Findings of Fact
of the
California Department of Fish and Wildlife

Under the California Endangered Species Act
(Fish & G. Code, § 2050 et seq.)
for the project proposed by

California Department of Water Resources
in reliance on and regarding the

Construction and Operation of Dual Conveyance Facilities of the State Water Project (California WaterFix) and the Bay Delta Conservation Plan/California WaterFix Final Environmental Impact Report/Environmental Impact Statement

Incidental Take Permit No.
2081-2016-055-03

July 2017

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I. INTRODUCTION

The California Department of Fish and Wildlife (CDFW) prepared these findings to comply with requirements established by the California Endangered Species Act (CESA). (Fish & G. Code, § 2050 et seq.) Regulations promulgated by CDFW implementing CESA require certain findings by CDFW under CESA and the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) prior to approving an Incidental Take Permit (ITP) under section 2081 of the Fish and Game Code. (Cal. Code Regs., tit. 14, § 783.5, subd. (c).) These findings are intended to comply with the findings requirement under CESA. CDFW's related CEQA findings are set forth in a separate document.

Pursuant to Fish and Game Code section 2081, CDFW adopts these findings as part of its approval of an ITP related to construction and operation of the California WaterFix Project (Project). The ITP issued by CDFW to the California Department of Water Resources (DWR/Permittee) is for incidental take of Giant garter snake (GGS), California tiger salamander (CTS), Swainson's hawk, Tricolored blackbird (TRBL), Delta smelt (DS), Longfin Smelt (LFS), Spring-run Chinook salmon (CHNSR), and Winter-run Chinook Salmon (CHNWR), collectively identified in this document as the "Covered Species."

II. BACKGROUND

A. Construction and Operation of Dual Conveyance Facilities of the State Water Project (California Water Fix)

The Department of Water Resources (Permittee) will build new water conveyance facilities to divert water from the Sacramento River in the north Sacramento-San Joaquin Delta (Delta) to south Delta pumping plants. Water will be conveyed by gravity through two underground tunnels to pumping plants at the northeast corner of Clifton Court Forebay (CCF). The Project includes the construction of new facilities and, once those facilities become operational, operations of the State Water Project (SWP) in the Delta using those new facilities and existing facilities. Currently, the Permittee's take associated with operations of the SWP in the Delta is authorized under CESA through ITP No. 2081-2009-001-03, issued February 23, 2009 for LFS, Consistency Determination No. 2080-2011-022-00, issued October 14, 2011 for DS, and Consistency Determination No.2080-2012-005-00, issued April 26, 2012 for CHNSR and CHNWR.

<u>Construction</u>: Permittee will undertake the following activities within the Project Area during Project construction: geotechnical exploration; North Delta Diversion (NDD) intake construction, tunneled conveyance (including safe haven access); the Intermediate Forebay (IF); CCF expansion and modifications; canal construction for connection to the Jones and Harvey O. Banks (Banks) pumping plants; Head of Old

River (HOR) Gate construction; barge landing construction and operations, temporary work areas, temporary access roads, reusable tunnel material (RTM) storage, and power supply and grid connections construction (ITP Attachment 1, Figures 4-10). These Project components and related construction activities are described in the *Conveyance Facility Construction Activities* subsection of the Project Description of the ITP. Construction may occur at any point within construction sites, the safe haven corridor, the transmission line corridor and the geotechnical corridor (ITP Attachment 1, Figures 4-10), and construction may occur at multiple locations simultaneously.

<u>Operations</u>: The Project includes operations of both new and existing water conveyance facilities in the SWP, including coordinated operations with the U.S. Bureau of Reclamation (Reclamation) through the joint Central Valley Project (CVP)/SWP facilities in the Delta which are described in the *Project Operations* subsection of the ITP Project Description. New and existing water conveyance facilities (such as pumping plants, outfalls, control gates, barriers, and distribution systems) included in the Project are the NDD intakes, south Delta export facilities, HOR Gate, North Bay Aqueduct (NBA), Georgiana Slough Non-Physical Barrier (NPB), and Suisun Marsh Facilities (Roaring River Distribution System [RRDS], Morrow Island Distribution System [MIDS], and Suisun Marsh Salinity Control Gates [SMSCG]) (ITP Attachment 1, Figures 1-3). The Project also includes ongoing maintenance of Project transmission lines. The Project will enable joint management of new north and existing south Delta water diversions, collectively called dual conveyance. The Project will enable joint management of new north and existing south Delta water diversions, collectively called dual conveyance.

<u>Location</u>: Construction and operation of the Project will be located within the legal Delta and Suisun Marsh (Project Area)[1]. The California Water Fix tunneled conveyance facilities and alignment, transmission line corridors, and geotechnical exploration corridor will be located within the Delta in Sacramento, San Joaquin, Contra Costa, and Alameda Counties. Project operations facilities will be located within Suisun Marsh and the Delta in Sacramento, San Joaquin, Contra Costa, Napa, and Solano Counties (see ITP Attachment 1, Figures 1-10).

Project operations will be in all fish-bearing waterways within the legal Delta and Suisun Marsh, including rivers, sloughs, and other channels. Project operations facilities will be located from the Barker Slough pumping plant, Solano County, to the Napa River watershed, Napa County; in Suisun Marsh, Solano County, at Morrow Island, Goodyear Slough, Montezuma Slough, Roaring River, and immediately north of east Honker Bay; and at the Delta Cross Channel (DCC) on the Sacramento River, extending south along the Sacramento River and Georgiana Slough to the North Mokelumne River, in Sacramento County (see ITP Attachment 1, Figures 1-3).

<u>Covered Activities</u>: Project activities contemplated under the ITP are detailed in the permit and include the following: geotechnical exploration, construction of safe haven work areas (which includes site clearing and grading), NDD intake construction and barge landing construction and operation (including site clearing and grading, cofferdam

[1] Each specific location will hereafter be referred to as a “construction site.”

installation, levee clearing and grading, riprap installation, dredging, and pile driving), operation of barges, construction of tunneled conveyance facilities (including site clearing and grading), CCF modifications (including relocating transmission towers, expansion and dredging of south Clifton Court Forebay (SCCF), construction of divider wall and east/west embankments, dewatering and excavation of north Clifton Court Forebay (NCCF), construction of NCCF outlet canals and siphons, construction of a SCCF intake structure and a NCCF emergency spillway), construction and maintenance of power supply and grid connections, construction and operation of the HOR Gate, reusable tunnel material (RTM) placement and storage, construction or improvement of access roads, construction of a new connection canal between the CCF and the Banks Pumping Plant, and other activities within the Project Area described in the Project Description section of the ITP (Covered Activities).

B. Environmental Review Process

On July 21, 2017, DWR, the lead agency under the California Environmental Quality Act (CEQA), certified the *Bay Delta Conservation Plan/California WaterFix Final Environmental Impact Report/Environmental Impact Statement* (Final EIR/EIS), which includes the document entitled, *Developments after Publication of the Final EIR/EIS* (State Clearinghouse No. 2008032062), issued findings of fact in accordance with CEQA, and adopted a statement of overriding considerations. DWR approved Alternative 4A, the California WaterFix. The Final EIR/EIS analyzed the significant environmental effects resulting from implementation of the Project, and various potentially feasible alternatives, as well as identified various mitigation measures and project design features to avoid or minimize the identified significant environmental effects. As required by CEQA, DWR also approved a Mitigation Monitoring and Reporting Program (MMRP). DWR issued the *Bay Delta Conservation Plan/California WaterFix Final Environmental Impact Report/Environmental Impact Statement* in December 2016 and the *Developments after Publication of the Proposed Final Environmental Impact Report*, on July 21, 2017. Together, these documents comprise the Final EIR certified for purposes of CEQA.

CDFW is a responsible agency under CEQA with respect to the Project. (See Cal. Code Regs., tit. 14, § 783.5, subd. (c).) CDFW's related CEQA findings are set forth in a separate document.

C. Requested Authorizations

DWR anticipates three authorizations from CDFW that represent the extent of CDFW's existing approval authority related to the Project Area. DWR requested two of these authorizations through its "State Incidental Take Permit Application for the Construction and Operation of Dual Conveyance Facilities of the State Water Project" to CDFW.

DWR requests the first authorization pursuant to CESA for incidental “take”[2] of Covered Species that could result from construction and operation of the Project within the Project Area, i.e., the Covered Activities. DWR submitted its ITP application in October 2016. As demonstrated by the record, and consistent with CESA’s implementing regulations and CDFW’s exercise of its independent judgment, CDFW consulted with DWR regarding its application and during the development of the ITP. (See Cal. Code Regs., tit. 14, §§ 783.2, subd. (b). 783.5, subd. (c).) This included requests for additional information from the applicant (see Cal. Code Regs., tit. 14, § 783.5, subd. (b)), coordination with federal fish and wildlife agencies in the federal Endangered Species Act Section 7 process, and participation in an independent scientific review of aquatic species analyses. CDFW engaged in such ongoing coordination to clarify Project details and analyses and to inform the technical and scientific bases underlying its decision to issue the ITP, as set forth in detail in these findings.

DWR requests the second authorization pursuant to the Native Plant Protection Act for incidental take of a rare plant, Mason's lilaeopsis (Lilaeopsis masonii), that could result from the construction of the Project. This second authorization is not being issued at this time and will be addressed by CDFW in the future. As the third authorization, CDFW anticipates receiving a notification in accordance with section 1602 of the Fish and Game Code. DWR has not yet submitted a notification. These findings are associated only with the CESA authorization for the Project.

III. Covered Species Take and Authorizations

A. Covered Species

As noted above, DWR’s ITP application seeks an ITP based on the information presented in the Final EIR/EIS, DWR’s “State Incidental Take Permit Application for the Construction and Operation of Dual Conveyance Facilities of the State Water Project” to CDFW, DWR’s responses to CDFW requests for information, and other information included in CDFW’s administrative record of proceedings. The ITP application seeks incidental take authorization under CESA (in reliance on the Final EIR/EIS, DWR findings, and record) for Project construction and operation, which are described specifically in the ITP application and the Final EIR/EIS.

The ITP grants incidental take authorization under CESA until December 31, 2042, for the following species:

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[2] For purposes of CESA, “take” means hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code § 86.) See also *Environmental Protection Information Center v. California Department of Forestry and Fire Protection* (2008) 44 Cal.4th 459, 507 (“‘take’ in this context means to catch, capture or kill”).

Name	**CESA Status**[3]
Giant garter snake (*Thamnophis gigas*)	Threatened[4]
California Tiger Salamander (*Ambystoma californiense*)	Threatened[5]
Tricolored blackbird (*Agelaius tricolor*)	Candidate[6]
Swainson's Hawk (*Buteo swainsoni*)	Threatened[7]
Delta smelt (*Hypomesus transpacificus*)	Endangered[8]
Longfin smelt (*Spirinchus thaleichthys*)	Threatened[9]
Spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened[10]
Winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	Endangered[11]

These species are referred to in these findings and the ITP as the "Covered Species." Additional details regarding each of the Covered Species is provided in the Final EIR/EIS, Chapters 11, Fish and Aquatic Resources, and 12, Terrestrial Biological Resources.

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[3] Under CESA, the Fish and Game Commission may designate species as endangered or threatened, or as a candidate species. (See Fish & G. Code, §§ 2070, 2074.2, subd. (a)(2), 2075.5.) All other species are "unlisted." The definitions of an endangered, threatened, and candidate species for purposes of CESA are found in Fish and Game Code sections 2062, 2067, and 2068, respectively.
[4] See Cal. Code Regs., tit. 14, § 670.5, subd. (b)(4)(C).
[5] See Cal. Code Regs., tit. 14, § 670.5, subd. (b)(3)(G).
[6] Take of this species is prohibited, unless otherwise authorized by the Department, during the period that the Fish and Game Commission considers a petition seeking its listing as an endangered species, and determines whether the petitioned action is warranted. The Fish and Game Commission accepted for consideration a petition to list this species on December 10, 2015, with notice of its designation as a candidate species published in the California Notice Register on January 8, 2016. (Cal. Reg. Notice Register 2016, No. 2-Z, p. 57.) If the species is added to the list of threatened or endangered species, the species will remain a Covered Species.
[7] Cal. Code Regs., tit. 14, § 670.5, subd. (b)(5)(A).
[8] See Cal. Code Regs. tit. 14 § 670.5, subd. (a)(2)(O)
[9] See Cal. Code Regs. tit. 14 § 670.5, subd. (b)(2)(E)
[10] See Cal. Code Regs. tit. 14 § 670.5, subd. (b)(2)(C)
[11] See Cal. Code Regs. tit. 14 § 670.5, subd. (a)(2)(M)

B. Take Authorization

The ITP authorizes the Permittee, its employees, contractors, and agents to take the Covered Species consistent with the ITP, which take is incidental to otherwise lawful activities within the Project Area, as described in the ITP, subject to the limitations set forth in the ITP.

IV. CRITERIA GOVERNING ISSUANCE OF INCIDENTAL TAKE PERMITS UNDER CESA

CDFW's CESA implementing regulations require the Director, prior to issuing an ITP under CESA, to "make findings substantiating compliance with section 783.4" of Title 14 of the California Code of Regulations. (Cal. Code Regs., tit. 14, § 783.5, subd. (c)(2).)[12] Section 783.4 sets forth ITP "review standards" and "issuance criteria" consistent with section 2081, subdivisions (b) and (c), of the Fish and Game Code. An ITP "may only be issued" under CESA based on findings consistent with these provisions. (*Id.*, § 783.4, subd. (a).) Likewise, CDFW may only amend an existing take authorization issued pursuant to Fish and Game Code section 2081, if the amendment "would continue to meet the standards in section 783.4." (*Id.*, § 783.6, subd. (c)(6).)

Consistent with CDFW's CESA implementing regulations, and Fish and Game Code section 2081, subdivision (b) and (c), an ITP may only be issued or amended upon CDFW findings that:

A. The take is incidental to an otherwise lawful activity.

B. The impacts of the authorized take shall be minimized and fully mitigated. For purposes of this issuance criterion, the measures required to meet this obligation shall be roughly proportional in extent to the impact of the authorized taking on the species. Where various measures are available to meet this obligation, the measures required shall maintain the applicant's objectives to the greatest extent possible. All required measures shall be capable of successful implementation. For purposes of this section only, impacts of taking include all impacts on the species that result from any act that would cause the proposed taking.

C. The permit is consistent with any regulations adopted pursuant to sections 2112 and 2114 of the Fish and Game Code.

[12] CDFW's findings obligations under CESA in the present case are governed by section 783.5, subdivision (c), of Title 14 of the California Code of Regulations because CDFW is a "responsible agency" for purposes of the ITP under CEQA. (See generally Cal. Code Regs., tit. 14, §15381.)

D. The applicant has ensured adequate funding to implement the measures required by paragraph B above, and for monitoring compliance with, and effectiveness of, those measures.

E. Issuance of the permit will not jeopardize the continued existence of the species. For purposes of this issuance criterion, CDFW shall make this determination based on the best scientific and other information that is reasonably available, and shall include consideration of the species' capability to survive and reproduce, and any adverse impacts of the taking on those abilities in light of: (1) known population trends; (2) known threats to the species; and (3) reasonably foreseeable impacts on the species from other related projects and activities.

(Fish & G. Code, § 2081, subds. (b)(1)-(4), (c); Cal. Code Regs., tit. 14, § 783.4, subds. (a), (b).)

V. FINDINGS

Consistent with CESA and the CESA implementing regulations, including the issuance criteria discussed in the preceding section, substantial evidence in CDFW's administrative record of proceedings relevant to the Permittee's ITP application, and the Final EIR/EIS, CDFW adopts the findings set forth below pursuant to section 2081 of the Fish and Game Code and section 783.4 of Title 14 of the California Code of Regulations. These findings reflect CDFW's independent judgment regarding the Permittee's ITP application. Having duly exercised its responsibility as the State's designated trustee for fish and wildlife resources, and in consideration of its public trust obligations generally, these findings also reflect CDFW's review and consideration of various documents and other information in its administrative record of proceedings relevant to the ITP application (including but not limited to information cited in this document), including the Final EIR/EIS, and CDFW's exercise of discretion and independent judgment under CESA as documented in these findings.

A. The take of Listed Covered Species under CESA as authorized by the ITP issued to the Permittee is incidental to otherwise lawful activities.

CDFW finds, based on substantial evidence in the ITP application, Final EIR/EIS, and administrative record of proceedings, that take of Covered Species pursuant to CESA as authorized by the ITP issued to DWR is incidental to otherwise lawful activities. DWR approved the Project on July 21, 2017, having exercised its discretion as the designated entity with general, plenary approval authority over the Project pursuant to the Central Valley Project Act (California Water Code, §§ 11100 et seq.) and the Burns-Porter Act (California Water Code, § 12930 et seq.). DWR will continue to exercise such approval authority over the Project as implementation occurs. The ITP only authorizes the take of Covered Species in connection with the Covered Activities detailed in the ITP and Final EIR/EIS, i.e., construction and operations activities and specified maintenance occurring within the Project Area. The ITP requires certain acreages and types of habitat restoration to fully mitigate Project impacts, discussed below. The ITP does not authorize any take associated with those activities, and the Department anticipates that future, additional review under CEQA and additional authorizations under the Fish and Game Code may be necessary before DWR can proceed with some restoration mitigation projects required by the permit.

DWR understands that the ITP is not a permit to proceed with the Project. Instead, the Project and associated mitigation efforts may only be implemented after DWR obtains any other permits required from federal, local, or other state agencies, and complies with other legal pre-requisites to Project construction or operations. This includes the requirement that construction of a new Delta conveyance facility shall not be initiated until the persons or entities that contract to receive water from the SWP and the federal CVP or a joint powers authority representing those entities have made arrangements or entered into contracts to pay for both the costs of the environmental review, planning, design, construction, and mitigation, including mitigation required pursuant to Division 13 (commencing with Section 21000 of the Public Resources Code), required for the construction, operation, and maintenance of any new Delta water conveyance facility, and full mitigation of property tax or assessments levied by local governments or special districts for land used in the construction, location, mitigation, or operation of new Delta conveyance facilities. (Cal. Water Code, § 85089.)

The permit does not authorize any take or possession other than that which is specifically authorized in the ITP, and any take or possession that is prohibited by the Fish and Game Code, and unauthorized by the ITP, is subject to enforcement pursuant to the Fish and Game Code.

Accordingly, any take resulting from Covered Activities authorized in the ITP will be incidental to, and not the purpose of, these otherwise lawful activities.

B. The Permittee will minimize and fully mitigate the impacts of the take authorized by the ITP under CESA.

CDFW finds, based on substantial evidence in the ITP application, Final EIR/EIS, and administrative record of proceedings, that the impacts of the take authorized by the ITP issued to the Permittee under CESA have been minimized and fully mitigated, including all impacts on Covered Species resulting from Covered Activities that would cause the authorized take.

Project Activities will result in the permanent and temporary disturbance of Covered Species habitat within the Project Area in a manner consistent with the ITP and Final EIR/EIS. Project-related disturbance and conversion of land developed for the dual conveyance facilities for the SWP, long-term maintenance of transmission lines, and operations of SWP facilities in the legal Delta and Suisun Marsh (i.e., Covered Activities) are expected to result in incidental take of Covered Species.

As is discussed in more detail under species-specific sections below, Table 1 outlines the acreages of impacts to Covered Species habitat, and Covered Species habitat that will be dedicated for protection in perpetuity and are required to be managed in accordance with a final management plan to be prepared and submitted to CDFW for approval in accordance with the ITP. The Permittee will restore temporary impacts to Covered Species habitat to pre-Project or better conditions.

Table 1. Impacts to Covered Species habitat associated with Project Construction and Operations, and Habitat Management Lands required as compensatory mitigation.

Impact Type	Acres
California Tiger Salamander	
Indirect permanent upland habitat	3
Direct permanent upland habitat	47
Total permanent impacts	**50**
Required compensatory mitigation	**150 upland**
Temporary upland habitat	6
Total temporary impacts	**6**
Swainson's Hawk	
Permanent foraging habitat	3,770
Permanent nesting habitat	22
Total permanent impacts	**3,792**
Required compensatory mitigation	**3,769 foraging**
(also see requirements below)	**44 nesting**
Total temporary impacts	**1,114**
Tricolored Blackbird	
Permanent foraging habitat - breeding	2,063
Permanent foraging habitat - nonbreeding	1,774
Permanent nesting habitat	16
Permanent roosting habitat	20
Total permanent impacts	**3,873**
Required compensatory mitigation	**2,063 foraging – breeding** **1,774 foraging - nonbreeding**

Impact Type	Acres
	48 nesting **40 roosting**
Temporary foraging habitat - breeding	299
Temporary foraging habitat - nonbreeding	377
Total temporary impacts	**676**
Giant Garter Snake	
Permanent upland habitat	570
Permanent aquatic habitat	205
Total permanent impacts	**775**
Required compensatory mitigation	**615 aquatic** **1,710 upland**
Temporary upland habitat	165
Total temporary impacts	**165**
Delta Smelt and Longfin Smelt	
Permanent shallow water habitat	500.6
Permanent tidal perennial habitat	25.3
Permanent tidal perennial habitat in CCF	2,190
Total permanent impacts	**2,715.9**
Required compensatory mitigation **(also see requirements below)**	**1,827.7**
Winter-run Chinook Salmon and Spring-run Chinook Salmon	
Permanent channel margin habitat	1.44 linear miles
Permanent tidal perennial habitat	31.9
Permanent tidal perennial habitat in CCF	2,190
Total permanent impacts	**2,221.9 acres** **1.44 linear miles channel margin**
Required compensatory mitigation **(also see requirements below)**	**154.8 acres** **4.3 linear miles channel margin**
Temporary tidal perennial habitat	20.1
Total temporary impacts	**20.1**

In addition to the acreages of permanently protected and managed lands outlined in Table 1, the Permittee will be required to conduct the following activities as mitigation for impacts to Covered Species as a result of Project Construction and Operations:

- Establish seven new SWHA nest sites which include transplanted mature and sapling suitable nest trees
- Plant five new saplings for each suitable SWHA nest tree removed during project construction and maintenance
- Install and maintain bird strike diverters on all new transmission lines and an equivalent length of existing transmission lines within the Project Area
- In addition to the compensatory mitigation shown in Table 1 above, provide $4,000,000 annually to benefit CHNWR and CHNSR in the Sacramento River watershed. This funding will support establishment of a new population of CHNWR and support that population with associated habitat restoration. In addition, this funding may also be used to restore habitat in the middle Sacramento River.

CDFW finds that the specific extent of take of Covered Species as defined by state law that will occur as a result of Covered Activities including Project construction, maintenance, and operations, is difficult to estimate, detect, and quantify. The relatively small body size of certain Covered Species makes the finding of a dead specimen difficult, and the secretive nature of certain Covered Species makes detection or quantification of take difficult. Likewise, abundance of certain Covered Species may be masked by seasonal fluctuations in numbers or other causes, and many Covered Species occur in habitats that make them difficult to detect. The Project will also affect habitat characteristics on which Covered Species depend, including flow magnitude, direction and velocity, salinity and water quality parameters. Furthermore, in many instances, use of habitat in the Project Area by certain Covered Species is intermittent. CDFW therefore finds that quantifying the amount of disturbance and the associated loss of existing and potential Covered Species habitat in the Project Area, and adverse changes to habitat characteristics that certain Covered Species rely upon, is an appropriate and necessary indicator of the extent of incidental take at issue, particularly in light of the statutory obligation to mitigate all impacts of the taking under CESA. (See Fish & G. Code, § 2081, subd. (b)(2).)[13]

Additionally, CDFW finds that using habitat-based effects as a proxy for take under CESA may result in an overestimate of the actual extent of incidental take in the form of mortality that will occur as defined under state law as a result of Project Activities because using habitat-based effects as a proxy for take under CESA may include potential habitat for the Covered Species, and may include an area different from the habitat actually occupied by the Covered Species or areas not ultimately impacted by the Covered Activities in final Project design. The impact to suitable habitat was

[13] This provision of the Fish and Game Code provides, in pertinent part, that the "impacts of taking" include all impacts on the species that result from any act that would cause the proposed taking.

calculated by assuming that 100 percent of Covered Species suitable habitat within the Project Area would be affected. The Permittee will document acreages of suitable habitat affected by Covered Activities throughout construction of the Project.

As discussed in species-specific sections below, the ITP addresses impacts of the taking from Project operations through a combination of operational criteria, compensatory habitat restoration, biological criteria, and adaptive management. The operational criteria required by the ITP are likely to be affected by other processes. Future SWP operations with under the Project and species' needs will be informed by these other processes, including the State Water Resources Control Board process to update the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (2006 Water Quality Control Plan), reinitiation of consultation on the U S Fish and Wildlife Service 2008 Biological Opinion for Delta smelt (USFWS 2008) and the National Marine Fisheries Service 2009 *Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project and the State Water Project* (NMFS 2009), replacement of ITP No. 2081-2009-001-03, the Collaborative Science and Adaptive Management Program (CSAMP), implementation of the *Adaptive Management Program for the California Water Fix and Current Biological Opinions on the Coordinated Operations of the Central Valley and State Water Projects* (hereafter Adaptive Management Program, Attachment 5 to the ITP), California EcoRestore, implementation of the Delta Smelt Resiliency Strategy, implementation of the Salmonid Resiliency Strategy, the Delta Smelt Recovery Plan update, and other actions that are likely to cause physical, chemical and biological changes within the watershed.

DWR is committed to and required by the ITP to work with CDFW and other agencies and stakeholders through the Adaptive Management Program, CSAMP and other processes to undertake additional focused research and analyses to improve scientific understanding concerning the tools used to analyze protected species effects and the impact of the facilities' operations on these species, their habitat and its characteristics, as well as the scientific understanding concerning the benefits of other actions (e.g. habitat restoration) on protected species and their habitats.

Individual operational components described in the ITP may be subject to change based on new scientific information developed through the adaptive management process. This is result of uncertainty associated with current scientific understanding of species' needs and effects of CVP/SWP operations under current authorizations and the Project, imprecision of modeling tools and other management processes affecting the Delta operational criteria including two key drivers of CVP/SWP operations, Fall X2 and spring outflow, as well as many of the individual operational components described below.

Therefore, in recognition of the ongoing and future processes and uncertainty issues described above, the Project includes a robust Adaptive Management Program that incorporates a collaborative science process to further refine, during the subsequent regulatory processes, what ultimately will be incorporated into a Test Period Operations Plan and Full Project Operations Plan (See, generally, Fish & G. Code, §§ 13.5, 703.3.). The Adaptive Management Program will continue to refine Project operations over time. The Adaptive Management Program will collect and analyze data for the purpose of evaluating the propriety of the anticipated operations in light of the evolving science and changing circumstances in the Delta.

The ITP identifies operating criteria applicable to the CWF that govern SWP operations once the NDD intake facilities become operational pursuant to a Test Period Operations Plan. The outcomes of the processes described above, as well as consideration of Delta conditions and relevant regulatory obligations existing at the time, will be considered in determining how the Project will be operated. DWR may seek modifications to the Project Description, monitoring, studies, or Project operational criteria identified in the ITP as those measures are incorporated into the Test Period Operations Plan or the Full Project Operations Plan (Conditions of Approval 9.6.7, 9.6.8).

Should an amendment to the ITP be necessary, DWR will propose, and CDFW will use the best scientific and commercial data available, including data collected and analysis conducted through the Adaptive Management Program, to determine the specific operational criteria required to comply with Fish and Game Code, section 2081, subdivision (b), when the NDD intake facilities become operational.

Based on the foregoing and the evidence in its administrative record, CDFW finds that the ITP application, EIR/EIS, and administrative record of proceedings provide a comprehensive, habitat-based and operational impacts analysis of the expected impacts on Covered Species as authorized by issuance of the ITP to the Permittee, including analysis for individual Covered Species and analysis by Covered Species habitat type and characteristics. (See ITP Application Sections 2, 4, and 5, and Appendices 4A, 4B, 4D, and 5A; EIR/EIS Sections 4.3.7 Fish and Aquatic Resources and 4.3.8 Terrestrial Biological Resources; EIR/EIS Executive Summary; EIR/EIS Chapter 3, Design of Alternatives, Environmental Commitments; EIR/EIS Chapter 8, Water Quality; EIR/EIS Chapter 11, Fish and Aquatic Resources; EIR/EIS Chapter 12, Terrestrial Biological Resources; EIR/EIS Appendix 3B, Environmental Commitments AMMs and CMs; EIR/EIS Appendix 5A, BDCP/California WaterFix FEIR/FEIS Modeling, Technical Appendix; EIR/EIS Appendix 5F, Comparison of FEIR Alternatives 2D, 4A, and 5A Modeling Results; EIR/EIS Appendix 5G, Comparison of FEIR'S Alternative 4A Modeling Results to the California Water Fix Section BA Proposed Action Modeling Results; EIR/EIS Appendix 8I, Mercury; EIR/EIS Appendix 8J, Nitrate; EIR/EIS Appendix 8K, Organic Carbon; EIR/EIS Appendix 8L, Pesticides; EIR/EIS Appendix 8M, Selenium; EIR/EIS Appendix 8N, Trace Metals; EIR/EIS Appendix 11A, Covered Species Description; EIR/EIS Appendix 11C, CALSIM II Model Results Utilized in the Fish Analysis; EIR/EIS Appendix 11D, Sacramento River Water Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis; and EIR/EIS Appendix 11E, Sensitivity Analysis to Confirm RDEIR/SDEIS Determinations for Fish and Aquatic Species Using Updated Model Outputs for Alternatives 2D, 4A, and 5A; 2013 Public Draft of the Bay Delta Conservation Plan Appendix 5J; 2016 Biological Assessment for the California Water Fix; 2017 USFWS Biological Opinion for California Water Fix; and 2017 NMFS Biological Opinion for California Water Fix.)

CDFW finds, based on substantial evidence in the ITP application, the Final EIR/EIS, and administrative record of proceedings, that all impacts of the authorized take associated with issuance of the ITP to the Permittee have been minimized and fully mitigated with required adherence to, and implementation of, the avoidance and mitigation measures required by the ITP and the Final EIR/EIS. These measures, discussed in Section V.B.1 below, are directed at habitat types and characteristics, individual Covered Species, and other indirect effects in a manner that maintains the Permittee's objectives to the greatest extent possible.

1. The mitigation measures discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of Covered Species.

As set forth below, CDFW finds that mitigation measures discussed in the EIR/EIS and required by the ITP for the individual Covered Species, and conditions of approval required by the ITP, support the conclusion that the impacts of the authorized take have been minimized and fully mitigated under CESA:

a. California Tiger Salamander (*Ambystoma californiense*)

i. CTS Project Construction Impacts and Avoidance and Minimization Measures

Covered Activities and their resulting impacts are expected to result in the incidental take of California tiger salamander individuals (CTS). The Covered Activities summarized in Section II A above and described in the ITP and the ITP application that are expected to result in incidental take of CTS include geotechnical exploration; the construction of a new connection canal between the CCF and the Banks Pumping Plant; a construction work site for the new connection canal and siphon 2; and the construction, installation, and maintenance of power supply facilities (e.g., poles and lines). Ongoing impacts of the taking will result from maintenance of the new connection canal.

Incidental take of CTS, and adverse impacts as a result of impacts of the taking on CTS, is expected to occur as a result of crushing of individuals or burrows; entrapment; capture, handling, and relocation; disturbance from light and vibration causing emergence from burrows and exposure to mortality risks; exposure to contaminants; and reduction of suitable habitat elements. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to CTS is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Incidental take of CTS individuals in the form of mortality ("kill") may occur as a result of vehicles, heavy equipment, foot traffic, or deposition of stockpiled materials or spoils crushing CTS individuals or crushing burrows, causing entombment inside occupied burrows, during vegetation clearing, excavation, pile driving, cofferdam and embankment construction, and operation of geotechnical exploration and construction equipment; entrapment or burial within trenches or open pipelines; entanglement in erosion control materials, fences, or construction staging materials; and increased light, noise, and vibration that could cause CTS individuals to exit burrows and become active at inappropriate times, potentially increasing exposure to predation and adverse environmental conditions. Incidental take of CTS individuals may also occur from the Covered Activities in the form of catch, capture, or attempt to do so from biologists that relocate individuals out of the construction site or remove trapped individuals. Authorized take of CTS is expected to occur within Project Area Group L and transmission line corridor locations, but only south of the Byron Highway (ITP Attachment 1, Figures 4 and 9).

The Project is expected to cause the permanent loss of 50 acres of terrestrial CTS habitat and the temporary loss of six acres of terrestrial CTS habitat. Impacts of the authorized taking also include adverse impacts to CTS related to temporal losses, increased habitat fragmentation and edge effects, and the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include: long-term health effects due to fugitive dust or other release of contaminants; pesticide or herbicide application affecting CTS directly, reducing vegetation cover, or reducing prey abundance; altered behavior from light disturbance, such as failing to migrate to a safer burrow; and loss of small mammal burrows from the use of rodenticides.

In general, Covered Activities would impact CTS as described above, but these impacts will be avoided or minimized by the following Conditions of Approval required by the ITP.

Multispecies Measures with Application to CTS:

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with the ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of the ITP.

7.2 Designated Biologist. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of one or more biological monitor(s) (Designated Biologist(s)) at least 30 days before starting Covered Activities. Permittee shall ensure that each Designated Biologist is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist(s) shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist(s) in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist(s) must be changed.

7.4 Designated Biologist Authority. To ensure compliance with the Conditions of

Approval of the ITP, the Designated Biologist(s) shall have authority to immediately stop any activity that does not comply with the ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist(s) that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers installation and monitoring; measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped; and roles and responsibilities of workers, managers, Designated Representative, Designated Biologist(s), and Designated Fisheries Biologist(s). Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of this ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.7 Trash Abatement. Permittee shall initiate a trash abatement program before starting Covered Activities and shall continue the program for the duration of the Project. Permittee shall ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators such as ravens, coyotes, and feral dogs.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s). Permittee shall keep the amount of water used to the minimum amount needed, and shall not allow water to form puddles.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee shall clearly delineate the boundaries of the construction site with fencing, stakes, or flags. Permittee shall restrict all Covered Activities to within the fenced, staked, or flagged areas. Permittee shall maintain all fencing, stakes, and flags until the completion of Covered Activities in that area.

7.10 Delineation of Habitat. Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of Covered Species' habitat.

7.11 Project Related Vehicle Use. Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.13 Visual Inspections. Project personnel shall visually check for Covered Species under vehicles and equipment prior to moving them.

7.14 Hazardous Waste. Permittee shall immediately stop and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

7.16 Refuse Removal. Upon completion of Covered Activities, Permittee shall remove from the Project Area and properly dispose of all temporary fill and construction refuse, including, but not limited to, broken equipment parts, wrapping material, cords, cables, wire, rope, strapping, twine, buckets, metal or plastic containers, flags, and boxes.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of the ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in the ITP and/or the MMRP. The Designated Representative shall report any non-compliance with the ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each construction site within the Project Area when Covered Activities occur and shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3) check for compliance with all measures of the ITP; (4) check all exclusion zones; (5) ensure that signs, stakes, and fencing are intact, and (6) ensure that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall monitor compliance continuously where Covered Activities are occurring; and after initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections a minimum of once per day where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by the ITP. Permittee shall compile and report observation and inspection records as described in Condition of Approval 8.6 *Compliance Report.* The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps, including metadata, depicting: 1) mapped areas of all land disturbances within the Project Area; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species within the Project Area (defined by Conditions of Approval 8.4.1), and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each construction site and surrounding buffer, no more than 14 days prior to initiation of Covered Activities, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species in the construction site and disturbed by Covered Activities, maintain this tracking using a GIS format, and include photo documentation of the habitat feature. The photo documentation of each habitat feature shall include a minimum of four photos facing the habitat feature, taken from the North, South, East, and West. Permittee shall include separate photo documentation of each habitat feature suitable for Covered Species; if there are multiple habitat features in a construction site, Permittee shall include multiple sets of photo documentation for that site. Permittee shall document the total disturbed acreage of habitat features for Covered Species compiled from the real-time tracking; compare the documented disturbance in each construction site to the Baseline Maps as shown in ITP Attachment 6; provide GIS layers and the associated metadata to CDFW with the Monthly Compliance Report; maintain maps for each Covered Species separately; include updates to any of the maps in the next Annual Status Report; provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report; and provide a summation of disturbance of identified habitat features annually with the Annual Status Report.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month, to the office listed in the Notices section of the ITP, and via e-mail to CDFW's Representative. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision, depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of the ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative

HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.9.1 Project Construction Report. No later than 180 days after completion of all Project construction, Permittee shall provide CDFW with a Project Construction Report. The Designated Biologist(s) shall prepare the Project Construction Report which shall include, at a minimum: (1) a summary of all Monthly Compliance Reports and all ASRs; (2) a copy of the table in the MMRP with notes showing when each of the mitigation measures was implemented; (3) all available information about Project-related incidental take of the Covered Species; (4) information about other Project impacts on the Covered Species; (5) beginning and ending dates of Covered Activities; (6) an assessment of the effectiveness of the ITP's Conditions of Approval in minimizing and fully mitigating Project impacts of the taking on Covered Species; (7) recommendations on how mitigation measures might be changed to more effectively minimize take and mitigate the impacts of future projects on the Covered Species; and (8) any other pertinent information.

8.10 Notification of Take or Injury. Permittee shall immediately notify the Designated Biologist(s) if a Covered Species is taken or injured by a Covered Activity, or if a Covered Species is otherwise found dead or injured within the vicinity of the Project Area. The initial notification to CDFW shall include information regarding the location, species, and number of animals taken or injured and the ITP Number. Following initial notification, Permittee shall send CDFW a written report within two calendar days. The report shall include the date and time of the finding or incident, location of the animal or carcass, and if possible provide a photograph, explanation as to cause of take or injury, and any other pertinent information.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye to prevent overspray.

9.1.2 Rodenticide use. Permittee shall prohibit the use of rodenticides in construction sites.

9.1.3 Artificial Lighting. Permittee shall use artificial outdoor lighting only as needed for safety and security. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and permanent facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access. All lighting shall be directed away from waterways near Project facilities with shielding to further minimize potential light spillover into Covered Fish Species habitat.

9.1.4 Covered Species Observations. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee shall cease Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is moved by the Designated Biologist(s) or it moves from the construction site of its own accord.

9.1.5 Hazards to Covered Species. Permittee shall not permit pets, campfires, or firearms in construction sites, except firearms carried by authorized security personnel or local, state, or federal law enforcement officials. To avoid attracting predators, Permittee shall ensure Project personnel will dispose of all food-related trash items such as wrappers, cans, bottles, and food scraps in enclosed containers. Permittee shall ensure trash is removed from the construction site and taken to an appropriate facility at least once a week for disposal.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of work, Permittee shall backfill geotechnical test pits with the excavated material on the same day as they are excavated, and shall place the stockpiled topsoil at the surface and restore the site where geotechnical exploration activities were conducted. Permittee shall backfill bored holes on the same day as they were drilled, after exploration is completed at that site.

9.1.7 Daily Entrapment Inspections. To prevent inadvertent entrapment of Covered Species during construction, Permittee shall cover all excavated, steep-walled holes or trenches more than six inches deep at the close of each working day with plywood or similar material and shall ensure the cover is sealed with rock bags or other methods to prevent animals from reentering. While pits or holes are open, Permittee shall provide one or more escape ramps constructed of earth fill or wooden planks, as approved by the Designated Biologist. When such holes or trenches are being covered or filled, the Designated Biologist(s) shall be present to ensure there are no trapped Covered Species and the hole or trench cover is secure. If a Covered Species or other Covered Species is encountered in holes or trenches during construction work, Permittee shall divert Covered Activities away from the Covered Species until Project personnel contact the Designated Biologist(s). The Designated Biologist(s) shall attempt to relocate the trapped Covered Species if safe or feasible to do so or shall determine further action.

9.1.8 Materials Inspection. The Designated Biologist(s) or Project personnel shall inspect all construction pipes, culverts, or similar structures with a diameter of 0.25 inch or greater that are stored for one or more overnight periods in construction sites that may be occupied by Covered Species, at the beginning of each day during which such materials will be used for construction, moved, buried, or capped. If Project personnel detect Covered Species within a pipe, culvert, or similar structure, they shall notify the Designated Biologist(s) and allow the animal to safely escape, or be relocated by the Designated Biologist(s) outside of the construction site, prior to moving, capping, burying, or utilizing the structure. If necessary, and under the direct supervision of the Designated Biologist(s), Project personnel may move the structure up to one time to isolate it from construction activities until the Covered Species moves from the structure of its own volition or the Designated Biologist(s) relocates the individual outside of the construction site. Immediately after inspection or after the animal has vacated the structure, Project personnel shall securely cap the pipes, culverts, or similar structures to prevent Covered Species from entering the structures.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, reusable tunnel material (RTM), and dredged material. The spoils disposal plan shall include protocols for sampling and analysis of dredge materials, spoils and RTM, that shall address: handling and disposal of hazardous material; the presence and concentrations of contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine pesticides); potential discharge of contaminants that would affect surface water or groundwater (e.g., instream discharges during dredging, effluent discharge from the disposal site; leachate from the disposal site); sediment analyses; chemical analyses; a protocol to reduce or eliminate the release of contaminated sediment; and BMPs to be implemented during handling and disposal of any potentially hazardous dredged or excavated material. Permittee shall conduct discharges from RTM draining operations in such a way as to not cause erosion at the discharge point. Permittee shall size the designated storage sites to accommodate all RTM, dredge material, or spoils expected to be generated by Covered Activities and shall size and locate the sites to minimize the impact or encroachment on environmentally sensitive areas within the Project Area. Permittee shall use rocks and other inorganic material grubbed from storage sites to backfill borrow pits or shall remove these materials from the site. Permittee shall not place grubbed material in environmentally sensitive areas.

9.1.11 In-Water Work Windows. Permittee shall restrict the times of year when certain in-water Covered Activities are conducted. The following Covered Activities are permitted only during certain dates within the in-water work window at the CCF between July 1 and November 30: over water geotechnical exploration, dredging, cofferdam installation and removal, pile driving, levee clearing and grading, riprap placement, construction of sheetpile walls, and placing of rock bedding and stone slopes. Permittee shall coordinate with the NDDTT, HGTT, CCFTT, and the TOT prior to finalizing Project engineering design to further limit the times when Permittee shall conduct in-water work, as feasible.

9.1.12 Daily In-Water Work Restriction. Permittee shall terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise. Permittee shall use sunrise and sunset times established by the U.S. Naval Observatory Astronomical Applications Department for the geographic area.

9.1.14 Pile Driving Plan. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a pile driving plan to minimize the impacts of pile driving on Covered Species. The pile driving plan shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the duration of pile driving within the in-water work windows (see Condition of Approval 9.1.11) and the duration of pile driving within the daily in-water work construction window. To minimize impacts of pile driving on Covered Species, the pile driving plan shall restrict impact pile driving activities to specific times of the day and for a specific duration to be determined in coordination with the TOT, and implement vibratory pile driving methods to minimize the noise generated from construction activities to the greatest extent feasible. Permittee shall ensure the pile driving plan is reviewed and finalized by the TOT and submitted to CDFW for written approval before Permittee initiates Covered Activities that require pile driving, and shall implement all measures in the approved plan.

9.1.18 Stormwater Pollution Prevention Plan. Permittee shall ensure compliance with all construction stormwater permitting requirements and shall ensure the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control short-term and long-term effects associated with construction-generated stormwater runoff. The SWPPP shall include all applicable SWRCB and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The SWPPP shall include measures that address erosion and sediment control, management of construction materials, waste management, site dewatering and pipeline testing, accidental spill prevention and response, site inspection and monitoring, and measures to prevent nonstormwater discharges from reaching surface water. Nonstormwater discharge examples include washing vehicles, cleaning streets, or applying erodible landscape material during rain. The SWPPP shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.19 Erosion and Sediment Control Plan. Permittee shall develop one or more erosion and sediment control plan(s) to be incorporated in the SWPPP prior to disturbance and throughout all phases of Construction Activities. The erosion and sediment control plan(s) shall include best management practices such as: physical erosion control stabilization; maintaining emergency erosion control supplies at all times during construction and replacing used materials within 48 hours; minimal disturbance of the terrain and natural land features; diverting runoff away from steep, denuded slopes; retaining trees and vegetation where practicable to stabilize hillsides, retain moisture, and reduce erosion; limiting disturbance to areas of proven stability; implementing site inspections before and after storm events; installing drainage control features; and installing wind erosion control features. Sediment control measures shall include retaining sediment transported by run-off; collecting and directing surface runoff at non-erosive velocities to common drainage courses; using sediment and turbidity areas where ground disturbance is adjacent to surface water or wetlands; preventing mud tracking; and depositing or storing excavated materials away from drainage courses and keeping them covered when stored over five days or within 48 hours of a forecasted rain event. The erosion and sediment control plan(s) shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.20 Erosion Control Stabilization Measures. Permittee shall not use plastic monofilament netting or similar material such as nylon for erosion control, to avoid entanglement or trapping of Covered Species. Permittee shall not use products that use photodegradable or biodegradable synthetic netting. Acceptable materials include natural fibers such as jute matting, coconut, twine, or other similar fibers or tackified hydroseeding compounds. Permittee shall communicate this measure to Project contractor(s) through specifications or special provisions included in the construction bid solicitation package. Permittee shall bury the edge of erosion control materials in the ground to prevent reptiles and amphibians from crawling underneath them. Permittee shall submit the erosion control stabilization measures to CDFW for written approval prior to initiating construction activities.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. In accordance with local, state, or federal regulations, Permittee or its contractors shall develop a spill prevention, containment, and countermeasure plan (SPCC) at each site where ground-disturbing activity will occur. Each SPCC shall address actions used to prevent spills and actions that will be taken should any spills occur, including emergency notification procedures. The SPCC plans shall include measures and processes that address the following: procedures for routine handling of products; discharge or drainage controls such as secondary containment and procedures for discharge control; countermeasures for discharge discovery, response, and cleanup; methods of disposal of recovered materials; personnel training in emergency response, spill containment techniques, and pollution control laws, rules, and regulations; storage of petroleum products in nonleaking containers at impervious storage sites from which an accidental spill cannot escape; storing and maintaining spill containment materials--such as absorbent pads, pillows, socks, or booms--in nonleaking sealed containers until transported and disposed of; using spill containment materials under transfer areas when transferring oil or other hazardous materials from trucks to storage containers; storage of concrete, wash water, and other contaminants in watertight containment structures; daily inspection of equipment for oil, grease, and other petroleum products if equipment is in contact with surface water; cleaning of external petroleum products off of equipment prior to its contact to water; and use of oil-absorbent booms for equipment used in or adjacent to water. In the event of a spill, personnel shall identify and secure the source of discharge and contain the discharge with spill kit materials, such as sorbents or sandbags, and shall contact CDFW and other appropriate regulatory authorities within 24 hours. Permittee shall submit the SPCC plans to CDFW for written approval prior to initiating construction activities.

9.1.22 Hazardous Materials Management Plan. Permittee or its contractors shall develop and implement one or more hazardous materials management plan(s) (HMMP) prior to initiating construction activities. The HMMP shall provide detailed information on the types of hazardous materials used; phone numbers of emergency response agencies; appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste; and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP shall address the following measures or practices: clear labeling, handling and safety instructions, and emergency contact information on hazardous material containers; use or transfer of hazardous materials near wet or dry streams; Material Safety Data Sheets, accumulation and temporary storage of hazardous wastes (e.g., not to exceed 90 days); and disposal of contaminated soils. Permittee shall submit the HMMP to CDFW for written approval prior to initiating construction activities.

9.1.23 Fugitive Dust Control. Permittee shall implement fugitive dust control measures and enhanced dust control measures at all construction and staging areas to reduce construction-related fugitive dust that are consistent with Air Quality Management District (AQMD) guidelines and requirements for each region. Fugitive dust control measures shall address: applying water to all exposed surfaces—such as soil piles, graded areas, unpaved parking areas, staging areas, and access roads--to prevent visible dust from leaving construction sites; covering and maintaining at least two feet of freeboard space on trucks transporting soil, sand, and other loose material; using wet power vacuum street sweepers to remove visible track-out of mud or dirt; limiting vehicle speeds on unpaved roads to 15 miles per hour; completing paving projects and laying construction pads as soon as possible after grading; watering exposed soil with adequate frequency; suspending excavation, grading, or demolition activity when wind speeds exceed 20 miles per hour or conducting fugitive dust control measures more frequently during dry summers and wind conditions higher than 20 miles per hour; installing wind breaks such as trees or solid fencing on the windward side(s) of construction sites; and planting vegetative ground cover, such as fast-germinating native grass seed, as soon as possible after construction is completed and ensuring vegetation becomes established. Permittee shall develop measures for entrained road dust—such as washing wheels and equipment or treating access to sites with material such as wood chips or gravel that would reduce carry-out. Permittee shall develop measures for concrete batching, such as achieving a 70-percent reduction in dust from concrete batching and 80 percent reduction in dust from aggregate and sand pile erosion. Permittee shall submit fugitive dust control and enhanced dust control measures to CDFW for written approval prior to initiating construction activities.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments shall occur only in July and August on an as-needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure.

Measures specific to CTS

9.4.1 Habitat Evaluation. The Designated Biologist(s) shall conduct a field evaluation of the Project Area southwest of Byron Highway and shall identify suitable aquatic breeding and upland habitat within the Project Area that may have been excluded from the modeled habitat. Suitable habitat shall be defined by Condition of Approval 8.4.1.1 and 8.4.1.2 and the Designated Biologist(s)' professional judgment.

9.4.2 Breeding Habitat Avoidance. If breeding habitat is identified by the Designated Biologist(s) within the Project Area southwest of Byron Highway, Permittee shall restrict Covered Activities to beyond 300 feet of the breeding habitat. Permittee shall consult with CDFW to develop further habitat protection measures to maintain connectivity between breeding habitat and suitable upland habitat and ensure impacts to breeding habitat are fully avoided. Permittee shall site transmission line poles or towers at least 300 feet from suitable breeding habitat. Permittee shall clearly demarcate the habitat to be avoided with signs or another type of marking that is visible to Project personnel.

9.4.3 CTS Relocation. Permittee shall prepare a CTS Mortality Reduction and Relocation Plan (Relocation Plan) that shall include, but not be limited to, the name(s) of the Designated Biologist(s) who will relocate CTS; pre-construction survey methodology; method for the hand excavation of burrows that cannot be avoided during Covered Activities; capture, handling, and relocation methods; a map and description of the relocation area(s) for captured CTS, including relative location, quality of habitat, non-native species or the potential for CTS-barred tiger salamander hybrids to be present, other CTS present, identified upland burrows determined to be suitable for CTS placement, distance to aquatic habitat, and potential barriers for movement; written permission from the landowner to use their land as a relocation site; and identification of a wildlife rehabilitation center or veterinary facility that routinely evaluates or treats amphibians. Permittee shall submit the Relocation Plan to CDFW for written approval at least 15 days prior to the beginning of any Covered Activities, including preconstruction surveys. Permittee shall not conduct Covered Activities within the Project Area south of Byron Highway until the Relocation Plan is approved in writing by CDFW. If CTS is found within a construction site or 75 feet beyond the construction site (75-foot boundary), Project personnel shall notify the Designated Biologist(s) immediately; If CTS is encountered within the construction site, the Designated Biologist(s) shall relocate CTS to a safe area if it is directly threatened by Covered Activities and is unable to move to a safe area on its own.

9.4.4 Mowing. Within suitable upland habitat, Permittee shall mow grasses within 24 hours of initiation of preconstruction surveys (see Condition of Approval 9.4.5) in each construction site where ground disturbance will occur and the 75-foot boundary. Permittee shall use light mowing equipment that would not crush burrows or impact the ground to mow vegetation until it reaches a height that allows the Designated Biologist(s) to see and survey for CTS and burrows. The Designated Biologist(s) shall walk in front of the mower and monitor for CTS escaping out of burrows. If CTS is found, mowing shall cease until the CTS is relocated by the Designated Biologist(s). Mowing shall occur in rows in a pattern that would not concentrate animals in the center of the construction site and shall only occur during the day in dry conditions (no rain within the past 24 hours), when the Designated Biologist(s) determines CTS is unlikely to be above ground.

9.4.5 Preconstruction Surveys. The Designated Biologist(s) shall complete nocturnal walking or cover-board surveys in each of the construction sites located within suitable upland habitat, that provide 100 percent visual coverage of the construction site and 75-foot boundary, including access roads. The Designated Biologist(s) shall pay particular attention to suitable CTS habitat features and search beneath woody debris. If CTS is found within the construction site, access roads, or the 75-foot boundary, the Designated Biologist(s) shall delay installation of the exclusion barrier until the Designated Biologist(s) relocate(s) the CTS out of the Project Area and 75-foot boundary. The Designated Biologist(s) shall visually inspect all small mammal burrows within suitable upland habitat in the construction site, access roads, and 75-foot boundary and shall immediately collapse small unoccupied burrows (e.g., less than three feet long and checked for dead ends). The Designated Biologist(s) shall inspect larger burrows for occupancy and shall collapse or block the burrow if determined they are not occupied. Permittee shall submit the preconstruction survey protocols to CDFW for written approval prior to initiating preconstruction surveys.

9.4.6. Flag Burrows. Permittee shall establish a 50-foot-radius no activity buffer (no activity buffer) around small mammal burrows that can be avoided within the construction site, access roads, and the 75-foot boundary and shall designate the no-activity buffers with flagging. If small mammal burrows cannot be avoided by a no-activity buffer and are within suitable upland habitat, Permittee shall excavate occupied burrows as described in Condition of Approval 9.4.7 *Burrow Excavation*.

9.4.7 Burrow Excavation. The Designated Biologist(s) shall fully excavated by hand small mammal burrows that cannot be avoided by the no-activity buffer and were found to be occupied by CTS during preconstruction surveys, located within the construction site, access roads, or the 75-foot boundary. The excavation method shall ensure CTS emerges or is removed from the burrow without causing harm to the individual. The Designated Biologist(s) shall relocate CTS from the burrow to a suitable burrow outside of the Project Area and 75-foot boundary in accordance with Condition of Approval 0.4.3 *CTS Relocation*. Once the Designated Biologist(s) determine(s) a burrow is no longer occupied, they shall collapse or block the burrow.

9.4.8 Exclusion Barrier. Permittee shall install an exclusion barrier around the perimeter of all construction sites and access roads within CTS suitable upland habitat, which are adjacent to CTS suitable habitat, to prevent CTS from migrating into the construction sites or using the access roads. Permittee shall install the exclusion barrier prior to the start of ground disturbing Covered Activities and within 24 hours after preconstruction surveys and burrow excavation are completed. The exclusion barrier shall consist of taut silt fencing extending at least 24 inches above ground; shall be buried a minimum of six inches below ground surface; and shall be constructed with a lip so that CTS cannot scale and go over the barrier. Permittee shall ensure no gaps or holes are allowed in the exclusion barrier except for access gates required for vehicular and pedestrian traffic and for one-way exit points (e.g., ramps or doors) to allow CTS to move out of the construction site; one-way exit points shall be no more than 200 feet apart and flush to the ground to prevent CTS or other wildlife from accessing the construction site. Permittee shall design the exclusion barrier to include redirection points at access gates and at no greater than 100-foot intervals (e.g., at least five feet of fencing perpendicular to the exclusion barrier) to redirect CTS on the outside of the barrier back to intact habitat. Permittee shall ensure the exclusion barrier is supported sufficiently to maintain its integrity under all conditions, such as wind and heavy rain, for the duration of the Covered

Activities in the Project Area, and shall provide refuge opportunities (such as cover boards or straw wattles) on both sides of the exclusion barrier.

9.4.9 Exclusion Barrier Installation and Maintenance. Permittee shall maintain vegetation within three feet of the edge of the exclusion barrier away from the construction site at a height that allows visibility of CTS (four to six inches, depending on the terrain and at the discretion of the Designated Biologist(s) near the barrier, using hand tools (e.g., trimmer, chainsaw, etc.) to trim or remove vegetation. The Designated Biologist(s) shall be onsite during all exclusion barrier installation activities that could result in take, including trenching, vehicular access, erecting fencing material, installing posts, and any other activity that requires vehicle or foot traffic in suitable upland habitat. The Designated Biologist(s) shall watch for burrows on either side of the exclusion barrier during trenching and shall halt construction until newly discovered burrows are checked for occupancy, CTS is relocated in accordance with Condition of Approval 9.4.3 *CTS Relocation,* and unoccupied burrows are blocked or collapsed. The Designated Biologist(s) shall check the exclusion barrier at least once daily, and during and after storm events (rainfall predicted to exceed 0.25 inches during a 24-hour period at the nearest weather station) to ensure that it is functional and without defects, that fencing material is taut, and that the bottom edge of the fencing material remains buried. If the fence is compromised, Permittee shall repair the barrier within 24 hours to ensure that it is functional and without defects, and, the Designated Biologist(s) shall conduct a survey, using CDFW-approved protocol, within 24 hours prior to initiation of Covered Activities that may result in take of CTS within the construction site or access roads. The Designated Biologist(s) shall carefully search potential hiding spots, such as along exclusion fences and in pipes, culverts, or other similar structures, trenches, large downed woody debris, and beneath vehicles or equipment before they are moved, and shall check new burrows for occupancy, collapse the burrows when they are not occupied, and relocate CTS found within burrows in accordance with 9.4.3 *CTS Relocation*. Permittee shall instruct workers to make sure access gates are securely closed when not in use; and if access gates are left open and unattended, the Designated Biologist(s) shall have the authority to stop Covered Activities until preconstruction surveys are repeated, CTS that are found are relocated from the construction site, and additional burrows are checked and collapsed. Permittee shall ensure the CTS exclusion barrier remains in place for the duration of Covered Activities other than ongoing maintenance.

9.4.10 Initial Site Clearing and Monitoring. Permittee shall confine ground disturbance and clearance activities that could result in take of CTS to the minimal area necessary to conduct Covered Activities, and shall avoid, to the extent practicable, clearance work during rainfall events between sunset and sunrise. If clearance work is conducted at night, the Designated Biologist(s) shall conduct daily surveys for CTS in suitable habitat within each construction site and access road, using a CDFW-approved protocol, prior to site clearing activities until the construction site has been completely cleared. The Designated Biologist(s) shall be onsite during clearance work and shall check potential hiding places. If CTS is discovered inside the exclusion fencing, the Designated Biologist(s) shall have the authority to stop construction activities until the CTS is relocated in accordance with Condition of Approval 9.4.3 *CTS Relocation* and appropriate corrective measures are implemented to ensure CTS cannot enter the construction site.

9.4.11 CTS Avoidance. Where possible, Permittee shall conduct Covered Activities within paved roads, farm roads, road shoulders, and similarly disturbed and compacted areas, or shall confine ground disturbance and habitat removal to the minimal area necessary. Project-related vehicles shall observe a posted speed limit of 10 miles per hour within suitable CTS habitat prior to ground clearance, within 300 feet of suitable aquatic habitat, or 50 feet from a flagged burrow, except on the Byron Highway and other roads where 10 miles per hour would unsafely impede the normal flow of traffic. If Project personnel observe CTS, or a salamander resembling CTS, retreating into an underground burrow, crack or crevice, or under woody debris (hereafter refuge) within a construction site, the 75-foot boundary, or on access roads during any phase of Covered Activities, Permittee shall not allow Covered Activities within a 50-foot radius of the refuge until a Designated Biologist(s) is contacted and is on site. If the Covered Activities cannot avoid the refuge, the Designated Biologist(s) shall excavate, expose, and relocate the CTS in accordance with Condition of Approval 9.4.3 *CTS Relocation Conditions*.

9.4.12 Rain Forecast. For geotechnical exploration, transmission line construction, transmission line maintenance, and facility maintenance within suitable CTS upland habitat, Permittee and the Designated Biologist(s) shall monitor the National Weather Service (NWS) 72-hour forecast for the location nearest to the Project Area. If a 40 percent or greater chance of rainfall is predicted within 72 hours, Permittee shall cease Covered Activities 24 hours prior to the 40 percent or greater forecast event within CTS suitable upland habitat and on access roads to construction sites. Work may continue 24 hours after the rain ceases if there is zero percent chance of precipitation in the 72-hour forecast. The Designated Biologist(s) shall survey each construction site before these Covered Activities resume, using the CDFW-approved preconstruction survey protocol. If CTS is found, the Designated Biologist(s) shall have the authority to stop the Covered Activities until the CTS is relocated in accordance with Condition of Approval 9.4.3 *CTS Relocation* and workers are further instructed by the Designated Biologist(s) to cease work during rain events when CTS are expected to be above ground.

9.4.13 Night Work. Permittee shall cease Covered Activities no less than 30 minutes before sunset on sites and access roads for geotechnical exploration, transmission line construction and maintenance, and facility maintenance within suitable CTS upland habitat or within 300 feet of suitable CTS aquatic habitat, and shall not begin Covered Activities again until no less than 30 minutes after sunrise. If night work is required within construction sites with an exclusion barrier, Permittee shall not use artificial lighting unless it is needed for worker safety. Where artificial lighting is required for worker safety, Permittee shall follow night lighting provisions in Condition of Approval 9.1.13. If light spillover into suitable CTS habitat occurs during night work, the Designated Biologist(s) shall be present to survey burrows for emerging CTS in portions of the 75-foot buffer illuminated by construction lighting. If CTS is found above-ground, the Designated Biologist(s) shall have the authority to stop Covered Activities until the light is directed away from the burrows, CTS moves out of or is removed from the illuminated area. The Designated Biologist(s) shall relocate removed CTS in accordance with Condition of Approval 9.4.3 *CTS Relocation Conditions*.

9.4.14 Geotechnical Exploration, Transmission Line Maintenance, and Canal Maintenance Activities. The Designated Biologist(s) shall be present during selection of geotechnical or maintenance sites, ingress and egress to these sites, and during set-up activities to guide workers to avoid visible burrows, cracks, or crevices (burrows) until avoidance routes are clearly established. The Designated Biologist(s) shall flag potentially occupied burrows to be avoided by a 50-foot radius no-activity buffer or shall designate and flag areas within the site and ingress/egress routes that avoid potentially occupied burrows. Permittee shall confine movement of heavy equipment to existing access roads or to locations at least 50 feet from flagged burrows; and vehicles shall follow the shortest possible routes from existing roads to the site. Project personnel shall limit vehicle speed to 10 miles per hour within the site and on non-public access routes (such as transmission line spur roads). The Designated Biologist(s) shall conduct preconstruction surveys prior to these Covered Activities; and if CTS is found, the Designated Biologist(s) shall have the authority to delay these Covered Activities until CTS leaves or is removed from the site. The Designated Biologist(s) shall relocate removed CTS in accordance with Condition of Approval 9.4.3 *CTS Relocation*.

Impact: Crushing of individuals or burrows

CTS spend most of their lives as adults in underground burrows within upland grassland communities and emerge at night during rain events to migrate to aquatic pond habitat, including vernal pools, for breeding (Loredo and Van Vuren 1996, Loredo, Van Vuren et al. 1996, Trenham, Shaffer et al. 2000, Cook, Trenham et al. 2005). Adults generally migrate once a year to breed after the first storm event, typically in November and December (Loredo, Van Vuren et al. 1996, Orloff 2011). However, CTS may skip breeding and remain in upland habitat for years or even decades, depending on environmental conditions (Loredo and Van Vuren 1996, Trenham, Shaffer et al. 2000). The length of time individuals spend in a breeding pond varies among years, averaging 54 days or less, before returning to upland habitat between January and April (Loredo and Van Vuren 1996, Orloff 2011). While in upland habitat, some CTS individuals may move from burrow to burrow during rain events (Trenham 2001). Juveniles emerge from aquatic habitat in the summer (typically May through August) and emigrate to upland burrows, cracks, or crevices once metamorphosis is complete (Loredo, Van Vuren et al. 1996). Juveniles may emigrate during periods of no rainfall on dry summer nights (Loredo, Van Vuren et al. 1996). The average migration distance observed between aquatic and upland habitat was less than 0.5 mile, and CTS commonly return to their same natal ponds and terrestrial habitat areas (Loredo, Van Vuren et al. 1996, Trenham 2001, Trenham and Shaffer 2005, Orloff 2011). However, some adults disperse longer distances. CTS have been observed as far as 1.3 miles from the nearest breeding ponds (69 FR 47212 , Orloff 2011, Searcy and Shaffer 2011).

Modeled aquatic habitat with nearby CNDDB occurrences of CTS (CNDDB EO# 205, 150) is well within 1.3 miles of the Project Area construction sites that overlap suitable upland habitat. CTS use upland habitat occupied by small mammals such as California ground squirrel (*Otospermophilus beecheyi*) or Botta's pocket gopher (*Thommomys bottae*), which create complex burrowing networks with multiple entrances connected by underground tunnels (Loredo, Van Vuren et al. 1996). Evidence suggests some individuals may remain active, at least into summer (Trenham, Shaffer et al. 2000, Trenham 2001); however, there aren't many studies of CTS behavior underground. If Covered Activities are conducted while CTS are underground, impacts to burrows at any location within the underground burrowing network could crush or entomb CTS at any time during the year. If Covered Activities are conducted when CTS are above ground, particularly on dark, rainy nights, there is a risk they would not be seen by Project personnel. This risk is due to their small size (as small as three inches in length) and mostly dark coloration (Loredo and Van Vuren 1996, USFWS 2016). When above ground, CTS may retreat into hiding places such as woody debris, cracks, or crevices in addition to burrows (Loredo, Van Vuren et al. 1996). CTS may even be found hiding along exclusion fences or under equipment or vehicles. Further, CTS tend to migrate or emigrate in groups corresponding with rain events; in one study, researchers counted several adults in one week migrating to the same breeding pond and over 15% of juveniles emigrating from a pond in a single day during a summer storm (Loredo, Van Vuren et al. 1996). Therefore, if CTS are above ground in the construction site during Covered Activities, one or more individuals could be crushed by workers, vehicles, equipment, debris, or other Project-related activity.

Conditions of Approval: Crushing of individuals or burrows

Covered Activities would impact CTS as described above, but these impacts will be avoided or minimized through following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring CTS and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of CTS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing crushing of CTS or occupied burrows and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing,

stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. CTS habitat will be clearly delineated within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of CTS habitat.

7.11 Project Related Vehicle Use. To minimize the risk of CTS or occupied burrows being crushed by vehicles or equipment during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to existing roadways, designated ingress/egress routes and adhere to speed limits.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of CTS or occupied burrows being crushed by vehicles or equipment during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible.

7.13 Visual Inspections. Project personnel will visually check for CTS under vehicles and equipment prior to moving them.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if CTS is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter CTS in or near the construction site and will cease Covered Activities until CTS is safely out of harm's way.

9.1.5 Hazards to Covered Species. Permittee shall not permit pets, campfires, or firearms in construction sites, except firearms carried by authorized security personnel or local, state, or federal law enforcement officials and trash will be removed at least once per week.

9.4.1 Habitat Evaluation. To minimize the risk of crushing CTS or occupied burrows, the Designated Biologist(s) will conduct pre-project surveys to identify and delineate suitable CTS upland or aquatic habitat within the Project Area for which to implement minimization and avoidance measures.

9.4.2 Breeding Habitat Avoidance. If suitable aquatic habitat is identified by the Designated Biologist(s) within the Project area Covered Activities will avoid the suitable aquatic habitat by a margin of 300 feet.

9.4.3 CTS Relocation. Permittee will develop and implement a CDFW-approved CTS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If CTS is found on or near the construction site, The Designated Biologist(s) will relocate CTS to pre-approved locations outside of the construction site to minimize the risk of Covered Activities crushing CTS or occupied burrows.

9.4.4 Mowing. Permittee will mow the construction site using methods and equipment that minimize ground impact for the Designated Biologist(s) to detect CTS and burrows during preconstruction surveys, and the Designated Biologist(s) will monitor mowing to minimize the risk of crushing CTS.

9.4.5 Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual CTS and minimize the risk of Covered Activities crushing individuals.

9.4.6 Flag Burrows. To minimize the risk of crushing occupied burrows as a result of Covered Activities, the Designated Biologist(s) will establish and delineate with flagging a 50-foot no-activity buffer around all small mammal burrows that can be avoided within construction sites.

9.4.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate CTS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent CTS from using the burrows.

9.4.9 Exclusion Barrier Installation and Maintenance. To minimize the risk of crushing CTS or occupied burrows within a construction site, prior to initiation of site clearing, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep CTS out, under the supervision of a Designated Biologist(s) and will maintain the barrier throughout Covered Activities.

9.4.10 Initial Site Clearing and Monitoring. To minimize the risk of crushing CTS or occupied burrows, the Designated Biologist(s) will monitor for CTS during barrier installation and will conduct regular inspections of the exclusion barrier to ensure its integrity. Permittee will maintain the exclusion barrier as needed until the completion of Covered Activities. If the barrier is compromised, the Designated Biologist(s) will monitor for CTS and remove any individuals found to a safe location outside of the construction site.

9.4.11 CTS Avoidance. Permittee will limit the spatial extent and limit the timing of Covered Activities near suitable CTS habitat, to the extent possible, to avoid crushing CTS while they are above ground or in burrows. A Designated Biologist(s) will monitor all initial site clearing activities daily and relocate CTS, as needed, to minimize the risk of crushing individuals.

9.4.12 Rain Forecast. To minimize the risk of crushing CTS or occupied burrows, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted during periods when there is a 40% or greater chance of rain and at night, when CTS is most likely to be above ground.

9.4.13 Night Work. To minimize the risk of crushing CTS or occupied burrows, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted at night, when CTS is most likely to be above ground.

9.4.14 Geotechnical Exploration, Transmission Line Maintenance, and Canal Maintenance Activities. To minimize the risk of crushing CTS or occupied burrows, Permittee will follow specific guidelines for the siting of Covered Activities and ingress/egress routes that involve geotechnical exploration, transmission line and new canal maintenance, and associated ingress and egress routes, including avoiding potentially occupied burrows, monitoring for CTS, and removing CTS from the work site as needed.

Impact: Entrapment

Most amphibians are susceptible to the effects of desiccation and seek microclimate refugia to withstand extreme environmental conditions (Schwarzkopf and Alford 1996). Salamanders are particularly vulnerable to dehydration because of their body shape, size, and high ratio of wet surface exposed to the air (Rothermel and Luhring 2005). Rothermel and Luhring (2005) found only a 40% survival rate of a congener, juvenile mole salamanders (*A. talpoideum),* emigrating in the summer without burrows for shelter and almost 100% survival of salamanders with access to burrows or other form of shelter. Adult CTS travel farther to seek out suitable burrows than subadults, and young CTS are more likely to seek shelter in the first refuge they encounter, such as cracks, crevices, or downed logs (Loredo, Van Vuren et al. 1996). Mole salamanders used logging debris and artificial burrows made of polyvinyl chloride (PVC) pipe where natural burrows were no longer available (Rothermel and Luhring 2005). Therefore, it is reasonable to assume that migrating CTS will use pipes and similar materials at construction sites where natural shelter is sparse or where the construction materials mimic natural shelters, in which they could become entrapped.

While migrating or moving between burrows, CTS could fall into excavated steep-walled holes or trenches and would not be able to escape. CTS are at risk of falling and becoming entrapped because they may move quickly to access preferred burrows before daylight, in order to minimize predation or desiccation while traveling long distances (Loredo, Van Vuren et al. 1996, Rothermel and Luhring 2005). CTS could also become entrapped or entangled in erosion control matting or exclusion fencing that is made of monofilament netting with mesh sizes greater than 0.25 inch (Alvarez 2009). Mesh sizes greater than 0.25 inch could result in the salamander's leg getting caught, and larger mesh sizes could catch the head of a metamorph (Alvarez 2009). Woven wire mesh or any woven material other than tightly woven erosion cloth could lodge CTS' toes into the small crevices between the wires (Alvarez 2009). Stranded or entangled salamanders could then die of dehydration, predation, or starvation if not rescued.

Conditions of Approval: Entrapment

Covered Activities would impact CTS as described above, but these impacts will be avoided or minimized through following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring CTS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of CTS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing entrapping CTS and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.7 Trash Abatement. Permittee will initiate a trash abatement program before starting Covered Activities to ensure prompt removal of trash in construction sites.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. CTS habitat will be clearly delineated within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of CTS habitat.

7.16 Refuse Removal. Upon completion of Covered Activities, Permittee will remove from the construction site and properly dispose of any refuse, trash, debris, or materials that CTS could use for shelter and become entrapped within.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

9.1.5 Hazards to Covered Species. To minimize predation of CTS that may become entrapped, Permittee will implement a trash abatement program to ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators to the construction site.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of exploration work, Permittee will backfill geotechnical test pits or exploration bore holes on the same day as they are excavated, to avoid later entrapment of CTS in open pits or bore holes.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if CTS is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter CTS in or near the construction site and will cease Covered Activities until CTS is safely out of harm's way.

9.1.7 Daily Entrapment Inspections. Project personnel will cover or fill holes and trenches at the end of each work day to prevent inadvertent entrapment of CTS and will provide escape ramps for open holes and trenches. The Designated Biologist(s) will inspect all steep-walled holes or trenches more than six inches deep before they are covered or capped. Project-personnel will divert Covered Activities away from trapped CTS until it is removed by the Designated Biologist(s).

9.1.8 Materials Inspection. To prevent inadvertent entrapment of CTS within construction site materials, structures, or debris, the Designated Biologist(s) and Project-personnel will inspect all construction materials that have the potential to contain sheltering CTS each day prior to using, moving, or capping them. Any CTS discovered will be relocated by the Designated Biologist(s), and Project personnel will securely cap structures or materials each day to prevent CTS from entering them.

9.1.20 Erosion Control Stabilization Measures. Permittee will not use harmful materials that could trap or entangle CTS, such as monofilament netting, for erosion control during Covered Activities and will prevent CTS from crawling underneath erosion control materials.

9.4.1 Habitat Evaluation. To minimize the risk of CTS entrapment, the Designated Biologist(s) will conduct pre-project surveys to identify and delineate suitable CTS upland or aquatic habitat within the Project Area for which to implement minimization and avoidance measures.

9.4.2 Breeding Habitat Avoidance. If suitable aquatic habitat is identified by the Designated Biologist(s) within the Project area Covered Activities will avoid the suitable aquatic habitat by a margin of 300 feet.

9.4.3 CTS Relocation. Permittee will develop and implement a CDFW-approved CTS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If CTS is found on or near the construction site, The Designated Biologist(s) will relocate CTS to pre-approved locations outside of the construction site, including those found entrapped.

9.4.4 Mowing. Permittee will mow the construction site to enable the Designated Biologist(s) to detect CTS and burrows during preconstruction surveys.

9.4.5 Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual CTS from the construction site and minimize the risk of Covered Activities entrapping individuals.

9.4.6 Flag Burrows. To minimize the risk of entrapment as a result of Covered Activities, the Designated Biologist(s) will establish and delineate with flagging a 50 foot no-activity buffer around all small mammal burrows that can be avoided within construction sites

9.4.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate CTS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent CTS from using the burrows.

9.4.9 Exclusion Barrier Installation and Maintenance. To minimize the risk of CTS entrapment within a construction site, prior to initiation of site clearing, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep CTS out, under the supervision of a Designated Biologist(s) and will maintain the barrier throughout Covered Activities.

9.4.10 Initial Site Clearing and Monitoring. The Designated Biologist(s) will monitor for CTS during barrier installation and will conduct regular inspections of the exclusion barrier. Permittee will maintain the exclusion barrier as needed until the completion of Covered Activities. If the barrier is compromised, the Designated Biologist(s) will monitor for CTS and remove any individuals found to a safe location outside of the construction site.

9.4.11 CTS Avoidance. Permittee will limit the spatial extent and limit the timing of Covered Activities near suitable CTS habitat, to the extent possible, to avoid crushing CTS while they are above ground or in burrows. A Designated Biologist(s) will monitor all initial site clearing activities daily and relocate CTS, as needed, to minimize the risk of entrapping individuals.

9.4.12 Rain Forecast. To minimize the risk of entrapping CTS, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted during periods when there is a 40% or greater chance of rain and at night, when CTS is most likely to be above ground.

9.4.13 Night Work. To minimize the risk of crushing CTS or occupied burrows, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted at night, when CTS is most likely to be above ground.

9.4.14 Geotechnical Exploration, Transmission Line Maintenance, and Canal Maintenance Activities To minimize the risk of entrapment, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted during periods when there is a 40% or greater chance of rain, when CTS are most likely to be above ground. To minimize the risk of entrapment, Permittee will follow specific guidelines for the siting of Covered Activities and ingress/egress routes that involve geotechnical exploration, transmission line and new canal maintenance, and associated ingress and egress routes, including avoiding potentially occupied burrows, monitoring for CTS, and removing CTS from the work site as needed.

Impact: Capture, handling, and relocation

When a Designated Biologist(s) handles CTS to relocate it out of a construction site, or holds it in captivity temporarily, the individual may become stressed or dehydrated if it is not kept in a moist environment while in captivity, not released quickly enough, or not handled with wet hands (USFWS federal recovery permit conditions; for example, TE-068745-3). If CTS are not properly handled, contamination from the handler's skin could result in illness or mortality. Amphibians have skin that is permeable to liquid and gases, and thus have a higher risk of contamination impacts than other taxa (Quaranta, Bellantuono et al. 2009). Biologists handling CTS could expose them to lotions, creams, oils, ointments, or other contaminants such as insect repellents or sunscreens that may be harmful to them (USFWS federal recovery permit conditions; for example, TE-068745-3). If not captured and handled properly by the Designated Biologist(s), CTS could be injured while struggling to escape. The USFWS requires an ESA Section 10 recovery permit to ensure the biologists handling CTS have the right qualifications and follow measures to keep the animal safe from harm. Biologists who are not screened for qualifications and experienced with proper capture and handling techniques could cause mortality of the animals they are trying to rescue from the Covered Activities.

Relocation can minimize mortality within a construction site, but can have deleterious longer-term impacts on wildlife (Germano, Field et al. 2015). If CTS are not released into a nearby refugium with sufficient protection, they could be placed in imminent danger (USFWS federal recovery permit conditions; for example, TE-068745-3). Many animals released outside of their territories or homes ranges, even within suitable habitats, are often not able to establish themselves (Germano, Field et al. 2015). Adult amphibians have strong associations with home sites; and translocation of amphibians is generally not successful and may result in significant stress such as reduced mass and fitness of individuals trying to return to the site of capture instead of engaging in normal foraging activity, particularly where translocation sites lack preferred habitat characteristics (Dodd Jr. and Seigel 1991, Matthews 2003, Germano and Bishop 2009). Adult CTS were observed using the same migration routes each year they were studied and are familiar with the routes' surroundings and available burrows (Loredo, Van Vuren et al. 1996). Therefore, it would be reasonable to assume relocated CTS may also engage in homing behavior and face similar stresses as other relocated amphibians. Further, results of relocation of amphibians for project impact minimization are generally not monitored or documented; therefore, the outcome of the relocation, including the animal's survival, remains unknown (Germano and Bishop 2009, Germano, Field et al. 2015).

Conditions of Approval: Capture, handling and relocation

Covered Activities would impact CTS as described above, but these impacts will be avoided or minimized through following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) qualified and responsible for capturing and handling CTS.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if CTS is taken or injured by a Project-related activity.

9.4.3 CTS Relocation. Prior to initiation of Covered Activities, Permittee will develop a CDFW-approved CTS Mortality Reduction and Relocation Plan which includes a specific protocol for Designated Biologist(s) to minimize impacts associated with capture, handling, and relocation on CTS individuals. Designated Biologist(s)s will carry state and federal permits to handle CTS and will capture, handle, or relocate CTS only when determined it is necessary.

Impact: Exposure to contaminants

Amphibians have skin that is permeable to liquid and gases and thus have a high risk of impacts following exposure to contaminants (Quaranta, Bellantuono et al. 2009). Quaranta, Bellatuono et al (2009) suggest that exposure to contaminants is correlated with worldwide declines in amphibian populations. Concentrations of toxic chemicals can accumulate in the tissues of susceptible amphibians from long distances; for example, chemicals from agricultural operations in the Central Valley had potential sublethal effects on frogs in the Sierra Nevada, including long-term increases in mortality and population decline (Smalling, Fellers et al. 2013). Covered Activities such as grading, dewatering, RTM processing, and excavation could expose CTS in upland habitat to contaminants aerially or through the soil. Leakage or spillage of petroleum products such as oil or fuels could result from any of the Covered Activities in or near CTS habitat. Pesticides or herbicides may be used for Covered Activities involving construction or maintenance. Short-range exposure of CTS to pesticides or herbicides from contaminated soils or containers used for temporary housing of these chemicals could result in harmful effects on CTS through contact with their skin. For example, commonly used anticoagulant baits disintegrate and remain in the soil before they slowly degrade (Eason and Wickstrom 2001). Rodenticides used to control burrowing mammals along embankments or within construction sites could have a direct effect on contamination of CTS if residue is absorbed through their skin while using the affected small mammal burrows. During terrestrial life stages, CTS consume invertebrates such as flies and moths, beetles, spiders, hexapods, and earthworms (USFWS 2016). Heavy use of insecticides within or near CTS habitat could cause indirect uptake of contaminants through consumption of contaminated prey.

Most of the Project impacts would be in upland habitat within the Project Area; however, Covered Activities involving construction, RTM processing, effects of erosion or fugitive dust, and the use of pesticides and herbicides could cause run-off, soil, or wind transport of contaminants from construction sites to nearby CTS aquatic habitat. Such transport of chemicals to aquatic habitat could expose larval CTS to contaminants such as petroleum products, pesticides, selenium, mercury, or herbicides. In Monterey County, die-offs of several CTS larvae were associated with water quality changes and contamination of ponds, mostly where pesticides were used nearby (Ryan, Johnson et al. 2013). Studies also reveal harmful effects of pesticide and herbicide contaminants on other *Ambystoma* species (USFWS 2014). Many of these studies, however, are from large-scale application of pesticides in agricultural operations. It is possible the low-volume, localized use of these chemicals during Covered Activities would lower the risk; although, the extent of contaminant drift without containment would have an unknown amount of impact on the water quality of the nearest breeding pools. It is also reasonable to assume aquatic prey exposed to pesticides could cause indirect contamination of larval CTS through consumption.

Conditions of Approval: Exposure to contaminants

Covered Activities would impact CTS as described above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist. CDFW-approved Designated Biologist(s) responsible for monitoring CTS and Covered Activities.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of CTS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing impacts to CTS and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of CTS by the Designated Biologist(s). Permittee shall keep the amount of water used to the minimum amount needed, and shall not allow water to form puddles.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. CTS habitat will be clearly delineated within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of CTS habitat.

7.11 Project Related Vehicle Use. To minimize the risk of CTS contaminant exposure petroleum spillage or leakage during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to existing roadways, designated ingress/egress routes and adhere to speed limits.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of CTS contaminant exposure petroleum spillage or leakage during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible.

7.14 Hazardous Waste. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

9.1.1 Herbicide and Pesticide Use. To minimize the extent to which CTS are exposed to contaminants as a result of herbicide and pesticide use during Covered Activities in and nearby suitable CTS habitat, the use and application of herbicides and pesticides by Permittee will be limited by specific conditions within the Project Area.

9.1.2 Rodenticide Use. To minimize the extent to which CTS are exposed to contaminants as a result of herbicide and pesticide use during Covered Activities in and nearby suitable CTS habitat rodenticides will not be used in construction sites.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter CTS in or near the construction site and will cease Covered Activities until CTS is safely out of harm's way.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. Permittee will develop and implement a CDFW-approved Spill Prevention, Containment and Countermeasure Plan to prevent spills of contaminants as a result of Covered Activities, which will minimize exposure of CTS to contaminants if a spill does occur. Measures will include repair of leaks or spills and clean-up, containment, and disposal of hazardous products.

9.1.22. Hazardous Materials Management Plan. Permittee will develop and implement a CDFW-approved Hazardous Materials Management Plan to prevent the release of hazardous materials as a result of Covered Activities, which will minimize exposure of CTS to contaminants if a spill does occur. Measures will include repair of leaks or spills and clean-up, containment, and disposal of hazardous products.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To contain contaminants from spoils, RTM, and dredged material, Permittee will develop and implement a plan for the disposal and storage of these materials. The plan will address potential discharge of contaminants, reducing potential exposure of CTS to the contaminants, and will minimize encroachment of these materials on environmentally sensitive areas.

9.1.18 Stormwater Pollution Prevention Plan. To minimize the extent to which CTS are exposed to contaminants as a result of stormwater runoff from construction sites, Permittee will prepare and implement a Stormwater Pollution Prevention Plan that minimizes contamination impacts by following all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge, which will be in place throughout the duration of Covered Activities.

9.1.19 Erosion and Sediment Control Plan. Covered Activities may result in increased erosion and mobilization of sediment in runoff from construction sites. Because potential mobilization of contaminants is closely linked to sediment disturbance and associated impacts on habitat, Permittee will develop erosion and sediment control plans to limit dispersal of contaminated sediments during Covered Activities, reducing potential exposure of CTS to contaminants.

9.1.23Fugitive Dust Control. Permittee will develop and implement a CDFW-approved Fugitive Dust Control Plan to limit the mobilization of fugitive dust as a result of Covered Activities, which will limit the exposure of CTS to contaminants in fugitive dust.

9.4.1 Habitat Evaluation. To minimize the risk of Covered Activities contaminating CTS or occupied burrows, the Designated Biologist(s) will conduct pre-project surveys to identify and delineate suitable CTS upland or aquatic habitat within the Project Area for which to implement minimization and avoidance measures.

9.4.2 Breeding Habitat Avoidance. If suitable aquatic habitat is identified by the Designated Biologist(s) within the Project area Covered Activities will avoid the suitable aquatic habitat by a margin of 300 feet to minimize the risk of Covered Activities contaminating CTS.

9.4.3 CTS Relocation. Permittee will develop and implement a CDFW-approved CTS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If CTS is found on or near the construction site, The Designated Biologist(s) will relocate CTS to pre-approved locations outside of the construction site to minimize the risk of Covered Activities contaminating CTS or occupied burrows.

9.4.4 Mowing. Permittee will mow the construction site using methods and equipment that minimize ground impact for the Designated Biologist(s) to detect CTS and burrows during preconstruction surveys, and the Designated Biologist(s) will monitor mowing to minimize the risk of contaminating individual CTS.

9.4.5 Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual CTS and minimize the risk of Covered Activities contaminating individual CTS.

9.4.6 Flag Burrows. To minimize the risk of exposing CTS to contaminants as a result of Covered Activities, the Designated Biologist(s) will establish and delineate with flagging a 50-foot no-activity buffer around all small mammal burrows that can be avoided within construction sites.

9.4.7 Burrow Excavation. To minimize the risk of contaminating soil in small mammal burrows, the Designated Biologist(s) will establish and delineate with flagging a 50-foot no-activity buffer around all small mammal burrows that can be avoided within construction sites or will excavate all small mammal burrows within a construction site that cannot be avoided to relocate CTS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent CTS from using the burrows.

9.4.9 Exclusion Barrier Installation and Maintenance. To minimize the risk of contaminating CTS or occupied burrows within a construction site, prior to initiation of site clearing, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep CTS out, under the supervision of a Designated Biologist(s) and will maintain the barrier throughout Covered Activities.

9.4.10 Initial Site Clearing and Monitoring. To minimize the risk of contaminating CTS or occupied burrows, the Designated Biologist(s) will monitor for CTS during barrier installation and will conduct regular inspections of the exclusion barrier to ensure its integrity. Permittee will maintain the exclusion barrier as needed until the completion of Covered Activities. If the barrier is compromised, the Designated Biologist(s) will monitor for CTS and remove any individuals found to a safe location outside of the construction site.

9.4.11 CTS Avoidance. Permittee will limit the spatial extent and limit the timing of Covered Activities near suitable CTS habitat, to the extent possible, to avoid crushing CTS while they are above ground or in burrows. A Designated Biologist(s) will monitor all initial site clearing activities daily and relocate CTS, as needed, to minimize the risk of contaminating individual CTS.

9.4.12 Rain Forecast. To minimize the risk of contaminating CTS or occupied burrows, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted during periods when there is a 40% or greater chance of rain and at night, when CTS is most likely to be above ground.

9.4.13 Night Work. To minimize the risk of contaminating CTS or occupied burrows, Covered Activities associated with geotechnical exploration, transmission line installation and maintenance, and facilities maintenance will be restricted at night, when CTS is most likely to be above ground.

9.4.14 Geotechnical Exploration, Transmission Line Maintenance, and Canal Maintenance Activities. To minimize the risk of contaminating CTS or occupied burrows with leakages of petroleum, Permittee will follow specific guidelines for the siting of Covered Activities and ingress/egress routes that involve geotechnical exploration, transmission line and new canal maintenance, and associated ingress and egress routes, including avoiding potentially occupied burrows, monitoring for CTS, and removing CTS from the work site as needed.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments in the CCF will be limited to July and August. This measure will minimize the potential exposure of CTS adjacent to CCF to herbicide contaminants as a result of Covered Activities.

Impact: Disturbance from light and vibration

Although salamanders lack the tympanic middle ear to hear airborne sounds through the conversion of sound waves to nerve signals, there is evidence tiger salamanders detect airborne sounds through vibrations induced by sound waves as well as detecting vibrations through substrates in the ground (Christensen, Lauridsen et al. 2015). It is possible airborne vibrations from sounds provide information about predators (Christensen, Lauridsen et al. 2015). Noise coupled with other disturbances, such as human or vehicle traffic, may flush above-ground CTS into burrows or hiding places, making it less likely for Project personnel or the Designated Biologist(s) to detect CTS during ground disturbance and clearance activities. This would increase the risk of CTS entombment within the burrow or being crushed while hiding in cracks, crevices, or debris. The highest levels of noise and vibration could result from vibratory and impact pile driving, as well as excavation equipment, tracked vehicles, pile-extraction equipment, and compaction equipment (California Department of Transportation 2013). Dust abatement water trucks may mimic vibration caused by rain (Dimmit and Ruibal 1980).

Construction-related vibration could cause CTS to emerge from burrows on dry nights, exposing them to predators, thermal effects, or vehicle strikes. It is possible for ground vibrations from construction equipment to mimic the vibration of rain and miscue CTS to emerge from burrows at the wrong time, as observed in a study on spadefoot toads (*Scaphiopus couchi* and *S. multiplicatus*), which have a similar life history as CTS (Dimmit and Ruibal 1980). Using water trucks within the construction site for dust control can also simulate rainfall, wet the soil, and stimulate emergence (Dimmit and Ruibal 1980). For example, CTS was observed emerging during dust abatement watering in a construction site in Sacramento County (ICF International 2016a). Besides emerging from burrows to breed, CTS in upland habitat may emerge multiple times to travel to different burrows on rainy nights (Trenham 2001). If vibrations from Covered Activities induce emergence when there is no rain, CTS could become dehydrated unless they immediately reenter the burrow. Vibratory pile drivers can produce measurable ground vibrations up to 100 feet, depending on the characteristics of the soil and perception sensitivity of the species (California Department of Transportation 2013). In addition, if construction sites are lit with artificial lighting during night work, individuals within the construction site and up to 100 feet outside of the construction site where light spills over could be negatively affected because CTS are active at night. CTS disturbed by artificial lighting may choose to remain in their burrows instead of migrate to other burrows or to breeding sites, or those that do make above-ground movements could become more visible to predators. Emergence within or near the construction site could increase CTS' vulnerability to predation and other impacts, such as being crushed by vehicles or entrapped.

<u>Conditions of Approval: Disturbance from light and vibration</u>

Covered Activities would impact CTS as described above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.1 <u>Designated Representative</u>. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 <u>Designated Biologist(s)</u>. CDFW-approved Designated Biologist(s) responsible for monitoring CTS and Covered Activities.

7.4 <u>Designated Biologist(s) and Designated Fisheries Biologist Authority</u>. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of CTS.

7.5 <u>Education Program</u>. Designated Biologist(s) will train Project personnel on avoiding and minimizing impacts to CTS and will monitor Covered Activities.

7.6 <u>Construction Monitoring Notebook</u>. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.10 Delineation of Habitat. CTS habitat will be clearly delineated within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of CTS habitat.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if CTS is taken or injured by a Project-related activity.

9.1.3 Artificial Lighting. Permittee will use artificial outdoor lighting only as needed for safety and security in construction and permanent facility sites. and will design lighting to minimize impacts to the surrounding environment. Limitations on the use of artificial lighting will reduce impacts to CTS as a result of exposure to lighting and vibration associated with Covered Activities.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter CTS in or near the construction site and will cease Covered Activities until CTS is safely out of harm’s way.

9.1.11 In-Water Work Windows. To reduce the amount of time pile driving and other Covered Activities causing noise, vibration, and light disturbances occur, Permittee will restrict certain in-water work at the CCF to certain dates between July 1 and November 30. This will reduce disturbance effects in areas that may be near or adjacent to CTS habitat.

9.1.12 Daily In-Water Work Restriction. To reduce the amount of nighttime pile driving and other Covered Activities causing noise, vibration, and light disturbances, Permittee will restrict in-water work between sunset and sunrise. This will reduce disturbance effects in areas that may be near or adjacent to CTS habitat.

9.1.14 Pile Driving Plan. Permittee will develop and implement a CDFW-approved Pile Driving Plan to minimize the timing and duration of impact or vibratory pile driving during construction. Limitations on pile driving will reduce impacts to CTSs a result of exposure to vibration associated with Covered Activities.

9.4.3 CTS Relocation. To minimize the risk to above-ground CTS, Permittee will develop and implement a CDFW-approved CTS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If CTS is found on or near the construction site, The Designated Biologist(s) will relocate CTS to pre-approved locations outside of the construction site

9.4.6 Flag Burrows. To minimize the risk of stimulating emergence by mimicking rain, the Designated Biologist(s) will establish and delineate with flagging a 50-foot no-activity buffer around all small mammal burrows that can be avoided within construction sites.

9.4.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate CTS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent CTS from using the burrows.

9.4.13 Night Work. All Covered Activities not enclosed by an exclusion barrier will be restricted to 30 minutes after sunrise until 30 minutes before sunset to minimize impacts to CTS as a result of vibration and artificial lighting associated with Covered Activities.

Impact: Reduction of Suitable Habitat Elements

In upland habitat, CTS consume insects such as flies and moths, beetles, spiders, hexapods, and earthworms (USFWS 2016). Use of insecticides within or near CTS upland habitat could significantly reduce insect prey, affecting the quality of the habitat. Insecticides used during construction could drift via wind or run-off into surrounding CTS habitat. Impacts to aquatic habitat could result from run-off and transport of contaminants to breeding pools near the Project Area. CTS' diet at the larval stage consists primarily of invertebrates, including zooplankton, small crustaceans, snails, aquatic insects, and tadpoles (Ryan, Johnson et al. 2013, USFWS 2016). Nearby use of pesticides resulted in starvation of larval CTS following algal blooms and depletion of aquatic invertebrates (Ryan, Johnson et al. 2013). It is possible the low-volume, localized use of these chemicals during Covered Activities would lower the risk; although, the extent of contaminant drift without containment would have an unknown amount of impact on the water quality of the nearest breeding pools. Use of herbicides or mechanical vegetation control could also decrease the value of CTS' habitat by reducing protective cover. Vegetation could be removed during construction or maintenance activities. Management may be used to shorten vegetation to optimize CTS upland habitat; however, land void of vegetation is not palatable for CTS dispersal (79 FR 49380).

Adult CTS, and juveniles to a lesser extent, are highly dependent on small mammal burrows for cover and aestivation, particularly California ground squirrel burrows, in the high-temperature climates of the Central Valley (Loredo, Van Vuren et al. 1996, Trenham 2001). Because unused burrows collapse over time, CTS in upland habitat require ground squirrels to maintain a burrow system (Loredo, Van Vuren et al. 1996). Because ground squirrel burrows can damage embankments and levees, rodenticides are typically used to protect vulnerable infrastructure (Marsh 1994, Van Vuren, Ordenana et al. 2014, Ballester 2015). Where Project maintenance along the approach canals or the southern edge of the CCF requires rodent control, the population of ground squirrels or gophers would be reduced in surrounding CTS upland habitat. If the abundance of ground squirrel burrows decreases, CTS mortality rates could increase if individuals have to travel farther from breeding ponds to find suitable burrows (Loredo, Van Vuren et al. 1996).

Conditions of Approval: Reduction of suitable habitat elements

Covered Activities would impact CTS as described above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring CTS and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of CTS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing impacts to CTS habitat and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.10 Delineation of Habitat. CTS habitat will be clearly delineated within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of CTS habitat.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

9.1.1 Herbicide and Pesticide Use. The use and application of herbicides and pesticides by Permittee will be limited by specific conditions within the Project Area. This measure will minimize the extent to which CTS habitat is exposed to contaminants resulting from herbicide and pesticide use during Covered Activities within and adjacent to suitable habitat.

9.1.2. Rodenticide Use. Permittee will prohibit the use of rodenticides in construction sites. This measure will minimize the reduction of small mammal burrows as a result of Covered Activities in suitable CTS upland habitat.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments in the CCF will be limited to July and August. As a result, the potential reduction of vegetation in habitat adjacent to CCF to contaminants as a result of Covered Activities will be minimized.

ii. CTS Mitigation Measures

The avoidance and minimization measures above will reduce, but not eliminate, the impacts on CTS resulting from Covered Activities; therefore, the following additional measures are required to achieve full mitigation.

Covered Activities associated with construction will result in a total of 50 acres of permanent impacts to CTS upland habitat—47 acres of direct impact and 3 acres of indirect impact from vibration and lighting effects. Permittee will not impact CTS aquatic habitat. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11). As compensatory mitigation for impacts to CTS Permittee shall preserve and permanently protect 150 total acres of CTS upland habitat. (See, generally, ITP Conditions of Approval 10 and 11) To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CTS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for California Tiger Salamander Terrestrial Cover and Aestivation Habitat* and will be consistent with CTS habitat conditions within the East Contra Costa County HCP/NCCP reserve system. Permittee will ensure permanent protection and funding for perpetual management of compensatory CTS upland habitat, including monitoring for suitable habitat features and presence of CTS for at least three years.

Covered Activities associated with stringing of transmission lines will result in temporary disturbance of six acres of CTS upland habitat. Temporary disturbance from geotechnical exploration will be followed by permanent impacts described above after geotechnical exploration is complete. Permittee will not temporarily impact CTS aquatic habitat. Permittee will restore on-site the six acres of CTS upland habitat that will be temporarily disturbed during Covered Activities to pre-project or better conditions. To ensure restored habitat fully mitigates for impacts to CTS, restoration and success criteria for temporarily affected habitat will comply with ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria California Tiger Salamander Terrestrial Cover and Aestivation Habitat* and will be consistent with the definition for suitable CTS upland habitat in Condition of Approval 8.4.1.1, and will be detailed in a Vegetation Restoration Plan approved by CDFW. Restored habitat will be monitored for one year for suitable habitat features and presence of CTS.

iii. CTS Final EIR/EIS Avoidance and Minimization Measures

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures (AMMs), conservation measures, environmental commitments, and resource restoration and protection principles (RRPP) required to be implemented by the ITP, that would further ensure that any impacts to CTS resulting from Covered Activities would be minimized and fully mitigated.

- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- AMM 2 (Construction best management practices and monitoring)
- Environmental Commitment 3B.2.5/ AMM 3 (Develop and implement stormwater pollution prevention plans)
- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- AMM 5 (Spill Prevention, Containment, and Countermeasure Plan)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material (RTM), and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- AMM10 (Restoration of temporarily affected natural communities)
- AMM13 (California tiger salamander)
- Environmental Commitment 3 (Natural communities protection and restoration)
- Environmental Commitment 8 (Grassland natural community restoration)
- Environmental Commitment 9 (Vernal pool and alkali seasonal wetland complex restoration)
- RRPP L2 (Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area)
- RRPP L3 (Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species)
- RRPP VP/AW1 (Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005)
- RRPP VP/AW3 (Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area)
- RRPP VP/AW6 (In grasslands surrounding protected and created vernal pool

and alkali seasonal wetlands, increase burrow availability for burrow-dependent species)

- RRPP G2 (Protect up to six acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles)
- RRPP G7 (Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species)
- RRPP G10 (Protect up to 647 acres of grassland in the Byron Hills area where practicable and/or in other appropriate locations)

b. Swainson's hawk (*Buteo swainsonii*)

i. SWHA Project Construction Impacts and Avoidance and Minimization Measures

Covered Activities and their resulting impacts are expected to result in the incidental take of Swainson's hawk individuals (SWHA). The Covered Activities summarized in Section II A above and described in the ITP and ITP application that are expected to result in incidental take of SWHA include geotechnical exploration; the construction of NDD intakes, tunneled conveyance facilities, the HOR Gate, and CCF modifications; construction and improvement of access roads; the construction, installation, and maintenance of power supply facilities (poles, towers, and lines); and RTM placement or processing. Ongoing impacts of the taking will result from maintenance of permanent land-side facilities such as forebay or canal embankments, the land-side portions of NDDs, landscaping, or operational lighting.

Incidental take of SWHA, and adverse impacts as a result of impacts of the taking on SWHA, are expected to occur as a result of disturbing nest trees or nesting SWHA and causing nest abandonment, resulting in loss of eggs or chicks; removal or trimming of nest trees; collisions with vehicles, equipment, or transmission lines; displacement and reduction of suitable habitat features; and contaminants. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to SWHA is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Incidental take of SWHA individuals in the form of mortality ("kill") may occur during the breeding season (March 1 – September 15), in SWHA nesting habitat within 0.5 miles of construction activities, as a result of drilling or construction noise or vibration (eg., pile driving, excavating, dredging, grading, helicopter operations, barge operations) and light disturbances that cause abandonment of nests and the loss of nestlings or eggs from exposure of the nest to predators and environmental conditions; vehicles, equipment, and workers, or construction activities approaching nest trees too closely or touching or disturbing a nest tree, causing nest abandonment and exposure of eggs or nestlings;

trimming or removal of nest trees that take down and destroy an occupied nest and result in mortality of eggs or nestlings;; and increased collisions with vehicles, equipment, or transmission lines that could cause direct mortality of SWHA. The areas where authorized take of SWHA is expected to occur are described above in Project Area impact locations groups A – D, F – I, and K – N, and in the utility line corridor (ITP Attachment 1, Figures 4-10).

The Project is expected to cause the permanent loss of 3,770 acres of SWHA foraging habitat and 22 acres of SWHA nesting habitat, and temporary loss of 1,114 acres of SWHA foraging habitat. In addition, seven nest sites with suitable nest trees will be removed. Vegetation and natural community cover types, crop cover types, and occurrence data were included in a CDFW-approved habitat model used as a habitat-based proxy to estimate the extent of incidental take in the form of mortality and indirect impacts that will occur as a result of the Project. Impacts of the authorized taking also include adverse impacts to SWHA related to temporal losses, increased habitat fragmentation and edge effects, and the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include: the removal of nest trees during the nonbreeding season (September 15 – March 1) resulting in a loss of reproductive activity in subsequent years; disturbance and displacement causing reduced foraging opportunities, farther foraging distances, and higher energetic expense to adults provisioning their young; fugitive dust and contaminants affecting the health and long-term survival of SWHA; and rodent control causing a decrease in available prey.

In general, Covered Activities would impact SWHA as described above, but these impacts will be avoided or minimized by the following Conditions of Approval required by the ITP.

Multispecies Measures with Application to SWHA:

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with the ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of the ITP.

7.2 Designated Biologist(s). Permittee shall submit to CDFW in writing the name qualifications, business address, and contact information of a biological monitor (Designated Biologist(s)) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Biologist(s) is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist(s) shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist(s) in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist(s) must be changed.

7.4 Designated Biologist(s) Authority. To ensure compliance with the Conditions of Approval of the ITP, the Designated Biologist(s) shall have authority to immediately stop any activity that does not comply with the ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist(s) that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; Take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers; and measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped. Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of the ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s).

7.9 Delineation of Property Boundaries. Before starting Covered Activities, Permittee shall clearly delineate the boundaries of the construction site with fencing, stakes, or flags. Permittee shall restrict all Covered Activities to within the fenced, staked, or flagged areas. Permittee shall maintain all fencing, stakes, and flags until the completion of Covered Activities in that area.

7.10 Delineation of Habitat. Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of Covered Species' habitat.

7.11 Project Related Vehicle Use. Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area. Project-related personnel shall observe a speed limit of 20 miles per hour in construction sites, except on county roads, state and federal highways, and other roads where 20 miles per hour would unsafely impede the normal flow of traffic. Permittee shall post a vehicle speed limit of 20 miles per hour on all nonpublic construction and access roads.

7.12 Vehicle Parking and Staging Areas. Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of the ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in the ITP and/or the MMRP. The Designated Representative shall report any non-compliance with the ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each construction site within the Project Area when Covered Activities occur and shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3) check for compliance with all measures of the ITP; (4) check all exclusion zones; (5) ensure that signs, stakes, and fencing are intact, and (6) ensure that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall monitor compliance continuously where Covered Activities are occurring; and after initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections a minimum of once per day where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by the ITP. Permittee shall compile and report observation and inspection records as described in Condition of Approval 8.6 *Compliance Report.* The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps, including metadata, depicting: 1) mapped areas of all land disturbances within the Project Area; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species within the Project Area (defined by Conditions of Approval 8.4.1), and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each construction site and surrounding buffer, no more than 14 days prior to initiation of Covered Activities, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species in the construction site and disturbed by Covered Activities, maintain this tracking using a GIS format, and include photo documentation of the habitat feature. The photo documentation of each habitat feature shall include a minimum of four photos facing the habitat feature, taken from the North, South, East, and West. Permittee shall include separate photo documentation of each habitat feature suitable for Covered Species; if there are multiple habitat features in a construction site, Permittee shall include multiple sets of photo documentation for that site. Permittee shall document the total disturbed acreage of habitat features for Covered Species compiled from the real-time tracking; compare the documented disturbance in each construction site to the Baseline Maps as shown in Attachment 6; provide GIS layers and the associated metadata to CDFW with the Monthly Compliance Report; maintain maps for each Covered Species separately; include updates to any of the maps in the next Annual Status Report; provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report; and provide a summation of disturbance of identified habitat features annually with the Annual Status Report.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in

Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month, to the office listed in the Notices section of the ITP, and via e-mail to CDFW's Representative. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision, depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of the ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within construction sites in the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.9.1 Project Construction Report. No later than 180 days after completion of all mitigation measures, Permittee shall provide CDFW with a Final Mitigation Report. The Designated Biologist(s) shall prepare the Final Mitigation Report which shall include, at a minimum: (1) a summary of all Monthly Compliance Reports and all ASRs; (2) a copy of the table in the MMRP with notes showing when each of the mitigation measures was implemented; (3) all available information about Project-related incidental take of the Covered Species; (4) information about other Project impacts on the Covered Species; (5) beginning and ending dates of Covered Activities; (6) an assessment of the effectiveness of the ITP's Conditions of Approval in minimizing and fully mitigating Project impacts of the taking on Covered Species; (7) recommendations on how mitigation measures might be changed to more effectively minimize take and mitigate the impacts of future projects on the Covered Species; and (8) any other pertinent information.

8.10 Notification of Take or Injury. Permittee shall immediately notify the Designated Biologist(s) if a Covered Species is taken or injured by a Covered Activity, or if a Covered Species is otherwise found dead or injured within the vicinity of the Project Area. The initial notification to CDFW shall include information regarding the location, species, and number of animals taken or injured and the ITP Number. Following initial notification, Permittee shall send CDFW a written report within two calendar days. The report shall include the date and time of the finding or incident, location of the animal or carcass, and if possible provide a photograph, explanation as to cause of take or injury, and any other pertinent information.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye to prevent overspray.

9.1.2 Rodenticide use. Permittee shall prohibit the use of rodenticides in the construction sites.

9.1.3 Artificial Lighting. Permittee shall use artificial outdoor lighting only as needed for safety and security. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and permanent facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access.

9.1.4 Covered Species Observations. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities.

9.1.5 Hazards to Covered Species. Permittee shall not permit pets, campfires, or firearms in construction sites, except firearms carried by authorized security personnel or local, state, or federal law enforcement officials.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Permittee shall size and locate the designated storage sites to accommodate all RTM, dredge material, or spoils expected to be generated by Covered Activities to minimize the impact or encroachment on environmentally sensitive areas within the Project Area.

9.1.10 Transmission Line Strikes. To minimize the potential for bird strikes with transmission lines, Permittee shall install bird strike diverters on all new permanent and temporary lines. For optimum results, Permittee shall space the diverters along the lines in accordance with the Avian Powerline Interaction Committee's guidance (Avian Power Line Interaction Committee 2012). Permittee shall use the most effective and appropriate diverter for minimizing strikes, according to best available science. Permittee shall install bird strike diverters in a configuration that research indicates would reduce bird strike risk by 60% or more. Permittee shall also install bird strike diverters on the same length of existing lines within the Project Area as the length of new transmission lines constructed, unless the new lines replace existing lines. Permittee shall periodically inspect and replace bird strike diverters placed on new and existing lines as needed until or unless the lines are removed.

9.1.11 In-Water Work Windows. Permittee shall restrict the times of year when certain in-water Covered Activities are conducted. The following Covered Activities are permitted only during certain dates within the in-water work windows between June 1 and November 30: over water geotechnical exploration, dredging, cofferdam installation and removal, pile driving, levee clearing and grading, riprap placement, construction of sheetpile walls, and placing of rock bedding and stone slopes. Permittee shall coordinate with the NDDTT, HGTT, CCFTT, and the TOT prior to finalizing Project engineering design to further limit the times when Permittee shall conduct in-water work, as feasible.

9.1.12 Daily In-Water Work Restriction: Permittee shall terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise. Permittee shall use sunrise and sunset times established by the U.S. Naval Observatory Astronomical Applications Department for the geographic area.

9.1.14 Pile Driving Plan. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a pile driving plan to minimize the impacts of pile driving on Covered Species. The pile driving plan shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the duration of pile driving within the in-water work windows, and the duration of pile driving within the daily in-water work construction window. To minimize impacts of pile driving on Covered Species, the pile driving plan shall restrict impact pile driving activities to specific times of the day and for a specific duration to be determined in coordination with the TOT; minimize impact pile driving used in the construction of barge landings by using floating docks instead of pile-supported docks, where feasible; and implement vibratory pile driving methods to minimize the noise generated from construction activities to the greatest extent feasible. Permittee shall ensure the pile driving plan is reviewed and finalized by the TOT and submitted to CDFW for written approval before Permittee initiates Covered Activities that require pile driving, and shall implement all measures in the approved plan.

9.1.15 Barge Operations Plan. Permittee shall develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities, identify the barge routes that minimize impacts, and minimize general barge operation related effects. Permittee shall not initiate Covered Activities that require barge operations until the final barge operations plan is approved in writing by CDFW.

9.1.23 Fugitive Dust Control. Permittee shall implement fugitive dust control measures and enhanced dust control measures at all construction and staging areas to reduce construction-related fugitive dust that are consistent with Air Quality Management District (AQMD) guidelines and requirements for each region. Fugitive dust control measures shall address: applying water to all exposed surfaces—such as soil piles, graded areas, unpaved parking areas, staging areas, and access roads--to prevent visible dust from leaving construction sites; covering and maintaining at least two feet of freeboard space on trucks transporting soil, sand, and other loose material; using wet power vacuum street sweepers to remove visible track-out of mud or dirt; limiting vehicle speeds on unpaved roads to 15 miles per hour; completing paving projects and laying construction pads as soon as possible after grading; watering exposed soil with adequate frequency; suspending excavation, grading, or demolition activity when wind speeds exceed 20 miles per hour or conducting fugitive dust control measures more frequently during dry summers and wind conditions higher than 20 miles per hour; installing wind breaks such as trees or solid fencing on the windward side(s) of construction sites; and planting vegetative ground cover, such as fast-germinating native grass seed, as soon as possible after construction is completed and ensuring vegetation becomes established. Permittee shall develop measures for entrained road dust—such as washing wheels and equipment or treating access to sites with material such as wood chips or gravel that would reduce carry-out. Permittee shall develop measures for concrete batching, such as achieving a 70-percent reduction in dust from concrete batching and 80 percent reduction in dust from aggregate and sand pile erosion. Permittee shall submit fugitive dust control and enhanced dust control measures to CDFW for written approval prior to initiating construction activities.

Measures specific to SWHA

9.2.1 Preconstruction Surveys. The Designated Biologist(s) shall conduct preconstruction surveys to identify the presence of suitable SWHA nest trees and known nest trees (occupied within one or more of the past five years) within 0.5 mile of the construction site, defined by Condition of Approval 8.4.1 and the Designated Biologist(s)' professional judgment. A nest tree shall be considered occupied from the time the SWHA pair starts constructing the nest until the young leave the nest, or until the Designated Biologist(s) determine(s) the nesting attempt failed and the nest is abandoned. The Designated Biologist(s) shall also conduct preconstruction surveys prior to maintenance activities that could disturb SWHA nests. Permittee shall ensure surveys for nesting SWHA are conducted in all suitable and known nest trees identified by the Designated Biologist(s), and are consistent with the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (SWHA Technical Advisory Committee 2000), or methodology modified with written approval from CDFW.

9.2.2 Timing Restrictions. Where the construction site occurs within 0.5 mile of known or occupied nest trees identified by the Designated Biologist(s), Permittee shall limit Covered Activities to outside the SWHA breeding season (March 1 – August 15), to the extent practicable. Where Covered Activities cannot be restricted to more than 0.5 mile of an occupied nest tree during the breeding season, Permittee shall restrict the Covered Activities to not occur during the period of egg laying to post-hatching, as determined by the Designated Biologist(s), to the extent practicable. If not practicable, Permittee shall initiate Covered Activities prior to egg laying to allow time for SWHA to acclimate to disturbance before eggs are laid. Where restricting work to outside the breeding season or during the period of egg laying to post-hatching is not practicable, Permittee shall submit plans to initiate Covered Activities to CDFW for written approval.

9.2.3 No-disturbance Buffer. Where Covered Activities must occur within 0.5 mile of an occupied SWHA nest tree, Permittee shall establish a 650-foot-radius, no-activity buffer (buffer) around each occupied nest tree, and the buffer shall remain in place until the end of the breeding season or until the last chick has left the nest. Permittee shall clearly delineate the buffer with fencing or other conspicuous marking. The Designated Biologist(s) shall monitor occupied nest trees to track progress of nesting activities. Permittee shall not conduct any Covered Activity within the buffer unless a smaller buffer is approved in writing by CDFW. If a Covered Activity must occur within 0.5 mile of an occupied nest tree, Permittee shall follow the conditions in Condition of Approval 9.2.4 and shall not conduct any Covered Activity within 150 feet of an occupied nest tree.

9.2.4 SWHA Nest Monitoring. Where Covered Activities must occur at any site that is within 0.5 mile of an occupied SWHA nest tree, Permittee shall monitor the nest as follows or implement a monitoring and management plan prepared by the Designated Biologist(s) and approved in writing by CDFW. Five days and three days prior to the initiation of Covered Activities at any site where an occupied nest tree is within 0.5 mile of the Covered Activity, the Designated Biologist(s) shall observe the occupied nest(s) for at least one hour or until nest status can be determined. The Designated Biologist(s) shall document nesting status and behaviors to compare to nesting status and behaviors after Covered Activities begin. Where an occupied nest tree occurs between 150 and 325 feet from Covered Activities, the Designated Biologist(s) shall observe the nest for at least four hours per day during Covered Activities to ensure the SWHA are engaged in normal nesting behavior; and Permittee shall limit Covered Activities to between 30 minutes after sunrise and 30 minutes before sunset . Where an occupied nest tree occurs between 325 and 650 feet of Covered Activities, the Designated Biologist(s) shall observe the nest for at least two hours per day during Covered Activities to ensure the SWHA are engaged in normal nesting behavior. Where an occupied nest tree occurs between 650 and 1,300 feet of Covered Activities, the Designated Biologist(s) shall observe the nest for at least one hour on at least three days per week during Covered Activities to ensure the SWHA are engaged in normal nesting behavior and to check the status of the nest. Where an occupied nest tree occurs between 1,300 and 2,640 feet of Covered Activities, the Designated Biologist(s) shall observe the nest for at least one hour on at least one day per week during Covered Activities to ensure the SWHA are engaged in normal nesting behavior and to check the status of the nest.

9.2.5 Disturbance of Occupied Nest Tree. Permittee shall prohibit physical contact with an occupied nest tree throughout the breeding season. All workers within 650 feet shall be out of the line of sight of the occupied nest tree during breaks, or shall take breaks more than 650 feet from the occupied nest tree.

9.2.6 Authority of Designated Biologist(s). If during Covered Activities the Designated Biologist(s) determine(s) that nesting SWHA within 0.5 mile of the construction site are disturbed by Covered Activities, to the point nest abandonment is likely, the Designated Biologist(s) shall immediately notify Permittee, and the Designated Representative shall contact CDFW within 24 hours to determine additional protective measures that can be implemented. The Designated Biologist(s) shall have the authority to stop Covered Activities until additional protective measures are implemented, unless SWHA behavior normalizes on its own. Potential nest abandonment and nest failure shall be indicated if, in the Designated Biologist(s)' professional judgment, SWHA exhibit distress and/or abnormal nesting behavior, such as swooping/stooping at equipment or personnel, excessive distress-call vocalization or agitated behavior directed at personnel, failure to remain on nest, or failure to deliver prey items. Additional protective measures shall remain in place until the Designated Biologist(s) determine(s) SWHA behavior has normalized. If additional protective measures are ineffective, the Designated Biologist(s) shall stop Covered Activities until the additional protective measures are modified and SWHA behavior has normalized. The Designated Representative or Biologist shall notify CDFW within 24 hours if nests or nestlings are abandoned and if the nestlings are still alive and shall work with CDFW to determine appropriate actions.

9.2.7 Nest Tree Avoidance. Permittee shall avoid removal of known SWHA nest trees or suitable nest trees to the maximum extent practicable. If a known nest tree must be removed for Covered Activities, Permittee shall notify and obtain written approval from CDFW. The notification shall include the location of the known nest tree, conditions to offset the loss of the nest tree, and the timing of removal, which shall generally be October 1 – February 1. Permittee shall not remove any occupied nest tree until the last of the young has left the nest.

9.2.8 Safe Haven Site Construction. Permittee shall restrict safe haven site construction activities to outside of the breeding season, to the extent practicable. The Designated Biologist(s) shall delineate with flagging or other visible markers suitable breeding habitat in the construction site. Permittee shall restrict safe haven site construction to areas outside of the delineated breeding habitat. If safe haven site construction must occur during the breeding season, the Designated Biologist(s) shall survey breeding habitat within 0.5 mile for nesting SWHA. The construction site shall be located at least 0.5 mile from any occupied nest tree, or Permittee shall notify and obtain written approval from CDFW prior to conducting safe haven site construction within 0.5 mile of the occupied nest tree(s). Permittee shall implement monitoring (Conditions of Approval 9.2.1 through 9.2.6) for any safe haven site construction work within 0.5 mile of the occupied nest tree.

9.2.9 Geotechnical Exploration. Permittee shall conduct geotechnical exploration outside of the breeding season, to the extent practicable. The Designated Biologist(s) shall delineate with flagging or other visible markers suitable breeding habitat within the geotechnical exploration site. Permittee shall restrict geotechnical exploration to areas outside of the delineated breeding habitat. If geotechnical exploration must occur during the breeding season, the Designated Biologist(s) shall survey the breeding habitat within 0.5 mile for nesting SWHA. Permittee shall limit geotechnical exploration activities to least 0.5 mile away from any occupied nest tree.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. Permittee shall not use helicopters to string transmission lines within 0.5 mile of an occupied nest tree. Permittee shall not remove or trim occupied nest trees for transmission line construction until after the breeding season has ended or the last of the young has left the nest. Permittee shall not remove or trim occupied nest trees during transmission line maintenance. If removal or trimming of an occupied nest tree needs to occur for human or wildlife safety, Permittee shall conduct removal outside of the breeding season (generally October 1 – February 1) or with written approval and guidance from CDFW. Permittee shall avoid removal or trimming of known or suitable nest trees, to the extent practicable, during transmission line stringing and reconductoring activities or during power and pole placement. Where practicable, Permittee shall place poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s). Permittee shall follow Condition of Approval 9.2.7 when removal or trimming of known or suitable nest trees cannot be avoided.

Impact: Disturbance and nest abandonment

The SWHA nesting season is between March 1 and September 30, beginning when SWHA first arrive at breeding grounds and engage in courtship and nest building and ending when post-fledging foraging flocks form prior to migration (Bloom 1980, Estep 1989, Swainson's Hawk TAC 2000, Bechard, Houston et al. 2010). Egg laying in the Central Valley is typically between mid-April and late May, and SWHA are engaged in nesting activity such as incubating, brooding, and nestling provision and protection until the last of the young fledge, generally between July 1 and late September (Estep 1989, Bechard, Houston et al. 2010). During this time, SWHA are most vulnerable to disturbances to nesting behavior caused by human activity that could result in mortality of eggs or nestlings. The risk of nest disturbance is greatest for nest sites that are not already exposed to high human use areas, with small amounts of anthropogenic noise, vehicles and equipment, and human access (Swainson's Hawk TAC 2000). Nesting pairs of SWHA might become accustomed to human disturbances if the Covered Activity is initiated prior to egg laying, reducing the risk of nest abandonment and harmful exposure (Swainson's Hawk TAC 2000). After egg-laying, there is a higher risk of impaired feeding or brooding behavior and eggs/nestlings exposed to the elements as a result of the disturbance. Nesting pairs that are already accustomed to human disturbances, such as those that nest near roadways, freeways, well-used waterways, airports, and other areas of high human use, would likely have developed some level of tolerance to disturbances when setting up a territory, lowering the risk of altered reproduction behavior (Swainson's Hawk TAC 2000). However, if a new type of disturbance is introduced, the pair may react adversely. The risk is highest for projects that span multiple years and multiple sites, generating substantial disturbances over time.

The highest risk of egg or nestling mortality comes from direct disturbance to or physical contact with the nest tree (Swainson's Hawk TAC 2000). Direct disturbance to or physical contact with a tree could come from Project personnel outside of their vehicles at the nest site or from vehicles or construction equipment approaching too closely, brushing against, or coming into contact with the nest tree. Encroachment could result from operation of tracked or wheeled vehicles, construction or drilling equipment, or barges and other vessels on waterways adjacent to occupied nest trees. The majority of the Central Valley population of SWHA nests in large trees in or near the Delta from Colusa to Stanislaus Counties (Anderson, Dinsdale et al. 2007, Gifford, Hofmann et al. 2012). Nests are typically well hidden in heavily vegetated parts of the tree and would likely not be seen by humans, drivers, or equipment operators approaching the tree (Swainson's Hawk TAC 2000). If surveyors or Project personnel approach an active nest tree within 150 feet, there is a risk of adults abandoning eggs or nestlings in response to the intrusion and not returning, or more commonly leaving the nest for a period of time to engage in defense behavior, and exposing eggs or nestlings to starvation, inclement weather, or predators (Carrie Battistone pers. comm.) (Swainson's Hawk TAC 2000). Construction activities, vehicles, helicopters, or equipment within 600 feet of an occupied nest tree typically poses the same risks to SWHA (Swainson's Hawk TAC 2000). Abandoned eggs or nestlings less than 10 days old are at the highest risk of mortality as a result of nest disturbance (Swainson's Hawk TAC 2000). Further, stressed adults could damage eggs or injure the nestlings (Carie Battistone, pers. comm.).

Covered Activities could potentially cause SWHA nesting behavior disturbance and abandonment or exposure of eggs or chicks within 0.5 mile of the nest tree from far-reaching effects such as noise (CEC and CDFG 2010). The highest levels of noise and vibration disturbances come from vibratory and impact pile driving, excavation equipment, tracked vehicles, pile-extraction equipment, and compaction equipment (Knauer and Pedersen 2011, California Department of Transportation 2013). From various noise studies, the standard threshold for disturbing or altering typical songbird breeding behavior was 60 dB(A) (Dooling and Popper 2007). It is reasonable to assume that noise exceeding 60 dB(A) could also pose a threat to SWHA breeding behavior. Impact pile driving noise could measure up to 101 dB(A) within the first 50 feet (Knauer and Pedersen 2011); however, construction activities combined with pile driving noise could reach up to 60 dB(A) at approximately 2,000 feet (0.4 miles) from the disturbance (ICF International 2016a). Many Covered Activities could exceed the 60 dB(A) threshold; for example, sound levels of increased truck traffic could reach up to 92 dB(A) and towboats for barges may project up to 81dB(A) within 50 feet (Thornton

1975). It is also possible for artificial night lighting from Covered Activities to cause disturbance to breeding SWHA. Artificial night lighting disturbs the circadium rhythm of birds, altering photoperiod-influenced behavior (Dominoni 2015). For example, songbirds such as American robins (*Turdus migratorius*) started dawn singing prematurely due to anthropogenic light pollution, and great tits (*Parus major*) chick provisioning behavior was affected by artificial light (Dominoni 2015). It could, therefore, be assumed SWHA behavior may also change from construction night lighting illuminating the nest, particularly if initiated after nesting begins. SWHA are primarily diurnal, with most foraging activity occurring during the day (Bechard, Houston et al. 2010). When chicks are about nine days old, the female will stop brooding during the day and may leave the nest to hunt (Bechard, Houston et al. 2010). Covered Activity night lighting during the first nine days after eggs hatch could disrupt SWHA brooding behavior if the night lighting cues the female to leave the nest. The nestlings would then be exposed to weather conditions and would be more visible to predators.

Conditions of Approval: Disturbance and nest abandonment

Covered Activities would impact SWHA as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring SWHA and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of SWHA.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing disturbance of nesting SWHA and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. To minimize disturbance to SWHA from Covered Activities, Permittee will confine Covered Activities within delineated and demarcated areas.

7.10 Delineation of Habitat. To minimize disturbance to SWHA from Covered Activities, Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags.

7.11 Project Related Vehicle Use. To minimize disturbance of and encroachment on nest trees from vehicles or equipment, Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize disturbance of and encroachment on nest trees from vehicles or equipment, Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Permittee will notify the Designated Biologist(s) if Covered Species are harmed or injured and will notify CDFW.

9.1.3 Artificial Lighting. Permittee will use artificial outdoor lighting only as needed for safety and security in construction and permanent facility sites and will design the lighting to minimize impacts to the surrounding environment. Limitations on the use of artificial lighting will reduce impacts to SWHA associated with Covered Activities as a result of light exposure to nests.

9.1.4 Covered Species Observations. Project personnel will inform the Designated Biologist(s) if SWHA is encountered in or near the construction site and the Designated Biologist(s) will have the authority to stop Covered Activities if SWHA nesting behavior is disrupted until corrective measures are put in place.

9.1.5 Hazards to Covered Species. To minimize disturbance to nesting SWHA, Permittee will not allow pets or firearms on construction sites, except as needed for law enforcement personnel.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize disturbance to nesting SWHA from RTM, dredged material, or spoils placement and processing, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact or encroachment on environmentally sensitive areas.

9.1.11 In-Water Work Windows. To reduce the amount of time pile driving and other Covered Activities causing noise, vibration, and light disturbances occur, Permittee will restrict certain in-water construction work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30. This will reduce disturbance effects in these areas that may be near or adjacent to SWHA breeding habitat during a portion of the nesting season.

9.1.12 Daily In-Water Work Restriction. To reduce the amount of Covered Activities causing noise, vibration, and light disturbances at night, Permittee will restrict in-water work between sunset and sunrise. This will reduce disturbance effects in areas that may be near or adjacent to SWHA breeding habitat during the breeding season.

9.1.14 Pile Driving Plan. Permittee will develop and implement a CDFW-approved Pile Driving Plan to minimize the timing and duration of impact or vibratory pile driving during construction. Limitations on pile driving will reduce impacts to nesting SWHA as a result of exposure to noise or vibration associated with pile driving activities.

9.1.15 Barge Operations Plan. Permittee will develop a barge operations plan that will minimize the number of barge trips necessary to conduct Covered Activities and identify routes that minimize impacts on fish. This will reduce the potential for disturbance of nesting SWHA exposed to excessive barge and tugboat traffic noise or encroachment on waterways adjacent to occupied nest trees.

9.2.1 Preconstruction Surveys. The Designated Biologist(s) will conduct preconstruction surveys to identify the presence of suitable or known SWHA nest trees that are occupied by nesting SWHA within 0.5 mile of the construction site, using a CDFW-approved protocol, to determine whether or not nesting SWHA could be disturbed by Covered Activities.

9.2.2 Timing Restrictions. To minimize disturbance to nesting SWHA, Permittee will limit Covered Activities within 0.5 mile of known or occupied nest trees to outside the SWHA breeding season (March 1 – August 15), if practicable, or will restrict the Covered Activities to not occur during the period of egg laying to post-hatching, to the extent practicable. Otherwise, Permittee will initiate Covered Activities prior to egg laying to allow time for SWHA to acclimate to disturbance before eggs are laid, subject to CDFW consultation and approval.

9.2.3 No Disturbance Buffer. Where Covered Activities are within 0.5 mile of an occupied SWHA nest tree, Permittee will establish a clearly delineated 650-foot-radius, no-activity buffer around each occupied nest tree, or a smaller buffer approved by CDFW, which will remain in place until the end of the breeding season or until the last chick has left the nest. Permittee will not conduct any Covered Activity within the buffer or within 150 feet of an occupied nest tree.

9.2.4 SWHA Nest Monitoring. The Designated Biologist(s) will monitor any nests that are within 0.5 mile of Covered Activities prior to the initiation of Covered Activities to determine base nesting status and behavior. To ensure SWHA are engaged in normal nesting behavior during Covered Activities, The Designated Biologist(s) will follow a CDFW-approved protocol to monitor the nests for changes in nesting behavior, increasing the duration and frequency of monitoring for nests closer to the disturbance. Permittee will limit Covered Activities at night if within 325 feet of an occupied nest

9.2.5 Disturbance of Occupied Nest. To minimize disturbance to nesting SWHA, Permittee will prohibit physical contact with an occupied nest tree throughout the breeding season. All workers within 650 feet of an occupied nest will stay out of the line of sight of the tree during breaks or will take breaks at a distance greater than 650 feet from the occupied nest tree.

9.2.6 Authority of Designated Biologist(s). If during Covered Activities the Designated Biologist(s) determines that nesting SWHA within 0.5 mile of the construction site are disturbed by Covered Activities, to the point nest abandonment is likely, Permittee will consult with CDFW to implement additional protective measures. The Designated Biologist(s) will have the authority to stop Covered Activities until additional protective measures are in place and SWHA return to normal breeding behavior. If eggs or nestlings are abandoned, Permittee will work with CDFW to determine appropriate actions.

9.2.7 Nest Tree Avoidance. To minimize disturbance to SWHA from Covered Activities, Permittee will clearly demarcate boundaries of occupied SWHA nesting trees and disturbance buffers and will clearly delineate and demarcate breeding habitat within construction sites and geotechnical exploration and safe haven work areas.

9.2.8 Safe Haven Construction. To minimize disturbance to nesting SWHA, Permittee will restrict safe haven site construction to outside of the breeding season, to the extent practicable, or will restrict safe haven site construction to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate the construction site at least 0.5 mile from any occupied nest tree, or with CDFW approval, will monitor occupied nest trees within 0.5 mile of the construction site for changes in SWHA breeding behavior. Permittee will stop construction and put corrective measures in place if safe haven site construction disturbs breeding SWHA.

9.2.9 Geotechnical Exploration. To minimize disturbance to nesting SWHA, Permittee will conduct geotechnical exploration outside of the breeding season, to the extent practicable, or will restrict geotechnical exploration to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate exploration sites at least 0.5 mile from any occupied nest tree.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. To minimize disturbance to nesting SWHA, Permittee will not use helicopters to string transmission lines within 0.5 mile of an occupied nest tree. Where practicable, Permittee will place poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s).

Impact: Nest removal

SWHA typically nest in the outer edges of riparian zones, but may also nest in small tree groves, isolated trees, or tree rows associated with agricultural fields or lots, roads, ditches, farmsteads, or dwellings (Bloom 1980, Estep 1989, Estep 2007, Estep 2008, Cahill 2014). Any Covered Activity that involves removing or trimming trees during the active breeding season of birds has the potential to destroy the nest and the eggs or nestlings within. Once nests fall to the ground, the young birds can be injured or killed in the fall; and if they survive, they are immediately exposed to ground predators, thermal stress, starvation, and other sources of mortality. Once a nest has fallen, adult SWHA will abandon the nest site and may build a new nest nearby (Bechard, Houston et al. 2010). Even if the nest tree is carefully removed and the nest relocated, many nesting birds would still likely abandon the nest and offspring (Golden Gate Audubon Society 2017). Both state and federal laws prohibit the removal or destruction of active nests except in the case of health or human safety emergencies (Fish and Game Code §3503 and §3503.5, 16 U.S.C. 703). However, since SWHA nests are generally hidden and difficult to see (Swainson's Hawk TAC 2000), Project personnel may not be aware of the nest until after the tree has been removed or the nest has been destroyed.

Typically, suitable SWHA nest trees are at a minimum 20 feet tall; however, nest heights average approximately 40 feet high, built on branches that are well hidden within a generally complex crown structure of limbs and forked branches (Bloom 1980, Estep 1989, Swainson's Hawk TAC 2000, Anderson, Dinsdale et al. 2007, Bechard, Houston et al. 2010, Cahill 2014). Such tall and complex trees may cause conflicts with transmission line safety requirements. If limbs and branches from a nest tree are removed, adults may abandon the nest tree from the disturbance, the branch containing the nest could fall to the ground, the nest may be dislodged and fall or degraded, or the nest may become exposed to predators or inclement weather (e.g., heat, wind, rain) when protective structure in the crown is removed. For example, nests built on the tips of smaller branches fall to the ground when exposed to high winds (Bechard, Houston et al. 2010). Fallen or abandoned nests from trimmed branches pose the same risks to eggs and nestlings as when a nest tree is removed.

Conditions of Approval: Nest removal

Covered Activities would impact SWHA as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring SWHA and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of SWHA.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing disturbance of SWHA nest trees and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. To minimize removal of SWHA nests as a result of Covered Activities, Permittee will confine Covered Activities within delineated and demarcated areas.

7.10 Delineation of Habitat. To minimize disturbance to SWHA from Covered Activities, Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags.

7.11 Project Related Vehicle Use. To minimize disturbance of and encroachment on nest trees from vehicles or equipment, Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize disturbance of and encroachment on nest trees from vehicles or equipment, Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Permittee will notify the Designated Biologist(s) if Covered Species are harmed or injured and will notify CDFW.

9.1.4 Covered Species Observations. Project personnel will inform the Designated Biologist(s) if SWHA is encountered in or near the construction site, and Permittee will stop Covered Activities that could cause SWHA injury or mortality until the individual is out of harm's way.

9.2.1 Preconstruction Surveys. To minimize nest tree or branch removal, the Designated Biologist(s) will conduct preconstruction surveys to identify the presence of suitable or known SWHA nest trees that are occupied by nesting SWHA within 0.5

mile of the construction site, using a CDFW-approved protocol, to determine whether or not nesting SWHA could be disturbed by Covered Activities.

9.2.2 Timing Restrictions. To minimize nest tree or branch removal, Permittee will limit Covered Activities within 0.5 mile of known or occupied nest trees to outside the SWHA breeding season (March 1 – August 15), if practicable, or will restrict the Covered Activities to not occur during the period of egg laying to post-hatching, to the extent practicable. Otherwise, Permittee will initiate Covered Activities prior to egg laying to allow time for SWHA to acclimate to disturbance before eggs are laid, subject to CDFW consultation and approval.

9.2.3 No Disturbance Buffer. To minimize removal of SWHA nests and nest tree or branch removal, Permittee will establish a clearly delineated 650-foot-radius, no-activity buffer around each occupied nest tree, or a smaller buffer approved by CDFW, which will remain in place until the end of the breeding season or until the last chick has left the nest. Permittee will not conduct any Covered Activity within the buffer or within 150 feet of an occupied nest tree.

9.2.4 SWHA Nest Monitoring. The Designated Biologist(s) will monitor any nests that are within 0.5 mile of Covered Activities prior to the initiation of Covered Activities to determine base nesting status and behavior. To ensure SWHA are engaged in normal nesting behavior during Covered Activities, The Designated Biologist(s) will follow a CDFW-approved protocol to monitor the nests for changes in nesting behavior, increasing the duration and frequency of monitoring for nests closer to the disturbance. Permittee will limit Covered Activities at night if within 325 feet of an occupied nest

9.2.5 Disturbance of Occupied Nest. To minimize disturbance to nesting SWHA, Permittee will prohibit physical contact with an occupied nest tree throughout the breeding season. All workers within 650 feet of an occupied nest will stay out of the line of sight of the tree during breaks or will take breaks at a distance greater than 650 feet from the occupied nest tree.

9.2.6 Authority of Designated Biologist(s). If during Covered Activities the Designated Biologist(s) determines that nesting SWHA within 0.5 mile of the construction site are disturbed by Covered Activities, to the point nest abandonment is likely, Permittee will consult with CDFW to implement additional protective measures. The Designated Biologist(s) will have the authority to stop Covered Activities until additional protective measures are in place and SWHA return to normal breeding behavior. If eggs or nestlings are abandoned, Permittee will work with CDFW to determine appropriate actions.

9.2.7 Nest Tree Avoidance. Permittee will not remove any occupied nest tree until the last of the young has left the nest. Permittee will not remove any known nest tree without consultation with CDFW, and will generally restrict removal of known nest trees to October 1 – February 1 (outside of the breeding season).

9.2.8 Safe Haven Shaft Construction. To minimize removal of SWHA nests, Permittee will restrict safe haven site construction to outside of the breeding season, to the extent practicable, or will restrict safe haven site construction to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate the construction site at least 0.5 mile from any occupied nest tree to the extent practicable. If the site is within 0.5 mile of an occupied nest tree, Permittee will establish a no-disturbance buffer around the tree.

9.2.9 Geotechnical Exploration. To minimize removal of SWHA nests, Permittee will conduct geotechnical exploration outside of the breeding season, to the extent practicable, or will restrict geotechnical exploration to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate exploration sites at least 0.5 mile from any occupied nest tree.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. To minimize removal of SWHA nests, Permittee will not remove or trim occupied nest trees for transmission line construction or maintenance until after the breeding season has ended or the last of the young has left the nest, or with written approval and guidance from CDFW in emergency situations. To the extent practicable, Permittee will avoid removal or trimming of known or suitable nest trees during transmission line construction and will place poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s); otherwise, known or suitable trees will be removed outside of the breeding season in consultation with CDFW.

Impact: Collisions with vehicles, project equipment, and transmission lines

SWHA are accustomed to foraging in agricultural fields in close proximity to agricultural equipment and vehicles during crop harvesting, flooding, disking, mowing, burning, or other farming operations that expose their rodent prey (Estep 1989, Swolgaard, Reeves et al. 2008, Bechard, Houston et al. 2010). Therefore, the risk of mortality or injury from collisions with vehicles or equipment may be low. SWHA are most susceptible to collisions with vehicles traveling at high speeds while foraging along the side of the road (Dorin Bradbury 2009). SWHA generally hunt by flying low to the ground, but may also hunt from perches or the ground (Estep 1989, Bechard, Houston et al. 2010). SWHA in the Central Valley form large foraging groups after their young have fledged and just prior to migration, but these groups are mainly found in association with agricultural harvest activities (Estep 1989, Cahill 2014). Juvenile or nonbreeding SWHA also hunt in groups (Estep 1989). SWHA foraging groups in July through September may hunt on the ground to capture invertebrate prey by walking, running and pouncing, or by perching on the ground to hunt burrowing mammals, particularly near dusk when the mammals emerge from their burrows (Babcock 1995, Bechard, Houston et al. 2010). If foraging on the ground, low to the ground, or in groups, SWHA could be vulnerable to construction equipment and vehicles during Covered Activities, particularly if such activities flush rodent prey. Vehicles and equipment in construction sites may operate at faster speeds and with less predictable directional patterns than the farming equipment and vehicles SWHA are accustomed to in the area. It is possible that while foraging as a group on the ground, the strike risk would be higher than for individuals. Collisions with helicopters are possible during the stringing of transmission lines. Raptors are frequently struck by military helicopters, particularly in the fall when most birds are migrating, including red-tailed hawks (*B. jamaicensis*) (Washburn, Cisar et al. 2014).

Most hawks are only moderately susceptible to collisions with transmission lines because of their wing loading and aspect ratio characteristics that give them a good amount of maneuverability (APLIC 2012) and high-acuity eyesight that allows the hawk to navigate its surroundings (BDCP 2013c). Flocking behavior increases a bird's risk of collision with powerlines (APLIC 2012). SWHA may be less likely affected by powerline collisions than other similar hawk species because they don't usually nest, perch, or hunt from power poles (Dorin Bradbury 2009). Although SWHA are territorial over foraging grounds while breeding, post-breeding adults and juveniles forage in large flocks in late summer and migrate in flocks to southern wintering grounds (Estep 1989, Bechard, Houston et al. 2010). SWHA are less susceptible to collision with powerlines when making individual flights separate from foraging groups, but they are more susceptible when flying in altitudes proposed for the new Project powerlines (50 to 110 feet), which may occur when stooping down during courtship or soaring (Fitzner 1980, BDCP 2013c). It is possible SWHA may be accustomed to the locations of existing transmission lines within their foraging range; however, the stringing of new transmission lines could pose additional risk, either during stringing operations or within a short time after they are installed. Electrocuted hawks have been occasionally found at powerlines, including SWHA, red-tailed hawks, and a rough-legged hawk (*B. lagopus*) (Brown and Drewien 1995, Yee 2007, Battistone, Marr et al. 2016).

<u>Conditions of Approval: Collisions with vehicles, project equipment, and transmission lines</u>

Covered Activities would impact SWHA as described above, but these impacts will be avoided and minimized by the following specific Conditions of Approval required by the ITP.

7.1 <u>Designated Representative</u>. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 <u>Designated Biologist(s)</u>. CDFW-approved Designated Biologist(s) responsible for monitoring SWHA and Covered Activities.

7.4 <u>Designated Biologist(s) and Designated Fisheries Biologist Authority</u>. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of SWHA.

7.5 <u>Education Program</u>. Designated Biologist(s) will train Project personnel on avoiding and minimizing encounters with SWHA and will monitor Covered Activities.

7.6 <u>Construction Monitoring Notebook</u>. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 <u>Delineation of Property Boundaries</u>. To minimize collisions with SWHA from Covered Activities, Permittee will confine Covered Activities within delineated and demarcated areas.

7.10 Delineation of Habitat. To minimize disturbance to SWHA from Covered Activities, Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags. This will raise awareness that a nest may be nearby and minimize collisions with SWHA flying to and from the nest or foraging near the nest.

7.11 Project Related Vehicle Use. To minimize collisions with SWHA, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area and will post a vehicle speed limit of 20 miles per hour on all nonpublic construction and access roads, where it is safe to do so.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Permittee will notify the Designated Biologist(s) if Covered Species are harmed or injured and will notify CDFW.

9.1.4 Covered Species Observations. Project personnel will inform the Designated Biologist(s) if SWHA is encountered in or near the construction site, and Permittee will stop Covered Activities that could cause SWHA injury or mortality until the individual is out of harm's way.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize collisions with SWHA from vehicles and equipment engaged in RTM or spoils placement and processing, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact or encroachment on environmentally sensitive areas.

9.1.10 Transmission Line Strikes. To minimize the potential for SWHA strikes with transmission lines, Permittee will install bird strike diverters on all new power lines, using the most effective guidelines and diverters to reduce strike risk by 60% or more. Permittee will periodically inspect and replace bird strike diverters as needed until or unless the lines are removed.

9.2.1 Preconstruction Surveys. The Designated Biologist(s) will conduct preconstruction surveys to identify the presence of occupied nest trees within 0.5 mile of the Covered Activity, using a CDFW-approved protocol. This will raise awareness that a nest is nearby and minimize collisions with SWHA flying to and from the nest or foraging in the vicinity of the nest.

9.2.2 Timing Restrictions. Permittee will limit Covered Activities within 0.5 mile of known or occupied nest trees to outside the SWHA breeding season (March 1 – August 15) where practicable. This would minimize the risk of collisions with breeding SWHA.

9.2.3 No-disturbance Buffer. Where Covered Activities are within 0.5 mile of an occupied SWHA nest tree, Permittee will establish a clearly delineated 650-foot-radius, no-activity buffer around each occupied nest tree, or a smaller buffer approved by CDFW, which will remain in place until the end of the breeding season or until the last chick has left the nest. Permittee will not conduct any Covered Activity within the buffer or within 150 feet of an occupied nest tree. This will minimize the risk of collisions with breeding SWHA flying to and from the nest or foraging in the vicinity of the nest.

9.2.7 Nest Tree Avoidance. Permittee will not remove any occupied nest tree until the last of the young has left the nest. This will minimize the risk of collisions with SWHA adults or young that have fallen from the nest or have been displaced from the removed nest.

9.2.8 Safe Haven Site Construction. Permittee will restrict safe haven site construction to outside of the breeding season, to the extent practicable, or will restrict safe haven site construction to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate the construction site at least 0.5 mile from any occupied nest tree where practicable. These measures will minimize collisions with breeding SWHA flying to and from the nest or foraging in the vicinity of the nest.

9.2.9 Geotechnical Exploration. Permittee will conduct geotechnical exploration outside of the breeding season, to the extent practicable, or will restrict geotechnical exploration to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate exploration sites at least 0.5 mile from any occupied nest tree. These measures will minimize collisions with breeding SWHA flying to and from the nest or foraging in the vicinity of the nest.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. To minimize helicopter collisions with nesting SWHA, Permittee will not use helicopters to string transmission lines within 0.5 mile of an occupied nest tree. Where practicable, Permittee will place poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s). This will minimize collisions with SWHA flying to and from the nest as well as flying off the nest in response to the helicopter disturbance.

Impact: Displacement and reduction of suitable habitat features

SWHA choose locations for nests that protect nestlings from environmental elements and predators. Suitable nest trees are at least 20 feet and typically up to 60 feet tall, and

SWHA often build their nests on the far reaches of limbs or branches approximately 40 to 60 feet high (Bloom 1980, Estep 1989, Swainson's Hawk TAC 2000, Anderson, Dinsdale et al. 2007, Bechard, Houston et al. 2010, Cahill 2014). In the Central Valley, SWHA breeding pairs will often return to the same nest each year and will generally select nest locations adjacent to or within good-quality foraging habitat (Estep 1989, Babcock 1995). If a clutch fails or the nest is blown down, SWHA may build a new nest nearby or refurbish an unoccupied nest created by another species (Bechard, Houston et al. 2010). Therefore, if branches from the nest tree or the whole nest tree is removed during Covered Activities, the pair may abandon the nest; and if prior to egg laying, breeding pairs may try to build or refurbish another nest in habitat with fewer suitable characteristics. For example, if the new built or refurbished nest is placed on far reaches of small branches, the nest could fall to the ground if exposed to storms and high winds (Bechard, Houston et al. 2010). Even if nesting or surrounding foraging habitat features are removed outside of the SWHA breeding season, returning pairs may try to find a different suitable nest tree in the same general location and may be forced to compete with other raptors such as red-tailed hawks or great-horned owls (*Bubo virginianus*), both of which can displace SWHA from available nesting habitat (Estep 1989). Such disturbances to a nest tree and competition for nest sites could displace SWHA into sub-prime nesting habitat. Although removing a SWHA nest prior to breeding and egg-laying would not cause direct mortality, indirect mortality of eggs or nestlings could result from new nests placed in locations less suitable for their survival needs.

Good-quality SWHA foraging habitat includes a mosaic of rotated and actively managed crops, particularly alfalfa, with dry-land pastures and fallowed fields that provide an abundance of preferred rodent prey (Estep 1989, Babcock 1995). SWHA could become accustomed to disturbances such as noise on or near their foraging grounds and readily escape approaching equipment or vehicles (ICF International 2016a). However, if the disturbance is excessive and Covered Activities remove the foraging habitat during the breeding season, the pair would likely be forced to travel farther in search of suitable foraging (Babcock 1995). When preferred foraging habitat is not available, SWHA pairs will increase the size of their home ranges, traveling up to 18 miles from the nest to forage (Estep 1989, Babcock 1995). The farther the distance traveled, the more the energetic cost of hunting to provision females and young (England, Estep et al. 1995). Although SWHA may travel long distances during periods of limited availability of good-quality foraging, it is generally within a temporal cycle of crop phenology or crop management activities—such that good-quality foraging near the nest will become available again; for example, during harvest (Estep 1989, Babcock 1995, England, Estep et al. 1995). If nests are surrounded by permanent removal of good-quality foraging too quickly, such that good-quality foraging habitat is beyond five miles from the nest, the nest is more likely to be abandoned and fail due to the energetic costs throughout the nesting cycle being too high (England, Estep et al. 1995).

The use of anticoagulant rodenticides in or near SWHA foraging habitat may reduce prey densities, resulting in SWHA traveling farther distances to find accessible prey. During the breeding season, SWHA prey on Botta's pocket gophers (*Thomomys bottae*), California voles (*Microtus californicus*), deer mice (*Peromyscus maniculatus*), house mice (*Mus musculus*), and other small rodents; however, the California vole is the principal prey item for SWHA in the Central Valley (Bloom 1980, Estep 1989, Estep 2007, Bechard, Houston et al. 2010). Anticoagulant rodenticides may be used during Covered Activities to protect the integrity of newly constructed banks and levees or buildings used for conveyance facilities. Rodenticides would mostly target burrowing mammals, such as ground squirrels and gophers, that cause the most damage to bank and levee infrastructure (Marsh 1994, Van Vuren, Ordenana et al. 2014, Ballester 2015). However, anticoagulant rodenticides also control voles (Hosea 2000). The poisoning of voles that consume bait targeted for other rodents could reduce vital prey population densities within or near SWHA nesting habitat, reducing the suitability of the foraging habitat near the nest site. If the energetic cost of provisioning the nest with suitable prey becomes too high as a result of Covered Activities reducing prey densities in otherwise suitable habitat, the parents may reduce or abandon provisioning the young.

Conditions of Approval: Displacement and reduction of suitable habitat features

Covered Activities would impact SWHA as described above, but these impacts will be avoided and minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring SWHA and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of SWHA.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing encounters with SWHA and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. To minimize removal of SWHA habitat or habitat elements resulting from Covered Activities, Permittee will confine Covered Activities within delineated and demarcated areas.

7.10 Delineation of Habitat. To minimize removal of SWHA habitat or habitat elements resulting from Covered Activities, Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags. This will raise awareness that a nest may be nearby and minimize collisions with SWHA flying to and from the nest or foraging near the nest.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Permittee will notify the Designated Biologist(s) if Covered Species are harmed or injured and will notify CDFW.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee will track and map areas of suitable SWHA habitat present in the Project Area and habitat disturbed by Covered Activities and will provide CDFW with reports of disturbed habitat monthly and annually. Permittee will provide updated mapping and tracking of all Covered Species habitat disturbed by Covered Activities. This will minimize excessive removal of SWHA habitat or habitat elements and will ensure avoidance of habitat removal where practicable.

8.6 Compliance Report. Permittee will provide monthly compliance reporting that documents impacts to Covered Species habitat, implementation of Permit measures. This will minimize excessive removal of SWHA habitat or habitat elements and will ensure avoidance of habitat removal where practicable.

8.7 Annual Status Report. Permittee will provide annual reports that document, among other things, Covered Activities' impacts to Covered Species habitat during the preceding year and since issuance of the ITP and acreages and features anticipated to be disturbed in the succeeding 12 months. This will minimize excessive removal of SWHA habitat or habitat elements and will ensure avoidance of habitat removal where practicable.

9.1.2 Rodenticide use. Permittee will prohibit the use of rodenticides in construction sites. This will allow alternative methods of controlling rodents damaging facility infrastructure without depleting population densities of non-target voles.

9.1.4 Covered Species Observations. Project personnel will inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. This will minimize removal of suitable habitat or habitat elements used by SWHA.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of work, Permittee will backfill geotechnical test pits with the excavated material on the same day as they are excavated, and shall place the stockpiled topsoil at the surface and restore the site where geotechnical exploration activities were conducted. This will minimize permanent reduction of available SWHA foraging habitat.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize removal of SWHA habitat for RTM sites, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact or encroachment on environmentally sensitive areas.

9.2.1 Preconstruction Surveys. The Designated Biologist(s) will conduct preconstruction surveys to identify the presence of suitable or known SWHA nest trees that are occupied by nesting SWHA, using a CDFW-approved protocol, to determine whether or not occupied nest trees could be disturbed by Covered Activities.

9.2.2 Timing Restrictions. To minimize removal of nesting SWHA habitat or habitat elements during the breeding season, Permittee will limit Covered Activities within 0.5 mile of known or occupied nest trees to outside the SWHA breeding season (March 1 – August 15), if practicable.

9.2.3 No-disturbance Buffer. Where Covered Activities are within 0.5 mile of an occupied SWHA nest tree, Permittee will establish a clearly delineated 650-foot-radius, no-activity buffer around each occupied nest tree, or a smaller buffer approved by CDFW, which will remain in place until the end of the breeding season or until the last chick has left the nest. Permittee will not conduct any Covered Activity within the buffer or within 150 feet of an occupied nest tree. This will prevent occupied nest trees, nest tree elements, or adjacent foraging habitat within the buffer from being removed during the breeding season.

9.2.6 Authority of Designated Biologist(s). If eggs or nestlings are abandoned, Permittee will work with CDFW to determine appropriate actions.

9.2.7 Nest Tree Avoidance. Permittee will not remove any occupied nest tree until the last of the young has left the nest. Permittee will not remove any known nest tree without consultation with CDFW, and will generally restrict removal of known nest trees to October 1 – February 1 (outside of the breeding season). Consultation with CDFW will minimize removal of nest trees that could cause SWHA displacement. Removing nest trees or habitat elements during the non-breeding season will avoid nest abandonment or re-nesting of SWHA pairs in less suitable nesting habitat during the breeding season.

9.2.8 Safe Haven Site Construction. To minimize removal of SWHA habitat or suitable habitat elements, Permittee will restrict safe haven site construction to areas outside of breeding habitat delineated by the Designated Biologist(s), where practicable. Permittee will locate the construction site at least 0.5 mile from any occupied nest tree to the extent practicable. If the site is within 0.5 mile of an occupied nest tree, Permittee will establish a no-disturbance buffer around the tree. This will minimize removal of nesting habitat elements and adjacent foraging habitat within the buffer.

9.2.9 Geotechnical Exploration. To minimize removal of SWHA nests, Permittee will restrict geotechnical exploration to areas outside of breeding habitat delineated by the Designated Biologist(s), where practicable, or Permittee will locate exploration sites at least 0.5 mile from any occupied nest tree. This will minimize removal of nesting habitat elements and adjacent foraging habitat.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. Where practicable, Permittee will place power poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s). This will minimize removal of nesting habitat or habitat elements.

Impact: Contaminants

The use of anticoagulant rodenticides could cause secondary poisoning of predators that consume rodent species (Hosea 2000). Second-generation products with highly toxic chemicals, such as brodifacoum, target rodents that are prey items for SWHA, such as squirrels, mice, and voles (Hosea 2000). Deceased birds analyzed by CDFW in 2000 had some level of anticoagulant rodenticides present in samples, indicating that toxicosis may have played a role to some extent in their demise (Hosea 2000). Previous studies found evidence that rodenticide exposure was common in deceased birds of prey, and CDFW found anticoagulants in samples from deceased red-tailed hawks and red-shouldered hawks (*B. lineatus*) as well as other raptors (Stone, Okoniewski et al. 1999, Hosea 2000). Exposure of red-tailed hawks, great-horned owls, and other raptors to anticoagulants could cause liver damage and, in some cases, death (Stone, Okoniewski et al. 1999, Stansley, Cummings et al. 2014). Red-tailed hawks and red-shouldered hawks consume similar small mammal prey items as SWHA (Estep 2008, Cornell Lab of Ornithology 2015), and many of the other raptor species affected likely consume the same or similar prey. In 2015, CDFW found two deceased SWHA that had been exposed to anticoagulant rodenticides, with one confirmed cause of death being toxicosis from the rodenticide (Battistone, Marr et al. 2016).

In addition to feeding on rodents, foraging flocks of SWHA feed on insects and small birds, particularly toward the end of the breeding season (Bloom 1980, Estep 1989, Estep 2007, Bechard, Houston et al. 2010). Mortality was reported in birds that had consumed insects that fed on rodent baits, causing secondary exposure to rodenticides from insect prey (Hosea 2000). Insecticides also pose a threat to SWHA when they consume insect prey (Bloom 1980, Dorin Bradbury 2009, Battistone, Marr et al. 2016). A massive die-off of wintering SWHA occurred in Argentina after consuming prey that had been treated with the organophosphate insecticide monocrotophos; and as a result of this die-off, that pesticide was banned and SWHA mortalities in the area decreased (Goldstein, Lacher et al. 1999). The USFWS described mortality of up to 40 SWHA killed by applications of organophosphate and carbamate insecticides in the fall when flocks fed on insects in harvested fields (Woodbridge 1998). The level of mortality of SWHA in the Central Valley resulting from secondary poisoning from insecticides is unknown (Battistone, Marr et al. 2016). It is possible some of the more lethal pesticides have been banned or regulated; however, illegal use of pesticides could still pose a significant threat to SWHA (Dorin Bradbury 2009). Sub-lethal effects, such as liver damage, could lead to indirect mortality from decreased fitness of SWHA in the long-term.

Drift of contaminants from herbicides, soil disturbance, fugitive dust, or from vehicle and equipment fuel emissions can affect the health of many wildlife species if they are exposed to them. An EIS for a project in the Plumas National Forest states raptors could be directly sprayed during herbicide application, if they are in the area targeted for treatment, with adverse effects if the exposure exceeds the LD/LC_{50} (lethal dose) for that species (USDA 2006). However, raptors that nest or perch in older, larger trees would not experience as much exposure compared to when they are on the ground or in the lower canopy (USDA 2006). The level of herbicide application and the product used may cause varying adverse effects on birds; however, it is reasonable to assume acutely toxic levels would result from large agricultural operations or roadside vegetation control, with an unknown level resulting from Covered Activities. Sublethal or indirect effects, such as damaging vegetation used by rodent prey and decreasing the value of foraging habitat, are more likely. Secondary exposure in raptors consuming rodents exposed to herbicides is also possible; however, a wide range of foraging grounds would decrease the chance birds of prey will consume rodents exposed to herbicide contaminants (USDA 2006). Fugitive dust from roads where contaminated soil, RTM, or dredge material is being hauled or construction sites where excavation and ground clearing occur could have negative effects on SWHA prey such as voles or small birds if the fugitive dust contains heavy metals (e.g. aluminum, barium, cadmium, lead, or zinc) and concentrations are high enough to cause biological effects (Brumbaugh, Mora et al. 2008). For example, acute effects from lead toxicosis were found at levels as low as 5 micrograms per gram of dry weight in rodents and as low as 3 micrograms per gram of dry weight in small birds (Brumbaugh, Mora et al. 2008); however, the secondary exposure on raptors to these contaminated species were not studied. Air-borne toxic contaminants come from a variety of sources, including the operation of trucks, ships (which may include barges), and fuel stations (BDCP 2013c). Adverse health effects of toxic air contaminants on humans could be carcinogenic, cause short-term (acute) effects, or cause chronic illnesses. Direct exposure to air pollutants could cause brain and nervous system damage, birth defects, heart problems, and respiratory disorders (Jaret 2001, BDCP 2013c). The California Air Resources Board described particulate matter from diesel-fueled engines of trucks or equipment as being responsible for 70 percent of total air toxicity risks, a primary concern associated with Covered Activities (CARB 2000, BDCP 2013c). New technologies and regulations significantly reduced toxic emissions by 2012 (McClellan, Hesterberg et al. 2012). The extent of risks of long-term health problems from effects of fugitive dust, diesel particulate matter, and other airborne contaminants on wildlife is not well studied; however, a few investigations have shown that fugitive dust is not only a hazard to humans, but to wildlife as well (Jaret 2001). There are no documented effects of environmental contaminants on SWHA with empirical data; although, there have been occasional reports of mortality, likely from pesticides (Woodbridge 1998).

Conditions of Approval: Contaminants*:*

Covered Activities could impact SWHA as described above, but these impacts will be avoided and minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring SWHA and Covered Activities.

7.4 Designated Biologist(s) and Designated Fisheries Biologist Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of SWHA.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing encounters with SWHA and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.8 Dust Control. To limit the exposure of SWHA to contaminants in fugitive dust Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s).

7.9 Delineation of Property Boundaries. To minimize exposure of SWHA to contaminants from Covered Activities, Permittee will confine Covered Activities within delineated and demarcated areas.

7.10 Delineation of Habitat. To minimize contamination from Covered Activities, Permittee will clearly demarcate boundaries of occupied SWHA nesting trees and disturbance buffers.

7.11 Project Related Vehicle Use. To minimize contaminants from diesel fuel emissions, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Permittee will notify the Designated Biologist(s) if Covered Species are harmed or injured and will notify CDFW.

9.1.1 Herbicide and Pesticide Use. To minimize the extent to which SWHA are exposed to contaminants as a result of herbicide and pesticide use during Covered

Activities in and nearby suitable SWHA habitat, the methods and types of herbicides and pesticides used by Permittee will be limited within the Project Area.

9.1.2 Rodenticide use. To minimize secondary exposure of rodenticides on SWHA from consuming contaminated prey, Permittee will prohibit the use of rodenticides in construction sites.

9.1.4 Covered Species Observations. Project personnel will inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee will cease Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is out of harm's way.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize contamination from RTM, dredged material, or spoils placement and processing, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact or encroachment on environmentally sensitive areas.

9.1.11 In-Water Work Windows. To minimize contamination, Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30. This will minimize drift of contaminants to adjacent or nearby nesting sites during certain portions of the nesting season.

9.1.12 Daily In-Water Work Restriction. To minimize contamination, Permittee will restrict in-water work to not occur between sunrise and sunset. This will minimize drift of contaminants to adjacent or nearby nesting sites at night.

9.1.23 Fugitive Dust Control Plan. Permittee will develop and implement a CDFW-approved Fugitive Dust Control Plan to limit the mobilization of fugitive dust as a result of Covered Activities, which will to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s).

9.2.1 Preconstruction Surveys. The Designated Biologist(s) will conduct preconstruction surveys to identify the presence of suitable or known SWHA nest trees that are occupied by nesting SWHA within 0.5 mile of the construction site, using a CDFW-approved protocol, to determine whether or not nesting SWHA could be harmed by Covered Activities.

9.2.2 Timing Restrictions. To minimize contamination, Permittee will limit Covered Activities within 0.5 mile of known or occupied nest trees to outside the SWHA breeding season (March 1 – August 15), if practicable.

9.2.3 No-disturbance Buffer. Where Covered Activities are within 0.5 mile of an occupied SWHA nest tree, Permittee will establish a clearly delineated 650-foot-radius, no-activity buffer around each occupied nest tree, or a smaller buffer approved by CDFW, which will remain in place until the end of the breeding season or until the last chick has left the nest. To minimize contamination, Permittee will not conduct any Covered Activity within the buffer or within 150 feet of an occupied nest tree.

9.2.4 SWHA Nest Monitoring. To minimize contamination, Permittee will limit Covered Activities at night if within 325 feet of an occupied nest.

9.2.7 Nest Tree Avoidance. To minimize contamination from Covered Activities, Permittee will clearly demarcate boundaries of known SWHA nesting trees.

9.2.8 Safe Haven Site Construction. To minimize contamination, Permittee will restrict safe haven site construction to outside of the breeding season, to the extent practicable, or will restrict safe haven site construction to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate the construction site at least 0.5 mile from any occupied nest tree, where practicable

9.2.9 Geotechnical Exploration. To minimize contamination, Permittee will conduct geotechnical exploration outside of the breeding season, to the extent practicable, or will restrict geotechnical exploration to areas outside of breeding habitat delineated by the Designated Biologist(s). Permittee will locate exploration sites at least 0.5 mile from any occupied nest tree.

9.2.10 Measures Specific to Transmission Line Construction and Maintenance. To minimize contamination, Permittee will not use helicopters to string transmission lines within 0.5 mile of an occupied nest tree. This will reduce diesel fuel that could contribute to contamination. Where practicable, Permittee will place poles and lines outside of breeding habitat, as delineated by the Designated Biologist(s), to minimize contamination.

ii. SWHA Mitigation Measures

The avoidance and minimization measures above will reduce but not eliminate the impacts on SWHA resulting from Covered Activities; therefore, the following additional measures are required to achieve full mitigation.

Covered Activities associated with construction will result in a total of 3,770 acres of permanent impacts to SWHA foraging habitat and 22 acres of SWHA nesting habitat. As compensatory mitigation Permittee shall permanently protect 3,770 acres of SWHA foraging habitat, protect 22 acres of SWHA nesting habitat, and restore 22 acres of SWHA nesting habitat at locations agreed upon by CDFW. Permittee will provide for the acquisition, protection or restoration and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11). To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to SWHA, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1.3 and 8.4.1.4 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for Swainson's Hawk Habitat*. Permittee will ensure permanent protection and funding for perpetual management of compensatory SWHA habitat, including monitoring for suitable habitat features and presence of SWHA for at least three years.

In addition to protecting or restoring suitable nesting habitat as compensatory mitigation, seven suitable nest sites that will be removed by Covered Activities will be mitigated as follows. Five mature suitable nest trees and 15 five-gallon container-sized suitable nest trees will be planted or transplanted to a location specified in a Vegetation Restoration Plan approved by CDFW. This will ensure full mitigation for SWHA during the temporal gap of restored nesting habitat developing tall, mature trees and will provide a heterogeneous nest site structure that will ensure suitable nest tree survival and sustainability over a long period of time. Permittee will follow criteria for the created nest sites described in *10.3 Swainson's Hawk Nest Site Replacement* to ensure the nest sites meet the life history needs of SWHA; for example, providing adequate spacing for SWHA territories, nest sites that are close to suitable foraging habitat, and timing that minimizes the impacts of the temporal gap between loss of mature trees and transplanting replacement trees. Additionally, for each suitable nest tree removed, Permittee will plant five five-gallon-container sized native trees to replace the lost trees. These trees will be planted near mature trees in the newly established nest sites and adjacent to conserved foraging habitat. Permittee shall monitor and maintain all replacement nest trees (mature trees and saplings) for a period of ten years to ensure survival and appropriate growth and development.

Covered Activities associated with stringing of transmission lines, geotechnical exploration, and pressurized safe havens will result in temporary disturbance of 1,114 acres of SWHA foraging habitat. Permittee will avoid temporary impacts to SWHA nesting habitat. Permittee will restore on-site the acres of SWHA foraging habitat that will be temporarily disturbed during Covered Activities to pre-project or better conditions. To ensure restored habitat fully mitigates for impacts to SWHA, restoration and success criteria will comply with ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation* - *HM Lands Criteria Swainson's Hawk Habitat* will be consistent with the definition for suitable SWHA foraging habitat in Condition of Approval 8.4.1.4, and will be detailed in a Vegetation Restoration Plan approved by CDFW. Restored habitat will be monitored for one year for suitable habitat features and presence of SWHA.

To mitigate for the loss of SWHA individuals resulting from transmission line strikes, Permittee will install bird strike diverters on existing transmission lines within the Project Area as well as all new transmission lines constructed as a part of Covered Activities and shown in ITP Attachment 1, Figures 4 c and d. Permittee will install bird strike diverters on existing transmission lines in the Project Area equal in length to the length of new permanent and temporary transmission lines constructed as a part of Covered Activities and shown in ITP Attachment 1, Figures 4 c and d, except where new transmission lines replace existing transmission lines. Permittee will space bird strike diverters along transmission lines in accordance with the Avian Powerline Interaction Committee's guidance (Avian Power Line Interaction Committee 2012) and select bird strike diverters according to the best available science. Permittee will inspect bird strike diverters annually and replace malfunctioning or lost diverters until the transmission line is removed. Permittee will submit a plan describing the location and type of bird strike diverters installed as compensatory mitigation for impacts to SWHA to CDFW for review. Upon written approval of the plan by CDFW, Permittee will install and maintain all bird strike diverters.

iii. SWHA Final EIR/EIS Avoidance and Minimization Measures

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures, resource restoration and protection principles, and environmental commitments, required to be implemented by the ITP, that would further ensure that any impacts to SWHA resulting from Covered Activities would be minimized and fully mitigated.

- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- AMM 2 (Construction best management practices and monitoring)
- Environmental Commitment 3B.2.5/AMM 3 (Develop and implement stormwater pollution prevention plans)
- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- Environmental Commitment 3B.2.13/AMM 5 (Spill Prevention, Containment, and Countermeasure Plan)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material [RTM], and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- AMM 7 (Barge operations plan)
- AMM 10 (Restoration of temporarily affected natural communities)
- AMM 18 (Swainson's hawk)
- AMM 20 (Greater sandhill crane)
- AMM 30 (Transmission Line Design and Alignment Guidelines)
- Environmental Commitment 3 (Natural communities protection and restoration)
- Environmental Commitment 7 (Riparian natural community restoration)
- Environmental Commitment 11(Natural communities enhancement and management)
- RRPP VFR1 (Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs)
- RRPP VFR2 (Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7)
- RRPP SH1(Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres)

- RRPP SH2 (Protect Swainson's hawk foraging habitat with at least 50% in very high-value habitat production and above -1 foot above mean sea level)
- RRPP CL1 (Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands)

c. Giant garter snake (Thamnophis gigas)

i. Project Construction Impacts and Avoidance and Minimization Measures

Project activities and their resulting impacts are expected to result in the incidental take of giant garter snake individuals (GGS). The Covered Activities expected to result in incidental take of GGS include geotechnical exploration; the construction of NDD intakes, tunneled conveyance facilities, the HOR Gate, and CCF modifications; construction and improvement of access roads; the construction, installation, and maintenance of power supply facilities (poles, towers, and lines); and RTM placement or processing. Ongoing impacts of the taking may result from maintenance of permanent land-side facilities such as forebay or canal embankments, the land-side portions of NDDs, landscaping, or operational lighting.

Incidental take of GGS, and adverse impacts as a result of impacts of the taking on GGS, is expected to occur as a result of crushing of individuals or burrows; entrapment; barge operation strikes; entrainment; disturbance and displacement; capture, handling, and relocation; exposure to contaminants; and reduction of suitable habitat elements. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to GGS is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Incidental take of GGS individuals in the form of mortality ("kill") may occur as a result of equipment or vehicles or deposition of stockpiled materials or spoils crushing GGS individuals or crushing burrows, causing entombment inside occupied burrows, during grading and vegetation clearance; facilities maintenance; road construction or improvements; removing equipment or vehicles from storage; stringing of transmission lines; construction of transmission poles, pads, or towers; and geotechnical exploration. Incidental take could also occur in construction sites as a result of trapping GGS individuals in excavated steep-wall holes or trenches; construction materials such as pipes, culverts, or similar structures; construction equipment; erosion material; or construction debris. In aquatic habitat, incidental take of GGS individuals could result from direct strikes with barges, tugboats, or propellers; being crushed by falling or moved rock (riprap); and entrainment by dredging equipment or dewatering pumps. Incidental take of GGS individuals may occur from the Covered Activities in the form of pursue, catch, capture, or attempt to do so from biologists relocating individuals out of project exclusion fencing or construction sites or removing trapped individuals. The areas where authorized take of GGS is expected to occur are described above in Project Area groups A – D, F – G, and I – N, in the geotechnical zone, and in the transmission line and safe haven corridors (ITP Attachment 1, Figures 4-10).

The Project is expected to cause the permanent loss of 570 acres of GGS upland habitat and the temporary loss of 165 acres of GGS upland habitat and the permanent loss of 205 acres of GGS aquatic habitat. Impacts of the authorized taking also include adverse impacts to GGS related to temporal losses, increased habitat fragmentation and edge effects, and the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include: direct or secondary poisoning from contaminants; displacement from loss of aquatic or upland habitat vegetation; displacement from noise, vibration, or other disturbances; disturbance or displacement resulting in risks of exposure to predation, vehicle strikes, stress, thermal effects, or recreation; and reduction of suitable habitat elements such as pesticides or contaminants causing reduction in prey and rodenticides causing a reduction in burrows.

In general, Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following Conditions of Approval required by the ITP.

Multispecies Measures with Application to GGS:

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with the ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of the ITP.

7.2 Designated Biologist(s). Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a biological monitor (Designated Biologist(s)) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Biologist(s) is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist(s) shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist(s) in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist(s) must be changed.

7.4 Designated Biologist(s) Authority. To ensure compliance with the Conditions of Approval of the ITP, the Designated Biologist(s) shall have authority to immediately stop any activity that does not comply with the ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist(s) that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers installation and monitoring; measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped; and roles and responsibilities of workers, managers, Designated Representative, Designated Biologist(s), and Designated Fisheries Biologist(s). Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of the ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.7 Trash Abatement. Permittee shall initiate a trash abatement program before starting Covered Activities and shall continue the program for the duration of the Project. Permittee shall ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators such as ravens, coyotes, and feral dogs.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s). Permittee shall keep the amount of water used to the minimum amount needed, and shall not allow water to form puddles.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee shall clearly delineate the boundaries of the construction site with fencing, stakes, or flags. Permittee shall restrict all Covered Activities to within the fenced, staked, or flagged areas. Permittee shall maintain all fencing, stakes, and flags until the completion of Covered Activities in that area.

7.10 Delineation of Habitat. Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of Covered Species’ habitat.

7.11 Project Related Vehicle Use. Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.13 Visual Inspections. Project personnel shall visually check for Covered Species under vehicles and equipment prior to moving them.

7.14 Hazardous Waste. Permittee shall immediately stop and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

7.16 Refuse Removal. Upon completion of Covered Activities, Permittee shall remove from the Project Area and properly dispose of all temporary fill and construction refuse, including, but not limited to, broken equipment parts, wrapping material, cords, cables, wire, rope, strapping, twine, buckets, metal or plastic containers, flags, and boxes.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of the ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in the ITP and/or the MMRP. The Designated Representative shall report any non-compliance with the ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each construction site within the Project Area when Covered Activities occur and shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3) check for compliance with all measures of the ITP; (4) check all exclusion zones; (5) ensure that signs, stakes, and fencing are intact, and (6) ensure that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall monitor compliance continuously where Covered Activities are occurring; and after initial vegetation and soil disturbance, the Designated

Biologist(s) shall conduct compliance inspections a minimum of once per day where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by the ITP. Permittee shall compile and report observation and inspection records as described in Condition of Approval 8.6 *Compliance Report.* The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps, including metadata, depicting: 1) mapped areas of all land disturbances within the Project Area; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species within the Project Area (defined by Conditions of Approval 8.4.1), and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each construction site and surrounding buffer, no more than 14 days prior to initiation of Covered Activities, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species in the construction site and disturbed by Covered Activities, maintain this tracking using a GIS format, and include photo documentation of the habitat feature. The photo documentation of each habitat feature shall include a minimum of four photos facing the habitat feature, taken from the North, South, East, and West. Permittee shall include separate photo documentation of each habitat feature suitable for Covered Species; if there are multiple habitat features in a construction site, Permittee shall include multiple sets of photo documentation for that site. Permittee shall document the total disturbed acreage of habitat features for Covered Species compiled from the real-time tracking; compare the documented disturbance in each construction site to the Baseline Maps as shown in Attachment 6; provide GIS layers and the associated metadata to CDFW with the Monthly Compliance Report; maintain maps for each Covered Species separately; include updates to any of the maps in the next Annual Status Report; provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report; and provide a summation of disturbance of identified habitat features annually with the Annual Status Report.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month, to the office listed in the Notices section of the ITP, and via e-mail to CDFW's Representative. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision, depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of the ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.9.1 Project Construction Report. No later than 180 days after completion of all mitigation measures, Permittee shall provide CDFW with a Final Mitigation Report. The Designated Biologist(s) shall prepare the Final Mitigation Report which shall include, at a minimum: (1) a summary of all Monthly Compliance Reports and all ASRs; (2) a copy of the table in the MMRP with notes showing when each of the mitigation measures was implemented; (3) all available information about Project-related incidental take of the Covered Species; (4) information about other Project impacts on the Covered Species; (5) beginning and ending dates of Covered Activities; (6) an assessment of the effectiveness of the ITP's Conditions of Approval in minimizing and fully mitigating Project impacts of the taking on Covered Species; (7) recommendations on how mitigation measures might be changed to more effectively minimize take and mitigate the impacts of future projects on the Covered Species; and (8) any other pertinent information.

8.10 Notification of Take or Injury. Permittee shall immediately notify the Designated Biologist(s) if a Covered Species is taken or injured by a Covered Activity, or if a Covered Species is otherwise found dead or injured within the vicinity of the Project Area. The initial notification to CDFW shall include information regarding the location, species, and number of animals taken or injured and the ITP Number. Following initial notification, Permittee shall send CDFW a written report within two calendar days. The report shall include the date and time of the finding or incident, location of the animal or carcass, and if possible provide a photograph, explanation as to cause of take or injury, and any other pertinent information.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye to prevent overspray.

9.1.2 Rodenticide use. Permittee shall prohibit the use of rodenticides in construction sites.

9.1.3 Artificial Lighting. Permittee shall use artificial outdoor lighting only as needed for safety and security requirements. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and permanent facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access.

9.1.4 Covered Species Observations. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee shall cease

Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is moved by the Designated Biologist(s) or it moves from the construction site of its own accord.

9.1.5 Hazards to Covered Species. Permittee shall not permit pets, campfires, or firearms in construction sites, except firearms carried by authorized security personnel or local, state, or federal law enforcement officials. To avoid attracting predators, Permittee shall ensure Project personnel will dispose of all food-related trash items such as wrappers, cans, bottles, and food scraps in enclosed containers. Permittee shall ensure trash is removed from the construction site and taken to an appropriate facility at least once a week for disposal.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of work, Permittee shall backfill geotechnical test pits with the excavated material on the same day as they are excavated, and shall place the stockpiled topsoil at the surface and restore the site where geotechnical exploration activities were conducted. Permittee shall backfill bored holes on the same day as they were drilled, after exploration is completed at that site.

9.1.7 Daily Entrapment Inspections. To prevent inadvertent entrapment of Covered Species during construction, Permittee shall cover all excavated, steep-walled holes or trenches more than six inches deep at the close of each working day with plywood or similar material and shall ensure the cover is sealed with rock bags or other methods to prevent animals from reentering. When such holes or trenches are being covered or filled, the Designated Biologist(s) shall be present to ensure there are no trapped animals and the hole or trench cover is secure. If a Covered Species is encountered in holes or trenches during construction work, Permittee shall divert Covered Activities away from the animal until Project personnel contact the Designated Biologist(s). The Designated Biologist(s) shall attempt to relocate the trapped Covered Species if safe or feasible to do so or shall determine further action.

9.1.8 Materials Inspection. The Designated Biologist(s) or Project personnel shall inspect all construction pipes, culverts, or similar structures with a diameter of 0.25 inch or greater that are stored for one or more overnight periods in construction sites that may be occupied by Covered Species, at the beginning of each day during which such materials will be used for construction, moved, buried, or capped. If Project personnel detect Covered Species within a pipe, culvert, or similar structure, they shall notify the Designated Biologist(s) and allow the animal to safely escape, or be relocated by the Designated Biologist(s) outside of the construction site, prior to moving, capping, burying, or utilizing the structure. If necessary, and under the direct supervision of the Designated Biologist(s), Project personnel may move the structure up to one time to isolate it from construction activities until the Covered Species moves from the structure of its own volition or the Designated Biologist(s) relocates the individual outside of the construction site. Immediately after inspection or after the animal has vacated the structure, Project personnel shall securely cap the pipes, culverts, or similar structures to prevent Covered Species from entering the structures.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, reusable tunnel material (RTM), and dredged material. The spoils disposal plan shall include protocols for sampling and analysis of dredge materials, spoils and RTM, that shall address: handling and disposal of hazardous material; the presence and concentrations of contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine pesticides); potential discharge of contaminants that would affect surface water or groundwater (e.g., instream discharges during dredging, effluent discharge from the disposal site; leachate from the disposal site); sediment analyses; chemical analyses; a protocol to reduce or eliminate the release of contaminated sediment; and BMPs to be implemented during handling and disposal of any potentially hazardous dredged or excavated material. Permittee shall conduct discharges from RTM draining operations in such a way as to not cause erosion at the discharge point. Permittee shall size the designated storage sites to accommodate all RTM, dredge material, or spoils expected to be generated by Covered Activities and shall size and locate the sites to minimize the impact or encroachment on environmentally sensitive areas within the Project Area. Permittee shall use rocks and other inorganic material grubbed from storage sites to backfill borrow pits or shall remove these materials from the site. Permittee shall not place grubbed material in environmentally sensitive areas.

9.1.11 In-Water Work Windows. Permittee shall restrict the times of year when certain in-water Covered Activities are conducted. The following Covered Activities are permitted only during certain dates within the in-water work windows between June 1 and November 30: over water geotechnical exploration, dredging, cofferdam installation and removal, pile driving, levee clearing and grading, riprap placement, construction of sheetpile walls, and placing of rock bedding and stone slopes [as relevant to minimizing impacts to GGS]. Permittee shall coordinate with the NDDTT, HGTT, CCFTT, and the TOT prior to finalizing Project engineering design to further limit the times when Permittee shall conduct in-water work, as feasible.

9.1.12 Daily In-Water Work Restriction. Permittee shall terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise. Permittee shall use sunrise and sunset times established by the U.S. Naval Observatory Astronomical Applications Department for the geographic area.

9.1.13 Underwater Sound Abatement Plan. Prior to finalizing Project engineering design Permittee shall coordinate with the TOT to develop an underwater sound abatement plan outlining specific measures to avoid and minimize the effects of underwater construction noise on Covered Fish Species. Permittee shall submit the underwater sound abatement plan to the TOT for review at least 90 days prior to finalization of the Project engineering design. Permittee shall not initiate in-water Covered Activities until the final underwater sound abatement plan is submitted to CDFW for written approval.

9.1.14 Pile Driving Plan. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a pile driving plan to minimize the impacts of pile driving on Covered Species. The pile driving plan shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the duration of pile driving within the in-water work windows (see Condition of Approval 9.1.11) and the duration of pile driving within the daily in-water work construction window. To minimize impacts of pile driving on Covered Species, the pile driving plan shall restrict impact pile driving activities to specific times of the day and for a specific duration to be determined in coordination with the TOT, and implement vibratory pile driving methods to minimize the noise generated from construction activities to the greatest extent feasible. Permittee shall ensure the pile driving plan is reviewed and finalized by the TOT and submitted to CDFW for written approval before Permittee initiates Covered Activities that require pile driving, and shall implement all measures in the approved plan.

9.1.15 Barge Operations Plan. Permittee shall develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities, identify the barge routes that minimize impacts on Covered Fish Species, and minimize general barge operation related effects on Covered Fish Species. Permittee shall not initiate Covered Activities that require barge operations until the final barge operations plan is approved in writing by CDFW. The barge operations plan shall describe measures to avoid and minimize impacts to Covered Fish Species caused by direct mortality due to propeller strikes or propeller wash, bank erosion or loss of emergent vegetation from propeller wash and/or excessive wakes, and accidental spillage of hazardous material. Permittee shall limit vessel speeds to maintain wake heights of less than two feet at shore to minimize the effects of wakes on unarmored or vegetated banks; Ensure that tug boat and barge operators are trained to minimize impacts on Covered Species' habitats such as reducing the effects of wake on vegetated banks; limit the direction and/or velocity of propeller wash to prevent loss of aquatic vegetation; ensure all vessels approach and depart from the NND intake and barge landing sites at dead slow to reduce vessel wakes and propeller wash; avoid pushing stationary vessels up against cofferdams, docks, or other structures for extended periods, which could result in excessive directed propeller wash impinging on a single location; visit each NDD intake and barge landing site to determine the extent of emergent vegetation, bank conditions, and general site conditions during the growing season prior to initiation of construction and then annually during and after construction until barge landings are disassembled; and monitor the condition of both river banks at each landing site.

9.1.17 Dewatering. Permittee shall screen dewatering pump intakes to prevent entrainment of Covered Species in accordance with screening criteria for salmonid fry NMFS 1997 *Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997b). During dewatering, a Designated Fisheries Biologist shall remain onsite to observe the process and remove Covered Species that were not successfully salvaged prior to dewatering. The Designated Fisheries Biologist will be on site with the aim of minimizing the number of Covered Species that become trapped or impinged on pump screens or isolation nets.

9.1.18 Stormwater Pollution Prevention Plan. Permittee shall ensure compliance with all construction stormwater permitting requirements and shall ensure the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control short-term and long-term effects associated with construction-generated stormwater runoff. The SWPPP shall include all applicable SWRCB and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The SWPPP shall include measures that address erosion and sediment control, management of construction materials, waste management, site dewatering and pipeline testing, accidental spill prevention and response, site inspection and monitoring, and measures to prevent nonstormwater discharges from reaching surface water. Nonstormwater discharge examples include washing vehicles, cleaning streets, or applying erodible landscape material during rain. The SWPPP shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.19 Erosion and Sediment Control Plan. Permittee shall develop one or more erosion and sediment control plan(s) to be incorporated in the SWPPP prior to disturbance and throughout all phases of Construction Activities. The erosion and sediment control plan(s) shall include best management practices such as: physical erosion control stabilization; maintaining emergency erosion control supplies at all times during construction and replacing used materials within 48 hours; minimal disturbance of the terrain and natural land features; diverting runoff away from steep, denuded slopes; retaining trees and vegetation where practicable to stabilize hillsides, retain moisture, and reduce erosion; limiting disturbance to areas of proven stability; implementing site inspections before and after storm events; installing drainage control features; and installing wind erosion control features. Sediment control measures shall include retaining sediment transported by run-off; collecting and directing surface runoff at non-erosive velocities to common drainage courses; using sediment and turbidity areas where ground disturbance is adjacent to surface water or wetlands; preventing mud tracking; and depositing or storing excavated materials away from drainage courses and keeping them covered when stored over five days or within 48 hours of a forecasted rain event. The erosion and sediment control plan(s) shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.20 Erosion Control Stabilization Measures. Permittee shall not use plastic monofilament netting or similar material such as nylon for erosion control, to avoid entanglement or trapping of Covered Species. Permittee shall not use products that use photodegradable or biodegradable synthetic netting. Acceptable materials include natural fibers such as jute matting, coconut, twine, or other similar fibers or tackified hydroseeding compounds. Permittee shall communicate this measure to Project contractor(s) through specifications or special provisions included in the construction bid solicitation package. Permittee shall bury the edge of erosion control materials in the ground to prevent reptiles and amphibians from crawling underneath them. Permittee shall submit the erosion control stabilization measures to CDFW for written approval prior to initiating construction activities.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. In accordance with local, state, or federal regulations, Permittee or its contractors shall develop a spill prevention, containment, and countermeasure plan (SPCC) at each site where ground-disturbing activity will occur. Each SPCC shall address actions used to prevent spills and actions that will be taken should any spills occur, including emergency notification procedures. The SPCC plans shall include measures and processes that address the following: procedures for routine handling of products; discharge or drainage controls such as secondary containment and procedures for discharge control; countermeasures for discharge discovery, response, and cleanup; methods of disposal of recovered materials; personnel training in emergency response, spill containment techniques, and pollution control laws, rules, and regulations; storage of petroleum products in nonleaking containers at impervious storage sites from which an accidental spill cannot escape; storing and maintaining spill containment materials--such as absorbent pads, pillows, socks, or booms--in nonleaking sealed containers until transported and disposed of; using spill containment materials under transfer areas when transferring oil or other hazardous materials from trucks to storage containers; storage of concrete, wash water, and other contaminants in watertight containment structures; daily inspection of equipment for oil, grease, and other petroleum products if equipment is in contact with surface water; cleaning of external petroleum products off of equipment prior to its contact to water; and use of oil-absorbent booms for equipment used in or adjacent to water. In the event of a spill, personnel shall identify and secure the source of discharge and contain the discharge with spill kit materials, such as sorbents or sandbags, and shall contact CDFW and other appropriate regulatory authorities within 24 hours. Permittee shall submit the SPCC plans to CDFW for written approval prior to initiating construction activities.

9.1.22 Hazardous Materials Management Plan. Permittee or its contractors shall develop and implement one or more hazardous materials management plan(s) (HMMP) prior to initiating construction activities. The HMMP shall provide detailed information on the types of hazardous materials used; phone numbers of emergency response agencies; appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste; and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP shall address the following measures or practices: clear labeling, handling and safety instructions, and emergency contact information on hazardous material containers; use or transfer of hazardous materials near wet or dry streams; Material Safety Data Sheets, accumulation and temporary storage of hazardous wastes (e.g., not to exceed 90 days); and disposal of contaminated soils. Permittee shall submit the HMMP to CDFW for written approval prior to initiating construction activities.

9.1.23 Fugitive Dust Control. Permittee shall implement fugitive dust control measures and enhanced dust control measures at all construction and staging areas to reduce construction-related fugitive dust that are consistent with Air Quality Management District (AQMD) guidelines and requirements for each region. Fugitive dust control measures shall address: applying water to all exposed surfaces—such as soil piles, graded areas, unpaved parking areas, staging areas, and access roads--to prevent visible dust from leaving construction sites; covering and maintaining at least two feet of freeboard space on trucks transporting soil, sand, and other loose material; using wet power vacuum street sweepers to remove visible track-out of mud or dirt; limiting vehicle speeds on unpaved roads to 15 miles per hour; completing paving projects and laying construction pads as soon as possible after grading; watering exposed soil with adequate frequency; suspending excavation, grading, or demolition activity when wind speeds exceed 20 miles per hour or conducting fugitive dust control measures more frequently during dry summers and wind conditions higher than 20 miles per hour; installing wind breaks such as trees or solid fencing on the windward side(s) of construction sites; and planting vegetative ground cover, such as fast-germinating native grass seed, as soon as possible after construction is completed and ensuring vegetation becomes established. Permittee shall develop measures for entrained road dust—such as washing wheels and equipment or treating access to sites with material such as wood chips or gravel that would reduce carry-out. Permittee shall develop measures for concrete batching, such as achieving a 70-percent reduction in dust from concrete batching and 80 percent reduction in dust from aggregate and sand pile erosion. Permittee shall submit fugitive dust control and enhanced dust control measures to CDFW for written approval prior to initiating construction activities.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments shall occur only in July and August on an as-needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure.

Measures specific to GGS

9.5.1. Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) shall evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities (disturbance-free zone). Permittee shall erect high visibility poly wire around suitable GGS habitat, as directed by the Designated Biologist(s), on stakes placed every six feet along the boundary, and shall also post and maintain signs identifying the disturbance-free zone every 50 feet along the edge of the suitable GGS habitat, and ensure signs are clearly visible and recognizable to Project personnel. Where agricultural ditches and other suitable aquatic habitat can be avoided and delineated, Permittee shall clearly mark the aquatic habitat by surrounding it with poly wire. Permittee shall inspect the stakes and high visibility poly wire before the start of each work day during ground disturbance activities, and Permittee shall maintain the stakes and poly wire until completion of Covered Activities within a construction site.

9.5.2. GGS Habitat Avoidance. All Project personnel shall avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities. Permittee shall avoid all suitable aquatic GGS habitat located at the southern tip of Zacharias Island on the inside of levees and demarcate it as a disturbance-free zone.

9.5.3. <u>GGS Relocation Conditions</u>. Permittee shall develop a Mortality Reduction and Relocation Plan (Relocation Plan) for GGS and submit it to CDFW for written approval no less than 30 days prior to initiating Covered Activities. Permittee will submit to CDFW the proposed GGS capture and handling technique and the amount, relative location, and quality of suitable habitat within proposed relocation sites and notify CDFW of each relocation event. If GGS, or a snake resembling GGS, is found within a construction site, or three feet beyond the construction site (three-foot boundary), Project personnel shall notify the Designated Biologist(s) immediately. The Designated Biologist(s) shall relocate GGS if the individual is directly threatened by Covered Activities and is unable to move to a safe area on its own. GGS shall only be captured and handled by Designated Biologist(s) holding required capture and handling permits (ESA Section 10(a)1(A) recovery permit and CDFW 2081(a) MOU). The Designated Biologist(s) shall determine whether or not GGS should be captured and handled and shall only relocate GGS to areas identified in the Relocation Plan. Relocated GGS shall be released as soon as possible.

9.5.4 <u>Dewatered Aquatic Habitat</u>. In suitable GGS aquatic habitat that cannot be avoided by Covered Activities, Permittee shall dewater the habitat within the construction site--or, in the case of rice fields, shall not irrigate the portion of rice field within the construction site---prior to starting the Covered Activity. The Designated Biologist shall be on site when dewatering begins and when the level of water reaches the level of the intake to salvage and relocate any GGS that cannot swim away from the suction pumps and escape on its own. If Project Personnel see GGS at the screen during dewatering, the pump shall be shut down and the Designated Biologist contacted to remove the snake. Permittee shall ensure the habitat remains dry for at least 15 consecutive days after May 1 and prior to excavating or filling aquatic habitat. Permittee shall limit dewatering to May 1 – October 1 and shall limit dewatering to the immediate construction site. Following de-watering of aquatic habitat, the Designated Biologist(s) shall survey for GGS in all suitable GGS aquatic or upland habitat within the construction site that is not within the disturbance-free zone. If GGS is observed, Permittee and the Designated Biologist(s) shall follow Condition of Approval 9.5.3 GGS *Relocation Conditions*. Permittee shall obtain written approval from CDFW for any deviation from this measure and shall coordinate alternative actions with CDFW.

9.5.5. <u>Mowing.</u> Within 24 hours of preconstruction surveys in construction sites with high grass cover or vegetation, Permittee shall mow the flagged construction site and three-foot boundary. Permittee shall use light mowing equipment that would not crush burrows or impact the ground, until vegetation reaches a maximum height of four inches or, at the Designated Biologist(s)'s discretion, a height that allows the Designated Biologist(s) to see and survey for snakes and burrows. The Designated Biologist(s) shall walk in front of the mower and monitor for GGS escaping the vegetation or burrows. If GGS is found, Permittee shall cease mowing until GGS moves out of the way or is relocated by the Designated Biologist(s). Permittee shall mow in rows and not in a circular pattern that would concentrate animals in the center of a construction site, and shall start mowing farthest from aquatic habitat to push GGS toward the water.

9.5.6. Preconstruction Surveys. The Designated Biologist(s) shall conduct two days of walking pre-construction surveys within each construction site and the three-foot boundary, beginning no more than seven days prior to initiating ground disturbing Covered Activities during the active season (May 1 to October 1). The final preconstruction survey shall occur within 24 hours preceding exclusion barrier installation. If GGS is discovered, the Designated Biologist(s) shall have the authority to delay installation of the exclusion barrier until the GGS leaves the construction site or three-foot boundary of its own volition or is removed from the construction site. The Designated Biologist(s) shall relocate removed GGS in accordance with Condition of Approval 9.5.3 *GGS Relocation Conditions*. Within the construction site and three-foot boundary, the Designated Biologist(s) shall investigate all small mammal burrows within suitable upland habitat outside of disturbance-free zones, using a CDFW-approved methodology at the biologist's discretion, to determine whether or not the burrows are occupied by GGS, and shall immediately collapse small unoccupied burrows (e.g., less than three feet long and with dead ends).

9.5.7 Burrow Excavation. If GGS is found present within a burrow, the Designated Biologist(s) shall fully excavate the occupied burrow by hand. If GGS does not leave the burrow, construction site, and three-foot boundary of its own volition, the Designated Biologist(s) shall relocate the snake in accordance with *GGS Relocation Conditions*. The Designated Biologist(s) shall conduct excavation upon discovery of GGS during preconstruction surveys. Once determined the burrow is not occupied, the Designated Biologist(s) shall collapse or block the burrow to prevent GGS from entering the burrow.

9.5.8 GGS Exclusion Barrier. To exclude GGS from entering any construction site where ground disturbing Covered Activities will occur, Permittee shall erect an exclusion barrier that encircles all suitable GGS habitat prior to habitat disturbance and within 24 hours after the pre-construction surveys have been completed. The Designated Biologist(s) shall be onsite during all barrier installation activities that could result in take and shall watch for GGS and burrows on either side of the barrier during trenching. If GGS are discovered during barrier construction, the Designated Biologist(s) shall have the authority to stop barrier construction until the GGS leaves the construction site of its own volition or is removed from the construction site. The Designated Biologist(s) shall relocate removed GGS in accordance with Condition of Approval 9.5.3 *GGS Relocation Conditions*. Permittee shall design the exclusion barrier to prevent and discourage GGS from entering the construction site in accordance with CDFW approval, inspect the exclusion barrier for defects, and repair the barrier immediately when defects are found. The Designated Biologist(s) shall survey for GGS after the barrier is repaired or if barrier access gates are left open, and shall capture and relocate any GGS found that does not safely leave the construction site of its own volition in accordance with GGS *Relocation Conditions.* Permittee shall ensure the GGS exclusion barrier remains in place and shall maintain the barrier for the duration of ground disturbing Covered Activities.

9.5.9 Seasonal Work Restriction. Permittee shall confine all fill, vegetation removal, and other ground disturbing Covered Activities in construction sites located within suitable GGS habitat to the active period between May 1 and October 1, with the exception of Condition of Approval 9.5.10, where an exclusion barrier is already in place.

