egg mortality rates are grossly underestimated, and water temperatures in the spawning reach will not support spring-run spawning or egg incubation.	Survival estimates are based on the best available science from the San Joaquin River Basin. Survival estimates were developed using available data and literature on extant populations of fall run in the San Joaquin Basin. A range of survival is given for each life stage to represent the variability present in those estimates. The program is an adaptive management framework and we will adjust our estimates as we receive new information. The estimate of 40% egg to emergent survival rates is based on the assumption that the spawning habitat would be enhanced in the Restoration Area to provide optimum survival rates. Adding clean gravel to construct spawning beds in the Project Area is a high priority action. The observed egg survival rate in newly placed gravel should be about 70% during the first few years and then decline to about 40% over time. So the estimate of 40% that was used in the application is conservative. Restoration flow releases during the fall (spawning and incubation) are anticipated to be of adequate temperature and volume to support these activities.
100	The possibility that high water temperatures, in combination with other factors such as poor survival through the Delta and in the ocean, may entirely preclude establishing a viable salmon population, has not been adequately addressed.	The hydrograph agreed to within the Settlement will mimic the historical flows of the San Joaquin River under which the historic San Joaquin River population of spring-run Chinook existed and thrived. The Service will continue to study and evaluate the flows regimes outlined in the hydrograph for successful reintroduction.
101	Climate change models have predicted scenarios of increased water temperatures in Central Valley rivers over the next 10 years; the reintroduction plan does not sufficiently consider the implications of these climate change scenarios on the experimental population or its progeny.	Climate change is an aspect of both NEPA and CEQA and will be part of that environmental analysis for the reintroduction. Although no specific studies focused on climate change are planned at this time, studies addressing the effects of climate change on this project may be conducted in the future.

102	It has been proposed that salmon will adapt over time, but existing populations in the Stanislaus, Tuolumne, and Merced Rivers have had the opportunity to adapt over successive generations and are still struggling to persist.	The San Joaquin River was once home to the largest run of spring-run Chinook in the Central Valley of California. Spring-run persisted in large numbers below Friant Dam for years until the flows were curtailed and the river was disconnected. This supports the premise that spring-run can persist over time in a connected San Joaquin River.
103	Fall-run populations in the lower San Joaquin River are already experiencing declines for multiple reasons—and fish from these populations are not exposed to the additional challenges that spring-run will experience. Spring-run survival is expected to be even lower than fall run and would be unsustainable under the proposed reintroduction methods.	The Service is working to address challenges and concerns of fish survival through studies during the Interim Flow periods. Data from these studies will help inform future decisions. Additional text on on-going studies has been added to the Application.
104	Survival estimates used to predict potential returns are too high for every life-stage considered, and lack confidence intervals, and therefore the numbers being stocked will not produce the desired conservation goal.	Survival estimates were developed using available data and literature on extant populations of fall run in the San Joaquin Basin. A range of survival is given for each life stage to represent the variability present in those estimates. The program is an adaptive management framework and we will adjust our estimates as we receive new information.
105	Proposers are aiming for an eventual spring-run population of 500 fish in the SJR, but a population consisting of 500 fish still represents a moderate extinction risk.	The Service agrees a population of 500 fish still represents a moderate extinction risk. For our purposes the 500 returning adults is a minimum number but the overall Conservation Program goal is a naturally producing and self-sustaining population.
106	The extent and exact nature of much of the existing conditions in the San Joaquin River have not been quantified, and restoration is planned for after re-introductions have occurred. There are 37 studies planned to address unknown conditions in the San Joaquin River. We suggest that these studies, and adequate restoration actions to address needs identified in these studies, be conducted before introducing spring-run salmon.	Several of the planned studies have already begun prior to the reintroduction, for instance, the first juvenile survival and acoustic telemetry study was conducted in the spring of 2011, and the spawning gravel study (egg survival) will be begin in the fall of 2011.
107	Reintroduction of spring-run Chinook to the SJR, as well as SJRRP Restoration Flows, may negatively affect fall-run Chinook (FRCS) Essential Fish Habitat (EFH) in nearby tributaries, FRCS populations in the San Joaquin River and its tributaries, and federally Threatened Central Valley steelhead in the San Joaquin River or in proposed donor streams.	The hydrograph agreed to within the Settlement will mimic the historical flows of the San Joaquin River under which the historic San Joaquin River population existed and thrived.