9.5.10 Seasonal Work Restriction Exception. Permittee may conduct Covered Activities within suitable GGS habitat after October 1, during the GGS inactive season, if Permittee notifies CDFW in writing, initiates Covered Activities prior to October 1, and the construction site already has an exclusion barrier in place.

9.5.11 Initial Site Clearing and Monitoring. Permittee shall confine ground disturbance to the minimal area necessary to facilitate Covered Activities. The Designated Biologist(s) shall be onsite during initial ground disturbing activities each morning before construction work for that day begins, and shall monitor for emerging GGS at burrows that had not been collapsed; potential hiding places such as cracks, crevices, or cavities; stockpiles that have been left for more than 24 hours; and under or around vehicles and equipment before they are moved. If GGS is discovered, the Designated Biologist(s) shall have the authority to delay construction activities until the GGS leaves the construction site of its own volition or is removed from the construction site and Permittee implements appropriate corrective measures to ensure GGS will not enter the exclusion barrier. The Designated Biologist(s) shall relocate removed GGS in accordance with GGS *Relocation Conditions*. If ground disturbance is delayed for more than seven days after the exclusion fencing is installed, the Designated Biologist(s) shall repeat preconstruction surveys and collapsing of burrows before ground disturbance begins.

9.5.12 Disposal of Debris. Permittee shall use one, but not both, of the following methods to handle natural debris (debris composed of on-site vegetation, usually removed from waterways, not including spoils from dredging):

1. Permittee shall place debris in piles 200 feet from suitable aquatic habitat and within the exclusion barrier. Permittee shall not disturb or remove debris piles once placed; or
2. Permittee shall haul debris outside of the Project Area for disposal within 24 hours of placement.

9.5.13 GGS Avoidance. Where possible, Permittee shall conduct Covered Activities within paved roads, farm roads, road shoulders, and similarly disturbed and compacted areas. Where Covered Activities cannot occur in already disturbed areas, Project-related vehicles shall observe a speed limit of 10 miles per hour in construction sites and access roads within suitable GGS upland habitat, except on county roads, highways, and other roads where 10 miles per hour would unsafely impede the normal flow of traffic. If GGS, or any snake resembling GGS, is found on or traversing a roadway, project Personnel shall allow the snake to safely move off the road on its own, maneuver to avoid striking it, or shall notify the Designated Biologist(s) to move the snake off the road. If project Personnel observe GGS, or any snake resembling GGS, retreating into an underground burrow, crack, or crevice, including rock riprap (hereafter refuge) within a construction site during any phase of Covered Activities, Permittee shall not allow the Covered Activity within a 50-foot radius of the refuge until Project personnel contact the Designated Biologist(s) and the Designated Biologist(s) is/are on site. If the refuge cannot be avoided by the Covered Activities, the Designated Biologist(s) shall attempt to excavate, expose, and identify the snake, and shall allow any GGS that is found to escape the construction site of its own volition or shall relocate it in accordance with *GGS Relocation Conditions.*

9.5.14 Restoration of Temporary Impacts. Upon completion of work, Permittee shall restore GGS habitat on-site by removing temporary fill and construction debris, re-contouring, if appropriate, and re-vegetating areas with CDFW approved and available native plant species (see Condition of Approval 10.8). The restoration effort shall comply with the USFWS Guidelines for the Restoration and/or Replacement of GGS Habitat (USFWS 2007), and Permittee shall monitor the restoration site for one year.

9.5.15 Safe Haven Sites. The Designated Biologist(s) shall delineate with flagging or other visible markers suitable GGS habitat within construction sites for atmospheric or pressurized safe havens. Permittee shall ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occur within delineated GGS habitat.

9.5.16 Geotechnical Exploration. The Designated Biologist(s) shall delineate suitable GGS aquatic habitat within geotechnical exploration sites with poly wire or other visible flagging approved by CDFW to demarcate it as a disturbance-free zone, and Permittee shall avoid geotechnical exploration activities in the aquatic habitat. The Designated Biologist(s) shall delineate with flagging or other visible markers suitable GGS upland habitat within geotechnical exploration sites, and Permittee shall avoid geotechnical exploration activities in upland habitat during the inactive season from October 2 – April 30. For Covered Activities conducted during the active season of May 1 – October 1 in suitable GGS upland habitat, Permittee shall: confine movement of heavy equipment to existing access roads or to locations outside of suitable GGS upland habitat to the extent practicable; limit vehicle speed to 10 miles per hour within exploration sites and on non-public access roads; ensure a Designated Biologist(s) is on-site during selection of the exploration site, ingress and egress to the exploration site, and during set-up activities to guide Project personnel to avoid visible burrows until access routes are clearly established; ensure the Designated Biologist(s) will conduct daily surveys prior to the start of each day of exploration activities to check for burrows within the exploration site; and ensure the Designated Biologist(s) either flags burrows to be avoided by a 50-foot radius no-activity buffer or designates and flags work sites, staging areas, and ingress/egress routes that avoid potentially occupied burrows. If GGS, or any snake resembling GGS, is detected retreating into or exiting a burrow, Project personnel shall allow GGS to leave the site, or notify the Designated Biologist(s) to relocate the GGS outside of the exploration site, before continuing Covered Activities; or the Designated Biologist(s) shall flag the burrow to be avoided by the no-activity buffer.

9.5.17 Permanent Facilities and Transmission Line Maintenance. For transmission line maintenance activity, Permittee shall follow the same measures as for geotechnical exploration, and shall follow *GGS Avoidance* measures for all maintenance-related Covered Activities. For vegetation control within suitable GGS upland habitat, Permittee shall only use burning or light mowing equipment to ensure maintenance activities do not include ground disturbance activity that would crush burrows or entomb GGS within a burrow. Permittee shall not use flail or other high-suction mowers in suitable GGS upland habitat during the active season unless a Designated Biologist(s) is on site in front of the mower to help GGS escape the blades. Permittee shall start mowing farthest from aquatic habitat in order to force GGS toward the water; limit mowing on channel banks to one side of the channel per year to maintain cover for GGS; avoid mowing emergent vegetation such as tules, cattail, sedge, or rush to the extent practicable; and shall keep grassy vegetation at a minimum height of four inches.

9.5.18 Suction Dredging. In suitable GGS channel habitat during the GGS active season and when practicable, Permittee shall suction dredge from only one side of the water channel during a given year and shall confine suction dredging to the channel bed below the high-water mark to avoid suction dredging near shallow water edges and channel-side banks. Where channel margin suction dredging cannot be avoided, The Designated Biologist(s) shall be on-site to look for GGS in riprap, on channel bank edges, or swimming in the shallow water margin before suction dredging begins. The Designated Biologist(s) shall have the authority to delay suction dredging until GGS is safely out of the water or removed from the construction site. The Designated Biologist(s) shall relocate removed GGS accordance with Condition of Approval 9.5.3 *GGS Relocation Conditions*.

Impact: Crushing of Individuals or Burrows

GGS upland habitat consists of vegetated levees or stream banks generally within 200 feet of GGS aquatic habitat and is used for basking, burrowing, and overwintering (USFWS 2015). GGS use small mammal or crayfish burrows, cracks, or crevices for hibernation, thermoregulation, ecdysis, and refuge from predators (USFWS 2015). GGS also use revetment such as riprap for thermoregulation and overwintering (Wylie, Cassaza et al. 1997, Wylie and Amarello 2008, USFWS 2012b). Halstead, Skalos et al. (2015) indicated GGS could be underground during the active season (April – September) up to 50% of the day. During the inactive season, GGS hibernate underground (USFWS 2015). When above ground, GGS generally exhibit cryptic behavior, preferring vegetative cover that keeps them hidden and not easily detected by predators (USFWS 2015, Hansen 2016). Therefore, Project personnel would not likely see a GGS individual or know it is there before an impact causes mortality. GGS hiding in riprap could be crushed by Covered Activities that move rocks or cause them to fall. Even skilled biologists on site to monitor for GGS may have difficulty finding and identifying individuals, particularly underground. GGS may also bask in open areas or roads for thermoregulation, or they may cross roads within upland habitat, and could be struck by vehicles or equipment operated in these locations (Wylie, Cassaza et al. 1997,

USFWS 2007, USFWS 2015).

Vehicles as well as construction or drilling equipment could kill GGS as a result of direct strikes or crushing of occupied burrows during ingress or egress to or movement within construction sites. GGS individuals or burrows could also be crushed by vehicles or equipment during mowing for vegetation control and setting up exclusion fencing at construction sites or by the laying down of stockpiles, construction debris, RTM, or spoils. The distribution of GGS throughout the Delta is currently not known (BDCP 2016). Documented populations in the California Natural Diversity Database (CNDDB; accessed June 22, 2017) and literature are in the northern and eastern Delta within the Yolo Basin, near White Slough on Shin Kee and Terminous Tracts, and Badger Creek east of the Delta (Engstrom 2010). However, recent sightings of GGS have occurred in areas of the western and central Delta not previously expected. For example, GGS was recently detected on Empire Tract (CNDDB Element Occurrence [EO] #307); along the False River on Jersey Island and Webb Tract (CNDDB EO #402, #359, #170); along the Mokelumne River on Bouldin Island; Sherman Island (CNDDB EO #298); and Bradford Island, Twitchell Island, and possibly Bacon Island (L. Patterson pers. comm. 5/30/17). Therefore, mortality of GGS individuals could occur at any location or time during Covered Activities in upland habitat.

Conditions of Approval: Crushing of Individuals or Burrows

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing crushing of GGS or occupied burrows and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.8 Dust Control. Permittee will implement dust control measures during Covered Activities to facilitate visibility for monitoring of GGS by the Designated Biologist(s).

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing,

stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of GGS habitat.

7.11 Project Related Vehicle Use. To minimize the risk of GGS or occupied burrows being crushed by vehicles or equipment during Covered Activities, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area

7.12 Vehicle Parking and Staging Areas. To minimize the risk of GGS or occupied burrows being crushed by vehicles or equipment during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.13 Visual Inspections. To minimize the risk of GGS being crushed by vehicles or equipment during Covered Activities, Project personnel will visually check for GGS under vehicles and equipment prior to moving them.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if GGS is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter GGS in or near the construction site and will cease Covered Activities until GGS is safely out of harm's way.

9.1.9. Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize the risk of GGS being crushed by the placement of RTM or spoils, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact or encroachment on environmentally sensitive areas.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities and clearly demarcate it as a disturbance-free zone.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities.

9.5.3. GGS Relocation Conditions. Permittee will develop and implement a CDFW-approved GGS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If GGS is found on or near the construction site and does not move out on its own, The Designated Biologist(s) will relocate GGS to pre-approved locations outside of the construction site to minimize the risk of Covered Activities crushing GGS or occupied burrows.

9.5.4 Dewatered Aquatic Habitat. The Designated Biologist(s) will survey for GGS following dewatering of habitat. If GGS is observed, the Designated Biologist(s) shall follow Condition of Approval 9.5.3 GGS *Relocation Conditions*.

9.5.5. Mowing. Permittee will mow the construction site using methods and equipment that minimize ground impact for the Designated Biologist(s) to detect GGS and burrows during preconstruction surveys, and the Designated Biologist(s) will monitor mowing to minimize the risk of crushing GGS.

9.5.6. Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual GGS in and near the construction site to minimize the risk of Covered Activities crushing individuals. The Designated Biologist(s) will investigate burrows, and if unoccupied, will collapse burrows to prevent GGS from using them.

9.5.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate GGS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent GGS from using the burrows.

9.5.8 GGS Exclusion Barrier. To minimize the risk of crushing GGS or occupied burrows within a construction site, prior to initiation of site clearing, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep GGS out, under the supervision of a Designated Biologist(s).

9.5.9 Seasonal Work Restriction. To avoid the risk of crushing GGS hibernating in burrows, Permittee will confine all fill, vegetation removal, and other ground disturbing Covered Activities in construction sites located within suitable GGS habitat to the active period between May 1 and October 1, except where an exclusion barrier is already in place.

9.5.10 Seasonal Work Restriction Exception. Permittee will conduct Covered Activities within suitable GGS habitat after October 1 if Permittee notifies CDFW in writing, initiates Covered Activities prior to October 1, and the construction site already has an exclusion barrier in place.

9.5.11 Initial Site Clearing and Monitoring. To minimize the risk of crushing GGS or occupied burrows, Permittee will confine ground clearance to the minimal area necessary, and the Designated Biologist(s) will conduct daily surveys during ground clearance to relocate GGS and collapse burrows if needed.

9.5.12 Disposal of Debris. To minimize GGS entering the construction site and being crushed, Permittee will remove vegetative debris used by GGS for cover from the

Project Area or will place piles within the exclusion barrier away from suitable aquatic habitat.

9.5.13 GGS Avoidance. Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas to the extent possible, to minimize crushing GGS while they are above ground or in burrows. Permittee will post speed limits and ensure Project personnel inform the Designated Biologist(s) if GGS is seen in or near the construction site retreating into refugia and will avoid disturbing occupied refugia until GGS is out of harm's way.

9.5.15 Safe Haven Shafts. To minimize crushing of GGS or occupied burrows, Permittee will ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occur within GGS habitat delineated by the Designated Biologist(s).

9.5.16 Geotechnical Exploration. To minimize crushing of GGS or potentially occupied burrows, Permittee will limit speed and access routes of moving vehicles and heavy equipment, and the Designated Biologist(s) will be on-site to flag burrows and guide drilling personnel to avoid visible or potentially occupied burrows. The Designated Biologist(s) will ensure any GGS seen on the site is allowed to leave the site or is relocated.

9.5.17 Transmission Line Maintenance. To minimize crushing of GGS or potentially occupied burrows, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas and will follow the same measures required for geotechnical exploration.

Impact: Entrapment

The long duration of many construction-related Covered Activities indicates that stockpiled equipment and materials will be common throughout Project construction sites, increasing the risk of GGS entrapment throughout Covered Activities if they recolonize disturbed sites during Project construction. Construction of the tunneled conveyance facilities will last approximately eight years, NDD construction will last approximately five years, and CCF modifications will last approximately six years. Construction of each segment of transmission line will last up to one year and RTM areas will be active for approximately 10 years. Dredging and pile driving for the HOR Gate will last approximately 22 days, with an adjacent staging area of approximately 10 acres overlapping GGS upland habitat. During these long construction timeframes, Permittee may stockpile supplies and construction materials such as pipes or culverts; create piles of construction debris; excavate steep-walled trenches, holes, or borrow pits; and use erosion control materials. Geotechnical exploration sites may include storage of well casing pipe or similar materials for time periods lasting from a few hours to 12 days. Test pits will be excavated at approximately 60 geotechnical exploration sites, with dimensions of 4 feet wide, 12 feet long, and 12 feet deep. During construction, debris such as bricks, wood, or concrete could be stockpiled at construction sites and left after construction is complete.

GGS are behaviorally distinguished from other similar snakes by their wary and alert nature, and commonly escape quickly when approached, generally into water (Hansen 2016). If farther upland, GGS may escape from predation under the cover of vegetation or into cracks, crevices, or burrows (Wylie and Amarello 2008, USFWS 2012b, USFWS 2015). If GGS enter construction sites, and vegetation has been removed from the construction site, GGS would likely seek shelter in piles of construction debris or materials such as pipes or culverts to remain out of sight, particularly if approached by Project personnel, vehicles, or equipment perceived as predators, or they may slip or fall into trenches or holes. If the structure or material is subsequently moved, filled, or capped such that GGS cannot escape, the individual will become entombed. Snakes are attracted to debris, and GGS are known to use post-construction fill and debris piles as an overwintering site (City of Sacramento, Sutter County et al. 2003). Therefore, placement and abandonment of construction debris could also trap a hidden snake. The long duration of many construction-related Covered Activities indicates that stockpiled equipment and materials will be common, increasing the entrapment risk.

GGS could become trapped or entangled in erosion control material that is made of lightweight netting or filament—particularly net-like mesh made of plastic, nylon, or jute twine (Stuart, Watson et al. 2001, Barton and Kinkead 2005). When a snake encounters such netting, its scales can catch on the netting, preventing escape from backing out of the mesh; when the snake tries to move forward, it is trapped in the mesh openings (USFWS 2012b). The trapped snake can injure itself trying to escape and become further entrapped, overheated, and vulnerable to predation and mortality (Stuart, Watson et al. 2001, Barton and Kinkead 2005, USFWS 2012b). Mortality associated with erosion control materials was observed in GGS' endangered congener, the San Francisco garter snake (*T. sirtalis tetrataenia*) (USFWS 2012b). Larger snakes such as GGS are more vulnerable to being trapped in netting than smaller snakes (Stuart, Watson et al. 2001), and GGS may be even more susceptible because of the use of such netting for erosion control near its aquatic habitat (USFWS 2012b). The risk of predation on a trapped snake could increase if construction practices such as trash being left on the construction site attract mammalian and avian predators of GGS.

Conditions of Approval: Entrapment

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing entrapment of GGS and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.7 Trash Abatement. To minimize predation on GGS that may become entrapped, Permittee will implement a trash abatement program to ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators to the construction site.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of GGS habitat.

7.16 Refuse Removal. Upon completion of Covered Activities, Permittee will remove from the construction site and properly dispose of any refuse, trash, debris, or materials that GGS could use for shelter and become entrapped within.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if GGS is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter GGS in or near the construction site and will cease Covered Activities until GGS is safely out of harm’s way.

9.1.5 Hazards to Covered Species. To minimize predation on GGS that may become entrapped, Permittee will implement a trash abatement program to ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators to the construction site.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of exploration work, Permittee will backfill geotechnical test pits or exploration bore holes on the same day as they are excavated, to avoid later entrapment of GGS in open pits or bore holes.

9.1.7 Daily Entrapment Inspections. Project personnel will cover or fill holes and trenches at the end of each work day to prevent inadvertent entrapment of GGS and will provide escape ramps for open holes and trenches. The Designated Biologist(s) will inspect all steep-walled holes or trenches more than six inches deep before they are covered or capped. Project-personnel will divert Covered Activities away from trapped GGS until it is removed by the Designated Biologist(s).

9.1.8 Materials Inspection. To prevent inadvertent entrapment of GGS within construction site materials, structures, or debris, the Designated Biologist(s) and Project-personnel will inspect all construction materials that have the potential to contain sheltering GGS each day prior to using, moving, or capping them. Any GGS discovered will be relocated by the Designated Biologist(s), and Project personnel will securely cap structures or materials each day to prevent GGS from entering them.

9.1.20 Erosion Control Stabilization Measures. Permittee will not use harmful materials that could trap or entangle GGS, such as monofilament netting, for erosion control during Covered Activities and will prevent GGS from crawling underneath erosion control materials.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities and clearly demarcate it as a disturbance-free zone.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities.

9.5.3. GGS Relocation Conditions. Permittee will develop and implement a CDFW-approved GGS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If GGS is found on or near the construction site and does not move out on its own, The Designated Biologist(s) will relocate GGS to pre-approved locations outside of the construction site to minimize the risk of Covered Activities entrapping GGS.

9.5.4 Dewatered Aquatic Habitat. The Designated Biologist(s) will survey for GGS following dewatering of habitat. If GGS is observed, the Designated Biologist(s) shall follow Condition of Approval 9.5.3 GGS *Relocation Conditions*.

9.5.5. Mowing. Permittee will mow the construction site to detect GGS and burrows during preconstruction surveys to facilitate exclusion fencing keeping GGS out of the construction site.

9.5.6. Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual GGS in and near the construction site to minimize the risk of GGS being entrapped within the construction site. The Designated Biologist(s) will investigate burrows, and if unoccupied, will collapse burrows to prevent GGS from using them.

9.5.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate GGS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent GGS from using the burrows again.

9.5.8 GGS Exclusion Barrier. To minimize the risk of GGS entering inside a construction site and becoming entrapped, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep GGS out, under the supervision of a Designated Biologist(s).

9.5.11 Initial Site Clearing and Monitoring. To minimize the risk of GGS being inside the exclusion barrier during construction and becoming entrapped, the Designated Biologist(s) will conduct daily surveys during ground clearance to relocate GGS and collapse burrows if needed.

9.5.13 GGS Avoidance. Permittee will limit Covered Activities near suitable GGS habitat to existing roads or disturbed and compacted areas, where possible, to minimize GGS in construction areas.

9.5.15 Safe Haven Shafts. To minimize entrapment of GGS, Permittee will ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occuring within GGS habitat delineated by the Designated Biologist(s).

9.5.16 Geotechnical Exploration. To minimize entrapment of GGS during exploration activities, The Designated Biologist(s) will ensure any GGS seen on the site is allowed to leave the site or is relocated.

9.5.17 Permanent Facilities and Transmission Line Maintenance. To minimize entrapment, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas, where possible.

Impact: Barge Operation Strikes

Suitable GGS aquatic habitat includes slow-moving or stagnant water with emergent vegetation for cover from predation and foraging (USFWS 2012b, USFWS 2015). Range-wide GGS aquatic habitat includes freshwater marsh, seasonal wetlands, small lakes or ponds, low-gradient streams, flooded rice fields, or agricultural waterways (USFWS 2015). In the Delta, most of the preferred GGS aquatic habitat—such as wetlands, rice fields, and perennial low-gradient streams—are not common. Although deep and fast-flowing waterways generally support predatory fish and are avoided by GGS (USFWS 2015), recent detections in the Delta imply GGS may use the edges of rivers and sloughs. For example, in 2015, an undocumented detection of GGS on the water side of the Bouldin Island levee near the confluence of the North Mokelumne and San Joaquin Rivers occurred where the Mokelumne River contained patches of tule (*Schoenoplectus* spp.) about 200 feet from the bank. These patches of tule are included as GGS aquatic habitat in Project habitat modeling. CNDDB detections indicate GGS are using upland habitat along the False River (CNDDB Element Occurrences #402, #359, #170) and along Little Connection Slough (CNDDB Element Occurrence #307). The distribution of GGS in the Delta is not well understood, and margins of larger waterways may be suitable for GGS use or dispersal where emergent vegetation slows down water flow (Patterson pers. comm. 8/21/16).

Barge landing docks and barge operations will occur primarily in larger waterways; for example, the Sacramento River, Snodgrass Slough, Potato Slough, San Joaquin River, Connection Slough, Old River, and West Canal. GGS are most likely to inhabit emergent vegetation along the banks of waterways used by barges and towing vessels, but they may also use emergent vegetation farther into the channel. Encounters with GGS could potentially result where barges and vessels move through or approach landings in emergent vegetation, potentially resulting in direct strikes or GGS being caught in propellers.

Conditions of Approval: Barge Operation Strikes

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.15 Project Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance.

9.1.11 In-Water Work Windows. Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30, which will minimize barge trips and other for in-water construction impacts to GGS.

9.1.12 Daily In-Water Work Restriction. Permittee will terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise, which will minimize barge trips at night for in-water construction.

9.1.15 Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities, reduce vessel speeds, and train operators to minimize impacts on emergent vegetation vegetation to minimize impacts on Covered Fish Species. This will also reduce the potential for barges or tugboats to strike GGS. Barges will approach landings and other bankside structures at near dead stop.

Impact: Entrainment

As described under the barge operations strikes discussion above, GGS may use the margins of rivers or sloughs as aquatic habitat. GGS occurring in those locations could be entrained and killed by dredging equipment or dewatering used for construction if they cannot swim quickly enough to escape. For example, suction cutterhead dredges will be used during certain Covered Activities. GGS could get killed from dredging activity (ICF International 2016a). Depending on the design of the cutterhead, GGS could be snagged in the cutterhead blades as it is lowered, particularly if it is spinning, and either suctioned into the pumps or lacerated by the blades. The likelihood of this occurring would depend on the location of the cutterhead influence relative to the margin of the channel where GGS are most likely to occur, how quickly GGS could swim out of the way, and the force of the suction pumping mechanism.

Dewatering of aquatic habitat could also cause entrainment of GGS into the pumps, depending on the location of the pump in the water column and the force of the suction pumping mechanism. GGS carcasses have been found at drainage canal dewatering pumps during a tracking study, and transmitters were recovered near the inlet and outlet of the pump (B. Halstead pers. comm. 6/29/17). It is possible the flow and suction of the pumping mechanism were stronger than the snakes' ability to swim, if the GGS hadn't died prior to being sucked into the screen or pump. Dewatering would take place in association with Project construction where GGS aquatic or dispersal habitat cannot be avoided by Covered Activities. However, the pumping is likely to be temporary, and the amount of water or suction power is not known. GGS generally swims on the surface of the water and is most likely to become entrained when the pumps start up or when the level of water is near the ground or at the level of the intakes. Dewatering in rivers, sloughs, or other channels associated with in-water construction could affect GGS if they are caught within cofferdams and don't escape in time once the dewatering begins.

Conditions of Approval: Entrainment

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing entrainment of GGS and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of GGS habitat.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if GGS is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter GGS in or near the construction site and will cease Covered Activities until GGS is safely out of harm's way.

9.1.11 In-Water Work Windows. Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30. This will minimize the potential of GGS being entrained during dewatering or dredging.

9.1.12 Daily In-Water Work Restriction. Permittee will restrict in-water work to daytime hours. This will minimize the potential of GGS being entrained during dewatering or dredging.

9.1.17 Dewatering. Permittee will screen dewatering pump intakes to prevent entrainment of Covered Species. The screens will also minimize GGS entrainment into dewatering pumps. Designated Fisheries Biologist(s) will be on-site to salvage Covered Species. This will minimize entrainment mortality if Designated Fisheries Biologist(s) also see and rescue GGS from screens or the dewatering pump.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered

Activities and clearly demarcate it as a disturbance-free zone. This will minimize entrainment by minimizing dewatering of aquatic habitat.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities. This will minimize entrainment by minimizing dewatering of aquatic habitat.

9.5.3. GGS Relocation Conditions. Permittee will develop and implement a CDFW-approved GGS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If a GGS individual is found in sites that are being dewatered or suction dredged and does not move out on its own, the Designated Biologist(s) will relocate the individual to pre-approved locations outside of the dewatering site to avoid the risk of entrainment.

9.5.4 Dewatered Aquatic Habitat. Permittee will limit dewatering of aquatic habitat to May 1 – October 1 and to the immediate construction site. The Designated Biologist(s) will be on site during initiation of dewatering or when water levels reach the intake level to salvage and relocate any GGS that cannot swim away from the suction pumps and escape on its own. Project Personnel will stop the pumps and contact the Designated Biologist(s) if GGS is found at the dewatering screen.

9.5.5. Mowing. Permittee will mow the construction site to detect GGS and burrows during preconstruction surveys to facilitate exclusion fencing keeping GGS out of the construction site.

9.5.6. Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual GGS in and near the construction site. Removal of GGS from upland habitat will minimize the risk of GGS using the nearby aquatic habitat that will be dewatered and will minimize entrainment.

9.5.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate GGS to a safe location outside of the construction site. The Designated Biologist(s) will collapse burrows to prevent GGS from using the burrows again. Removal of GGS from upland habitat will minimize the risk of GGS using the nearby aquatic habitat that will be dewatered and will minimize entrainment.

9.5.8 GGS Exclusion Barrier. To minimize the risk of GGS entering a construction site and becoming entrained in aquatic habitat that will be dewatered, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to exclude GGS, under the supervision of a Designated Biologist(s).

9.5.15 Safe Havens. Permittee will not conduct construction of, access to, or operation of safe havens within GGS aquatic habitat delineated by the Designated Biologist(s). This will avoid dewatering and entrainment at these sites.

9.5.16 Geotechnical Exploration. Permittee will not conduct geotechnical exploration Covered Activities in suitable GGS aquatic habitat delineated by the Designated Biologist(s). This will avoid dewatering and entrainment at these sites.

9.5.17. <u>Transmission Line</u> <u>Maintenance</u>. Permittee will not conduct maintenance activities in suitable GGS aquatic habitat delineated by the Designated Biologist(s). This will avoid dewatering and entrainment at these sites.

9.5.18 <u>Suction Dredging.</u> To minimize entrainment of GGS, the Designated Biologist(s) will be on-site to look for GGS in riprap, on channel bank edges, or swimming in the shallow water margin before suction dredging begins. The Designated Biologist(s) will have the authority to delay suction dredging until the GGS moves out of the water or is relocated.

<u>Impact: Capture, Handling, and Relocation</u>

Capture and handling of GGS by the Designated Biologist(s) to move individuals out of a construction or dewatering site could cause impacts if handlers do not have sufficient skills to minimize GGS stress levels and do not release the snakes quickly enough to reduce the effects of stress and compromised thermoregulation. Capture stress in snakes has been documented through measurements of hormones such as corticosterone (Holding et al. 2014). Repeated events of capturing and handling snakes and long-distance translocations could raise stress hormones to the point of affecting body condition, altering reproductive output, and suppressing the immune system (Holding et al. 2014). Reptiles, including snakes, depend on behavioral responses to their surrounding environment for thermoregulation, which affects daily activities and survival (Osgood 1970, Huey 1982). Basking is a common thermoregulatory behavior for GGS, as well as retreating to underground burrows, cracks, or crevices during extreme temperatures (USFWS 2012b, Halstead, Skalos et al. 2015, USFWS 2015). Water snakes may also maintain optimal body temperature by retreating into water (Osgood 1970). Thermoregulation could be disrupted when GGS are captured and handled for relocation. If a GGS is held too long in captivity, thermal effects could affect daily activity such as foraging or evasion of predators once the snake is released; if thermal temperatures reach critical levels, mortality could result (Huey 1982).

GGS may also experience adverse effects if destinations for relocation are not in suitable habitat and not carefully evaluated. Although relocation can prevent direct mortality at a construction site, it can also have deleterious longer-term impacts (Germano, Field et al. 2015). Scientific practices such as monitoring the outcome of relocation are often lacking, thus survival of the relocated animal is not known (Germano, Field et al. 2015). Rattlesnakes that were translocated far beyond their home ranges were not able to adapt to the new environment and died within one year (Hardy Sr., Greene et al. 2001). Short-term capture and short-distance translocation did not result in deleterious effects; however, the rattlesnakes often returned to the site of capture (Hardy Sr., Greene et al. 2001). The fate of relocated GGS has not been studied. It is possible GGS may have similar homing behavior. GGS is not an effective competitor in comparison to the introduced water snake (*Nerodia fasciata*), since they more restrictive habitat needs (Balfour and Stitt 2007), and they are less aggressive than congeners such as the Valley garter snake (*T. sirtalis*) (Hansen 2016). Relocated GGS may fail to sufficiently forage or reproduce in locations outside of their home range.

Conditions of Approval: Capture, Handling, and Relocation

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

> 7.2 Designated Biologist(s). Permittee will submit to CDFW for approval the qualifications of the Designated Biologist(s) and will ensure the Designated Biologist(s) is knowledgeable and experienced in the biology, natural history, collecting, and handling of GGS.
>
> 9.5.3. GGS Relocation Conditions. Permittee will develop a CDFW-approved Mortality Reduction and Relocation Plan for GGS. The Designated Biologist(s) will carry state and federal handling permits and will relocate GGS when necessary to a CDFW-approved location and will release GGS as quickly as possible.

Impact: Contaminants

Contamination could come from mobilization of contaminated soils and resuspension of contaminated sediment through disturbance of soil or sediments, accidental spills, and other sources during construction activities, barge operations, RTM and spoils processing, dewatering, and geotechnical exploration. For example, contaminants may enter GGS aquatic or upland habitat through ground disturbance; fugitive dust; discharge or runoff of contaminants from construction or drilling sites; increased erosion; discharge or runoff of contaminants from RTM or dredge spoils; or oil, fuel, hydraulic fluids, concrete, paint, and other construction-related materials leaking or spilling from equipment, vehicles, or vessels. Contaminants were listed as a factor affecting the continued existence of GGS in the USFWS 1993 listing rule (58 FR 54053). Recent evidence of selenium and arsenic exposure in GGS tissues from groundwater pumping was evaluated as a possible factor of decline in the study population, but the researchers found no evidence of contaminant effects on GGS survival (Scherer, Hansen et al. 2016). The extent to which GGS could be harmed by primary or secondary effects of absorbing or consuming prey affected by contaminants is not known (USFWS 2012b).

Toxic levels of environmental contaminants--such as mercury, selenium, and chemicals in pesticides and herbicides--may reduce populations of aquatic prey species on which GGS depend (USFWS 2012b). GGS prey on amphibians, such as Sierran tree frogs (*Pseudacris sierra*) or young bullfrogs (*Lithobates catesbeianus*), and fish (Ersan, Halstead et al. 2016). For example, selenium in irrigation water threatens GGS populations in the San Joaquin Valley, where documented water levels of selenium exceeded toxicity thresholds for GGS prey species (58 FR 54053). Concentrations of herbicide and fungicide chemicals can accumulate in tissues of *P. sierra* (Smalling, Fellers et al. 2013). Pesticide chemicals used in the Project Area for vegetation control, landscape maintenance, or discharged from construction sites could directly affect amphibian prey in the Project Area. The lethal effect of these chemicals on amphibians has not been documented; however, sublethal effects could include stressors such as decreasing resistance to disease, which may affect amphibian populations (Smalling, Fellers et al. 2013). Potential effects of contaminants on fish, also GGS prey, include direct injury and mortality or delayed effects on growth and survival. Resuspension of contaminated sediments may have an adverse effect on fish that come into contact with the newly exposed contaminant.

Conditions of Approval: Contaminants

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on identification, habitat, and sensitivities of GGS and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas. This will contain some contamination sources to the already disturbed construction site.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize contamination of GGS habitat.

7.11 Project Related Vehicle Use. To minimize the risk of vehicles or equipment leaking contaminants into GGS habitat during Covered Activities, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of vehicles or equipment leaking contaminants into GGS habitat during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.14 Hazardous Waste. Permittee will repair and clean up any fuel or hazardous waste leaks or spills. Permittee will exclude the storage and handling of hazardous materials from the Project Area and properly contain and dispose of any unused or leftover hazardous products off-site.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project and will cooperate with CDFW efforts to verify compliance with the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if GGS is taken or injured by a Project-related activity.

9.1.1 Herbicide and Pesticide Use. To minimize the extent to which SWHA are exposed to contaminants as a result of herbicide and pesticide use during Covered Activities in and nearby suitable SWHA habitat, the methods and types of herbicides and pesticides used by Permittee will be limited within the Project Area.

9.1.4 Covered Species Observations. To minimize contamination of GGS, Project Personnel will inform the Designated Biologist(s) if they encounter GGS in or near the construction site and will cease Covered Activities until GGS is safely out of harm's way.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To contain contaminants from spoils, RTM, and dredged material, Permittee will develop and implement a plan for the disposal and storage of these materials. The plan will address potential discharge of contaminants, reducing potential exposure of GGS and their prey to the contaminants, and will minimize encroachment of these materials on environmentally sensitive areas.

9.1.11 In-Water Work Windows. Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30., which will minimize barge trips and other in-water construction activities with the potential to leak contaminants in GGS aquatic habitat.

9.1.12 Daily In-Water Work Restriction. Permittee will terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise, which will minimize barge trips at night for in-water construction and potential contaminants from leakage in GGS aquatic habitat.

9.1.15 Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities, and address and accidental spillage of hazardous material. This will also minimize the potential for barges or tugboats to leak contaminants in GGS aquatic habitat.

9.1.18 Stormwater Pollution Prevention Plan. To minimize the extent to which GGS or their prey are exposed to contaminants as a result of stormwater runoff from construction sites, Permittee will prepare and implement a Stormwater Pollution Prevention Plan that minimizes contamination impacts by following all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge, which will be in place throughout the duration of Covered Activities.

9.1.19 Erosion and Sediment Control Plan. Covered Activities may result in increased erosion and mobilization of sediment in runoff from construction sites. Because potential mobilization of contaminants is closely linked to sediment disturbance and associated impacts on habitat, Permittee will develop erosion and sediment control plans to limit dispersal of contaminated sediments during Covered Activities, reducing potential exposure of GGS to contaminants.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. Permittee will develop and implement a CDFW-approved Spill Prevention, Containment and Countermeasure Plan to prevent spills of contaminants as a result of Covered Activities, which will minimize exposure of GGS and their prey to contaminants if a spill does occur. Measures will include repair of leaks or spills and clean-up, containment, and disposal of hazardous products.

9.1.22 Hazardous Materials Management Plan. Permittee will develop and implement a CDFW-approved Hazardous Materials Management Plan to prevent the release of hazardous materials as a result of Covered Activities, which will minimize exposure of GGS and their prey to contaminants.

9.1.23 Fugitive Dust Control. Permittee will develop and implement a CDFW-approved Fugitive Dust Control Plan to limit the mobilization of fugitive dust as a result of Covered Activities, which will limit the exposure of GGS to contaminants in fugitive dust.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities and clearly demarcate it as a disturbance-free zone.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities.

9.5.6. Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual GGS in and near the construction site to minimize the risk of GGS being contaminated within the construction site. The Designated Biologist(s) will investigate burrows, and if unoccupied, will collapse burrows to prevent GGS from using them.

9.5.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate GGS to a safe location outside of the construction site to minimize the risk of GGS being exposed to contaminants within the construction site. The Designated Biologist(s) will collapse burrows to prevent GGS from using the burrows again.

9.5.8 GGS Exclusion Barrier. To minimize the risk of GGS entering inside a construction site and being exposed to contamination, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to exclude GGS, under the supervision of a Designated Biologist(s).

9.5.12 Disposal of Debris. To minimize GGS entering the construction site and being exposed to contamination, Permittee will remove vegetative debris used by GGS for cover from the Project Area or will place piles within the exclusion barrier away from suitable aquatic habitat.

9.5.13 GGS Avoidance. Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas to the extent possible, to minimize exposing GGS or their prey to contaminants.

9.5.15 Safe Haven Shafts. To minimize exposing GGS or their prey to contaminants, Permittee will ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occur within GGS habitat delineated by the Designated Biologist(s).

9.5.16 Geotechnical Exploration. To minimize exposing GGS or their prey to contaminant leaks from vehicles or equipment, Permittee will limit access routes of moving vehicles and heavy equipment, and the Designated Biologist(s) will ensure any GGS seen on the site is allowed to leave the site or is relocated.

9.5.17 Permanent Facilities and Transmission Line Maintenance. To minimize exposure of GGS or their prey to contaminant leaks from vehicles or equipment, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas and will follow the same measures required for geotechnical exploration.

Impact: Disturbance and Displacement

Covered Activities could cause disturbance to GGS in the form of noise, vibration, or artificial light. Noise or vibration disturbances could potentially result in GGS abandoning suitable habitat, which could expose them to predators, thermal effects, stress response, or other impacts such as vehicle strikes during dispersal. Snakes detect ground vibration rather than noise pressure through their inner ear; however, they also respond to low-frequency airborne sounds through vibrations in their skulls (Christensen, Christensen-Dalsgaard et al. 2012). Vibratory and impact pile driving, excavation equipment, tracked vehicles, pile-extraction equipment, and compaction equipment have the greatest potential to generate continuous vibration disturbance (California Department of Transportation 2013). Low-frequency noise disturbance could result from any Covered Activity; the most likely source would be from pile driving (Knauer and Pedersen 2011). Pile driving could occur in the vicinity of GGS habitat over six years during construction of the NDD intakes, IF, CCF modifications, and HOR Gate. The effects of artificial lighting on snakes in natural environments are not well studied or known. It is possible night lighting affects snakes' interactions with predators and prey and the development, reproduction, physiology, or life history of amphibian prey species (Perry, Buchanan et al. 2008). GGS are primarily diurnal; although, they have been observed above ground at night (USFWS 2015). Therefore, they could be vulnerable to behavioral changes or prey reduction resulting from artificial light.

GGS are averse to routine disturbance—for example, from people, animals, vehicles, equipment, or wind from helicopters--and will actively move out of areas subject to repeated disturbance (USFWS 2012b). For example, GGS basking on top of emergent vegetation will dive into the water to escape as surveyors approach (Hansen 2016). Prolonged disturbance from Covered Activities could cause GGS to leave suitable habitat, potentially resulting in exposure to other stressors such as predation or vehicle strikes (USFWS 2012b). Project personnel could bring pets or attract animals to the construction site, which could also disrupt GGS' normal daily activities and cause them to abandon the habitat.

Conditions of Approval: Disturbance and Displacement

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on avoiding and minimizing crushing of GGS or occupied burrows and will monitor Covered Activities.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.7 Trash Abatement. Permittee will initiate a trash abatement program before starting Covered Activities to ensure prompt removal of trash in construction sites and ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting animals that could disturb GGS.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas, which will minimize disturbance to GGS.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of GGS habitat.

7.11 Project Related Vehicle Use. To minimize disturbance to GGS, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area

7.12 Vehicle Parking and Staging Areas. To minimize disturbance to GGS, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if GGS is taken or injured by a Project-related activity.

9.1.3 Artificial Lighting. Permittee will only use artificial outdoor lighting as needed for safety and security in construction and permanent facility sites and will design the lighting to minimize impacts to the surrounding environment. Limitations on the use of artificial lighting will reduce disturbance to GGS.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter GGS in or near the construction site and will cease Covered Activities until GGS is safely relocated to suitable habitat.

9.1.5 Hazards to Covered Species. To minimize disturbance to GGS, Permittee will not permit pets, campfires, or firearms in construction sites, except as needed for enforcement.

9.1.9. Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize the risk of disturbance to GGS, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact on environmentally sensitive areas.

9.1.11 In-Water Work Windows. Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30, which will minimize disturbance to GGS from in-water construction.

9.1.12. Daily In-Water Work Restriction. Permittee will terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise, which will minimize disturbance to GGS from in-water construction.

9.1.13 Underwater Sound Abatement Plan. Permittee will develop an underwater sound abatement plan outlining specific measures to avoid and minimize the effects of underwater construction noise on Covered Fish Species. This will also minimize disturbance to GGS diving under water to hunt fish.

9.1.14 Pile Driving Plan. Permittee will develop and implement a CDFW-approved Pile Driving Plan to minimize the timing and duration of impact or vibratory pile driving during construction. Limitations on pile driving will reduce disturbance to GGS resulting from noise and vibration.

9.1.15. Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities. This will minimize disturbance to GGS from barge and tugboat encroachment or noise.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities and clearly demarcate it as a disturbance-free zone.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid disturbance in suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities.

9.5.3. GGS Relocation Conditions. Permittee will develop and implement a CDFW-approved GGS Mortality Reduction and Relocation Plan prior to initiation of preconstruction surveys and Covered Activities. If GGS is found on or near the construction site and does not move out on its own, The Designated Biologist(s) will relocate GGS to pre-approved locations outside of the construction site, which will minimize the risk of disturbance to GGS causing risks of dispersal.

9.5.5. Mowing. Permittee will mow the construction site for the Designated Biologist(s) to detect GGS and burrows during preconstruction surveys, which will minimize disturbance to GGS detected and removed from the construction site.

9.5.6. Preconstruction Surveys. Prior to installation of exclusion fencing and initiation of Covered Activities, the Designated Biologist(s) will conduct surveys to find and relocate individual GGS in and near the construction site to minimize the risk of disturbing individuals. The Designated Biologist(s) will investigate burrows, and if unoccupied, will collapse burrows to prevent GGS from using them.

9.5.7 Burrow Excavation. The Designated Biologist(s) will excavate all small mammal burrows within a construction site that cannot be avoided to relocate GGS to a pre-approved location outside of the construction site, which will minimize disturbance to GGS causing risks of dispersal. The Designated Biologist(s) will collapse burrows to prevent GGS from using the burrows.

9.5.8 GGS Exclusion Barrier. To minimize the risk of GGS entering a construction site and being exposed to disturbance, Permittee will install an exclusion barrier made of fencing to delineate the construction site, designed to keep GGS out, under the supervision of a Designated Biologist(s).

9.5.11 Initial Site Clearing and Monitoring. To minimize the risk of GGS disturbance, Permittee will confine ground clearance to the minimal area necessary, and the Designated Biologist(s) will conduct daily surveys during ground clearance to relocate GGS and collapse burrows if needed.

9.5.12 Disposal of Debris. To minimize GGS entering the construction site and being exposed to disturbance, Permittee will remove vegetative debris used by GGS for cover from the Project Area or will place piles within the exclusion barrier away from suitable aquatic habitat.

9.5.13 GGS Avoidance. To minimize disturbance to GGS, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas to the extent possible. Permittee will post speed limits and ensure Project personnel inform the Designated Biologist(s) if GGS is seen in or near the construction site.

9.5.15 Safe Haven Shafts. To minimize disturbance of GGS, Permittee will ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occur within GGS habitat delineated by the Designated Biologist(s).

9.5.16 Geotechnical Exploration. To minimize disturbance of GGS, Permittee will limit speed and access routes of moving vehicles and heavy equipment, and the Designated Biologist(s) will be on-site to flag burrows and guide drilling personnel to avoid visible or potentially occupied burrows. The Designated Biologist(s) will ensure any GGS seen on the site is allowed to leave the site or is relocated.

9.5.17 Facilities and Transmission Line Maintenance. To minimize disturbance of GGS, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas and will follow the same measures required for geotechnical exploration.

9.5.18 Suction Dredging. To minimize disturbance to GGS, the Designated Biologist(s) will be on-site to look for GGS in riprap, on channel bank edges, or swimming in the shallow water margin during suction dredging. The Designated Biologist(s) will have the authority to delay suction dredging until the GGS individual has moved out of the water or is relocated.

Impact: Reduction of Suitable Habitat Elements

Herbicides and rodenticides would most likely be used for Covered Activities associated with construction and maintenance of Project facilities. After construction, GGS upland habitat may overlap with the Project Area, such as at the base of transmission poles or towers, on the grounds of Project facilities, or on embankments or levees. GGS may use tall vegetation for crypsis to avoid being seen by predators and for thermoregulation (USFWS 2015, Hansen 2016). Herbicides or other vegetation control used for maintenance of grounds or facilities could reduce the amount of vegetative cover for GGS, affecting thermoregulation and potentially increasing exposure to predators. Managing vegetation around Project facilities, transmission line poles or towers, or embankments and levees, as well as vehicles driving off road, could also decrease GGS upland habitat suitability, potentially causing displacement and the risks associated with dispersal. Rodenticide use could alter the suitability of GGS upland habitat by decreasing the availability of small mammal burrows. In upland habitat, GGS depend primarily on small mammal burrows for hibernation and cover and the presence of such burrows is important to the survival of GGS (Wylie, Cassaza et al. 1997, USFWS 2015). Burrowing mammals, however, may also cause damage to the integrity of Project levees and embankments (Marsh 1994, Van Vuren, Ordenana et al. 2014, Ballester 2015). Eradication of burrowing mammals using rodenticides or other means may be needed to maintain facilities, including forebay embankments and RTM storage sites, during Project operations. Reducing the abundance of burrowing mammals in GGS upland habitat will reduce the ability of GGS to use the burrows to evade harm. Burrows are especially important during extreme temperatures for GGS thermoregulation (Wylie, Cassaza et al. 1997, Halstead, Skalos et al. 2015) and during ecdysis (USFWS 2012b), when the shedding of skin can leave snakes even more vulnerable to temperature stress and predation.

Disturbances to emergent vegetation in aquatic habitat could cause GGS displacement and forced dispersal to seek alternative suitable habitat. Emergent vegetation could be removed from dredging, barge operations, or herbicide drift. Suction dredging could rip up vegetation near banks, and barges or tugboats could destroy emergent vegetation and bank habitat through excessive wake or propeller wash (ICF International 2016a). Emergent vegetation could be affected by drift of particles or vapor resulting from application of herbicides on aquatic or terrestrial plants, especially when not applied correctly (Al-Khatib 2017). Emergent vegetation could also be removed during construction or geotechnical exploration. While dispersing and finding alternative aquatic habitat for foraging, GGS could be exposed to other disturbances such as recreation (USFWS 2012b).

Conditions of Approval: Reduction of Suitable Habitat Elements

Covered Activities would impact GGS as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring GGS and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of GGS.

7.5 Education Program. Designated Biologist(s) will train Project personnel on identifying GGS habitat and will monitor Covered Activities.

7.10 Delineation of Habitat. Permittee will clearly delineate GGS habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of GGS habitat.

7.11 Project Related Vehicle Use. To minimize the crushing of vegetation in GGS habitat, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area

7.12 Vehicle Parking and Staging Areas. To minimize the crushing of vegetation in GGS habitat, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project and will cooperate with CDFW efforts to verify compliance with the ITP.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3 Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.4. Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee will track and map areas of suitable GGS habitat present in the Project Area and habitat disturbed by Covered Activities and will provide CDFW with reports of disturbed habitat monthly and annually. This will minimize excessive removal of GGS habitat or habitat elements.

8.5 Reporting Approved Maps. Permittee will document the cumulatively disturbed acreages of identified GGS habitat suitable for GGS within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, and will provide the information to CDFW monthly.

8.6 Compliance Report. Permittee will submit a Monthly Compliance Report to CDFW showing cumulatively disturbed acreages of identified GGS habitat features, the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, and up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities.

8.7 Annual Status Report. Permittee will submit to CDFW an annual report updating identification of and disturbances to GGS habitat over the past year and anticipated for the next year and dates of Covered Activities associated with maintenance.

9.1.1 Herbicide and Pesticide Use. To minimize the extent to which GGS habitat is affected by herbicide use, herbicides will be applied by a licensed applicator in accordance with state, federal, and local regulations, using ground application when wind speed measures less than three miles per hour, and following measures to prevent overspray.

9.1.2 Rodenticide Use. To minimize the extent to which GGS burrows are reduced, rodenticides will not be used in construction sites.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of exploration work, Permittee will backfill pits and holes and will restore the site where geotechnical exploration activities were conducted, to reduce the extent vegetation is lost from GGS upland habitat.

9.1.11 In-Water Work Windows. Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR Gate, and barge landings to certain dates between June 1 and November 30., which will minimize barge and dredging damage to emergent vegetation.

9.1.12 Daily In-Water Work Restriction. Permittee will terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise, which will minimize barge and dredging damage to emergent vegetation in GGS aquatic habitat.

9.1.15 Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities. To prevent loss of emergent vegetation, Permittee will limit vessel speed to minimize wake; limit direction, velocity, and duration of propeller wash; and will monitor river bank conditions throughout the duration of barge operations. This will minimize the potential for barges to damage emergent vegetation in GGS aquatic habitat.

9.5.1 Establishment of Habitat Disturbance-Free Zones. Prior to ground disturbing Covered Activities, the Designated Biologist(s) will evaluate and clearly delineate suitable GGS habitat, within each construction site, that will be avoided by Covered Activities and clearly demarcate it as a disturbance-free zone.

9.5.2 GGS Habitat Avoidance. Project personnel will avoid suitable GGS habitat in the disturbance-free zone during all phases of Covered Activities, which will minimize loss of vegetation used by GGS for cover.

9.5.14 Restoration of Temporary Impacts. Upon completion of work, Permittee will restore GGS habitat on-site by re-vegetating areas with CDFW approved and available native plant species. This will minimize loss of vegetation used by GGS for cover.

9.5.15 Safe Haven Shafts. To minimize destruction of GGS habitat elements, Permittee will ensure no Covered Activities associated with the construction of, access to, or operation of safe havens occur within GGS habitat delineated by the Designated Biologist(s).

9.5.16 Geotechnical Exploration. To minimize removal of GGS aquatic habitat vegetation, Permittee will ensure no Covered Activities associated with geotechnical exploration will occur within GGS aquatic habitat delineated by the Designated Biologist(s).

9.5.17 Permanent Facilities and Transmission Line Maintenance. To minimize disturbance of GGS habitat, Permittee will conduct maintenance activities within existing roads or disturbed and compacted areas; limit mowing on channel banks to one side of the channel per year to maintain cover for GGS; avoid mowing emergent vegetation such as tules, cattail, sedge, or rush to the extent practicable; and keep grassy vegetation at a minimum height of four inches.

9.5.18 Suction Dredging. When practicable, Permittee will suction dredge from only one side of the water channel during a given year and confine suction dredging to the channel bed below the high-water mark to avoid suction dredging near shallow water edges and channel-side banks, which will minimize loss of vegetation used by GGS for cover.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments will occur only in July and August on an as-needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure, which will minimize loss of vegetation used by GGS for cover.

ii. GGS Mitigation Measures

The avoidance and minimization measures above will reduce but not eliminate the impacts on GGS resulting from Covered Activities; therefore, the following additional measures are required to achieve full mitigation.

Covered Activities associated with construction will result in a total of 570 acres of permanent impacts to GGS upland habitat and 205 acres of permanent impacts to GGS aquatic habitat. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11). Permittee shall restore and protect 615 acres of aquatic habitat and 1,710 acres of upland habitat as compensatory mitigation, unless all mitigation lands are located within high-priority conservation areas that meet the requirements of large contiguous blocks of aquatic and upland habitat surrounded by compatible land uses outlined in the USFWS *2015 Revised Draft Recovery Plan for Giant Garter Snake*, and that CDFW approves in writing. If all compensatory mitigation is located within these high-priority conservation areas Permittee will restore and protect 410 acres of aquatic habitat and 1,140 acres of upland habitat. To ensure restored or protected habitat used as compensatory mitigation fully mitigates for impacts to GGS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1.5 and 8.4.1 and the requirements of Appendix 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for Giant Garter Snake Habitat*. Permittee will ensure permanent protection and funding for perpetual management of compensatory GGS habitat, including monitoring for suitable habitat features and presence of GGS for at least three years.

Covered Activities associated with geotechnical exploration and stringing of transmission lines will result in temporary disturbance of 165 acres of GGS upland habitat. Permittee will restore on-site the 165 acres of GGS upland habitat that will be temporarily disturbed during Covered Activities to pre-project or better conditions. To ensure restored habitat fully mitigates for impacts to GGS, restoration and success criteria will comply with USFWS restoration guidelines (USFWS 2007), will meet the definition for suitable upland habitat in Condition of Approval 8.4.1.6, and will be detailed in a Vegetation Restoration Plan approved by CDFW. Restored upland habitat will also have ample exposure to sunlight to facilitate GGS thermoregulation and contain low vegetation and bankside burrows, holes, cracks, or crevices to provide critical shelter for GGS throughout the day. Restored habitat will be monitored for one year for suitable habitat features and presence of GGS.

iii. GGS Final EIR/EIS Avoidance and Minimization Measures

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures, resource restoration and protection principles, and environmental commitments, required to be implemented by the ITP, that would further ensure that any impacts to GGS resulting from Covered Activities would be minimized and fully mitigated.

- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- AMM 2 (Construction best management practices and monitoring)
- Environmental Commitment 3B.2.5/AMM 3 (Develop and implement stormwater pollution prevention plans)
- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- AMM 5 (Spill Prevention, Containment, and Countermeasure Plan)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material (RTM), and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- AMM 7 (Barge Operations Plan)
- AMM10 (Restoration of temporarily affected natural communities)
- AMM 16 (Giant garter snake)
- Environmental Commitment 3 (Natural communities protection and restoration)
- Environmental Commitment 8 (Grassland natural community restoration)
- Environmental Commitment 10 (Vernal pool and alkali seasonal complex restoration)
- Environmental Commitment 11 (Natural communities enhancement and management)

- Environmental Commitment 12 (Methylmercury management)
- RRPP GGS1 (Create aquatic habitat for the giant garter snake will be connected to the protected rice land or equivalent-value habitat)
- RRPP GGS2 (Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands and from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development)
- RRPP GGS3 (Protect, restore, and/or create rice land or equivalent-value habitat [e.g., perennial wetland] for the giant garter snake in Conservation Zones 4 and/or 5)
- RRPP GGS4 (Create or protect high-value upland giant garter snake habitat adjacent to the nontidal perennial aquatic habitat being restored and created)
- RRPP GGS5 (Create connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting up to 255 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 255 acres may consist of muted tidal freshwater emergent wetland and may overlap with the estimated 160 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria)
- RRPP L2 (Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area)
- RRPP L3 (Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species)
- RRPP CL1 (Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands)
- RRPP CL2 (Target cultivated land conservation to provide connectivity between other conservation lands)

d. Tricolored blackbird (*Agelaius tricolor*)

i. TRBL Project Construction Impacts and Avoidance and Minimization Measures

Covered Activities and their resulting impacts are expected to result in the incidental take of tricolored blackbird individuals (TRBL). The Covered Activities described in Section II A above expected to result in incidental take of TRBL include geotechnical exploration; the construction of NDD intakes, tunneled conveyance facilities, the HOR Gate, and CCF modifications; construction and improvement of access roads; the construction, installation, and maintenance of power supply facilities (poles, towers, and lines); and RTM placement or processing. Ongoing impacts of the taking will result from maintenance of permanent land-side facilities such as forebay or canal embankments, the land-side portions of NDDs, landscaping, or operational lighting.

Incidental take of TRBL, and adverse impacts as a result of impacts of the taking on TRBL, is expected to occur as a result of crushing of nesting colonies; disturbance and nest or roost abandonment, collisions, displacement and reduction of suitable habitat features, and exposure to contaminants. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to TRBL is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Incidental take of TRBL individuals in the form of mortality ("kill") may occur during the breeding season (March 1 – August 15) as a result of vehicles or construction equipment crushing occupied nesting colonies; drilling or construction disturbance (eg., pile driving, dredging, excavating, grading, barge traffic, helicopters) causing nest abandonment that exposes eggs or chicks to predation or the elements; removing vegetative cover and exposing eggs or chicks to predation or the elements; and workers or construction activities approaching colonies too closely and causing disturbance. Vehicle or equipment strikes and collisions with transmission lines could cause direct mortality of TRBL individuals in flight. The areas where authorized take of TRBL is expected to occur are described above in Project Area groups A – D, F – I, K – N and in the utility line and geotechnical corridors (ITP Attachment 1, Figures 4-10).

The Project is expected to cause the permanent loss of 3,837 acres of TRBL foraging habitat and the temporary loss of 676 acres of TRBL foraging habitat, the permanent loss of 16 acres of TRBL nesting habitat; and the permanent loss of 20 acres of TRBL roosting habitat. Impacts of the authorized taking also include adverse impacts to TRBL related to temporal losses, increased habitat fragmentation and edge effects, and the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include Construction disturbance causing potential displacement from preferred habitat to less protective habitat; herbicides or vegetation removal causing a decrease in suitable nesting substrate or displaced nesting to less protective habitat; removal or disturbance of roosting habitat impacting protective roosting opportunities; loss of foraging habitat that affects survival of TRBL young due to reduced foraging opportunities; insecticides or other pest control causing a decrease in prey abundance; and fugitive dust or release of other contaminants affecting the health and long-term survival of TRBL.

In general, Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following Conditions of Approval required by the ITP.

Multispecies Measures with Application to TRBL:

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with the ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of the ITP.

7.2 Designated Biologist(s). Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a biological monitor (Designated Biologist(s)) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Biologist(s) is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist(s) shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist(s) in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist(s) must be changed.

7.4 Designated Biologist(s) Authority. To ensure compliance with the Conditions of Approval of the ITP, the Designated Biologist(s) shall have authority to immediately stop any activity that does not comply with the ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist(s) that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers installation and monitoring; measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped; and roles and responsibilities of workers, managers, Designated Representative, Designated Biologist(s), and Designated Fisheries Biologist(s). Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of the ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.7 Trash Abatement. Permittee shall initiate a trash abatement program before starting Covered Activities and shall continue the program for the duration of the Project. Permittee shall ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic predators such as ravens, coyotes, and feral dogs.

7.8 Dust Control. Permittee shall implement dust control measures during Covered Activities to facilitate visibility for monitoring of the Covered Species by the Designated Biologist(s). Permittee shall keep the amount of water used to the minimum amount needed, and shall not allow water to form puddles.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee shall clearly delineate the boundaries of the construction site with fencing, stakes, or flags. Permittee shall restrict all Covered Activities to within the fenced, staked, or flagged areas. Permittee shall maintain all fencing, stakes, and flags until the completion of Covered Activities in that area.

7.10 Delineation of Habitat. Permittee shall clearly delineate habitat of the Covered Species within the construction site with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of Covered Species' habitat.

7.11 Project Related Vehicle Use. Permittee shall restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. Permittee shall confine Project-related vehicles, storage areas, equipment storage, and laydown sites to the Project Area using previously disturbed locations to the extent possible. Permittee shall restrict all vehicle parking to established construction sites, existing roads, or cleared areas.

7.14 Hazardous Waste. Permittee shall immediately stop and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

7.15 CDFW Access. Permittee shall provide CDFW staff with reasonable access to the Project, and shall otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

7.16 Refuse Removal. Upon completion of Covered Activities, Permittee shall remove from the Project Area and properly dispose of all temporary fill and construction refuse, including, but not limited to, broken equipment parts, wrapping material, cords, cables, wire, rope, strapping, twine, buckets, metal or plastic containers, flags, and boxes.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of the ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in the ITP and/or the MMRP. The Designated Representative shall report any non-compliance with the ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each construction site within the Project Area when Covered Activities occur and shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3) check for compliance with all measures of the ITP; (4) check all exclusion zones; (5) ensure that signs, stakes, and fencing are intact, and (6) ensure that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall monitor compliance continuously where Covered Activities are occurring; and after initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections a minimum of once per day where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by the ITP. Permittee shall compile and report observation and inspection records as described in Condition of Approval 8.6 *Compliance Report.* The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps, including metadata, depicting: 1) mapped areas of all land disturbances within the Project Area; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species within the Project Area (defined by Conditions of Approval 8.4.1), and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each construction site and surrounding buffer, no more than 14 days prior to initiation of Covered Activities, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species in the construction site and disturbed by Covered Activities, maintain this tracking using a GIS format, and include photo documentation of the habitat feature. The photo documentation of each habitat feature shall include a minimum of four photos facing the habitat feature, taken from the North, South, East, and West. Permittee shall include separate photo documentation of each habitat feature suitable for Covered Species; if there are multiple habitat features in a construction site, Permittee shall include multiple sets of photo documentation for that site. Permittee shall document the total disturbed acreage of habitat features for Covered Species compiled from the real-time tracking; compare the documented disturbance in each construction site to the Baseline Maps as shown in Attachment 6; provide GIS layers and the associated metadata to CDFW with the Monthly Compliance Report; maintain maps for each Covered Species separately; include updates to any of the maps in the next Annual Status Report; provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report; and provide a summation of disturbance of identified habitat features annually with the Annual Status Report.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month, to the office listed in the Notices section of the ITP, and via e-mail to CDFW's Representative. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision, depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of the ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.10 Notification of Take or Injury. Permittee shall immediately notify the Designated Biologist(s) if a Covered Species is taken or injured by a Covered Activity, or if a Covered Species is otherwise found dead or injured within the vicinity of the Project Area. The initial notification to CDFW shall include information regarding the location, species, and number of animals taken or injured and the ITP Number. Following initial notification, Permittee shall send CDFW a written report within two calendar days. The report shall include the date and time of the finding or incident, location of the animal or carcass, and if possible provide a photograph, explanation as to cause of take or injury, and any other pertinent information.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye to prevent overspray.

9.1.2 Rodenticide use. Permittee shall prohibit the use of rodenticides in construction sites.

9.1.3 Artificial Lighting. Permittee will only use artificial outdoor lighting as needed for safety and security. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and permanent facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access.

9.1.4 <u>Covered Species Observations</u>. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee shall cease Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is moved by the Designated Biologist(s) or it moves from the construction site of its own accord.

9.1.5 <u>Hazards to Covered Species</u>. Permittee shall not permit pets, campfires, or firearms in construction sites, except firearms carried by authorized security personnel or local, state, or federal law enforcement officials. To avoid attracting predators, Permittee shall ensure Project personnel will dispose of all food-related trash items such as wrappers, cans, bottles, and food scraps in enclosed containers. Permittee shall ensure trash is removed from the construction site and taken to an appropriate facility at least once a week for disposal.

9.1.6 <u>Restoration for Geotechnical Exploration Impacts</u>. Upon completion of work, Permittee shall backfill geotechnical test pits with the excavated material on the same day as they are excavated, and shall place the stockpiled topsoil at the surface and restore the site where geotechnical exploration activities were conducted. Permittee shall backfill bored holes on the same day as they were drilled, after exploration is completed at that site.

9.1.9 <u>Disposal of Spoils, Reusable Tunnel Material, and Dredged Material</u>. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, reusable tunnel material (RTM), and dredged material. The spoils disposal plan shall include protocols for sampling and analysis of dredge materials, spoils and RTM, that shall address: handling and disposal of hazardous material; the presence and concentrations of contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine pesticides); potential discharge of contaminants that would affect surface water or groundwater (e.g., instream discharges during dredging, effluent discharge from the disposal site; leachate from the disposal site); sediment analyses; chemical analyses; a protocol to reduce or eliminate the release of contaminated sediment; and BMPs to be implemented during handling and disposal of any potentially hazardous dredged or excavated material. Permittee shall conduct discharges from RTM draining operations in such a way as to not cause erosion at the discharge point. Permittee shall size the designated storage sites to accommodate all RTM, dredge material, or spoils expected to be generated by Covered Activities and shall size and locate the sites to minimize the impact or encroachment on environmentally sensitive areas within the Project Area. Permittee shall use rocks and other inorganic material grubbed from storage sites to backfill borrow pits or shall remove these materials from the site. Permittee shall not place grubbed material in environmentally sensitive areas.

9.1.10 Transmission Line Strikes. To minimize the potential for bird strikes with transmission lines, Permittee shall install bird strike diverters on all new permanent and temporary lines. For optimum results, Permittee shall space the diverters along the lines in accordance with the Avian Powerline Interaction Committee's guidance (Avian Power Line Interaction Committee 2012). Permittee shall use the most effective and appropriate diverter for minimizing strikes, according to best available science. Permittee shall install bird strike diverters in a configuration that research indicates would reduce bird strike risk by 60% or more. Permittee shall also install bird strike diverters on the same length of existing lines within the Project Area as the length of new transmission lines constructed, unless the new lines replace existing lines. Permittee shall periodically inspect and replace bird strike diverters placed on new and existing lines as needed until or unless the lines are removed.

9.1.11 In-Water Work Windows. Permittee shall restrict the times of year when certain in-water Covered Activities are conducted. The following Covered Activities are permitted only during certain dates within the in-water work windows between June 1 and November 30: over water geotechnical exploration, dredging, cofferdam installation and removal, pile driving, levee clearing and grading, riprap placement, construction of sheetpile walls, and placing of rock bedding and stone slopes. Permittee shall coordinate with the NDDTT, HGTT, CCFTT, and the TOT prior to finalizing Project engineering design to further limit the times when Permittee shall conduct in-water work, as feasible.

9.1.12 Daily In-Water Work Restriction. Permittee shall terminate all in-water Covered Activities 30 minutes before sunset and shall not resume until 30 minutes after sunrise. Permittee shall use sunrise and sunset times established by the U.S. Naval Observatory Astronomical Applications Department for the geographic area.

9.1.14 Pile Driving Plan. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a pile driving plan to minimize the impacts of pile driving on Covered Species. The pile driving plan shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the duration of pile driving within the in-water work windows (see Condition of Approval 9.1.11) and the duration of pile driving within the daily in-water work construction window. To minimize impacts of pile driving on Covered Species, the pile driving plan shall restrict impact pile driving activities to specific times of the day and for a specific duration to be determined in coordination with the TOT, and implement vibratory pile driving methods to minimize the noise generated from construction activities to the greatest extent feasible. Permittee shall ensure the pile driving plan is reviewed and finalized by the TOT and submitted to CDFW for written approval before Permittee initiates Covered Activities that require pile driving, and shall implement all measures in the approved plan.

9.1.15 Barge Operations Plan. Permittee shall develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities, identify the barge routes that minimize impacts on Covered Fish Species, and minimize general barge operation related effects on Covered Fish Species. Permittee shall not initiate Covered Activities that require barge operations until the final barge operations plan is approved in writing by CDFW. The barge operations plan shall describe measures to avoid and minimize impacts to Covered Fish Species caused by direct mortality due to propeller strikes or propeller wash, bank erosion or loss of emergent vegetation from propeller wash and/or excessive wakes, and accidental spillage of hazardous material. Permittee shall limit vessel speeds to maintain wake heights of less than two feet at shore to minimize the effects of wakes on unarmored or vegetated banks; Ensure that tug boat and barge operators are trained to minimize impacts on Covered Species' habitats such as reducing the effects of wake on vegetated banks; limit the direction and/or velocity of propeller wash to prevent loss of aquatic vegetation; ensure all vessels approach and depart from the NND intake and barge landing sites at dead slow to reduce vessel wakes and propeller wash; avoid pushing stationary vessels up against cofferdams, docks, or other structures for extended periods, which could result in excessive directed propeller wash impinging on a single location; visit each NDD intake and barge landing site to determine the extent of emergent vegetation, bank conditions, and general site conditions during the growing season prior to initiation of construction and then annually during and after construction until barge landings are disassembled; and monitor the condition of both river banks at each landing site.

9.1.18 Stormwater Pollution Prevention Plan. Permittee shall ensure compliance with all construction stormwater permitting requirements and shall ensure the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) to control short-term and long-term effects associated with construction-generated stormwater runoff. The SWPPP shall include all applicable SWRCB and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The SWPPP shall include measures that address erosion and sediment control, management of construction materials, waste management, site dewatering and pipeline testing, accidental spill prevention and response, site inspection and monitoring, and measures to prevent nonstormwater discharges from reaching surface water. Nonstormwater discharge examples include washing vehicles, cleaning streets, or applying erodible landscape material during rain. The SWPPP shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.19 Erosion and Sediment Control Plan. Permittee shall develop one or more erosion and sediment control plan(s) to be incorporated in the SWPPP prior to disturbance and throughout all phases of Construction Activities. The erosion and sediment control plan(s) shall include best management practices such as: physical erosion control stabilization; maintaining emergency erosion control supplies at all times during construction and replacing used materials within 48 hours; minimal disturbance of the terrain and natural land features; diverting runoff away from steep, denuded slopes; retaining trees and vegetation where practicable to stabilize hillsides, retain moisture, and reduce erosion; limiting disturbance to areas of proven stability; implementing site inspections before and after storm events; installing drainage control features; and installing wind erosion control features. Sediment control measures shall include retaining sediment transported by run-off; collecting and directing surface runoff at non-erosive velocities to common drainage courses; using sediment and turbidity areas where ground disturbance is adjacent to surface water or wetlands; preventing mud tracking; and depositing or storing excavated materials away from drainage courses and keeping them covered when stored over five days or within 48 hours of a forecasted rain event. The erosion and sediment control plan(s) shall be submitted to CDFW for written approval prior to initiating construction activities.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. In accordance with local, state, or federal regulations, Permittee or its contractors shall develop a spill prevention, containment, and countermeasure plan (SPCC) at each site where ground-disturbing activity will occur. Each SPCC shall address actions used to prevent spills and actions that will be taken should any spills occur, including emergency notification procedures. The SPCC plans shall include measures and processes that address the following: procedures for routine handling of products; discharge or drainage controls such as secondary containment and procedures for discharge control; countermeasures for discharge discovery, response, and cleanup; methods of disposal of recovered materials; personnel training in emergency response, spill containment techniques, and pollution control laws, rules, and regulations; storage of petroleum products in nonleaking containers at impervious storage sites from which an accidental spill cannot escape; storing and maintaining spill containment materials--such as absorbent pads, pillows, socks, or booms--in nonleaking sealed containers until transported and disposed of; using spill containment materials under transfer areas when transferring oil or other hazardous materials from trucks to storage containers; storage of concrete, wash water, and other contaminants in watertight containment structures; daily inspection of equipment for oil, grease, and other petroleum products if equipment is in contact with surface water; cleaning of external petroleum products off of equipment prior to its contact to water; and use of oil-absorbent booms for equipment used in or adjacent to water. In the event of a spill, personnel shall identify and secure the source of discharge and contain the discharge with spill kit materials, such as sorbents or sandbags, and shall contact CDFW and other appropriate regulatory authorities within 24 hours. Permittee shall submit the SPCC plans to CDFW for written approval prior to initiating construction activities.

9.1.22 Hazardous Materials Management Plan. Permittee or its contractors shall develop and implement one or more hazardous materials management plan(s) (HMMP) prior to initiating construction activities. The HMMP shall provide detailed information on the types of hazardous materials used; phone numbers of emergency response agencies; appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste; and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP shall address the following measures or practices: clear labeling, handling and safety instructions, and emergency contact information on hazardous material containers; use or transfer of hazardous materials near wet or dry streams; Material Safety Data Sheets, accumulation and temporary storage of hazardous wastes (e.g., not to exceed 90 days); and disposal of contaminated soils. Permittee shall submit the HMMP to CDFW for written approval prior to initiating construction activities.

9.1.23 Fugitive Dust Control. Permittee shall implement fugitive dust control measures and enhanced dust control measures at all construction and staging areas to reduce construction-related fugitive dust that are consistent with Air Quality Management District (AQMD) guidelines and requirements for each region. Fugitive dust control measures shall address: applying water to all exposed surfaces—such as soil piles, graded areas, unpaved parking areas, staging areas, and access roads--to prevent visible dust from leaving construction sites; covering and maintaining at least two feet of freeboard space on trucks transporting soil, sand, and other loose material; using wet power vacuum street sweepers to remove visible track-out of mud or dirt; limiting vehicle speeds on unpaved roads to 15 miles per hour; completing paving projects and laying construction pads as soon as possible after grading; watering exposed soil with adequate frequency; suspending excavation, grading, or demolition activity when wind speeds exceed 20 miles per hour or conducting fugitive dust control measures more frequently during dry summers and wind conditions higher than 20 miles per hour; installing wind breaks such as trees or solid fencing on the windward side(s) of construction sites; and planting vegetative ground cover, such as fast-germinating native grass seed, as soon as possible after construction is completed and ensuring vegetation becomes established. Permittee shall develop measures for entrained road dust—such as washing wheels and equipment or treating access to sites with material such as wood chips or gravel that would reduce carry-out. Permittee shall develop measures for concrete batching, such as achieving a 70-percent reduction in dust from concrete batching and 80 percent reduction in dust from aggregate and sand pile erosion. Permittee shall submit fugitive dust control and enhanced dust control measures to CDFW for written approval prior to initiating construction activities.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program. Herbicide treatments shall occur only in July and August on an as-needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure.

Measures specific to TRBL:

9.3.1 Preconstruction Surveys. Prior to initiation of Covered Activities in the Project Area and within 1,300 feet of the Project Area, the Designated Biologist(s) shall conduct preconstruction surveys to evaluate the presence of TRBL breeding colonies and suitable nesting habitat. Surveys shall be conducted during the breeding season (March 15 to July 31) one year prior to, and then again the year of, the Covered Activities within the Project Area. During each year, surveys shall be conducted monthly in March, April, May, June, and July. If Covered Activities are initiated during the breeding season, the Designated Biologist(s) shall conduct three surveys within 15 days of the Covered Activities, with one of the surveys within five days of the start of the Covered Activities. Permittee shall use a breeding season survey protocol approved in writing by CDFW. The Designated Biologist(s) shall delineate suitable nesting habitat and breeding colonies with flagging or other visible marking.

Prior to initiation of Covered Activities in the Project Area and within 300 feet of the construction site, the Designated Biologist(s) shall conduct preconstruction surveys to establish the existence and use of roosting habitat by TRBL. Surveys shall be conducted during the nonbreeding season (August 1 to March 14) one year prior to, and then again the year of, the Covered Activities. If construction is initiated at a site during the nonbreeding season, the Designated Biologist(s) shall conduct three surveys within 15 days prior to the Covered Activity, with one of the surveys within five days prior to the start of the Covered Activity. Permittee shall use a roosting survey protocol approved in writing by CDFW. Permittee shall consider roosting habitat occupied by large mixed flocks to be occupied by TRBL if the Designated Biologist(s) cannot clearly identify TRBL presence within the flock. The Designated Biologist(s) shall check daily throughout the nonbreeding season suitable roost sites within 300 feet of Covered Activities that are not occupied at the time of preconstruction surveys , in accordance with the roosting survey protocol approved by CDFW, to determine whether or not TRBL later occupies the roost site.

9.3.2 No-Activity Buffer for Breeding. Permittee shall ensure Covered Activities avoid suitable nesting habitat within 1,300 feet, to the extent practicable. If nesting habitat cannot be avoided and a TRBL breeding colony is detected, Permittee shall ensure Covered Activities do not occur within a 1,300-foot diameter no-activity buffer surrounding the colony and associated habitat during the breeding season (March 15–July 31) (no-activity buffer). The no-activity buffer may be reduced to a minimum of 300 feet, with written approval from CDFW, in areas with dense forest, buildings, or other features between the Covered Activities and the breeding colony; where there is sufficient topographic relief to protect the colony from excessive noise or visual disturbance; or where sound curtains have been installed. If TRBL colonizes habitat adjacent to Covered Activities after they have been initiated, Permittee shall reduce disturbance through establishment of no-activity buffers or sound curtains, as determined in consultation with CDFW.

9.3.3 Night Work. Permittee shall restrict Covered Activities to 30 minutes after sunrise to 30 minutes before sunset if occurring within 1,300 feet of a breeding colony or a roost site occupied by TRBL.

9.3.4 Daily Monitoring. The Designated Biologist(s) shall monitor breeding colonies that are within 1,300 feet of Covered Activities for at least six hours per day, to verify the Covered Activity is not disrupting the colony. If the Designated Biologist(s) determines that the Covered Activity is causing a disruption to the colony, the Designated Biologist(s) shall have the authority to stop Covered Activities and shall notify Permittee immediately. The Designated Representative and shall notify CDFW within 24 hours to determine additional protective measures that can be implemented. The Designated Biologist(s) shall have the authority to stop Covered Activities until additional protective measures are implemented, unless TRBL breeding behavior normalizes on its own. The Designated Biologist(s) shall continue monitoring and ensure additional protective measures remain in place for the duration of the Covered Activities. If the Designated Biologist(s) determine additional protective measures are ineffective, the Designated Biologist(s) shall stop Covered Activities as needed until the additional protective measures are modified and TRBL behavior is normalized. Additional protective measures may include increasing the size of the buffer, delaying Covered Activities until the colony is finished breeding and chicks have left the nest site, temporarily relocating staging areas, or temporarily rerouting access to the construction site. The Designated Biologist(s) shall notify CDFW within 24 hours if nests or nestlings are abandoned. If the nestlings are still alive, the Designated Biologist(s) shall work with CDFW to determine appropriate actions. Notification to CDFW shall be via telephone or email, followed by a written incident report. Notification shall include the date, time, location, and circumstances of the incident.

9.3.5 <u>No-Activity Buffer for Roosting</u>. Permittee shall not conduct Covered Activities within 300 feet of suitable roosting habitat, to the extent practicable. If occupied roosting habitat cannot be avoided, Permittee shall not conduct Covered Activities within a 300-foot no-activity buffer surrounding the roost site (no-activity buffer). The no-activity buffer may be modified in areas with dense forest, buildings, or other features between the Covered Activities and the occupied roost site; where there is sufficient topographic relief to protect the roost site from excessive noise or visual disturbance; or where sound curtains are installed, as approved in writing by CDFW. Occupied roost sites that are within 300 feet of Covered Activities shall be monitored daily by the Designated Biologist(s), for at least four hours or until the roost site is no longer occupied, to verify that the activity is not disrupting the roosting birds. If the Designated Biologist(s) determines Covered Activities are disrupting roosting activity, Permittee shall put additional protective measures in place until the TRBL behavior normalizes. Additional protective measures may include increasing the size of the no-activity buffer, delaying Covered Activities until the flock has left the roost site or the end of the nonbreeding season, temporarily relocating staging areas, temporarily rerouting access to the construction site, or installation of sound curtains. Permittee shall contact CDFW if protective measures are not effectively reducing disruption to the roost site.

9.3.6 <u>Disturbance of Breeding Colonies and Roost Sites</u>. Permittee shall prohibit physical contact with a breeding colony during the breeding season from the time of nest site selection until after the chicks have fledged. Permittee shall prohibit physical contact with an occupied roost site during the nonbreeding season. Project personnel shall not exit vehicles when inside the established no-activity buffer for breeding or roosting when TRBL is present (see Conditions of Approval 9.3.3 and 9.3.5).

9.3.7 <u>Nesting and Roosting Habitat Avoidance</u>. The Designated Biologist(s) shall delineate suitable nesting and roosting habitat with flagging or other visible marking at construction sites for geotechnical exploration, transmission line construction, transmission line maintenance, facilities maintenance, and safe haven construction, including work and staging areas and access roads. Permittee shall restrict these

Covered Activities to construction sites outside of the delineated habitat. Permittee shall not conduct these Covered Activities within no-activity buffers established for breeding colonies or occupied roost sites (see Conditions of Approval 9.3.3 and 9.3.5).

9.3.8 Helicopters. Permittee shall not use helicopters to string transmission lines within 200 horizontal feet or 150 vertical feet of breeding colonies or occupied roost sites unless the helicopter is small enough to only cause a down draft of 15 to 18 miles per hour at up to 150 feet. Permittee shall only operate helicopters at these distances from the breeding colony or occupied roost site for up to three minutes in duration, once or twice per day, with a minimum of four hours between helicopter activities. For larger helicopters or longer work periods, Permittee shall consult with CDFW to establish the appropriate buffer. Permittee shall ensure helicopters do not land or take off within 500 feet of any breeding colony or occupied roost site. This buffer may be modified in areas with dense forest, buildings, or other features between the helicopter landing/take-off site and the occupied roost site; where there is sufficient topographic relief to protect the roost site from excessive noise or disturbance; or as approved in writing by CDFW.

Impact: Crushing of Nesting Colonies

During the breeding season (March 1 – August 15), vehicles, Project personnel, construction or drilling equipment, any vegetation removal or ground disturbance, storage of equipment, or laying down of spoils or debris could cause egg or nestling mortality by crushing them in unseen colonies. Even vehicular or foot traffic accessing construction sites could crush eggs or nestlings if traveling over occupied nesting sites. TRBL historically nested in thick cattail (*Typha* spp.) or tule (*Scirpus* spp.) marsh; however, alternative nesting substrates such as thistles (*Cirsium* spp.) and nettles (*Urtica* spp.) were also used (Neff 1937, Beedy 2008). Covered Activities are not likely to impact colonies in TRBL's traditionally used marsh habitat, because the habitat is scarce within the Delta (BDCP 2013a). Instead, impacts to TRBL are more likely to occur in alternative nesting substrates that may include agricultural fields, such as triticale, barley, wheat, fava beans, or safflower; large weedy fields of mallow (*Malva*ceae), foxtail (*Hordeum murinum*), or mustard (*Brassicacea*); flooded riparian bushes such as willows (*Salix* spp.), giant reed (*Arundo donax*), tamarisk (*Tamarix* spp.), elderberry (*Sambucus* spp.), buttonwillow (*Cephalanthus occidentalis*), or poison oak (*Toxicodendron diversilobum*); or armored plants such as milk thistle (*Silybum marianum*), nettle, prickly lettuce (*Lactuca serriola*), wild rose (*Rosa californica*), or blackberry (*Rubus* spp.) (Neff 1937, Beedy 2008, ICE 2014, Meese 2014, Meese 2015). Himalayan blackberry (*R. discolor*) copses are one of the most commonly used substrates, particularly north of the San Joaquin Valley (ICE 2014, Meese 2015). Unless vegetation is armored or flooded, TRBL typically nest in the interior of a patch of vegetation about 30 feet or more wide, so nests are well hidden from predators (Hamilton III 2004). Therefore, Project personnel operating vehicles or equipment would not see the nests hidden within the vegetation. In some cases, particularly where the substrate contains armored vegetation or is flooded, nests may be placed in smaller patches of vegetation only a few feet in width and near the edge of the substrate (Hamilton III 2004) (N. Clipperton, pers. comm. 6/12/17). Additionally, later nesting pairs may need to use less preferred locations that skirt the outer edges of colonies in larger patches of vegetation, where the interior is already taken by earlier nesting pairs (Meese, Beedy et al. 2014). In these cases, vehicles or equipment are more likely to hit or crush hidden nests if not driving over the whole patch of vegetation. TRBL are extremely quiet during egg-laying and incubation (ICE 2014, Meese and Iglecia 2014), which would make it difficult for Project personnel or the Designated Biologist(s) to detect a colony within the construction site. Project personnel may see adults flying away from the colony as they approach, thinking it is safe to proceed, without realizing there are eggs and chicks hidden in the vegetation. TRBL activity is diurnal, and the colony roosts at night (Granholm 2008, Meese, Beedy et al. 2014). Project personnel could also fail to detect a nesting colony if working at night when visibility is low and TRBL are inactive.

Maintenance activities also have the potential to crush eggs or chicks hidden in nesting colony substrates if drivers of off-road vehicles or maintenance equipment roll over active colonies without detecting them. Vegetation trimming or removal may be required on grounds of facilities or under transmission lines. Routine maintenance of NDD intakes, HOR Gate, and CCF modifications could result in additional disturbance from workers, vehicles, and equipment if they are not using already cleared areas or existing roads. TRBL may return to the same nesting sites in consecutive years (Tricolored blackbird portal 2017) if suitable nesting substrate remains; however, the nesting site must maintain the necessary characteristics of predator protection, close proximity to water, and nearby foraging habitat with abundant prey (Beedy and Hamilton III 1997). TRBL frequently shift nesting locations between years as local conditions change, but will return to previously used locations over longer time periods. As a result, TRBL breeding colonies can rotate through known nesting locations as favorable nesting conditions shift across the landscape between years (Beedy and Hamilton III 1997, ICE 2014, Tricolored blackbird portal 2017). TRBL also occasionally establish new nesting colony locations as landscape conditions change (ICE 2014, Tricolored blackbird portal 2017). Also, TRBL are itinerant breeders. If a nesting attempt fails, TRBL will move around the landscape to find suitable habitat to nest again (Beedy and Hamilton III 1997). If nesting criteria are met at new locations on or near the grounds of a Project facility or transmission line, TRBL could colonize the area well after construction has been completed as conditions within the Project Area change over time. A similar time delay during construction could coincide with a change in the occupancy of TRBL. Therefore, later construction or maintenance activities could result in crushing of colonies that were not previously present at the site.

Conditions of Approval: Crushing of Nesting Colonies

Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring TRBL and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of TRBL.

7.5 Education Program. The Designated Biologist(s) will train Project personnel on identifying TRBL, its habitat, and sensitivities and will monitor Covered Activities. This will minimize crushing of TRBL nesting colonies.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will be clearly delineate TRBL habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of TRBL habitat.

7.11 Project Related Vehicle Use. To minimize the risk of TRBL being crushed by vehicles or equipment during Covered Activities, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of TRBL being crushed by vehicles or equipment during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if TRBL is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter TRBL in or near the construction site.

9.1.5 Hazards to Covered Species. Permittee will not permit pets in construction sites, which will avoid large pets entering and crushing eggs or chicks in a colony.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize crushing of colonies from placement of RTM or spoils, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact on environmentally sensitive areas.

9.3.1 Preconstruction Surveys. Within 1,300 feet of the Project Area, the Designated Biologist(s) will conduct preconstruction surveys during the breeding season using a CDFW-protocol to evaluate the presence of TRBL breeding colonies and suitable nesting habitat and will delineate suitable nesting habitat and breeding colonies with flagging or other visible marking.

9.3.2 No-Activity Buffer for Breeding. Permittee will ensure Covered Activities do not occur within a 1,300-foot diameter no-activity buffer surrounding the colony and associated habitat during the breeding season (March 15–July 31) or a smaller buffer approved by CDFW.

9.3.3 Night Work. Permittee will restrict Covered Activities to 30 minutes after sunrise to 30 minutes before sunset if occurring within 1,300 feet of a breeding colony occupied by TRBL.

9.3.6 Disturbance of Breeding Colonies and Roost Sites. Permittee shall prohibit physical contact with a breeding colony during the breeding season from the time of nest site selection until after the chicks have fledged and are no longer dependent on the colony site.

9.3.7 Nesting and Roosting Habitat Avoidance. Permittee will avoid TRBL nesting or roosting habitat demarcated by the Designated Biologist(s) during geotechnical exploration, transmission line construction, transmission line maintenance, and safe haven construction and will not conduct these Covered Activities within 1,300 feet of a breeding colony.

Impact: Disturbance and Nest or Roost Abandonment

TRBL typically place nests out of sight in patches of dense vegetation or on flooded or well-armored vegetation (ICE 2014). The chosen substrate used for the nesting colony is based on deterring easy predator access to the colony (Hamilton III 2004). If a predator approaches the colony too closely, TRBL adults could leave the colony and abandon eggs or nestlings. Waves of adults may temporarily abandon the colony when humans approach too closely; when nestlings were under six days old, flocks were seen leaving the nests to try to defend the colony from the human intruder (Meese, Beedy et al. 2014). Thus, surveyors need to be very alert to changes in TRBL breeding behavior as they choose the distance from the colony from which they make their observations (ICE 2014). During the breeding season (March 1 – August 15), vehicles, Project personnel or pets, Designated Biologist(s), construction equipment, or any construction activity that approaches a colony too closely could cause nest abandonment. Abandoned nests may result in mortality of nestlings from predation, starvation, or disease; or females may abandon incubation of eggs (Weintraub 2013). TRBL could be nesting within unexpected substrates on the construction site, such as agricultural fields; large patches of mallow or mustard; flooded willows, giant reeds, or other riparian species; or armored weedy plants such as thistle, prickly lettuce, nettle, or blackberry (Neff 1937, Hamilton III 2004, ICE 2014, Meese and Iglecia 2014). Himalayan blackberry (*R. discolor*) copses are one of the most commonly used substrates, particularly north of the San Joaquin Valley (ICE 2014, Meese 2015). TRBL are extremely quiet during egg-laying and incubation (ICE 2014, Meese and Iglecia 2014), which would make it difficult for Project personnel or Designated Biologist(s)s to detect a colony within the construction site before approaching it. Project personnel are also less likely to detect a TRBL colony at night. Construction site trash and food waste could attract and increase the density of predators, increasing the risk of predation on any TRBL that are exposed due to disturbance. Predators of TRBL in the Delta are common and ubiquitous and could include raccoons (*Procyon lotor*), Virginia opossums (*Didelphis virginiana*), minks (*Mustela vision*), common ravens (*Coryus corax*), yellow-billed magpies (*Pica nuttalli*), merlins (*Falco columbarius*), American crows (*Corvus brachyrhynchos*), coyotes (*Canis latrans*), gray foxes (*Urocyon cinereoargenteus*), striped skunks (*Mephitis mephitis*), feral cats (*Felis catus*), and rats (*Rattus* spp.) (Beedy and Hamilton III 1997, Hamilton III 2004, Meese 2010, Center for Biological Diversity 2015).

Besides direct disturbance, certain levels of noise, vibration, or light from Covered Activities could cause disruption of colony behavior and communication, resulting in mortality of eggs or chicks. Loud noise disturbances could come from drilling rigs, pile driving, excavating, dredging, grading, cranes, increased truck traffic, barge or tugboat horns, and helicopters stringing transmission lines. Construction noise on its own may not disrupt a colony. A large colony was observed in Folsom adjacent to a construction site with operating cranes, and males perched on the sound barrier (Logsdon personal observation 5/5/16). The birds were vocalizing, and colony activity did not seem to be disrupted (C. Conard, TRBL workshop field training, 5/5/16) . However, the threshold of noise and vibration that would disrupt breeding behavior resulting in possible adverse effects on TRBL is not known. The highest levels of noise and vibration disturbances come from pile driving, excavation equipment, tracked vehicles, pile-extraction equipment, and compaction equipment (Knauer and Pedersen 2011, California Department of Transportation 2013). The standard threshold for noise disturbance for typical passerine communication and behavior was measured at 60 dBA (Dooling and Popper 2007). The operation of most construction equipment within 50 feet generally falls in the range of approximately 70 to 90 dBA, and cranes that were tolerated by TRBL are approximately 81 dBA (Knauer and Pedersen 2011). Pile driving, however, has been measured up to 101 dBA within the first 50 feet (Knauer and Pedersen 2011), and pile driving combined with construction noise could exceed 60 dBA for up to 2,000 feet (ICF International 2016a). Helicopters used to string transmission lines may cause the flushing of TRBL from colonies or roost sites from the noise, encroachment, and down draft. In one study, extensive flushing of blackbird (*Icteridae*) and European starling (*Sturnus vulgaris*) roost sites was observed from low-flying helicopters (29 to 131 feet altitude) (Mott 1983). Disturbance of TRBL nests from artificial lighting for Covered Activities conducted at night is also possible, but not well understood. Most TRBL activity is during the day, and the colony roosts at night; however, fledged young sometimes do not return to the colony at night (Meese, Beedy et al. 2014). Night lighting could disturb TRBL colonies or could expose fledglings to predators if they are outside the colony and illuminated.

During the winter or when not breeding, TRBL may roost at night in large flocks that could contain up to hundreds of thousands of birds of mixed species (Meese, Beedy et al. 2014). Passerines may roost communally for protection from predators, extreme temperatures, or weather conditions (Beauchamp 1999). Blackbird flocks generally prefer large, heavily vegetated marshes for roosting (Meese, Beedy et al. 2014), and non-breeding TRBL may also roost in riparian trees or orchards (Graves, Holyoak et al. 2013). If a roosting flock is encountered in the Project Area, disturbance from Covered Activities could flush and break up the flock, increasing individual TRBL's vulnerability to predation, environmental extremes, or other mortality factors.

Conditions of Approval: Disturbance and Nest or Roost Abandonment

Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). To minimize colony disturbance and nest abandonment, Permittee will submit to CDFW the qualifications of the Designated Biologist(s) that will monitor TRBL and will ensure the Designated Biologist(s) is knowledgeable and experienced in the biology and natural history of TRBL.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of TRBL.

7.5 Education Program. The Designated Biologist(s) will train Project personnel on identifying TRBL, its habitat, and sensitivities and will monitor Covered Activities. This will minimize disturbance to TRBL colonies and roost sites.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.7 Trash Abatement. Permittee will initiate a trash abatement program before starting Covered Activities to ensure prompt removal of trash in construction sites to avoid attracting predators to the site.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing,

stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will be clearly delineate TRBL habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize disturbance of TRBL habitat.

7.11 Project Related Vehicle Use. To minimize the risk of TRBL being disturbed by vehicles or equipment during Covered Activities, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of TRBL being disturbed by vehicles or equipment during Covered Activities, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if TRBL is taken or injured by a Project-related activity.

9.1.3 Artificial Lighting. Pemittee will only use artificial outdoor lighting as needed for safety and security in construction and permanent facility sites and will design the lights to minimize impacts to the surrounding environment. Limitations on the use of artificial lighting will reduce disturbance to TRBL and the risk of predation.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter TRBL in or near the construction site.

9.1.5 Hazards to Covered Species. To minimize disturbance to TRBL, Permittee will not permit pets, campfires, or firearms in construction sites, except as needed for enforcement, and trash will be removed at least once per week to avoid attracting predators to the site.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize disturbance to TRBL colonies from placement of RTM or spoils, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact on environmentally sensitive areas.

9.1.11 In-Water Work Windows. To reduce the amount of time pile driving and other Covered Activities causing noise, vibration, and light disturbances occur, Permittee will restrict certain in-water work at the CCF, NDD intakes, HOR GateGate, and barge landings to certain dates between June 1 and November 30. This will reduce disturbance effects in areas that may be near or adjacent to TRBL roost sites or colonies.

9.1.12 Daily In-Water Work Restriction. To reduce the amount of nighttime pile driving and other Covered Activities causing noise, vibration, and light disturbances, Permittee will restrict in-water work between sunset and sunrise. This will reduce disturbance effects in areas that may be near or adjacent to TRBL habitat.

9.1.14 Pile Driving Plan. Permittee will develop and implement a CDFW-approved Pile Driving Plan to minimize the timing and duration of impact or vibratory pile driving during construction. Limitations on pile driving will reduce impacts to TRBL as a result of exposure to vibration associated with Covered Activities.

9.1.15. Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities. This will also minimize the potential for noise disturbance from barges or tugboats near TRBL colonies or roost sites.

9.3.1 Preconstruction Surveys. Within 1,300 feet of the Project Area, the Designated Biologist(s) will conduct preconstruction surveys during the breeding season using a CDFW-protocol to evaluate the presence of TRBL breeding colonies and suitable nesting habitat and will delineate suitable nesting habitat and breeding colonies with flagging or other visible marking.

9.3.2 No-Activity Buffer for Breeding. Permittee will ensure Covered Activities do not occur within a 1,300-foot diameter no-activity buffer surrounding the colony and associated habitat during the breeding season (March 15–July 31) or a smaller buffer approved by CDFW.

9.3.3 Night Work. Permittee will restrict Covered Activities to 30 minutes after sunrise to 30 minutes before sunset if occurring within 1,300 feet of a breeding colony occupied by TRBL.

9.3.4 Daily Monitoring. The Designated Biologist(s) will monitor TRBL breeding colonies within 1,300 feet of Covered Activities for at least six hours per day, to verify the Covered Activity is not disrupting the colony. If Covered Activities disrupt a colony, the Designated Biologist(s) will have the authority to stop Covered Activities until additional protective measures are in place, in consultation with CDFW. The Designated Biologist(s) will notify CDFW if nests or nestlings are abandoned to determine appropriate actions.

9.3.5 No-Activity Buffer for Roosting. Permittee will not conduct Covered Activities within 300 feet of suitable roosting habitat, to the extent practicable, or within 300 feet of a roost site occupied by TRBL. A smaller buffer will only be used if approved by CDFW. If the Designated Biologist(s) determines Covered Activities are disrupting roosting activity, Permittee will put additional protective measures in place until the TRBL roosting behavior normalizes.

9.3.6 Disturbance of Breeding Colonies and Roost Sites. Permittee will prohibit physical contact with a breeding colony or occupied roost site. Project personnel will not exit vehicles when inside the established no-activity buffer for breeding or roosting TRBL.

9.3.7 Nesting and Roosting Habitat Avoidance. Permittee will avoid TRBL nesting or roosting habitat demarcated by the Designated Biologist(s) during geotechnical exploration, transmission line construction, transmission line maintenance, and safe haven construction and will not conduct these Covered Activities within no-activity buffers.

9.3.8 Helicopters. Permittee will not use helicopters to string transmission lines within 200 horizontal feet or 150 vertical feet of breeding colonies or occupied roost sites unless the helicopter is operated to minimize downdraft and within minimal time constraints. Helicopters will not land or take off within 500 feet of any breeding colony or occupied roost site unless approved in writing by CDFW.

Impact: Collisions

Covered Activities could potentially result in mortality of TRBL from collisions with moving vehicles or construction equipment. TRBL are accustomed to foraging in grasslands, agricultural fields, pastures, feeding lots, and dairies (Hamilton III 2004, Beedy 2008, Meese, Beedy et al. 2014). In these areas, they are in close proximity to farmsteads, agricultural equipment, and moving vehicles. However, farm vehicles generally move slowly. If TRBL colonies are alongside a road, faster-moving vehicles could regularly strike TRBL; numerous deceased TRBL were observed by surveyors from colonies adjacent to county roads (N. Clipperton, pers. comm. 6/25/17). This implies the risk of Project-related vehicle or equipment collisions on foraging TRBL is likely to be higher than the risk TRBL generally encounter in agricultural environments. Increased truck traffic resulting from Covered Activities could further increase the strike risk. In a beach study, large vehicles such as trucks or buses had twice the likelihood of flushing birds than cars and eliciting escape; however, the frequency of direct hits or near misses from buses was higher than from cars if birds were approached too closely (Schlacher, Weston et al. 2103). Road collisions have been documented for similar species that TRBL flock with, including red-winged blackbird (*A. phoeniceus*; e.g., CROS ID 70560, 70406, 70403), European starling (e.g., CROS ID 67552), and Brewer's blackbird (*Euphagus cyanocephalus*; e.g., CROS ID 70428, 70409, 67469), particularly in the evening and when vehicles traveled at high speeds (CROS 2017). Fledglings could be at a higher risk of vehicular collision (e.g., CROS ID 70406), as well as adults that are suddenly flushed from colonies or roost sites at night or during dense fog. Collisions with vehicles or equipment could directly kill foraging or flushed TRBL or could injure them, causing secondary mortality from predation, lack of fitness, and lack of foraging capability. An injured adult's inability to provision young could result in malnutrition mortality of nestlings prior to fledging. Collisions with helicopters stringing transmission lines could occur, particularly if the helicopter flushes TRBL from a roost site. Helicopters passing over blackbird and starling roost sites to test disturbance thresholds caused numerous bird strikes on the rotor blades and fuselage when massive flushing occurred (Mott 1983).

The construction and stringing of new transmission lines could increase the threat of TRBL colliding with powerlines while in flight. Collision problems may arise when TRBL cross power lines during multiple flights between foraging grounds and nesting or roosting sites. TRBL often fly in compact foraging flocks with long and shallow flight undulations (Hamilton III 2004, ICE 2014, Meese, Beedy et al. 2014). Breeding TRBL make multiple foraging flights per day to and from the colony, and may fly in a single-file, bill-to-tail formation (Meese, Beedy et al. 2014). This flocking behavior could increase the risk of transmission line strikes (APLIC 2012). New Project power lines are proposed at 50 to 110 feet high (BDCP 2013c). TRBL generally access prey from the ground or vegetation (Meese, Beedy et al. 2014) and make short, low-altitude, direct flights between foraging grounds (BDCP 2013c). However, breeding adults may also catch prey in flight over a hundred feet above or near the colony (N. Clipperton, pers. comm. 6/25/17, Meese, Beedy et al. 2014). TRBL flocks also roam across the landscape in less direct flights in search of suitable nesting locations around February, right before the breeding season starts (Beedy 2008), and later in the season between first and second nesting attempts. Roosting TRBL make daily flights to foraging locations to and from roost sites and between roost sites at potentially higher altitudes than when foraging, and have the highest potential for transmission line strikes during migration and dense winter fog conditions in the Delta (BDCP 2013c). Most passerines do not have heavy bodies and may not be as susceptible to collisions as larger-bodied birds (APLIC 2012). TRBL are strong, agile fliers with low wing loading (weight per unit of wing surface), giving them a moderate level of maneuverability to avoid strikes (BDCP 2013c, Meese, Beedy et al. 2014). There is no direct evidence of TRBL mortality from transmission line strikes; however, passerine carcasses may be removed quickly by scavengers and go undetected (Yee 2007, APLIC 2012). Red-winged blackbirds, Brewer’s blackbirds, yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), and European starlings have been found dead beneath power lines (Brown and Drewien 1995, Yee 2007). These birds have similar morphology as TRBL and generally forage and roost in association with TRBL (Meese, Beedy et al. 2014). Therefore, there is a potential for transmission line strikes even though the risk is not particularly high. Such collisions could directly kill foraging or flushed TRBL or could injure them, causing secondary mortality from predation, lack of fitness, and lack of foraging capability. An injured adult’s inability to provision young could result in malnutrition mortality of nestlings prior to fledging.

Conditions of Approval: Collisions

Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring TRBL and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of TRBL.

7.5 Education Program. The Designated Biologist(s) will train Project personnel on identifying TRBL, its habitat, and sensitivities and will monitor Covered Activities. This will minimize collisions with TRBL

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will be clearly delineate TRBL habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the disturbance of TRBL habitat.

7.11 Project Related Vehicle Use. To minimize the risk of TRBL being struck by vehicles or equipment during Covered Activities, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area and will post a speed limit of 20 miles per hour in construction sites.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if TRBL is taken or injured by a Project-related activity.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter TRBL in or near the construction site.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize collisions with trucks carrying RTM or spoils, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact on environmentally sensitive areas.

9.1.10 Transmission Line Strikes. To minimize the potential for SWHA strikes with power lines, Permittee will install bird strike diverters on all new and the equivalent length of existing power lines, using the most effective guidelines and diverters to reduce strike risk by 60% or more. Permittee will periodically inspect and replace bird strike diverters as needed until or unless the lines are removed.

9.3.1 Preconstruction Surveys. Within 1,300 feet of the Project Area, the Designated Biologist(s) will conduct preconstruction surveys during the breeding season using a CDFW-protocol to evaluate the presence of TRBL breeding colonies and suitable nesting habitat and will delineate suitable nesting habitat and breeding colonies with flagging or other visible marking.

9.3.2 No-Activity Buffer for Breeding. To reduce collisions with vehicles or equipment, Permittee will ensure Covered Activities do not occur within a 1,300-foot diameter no-activity buffer surrounding the colony and associated habitat during the breeding season (March 15–July 31) or a smaller buffer approved by CDFW.

9.3.3 Night Work. Permittee will restrict Covered Activities to 30 minutes after sunrise to 30 minutes before sunset if occurring within 1,300 feet of a breeding colony occupied by TRBL, which will prevent collisions with TRBL that are out during evening hours.

9.3.5 No-Activity Buffer for Roosting. Permittee will not conduct Covered Activities within a CDFW-approved no-disturbance buffer around suitable roosting habitat, to the extent practicable, or 300 feet from an occupied roost site. This will reduce vehicle and equipment collisions with roosting TRBL.

9.3.6 Disturbance of Breeding Colonies and Roost Sites. To reduce collisions with vehicles or equipment, Permittee will prohibit physical contact with a breeding colony during the breeding season from the time of nest site selection until after the chicks have fledged and are no longer dependent on the colony site.

9.3.7 Nesting and Roosting Habitat Avoidance. Permittee will avoid TRBL nesting or roosting habitat demarcated by the Designated Biologist(s) during geotechnical exploration, transmission line construction, transmission line maintenance, and safe haven construction and will not conduct these Covered Activities within 1,300 feet of a breeding colony. This will reduce collisions with vehicles and equipment engaged in these Covered Activities.

9.3.8 Helicopters. Permittee will not use helicopters to string transmission lines within 200 horizontal feet or 150 vertical feet of breeding colonies or occupied roost sites unless the helicopter is operated to minimize downdraft and within minimal time constraints. Helicopters will not land or take off within 500 feet of any breeding colony or occupied roost site unless approved in writing by CDFW.

Impact: Displacement and Reduction of Suitable Habitat Features

Covered Activities could have an adverse effect on TRBL as a result of removal of suitable habitat elements and displacement of TRBL to less suitable nesting or foraging habitat. Removal of nesting habitat elements could result in exposure of TRBL to predators and inclement weather, causing mortality of females, eggs, or nestlings. To successfully reproduce, nest sites need to be protective from the approach of predators, within 0.3 mile of an accessible water source, and within two to three miles of suitable foraging to provision females and nestlings with sufficient insect prey (Beedy and Hamilton III 1997, Hamilton III 2004, Meese, Beedy et al. 2014). In the Project Area, the altered landscape may have degraded much of the suitable and preferred nesting habitat . Within the interior of the Delta, historic records of nesting colonies are lacking in the California Natural Diversity Database (CNDDB; query 6/9/17) and in the literature (Neff 1937, Hamilton III 1998, Hamilton III 2000). However, TRBL nesting has been recently detected just west of the Project Area in Contra Costa County (BDCP 2016, Tricolored blackbird portal 2017) and in the Yolo Bypass (CDFG, Yolo Basin Foundation et al. 2008). Removal of remaining suitable nesting habitat or habitat elements as a result of vegetation clearance or vegetation control during Covered Activities could result in any prospecting TRBL abandoning a potential nesting location. Disturbance from construction personnel, equipment and vehicles; increased truck traffic; or attracting predators near a potential nest site could also cause site abandonment. For example, a researcher in Kern County discovered some nests that had never been incubated (Weintraub 2013), with the possibility of encroachment disturbance from the research itself causing abandonment of nests that were constructed but not used (Meese, Beedy et al. 2014). Vehicles, equipment, fugitive dust, and other construction effects could impact vegetation used as nesting substrate. As conditions change or nesting attempts fail, TRBL will move around the landscape to find suitable habitat to nest again (Beedy and Hamilton III 1997). As a result of Covered Activities, late or displaced breeders may have a difficult time finding remaining suitable habitat that isn’t already occupied. Late or displaced breeders may nest in less protective habitat or nest in the margin of existing colonies (Beedy and Hamilton III 1997, Meese, Beedy et al. 2014), resulting in a higher risk of predation on females, eggs, or nestlings or exposure to direct sun or inclement weather. For example, mortality of thousands of nestlings resulted from rain storms and high wind in colonies nesting in mustard and milk thistle, and high winds destroyed nests in unprotected cattails and tules (Neff 1937, Meese 2010). If vegetation is removed by a Covered Activity from a colony site that is not abandoned, the reduction of protective vegetation could have the same exposure and mortality effects on females or nestlings.

The Delta has been for a long time considered a primary wintering area for TRBL (Hamilton III 2004, Meese, Beedy et al. 2014). Blackbird flocks generally prefer large, heavily vegetated marshes for roosting (Meese, Beedy et al. 2014) or may roost in riparian trees or even orchards (Graves, Holyoak et al. 2013). A roost site may contain hundreds of thousands of birds, including TRBL, Brewer’s blackbirds, red-winged blackbirds, brown-headed cowbirds (*Molotus ater*), yellow-headed blackbirds, and European starlings (Tricolored Blackbird Working Group 2007, ICE 2017), and such large flocks may provide protection from predators or effects of weather (Beauchamp

1999). In the Delta, two known roost sites hosting large flocks include Sandy Beach Campground on Sherman Island and Bird's Landing (ICE 2017). Removal of roost site vegetation or trees as a result of Covered Activities could impact roost site availability for wintering TRBL in the Delta. Particularly if existing roost sites reach or exceed capacity, smaller groups of TRBL may need to spend more time seeking additional roost sites, increasing exposure to predators, transmission line strikes, or inclement weather.

Removal of suitable foraging habitat features could result in fewer provisions for the young, causing starvation. In order to provision a colony that successfully fledges young, sufficient foraging habitat must be present within two or three miles of the colony (Beedy and Hamilton III 1997, Meese, Beedy et al. 2014). Although, adults could forage up to 13 miles to exploit available food resources, a higher energy cost results (Crase and DeHaven 1977, Meese, Beedy et al. 2014). Therefore, if all foraging habitat is beyond two or three miles from a potential nesting site, the nesting site would not likely be used. An abundant source of large insect prey is necessary for egg formation by the adult female and for provisioning of nestlings for the first nine days after hatching (Meese 2014). In grassland foraging habitat, these insects are often primarily grasshoppers (Orthoptera), but TRBL take a variety of insect prey including beetles and weevils (Coleoptera), true bugs (Hemiptera), caddis flies or midges (Diptera), moths and butterflies (Lepidoptera), dragonflies (Anisoptera), and other aquatic insect larvae (Crase and DeHaven 1977, Meese 2013, Meese, Beedy et al. 2014). Spiders (Arachnida) and snails (Mollusca) are also sometimes taken (Crase and DeHaven 1977). Reducing the abundance of insect prey could result in insufficient food for nestlings, which could result in mortality of all or a portion of the clutch (Beedy and Hamilton III 1997). Suitable foraging habitat could be removed as a result of vegetation clearance or control for Covered Activities, and insect reduction could result from pesticide treatment affecting the habitat directly or drifting into highly productive foraging areas. Construction noise or vibration disturbance as a result of pile driving or other construction activities can also decrease arthropod abundance. One study found a negative association between low-frequency anthropogenic noise and abundance of grasshoppers, spiders, and other insects that are sensitive to acoustic and vibrational signals (Bunkley, McClure et al. 2017).

Conditions of Approval: Displacement and Reduction of Suitable Habitat Features

Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 Designated Representative. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring TRBL and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of TRBL.

7.5 Education Program. The Designated Biologist(s) will train Project personnel on identifying TRBL, its habitat, and sensitivities and will monitor Covered Activities. This will minimize removal of TRBL habitat.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.8 Dust Control. Permittee will implement dust control measures during Covered Activities.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will be clearly delineate TRBL habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize the removal of TRBL habitat.

7.11 Project Related Vehicle Use. To minimize the risk of TRBL habitat vegetation being impacted by vehicle use, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize impacts on vegetation that could be used by TRBL for nesting or roosting, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

7.16 Refuse Removal. To minimize impacts on vegetation that could be used by TRBL for nesting or roosting, Permittee will remove from the Project Area temporary fill and construction refuse.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.4. Tracking Suitable Habitat Feature Disturbances. Permittee will track and map areas of suitable GGS habitat present in the Project Area and habitat disturbed by Covered Activities and will provide CDFW with reports of disturbed habitat monthly and annually. This will minimize excessive removal of TRBL habitat or habitat elements.

8.5 Reporting Approved Maps. Permittee will document the cumulatively disturbed acreages of identified GGS habitat suitable for GGS within the Project Area, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, and will provide the information to CDFW monthly.

8.6 Compliance Report. Permittee will submit a Monthly Compliance Report to CDFW showing cumulatively disturbed acreages of identified TRBL habitat features, the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, and up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities.

8.7 Annual Status Report. Permittee will submit to CDFW an annual report updating identification of and disturbances to TRBL habitat over the past year and anticipated for the next year and dates of Covered Activities associated with maintenance.

9.1.1 Herbicide and Pesticide Use. To minimize loss of vegetation and insect prey in TRBL habitat, pesticides and herbicides will be applied by a licensed applicator in accordance with state, federal, and local regulations, and following measures to prevent drift and overspray.

9.1.6 Restoration for Geotechnical Exploration Impacts. Upon completion of exploration work, Permittee will backfill pits and holes and will restore the site where geotechnical exploration activities were conducted, to reduce the extent vegetation is lost from TRBL habitat.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize loss of vegetation in TRBL habitat, Permittee will develop a spoils disposal plan to address the size and location of disposal sites and to minimize the impact on environmentally sensitive areas.

9.1.11 In-Water Work Windows. To reduce the amount of time pile driving and other Covered Activities causing noise, vibration, and light disturbances occur, Permittee will restrict certain in-water work at the CCF to specific dates between July 1 and November 30. This will reduce disturbance effects in areas that could be used as TRBL habitat.

9.1.12 Daily In-Water Work Restriction. To reduce the amount of nighttime pile driving and other Covered Activities causing noise, vibration, and light disturbances, Permittee will restrict in-water work between sunset and sunrise. This will reduce disturbance effects in areas that could be used as TRBL habitat.

9.1.14 Pile Driving Plan. Permittee will develop and implement a CDFW-approved Pile Driving Plan to minimize the timing and duration of impact or vibratory pile driving during construction. This will reduce disturbance effects in areas that could be used as TRBL habitat.

9.1.15. Barge Operations Plan. To minimize the potential for noise disturbance from barges or tugboats near TRBL colonies or roost sites, Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities. This will reduce disturbance effects in areas that could be used as TRBL habitat.

9.3.2 No-Activity Buffer for Breeding. Permittee will ensure Covered Activities avoid suitable nesting habitat within 1,300 feet, to the extent practicable. This will minimize removal of nesting habitat.

9.3.5 No-Activity Buffer for Roosting. Permittee will not conduct Covered Activities within 300 feet of suitable roosting habitat, to the extent practicable. This will minimize removal of roosting habitat.

9.3.7 Nesting and Roosting Habitat Avoidance. Permittee will avoid TRBL nesting or roosting habitat demarcated by the Designated Biologist(s) during geotechnical exploration, transmission line construction, transmission line maintenance, and safe haven construction.

Impact: Contaminants

Covered Activities may result in contamination of TRBL from fugitive dust, airborne contaminant drift, contamination of soils or vegetation, or contamination of water sources. TRBL are primarily ground-dwelling birds, conducting most of their life history activities on the ground or on vegetation. TRBL occasionally forage in the air or shallow water but mostly forage by picking seeds and insect prey from the ground and gleaning vegetation (Crase and DeHaven 1977, Meese, Beedy et al. 2014). Nests are generally bound to strands of vegetation and can be as low as 1.2 inches above the ground or water, or in rare instances, on the ground itself (Neff 1937, Beedy and Hamilton III 1997, Meese, Beedy et al. 2014). Contamination of soils or low vegetation could result from Covered Activities such as dewatering, placement of dredge and spoils, spillage or leakage of hazardous materials such as fuel and other petroleum products, or leaching ground contaminants from RTM sites. Contamination of nearby water sources could result from dredging, resuspension of contaminated sediment, spillage and leakage of hazardous materials, discharge, or run-off. Female TRBL use nearby water sources to obtain mud, which is used with wetted vegetation to construct nests (Emlen Jr. 1941). Adults will also often submerge insect prey at a local water source prior to feeding the insects to young (Meese, Beedy et al. 2014). If the nearby water source is contaminated as a result of Covered Activities, the females could bring the contaminated water to the nest, resulting in direct exposure to the chicks. Through activities such as dewatering, grading, or excavating, construction sites may be a source of existing soil contaminants such as mercury and selenium. Herbicides and other pesticides could also affect soil, water, or vegetation used for nesting and foraging or expose TRBL to airborne toxicity. Several commonly used insecticides, fungicides, and rodenticides are toxic to birds

(Mineau, Baril et al. 2001). Spray drift from some insecticides can be very toxic to birds in the vicinity of crops, and birds that receive the spray directly on the feathers or absorbed through the feet may get more exposure than those who secondarily consume affected grain or insects, resulting in lethal or sub-lethal effects that lead to indirect mortality (Mineau 2011, Sanchez-Bayo 2012). At least two TRBL colonies were reported as lost to aerial herbicide applications (Center for Biological Diversity 2015). These losses were likely associated with large agricultural applications; therefore, exposure from the methods and frequency of application as a result of Covered Activities could pose a lower risk to TRBL. Anticoagulant baits commonly used as rodenticides disintegrate and remain in the soil before they slowly degrade (Eason and Wickstrom 2001), and a recent occurrence was reported of TRBL poisoning from bait left out for ground squirrels (*Otospermophilus beecheyi*) (Center for Biological Diversity 2015).

Secondary contamination of TRBL could result from consuming insect prey treated with insecticides used during Covered Activities. Egg-laying and provisioning nestlings is dependent on an abundance of large insect prey (Meese 2014); however, non-breeding or wintering TRBL also consume insects (Beedy and Hamilton III 1997, Hamilton III 2004). Invertebrate prey for breeding TRBL mostly includes grasshoppers, beetles, weevils , true bugs, caddis flies, moths and butterflies, dragonflies, spiders, or snails; however, TRBL will also exploit other locally abundant invertebrates (Crase and DeHaven 1977, Meese 2013). Insecticides may be used to maintain the integrity of structures or for landscaping and maintaining grounds, and could affect both targeted and non-target invertebrates, including those consumed by TRBL. Secondary poisoning of birds may result from consumption of insects treated with insecticides (Sanchez-Bayo 2012). Although this may not result in direct mortality, accumulation over time could result in sub-lethal effects and indirect mortality, including changes in reproductive behavior. For example, European starlings exposed to organophosphorous insecticides (cholinesterase inhibitors) reduced the feeding of their nestlings, resulting in significant weight loss of chicks, potentially causing reduced fitness and survival (Grue, Powell et al. 1982). The authors described other studies of red-winged blackbirds and common grackles (*Quiscalus quiscula*) receiving similar doses of cholinesterase inhibitors that had lethal effects or affected nerve function and behavior, leading to conditions such as anorexia and lethargy that could affect parental care of chicks (Grue, Powell et al. 1982). TRBL being a similar species, the resulting effect could be starvation of chicks compounded by a reduction in insect prey caused by the use of insecticides.

<u>Conditions of Approval: Contaminants</u>

Covered Activities would impact TRBL as described above, but these impacts will be avoided or minimized by the following specific Conditions of Approval required by the ITP.

7.1 <u>Designated Representative</u>. Person designated by Permittee responsible for communications with CDFW and overseeing compliance with the ITP.

7.2 Designated Biologist(s). CDFW-approved Designated Biologist(s) responsible for monitoring TRBL and Covered Activities.

7.4 Designated Biologist(s) Authority. The Designated Biologist(s) will have the authority to stop Covered Activities that do not comply with the ITP or order any reasonable measure to avoid unauthorized take of TRBL.

7.5 Education Program. The Designated Biologist(s) will train Project personnel on identifying TRBL, its habitat, and sensitivities and will monitor Covered Activities. This will minimize contamination near TRBL colonies and roost sites.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) will maintain a construction monitoring notebook throughout the construction period.

7.9 Delineation of Property Boundaries. Before starting Covered Activities Permittee will clearly delineate the boundaries of the construction site with fencing, stakes, or flags and restrict Covered Activities to within the fenced, staked, or flagged areas.

7.10 Delineation of Habitat. Permittee will be clearly delineate TRBL habitat within the Project Area with posted signs, posting stakes, flags, and/or rope or cord, and place fencing as necessary to minimize contamination of TRBL habitat.

7.11 Project Related Vehicle Use. To minimize the risk of TRBL being contaminated from vehicles leaking petroleum products, Permittee will restrict all project-related vehicle or heavy equipment traffic to established roadways or designated ingress/egress routes within the Project Area.

7.12 Vehicle Parking and Staging Areas. To minimize the risk of TRBL being contaminated from vehicles leaking petroleum products, Project-related vehicle or equipment use, parking, and staging areas will be restricted to previously disturbed areas to the extent possible and will be contained in established or existing areas.

7.15 CDFW Access. Permittee will provide CDFW staff with reasonable access to the Project, and will otherwise fully cooperate with CDFW efforts to verify compliance with or effectiveness of mitigation measures set forth in the ITP.

8.1 Notification Before Commencement. A Designated Representative will notify CDFW before Covered Activities commence.

8.2 Notification of Non-compliance. A Designated Representative will notify CDFW if Permittee is not in compliance with any conditions of the ITP.

8.3. Compliance Monitoring. Permittee will provide Project access to CDFW staff to monitor or ensure compliance. The Designated Biologist(s) will be onsite daily at each construction site when Covered Activities occur to monitor and ensure compliance with the ITP.

8.10 Notification of Take or Injury. Project Personnel will inform the Designated Biologist(s) if TRBL is taken or injured by a Project-related activity.

9.1.1 Herbicide and Pesticide Use. To minimize the extent to which TRBL or their prey are exposed to contaminants as a result of herbicide and pesticide use during

Covered Activities in and nearby suitable TRBL habitat, the methods and types of herbicides and pesticides used by Permittee will be limited within the Project Area.

9.1.2. Rodenticide Use. Permittee will prohibit the use of rodenticides in construction sites. This measure will minimize the extent to which TRBL or their prey are exposed to contaminants.

9.1.4 Covered Species Observations. Project Personnel will inform the Designated Biologist(s) if they encounter TRBL in or near the construction site.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. To minimize contamination from placement of RTM or spoils, Permittee will develop a spoils disposal plan to address the size and location of disposal sites to minimize the impact on environmentally sensitive areas, containment of contaminants, disposal and storage of contaminated materials, and potential discharge of contaminants.

9.1.11 In-Water Work Windows. To reduce the amount of time Covered Activities may contaminate water sources, Permittee will restrict certain in-water work to specific dates between June and November. This will reduce contamination effects in water sources near TRBL colonies.

9.1.12 Daily In-Water Work Restriction. To reduce the amount of time Covered Activities may contaminate water sources, Permittee will restrict in-water work between sunset and sunrise. This will reduce contamination effects in water sources near TRBL colonies.

9.1.15. Barge Operations Plan. Permittee will develop a barge operations plan to minimize the number of barge trips necessary to conduct Covered Activities and address accidental spillage of hazardous material. This will also minimize the potential for contamination of water sources from barges or tugboats near TRBL colonies.

9.1.18 Stormwater Pollution Prevention Plan. To minimize the extent to which TRBL or their prey are exposed to contaminants as a result of stormwater runoff from construction sites, Permittee will prepare and implement a Stormwater Pollution Prevention Plan that minimizes contamination impacts by following all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge, which will be in place throughout the duration of Covered Activities.

9.1.19 Erosion and Sediment Control Plan. Permittee will develop erosion and sediment control plans to limit dispersal of contaminated sediments during Covered Activities, reducing potential contamination of TRBL water sources.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. Permittee will develop and implement a CDFW-approved Spill Prevention, Containment and Countermeasure Plan to prevent spills of contaminants as a result of Covered Activities, including repair of leaks or spills and clean-up, containment, and disposal of hazardous products, which will minimize exposure to TRBL if a spill does occur.

9.1.22 Hazardous Materials Management Plan. Permittee will develop and implement a CDFW-approved Hazardous Materials Management Plan to prevent the release of hazardous materials as a result of Covered Activities, which will minimize exposure of TRBL to contaminants.

9.1.23 Fugitive Dust Control. Permittee will develop and implement a CDFW-approved Fugitive Dust Control Plan to limit the mobilization of fugitive dust as a result of Covered Activities, which will limit the exposure of TRBL to contaminants in fugitive dust.

9.3.1 Preconstruction Surveys. Within 1,300 feet of the Project Area, the Designated Biologist(s) will conduct preconstruction surveys during the breeding season using a CDFW-protocol to evaluate the presence of TRBL breeding colonies and suitable nesting habitat and will delineate suitable nesting habitat and breeding colonies with flagging or other visible marking.

9.3.2 No-Activity Buffer for Breeding. Permittee will ensure Covered Activities do not occur within a 1,300-foot diameter no-activity buffer surrounding the colony and associated habitat during the breeding season (March 15–July 31) or a smaller buffer approved by CDFW, which will reduce contamination effects on TRBL.

9.3.3 Night Work. Permittee will restrict Covered Activities to 30 minutes after sunrise to 30 minutes before sunset if occurring within 1,300 feet of a breeding colony occupied by TRBL, which will reduce contamination effects on TRBL.

9.3.5 No-Activity Buffer for Roosting. Permittee will not conduct Covered Activities within 300 feet of suitable roosting habitat, to the extent practicable, or within 300 feet of a roost site occupied by TRBL. A smaller buffer will only be used if approved by CDFW. This will minimize contamination of roosting TRBL.

9.3.6 Disturbance of Breeding Colonies and Roost Sites. Permittee will prohibit physical contact with a breeding colony or occupied roost site. This will reduce contamination of breeding TRBL.

9.3.7 Nesting and Roosting Habitat Avoidance. Permittee will avoid TRBL nesting or roosting habitat demarcated by the Designated Biologist(s) during geotechnical exploration, transmission line construction, transmission line maintenance, and safe haven construction and will not conduct these Covered Activities within no-activity buffers. This will reduce contamination of TRBL.

ii. TRBL Mitigation Measures

The avoidance and minimization measures above will reduce but not eliminate the impacts on TRBL resulting from Covered Activities; therefore, the following additional measures are required to achieve full mitigation.

Covered Activities associated with construction will result in a total of 3,837 acres of permanent impacts to TRBL foraging habitat, 16 acres of TRBL nesting habitat, and 20 acres of TRBL roosting habitat. Impacts to foraging habitat include 2,063 acres of breeding season foraging habitat and 1,774 acres of nonbreeding season (wintering) foraging habitat. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11). As compensatory mitigation for impacts to TRBL 3,837 acres of TRBL foraging habitat, 48 acres of TRBL nesting habitat and 40 acres of TRBL roosting habitat will be permanently protected. To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to TRBL, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1.7, 8.4.1.8, and 8.4.1.9 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for Tricolored Blackbird Habitat*. Permittee will ensure permanent protection and funding for perpetual management of compensatory TRBL habitat, including monitoring for suitable habitat features and presence of TRBL for at least three years.

Covered Activities associated with stringing of transmission lines, geotechnical exploration, and pressurized safe havens will result in temporary disturbance of 676 acres of TRBL foraging habitat, including 299 acres of breeding season foraging habitat and 377 acres of nonbreeding season (wintering) foraging habitat. Permittee will avoid temporary impacts to TRBL nesting habitat. Permittee will restore on-site the 676 acres of TRBL foraging habitat that will be temporarily disturbed during Covered Activities to pre-project or better conditions. To ensure restored habitat fully mitigates for impacts to TRBL, restoration and success criteria will comply with ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for Tricolored Blackbird Habitat,* will be consistent with the definition for suitable TRBL foraging habitat in Condition of Approval 8.4.1.8, and will be detailed in a Vegetation Restoration Plan approved by CDFW. Restored habitat will be monitored for one year for suitable habitat features and presence of TRBL.

To mitigate for the loss of TRBL individuals resulting from transmission line strikes, Permittee will install bird strike diverters on existing transmission lines within the Project Area as well as all new transmission lines constructed as a part of Covered Activities and shown in Attachment 1, Figures 4 c and d. Permittee will install bird strike diverters on existing transmission lines in the Project Area equal in length to the length of new permanent and temporary transmission lines constructed as a part of Covered Activities and shown in Attachment 1, Figures 4 c and d, except where new transmission lines replace existing transmission lines. Permittee will space bird strike diverters along transmission lines in accordance with the Avian Powerline Interaction Committee’s guidance (Avian Power Line Interaction Committee 2012) and select bird strike diverters according to the best available science. Permittee will inspect bird strike diverters annually and replace malfunctioning or lost diverters until the transmission line is removed. Permittee will submit a plan describing the location and type of bird strike diverters installed as compensatory mitigation for impacts to TRBL to CDFW for review. Upon written approval of the plan by CDFW, Permittee will install and maintain all bird strike diverters.

iii. TRBL Final EIR/EIS Avoidance and Minimization Measures

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures, resource restoration and protection principles, and environmental commitments, required to be implemented by the ITP, that would further ensure that any impacts to TRBL resulting from Covered Activities would be minimized and fully mitigated.

- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- AMM 2 (Construction best management practices and monitoring)
- Environmental Commitment 3B.2.5/AMM 3 (Develop and implement stormwater pollution prevention plans)
- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- AMM 5 (Spill Prevention, Containment, and Countermeasure Plan)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material (RTM), and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- AMM 7 (Barge operations plan)
- AMM 10 (Restoration of temporarily affected natural communities)
- AMM 21 (Tricolored blackbird)
- AMM 20 (Greater sandhill crane)
- AMM 30 (Transmission Line Design and Alignment Guidelines)
- AMM 27 (Selenium management)
- Environmental Commitment 3 (Natural communities protection and restoration)
- Environmental Commitment 7 (Riparian natural community restoration)
- Environmental Commitment 11(Natural communities enhancement and management)
- Environmental Commitment 12 (Methylmercury management)
- RRPP TB1 - Protect and manage occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence, or other non-marsh nesting habitat suitable for the species.
- RRPP TB2 - Protect high- to very high-value breeding-foraging habitat within 5

miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat. At least 130 acres will be within 3 miles of the 38 acres of nontidal wetland nesting habitat protected.

- RRPP TB3 - Protect moderate-, high-, or very high-value cultivated lands as nonbreeding foraging
habitat, at least 50% of which is of high or very high value.
- RRPP TB4 - Nonbreeding roosting habitat mitigation needs assumed to be met through early successional riparian (blackberry) and tidal (*Scirpus*) restoration.

e. Winter-run Chinook salmon and Spring-run Chinook salmon (*Oncorhynchus tshawytscha*)

i. CHNWR and CHNSR Project Construction Impacts and Avoidance and Minimization Measures

Project construction activities and their resulting impacts are expected to result in the incidental take of individuals of winter-run Chinook salmon (CHNWR) and spring-run Chinook salmon (CHNSR). The Covered Activities described in Section II A above expected to result in incidental take of CHNWR and CHNSR include: geotechnical exploration; construction activities at the NDD intakes, barge landings, and HOR Gate that include cofferdam installation, levee clearing and grading, riprap installation dredging, pile driving; modifications to CCF that include expansion and dredging of SCCF, construction of divider wall and east/west embankments, dewatering and excavation of NCCF, construction of NCCF outlet canals and siphons, and construction of a SCCF intake structure and NCCF emergency spillway; and barge operations.

Incidental take of CHNWR and CHNSR, and related impacts of the taking on CHNWR and CHNSR, are expected to occur as a result of direct physical injury, mortality, adverse impacts to habitat, and exposure to underwater noise, increased turbidity, suspended sediment, and contaminants. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to CHNWR and CHNSR is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Construction of the Project is expected to cause the permanent loss of 1.02 linear miles of channel margin habitat and 31.9 acres of tidal perennial aquatic habitat suitable for CHNWR and CHNSR, and permanently alter 2,190 acres of tidal aquatic habitat in CCF. The Project is expected to temporarily affect 20.1 acres of tidal perennial aquatic habitat. Impacts of the authorized taking also include adverse impacts to CHNWR and CHNSR related to temporal losses and increased habitat fragmentation, through the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include: stress resulting from underwater noise and vibrations from pile driving, barge operations, dredging, increased turbidity and sedimentation, capture and relocation, long-term effects due to increased contamination, and displacement from habitat. The creation of new predator habitat at the facilities (NDD intakes, HOR Gate, and barge landings) may increase juvenile CHNWR and CHNSR vulnerability to predation.

In general, Covered Activities would impact CHNWR and CHNSR as described above, but these impacts will be avoided and minimized by the following Conditions of Approval required by the ITP.

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with the ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of the ITP.

7.2 Designated Biologist(s). Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a biological monitor (Designated Biologist(s) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Biologist(s) is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist(s) shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist(s) in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist(s) must be changed.

7.3 Designated Fisheries Biologist. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a fisheries biologist (Designated Fisheries Biologist) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Fisheries Biologist has 1) a 4-year college degree in fisheries or biology, or a related degree, 2) at least 2 years of professional experience in fisheries field surveys and fish capture and handling procedures, and 3) completed an electrofishing training course such as Principles and Techniques of Electrofishing (USFWS, National Conservation Training Center), or similar course. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat. Permittee shall obtain CDFW approval of the Designated Fisheries Biologist in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Fisheries Biologist must be changed.

7.4 Designated Biologist(s) Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist(s) shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist(s) that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; Take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers; and measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped. Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist(s) shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of this ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.14 Hazardous Waste. Permittee shall immediately stop and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of this ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in this ITP and/or the MMRP. The Designated Representative shall report any non-compliance with this ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each Work Area within the Project Area when Covered Activities occur. The Designated Biologist(s) shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3)

check for compliance with all measures of this ITP; (4) check all exclusion zones; (5) ensure that signs, stakes, and fencing are intact, and (6) that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall monitor compliance continuously within each of the Work Area(s) where Covered Activities are occurring. After initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections a minimum of once per day within each of the Work Area(s) where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by this ITP. Observation and inspection records shall be compiled and reported as described in Condition of Approval 7.6. The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps depicting: 1) mapped areas of all land disturbances within the Construction Footprint; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species (see Condition of Approval 8.4.1 for habitat features) within the Construction Footprint (as depicted in ITP Attachment 1, Figures 1-10). Permittee shall maintain the GIS layers and metadata for those maps and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each Work Area of the Construction Footprint, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species disturbed by Covered Activities. This tracking shall be maintained using a GIS format and include photo documentation of the habitat feature within a Work Area conducted no more than 14 days prior to initiation of Covered Activities. The photo documentation of each habitat feature shall include a minimum of four photos: one taken each from the North, South, East, and West and facing the habitat feature. There shall be separate photo documentation of each habitat feature suitable for Covered Species within a Work Area. Accordingly, if there are multiple habitat features in a Work Area, there will be multiple sets of photo documentation for that Work Area. The Permittee shall document the total disturbed acreage of habitat features for each Covered Species compiled from the real time tracking, and compare the documented disturbance in each Work Area to the Baseline Maps as shown in Attachment 6. Permittee shall provide GIS layers and the associated metadata to CDFW with the Monthly Compliance Report (see Condition of Approval 8.6). Permittee shall also maintain maps for each Covered Species separately, and shall include updates to any of the maps in the next successive Annual Status Report (see Condition of Approval 8.7). Permittee shall also provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report and a summation of disturbance of identified habitat features annually at the time of Annual Status Report submission.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Construction Footprint, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative(s) or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; and 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month. The Monthly Compliance Report is due at the office listed in the Notices section of this ITP and via e-mail to CDFW's Representative and Headquarters CESA Program. At the time of this ITP's approval, the CDFW Representative is Carl Wilcox Carl.Wilcox@wildlife.ca.gov) and Headquarters CESA Program email is CESA@wildlife.ca.gov. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of this ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.8 CNDDB Observations. The Designated Biologist shall submit all observations of Covered Species to CDFW's California Natural Diversity Database (CNDDB) within 60 calendar days of the observation and the Designated Biologist shall include copies of the submitted forms with the next Monthly Compliance Report or ASR, whichever is submitted first relative to the observation.

8.9.1 Project Construction Report. No later than 180 days after completion of all mitigation measures, Permittee shall provide CDFW with a Final Mitigation Report. The Designated Biologist(s) shall prepare the Final Mitigation Report which shall include, at a minimum: (1) a summary of all Monthly Compliance Reports and all ASRs; (2) a copy of the table in the MMRP with notes showing when each of the mitigation measures was implemented; (3) all available information about Project-related incidental take of the Covered Species; (4) information about other Project impacts on the Covered Species; (5) beginning and ending dates of Covered Activities; (6) an assessment of the effectiveness of this ITP's Conditions of Approval in minimizing and fully mitigating Project impacts of the taking on Covered Species; (7) recommendations on how mitigation measures might be changed to more effectively minimize take and mitigate the impacts of future projects on the Covered Species; and (8) any other pertinent information.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye (registered for aquatic use by the California Department of Pesticide Regulation, if warranted) to prevent overspray.

9.1.3 Artificial Lighting. Permittee shall use artificial outdoor lighting only as needed for safety and security. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and permanent facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access. All lighting shall be directed away from waterways near Project facilities with shielding to further minimize potential light spillover into Covered Fish Species habitat.

9.1.4 Covered Species Observations. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee shall cease Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is moved by the Designated Biologist(s) or it moves from the construction site of its own accord.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Prior to finalizing Project engineering design, Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, RTM, and dredged material. Permittee shall implement the plan to minimize impacts to CHNWR and CHNSR as a result of exposure to contaminants and adverse impacts to habitat.

9.1.11 In-Water Work Windows. Permittee shall restrict certain in-water Covered Activities and Covered Activities within dewatered cofferdams according to the following work windows and restrictions:

Permittee shall restrict in-water Covered Activities associated with construction of the NDD intakes, CCF, HOR Gate and barge landings to the following in-water work windows:

- Permittee shall only conduct in-water work at the NDD intakes from June 1 through October 31:
    - Permittee shall only conduct in-water impact pile driving at the NDD intakes from June 15 - September 15. Mobilization and demobilization are not included within this work window.
    - Permittee may conduct in-water impact pile driving at the NDD intakes from June 1 – June 15 and September 16 - October 31 if bubble curtains and other measures demonstrate that an equivalent level of protection can be achieved during the primary work window, and as approved in writing by CDFW.
    - Permittee may conduct impact pile driving between June 1 – June 15 and September 16 – October 31 behind cofferdams at the NDD Intakes construction sites outside of the above shortened work window with in-channel acoustic monitoring (see Condition of Approval 9.1.13) required to verify that generated sound thresholds do not exceed the disturbance threshold of 150 dB.
    - Permittee shall conduct acoustic monitoring (see Condition of Approval 9.1.13) to verify that any sound transmitted to the water

column is below the disturbance threshold of 150 dB for all other in-water Covered Activities at the NDD intakes, including drilled shaft (also known as cast-in-drilled hole piles) construction, riprap placement, and dredging in NDD intake dewatered cofferdams outside the above referenced work windows.

- Permittee shall only conduct in-water Covered Activities associated with the construction of the HOR Gate from August 1 - October 31.
    - Permittee shall implement use of bubble/sound barrier with acoustic monitoring to verify reduction in the sound field when impact hammers are used.
- Permittee shall only conduct in-water Covered Activities associated with the construction of barge landings from July 1 - August 31.
- Permittee shall only conduct barge operations within the following windows and associated locations:
    - Permittee shall only conduct barge operations from the Port of Stockton, San Francisco, and Antioch to all barge landings from June 1 – October 31
    - Permittee shall only conduct barge operations from the Port of Stockton to Bouldin Island from November 1 - February 28.
    - Permittee shall only conduct barge operations from the Port of Stockton to Bouldin Island from March 1 - May 31 to move critical heavy construction equipment and materials that cannot be moved by land. Barge traffic shall be restricted to minimize impacts to emigrating CHNSR from the San Joaquin River basin.
    - During the period from November 1 to May 31 no trips will originate from the ports in San Francisco or Antioch.
- Permittee shall only conduct over-water geotechnical exploration from August 1 - October 31.
- Permittee shall only conduct in-water Covered Activities associated with construction of the CCF facilities from July 1 - November 30
    - Permittee shall only conduct in-water impact pile driving from July 1 - October 31. Mobilization and demobilization could continue to occur outside this window.
    - Permittee shall only conduct dredging operations from July 1 – October 31 at South CCF.
    - Permittee shall only conduct dredging of the North CCF after fish have been rescued/salvaged.
    - Permittee may conduct other low impact in-water work from November 1 – November 30.

The NDD June 1 through October 31 In-water work window substantially minimizes Covered Activities' impacts by avoiding the primary adult migration and juvenile rearing and emigration period for CHNWR and CHNSR in the lower Sacramento River. Potential Covered Activities-related impacts to early-arriving juveniles are possible particularly if the first major rain event of the season result in September and October migration of CHNWR and CHNSR juveniles and yearlings. Exposure of adult CHNWR and CHNSR to Covered Activities-related impacts could occur during in-water construction period to the smaller proportion of adults that will be migrating upstream through the Project Area after the primary migration period, in June and July.

Restriction of CCF construction related Covered Activities to the CCF July 1 through November 30 in-water work window avoids the primary adult migration period and primary juvenile migration and rearing periods of CHNWR and CHNSR in the Delta. Based on the general timing and distribution of CHNWR and CHNSR in the Delta, there is some potential for adult CHNWR and juvenile CHNSR in November and juvenile CHNWR in October and November to be directly exposed to the impacts of Covered Activities. However, adult CHNWR are unlikely to occur in the south Delta based on their attraction to Sacramento River water. Juvenile CHNWR salmon may occur in the south Delta as early as September, October, or November depending on Sacramento flows, Delta inflows, CVP and SWP pumping rates, and operation of the DCC gates, although salvage records at the CVP and SWP fish collection facilities indicate that CHNWR juveniles typically do not appear in CCF until November or December.

Restriction of geotechnical exploration to August 1 through October 31, barge landing activities to July 1 through August 31 and HOR Gate construction activities to the August 1–October 31 in-water work windows avoids the primary adult migration periods and primary juvenile migration and rearing periods of CHNWR and CHNSR in the Delta. Adult CHNWR may enter the lower San Joaquin River in November but are unlikely to occur as far upstream as the HOR Gate, based on their attraction to Sacramento River water. Specifically, Sacramento River water may be drawn into the San Joaquin River side of the Delta through the DCC (when open), Georgiana Slough, and Three Mile Slough, but generally would not be drawn as far upstream as the HOR Gate. Similarly, juvenile CHNWR may enter this region of the Delta as early as September/October via these same pathways, but they are not expected to occur in significant numbers as far upstream as the HOR Gate because the general effects of flow and export pumping on route selection in the Delta cause most juvenile CHNWR to be entrained into the south Delta. However, in some years, pile driving activities associated with barge landing construction or HOR Gate construction and geotechnical exploration may overlap with the potential occurrence of juvenile CHNWR in the Delta in September/October.

Restriction of barge operations to the in-water work windows summarized above minimize the exposure of emigrating juvenile CHNWR and CHNSR to barge operations. Year-round barge traffic has the potential to impact CHNWR and CHNSR juveniles through increased turbidity and sedimentation, exposure to contaminants, underwater noise, direct mortality, and through increased frequency of wave-induced shoreline disturbances, which could affect rearing juveniles that depend on shallow nearshore areas for resting, feeding, and protection from predators. Restriction of barge traffic from Antioch, Stockton, and San Francisco to all barge landings and the NDD Intakes from June 1-October 31 substantially avoids the primary November through May emigration window for CHNWR and CHNSR but does overlap with CHNWR and CHNSR emigration in September, October, and June. The restriction of barge operations from the Port of Stockton to Bouldin Island from November 1-February 28 and from March 1-May 31 only to move heavy equipment as necessary, exposes CHNWR and CHNSR along that barge traffic route but avoids exposure of juvenile CHNWR and CHNSR emigrating through other Delta channels.

9.1.12 Daily In-water Work Restriction. Permittee shall cease all in-water Covered Activities thirty minutes before sunset and not resume until 30 minutes after sunrise. This daily in-water work restriction further reduces Covered Activities' impacts during the periods when CHNWR and CHNSR presence overlaps with seasonal in-water work windows, and barge operations periods. By restricting in-water Covered Activities to the daytime, adults can pass construction sites at night (dusk to dawn) when Covered Activities will cease. Covered Activities would still impact juvenile salmonids that may be holding, sheltering, or feeding in close proximity to construction sites during the daytime. Such juveniles may be forced to leave protective cover or exhibit alarm responses that could make them more vulnerable to predators.

9.1.13 Underwater Sound Abatement Plan. Permittee shall coordinate with the TOT develop and implement an underwater sound abatement plan to evaluate the potential effects of underwater noise on Covered Fish Species in the context of interim underwater noise thresholds and to reduce underwater noise, to the extent possible, below thresholds established for disturbance and injury of fish (ICF Jones and Stokes 2009). The underwater sound abatement plan shall also include procedures for measuring pile driving sound consistent with ICF Jones and Stokes (2009). Underwater noise thresholds include:

- Injury threshold for fish of all sizes at a peak sound pressure level of 206 decibels (dB) relative to 1 micropascal;
- Injury threshold for fish less than 2 grams is 183 dB relative to 1 micropascal cumulative sound exposure level, and 187 dB relative to 1 micropascal cumulative sound exposure level for fish greater than or equal to 2 grams;
- Disturbance threshold for fish of all sizes is 150 dB root mean square relative to 1 micropascal.

Permittee shall verify that any sound transmitted to the water column by Covered Activities conducted outside the in-water work window, but within de-watered areas, is below the disturbance threshold of 150 dB. The Designated Fisheries Biologist shall retain the authority to stop work in the event that measured sound pressure level (SPL) exceed the disturbance threshold.

Permittee shall submit the underwater sound abatement plan to the TOT for review at least 90 days prior to finalization of the Project engineering design. Permittee shall not initiate in-water Covered Activities until the final underwater sound abatement plan is approved in writing by CDFW.

9.1.14 Pile Driving Plan. Permittee shall coordinate with the TOT to develop and implement a pile driving plan to further minimize underwater noise impacts to CHNWR and CHNSR. The pile driving plan shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the timing and duration of pile driving within the in-water work windows, and the duration of pile driving within the daily in-water work construction window. The underwater noise generated by impact pile driving shall be abated using the best available and practicable technologies. Examples of such technologies include, but are not limited to: using cast-in-drilled-hole rather than driven piles; using vibratory rather than impact pile driving equipment; using an impact pile driver to proof piles initially placed with a vibratory pile driver; using pile caps (e.g., wood or micarta), bubble curtains, air-filled fabric barriers, or isolation piles to attenuate underwater noise; and installing piling-specific cofferdams. Specific techniques used will be selected based on site-specific conditions.

In addition to primarily using vibratory pile driving methods and establishing protocols for attenuating underwater noise levels produced during in-water construction activities, Permittee will develop and implement operational protocols for when impact pile driving is necessary to minimize the overall extent, intensity, and duration of potential underwater noise effects of impact pile driving on Covered Fish Species. These protocols may include, but not be limited to, the following: monitoring the in-water work area for fish that may be showing signs of distress or injury as a result of pile driving activities and stopping work when distressed or injured fish are observed; initiating impact pile driving with a “soft-start,” such that pile strikes are initiated at reduced impact and increase to full impact over several strikes to provide fish an opportunity to move out of the area; restricting impact pile driving activities to specific times of the day and for a specific duration to be determined through coordination with the fish and wildlife agencies; and, when more than one pile driving rig is employed, ensure pile driving activities are initiated in a way that provides an escape route and avoids “trapping” fish between pile drivers in waters exposed to underwater noise levels that could potentially cause injury. These protocols are expected to avoid and minimize the overall extent, intensity, and duration of potential underwater noise effects associated with impact pile driving activities.

9.1.15 Barge Operations Plan. Permittee shall develop and implement a barge operations plan to further avoid and minimize underwater noise impacts to CHNWR and CHNSR. Permittee shall coordinate with the TOT prior to finalizing Project engineering design, to develop a barge operations plan to minimize the number of trips necessary to conduct Covered Activities and to identify barge routes that minimize underwater noise related impacts on CHNWR and CHNSR. Permittee shall develop plans for which materials can be transported by truck or rail to launch and retrieval points along the proposed tunnel alignment. Permittee shall also investigate the potential of using rail to deliver materials and components to Stockton and the CCF location.

Permittee shall submit a draft barge operations plan to the TOT at least 90 days prior to finalization of the Project engineering design. Permittee shall not initiate barge operations until the final barge operations plan is approved in writing by CDFW.

9.1.16 Fish Salvage Plan. Permittee shall coordinate with the TOT to develop a fish salvage plan that describes procedures for fish rescue and salvage to minimize the number of Covered Fish Species stranded during Project construction. Permittee shall submit a draft fish salvage plan to the TOT at least 90 days prior to finalization of Project engineering design. Permittee shall not initiate Covered Activities that have the potential to strand fish until the final fish salvage plan is approved in writing by CDFW.

The fish salvage plan must be reviewed and finalized by the TOT and approved in writing by CDFW. Permittee shall implement all measures in the approved plan.

9.1.17 Dewatering. Permittee shall screen dewatering pump intakes to prevent entrainment of fish in accordance with screening criteria for salmonid fry NMFS 1997 *Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997b). During dewatering a Designated Fisheries Biologist shall remain onsite to observe the process and remove Covered Species that were not successfully salvaged prior to dewatering (see Condition of Approval 9.1.16).

If Covered Species salvage operations cannot be conducted effectively or safely by the Designated Fisheries Biologist, it may be necessary to begin the dewatering process prior to salvage. During the dewatering process, a Designated Fisheries Biologist shall be onsite to implement Covered Species salvage during dewatering with the aim of minimizing the number of Covered Species that become trapped in isolated areas or impinged on pump screen(s) or isolation nets. If the Designated Fisheries Biologist determines the proposed methods are found to be insufficient to avoid undue losses of Covered Species, they shall implement alternative salvage methods to minimize impacts to Covered Species.

Permittee shall temporarily stop dewatering if the Designated Fisheries Biologist or CDFW personnel determine that water levels may drop too quickly to allow successful fish salvage.

Upon dewatering to water depths at which neither electrofishing nor seining can effectively occur (e.g., less than 3 inches [0.1 meter]), the Designated Fisheries Biologist shall inspect the dewatered areas to locate any remaining fish and collect them by dip net. The Designated Fisheries Biologist shall notify the Permittee and CDFW when the fish salvage has been completed and construction can recommence.

9.1.18 Stormwater Pollution Prevention Plan. To minimize impacts on CHNWR and CHNSR from exposure to contaminated stormwater, which could occur due to year-round Covered Activities adjacent to waterways, Permittee shall develop and implement a stormwater pollution prevention plan. The primary elements of the stormwater pollution prevention plan include a commitment by Permittee to follow all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The plan will also describe protocol for accidental spill prevention and response and measures to prevent nonstormwater discharges from reaching surface water.

Permittee shall not initiate Covered Activities until the Stormwater Pollution Prevention Plan is approved in writing by CDFW.

9.1.19 <u>Erosion and Sediment Control Plan</u>. Permittee shall develop and implement an erosion and sediment control plan to further minimize potential impacts to CHNWR and CHNSR as a result of Covered Activities occurring year-round and adjacent to waterways. Specific elements of the plan to reduce these impacts include actions that divert runoff away from steep, denuded slopes, retain sediment transported by run-off, collect and direct surface runoff at non-erosive velocities to common drainage courses, use sediment and turbidity areas where ground disturbance is adjacent to surface water or wetlands, and deposit or store excavated materials away from drainage courses and keep them covered when stored over five days or within 48 hours of a forecasted rain event.

The Erosion and Sediment Control Plan(s) shall be approved by CDFW prior to initiating construction activities.

<u>9.1.20 Erosion Control Stabilization Measures.</u> Permittee shall not use plastic monofilament netting or similar material such as nylon for erosion control, to avoid entanglement or trapping of small wildlife. Permittee shall not use products that use photodegradable or biodegradable synthetic netting. Acceptable materials include natural fibers such as jute matting, coconut, twine, or other similar fibers or tackified hydroseeding compounds. Permittee shall communicate this measure to Project contractor(s) through specifications or special provisions included in the construction bid solicitation package.

9.1.21 <u>Spill Prevention, Containment, and Countermeasure Plan.</u> In accordance with local, state, or federal regulations, Permittee or its contractors shall develop a spill prevention, containment, and countermeasure plan (SPCC) at each site where ground-disturbing activity will occur. Each SPCC shall address actions used to prevent spills and actions that will be taken should any spills occur, including emergency notification procedures. The SPCC plans shall include measures and processes that address the following: procedures for routine handling of products; discharge or drainage controls such as secondary containment and procedures for discharge control; countermeasures for discharge discovery, response, and cleanup; methods of disposal of recovered materials; personnel training in emergency response, spill containment techniques, and pollution control laws, rules, and regulations; storage of petroleum products in nonleaking containers at impervious storage sites from which an accidental spill cannot escape; storing and maintaining spill containment materials--such as absorbent pads, pillows, socks, or booms--in nonleaking sealed containers until transported and disposed of; using spill containment materials under transfer areas when transferring oil or other hazardous materials from trucks to storage containers; storage of concrete, wash water, and other contaminants in watertight containment structures; daily inspection of equipment for oil, grease, and other petroleum products if equipment is in contact with surface water; cleaning of external petroleum products off of equipment prior to its contact to water; and use of oil-absorbent booms for equipment used in or adjacent to water. In the event of a spill, personnel shall identify and secure the source of discharge and contain the discharge with spill kit materials, such as sorbents or sandbags, and shall contact CDFW and other appropriate regulatory authorities within 24 hours. Permittee shall submit the SPCC plans to CDFW for written approval prior to initiating construction activities.

9.1.22 Hazardous Materials Management Plan. Permittee or its contractors shall develop and implement one or more hazardous materials management plan(s) (HMMP) prior to initiating construction activities. The HMMP shall provide detailed information on the types of hazardous materials used; phone numbers of emergency response agencies; appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste; and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP shall address the following measures or practices: clear labeling, handling and safety instructions, and emergency contact information on hazardous material containers; use or transfer of hazardous materials near wet or dry streams; Material Safety Data Sheets, accumulation and temporary storage of hazardous wastes (e.g., not to exceed 90 days); and disposal of contaminated soils. Permittee shall submit the HMMP to CDFW for written approval prior to initiating construction activities.

9.6.10 NDD Intakes Pre-Construction Studies. Permittee will design and implement four studies to inform the final design of the NDD intakes and provide critical information related to the spatial and temporal patterns of both native and nonnative fish species in the vicinity of the NDD intakes (pre-construction Studies 5 and 6) characterizing hydrodynamics within the NDD intake reach to achieve design requirements to minimize Covered Fish Species impingement and entrainment (pre-construction Studies 7 and 8).

Construction impact: Underwater noise

Covered Activities associated with Project construction that are likely to generate underwater noise include over-water geotechnical exploration, cofferdam installation, pile driving, riprap placement, dredging, and barge operations. These Covered Activities will occur in over-water geotechnical exploration sites, and construction sites associated with NDD intakes, barge landings, CCF, and the HOR Gate.

Anthropogenic noise has the potential to affect fish through a broad range of behavioral, physiological, or physical effects (McCauley et al. 2003, Popper and Hastings 2009). Exposure to underwater noise associated with impact pile driving may lead to direct mortality of CHNWR and CHNSR because the extent, timing, and duration of pile driving noise levels associated with the Covered Activities are predicted to exceed the interim injury and behavioral thresholds. During impact pile driving, underwater noise levels sufficient to cause injury or mortality will extend across the entire width of the river and up to 3,280 feet away from the source piles. Pile driving noise can potentially delay or block migration of CHNWR and CHNSR, or result in avoidance responses that could increase their exposure to other stressors such as elevated water temperatures, predators, or increased metabolic demands associated with prolonged delays. Juvenile CHNWR and CHNSR that may be holding, sheltering, or feeding in the vicinity of construction sites following initiation of pile driving activities may be forced to leave protective cover or exhibit alarm responses that could result in increased vulnerability to predation.

Exposure to underwater noise generated by geotechnical exploration, cofferdam installation, riprap placement, dredging, and barge operations may impair survival through behavioral responses, physiological stress, temporary and permanent hearing loss, and tissue damage (auditory and non-auditory) if avoidance is not possible or exposure is prolonged (McCauley et al. 2003, Popper and Hastings 2009). Underwater noise exposure may also cause mortality, depending on the intensity and duration of exposure. In salmonids and most other teleost fish, the presence of a swim bladder to maintain buoyancy increases their vulnerability to direct physical injury (i.e., tissue and organ damage) from underwater noise (Hastings and Popper 2005). Pile driving poses the greatest risk to fish because the levels of underwater noise produced by impulsive types of sounds can reach levels of sufficient intensity to injure or kill fish within a certain radius of the source piles (Popper and Hastings 2009). Underwater noise may also damage hearing organs that may temporarily affect hearing sensitivity, communication, and ability to detect predators or prey (Popper and Hastings 2009). Underwater noise may also cause behavioral effects (e.g., startle or avoidance responses) that can disrupt or alter normal activities (e.g., migration, holding, or feeding) resulting in adverse effects on survival, growth, and reproductive success or expose individuals to increased predation risk.

<u>Conditions of Approval: Underwater noise</u>

Covered Activities would impact CHNWR and CHNSR as described above, but these impacts will be avoided and minimized through Conditions of Approval required by the ITP. In particular, the following measures are key means to reduce this impact to CHNWR and CHNSR.

7.3 <u>Designated Fisheries Biologist</u>. The Designated Fisheries Biologist will be required for continual acoustic monitoring of pile driving conducted outside in-water work windows in dewatered areas and implementing procedures for measuring pile driving sound.

7.4 <u>Designated Biologist and Designated Fisheries Biologist Authority</u>. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. In-water work windows restrict the timing when Permittee is authorized to conduct Covered Activities that generate underwater noise to minimize associated impacts to CHNWR and CHNSR. All in-water Covered Activities and Covered Activities behind dewatered cofferdams that are expected to generate underwater noise are restricted by in-water work windows at over-water geotechnical exploration sites and the NDD intakes, CCF, HOR Gate, and barge landing construction sites. Additional Conditions of Approval discussed in these findings serve to minimize remaining risks of underwater noise exposure that remain because CHNWR and CHNSR may be present during Covered Activities within the in-water work windows.

9.1.12 Daily In-water Work Restriction. Daily in-water work restrictions, applicable year-round, limit in-water Covered Activities that are expected to generate underwater noise by requiring that in-water Covered Activities cease 30 minutes before sunset and not resume until 30 minutes after sunrise. This daily in-water work restriction further reduces underwater noise impacts during the periods when CHNWR and CHNSR presence overlaps with seasonal in-water work windows. This allows adult CHNSR and CHNWR to pass construction sites at night (dusk to dawn) when Covered Activities will cease.

9.1.13 Underwater Sound Abatement Plan. Permittee shall coordinate with the TOT to develop and implement an underwater sound abatement plan to evaluate the potential effects of underwater noise on Covered Fish Species in the context of interim underwater noise thresholds and to reduce underwater noise, to the extent possible, below thresholds established for disturbance and injury of fish (California ICF Jones and Stokes 2009). To the extent that seasonal in-water work windows do not fully avoid reduces impacts due to the presence of early- or late-arriving CHNWR or CHNSR and variable weather and hydrological conditions, this measure further minimizes such impacts.

9.1.14 Pile Driving Plan. To the extent underwater noise associated with impact pile driving cannot be entirely abated to levels below the California Department of Transportation thresholds (ICF Jones and Stokes 2009), Permittee shall coordinate with the TOT to develop and implement a pile driving plan to further minimize underwater noise impacts to CHNWR and CHNSR associated with pile-driving.

9.1.15 Barge Operations Plan. Permittee shall coordinate with the TOT to develop and implement a barge operations plan to further minimize impacts to CHNWR and CHNSR as a result of underwater noise generated by barge operations.

Construction impact: Turbidity and suspended sediment

Covered Activities associated with Project construction that are likely to generate turbidity and suspended sediment include geotechnical exploration, pile driving, riprap placement, barge operations, dredging, cofferdam installation and removal, and levee clearing and grading. These Covered Activities will disturb the channel bed and banks, resulting in periodic increases in turbidity and suspended sediment in the adjacent waterways. Barge operations will result in temporary increases in turbidity and suspended sediment along the routes that will be used to transport construction equipment and materials between the barge loading and unloading facilities. Dredging will likely generate the most continuous sources of elevated turbidity and suspended sediment resulting disruptions in migration, holding, and rearing behavior. Covered Activities that disturb the riverbed and banks above the waterline, including cofferdam installation and removal, levee clearing and grading, and riprap placement may also temporarily increase turbidity and suspended sediment levels in the Project Area.

Laboratory studies have demonstrated that chronic or prolonged exposure to high turbidity and suspended sediment levels can lead to reduced growth rates in salmonids. For example, Sigler et al. (1984) found that juvenile Coho salmon and steelhead trout exhibited reduced growth rates and higher emigration rates in turbid water (25–50 NTU) compared to clear water. Reduced growth rates generally have been attributed to an inability of fish to feed effectively in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment also may affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Suspended sediment can cause physiological stress in fish by causing localized increases in chemical oxygen demand in waters in or near plumes. For salmonids, elevated suspended sediment has been linked to a number of behavioral and physiological responses indicative of stress: gill flaring, coughing, avoidance, and increase in blood sugar levels (Bisson and Bilby 1982; Sigler et al. 1984; Berg and Northcote 1985; Servizi and Martens 1992). High suspended sediment levels can clog gill tissues, interfering with respiration and increasing physiological stress.

Adult salmonids are expected to readily avoid high turbidity and suspended sediment and move to adjacent holding areas or continue their migration in deeper, offshore portions of the channel. Because of their small size and reliance on shallower, nearshore waters and associated cover, displacement of juvenile salmonids from nearshore waters and into deeper, offshore portions of the channel may increase their vulnerability to predators, potentially increasing mortality. However, use of nearshore areas by CHNWR and CHNSR is generally reduced by June and July and because most juveniles are large, actively migrating smolts that are known to move rapidly through the Delta and estuary during their seaward migration (Williams 2006).

Juvenile salmonids tend to avoid streams that are chronically turbid (Bisson and Bilby 1982; Lloyd 1987) or to move laterally or downstream to avoid turbidity plumes (Sigler et al. 1984; Lloyd 1987; Servizi and Martens 1992). Juvenile Coho salmon have been reported to avoid turbidities exceeding 70 NTU (Bisson and Bilby 1982) and cease territorial behavior when exposed to a pulse of turbidity of 60 NTU (Berg 1982). Such behavior could result in displacement of juveniles from preferred habitat or protective cover, which may reduce growth and survival by affecting foraging success or increasing their susceptibility to predation. Juvenile salmonids, if holding or rearing in the affected areas, are likely to respond by avoiding or moving away from affected shoreline areas, disrupting normal activities and increasing their exposure to predators. Such disruptions are expected to be brief, however, juvenile salmonids could face increased predation mortality.

In addition to temporary water quality impacts discussed above, increases in sediment loads in the Sacramento River, Old River, and other waterways in the project footprint can bury river substrates that support important food organisms (benthic invertebrates) for juvenile CHNWR and CHNSR. The natural channel substrate in the Project Area is dominated by fine sediment (sand and silt) that is frequently disturbed by high flows and human activities (e.g., boat wakes). Increases in suspended sediment during in-water construction activities may result in localized sediment deposition, potentially degrading food-producing areas by burying benthic substrates that support important food organisms (benthic invertebrates) for juvenile salmonids.

<u>Conditions of Approval: Turbidity and suspended sediment</u>

Covered Activities would impact CHNWR and CHNSR as described above, but these impacts will be avoided and minimized through Conditions of Approval required by the ITP. In particular, the following measures are key means to reduce this impact to CHNWR and CHNSR.

7.3 <u>Designated Fisheries Biologist</u>. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 <u>Designated Biologist and Designated Fisheries Biologist Authority</u>. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 <u>Education Program</u>. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. In-water work windows will minimize the risk of exposure of CHNWR and CHNSR to turbidity and suspended sediment by avoiding the primary time periods of adult migration and juvenile migration and rearing in the Delta. Additional Conditions of Approval discussed in these findings serve to minimize remaining risks of increased sediment exposure that remain because CHNWR and CHNSR may be present during Covered Activities within the in-water work windows.

9.1.12 Daily In-Water Work Restriction. Daily in-water work restrictions will further minimize exposure of CHNWR and CHNSR to increased turbidity and suspended sediment associated with in-water Covered Activities, during the periods when CHNWR and CHNSR presence overlaps with seasonal in-water work windows, because adult CHNWR and CHNSR may pass construction sites at night (dusk to dawn) without exposure to increased turbidity and sediment.

9.1.15 Barge Operations Plan. Permittee shall develop and implement the barge operations plan to further avoid and minimize turbidity and suspended sediment impacts to CHNWR and CHNSR. The primary elements of the Barge Operations Plan to minimize increases in turbidity and suspended sediment are limiting the number of barge trips, limiting vessel speeds to reduce potential effects of wakes on unarmored banks, limiting direction and velocity of propeller wash to prevent bottom scour, prohibiting barge operators from dragging anchors across the channel bed, and using deck walls to prevent loose materials from blowing or washing off of the deck.

9.1.19 Erosion and Sediment Control Plan. Year-round Covered Activities adjacent to waterways have the potential to expose CHNWR and CHNSR to increased turbidity and suspended sediment from runoff. Permittee shall develop and implement an erosion and sediment control plan to further minimize turbidity and suspended sediment impacts to CHNWR and CHNSR associated with runoff from Covered Activities into Delta waterways.

Construction impact: Exposure to contaminants

Covered Activities associated with Project construction that are likely to expose CHNWR and CHNSR to contaminants include over-water geotechnical exploration and construction of the NDD intakes, barge landings, HOR Gate, and CCF due to disturbance of contaminated sediments, or release of hazardous materials including oil, fuel, hydraulic fluids, concrete, paint, and other construction-related materials from construction equipment, barges and towing vessels, and other machinery, resulting in localized water quality degradation. The risk of contaminant exposure is highest during in-water Covered Activities, including cofferdam installation, levee clearing and grading, pile driving, and barge operations, because of the proximity of construction equipment to the Sacramento River, Old River, and adjacent waterways.

Permittee will conduct approximately 100 over-water borings to collect geotechnical data at the NDD intakes, barge landings, tunnel alignment crossings, HOR Gate, and CCF facilities. These borings have the potential to re-suspend contaminated sediments. Covered Activities during the expansion of the CCF and construction of the NDD intakes also presents an exposure risk to CHNWR and CHNSR from hazardous materials releases from construction equipment, and resuspension of contaminated sediments.

During NDD intake construction Permittee will dredge and disturb 12.1 acres of the riverbed adjacent to the NDD intake structures, which could result in resuspension of sediments and associated contaminants and may also cause short lived changes in dissolved oxygen (DO), pH, hydrogen sulfide (H2S), and ammonia (NH3).

Exposure of CHNWR and CHNSR to contaminants can cause injury, mortality (e.g., damage to gill tissue causing asphyxiation), physiological stress (potentially resulting in delayed effects on growth, survival, and reproductive success), increased susceptibility to other sources of mortality, and behavioral changes depending on the type of contaminant, extent of the spill, and exposure concentrations. In addition to the direct effects of exposure, contaminants can enter the aquatic food web and accumulate in fish through their diet, leading to lethal and sublethal effects, including effects on behavior, tissues and organs, reproduction, growth, and immune system (Connon et al. 2009). Studies have shown that dredging contaminated sediments increases particulate-bound contaminants in waters next to or near to the dredge, producing deleterious effects on species that occupy those areas. (Bellas et al. 2007; Bocchetti et al. 2008; Engwall et al. 1998; Sundberg et al. 2007; Sturve et al. 2005; Yeager et al. 2010). Heavy metals and organic contaminants (PAHs, PCBs, and pesticides) are of most concern. Generally, toxic metal and pesticide contamination can cause acute toxicity in aquatic organisms (as seen in some first flush events in urban creeks and streams) which may result in death from high concentrations, or chronic (sublethal) effects which reduces the organism's health and may lessen survival over time. Increased levels of heavy metals are detrimental because they interfere with metabolic functions through inhibition of enzyme activity, decrease neurological function, degrade cardiovascular output, and can act as mutagens, teratogens, or carcinogens to organisms that are exposed to them (Rand et al. 1995; Goyer and Clarkson 1996). Charged particles (metals like copper) can also interfere with ion exchange channels in sensitive membranes or structures like gills or olfactory rosettes. Lipophilic compounds in fine sediment, such as toxic polyaromatic hydrocarbons (PAHs) can be absorbed through lipid membranes of gill tissue, providing a pathway for exposure if fish swim through a sediment plume. Exposure to PAHs and other aromatic compounds typical of petroleum hydrocarbon contamination from industry, spills, and engine exhausts was shown to suppress immune responses in Chinook salmon (Varanasi et al. 1993; Arkoosh et al. 1998, 2001).

The proposed NDD intake sites are downstream of the City of Sacramento where sediments have been affected by historical and current urban discharges from the city. No information on sediment contaminants at these sites is currently available, however metals, PCBs, and hydrocarbons (typically oil and grease) are common urban contaminants that are introduced to aquatic systems via nonpoint-source stormwater drainage, industrial discharges, and municipal wastewater discharges. Many of these contaminants readily adhere to sediment particles and tend to settle out of solution relatively close to the primary source of contaminants. PCBs are persistent, adsorb to soil and organic matter, and accumulate in the food web. Lead and other metals also will adhere to particulates and can bioaccumulate to levels sufficient to cause adverse biological effects. Mercury is also present in the Sacramento River and San Joaquin River systems and could be sequestered in riverbed sediments.

Conditions of Approval: Exposure to contaminants

Covered Activities would impact CHNWR and CHNSR as described above, but these impacts will be avoided and minimized through following Conditions of Approval required by the ITP. In particular, the following measures are key means to reduce this impact to CHNWR and CHNSR.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing work on-site. The Project education program includes several elements related to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

7.13 Hazardous Waste. Permittee shall immediately stop Covered Activities and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three miles per hour. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye (registered for aquatic use by the California Department of Pesticide Regulation, if warranted) to prevent overspray. This measure will minimize the extent to which

CHNSR and CHNWR are exposed to contaminants resulting from herbicide and pesticide use in Covered Activities occurring adjacent to waterways.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Spoils, reusable tunnel material, and dredged material have the potential to contain contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine pesticides). Prior to finalizing Project engineering design and to minimize the potential for Covered Species' exposure to such contaminants, Permittee shall develop a spoils disposal plan that shall address: protocols for sampling and analysis of contaminants in dredge materials, spoils and RTM; handling and disposal of hazardous material; the presence and concentrations of contaminants; potential discharge of contaminants that would affect surface water or groundwater (e.g., instream discharges during dredging, effluent discharge from the disposal site; leachate from the disposal site); a protocol to reduce or eliminate the release of contaminated sediment; and BMPs to be implemented during handling and disposal of any potentially hazardous dredged or excavated material.

9.1.11 In-Water Work Windows. In-water work windows restrict the timing when Permittee is authorized to conduct Covered Activities that may expose CHNWR and CHNSR to contaminants through potential spills of hazardous materials and mobilization of contaminated sediment by minimizing the overlap of Covered Activities with the primary time periods of CHNWR and CHNSR adult and juvenile migration and juvenile rearing in the Delta. All in-water Covered Activities and Covered Activities behind dewatered cofferdams which are expected to generate contaminants are restricted by in-water work windows at over-water geotechnical exploration sites and the NDD intakes, CCF, HOR Gate, and barge landing construction sites. Additional Conditions of Approval discussed in these findings serve to minimize remaining risks of contaminant exposure that remain because CHNWR and CHNSR may be present during Covered Activities within the in-water work windows.

9.1.12 Daily In-Water Work Restriction. Covered Activities may expose CHNWR and CHNSR to contaminants from spills of hazardous materials and mobilization of contaminated sediment. Daily in-water work restrictions will minimize the risk of exposure to contaminants associated with in-water Covered Activities by allowing for fish to pass construction areas at night.

9.1.15 Barge Operations Plan. Permittee shall develop and implement a barge operations plan to further avoid and minimize contamination impacts to CHNWR and CHNSR. The barge operations plan will include measures to minimize mobilization of contaminated sediment by limiting vessel speeds to minimize potential effects of wakes on unarmored banks, limiting direction and velocity of propeller wash to prevent bottom scour, prohibiting anchors from being dragged across the channel bed, requiring use of deck walls to prevent loose materials from blowing or washing off of the deck, and requiring barge operators to adhere to the spill prevention and response plan required by Condition of Approval 9.1.21, and to carry an onboard oil spill containment kit.

9.1.18 Stormwater Pollution Prevention Plan. The primary elements of the Stormwater Pollution Prevention Plan that minimize contamination impacts include the requirement that the Permittee follow all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The plan will also include an accidental spill prevention and response component and measures to prevent nonstormwater discharges from reaching surface water.

9.1.19 Erosion and Sediment Control Plan. Year-round Covered Activities adjacent to waterways have the potential to expose CHNWR and CHNSR to contaminants in runoff. Permittee shall develop and implement an erosion and sediment control plan to further minimize contaminant impacts to CHNWR and CHNSR associated with runoff from Covered Activities into Delta waterways.

Because Covered Activities, such as barge landing construction, will be conducted along Delta waterways adjacent to major agricultural islands, construction sites are likely to contain agricultural-related toxins such as copper and organochlorine pesticides. Sediments act as a sink or source of contaminant exposure, and resuspension of contaminated sediments may have adverse effects on fish that encounter sediment plumes or come into contact with newly exposed sediment. The required erosion and sediment control plan will further minimize exposure of CHNWR and CHNSR to contaminants. Specific elements of the plan to reduce exposure to contamination include actions that divert runoff away from steep, denuded slopes, retain sediment transported by run-off, collect and direct surface runoff at non-erosive velocities to common drainage courses, use sediment and turbidity areas where ground disturbance is adjacent to surface water or wetlands, and deposit or store excavated materials away from drainage courses and keep them covered when stored over five days or within 48 hours of a forecasted rain event.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. Permittee shall develop and implement a Spill Prevention, Containment, and Countermeasure Plan to minimize the potential exposure of CHNWR and CHNSR to contaminants as a result of Covered Activities throughout construction. The Spill Prevention, Containment, and Countermeasure Plan shall include specific actions Permittee shall use to prevent spills, and Permittee shall take in the event of a spill, including emergency notification procedures.

9.1.22 Hazardous Materials Management Plan. Permittee shall develop and implement one or more Hazardous Materials Management Plans (HMMPs) prior to initiating Covered Activities to minimize the risk of exposure of CHNWR and CHNSR to contaminants. The Hazardous Materials Management Plan(s) will include detailed information on the types of hazardous materials used during Covered Activities, phone numbers of emergency response agencies, appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste, and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP(s) shall be approved by in writing by CDFW prior to initiating Covered Activities.

Construction impact: Direct physical injury and mortality

Covered Activities associated with Project construction that are likely to injure or kill CHNWR and CHNSR include construction of the NDD intakes, barge landings, HOR Gate, and CCF. CHNWR and CHNSR may be injured or killed by direct contact with equipment or materials that enter or operate within the open waters of the Sacramento River, adjacent Delta channels, and Old River during construction. There is also a risk of direct mortality of CHNWR and CHNSR as a result of propeller entrainment and wave-induced shoreline impacts (e.g., dewatering). Barge operations may also cause direct physical injury and mortality. Incidental take of individuals of CHNWR and CHNSR may also occur from the Covered Activities in the form of pursue, catch, capture, or attempt to do so as the result of implementation of Conditions of Approval requiring fish collection, handling, transportation, and release. Sub-lethal injury to DS and LFS may lead to increased vulnerability to predation and reduced ability for successful migration, feeding, and spawning.

Potential mechanisms of direct physical injury or mortality include fish being crushed by falling rock (riprap), impinged by sheetpiles, entrained by dredges, struck or entrained by propellers, exposed to violent “prop wash” conditions associated with barge operations, and stranding due to vessel wake action. Direct mortality of CHNWR and CHNSR may also occur as a result of stranding during installation of cofferdams or silt curtains. CHNWR and CHNSR that may be present in the Project Area during in-water work windows will be large, migrating adults that are capable of readily avoiding or moving away from active construction areas, minimizing their risk of being stranded. Smaller, rearing juveniles that may be present in September/October would be at a higher risk of entrapment during dewatering activities. Any stranded fish may experience stress and potential mortality in response to poor water quality (e.g., low dissolved oxygen) and would ultimately die as a result of dewatering or injuries caused by construction activities within the enclosed cofferdam.

The extent, timing, and duration of Covered Activities likely to result in injury or direct mortality overlaps with CHNWR and CHNSR adult and juvenile presence in the Sacramento-San Joaquin Delta. Although there are few direct observations of fish being seriously injured or killed by boat traffic (Rosen and Hales, 1980; Gutreuter et al. 2003), there is general agreement that the shear stresses caused by propellers can injure or kill early life stages (eggs and larval stages of fish) and that juvenile and adult fish are much less susceptible to entrainment because of their greater swimming capability (Morgan et al., 1976; Holland, 1986; Killgore et al., 2001; Wolter and Arlinghaus 2003). Migrating and rearing juveniles may also exhibit an avoidance response but may be less able to avoid direct contact with construction equipment, materials (e.g., riprap), and vessels based on their swimming abilities and greater nearshore and surface orientation. The potential effects of barge operations also include wave-induced disturbances that can affect nearshore juvenile fishes by causing disorientation and stranding during vessel passage (Wolter and Arlinghaus 2003).

Conditions of Approval: Direct physical injury and mortality

Covered Activities would impact CHNWR and CHNSR as described above, but these impacts will be avoided and minimized through following Conditions of Approval required by the ITP. In particular, the following measures are key means to reduce this impact to CHNWR and CHNSR.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. All in-water Covered Activities and Covered Activities behind dewatered cofferdams that are expected to result in direct injury or mortality are restricted by in-water work windows at over-water geotechnical exploration sites and the NDD intakes, CCF, HOR Gate, and barge landing construction sites. The in-water work windows prohibit specific Covered Activities during the primary time periods of CHNWR and CHNSR adult and juvenile migration and juvenile rearing in the Delta. Additional Conditions of Approval discussed in these findings serve to minimize remaining risks of direct injury and mortality that remain because CHNWR and CHNSR may be present during Covered Activities within the in-water work windows.

9.1.12 Daily In-Water Work Restriction. Daily In-Water Work Restrictions will minimize the risk of exposure of migrating adult CHNWR and CHNSR to in-water Covered Activities by allowing for adults can pass construction sites at night (dusk to dawn) when Covered Activities will cease.

9.1.13 Underwater Sound Abatement Plan. Permittee shall develop and implement an underwater sound abatement plan to evaluate the potential effects of underwater noise on CHNWR and CHNSR in the context of applicable and interim underwater noise thresholds, and to reduce underwater noise, to the extent possible, to less than that established for disturbance and injury of fish (ICF Jones and Stokes 2009).

9.1.14 Pile Driving Plan. To the extent that the risk of direct injury or mortality of CHNWR and CHNSR as a result of exposure to impact pile driving cannot be entirely avoided because underwater noise cannot be abated to levels below the California Department of Transportation thresholds (ICF Jones and Stokes 2009), the required pile driving plan will include measures to further reduce direct injury and mortality due to this activity.

9.1.18 Stormwater Pollution Prevention Plan. The Stormwater Pollution Prevention Plan will be developed and implemented to further minimize contamination impacts to CHNWR and CHNSR. Potential effects of contaminants on fish include direct injury and mortality (e.g., damage to gill tissue causing asphyxiation) or delayed effects on growth and survival (e.g., increased stress or reduced feeding), depending on the type of contaminant, extent of the spill, and exposure concentrations.

9.1.19 Erosion and Sediment Control Plan. Permittee shall develop and implement an erosion and sediment control plan to minimize the potential of direct mortality caused by exposure to contamination from erosion and sediment introduction from construction sites year-round. Because construction activities such as barge landings will be constructed on Delta waterways adjacent to major agricultural islands, sites are more likely to contain agricultural-related toxins such as copper and organochlorine pesticides.

9.1.15 Barge Operations Plan. There is a higher risk of direct injury or mortality of juvenile salmonids from propeller strikes than adult salmonids. Barge traffic will also increase the frequency of wave-induced shoreline disturbances, and could result in increased stranding of rearing juveniles that depend on shallow nearshore areas for resting, feeding, and protection from predators. Permittee shall develop a barge operations plan that contains specified measures to minimize physical injury and direct mortality of CHNWR and CHNSR resulting from barges due to propeller strikes or propeller wash, bottom scour from propeller wash, fish stranding due to wakes, accidental spillage of hazardous material, and other impacts to CHNWR and CHNSR due to barge operations.

9.1.16 Fish Salvage Plan. Permittee shall develop and implement a fish salvage plan to minimize the risk of injury and mortality associated with dewatering during Covered Activities. All fish rescue and salvage operations will be conducted under the guidance of a Designated Fisheries Biologist. The Designated Fisheries Biologist, in consultation with CDFW, will determine the appropriate fish collection and relocation methods based on site-specific conditions and construction methods. Permittee shall adhere to specific requirements in the fish salvage plan to minimize the risk of injury and mortality including: notify CDFW at least 7-days prior to an anticipated activity that could result in isolating fish or require fish salvage, determine appropriate site-specific procedures for excluding fish from construction zones, remove fish from construction zones should they become trapped, prevent fish from reentering construction zones prior to dewatering in consultation with CDFW, always precede the use of electrofishing equipment with attempts to seine and/or net fish, conduct electrofishing in accordance with NMFS electrofishing guidelines (NMFS 2000), and follow guidelines to monitor temperatures of holding tanks, avoid overcrowding fish in holding tanks, segregate fish by size, and minimize handling exposure to the extent possible.

9.1.17 Dewatering. Installation of cofferdams or silt curtains in the Sacramento River, construction areas of the HOR Gate, construction and dredging areas of CCF, and the adjacent Old River channel has the potential to strand and subject fish to direct exposure to dewatering. Dewatering will be limited to the in-water construction windows (Condition of Approval 9.1.11 and 9.1.12) to avoid the peak abundance of CHNWR and CHNSR in the Project Area, but will not fully avoid impacts. For CHNSR and CHNWR that may be present during work windows, Condition of Approval 9.1.17 includes various measures to reduce the risk of injury and mortality of CHNWR and CHNSR during dewatering, including a requirement that dewatering intake pumps are screened, and that a Designated Fisheries Biologist shall remain onsite to observe the process and remove fish that were not successfully salvaged prior to dewatering.

Construction impact: Loss and Alteration of Habitat

Construction of the NDD intakes, barge landings, and HOR Gate will result in permanent losses of 1.02 linear miles of channel margin habitat and 31.9 acres of tidal perennial aquatic habitat on the Sacramento River, several channels of the east, south, and north Delta, and the Old River corridor. Covered Activities at the NDD intakes will result in the temporary loss of 20.1 acres of tidal perennial aquatic habitat. Covered Activities in CCF will permanently alter 2,190 acres of tidal perennial habitat.

Almost all of the of the CHNWR and CHNSR adults and juveniles that migrate annually through the lower Sacramento River and Delta will pass the three NDD intake sites during the construction period, and thus will be exposed to the physical changes in aquatic and channel margin habitat. At each intake location, these structures will encompass 1,600-2,000 linear feet of shoreline and 35 feet (5-7%) of the total channel width. During and following construction, no significant changes in passage conditions (water depths and velocities) for adults are expected at the NDD intake sites because they use deeper, offshore portions of the channel for holding and migration. However, permanent loss and alteration of shoreline and nearshore areas resulting from the installation of cofferdams and riprap, removal of vegetation, and construction dredging will permanently reduce the quality of channel margin and nearshore habitat for rearing and migrating juveniles within the footprint of each intake.

Construction of the proposed NDD intake facilities will result in temporary and permanent losses or alteration of aquatic habitat suitable for juvenile CHNWR and CHNSR on the Sacramento River through changes in channel depths, benthic habitat, cover, and temporary in-water and overwater structure (barges, spud piles) within active work areas adjacent to the NDD intake structures and installation of levee slope cofferdams, transition wall structures, and bank protection (riprap). Covered Activities at the NDD intake construction sites will result in temporary effects on water quality, including turbidity and suspended sediment, underwater noise, and contaminants in approximately 20.1 acres of tidal perennial habitat. Permanent impacts in the footprint of the NDD intake structures, including cofferdams, transition wall structures, and bank protection (riprap), will result in the permanent loss of approximately 6.6 acres of tidal perennial habitat and 1.02 linear miles of shoreline and associated riparian vegetation.

Construction and operation of barge landings will result in permanent loss of 22.4 acres of tidal perennial habitat in several channels of the east, south, and north Delta. Permanent loss or alteration of habitat associated with construction of barge landings include the in-water work areas and permanent footprints of docks, mooring structures, and other in-water and overwater structures. The aquatic construction sites at individual barge landings will encompass 0.34 acre of overwater structures, approximately 300 linear feet of shoreline, and 5-19% of the total width of the adjacent channel or slough. These conditions will exist throughout the construction period.

CHNWR and CHNSR adults and juveniles that enter the east and south Delta via the Delta Cross Channel, Georgiana Slough, Three Mile Slough, and the San Joaquin River (junction of Sacramento and San Joaquin River at Sherman Island), and the NDD intakes will be impacted by habitat loss or alteration associated with construction barge landings and barge operations. The lack of natural cover for juvenile fish and presence of structural and overhead cover for predators may increase the risk of predation at the proposed barge landing sites.

Dredging, excavation, and expansion of CCF and construction of the new water conveyance facilities at CCF will result in temporary and permanent alteration of aquatic habitat in CCF. CCF is considered highly degraded habitat for CHNWR and CHNSR because it has been highly altered for the purpose of water conveyance and lacks many of the structural and functional attributes of habitat for CHNWR and CHNSR due to channelization, levee clearing and armoring, maintenance dredging, unfavorable hydrodynamic conditions, lost connectivity of migration corridors high predator densities, and entrainment into existing Project facilities. Construction activities at CCF are expected to permanently alter 2,190 acres of tidal perennial aquatic habitat at CCF through changes in water depths, vegetation, and substrate within CCF and Old River. Temporary effects of construction activities on water quality, including turbidity and suspended sediment, underwater noise, and contaminants, were previously discussed in these findings, and Conditions of Approval related to these construction effects would apply within the CCF.

Operations of the SWP during the Project construction period are subject to the terms of separate CESA and federal ESA authorizations that require flow-based measures to reduce the entrainment of CHNWR and CHNSR into the CCF and monitoring of loss and salvage at the John E. Skinner Fish Protection Facility (Skinner Fish Facility). No additional compensatory habitat mitigation is required by the ITP for the loss and alteration of habitat within CCF. Condition of Approval 9.6.6 Clifton Court Forebay Loss Multiplier requires the Permittee to re-evaluate the methods used to calculate loss of CHNWR and CHNSR in CCF due to physical changes in CCF.

Conditions of Approval: Loss and Alteration of Habitat

Covered Activities would impact CHNSR and CHNWR through loss and alteration of habitat as summarized above, but these impacts will be avoided and minimized through the following Conditions of Approval required by the ITP, summarized below.

7.3 Designated Fisheries Biologist. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a fisheries biologist (Designated Fisheries Biologist) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Fisheries Biologist has 1) a 4-year college degree in fisheries or biology, or a related degree, 2) at least 2 years of professional experience in fisheries field surveys and fish capture and handling procedures, and 3) completed an electrofishing training course such as Principles and Techniques of Electrofishing (USFWS, National Conservation Training Center), or similar course. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat. Permittee shall obtain CDFW approval of the Designated Fisheries Biologist in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Fisheries Biologist must be changed.

7.4 Designated Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Requiring updated mapping and tracking of all Covered Species habitat disturbed by Covered Activities.

8.6 Compliance Report. Requiring monthly compliance reporting that documents impacts to Covered Species habitat, implementation of Permit measures.

8.7 Annual Status Report. Requiring annual reports that document, among other things, Covered Activities' impacts to Covered Species habitat during the preceding year and since issuance of the ITP and acreages and features anticipated to be disturbed in the succeeding 12 months.

8.8 CNDDB Observations. The Designated Biologist shall submit all observations of Covered Species to CDFW's California Natural Diversity Database (CNDDB) within 60 calendar days of the observation and the Designated Biologist shall include copies of the submitted forms with the next Monthly Compliance Report or ASR, whichever is submitted first relative to the observation.

8.9.1 Project Construction Report. Requiring a report no later than 180 days of completion of all mitigation measures that includes documentation of implementation of all mitigation measures, all information about Project-related incidental take and impacts of the taking to Covered Species.

9.6.10 NDD Intakes Pre-construction Studies. Pre-construction studies 5 and 6 are intended to both inform final design of the NDD intakes as well as provide critical information related to the spatial and temporal patterns of both native and nonnative fish species in the vicinity of the NDD intakes. The following studies will further minimize the adverse effects associated with construction of the NDD Intakes and increased vulnerability to predation due to NDD construction described above.

Pre-construction Study 5 - Predator Habitat Locations: The purpose of this study shall be to perform a field evaluation of predator habitat at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District) to inform final design of the NDD intakes. This study will help determine the best designs possible for deterring favorable holding habitat for large predatory fish, by reducing or modifying structural aspects of the design and construction of the NDD.

Pre-construction Study 6 Predator Reduction Methods: The purpose of this study shall be to evaluate predator reduction techniques implemented at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District), to determine whether similar techniques could minimize potential predation impacts on Covered Fish Species and be feasible to implement at the NDD intakes.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Prior to finalizing Project engineering design Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, RTM, and dredged material. The spoils disposal plan shall contribute to minimizing impacts to CHNWR and CHNSR habitat by describing requirements for the size, locations, and required characteristics of designated storage areas; storage site preparation and dewatering; excavation of contaminated material; and chemical characterization, drainage, and treatment. These measures will minimize temporary habitat impacts associated with increased sediment, turbidity, and contaminant exposure to CHNWR and CHNSR.

9.1.11 In-Water Work Windows. Implementation of in-water work windows will minimize temporary habitat impacts associated with dredging and other Covered Activities at the NDD intakes, HOR Gate, barge landings, and CCF construction sites and adjacent waterways that increase sediment, turbidity and contaminant exposure to CHNWR and CHNSR habitat.

9.1.19 Erosion and Sediment Control Plan and 9.1.20 Erosion Control Stabilization Measures. Increased erosion and mobilization of sediment in runoff from disturbed levee surfaces and in-water Covered Activities may increase turbidity and suspended sediment during winter and spring. Because potential mobilization of contaminants is closely linked to sediment disturbance and associated increases in turbidity and suspended sediment impacts on habitat, turbidity monitoring and control measures (e.g., silt curtains) to achieve compliance with existing Basin Plan objectives (Central Valley Water Board 1998) will be an important measures for limiting dispersal of contaminated sediments during dredging and other in-water construction activities, and reducing potential temporary habitat impacts to CHNSR and CHNWR.

9.1.15 Barge Operations Plan. Barge operations will occur year round, therefore impacts on CHNWR and CHNSR habitat as a result of elevated turbidity and contaminant exposure due to barge operations will not be avoided through implementation of Conditions of Approval 9.1.11 and 9.1.12 (In-Water Work Windows and Daily In-water Work Restriction). Restriction of barge traffic port of origination to barge landing destination to seasonal windows as described above will minimize impacts temporary habitat impacts of barge operations on CHNWR and CHNSR. Permittee shall develop and implement a barge operations plan to further avoid and minimize impacts to CHNWR and CHNSR habitat. The barge operations plan will include a commitment by the Permittee to work in conjunction with CDFW and other responsible agencies through the engineering design phase to minimize the number of trips necessary to conduct Covered Activities and to identify barge routes and operational criteria that minimize temporary turbidity, contaminant, and habitat alteration effects to benthic habitats.

ii. CHNWR and CHNSR Project Construction Mitigation Measures

The Conditions of Approval above will reduce, but not eliminate, the impacts to CHNWR and CHNSR of construction related underwater noise, increased turbidity and suspended sediment, contaminant exposure, direct physical injury and mortality, and the temporary and permanent loss and alteration of habitat. Therefore, the following mitigation measures are required to ensure full mitigation of the impacts of the taking.

Covered Activities associated with construction will result in a total of 31.9 acres of permanent impacts to CHNWR and CHNSR tidal perennial aquatic habitat and 1.02 linear miles of channel margin habitat. Covered activities will also result in temporary impacts to 20.1 acres of tidal perennial aquatic habitat. Permittee shall restore and permanently protect 154.8 acres of tidal perennial habitat and 3.06 linear miles of channel margin habitat as compensatory mitigation for permanent, construction-related impacts. Potential locations for compensatory habitat restoration include upstream (above Red Bluff Diversion Dam), Sherman Island, Cache Slough, North Delta or other areas approved by CDFW.

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CHNWR and CHNSR, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1 and the requirements of Attachment 4 – *Covered Species-Specific Criteria for HM Lands*. Permittee shall ensure permanent protection and funding for perpetual management of compensatory CHNWR and CHNSR tidal perennial and channel margin habitat, including monitoring for suitable habitat features and presence of CHNWR and CHNSR.

iii. CHNWR and CHNSR Project Construction Final EIR/EIS Avoidance and Minimization Measures

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures and environmental commitments, required to be implemented by the ITP that would further ensure that any impacts to CHNSR and CHNWR resulting from Covered Activities would be minimized and fully mitigated.

- Mitigation Measure AQUA 1A (Minimize the use of impact pile driving to address effects of pile driving and other construction-related underwater noise)
- Mitigation Measure AQUA 1B (Monitor underwater noise and, if necessary, use an attenuation device to reduce effects of pile driving and other construction-related underwater noise)
- Environmental Commitment 3B.2.1/AMM 28 (Geotechnical studies)
- Environmental Commitment 3B.2.5/AMM 3 (Develop and implement stormwater pollution prevention plans)
- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- Environmental Commitment 3B.2.7 (Develop and implement fish rescue and salvage plans)
- Environmental Commitment 3B.2.8/AMM 7 (Develop and implement a barge operations plan, including sensitive resources, responsibilities, avoidance and minimization measures, performance measures, contingency measures
- Environmental Commitment 3B.2.12/AMM 32 (Develop and implement hazardous materials management plans)
- Environmental Commitment 3B.2.13/AMM 5 (Develop and implement spill prevention, containment, and countermeasure plans)
- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material (RTM), and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- Environmental Commitment 3B.2.20/AMM 27 (Selenium management)
- Environmental Commitment 4 (Tidal natural communities restoration)

- Environmental Commitment 6 (Channel margin enhancement)
- Environmental Commitment 12 (Methylmercury management)
- AMM 2 (Construction best management practices and monitoring)
- AMM 10 (Restoration of temporarily affected natural communities)
- AMM 29 (Design standards and building codes)

iv. CHNWR and CHNSR Project Operations Impacts and Avoidance and Minimization Measures

Project operation activities and their resulting impacts are expected to result in the incidental take of CHNWR and CHNSR. The Covered Activities which are expected to result in incidental take of individuals of CHNWR and CHNSR include operations of the: NDD intakes, South Delta Export Facilities, Skinner Fish Facility, HOR Gate, and CCF Aquatic Weed Control Program. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to CHNWR and CHNSWR is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Analyses of the effects of Project operations on CHNWR and CHNSR, comprised of both take and impacts of the taking, are split between near field effects occurring at or near Project facilities and far field effects associated with Project-caused alterations to flow conditions. In general, analyses of take and impacts of the taking below relied upon scientific literature in peer-reviewed journals, state and federal agency publications, the current Biological Opinions on the operations of the SWP and CVP (USFWS 2008 and NMFS 2009), the California Water Fix Biological Opinions (USFWS 2017 and NMFS 2017) the *Bay Delta Conservation Plan/California WaterFix Final Environmental Impact Report/Environmental Impact Statement*, hydrologic analyses conducted to support the California Water Fix 2081(b) application and the Independent Review Panel Report for the 2016 California Water Fix Aquatic Science Peer Review (Simenstad 2017). Near-field and far-field effects are characterized for the following Project facilities associated with Project operations: North Delta Diversion Intakes, South Delta Export Facilities, HOR Gate, and Suisun Marsh facilities.

Several model-based analyses in the CWF 2081(b) application compare physical and biological conditions between two primary modeling runs, the no action alternative (NAA) and Project operations. The NAA model runs are used to represent physical conditions associated with CVP/SWP operations using existing facilities and governed by NMFS (2009), USFWS (2008) and CDFG (2009) and other currently existing regulatory constraints, forecasted at year 2030. The Project operations model Project runs incorporate ongoing operation of the SWP and CVP with construction and operation of the NDD intakes and modified operational critieria for the existing south Delta export facilities that are a part of the Project, also forecasted at about 2030. By comparing outputs from the NAA and Project operations modeling runs the CWF BA (ICF International 2016b) characterizes potential physical and biological effects of Project operations when the NDD Intakes are expected to be complete, in about year

2030, with climate change and sea level rise. The comparative analyses of the NAA and Project operations were used in the biological assessments prepared for federal ESA documentation and were carried over to the 2081(b) application and are summarized below.

North Delta Diversions Near Field Effects

Incidental take of rearing and emigrating juvenile CHNWR and CHNSR in the form of mortality ("kill") may occur as a result of operations of the NDD by means of entrainment and impingement. Increased vulnerability to predation is also expected to occur in the vicinity of the NDD intakes.

The areas where authorized take of the CHNWR and CHNSR is expected to occur include: the location of the NDD intakes at the east bank of the Sacramento River between Clarksburg and Courtland at river miles 41.1, 39.4, and 36.8 and the Delta downstream of the NDD intakes.