108	Feather River hatchery (FRFH) introgression has been found to be a major threat to the genetic integrity of wild stocks, yet the SJRRP still included these stocks as an option for reintroduction.	Feather River Spring-Run stock has the highest genetic diversity of the three primary runs discussed in the foundation technical documents. However, this stock is known to have been affected by hybridization with fall-run Chinook at the Feather River Hatchery (Garza et al. 2008) and hybridization is ongoing (M. Lacy, pers. comm.). It is also likely that hybridization occurs in the spawning grounds of the lower Feather River. So, at least some of the additional genetic diversity seen in the Feather River stock is likely due to the addition of fall-run genes. It is also important to point out that, while this may be unfavorable for the maintenance of phenotypic differentiation, it also reduces the risk of inbreeding in a reintroduction project and the consequent reduction in fitness from inbreeding depression. Each of the three spring-run lineages has biological characteristics that might be favorable for a successful reintroduction project and each also has unfavorable characteristics. The Application has been developed both to address the genetic goals, but also ensure consideration for feasibility of donor stock collections. The genetic integrity goal is valid, but the realities of the donor stock status must be taken into account when developing each annual Donor Stock Collection Plan.
109	There is no consideration given to the potential for broodstock (mixed from various populations) to stray and spawn with natural populations (Butte, Mill, and Deer creeks) resulting in hybridization of the last remaining spring-run populations in the Central Valley.	Hybridization is defined as introgression of two species. The mixing of genetic material from the donor stocks may aid in the persistence of some donor stocks by increasing the genetic diversity of the population. A good example is the Butte Creek population which has gone through bottlenecks in its history and has very low genetic diversity. This low genetic diversity puts the population at a higher risk of extinction. Straying may lower extinction risk in some populations. However, Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
110	Document is not clear about how many fish or from where they will be taken.	Based on our continued interagency technical workgroups discussions and documentation, additional new and clarifying language has been added to the Application. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
111	The donor stock collection plan is not specific enough for 30 day response time.	Based on our continued interagency technical workgroups discussions and documentation, additional new and clarifying language has been added to the Application.
112	In the life of the permit the Appendix A criteria will prohibit take of Mill Creek and Deer Creek fish. So, why include them? If important for genetics, develop different criterion or take approaches, (e.g. eggs for broodstock maybe at year 6-7.)	The criteria listed in the permit application were cited to highlight that the populations under consideration are highly imperiled and that consideration of that will be used to determine numbers for collection from the stock to both meet the Conservation Facility goals and be protective of existing stocks. However, Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.

113	Donor stock collection plan process and Appendix A need to be tested. Then re-written for something that can be applied.	The Service and other Implementing Agencies are in the process of further refining and studying the criteria to aid in the annual donor stock collection decision. The Service has requested participation from many of the donor stream experts. Additional new and clarifying language has been added to the Project Description section within the Application. We agree and will test the validity of the process prior to implementation of the process. However, Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
114	The take criteria needs to be reworked, more justification and documentation is needed to justify the take levels. Why 15% of the population? How will you prove that it's 15% of populations when you don't know the pop. numbers before the run is over?	The September 29, 2010, Application stated that "If all of the above criteria are met, then the total approved numbers for collection will be scaled to no greater than 15 percent of the run. The percentage was based on the 2001, Broodstock Collection Plan for winter-run Chinook, as was permitted when winter-run numbers were extremely low and there were serious concerns about the viability of run. During recent discussion with NMFS the Service has agreed to remove this criterion from the Revised Application and Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
115	Make sure that all of the population numbers match up and are pertinent to the proposed study. The amount of numbers in the document are confusing.	Based on our continued interagency technical workgroups discussions and documentation, additional new and clarifying language has been added to the Application.
116	Put language into the document to exclude watersheds that cannot or will not be used due to your own exclusion criteria.	The Decision Matrix criteria suggested in Appendix A, of the September 2010, Application has been reevaluated and now outlines the importance of following the donor stock collection criteria to ensure there is minimal or no effect on the donor populations. Butte, Mill and Deer creeks are no longer being considered donor stock collection sources in the Revised Application.
117	The project description needs to be clearer, perhaps the project overview should be moved to the project description area.	Based on our continued interagency technical workgroups discussions and documentation, additional new and clarifying language has been added to the Application.