Emigrating juvenile CHNWR pass the Red Bluff Diversion Dam beginning as early as mid-July, typically peaking in September, and can continue through March (Vogel and Marine 1991; NMFS 1997a). Many juveniles rear in the Sacramento River below Red Bluff Diversion Dam for several months before they reach the Delta (Williams 2006). Juvenile CHNWR from the upper Sacramento River enter the Delta from September through April with the main pulse in December and January, although this emigration pulse can extend through April, depending on the water year type. Beach seines and mid-water trawls on the mainstem Sacramento River near the City of Sacramento have detected fish entering the Delta as early as mid-November (USFWS 2001, 2003). However, rotary screw trap data at Knights Landing indicate some CHNWR juveniles may enter the Delta as early as September (pers. comm. Jason Julienne 2017). The timing of migration varies annually because of changes in river flows, dam operations, seasonal water temperatures, hydrologic conditions, and water year type. The entire population of the winter-run Chinook salmon must pass the NDD Intakes as emigrating juveniles. Juvenile CHNWR are present in the Delta primarily from November through early May based on data collected from trawls in the Sacramento River at West Sacramento (river mile 55) (USFWS 2006), although the overall timing may extend from September through May (NMFS 2012). Additionally, a study of CHNWR juvenile migration showed differences in timing of catch at Knights Landing and subsequent catch at Chipps Island indicating the apparent use of the Delta or habitats just north of the Delta for extended periods (41-117 days) prior to ocean entry (Del Rosario et al. 2013). CHNWR juveniles remain in the Delta until they reach a fork length of approximately 118 millimeters and are between 5 and 10 months of age. Distinct emigration pulses from the Delta appear to coincide with high precipitation and increased turbidity (Hood 1990, as cited in Reclamation 2008). Monitoring by the USFWS at Chipps Island in the western Delta indicates that CHNWR (identified with genetic methods) leave the Delta from January through June, with a peak in emigration occurring in late February/March/early April (Pyper et al. 2013). This peak in emigration timing is supported by abundance data obtained from recoveries of CHNWR salmon (identified with genetic methods) at the SWP's Skinner Fish Facility and the CVP's

Tracy Fish Collection Facility (TFCF) in the South Delta. (Harvey et al. 2014).

CHNSR emigration timing is highly variable within and across years because they may migrate downstream as fry, parr, smolts, or yearlings. CHNSR fry migrants are approximately 40 millimeters between December and April in Mill, Butte, and Deer Creeks (Lindley et al. 2004). Studies in Butte Creek found that the majority of CHNSR migrants are fry during December, January, and February, and that fry movements appear to be influenced by flow (Ward et al. 2002, 2003; McReynolds et al. 2005). Small numbers of CHNSR remained in Butte Creek to rear and emigrate as yearlings the following November through February. Juvenile emigration patterns in Mill and Deer Creeks are very similar to patterns observed in Butte Creek, with the exception that juveniles from Mill and Deer creeks typically exhibit a later young-of-the-year migration and an earlier yearling migration (Lindley et al. 2006.) Mill and Deer creeks peak smolt outmigration is generally between April and May. Peak catches of juveniles at Knights Landing are from February through May and CHNSR are found in the Delta into late August. (ICF International 2016a). Peak movement of yearling CHNSR in the Sacramento River at Knights Landing occurs in December, and is high in January, tapering off through the middle of February; however, juveniles were also observed between November and the end of February. (Snider and Titus 2000.) Monitoring by the USFWS at Chipps Island in the western Delta indicates that CHNSR (identified with genetic methods) leave the Delta from February through June, with a peak in emigration occurring in mid-March through May (Pyper et al. 2013). The timing of migration varies annually because of changes in river flows, dam operations, seasonal water temperatures, hydrologic conditions, and water year type.

<u>Near-field effect of NDD intake operations: Entrainment</u>

The fish screens on the NDD intakes will be sized and operated to exclude most juvenile CHNWR and CHNSR, resulting in little take by entrainment. Juvenile Chinook salmon at sizes of 30 mm or greater may occur near the NDD intakes (NMFS 1997b). Based on a conservative body fineness ratio of 10 (from Delta Smelt estimates by Young et al. 1997) and applying the equations of Young et al. (1997), the NDD Intake fish screens with a 1.75-mm opening would be estimated to be effective at excluding juvenile CHNWR and CHNSR of 22-mm standard length and greater (McEwan 2001). Therefore, little to no entrainment of salmonids is expected at the north Delta diversions. Note, however, that one juvenile Chinook salmon of 32-mm fork length—standard length would be slightly shorter—was collected during entrainment monitoring at the Freeport Regional Water Project intake in January 2012 (Kozlowski pers comm.), a facility with the same screen opening size as proposed for the NDD intakes. This suggests occasional entrainment of very small CHNWR and CHNSR could occur at the NDD intakes.

<u>Near-field effect of NDD intake operations: Impingement</u>

Juvenile CHNWR and CHNSR will have the potential to contact and be impinged on the NDD Intake screens resulting in take. As discussed further under the "*Uncertainty in* *near-field effects of NDD intake operations*," below, while the potential for impingement has been evaluated through laboratory studies, there are no existing field evaluations of screens of the type and scale planned for the NDD intakes, therefore extent or magnitude of impingement cannot be stated with certainty based on best available scientific and other information.

Near-field effect of NDD intake operations: Increased vulnerability to predation

There is potential for the NDD intake structures and export operations to result in increased vulnerability of CHNWR and CHNSR to predation within the NDD intake reach and in front of each NDD intake screen. Predation of juvenile CHNWR and CHNSR at the NDD intakes could occur if predatory fish aggregate along the screens, as has been observed at a long fish screen on the Glenn Colusa Irrigation District's (GCID) Sacramento River pump station (Vogel 2008). In that study, mean survival of tagged juvenile Chinook salmon was ~95% along the fish screens (total length just under 1,300 feet) in 2007. 2007 was the only year of the study in which flow-control blocks at the weir at the downstream end of the fish screen were removed to reduce predatory fish concentration. However, the percentage of tagged juvenile Chinook salmon released at the upstream end of the fish screen that were recaptured at a downstream sampling location was similar or slightly greater than that measured in a control reach (i.e. the percentage of tagged juvenile Chinook salmon released at the downstream end of the fish screen), when standardized for the distance that the fish had to travel to the recapture site. These data suggest that the predation rates were similar in the screen reach and the control reach and that presence of the screen did not affect survival within the channel. However, test juvenile Chinook salmon used to estimate survival in the channel downstream of the screen were released prior to those released at the upstream end of the fish screen, which could have confounded comparisons of relative survival between these groups if predatory fishes became partly satiated prior to the arrival of the fish released at the upstream end of the screen (thus making their survival relatively higher than otherwise would have occurred) (Vogel 2008).

Uncertainty in near-field effects of NDD intake operations:

The Project includes construction of three intakes (Intake 2, Intake 3, and Intake 5) on the east bank of the Sacramento River between Clarksburg and Courtland, in Sacramento County, California. The proposed lengths for the overall structures of Intake 2, Intake 3, and Intake 5 fish screens are 1,969, 1497, and 1901 feet respectively and together total 5,367 feet or approximately one mile. Excluding concrete approach structures and fish refugia at each intake, the fish screen lengths for Intake 2, Intake 3, and Intake 5 total 1,350, 1,110, and 1,350 feet respectively. Each intake will be designed to allow for a 3,000 cfs diversion capacity. There is no series of fish screens of comparable size in similar proximities in existence against which entrainment, impingement, and increased vulnerability to predation impacts to Covered Fish Species can be compared.

Although the best available scientific information has been utilized to estimate impacts, performance of the NDD intake structures (including fish screens and refugia), the efficacy of design criteria, and the associated avoidance and minimization measures cannot be simulated in the laboratory environment and therefore will require further laboratory and field studies and coordination during design, construction and operations monitoring to ensure impacts to Covered Fish Species are minimized.

Specifically related to impingement effects, experimental studies at the UC Davis Fish Treadmill Facility found that Chinook salmon experienced frequent contact with a simulated fish screen but were rarely impinged (defined as prolonged screen contacts >2.5 minutes) and impingement was not related to any of the experimental variables examined (Swanson et al. 2004). Swanson et al. (2004) found that juvenile Chinook salmon mortality and injury rate in fish treadmill experiments were not statistically related to flow regime or screen contact rate. Although Swanson et al. (2004) provide equations to estimate screen contact rate for juvenile Chinook salmon, preliminary calculations for this effects analysis suggested that these equations did not perform well for the lengths of screen contemplated for the proposed NDD. Additionally, because this study was conducted in a two-foot wide channel, the equations may not be wholly applicable to the effects of NDD Intakes, where fish will be in a much wider channel and may be able to move away from the screens or may not be in an area of the channel exposed to their effects. The extent to which the relatively benign experimental environment at UC Davis Fish Treadmill Facility is representative of Sacramento River conditions is uncertain. However, the proposed NDD intake screens will have a smooth surface and the potential for frequent screen cleaning (cycle time no more than 5 minutes) will provide additional protection to minimize screen surface impingement of juvenile Chinook salmon and reduce the risk of abrasion and scale loss for any fish that does come into contact with the screens (Swanson et al. 2004).

Screen passage time is another useful measure of potential effects on Chinook salmon as a result of the NDD intakes. Shorter passage times would limit the potential for adverse effects (e.g., predation or screen contact). Swanson et al. (2004) also showed that screen passage time for a representative winter water temperature of 12° C may vary as a result of sweeping velocity at an approach velocity of 0.2 ft/s. Although Swanson et al. (2004) provide equations to estimate screen contact rate for juvenile Chinook salmon, preliminary calculations for this effects analysis suggested that these equations did not perform well for the lengths of screen contemplated for the proposed NDD (ICF International 2016b, Appendix 5.D Quantitative Methods and Detailed Results for Effects Analysis of Chinook Salmon, Central Valley Steelhead, Green Sturgeon, and Killer Whale, Section 5.D.1.1.1.1, Screen Passage Time (Figure 4.3-1 and Figure 4.3-2). It should be noted that the equations of Swanson et al. (2004) estimate very long screen passage times across the NDD intake screens at certain sweeping velocity and approach velocity combinations, e.g., over 4,600 minutes for 7.9-cm fish along NDD intakes 2 and 5 at sweeping velocity of 0.4 ft/s. Such estimates are far in excess of the duration of the experimental trials (120 minutes) used to derive the swimming data and therefore should be treated with caution.

Estimates of screen passage times vary depending on the size of juvenile Chinook salmon and their general negative rheotaxis (swimming against the prevailing current)

(Swanson et al. 2004). Larger fish have greater swimming ability, so their peak screen passage time is somewhat greater than that of smaller fish. Swimming velocity is also lower at night than during the day for a given set of flow conditions; this generally results in screen passage time decreasing as sweeping velocity increases over the full range of sweeping flows examined, because screen passage velocity becomes more negative (i.e., fish move downstream more quickly). Swanson et al. (2004) also found that at warmer temperatures (19° C), the larger fish had a greater tendency to move downstream with the current (negative rheotaxis), consistent with a behavioral shift to outmigration; this would result in considerably lower screen passage times.

In summary, juvenile CHNWR and CHNSR migrating downstream close to shore may encounter several of the proposed intakes within a few hours, depending on travel time. Because of the lack of an established relationship between passage time, screen contact rate and injury or mortality, it is not possible to state with certainty the extent of the effects of the NDD intakes on juvenile CHNWR and CHNSR. As discussed further under the "Summary of Avoidance and Minimization Measures Included in the ITP," below, this uncertainty will be addressed during implementation of the Project through monitoring and targeted studies examining impingement and passage time along the intakes.

North Delta Diversions: Far Field Effects

Impacts of the authorized taking associated with Project operations also include indirect impacts to CHNWR and CHNSR related to temporal losses, increased habitat fragmentation and the Project's incremental contribution to cumulative impacts (indirect impacts). These impacts include: increased migration time of emigrating fry, parr and smolts leading to increased vulnerability to predation, other sources of mortality and injury, and greater risk of entry into migration routes with higher mortality such as Georgiana Slough. Risk of entry into the interior Delta, where mortality rates of juvenile salmonids are higher, is expected to increase with operations of the Project because reduced net flow downstream of the NDD intakes would result in greater tidal influence and, therefore, more reverse flow at the Sacramento River junction with the DCC and Georgiana Slough.

The primary cause of NDD export impacts is reduced flow velocities and volumes in the Sacramento River and other north Delta channels downstream of the NDD, particularly during wetter water years. Reduced net flow downstream of the NDD intakes would result in greater tidal influence and more low flows, slack flows, and reverse flows at the Sacramento River junction with the DCC and Georgiana Slough.

The following modeling analyses were utilized to assess the flow-survival relationships and impacts of NDD intake operations on CHNWR and CHNSR:

- Channel Velocity (DSM2-HYDRO)
- Entry Into Interior Delta
- Flow Routing Into Channel Junctions

- Through-Delta Survival
    - Delta Passage Model
    - Newman 2003 (CHNSR only)
    - Perry 2010
    - Perry Survival Model
- Life Cycle Models (CHNWR only)
    - IOS
    - OBAN
    - WRLCM

<u>Far-field effect of NDD intake operations: Channel velocity (DSM2-HYDRO)</u>

Three velocity metrics were assessed using the DSM2-HYDRO model to understand impacts of NDD intake operations on channel velocity: magnitude of channel velocity, magnitude of negative velocity, and proportion of time in each day that velocity was negative. Lower overall velocity, greater negative velocity, and a greater proportion of negative velocity are all indicators of potential adverse effects to juvenile CHNWR and CHNSR, because they are associated with delayed migration or advection into migration pathways with lower survival. In the north Delta, lower flows in the Sacramento River downstream of the NDD intakes as a result of Project operations led to lower median channel velocity under the Project operations relative to the NAA (ICF International 2016a, Table 4.3-10). Assuming that greater diversions at the NDD intakes will occur in wetter years, the reduction in median velocity as a result of the Project ranged from 10–24% in wet years to 4–11% in critical years, which equates to absolute differences of 0.23–0.57 ft/s in wet years to 0.04–0.15 ft/s in critical years. Sacramento River channels farther downstream upstream and downstream of Georgiana Slough had similar patterns of difference, but with lower magnitude of change, reflecting greater tidal influence; this was also evident in Sutter Slough and Steamboat Slough (ICF International 2016a, Table 4.3-10), with the latter being farther downstream than the former. Overall, the results of the analysis of channel velocity suggest the potential for adverse effects to migrating juvenile CHNWR and CHNSR migrating downstream through the north Delta from the Sacramento River basin caused by lower overall velocity, somewhat greater negative velocity, and a greater proportion of time with negative velocity. Combined, these changes may delay migration and result in greater repeated exposure of juvenile CHNWR and CHNSR to entry into migration routes with lower survival, particularly Georgiana Slough (ICF International 2016a).

<u>Far-field effect of NDD intake operations: Entry into interior Delta</u>

Juvenile CHNWR and CHNSR may enter the interior Delta from the mainstem Sacramento River through the Georgiana Slough and Delta Cross Channel junctions. Survival through the interior Delta from the Sacramento River has been shown to be consistently lower than in the river mainstem (Perry et al. 2010, 2012b; Brandes and McLain 2001; Singer et al. 2013). Based on observed patterns for hatchery-origin late fall–run Chinook salmon Perry et al. (2012b) found that eliminating entry into the interior Delta through Georgiana Slough and the Delta Cross Channel would increase overall through-Delta survival by up to approximately one-third (10–35%); this represents an absolute increase in survival of 2–7%.

The Project has the potential to result in changes in interior Delta entry on the Sacramento River and the San Joaquin River. Less flow in the Sacramento River (which would occur because of exports at the NDD intakes) will lead to a greater tidal influence at the Georgiana Slough/DCC junction (Perry et al. 2015) and a greater proportion of flow entering the junction (Cavallo et al. 2015).

Far-field effect of NDD intake operations: Flow routing into channel junctions

A comparison of the proportion of flow entering important channel junctions from the Sacramento River between modeled operations of the Project and the NAA provides an indication of potential differences in juvenile CHNWR and CHNSR entry into the interior Delta. The proportion of flow entering a junction generally is a reasonable proxy for the proportion of fish entering the junction (Cavallo et al. 2015). For the Sacramento River, the junctions analyzed included Sutter and Steamboat Sloughs Georgiana Slough, and the DCC. Entry into the Sutter and Steamboat Sloughs is considered beneficial as these are relatively high survival migration pathways that allow fish to avoid entry into the interior Delta Georgiana Slough and the DCC where survival is lower (Perry et al. 2010; 2012a).

Overall, the flow routing analysis suggested that CHNWR and CHNSR migrating down the Sacramento River would have somewhat greater potential to enter the interior Delta through Georgiana Slough, potentially resulting in adverse effects because of the relatively low survival rates in that migration route. At Sutter Slough, the most upstream junction, there would be little change in flow routing patterns between the NAA and Project operations, although in one case (December of critical years) there was a 5% reduction in flow routing into Sutter Slough under Project operations (ICF International 2016a, Table 4.4-12). Slightly farther downstream at Steamboat Slough, Project operations are expected to result in a change of less than 5% in flow routing in February and March of below normal and dry years. The DCC gates are generally closed from December through May, limiting the impacts of changes in flow routing into the DCC in that period because CHNWR and CHNSR would not ultimately be routed into the interior Delta during these times. However, there are small impacts of changes in flow routing as a result of the Project in June, when the DCC gates are open.

Far-field effect of NDD intake operations: Through-Delta survival

Various analytical tools were used to provide biological context for the anticipated differences in Delta hydrodynamics between the NAA and Project operations. These include the Delta Passage Model, analyses based on Newman (2003), Perry (2010), the

Perry Survival Analysis 2017 (NMFS 2017b), the Interactive Object-oriented Simulation Chinook Life Cycle Model (IOS), the Oncorhynchus Bayesian Analysis (OBAN), and the Sacramento River Winter-run Life Cycle Model (WRLCM). For detailed descriptions of these models see ITP Attachment 6.

Delta Passage Model. The Delta Passage Model (DPM) simulates survival differences between scenarios by migratory route and for overall through Delta survival to Chipps Island. The DPM utilizes DSM2 hydrology of CWF operating scenarios based from acoustic tag data (Perry et al. 2010) and statistical equations (Newman & Brandes 2010) and is applicable to Sacramento basin Chinook smolts. The DPM relies predominantly on data from acoustic-tagging studies of large (>140 mm) smolts, and therefore its conclusions should be applied very cautiously to pre-smolt migrants. Salmon juveniles less than 80 mm are more likely to exhibit rearing behavior in the Delta (Moyle 2002) and thus likely will be represented poorly by the DPM.

The DPM results for CHNWR suggested that total through-Delta survival would be similar or lower under the Project as under the NAA as a result of Project operations reducing river flow downstream of the NDD intakes. Mean total through-Delta survival is expected to be reduced by 2% (to 0.43 survival under Project operations) in wet years, 2% (to 0.39 under Project operations) in above normal years, 6% (to 0.29 under Project operations) in below normal years, 7% (to 0.28 under Project operations) in dry years, and 4% (to 0.24 under Project operations) in critical years as a result of Project operations (ICF International 2016a, Table 4.3-14). Mean survival down the mainstem Sacramento River route is expected to be reduced by 5% (to 0.46 under Project operations) in wet years, 6% (to 0.42 under Project operations) in above normal years, 8% (to 0.31 under Project operations) in below normal, 8% (to 0.30 under Project operations) in dry years, and 4% (to 0.26 under Project operations) in critical years(ICF International 2016a, Table 4.3-14). A slightly lower (1–2%) proportion of fish were predicted to enter Sutter and Steamboat Sloughs under the Project compared to NAA as a result of changes in the flow routing into junctions. Mean survival down the Sutter and Steamboat Sloughs is expected to be reduced by 4% (to 0.50 survival under Project operations) in wet years, 5% (to 0.46 under Project operations) in above normal years, 7% (to 0.35 under Project operations) in below normal years, 8% (to 0.34 under Project operations) in dry years, and 4% (to 0.30 under Project operations) in critical years (ICF International 2016a, Table 4.3-14). A slightly greater (1–2%) proportion of fish used the interior Delta (Georgiana Slough/DCC) migration route under the Project compared to NAA as a result of changes in the flow routing into junctions. Mean survival through the interior Delta route is expected to increase by 28% (to 0.23 survival under Project operations) in wet years, 19% (to 0.20 under Project operations) in above normal years, and increase by 5% (0.15) in below normal years as a result of reductions in south Delta exports in comparison to the NAA, but will remain poor relative to predicted survival in other channels. Mean survival through the interior Delta route is expected to remain the same in below normal years (to 0.15 under Project operations) and decrease slightly in critical years by 1% (to 0.12 under

Project operations) (ICF International 2016a, Table 4.3-14). Both scenarios assumed a notched Fremont Weir, Yolo Bypass entry, therefore survival in the Yolo Bypass was projected to be similar between NAA and Project scenarios (ICF International 2016b, Appendix 5.D, Section 5.D.1.2.2.2.5.4 Route-Specific Survival).

For CHNSR, the DPM results suggested that through-Delta survival under the Project would be similar to or lower than the NAA as a result of Project operations reducing river flow downstream of the NDD intakes (ICF International 2016a, Figure 4.4-4 and Table 4.4-13). Mean total through-Delta survival is expected to be reduced as a result of the Project by 1% (to 0.42 survival) in wet years, 2% (to 0.36 under Project operations) in above normal years, 3% (to 0.26 under Project operations) in below normal years, 4% (to 0.27 under Project operations) in dry years, and 1% (to 0.22 under Project operations) in critical years (ICF International 2016a, Table 4.4-13). Mean survival down the mainstem Sacramento River route is expected to be reduced as a result of the Project by 4% (to 0.44 under Project operations) in wet years, 5% (to 0.37 under Project operations) in above normal years, 4% (to 0.28 under Project operations) in below normal years, 5% (to 0.28 under Project operations) in dry years, and 1% (to 0.23 under Project operations) in critical years as a result of reduced river flow downstream of the NDD intakes during Project operations (ICF International 2016a, Table 4.4-13). A slightly lower (1–2%) proportion of fish were predicted to enter Sutter and Steamboat Sloughs under the Project compared to NAA as a result of changes in the flow routing into junctions. Mean survival down the Sutter and Steamboat Sloughs is expected to be reduced by 4% (to 0.48 survival under Project operations) in wet years, 4% (to 0.41 under Project operations) in above normal years, 4% (to 0.31 under Project operations) in below normal years, 4% (to 0.32 under Project operations) in dry years, and 1% (to 0.27 under Project operations) in critical years (ICF International 2016a, Table 4.4-13). A slightly greater (1%) proportion of fish used the interior Delta (Georgiana Slough/DCC) migration route under the Project compared to NAA as a result of changes in the flow routing into junctions. Mean survival through the interior Delta route is expected to increase by 19% (to 0.25 survival under Project operations) in wet years, 11% (to 0.21 under Project operations) in above normal years, 2% (to 0.15 under Project operations) in below normal years, 1% (to 0.15 under Project operations) in dry years, and 1% (to 0.13 under Project operations) in critical years as a result of reductions in south Delta exports in comparison to the NAA, but will remain poor relative to predicted survival in other channels (ICF International 2016a, Table 4.4-13).

Newman 2003. Newman (2003) investigated through-Delta Chinook salmon survival of hatchery-origin coded-wire tagged fall-run Chinook salmon smolts released between 1979 and 1994 as a function of various biological and environmental variables using Bayesian hierarchical nonlinear modeling, as well as two additional model formulations. A through-Delta Chinook smolt survival model based on Newman (2003) was applied in the ITP application to spring-run and fall-run Chinook salmon because the studies upon which the model is based were conducted during the spring migration period of these two runs and do not overlap the main migration periods of winter-run or late fall-run Chinook salmon. The Newman (2003) model uses CWT data to correlate survival with covariates such as temperature, flow, and south Delta exports. This model applies the covariates equally to all smolts as it does not distinguish among migratory routes of smolts traveling through the north Delta. As evidenced over several CWT and acoustic tag studies, the migratory route taken affects survival probability and environmental conditions experienced. This model is limited in that a south Delta export covariate is also applied to the majority of smolts that do not enter the interior and/or south Delta. Therefore, when interpreting results on through-Delta survival it is important to acknowledge that the reduction in south Delta exports under the Project, in comparison to the NAA, is often influencing survival for the majority of Sacramento basin smolts even though they do not enter the interior Delta.

The results of the analysis based on Newman (2003) suggest there would be very little difference in overall mean CHNSR survival between the NAA and Project across all water year types (ICF International 2016a, Figure 4.4-7; Figure 4.4-8; Figure 4.4-9). When examined by NDD bypass flow level, the minor differences between NAA and Project are also apparent (ICF International 2016, Table 4.4-14). The results are driven by several factors. The timing of spring-run Chinook salmon entry into the Delta is assumed to be the same as that used for the DPM, for which entry occurs during spring (March–May), with a pronounced unimodal peak in April (ICF International 2016b, Appendix 5.D, Figure 5.D-42). During April under the Project, south Delta exports and Sacramento River flow downstream of the NDD are very similar in their absolute differences from the NAA (ICF International 2016a, Table 4.4-15; for additional south Delta exports information, see also Figures 5.A.6-27-1 to 5.A.6-27-6, Figures 5.A.6-27-7 to 5.A.6-27-19, and Table 5.A.6-27 in *CalSim II Modeling and Results* ICF International 2016b, Appendix 5.A]). In other words, reduced Sacramento River flow downstream of the NDD is offset by reduced south Delta exports. The analysis based on Newman (2003) includes a rate of change in juvenile Chinook salmon survival per unit of flow that is similar for the Sacramento River and south Delta exports (ICF International 2016b, Appendix 5.D, Figure 5.D-61), so that a similar change in Sacramento River flows (less) and exports (less) results in similar survival, as the analysis showed. As noted in the previous section describing the DPM results, this results in differences in the results compared to DPM results, for which survival under Project was marginally lower than under NAA.

Perry 2010. An analysis based on Perry (2010) was undertaken to analyze the potential flow-survival effects of NDD intake operations on juvenile CHNWR and CHNSR survival. This analysis focused on the effects of Sacramento River bypass flows at the NDD intakes and allowed estimation of through-Delta survival from the Sacramento River at Georgiana Slough to Chipps Island using the flow-survival relationship from the DPM. Project operational criteria require bypass flows at certain times of the year that bracket the main juvenile salmon migration period (mostly from December through June). This is achieved by restricting the north Delta diversion to low level pumping (maximum diversion of 6 percent of Sacramento River flow measured upstream of the intakes up to 900 cfs [300 cfs per intake]) when the juvenile fish begin their outmigration, which generally coincides with seasonal high flows triggered by fall/winter rains followed by a ramping up of allowable diversion rates (L1, L2, and L3 bypass flows), while ensuring flows are adequate to be protective of aquatic species during the remainder of the outmigration (see Condition of Approval 9.9.4, Sub Table A. Post-Pulse Operations for NDD Intake Bypass Flows). Additional but less restrictive requirements apply for the late spring to late fall period.

Analysis based on Perry (2010) does not include representation of near-field mortality effects at the NDD intakes (e.g., predation or impingement), but instead focuses on far-field effects in CHNWR and CHNSR. While the focus of the analysis is on the biological effects of the NDD intake operations, the hydrology simulations utilized include all Project operations, including south Delta exports.

The results of the analysis based on Perry (2010) suggested that juvenile CHNWR annual through-Delta survival in the Sacramento River from Georgiana Slough to Chipps Island would be slightly lower under the Project relative to the NAA. The reduction in weighted CHNWR survival as a result of Project operations was greater with the progression from pulse protection flows (0–2% relative difference), to level 1 bypass flows (2–5% relative difference), to level 2 bypass flows (3–7% relative difference), to level 3 bypass flows (2–12%) (ICF International 2016a, Table 4.3-15). For CHNWR, the greatest differences in overall survival (4–5% less under Project in comparison to the NAA) were in above normal, below normal, and dry years. (ICF International 2016a, Table 4.3-16.) Through-Delta survival of CHNWR was expected to decrease by 2–5% as a result of Project operations.

The results of the analysis based on Perry (2010) suggested that annual through-Delta survival in the Sacramento River from Georgiana Slough to Chipps Island would be slightly lower under the Project relative to the NAA for juvenile CHNSR. For CHNSR, the greatest reduction in overall survival (4–5% less under Project in comparison to the NAA) were in above normal, below normal, and dry years. (ICF International 2016a, Table 4.4-16.) However, overall through-Delta survival of spring-run Chinook salmon was expected to be reduced by 1–3% as a result of the Project, depending on water year type.

Perry Survival Model. The Perry Survival Model was utilized in NMFS (2017) to provide additional analysis of through Delta survival. The Perry Survival Model utilizes the most up-to-date flow survival relationships (ranging from 6,800 to 77,000 cfs as measured at Freeport) using 2,170 acoustically tagged hatchery smolts from the years 2007 through 2011. It allows for individual tracking of smolts to understand the proportion that use specific migratory routes as well as specific route-survival and overall through-Delta survival. This analysis is unique in that it summarizes *daily* through-Delta survival of CHNSR and CHNWR under the NAA and Project operations scenarios, so it is a more realistic representation of differences in survival that fish would experience on any given day. This is a more realistic representation of effects experienced by outmigrating smolts than the summary statistics used in some of the methods in other analyses. Results of the DPM and Newman 2003, for example, provide boxplots of the highest to lowest survival for each scenario over the 82 year hydrologic record and then summarize those differences collectively. This grouping of results can dampen the level of effect an individual fish may experience at a smaller time scale which may underestimate the actual impact to survival.

Two primary analyses were run using the Perry Survival Model (NMFS 2017). The L1 scenario caps NDD operations to Level 1 diversions at all times from December through June. NMFS evaluated this scenario to provide context for the range of effects that may be experienced by migrating salmonids given that the Project description states that post-pulse bypass flow operations will remain at Level 1 diversions while juvenile salmonids are migrating through and rearing in the north Delta. This “Unlimited Pulse Protection” (UPP) analysis incorporated real time operations of the NDD intakes, which modify diversion rates according to fish presence and bypass flow criteria.

Perry Survival Model - L1 effects analysis: This analysis indicates that Project operations increase mortality consistently (over 75% of the time) for CHNWR over the NAA scenario by up to 11% during the core emigration period of December through April. Approximately 25% of the time, survival may increase across all water year types up to 6%. Although effects of the NDD intakes vary from month to month and over water year types, the results show that the biggest reductions in survival as a result of Project operations occur when the majority of CHNWR smolts are migrating through the Delta. As a result, operations of the NDD intakes result in an adverse effect on the majority of outmigrating CHNWR smolts.

This analysis indicates that the Project operations increase mortality consistently (usually more than 75% of the time) of CHNSR over the NAA scenario by up to 12%. Survival may also increase, by up to 2.7%, less than 25% of the time. The NDD intake operations of the Project result in an adverse effect on the majority of outmigrating spring-run Chinook salmon smolts. Although effects of the diversions vary from month to month and over water year types, the results show that the smallest reductions in survival as a result of Project operations occur when the majority of CHNSR smolts are migrating through the Delta in April and the largest survival impacts occur during the month of March.

Perry Survival Model - UPP Effects Analysis: The UPP scenario is challenging to evaluate because it involves real-time operations that will occur under varying fish presence and hydrologic conditions. This scenario was based on the real time operating criteria described in Condition of Approval 9.9.5.1.

Specifically, from October 1 through June 30 Permittee will protect all pulses of CHNWR and CHNSR by adhering to the following operational criteria:

- A fish pulse is defined as a Knights Landing Catch Index (KLCI) ≥ 5 where KLCI = (# of CHNWR + # of CHNSR)/(Total Hours Fished/24)[14].
- Pulse protection operations shall be implemented within 24 hours of detection of a fish pulse.
- Diversions from the NDD intakes shall be reduced to low-level pumping of up to 6% of inflow measured at Freeport, but shall not exceed 900 cfs total and shall not exceed 300 cfs per intake.
- During the period of pulse protection, additional diversions above low-level pumping may occur provided that a minimum of 35,000 cfs bypass flow at the NDD intakes is maintained. Pulse protection ends after five consecutive days of daily KLCI < 5.
- All subsequent pulses of combined CHNWR and CHNSR will be afforded the same level of protection as the first pulse.
- Unlimited fish pulses are protected in any given year.

UPP Effects Analysis Assumption #1: Posterior distributions of annual survival were calculated by weighting each daily survival by the fraction of the total Knights Landing Catch Index for each day. In addition, posterior distributions were calculated for the difference in annual survival of each scenario relative to no diversion. Because this analytical method is bound by the frequency of monitoring and capture efficiency at Knights Landing, reliance on the existing Knights Landing monitoring data could underestimate both the abundance and the temporal extent of CHNWR and CHNSR presence during the migration season.

UPP Effects Analysis Assumption #2: The violin plots used to describe mean annual survival are not inclusive of all daily survival probabilities that could occur during the winter-run and spring-run Chinook salmon migration window for any given year (NMFS 2017). These only include survival probabilities for those days when winter-run and spring-run Chinook salmon were captured at Knights Landing. If no catch occurred, the daily survival rates were not included in the estimate of mean annual survival because the proportion of total annual catch for those days was zero. Therefore, the results may underestimate the survival reductions experienced in any given year since fish presence is solely dependent on fish catch at Knights Landing. In other words, this modeling exercise assumes any fish present would be captured with 100 percent accuracy, which is an overestimate given that 100 percent catch is extremely unlikely. Furthermore, UPP would cease when capture of fish is fewer than 5 winter-run or spring-run Chinook sized fish for five consecutive days, thereby exposing any fish still present near or downstream of the intakes to the more adverse L1, L2, or L3 operating scenarios

[14] KLCI is based on length at date criteria to identify CHNWR and CHNSR.

UPP Effects Analysis Assumption #3: Fish passing Knights Landing on a given day experience the calculated bypass flows on that day. This means that for the purposes of this analysis: 1) no lag time was applied to the weighted survival values to account for fish travel time from Knights Landing to the north Delta diversion, and 2) no travel times were applied to different reaches within the Delta to account for flow variation over a given cohort of fish. When real-time operations are implemented, new/additional monitoring locations and information from baseline studies are expected to allow a better characterization of the typical travel time, and therefore lag time, from monitoring stations to the diversion locations. This would allow better resolution of fish presence and abundance to coordinate operations.

The Perry Survival model analysis indicates that low level pumping under the UPP scenario greatly reduces the Project's impact of Delta diversions to CHNWR and CHNSR migrants. This analysis confirms that survival reductions are minimized for the majority of migrating CHNWR and CHNSR by low-level pumping. However, the modeling in this analysis is based on operating criteria in Condition of Approval 9.9.5.1, which may be modified based on results of pre-construction studies, new monitoring stations, and genetic identification methods and other considerations as a part of the Adaptive Management Program. For instance, under the modeling, when the KLCI 5-fish trigger is reached, immediate low level pumping mortality rates were applied to that population, which lasted throughout the hypothesized migration window of those captured fish as per Assumption #3. Thus, the survival reduction is based on a one day bypass flow rate under low level pumping for any fish captured on a trigger day (greater than or equal to 5 fish). The analysis also assumes that capture rates at Knights Landing are extrapolated to be 100% of the fish passing the NDD as explained by Assumptions #1 and #2. Therefore reduction in impacts may be overestimated under the UPP scenario. This is due to catch efficiencies at monitoring sites, varying travel times, varying lag time in reporting and operations implementation, and the unknown element of varying fish behavior. Additional monitoring stations and/or catch and index values that would trigger operational adjustments would be evaluated through the Adaptive Management Program. The effectiveness of these operations relies on a robust monitoring program coupled with efficient and expedient real-time data.

Life Cycle Models: The IOS, OBAN, and WRLCM life cycle models were also run to provide perspective on potential effects of Project operations on CHNWR and CHNSR with respect to both in-Delta and upstream conditions. In the IOS and OBAN models, ocean conditions were assumed not to differ between the NAA and Project, in order to focus the analysis on potential Project effects. Upstream differences in environmental stressors between the NAA and Project were found to be small, so the main driver of differences in escapement between NAA and Project was the difference in Delta survival.

The DPM serves as the in-Delta component of IOS, although with one important difference from the DPM results previously discussed. Delta entry in IOS consists of a unimodal peak, the timing of which depends on upstream fry/egg rearing, in contrast to the fixed nature of Delta entry for the standalone DPM. In IOS, as with the DPM, in-Delta channel flow-survival relationships tend to have a greater effect on survival than the reduced South Delta export increased survival effect. In contrast, OBAN's through-Delta survival component includes Yolo Bypass inundation (which was assumed the same for NAA and Project, based on both scenarios having a notched Fremont Weir) and south Delta exports, which would be appreciably less under the Project than NAA.

OBAN predicted that the benefits of reduced south Delta exports in comparison to the NAA offset up to ~ 5% additional mortality from the NDD intakes, which would result in no net effect of the Project on through-Delta survival. In contrast to OBAN, the IOS escapement estimates suggested that lower through-Delta survival would result in increasing divergence of Project and NAA escapement estimates, resulting in a median 25% lower escapement for the Project over the years simulated. An important reason that OBAN and IOS differ in their results with respect to potential effects of NDD intake operations is that OBAN has a relatively strong relationship between through-Delta survival and south Delta exports. For both life cycle models, the uncertainty in the relationships between environmental parameters and fish survival, coupled with extrapolation beyond the data from which the relationships were established, resulted in wide variation in the range of escapement estimates.

The WRLCM is a state-space life-cycle model for CHNWR developed by the NMFS Southwest Fisheries Science Center and was utilized in NMFS (2017) to provide additional analysis of through Delta survival. The model incorporates multiple life stages, includes density-dependent movement among habitats during the fry rearing stage, and also incorporates ePTM that simulates the location where juvenile CHNWR undergo smoltification and begin their migration through Chipps Island to the ocean environment. The model operates in a monthly time step for the freshwater stages and an annual time step for the ocean stages.

Six different scenarios were run. Each scenario varied in initial abundance, hydrology, and NDD near-field mortality. Initial abundance ranged from 5,000 to 20,000 adult CHNWR spawners to allow exploration of varying populations to utilize the model's habitat and density dependent components. The standard hydrology scenario used the standard 82-year CalSim record and the revised hydrology scenario reordered the same 82-year CalSim record so that the extreme drought years of 1929 through 1937 happened later in the simulation after a longer sequence of more moderate hydrologic conditions.

Overall, the WRLCM results indicated lower abundances and lower cohort replacement rates under the Project compared to the NAA. Under all scenarios, abundance was lower under the Project relative to the NAA throughout the time series and all scenarios had a lower mean and median cohort replacement rate than the NAA. The relative difference in the cohort replacement rate between the alternatives averaged around 8% lower under the Project for all six scenarios. Relative difference in mean and median cohort replacement rates were -8.33%

and -8.16% for Scenario 1, -8.15% and -7.95% for Scenario 1A, -8.53% and -8.74% for Scenario 1B, -8.78% and -8.99% for Scenario 2, -7.48% and -7.715 for Scenario 2A, and -8.24% and -8.46% for Scenario 2B.

Lower abundance and productivity under the Project relative to the NAA are largely due to the dynamics in the lower river and Delta habitats. There was little difference between the alternatives in the egg to fry mortality that occurs from Keswick to Red Bluff Diversion Dam (RBDD), except for minor differences in critical years. There were moderate differences in the modeled survival of CHNWR undergoing smoltification in lower river habitats (RBDD to the Delta). Under all months and water year types, survival under the Project was lower except for critical years in April when survival was similar.

NMFS (2017) includes two additional WRLCM analyses used to evaluate proposed modifications to fish routing and habitat restoration acreages. The analysis of both runs were compared to the NAA analysis. Components of each scenario pertaining to fish routing included DCC operations, increased proportion of fish entrained into the Yolo Bypass, Sutter Slough and Steamboat Slough, and decreased proportion of fish entrained into Georgiana Slough. Habitat restoration components included upper Sacramento River habitat restoration acreage, lower Sacramento River habitat restoration acreage, and Delta habitat restoration acreage. Both scenarios increased upper Sacramento River habitat restoration acreage to 80 acres. The first scenarios increased lower Sacramento River habitat restoration acreage to 80 acres and increased Delta habitat capacity to 80 acres. The results of this model run showed little improvement from the previous analysis likely due to the relatively small acreages of restoration evaluated.

The second model run evaluated increased lower Sacramento River habitat restoration acreage to 9,000 acres and increased Delta habitat capacity to 11,000 acres. The restored habitat in the Lower River increased the proportion of fry rearing and subsequently smolting in this habitat; however, the Lower River smolts experienced through-Delta survival rates that were affected by the north Delta diversions. The implementation of nonphysical barriers at Georgiana Slough, Steamboat Slough, and Sacramento Slough under the second scenario did improve the survival rates of smolts originating in the Lower Sacramento River over the Project, however, these routing measures did not fully mitigate for the overall reduction in smolt survival due to operation of the North Delta Diversions under the Project. Moderate improvement shown was likely due to the population dynamics of the CHNWR (one population at low abundance) and how the different aspects of the species life-cycle are modeled relative to the fishes habitat use. The proposed Delta habitat restoration did not improve the cohort replacement rate under the scenario because the current low abundance of the winter-run population is not limited in the model by Delta rearing habitat. As the population abundance increases because of recovery action implementation (such as newly reintroduced populations in Battle Creek and upper Sacramento River – above Shasta Reservoir) the availability of additional tidal Delta rearing habitats will become more important for the species.

Far-field effect of NDD intake operations: Habitat suitability

The operation of the NDDs is also expected to cause the permanent loss of 0.42 linear miles of restored channel margin habitat and impacts to natural riparian bench habitat and other habitat types utilized by CHNWR and CHNSR for juvenile rearing and as temporary migration refugia, as a result of reduction in flow downstream of the NDD intakes.

Several levee improvement projects along the Sacramento River have been implemented by the USACE and others, and have included the restoration of benches intended to be inundated under specific flows during certain months to provide suitable habitat for CHNWR and CHNSR. Restored benches in the north Delta will be affected by the Project because of changes in water level; for example, less water in the Sacramento River below the NDD intakes could result in riparian benches being inundated less frequently. This impact was examined by calculating bench inundation indices for juvenile CHNWR and CHNSR. These indices range from 0 (no availability of bench habitat) to 1 (water depth on the bench is optimal for juvenile Chinook salmon all of the time). The analysis was undertaken for a number of riparian and wetland benches in five geographic locations within the north Delta, by linking bench elevation data to DSM2-HYDRO-simulated water surface elevation.

This analysis does not include an assessment of the potential effects of the Project on natural, existing channel margin bench habitat, riparian and wetland benches, or to future habitat enhancement projects. Channel margin habitat in the Delta, and in much of the Sacramento/San Joaquin Rivers in general, has been considerably reduced because of the construction of levees and the armoring of their banks with riprap (Williams 2009). This has reduced the extent of high-value rearing habitat for rearing juvenile Chinook salmon because such shallow-water habitat provides refuge from unfavorable hydraulic conditions and predation, as well as foraging habitat. However, this favorable habitat has been reduced but not eliminated. Monitoring surveys conducted at USACE mitigated levee repair sites and control sites of both unmitigated levee repair sites and naturalized habitat indicate that naturalized sites are associated with a significantly higher probability of Chinook occupancy than unmitigated repair sites. As such, the respective odds ratios indicate that probability of CHNWR and CHNSR habitat occupancy, all other factors being equal, nearly triples at naturalized sites (FISHBIO 2014).

The bench inundation analysis suggested that the effects of changes in water surface elevation caused by Project operations would vary by location and bench type (ICF International 2016a, Table 4.3-17). As noted above, wetland benches are located at lower elevations than riparian benches and are intended to be inundated much of the time; this results in relatively high bench inundation indices in all water year types, and makes them less susceptible to differences in water levels that could be caused by operation of the NDD intakes, as reflected by the small differences between NAA and Project in all locations and water year types. In the Sacramento River above the NDD intakes, the wetland bench inundation indices were greater in drier than wetter years, because the water depth became shallower and therefore moved toward the optimum for juvenile Chinook salmon i.e., 2.2-2.5 feet (ICF International 2016b, Section 5.D.1.3.1).

In contrast to wetland benches, riparian benches are located at higher elevations and are inundated only for portions of winter and spring. Riparian bench inundation indices with the Project were higher in wetter years and smaller in drier years, particularly in spring (ICF International 2016a, Table 4.3-17). Although there were some large relative differences in bench inundation indices between NAA and the Project (e.g., ~40–90% lower under Project in below normal to critical years in the Sacramento River below the NDD to Sutter/Steamboat sloughs), these differences occurred in drier years when there was little habitat value under either Project or NAA. The greatest differences during the periods when the riparian benches would provide more than minimal habitat value (assumed here to be a bench inundation index > 0.0527) were: 29% lower riparian bench inundation index under Project in the Sacramento River from Sutter Steamboat sloughs to Rio Vista in spring of above normal years; 24% lower riparian bench inundation index under Project in the Sacramento River below the NDD to Sutter/Steamboat sloughs in spring of above normal years; and 19% lower riparian bench inundation index under Project in Sutter/Steamboat Sloughs in spring of wet years.

<u>Constraints in modeling far-field effects of NDD intake operations</u>

The modeling and datasets used to characterize far-field effects of NDD intake operations on CHNWR and CHNSR provided in the 2081(b) application used by CDFW in and preparation of the ITP represent the best available science. However, CDFW acknowledges that inherent in using models to predict potential Project impacts, these analyses come with limitations of which users of the results must be aware. For example, it is not possible to link quantitative biological outcomes to Project induced changes in the abiotic physical parameters assessed (channel velocity, entry into interior Delta, flow routing into channel junctions). Instead, through-Delta survival models, based on acoustic tag or coded wire tag data, have been utilized to assess the overall effects of these abiotic and other biotic factors. While models are the best available tool for evaluating Project impacts, they cannot predict those impacts with absolute certainty.

To help address these limitations, the ITP Conditions of Approval include, among other requirements, clear biological criteria for the Project to ensure that the impacts of the taking of CHNWR and CHNWR are minimized and fully mitigated. As discussed more below under “Conditions of Approval: Biological Criteria,” these permit conditions require that juvenile CHNWR and CHNSR survival through the NDD intake reach is not reduced by more than 5% from pre-Project conditions and the Project does not result in a reduction in CHNWR and CHNSR survival through Chipps Island from pre-Project conditions. Pre-construction studies will be conducted to establish pre-Project survival rates. Implementation of these criteria will be supported by substantial new information that is not available at the time of issuing the ITP because such information cannot be simulated in the laboratory and can only be gathered once the Project is operational. This information will be acquired through substantial new data collection, studies, monitoring stations, and modeling, and review of this information through the collaborative Adaptive Management Program.

The following discussion presents and summarizes the recognized constraints and limitations in the analysis of the NDD intakes' operations on CHNSR and CHNWR.

- When linking a series of physical and biological models together such that a run of one model is dependent upon the outcome of a previous model, as was done in the life cycle models and through-Delta survival models used in the analysis for the ITP and as is commonly done in other circumstances, it is important to have confidence in each model in the chain. Limitations in the data received from input models, such as large time steps or limited confidence in model calibration, need to be accounted for when drawing conclusions from any models in the modeling chain (Simenstad et al 2017).
- The CHNWR and CHNSR through-Delta survival and life cycle models rely upon inputs of empirical biological data. These datasets are often limited in scope which results in an additional source of uncertainty in the interpretation of modeling. For example, the DPM, which is also component of the IOS life cycle model, and Perry 2010 analysis rely predominantly on data from acoustic-tagging studies of large (>140 mm) late-fall run hatchery Chinook smolts; therefore, conclusions should be applied very cautiously to pre-smolt migrants. Juvenile salmon less than 80 mm are more likely to rear in the Delta (Moyle 2002) for extended periods of time rather than emigrate quickly from the Delta and thus will not be represented well by the DPM or Perry 2010 analysis. Because survival data are lacking for small (fry-sized) juvenile emigrants is not available because of the difficulty of tagging such small individuals, through-Delta survival estimates should be used only to inform smolt survival estimates and not rearing survival (Simenstad et al. 2017).
- The use of summary statistics and grouping of results can dampen the level of effect an individual fish may experience at a smaller time scale which may underestimate the actual impact of modeled operations to survival. Results of the DPM and Newman 2003, for example, provide boxplots of the highest to lowest survival for each scenario over the 82 years of analysis and then summarize those differences collectively.
- The modeling tools utilized do not account for the results of the coordinated monitoring under the Adaptive Management Program and real-time operational adjustments that would occur in relation to fish presence because input models such as CalSim II and DSM2-HYDRO. However these real-time operational adjustments are required by the Conditions of Approval and would serve to reduce Project impacts to Covered Species. One exception to this general limitation is the Perry Survival Model which was utilized in conjunction with a limited set of years of historic hydrologic and fisheries data to evaluate the potential effectiveness of Condition of Approval 9.9.5.1 to minimize the impacts of NDD intake operations.
- Sensitivity analyses and the characterization of overlapping confidence intervals

surrounding conclusions of analyses must also be considered. For example, Simenstad et al. (2017) noted that it is possible that the true annual values analyzed by the DPM analysis could lie near the bottom boundary of the confidence interval for Project and near the top boundary of the confidence interval for NAA (Simenstad et al. 2017). This would result in greater differences than suggested by the comparison of annual mean values. By the same rationale, it is also possible that the true annual values could lie near the top boundary of the confidence intervals for both Project and NAA, in which case the differences would be more similar to the differences between means. As such, biological models may have limited utility in comparing scenarios if the limited confidence associated with abiotic and biotic input models is equivalent between scenarios. In summary, the results of modeling efforts provide insight but they do not provide absolute conclusions regarding the far field effects of Project operations.

- The habitat suitability analysis for impacts due to export of water at the NDD analyzes impacts to levees sites that have been restored to provide bench habitat due to USACE mitigation requirements, but did not model other Project impacts to habitat characteristics. As such there is no comprehensive analysis of the Project's impacts on all suitable CHNWR and CHNSR habitat. While through-Delta survival metrics and life cycle model analyses serve as proxies for Project impacts on habitat suitability, these analyses are subject to the aforementioned limitations inherent in any modeling exercise. Consequently, Biological Criterion 2 incorporates habitat suitability impacts by requiring no change in juvenile survival to Chipps Island as a result of the Project. Furthermore, understanding of the Project's flow-related impacts on all suitable CHNWR and CHNSR habitat characteristics will be further informed through implementation of the salmon life cycle models (Pre- and Post- construction Studies 16) which include a Delta habitat component.

Estimates of take and impacts of the taking on CHNWR and CHNSR as a result of Project operations are based upon the likelihood of physical injury or mortality to individuals of CHNWR and CHNSR, or habitat alteration. Due to limitations in currently available models and biological data, discussed in detail in the preceding paragraphs, there is inherent uncertainty in the characterization of the extent of take and impacts of the taking due to Project operations. Furthermore, due to the complexity of the Delta ecosystem, it is not possible with currently available modeling tools and biological data to parse impacts discretely or to quantify take associated with individual mechanisms of take such as increased travel time, reduced suitable rearing and refugia habitat, and increased vulnerability to predation, by which mortality and associated impacts of the taking would occur. Nor is it possible to definitively conclude that impacts associated with specific aspects of the Project, such as impacts of NDD intake diversions, would be offset by other specifics of the Project such as reduced South Delta exports, RTO, and compensatory habitat restoration commitments.

To address this uncertainty and establish a performance standard for the Project against which these findings can be made, the ITP Conditions of Approval include clear biological criteria for the Project. These require that juvenile CHNWR and CHNSR survival through the NDD intake reach is not reduced by more than 5% from pre-Project conditions and the Project does not result in a reduction in CHNWR and CHNSR survival through Chipps Island from pre-Project conditions. Implementation of these criteria will be supported by substantial new modeling, data collection, studies, monitoring stations, and review through the collaborative Adaptive Management Program.

South Delta Export Facilities: Near Field Effects

Incidental take of CHNWR and CHNSR in the form of mortality ("kill") may occur as a result of operations of the South Delta Export Facilities by means of entrainment, mechanical removal of aquatic vegetation, exposure to herbicides used to control aquatic vegetation, fish bypassing salvage operations through the louvered (behavioral) fish screens to the export pumps, and losses during the salvage process. These impacts may include increased vulnerability to predation within CCF. Incidental take of individuals of CHNWR and CHNSR may also occur from the Covered Activities in the form of pursue, catch, capture, or attempt to do so of individuals during salvage at the Skinner Fish Facility.

The areas where authorized take of CHNWR and CHNSR is expected to occur include: the South Delta export facilities and CCF located about eight miles northwest of Tracy.

The salvage-density method was used to assess differences in south Delta exports and resulting entrainment during the periods of occurrence of juvenile salmonids in the Delta, based on historical salvage data (ICF International 2016b, Section 5.D.1.1.2). The projected reductions in salvage between Project and NAA were greater in wetter water years, as a result of reduced south Delta export pumping facilitated by operation of the NDD. Entrainment of CHNWR by Project operations was expected to be reduced by 16% in critical years, 17% in dry years, 39% in below normal years, 49% in above normal years, and 67% in wet years when compared to the NAA. Entrainment of CHNSR by Project operations was expected to be reduced by 18% in critical years, 33% in dry years, 37% in below normal years, 83% in above normal years, and 79% in wet years.

As described by NMFS (2009), direct entrainment of juvenile CHNWR and CHNSR includes a number of components that contribute to loss.

At the SWP:

- Prescreen loss (from CCF radial gates to primary louvers at the Skinner Fish Facility): 75% loss,
- Louver efficiency: 25% loss,
- Collection, handling, trucking, and release: 2% loss,
- Post release: 10% loss
- Total loss (combination of the above): 83.5%

Modeling analysis indicates that entrainment loss of CHNWR and CHNSR at the south Delta export facilities will be reduced in comparison to the NAA but not eliminated under Project operations in all water types. Take of CHNWR and CHNSR will be lowest in wet years, as a result of lower south Delta export pumping facilitated by operation of the NDD, and take of CHNWR and CHNSR will be highest in critical water years. Lower south Delta exports will also result in less impingement injury and mortality and lower predation mortality in CCF and other parts of the pumping facilities.

Appreciable loss of juvenile salmonids also occurs because of predation in association with the south Delta export facilities (Gingras 1997 and Clark et al. 2009). Less entrainment of juvenile salmonids, as estimated in the preceding sections with the salvage-density method and salvage estimates based on Zeug and Cavallo (2014), is expected to result in less entrainment-related predation loss. The above loss percentages were assumed to not differ between NAA and the Project, so the differences in entrainment loss were assumed to be attributable to differences in export pumping.

Mechanical removal of aquatic weeds has the potential to result in take through direct physical injury. The CCF Aquatic Weed Control Program uses copper-based herbicides in CCF, which would result in injury and mortality of CHNWR and CHNSR. The areas where authorized take of CHNWR and CHNSR is expected to occur include: the South Delta export facilities and CCF located about eight miles northwest of Tracy.

In assessing the potential for adverse effects of the 2013-2017 Water Hyacinth Control Program in the Delta, NMFS (2013: 11) concluded that mechanical removal could have negative effects on CHNWR and CHNSR but that these would be minimized by limiting mechanical removal to dense water hyacinth mats where CHNWR and CHNSR are not likely to be present. Presumably within CCF there will be potential for juvenile CHNWR and CHNSR to encounter mechanical removal of water hyacinth, given that hyacinth and fish may follow similar pathways across CCF toward the intake channel and the trash racks. Potential for mortality as a result of mechanical removal of water hyacinth or other aquatic weeds (e.g., injury from contact with cutting blades) will potentially be offset by the reduced probability of predation by weed-associated predatory fishes and increases in salvage efficiency at the Skinner Fish Facility because of reduced smothering by weeds. The application of copper-based herbicides in CCF is intended to reduce the standing crop of invasive aquatic weeds, among which the dominant species is Egeria densa. As reviewed by NMFS (2009), aquatic weed control with copper-based herbicides to treat Egeria and other aquatic weeds in CCF has the potential to result in a variety of negative physiological effects on juvenile salmonids, ranging from sub-lethal effects such as diminished olfactory sensitivity (e.g., reduced ability to imprint on natal streams or to avoid chemical contaminants) to lethal effects. CHNWR and CHNSR will be minimally exposed to such effects because their period of occurrence within CCF is entirely or nearly entirely before the July/August timeframe for herbicide treatment. Entrainment of juvenile CHNWR and CHNSR into CCF is expected to be less under the Project than NAA in July-August (ICF International 2016b, Appendix 5.D), which will reduce the exposure of these species to any adverse effects of herbicide treatment compared to the situation under the NAA (although exposure would be minimal under both the NAA and Project scenarios).

South Delta Facilities: Far Field Effects

Impacts of the authorized taking associated with Project operations also include adverse impacts to CHNWR and CHNSR related to the Project's incremental contribution to cumulative impacts. Project operations of the south Delta export facilities will cause hydrodynamic effects that will result in take of juvenile CHNWR and CHNSR emigrating from the Sacramento River basin and entering the interior Delta, principally at Georgiana Slough (the DCC will generally be closed during this period). However, reduced south Delta exports under Project operating criteria will reduce take relative to the NAA.

<u>Far-field effect of south Delta operations: Channel velocity</u>

Interior Delta channel velocity (i.e., channels off the main stem San Joaquin River such as Old River downstream of the south Delta export facilities) are less positive and more negative as a result of south Delta exports resulting in take of CHNWR and CHNSR. However, reduced south Delta exports under Project operating criteria relative to the NAA will reduce this impact and potentially reducing take of CHNWR and CHNSR juveniles diverted into the central and south Delta in comparison to the NAA. In the San Joaquin River, closure of the HOR Gate results in 50% greater (0.02–0.08 ft/s) median channel velocity downstream of the HOR. In Old River downstream of the south Delta export facilities, anticipated differences in channel velocity are attributable to reduced south Delta exports under the Project as compared to the NAA. However, in drier years in April and May it was also apparent that median channel velocity in Old River was less positive under the Project than NAA.

Channel velocity in Old River upstream of the south Delta export facilities was less positive under the Project than NAA as a result of: reduced south Delta exports under the Project (i.e., the export facilities exert some hydrodynamic influence by increasing velocity toward them), and HOR Gate operations that block flow from entering 50% of the time from January 1 to June 15.

The median negative velocity in the San Joaquin River downstream of Old River was greater (closer to zero) under Project operations than under NAA, with the relative difference decreasing as water years became drier. There was little difference in median negative velocity between NAA and the Project farther downstream near the confluence with the Mokelumne River as a result of greater tidal influence in this area. Negative velocity estimates in Old River downstream of the south Delta export facilities under the Project were either less than, or similar to, those under NAA. However, the negative channel velocities in Old River upstream of the facilities were greater with Project operations than the NAA. This is likely as result of reduced south Delta exports and HOR Gate operations associated with the Project, both of which would increase the influence of flood tides in this channel.

The daily proportion of negative velocity in the San Joaquin River downstream of HOR was generally less under Project operations than the NAA, although farther downstream near the confluence with the Mokelumne River the tidal influence resulted in little to no difference between Project and NAA. The daily proportion of negative velocity in Old River downstream of the south Delta export facilities under Project operations was similar to, or less negative than, NAA. However, upstream of the facilities there was a greater proportion of time with negative velocity as a result of increased tidal influence caused by the HOR Gate and reduced south Delta exports. The Project would generally result in reduced levels of take of CHNWR and CHNSR in comparison to the NAA due to interior Delta channel velocity (e.g., Old River downstream of the south Delta export facilities) being somewhat more positive and less frequently negative than under the NAA.

Far-field effect of south Delta operations: Flow routing

Changes in flow routing resulting from the Project may affect CHNWR and CHNSR by moving them into less favorable rearing conditions in the Central Delta, in comparison to the NAA. The assumption of 50% closure of the HOR Gate from January 1 to June 15, subject to RTO adjustments, on the San Joaquin River led to less flow entering Old River under the Project compared to NAA. For Turner Cut, the next downstream junction, the proportion of flow entering the junction generally was greater under Project than NAA, reflecting more flow remaining in the river main stem because of HOR Gate operations. This result is consistent with the estimate in Cavallo et al. (2015), based on DSM2-HYDRO modeling, that more fish would enter the HOR with higher flows. As a result of Project operations the flow that otherwise would have gone into Old River progresses to Turner Cut, thus producing a similar effect at that location. As water moves downstream to subsequent junctions, differences in flow routing into the junctions between the NAA and the Project were lower as a result of greater tidal influence, as noted by Cavallo et al. (2015). The differences in flow routing between the NAA and the Project operations are likely the result of reduced south Delta export pumping under Project operations than the NAA.

Far-field effect of south Delta operations: Through-Delta survival (SalSim)

Through-Delta survival for spring-run Chinook salmon from the San Joaquin River basin was estimated using the survival function from the Juvenile Delta Module of the Salmon Simulator (SalSim; AD Consultants 2014). Although SalSim is a standalone life cycle modeling tool, the coefficients of the survival function from its Delta Module were used in a spreadsheet to compare potential survival differences between NAA and the Project.

The results of the analysis based on the SalSim through-Delta survival function suggested that the through-Delta survival of San Joaquin River CHNSR would be greater under the Project than NAA resulting in less take under the Project than under the NAA (ICF International 2016b, Figure 5.4-24 and Figure 5.4-25, and Table 5.4-20). This is the result of the implementation of the HOR Gate, which was modeled to be 50% closed during the main period of CHNSR migration, with the result that flow into the Stockton Deepwater Ship Channel is considerably greater under the Project (ICF

International 2016b, Table 5.4-20). The relative differences in survival between NAA and Project were greatest in intermediate water-year types (above normal, below normal, and dry), as a result of two factors. First, the HOR Gate would not be closed when Vernalis flow is greater than 10,000 cfs; this results in the top 5% of survival estimates being identical between NAA and Project, which limits the overall differences in wet years (ICF International 2016b, Figure 5.4-25). Second, in critical years when flows are very low and water temperature would be high, the rate of change in survival is considerably less than with more flow and lower temperature (ICF International 2016b, Appendix 5.E, Essential Fish Habitat).

Uncertainty in near-field effects of south Delta facilities operations

The greatest area of uncertainty in near-field effects of the south Delta export facilities' operations relates to potential changes in the levels of pre-screen loss following reconfiguration of the CCF. Given the lack of clear relationships between residence time and prescreen loss of juvenile salmonids in this effects analysis, it is assumed that there is no difference in prescreen loss between NAA and Project within CCF as a result of operations of the Banks Pumping Plant and the reconfiguration of the Forebay. Conversely, the potential active storage for the proposed SCCF will be somewhat less than the active storage under existing conditions as a result of the changes in CCF configuration. This could result in lower residence times for a given level of pumping at the Banks Pumping Plant, which may reduce prescreen loss under the Project compared to NAA. Gingras (1997: 16-17) found a significant negative relationship between export rate and prescreen loss for marked juvenile Chinook salmon in CCF and concluded that this reflected the inverse relationship between export rate and residence time in CCF. Recent hydrodynamic studies have confirmed the inverse relationship between export pumping and transit time for passive particles across CCF (MacWilliams and Gross 2013), although specific relationships for juvenile salmonids are not available.

The salvage-density method does not account for differences in salvage and entrainment loss that could occur because of other operational effects, e.g., changes in juvenile salmonid routing because of operations of the NDD intakes or the HOR Gate. Non-parametric bootstrapping (i.e., generation of 500 annual salvage estimates for each scenario by randomly sampling from the original data, with replacement, and refitting the statistical model) revealed that the 95% confidence intervals for the NAA and the Project scenarios overlapped in all years (ICF International 2016b). However, the inability to detect a difference between the NAA and the Project could be a result of extrapolation beyond the range of the data from which the model was developed. As a result, there is uncertainty regarding the magnitude of difference in salvage that may occur between NAA and the Project, although the mean predictions were within the range of those observed in the data used to develop the relationships.

If predatory fishes are able to exploit the hydrodynamics created by Project modifications to CCF, predation risk in CCF could increase under the Project. However, this risk cannot be quantified using available data. There is also uncertainty regarding the efficacy of predatory fish reduction in reducing the risk of predation for CHNWR and

CHNSR, given that previous efforts did not yield measurable changes in predator population size within CCF (Brown et al. 1996).

Head of Old River Gate: Near Field Effects

Impacts of the authorized taking associated with Project operations of the HOR Gate include adverse impacts to CHNWR and CHNSR related to the Project's incremental contribution to cumulative impacts (indirect impacts). Although the HOR Gate would have the potential to considerably increase the proportion of San Joaquin River basin-origin juvenile CHNSR that remain in the main-stem San Joaquin River rather than entering Old River, as well as increasing their migration speed, near-field impacts of the HOR Gate include increased vulnerability to predation in the vicinity of the HOR Gate and blockage of upstream passage. The area where authorized take of CHNWR and CHNSR is expected to occur is located at the divergence of the head of Old River and the San Joaquin River. This evaluation focuses on potential near-field operational effects of the HOR Gate, namely predation and blockage of upstream passage.

The new permanent, operable gate at the head of Old River (at the divergence from the San Joaquin River) will be constructed and operated to protect outmigrating San Joaquin River salmonids in the spring and to provide water quality improvements in the San Joaquin River in the fall. The new HOR Gate will replace the temporary rock barrier that is typically installed at the same location. (Temporary agricultural barriers on Middle River and Old River near Tracy and Grant Line Canal will continue to be installed consistent with current operations and pursuant to separate CESA authorization.)

Adult CHNWR are not expected to occur upstream of Middle River on the San Joaquin River mainstem or within the waterways of the South Delta in any appreciable numbers. (NMFS 2009.) Juvenile CHNWR are not expected to occur in substantial numbers in the Eastern Delta near Stockton (i.e., White Slough, Disappointment Slough, Fourteenmile Slough), or the mainstem of the San Joaquin River upstream of Columbia and Turner Cuts. Therefore, adult and juvenile CHNWR are assumed to be present only in very low numbers and occurrences at the HOR Gate are expected to be rare.

CHNSR from the San Joaquin River basin would be expected to be exposed to near-field effects of the HOR Gate based on its geographic location. Operations of the gate would coincide with juveniles and adult occurrence in spring (with a lesser overlap possibly in fall for any emigrating yearlings). Far-field effects of the HOR Gate in terms of flow routing down the San Joaquin River would also affect CHNSR from the San Joaquin basin, and could also affect CHNWR and CHNSR from the Sacramento River basin if occurring in the interior Delta in the vicinity of the HOR Gate.

Studies of the rock barrier installed at the HOR in 2012 suggested that the structure created eddies that could result in enhanced predatory fish habitat and increase predation on juvenile San Joaquin River basin CHNSR and CHNWR and CHNSR from the Sacramento River. (DWR 2015) Given that the HOR Gate could be operated in intermediate positions between fully closed and fully open (lying flat on the channel bed), there is the potential to create hydrodynamic conditions that provide opportunities for predators to ambush passing (possibly disoriented) juvenile CHNWR and CHNSR.

Adult CHNWR and CHNSR returning to natal tributaries in the Sacramento River and San Joaquin River basins via Old River could experience migration delay when encountering the HOR Gate during its October- June operational period. The HOR Gate will include a fish passage structure that meets NMFS and USFWS guidelines to allow passage of upstream migrating salmonids, including steelhead and Chinook salmon. The fish passage structure for the HOR Gate is also intended to minimize delay of upstream migrants, therefore minimizing the potential for take of CHNWR and CHNSR.

Head of Old River Gate: Far-field effects

Far-field effects of HOR Gate operation on CHNWR and CHNSR are not likely to result in take of CHNWR and CHNSR in the form of mortality, due to the geographical location and operational criteria for HOR Gate. However, HOR Gate operations could alter patterns of flow routing down the San Joaquin River and could affect CHNWR and CHNSR if occurring in the interior Delta.

Operations of the HOR Gate would coincide with presence of CHNSR juveniles and adults in spring, and to a limited extent, in fall with presence of emigrating CHNSR yearlings in the fall. The HOR Gate will have the potential to considerably increase the proportion of San Joaquin River basin-origin juvenile CHNSR that remain in the main-stem San Joaquin River rather than entering Old River, as well as increasing their migration speed. (ICF International 2016a, Sections 4.3.4.1.3.2.1.1 and 4.3.4.1.3.2.1.3) In the San Joaquin River, changes in channel velocity are caused by the closure of the HOR Gate which is assumed in the modeling to be open during days in October prior to the D-1641 San Joaquin River pulse, closed 100% of the time during the pulse, closed 50% of the time from January 1 to June 15, and open 100% of the time during the remaining months. As a result, median channel velocity downstream of the HOR is expected to be 10–50% greater (0.02–0.08 ft/s greater) with the Project, than the NAA.

The HOR Gate operations will result in greater channel velocity within the south Delta and San Joaquin River downstream of the HOR Gate, and potentially result in less take of migrating CHNWR and CHNSR at the south Delta export facilities under the Project as compared to the NAA. Far-field effects of the HOR Gate operations on San Joaquin basin CHNSR as a result of flow routing down the San Joaquin River could also affect CHNWR and CHNSR from the Sacramento River basin if occurring in the interior Delta in the vicinity of the HOR Gate. In Old River, downstream of the south Delta export facilities, differences in channel velocity were not related to reduced south Delta exports. (ICF International 2016b, Appendix 5.A.) However, in April and May operation of south Delta facilities combined with an assumption that the HOR Gate is closed 50% of the time results in Old River channel velocity that was slightly lower under the Project than the NAA (although both had positive median velocity). Channel velocity in Old River upstream of the south Delta export facilities is expected to be less positive under the Project than the NAA as a result of reduced south Delta exports (i.e., the export facilities exert some hydrodynamic influence by increasing velocity toward them) and operation of the HOR Gate, which blocks flow from entering 50% of the time from January 1 to June 15.

Reduction in the median daily proportion of negative velocity associated with Project operations, when compared to the NAA again illustrated the effect of HOR Gate operations in the San Joaquin River downstream of HOR. The daily proportion of negative velocity in Old River downstream of the south Delta export facilities under Project operations was similar to, or less than NAA. However, upstream of the facilities, the greater tidal influence caused by the HOR Gate operations and reduced south Delta exports led to a greater proportion of time with negative velocity under Project operations than the NAA which may increase entrainment of CHNWR and CHNSR.

Take of CHNSR emigrating from the San Joaquin River basin under the Project could be reduced relative to the NAA as a result of HOR Gate operations, which would increase overall velocity and reduce negative velocity in the San Joaquin River, as well as reducing the daily proportion of negative velocity flows. These effects would be greatest farther upstream. Take of CHNWR and CHNSR from the Sacramento River basin and CHNSR from San Joaquin River basin generally would be reduced as a results of interior Delta channel velocity under Project operations (e.g., Old River downstream of the south Delta export facilities) that would be somewhat more positive and less frequently negative than the NAA.

Take of CHNSR migrating down the San Joaquin River would, based on flow routing, be expected to be reduced as a result of the Project’s HOR Gate, which would considerably reduce entry into Old River and therefore reduce entrainment at the south Delta export facilities relative to the NAA. For the San Joaquin River, the assumption of 50% closure of the HOR Gate from January 1 to June 15, subject to RTO adjustments, led to appreciably less flow (~30–50%) entering Old River under the Project compared to NAA. For Turner Cut, the next downstream junction, the proportion of flow entering the junction generally was greater under the Project (median by water year type up to 11% greater, or 0.02 in absolute value). This reflects more flow remaining in the river main stem because of the HOR Gate than would occur under the NAA. This is consistent the observations of Cavallo et al. (2015), who estimated (based on DSM2-HYDRO modeling) that more fish would enter the HOR with higher flow and the flow that otherwise would have gone into Old River progresses to Turner Cut, thus producing a similar effect at that location. With movement downstream to other junctions, differences in flow routing into the junctions between NAA and Project were less pronounced which, as noted by Cavallo et al. (2015) reflects greater tidal influence.

The results of the analysis based on the SalSim through-Delta survival function suggested that the through-Delta survival of San Joaquin River CHNSR would be greater under the Project than under the NAA resulting in less take of CHNSR under the Project relative to the NAA. This is the result of the implementation of the HOR Gate, which was modeled to be 50% closed during the main period of spring-run Chinook salmon migration, with the result that flow into the Stockton Deepwater Ship Channel is considerably greater under the Project. (ICF International 2016b, Table 5.4-20.) The relative differences in survival between NAA and Project were greatest in intermediate water-year types (above normal, below normal, and dry), as a result of two factors. First, the HOR Gate would not be closed when Vernalis flow is greater than 10,000 cfs; this results in the top 5% of survival estimates being identical, which limits the overall differences in wet years. Second, in critical years when flows are very low and water temperature would be high, the rate of change in survival is considerably less than with more flow and lower temperature. Overall, the analysis based on the SalSim Juvenile Delta Module survival function suggested that the Project would likely reduce adverse effect on San Joaquin River CHNSR in the Delta relative to the NAA.

<u>Uncertainty in near- and far- field effects of HOR Gate operations</u>

The summary of results based on DSM2 and DPM does not account for real-time operational adjustments that would occur in relation to fish presence or results of the coordinated monitoring and research under the Collaborative Science and Adaptive Management Program.

The extent to which any near-field predation at the HOR Gate would offset the anticipated beneficial effects of a greater proportion of fish and flow remaining in the San Joaquin River is unclear, although the available data for fall-run juvenile Chinook salmon suggest that in general the presence of a barrier improves through-Delta survival (See review by Hankin et al. (2010) and comparison of 2012 [rock barrier] versus 2013 [no barrier] by Brandes and Buchanan 2016; however, see also comments by Anderson et al. [2012] with specific reference to the uncertainty in the effectiveness of the 2012 HOR rock barrier implementation in protecting out-migrating salmonid smolts).

Effects of Suisun Marsh Salinity Control Gate Operations

Impacts of the authorized taking to CHNSR and CHNWR from the SMSCG may occur as a result of operations include adverse impacts to CHNWR and CHNSR related to the Project’s incremental contribution to cumulative impacts (indirect impacts). These impacts include non-lethal impingement/screen contact, increased vulnerability to predation, and potential migration delays for adult CHNWR and CHNSR at the SMSCG.

Operational criteria for the SMSCG will not change under the Project operations relative to the NAA. NAA and Project operations modeling suggested that there will be little difference in the pattern of SMSCG opening between NAA and Project operations in terms of SMSCG opening. There is only limited potential for adverse near-field effects on downstream-migrating juvenile CHNWR and CHNSR due to this Project component.

Operation of the SMSCG from October through May overlaps with the upstream migration of adult CHNWR and CHNSR. The late winter and spring downstream migration of Central Valley salmonids also overlaps with the operational period of the SMSCG. As adult CHNWR and CHNSR travel between the ocean and their natal Central Valley streams, Montezuma Slough provides an alternative route to their primary migration corridor through Suisun Bay. Fisheries sampling conducted by CDFW indicates many adult Central Valley salmon migrate upstream through Montezuma Slough (Edwards et al. 1996, Tillman et al. 1996), but the proportion of the total run and the relative proportion of CHNWR and CHNSR utilizing this route is unknown.

The principal potential effect of the SMSCG being closed up to 20 days per year from October through May is delay of upstream-migrating adult CHNWR and CHNSR that have entered Montezuma Slough from its westward end and are seeking to exit the slough at its eastward end. Vincik (2013) found some evidence that opening the boat lock at the SMSCG improved passage rates of acoustically tagged adult Chinook salmon, and that even with the gates up ~30–40% of fish returned downstream. Adult CHNWR and CHNSR that do not continue upstream past the SMSCG are expected to return downstream by backtracking through Montezuma Slough to Suisun Bay, and they likely find the alternative upstream route to their natal Central Valley streams through Suisun and Honker Bays. NMFS 2009 noted that the effect of the SMSCG when closed on adult salmonids is uncertain, but suggested that if the ultimate destination of adult CHNSR is reliant on access provided by short-duration, high-streamflow events, delay in the Delta could affect reproductive viability. This is less of an issue for CHNWR, which are typically several weeks or months away from spawning when in the Delta and use the mainstem Sacramento River for spawning, to which access would not be dependent on short-duration streamflow events. Operational criteria for the SMSCG will not change under Project operations relative to the NAA. Results of the DSM2 modeling indicate that the flow through the SMSCG and operations would be very similar under NAA and with the Project (ICF International 2016b, Table 5.B.5-29 in Appendix 5.B), indicating that operation of the gates would be similar under NAA and Project.

Effects of Roaring River Distribution System Operations

Incidental take of juvenile CHNWR and CHNSR may occur as a result of operations of RRDS by means of entrainment, impingement, and screen contact. The areas where authorized take of CHNWR and CHNSR is expected to occur include: Montezuma Slough about two miles downstream from the confluence of the Sacramento and San Joaquin Rivers, the confluence of Roaring River and Montezuma Slough, and at Goodyear Slough south of Pierce Harbor.

Some CHNWR and CHNSR (juveniles and adults) occur in Montezuma Slough and therefore could be exposed to the RRDS, although the intake is screened. As described by NMFS (2009), the RRDS's water intake (eight 60-inch-diameter culverts) is equipped with fish screens (3/32-inch opening, or 2.4 mm) operated to maintain screen approach velocity of 0.2 ft/s for Delta Smelt protection. As a result juvenile CHNWR and CHNSR are also excluded from entrainment; however, impingement and increased vulnerability to predation may occur. There is minimal potential for any adverse effect to CHNWR and CHNSR the RRDS.

Effects of Morrow Island Distribution System Operations

Incidental take of juvenile CHNWR and CHNSR may occur as a result of operations of the MIDS by means of entrainment, impingement, and screen contact. The areas where authorized take of CHNWR and CHNSR is expected to occur include: Montezuma

Slough about two miles downstream from the confluence of the Sacramento and San Joaquin Rivers, the confluence of Roaring River and Montezuma Slough, and at Goodyear Slough south of Pierce Harbor.

NMFS (2009) noted that Goodyear Slough is not a migratory corridor for CHNWR and CHNSR, which limits the species' potential for exposure to the MIDS operations. NMFS (2009) considered it unlikely that juvenile CHNWR and CHNSR are entrained by the three unscreened 48-inch culverts that form the MIDS water intake, as a result of their larger size and better swimming ability relative to the size of fall-run Chinook salmon observed to have been entrained (<45 mm), and also because the location of the MIDS intake on Goodyear Slough is not on a migratory corridor for CHNWR and CHNSR. Therefore there will be minimal potential for take of CHNWR and CHNSR from MIDS operations.

Effects of Goodyear Slough Outfall Operations

NMFS (2009) concluded that CHNWR and CHNSR are not likely to encounter the Goodyear Slough structure, or be negatively affected by the Goodyear Slough outfall, given its location and design. Additionally, because the Goodyear Slough outfall is intended to improve water circulation in Suisun Marsh it is likely be of benefit to juvenile salmonids by improving water quality and increasing foraging opportunities (NMFS 2009).

Effects of North Bay Aqueduct Operations

There will be a minimal potential for the operations of the North Bay Aqueduct intake to cause take of juvenile CHNWR and CHNSR. CHNWR and CHNSR may be present in the waterways adjacent to the Barker Slough Pumping Plant; however, several years of monitoring have failed to consistently capture any salmonids during the winter Delta smelt surveys (1996 to 2004) in Lindsey Slough or Barker Slough. Captures of Chinook salmon have usually occurred in the months of February and March and typically are only a single fish per net haul (CDFW 2017). Most Chinook salmon captured have come from Miner Slough, which is a direct distributary from the Sacramento River via Steamboat and Sutter Sloughs. Based on the geographic location of the Barker Slough Pumping Plant in the north Delta, it is unlikely that any CHNSR from the San Joaquin River basin would be exposed to the facility.

Pumping rates at the North Bay Aqueduct Barker Slough Intake generally would be similar under the NAA and Project. (ICF International 2016b, Table 5.B.5-35 in DSM2 Methods and Results Appendix 5.B.) Regardless of differences in the rate of pumping and any resulting differences in exposure to the intake under NAA and Project, the basic conclusions from NMFS (2009) apply:

> [The] screens, which were designed to protect juvenile salmonids per NMFS criteria, should prevent entrainment and greatly minimize any impingement of fish against the screen itself. Furthermore, the location of the pumping plant on Barker Slough is substantially removed from the

expected migrational corridors utilized by emigrating Chinook salmon and steelhead smolts in the North Delta system.

Delta Cross Channel and Contra Costa Canal Rock Slough Intake

Permittee has confirmed it is not seeking take authorization for the Delta Cross Channel and Contra Costa Canal Rock Slough Intake facilities and they are not included within the Covered Activities.

Summary of Avoidance and Minimization Measures Included in the ITP

Covered Activities associated with Project operations would impact CHNSR and CHNWR as summarized above, but these impacts will be avoided and minimized through Conditions of Approval required by the ITP.

Conditions of Approval: Biological Criteria

The best available scientific models and biological data (discussed above) contains inherent constraints and limitations regarding identifying the magnitude of take of CHNWR and CHNSR and associated impacts of the taking resulting from Project operations. Therefore, the Conditions of Approval for the ITP establish a suite of required measures to minimize and fully mitigate the impacts of the authorized taking. This suite consists of a combination of 1) operational criteria; 2) compensatory mitigation; 3) implementation of ongoing and new scientific studies and monitoring; 4) robust scientific analysis using independent peer review and decision making through the Adaptive Management Program; and 5) biological criteria. The biological criteria will serve as a performance standard against which the Project’s operational impacts may be evaluated to ensure ongoing adherence to ITP issuance criteria as Project design, scientific information and regulatory conditions evolve. In combination, the required mitigation, studies, monitoring, and adaptive management and mitigation outcomes must contribute to the attainment of two biological criteria described in Condition of Approval 9.7 (Biological Criterion 1 and Biological Criterion 2) that are applicable to CHNSR and CHNWR.

> *Biological Criterion 1:* Permittee shall operate the NDD intakes to achieve juvenile[15] CHNWR and CHNSR survival rates through NDD intake reach of 95 percent or more of the pre-project survival rate (established by Pre-construction Study 10 and Post-construction Study 10 in Conditions of Approval 9.6.10 and 9.6.11). For the purposes of Biological Criterion 1 only, the NDD intake reach shall be defined as beginning 0.25 miles upstream of Intake 2 and ending 0.25 miles downstream of Intake 5. Permittee shall provide survival estimates on an annual basis to CDFW, the TOT and the NDDTT.

[15] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.

Biological Criterion 2: Permittee shall operate the Project to achieve pre-project juvenile CHNWR and CHNSR survival rates to Chipps Island (as established by Pre-construction Study 12 in Condition of Approval 9.6.10). Test Period and Full Project Operations survival rates shall be determined by Post-Construction Study 12 (see Condition of Approval 9.6.11). Permittee shall provide survival estimates on an annual basis to CDFW, the TOT and the NDDTT[16].

These biological criteria are an important instrument for ensuring that the impacts of the authorized taking resulting from entrainment, impingement, predation, and associated impacts of the taking to CHNWR and CHNSR as a result of Project operations will be minimized and fully mitigated. The combination of Project operating criteria, real-time operations, habitat restoration, and other Conditions of Approval, have been developed to result in minimization and full mitigation of Project impacts based on currently available modeling tools, biological data, and available Project design information. Biological criteria provide certainty that such standards will continue to be met in light of new scientific information, further Project design efforts, and implementation and evaluation of compensatory mitigation, and will serve an important role in evaluating the effectiveness of the Conditions of Approval in light of permit issuance criteria. This requires that predictions of modeled analyses be empirically verified utilizing robust monitoring programs with operating criteria, real-time operations, habitat restoration, and other measures subject to adjustment through the Adaptive Management Program.

Conditions of Approval: Operating Criteria and Real-Time Operations

Conditions of Approval 9.9.4 *General Operating Criteria* and Condition Approval 9.9.5 *Real-Time Operations* are the primary means of minimizing Project operational impacts to Covered Species. Modeling analyses used to analyze effects of Project operations on CHNWR and CHNSR indicate that operating conditions in NMFS (2009), USFWS (2008) and CDFG (2009) required augmentation with new and existing RTO criteria to further minimize take by reducing NDD intake diversions and south Delta export rates based on the presence of Covered Fish Species. The Permittee shall continue to fund and implement both new and existing studies and monitoring programs necessary to support RTO at the NDD intakes, South Delta export facilities, HOR Gate, and other locations as necessary.

Conditions of Approval: NDD Intake Design

The NDD intakes will be provided with fish screens designed to minimize the risk that CHNSR and CHNWR will be entrained into the intakes, or injured by impingement on the fish screens during operations. Condition of Approval 9.6.3 requires that the final fish screen design shall be consistent with criteria described in *NMFS 1997 Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997b) and *CDFG 2000 Fish*

[16] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.

Screening Criteria (CDFG 2000). Specifically, the screens must be designed to meet criteria established by NMFS, USFWS and CDFW, which limit water velocities through the screen (called the approach velocity) to values substantially less than swimming speeds achievable by Covered Fish Species and limit water velocities parallel to the surface of the screen (called the sweeping velocity) to values that will allow fish to travel past the screen with minimal additional effort or risk of impingement. (Fish Facilities Technical Team 2011.) Project design specifications for the fish screens meet criteria established to minimize impacts to DS and require an approach velocity less than or equal to 0.2 ft/s. This approach velocity, required in combination with equal or greater sweeping velocities, ensures that DS impingement and screen contact are minimized. (Swanson et al. 2005; White et al. 2007). The DS approach velocity and sweeping velocity criteria are protective of CHNSR and CHNWR, because they are well below the 0.33 ft/s approach velocity standard for Chinook salmon fry. Fish screens will be equipped with monitoring systems capable of verifying compliance with approach and sweeping velocity criteria in real time.

Sweeping and approach velocity criteria, along with other aspects of facility design that may also help minimize the effects of NDD intake operations on Covered Species, have been subject to collaborative discussion with CDFW during Project development. Finalization of facility design will continue to be subject to extensive collaborative discussions with CDFW via the NDD Intakes Technical Team (NDDTT) required by Condition of Approval 9.6.3. Within the NDDTT, Permittee, Reclamation, CDFW, NMFS and USFWS will develop studies required by Conditions of Approval 9.6.10 (NDD Intakes Pre-construction Studies 1-9) and 9.6.11 (Post-construction Studies 1-9, and 13). The results of these studies will inform design of the fish screens to achieve Biological Criteria 1. The NDDTT work products pertaining to pre-construction screen design and post-construction operation shall be submitted to the Technical Oversight Team (TOT) (established by Condition of Approval 9.6.1) for the TOT's approval and incorporation into final Project design, construction contract documents, and studies and monitoring programs. In addition, the CSAMP CWF Project Work Team shall be established to develop initial study plans for Pre-construction Studies 10 and 12, establishing baseline, pre-Project CHNSR and CHNWR survival rates through the NDD intakes reach and through-Delta, and Post-construction Study 10 and 12, evaluating survival rates during Project operations. (Condition of Approval 9.6.2.) CSAMP will oversee the CSAMP CWF Project Work Team. After final written approval by CSAMP, the TOT, and CDFW, Condition of Approval 9.6.2 requires that all study plans completed by the CSAMP CWF Project Work Team shall be submitted to the IICG for incorporation into the Adaptive Management Program and independent peer review prior to initiation.

Conditions of Approval: Georgiana Slough Nonphysical Fish Barrier

Per Condition of Approval 9.8.8, installation of the nonphysical fish barrier at the Georgiana Slough junction will minimize the potential for increased entry of fish into the junction, where survival probabilities are expected to be lower as a result of hydrodynamic changes associated with operation of the NDD intakes. The two types of nonphysical barrier with greatest potential for use at this junction are the Bio Acoustic Fish Fence (BAFF) and Floating Fish Guidance Structure (FFGS) which have both have been tested at this location. Prior to the initiation of the Test Period, Permittee shall continue pilot investigations to refine the understanding of barrier efficiency and impacts on Covered Fish Species.

Conditions of Approval: South Delta Export Facilities Operations

Project operations at the South Delta Export Facilities will be governed by operational criteria and RTO designed to minimize take resulting from the coordinated Project operations of the NDD intakes and the South Delta Export Facilities. CHNWR and CHNSR juveniles migrate primarily through the north Delta and the reduction in flow velocities downstream of the NDD is expected to have an appreciable impact on the CHNWR and CHNSR, as discussed in "North Delta Diversions: Far Field Effects," above. New operating criteria and RTO applicable to the South Delta Export Facilities, that reduce the adverse impacts of flow conditions to CHNSR and CHNWR occurring under current CVP/SWP operations are an important means of minimizing the Project's overall impacts to these species in light of the NDD intakes and analyses that have considered the Project as a whole.

Per Conditions of Approval 9.6.5 and 9.6.6, following completion of Project construction and commencement of Project operations, studies will be undertaken as part of the Clifton Court Forebay Technical Team to estimate the extent to which the reconfigured CCF and changes to the south Delta export facilities change the prescreen loss of juvenile salmonids (i.e., from the CCF radial gates to the primary louvers at the Skinner Fish Facility), relative to the assumptions currently made for estimating loss and take in NMFS (2009). Condition of Approval 9.9.6 requires Permittee to conduct studies consisting of releases of tagged (acoustic or PIT) or otherwise marked juvenile salmonids, followed by recapture or detection, to estimate survival in different parts of the salvage process. Similar studies have been done previously for the existing SWP facilities. (Gingras 1997; Clark et al. 2009.) The results of these studies will determine the need to change the loss multipliers used to estimate loss and take as a function of expanded salvage. If the results of these studies indicate statistically significant differences between the Project loss multipliers and the multipliers used prior to the commencement of Project operations, and CDFW approves, the new Project multipliers will be applied to subsequent loss estimates that are used to quantify take of CHNWR and CHNSR in each water year. South Delta export pumping will be managed in real time, as currently occurs, in order to minimize losses of CHNWR and CHNSR.

Conditions of Approval: HOR Gate Fish Passage

The HOR Gate will include a fish passage structure to minimize impacts associated with migration blockage for both adult and juvenile CHNWR and CHNSR. Under Condition of Approval 9.6.4 the Permittee is required to convene a HOR Gate Technical Team (HGTT) that will meet periodically to provide technical input to the Permittee during the design process to ensure that final design minimizes impacts to CHNWR and CHNSR.

Prior to completion of final HOR Gate design, the Permittee shall prepare and submit draft and final reports summarizing HGTT work products to the TOT for final approval.

Conditions of Approval: Test Period Operations

To ensure that the avoidance, minimization, and mitigation measures achieve Biological Criterion 1 and Biological Criterion 2, Full Project Operations shall be preceded by a Test Period, described in Condition of Approval 9.6.7. Prior to initiation of the Test Period Permittee shall develop a draft Test Period Operations Plan and submit it to the NDDTT, CCFTT, HGTT, and the TOT for review and finalization. The Test Period Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with NDD intake operating criteria and the biological criteria in Condition of Approval 9.7, over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Test Period Operations Plan shall include the synthesis of results from all pre-construction studies approved by the TOT and shall describe how Permittee shall implement all post-construction studies during the Test Period. The Test period may not commence until the Test Period Operations Plan is approved in writing by CDFW.

In collaboration with the NDDTT, CCFTT, HGTT, and TOT, Permittee shall develop a Full Project Operations Plan prior to completion of the Test Period and initiation of coordinated long-term operations of all Project facilities described in Condition of Approval 9.9, *Full Project Operations*. The Full Project Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term.

In addition to and including those Conditions of Approval discussed above, the following Conditions of Approval, required by the ITP, will avoid and minimize Covered Activities' impacts to CHNWR and CHNSR.

Conditions of Approval: Near- and far-field effects of Project operations

In addition to the Conditions of Approval summarized above, the following Conditions of Approval are required by the ITP to avoid and minimize the impacts of Covered Activities on CHNWR and CHNSR as a result of Project Operations.

9.6 Required Technical Teams, Studies, and Project Operations Plans

9.6.1 Technical Oversight Team. Permittee shall, in consultation with CDFW, identify participants in a Technical Oversight Team (TOT) within 30 days of issuance of a SWRCB approval of a change in point of diversion for the Project. The purpose of the TOT is to ensure that the final design, construction, and operations of the Project minimize effects on Covered Fish Species. The TOT shall include only representatives from CDFW, USFWS, NMFS, DWR, and Reclamation. If at least three of the participating TOT agencies approve, other experts in fish biology, hydrology, or engineering may also participate in the TOT to assist in the development, review and finalization of specific TOT work products. The TOT shall:

- Ensure the final construction plan incorporates final fish screen design recommendations developed by the NDDTT, final HOR Gate construction and design recommendations developed by the HGTT, and final CCF construction and design recommendations developed by the CCFTT.
- Synthesize results from pre-construction studies and incorporate into the draft Test Period Operations Plan prepared by Permittee (see Condition of Approval 9.6.7).
- Synthesize results from all pre-construction and test period studies and incorporate into the draft Full Project Operations Plan prepared by Permittee (see Condition of Approval 9.6.8).
- Annually synthesize results from all post-construction studies, and operations modeling and measurement, to evaluate Project performance relative to required biological criteria (see Condition of Approval 9.7) and to evaluate compliance with operating criteria described in the Condition of Approval 9.9, the Test Period Operations Plan, and the Full Project Operations Plan.

Plans for Pre-construction studies 10, 12, and 13, plans for Post-construction studies 10-12, the Test Period Operations Plan, and the Full Project Operations Plan shall be finalized by the TOT, then provided to the IICG for review and integration into the Adaptive Management Framework decision-making process. As a part of the Adaptive Management Framework decision-making process final plans approved by the TOT, as appropriate, shall be independently peer reviewed prior to implementation by Permittee, as determined in consultation with CDFW.

9.6.2 CSAMP CWF Project Work Team. The TOT shall collaborate with CSAMP to establish a CWF project work team (CSAMP CWF Project Work Team) responsible for developing initial study plans for Pre-construction studies 10, 12, and 13 and Post-construction studies 10 and12. The CSAMP CWF Project Work Team shall be overseen by CSAMP. After final written approval by CSAMP, the TOT, and CDFW all study plans completed by the CSAMP CWF Project Work Team shall be submitted to the IICG for incorporation into the Adaptive Management Framework process and independent peer review prior to initiation.

9.6.3 NDD Intakes Technical Team. Permittee shall convene the NDD Intake Technical Team (NDDTT) within 60 days of TOT establishment and regularly thereafter throughout the development of the final design of NDD intakes, the Test Period, and Full Project Operations. The NDDTT shall only include representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With the approval of three or more of the original five agencies participating in the NDDTT, other individual experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts may also participate in the NDDTT to assist in the review and finalization of specific NDDTT work products.

The TOT shall collaborate with the NDDTT to:

- Develop final fish screen design. Final fish screen design shall be consistent with criteria described in *NMFS 1997 Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997b) and *CDFG 2000 Fish Screening Criteria* (CDFG 2000). Final fish screen design must receive written CDFW approval before construction can begin.
- Develop study plans for all Pre-construction Studies 1-9, and Post-construction studies 1-9 and 13 (see Conditions of Approval 9.6.10 and 9.6.11).
- Review and finalize annual reports for all required pre-construction, test period, and post-construction studies (see Conditions of Approval 9.6.10 and 9.6.11).
- Review and comment on the NDD intake subcomponent of the draft Test Period Operations Plan (see Condition of Approval 9.6.7).
- Review and comment on the NDD intake subcomponent of the draft Full Project Operations Plan (see Condition of Approval 9.6.8).
- Annually synthesize results from Project operations modeling and measurement (see Condition of Approval 9.8) to evaluate compliance with operating criteria described in the Test Period Operations Plan and the Full Project Operations Plan.

All final work products produced by the NDDTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, future studies, and monitoring programs.

9.6.4 HOR Gate Technical Team. Permittee shall convene an HOR Gate Technical Team (HGTT) at the initiation of the HOR Gate design that will meet periodically (at least quarterly) to provide technical input to the Permittee on the design process of the HOR Gate until Permittee completes final design (a time period expected to be at least two years). The HGTT shall include only representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With the approval of three or more of the initial agencies participating in the HGTT, experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts may also be participate in the HGTT to assist in the development, review and finalization of specific HGTT work products.

The TOT shall collaborate with the HGTT to:

- Review construction plans and make recommendations regarding appropriate techniques for dewatering, fish rescue, and fish exclusion during in-water work at the HOR Gate.
- Identify near-term research/monitoring needs, if any, to reduce Covered Species impact uncertainties (e.g. HOR Gate area habitat use) prior to construction.

- Prior to completion of final HOR Gate design, prepare draft and final reports summarizing HGTT work products that have been provided to the TOT for final approval prior to completion of final HOR Gate design.

All final work products produced by the HGTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, and studies and monitoring programs.

9.6.5 Clifton Court Forebay Technical Team. Permittee shall convene a Clifton Court Forebay Technical Team (CCFTT) regularly (at least quarterly) throughout the development of the final design of CCF modifications, the Test Period, and Full Project Operations. The CCFTT shall include only representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With approval of three or more of the original agencies participating in the CCFTT, other individual experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts, may also participate in the CCFTT to assist in the development, review and finalization of specific TOT work products.

The TOT shall collaborate with the CCFTT to:

- Review construction plans and make recommendations regarding phasing of CCF construction to further minimize impacts to Covered Species.
- Review Permittee’s construction plans and make recommendations regarding appropriate techniques for dewatering, fish rescue, and fish exclusion during in-water work. Dewatering and fish rescue shall be conducted for all cofferdam work at CCF, and fish exclusion shall be conducted for dredging.
- Implement requirements and recommendations described in Condition of Approval 9.8.13.
- Develop studies and monitoring programs to assess impacts on Covered Fish Species resulting from CCFPP and CCF operations and as part of requirements described in Condition of Approval 9.8.4.
- Annually, synthesize results from south Delta and CCF operations modeling and monitoring (described in Condition of Approval 9.8) to evaluate compliance with operating criteria described in the Test Period Operations Plan and the Full Project Operations Plan.
- Review and comment on the CCF subcomponent of the draft Test Period Operations Plan (see Condition of Approval 9.8.7).
- Review and comment on the CCF subcomponent of the draft Full Project Operations Plan (see Condition of Approval 9.8.8).

All final work products produced by the CCFTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, and studies and monitoring programs.

9.6.6 Clifton Court Forebay Loss Multiplier. The purpose of this condition is to estimate the extent to which the reconfigured CCF, and associated changes to the south Delta export facilities, change the prescreen loss of juvenile salmonids (i.e., from the CCF radial gates to the primary louvers at the Skinner Fish Facility) relative to the assumptions currently made for estimating loss and take in NMFS (2009).

Upon completion of construction and initiation of the Test Period Permittee shall implement studies to estimate prescreen loss of juvenile salmonids in coordination with the CCFTT as described in the *CCF* subsection of the Project Description. These studies shall consist of releases of tagged or marked juvenile salmonids, followed by recapture or detection to estimate survival during passage through CCF. The results of these studies shall be used by CDFW to determine whether the pre-screen loss multipliers used to estimate loss and take need to be revised. If CDFW determines that these studies indicate biologically significant differences between the loss multipliers calculated prior to issuance of this permit and the multipliers following completion of Project construction, the new Project multipliers shall from then on be employed in subsequent loss estimates to quantify the level of incidental take of CHNWR and CHNSR for the Project in each water year. South Delta export pumping shall be managed in real time, as currently occurs, in order to ensure that losses of CHNWR and CHNSR remain below the authorized incidental take (see Condition of Approval 9.9.8).

9.6.7 Test Period. Full Project Operations shall be preceded by a period of testing (Test Period) during which Permittee, in collaboration with the TOT, shall evaluate and demonstrate compliance with operating criteria for all Project facilities and biological criteria set forth in the permit (see Condition of Approval 9.9, and the *Operational Criteria for the NDD Intakes* subsection of the Project Description).

Prior to initiation of the Test Period Permittee shall develop a draft Test Period Operations Plan and submit it to the NDDTT, CCFTT, and the TOT for review and finalization. The Test Period Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with NDD intake operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Test Period Operations Plan shall include the synthesis of results from all pre-construction studies approved by the TOT and shall describe how Permittee shall implement all post-construction studies during the Test Period.

Operation of the NDD intakes shall be restricted to isolated and brief tests of individual intakes to verify functionality of primary structural components prior to initiation of the Test Period in consultation with CDFW, NMFS, and USFWS. The Test Period shall not commence until after construction of all Project components is complete and the final Test Period Operations Plan is approved in writing by CDFW.

Upon initiation of the Test Period the terms of this permit shall prevail over existing incidental take permit(s) or other approvals pursuant to CESA authorizing take of Covered Species for the operations of the SWP.

During the Test Period, Permittee shall implement post-construction studies described in the Test Period Operations Plan and provide draft annual reports to the NDDTT and the TOT for review. The TOT shall approve final reports prior to submission to the IICG and incorporation into the Adaptive Management Framework decision-making process.

CDFW, NMFS, and USFWS shall determine when the Test Period ends, and when Full Project Operations can commence, consistent with operating criteria evaluated during the Test Period and as described in Condition of Approval 9.9 and the Full Project Operations Plan.

Following completion of the Test Period subsequent tests of the NDD intakes shall continue during infrequently occurring hydrologic conditions to determine compliance with NDD intake operating criteria and biological requirements. The Full Project Operations Plan shall include a description of subsequent tests to evaluate operations of the NDD intakes in hydrologic conditions that were not evaluated during the Test Period.

9.6.8 Full Project Operations. In collaboration with the NDDTT, CCFTT, and TOT, Permittee shall develop and obtain approval of a Full Project Operations Plan prior to completion of the Test Period and initiation of coordinated long-term operations of all Project facilities described in Condition of Approval 9.9 (Full Project Operations). Permittee shall submit a draft Full Project Operations Plan to the NDDTT, CCFTT and the TOT for review and finalization.

The Full Project Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Full Project Operations Plan shall include the synthesis of all pre-construction and test period studies prepared by the TOT and use such information to provide a detailed description of how Permittee shall meet all required operating criteria and ensure compliance with biological criteria during Full Project Operations. The Full Project Operations Plan shall describe how Permittee will implement all required post-construction studies and monitoring during Full Project Operations. Full Project Operations shall not commence until after the final Full Project Operations Plan is approved in writing by CDFW.

The Full Project Operations Plan shall include:

- Detailed descriptions of how the biological criteria established in Condition of Approval 9.7 will be met following completion of the Test Period.

- All operational criteria included in Condition of Approval 9.9 of the permit (also see Condition 6).

- Results of pre-construction studies and post-construction studies conducted during the Test Period (see Conditions of Approval 9.6.10 and 9.6.11).

Upon completion of the Test Period, and initiation of Full Project Operations, Permittee shall adhere to the Full Project Operations Plan.

9.6.9 Sediment Reintroduction Plan. Permittee shall develop and implement a sediment reintroduction plan that enhances Covered Fish Species habitat through recurring sediment reintroduction and placement to maintain turbidity and create and maintain spawning habitat for DS and LFS and rearing habitat for CHNWR and CHNSR. The sediment reintroduction plan shall include monitoring programs to assess the effectiveness of sediment reintroduction in maintaining turbidity, DS and LFS spawning habitat, and rearing habitat for CHNWR and CHNSR in the Delta. The sediment reintroduction plan shall also identify separate CEQA and other permitting requirements and a plan for compliance with those requirements. Permittee shall develop the sediment reintroduction plan in coordination with CDFW and submit a draft to the TOT for review and finalization. The Test Period shall not commence until the sediment reintroduction plan is finalized by the TOT and approved in writing by CDFW.

9.6.10 NDD Intakes Pre-construction Studies. Permittee shall coordinate with the NDDTT to develop study plans for Pre-construction studies 1-9 and with the CSAMP CWF Project Work Team to develop study plans for Pre-construction studies 10-15, as identified in the Fish Facilities Technical Memorandum 2011[17], further described in the Fish Facilities Work Plan 2013[18], and as described below. Study plans shall include requirements for the timing of study initiation, study duration, timing of report review and finalization, and final approval prior to study

Pre-construction Study 1 - Site Locations Lab Study: The purpose of this study shall be to develop physical hydraulic models to optimize hydraulics and sediment transport at each NDD intake site to ensure NDD intake designs minimize Covered Fish Species impingement and entrainment risk.

Pre-construction Study 2 - Site Locations Mathematical Modeling Study: The purpose of this study shall be to develop site specific mathematical models to assess the performance of each NDD intake under the full range of tidal and river hydraulic conditions and associated operating conditions.

Pre-construction Study 3 - Refugia Lab Study: The purpose of this study shall be to use laboratory studies to test and optimize fish refugia designs to be incorporated in the final design of the NDD intakes.

Pre-construction Study 4 - Refugia Field Study: The purpose of this study shall be to conduct field experiments to evaluate the effectiveness of incorporating refugia into

[17] Fish Facilities Technical Team. 2011. BDCP Fish Facilities Technical Team Technical Memorandum.

[18] Fish Facilities Working Team. 2013. Work Plan—Intake Design Criteria and Performance Monitoring Development. June 28. California Department of Water Resources, California Department of Fish and Wildlife, U. S. Bureau of Reclamation, U. S. Fish and Wildlife Service, and the National Marine Fisheries Service.

the NDD intakes to provide areas for juvenile fish passing the screen to hold and recover from swimming fatigue and avoid exposure to predatory fish.

Pre-construction Study 5 - Predator Habitat Locations: The purpose of this study shall be to perform a field evaluation of predator habitat at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District) to inform final design of the NDD intakes.

Pre-construction Study 6 Predator Reduction Methods: The purpose of this study shall be to evaluate predator reduction techniques implemented at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District), to determine whether similar techniques could minimize potential predation impacts on Covered Fish Species and be feasible to implement at the NDD intakes.

Pre-construction Study 7 - Flow Profiling Field Study: The purpose of this study shall be to use field data collection to characterize the water velocity distribution at river transects within the NDD intake reach for a range of flow conditions. Water velocity distributions within the NDD intake reach will identify how hydraulics change with flow rate and tidal cycle. This information shall be used to inform fish screen final design and model-based testing of fish screen performance (see Pre-construction Study 8 below).

Pre-construction Study 8 - Deep Water Screens Study: The purpose of this study shall be to develop a computational fluid dynamics model to evaluate the need for hydraulic tuning baffles which can be adjusted in both the vertical and horizontal directions to achieve NDD intake design requirements to minimize Covered Fish Species impingement and entrainment.

Pre-construction Study 9 - Predator Density and Distribution: The purpose of this study is to determine the baseline densities, species composition, and seasonal and geographic distribution of predatory fish (and birds and mammals if appropriate) within the Sacramento River in the NDD intake reach and in adjacent control reaches. Baseline data collected on predator occurrence in the vicinity of each NDD intake and adjacent control reaches shall be used in the future, during the Test Period and Full Project Operations, to determine changes in predator density and distribution associated with construction and operation of the NDD intakes (see Post-construction Study 9 in Condition of Approval 9.6.11).

Pre-construction Study 10 – NDD Intake Reach Baseline Juvenile[19] CHNWR and CHNSR Survival Rates: The purpose of this study shall be to quantify baseline survival rates for juvenile CHNWR and CHNSR before initiation of construction activities at the NDD intakes based on empirical field data collection. This study shall be conducted within the NDD intake reach over the full range of flow conditions anticipated to occur over the permit term prior to initiation of construction and during Project construction to monitor impacts of construction on CHNWR and CHNSR.

[19] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.

Pre-construction Study 10 – NDD Intake Reach Baseline Juvenile[20] CHNWR and CHNSR Survival Rates: The purpose of this study shall be to quantify baseline survival rates for juvenile CHNWR and CHNSR before initiation of construction activities at the NDD intakes based on empirical field data collection. This study shall be conducted within the NDD intake reach over the full range of flow conditions anticipated to occur over the permit term prior to initiation of construction and during Project construction to monitor impacts of construction on CHNWR and CHNSR. For the purposes of this study and Post-construction Study 10 only, the NDD intake reach shall begin 0.25 miles upstream of Intake 2 and end 0.25 miles downstream of Intake 5.

During the Test Period and Full Project Operations, this study shall continue as Post-construction Study 10 (in Condition of Approval 9.6.11), using the same methodology. Together, these studies will quantify the change in survival rates of juvenile CHNWR and CHNSR due to construction and operation of the NDD intakes (see Biological Criteria 1 in Condition of Approval 9.7).

Pre-construction Study 12 – Through Delta Baseline Juvenile CHNWR and CHNSR Survival Rates: The purpose of this study shall be to develop a flow-based index of baseline survival rates for juvenile CHNWR and CHNSR from upstream of NDD intake 2 to Chipps Island through the full range of inflows and South Delta exports. The flow-based index shall be based on Sacramento River inflow at Freeport. Best available science shall be used to develop a method utilizing mark/recapture, acoustic telemetry, or other methods to implement this study.

During the Test Period and Full Project Operations, this study shall continue as Post-construction Study 12, using the same or compatible methodology. Together, the results of these studies shall be used to quantify changes in juvenile CHNWR and CHNSR survivorship from upstream of the NDD intakes to Chipps Island as a result of the Project and ensure compliance with Biological Criterion 2 (see Condition of Approval 9.7).

Pre-construction Study 13 – Monitoring Sacramento River Reverse Flows: The purpose of this study is to monitor the magnitude, frequency, and duration of Sacramento River reverse flows at the Georgiana Slough junction prior to initiation of the Test Period. This study shall be used to establish a pre-Project baseline and inform development of the Test Period Operations Plan and the Full Project Operations Plan. This study shall continue during the Test Period and Full Project Operations as Post-construction Study 13 (see Condition of Approval 9.6.11) using the same methodology. Together, the results of these studies shall be used to ensure compliance with Condition of Approval 9.9.4.1.

Pre-construction Study 16 – CHNWR and CHNSR Life Cycle Models: The purpose of this study is to use best available science to continue to support and refine the existing NMFS mathematical life cycle models for CHNWR, and verify it with field

[20] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.

data collection, as a quantitative tool to characterize the effects of abiotic (including climate change effects) and biotic factors on CHNWR populations. This CHNWR life cycle model shall be expanded and adapted to CHNSR. The CHNWR and CHNSR life cycle models shall be used to quantify the effects of the Project throughout construction, the Test Period, and Full Project Operations to ensure compliance with CHNWR and CHNSR biological criteria (see Conditions of Approval 9.6.11 and 9.7).

9.6.11 NDD Intakes Post-construction Studies. Prior to initiation of the Test Period Permittee shall coordinate with the NDDTT to develop study plans for Post-construction studies 1-9 and 13, and with the CSAMP CWF Project Work Team to develop study plans for Post-construction studies 10-12, as identified in the Fish Facilities Technical Memorandum 2011[21], further described in the Fish Facilities Work Plan 2013[22], and as described below. Post-construction studies shall be implemented throughout the Test Period to inform the development of the Full Project Operations Plan, and throughout Full Project Operations. Study plans shall include requirements for the timing of study initiation, study duration, timing of report review and finalization, and written approval from CDFW prior to study termination.

Permittee shall implement additional studies, as recommended through the Adaptive Management Framework decision-making process, to evaluate relevant physical and biological parameters.

Permittee shall initiate each study within 60 days of study plan finalization and written approval from CDFW. Following final approval by the TOT, Permittee shall fully fund and implement post-construction studies, and submit annual reports to the NDDTT for review and finalization. Annual and final written reports must be approved in writing by the TOT.

Post-construction Study 1 – Hydraulic Screen Evaluations to Set Baffles: The purpose of this study shall be to conduct initial hydraulic field evaluations of the NDD intakes to measure velocities over a designated grid in front of each screen panel. This study shall be conducted at diversion rates close to the maximum diversion rate. Results of this study shall be used to set initial baffle positions.

Post-construction Study 2 - Long-term Hydraulic Screen Evaluations: The purpose of this long term monitoring program shall be to measure approach velocities, sweeping velocities, and other hydrodynamic characteristics across the entire fish screen face at each intake. Results of this monitoring program shall be used to “tune” baffles and other components of the screen system to consistently achieve compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 3 - Periodic Visual Inspections: The purpose of this monitoring program shall be to perform visual inspections of NDD intake screens to

[21] Fish Facilities Technical Team. 2011. BDCP Fish Facilities Technical Team Technical Memorandum.
[22] Fish Facilities Working Team. 2013. Work Plan—Intake Design Criteria and Performance Monitoring Development. June 28. California Department of Water Resources, California Department of Fish and Wildlife, U. S. Bureau of Reclamation, U. S. Fish and Wildlife Service, and the National Marine Fisheries Service.

evaluate screen integrity and the effectiveness of the cleaning mechanism in protecting the structural integrity of the screen and maintaining uniform flow distribution through the screen. Results of this monitoring program shall be used to adjust cleaning intervals as needed to achieve compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 4 - Velocity Measurement Evaluations: The purpose of this monitoring program shall be to determine sweeping velocities along the length of each fish screen and in front of, and within, refugia areas over a range of flow conditions. The results of this monitoring program shall be used to determine if sweeping velocities and refugia areas are within the final fish screen design criteria (see Condition of Approval 9.6.3). Sweeping velocities in front of and within refugia areas shall be implemented if refugia are incorporated into the design of the NDD intakes.

Post-construction Study 5: - Refugia Effectiveness: This study shall be implemented if refugia are incorporated into the design of the NDD intakes. The purpose of this study shall be to monitor NDD intake fish screen refugia to evaluate effectiveness in minimizing screen impingement and near-screen predation. This includes evaluating refugia effectiveness at a range of flow conditions. Results of this monitoring program shall be used to evaluate compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 6 - Sediment Management: The purpose of this study is to quantify sediment deposition in front of the NDD intake screen base, and behind screens, to evaluate the effectiveness of sediment management devices and ensure compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 7 - Evaluation of Screen Impingement: The purpose of this monitoring program shall be to observe fish activity at the screen face and quantify Covered Fish Species impingement and injury rates. Results of this monitoring program shall be used to assess NDD intake performance relative to final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 8 - Screen Entrainment: The purpose of this study shall be to monitor densities of all Covered Fish Species life stages behind fish screens to quantify entrainment rates into the NDD intakes. Permittee shall identify the species and size of all entrained fish. Results of this study shall be used to assess performance of NDD intakes relative to biological criteria in Condition of Approval 9.7 and final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 9 – Predator Density and Distribution: The purpose of this study, which is associated with Pre-construction Study 9 in Condition of Approval 9.6.10, is to determine the densities, species composition, and seasonal and geographic distribution of predatory fish (and birds and mammals if appropriate) within the Sacramento River in the NDD intake reach and adjacent control reaches during the Test Period and Full Project Operations. Data collected on predator occurrence in the vicinity of each NDD intake and control reaches shall be used to determine whether predator control, facility modification, or operational changes at the NDD intakes are warranted to reduce predation of Covered Fish Species.

Post-construction Study 10 – Post-construction NDD Intake Reach Juvenile Salmon Survival Rates: The purpose of this study shall be to quantify survival rates for juvenile CHNWR and CHNSR at the NDD intakes based on empirical field data collection. This study shall be conducted within the NDD intake reach throughout the Test Period and Full Project Operations. This study shall use the same or compatible methods as Pre-construction Study 10 to enable direct comparison of juvenile CHNWR and CHNSR survival rates quantified before construction, during construction, throughout the Test Period, and throughout Full Project Operations. Together, these studies will quantify the change in survival rates of juvenile CHNWR and CHNSR due to construction and operation of the NDD intakes (see Biological Criteria 1 in Condition of Approval 9.7). For the purposes of this study and Pre-construction Study 10 only, the NDD intake reach shall begin 0.25 miles upstream of Intake 2 and end 0.25 miles downstream of Intake 5.

Post-construction Study 12 –Through Delta Post-construction Juvenile CHNWR and CHNSR Survival Rates: The purpose of this study shall be to quantify flow-based survival rates of juvenile CHNWR and CHNSR from upstream of NDD intake 2 to Chipps Island throughout the Test Period and Full Project Operations. This study shall use the same methods as Pre-construction Study 12 to enable direct comparison of pre-construction and post-construction juvenile CHNWR and CHNSR flow-based survival rates quantified before construction, during construction, the Test Period and Full Project Operations. Together, the results of these studies shall be used to verify that flow-based juvenile CHNWR and CHNSR survival rates established by Pre-construction Study 12 are not impacted by Test Period and Full Project Operations and ensure compliance with Biological Criteria 2 (see Condition of Approval 9.7).

Post-construction Study 13 – Monitoring Sacramento River Reverse Flows: The purpose of this study is to monitor the magnitude, frequency, and duration of Sacramento River reverse flows at the Georgiana Slough junction throughout the Test Period and Full Project Operations. This study shall use the same methodology as Pre-construction Study 13 in Condition of Approval 9.6.10. Together, the results of these studies shall be used to determine compliance with Condition of Approval 9.9.4.1.

Post-construction Study 16 – CHNWR and CHNSR Life Cycle Models: The purpose of this study is to use best available science to continue to support and refine the life cycle models for CHNWR and CHNSR, and verify them with field data collection, as a quantitative tool to characterize the effects of abiotic (including climate change effects) and biotic factors on CHNWR and CHNSR populations. The CHNWR and CHNSR life cycle models shall be used to quantify the effects of the Project throughout construction, the Test Period, and Full Project Operations to ensure compliance with CHNWR biological criteria (see Condition of Approval 9.7).

9.6.12 Personnel Conducting Studies and Monitoring. Permittee shall ensure that all pre-construction studies, post-construction studies and monitoring programs which result in the direct take of CHNWR, CHNSR, DS, and LFS are conducted by a person or entity with necessary state and federal scientific collecting permits and take authorizations.

9.7 Covered Fish Species Biological Criteria. Permittee shall utilize operating criteria described in Condition of Approval 9.9 to meet or exceed the following biological criteria for CHNWR, CHNSR, DS and LFS (Covered Fish Species):

Biological Criterion 1: Permittee shall operate the NDD intakes to achieve juvenile[23] CHNWR and CHNSR survival rates through NDD intake reach of 95 percent or more of the pre-project survival rate (established by Pre-construction Study 10 and Post-construction Study 10 in Conditions of Approval 9.6.10 and 9.6.11). For the purposes of Biological Criterion 1 only, the NDD intake reach shall be defined as beginning 0.25 miles upstream of Intake 2 and ending 0.25 miles downstream of Intake 5. Permittee shall provide survival estimates on an annual basis to CDFW, the TOT and the NDDTT.

Biological Criterion 2: Permittee shall operate the Project to achieve pre-project juvenile[24] CHNWR and CHNSR survival rates to Chipps Island (as established by Pre-construction Study 12 in Condition of Approval 9.6.10). Test Period and Full Project Operations survival rates shall be determined by Post-Construction Study 12 (see Condition of Approval 9.6.11). Permittee shall provide survival estimates on an annual basis to CDFW, the TOT and the NDDTT.

9.8 Project Operations Monitoring and Funding

9.8.1 Operations-Independent Measurement. Permittee shall document NDD intake compliance using data obtained from existing environmental monitoring programs including (1) Interagency Ecological Program Environmental Monitoring Program: Continuous Multi-parameter Monitoring, Discrete Physical/ Chemical Water Quality Sampling; (2) DWR and Reclamation: Continuous Recorder Sites; (3) Central Valley RWQCB: NPDES Self- Monitoring Program; and (4) USGS Delta Flows Network and National Water Quality Assessment Program. Permittee shall provide copies of monitoring reports prepared for these environmental monitoring programs to the TOT with other monitoring reporting required by the permit. Permittee shall fully fund and implement these existing environmental monitoring programs prior to initiation of Covered Activities and continue funding and implementation for the duration of the permit term.

9.8.2 Red Bluff Diversion Dam Rotary Screw Traps. Permittee shall coordinate with Reclamation to continue Red Bluff Diversion Dam rotary screw trapping operations to determine juvenile CHNWR and CHNSR passage and abundance year-round through the duration of the ITP.

[23] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.
[24] Juvenile CHNWR and CHNSR survival rates shall be determined for the fry, parr, smolt, and yearling life stages and the rearing and emigrating life history strategies.

9.8.3 Operations Measurement and Modeling. Permittee shall fund and implement hydrologic monitoring and modeling to document Project operations and ensure that the Project is operated consistent with required operational criteria (see Condition of Approval 9.9). This Condition of Approval shall commence upon initiation of the Test Period and continue for the duration of the permit term. Permittee shall submit annual reports describing hydrologic monitoring and modeling conducted throughout the previous year with other monitoring reporting required by Condition of Approval 9.8 to the TOT for review and approval.

9.8.5 Initiation of Pre-construction Studies and Continuation of Post-construction Studies. Permittee shall fund and implement Pre-construction Studies 10 - 15 upon completion of approval of the change in point of diversion for the Project by the State Water Resources Control Board until the initiation of the Test Period (see Condition of Approval 9.6.10). Upon initiation of the Test Period (see Condition of Approval 9.6.7), Permittee shall fund and implement Post-construction Studies 10 - 13 (see Condition of Approval 9.6.11*)* throughout the duration of the permit term.

9.8.6 Hatchery Origin Chinook Salmon Required for Studies and Monitoring. Permittee shall fund all costs associated with the annual production of hatchery origin Chinook salmon necessary to implement studies and monitoring including, but not limited to, pre-construction studies, post-construction studies, and long term compliance and effectiveness research and monitoring (see Conditions of Approval 9.6.10, 9.6.11, and 9.8). These hatchery-origin Chinook salmon shall be provided to support implementation of the Project, in addition to Permittee's existing mitigation requirements, through the duration of the permit term.

9.8.7 Genetic Testing and CWT Analysis Required for Studies and Monitoring. Permittee shall provide funding for all costs associated with genetic testing and coded wire tag (CWT) tagging and processing and analysis necessary to implement studies and monitoring required by the permit including pre-construction studies, post-construction studies, and long term compliance and effectiveness research and monitoring (see Conditions of Approval 9.6.10, 9.6.11, and 9.8). Permittee shall provide this funding throughout the duration of the permit term.

9.8.9 Existing Monitoring and IEP Funding[25,26]. Permittee shall fund its share of the Interagency Ecological Program (IEP) and other existing monitoring efforts in the lower Sacramento River, the lower Feather River, the lower San Joaquin River, and the Delta to establish presence and timing of migration of Covered Fish Species and inform implementation of RTO (described in Condition of Approval 9.9.5) including Fall Midwater Trawl, Spring Kodiak Trawl, 20 mm Survey, Smelt Larval Survey, Summer Townet, Bay Study sampling, Tisdale RST, Knights Landing RST, Beach Seine, Sacramento Trawl, Mossdale Trawl, and Chipps Island Trawl. This condition includes Permittee funding its share of any modifications or additions that may be made to IEP or other existing monitoring efforts through the Adaptive Management Program, consistent with Condition of Approval 9.8.11.

[25] This measure was initially implemented as Condition 8.1 of CDFG (2009).
[26] This measure was initially implemented under Section 11.2.1.3 of NMFS (2009).

9.8.10 Long Term Funding, Monitoring, and Reporting Requirements. Permittee shall fund and conduct required monitoring, and the staff and equipment that are needed for such monitoring, throughout the Test Period and Full Project Operations to document Project compliance with required operating criteria (see Condition of Approval 9.9).

9.8.11 Funding for Additional Studies and Monitoring Identified Through Adaptive Management. Permittee shall fund additional studies and monitoring, and the staff and equipment that are needed for such studies and monitoring, to document compliance with the terms of the permit, the Test Period Operations Plan, and the Full Project Operations Plan as deemed necessary under the Adaptive Management Framework.

9.8.12 Real Time Operations Fish Monitoring. Permittee shall fund long term fish monitoring and any subsequent fish and water quality monitoring stations required to implement RTO of the Project throughout the Test Period and Full Project Operations, as described in Condition of Approval 9.9.5, and as may be further described in the Real Time Operations sections of the Test Period Operations Plan and the Full Project Operations Plan

9.8.13 Clifton Court Forebay Aquatic Weed Control Program: Permittee shall implement the CCF Aquatic Weed Control Program as follows:

Permittee shall apply herbicides or use mechanical harvesters on an as-needed basis to control aquatic weeds and algal blooms in CCF. Herbicides may include Komeen®, a chelated copper herbicide (copper-ethylenediamine complex and copper sulfate pentahydrate) and Nautique®, a copper carbonate compound. Herbicide treatments shall occur only in July and August on an as needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure.

9.9 Specific Measures for Covered Fish Species

9.9.1 Coordinated Operating Agreement: The operational criteria specified in Conditions of Approval 9.9.4 and 9.9.5 shall be implemented consistent with the Coordinated Operating Agreement (COA), as follows:

Under the COA, Reclamation and DWR agree to operate the CVP/SWP under balanced conditions in a manner that meets Sacramento Valley and Delta needs while maintaining their respective annual water supplies as identified in the COA. Balanced conditions are defined as periods when the two projects agree that releases from upstream reservoirs, plus unregulated flow, approximately equal water supply needed to meet Sacramento Valley in-basin uses and CVP and SWP exports. Coordination between the CVP and the SWP is facilitated by implementing an accounting procedure based on the sharing principles outlined in the COA. During balanced conditions in the Delta when water must be withdrawn from storage to meet Sacramento Valley and Delta requirements.

9.9.2 Project Operations. Upon initiation of the Test Period, Permittee shall adhere to the requirements outlined in the Test Period Operations Plan. Upon initiation of Full Project Operations Permittee shall adhere to the operating criteria described in the Full Project Operations Plan. The Test Period Operations Plan and the Full Project Operations Plan shall include all operational criteria and real-time operations requirements described in this Condition, or as modified through amendments to the permit (see Condition of Approval 6).

9.9.3 Controlling Operational Criteria. When the permit, D-1641, the biological opinion(s), or other SWP authorizations establish operational criteria, the criteria that provide the highest level of protection for Covered Fish Species shall control Project operations.

9.9.4 General Operating Criteria. The General Operating Criteria include both new and existing operational criteria for Project operations. The new operating criteria presented in Condition of Approval 9.9.4 restrict Project operations to minimize impacts to Covered Fish Species, which shall be met unless superseded by real-time operational criteria described in Condition of Approval 9.9.5. The new NDD minimum bypass flow objectives in Condition of Approval 9.9.4.2, including pulse protection criteria, regulate flows to (1) maintain fish screen sweeping velocities, (2) minimize potential increase in upstream transport of productivity in the channels downstream of the intakes, (3) support salmonid and pelagic fish movements to regions of suitable habitat, (4) reduce losses to predation downstream of the diversions, and (5) maintain or improve rearing habitat conditions in the north Delta. South Delta operational criteria in Table 1 of Conditions of Approval 9.9.4 include new Old and Middle River (OMR) criteria to further minimize take at south Delta export facilities by reducing the hydrodynamic effects of south Delta operations that affect fish movement and migration routing during critical periods for Covered Fish Species. Condition of Approval 9.9.4.3 requires that the Project operate to achieve spring outflow criteria designed to meet the objective of minimizing potential adverse effects to LFS through the curtailment of exports during March, April, and May. Within the Delta, reduction in south Delta exports to achieve longfin smelt spring outflow criteria would result in more positive OMR flows in March of below normal and dry water years, possibly providing a benefit to CHNWR and CHNSR in the form of improved south Delta hydrodynamics.

9.9.4.1 Sacramento River Flow Reversal Avoidance. Permittee shall manage NDD intake operations at all times to avoid increasing the magnitude, frequency, or duration of flow reversals in the Sacramento River at the Georgiana Slough junction above pre-Project levels. Permittee shall develop operational measures to ensure this requirement is met throughout the Test Period and Full Project Operations and for inclusion in the Test Period Operations Plan and the Full Operations Plan. Permittee shall monitor the magnitude, frequency, and duration of Sacramento River flow reversals at the Georgiana Slough junction throughout the Test Period and Full Project Operations (see Pre-construction Study 13 and Post-construction Study 13 in Conditions of Approval 9.6.10 and 9.6.11).

9.9.4.2 NDD Intake Operations. During the Test Period Permittee shall evaluate the level of Covered Fish Species protection afforded by Level 1, 2, and 3 pumping. Upon initiation of Full Project Operations, post-pulse operations (described in Sub Table A in Condition of Approval 9.9.4) shall be restricted to Level 1 diversions until it can be demonstrated that Level 2 and Level 3 pumping afford the same level of Covered Fish Species protection as Level 1 through real time operations described in Condition of Approval 9.9.5. The baseline Project operations water yield shall be defined by the RTO criteria in the Full Project Operations Plan.

9.9.4.3 Spring Outflow: Abiotic Habitat for Longfin Smelt. Permittee shall maintain Delta outflows that are protective of LFS every year from March 1 – May 31. These outflows will: 1) maintain estuarine processes and flow positively associated with LFS abundance; 2) maintain downstream transport of LFS larvae to rearing habitat; and 3) dedicate water to maintain LFS habitat quality and quantity at levels consistent with recent conditions. Protective outflows from March 1 – May 31 every year shall be determined by the use of a lookup table derived from a linear relationship between the 50% exceedance forecast for the current month's 8RI and recent historic Delta outflow (1980 – 2016).

9.9.4.5 Winter and Summer Outflow. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to Net Delta Outflow Index as defined in D-1641 from January 1 – August 31.

9.9.4.6 Export to Inflow Ratio. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to the export to inflow ratios as defined in D-1641 to conduct coordinated operations of all Project facilities.

9.9.5 Real-Time Operations. The real-time operational decision-making process (RTO) shall allow short-term (*i.e.*, daily and weekly) adjustments to be made to water operations, within the range of criteria described in Condition of Approval 9.9.4. RTO provides flexibility in operations based on monitoring for fish presence (see Condition of Approval 9.8), hydrologic conditions, and operational criteria throughout the Delta and as described in Condition of Approval 9.9.4 to contribute to meeting the biological criteria established in Condition of Approval 9.7.

9.9.5.1 Real Time Operations of the NDD Intakes. RTOs will govern operations, when they are controlling (see Condition of Approval 9.9.3 *Controlling Operational Criteria*), during the October through June CHNWR and CHNSR migration period. Under RTOs, the NDD intakes shall be operated within the range of pulse protection and Levels 1, 2, and 3, with pulse protection operations in place when CHNWR and CHNSR migration is occurring. Post-pulse bypass flow operations from December 1 through June 30 may remain at Level 1 pumping depending on fish presence, abundance, and movement in the north Delta; however, the exact levels will be determined through initial operating studies evaluating the level of protection provided at various levels of diversions.

The NDDTT shall develop criteria for transitioning between and among pulse protection, Levels 1, 2 and 3 based on best available science. The NDDTT shall recommend transitional criteria to the TOT and IICG for consideration through the Adaptive Management Program, to ensure that the Project will achieve the objectives of Biological Criteria 1 and 2. New transitional criteria are subject to CDFW approval.

The NDDTT shall evaluate fish triggers for initiating pulse protection and pulse duration based on new data (including but not limited to data obtained from Pre-construction Studies 7, 10 and 12), new monitoring stations and techniques, the method used to identify CHNWR and CHNSR, and the time of year when fish pulses are observed. The NDDTT may recommend new fish triggers for initiating pulse protection and pulse durations to the TOT and IICG for consideration through the Adaptive Management Program, to ensure that the Project will achieve the objectives of Biological Criteria 1 and 2. New fish triggers and pulse durations are subject to CDFW approval.

October 1 through June 30: Permittee shall protect all CHNWR and CHNSR pulses by adhering to the following pulse protection criteria:

- A fish pulse is defined as a Knights Landing Catch Index (KLCI) ≥ 5 where KLCI = (# of CHNWR + # of CHNSR)/(Total Hours Fished/24)[27].
- Pulse protection operations shall be implemented within 24 hours of detection of a fish pulse.
- Diversions from the NDD intakes shall be reduced to low-level diversions of up to 6% of inflow measured at Freeport, but shall not exceed 900 cfs total and shall not exceed 300 cfs per intake.
- During the period of pulse protection, additional diversions above low-level diversions may occur provided that a minimum of 35,000 cfs bypass flow at the NDD intakes is maintained.
- Pulse protection ends after 5 consecutive days of daily KLCI < 5.

October, November**:** Post-pulse minimum bypass flows of 7,000 cfs shall be maintained in river after diverting at the NDD intakes.

9.9.5.2 Real Time Operations of South Delta Export Facilities. Real time operations shall be implemented to make short-term decisions regarding operation of south Delta export facilities in coordination with real time operations of all other Project facilities. The south Delta facilities shall be operated within the range of criteria listed in Condition of Approval 9.9.4, and be subject to RTO decision making based on anticipated impacts to DS, LFS, CHNWR, and CHNSR. South Delta RTO criteria, as described in the Test Period Operations Plan and the Full Project Operations Plan, shall include the following Measures:

South Delta RTO Measure 6 - OMR RTO Criteria for Juvenile CHNWR and CHNSR Entrainment Protection (Action IV.2.3 NMFS BiOp): The purpose of this measure is to reduce the vulnerability of emigrating CHNWR and CHNSR within the lower Sacramento and San Joaquin rivers to entrainment into the channels of the South Delta and at the SWP South Delta export facilities.

[27] KLCI is based on length at date criteria to identify CHNWR and CHNSR.

Permittee shall implement the following CHNWR and CHNSR Measure 6 criteria upon initiation of Full Project Operations if at least one of the Measure 6 triggers is met:[28]

Measure 6 criteria 1: To protect juvenile CHNWR and CHNSR from south Delta entrainment from January 1 through June 15, DOSS or CDFW DOSS personnel shall provide OMR flow advice to the WOMT and to the Director weekly. WOMT shall provide weekly advice which may include information on other ecosystem and water supply considerations to the Director.

Measure 6 criteria 2: From January 1 through June 15 Permittee shall coordinate with Reclamation to reduce exports, as necessary, to limit negative flows to -2,500 to -5,000 cfs in Old and Middle Rivers, depending on the presence of CHNWR and CHNSR. The specific OMR objective within this range shall be determined based on whether Measure 6 Criteria 2 stage 1 or stage 2 triggers are met.

Measure 6 criteria 3: Permittee shall coordinate with Reclamation to provide for an OMR flow of no more negative than -5,000 cfs, during the period between January 1 and June 15. The 5-day running average shall be no more than 25 percent more negative than the targeted flow requirement.[29] Further reductions in exports shall occur in a tiered fashion depending on the magnitude covered salmonid salvage at the CVP and SWP fish salvage facilities.

Measure 6 criteria 4: The combined CVP and SWP South Delta export facilities CHNWR incidental take limit is established in NMFS (2009) to govern operations of these facilities under this Measure. The juvenile CHNWR incidental take limit is 2 percent (based on Fisher length by date criteria[30]) or 1 percent (based on real time genetic testing) of the annual Juvenile Production Estimate (JPE). The JPE is an estimate of the number of juvenile CHNWR entering the Delta and shall be developed annually by the IEP Winter-run Project Work Team utilizing CHNWR adult in-river escapement data, the Juvenile Production Index at RBDD, juvenile in-river survival data and other information.

Measure 6 criteria 2 triggers[31] (first stage):

(1) Daily CVP/SWP CHNWR and CHNSR[32] loss density (fish per TAF) as determined by rapid genetic testing is greater than incidental take limit divided by 2,000 (1% WRJPE ÷ 2,000), with a minimum value of 2.5 fish per TAF, or

[28] These measures were initially implemented under the as Action IV.2.3 of NMFS (2009).
[29] The daily OMR flows used to compute both the 14-day and the 5-day averages shall be based on the definition in Condition of Approval 9.9.2.
[30] Fisher, F. W. 1992. Chinook salmon, *Oncorhynchus tshawytscha*, growth and occurrence in the Sacramento-San Joaquin River system. California Department Fish and Game.
[31] Reductions are required when any one criterion is met.
[32] Permittee shall implement rapid genetic testing protocol to determine CHNWR and CHNSR genetic origin.

(2) Daily CVP/SWP CHNWR and CHNSR salmon loss is greater than 8 fish per TAF multiplied by volume exported (in TAF), or

(3) Coleman National Fish Hatchery coded wire tagged CHNSR surrogate late fall-run Chinook salmon or Livingston Stone National Fish Hatchery coded wire tagged CHNWR cumulative CVP/SWP export facility entrainment loss is greater than 0.5% for each surrogate release group[33].

Measure 6 criteria 2 triggers[34] (second stage):

(1) Daily CVP/SWP CHNWR salmon loss density (fish per TAF) is greater than incidental take limit divided by 1,000 (1% of WRJPE ÷ 1,000), with a minimum value of 5 fish per TAF, or

(2) Daily CVP/SWP CHNWR and CHNSR loss is greater than 12 fish per TAF multiplied by volume exported (in TAF).

Measure 6 criteria 2 response (first stage):

Permittee shall implement the first stage reduction to decrease exports to achieve, in coordination with Reclamation, a net average OMR flow of no more negative than -3,500 cfs over a minimum of 5 consecutive days. The 5-day running average OMR flows will be no more than 25% more negative than the targeted flow level at any time during the 5-day running average period (e.g., -4,375 cfs average over 5 days).

Measure 6 criteria 2 response (second stage):

Permittee, in coordination with Reclamation, shall implement the second stage reduction, based on higher salvage numbers, to further reduce exports to achieve a net average OMR flow of -2,500 cfs over a minimum of 5 days.

Measure 6 criteria 2 off ramps:

Off Ramp from First Stage Trigger: Resumption of no more negative than -5,000 cfs OMR flow is allowed when average daily fish density is less than trigger density for the last 3 days of export reduction.

Off ramp from second stage trigger: Resumption of no more negative than -5,000 OMR cfs flows is allowed when average daily fish density is less than trigger density for the last 3 days of export reduction.

End of Measure 6: June 15 or until average daily water temperature at Mossdale is greater than 72° F (22° C) for 7 consecutive days, whichever is earlier.

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[33] Three consecutive days in which the combined loss numbers are below the action triggers are required before the OMR flow reductions can be relaxed to no more negative than -5,000 cfs. A minimum of 5 consecutive days of export reduction are required for the protection of listed salmonids under the action. Starting on day 3 of the export curtailment, the level of fish loss must be below the action triggers for the remainder of the 5-day export reduction to relax the OMR requirements on day 6. Any exceedance of a more conservative trigger restarts the 5-day OMR action response with the 3 consecutive days of loss monitoring criteria.

[34] Reductions are required when any one criterion is met.

South Delta RTO Measure 7 - Export RTO Criteria for CHNWR and CHNSR (Action 4.3 from NMFS 2009 BiOp): The purpose of this measure is to reduce losses of CHNWR and CHNSR migrating into the upper Delta region by reducing exports to minimize risk of entrainment into the central and south Delta, and then to the south Delta SWP facilities in the following weeks.

From November 1 through December 31, when salvage numbers reach a first stage trigger, Permittee in coordination with Reclamation shall reduce south Delta exports to a combined 6,000 cfs. When salvage numbers reach a second stage trigger, Permittee in coordination with Reclamation shall reduce south Delta exports to a combined 4,000 cfs. This measure shall be implemented in concert with South Delta RTO Measure 6.

Measure 7 triggers[35] (first stage):

(1) Daily SWP/CVP CHNWR and CHNSR loss density greater than 8 fish/thousand acre feet (TAF), or

(2) Daily loss is greater than 95 CHNWR and CHNSR per day, or

(3) Coleman National Fish Hatchery coded wire tagged late fall-run Chinook salmon (CNFH CWT LFR) cumulative CVP/SWP south Delta export facility loss is greater than 0.5% or

(4) Livingston Stone National Fish Hatchery coded wire tagged winter-run (LSNFH CWT WNT) cumulative CVP/SWP south Delta export facility loss is greater than 0.5%.

Measure 7 triggers[36] (second stage):

(1) Daily SWP/CVP older juvenile loss density greater than 15 fish/taf, or

(2) Daily loss is greater 120 fish per day, or

(3) CNFH CWT LFR cumulative CVP/SWP south Delta export facility loss greater than 0.5%, or

(4) LSNFH CWT WNT cumulative CVP/SWP south Delta export facility loss greater than 0.5%.

Measure 7 response (first stage): Permittee in coordination with Reclamation shall reduce south Delta exports to a combined 6,000 cfs for 3 days.

Measure 7 response (second stage): Reduce exports in coordination with Reclamation to a combined 4,000 cfs for 3 days.

Measure 7 off ramps (first stage):

1) 3 days or
2) CVP/SWP daily loss density is less than 8 fish/TAF.

[35] Export reductions are required when any one of the four criteria is met.
[36] Export reductions are required when any one of the four criteria is met.

Measure 7 off ramps (second stage):

1) 3 days or
2) CVP/SWP daily loss density is less than 8 fish/TAF.

9.9.5.3 Real Time Operations of the HOR Gate. October 1 – November 30: HOR Gate shall be operated during the SJR pulse period, as determined by the SOG. During this pulse period operation shall be to close the gate subject to RTO for purposes of water quality, stage and flood control considerations.

January 1 – March 31, and June 1 – June 15: Operation of the HOR Gate will be based on presence of migrating juvenile salmonids. During their migration, operation will be to close the gate for purposes of water quality, stage, and flood control.

April 1 – May 31: Permittee shall close the gate 100% of the time for purposes for water quality, stage, and flood control. Reclamation, DWR, NMFS, USFWS and CDFW will explore the implementation of reliable juvenile salmonid tracking technology that may enable shifting to a more flexible real time operating criterion based on the presence/absence of Covered Fish Species.

June 16 – September 30, and December 1 – December 31: Operable gates will be open

At any time during the year Permittee may open the HOR Gate to reduce downstream flood risks based on current conditions if San Joaquin River flow at Vernalis is greater than 10,000 cfs. This threshold may be revised to align with any future flood protection actions and with written approval from CDFW.

9.9.5.4 Suisun Marsh Facilities Real Time Operations. RTO shall be implemented to make short-term decisions regarding operation of Suisun Marsh facilities (SMSCG, RRDS, MIDS, and Goodyear Slough Outfall) in coordination with real time operations of all other Project facilities. The Suisun Marsh facilities shall be operated within the range of criteria listed in Condition of Approval 9.9.4, and be subject to RTO decision making based on anticipated impacts to DS, LFS, CHNWR, and CHNSR. Suisun Marsh facility RTO criteria, as described in the Real Time Operations Plan, shall include all Suisun Marsh RTO Measures included in this term.

Permittee may modify requirements in Suisun Marsh RTO Measure 2 using a minor amendment to the permit if such modifications are recommended as a result of reinitiation of USFWS (2009) or under the Adaptive Management Program.

Suisun Marsh RTO Measure 1 - Suisun Marsh Salinity Control Gates Operating Criteria: Permittee shall adhere to operating criteria as required by D-1641 and the following seasonal operation requirements from October 1 through February 28:

1) The radial gates shall be operational if Martinez EC is greater than 20,000, and for remaining months they remain open.
2) Permittee shall close gates when downstream channel flow velocity is < 0.1 (onset of flood tide); gates open when upstream to downstream stage difference is greater than 0.3 ft (onset of ebb tide).

Suisun Marsh RTO Measure 2 - MIDS Operating Criteria (LFS ITP Condition 6.1): To minimize take of LFS at the MIDS diversion, in addition to any existing operating rules, Permittee shall adhere to CDFW average intake velocity specifications.

CDFW will specify the required average intake velocities by August 15 each year in order to adequately protect LFS and, if appropriate, to allow Permittee to meet contractual water delivery requirements. Permittee shall maintain this velocity from September 1 to December 31 each year to protect staging and spawning LFS from entrainment until alternative operational criteria are developed from completion of the study below.

9.9.5.5 Real Time Operations of the North Bay Aqueduct (LFS ITP Condition 5.3): The purpose of this measure is to operate the North Bay Aqueduct to protect larval DS and LFS.

Throughout the Test Period and Full Project Operations Permittee shall implement this measure from January 15 through March 31 of dry and critically dry years, as defined in D-1641 for the Sacramento River. If the Water Year type changes after January 1 to below normal, above normal, or wet, this measure shall be suspended. If the Water Year type changes after January to dry or critical, this measure shall apply.

The SWG or CDFW SWG personnel shall provide Barker Slough Pumping Plant operations advice to the WOMT and to the Director weekly based on a review of the abundance and distribution survey data and other pertinent biological factors that influence the entrainment risk including detection of larval DS or LFS at Station 716. The advice for the Barker Slough Pumping Plant’s maximum seven day average shall not exceed 50 cfs. WOMT shall provide weekly advice which may include information on other ecosystem and water supply considerations to the Director and may accept, reject, or revise the recommendation of the SWG. If WOMT rejects or revises the recommendation, the Director may require a Barker Slough diversion rate and Permittee shall implement the rate required by the Director. Once notice is provided by the Director that a diversion rate is required, or the WOMT accepts the SWG or CDFW SWG advice, the rate of diversion at Barker Slough shall not increase. Beginning on the day on which notice is provided or the WOMT accepts the advice, the maximum diversion rate shall not exceed 50 cfs. This restriction shall be suspended when larval DS or LFS are no longer detected at Station 716 or after March 31, whichever occurs sooner.

9.9.5.6 Georgiana Slough Non-physical Barrier. Permittee will construct a non-physical barrier at Georgiana Slough to provide a higher probability of survival for juvenile CHNWR and CHNSR that pass the NDD intakes and encounter the Sacramento River-Georgiana Slough junction since the reduced Sacramento River flows that result from the operation of the NDD intakes could increase the potential for entrainment into Georgiana Slough.

v. CHNWR and CHNSR Project Operations Mitigation Measures

The Conditions of Approval above will reduce, but not eliminate, the impacts to CHNWR and CHNSR as a result of operations of the Project. Therefore, the following mitigation measures are required to ensure full mitigation of the impacts of the taking. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11).

Covered Activities associated with Project operations will result in permanent impacts to 0.42 linear miles of CHNWR and CHNSR channel margin habitat. Permittee shall restore and permanently protect 1.26 miles of channel margin habitat as compensatory mitigation for permanent impacts. Potential locations for compensatory habitat restoration include in the Sacramento River, Steamboat and Sutter Sloughs, or other areas agreed to by CDFW.

Additionally, upon approval of the change in point of diversion for the Project by the State Water Resources Control Board Permittee shall provide $4,000,000 annually to benefit CHNWR and CHNSR in the Sacramento River watershed with primary focus on projects upstream of the Delta in addition to the compensatory mitigation requirements described above.

Using this funding, Permittee shall establish a new population of CHNWR through introduction and reintroduction of fish into Sacramento River tributaries (which may include Battle Creek and/or upstream of Shasta Reservoir) and support that population with associated habitat restoration prior to initiation of the Test Period or within 12 years of permit issuance. Reintroduction and establishment of a new population, habitat restoration, or other measures shall meet the low extinction risk criteria identified by the Central Valley Technical Recovery Team (CVTRT) (Lindley et. al.2007) within the term of the ITP. Permittee shall fully fund and implement reintroduction and restoration action effectiveness monitoring and extinction risk monitoring to ensure that the goal is met.

Permittee shall focus siting and design of required CHNWR and CHNSR compensatory mitigation on restoring 80 acres of spawning and rearing habitat in the upper Sacramento River above the RBDD. Restoration of rearing habitat in particular above RBDD is targeted at reducing density dependent reductions in CHNWR survival above RBDD. The committed annual funds may also be used to restore habitat in the middle Sacramento River (e.g., in Sutter Bypass).

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CHNWR and CHNSR as a result of Project operations, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands*. Permittee shall ensure permanent protection and funding for perpetual management of compensatory CHNWR and CHNSR tidal perennial and channel margin habitat, including monitoring for suitable habitat features and presence of CHNWR and CHNSR.

vi. CHNWR and CHNSR Project Operations Final EIR/EIS Avoidance and Minimization Measures

In addition to the operations-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional operations-related environmental commitments incorporated into the Project as approved by DWR and required to be implemented by the ITP that would further ensure that any impacts to CHNSR and CHNWR resulting from Covered Activities would be minimized and fully mitigated.

- Environmental Commitment 4 (Tidal natural communities restoration)
- Environmental Commitment 6 (Channel margin habitat enhancement)
- Environmental Commitment 12 (Methylmercury management)
- Environmental Commitment 16: Nonphysical Fish Barriers

f. Delta smelt (*Hypomesus transpacificus*) and longfin smelt (*Spirinchus thaleichthys*)

i. DS and LFS Project Construction Impacts and Avoidance and Minimization Measures

Project construction activities and their resulting impacts are expected to result in the incidental take of individuals of Delta smelt (DS) and longfin smelt (LFS). The Covered Activities described in Section II A above expected to result in incidental take of DS and LFS include: over-water geotechnical exploration; construction activities at the NDD intakes, barge landings, and HOR Gate that include cofferdam installation, levee clearing and grading, riprap installation, dredging, and pile driving; modifications to CCF that include expansion and dredging of SCCF, construction of divider wall and east/west embankments, dewatering and excavation of NCCF, construction of NCCF outlet canals and siphons, and construction of a SCCF intake structure and NCCF emergency spillway; and barge operations.

Incidental take of DS and LFS, and adverse impacts as a result of impacts of the taking on DS and LFS, is expected to occur as a result of direct physical injury, mortality, adverse impacts to habitat, and exposure to underwater noise, increased turbidity, suspended sediment, and contaminants. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to DS and LFS is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

The Project is expected to cause the permanent loss of 500.6 acres of shallow water habitat and 25.3 acres of tidal perennial aquatic habitat. The Project is expected to permanently alter 2,190 acres of tidal perennial habitat in CCF. Impacts of the authorized taking also include adverse impacts to DS and LFS related to temporal losses, increased habitat fragmentation, and the Project’s incremental contribution to cumulative impacts (indirect impacts). These impacts include: non-lethal stress due to underwater noise and vibrations from pile driving, barge operations, dredging, increased turbidity and sedimentation, long-term effects due to increased contamination, and displacement from habitat. The creation of new predator habitat from the Covered Activities at the NDD intakes, HOR Gate, Georgiana NPB, and barge landings has the potential to lead to an increased vulnerability of DS and LFS to predation mortality. Indirect impacts also include entrainment of food web resources, disruptions in feeding behavior, and elevated selenium concentrations in fish tissues, and the modification and loss of habitat. NDD intake construction has the potential to impede spawning migrations through the affected reach of the Sacramento River due to behavioral responses to construction activity and loss of low velocity shoreline habitat.

Covered Activities would impact DS and LFS as described above, but these impacts will be avoided and minimized to the greatest extent practicable through following Conditions of Approval required by the ITP.

7.1 Designated Representative. Before starting Covered Activities, Permittee shall designate a representative (Designated Representative) responsible for communications with CDFW and overseeing compliance with this ITP. Permittee shall notify CDFW in writing before starting Covered Activities of the Designated Representative's name, business address, and contact information, and shall notify CDFW in writing if a substitute Designated Representative is selected or identified at any time during the term of this ITP.

7.2 Designated Biologist. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a biological monitor (Designated Biologist) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Biologist is knowledgeable and experienced in the biology, natural history, collecting and handling of the Covered Species. The Designated Biologist shall be responsible for monitoring Covered Activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of Covered Species' habitat. Permittee shall obtain CDFW approval of the Designated Biologist in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Biologist must be changed.

7.3 Designated Fisheries Biologist. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a fisheries biologist (Designated Fisheries Biologist) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Fisheries Biologist has 1) a 4-year college degree in fisheries or biology, or a related degree, 2) at least 2 years of professional experience in fisheries field surveys and fish capture and handling procedures, and 3) completed an electrofishing training course such as Principles and Techniques of Electrofishing (USFWS, National Conservation Training Center), or similar course. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat. Permittee shall obtain CDFW approval of the

Designated Fisheries Biologist in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Fisheries Biologist must be changed.

7.4 Designated Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Permittee shall conduct an education program for all Project personnel working in the Project Area before performing any work. The program shall consist of a presentation from the Designated Biologist that includes: Important timing windows for Covered Species; information about the distribution, habitat needs, and sensitivity of Covered Species; Take minimization measures that will be implemented during Covered Activities, including habitat avoidance commitments, and protocols for identifying appropriate take minimization measures; special status species that may be on the construction site and penalties for violations of CESA; boundaries of the construction site and demarcation of disturbance-free zones, including exclusion barriers; and measures to take when encountering Covered Species and what to do when Covered Species are found dead, injured, stressed, or entrapped. Permittee shall provide interpretation when needed and instruction to any new workers before they are authorized to perform Covered Activities. Permittee shall prepare and distribute a handout containing this information for workers to carry in the Project Area. Project personnel shall sign a form stating they attended the program and understand all protection measures; and the training shall be repeated at least once annually for long-term and/or permanent Project personnel.

7.6 Construction Monitoring Notebook. The Designated Biologist shall maintain a construction-monitoring notebook on-site throughout the construction period, which shall include a copy of this ITP with attachments and a list of signatures of all personnel who have successfully completed the education program. Permittee shall ensure a copy of the construction-monitoring notebook is available for review at the Project site upon request by CDFW.

7.14 Hazardous Waste. Permittee shall immediately stop and, pursuant to pertinent state and federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so. Permittee shall exclude the storage and handling of hazardous materials from the Project Area and shall properly contain and dispose of any unused or leftover hazardous products off-site.

8.1 Notification Before Commencement. The Designated Representative shall notify CDFW 14 calendar days before starting Covered Activities and shall document compliance with all pre-Project Conditions of Approval before starting Covered Activities.

8.2 Notification of Non-compliance. The Designated Representative shall immediately notify CDFW in writing if it determines that the Permittee is not in compliance with any Condition of Approval of this ITP, including but not limited to any actual or anticipated failure to implement measures within the time periods indicated in this ITP and/or the MMRP. The Designated Representative shall report any non-compliance with this ITP to CDFW within 24 hours.

8.3 Compliance Monitoring. The Designated Biologist(s) shall be on-site daily at each Work Area within the Project Area when Covered Activities occur. The Designated Biologist(s) shall conduct compliance inspections to: (1) minimize incidental take of the Covered Species; (2) prevent unlawful take of species; (3) check for compliance with all measures of this ITP; (4) check all exclusion zones; and (5) ensure that signs, stakes, and fencing are intact, and (6) that Covered Activities are only occurring in the Project Area. During initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections continuously within each of the Work Area(s) where Covered Activities are occurring. After initial vegetation and soil disturbance, the Designated Biologist(s) shall conduct compliance inspections a minimum of once per day within each of the Work Area(s) where Covered Activities are occurring. The Designated Representative or Designated Biologist(s) shall prepare daily written observation and inspection records summarizing: oversight activities and compliance inspections, observations of Covered Species and their sign, survey results, and monitoring activities required by this ITP. Observation and inspection records shall be compiled and reported as described in Condition of Approval 7.6. The Designated Biologist(s) shall conduct compliance inspections a minimum of monthly during periods of inactivity and after clearing, grubbing, and grading are completed.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Permittee shall maintain Geographic Information System (GIS) shapefile layers and associated maps depicting: 1) mapped areas of all land disturbances within the Construction Footprint; and 2) mapped areas of disturbed identified habitat features suitable for Covered Species (see Condition of Approval 8.4.1 for habitat features) within the Construction Footprint (as depicted in ITP Attachment 1, Figures 1-10). Permittee shall maintain the GIS layers and metadata for those maps and shall update the GIS layers and maps if there are any new detections of Covered Species or their habitat features. Within each Work Area of the Construction Footprint, Permittee shall track, in real time, acreages of identified habitat features suitable for Covered Species disturbed by Covered Activities. This tracking shall be maintained using a GIS format and include photo documentation of the habitat feature within a Work Area conducted no more than 14 days prior to initiation of Covered Activities. The photo documentation of each habitat feature shall include a minimum of four photos: one taken each from the North, South, East, and West and facing the habitat feature. There shall be separate photo documentation of each habitat feature suitable for Covered Species within a Work Area. Accordingly, if there are multiple habitat features in a Work Area, there will be multiple sets of photo documentation for that Work Area. The Permittee shall document the total disturbed acreage of habitat features for each Covered Species compiled from the real time tracking, and compare the documented disturbance in each Work Area to the Baseline Maps. Permittee shall provide GIS layers and the associated metadata to CDFW with the

Monthly Compliance Report (see Condition of Approval 8.6). Permittee shall also maintain maps for each Covered Species separately, and shall include updates to any of the maps in the next successive Annual Status Report (see Condition of Approval 8.7). Permittee shall also provide up-to-date GIS layers of the identified habitat features suitable for Covered Species with the Monthly Compliance Report and a summation of disturbance of identified habitat features annually at the time of Annual Status Report submission.

8.5 Reporting Approved Maps. Permittee shall document the cumulatively disturbed acreages of identified habitat suitable for each Covered Species within the Construction Footprint, as well as acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days, using the data maintained according to Condition of Approval 8.4. Permittee shall provide the above information to CDFW with the Monthly Compliance Report.

8.6 Compliance Report. For the duration of the Covered Activities, the Designated Representative(s) or Designated Biologist(s) shall compile the observation and inspection records identified in Conditions of Approval 8.3 and 8.4 into a Monthly Compliance Report and submit it to CDFW along with a copy of the MMRP table with notes showing the current implementation status of each mitigation measure. Monthly Compliance Reports shall also include: 1) an accounting of the number of acres that have been disturbed within the Project area, both for the prior month and a total since ITP issuance; 2) the cumulatively disturbed acreages of identified habitat features for each of the Covered Species within the Project Area, both for preceding 30 days and a total since ITP issuance; and 3) the acreages of identified habitat features anticipated to be disturbed over the succeeding 30 days; and 4) the up-to-date GIS layers, associated metadata, and photo documentation used to track acreages disturbed during Covered Activities and as identified in Conditions of Approval 8.4 and 8.5. Permittee shall submit Monthly Compliance Reports to CDFW no later than the 15th day of the month. The Monthly Compliance Report is due at the office listed in the Notices section of this ITP and via e-mail to CDFW's Representative and Headquarters CESA Program. At the time of this ITP's approval, the CDFW Representative is Carl Wilcox Carl.Wilcox@wildlife.ca.gov) and Headquarters CESA Program email is CESA@wildlife.ca.gov. CDFW may at any time increase the timing and number of compliance inspections and reports required under this provision depending upon the results of previous compliance inspections. If CDFW determines the reporting schedule must be changed, CDFW will notify Permittee in writing of the new reporting schedule.

8.7 Annual Status Report. Permittee shall provide CDFW with an Annual Status Report (ASR) no later than January 31st of every year beginning with issuance of this ITP and continuing until CDFW accepts the Full Project Operations Report identified below. Each ASR shall include, at a minimum: (1) a summary of all Monthly Compliance Reports for that year identified in Condition of Approval 8.7; (2) a general description of the status of the Project Area and Covered Activities, including actual or projected completion dates, if known; (3) a copy of the table in the MMRP with notes showing the current implementation status of each mitigation measure; (4) an assessment of the effectiveness of each completed or partially completed mitigation measure in avoiding, minimizing and mitigating Project impacts; (5) all available information about Project-related incidental take of the Covered Species; (6) information about other Project impacts on the Covered Species; (7) updates to the mapped areas of all land disturbances and mapped areas of identified habitat features suitable for Covered Species within the Project Area in accordance with Condition of Approval 8.4 above; 8) a summary of findings from pre-construction surveys (e.g., number of times a Covered Species or a burrow or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented); 9) beginning and ending dates of maintenance and emergency related and other Covered Activities undertaken during the reporting year; and 10) a summary of the cumulative status of the disturbed acreages of all land disturbances and identified habitat features for each of the Covered Species within the Project Area, both for the preceding twelve months and a total since ITP issuance, and the acreages of all land and identified habitat features anticipated to be disturbed over the succeeding twelve months in accordance with Conditions of Approval 8.4 and 8.5 above; and 11) documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative acreages of land disturbance for each Covered Species' habitat in accordance with Condition of Approval 10, below.

8.8 <u>CNDDB Observations</u>. The Designated Biologist shall submit all observations of Covered Species to CDFW's California Natural Diversity Database (CNDDB) within 60 calendar days of the observation and the Designated Biologist shall include copies of the submitted forms with the next Monthly Compliance Report or ASR, whichever is submitted first relative to the observation.

8.9.1 <u>Project Construction Report</u>. No later than 180 days after completion of all mitigation measures, Permittee shall provide CDFW with a Final Mitigation Report. The Designated Biologist(s) shall prepare the Final Mitigation Report which shall include, at a minimum: (1) a summary of all Monthly Compliance Reports and all ASRs; (2) a copy of the table in the MMRP with notes showing when each of the mitigation measures was implemented; (3) all available information about Project-related incidental take of the Covered Species; (4) information about other Project impacts on the Covered Species; (5) beginning and ending dates of Covered Activities; (6) an assessment of the effectiveness of this ITP's Conditions of Approval in minimizing and fully mitigating Project impacts of the taking on Covered Species; (7) recommendations on how mitigation measures might be changed to more effectively minimize take and mitigate the impacts of future projects on the Covered Species; and (8) any other pertinent information.

9.1.1 <u>Herbicide and Pesticide Use</u>. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by a licensed applicator in accordance with all applicable state, federal, and local regulations. Permittee shall only apply herbicide sprays via ground application when wind speed measures less than three mph. Permittee shall ensure all herbicide sprays utilized within and adjacent to identified habitat features suitable for Covered Species contain a dye (registered for aquatic use by the California Department of Pesticide Regulation, if warranted) to prevent overspray.

9.1.3 Artificial Lighting. Permittee shall limit artificial outdoor lighting to safety and security requirements. Permittee shall ensure all lighting minimally impacts the surrounding environment, and Permittee or contractors shall shield lighting to direct the light only toward objects requiring illumination in construction and facility sites within the Project Area. Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties or open spaces and backscatter into the nighttime sky. Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety, and personnel access. All lighting shall be directed away from waterways near Project facilities with shielding to further minimize potential light spillover into Covered Fish Species habitat.

9.1.4 Covered Species Observations. Project personnel shall inform the Designated Biologist(s) if they encounter Covered Species within or near the construction site during all phases of Covered Activities. Permittee shall cease Covered Activities in the vicinity of Covered Species that could cause injury or mortality until the Covered Species is moved by the Designated Biologist(s) or it moves from the construction site of its own accord.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Permittee shall develop and implement a spoils disposal plan, for the storage of spoils, reusable tunnel material (RTM), and dredged material. The spoils disposal plan shall address size, locations, and required characteristics of designated storage areas; storage site preparation and dewatering; excavation of contaminated material; and chemical characterization, drainage, and treatment. The spoils disposal plan shall include protocols for sampling and analysis of dredge materials, spoils and RTM, that shall address: handling and disposal of hazardous material; the presence and concentrations of contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine and pyrethroid pesticides); potential discharge of contaminants that would affect surface water or groundwater (e.g., instream discharges during dredging, effluent discharge from the disposal site; leachate from the disposal site); sediment analyses; chemical analyses; a protocol to reduce or eliminate the release of contaminated sediment; and BMPs to be implemented during handling and disposal of any potentially hazardous dredged or excavated material (see Condition of Approval 9.1.21).

9.1.11 In-Water Work Windows. In-water work windows minimize the risk of injury, mortality and impacts to DS and LFS habitat, and potential impacts to DS and LFS as a result of exposure to underwater noise, increased turbidity and suspended sediments, and contaminants by restricting the times of year when in-water Covered Activities may be conducted. The following site-specific in-water work windows minimize impacts to DS and LFS, as described.

- Permittee shall only conduct in-water work at the NDD intakes from June 1 through October 31:

- Permittee shall only conduct in-water impact pile driving at the NDD intakes from June 15 - September 15. Mobilization and demobilization are not included within this work window.
- Permittee may conduct in-water impact pile driving at the NDD intakes from June 1 – June 15 and September 16 - October 31 if bubble curtains and other measures demonstrate that an equivalent level of protection can be achieved during the primary work window, and as approved in writing by CDFW.
- Permittee may conduct impact pile driving between June 1 – June 15 and September 16 – October 31 behind cofferdams at the NDD Intakes construction sites outside of the above shortened work window with in-channel acoustic monitoring (see Condition of Approval 9.1.13) required to verify that generated sound thresholds do not exceed the disturbance threshold of 150 dB.

- Permittee shall only conduct in-water Covered Activities associated with the construction of the HOR Gate from August 1 - October 31.
    - Permittee shall implement use of bubble/sound barrier with acoustic monitoring to verify reduction in the sound field when impact hammers are used.
- Permittee shall only conduct in-water Covered Activities associated with the construction of barge landings from July 1 through August 31.
- Permittee shall only conduct over-water geotechnical exploration from August 1 through October 31.
- Permittee shall only conduct in-water Covered Activities associated with construction of the CCF facilities from July 1 - November 30
    - Permittee shall only conduct in-water impact pile driving from July 1 - October 31. Mobilization and demobilization could continue to occur outside this window.
    - Permittee shall only conduct dredging operations from July 1 – October 31 at South CCF.
    - Permittee shall only conduct dredging of the North CCF after fish have been rescued/salvaged.
    - Permittee may conduct other low impact in-water work from November 1 – November 30.
- Permittee shall only conduct barge operations within the following windows and associated locations:
    - Permittee shall only conduct barge operations from the Port of Stockton, San Francisco, and Antioch to all barge landings from June 1 – October 31

- Permittee shall only conduct barge operations from the Port of Stockton to Bouldin Island from November 1 - February 28.
- Permittee shall only conduct barge operations from the Port of Stockton to Bouldin Island from March 1 - May 31 to move critical heavy construction equipment and materials that cannot be moved by land. Barge traffic shall be restricted to minimize impacts to emigrating CHNSR from the San Joaquin River basin.
- During the period from November 1 to May 31 no trips will originate from the ports in San Francisco or Antioch.

Adult DS and LFS migrate upstream into and through the NDD intake reach of the Sacramento River from early winter through late spring (CDFG 2009, Merz et al 2011, Merz et al 2013), such that the June 1 to October 31 NDD work window precludes exposure to any construction-related impacts for the adult life stages. By June, most smelt eggs have hatched and larvae transported downstream past the NDDs, so the work window substantially minimizes take and associated impacts of the taking due to NDD intake construction-related underwater noise for these life stages. In addition, by June, juvenile LFS have generally moved downstream of the Delta, so the work window is substantially protective of this LFS life stage. However, juvenile DS may persist in the NDD reach in relatively small numbers into the summer. Additionally there is a small population of resident fish that are present year round in the northern Delta (Sommer et al 2011).

DS and LFS have a very limited presence in the southern Delta where CCF is located within the July 1 to November 31 CCF in-water work window and the July 1 to October 31 impact pile driving window (Rosenfield and Baxter 2007, Nobriga et al 2008). This is mostly due to high water temperatures (> 25^{O}C) and high water clarity (Nobriga Et al. 2008). The spawning migrations of maturing DS and LFS into the interior and southern Delta do not begin until late fall and early winter. They are typically observed in in CVP and SWP fish salvage sampling beginning in mid-December to early January. DS and LFS spawning, incubation, and larval rearing take place throughout the winter and spring, with most juvenile smelt moving downstream from the southern Delta prior to July 1 as water temperatures increase. Given the temporal distribution of DS and LFS in the southern Delta, the CCF work window provide a high level of avoidance and minimization relative to construction-related underwater noise.

The HOR Gate and CCF are both located in the southern Delta and the seasonality of DS and LFS presence is expected to be very similar for the two sites. Because the August 1 to October 31 HOR Gate in-water work window is shorter than the in-water work window at CCF, DS and LFS are expected to be less exposed underwater noise as a result of Covered Activities at the HOR Gate, than in CCF.

The July 1 through August 31 in-water work window for barge landing construction and the August 1 through October 31 geotechnical exploration in-water work window provide a high level of LFS take avoidance and minimization because DS and LFS are essentially absent from the Delta during these windows. Rearing juvenile and subadult DS are present in several regions of the Delta during the window, so there is the potential for underwater noise related take and associated impacts of the taking to these life stages of DS. The potential for take and associated impacts of the taking is highest for barge landing sites located in the Sacramento River below Rio Vista.

Restricting barge operations to only occur from Antioch, Stockton, and San Francisco to all barge landings and potentially the NDD Intakes from June 1-October 31, will substantially avoid the primary spawning season for both DS and LFS (December – June). However, barge operations can still be conducted from the Port of Stockton to Bouldin Island from November 1-May 31st, with March 1-May 31 restricted to only moving heavy equipment as necessary. This will expose any DS and LFS adults, eggs, and larvae that are occupying that reach of the SJR to barge operations during that time.

LFS and DS larvae and juveniles, as well as some spawning adult DS and their eggs, will potentially still be exposed to construction activities in the vicinity of the NDD, as the start of the in-water construction window overlaps with the presence of these life stages for these species. The presence of individuals can occur until water temperatures in the vicinity of the construction sites meet or exceeds 25° C (Swanson et al 2000, USFWS 2008).

9.1.12 Daily In-Water Work Restriction. Permittee shall confine all in-water Covered Activities to times between sunrise and sunset. In general, most smelt species are nocturnal spawners, making overnight forays into spawning microhabitats and leaving them before dawn, as evidenced in marine beach spawners, estuarine populations, and the landlocked Lake Washington longfin smelt (Nobriga and Herbold 2009, Moulton 1974, Martz et. al 1996). Because of this, it is assumed that both populations of DS and LFS exhibit nocturnal spawning behaviors, and move at night when migrating upstream. The daily in-water work restriction (sunrise – sunset) will minimize exposure of migrating adult LFS and DS to construction related impacts. However, early life stage DS and LFS are much weaker swimming fish and their downstream movement is mostly influenced by freshwater flows. As a result, Covered Activities occurring between sunrise and sunset could still impact these younger life stages of DS and LFS.

9.1.13 Underwater Sound Abatement Plan. Permittee shall coordinate with the TOT to develop and implement an underwater sound abatement plan to evaluate the potential effects of underwater noise on Covered Fish Species in the context of interim underwater noise thresholds and to reduce underwater noise, to the extent possible, below thresholds established for disturbance and injury of fish (ICF Jones and Stokes 2009). The underwater sound abatement plan shall also include procedures for measuring pile driving sound consistent with ICF Jones and Stokes (2009). Underwater noise thresholds include:

- Injury threshold for fish of all sizes at a peak sound pressure level of 206 decibels (dB) relative to 1 micropascal;

- Injury threshold for fish less than 2 grams is 183 dB relative to 1 micropascal cumulative sound exposure level, and 187 dB relative to 1 micropascal cumulative sound exposure level for fish greater than or equal to 2 grams;
- Disturbance threshold for fish of all sizes is 150 dB root mean square relative to 1 micropascal.

Permittee shall verify that any sound transmitted to the water column by Covered Activities conducted outside the in-water work window, but within de-watered areas, is below the disturbance threshold of 150 dB. The Designated Fisheries Biologist shall retain the authority to stop work in the event that measured sound pressure level (SPL) exceed the disturbance threshold.

Permittee shall submit the underwater sound abatement plan to the TOT for review at least 90 days prior to finalization of the Project engineering design. Permittee shall not initiate in-water Covered Activities until the final underwater sound abatement plan is approved in writing by CDFW.

9.1.14 Pile Driving Plan. Because under-water noise generated from impact pile driving cannot be abated to levels below the California Department of Transportation thresholds (ICF Jones and Stokes 2009) in all cases, Permittee shall develop a pile driving plan prior to finalization of Project engineering design. As part of this plan, Permittee shall include an explanation of how the Project engineering design minimizes the total number of pilings, the number of pilings that will be driven per day with an impact pile driver, the number of pile driving strikes per day, the duration of pile driving within the in-water work windows, and the duration of pile driving within the daily in-water work construction windows.

The underwater noise generated by impact pile driving will be abated using the best available and practicable technologies. Examples of such technologies include, but are not limited to, the use of cast-in-drilled-hole rather than driven piles; use of vibratory rather than impact pile driving equipment; using an impact pile driver to proof piles initially placed with a vibratory pile driver; noise attenuation using of pile caps (e.g., wood or micarta), bubble curtains, air-filled fabric barriers, or isolation piles; or installation of piling-specific cofferdams. Specific techniques to be used will be selected based on site-specific conditions.

In addition to using vibratory pile driving methods whenever possible, and establishing protocols for attenuating underwater noise levels produced during in-water construction activities, Permittee will develop and implement operational protocols when impact pile driving is necessary. These operational protocols will be used to minimize the effects of impact pile driving on Covered Fish Species and may include, but not be limited to, the following: monitoring the in-water work area for fish that may be showing signs of distress or injury as a result of pile driving activities and stopping work when distressed or injured fish are observed; initiating impact pile driving with a “soft-start,” such that pile strikes are initiated at reduced impact and increase to full impact over several strikes to provide fish an opportunity to move out of the area; restricting impact pile driving activities to specific times of the day and for a specific duration to be determined through coordination with the fish and wildlife agencies; and, when more than one pile driving rig is employed, ensure pile driving activities are initiated in a way that provides an escape route and avoids “trapping” fish between pile drivers in waters exposed to underwater noise levels that could potentially cause injury. These protocols are expected to avoid and minimize the overall extent, intensity, and duration of potential underwater noise effects associated with impact pile driving activities.

Permittee shall coordinate with the Technical Oversight Team (TOT) to develop the pile driving plan prior to finalizing Project engineering design. Permittee shall not initiate in-water pile driving until the final Pile Driving Plan is approved in writing by CDFW.

9.1.15 Barge Operations Plan. Permittee shall develop and implement a barge operations plan to further avoid and minimize underwater noise impacts to CHNWR and CHNSR. Permittee shall coordinate with the TOT prior to finalizing Project engineering design, to develop a barge operations plan to minimize the number of trips necessary to conduct Covered Activities and to identify barge routes that minimize underwater noise related impacts on CHNWR and CHNSR. Permittee shall develop plans for which materials can be transported by truck or rail to launch and retrieval points along the proposed tunnel alignment. Permittee shall also investigate the potential of using rail to deliver materials and components to Stockton and the CCF location.

Permittee shall submit a draft barge operations plan to the TOT at least 90 days prior to finalization of the Project engineering design. Permittee shall coordinate with the TOT to develop the barge operations plan prior to finalizing Project engineering design. Permittee shall not initiate barge operations until the final barge operations plan is approved in writing by CDFW.

9.1.16 Fish Salvage Plan. Permittee shall coordinate with the TOT to develop a fish salvage plan that describes procedures for fish rescue and salvage to minimize the number of Covered Fish Species stranded during Project construction. Permittee shall submit a draft fish salvage plan to the TOT at least 90 days prior to finalization of Project engineering design. Permittee shall not initiate Covered Activities that have the potential to strand fish until the final fish salvage plan is approved in writing by CDFW.

The fish salvage plan must be reviewed and finalized by the TOT and approved in writing by CDFW. Permittee shall implement all measures in the approved plan.

9.1.17 Dewatering. Permittee shall screen dewatering pump intakes to prevent entrainment of fish in accordance with screening criteria for salmonid fry *NMFS 1997 Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997b). During dewatering a Designated Fisheries Biologist shall remain onsite to observe the process and remove fish that were not successfully salvaged prior to dewatering (see Condition of Approval 9.1.16).

If fish salvage operations cannot be conducted effectively or safely by the Designated Fisheries Biologist, it may be necessary to begin the dewatering process prior to fish salvage. During the dewatering process, a Designated Fisheries

Biologist shall be onsite to implement fish salvage during dewatering with the aim of minimizing the number of fish that become trapped in isolated areas or impinged on pump screen(s) or isolation nets. If the Designated Fisheries Biologist determines the proposed methods are found to be insufficient to avoid undue losses of fish, they shall implement alternative salvage methods to minimize impacts to Covered Fish Species.

Dewatering shall be temporarily stopped if the Designated Fisheries Biologist or CDFW personnel determine that water levels may drop too quickly to allow successful fish salvage.

Upon dewatering to water depths at which neither electrofishing nor seining can effectively occur (e.g., less than 3 inches [0.1 meter]), the Designated Fisheries Biologist shall inspect the dewatered areas to locate any remaining fish. And collect them by dip net. The Designated Fisheries Biologist shall notify the Permittee and CDFW when the fish salvage has been completed and construction can recommence.

9.1.18 Stormwater Pollution Prevention Plan. To minimize impacts on CHNWR and CHNSR from exposure to contaminated stormwater, which could occur due to year-round Covered Activities adjacent to waterways, Permittee shall develop and implement a stormwater pollution prevention plan. The primary elements of the stormwater pollution prevention plan include a commitment by Permittee to follow all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction eactivities. The plan will also describe protocol for accidental spill prevention and response and measures to prevent nonstormwater discharges from reaching surface water.

Permittee shall not initiate Covered Activities until the Stormwater Pollution Prevention Plan is approved in writing by CDFW.

9.1.19 Erosion and Sediment Control Plan. Covered Activities will occur year-round at sites adjacent to Delta waterways, creating the potential for impacts to DS and LFS and their habitat from exposure to contamination and increased suspended sediments that will not be avoided through Conditions of Approval 9.1.11 and 9.1.12 (In-Water Work Windows and Daily In-water Work Restriction). Permittee shall develop and implement a sediment and erosion control plan to minimize these potential impacts to DS and LFS. The plan shall include specific requirements to divert runoff away from steep, denuded slopes; direct runoff to common drainage courses under non-erosive velocities, using erosion control materials such as jute matting and tackified hydro seeding compounds; retain sediment transported by run-off; collect and direct surface runoff at non-erosive velocities to common drainage courses; use sediment and turbidity settlement areas where ground disturbance is adjacent to surface water or wetlands; deposit or store excavated materials away from drainage courses and covering the deposits and implement all control measures prior to any forecasted storm that will meet or exceed 0.5 inches of rainfall in a 24 hour period.

The Erosion and Sediment Control Plan(s) shall be approved by CDFW prior to initiating construction activities.

9.1.20 Erosion Control Stabilization Measures. Permittee shall not use plastic monofilament netting or similar material such as nylon for erosion control, to avoid entanglement or trapping of small wildlife. Permittee shall not use products that use photodegradable or biodegradable synthetic netting. Acceptable materials include natural fibers such as jute matting, coconut, twine, or other similar fibers or tackified hydroseeding compounds. Permittee shall communicate this measure to Project contractor(s) through specifications or special provisions included in the construction bid solicitation package.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. In accordance with local, state, or federal regulations, Permittee or its contractors shall develop a spill prevention, containment, and countermeasure plan (SPCC) at each site where ground-disturbing activity will occur. Each SPCC shall address actions used to prevent spills and actions that will be taken should any spills occur, including emergency notification procedures. The SPCC plans shall include measures and processes that address the following: procedures for routine handling of products; discharge or drainage controls such as secondary containment and procedures for discharge control; countermeasures for discharge discovery, response, and cleanup; methods of disposal of recovered materials; personnel training in emergency response, spill containment techniques, and pollution control laws, rules, and regulations; storage of petroleum products in nonleaking containers at impervious storage sites from which an accidental spill cannot escape; storing and maintaining spill containment materials--such as absorbent pads, pillows, socks, or booms--in nonleaking sealed containers until transported and disposed of; using spill containment materials under transfer areas when transferring oil or other hazardous materials from trucks to storage containers; storage of concrete, wash water, and other contaminants in watertight containment structures; daily inspection of equipment for oil, grease, and other petroleum products if equipment is in contact with surface water; cleaning of external petroleum products off of equipment prior to its contact to water; and use of oil-absorbent booms for equipment used in or adjacent to water. In the event of a spill, personnel shall identify and secure the source of discharge and contain the discharge with spill kit materials, such as sorbents or sandbags, and shall contact CDFW and other appropriate regulatory authorities within 24 hours. Permittee shall submit the SPCC plans to CDFW for written approval prior to initiating construction activities.

9.1.22 Hazardous Materials Management Plan. Permittee or its contractors shall develop and implement one or more hazardous materials management plan(s) (HMMP) prior to initiating construction activities. The HMMP shall provide detailed information on the types of hazardous materials used; phone numbers of emergency response agencies; appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste; and a specific protocol for the proper handling and disposal of hazardous materials. The HMMP shall address the following measures or practices: clear labeling, handling and safety instructions, and emergency contact information on hazardous material containers; use or transfer of hazardous materials near wet or dry streams; Material Safety Data Sheets, accumulation and temporary storage of hazardous wastes (e.g., not to exceed 90 days); and disposal of contaminated soils. Permittee shall submit the HMMP to CDFW for written approval prior to initiating construction activities.

9.6.10 Pre-construction Studies. Permittee will design and implement four studies to inform the final design of the NDD intakes and provide critical information related to the spatial and temporal patterns of both native and nonnative fish species in the vicinity of the NDD intakes (pre-construction Studies 5 and 6) characterizing hydrodynamics within the NDD intake reach to achieve design requirements to minimize Covered Fish Species impingement and entrainment (pre-construction Studies 7 and 8).

Construction impact: Underwater noise

Covered Activities associated with construction that are likely to generate underwater noise include pile driving, riprap placement, dredging, and barge operations. All post-embryonic life stages of DS and LFS are potentially vulnerable to Project construction related underwater noise effects because the species' distribution overlaps with the locations of Covered Activities throughout the multi-year timeframe of Project construction (Moyle 2002, IEP MAST 2015). However, juvenile and sub-adult life stages of LFS are primarily distributed downstream of the Delta and may be less vulnerable than all other life stages (Merz et al. 2013, Rosenfield and Baxter 2007).

Impact pile driving poses the greatest risk to DS and LFS because associated impulsive type sounds can be sufficiently intense to injure or kill fish (Popper and Hastings 2009). Sub-lethal effects of pile driving noise on fish include behavioral responses, physiological stress, temporary and permanent hearing loss, and tissue damage (auditory and non-auditory) depending on life stage, fish size, and the specifics of pile driving operations and site characteristics (e.g., depth). The presence of a swim bladder in DS and LFS increases their vulnerability to underwater noise (Hastings and Popper 2005).

Other in-water construction activities, including riprap placement, dredging, and barge operations, generally produce more continuous, lower energy sounds below the thresholds associated with direct mortality. Underwater noise generated by these Covered Activities could have sub-lethal effects on DS and LFS including damage to hearing organs that may reduce the ability of fish to detect predators or prey. Non-injurious levels of underwater noise can cause behavioral effects (e.g., startle or avoidance responses) that can disrupt or alter normal activities (e.g., migration, holding, or feeding), potentially increasing an individual's vulnerability to predation or reducing growth or spawning success if avoidance is not possible or exposure is prolonged (Popper and Hastings 2009).

Conditions of Approval: Underwater noise

Covered Activities would impact DS and LFS as summarized above, but these impacts will be avoided and minimized by the following specific Conditions of Approval required by the ITP.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist will be required for continual acoustic monitoring of pile driving conducted outside in-water work windows in dewatered areas and implementing procedures for measuring pile driving sound.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. In-water work windows reduce DS and LFS exposure to potentially harmful underwater noise by restricting the times of year when in-water Covered Activities may be conducted outside DS and LFS peak abundance in the Project Area.

9.1.12 Daily In-Water Work Restriction. Permittee shall confine all in-water Covered Activities to times between sunrise and sunset to minimize exposure of DS and LFS to underwater noise associated with Covered Activities.

9.1.13 Underwater Sound Abatement Plan. Permittee shall coordinate with the TOT to develop and implement an underwater sound abatement plan to evaluate the potential effects of underwater noise on Covered Fish Species in the context of interim underwater noise thresholds and to reduce underwater noise, to the extent possible, below thresholds established for disturbance and injury of fish (ICF Jones and Stokes 2009). To the extent that seasonal in-water work windows do not fully avoid reduces impacts due to the presence of early- or late-arriving CHNWR or CHNSR and variable weather and hydrological conditions, this measure further minimizes such impacts.

9.1.14 Pile Driving Plan. To the extent underwater noise associated with impact pile driving cannot be entirely abated to levels below the California Department of Transportation thresholds (ICF Jones and Stokes 2009), Permittee shall coordinate with the TOT to develop and implement a pile driving plan to further minimize underwater noise impacts to CHNWR and CHNSR associated with pile-driving.

9.1.15 Barge Operations Plan. To avoid and minimize underwater noise impacts to DS and LFS from barge operations Permittee shall coordinate with the TOT to develop and implement a barge operations plan. The barge operations plan shall include a commitment by the Permittee to work in conjunction with CDFW and other responsible agencies through the engineering design phase to minimize the number of trips necessary to conduct Covered Activities and identify barge routes that minimize underwater noise related impacts on DS and LFS.

Construction impact: Increased turbidity and suspended sediment

Covered Activities which are expected to result in elevated turbidity and suspended sediment levels are; geotechnical exploration, cofferdam installation, levee clearing and grading, dredging, pile driving, and barge operations in the vicinity of the NDD intakes, barge landings, CCF and the HOR Gate.

Both LFS and DS are known to lay adhesive demersal eggs (Moyle 2002) likely in sandy substrates that are in low velocity areas throughout the fresh to low salinity areas of the Delta. LFS eggs and embryos are assumed to be present in the Delta from December through April by proxy of spent females, newly hatch larvae and some well-established incubation times (CDFG 2009). Similarly, DS eggs and embryos occur later in the spring and are generally assumed to be present between March and June (Bennet 2005, Damon et al 2016). Based on these observations suitable spawning habitat is likely to be in close proximity to all of the in-water Covered Activities and the barge operation routes to be identified during the construction design finalization phase.

In general, turbidity and suspended sediment negatively affect the growth and survival of LFS and DS egg and embryo life stages when they are buried by the deposition of suspended sediment generated by in-water construction activities. Other life stages of LFS and DS are not expected to be adversely affected by increased turbidity and suspended sediments as a result of Covered Activities.

Conditions of Approval: Increased turbidity and suspended sediment

Covered Activities would impact DS and LFS as summarized above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. It is likely that LFS and DS eggs and embryos at the NDD intakes, barge landings, CCF, and HOR Gate construction sites will be injured due to increased turbidities and suspended sediments associated with Covered Activities. In-water work windows for each Project construction site will partially avoid these effects by preventing elevated turbidities and suspended sediments resulting from construction from occurring during the primary incubation period for LFS and most of the incubation period for DS in the lower Sacramento and San Joaquin rivers (Bennet 2005, CDFG 2009, Damon et al. 2016, Wang 2007). Potential impacts to late season incubating DS eggs in the vicinity NDD intakes and along barge operation routes remain, especially if cooler water temperatures (<20° C) persist into late May and early June.

9.1.15 Barge Operations Plan. Barge operations will occur year round and will not be constrained by in-water work windows. Permittee shall develop and implement a barge operations plan that includes a commitment to work in conjunction with CDFW and other responsible agencies throughout the engineering design phase to minimize the number of trips necessary to conduct Covered Activities and to identify barge routes and operational criteria that minimize elevated turbidities and suspended sediment related impacts on LFS and DS eggs and embryos in the barge operations plan.

9.1.19 Erosion and Sediment Control Plan. Permittee shall develop and implement an erosion and sediment control plan to reduce the amount of sediment input from land-based Covered Activities such as levee clearing and grading and the placement of dredge and excavated material, thereby reducing potential exposure of DS and LFS to increased suspended sediment.

Construction impact: Exposure to contaminants

Construction of the north Delta intakes, CCF facilities, HOR Gate, barge landings, and barge operations could result in accidental spills of contaminants, including oil, fuel, hydraulic fluids, concrete, paint, and other construction-related materials, resulting in localized water quality degradation. Potential effects of contaminants on DS and LFS include direct injury and mortality (e.g., damage to gill tissue causing asphyxiation) depending on the type of contaminant, extent of the spill, and exposure concentrations. Potential sub-lethal effects of contaminants on fish include delayed effects on growth and survival (e.g., increased stress or reduced feeding), depending on the type of contaminant, extent of the spill, and exposure concentrations.

All life stages of DS are potentially at risk of exposure to contaminants associated with Covered Activities. During winter and early spring, USFWS beach seine (1976 – 2016) in addition to CDFG Striped Bass egg and larval data (1988 – 1994) shows evidence that some mature adult DS migrate through and upstream of the NDD reach of the Sacramento River to spawn. As a result DS eggs, larvae and adults could be exposed to contaminants at the NDD construction sites and downstream of the NDD intake reach. Similarly, some juvenile and mature adult DS migrate into the southern Delta in the winter and early spring and could be exposed to contaminants at, and downstream of, the HOR Gate and CCF construction sites (Sommer et al. 2011). A substantial portion of the DS population rears in late spring, summer, and fall in the confluence area of the Delta and the Sacramento River below the town Rio Vista (Dege and Brown 2004, Nobriga et al. 2008). As a result, these juvenile and subadult DS life stages could be exposed to contaminants associated with barge landing construction and barge operations.

LFS will have less potential exposure to contaminants associated with Covered Activities. A smaller proportion of maturing adult LFS migrate through the NDD intake reach or into the southern Delta to spawn (CDFG 2009b). Juvenile and subadult LFS tend to rear in the lower estuary or coastal ocean (Rosenfield and Baxter 2007) where there is little or no potential exposure to Project construction-related contaminants. However, some LFS spawn and rear in the north Delta, and those individuals could be exposed to contaminants (Dege and Brown 2004, Grimaldo et al 2017).

Contaminants may also enter the aquatic environment through the disturbance, resuspension, or discharge of contaminated soil and sediments at construction sites. Sediments act as a sink or source of contaminant exposure depending on local hydrologic conditions, habitat type, and frequency of disturbance. Sediment is a major sink for more persistent chemicals that have been introduced into the aquatic environment, with most organic and inorganic anthropogenic chemicals and waste materials accumulating in sediment (Ingersoll et al. 1995). The NDD intake sites are located downstream of major urban and agricultural regions where sediments have been affected by discharges from these sources for many decades. Although no information on sediment contaminants at these sites is currently available, metals, PCBs, hydrocarbons (typically oil and grease), and ammonia are common urban contaminants that are introduced to aquatic systems via nonpoint-source stormwater drainage, industrial discharges, and municipal wastewater discharges (Anderson et al. 2007, Brooks et al 2012). Many of these contaminants readily adhere to sediment particles and tend to settle out of solution relatively close to the primary source of contaminants. PCBs are persistent, adsorb to soil and organic matter, and accumulate in the food web. Lead and other metals also will adhere to particulates and can bioaccumulate to levels sufficient to cause adverse biological effects. Mercury is also present in the Sacramento River system and could be sequestered in riverbed sediments.

Resuspension of contaminated sediments may have adverse effects on fish that encounter sediment plumes or come into contact with deposited or newly exposed sediment. Suspended sediment can also adversely affect fish by causing localized increases in chemical oxygen demand in waters in or near plumes. Exposure of DS and LFS to contaminants as a result of spills or sediment disturbance can cause effects that range from physiological stress, potentially resulting in delayed effects on growth, survival, and reproductive success, to direct mortality (acute toxicity) depending on the concentration, toxicity, solubility, bioavailability, and duration of exposure, as well as the sensitivity of the exposed organisms. For example, DS are highly sensitive to sublethal levels of pyrethrin which causes neurological damage and results in impaired swimming ability and potential effects on chemosensory abilities (Connon et al. 2009). Such impairments may affect the ability of DS and LFS to swim against tides or water currents, increasing their susceptibility to predation and lowering their ability to find food (Connon et al. 2009). Chemosensory impairment may also affect the ability of DS and LFS to detect pheromones and find mates (Connon et al. 2009). In addition, contaminants can enter the aquatic food web and accumulate in fish through their diet, leading to adverse effects on behavior, tissues and organs, reproduction, growth, and immune system (Connon et al. 2009). Recent histological studies by Hammock et al. (2015) suggest that exposure to contaminants is currently having negative effects (e.g. damage to gills and livers) on juvenile DS and LFS rearing in the confluence area and upstream areas of the Delta.

Conditions of Approval: Contaminant exposure

Covered Activities would impact DS and LFS as summarized above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

7.14 Hazardous Waste. In the event that contamination to waterways does occur, Permittee shall stop all Covered Activities at the construction site immediately. Permittee shall repair any damaged equipment causing contaminant discharge and clean up contaminants at the time of occurrence, or as soon as it is safe to do so, pursuant to pertinent state and federal statutes and regulations.

9.1.1 Herbicide and Pesticide Use. Permittee shall ensure that all herbicide and pesticide use (mixing, application, and clean-up) is done by licensed applicators in accordance with all applicable state, federal, and local regulations. Herbicide sprays shall only be applied via ground application when wind speed measures less than three miles per hour. Permittee shall ensure that all herbicide sprays used adjacent to identified habitat features suitable for Covered Species, including waterways suitable for DS and LFS, contain dye, registered for aquatic use by the California Department of Pesticide Regulation if warranted, to prevent overspray.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Spoils, RTM, and dredged material have the potential to contain contaminants (including mercury, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc, tributyltin, polycyclic aromatic hydrocarbons, and organochlorine pesticides). Permittee shall develop and implement a spoils disposal plan which will minimize potential exposure of DS and LFS to contaminants as a result of Covered Activities.

9.1.11 In-Water Work Windows. As discussed previously in general Project Construction avoidance and minimization measures, the In-water work windows will reduce DS and LFS exposure to contaminants by restricting the times of year when in-water Covered Activities can occur, thereby reducing exposure to contaminant spills or resuspension of contaminated sediment.

9.1.15 Barge Operations Plan. Permittee shall develop and implement the barge operations plan to further avoid and minimize contamination impacts to DS and LFS. The barge operations plan shall include a commitment from the Permittee to work in conjunction with CDFW and other responsible agencies through the engineering design phase to minimize the number of trips necessary to conduct Covered Activities, thereby reducing contamination impacts.

9.1.18 Stormwater Pollution Prevention Plan. Permittee shall develop and implement a Stormwater Pollution Prevention Plan to further minimize contamination from stormwater runoff through disposal sites and construction sites year-round, and resulting impacts to DS and LFS. Permittee shall follow all applicable State Water Resources Control Board and Central Valley Regional Quality Control Board requirements regarding construction-generated stormwater collection, detention, treatment, and discharge that will be in place throughout the duration of construction activities. The plan will also include an accidental spill prevention and response component and measures to prevent nonstormwater discharges from reaching surface water.

The Stormwater Pollution Prevention Plan shall be approved in writing by CDFW prior to initiating construction activities.

9.1.19 Erosion and Sediment Control Plan. Because some construction sites (e.g. barge landings) are located along Delta waterways adjacent to major agricultural islands, they are more likely to contain agricultural-related toxins such as copper and organochlorine pesticides. Permittee shall develop and implement an erosion and sediment control plan to address this potential source of contaminant exposure and further minimize contamination impacts to DS and LFS.

9.1.21 Spill Prevention, Containment, and Countermeasure Plan. Covered Activities with the potential to contaminate adjacent Delta waterways will occur year-round (i.e. outside of the designated in-water work windows). Permittee shall further limit the exposure of DS and LFS to contaminants in Delta waterways by developing and implementing a spill prevention, containment, and countermeasure plan prior to the start of construction. The Spill Prevention, Containment, and Countermeasure Plan will limit contaminant exposure by requiring actions designed to prevent spills, actions to take should spills occur, and emergency notification procedures.

9.1.22 Hazardous Materials Management Plan. Covered Activities involving hazardous materials with the potential to contaminate aquatic habitats occupied by DS and LFS would occur throughout the construction period, including activities that fall outside of the designated work windows. Therefore, Permittee shall develop and implement a one or more Hazardous Materials Management Plans (HMMP) prior to initiating construction activities to further avoid and minimize potential smelt take and associated impacts of the taking due to hazardous material exposure. HMMP(s) will include detailed information on the types of hazardous materials used, phone numbers of emergency response agencies, appropriate practices to reduce the likelihood of a spill of toxic chemicals or other hazardous waste, and a specific protocol for the proper handling and disposal of hazardous materials.

The HMMP(s) shall be approved by in writing by CDFW prior to initiating construction activities.

Construction impact: Direct physical injury and mortality

LFS and DS may be injured or killed by direct contact with equipment or materials in the open waters of the Sacramento and San Joaquin Rivers and adjacent Delta channels during construction of the NDD intakes, barge landings, HOR Gate, and CCF, geotechnical exploration, and during barge operations. Potential mechanisms include fish being crushed by falling rock (riprap), impinged by sheetpiles, entrained by dredges, or struck by propellers. Additional sources of injury and mortality include fish stranding behind cofferdams in the course of dewatering activities or stranding along the shoreline by barge wakes and injury or mortality during fish salvage from behind the cofferdams, which includes fish collection, handling, transportation, and release. All life stages of DS and most life stages of LFS could be exposed to Covered Activities which could result in injury and mortality. Sub-lethal injury to DS and LFS may lead to increased vulnerability to predation and reduced ability for successful migration, feeding, and spawning. Juvenile LFS rearing in San Pablo bay and further downstream are not likely to be affected by Covered Activities leading to direct physical injury of individuals as they are occupying habitat outside of the range of effects from construction of the Project.

Conditions of Approval: Direct physical injury and mortality

Covered Activities would impact DS and LFS as summarized above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP.

7.3 Designated Fisheries Biologist. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat.

7.4 Designated Biologist and Designated Fisheries Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist and Designated Fisheries Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

9.1.11 In-Water Work Windows. There is a potential for direct physical injury of LFS and DS at as a result of Covered Activities at the NDD intake, barge landing, CCF, and HOR Gate construction sites due to direct contact with equipment or materials that enter or operate within the open waters of the Sacramento and San Joaquin Rivers and adjacent Delta channels. These effects will be mostly avoided through the use of mandatory in-water work windows for each of the Project construction sites.

9.1.12 Daily In-Water Work Restriction. Permittee shall confine all in-water Covered Activities to times between sunrise and sunset to minimize the risk of direct injury and mortality of DS and LFS associated with in-water Covered Activities.

9.1.14 Pile Driving Plan. Permittee shall develop a pile driving plan that will help to minimize direct physical injury and mortality associated with pile driving strikes. By reducing the number of pilings and maximizing the use of vibratory pile driving methods where possible, the risk of direct DS and LFS injury and mortality from pile driving during the in-water work window will be minimized.

9.1.15 Barge Operations Plan. Permittee shall develop and implement a barge operations plan with a commitment to work in conjunction with CDFW and other responsible agencies through the engineering design phase to develop operational criteria and to minimize the number of barge trips necessary to conduct Covered Activities thereby minimizing the exposure of LFS and DS individuals to direct physical injury associated with barge operations.