16. DEFINITIONS AND ACRONYMS

AFRP: Anadromous Fish Recovery Plan; The Central Valley Project Improvement Act (CVPIA) directed the Secretary of the Interior to develop and implement a program that makes all reasonable efforts to double natural production of anadromous fish in Central Valley streams. The program is known as the Anadromous Fish Restoration Program (AFRP).

CDFG: California Department of Fish and Game

Conservation Stock: Any individual Chinook, at any life stage which is physically in the possession of the salmon reintroduction team, (i.e. the fish has been collected from donor stock and is being transported to a hatchery or for direct release into the San Joaquin River, or is being held within a hatchery facility for rearing or for use as broodstock).

Direct Release: The release of any fish from any source directly into the San Joaquin River Restoration area.

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 annual formal request made to NMFS via the Service for donor stock collections then sent to DFG for concurrence.

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.

ECPMG: Environmental Compliance and Permitting Working Group

ESA: Endangered Species Act. The law is administered by the Interior Department's U.S. Fish and Wildlife Service and the Commerce Department's National Marine Fisheries Service.

ESU: Evolutionarily Significant Unit: A sub-portion of a species that is defined by substantial reproductive isolation from other conspecific units, and represents an important component of the evolutionary legacy of the species.

Experimental Population: A geographically described group of reintroduced plants or animals that is isolated from other existing populations of the species. For the purposes of the SJRRP, any spring run Chinook released into the San Joaquin River restoration area is anticipated to be considered part of the experimental population.

Experimental Stock: Any group of salmon upon release into the San Joaquin River Restoration Project area is identified as experimental stock. These can be from Donor Stock (for translocations) or Conservation Stock (if transported or indirectly released from the hatchery)

FMP: Fisheries Management Plan

FMWG: Fish Management Working Group

FRFH: Feather River Fish Hatchery

GrandTab: A compilation of sources estimating the late-fall, winter, spring, and fall-run Chinook populations for streams surveyed. Estimates are based on counts of fish entering hatcheries and migrating past dams, carcass surveys, live fish counts, and ground and aerial redd counts. Estimates are provided by the California Department of Fish and Game, the US Fish and Wildlife Service, the California Department of Water Resources, the East Bay Municipal Utilities District, the Pacific Gas and Electric Company, and the Fisheries Foundation of California.

HGMP: Hatchery and Genetics Management Plan

IEP: The Interagency Ecological Program; a consortium of nine State and Federal agencies, has been monitoring aquatic organisms and water quality in the San Francisco estuary since about 1970.

Indirect Release: Refers to the release of fish from any rearing facility or structure into the San Joaquin River Restoration area. This may include the use of instream incubators like Whitlock-Vibert boxes.

NMFS: United States Department of Commerce, National Marine Fisheries Service.

PMP: (SJRRP) Program Management Plan

PMT: (SJRRP) Program Management Team

RA: (SJRRP) Restoration Administrator

Relocation: Any transport of Conservation Stock where the source and destination locations are fully protected pursuant to §7 of the ESA.

Reintroduction: Re-establishing a population or species to an area previously occupied by the species.

RST: Rotary Screw Trap

SJRRP: San Joaquin River Restoration Program

Spring-running other: Spring or summer in migrating adult fish found in streams or tributaries without an existing spring-run Chinook population.

Surplus: Fish remaining after the FRFH has met their production goals. Currently these surplus fish have been released back into the river, euthanized or allowed to die on site.

Take: A regulatory term within the ESA, as defined to mean: harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.

Translocation: The transport of Donor Stock directly to a release site within the San Joaquin River Restoration area.

Service: United States Department of the Interior, Fish and Wildlife Service