9.1.16 Fish Salvage Plan. Permittee shall develop and implement a Fish Salvage Plan to minimize the number of DS and LFS that are injured or killed during dewatering. All fish rescue and salvage operations will be conducted under the guidance of a Designated Fisheries Biologist. The Designated Fisheries Biologist, in consultation with CDFW, will determine the appropriate fish collection and relocation methods based on site-specific conditions and construction methods. Specific actions in the plan to address this issue include: notification and coordination with CDFW at least 7-days prior to initiation of a Covered Activity that could result in isolating fish or require fish salvage, determining appropriate site-specific procedures for excluding fish from construction zones, removing fish from construction zones should they become trapped, and preventing fish from reentering construction zones prior to dewatering based on site-specific conditions and construction methods.

Direct physical injury of DS and LFS individuals may also occur from fish collection, handling, transportation and release during fish salvage and rescue efforts. Morinaka 2013 observed fairly high survival rates for adult Delta smelt (85%-93%) and highly variable survival rates with juveniles exposed to collection, handling, transport and release. However, survivorship quickly decreases as water temperatures exceed 15ºC (Swanson et al. 1996, Young et al. 1999). The Fish Salvage Plan will also include measures to minimize impacts to individuals. For example, attempts to seine and/or net fish shall always precede the use of electrofishing equipment. Electrofishing shall be conducted in accordance with NMFS electrofishing guidelines (NMFS 2000), monitoring temperatures of holding tanks, avoid overcrowding fish in holding tanks, segregating fish by size, and minimizing handling exposure to the extent possible.

9.1.17 Dewatering. Installation of cofferdams or silt curtains in the Sacramento River, construction areas of the HOR Gate, construction and dredging areas of CCF, and the adjacent Old River channel has the potential to strand, injure or fish. Implementation of Condition of Approval 9.1.11 (In-Water Work Windows) will help to avoid injury and mortality of the majority of LFS and DS individuals. Individuals that are present outside the in-water work windows and exposed to construction activities, may be subject to stranding behind cofferdams where mortality is likely to occur during dewatering.

DS spawning adults, eggs, larvae, and juveniles may be present in the vicinity of in-water Covered Activities in June. Only larval and juvenile LFS are potentially present in the vicinity of in-water Covered Activities. Stranded fish may experience stress in response to poor water quality (e.g., high water temperatures) and may ultimately die as a result of poor water quality during dewatering or injuries caused by Covered Activities within the enclosed cofferdam.

A Designated Fisheries Biologist will be on site during all dewatering events to ensure that fish are effectively rescued from the dewatered areas behind cofferdams, and that dewatering devices are equipped with a screen to avoid injuring fish. Direct injury or mortality of individuals of DS and LFS may still occur from fish collection, handling, transportation and release during fish salvage and rescue efforts.

Construction impact: Loss and alteration of habitat

The Project is expected to cause permanent impacts to, or loss of access to, 500.6 acres of shallow water habitat suitable for DS and LFS from the downstream edge of the NDD intake reach and upstream past the I Street Bridge to Knights Landing. Suitable habitat for DS and LFS in the vicinity of NDD intakes will be altered by dredging and barge operations through changes in channel depths, benthic habitat, cover, and temporary in-water and overwater structures (barges, spud piles) within active construction sites adjacent to the NDD intake sites and associated levees. Construction of NDD intake structures, transition walls, and bank protection will result in the permanent loss of shallow water DS and LFS habitat.

DS and LFS are expected to lose access to shallow water habitat upstream of the NDD intake reach due to higher shoreline velocities at the NDD intake construction sites, including wing wall transitions, and the presence of the NDD intakes post-construction. The NDD intakes are located near the northern limit of the geographic area used by DS and LFS for migration, spawning, and larval dispersal to the estuary. Cofferdams used to isolate in-water construction sites will temporarily reduce the width of the river channel and eliminate the shallow, low-velocity nearshore zones currently available to migrating DS and LFS along the east bank of the river, thus impairing their ability to migrate upstream. The loss of low-velocity shoreline areas and increased predation risk at the intake construction sites may reduce the number of migrating adult DS and LFS that successfully pass the sites and survive to reach upstream spawning areas. DS and LFS larvae and young juveniles migrating from upstream spawning areas to estuarine rearing areas may also be subject to an elevated risk of predation as they pass the NDD intake construction sites because of the presence of in-water and overwater structures and the loss of shallow, low-velocity nearshore areas. To the extent that these conditions provide beneficial habitat or increased predation opportunities for predators of larvae and early juveniles there could be an elevated risk of predation for these young life stages. The effect of NDD intake construction on passage success depends on the number of fish attempting to pass through the NDD intake on the east side of river and the ability of adults to use alternative routes (e.g., the west side of the river will remain unaffected) or spawning areas (e.g., remaining downstream to spawn).

Construction of barge landings will result in permanent impacts to 22.4 acres of DS and LFS tidal perennial aquatic habitat (approximately 3.2 acres per landing). At each site, approximately 0.34 acres of tidal perennial aquatic habitat will be covered by a dock. During construction, and continuing during year-round operation of the barge landings, the channel banks, bed, and waters adjacent to the dock will be periodically disturbed by propeller wash and scour from barges and tidal action, resulting in changes in water depths, benthic substrates, and loss of submerged and emergent vegetation that may be present. Migrating adult DS and LFS may be subject to an elevated risk of predation and mortality as they migrate past the barge landing sites because of potential increases in predator habitat. The presence of in-water and overwater structures (docks, piles, and vessels) provides shade and cover that may attract certain predatory fish species (e.g., striped bass, largemouth bass, Sacramento pikeminnow) and increase their ability to ambush prey. These structures may also improve predation opportunities for piscivorous birds (e.g., egrets, herons, cormorants) by providing perch sites immediately adjacent to open water. Construction of the barge landings and subsequent barge operations may result in loss or alteration of nearshore areas and potential loss or degradation of DS and LFS spawning habitat at the barge landing sites and in the Delta channels used by the barges to transport equipment and materials between the loading and unloading facilities. Barge operations following construction of the barge landing and during construction of the Project will potentially result in increased disturbance of nearshore areas along the barge transport routes which could affect the suitability of these areas for spawning.

Construction of the HOR Gate will result in permanent impacts to approximately 2.9 acres of DS and LFS tidal perennial aquatic habitat at the gate construction site, and in channel segments upstream and downstream of the gate that will be affected by dredging. Migrating DS and LFS adults may be subject to potential delays in migration and increased predation as they attempt to pass cofferdams in place during the two-year construction period. Cofferdams that constrict flow to half the channel's width will increase water velocities and potentially impede the migration of adults attempting to move upstream of the construction site. The presence of in-channel cofferdams and the HOR Gate structure may also increase the amount of predatory fish habitat and create hydraulic conditions that improve their ability to prey on DS and LFS migrating adults, larvae and juveniles as they move past the site. Little or no potential spawning habitat will be affected by construction of HOR Gate and thus there is little likelihood of adverse effects on spawning adults, because this portion of the Old River channel is frequently disturbed by the annual installation of a temporary rock barrier and is dominated by steep levee slopes, riprap, and low quantities of riparian and aquatic vegetation. Based on the apparent low abundance of DS in the San Joaquin River in the vicinity of the HOR Gate (Merz et al 2011, Merz et al. 2013), potential adverse effects on survival of larvae and juveniles will likely be limited to a very small proportion of the total DS population. Additionally, juvenile DS and LFS rear downstream of the HOR Gate in summer and fall and therefore are unlikely to be affected by losses or alteration of habitat during construction.

Dredging, excavation, and expansion of CCF and construction of the new water conveyance facilities at CCF will result in temporary and permanent alteration of aquatic habitat in CCF. CCF is considered highly degraded habitat for CHNWR and CHNSR because it has been highly altered for the purpose of water conveyance and lacks many of the structural and functional attributes of habitat for CHNWR and CHNSR due to channelization, levee clearing and armoring, maintenance dredging, unfavorable hydrodynamic conditions, lost connectivity of migration corridors high predator densities, and entrainment into existing Project facilities. Construction activities at CCF are expected to permanently alter 2,190 acres of tidal perennial aquatic habitat at CCF through changes in water depths, vegetation, and substrate within CCF and Old River. Temporary effects of construction activities on water quality, including turbidity and suspended sediment, underwater noise, and contaminants, were previously discussed in these findings, and Conditions of Approval related to these construction effects would apply within the CCF.

Dredging and expansion of CCF and construction of the new water conveyance facilities at CCF will result in long-term or permanent impacts on aquatic habitat. Construction activities at CCF are expected to permanently alter 2,190 acres of tidal perennial aquatic habitat at CCF through changes in water depths, vegetation, and substrate within CCF and Old River. Temporary effects of construction activities on water quality, including turbidity and suspended sediment, underwater noise, and contaminants, were previously discussed would apply within the CCF.CCF, and Old River in the vicinity of CCF, are considered highly degraded habitat for DS and LFS because these habitats have been highly altered for the purpose of water conveyance and lack many of the structural and functional attributes of habitat for DS and LFS due to channelization, levee clearing and armoring, maintenance dredging, unfavorable hydrodynamic conditions, high predator densities, and entrainment into existing Project facilities.

Take of DS in CCF due to south Delta SWP operations is currently permitted under the USFWS 2008 Biological Opinion and the associated CDFW Consistency Determination and take of LFS due SWP operations is currently permitted under the CDFG 2009 ITP that require flow-based measures to reduce the entrainment of DS and LFS into the CCF and monitoring of loss and salvage at the Skinner Fish Facility. Take of DS and LFS will be permitted upon initiation of the Test Period under the terms of this ITP. The permanent loss and alteration of tidal perennial habitat in CCF may affect the calculations of loss and salvage used to quantify take due to Project operations in CCF, however Conditions of Approval summarized in the discussion below of South Delta operational impacts on DS and LFS will address this impact.

All loss and alteration of habitat are considered permanent impacts to DS and LFS because they will occur over multiple years, which could affect multiple generations of DS and LFS, given the species predominately one- and two-year life cycles, respectively.

<u>Conditions of Approval: Loss and alteration of habitat</u>

Covered Activities would impact DS and LFS through loss and alteration of habitat as summarized above, but these impacts will be avoided and minimized through the following specific Conditions of Approval required by the ITP, summarized below.

7.3 <u>Designated Fisheries Biologist</u>. Permittee shall submit to CDFW in writing the name, qualifications, business address, and contact information of a fisheries biologist (Designated Fisheries Biologist) at least 30 days before starting Covered Activities. Permittee shall ensure that the Designated Fisheries Biologist has 1) a 4-year college degree in fisheries or biology, or a related degree, 2) at least 2 years of professional experience in fisheries field surveys and fish capture and handling procedures, and 3) completed an electrofishing training course such as Principles and Techniques of Electrofishing (USFWS, National Conservation Training Center), or similar course. The Designated Fisheries Biologist shall be responsible for monitoring in-water Covered Activities and fish salvage to help minimize or avoid the incidental take of individual Covered Fish Species and to minimize disturbance of Covered Fish Species' habitat. Permittee shall obtain CDFW approval of the

Designated Fisheries Biologist in writing before starting Covered Activities, and shall also obtain approval in advance in writing if the Designated Fisheries Biologist must be changed.

7.4 Designated Biologist Authority. To ensure compliance with the Conditions of Approval of this ITP, the Designated Biologist shall have authority to immediately stop any activity that does not comply with this ITP, and/or to order any reasonable measure to avoid the unauthorized take of an individual of the Covered Species.

7.5 Education Program. Due to the potential for exposure of contaminants to Covered Fish Species including CHNWR and CHNSR, an education program will be developed and implemented providing training for all persons employed or otherwise working in the Project Area. Training will take place before these persons begin performing on-site. The Project education program includes several elements relating to minimizing contaminant exposure risk, including species distribution and habitat needs, Conditions of Approval to be implemented, and Covered Species' legal protection.

8.4 Tracking Suitable Habitat Feature Disturbances, Map Updating, and Reporting. Requiring updated mapping and tracking of all Covered Species habitat disturbed by Covered Activities.

8.6 Compliance Report. Requiring monthly compliance reporting that documents impacts to Covered Species habitat, implementation of Permit measures.

8.7 Annual Status Report. Requiring annual reports that document, among other things, Covered Activities' impacts to Covered Species habitat during the preceding year and since issuance of the ITP and acreages and features anticipated to be disturbed in the succeeding 12 months.

8.8 CNDDB Observations. The Designated Biologist shall submit all observations of Covered Species to CDFW's California Natural Diversity Database (CNDDB) within 60 calendar days of the observation and the Designated Biologist shall include copies of the submitted forms with the next Monthly Compliance Report or ASR, whichever is submitted first relative to the observation.

8.9.1 Project Construction Report. Requiring a report no later than 180 days of completion of all mitigation measures that includes documentation of implementation of all mitigation measures, all information about Project-related incidental take and impacts of the taking to Covered Species.

9.6.10 NDD Intakes Pre-construction Studies. Pre-construction studies are intended to inform final design of the NDD intakes and provide critical information related to the spatial and temporal patterns of both native and nonnative fish species in the vicinity of the NDD intakes. The following studies further minimize the adverse effects associated with construction-related Covered Activities and increased DS and LFS vulnerability to predation due to NDD intake construction described above.

Pre-construction Study 5 - Predator Habitat Locations: The purpose of this study shall be to perform a field evaluation of predator habitat at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and

Glenn Colusa Irrigation District) to inform final design of the NDD intakes. This study will help determine the best designs possible for deterring favorable holding habitat for large predatory fish, by reducing or modifying structural aspects of the design and construction of the NDD.

Pre-construction Study 6 Predator Reduction Methods: The purpose of this study shall be to evaluate predator reduction techniques implemented at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District), to determine whether similar techniques could minimize potential predation impacts on Covered Fish Species and be feasible to implement at the NDD intakes.

Pre-construction Study 11 - Baseline DS and LFS Survey: The purpose of this study shall be to determine baseline abundance and distribution of all life stages of DS and LFS inhabiting and migrating through all portions of the Sacramento River upstream of Intake 5. Construction of the NDD intakes is anticipated to cause permanent loss of access of DS and LFS to habitat upstream of the NDD intake reach. However, the proportion of the DS and LFS population that travels past the NDD intake reach and utilizes upstream habitat is not known. Pre-construction study 11 is needed to quantify the actual proportion of the populations of DS and LFS and their habitat impacted by construction and establish a baseline to ensure that Permittee achieves Biological Criteria 3 throughout the permit term.

9.1.9 Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Prior to finalizing Project engineering design Permittee shall coordinate with the TOT to develop a spoils disposal plan for the storage of spoils, reusable tunnel material (RTM), and dredged material. The spoils disposal plan shall address size, locations, and required characteristics of designated storage areas; storage site preparation and dewatering; excavation of contaminated material; and chemical characterization, drainage, and treatment.

9.1.11 In-Water Work Windows. Implementation of in-water work windows will minimize temporary habitat impacts associated with dredging and other Covered Activities at the NDD intakes, HOR Gate, barge landings, and CCF construction sites and adjacent waterways that increase sediment, turbidity and contaminant exposure to CHNWR and CHNSR habitat.

9.1.19 Erosion and Sediment Control Plan and 9.1.20 Erosion Control Stabilization Measures. Increased erosion and mobilization of sediment in runoff from disturbed levee surfaces and in-water Covered Activities may increase turbidity and suspended sediment during winter and spring. Because potential mobilization of contaminants is closely linked to sediment disturbance and associated increases in turbidity and suspended sediment impacts on habitat, turbidity monitoring and control measures (e.g., silt curtains) to achieve compliance with existing Basin Plan objectives (Central Valley Water Board 1998) will be an important measures for limiting dispersal of contaminated sediments during dredging and other in-water construction activities, and reducing potential temporary habitat impacts to CHNSR and CHNWR.

9.1.15 Barge Operations Plan. Impacts to DS and LFS benthic habitat as a result of elevated turbidity and suspended sediment effects and other impacts on DS and LFS habitat due to barge operations will not be avoided through implementation of Conditions of Approval 9.1.11 In-Water Work Windows and 9.1.12 (In-Water Work Windows and Daily In-water Work Restriction. Permittee shall develop and implement a barge operations plan which includes a commitment of the to work in conjunction with CDFW and other responsible agencies throughout the engineering design phase to minimize the number of trips necessary to conduct Covered Activities and to identify barge routes that minimize temporary turbidity effects to benthic habitats. The barge operations plan shall describe measures to avoid and minimize impacts to Covered Fish Species caused by bottom scour from propeller wash, bank erosion or loss of submerged or emergent vegetation from propeller wash and/or excessive wakes, accidental spillage of hazardous material, sediment that could cause turbidity or changes to bathymetry if disturbed, and disturbance to the bottom dwelling (benthic) invertebrates that provide a prey base for Covered Fish Species. Additional measures in the Barge Operations Plan shall also include requirements to minimize these adverse impacts include the following. Permittee shall limit vessel speeds to maintain wake heights of less than 2 feet at shore to minimize the effects of wakes on unarmored or vegetated banks; ensure that tug boat and barge operators are trained to minimize impacts on Covered Species' habitats such as reducing the effects of wake on vegetated banks; limit the direction and/or velocity of propeller wash shall be limited to prevent bottom scour and loss of aquatic vegetation; all vessels shall approach and depart from the NDD intake and barge landing sites at dead slow to reduce vessel wakes and propeller wash; barges shall be tied up whenever possible to avoid the necessity of maintaining stationary position by tugboat or by the use of barge spuds; barges shall not be anchored where they will ground during low tides; anchors shall be lowered in place in order to avoid dragging across the channel bed; vessel operators shall avoid pushing stationary vessels up against cofferdams, docks, or other structures for extended periods, because this could result in excessive directed propeller wash impinging on a single location; and when transporting loose materials (e.g., sand, aggregate), barges shall use deck walls or other features to prevent loose materials from blowing or washing off of the deck; the Designated Representative shall report to CDFW within 24 hours any vessel grounding and deviations from the barge operations plan, and barge operations that could have resulted in the disturbance of bottom sediments, damage to river banks, loss of submerged, emergent, or riparian vegetation or impacts to Covered Fish Species; and all vessels shall keep an oil spill containment kit and spill prevention and response plan onboard.

Permittee shall coordinate with the Technical Oversight Team (TOT) to develop the Barge Operations Plan prior to finalizing Project engineering design. Permittee shall not initiate barge operations until the final Barge Operations Plan is approved in writing by CDFW.

9.6.9 Sediment Reintroduction Plan. Permittee shall develop and implement a sediment reintroduction plan that enhances DS and LFS habitat through recurring sediment reintroduction and placement to maintain turbidity and create and maintain spawning habitat for DS and LFS. The sediment reintroduction plan shall include monitoring programs to assess the effectiveness of sediment reintroduction in maintaining turbidity and DS and LFS spawning habitat in the Delta.

ii. DS and LFS Project Construction Mitigation Measures

The Conditions of Approval above will reduce, but not eliminate, the impacts to DS and LFS of construction related underwater noise, increased turbidity and suspended sediment, contaminant exposure, direct physical injury and mortality, and the permanent loss and alteration of habitat. Therefore, the following mitigation measures are required to ensure full mitigation of the impacts of the taking.

Covered Activities associated with construction will result in a total of 500.7 acres of permanent impacts to DS and LFS shallow water habitat and 25.3 acres of DS and LFS tidal perennial habitat, Permittee shall restore and permanently protect 1,827.7 acres of tidal perennial habitat as compensatory mitigation for these permanent impacts. Potential locations for compensatory habitat restoration include Sherman Island, Cache Slough, North Delta or other areas approved by CDFW. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11).

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to DS and LFS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1 and be guided by the crediting process described in ITP Attachment 8, Guidance for Smelt HM Lands Suitable for Compensatory Mitigation. Permittee shall ensure permanent protection and funding for perpetual management of compensatory DS and LFS shallow water and tidal perennial habitat, including monitoring for suitable habitat features and presence of DS and LFS.

iii. Project Construction Final EIR/EIS Avoidance and Minimization

In addition to the construction-related minimization and mitigation measures required by the ITP and summarized above, the Final EIR/EIS includes additional construction-related mitigation measures, avoidance and minimization measures and environmental commitments, required to be implemented by the ITP that would further ensure that any impacts to DS and LFS resulting from Covered Activities would be minimized and fully mitigated.

- Mitigation Measure AQUA 1A (Minimize the use of impact pile driving to address effects of pile driving and other construction-related underwater noise)
- Mitigation Measure AQUA 1B (Monitor underwater noise and, if necessary, use an attenuation device to reduce effects of pile driving and other construction-related underwater noise)
- Environmental Commitment 3B.2.5/AMM 3 (Develop and

implement stormwater pollution prevention plans)

- Environmental Commitment 3B.2.6/AMM 4 (Develop and implement erosion and sediment control plans)
- Environmental Commitment 3B.2.7 (Develop and implement fish rescue and salvage plans)
- Environmental Commitment 3B.2.8/AMM 7 (Develop and implement a barge operations plan, including sensitive resources, responsibilities, avoidance and minimization measures, performance measures, contingency measures
- Environmental Commitment 3B.2.12 (Develop and implement hazardous materials management plans)
- Environmental Commitment 3B.2.13 (Develop and implement spill prevention, containment, and countermeasure plans)
- Environmental Commitment 3B.2.16/AMM 1 (Conduct environmental training)
- Environmental Commitment 3B.2.18/AMM 6 (Disposal and reuse of spoils, reusable tunnel material (RTM), and dredged material, material storage site determination, including material storage site preparation, draining, chemical characterization, and treatment, material reuse plans, potential environmental effects)
- AMM 2 (Construction best management practices and monitoring)
- AMM 10 (Restoration of temporarily affected natural communities)
- AMM 29 (Design standards and building codes)
- Environmental Commitment 3B.2.20/AMM 27 (Selenium management)
- Environmental Commitment 4 (Tidal natural communities restoration)
- Environmental Commitment 6 (Channel margin enhancement)
- Environmental Commitment 12 (Methylmercury management)

iv. DS and LFS Project Operations Impacts and Avoidance and Minimization Measures

Project operation activities and their resulting impacts are expected to result in the incidental take of DS and LFS. The Covered Activities that are expected to result in incidental take of individuals of DS and LFS include operations of the: NDD intakes, South Delta Export Facilities, Skinner Fish Facility, HOR Gate, and CCF Aquatic Weed Control Program. Each of these means through which Covered Activities are expected to take or result in impacts of the taking to DS and LFS is discussed in detail below, followed by a summary of the Conditions of Approval required by the ITP to avoid or minimize the impacts.

Analyses of the effects of Project operations on DS and LFS, comprised of take and impacts of the taking, are split between near field effects occurring at or near Project facilities and far field effects associated with Project-caused alterations to flow conditions and other habitat characteristics, discussed in the subsequent sections. In general, analyses of take and impacts of the taking below relied upon scientific literature in peer-review journals, state and federal agency publications, the current Biological Opinion on the operations of the SWP and CVP (USFWS 2008), the California Water Fix Biological Opinions (USFWS 2017 and NMFS 2017), the *Bay Delta Conservation Plan/California WaterFix Final Environmental Impact Report/Environmental Impact Statement*, hydrologic analyses conducted to support the California Water Fix 2081(b) application (ICF International 2016a) and the Independent Review Panel Report for the 2016 California Water Fix Aquatic Science Peer Review (Simenstad 2017). Near-field and far-field effects are characterized for the following Project facilities associated with Project operations: NDD intakes, south Delta export facilities, HOR Gate, and Suisun marsh facilities. The potential adverse effects of entrainment of food web resources, reduced Delta outflow, reduced turbidity, exacerbation of harmful algal blooms, and changes in X2 (2 ‰ (parts per thousand) salinity isohaline -- as measured in kilometers from the Golden Gate Bridge) will be discussed in the section describing habitat effects as a result of overall Project operations, including reduction in south Delta exports.

Several model-based analyses in the CWF 2081(b) application and the CWF Biological Assessment compare physical and biological conditions between two primary modeling runs, the no action alternative (NAA) and Project operations. The NAA model runs are used to represent physical conditions associated with CVP/SWP operations using existing facilities and governed by NMFS (2009), USFWS (2008) and CDFG (2009) and other currently existing regulatory constraints, forecasted at about year 2030. The Project operations model runs incorporate ongoing operation of the SWP and CVP with construction and operation of the NDD intakes and modified operations for the existing south Delta export facilities that are a part of the Project, also forecasted at about 2030. By comparing outputs from the NAA and Project operations modeling runs the CWF 2081(b) application and Biological Assessment characterize potential physical and biological effects of Project operations when the NDD Intakes are expected to be complete, in about year 2030, with climate change and sea level rise. The comparative analyses of the NAA and Project operations are summarized below.

North Delta Diversions: Near Field Effects

Incidental take of migrating adult and larval DS and LFS in the form of mortality (“kill”) may result from NDD water export operations through both entrainment and impingement. In addition, increased vulnerability to predation is expected to occur in the vicinity of the intakes.

The areas where authorized take of the DS and LFS is expected to occur include: the location of the NDD intakes at the east bank of the Sacramento River between Clarksburg and Courtland at river miles 41.1, 39.4, and 36.8.

Both smelt species migrate into, and through, the NDD reach of the river to spawn. There are no robust species-specific sampling programs currently in place to monitor the timing and abundance of DS and LFS spawning migrations into the NDD river reach. In general, maturing adult DS move from downstream rearing areas to upstream freshwater spawning areas in winter and early spring. Strong upstream movements coincide with the onset of winter precipitation and associated increases in river flow and turbidity, often referred to as “first flush”, typically beginning in December (Grimmaldo et al 2009, Sommer et al. 2011). Spawning generally occurs February through June, as long as water temperatures are between 15 and 20ºC, with peak spawning occurring in March and April (Bennet 2005, IEP MAST 2015). As with adult DS, the timing of adult LFS spawning-related movements into the NDD intake reach are not precisely known. LFS spawning generally occurs earlier, from November to April, with peak spawning from December through February (CDFG 2009).

The timing of DS and LFS larval movement downstream through the NDD reach is not well documented, but the center of distribution for DS and LFS larvae does shift downstream to the low salinity zone during April-July (Dege and Brown 2004). Larval fish will be further upstream in drier years. Fish larvae sampling conducted by CDFW during the period 1991-1994 found DS larvae present in the Sacramento River above the Delta Cross Channel from February through June, with a clear peak in abundance from April through May (ICF International 2016, Table 4.1-5). Although precise information regarding the temporal distribution of LFS larvae above the Delta Cross Channel is not available (ICF International 2016, Table 4.2-4), known seasonal distribution trends in the Delta (Merz et al. 2013) indicate that it is possible LFS larvae are present from December through April, with peak abundance in February and March. Seasonal densities of LFS larvae in the same CDFW surveys were roughly 20% of DS densities at sites sampled above the DCC.

Survey data and general life history patterns (Moyle 2002) suggest that juvenile DS and LFS are primarily distributed downstream of the NDD intakes, although a greater proportion of LFS juveniles are thought to occur downstream of the NDD intakes than DS. Knowledge about the distribution and abundance of DS and LFS in the Sacramento River near the NDD intake locations is limited because of the relatively low sampling efforts in this region, as compared to other areas of the Delta. Although the fall midwater trawl (FMWT) only caught DS in three years from 1991 to 2010 at stations near the NDD intakes (ICF International 2016, Table 4.1-11) it is conducted from September – December and the migration period for adult DS begins as early as December and extends into May and June depending on water temperature (Bennet 2005, CDFG unpublished salvage data). In contrast, the USFWS Delta Juvenile Fish Monitoring Program (USFWS DJFMP) has routinely detected fish >60 mm at sampling sites upstream of the NDD intakes in the late winter/early spring period in most years from 1991 – 2016 (USFWS DJFMP). Based on the USFWS survey results, and the best current understanding of DS and LFS life history patterns (Moyle 2002), it is likely that adults migrating upstream past the NDD intakes and juvenile post hatch DS and LFS will be impinged on the NDD intakes. However the total proportion of the DS and LFS populations that will be impacted by NDD intake operations is unknown.

Near-field effect of NDD intake operations: Entrainment

The screening effectiveness analysis and known DS body depth to body length ratios indicate that the proposed NDD intake fish screen mesh size of 1.75 mm will prevent DS larger than around 20-21 mm standard length (SL) from being entrained (ICF International 2016, Section 6.A.2.2). The NDD intake fish screens are also expected to effectively exclude LFS larger than 20-21 mm SL, based on known body depth to body length ratios (ICF International 2016, Section 4.1.3.2.1). Therefore, DS older than 40 days (Bennet 2005) and LFS juveniles older than approximately 90 days (Hobbs et al. 2007) would not be entrained into the NDD intakes through the fish screens. DS and LFS eggs are demersal and adhesive, and are not likely to be entrained (Bennet 2005, Rosenfield 2010).

Larval DS and LFS originating upstream of the NDD intakes will hatch into an environment of continuous downstream flows and are likely to pass the NDD intakes at a size well under the 20-21 mm SL threshold for entrainment. Although the horizontal and vertical distribution of larval smelt transported downstream through the NDD intake reach of the Sacramento River is presently unknown, all larval DS and LFS occupying flows diverted into the NDD intakes will be entrained. To estimate take associated with entrainment into the NDD intakes, it is assumed here that entrainment risk of early life stage smelt is proportional to the percentage of river flow diverted by the intakes, with the risk increasing as higher percentages of flow are diverted (ICF Jones and Stokes 2008). Based on this assumption, CalSim monthly mean modeling outputs can be used to provide estimates of the percentage of flow diverted by dividing the NDD intake diversions by the Sacramento River flow at Freeport (ICF International 2016, Table 4.1-4) and associated entrainment.

The modeled percentage of flow diverted by the NDD intakes increased as bypass flow constraints decreased. Generally, CalSim modeled average monthly NDD intake diversions (percentage of Sacramento River flow at Freeport) was higher in March and June than in April and May, and was similar for all water year types except critically dry years (ICF International 2016, Table 4.1-4). In March the maximum percent diverted ranged from 31% in below normal years to 35% in wet years. In June the maximum percent diverted ranged from 36% in below normal years to 38% in wet and above normal years (excluding critical water year types) (ICF International 2016, Table 4.1-5). In contrast, the maximum percent of flow diverted in April ranged from 8% in below normal years to 15% in wet and dry years. In May the maximum percent of flow diverted ranged from 12% in below normal years to 21% in wet years (excluding critical water year types) (ICF International 2016, Table 4.1-5). CalSim modeling projected the maximum percent of flow diverted at the NDD intakes in critically dry water years to be 17% in March, 4% in April, 6% in May, and 8% in June (ICF International 2016, Table 4.1-5). Based on the assumption that take of DS and LFS larvae and juveniles due to NDD entrainment is a function of percent of flow diverted; entrainment would be similar in all water year types with the exception of critical water year types, and take would be higher in March and June than in April and May. However, this expectation relies upon the assumption that the temporal distribution of DS and LFS larvae and juveniles at the NDD intakes is equal from March through June for all water year types. As noted above, knowledge about the temporal and spatial distribution of DS and LFS is limited but larval fish sampling in the Sacramento River above the DCC during the period 1991-1994 indicated that larval densities of DS peak in April and May (ICF International 2016, Table 4.1-5).

The DSM2-PTM was used to estimate DS larval and juvenile entrainment into the NDD intakes. The average percentage of particles entrained into the NDD intakes under Project operations was consistently less than 1% of the total particles simulated (ICF International 2016; Table 4.1-17). However, because there are currently no 20-mm survey stations upstream of the NDD intake reach, the same weighting of particles at downstream stations in the north Delta was assumed for the NDD intakes. This assumption may not be reflective of NDD intake entrainment effects because the 20-mm survey stations do not provide information about where larval smelt originated and cannot sample newly hatched larvae less than 20 mm SL. Estimates of DS larval entrainment into the NDD intakes depends on assumptions about the abundance of DS that migrate through the NDD intake reach to spawn upstream. Entrainment of DS larvae during NDD intake operations could be greater if than expected if a higher percentage of DS larvae originate upstream of the NDD intakes than was assumed in the 2081(b) application.

<u>Near-field effect of NDD intake operations: Impingement</u>

Adult and juvenile DS and LFS greater than 20-21-mm SL are likely to contact and be impinged on the NDD intake screens. The best available scientific information based on laboratory studies is assessed below, and this information will be further quantified with enhanced monitoring and targeted studies before, during and after construction of the intakes. However, the magnitude of impacts on DS and LFS populations as a result of impingement on NDD intake screens cannot be quantified with certainty at this time for reasons discussed below in the section, "*Uncertainty in near-field effects of NDD intake operations.*"

The Project includes construction of three intakes (Intake 2, Intake 3, and Intake 5) on the east bank of the Sacramento River between Clarksburg and Courtland, in Sacramento County, California. The proposed lengths for the overall structures of Intake 2, Intake 3, and Intake 5 fish screens are 1,969, 1497, and 1901 feet respectively and together total 5,367 feet or approximately one mile. Excluding each concrete approach structure and fish refugia at each intake, the proposed fish screen lengths for Intake 2, Intake 3, and Intake 5 total 1,350, 1,110, and 1,350 feet respectively. Each intake will be designed to allow for a 3,000 cfs diversion capacity. There is no series of fish screens of comparable size and in similar proximities in existence for which entrainment, impingement, and increased vulnerability to predation impacts to DS and LFS can be compared.

Although the best available scientific and other information available has been utilized to estimate impacts, the performance of the NDD intake structures (including fish screens and refugia), the efficacy of design criteria, and the associated avoidance and minimization measures cannot be stated with certainty based on laboratory studies, alone. However, the results of laboratory studies designed to assess the risk of smelt impingement on the NDD intake fish screens indicate a substantial risk of injury and mortality to migrating adults and likely mortality for impinged larvae and juveniles. The design criteria and associated avoidance and minimization measures require further laboratory and field studies and coordination during design, construction and operations monitoring to ensure impacts to Covered Fish Species are minimized.

One of the primary mechanisms which Delta smelt utilize for upstream movement is “Tidal Surfing” (Bennett and Burau 2014). However, behavior-based PTM analyses show that tidal influence is insufficient to move fish through the NDD intake reach (ICF International 2016, Section 4.1.3.2.2.1). While adult LFS are not known to employ similar tidal surfing strategies as DS, they do appear to utilize the margins of inlet creeks during their spawning migration within Lake Washington (Moulton 1974). Thus DS and LFS are likely to seek and utilize low velocity habitats on the margins of the river to facilitate upstream movement (ICF International 2016, Section 4.1.3.2.2.1) because the typical tidal surfing behavioral conceptual model shows that tidal influence is insufficient to move fish through the NDD intake reach (Bennett and Burau 2014). Behavior-based PTM analyses support the hypothesis that adult DS and LFS migrating upstream in the vicinity of the NDD intake reach will likely use the lower velocity periphery of the channel to swim upstream against unidirectional flow during periods when the NDD intakes will be operating (ICF International 2016, Section 4.1.3.2.2.1). As a result, individuals that do migrate through the NDD intake reach may face a higher risk of impingement on the screens if they migrate along the eastern bank of the river where the NDD intakes are located.

It is likely that adult DS and LFS will be impinged on the NDD intake screens because of the substantial overlap in the timing of their spawning migration with the timing of water diversions at the NDD intakes, limitations in their swimming abilities, and hydrodynamics at the face of NDD intake fish screens. DS, and to a lesser extent LFS, are relatively weak swimmers and will generally approach the NDD intakes when downstream river flow volumes and velocities are high relative to the swimming capability of these two species (ICF International 2016, Section 4.1.3.2.2.1). DS and LFS migrating upstream will have to engage in a sustained swimming effort along the face of the screens to avoid impingement. Laboratory studies (described below) indicate that adult DS are incapable of this effort, and upon exhaustion would likely succumb to injuries related to impingement or screen contact (Swanson et al. 2005). The NDD intakes will be operated such that approach velocity is consistent with recommendations for DS (0.2 ft/s); however, there remains the potential that DS and LFS larger than the minimum screenable size of ~20-21 mm SL, including all upstream migrating adults, could contact the NDD screens and be injured or die.

Experiments conducted at the UC Davis Fish Treadmill Facility have documented juvenile and adult DS injury and mortality following screen contact in a laboratory setting (Swanson *et al.* 2005; White *et al.* 2007). Stress (measured as plasma cortisol) is also positively correlated with screen contact in adult DS (Young *et al.* 2010). Laboratory studies indicate that adult DS migrating upstream past one of the NDD intake screens are expected to contact the screen 3 to 5 times, regardless of the sweeping velocity at the screen face (ICF International 2016, Sections 6.A.2.3.1.1 and 6.A.2.3.1.2). Swanson et al. (2005) observed that screen contact and impingement were injurious to DS, and that mortality was directly correlated to the number of screen contacts and both sweeping and approach velocities. Swanson et al 2005 also noted that DS experienced screen contact and impingement at all of the tested sweeping velocities, with the exception of the control group (0.0 ft/s). Thus it is likely that migration along the screen of each intake will result in multiple screen contacts or impingement at all sweeping velocities > 0.0 ft/s, greatly decreasing the ability for DS to successfully migrate past the NDD on the East bank of the Sacramento River.

An additional analysis, adapted from work conducted by USFWS (ICF International 2016, Section 6.A.2.3.1.3), characterized the ability of DS moving upstream near the east bank of the river to pass the lowermost NDD intake fish screen, given historic Sacramento River at Freeport water velocity, and the potential survival of DS successfully passing the screen. This analysis used December–June Freeport velocity data to determine that individual adult DS have a 0.073 to 0.075 probability of successfully passing the fish screens at NDD Intake 5. When this analysis focused on velocity data from the December–March period, when DS are more likely to migrate through the NDD intake reach, the probability of an individual adult successfully passing NDD Intake 5 declined to 0.040 (0.0398 to 0.0405). Although the probability of survival for individuals that pass the screen were relatively high and had low variability (mean = 0.916, standard deviation = 0.0079), the river velocity was almost always too high for DS to swim the required distance upstream past the NDD intake screen. It is possible that 22-foot-wide refugia between each of the six screen bay groups at the three intakes could provide resting areas and predator refuge for DS and LFS occurring near the intakes and improve individual passage probabilities (ICF International 2016, Section 3.2.2.2). However, because the refugia are still in the conceptual design phase and there is uncertainty as to their effectiveness for DS and LFS, the analyses presented above only accounted for the refugia by excluding the refugia length from the estimates of overall screen length at each intake.

The impingement investigations described above were designed to address risks to migrating DS adults. However, it can be assumed that migrating adult LFS are generally larger than DS, so the results are considered conservative estimates of impingement risks for LFS. Presumably, spawning adults that hold in a similar location prior to, during, and after spawning, possibly to spawn more than once in the case of DS (Damon et al 2016), would face a lower risk of impingement than migrating adults. However, for those spawning adults moving past the NDD, the risk of impingement-related injury and mortality is assumed to be as described for migrating adults.

Near-field effect of NDD intake operations: Increased vulnerability to predation

There is potential for the NDD intake structures and export operations to increase DS and LFS exposure to predation within the NDD intake reach, and in front of each NDD intake screen. Predatory fish may aggregate along the NDD intake screens, as has been observed at a long fish screen on the Glenn Colusa Irrigation District's (GCID) Sacramento River pump station (Vogel 2008b).

Migrating adult DS and LFS occurring in front of the NDD intake screens may be susceptible to an elevated risk of predation as they approach and attempt to pass the fish screens. The NDD intake structures will present a vertical wall with little cover, other than (possibly) the proposed in-screen refugia and the hydraulic effects of the water diversion described above. It is uncertain to what extent the predation rate in front of the screens will differ from the predation rate that would otherwise occur in this reach without the NDD intakes because there are no data available to estimate predation rates on DS and LFS in this reach. A hydroacoustic survey as part of Freeport intake monitoring in 2014 (when diversions were over 130 cfs) found that predator-sized fish (i.e., 12 inches long [305 mm long] and larger) density at the intake was similar to or less than the density in upstream and downstream control reaches (ICF International 2015a). However only four surveys were conducted, so there are few data from which to draw conclusions. Additionally, riprap installed in association with the intakes could result in increased predator habitat and predation risk (ICF International 2016, Section 4.1.1.2).

Spawning adult DS and LFS occurring near the NDD intakes are also expected to be exposed to increased risk of predation. It is also possible that larval and early juvenile DS and LFS could be exposed to an elevated risk of predation if the density and abundance of predators of these life stages increases in proximity to the NDD intakes (Baerwald *et al.* 2012 and Bennett 2005).

<u>Uncertainty in near-field effects of NDD intake operations</u>:

CDFW acknowledges that the analyses summarized above come with limitations of which users of the results must be aware. Consequently, the population level effect of entrainment and impingement at NDD intake diversions on DS and LFS cannot be predicted with certainty at this time for four primary reasons:

1. There is a lack of sufficient data to precisely parameterize a DS life cycle model to characterize DS population dynamics. Although a LFS conceptual life cycle model is currently under development, research to develop a quantitative life cycle mode suitable for analyzing Project impacts has not yet begun. DS and LFS life cycle models are essential tools to characterize the effects of multiple abiotic and biotic factors on the population dynamics and key demographic rates.
2. There is considerable uncertainty as to the actual exposure of DS and LFS to the NDD intake screens because it is not known whether larvae and migrating adult DS and LFS prefer to utilize the mid-channel open water, the demersal zones, or the low velocity channel margin habitat on the east and west banks.
3. Due to a lack of consistent, focused DS and LFS survey efforts, there is significant uncertainty regarding the number of DS and LFS that spawn in and above the NDD intake reach, in absolute terms and in proportion to the overall population of DS and LFS. However, beach sampling surveys targeted to

Chinook salmon consistently observe adult DS and LFS as bycatch, indicating that both DS and LFS spawn in these areas (USFWS DJFMP).

Larval smelt data from sampling conducted by CDFW in the early 1990s (ICF International 2016, Tables 4.1-5 and 4.2-4) indicates that both species regularly spawn in the Sacramento River above the DCC, and up to a few percent of adults spawn in that reach. However, there are no suitable recent data to provide an estimate of the relative density of LFS larvae near the NDD intakes compared to other areas of the Delta and downstream of the Delta.

Beach seine survey data from the USFWS DJFMP and Freeport diversion monitoring data were used as a surrogate for assessing DS and LFS habitat use near the NDD intakes, but users of the data must consider certain caveats. The beach seines are deployed throughout the year, and the geographic range of deployment extends long distances both upstream and downstream of the NDD intakes. However, the beach seines are almost entirely deployed where there is minimal chance of snagging on subsurface obstructions. As a result, these monitoring data are likely representative of DS geographic occurrence along obstruction-free shorelines and at boat ramps, but are much less representative of more typical shoreline types across the Delta (Simenstad et al 2017). Catches of DS were relatively low in the area near the NDD intake reach (0-78 individuals annually) and for the area downstream of the NDD intake reach (0 to 411 individuals annually) from 1977 through 2011. The average catch per unit of effort (CPUE) was similar between the NDD intake reach (average CPUE = 0.16) and downstream areas (average CPUE = 0.18). This information indicates that DS are not effectively sampled utilizing beach seine surveys and estimates of the percentage of the DS population that spawn above and below the NDD intakes are inherently uncertain.

Additional data from the Spring Kodiak Trawl were considered to provide perspective on the presence of DS and LFS near the NDD intake reach. These data characterize DS and LFS presence in open-water habitats, where they are more commonly found in other parts of the Delta (ICF International 2016). However they do not provide information regarding the presence of migrating adult DS and LFS in the lower velocity periphery of the channel, where they are expected to swim upstream against unidirectional flow during periods when the NDD intakes will be operating (i.e., the typical tidal surfing behavioral conceptual model) (Bennett and Burau 2014 and ICF International 2016, Section 4.1.3.2.2.1).

4. Laboratory investigations clearly demonstrate a high risk of impingement of adult DS and LFS migrating upstream through the NDD intake reach to spawn. However there is still substantial uncertainty regarding the extent to which the NDD intakes could constitute a complete barrier to DS and LFS migration to upstream habitat. DS and LFS passage upstream through the NDD intake reach will also depend on the ability of DS and LFS to use lower velocity habitat on the west bank of the river, near the channel bottom, or within the refugia along the intake fish screens.

Additional research focused on migrating adult DS is necessary to further evaluate the impingement risk posed by the NDD intakes on juvenile DS migrating downstream and LFS. It is essential to conduct additional field studies within the NDD intake reach to validate observations from controlled experimental settings. Migrating adult LFS are generally larger than DS and the results of laboratory studies may overestimate LFS impingement risks.

North Delta Diversions: Far Field Effects

Impacts of the authorized taking also include adverse impacts to DS and LFS individuals related to temporal losses, increased habitat fragmentation and edge effects, and the Project's incremental contribution to cumulative impacts (indirect effects). These impacts include: limited access to spawning habitat upstream of the NDD intakes, reduced Sacramento River flows below the NDD intakes (which has the potential to indirectly take DS and LFS through alteration of larval transport to key rearing areas), entrainment of food web resources, reduced Delta outflow, reduced turbidity, and exacerbation of harmful algal blooms in rearing habitat downstream of Rio Vista. The potential adverse effects of entrainment of food web resources, reduced Delta outflow, reduced turbidity, exacerbation of harmful algal blooms, and changes in X2 are discussed in the *Effects of Coordinated Project Operations on DS and LFS Habitat* section in the context of overall coordinated Project operations.

Far-field effect of NDD intake operations: Migration impedance and lost reproduction opportunity

Operation of the NDD intakes is likely to result in increased physiological stress and increased mortality of migrating DS and LFS, which reduces the probability of successful spawning of DS and LFS upstream of Intake 2 through Knight's Landing. Adult DS and LFS upstream migration may be impeded if the NDD intake screens create impassible high-velocity nearshore habitat on the east bank of the Sacramento River at the NDD intakes, which may result in population level impacts due to lost reproductive opportunity.

As previously discussed, the UC Davis Fish Treadmill studies indicate that there is potential for injury and mortality of juvenile and adult DS from screen contact and impingement for the subset of the population occurring in the reach of the river where the NDD intakes will be located (Swanson et al. 2005, White et al. 2007, Young et al. 2010). The NDD fish screens are long (1,497 – 1,969 feet), and may create barrier to DS and LFS upstream spawning migrations. The analysis of the migrating adult DS suggested that only 4% will be able to pass NDD Intake 5 on the east bank. If they successfully pass NDD Intake 5 and remain on the east bank, the adult DS will have to pass Intakes 3 and 2 with a similarly low probability of success, to access upstream spawning habitat. Sweeping velocities generated by river flows along the screen are the primary cause of the migration impediment and are essentially independent of water diversion rates.

The extent to which these factors could constitute a barrier to DS and LFS migration to upstream habitat that results in an overall population level impact will depend on the mortality of DS and LFS at the NDD intakes, and the ability of DS and LFS to use lower velocity habitat on the west bank of the river, near the channel bottom, or within the refugia along the intakes.

<u>Far-field effect of NDD intake operations: Changes in larval transport</u>

Water diversions at the NDD intakes have the potential to negatively impact DS and LFS larval transport through the Delta, which may in turn result in reduced recruitment and population-level impacts. Reduced winter-spring flows in the Sacramento River below the NDD intakes could slow the transport of larval smelt originating both upstream and downstream of the NDD intake reach, into the estuarine low salinity zone rearing habitats. Reduced river flows may also increase the proportion of Sacramento River flow diverted into the DCC and Georgiana Slough. Increased flows into the DCC and Georgiana Slough could result in a greater proportion of larval smelt being transported into the interior Delta and lower San Joaquin River, which are less favorable rearing habitats than the lower Sacramento River, confluence areas, and the low salinity zone.

Analyses of two flow metrics, channel velocity (using DSM2-HYDRO) and flow routing into channel junctions downstream of the NDD intakes, presented in the 2081(b) application for CHNWR and CHNSR are used as a proxy to evaluate Project impacts to DS and LFS larval transport. Because transport of larval DS and LFS and CHNWR and CHNSR juvenile migration are influenced by flow patterns within the Delta, these analyses help to inform the analysis of potential effects of Project operations on DS and LFS larval transport.

> *Channel Velocity (DSM2-HYDRO):* Three velocity metrics were assessed using the DSM2-HYDRO model to understand impacts of NDD intake operations on channel velocity: magnitude of channel velocity, magnitude of negative velocity, and proportion of time in each day that velocity was negative. Lower overall velocity, greater negative velocity, and a greater proportion of negative velocity are all indicators of potential adverse effects to larval DS and LFS transport to suitable downstream habitat, because they are associated with delayed transport or advection into migration pathways with lower survival. In the north Delta, lower flows in the Sacramento River downstream of the NDD intakes as a result of Project operations led to lower median channel velocity under the Project relative to the NAA (ICF International, Table 4.3-10). Assuming that greater diversions at the NDD intakes will occur in wetter years, the reduction in median velocity as a result of the Project ranged from 10–24% in wet years (0.23–0.57 ft/s) and 4–11% (0.04–0.15 ft/s) in critically dry years. Sacramento River channels farther downstream in Sutter Slough, Steamboat Slough, and above and below Georgiana Slough also decreased in response to Project operations, but with lower magnitude of change as a result of greater tidal influence (ICF International 2016, Table 4.3-10). Overall, the results of the DSM2-HYDRO analysis of channel velocity suggest the potential for adverse effects on DS and LFS larval

transport downstream through the north Delta from the Sacramento River caused by lower overall velocity, somewhat greater negative velocity, and a greater proportion of time with negative velocity (ICF International 2016, Section 4.3.4.1.2.2.1.1). Combined, these changes may delay transport and result in greater repeated exposure of larval DS and LFS to interior Delta routes, particularly Georgiana Slough.

Flow Routing Into Channel Junctions: A comparison of the proportion of flow entering important channel junctions from the Sacramento River between modeled operations of the Project and the NAA provides an indication of potential differences in juvenile DS and LFS entry into the interior Delta. The proportion of flow entering a junction is generally a reasonable proxy for the proportion of fish entering the junction (Cavallo et al. 2015). The Sacramento River junctions analyzed included Sutter, Steamboat Sloughs, Georgiana Slough, and the DCC.

Overall, the flow routing analysis suggested that larval DS and LFS migrating down the Sacramento River would have somewhat greater potential to enter the interior Delta through Georgiana Slough. Entry into the interior Delta could result in adverse effects to DS and LFS due to longer transport time to the areas of suitable rearing habitat and greater exposure to south Delta export operations and entrainment. At Sutter Slough, the most upstream junction, there would be little change in flow routing patterns between the NAA and Project operations, although in one case (December of critical years) there was a 5% reduction in flow routing into Sutter Slough under Project operations (ICF International 2016, Table 4.4-12). Slightly farther downstream at Steamboat Slough, Project operations are expected to result in a change of less than 5% in flow routing in February and March of below normal and dry years. The impacts of changes in flow routing into the DCC from December through May on larval DS and LFS transport are discountable because the gates are usually closed in these months and DS and LFS would not ultimately be routed through the DCC into the interior Delta. However, there are small impacts of changes in flow routing as a result of the Project in June, when the DCC gates are open.

<u>Uncertainty in far-field effects of NDD intake operations</u>*:*

The modeling and datasets used to characterize far-field effects of NDD intake operations on DS and LFS provided in the 2081(b) application used by CDFW in and preparation of the ITP represent the best available science. However, these analyses of the potential impact of lost reproductive potential due to migration impedance come with the limitations presented for near-field entrainment and impingement effects on migrating adult DS and LFS. As previously stated, knowledge about migratory behavior of DS and LFS in the vicinity of the NDD intake reach is currently limited. Additionally, the percentage of migrating DS and LFS that will attempt to navigate past the NDD intakes to spawn (and potentially become impinged on the screens) and the percentage of DS and LFS that will choose to spawn downstream of the NDD intakes is not known. Therefore, the effect of NDD intake operations on DS and LFS migration, and the potential for lost reproductive opportunity upstream of the NDD intakes, cannot be predicted with certainty at this time.

It is not currently possible to link population level quantitative biological outcomes to changes in the abiotic physical parameters assessed (channel velocity and flow routing into channel junctions) as a result of Project operations. As previously discussed, there is uncertainty regarding the relative abundance of larval and adult DS and LFS upstream and downstream of the NDD intake reach. This information is needed to inform and parameterize life cycle models of DS and LFS that can be used to assess the effects of Project operations and the benefits of compensatory mitigation on overall population levels. Taken together, the lack of life cycle models designed to analyze effects of the Project on both DS and LFS, the uncertainty associated with cascading modeling analyses, and the averaging of results by water year types over the 82 year CalSim II record constitute a substantial source of uncertainty regarding far-field effects of Project operations on DS and LFS.

South Delta Export Facilities: Near Field Effects

Incidental take of DS and LFS in the form of mortality (“kill”) may occur as a result of operations of the south Delta export facilities and the CCF Aquatic Weed Control Program. For the purposes of this Project, take assessment at the south Delta export facilities includes CCF, Skinner Fish Facility, and Banks Pumping Plant. Operations of the south Delta export facilities will result in take of all life stages of DS and LFS beyond the egg stage, but adults, larvae, and early stage juveniles are expected to have the highest risk of take. After being entrained into the export facilities take may occur as a result of pre-screen loss in CCF, fish bypassing salvage operations through the louvered (behavioral) fish screens to the export pumps, and losses during the fish salvage process. Incidental take of larval and juvenile DS and LFS is similar to adults, except that these smaller life stages are much less likely to be effectively screened by the louvered (behavioral) screens employed at the Skinner Fish Facility, and thus tend to be transported to the export pumps. Incidental take of individuals of DS and LFS may also occur from the Covered Activities in the form of pursue, catch, capture, or attempt to do so during the fish salvage process. The areas where authorized take of DS and LFS is expected to occur include: the south Delta export facilities and CCF located about eight miles northwest of Tracy.

Impacts of the authorized taking also include adverse impacts to DS and LFS individuals related to the Project’s incremental contribution to cumulative impacts (indirect effects). These impacts include potentially increased vulnerability to predation within the modified CCF.

<u>Near-field effect of south Delta export facilities operations: Entrainment</u>

Adult, juvenile, and larval LFS and DS are collected every year during salvage operations in the Skinner Fish Facility from December through June (Brown et al.1996), and many more are entrained into CCF as a result of Project operations. In the years since USFWS (2008) was issued, combined CVP and SWP annual salvage estimates of DS at the south Delta export facilities has ranged from 0 to 260 adult fish, and from 0 to 2,155 juvenile fish (ICF International, Table 4.1-49). The prior year's FMWT index is used to calculate the maximum number of DS individuals the SWP/CVP is authorized to salvage during south Delta operations pursuant to USFWS (2008). Salvage in each year has ranged from 0% to approximately 75% of the incidental take limit for both adult and juvenile DS. Salvage of LFS from water year 1993 to 2016 has varied from 0 to almost 300 adults in December through February, and from 0 to almost 100,000 juveniles in April and May (based on the temporal conventions of greatest occurrence described in Grimaldo et al. 2009) (ICF International 2016, Table 4.2-7).

Entrainment loss of DS and LFS is estimated by extrapolating the number of individuals salvaged to account for prescreen loss, louver efficiency, and other factors, and is likely to be several times greater than salvage. Fujimura (2009) estimated that entrainment loss is 17-21 times greater than salvage for the SWP and four times greater than salvage for the CVP, based on studies of other species.

Entrainment of adults: The distribution of DS and LFS in the south Delta, and associated entrainment risk, is a function of several abiotic and biotic factors including overall species abundance and turbidity. There are currently no tools available to model future adult DS and LFS entrainment risk at the south Delta export facilities with the same degree of precision as hind-cast estimates of historical percentage loss as a function of historical OMR flows. Ongoing scientific investigations are being conducted to improve the ability of models to predict the distribution and entrainment risk of DS and LFS as a function of Project operations in the south Delta.

Bennett (2005) suggested that many, if not most, of the entrained DS that reach the fish salvage facilities likely die due to handling stress and predation. Similarly, many entrained LFS likely do not survive the salvage process (CDFG 2009). However, relatively high percentages of adult DS and LFS can survive collection, handling, transport, and release if they are salvaged during cool temperature conditions (Morinaka 2013).

Collection efforts by the UC Davis Fish Conservation and Culture Laboratory (FCCL) for DS spawning in culture have provided useful information to improve handling techniques. Wild DS are very sensitive to capture and FCCL collection methods have had to evolve substantially to reduce initially extremely high mortality of wild caught fish. The FCCL found that temperature and life stage are important factors affecting survivorship of wild caught DS, and that survivorship can be increased if passive sampling gear are used to avoid impingement of DS. FCCL observed extremely high mortality (90%) at temperatures >15°C (Swanson et al. 1996, Baskerville-Bridges et al. 2005) which are commonly observed in the lower Sacramento River throughout the year, except in December, January and February. Experiments by FCCL have shown that delayed mortality can occur 48 hours (Young et al. 1999) and 72 hours post-collection (Swanson et al. 1996). In another experimental venue, stress, injury, and survival of SWP entrained DS following capture, handling, and transport was highly influenced by water temperature and fish handling technique (Afentoulis et al. 2013, Morinaka 2013). It is likely that the impacts of capture and handling on DS also apply to LFS, however no LFS-specific research has been conducted to date. It is not known whether salvaged adult DS and LFS can successfully spawn after translocation and release at Delta release sites.

The effects analysis submitted as a part of the 2081(b) application estimated the percentage entrainment of adult DS using OMR flow predictions derived from CalSim II model outputs (USFWS 2008; ICF International 2016, Section 6.A.3.1). Entrainment risks are assumed to be similar for LFS in the south Delta. Overall, entrainment and mortality of DS and LFS is expected to continue as a result of Project operations in the south Delta. Averaged across all years, entrainment is expected to decrease 20% as a result of Project operations as compared to the NAA, ranging from a 3% reduction in critical years to a 40% reduction in wet years (ICF International 2016, Section 4.1.3.3.1). Although analyses indicated that the percentage entrainment loss of adult DS will be lower under the Project than NAA, the difference between expected entrainment under Project and NAA scenarios varies by water year type (ICF International 2016, Table 4.1-14 and Figure 4.1-10). The levels of adult DS entrainment under the Project will be similar in drier years, and lower in wetter years, as compared to the NAA. Bypass flow requirements at the NDD intakes and D-1641 Delta outflow requirements limit diversions from the NDD intakes in drier years. As a result, south Delta exports in drier years would be greater in these drier years, and entrainment loss of adult DS is not expected to differ substantially between the NAA and Project operations. The magnitude of the expected reduction in entrainment and mortality is uncertain at this time because there is considerable variability that cannot be forecasted (i.e. turbidity, DS abundance and RTO responses) and, as a result, prediction intervals on model outputs are broad (ICF International 2016, Figure 4.1-11).

Entrainment of larvae and juveniles: Most entrainment of age–0 DS at the south Delta export facilities occurs during the true larval stage and is not observed and counted at salvage facilities (Kimmerer 2008). Salvage estimates of age-0 DS reflects the tail end of the entrainment of age–0 cohorts that started before the fish were large enough to be observed in the fish salvage facilities. DS are not counted in fish salvage until they reach a minimum length of 20 mm SL and Kimmerer (2008) showed that DS salvage was inefficient until the fish were 30 mm long morphologically juveniles (Mager *et al.* 2004). DS typically reach 20-30 mm in May and June. Thus, April is likely to be the month of highest south Delta entrainment of larval and juvenile DS (> 20mm), while May–June are the months of highest salvage (Kimmerer 2008).

LFS entrainment at the south Delta export facilities typically begins in December and can last into May (CDFG 2009). Larval LFS, which were not identified or counted prior to 2008, are probably entrained from late December through April (CDFG 2009). Surviving larval LFS reach juvenile size (20 mm) and are recognized in salvage from March through June, sometimes later (CDFG 2009). Many entrained LFS are not salvaged at the Skinner Facility and are taken or otherwise lost at the Banks Pumping Plant Complex and the California Aqueduct (CDFG 2009).

The analysis of potential differences in salvage of larval/juvenile DS and LFS in the south Delta between the NAA and Project operations in the 2081(b) application recreates and applies the Grimaldo et al. (2009) relationship between salvage and OMR flows (ICF International 2016, Section 4.A.3). Salvage was estimated to be lower in wet water years under Project operations than the NAA but similar or greater in drier years (ICF International 2016, Table 4.A-11, Figure 4.A-31, and Figure 4.A-32). The differences in estimated salvage between NAA and Project operations in all years were small compared to the range in the 95% prediction intervals for the analysis of the relationship between salvage and OMR flow, and the 95% prediction intervals in the relative abundance indices overlapped in all years (ICF International 2016, Figure 4.A-33).

Two approaches were used to estimate entrainment of larval and young juvenile DS as a result of Project operations. First, percentage entrainment loss regression equations, similar to those used in USFWS (2008), were used to estimate differences in potential larval and juvenile (< 20 mm) DS entrainment at the south Delta export facilities based on CalSim II simulations of Project operations (ICF International 2016, Section 6.A.3.1.2). These analyses indicate that the percentage entrainment of larval and juvenile DS will tend to be very similar under the Project and the NAA scenarios (ICF International, Table 4.1-15, Table 4.1-16, Figure 4.1-12, Figure 4.1-13; Figure 4.1-14; Figure 4.1-15), except in drier years when entrainment is expected to be greater because OMR flows are more negative as a result of Project operations.

The second approach utilized the DSM2-PTM model to estimate entrainment of larval and juvenile DS and LFS (ICF International 2016, Section 6.A.3.2) and accounted for the four main entrainment locations in the Delta (NDD intakes, North Bay Aqueduct, and south Delta CVP and SWP facilities). One DSM2-PTM model run was weighted by data from the 20-mm survey to characterize differences in DS entrainment between Project operations and the NAA. A separate DSM2-PTM model run was weighted by Smelt Larval Survey (SLS) data from 2009-2014 to characterize LFS entrainment (ICF International 2016, Section 4.A.2).

The results of the DSM2-PTM analysis weighted with data from the 20-mm survey suggest that there will be entrainment of larval and juvenile DS from March through June will be reduced as a result of Project operations on average in wetter years. However, in drier years there will be little to no difference in DS entrainment between Project operations and the NAA. South Delta entrainment is the primary driver of total DS larval and juvenile entrainment across all Project facilities analyzed. Analyses of south Delta larval and juvenile entrainment using the DSM2-PTM model suggested that Project operations may result in increased CVP entrainment (particularly in April and May) but decreased SWP entrainment (except in April) as compared to the NAA. Overall, the results of the entrainment analyses at the south Delta export facilities conducted using the DSM2-PTM model are consistent with the differences in entrainment between Project operations and the NAA observed in the percentage entrainment regression analysis from March to June (ICF International 2016, Table 4.1-18) and April to May and discussed above (ICF International 2016, Table 4.1-19).

The results of the DSM2-PTM analysis weighted with SLS data indicate that changes in larval and juvenile LFS entrainment as a result of Project operations compared to the NAA are likely to vary among locations, months, and water year types (ICF International 2016, Table 4.A-7). Entrainment at the south Delta facilities under Project operations would be less than the NAA, particularly in wetter years when NDD intake operations would be less constrained (ICF International 2016, Figures 4.A-7 through Figure 4.A-12). This DSM2-PTM analysis suggests that most larval and juvenile LFS entrainment will occur at the NBA (where larval and juvenile LFS are most frequently observed by the SLS. Relative differences in entrainment at the south Delta export facilities between NAA and Project are considerably greater than the relative differences in total entrainment across all four facilities analyzed (ICF International 2016, Section 4.A.1.3).

Near-field effect of south Delta export facilities operations: Predation

Predation of adult and larval DS and LFS is considered to be the primary contributor to pre-screen mortality. Pre-screen predation occurs when adult DS and LFS occur in the vicinity of south Delta export facilities and in CCF, but before they encounter fish screening facilities and export pumps. A large proportion of adult DS individuals are expected to die as a result of predation in CCF before they reach the fish screening facilities or the export pumps behind them (Castillo et al. 2012). Similar predation mortality is assumed for LFS. Given that a substantial proportion of the migrating adult DS and LFS population in the south Delta can be entrained in the south Delta facilities and subsequently die as a result of predation, lower entrainment under Project operations should translate into lower overall adult mortality, compared to NAA. However, as described above, the entrainment risk for individual DS and LFS under Project operations is expected to decrease as compared to the NAA.

Predation losses of larval DS and LFS in association with the south Delta export facilities have not been quantified, whereas losses of juvenile DS as a result of pre-screen predation have been shown to be substantial under some conditions (Castillo et al. 2012), as is the case with other species (Gingras 1997; Clark et al. 2009). The influence of water project operations on pre-screen predation on larval and small juvenile DS and LFS is built into the percentage loss estimates based on Kimmerer (2008), and described in the entrainment section above. Individual juvenile DS and LFS are expected to leave the south Delta as water temperatures increase to inhospitable levels, which can be as early as May. As a result, although this is an ongoing risk under Project operations, it is not anticipated that there will be changes in predation risk to individual larvae and juveniles at or near the south Delta export facilities between the NAA and Project operations scenarios.

Near-field effect of south Delta export facilities operations: Clifton Court Forebay Aquatic Weed Control Program

The Clifton Court Forebay Aquatic Weed Control Program uses copper-based herbicides and mechanical removal in CCF to control the abundance of invasive aquatic weeds. DS and LFS exposed to herbicides could be injured or killed. To minimize the risk of injury and mortality, herbicide application is limited to July and August, when few DS and LFS are expected in CCF and water temperatures are high. Mechanical removal of aquatic weeds may be conducted at times of the year when DS and LFS may be present in CCF resulting in injury and mortality. Although chemical and mechanical control of invasive aquatic weeds in CCF is likely to result in injury and mortality of DS and LFS, it may also contribute to reducing the abundance of predatory fishes that inhabit the weed mats and the likelihood of mortality as a result of smothering DS and LFS during salvage operations.

South Delta Export Facilities: Far Field Effects

Impacts of the authorized taking also include adverse impacts to DS and LFS individuals related to the Project's incremental contribution to cumulative impacts (indirect effects). These impacts include entrainment of larval and juvenile DS and LFS into unfavorable southern Delta habitats through reverse flows in the Old and Middle rivers as a result of south Delta export operations. South Delta export-related reverse flows in Old and Middle Rivers can draw turbidity and alter Delta channel hydrodynamics that draw pre-spawn adult DS and LFS into the interior Delta where they are subjected to increased entrainment risk at the south Delta export facilities. Adult DS and LFS that are drawn in the south Delta, but are not directly entrained, may spawn there. The larvae and juveniles originating in the south Delta are particularly susceptible to take at the south Delta export facilities as a result of predation and entrainment, even at low levels of operation.

LFS and DS spawning migrations occur during the winter when precipitation increases freshwater flows in the Delta. Salvage of adult DS and LFS at the south Delta export facilities is used to calculate a rough index of entrainment (CDFG 2009b, Grimaldo et al. 2009, USFWS 2008). The risk of entrainment of migrating adult DS is likely influenced by flow cues and dispersion of turbidity into the south Delta (Grimaldo et al. 2009). However, similar environmental variables were not associated with adult LFS salvage (Grimaldo et al. 2009). Old and Middle rivers are distributary channels of the San Joaquin River, with Old River being the main corridor to the south Delta facilities. Pumping at the south Delta CVP/SWP facilities can cause the tidally filtered or "net" OMR flows to move "upstream." This occurs because water removed by the Banks and Jones pumping plants, along with other diversions in the area, is back-filled by tidal and river flows. This phenomenon is depicted in models as a negative OMR flow, and is negatively correlated with salvage (i.e. more negative OMR flows result in increased DS and LFS salvage, Grimaldo et al. 2009). Negative OMR flows are often qualitatively associated with adult DS and LFS entrainment (USFWS 2008 and CDFG 2009). Although net OMR flows indicate how strongly the tidally averaged flows in these channels are moving toward Banks and Jones pumping plants, there is not a reliable quantitative relationship between OMR flow and entrainment.

CalSim II modeling in the 2081(b) application showed that Project operations should result in less negative OMR flows as compared to the NAA during the months when adult DS and LFS are expected to be present in the south Delta. As a result, Project operations are generally expected to improve OMR flows more in wetter years compared to the NAA. Therefore individual adult DS and LFS will be less likely to be drawn into the southern Delta, and thus less susceptible to poor conditions there, or to eventual near-field entrainment impacts at the South Delta facilities, under the Project Operations relative to the NAA.

Additional DSM2-PTM analyses compared the potential for LFS larvae to enter the south Delta, where survival is expected to be low, between Project operations and the NAA. Results of this analysis suggest that substantially fewer LFS larvae and juveniles will enter into the south Delta under Project operations than under the NAA as a result of reduced south Delta exports (ICF International 2016, Figure 4.A-13 through Figure 4.A-18 and Table 4.A-8). As a result, Project operations are expected to provide improved hydrodynamic conditions for LFS larvae in the Delta, in comparison to what would be observed if Project operations did not include the CWF. This general pattern was also confirmed by an analysis of the percentage of particles reaching Chipps Island, for which a greater percentage of particles reached Chipps Island under Project operations in January than the NAA, although this difference is lower in February and March. The extent of the differences between NAA and Project operations is difficult to accurately predict given the real-time operational decisions involving fish distribution and other factors (e.g., prevailing flows and operations) that will occur.

Uncertainty in Near-Field Effects and Far-Field Effects of South Delta Facilities Operations

As with analyses of the NDD Intakes, while the analyses summarized above represent the best available science, CDFW recognizes certain limitations in the current understanding of impacts of south Delta facilities operations on LFS and DS.

The population-level effects of DS and LFS entrainment vary across years and can have a significant negative effect on population dynamics. Kimmerer (2008) estimated that annual entrainment of the DS population (adults and their progeny combined) ranged from approximately 10-60% per year from 2002–2006. Substantial population declines during the early 1980s (Moyle et al. 1992) were followed by declining smelt abundance indices associated with drought (1987-1994), introduced species (the clam *Potamocorbula amurensis* as well as several copepods during this period) that altered the amounts and types of prey available to smelt, and the subsequent pelagic organism decline (POD) beginning in 2002 (Sommer et al. 2007). As smelt indices declined, annual salvage numbers remained high through the 1980s and 1990s (Aasen 2016). However, salvage estimates do not represent total take as a result of entrainment because the majority of entrained fish are not salvaged and therefore do not survive after they are entrained in the vicinity of south Delta export facilities. The relationship between entrainment and DS population dynamics is an area of ongoing scientific debate. Currently published analyses of long-term associations between DS salvage and subsequent abundance do not support the hypothesis that entrainment is driving population dynamics across years (Bennett 2005; Manly and Chotkowski 2006; Kimmerer 2008; Mac Nally et al. 2010; Maunder and Deriso 2011; Miller et al. 2012). However, other researchers have found that entrainment (or water diversions during the time period when entrainment would be of concern) may affect population dynamics (Rose et al. 2013b; Thomson et al. 2010).

Regression models used to evaluate larval entrainment in the NAA and Project operations scenarios had broad prediction intervals, which were overlapping across all exceedance values (ICF International 2016, Figures 4.1-13, 4.1-15, 4.1-16 and 4.1-17). Simenstad et al (2017) noted that the true annual values could lie near the bottom boundary of the prediction interval for Project and near the top boundary of the prediction interval for NAA. This would result in greater differences than suggested by the comparison of annual mean values. By the same rationale, it is also possible that the true annual values could lie near the top boundary of the prediction intervals for both Project and NAA, in which case the differences would be more similar to the differences between means (Simenstad et al 2017).

DSM2-PTM analyses used to estimate larval entrainment only provide a comparison of potential relative differences between two operational scenarios, which is assumed to be a surrogate for risk of take. Once more information is available characterizing the percentage of DS and LFS larvae entrained as a result of Project operations, operational adjustments could then be made to minimize the potential for take of DS, LFS, and other fishes, based on real-time biological and physical monitoring. However, such adjustments cannot currently be simulated in DSM2-PTM analysis.

Effects of Head of Old River Gate Operations

Incidental take of DS and LFS in the form of mortality ("kill") may occur as a result of operations of the HOR Gate. HOR Gate operations will alter Old and Middle River hydraulics, resulting in short term increases Old and Middle river reverse flows. Increases in Old and Middle River reverse flows in turn may increase the entrainment of DS and LFS (larvae, early juvenile life stages, and migrating and spawning adults) into the south Delta export facilities. Impacts of the authorized taking also include adverse impacts to DS and LFS individuals related to the Project's incremental contribution to cumulative impacts (indirect effects). These impacts include increased vulnerability to predation through creation of enhanced predatory fish habitat adjacent to the HOR Gate. The area where authorized take of DS and LFS is expected to occur is at the divergence of the head of Old River and the San Joaquin River and downstream of this location.

The potential for effects at the HOR Gate is similar to the effects described for the south Delta Temporary Barriers Project (TBP) described in USFWS (2008). Unlike the rock barrier currently used in some years, however, HOR Gate operations will occur in the context of real-time changes in both gate position and management of north and south

Delta exports in order to limit the potential for adverse hydraulic effects to adult DS and LFS during their winter dispersal. In particular, management of OMR flows in consideration of fish distribution and turbidity cues (among other factors), will be undertaken to limit adverse effects to DS and LFS under Condition of Approval 9.9.4 General Operating Criteria and Condition of Approval 9.9.5 Real-Time Operations .

The 2081(b) application noted the potential for negative effects of the TBP, including an HOR Gate, on DS which are likely to be similar for LFS:

> *"The TBP does not alter total Delta outflow, or the position of X2. However, the TBP causes changes in the hydraulics of the Delta, which may affect Delta smelt. The HORB blocks San Joaquin River flow, which prevents it from entering Old River at that point. This situation increases the flow toward Banks and Jones from Turner and Columbia cuts, which can increase the predicted entrainment risk for particles in the East and Central Delta by up to about 10 percent (Kimmerer and Nobriga 2008). In most instances, net flow is directed towards the Banks and Jones pumps and local agricultural diversions. Computer simulations have shown that placement of the barriers changes South Delta hydrodynamics, increasing Central Delta flows toward the export facilities (Reclamation 2008). In years with substantial numbers of adult Delta smelt moving into the Central Delta, increases in negative OMR flow caused by installation of the [temporary barriers] can increase entrainment. The directional flow towards Banks and Jones increases the vulnerability of fish to entrainment. Larval and juvenile Delta smelt are especially susceptible to these flows.*
>
> *The varying proposed operational configurations of the TBP, natural variations in fish distribution, and a number of other physical and environmental variables limit statistical confidence in assessing fish salvage when the TBP is operational versus when it is not. In 1996, the installation of the spring HORB caused a sharp reversal of net flow in the South Delta to the upstream direction. Coincident with this change was a strong peak in Delta smelt salvage (Nobriga et al. 2000). This observation indicates that short-term salvage can significantly increase when the HORB is installed in such a manner that it causes a sharp change or reversal of positive net daily flow in the South and Central Delta."*

Based on this assessment in the 2081(b) application (ICF International 2016a), which relies upon analyses included in USFWS (2008), there is the potential for the HOR Gate to result in short-term negative effects to DS and LFS by influencing the hydraulics of Old and Middle Rivers and creating greater short-term increased reverse OMR flows when it is initially closed. However, the potential for adverse effects on DS and LFS are likely to be limited as a result of changes in OMR flows as a result of Project operations and the ability to manage the proposed HOR Gate in real time.

In addition to broad-scale, far-field effects of the HOR Gate on south Delta hydrodynamics, there may be long-term localized effects on migrating adult DS and LFS. Studies of the temporary barrier installed at the HOR in 2012 suggested that the structure created eddies that could have resulted in enhanced predatory fish habitat and increased predation on juvenile salmonids (DWR 2015a); such adverse effects could also impact DS and LFS as a result of HOR Gate operations. However, DS and LFS presence in the vicinity of the HOR is uncommon and thus the number of individuals affected in any given year is likely to be relatively low (Merz et al. 2011, Merz et al. 2013).

Effects of Coordinated Project Operations on DS and LFS Habitat Characteristics

Impact of coordinated Project operations: Reduced winter-spring Delta outflow

Indirect effects on LFS in the form of annual reductions in juvenile recruitment are likely to occur as a result of Project operational effects on winter-spring Delta outflow. Fresh water flow is integral in many biotic and abiotic processes occurring within the Delta and San Francisco Bay estuary. The magnitude of Delta inflows and outflow affects salinity, turbidity, production and transport of food resources, the volume and area of the low salinity zone, and concentrations of contaminants. Many of the fish and macroinvertebrate species in the estuary downstream of the Delta have demonstrated increased abundance associated with increased magnitude of seasonal freshwater flows (Kimmerer 2002), although there are considerable uncertainties regarding the mechanisms underlying these responses. The annual magnitude and seasonality of Delta inflows and outflow will likely be greatly affected by climate change, sea-level rise, and increasing water demand outside of the Project (exports).

A strong positive correlation has been observed between annual winter-spring Delta outflow and LFS abundance in the fall of the same year (Rosenfield and Baxter 2007; Kimmerer et al. 2009). Specifically, a more seaward winter-spring X2 has been associated with greater abundance of LFS juveniles in the subsequent fall, as indexed by the FMWT survey (Kimmerer 2002; Kimmerer et al. 2009). While the complex and interrelated mechanisms underlying the effect of winter/spring outflow on fall LFS abundance cannot be deconstructed with available data, the significant X2-abundance relationship enables a quantitative analysis of the overall effects of changes in spring outflow on LFS. This analysis suggests that higher outflow (lower X2) produces conditions that enhance recruitment of eggs and larvae to juvenile life stages. Hypotheses about underlying mechanisms of this X2-abundance relationship include transport of larval LFS out of the Delta to downstream rearing habitats (Moyle 2002 and Rosenfield and Baxter 2007); increased extent of rearing habitat as X2 moves seaward (Kimmerer et al. 2009); retention of larvae in suitable rearing habitats (Kimmerer et al. 2009); increased food abundance under higher flows (CDFG 2009b); and reduced clam grazing effects on primary and secondary production (CDFG 2009b).

Based on these known relationships between X2 and LFS abundance, changes in Delta outflow associated with Project operations are expected to impact LFS (Kimmerer et al. 2009; recently updated by Mount et al. 2013). To analyze the effect of Project operations on LFS an update of the X2-abundance regression conducted by Kimmerer et al. (2009) and Mount et al. (2013) was included in the 2081(b) application. This updated analysis used a general linear model to predict the log10 LFS FMWT index as a function of mean January-June X2 and step changes associated with the introduction of *P. amurensis* and the POD. The updated method and detailed results of the analysis are presented in ICF International (2016, Appendix 4.A). When the results of this analysis were combined with results from CalSim II they indicated that the annual FMWT LFS abundance index would reduce by 9.6% on average (with a median of -10.51%) as a result of climate change, sea level rise, and existing operations across all water year types as compared to the NAA. In three of the five water year types analyzed, fall LFS abundance declined in excess of 10% (dry years = 10.65%, below normal years = 11.31%, and wet years = 11.53%). The decline in LFS abundance could be greater as a result of Project operations because operational flexibility provided by the NDD intakes could allow for additional exports during the winter-spring period in the absence of new operating criteria.

Subsequent CalSim II modeling incorporated the spring outflow criteria required by ITP Condition of Approval 9.9.4.3. On average, LFS juvenile abundance is expected to decrease across all year types (7.48% reduction) by the ELT (2030) as a result of climate change-related shifts in hydrology and increased exports in the months of January and February. However, the CalSim II analysis which included criteria in Condition of Approval 9.9.4.3 showed that reductions in overall LFS abundance associated with changes in outflow during Project operations were minimized through implementation of the criteria, which are designed to maintain current levels of outflow from March through May (K. Kundargi pers comm. 2017). The decline in LFS abundance in wet years is not expected to differ between Project operations with spring outflow criteria (Condition of Approval 9.9.4.3) as compared to the NAA (12.47% decline under the Project vs. 11.53% decline under the NAA). When wet years were excluded from both analyses, the expected declines in average fall juvenile LFS abundance were reduced by nearly half (5.17% decline with spring outflow criteria versus a 9.13% decline under the NAA) (K. Kundargi pers comm. 2017).

In the Sacramento River, comparisons of late-long term (2060) climate change scenarios indicate that climate change is expected to cause small increases in mean monthly flows between December and March and reduced flows during April through July (ICF International 2017c, Table SR1 through SR4). As such, the ITP spring outflow criteria minimize changes in Delta outflow throughout the permit term, during months when outflow is otherwise expected to decline through 2060.

Recent evidence for the potential positive effects of spring outflow for DS early life stages (IEP MAST Team 2015) suggests that Condition of Approval 9.9.4.3 could also reduce Project effects to DS.

<u>Impact of coordinated Project operations: Entrainment of food web materials</u>

CVP/SWP water exports directly entrain phytoplankton and zooplankton which are the base of the food web supporting DS and LFS populations (Arthur *et al.* 1996, Jassby and Cloern 2000 and Jassby *et al.* 2002). These food web materials are exported out of the Delta, and hydrodynamics associated with Project operations may limit their transport into Suisun Bay (Jassby and Cloern 2000). However, it is not known whether losses of food web materials as a result of Project operations greatly affect overall DS and LFS production because the aquatic food web is also affected by other factors unrelated to Project operations (e.g., clam grazing and ammonium inhibition of per capita diatom growth rates). Entrainment of phytoplankton and zooplankton by the south

Delta export facilities is generally expected to be reduced as a result of Project operations compared to NAA, but the NDD intakes will add a new point of food web entrainment along the Sacramento River.

The impact of Project operations on food web dynamics was examined using an assessment of phytoplankton carbon entrained, based on chlorophyll *a* concentration data at Hood (representing the load of entrained phytoplankton), in relation to the biomass of phytoplankton in the Delta (taken from Antioch chlorophyll *a* data, scaled up to the volume of the Delta) (ICF International 2016, Section 6A.4.2). This analysis approximates the phytoplankton carbon load that could be entrained by the NDD intakes during Project operations. Project operations may result in reduced entrainment of phytoplankton carbon by the south Delta export facilities in comparison to the NAA scenario. These factors vary substantially by water year type and are discussed qualitatively in the analysis.

Estimates of phytoplankton carbon load entrained by the NDD intakes ranged from an average of 0.2 metric tons/day in April and May (5th to 95th percentile ranges were 0.01 to 1.8 metric tons/day) to 1.6 metric tons/day in February (5th to 95th percentile range 0.13 to 5.7 metric tons/day) (ICF International 2016, Table 4.1-22). Estimates of total phytoplankton carbon biomass in the Delta from 2004 to 2015 ranged from just under 23 metric tons (December 2011) to over 230 metric tons (May 2010) (ICF International 2016, Table 4.1-23). Thus, the median percentage of Delta phytoplankton carbon biomass estimated to be entrained by the NDD intakes ranges from 0% (based on the 5th percentile of entrained load estimates), up to 12% (based on the 95th percentile load estimate combined with the minimum biomass estimate in December, ICF International 2016, Table 4.1-24). The median estimates of total fraction of phytoplankton biomass removed by the NDD intakes ranged from 0.5% to 2% per month, when compared to minimum Delta phytoplankton carbon biomass estimates, down to 0.1% to 1% when compared to maximum Delta phytoplankton carbon biomass estimates (ICF International 2016, Table 4.1-24). On the basis of these analyses the NDD intakes are not expected to entrain more than 5 percent of the Delta's standing stock of phytoplankton in any given month.

Exports from south Delta facilities are expected to be reduced during Project operations as compared to the NAA. Jassby *et al.* (2002) estimated that from spring through fall, the Delta produces 44 metric tons/day of phytoplankton carbon and another 12 metric tons/day flows into the Delta from its tributaries on average. The south Delta export facilities remove about 14% of that 56 tons/day (8 metric tons/day) (Jassby *et al.* 2002). It is anticipated that the 50% reduction in south Delta exports over the long-term under Project operations will increase the input of productive San Joaquin River water to the western Delta and Suisun Bay (Application Table 4.1-25) and could offset some or all of the loss of food web productivity attributable to operation of the NDD intakes.

Relationship between food web entrainment and impacts on DS and LFS: The primary mechanisms by which entrainment of food web materials might affect DS and LFS is by temporarily reducing density of zooplankton immediately downstream of the NDD intakes, or by reducing the abundance of phytoplankton transported further into the estuary, causing some reduction in food for the zooplankton that DS and LFS eat.

Research on DS food web ecology is summarized below. No equivalent research on LFS ecology has been conducted, and for the purposes of this effects analysis the relationships between phytoplankton and LFS abundance are assumed to be the same as DS.

Overall, the effects of Project entrainment of phytoplankton carbon on zooplankton prey abundance and DS and LFS populations are likely to be low. As noted by Baxter et al. (2010) and the IEP MAST Team (2015), there has been little study of feeding habits of migrating and spawning adult DS. There is evidence that DS prey on larval fish which may be subject to entrainment at the NDD intakes (IEP MAST 2015), and adult DS life stages may be food limited in the north Delta (Hammock et al 2015). As with adult DS, lower loads of phytoplankton carbon into the estuary because of entrainment in the NDD intakes could translate into less food for individual DS and LFS larvae and young juveniles, but this is not certain. It was estimated that 0.1% to 5% of phytoplankton carbon in the Delta could be entrained by the NDD intakes from March through June (ICF International 2016, Table 4.1-24). However, the phytoplankton has to be converted into copepod biomass to be prey for larval DS and that process is not always directly related to phytoplankton density as indexed by chlorophyll *a* concentrations in the water (Kimmerer 2002).

The feeding success of DS larvae appears to be related to prey density and prey type (Nobriga 2002). Smelt do not prefer all zooplankton equally. DS rely heavily on calanoid copepods (*Eurytemora affinis* and *Pseudodiaptomus forbesi)* in early life stages, and *Eurytemora affinis* is a very important prey item for young LFS (Slater and Baxter 2014). Some analyses of DS population dynamics have shown that prey abundance for larval and juvenile DS may contribute to increased DS abundance (Maunder and Deriso 2011; Miller et al. 2012), while others have found less support for this relationship (Mac Nally et al. 2010; Thomson et al. 2010). A recent empirical study of DS feeding ecology and food limitation (Slater and Baxter 2014) found that food limitation was greater for juvenile DS in the late summer than it was for larvae or small juveniles during the late spring.

It is likely that food limitation impacts multiple life stages of DS and varies across regions of the Delta (Rose et al. 2013a,b), although the empirical evidence for food limitation during the juvenile life stage is generally stronger than it is for other life stages (Slater and Baxter 2014; Hammock et al. 2015). Less phytoplankton carbon loading to the estuary because of entrainment at the NDD intakes could reduce the abundance of zooplankton prey for DS. Kimmerer et al (2005) found chronic food limitation in *Acartia* copepods resulted in low egg production due to low chlorophyll in Suisun Bay. However, in situ production of phytoplankton carbon within the Delta is several times greater than inputs from freshwater inflow (Jassby et al. 2002). Because in situ production is the dominant source of phytoplankton to the planktonic food web (Sobczak et al. 2002) a 5% increase in entrainment of phytoplankton carbon by the NDD intakes would only have a minor, if any, adverse population-level effect. Any potential impacts as a result of NDD intake food web entrainment during Project operations could be offset by increases in inputs from relatively more productive San Joaquin River water during these months (ICF International 2016, Table 4.1-25).

Impact of coordinated Project operations: Microcystis

Toxic cyanobacterium, *Microcystis spp. (Microcystis),* have been shown to have negative effects on the aquatic foodweb of the Delta (Brooks *et al.* 2012), principally in the south Delta and the middle to upper portions of the west/central Delta near locations such as Antioch, and Franks Tract (Lehman *et al.* 2010). *Microcystis* could affect DS through direct ingestion, consumption of prey containing high concentrations of toxins, or toxic effects to prey leading to lower prey abundance (reviewed by Brooks *et al.* 2012, Ger et al 2010). *Microcystis* blooms generally occur from June to October, when the water temperature is at least 19°C (Lehman *et al.* 2013). Although no direct research linking impacts to LFS with *Microcystis* exposure is available, the impacts on LFS are assumed to be similar to DS. The potential effects of Project operations on *Microcystis* blooms were assessed using two approaches:

Flow conditions conductive to Microcystis: The frequency of flow conditions conducive to *Microcystis* occurrence (as defined by Lehman *et al.* 2013) was assessed in the San Joaquin River past Jersey Point (QWEST) and in the Sacramento River at Rio Vista (QRIO). DSM2-HYDRO modeling was used to examine the frequency of years when mean monthly flows from July–November were within the range at which *Microcystis* has been shown to occur (Lehman *et al.* 2013). In neither the NAA nor the Project scenario were mean monthly flows below the range noted for *Microcystis* occurrence, whereas for Project there were substantially more years within the range for *Microcystis* occurrence than for NAA (ICF International 2016, Table 4.1-26). These results are attributable to reduced south Delta exports under Project than NAA. Because operation of the NDD intakes would reduce Sacramento River flow (ICF International 2016, Table 4.1-27) there could be greater potential for *Microcystis* occurrence in the lower Sacramento River as a result of Project operations when compared to the NAA.

Water temperature and residence timing: Microcystis is more likely to occur under warmer water temperatures and when residence times are greater (Lehman et al 2017). DSM2-QUAL water temperature modeling (ICF International 2016, Section 4.1.3.5.2) and DSM2-PTM estimates of residence time (ICF International 2016, Section 6.A.4.3) were used to infer the potential for *Microcystis* occurrence under Project operations and the NAA scenarios. The results of the DSM2-PTM-based residence time analysis presented focus only on the particle insertion locations upstream (east) of Suisun Bay and Suisun Marsh, because this is where effects of the Project on hydraulic residence time are highest.

The effects of Project operations on residence time varied among subregions. Subregions with short residence times are predicted to occasionally have large percentage changes in residence time (e.g., locations near the NDD intakes), and regions with comparatively long residence times are typically predicted to have moderate to low percentage changes in residence time (ICF International 2016, Tables 4.1-28 through Table 4.1-48) between Project operations and the NAA. Differences between NAA and Project operations ranged from almost no change in the Sacramento River Deepwater Ship Channel, to substantial increases in predicted residence times as a result of Project operations. For example, in

Disappointment Slough median predicted residence time ranged from reductions of 3.8 days to increases of 11.9 days as a result of Project operations in comparison to the NAA. In Mildred Island mean residence times were expected to increase from 5.8 to 16.5 days above NAA conditions, and in Victoria Canal median residence times were expected to increase from 3.0 to 11.7 days. These results indicate that *Microcystis* may have considerably more opportunity for growth in parts of the southern Delta where water temperatures are relatively high during the summer and present-day blooms are often observed.

Most of the DS population is not distributed in the southern Delta during the summer and fall because the water is too warm and too clear (Feyrer et al. 2007; Nobriga et al. 2008). Therefore, the DS population does not presently overlap the peak of the *Microcystis* bloom in space and time. If *Microcystis* blooms increase in duration and intensity as a result of Project operations, in part from longer residence times, it is possible that there will be overlap between the timing of larval and juvenile life stages of DS in the Delta and *Microcystis* blooms early in the year. Additionally, warm periods in late fall-early winter could result in *Microcystis* blooms that may affect migrating adult DS and LFS. Additionally, longer residence times due to Project operations could create an overlap between potential *Microcystis* blooms during Project operations and DS occurrences in the low-salinity zone. Because *Microcystis* can be toxic to copepods there is potential for the higher residence times in this region to intensify blooms that harm or kill DS directly, by killing their prey, or by increasing toxin concentrations within their prey (Ger et al. 2009; 2010; Lehman et al. 2010; Acuña et al. 2012; Brooks et al. 2012). If the lower Sacramento River temperatures increase over time due to climate change, and become clearer due to Project operations or other factors, *Microcystis* blooms could also expand into this important DS rearing area.

<u>Impact of coordinated Project operations: Sediment removal and changes in turbidity</u>

Water clarity (turbidity) is an important habitat characteristic for DS and is a significant predictor of larval feeding success (presumably by providing a visual contrast to enable the larvae to locate and ingest prey, Baskerville-Bridges *et al.* 2004); and juvenile distribution (Nobriga *et al.* 2008; Feyrer *et al.* 2011) that has been correlated to long-term changes in abundance or survival either by itself or in combination with other factors (Thomson *et al.* 2010; Maunder and Deriso 2011). Over the past 40 years turbidity has declined, on average, 1.6% per year (Cloern *et al.* 2011). It is uncertain whether this average decline in turbidity will continue at this rate, slow down, or level off as a result of Project operations (Cloern *et al.* 2011). Should this average trend continue, it presumably will further exacerbate ongoing downward trends in DS habitat quality (Feyrer *et al.* 2011 and Brown *et al.* 2013).

Most of the sediment entering the Delta comes from the Sacramento River (Wright and Schoellhamer 2004). The NDD intakes will entrain a portion of the Sacramento River's sediment load, which could result in higher water clarity downstream when erosion increases and wind- and velocity-driven resuspension of sediment into the water column decreases. In 2013, DWR and Reclamation estimated the amount of sediment that will be diverted by the NDD intakes through 2060 based on historic sediment load estimates from 1991–2002 (DWR and Reclamation 2013, Section 5C.D.3). The 2081(b) application includes an analysis, using very similar methods, of sediment entrainment at the NDD intakes for water years 1991–2003 matched to CalSim flow and NDD intake diversion estimates. This analysis suggested that on average 10% (range 5–15%) of combined sediment load entering the Delta from inflow at Freeport and the Yolo Bypass will be removed by the NDD intakes. If this sediment is not returned to the system, it is likely that water transparency in the Delta will increase over time due to Project operations (ICF International 2016, Section 3.2.2). However, the magnitude of the expected increase in water clarity as a result of Project operations cannot be accurately predicted without application of a full suspended sediment model incorporating the whole estuary (Schoellhamer *et al.* 2012). Additionally, analyses in the 2081(b) application did not quantify sediment removal by the south Delta export facilities under the NAA or Project operations. Based on the estimates by Wright and Schoellhamer (2005), sediment removal by the south Delta export facilities is approximately 2% of the sediment entering the Delta at Freeport. As a result, the net sediment removal as a result of Project operations (exports at the NDD intakes and reduced south Delta exports) will be appreciably greater than sediment removal under NAA.

Suspended sediment concentrations and turbidity are important to a variety of life stages of DS. Suspended sediment may conceal DS from visual predators (Schreier et al. 2016 and Sommer and Mejia 2013). As a result, increases in water clarity during the latter parts of spring when suspended sediment concentration in river inflow goes down (ICF International 2016, Table 4.1-21) may result in reduced available habitat exposing individual DS to increased predation and reduced foraging success. Water clarity is also positively correlated with larval/young juvenile DS feeding success (Baskerville-Bridges *et al.* 2004, Moyle et al. 2016).

Suspended sediment and turbidity are habitat components associated with the distribution of several life stages of DS in the Delta. As described previously, some adult DS migrate upstream in response to winter increases in suspended sediment and flow (Grimaldo et al. 2009), and changes in suspended sediment concentrations in the winter could alter the timing of adult migration. The spatial distribution of larval and juvenile DS is also linked to turbidity (Sommer and Mejia 2013). The occurrence of larval/young juvenile DS bridges the transition between higher flow winter months and lower flow summer months, during which time the suspended sediment concentration in inflowing Sacramento River water decreases and resuspension of sediment delivered in the higher flow months becomes more important. Juvenile DS occur during the low-flow time of year when suspended sediment concentration in inflow is at a minimum (ICF International 2016: Table 4.1-21). This suggests that the NDD intakes' removal of sediment could affect juvenile DS by increasing water clarity.

Following from this consideration of individual-level effects, population-level adverse effects on all life stages of DS from sediment removal by the NDD intakes may be limited by the occurrence of this life stage in higher flow months, when suspended sediment concentration often is relatively high. The population-level impact of sediment removal at the NDD intakes cannot be reliably predicted at this time. If there is an effect, it may be manifested in the long term. The relationship between LFS distribution, abundance, and turbidity is less clear. As a result, impacts to LFS as a result of removing suspended sediment through operations of the NDD intakes are uncertain.

Impact of coordinated Project operations: Changes in fall abiotic habitat (X2)

From September through December, sub-adult DS respond to changes in abiotic conditions in the low salinity portion of the estuary (Feyrer et al. 2011). USFWS (2008) defined suitable habitat for DS during this time period as “the abiotic and biotic components of habitat that allow DS to survive and grow to adulthood: biotic components of habitat include suitable amounts of food resources and sufficiently low predation pressures; abiotic components of habitat include the physical characteristics of water quality parameters, especially salinity and turbidity.”

Changes in the position of X2 as a result of Project operations have the potential to impact rearing DS by limiting the size of the low salinity zone and shifting the low salinity zone east where food production is lower, water temperatures are higher, and turbidity is reduced (Kimmerer 2009). Conceptually, the freshwater flow regime interacts with the system bathymetry and landscape to determine the quantity and quality of available DS habitat (e.g., Peterson 2003). USFWS (2008) included actions to increase Delta outflow in fall following wet and above normal years to achieve specific targets for X2. This action was intended to improve the extent and quality of fall habitat for juvenile DS in wetter years and counteract the lower variability and smaller size of the low-salinity zone during fall as a result of CVP/SWP operations prior to issuance of USFWS (2008) (Feyrer *et al.* 2011 and Cloern and Jassby 2012) and has been included in operational criteria in the ITP.

Ongoing scientific research has demonstrated that changes in abiotic conditions encountered by rearing DS have significant overall effects on population size. To quantify the relationship between DS population dynamics and abiotic factors Feyrer et al. (2011) developed a population index for fall habitat conditions that predicts population size based on specific fall habitat characteristics, including X2. In addition, Miller et al. (2012) and Rose et al. (2013a, b) have demonstrated that prey density and food limitation for rearing DS may also have significant overall effects on population size. The abiotic habitat index developed by Feyrer et al. (2011) was used in combination with an analysis of abiotic conditions (X2) in the 2081(b) application to assess the effectiveness of the required fall X2 operational criteria under the NAA and Project operations (ICF International 2016, Section 6A.4.1). Overall, because the NAA and Project operations include the same fall X2 operational criteria, there was considerable similarity in X2 and mean DS fall abiotic habitat index across all water year types between the NAA and Project operations (ICF International 2016, Table 4.1-20, Figures 4.1-26 and 4.1-27).

Impact of coordinated Project operations: Selenium exposure

Selenium is an important micronutrient for most species, including humans; however it can become toxic at higher concentrations. Selenium concentrations in the San Joaquin River have been a point of management concern since the late 1980s when deformed waterfowl were documented on the Kesterson Reservoir in Grasslands State Park. Because Project operations are expected to result in reduced south Delta exports and an increase in the proportion of San Joaquin River water entering the Delta, the selenium concentration in the Delta is expected to be higher under Project operations than the NAA. Increased selenium exposure as a result of feeding on contaminated prey could result in DS and LFS body deformities. The 2081(b) application combined DSM2 volumetric fingerprinting estimates with estimates of Delta water source selenium input concentrations, conversions of water selenium concentration to particulate selenium concentration, and trophic transfer factors to estimate the potential impact of increased selenium associated with Project operations on DS (ICF International 2016, Section 4.1.3.5.6). However, the results of this analysis are uncertain because it relies upon has a number of assumptions leading to uncertainty in the results, including the assumption that the selenium toxicity threshold for Sacramento splittail (7.2 µg/g selenium whole-body tissue concentration) is representative of DS, and an assumption about the concentration of selenium in the diet that results in toxic effects on DS. LFS-specific analyses are not available and similar effects are assumed for LFS.

Predicted monthly mean DS selenium tissue concentrations were highly variable among the five sites that were examined (San Joaquin River at Prisoners Point, Cache Slough at Ryer Island, Sacramento River at Emmaton, San Joaquin River at Antioch, and Suisun Bay at Mallard Island) and are assumed to be similar for LFS. In general, predicted DS monthly selenium tissue concentrations were higher under Project operations than the NAA, sometimes as much as double (ICF International 2016, Section 4.1.3.5.6). However, predicted selenium concentrations were almost always well below the Sacramento splittail toxicity threshold of 7.2 µg/g. Prisoners Point was the only site at which predicted tissue concentrations exceeded the toxicity threshold. This is likely because the predicted tissue concentrations are strongly influenced by the proportion of San Joaquin River water entering the Delta past Prisoner's Point. As a result, data from Prisoners Point represent a conservative high end of selenium exposure to DS and LFS from Project operations overall.

Little is known about the tissue accumulation threshold at which selenium becomes acutely toxic to DS or LFS. Unlike many other contaminants for which water exposure is the critical pathway for environmental effects, selenium ecotoxicology is driven by bioaccumulation in invertebrates and exposure to fish and birds via the diet (Brix & DeForest, 2000). Selenium toxicity can be measured in many ways, however two of the more prominent effects are related to juvenile survival and adult reproductive success. Adult fish can survive and appear healthy despite the fact that extensive reproductive failure is occurring (Lemly 2002). The difference in tissue thresholds between these two effects in DS and LFS is not known; however, (Lemly 2002) states that biochemical functions can be disrupted in most fish eggs at concentrations as low as 10 µg/L, solely from maternal contribution. This implies that the toxicity threshold for adult fish may be higher than 10 µg/L; however, there is no data available characterizing the selenium toxicity thresholds for DS and LFS.

The results of these analyses suggest that increased selenium concentrations within the Delta as a result of Project operations could result in increased selenium in the tissues of DS and LFS in the lower San Joaquin River. Because the relationship between tissue concentrations and acute toxicity effects is not well understood for DS and LFS, it is possible that changes in selenium concentrations as a result of Project operations will have no measurable effect on either species. Conversely, DS and LFS may be more sensitive to selenium than Sacramento splittail, and Project operations could impact both juvenile survival and adult reproductive success.

<u>Uncertainty in the effects of coordinated Project operations on DS and LFS habitat</u>

Analyses of the effects of Project operations on DS habitat that rely upon modeling to predict differences in abiotic physical conditions between the NAA and Project operations scenarios, provided in the 2081(b) application used by CDFW in and preparation of the ITP represent the best available science. However, CDFW acknowledges that inherent in using models to predict potential Project impacts, these analyses come with limitations of which users of the results must be aware.. For example, because DS-specific analyses of Project effects are assumed to be similar for LFS, when no LFS-specific analyses are available, these same sources of uncertainty apply to both species.

When linking a series of physical and biological models it is important to have confidence in each model incorporated into the modeling cascade. When drawing conclusions from the results of any models in the modeling chain it is important to account for limitations associated with data received from input models, such as large time steps or limited confidence in model calibration (Simenstad et al 2016). As such, the results of the analyses used to characterize DS and LFS habitat impacts in the 2081(b) application come with limitations in their ability to predict differences in physical abiotic parameters between the NAA and the Project scenarios. The uncertainty associated with these predictions is further complicated because the linkage between changes in physical parameters and biological outcomes are analyzed qualitatively rather than quantitatively.

As a part of the 2016 Independent Scientific Review of the California Water Fix 2081(b) application and Biological Assessment S. Simenstad noted limitations of modeling based on water-year type to capture monthly conditions:

> *“Delta Smelt population dynamics were not modeled due to widely recognized uncertainties in model parameterization. Year-to-year variation in individual effects (entrainment, X2, abiotic habitat index) was classified by water-year type. However, water-year type cannot represent monthly conditions because it is based on differently weighted flows during particular seasons plus the weighted index for the previous year. In reality, wet months can occur during dry years and vice versa. Given that the Delta Smelt is an annual species (i.e., each year class must survive continuously and then successfully reproduce), additional analyses should be based on months that were independent of water-year type. It appears that averaging months within water-year classes diminished the numerical difference between the PA and NAA.”*

Finally, as discussed above under “<u>Impact of coordinated Project operations: Reduced winter-spring Delta outflow</u>,” analysis of Project impacts to LFS incorporates a quantitative relationship between winter/spring outflow (January to June) and juvenile abundance during the fall (LFS flow-abundance relationship, Rosenfield and Baxter 2007 and Kimmerer et al. 2009). However, the complex and interrelated mechanisms underlying the effect of winter/spring outflow on fall LFS abundance cannot be deconstructed with available data.

Effects of Georgiana Slough Non-Physical Barrier (NPB) Operations

The Georgiana Slough Nonphysical Fish Barrier (NPB) will consist of a NPB to reduce the likelihood of Sacramento River-origin juvenile salmonids entering the interior Delta through Georgiana Slough. Based on a recent evaluation of technology that could be used to achieve this goal, a bioacoustic fish fence (BAFF) appears to offer more potential than a floating fish guidance structure (FFGS) for this location (DWR 2015b). The analysis presented here focuses on the potential effects of BAFF and FFGS NPBs, as there is precedent for their installation at this location: a BAFF was tested in 2011 and 2012, and a FFGS was tested in 2014. Both technologies block the upper portion of the water column to dissuade surface-oriented juvenile salmonids. The BAFF consists of acoustic deterrence stimuli broadcast from loudspeakers and is contained within a bubble curtain that is illuminated with strobe lights (to allow the fish to orient away from the sound stimulus). In contrast, the FFGS is a floating series of metal plates that deter fish based on visual cues and associated changes in flow.

The effects of Georgiana Slough NPB operations to DS and LFS could include enhanced risk of predation near the NPB because of in-water structures that predatory fish may use as ambush habitat. Although DS and LFS were not targeted in pilot studies of the BAFF, there was no evidence from acoustic tracking during pilot studies that juvenile salmonids were being preyed upon at higher rates near the BAFF compared to sites farther away in 2011 and 2012, and acoustic tracking of predators provided little evidence that they occupied areas near the BAFF more frequently than other areas (DWR 2012, 2015a). Indeed, the 2011 and 2012 BAFF pilot studies provided evidence that predatory fish were deterred by the BAFF, although some species may have become conditioned to the BAFF over time. Studies of the 2014 FFGS have not been completed to address these topics.

The NPB is designed to startle fish to change their course (particularly the BAFF, with its acoustic deterrence), potentially resulting in increased stress to DS and LFS. Migrating adult DS and LFS encountering the NPB could be dissuaded from moving further upstream or startled by the NPB if attempting to move upstream from Georgiana Slough to the Sacramento River, although based on the configurations used during the pilot studies, they will likely be able to swim under/around the FFGS, or under the BAFF. The construction and removal of the NPB will not be conducted when DS and LFS eggs are likely to be present. No adverse effects on eggs are anticipated as a result of operations. Larval and young juvenile DS and LFS moving down the Sacramento River could encounter the NPB. Given their weak swimming abilities, they may be subject to near-field hydraulic effects such as slight alterations of direction in response to changes in flows, and possibly mortality when contacting the structures associated with the NPB. Altered behavior and locally elevated predation risk could occur for juvenile DS and LFS at the NPB.

Effects of Suisun Marsh Salinity Control Gates Operations

Migrating adult DS and LFS may be entrained behind the SMSCG when the SMSCG are closed (USFWS 2008). SMSCG are expected to be closed ~10-20 days per year during Project operations (ICF International 2016, Section 3.3.2.5.1).

As described by USFWS (2008):

> *"Fish may enter Montezuma Slough from the Sacramento River when the gates are open to draw freshwater into the marsh and then may not be able to move back out when the gates are closed. It is not known whether this harms Delta Smelt in any way, but they could be exposed to predators hovering around the SMSCG or they could have an increased risk of exposure to water diversions in the marsh"… "The degree to which movement around the low salinity zone is constrained by opening and closing the SMSCG is unknown."*

Any effects of the SMSCG on DS movement in Montezuma Slough would be similar between NAA and Project operations because flows in Montezuma Slough from December through March, just upstream of the SMSCG, are not expected to change as a result of Project operations (ICF International 2016, Table 5.B.5-29). Because the SMSCG is expected to be operated for no more than around 10-20 days per year, the potential for population-level effects on migrating adult DS and LFS is limited. Spawning adult DS and LFS will be less susceptible to the effects of the SMSCG than migrating adult DS and LFS because they do not move at the same spatial scale as migrating adults. However, it is still possible that movement of adult DS may be restricted by SMSCG operations and adults could be exposed to increased risk of predation at the gates, as suggested in USFWS (2008). Given the relatively limited area of influence for the SMSCG relative to the overall area of potential DS and LFS spawning habitat, there will probably be minimal population-level effects on spawning adult DS and LFS from the SMSCG. Operation of the SMSCG will not affect DS and LFS eggs, which as previously, noted are demersal and adhesive

As noted for adult DS and LFS life stages, operation of the SMSCG could trap larval/young juvenile DS and LFS in Montezuma Slough downstream of the SMSCG, resulting in increased predation risks and exposure to entrainment at diversions within Suisun Marsh (Culberson et al. 2004). Any such effects would be similar for the NAA and Project operations because March–June flows in Montezuma Slough just upstream of the SMSCG do not change as a result of Project operations (ICF International 2016, Table 5.B.5-29). Given that the range of habitat that can be occupied by larval/young juvenile DS and LFS is large compared to the area affected by the SMSCG, any population-level effects of the SMSCG on larval/young juvenile DS and LFS would be small. Similar effects to those noted for adult DS and LFS could also occur for juvenile DS and LFS with respect to SMSCG operations, i.e., near-field predation or movement blockage, as well as susceptibility to effects of Suisun Marsh diversions. Any such effects would be similar for NAA and Project operations because the July–December flows in Montezuma Slough just upstream of the SMSCG would be similar under both scenarios (ICF International 2016, Table 5.B.5-29).

USFWS (2008) emphasized the potential upstream shift in the low salinity zone (indexed by X2) that is associated with SMSCG operations, for a given Delta inflow and exports. However, the analysis of abiotic fall rearing habitat illustrated that X2 and the low salinity zone would be similar between NAA and Project, because both scenarios include requirements to adhere to fall X2 management criteria (ICF International 2016, Section 4.1.3.5.1.1). Because the SMSCG will be operated during relatively few days (10 to 20) of the year, there are likely to be only minimal population-level effects of the SMSCG on juvenile DS.

Consistent with the analysis of impacts of SMSCG operations on DS, there is potential for take of LFS as a result of predation near SMSCG and effects on habitat availability resulting from changes in X2 locations. Impacts to DS and LFS from habitat changes because of SMSCG effects on X2 would be limited because Project operations will be required to meet D-1641 standards and fall X2 criteria, and will be closed for only 10-20 days per year.

Effects of Roaring River Distribution System Operations

The water intake for the RRDS is equipped with fish screens operated to maintain screen approach velocity of 0.2 ft/s for DS protection, eliminating the risk of adult DS and LFS entrainment and minimizing the risk of adult DS and LFS impingement. As a result, any potential adverse effects to individual migrating and spawning adult DS and LFS will be minimal. DS and LFS eggs are demersal and adhesive, attaching to substrates with an adhesive stalk formed by the outer layer of the egg (Bennett 2005) and individual eggs will not be subject to entrainment. No population-level effects of RRDS operations are anticipated for DS and LFS adults and eggs.

Before the RRDS intakes were screened, Pickard *et al.* (1982) found that older life stages of DS were being entrained, which suggests that larval/juvenile are present in the vicinity of the RRDS. However, previous DSM2-PTM models indicated that juvenile LFS entrainment risk into RRDS is limited (CDFW 2009). If present, individual larval and young juvenile DS and LFS smaller than 30 mm SL could be susceptible to entrainment into the RRDS intakes (ICF International 2016, Section 6.A.2.2). Small juveniles slightly larger than 30 mm SL could be impinged on the screens without being entrained. Any population-level effects on larval/young juvenile DS and LFS from operation of the RRDS that do occur are expected to be similar between the NAA and Project operations because flows in Montezuma Slough as a result of SMSCG operations will not change.

Effects of Morrow Island Distribution System Operations

Individual migrating adult DS and LFS could be entrained into the MIDS unscreened intakes, although entrainment is only likely in wet years (Enos et al 2007). Studies conducted at the MIDS from 2004 – 2006 did not collect any adult or juvenile DS and LFS during sampling, although they did capture adult DS with purse seines during sampling in the adjacent Goodyear Slough (Enos *et al.* 2007; Hobbs *et al.* 2005). Particle tracking models conducted to support USFWS (2008) also showed low entrainment vulnerability for particles released at random locations throughout Suisun Marsh (3.7%), and almost no entrainment vulnerability (<0.1%) to particles released at Rio Vista (Culberson *et al.* 2004). Enos *et al.* (2007) also noted that the MIDS is often closed or diverting very little water in the spring when DS and LFS are expected to be present, which may also limit entrainment of spring-spawning and spring-migrating fish, particularly open-water fish like DS and LFS that do not aggregate around in-stream structures such as diversions.

The possibility of entrainment of LFS into the MIDS intakes was assessed based studies conducted from 2004 – 2006 (Enos et al. 2007). As summarized in CDFW (2009a):

> *"…124 longfin juveniles and adults were found in 2.3 million m^3 water diverted from Goodyear Slough in the western Suisun Marsh (Enos et al. 2007). When larvae were included, the total increased to 284 LFS (all life stages) over the same period. Entrainment was periodic with most entrainment of adults in December 2004, larvae in April 2005, and juveniles in May 2005. Entrainment was likely influenced by the large proportion (1/3 of the volume) of Goodyear Slough diverted when the intakes were open and operating on a flood tide. LFS larvae were abundant in Suisun Marsh starting in February (when annual sampling commenced) through April (Meng and Matern 2001). Though present in small numbers throughout the year, older juveniles and adults were primarily present from October-February (Rosenfield and Baxter 2007)."*

Overall, based on the results of PTM studies, very little entrainment of LFS larvae is expected at MIDS (Culberson et al. 2004). Entrainment of LFS larvae is not expected to differ between the NAA and Project operations because operations of the MIDS will not change (ICF International, Section 4.2.6.3.6)

As previously noted DS and LFS eggs are demersal and adhesive. As a result, they will not be subject to entrainment into the MIDS and there will be no individual-level or population-level adverse effects from operations of the MIDS on DS and LFS eggs.

Effects of Goodyear Slough Outfall Operations

Opening of the Goodyear Slough outfall culvert flap gates results in a small net flow south, to draw fresher water from Suisun Slough into Goodyear Slough. As a result, operation of the Goodyear Slough Outfall may increase the possibility that DS and LFS will enter into Goodyear Slough and be entrained into the MIDS intakes.

As discussed previously for MIDS, the available sampling data in the area suggest that migrating adult, larvae, and juvenile DS and LFS will only be susceptible to entering Goodyear Slough in wet years (Enos *et al.* 2007). Entrainment will not differ between the NAA and Project operations because flows in Goodyear Slough are not expected to differ between scenarios (ICF International 2016, Appendix 5.B, Table 5.B.5-34).

Eggs will not be susceptible to any entrainment effects from the Goodyear Slough outfall, but may experience improved circulation because of flap gate operations which may be beneficial during incubation. As noted for adult DS, only a small portion of DS eggs are expected to occur in Goodyear Slough (possibly only in wet years), so the population-level effects as a result of larvae hatching in the zone of entrainment associated with the Goodyear Slough outfall likely will be small. Similar effects are assumed for LFS.

Effects of North Bay Aqueduct Operations

The NBA fish screen at the Barker Slough pumping plant was designed to exclude DS larger than 25 mm, consistent with DS screening criteria, and is expected to exclude migrating and spawning DS and LFS adults from entrainment by the NBA and reduce the risk of impingement (USFWS 2008; ICF International, Section 3.3.2.6). However, adult DS and LFS that are excluded by fish screens at the NBA could be susceptible to increased predation. Pumping rates at the NBA Barker Slough Intake are expected to be similar under the NAA and Project operations (ICF International 2016, Table 5.B.5-35). No population level effects on adult DS and LFS are anticipated.

Due to the demersal and adhesive nature of DS and LFS eggs they are not subject to entrainment by the NBA. As a result no individual-level or population-level adverse effect on DS eggs is expected as a result of Project operations at the NBA.

Larval and young juvenile DS less than 25 mm could be entrained at the NBA Barker Slough pumping plant because the fish screen can only exclude DS and LFS 25 mm and greater. Additionally, DS and LFS individuals slightly greater than 25 mm could be impinged on the NBA fish screens and may be exposed to greater predation risk. A DSM2-PTM analysis of larval DS entrainment showed that entrainment at the NBA under the NAA and Project operations was likely to be similar (ICF International 2016, Table 4.1-16) because NBA operational criteria do not differ between NAA and Project operations. Similar effects are assumed for LFS.

Effects of Delta Cross Channel and Contra Costa Canal Rock Slough Intake Operations

Permittee has confirmed it is not seeking take authorization for operations of the Delta Cross Channel and Contra Costa Canal Rock Slough Intake facilities. As a result, are not included in the ITP as Covered Activities.

Summary of Avoidance, Minimization, and Mitigation Measures Included in the ITP

Covered Activities associated with Project operations would impact DS and LFS as summarized above, but these impacts will be avoided and minimized through the specific Conditions of Approval required by the ITP.

<u>Conditions of Approval: Biological Criteria and Required Studies</u>

Analyses of the current, best available scientific models and biological data (discussed above) contain inherent uncertainties regarding the magnitude of take of DS and LFS and associated impacts of the taking resulting from Project operations. Therefore, the Conditions of Approval for this ITP establish a suite of required measures to minimize and fully mitigate the impacts of the authorized taking. These measures rely upon a combination of 1) operational criteria; 2) compensatory mitigation; 3) implementation of ongoing and new scientific studies and monitoring; 4) development and implementation of DS and LFS mathematical life cycle models, verified with field data collection to characterize the effects of abiotic and biotic factors on the DS and LFS populations; 5) robust scientific analysis using independent peer review and decision making through the Adaptive Management Program; and 6) biological criteria. The biological criteria will serve as a performance standard against which the Project's operational impacts may be evaluated to ensure ongoing adherence to ITP issuance criteria as Project design, scientific information and regulatory conditions evolve. In combination, the required mitigation, studies, monitoring, and adaptive management and mitigation outcomes must support attainment of biological criterion described in Condition of Approval 9.7 (Biological Criterion 3) that are applicable to DS and LFS.

> *Biological Criterion 3:* Permittee shall ensure that the Project, including effects from construction and operation of NDD intakes, does not result in an overall decrease in the population size of DS and LFS from pre-project conditions. On an annual basis, Permittee shall provide estimates of overall adult DS and LFS population size, and an analysis of how the Project affected population size as determined through life cycle modeling, to CDFW, the TOT and the NDDTT (see Pre-construction Studies 14 and 15 in Condition of Approval 9.6.10 and Post-construction Studies 14 and 15 in Condition of Approval 9.6.11). These analyses shall incorporate the results of Pre-construction Study 11 and Post-construction Study 11 in Conditions of Approval 9.6.10 and 9.6.11.

This Biological Criterion 3 is an important instrument ensuring that the impacts of the authorized taking resulting from entrainment, impingement, predation, and associated impacts of the taking to DS and LFS as a result of Project operations will be minimized and fully mitigated. The combination of Project operating criteria, real-time operations, habitat restoration, and other Conditions of Approval, have been developed to result in minimization and full mitigation of Project impacts based on currently available modeling tools, biological data, and available Project design information. This biological criterion provides certainty that such standards will continue to be met in light of new scientific information, further Project design efforts, and implementation and evaluation of compensatory mitigation, and will serve an important role in evaluating the effectiveness of the Conditions of Approval in light of permit issuance criteria. This requires that predictions of modeled analyses be empirically verified utilizing robust monitoring programs with operating criteria, real-time operations, habitat restoration, and other measures subject to adjustment through the Adaptive Management Program.

<u>Conditions of Approval: Life Cycle Models</u>

Permittee shall develop and implement mathematical life cycle models that are capable of evaluating the relationship between DS and LFS populations, operating criteria, RTO criteria, habitat restoration, and other measures required by the Adaptive Management Program (Condition of Approval 9.6.10). Permittee shall use these life cycles models, in collaboration with CDFW and USFWS, to quantify the effects of Project operations on DS and LFS to assess whether Project operations achieve the requirements in Biological Criterion 3. To support implementation and validation of these mathematical life cycle models Permittee shall continue to fund and implement both new and existing studies and monitoring programs at the NDD Intakes, South Delta export facilities, HOR Gate, and other locations as necessary, to ensure impacts as a result of Project operations are fully mitigated.

Conditions of Approval: Operating Criteria and Real-Time Operations

Conditions of Approval 9.9.4 *General Operating Criteria* and Condition Approval 9.9.5 *Real-Time Operations* are the primary means of minimizing Project operational impacts on Covered Species. Modeling analyses used to analyze effects of Project operations on DS and LFS indicate that operating conditions in NMFS (2009), USFWS (2008) and CDFG (2009) required augmentation with new and existing RTO criteria to further minimize take by reducing NDD intake diversions and south Delta export rates based on the presence of Covered Fish Species. The Permittee shall continue to fund and implement both new and existing studies and monitoring programs necessary to support RTO at the NDD intakes, South Delta export facilities, HOR Gate, and other locations as necessary.

Conditions of Approval: NDD Intake Design

The NDD intakes will include fish screens designed to minimize the risk that DS and LFS will be entrained into the intakes, or injured by impingement on the fish screens during operations. The screens must be designed to meet criteria established by NMFS, USFWS, and CDFW, which limit water velocities through the screen (the approach velocity) to values substantially less than swimming speeds achievable by Covered Fish Species, and limit water velocities parallel to the surface of the screen (the sweeping velocity) to values that will allow Covered Fish Species to travel past the screen with minimal additional effort or risk of impingement (see Condition of Approval 9.6.3). Project design specifications for the fish screens meet criteria established to minimize impacts to DS and require an approach velocity. An approach velocity less than or equal to 0.2 ft/s, in combination with equal or greater sweeping velocities, ensures that impingement and screen contact by DS moving downstream past the intakes is minimized (Swanson et al. 2005 and White et al. 2007). The DS approach velocity and sweeping velocity criteria are assumed to also minimize the risk of LFS entrainment and impingement for fish moving downstream past the intakes. However, it is unlikely that required approach and sweeping velocities at the fish screens will facilitate movement of adult DS and LFS migrating upstream past the intakes to spawning.

Sweeping and approach velocity criteria, along with other aspects of facility design that may also help minimize the effects of NDD intake operations on Covered Species such as predator refugia and horizontal baffles, have been developed collaboratively with CDFW during Project development. Finalization of facility design will continue to be subject to extensive collaborative discussions with CDFW via the NDD Intakes Technical Team (NDDTT) required by Condition of Approval 9.6.3. Within the NDDTT, Permittee, Reclamation, CDFW, NMFS and USFWS will develop studies required by Conditions of Approval 9.6.10 (NDD Intakes Pre-construction Studies 1-9) and 9.6.11 (Post-construction Studies 1-9, and 13). The results of these studies will inform design of the fish screens to achieve Biological Criterion 3. The NDDTT work products pertaining to pre-construction screen design and post-construction operation shall be submitted to the Technical Oversight Team (TOT) (established by Condition of Approval 9.6.1) for the TOT's approval and incorporation into final Project design, construction contract documents, and studies and monitoring programs. In addition, the CSAMP CWF Project Work Team shall be established to develop initial study plans for Pre-construction Study 11 and Pre-construction Studies 13-15 to quantify pre-project seasonal and geographic variation in DS and LFS abundance within the NDD intake reach, the percentage of the total population of adult DS and LFS that spawn in the NDD intake reach and in the Sacramento River upstream of the NDD intakes, the percentage of the total population of juvenile and larval DS and LFS that migrate through the NDD intake reach, and the relative use of right-bank, left-bank and low velocity bottom habitats for adult upstream migration and for downstream larval and juvenile migration. CSAMP will oversee the CSAMP CWF Project Work Team. After final written approval by CSAMP, the TOT, and CDFW all study plans completed by the CSAMP CWF Project Work Team shall be submitted to the IICG for incorporation into the Adaptive Management Program and independent peer review prior to initiation.

<u>Conditions of Approval: South Delta Export Facilities Operations</u>

Project operations at the south Delta export facilities are governed by operational criteria and RTO designed to minimize take of DS and LFS. These requirements are necessary because modeling analyses indicate that reduced exports at south Delta facilities may reduce take associated with near and far-field effects of Project operations in the south Delta and contribute to the ability of the Project as a whole (including operations of the NDD intakes) to meet Biological Criterion 3.

Following completion of Project construction and initiation of the Test Period, Permittee is also required to implement new DS and LFS larval abundance and entrainment monitoring to quantify larval entrainment at south Delta salvage facilities and support implementation of Biological Criterion 3 (see Condition of Approval 9.8.4).

<u>Conditions of Approval: Test Period Operations and Full Project Operations</u>

Prior to initiation of the Test Period Permittee shall develop a draft Test Period Operations Plan and submit it to the NDDTT, CCFTT, HGTT, and the TOT for review and finalization (Condition of Approval 9.6.7). The Test Period Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with NDD intake operating criteria and Biological Criterion 3, over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Test Period Operations Plan shall include the synthesis of results from all required pre-construction studies, and shall describe how Permittee shall implement all post-construction studies during the Test Period. The Test Period may not commence until the Test Period Operations Plan is approved in writing by CDFW.

In collaboration with CDFW, USFWS, NMFS, and Reclamation, Permittee shall develop a Full Project Operations Plan prior to completion of the Test Period and initiation of coordinated long-term operations of all Project facilities described in Condition of Approval 9.9.4 and 9.9.5 (Condition of Approval 9.6.8). The Full Project Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term.

Conditions of Approval: Near- and far-field effects of Project operations

In addition to the Conditions of Approval summarized above, the following Conditions of Approval are required by the ITP to avoid and minimize the impacts of Covered Activities on DS and LFS as a result of Project Operations.

9.6 Required Technical Teams, Studies, and Project Operations Plans

9.6.1 Technical Oversight Team. Permittee shall, in consultation with CDFW, identify participants in a Technical Oversight Team (TOT) within 30 days of issuance of a SWRCB approval of a change in point of diversion for the Project. The purpose of the TOT is to ensure that the final design, construction, and operations of the Project minimize effects on Covered Fish Species. The TOT shall include only representatives from CDFW, USFWS, NMFS, DWR, and Reclamation. If at least three of the participating TOT agencies approve, other experts in fish biology, hydrology, or engineering may also participate in the TOT to assist in the development, review and finalization of specific TOT work products. The TOT shall:

- Ensure the final construction plan incorporates final fish screen design recommendations developed by the NDDTT, final HOR Gate construction and design recommendations developed by the HGTT, and final CCF construction and design recommendations developed by the CCFTT.
- Synthesize results from pre-construction studies and incorporate into the draft Test Period Operations Plan prepared by Permittee (see Condition of Approval 9.6.7).
- Synthesize results from all pre-construction and test period studies and incorporate into the draft Full Project Operations Plan prepared by Permittee (see Condition of Approval 9.6.8).

- Annually synthesize results from all post-construction studies, and operations modeling and measurement, to evaluate Project performance relative to required biological criteria (see Condition of Approval 9.7) and to evaluate compliance with operating criteria described in the Condition of Approval 9.9, the Test Period Operations Plan, and the Full Project Operations Plan.

Plans for Pre-construction studies 11 and 13-15, plans for Post-construction study11, the Test Period Operations Plan, and the Full Project Operations Plan shall be finalized by the TOT, then provided to the IICG for review and integration into the Adaptive Management Framework decision-making process. As a part of the Adaptive Management Framework decision-making process final plans approved by the TOT, as appropriate, shall be independently peer reviewed prior to implementation by Permittee, as determined in consultation with CDFW.

9.6.2 CSAMP CWF Project Work Team. The TOT shall collaborate with CSAMP to establish a CWF project work team (CSAMP CWF Project Work Team) responsible for developing initial study plans for Pre-construction studies 11 and 13-15 and Post-construction study 11. The CSAMP CWF Project Work Team shall be overseen by CSAMP. After final written approval by CSAMP, the TOT, and CDFW all study plans completed by the CSAMP CWF Project Work Team shall be submitted to the IICG for incorporation into the Adaptive Management Framework process and independent peer review prior to initiation.

9.6.3 NDD Intakes Technical Team. Permittee shall convene the NDD Intake Technical Team (NDDTT) within 60 days of TOT establishment and regularly thereafter throughout the development of the final design of NDD intakes, the Test Period, and Full Project Operations. The NDDTT shall only include representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With the approval of three or more of the original five agencies participating in the NDDTT, other individual experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts may also participate in the NDDTT to assist in the review and finalization of specific NDDTT work products.

The TOT shall collaborate with the NDDTT to:

- Develop final fish screen design. Final fish screen design shall be consistent with criteria described in *NMFS 1997 Fish Screening Criteria for Anadromous Salmonids* and *CDFG 2000 Fish Screening Criteria*. Final fish screen design must receive written CDFW approval before construction can begin.
- Develop study plans for all Pre-construction Studies 1-9, and Post-construction studies 1-9 and 13 (see Conditions of Approval 9.6.10 and 9.6.11).
- Review and finalize annual reports for all required pre-construction, test period, and post-construction studies (see Conditions of Approval 9.6.10 and 9.6.11).

- Review and comment on the NDD intake subcomponent of the draft Test Period Operations Plan (see Condition of Approval 9.6.7).
- Review and comment on the NDD intake subcomponent of the draft Full Project Operations Plan (see Condition of Approval 9.6.8).
- Annually synthesize results from Project operations modeling and measurement (see Condition of Approval 9.8) to evaluate compliance with operating criteria described in the Test Period Operations Plan and the Full Project Operations Plan.

All final work products produced by the NDDTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, future studies, and monitoring programs.

9.6.4 HOR Gate Technical Team. Permittee shall convene an HOR Gate Technical Team (HGTT) at the initiation of the HOR Gate design that will meet periodically (at least quarterly) to provide technical input to the Permittee on the design process of the HOR Gate until Permittee completes final design (a time period expected to be at least two years). The HGTT shall include only representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With the approval of three or more of the initial agencies participating in the HGTT, experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts may also be participate in the HGTT to assist in the development, review and finalization of specific HGTT work products.

The TOT shall collaborate with the HGTT to:

- Review construction plans and make recommendations regarding appropriate techniques for dewatering, fish rescue, and fish exclusion during in-water work at the HOR Gate.
- Identify near-term research/monitoring needs, if any, to reduce Covered Species impact uncertainties (e.g. HOR Gate area habitat use) prior to construction.
- Prior to completion of final HOR Gate design, prepare draft and final reports summarizing HGTT work products that have been provided to the TOT for final approval prior to completion of final HOR Gate design.

All final work products produced by the HGTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, and studies and monitoring programs.

9.6.5 Clifton Court Forebay Technical Team. Permittee shall convene a Clifton Court Forebay Technical Team (CCFTT) regularly (at least quarterly) throughout the development of the final design of CCF modifications, the Test Period, and Full Project Operations. The CCFTT shall include only representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With approval of three or more of the original agencies participating in the CCFTT, other individual experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts, may also participate in the CCFTT to assist in the development, review and finalization of specific TOT work products.

Permittee shall convene a Clifton Court Forebay Technical Team (CCFTT) regularly (at least quarterly) throughout the development of the final design of CCF modifications, the Test Period, and Full Project Operations. The CCFTT shall include only representatives from CDFW, NMFS, USFWS, DWR, and Reclamation. With approval of three or more of the original agencies participating in the CCFTT, other individual experts in fish biology, hydrology, and engineering from other agencies, or non-agency experts, may also be included in the CCFTT.

The TOT shall collaborate with the CCFTT to:

- Review construction plans and make recommendations regarding phasing of CCF construction to further minimize impacts to Covered Species.
- Review Permittee's construction plans and make recommendations regarding appropriate techniques for dewatering, fish rescue, and fish exclusion during in-water work. Dewatering and fish rescue shall be conducted for all cofferdam work at CCF, and fish exclusion shall be conducted for dredging.
- Implement requirements and recommendations described in Condition of Approval 9.8.13.
- Develop studies and monitoring programs to assess impacts on Covered Fish Species resulting from CCFPP and CCF operations and as part of requirements described in Condition of Approval 9.8.4.
- Annually, synthesize results from south Delta and CCF operations modeling and monitoring (described in Condition of Approval 9.8) to evaluate compliance with operating criteria described in the Test Period Operations Plan and the Full Project Operations Plan.
- Review and comment on the CCF subcomponent of the draft Test Period Operations Plan (see Condition of Approval 9.8.7).
- Review and comment on the CCF subcomponent of the draft Full Project Operations Plan (see Condition of Approval 9.8.8).

All final work products produced by the CCFTT (including but not limited to construction designs, study plans, reports, and recommendations) shall be submitted to the TOT for approval and incorporation into final project design, construction contract documents, and studies and monitoring programs.

9.6.7 Test Period. Full Project Operations shall be preceded by a period of testing (Test Period) during which Permittee, in collaboration with the TOT, shall evaluate and demonstrate compliance with operating criteria for all Project facilities and biological criteria set forth in the permit (see Condition of Approval 9.9, and the *Operational Criteria for the NDD Intakes* subsection of the Project Description).

Prior to initiation of the Test Period Permittee shall develop a draft Test Period Operations Plan and submit it to the NDDTT, CCFTT, and the TOT for review and finalization. The Test Period Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with NDD intake operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Test Period Operations Plan shall include the synthesis of results from all pre-construction studies approved by the TOT and shall describe how Permittee shall implement all post-construction studies during the Test Period.

Operation of the NDD intakes shall be restricted to isolated and brief tests of individual intakes to verify functionality of primary structural components prior to initiation of the Test Period in consultation with CDFW, NMFS, and USFWS. The Test Period shall not commence until after construction of all Project components is complete and the final Test Period Operations Plan is approved in writing by CDFW.

Upon initiation of the Test Period the terms of this permit shall prevail over existing incidental take permit(s) or other approvals pursuant to CESA authorizing take of Covered Species for the operations of the SWP.

During the Test Period, Permittee shall implement post-construction studies described in the Test Period Operations Plan and provide draft annual reports to the NDDTT and the TOT for review. The TOT shall approve final reports prior to submission to the IICG and incorporation into the Adaptive Management Framework decision-making process.

CDFW, NMFS, and USFWS shall determine when the Test Period ends, and when Full Project Operations can commence, consistent with operating criteria evaluated during the Test Period and as described in Condition of Approval 9.9 and the Full Project Operations Plan.

Following completion of the Test Period subsequent tests of the NDD intakes shall continue during infrequently occurring hydrologic conditions to determine compliance with NDD intake operating criteria and biological requirements. The Full Project Operations Plan shall include a description of subsequent tests to evaluate operations of the NDD intakes in hydrologic conditions that were not evaluated during the Test Period.

9.6.8 Full Project Operations. In collaboration with the NDDTT, CCFTT, and TOT, Permittee shall develop and obtain approval of a Full Project Operations Plan prior to completion of the Test Period and initiation of coordinated long-term operations of all Project facilities described in Condition of Approval 9.9 (Full Project Operations). Permittee shall submit a draft Full Project Operations Plan to the NDDTT, CCFTT and the TOT for review and finalization.

The Full Project Operations Plan shall be used to conduct coordinated operations of all Project facilities and evaluate compliance with operating criteria and biological criteria over the full range of diversion rates and flow conditions anticipated throughout the permit term. The Full Project Operations Plan shall include the synthesis of all pre-construction and test period studies prepared by the TOT and use such information to provide a detailed description of how Permittee shall meet all required operating criteria and ensure compliance with biological criteria during Full Project Operations. The Full Project Operations Plan shall describe how Permittee will implement all required post-construction studies and monitoring during Full Project Operations. Full Project Operations shall not commence until after the final Full Project Operations Plan is approved in writing by CDFW.

The Full Project Operations Plan shall include:

- Detailed descriptions of how the biological criteria established in Condition of Approval 9.7 will be met following completion of the Test Period.
- All operational criteria included in Condition of Approval 9.9 of this permit (also see Condition 6).
- Results of pre-construction studies and post-construction studies conducted during the Test Period (see Conditions of Approval 9.6.10 and 9.6.11).

Upon completion of the Test Period, and initiation of Full Project Operations, Permittee shall adhere to the Full Project Operations Plan.

9.6.9 Sediment Reintroduction Plan. Permittee shall develop and implement a sediment reintroduction plan that enhances Covered Fish Species habitat through recurring sediment reintroduction and placement, over the course of Project operations governed by this ITP, to maintain turbidity and create and maintain spawning habitat conditions for DS and LFS and rearing habitat for CHNWR and CHNSR. The sediment reintroduction plan shall include monitoring programs to assess the effectiveness of sediment reintroduction in maintaining turbidity, DS and LFS spawning habitat, and rearing habitat for CHNWR and CHNSR in the Delta. The sediment reintroduction plan shall also identify separate CEQA and other permitting requirements and a plan for compliance with those requirements. Permittee shall develop the sediment reintroduction plan in coordination with CDFW and submit a draft to the TOT for review and finalization. The Test Period shall not commence until the sediment reintroduction plan is finalized by the TOT and approved in writing by CDFW.

9.6.10 NDD Intakes Pre-construction Studies. Permittee shall coordinate with the NDDTT to develop study plans for Pre-construction studies 1-9 and with the CSAMP CWF Project Work Team to develop study plans for Pre-construction studies 10-15, as identified in the Fish Facilities Technical Memorandum 2011[37], further described in the Fish Facilities Work Plan 2013[38], and as described below. Study plans shall

[37] Fish Facilities Technical Team. 2011. BDCP Fish Facilities Technical Team Technical Memorandum.
[38] Fish Facilities Working Team. 2013. Work Plan—Intake Design Criteria and Performance Monitoring Development. June 28. California Department of Water Resources, California Department of Fish and Wildlife, U. S. Bureau of Reclamation, U. S. Fish and Wildlife Service, and the National Marine Fisheries Service.

include requirements for the timing of study initiation, study duration, timing of report review and finalization, and final approval prior to study

Pre-construction Study 1 - Site Locations Lab Study: The purpose of this study shall be to develop physical hydraulic models to optimize hydraulics and sediment transport at each NDD intake site to ensure NDD intake designs minimize Covered Fish Species impingement and entrainment risk.

Pre-construction Study 2 - Site Locations Mathematical Modeling Study: The purpose of this study shall be to develop site specific mathematical models to assess the performance of each NDD intake under the full range of tidal and river hydraulic conditions and associated operating conditions.

Pre-construction Study 3 - Refugia Lab Study: The purpose of this study shall be to use laboratory studies to test and optimize fish refugia designs to be incorporated in the final design of the NDD intakes.

Pre-construction Study 4 - Refugia Field Study: The purpose of this study shall be to conduct field experiments to evaluate the effectiveness of incorporating refugia into the NDD intakes to provide areas for juvenile fish passing the screen to hold and recover from swimming fatigue and avoid exposure to predatory fish.

Pre-construction Study 5 - Predator Habitat Locations: The purpose of this study shall be to perform a field evaluation of predator habitat at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District) to inform final design of the NDD intakes.

Pre-construction Study 6 Predator Reduction Methods: The purpose of this study shall be to evaluate predator reduction techniques implemented at facilities similar to the NDD intakes (e.g., Freeport, RD 108, Sutter Mutual, Patterson Irrigation District, and Glenn Colusa Irrigation District), to determine whether similar techniques could minimize potential predation impacts on Covered Fish Species and be feasible to implement at the NDD intakes.

Pre-construction Study 7 - Flow Profiling Field Study: The purpose of this study shall be to use field data collection to characterize the water velocity distribution at river transects within the NDD intake reach for a range of flow conditions. Water velocity distributions within the NDD intake reach will identify how hydraulics change with flow rate and tidal cycle. This information shall be used to inform fish screen final design and model-based testing of fish screen performance (see Pre-construction Study 8 below).

Pre-construction Study 8 - Deep Water Screens Study: The purpose of this study shall be to develop a computational fluid dynamics model to evaluate the need for hydraulic tuning baffles which can be adjusted in both the vertical and horizontal directions to achieve NDD intake design requirements to minimize Covered Fish Species impingement and entrainment.

Pre-construction Study 9 - Predator Density and Distribution: The purpose of this study is to determine the baseline densities, species composition, and seasonal and geographic distribution of predatory fish (and birds and mammals if appropriate) within the Sacramento River in the NDD intake reach and in adjacent control reaches. Baseline data collected on predator occurrence in the vicinity of each NDD intake and adjacent control reaches shall be used in the future, during the Test Period and Full Project Operations, to determine changes in predator density and distribution associated with construction and operation of the NDD intakes (see Post-construction Study 9 in Condition of Approval 9.6.11).

Pre-construction Study 11 - Baseline DS and LFS Survey: The purpose of this study shall be to determine baseline abundance and distribution of all life stages of DS and LFS inhabiting all portions of the Sacramento River upstream of Intake 5. This study shall quantify:

- Seasonal and geographic variation in DS and LFS abundance within the study reach
- The percentage of the total population of adult DS and LFS that spawn in the NDD intake reach and in the Sacramento River upstream of the NDD intakes
- The percentage of the total population of juvenile and larval DS and LFS that migrate through the NDD intake reach.
- The relative use of right-bank, left-bank and low velocity bottom habitats for adult upstream migration and for downstream larval and juvenile migration.

During the Test Period and Full Project Operations, this study shall continue as Post-construction Study 11 (in Condition of Approval 9.6.11), using the same methodology. Together, these studies will be used as inputs to the DS and LFS life cycle models (Pre-construction Studies 14 and 15) to quantify the effect of NDD intake operations on population dynamics of DS and LFS (see Biological Criteria 3 in Condition of Approval 9.7).

Pre-construction Study 13 – Monitoring Sacramento River Reverse Flows: The purpose of this study is to monitor the magnitude, frequency, and duration of Sacramento River reverse flows at the Georgiana Slough junction prior to initiation of the Test Period. This study shall be used to establish a pre-Project baseline and inform development of the Test Period Operations Plan and the Full Project Operations Plan. This study shall continue during the Test Period and Full Project Operations as Post-construction Study 13 (see Condition of Approval 9.6.11) using the same methodology. Together, the results of these studies shall be used to ensure compliance with Condition of Approval 9.9.4.1.

Pre-construction Study 14 – DS Life Cycle Model: The purpose of this study is to enhance mathematical life cycle models for use as quantitative tools to characterize the effects of abiotic and biotic factors on the DS population. Model enhancements shall employ best available science and modeling methods, and be verified through empirical data collection. The life cycle model shall be used to quantify the effects of the Project throughout construction, the Test Period, and Full Project Operations to ensure compliance with DS biological criteria (see Condition of Approval 9.7).

Pre-construction Study 15 – LFS Life Cycle Model: The purpose of this study is to use best available science to develop a mathematical life cycle model for LFS, verified with field data collection, as a quantitative tool to characterize the effects of abiotic and biotic factors on LFS populations. The life cycle model shall be used to quantify the effects of the Project throughout construction, the Test Period, and Full Project Operations to ensure compliance with LFS biological criteria (see Condition of Approval 9.7).

9.6.11 NDD Intakes Post-construction Studies. Prior to initiation of the Test Period Permittee shall coordinate with the NDDTT to develop study plans for Post-construction studies 1-9 and 13, and with the CSAMP CWF Project Work Team to develop study plans for Post-construction studies 10-12, as identified in the Fish Facilities Technical Memorandum 2011[39], further described in the Fish Facilities Work Plan 2013[40], and as described below. Post-construction studies shall be implemented throughout the Test Period to inform the development of the Full Project Operations Plan, and throughout Full Project Operations. Study plans shall include requirements for the timing of study initiation, study duration, timing of report review and finalization, and written approval from CDFW prior to study termination.

Permittee shall implement additional studies, as recommended through the Adaptive Management Framework decision-making process, to evaluate relevant physical and biological parameters.

Permittee shall initiate each study within 60 days of study plan finalization and written approval from CDFW. Following final approval by the TOT, Permittee shall fully fund and implement post-construction studies, and submit annual reports to the NDDTT for review and finalization. Annual and final written reports must be approved in writing by the TOT.

Post-construction Study 1 – Hydraulic Screen Evaluations to Set Baffles: The purpose of this study shall be to conduct initial hydraulic field evaluations of the NDD intakes to measure velocities over a designated grid in front of each screen panel. This study shall be conducted at diversion rates close to the maximum diversion rate. Results of this study shall be used to set initial baffle positions.

Post-construction Study 2 - Long-term Hydraulic Screen Evaluations: The purpose of this long term monitoring program shall be to measure approach velocities, sweeping velocities, and other hydrodynamic characteristics across the entire fish screen face at each intake. Results of this monitoring program shall be used to “tune” baffles and other components of the screen system to

[39] Fish Facilities Technical Team. 2011. BDCP Fish Facilities Technical Team Technical Memorandum.
[40] Fish Facilities Working Team. 2013. Work Plan—Intake Design Criteria and Performance Monitoring Development. June 28. California Department of Water Resources, California Department of Fish and Wildlife, U. S. Bureau of Reclamation, U. S. Fish and Wildlife Service, and the National Marine Fisheries Service.

consistently achieve compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 3 - Periodic Visual Inspections: The purpose of this monitoring program shall be to perform visual inspections of NDD intake screens to evaluate screen integrity and the effectiveness of the cleaning mechanism in protecting the structural integrity of the screen and maintaining uniform flow distribution through the screen. Results of this monitoring program shall be used to adjust cleaning intervals as needed to achieve compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 4 - Velocity Measurement Evaluations: The purpose of this monitoring program shall be to determine sweeping velocities along the length of each fish screen and in front of, and within, refugia areas over a range of flow conditions. The results of this monitoring program shall be used to determine if sweeping velocities and refugia areas are within the final fish screen design criteria (see Condition of Approval 9.6.3). Sweeping velocities in front of and within refugia areas shall be implemented if refugia are incorporated into the design of the NDD intakes.

Post-construction Study 5: - Refugia Effectiveness: This study shall be implemented if refugia are incorporated into the design of the NDD intakes. The purpose of this study shall be to monitor NDD intake fish screen refugia to evaluate effectiveness in minimizing screen impingement and near-screen predation. This includes evaluating refugia effectiveness at a range of flow conditions. Results of this monitoring program shall be used to evaluate compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 6 - Sediment Management: The purpose of this study is to quantify sediment deposition in front of the NDD intake screen base, and behind screens, to evaluate the effectiveness of sediment management devices and ensure compliance with final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 7 - Evaluation of Screen Impingement: The purpose of this monitoring program shall be to observe fish activity at the screen face and quantify Covered Fish Species impingement and injury rates. Results of this monitoring program shall be used to assess NDD intake performance relative to final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 8 - Screen Entrainment: The purpose of this study shall be to monitor densities of all Covered Fish Species life stages behind fish screens to quantify entrainment rates into the NDD intakes. Permittee shall identify the species and size of all entrained fish. Results of this study shall be used to assess performance of NDD intakes relative to biological criteria in Condition of Approval 9.7 and final fish screen design criteria (see Condition of Approval 9.6.3).

Post-construction Study 9 – Predator Density and Distribution: The purpose of this study, which is associated with Pre-construction Study 9 in Condition of Approval 9.6.10, is to determine the densities, species composition, and seasonal and geographic distribution of predatory fish (and birds and mammals if appropriate) within the Sacramento River in the NDD intake reach and adjacent control reaches during the Test Period and Full Project Operations. Data collected on predator occurrence in the vicinity of each NDD intake and control reaches shall be used to determine whether predator control, facility modification, or operational changes at the NDD intakes are warranted to reduce predation of Covered Fish Species.

Post-construction Study 11 – Post-construction DS and LFS Surveys: The purpose of this study shall be to determine the distribution and abundance of all life stages of DS and LFS inhabiting all portions of the Sacramento River upstream of Intake 5 throughout the Test Period and Full Project Operations. This study shall quantify:

- Seasonal and geographic variation in DS and LFS abundance within the study reach.
- The percentage of the total population of DS and LFS that spawn in the NDD intake reach and in the Sacramento River upstream of the NDD intakes.
- The percentage of the total population of juvenile and larval DS and LFS that migrate through the NDD intake reach.
- The relative use of right-bank, left-bank and low velocity bottom habitats for adult upstream migration and for downstream larval and juvenile migration.

This study shall use the same or compatible methods as Pre-construction Study 11 to enable direct comparison of DS and LFS distribution and abundance quantified before construction, during construction, throughout the Test Period, and throughout Full Project Operations. Together, these studies will be used as inputs to the DS and LFS life cycle models (Pre-construction Studies 14 and 15) to quantify the effect of NDD intake construction and operations on population dynamics of DS and LFS (see Biological Criteria 3 in Condition of Approval 9.7).

Post-construction Study 13 – Monitoring Sacramento River Reverse Flows: The purpose of this study is to monitor the magnitude, frequency, and duration of Sacramento River reverse flows at the Georgiana Slough junction throughout the Test Period and Full Project Operations. This study shall use the same methodology as Pre-construction Study 13 in Condition of Approval 9.6.10. Together, the results of these studies shall be used to determine compliance with Condition of Approval 9.9.4.1.

9.6.12 Personnel Conducting Studies and Monitoring. Permittee shall ensure that all pre-construction studies, post-construction studies and monitoring programs which result in the direct take of CHNWR, CHNSR, DS, and LFS are conducted by a person or entity with necessary state and federal scientific collecting permits and take authorizations.

9.7 Covered Fish Species Biological Criteria. Permittee shall utilize operating criteria described in Condition of Approval 9.9 to meet or exceed the following biological criteria for CHNWR, CHNSR, DS and LFS (Covered Fish Species):

Biological Criterion 3: Permittee shall ensure that the Project, including effects from construction and operation of NDD intakes, does not result in an overall decrease in the population size of DS and LFS from pre-project conditions. On an annual basis, Permittee shall provide estimates of overall adult DS and LFS population size, and an analysis of how the Project affected population size as determined through life cycle modeling, to CDFW, the TOT and the NDDTT (see Pre-construction Studies 14 and 15 in Condition of Approval 9.6.10 and Post-construction Studies 14 and 15 in Condition of Approval 9.6.11). These analyses shall incorporate the results of Pre-construction Study 11 and Post-construction Study 11 in Conditions of Approval 9.6.10 and 9.6.11.

9.8 Project Operations Monitoring and Funding

9.8.1 Operations-Independent Measurement. Permittee shall document NDD intake compliance using data obtained from existing environmental monitoring programs including (1) Interagency Ecological Program Environmental Monitoring Program: Continuous Multi-parameter Monitoring, Discrete Physical/ Chemical Water Quality Sampling; (2) DWR and Reclamation: Continuous Recorder Sites; (3) Central Valley RWQCB: NPDES Self- Monitoring Program; and (4) USGS Delta Flows Network and National Water Quality Assessment Program. Permittee shall provide copies of monitoring reports prepared for these environmental monitoring programs to the TOT with other monitoring reporting required by this permit. Permittee shall fully fund and implement these existing environmental monitoring programs prior to initiation of Covered Activities and continue funding and implementation for the duration of the permit term.

9.8.3 Operations Measurement and Modeling. Permittee shall fund and implement hydrologic monitoring and modeling to document Project operations and ensure that the Project is operated consistent with required operational criteria (see Condition of Approval 9.9). This Condition of Approval shall commence upon initiation of the Test Period and continue for the duration of the permit term. Permittee shall submit annual reports describing hydrologic monitoring and modeling conducted throughout the previous year with other monitoring reporting required by Condition of Approval 9.8 to the TOT for review and approval.

9.8.4 DS and LFS Larval South Delta Abundance and Entrainment Monitoring. Permittee shall collaborate with the CCFTT to develop a Larval South Delta DS and LFS Monitoring and Reporting Program to quantify DS and LFS larval entrainment at south Delta salvage facilities and support implementation of Biological Criteria 3 (see Condition of Approval 9.7) throughout the Test Period and Full Project Operations. Permittee shall submit the draft plan to the TOT at least 90 days prior to the initiation of the Test Period. Permittee shall fully fund and implement the final Larval South Delta DS and LFS Monitoring and Reporting Program approved by the TOT, and submit annual reports describing results of this entrainment monitoring to the TOT for review and approval.

9.8.5 Initiation of Pre-construction Studies and Continuation of Post-construction Studies. Permittee shall fund and implement Pre-construction Studies 10 - 15 upon completion of approval of the change in point of diversion for the Project by the State Water Resources Control Board until the initiation of the Test Period (see Condition of Approval 9.6.10). Upon initiation of the Test Period (see Condition of Approval 9.6.7), Permittee shall fund and implement Post-construction Studies 10 - 13 (see Condition of Approval 9.6.11*)* throughout the duration of the permit term*.*

9.8.7 Genetic Testing and CWT Analysis Required for Studies and Monitoring. Permittee shall provide funding for all costs associated with genetic testing and coded wire tag (CWT) tagging and processing and analysis necessary to implement studies and monitoring required by the permit including pre-construction studies, post-construction studies, and long term compliance and effectiveness research and monitoring (see Conditions of Approval 9.6.10, 9.6.11, and 9.8). Permittee shall provide this funding throughout the duration of the permit term.

9.8.9 Existing Monitoring and IEP Funding[41,42]. Permittee shall fund its share of the Interagency Ecological Program (IEP) and other existing monitoring efforts in the lower Sacramento River, the lower Feather River, the lower San Joaquin River, and the Delta to establish presence and timing of migration of Covered Fish Species and inform implementation of RTO (described in Condition of Approval 9.9.5) including Fall Midwater Trawl, Spring Kodiak Trawl, 20 mm Survey, Smelt Larval Survey, Summer Townet, Bay Study sampling, Tisdale RST, Knights Landing RST, Beach Seine, Sacramento Trawl, Mossdale Trawl, and Chipps Island Trawl. This condition includes Permittee funding its share of any modifications or additions that may be made to IEP or other existing monitoring efforts through the Adaptive Management Framework, consistent with Condition of Approval 9.8.11.

9.8.10 Long Term Funding, Monitoring, and Reporting Requirements. Permittee shall fund and conduct required monitoring, and the staff and equipment that are needed for such monitoring, throughout the Test Period and Full Project Operations to document Project compliance with required operating criteria (see Condition of Approval 9.9).

9.8.11 Funding for Additional Studies and Monitoring Identified Through Adaptive Management. Permittee shall fund additional studies and monitoring, and the staff and equipment that are needed for such studies and monitoring, to document compliance with the terms of the permit, the Test Period Operations Plan, and the Full Project Operations Plan as deemed necessary under the Adaptive Management Framework.

9.8.12 Real Time Operations Fish Monitoring. Permittee shall fund long term fish monitoring and any subsequent fish and water quality monitoring stations required to implement RTO of the Project throughout the Test Period and Full Project Operations, as described in Condition of Approval 9.9.5, and as may be further

[41] This measure was initially implemented as Condition 8.1 of CDFW (2009).
[42] This measure was initially implemented under Section 11.2.1.3 of NMFS (2009).

described in the Real Time Operations sections of the Test Period Operations Plan and the Full Project Operations Plan.

9.8.13 Clifton Court Forebay Aquatic Weed Control Program: Permittee shall implement the CCF Aquatic Weed Control Program as follows:

> Permittee shall apply herbicides or use mechanical harvesters on an as-needed basis to control aquatic weeds and algal blooms in CCF. Herbicides may include Komeen®, a chelated copper herbicide (copper-ethylenediamine complex and copper sulfate pentahydrate) and Nautique®, a copper carbonate compound. Herbicide treatments shall occur only in July and August on an as needed basis in the CCF, dependent upon the level of vegetation biomass in the enclosure.

9.9 Specific Measures for Covered Fish Species

9.9.1 Coordinated Operating Agreement: The operational criteria specified in Section 8.6.1 *Operational Criteria* shall be implemented consistent with the Coordinated Operating Agreement (COA), as follows:

Under the COA, Reclamation and DWR agree to operate the CVP/SWP under balanced conditions in a manner that meets Sacramento Valley and Delta needs while maintaining their respective annual water supplies as identified in the COA. Balanced conditions are defined as periods when the two projects agree that releases from upstream reservoirs, plus unregulated flow, approximately equal water supply needed to meet Sacramento Valley in-basin uses and CVP and SWP exports. Coordination between the CVP and the SWP is facilitated by implementing an accounting procedure based on the sharing principles outlined in the COA. During balanced conditions in the Delta when water must be withdrawn from storage to meet Sacramento Valley and Delta requirements.

9.9.2 Project Operations. Upon initiation of the Test Period, Permittee shall adhere to the requirements outlined in the Test Period Operations Plan. Upon initiation of Full Project Operations Permittee shall adhere to the operating criteria described in the Full Project Operations Plan. The Test Period Operations Plan and the Full Project Operations Plan shall include all operational criteria and real-time operations requirements described in this Condition, or as modified through amendments to the permit (see Condition of Approval 6).

9.9.3 Controlling Operational Criteria. When the permit, D-1641, the biological opinion(s), or other SWP authorizations establish operational criteria, the criteria that provide the highest level of protection for Covered Fish Species shall control Project operations.

9.9.4 General Operating Criteria. The General Operating Criteria include both new and existing operational criteria for Project operations. The new North Delta South Delta operations criteria presented in the ITP represent restrictions on Project operations to be implemented to protect Covered Fish Species, which shall be met unless superseded by real-time operations described in Condition of Approval 9.9.5. The new North Delta diversion minimum bypass flow, including pulse protection criteria, objectives include regulation of flows to (1) maintain fish screen sweeping velocities, (2) minimize potential increase in upstream transport of productivity in the channels downstream of the intakes, (3) support salmonid and pelagic fish movements to regions of suitable habitat, (4) reduce losses to predation downstream of the diversions, and (5) maintain or improve rearing habitat conditions in the north Delta. South Delta operational include new OMR criteria to further minimize take at south Delta pumps by reducing the hydrodynamic effects of south Delta operations that may affect fish movement and migration routing during critical periods for covered fish species. While these objective were designed for CHNWR and CHNSR, these operational requirements are likely to minimize far-field effects on DS and LFS. The Project includes Spring Outflow Criteria designed to minimize take of LFS associated with impacts of Project operations on abiotic habitat, Permittee shall maintain Delta outflows that are protective of LFS every year from March 1 through May 31. These outflows will: 1) maintain estuarine processes and flow positively associated with LFS abundance; 2) maintain downstream transport of LFS larvae to rearing habitat; and 3) dedicate water to maintain LFS habitat quality and quantity at levels consistent with recent conditions. Protective outflows from March 1 through May 31 every year shall be determined by the use of a lookup table derived from a linear relationship between the 50% exceedance forecast for the current month's 8RI and recent historic Delta outflow (1980 – 2016). Within the Delta, reduction in south Delta exports to achieve longfin smelt spring outflow criteria would result in more positive Old and Middle River flows in March of below normal and dry water years in particular possibly providing a benefit to DS in terms of improved south Delta hydrodynamics.

9.9.4.1 Sacramento River Flow Reversal Avoidance. Permittee shall manage NDD intake operations at all times to avoid increasing the magnitude, frequency, or duration of flow reversals in the Sacramento River at the Georgiana Slough junction above pre-Project levels.

Permittee shall develop operational measures to ensure this requirement is met throughout the Test Period and Full Project Operations and for inclusion in the Test Period Operations Plan and the Full Operations Plan. Permittee shall monitor the magnitude, frequency, and duration of Sacramento River flow reversals at the Georgiana Slough junction throughout the Test Period and Full Project Operations (see Pre-construction Study 13 and Post-construction Study 13 in Conditions of Approval 9.6.10 and 9.6.11).

9.9.4.2 NDD Intake Operations. During the Test Period Permittee shall evaluate the level of Covered Fish Species protection afforded by Level 1, 2, and 3 pumping. Upon initiation of Full Project Operations, post-pulse operations (described in Sub Table A in Condition of Approval 9.9.4) shall be restricted to Level 1 diversions until it can be demonstrated that Level 2 and Level 3 diversions afford the same level of Covered Fish Species protection as Level 1 through real time operations described in Condition of Approval 9.9.5. The baseline Project operations water yield shall be defined by the RTO criteria in the Full Project Operations Plan.

9.9.4.3 Spring Outflow: Abiotic Habitat for Longfin Smelt. To minimize take of LFS associated with impacts of Project operations on abiotic habitat, Permittee shall maintain Delta outflows that are protective of LFS every year from March 1 – May 31. These outflows will: 1) maintain estuarine processes and flow positively associated with LFS abundance; 2) maintain downstream transport of LFS larvae to rearing habitat; and 3) dedicate water to maintain LFS habitat quality and quantity at levels consistent with recent conditions. Protective outflows from March 1 – May 31 every year shall be determined by the use of a lookup table derived from a linear relationship between the 50% exceedance forecast for the current month's 8RI and recent historic Delta outflow (1980 – 2016), as shown in Sub Table B.

Upon initiation of the Test Period and throughout the permit term, Permittee shall provide average Delta outflow for LFS based on the 50% exceedance forecast for the current month's 8RI, as specified in Sub Table B in Condition of Approval 9.9.4 and below:

- February 8RI 50% exceedance forecast shall be used to establish the target average Delta outflow beginning on March 1, until the March 8RI 50% exceedance forecast is made available.
- March 8RI 50% exceedance forecast shall be used to establish the target average Delta outflow beginning when the March 8RI 50% exceedance forecast is made available through March 31.
- April 8RI 50% exceedance forecast shall be used to establish the target average Delta outflow beginning when the April 8RI 50% exceedance forecast is made available through April 30. If April 8RI 50% exceedance forecast is not available on April 1, March 8RI 50% exceedance forecast shall be used to establish target Delta outflow until April 50% exceedance forecast is available.
- May 8RI 50% exceedance forecast shall be used to establish the target average Delta outflow from beginning when the May 8RI 50% exceedance forecast is available through May 31. If May 8RI 50% exceedance forecast is not available beginning May 1, April 8RI 50% exceedance forecast shall be used to establish target Delta outflow until May 50% exceedance forecast is available.

Permittee may use preliminary 8RI 50% exceedance forecast estimates to establish outflow targets in the first ten days of each month, if approved by CDFW in writing.

Reduction in combined exports below minimum health and safety requirements (1,500 cfs) is not required by this Condition of Approval.

These targets are intended to be provided through the acquisition of water from willing sellers and through operations of the CVP/SWP. Permittee shall achieve Delta outflow targets through shared export allocations between the NDD and South Delta, consistent with required Operating Criteria described in Condition of Approval 9.9. If the target average Delta outflow is greater than 44,500 cfs Permittee shall consult with CDFW to determine how to allocate exports between the NDD intakes and the South Delta.

Permittee shall utilize Net Delta Outflow Index (NDOI) data to confirm that the average Delta outflow target was met from March 1 – March 31, April 1 – April 30, and May 1 – May 31. Permittee shall provide daily NDOI data quantifying daily Delta outflow in each 30 day period to CDFW on or before April 5, May 5, and June 5 every year.

Permittee shall submit a written report to CDFW on or before June 30 every year explaining how operations of the Project complied with the requirements of this term. This annual report shall include, but is not limited to:

1) 50% exceedance 8RI forecasts in February, March, April, and May

2) Daily NDOI from March 1 – May 31

3) Daily diversion rates from each NDD intake

4) Daily total exports from the South Delta CVP/SWP facilities

5) Description of water obtained from willing sellers to contribute to achieving the outflow targets from March 1 –March 31, April 1 – April 30, and May 1 – May 31.

This report will be used to determine whether Permittee complied with the operational requirements in this Condition of Approval on an annual basis.

9.9.4.4 Fall Outflow – Estuarine Habitat for Delta Smelt. Permittee shall coordinate with Reclamation to provide sufficient Delta outflow to maintain average X2 from September 1 through October 31 no greater (more eastward) than 74 km in the fall following wet years, and 81 km from September 1 through November 30 following above normal years. The monthly average X2 shall be maintained at or seaward of these values for each individual month and not averaged over the two month period. In November, the inflow to CVP/SWP reservoirs in the Sacramento Basin shall be added to CVP/SWP reservoir releases to provide an added increment of Delta inflow and augment Delta outflow to achieve the target X2 location. Permittee shall utilize wet and above normal water year type classifications as defined in the Water Quality Control Plan.

9.9.4.5 Winter and Summer Outflow. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to Net Delta Outflow Index as defined in D-1641 from January 1 through August 31.

9.9.4.6 Export to Inflow Ratio. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to the export to inflow ratios as defined in D-1641 to conduct coordinated operations of all Project facilities.

9.9.5 Real-Time Operations. The real-time operational decision-making process (RTO) shall allow short-term (*i.e.*, daily and weekly) adjustments to be made to water operations, within the range of criteria described in Condition of Approval 9.9.4. RTO provides flexibility in operations based on monitoring for fish presence (see Condition of Approval 9.8), hydrologic conditions, and operational criteria throughout the Delta and as described in Condition of Approval 9.9.4 to contribute to meeting the biological criteria established in Condition of Approval 9.7.

9.9.4.5 Winter and Summer Outflow. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to Net Delta Outflow Index as defined in D-1641 from January 1 through August 31.

9.9.4.6 Export to Inflow Ratio. Upon initiation of the Test Period and Full Project Operations Permittee shall adhere to the export to inflow ratios as defined in D-1641 to conduct coordinated operations of all Project facilities.

9.9.5.1 Real Time Operations of the NDD Intakes. RTOs will govern operations, when they are controlling (see Condition of Approval 9.9.3 *Controlling Operational Criteria*), during the October through June CHNWR and CHNSR migration period. Under RTOs, the NDD intakes shall be operated within the range of pulse protection and Levels 1, 2, and 3, with pulse protection operations in place when CHNWR and CHNSR migration is occurring. Post-pulse bypass flow operations from December 1 through June 30 may remain at Level 1 pumping depending on fish presence, abundance, and movement in the north Delta; however, the exact levels will be determined through initial operating studies evaluating the level of protection provided at various levels of diversions. Real-time operational criteria for DS and LFS at the NDD intakes may be considered and implemented through the Adaptive Management Program based on initial results from pre-construction studies.

The NDDTT shall develop criteria for transitioning between and among pulse protection, Levels 1, 2 and 3 based on best available science. The NDDTT shall recommend transitional criteria to the TOT and IICG for consideration through the Adaptive Management Program, to ensure that the Project will achieve the objectives of Biological Criteria 1 and 2. New transitional criteria are subject to CDFW approval.

9.9.5.2 Real Time Operations of South Delta Export Facilities. Real time operations shall be implemented to make short-term decisions regarding operation of south Delta export facilities in coordination with real time operations of all other Project facilities. The south Delta facilities shall be operated within the range of criteria listed in Condition of Approval 9.9.4, and be subject to RTO decision making based on anticipated impacts to DS, LFS, CHNWR, and CHNSR. South Delta RTO criteria, as described in the Test Period Operations Plan and the Full Project Operations Plan, shall include the following Measures:

9.9.5.2 Real Time Operations of South Delta Export Facilities. Real time operations shall be implemented to make short-term decisions regarding operation of south Delta export facilities in coordination with real time operations of all other Project facilities. The south Delta facilities shall be operated within the range of criteria listed in Condition of Approval 9.9.4, and be subject to RTO decision making based on anticipated impacts to DS, LFS, CHNWR, and CHNSR. South Delta RTO criteria, as described in the Test Period Operations Plan and the Full Project Operations Plan, shall include the following Measures:

South Delta RTO Measure 1[43] - Adult DS Migration and Entrainment First Flush Protection (Action 1): Permittee shall coordinate with Reclamation to limit exports so that the average daily OMR flow[44] shall be no more negative than -2,000 cfs for a total duration of 14 days, and no more negative than -2,500 cfs (within 25 percent) on a 5-day running average.

Part A: From December 1 to December 20: Based upon an examination of turbidity data from Prisoner's Point, Holland Cut, and Victoria Canal (supplemented by turbidity transects conducted by Permittee on a daily basis) and salvage data from CVP/SWP (see Triggers below), and other parameters important to the protection of DS including, but not limited to, preceding conditions of X2, QWEST, FMWT, and river flows the SWG or CDFW SWG personnel may recommend a start date to WOMT and WOMT may accept, reject, or revise the recommendation. If WOMT accepts the recommendation, Permittee shall implement the recommended start date. If WOMT rejects or revises the recommendation, the Director of CDFW (Director) may require a start date and Permittee shall implement the start date required by the Director.

Part B: After December 20 Permittee shall implement this measure if at least one of the two Measure 1 triggers is met. The SWG can recommend a delayed start or interruption in implementation based on other conditions such as Delta inflow that may affect DS vulnerability to entrainment. If either off ramp condition is met, South Delta RTO Measure 1 shall not be implemented. If either Measure 1 off ramp condition is met, and South Delta RTO Measure 1 has not been implemented, South Delta RTO Measure 3 shall be implemented and South Delta RTO Measure 2 is not required, unless CDFW concludes, on the basis of the totality of available information, that South Delta RTO Measure 2 shall be implemented instead.

Measure 1 (Part B) triggers:

(1) Turbidity: 3-day average of 12 NTU or greater at all three stations (Prisoner's Point, Holland Cut, Victoria Canal)

(2) Salvage: Three days or delta smelt salvage after December 20 at either facility or cumulative daily salvage count that is above a risk threshold based upon the "daily salvage index" approach reflected in a daily salvage index value ≥0.5 (daily delta smelt salvage > one-half prior year FMWT index value).

Measure 1 (Part B) off ramps:

(1) Temperature: Water temperature reaches 12°C based on a three station daily mean at Mossdale, Antioch, and Rio Vista

[43] This measure was initially implemented as RPA Component 1 (Actions 1) under USFWS (2008).

[44] OMR Flows for this and all relevant actions shall be measured at the Old River at Bacon Island and Middle River at Middle River stations.

(2) Biological: Onset of spawning (presence of spent females in SKT or at TFCF or Skinner Fish Facility salvage samples).

South Delta RTO Measure 2[45] - Adult DS Migration and Entrainment Protection (Action 2): This measure shall be implemented using an adaptive process to tailor protection to changing environmental conditions after South Delta RTO Measure 1 ceases. As in South Delta RTO Measure 1, the purpose of this measure is to protect pre-spawning DS adults from entrainment and, to the extent possible, from adverse hydrodynamic conditions.

Permittee shall coordinate with Reclamation to operate to a range of net daily OMR flows that will be no more negative than -1,250 to - 5,000 cfs. Specific OMR flows within this range shall be recommended by the SWG throughout implementation of this measure based on extant conditions and the general guidelines below.

The SWG or CDFW SWG personnel shall provide WOMT and the Director weekly recommendations for required OMR flows based upon review of the sampling data from real-time salvage data at the SWP, and utilizing most up-to-date technological expertise and knowledge relating DS population status and predicted distribution to monitored physical variables of flow and turbidity. WOMT may accept, reject, or revise the recommendations. If WOMT accepts the recommendations, Permittee shall coordinate with Reclamation to implement the required OMR flow. If WOMT rejects or revises the recommendation, the Director may require an OMR flow and Permittee shall coordinate with Reclamation to implement the OMR flow required by the Director.

Timing: Before Measure 2 is implemented, and in time for Permittee to implement the flow requirement, the SWG or CDFW SWG personnel shall recommend to WOMT and to Director specific OMR flow requirements based on salvage and on physical and biological data on an ongoing basis (see 9.8 Project Operations Monitoring and Funding). This Measure shall be implemented immediately after South Delta RTO Measure 1 off-ramps occur. If South Delta RTO Measure 1 is not implemented, the SWG or CDFW SWG personnel may recommend a start date for the implementation of South Delta RTO Measure 2 to protect adult DS.

Suspension of Measure 2: OMR flow requirements in this measure do not apply whenever a three day flow average is greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and 10,000 cfs in San Joaquin River at Vernalis. Once such flows have abated, the OMR flow requirements of this Measure are again in place.

Measure 2 off -ramps: South Delta RTO Measure 2 shall cease and South Delta RTO Measure 3 shall commence if one of the following two conditions is met:

(1) Temperature: When water temperature reaches 12°C based on a three station daily average (Rio Vista, Antioch, and Mossdale) or

[45] This measure was initially implemented as RPA Component 1 (Actions 2) under USFWS (2008).

(2) Biological: Onset of spawning (presence of spent females in Spring Kodiak Trawl or at either facility) occurs

Adaptive Process Required Parameters**:**

Two scenarios span the range of circumstances likely to exist during implementation of South Delta RTO Measure 2. First, the low-entrainment risk scenario. There may be a low risk of adult DS entrainment because (a) there has been no discernable migration of DS adults into the South and Central Delta (b) the upstream migration has already occurred but turbidity is low and there is no evidence of ongoing adult entrainment. In this scenario, more negative net daily OMR flow rates as negative as -5,000 cfs may be allowed as long as entrainment risk factors and salvage permit.

The second scenario, the high-entrainment risk scenario, is one in which either (a) there is evidence that upstream adult migration is currently occurring, or (b) upstream migration has already occurred and there are adult fish in the South and Central Delta and turbidity is high, increasing the risk of entrainment, or (c) there is evidence of ongoing entrainment, regardless of other risk factors. In this case, OMR flow will be set to reduce entrainment and/or the risk of entrainment as the totality of circumstances warrant.

If the available distributional information suggests that most DS are in the North or North/Central Delta, then OMR flow can be chosen to minimize Central Delta DS entrainment. However, if the distributional information suggests there are DS in the Central or South Delta, then OMR flow will have to be set more positive to reduce entrainment of DS.

The following two paragraphs describe how these action guidelines would be implemented at the start of South Delta RTO Measure 2 and at other times during implementation of South Delta RTO Measure 2.

1. OMR flow setting at initiation of South Delta RTO Measure 2

a) If salvage is zero during the final seven (7) days of South Delta RTO Measure 1, and three station mean turbidity is below 15 NTU, OMR flow shall be no more negative than -5,000 cfs on a 14-day running average with a simultaneous 5-day running average within 25 percent of the applicable required OMR flow[46]; *UNLESS*

b) If salvage is less in the most recent three days than in the preceding three days of South Delta RTO Measure 1, and the maximum DS Daily Salvage Index is ≤1 during the prior 7 days, then limit exports to achieve OMR flows no more negative than -3,500 cfs on a 14-day running average for 7 days (or until 4 consecutive days of zero salvage or any 5 of 7 days with zero

[46] The daily OMR flows used to compute both the 14-day and the 5-day averages shall be based on the definition in Condition of Approval 9.9.2.

salvage), with a 5-day running average within 25 percent of the applicable required OMR flow; *OR*

c) If salvage is greater or equal in the last three days than in the preceding three days of South Delta RTO Measure 1, and maximum Daily Salvage Index ≥1 during any of those days, then continue OMR flow at no more negative than -2,000 cfs on a 14-day running average for an additional 7 days (or until 4 succeeding days of zero salvage or any 5 of 7 days zero salvage), with a simultaneous 5-day running average within 25 percent of the applicable requirement OMR; *OR*

d) If circumstances existing at the initiation of South Delta RTO Measure 2 are, in the judgment of CDFW, less protective from those anticipated in (a) through (c) above, then the OMR flow requirement in (c) will be applied and the SWG will review available data and recommend an initial flow rate to CDFW.

2. OMR flow setting after initiation of South Delta RTO Measure 2

a) The SWG will review all available information and request updated entrainment simulations (including particle tracking models) and/or other information, as needed, on a weekly basis to decide whether the current OMR flow requirement is appropriate or should be changed based on adult DS entrainment risk through consideration of (1) salvage or other actual entrainment indicators, (2) turbidity, (3) available monitoring results, hydrologic variables other than export pumping rates that affect OMR flow, (4) apparent population size from the preceding FMWT survey, and (5) particle tracking or other model-based entrainment risk information.

c) As described above, the risk of entrainment is generally higher when there is evidence of ongoing entrainment or turbidity is high, and these two variables are the primary triggers of decisions to raise or lower OMR flow requirements.

d) Based on historical experience, OMR flow requirements between the limits of -2,000 cfs and -5,000 cfs are likely to be adequate in most years. The exception is years in which there is a substantial fraction of the adult spawning migrant population in the Central and/or South Delta. When this occurs, more stringent OMR limitations (possibly to no more negative than - 1,250 cfs) may be required.

<u>South Delta RTO Measure 3 - Larval DS Entrainment Protection (Action 3)[47]:</u> Permittee shall implement this measure to minimize the number of larval DS entrained at the south Delta facilities by managing the hydrodynamics in the

[47] This measure was initially implemented as RPA Component 2 (Action 3) under USFWS (2008).

Central Delta, flow levels, and pumping rates. Because protective OMR flow requirements vary over time (within and among years), implementation of this measure is flexible within constraints.

Permittee shall coordinate with Reclamation on the operation of south Delta facilities to achieve a net daily OMR flow no more negative than -1,250 to -5,000 cfs based on a 14-day running average with a simultaneous 5-day running average within 25 percent of the applicable requirement for OMR[48]. Depending on extant conditions (and the general guidelines below) specific OMR flows within this range shall be recommended by the SWG or CDFW SWG personnel to WOMT and the Director from initiation through termination of this measure[49]. The SWG shall provide these recommendations based upon weekly review of sampling data, real-time salvage data at the CVP/SWP, and knowledge relating DS population status and predicted distribution to flow and turbidity. WOMT may accept, reject, or revise the recommendations. If WOMT accepts the recommendations, Permittee shall implement the required OMR flow. If WOMT rejects or revises the recommendation, the Director may require an OMR flow and Permittee shall implement the OMR flow required by the Director.

Timing: Permittee shall implement this measure if at least one of the two Measure 3 triggers is met. Measure 3 triggers are indicative of DS spawning activity and the presence of larval DS in the South and Central Delta. Based upon daily salvage data, the SWG or CDFW SWG personnel may recommend an earlier start to South Delta RTO Measure 3. WOMT may accept, reject, or revise the recommended start date. If WOMT accepts the recommendation, Permittee shall implement the measure. If WOMT rejects or revises the recommendation, the Director may require an OMR flow and Permittee shall implement the OMR flow required by the Director. South Delta RTO Measure 3 shall terminate if one of the two Measure 3 off ramps is met.

Measure 3 triggers:

1) Temperature – When temperature reaches 12°C based on a three station average at Mossdale, Antioch, and Rio Vista, or

2) Biological: Onset of spawning (presence of spent females in SKT or at either fish salvage facility).

Measure 3 off ramps:

1) Temporal - June 30, or
2) Temperature: Water temperature reaches a daily average of 25°C for three consecutive days at Clifton Court Forebay.

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[48] The daily OMR flows used to compute both the 14-day and the 5-day averages shall be based on the definition in Condition of Approval 9.9.2.

[49] During most conditions, it is expected that maximum negative OMR flows will range between -2000 and -3500. During certain years of higher or lower predicted entrainment risk, requirements as low as -1,250 or -5,000 will be recommended to CDFW by the SWG.

South Delta RTO Measure 4 – Adult LFS Migration and Entrainment Protection (LFS 2009 Condition 5.1)[50]: The purpose of this measure is to protect adult LFS migration and spawning from December 1 through February 28. Permittee shall ensure the OMR flow requirement recommended by WOMT, or required by the Director, is met by coordinating operations with Reclamation to ensure the OMR flow 14-day running average is no more negative than -5,000 cfs and the initial 5-day running average is no more negative than -6,250 cfs[51].

The SWG or CDFW SWG personnel shall provide OMR flow advice based on the Measure 4 triggers to the WOMT and to the Director weekly. WOMT shall provide weekly advice which may include information on other ecosystem and water supply considerations to the Director.

Based on OMR flow advice from SWG or CDFW SWG personnel, CDFW shall make an OMR flow recommendation to WOMT and WOMT may accept, reject, or revise the recommendation. If WOMT accepts the recommendation, Permittee shall implement the required OMR flow. If WOMT rejects, revises, or declines to accept the recommendation, the Director may require an OMR flow and Permittee shall implement the OMR flow required by the Director.

Measure 4 triggers:

1) The cumulative salvage index (defined as the total LFS salvage at the CVP and SWP in the December through February period divided by the immediately previous Fall Mid-Water Trawl (FMWT) LFS annual abundance index[52]) exceeds five (5); or
2) When a review of all abundance and distribution survey data and other pertinent biological factors that influence the entrainment risk of adult LFS indicate OMR flow advice is warranted.

Measure 4 off ramps:

1) During any time OMR flow restrictions for DS are being implemented (South Delta RTO Measures 1, 2, and 3), this measure shall not result in additional OMR flow requirements for protection of adult LFS, or

2) When LFS spawning has been detected in the system, South Delta RTO Measure 4 shall terminate and South Delta RTO Measure 5 shall be implemented, or

3) South Delta RTO Measure 4, including the OMR requirement, is not required or would cease if previously required when river flows are: a)

[50] This measure was initially implemented as Condition 5.1 of CDFW (2009).
[51] The daily OMR flows used to compute both the 14-day and the 5-day averages shall be based on the definition in Condition of Approval 9.9.2.
[52] The FMWT survey annual abundance index for longfin smelt is calculated as the sum of September through December monthly abundance indices, and is typically reported at about the same date as adult salvage begins in December. Early December salvage can be compared to September through November abundance as an approximation of the salvage index.

greater than 55,000 cfs in the Sacramento River at Rio Vista; or b) greater than 8,000 cfs in the San Joaquin River at Vernalis, or

If flows go below 40,000 cfs in the Sacramento River at Rio Vista or 5,000 cfs in the San Joaquin River at Vernalis, the OMR flow in South Delta RTO Measure 4 shall resume if triggered previously and not precluded by another Measure 4 off ramp. In implementation of this resumption, in addition to river flows, the SWG or CDFW SWG personnel review of survey data and other pertinent biological factors that influence the entrainment risk of adult LFS may result in advice to WOMT and the Director and may result in a recommendation by CDFW to WOMT and the Director to relax or cease this OMR flow requirement.

South Delta RTO Measure 5 – Larval LFS Entrainment Protection (LFS 2009 Condition 5.2)[53]: The SWG or CDFW SWG personnel shall provide OMR flow advice to the WOMT and to the Director weekly to protect larval and juvenile LFS during from January 1 through June 30. The OMR flow advice shall be an OMR flow between -1,250 and -5,000 cfs and be based on review of survey data (see Measure 5 triggers below), including all current LFS distributional and abundance data, and other pertinent biological factors that influence the entrainment risk of larval and juvenile LFS. The OMR flow requirement is likely to vary from January 1 through June 30 based upon LFS survey results, data analysis, and environmental factors. Based on prior analysis, CDFW has identified three likely scenarios that illustrate the typical LFS entrainment risk level and associated protective OMR flow measures for larval LFS over the period:

- High Entrainment Risk Period – January 1 through March 30

  OMR range from -1,250 cfs to -5,000 cfs

- Medium Entrainment Risk Period – April 1 through May 30

  OMR range from -2,000 cfs to -5,000 cfs

- Low Entrainment Risk Period - June 1 through June 30

  OMR -5,000 cfs

Based on SWG or CDFW SWG personnel OMR flow advice, CDFW shall make an OMR flow recommendation to WOMT and WOMT may accept, reject, or revise the recommendation. If WOMT accepts the recommendation, Permittee shall implement the OMR flow as recommended by the SWG. If WOMT rejects or revises the recommendation, the Director may require an OMR flow and Permittee shall implement the OMR flow required by the Director. Permittee shall coordinate with Reclamation to ensure the OMR flow requirement is met by maintaining the OMR flow 14-day running average no more negative than the

[53] This measure was initially implemented as Condition 5.2 of CDFW (2009).

required OMR flow and the 5-day running average is within 25 percent of the required OMR flow[54].

Measure 5 triggers: All current LFS distributional and abundance data, including the Smelt Larval Survey, and other pertinent biological factors that influence the entrainment risk of larval and juvenile LFS shall be used to determine OMR flow advice. When a single Smelt Larva Survey (SLS) or 20 mm Survey (20 mm) sampling period results in one of the following triggers Permittee shall implement South Delta RTO Measure 5 and OMR flow advice shall be warranted:

1) LFS larvae or juveniles found in 8 or more of the 12 SLS or 20 mm stations in the central and south Delta (Stations 809, 812, 815, 901, 902, 906, 910, 912, 914, 915, 918, 919) or,
2) LFS catch per tow exceeds 15 LFS larvae or juveniles in 4 or more of the 12 central and south Delta (Stations 809, 812, 815, 901, 902, 906, 910, 912, 914, 915, 918, 919).

Measure 5 off ramps: When river flows meet one of the following requirements South Delta RTO Measure 5 would not trigger, or would be relaxed if triggered previously.

1) Greater than 55,000 cfs in the Sacramento River at Rio Vista; or
2) Greater than 8,000 cfs in the San Joaquin River at Vernalis

Should the flows drop below 40,000 cfs in the Sacramento River at Rio Vista or 5,000 cfs in the San Joaquin River at Vernalis, Measure 5 shall resume if triggered previously.

In implementing this resumption, in addition to river flows, the SWG or CDFW SWG personnel review of all abundance and distribution survey data and other pertinent biological factors that influence the entrainment risk of adult LFS may result in advice to WOMT and the Director, and may result in a recommendation by CDFW to WOMT to relax or cease an OMR flow requirement per this Measure.

<u>South Delta RTO Measure 8 - Skinner Fish Facility Operations (2009 LFS Conditions 6.2 and 6.3)</u>: The purpose of this measure is to ensure that the maintenance, inspection and reporting schedule at the Skinner Fish Facility is effective in minimizing take of Covered Fish Species.

At least one year prior to initiation of the Test Period Permittee shall consult with CDFW on projects and actions that will improve the survival rates of salvaged DS and LFS at the Skinner Fish Facility. This consultation shall inform development of the draft and final Test Period Operations Plan and Full Project Operations Plan which shall include a list of feasible actions and projects, and plans to

[54] The daily OMR flows used to compute both the 14-day and the 5-day averages shall be based on the definition in Condition of Approval 9.9.2.

implement them, throughout the Test Period and Full Project Operations to improve the survival rates of salvaged DS and LFS at the Skinner Fish Facility.

The Test Period Operations Plan and the Full Project Operations Plan shall include, but not be limited to, the following Skinner Fish Facility operations requirements from November 1 through June 30:

1) Permittee shall salvage Covered Species according to CDFW and DWR protocol (see Skinner Fish Facility Operations Manual (v 2.0 October 19, 2005)) when exporting water via the Banks Pumping Plant

2) Permittee shall promptly report unplanned salvage outages to CDFW

3) Permittee shall consult with CDFW to plan salvage outages

4) For unplanned salvage outages greater than one hour, Permittee shall notify the CDFW Salvage Biologist (see 6.3.1.1) by phone immediately. If discussion by phone isn't possible, Permittee shall leave a message detailing the source and estimated duration of the outage.

Salvage Biologist: (209) 234-3672; (209) 639-2750

Salvage Supervisor: (209) 234-3485; (209) 639-2686

Salvage Manager: (831) 372-2581

5) For all planned salvage outages to be conducted for normal maintenance and repair work (e.g., predator clean-outs, normal maintenance procedures, repairs to valves and controls), Permittee shall contact the CDFW Salvage Biologist at least one business day in advance of outages. Export rates shall not increase during any outage period.

6) Permittee shall submit annual reports that document and describe the regular inspection and maintenance at the Skinner Fish Facility performed on fish protective equipment that may affect screening and salvage efficiencies to the TOT.

7) The Permittee shall ensure the Skinner Fish Facility salvage monitoring and reporting program samples no less than 30 minutes for every 2 hours from December 1 through June 30. If the presence of large number of fish or debris in the salvage will result in the significant loss of Covered Species in the salvage monitoring process, Permittee shall operate to the existing protocols for such circumstances (see Skinner Fish Facility Operations Manual (v 2.0 October 19, 2005)).

8) Permittee shall implement an effectiveness monitoring program for the Skinner Fish Facility that covers the November through June monitoring period to ensure the minimization measures are successfully reducing incidental take of the Covered Species. The Permittee shall continue to work and coordinate with CDFW salvage staff to information is shared as promptly as possible.

9.9.5.3 Real Time Operations of the HOR Gate.

October 1 – November 30: HOR Gate shall be operated during the SJR pulse period, as determined by the SOG. During this pulse period operation shall be to close the gate subject to RTO for purposes of water quality, stage and flood control considerations.

January 1 – March 31, and June 1 – June 15: Operation of the HOR Gate will be based on presence of migrating juvenile salmonids. During their migration, operation will be to close the gate for purposes of water quality, stage, and flood control.

April 1 – May 31: Permittee shall close the gate 100% of the time for purposes for water quality, stage, and flood control. Reclamation, DWR, NMFS, USFWS and CDFW will explore the implementation of reliable juvenile salmonid tracking technology that may enable shifting to a more flexible real time operating criterion based on the presence/absence of Covered Fish Species.

June 16 – September 30, and December 1 – December 31: Operable gates will be open

At any time during the year Permittee may open the HOR Gate to reduce downstream flood risks based on current conditions if San Joaquin River flow at Vernalis is greater than 10,000 cfs. This threshold may be revised to align with any future flood protection actions and with written approval from CDFW.

9.9.5.4 Suisun Marsh Facilities Real Time Operations. RTO shall be implemented to make short-term decisions regarding operation of Suisun Marsh facilities (Suisun Marsh Salinity Control Gates (SMSCG), Roaring River Distribution System (RRDS), Morrow Island Distribution System (MIDS), and Goodyear Slough Outfall) in coordination with real time operations of all other Project facilities. The Suisun Marsh facilities shall be operated within the range of criteria listed in Condition of Approval 9.9.4, and be subject to RTO decision making based on anticipated impacts to DS, LFS, CHNWR, and CHNSR. Suisun Marsh facility RTO criteria, as described in the Real Time Operations Plan, shall include all Suisun Marsh RTO Measures included in this term.

Permittee may modify requirements in Suisun Marsh RTO Measure 2 using a minor amendment to this permit if such modifications are recommended as a result of reinitiation of USFWS (2009) or under the Adaptive Management Framework.

Suisun Marsh RTO Measure 1 - Suisun Marsh Salinity Control Gates Operating Criteria: Permittee shall adhere to operating criteria as required by D-1641 and the following seasonal operation requirements from October 1 through February 28:

3) The radial gates shall be operational if Martinez EC is greater than 20,000, and for remaining months they remain open.

4) Permittee shall close gates when downstream channel flow velocity is < 0.1 (onset of flood tide); gates open when upstream to downstream stage difference is greater than 0.3 ft (onset of ebb tide).

Suisun Marsh RTO Measure 2 - MIDS Operating Criteria (LFS ITP Condition 6.1): To minimize take of LFS at the MIDS diversion, in addition to any existing operating rules, Permittee shall adhere to CDFW average intake velocity specifications.

CDFW will specify the required average intake velocities by August 15 each year in order to adequately protect LFS and, if appropriate, to allow Permittee to meet contractual water delivery requirements. Permittee shall maintain this velocity from September 1 to December 31 each year to protect staging and spawning LFS from entrainment until alternative operational criteria are developed from completion of the study below.

9.9.5.5 Real Time Operations of the North Bay Aqueduct[55]. The purpose of this measure is to operate the North Bay Aqueduct to protect larval DS and LFS.

Throughout the Test Period and Full Project Operations Permittee shall implement this measure from January 15 – March 31 of dry and critically dry years, as defined in D-1641 for the Sacramento River. If the Water Year type changes after January 1 to below normal, above normal, or wet, this measure shall be suspended. If the Water Year type changes after January to dry or critical, this measure shall apply.

The SWG or CDFW SWG personnel shall provide Barker Slough Pumping Plant operations advice to the WOMT and to the Director weekly based on a review of the abundance and distribution survey data and other pertinent biological factors that influence the entrainment risk including detection of larval DS or LFS at Station 716. The advice for the Barker Slough Pumping Plant's maximum seven day average shall not exceed 50 cfs. WOMT shall provide weekly advice which may include information on other ecosystem and water supply considerations to the Director and may accept, reject, or revise the recommendation of the SWG. If WOMT rejects or revises the recommendation, the Director may require a Barker Slough diversion rate and Permittee shall implement the rate required by the Director. Once notice is provided by the Director that a diversion rate is required, or the WOMT accepts the SWG or CDFW SWG advice,, the rate of diversion at Barker Slough shall not increase. Beginning on the day on which notice is provided or the WOMT accepts the advice, the maximum diversion rate shall not exceed 50 cfs. This restriction shall be suspended when larval DS or LFS are no longer detected at Station 716 or after March 31, whichever occurs sooner.

v. DS and LFS Project Operations Mitigation Measures

The Conditions of Approval above will reduce, but not eliminate, the impacts to DS and LFS as a result of operations of the Project. Therefore, the following mitigation measures are required to ensure full mitigation of the impacts of the taking.

Permittee shall restore and permanently protect 1,827.7 acres of tidal perennial habitat as compensatory mitigation for impacts associated with Project construction and

[55] This measure was initially implemented as Condition 5.3 of CDFW (2009).

operations. Potential locations for compensatory habitat restoration include Sherman Island, Cache Slough, North Delta or other areas approved by CDFW. Permittee will provide for the acquisition, protection and management of HM lands (Condition of Approval 10.6) and will provide performance security for required compensatory mitigation (Condition of Approval 11).

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to DS and LFS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1 and be guided by the crediting process described in ITP Attachment 8, Guidance for Smelt HM Lands Suitable for Compensatory Mitigation. Permittee shall ensure permanent protection and funding for perpetual management of compensatory DS and LFS shallow water and tidal perennial habitat, including monitoring for suitable habitat features and presence of DS and LFS.

vi. DS and LFS Project Operations EIS/EIR Avoidance and Minimization Measures

In addition to the operations-related minimization and mitigation measures required by the ITP and summarized above, the EIS/EIR includes additional operations-related mitigation measures and environmental commitments incorporated into the Project as approved by DWR and required to be implemented by this ITP that would further ensure that any impacts to DS and LFS resulting from Covered Activities would be minimized and fully mitigated.

- Mitigation Measure AQUA 22d
- Environmental Commitment 4 (Tidal natural communities restoration)
- Environmental Commitment 6 (Channel margin habitat enhancement)
- Environmental Commitment 12 (Methylmercury management)

2. The measures required by the ITP are roughly proportional in extent to the impacts of the authorized taking on the Covered Species that will result from Covered Activities.

CDFW finds, based on substantial evidence in the ITP application, the Final EIR/EIS, and the administrative record of proceedings, that the measures required by the ITP issued to the Permittee are roughly proportional in extent to the impacts of the authorized taking on the Covered Species that will result from Covered Activities.

CDFW bases this finding on the compensatory mitigation required by the ITP:

- For impacts to Covered Species, as determined through the mapping of suitable habitat within the Project Area for the Covered Species (as described in Final EIR/EIS Chapters 11 and 12), further evaluation and tracking of habitat disturbance as required by Condition of Approval 8.4, 8.5 and 8.6, replacement habitat shall be protected or restored, and enhanced according to ITP Condition of Approval 10 and consistent with Covered Species habitat criteria described in ITP Attachments 4 and 8. All compensatory mitigation required in by the ITP shall be subject to CDFW approval in writing.

- Permanent loss of up to 50 acres of CTS upland refugia habitat will be mitigated through the protection and management of 150 CTS upland refugia habitat that meets the criteria in ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation* and is consistent with CTS habitat conditions within the East Contra Costa County HCP/NCCP reserve system. Temporary loss of up to 6 acres of CTS upland refugia habitat will be mitigated through on-site restoration to pre-project or better conditions following completion of Covered Activities.
- Permanent loss of up to 3,770 acres of Swainson's hawk foraging habitat and 22 acres of SWHA nesting habitat will be mitigated through the protection and management of 3,770 acres of SWHA foraging habitat, 44 acres of SWHA nesting habitat, establishment of seven new SWHA nest sites, and planting five new suitable nest tree saplings for every suitable nest tree removed that meet the criteria in ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Injury and mortality of SWHA as a result of collisions with transmission lines will be mitigated by installation of bird strike diverters on all new Project transmission lines and an equivalent length of existing transmission lines in the Project Area. Temporary loss of up to 1,114 acres of SWHA foraging habitat will be mitigated through on-site restoration to pre-project or better conditions following completion of Covered Activities.
- Permanent loss of up to 570 acres of GGS upland habitat, 205 acres of GGS aquatic habitat will be mitigated through the protection and management of 1,710 acres of GGS upland habitat and 615 acres of GGS aquatic habitat that meets the criteria in ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. If GGS HM lands are located within high-priority conservation areas that meet the requirements of large contiguous blocks of aquatic and upland habitat surrounded by compatible land uses outlined in the USFWS *2015 Revised Draft Recovery Plan for Giant Garter Snake*, and that CDFW approves in writing loss of GGS habitat will be mitigated with 1,140 acres of GGS upland habitat and 410 acres of GGS aquatic habitat. Temporary loss of up to 165 acres of GGS upland habitat will be mitigated through on-site restoration to pre-project or better conditions following completion of Covered Activities.
- Permanent loss of up to 2,063 acres of TRBL foraging-breeding habitat, 1,774 TRBL foraging-nonbreeding habitat, 16 acres TRBL nesting habitat, and 20 acres TRBL roosting habitat will be mitigated through the protection and management of 2,063 acres of TRBL foraging-breeding habitat, 1,774 TRBL foraging-nonbreeding habitat, 48 acres TRBL nesting habitat, and 40 acres TRBL roosting habitat that meets the criteria in ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Temporary loss of

up to 299 acres of TRBL foraging-breeding habitat and 377 acres of TRBL foraging-nonbreeding habitat will be mitigated through on-site restoration to pre-project or better conditions following completion of Covered Activities.

- Permanent loss of up to 500.6 acres of DS and LFS shallow water habitat and 25.3 acres of tidal perennial habitat will be mitigated through the protection and management of 1,827.7 acres of tidal perennial habitat that conforms to the specifications outlined in the FRPA Implementation Strategy and Crediting outlined in ITP Attachment 8. Conditions of Approval in the ITP, discussed above, minimize the impacts of construction-related Covered Activities to DS and LFS that may be present within the CCF and the permanent alteration of 2,190 acres of tidal perennial habitat in CCF. Operations of the SWP during the Project construction period are subject to the terms of separate CESA and federal ESA authorizations that require flow-based measures to reduce the entrainment of DS and LFS into the CCF and monitoring of loss and salvage at the Skinner Fish Facility.
- Permanent loss of up to 1.44 linear miles of channel margin habitat and 31.9 acres of tidal perennial habitat and the temporary loss of 20.1 acres of tidal perennial habitat will be mitigated through the protection and management of 4.3 linear miles of channel margin habitat and 154.8 acres of suitable CHNWR and CHNSR habitat that meets the criteria in ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. In addition, Permittee will provide $4,000,000 annually to establish a new population of CHNWR through introduction and reintroduction of fish into Sacramento River tributaries (which may include Battle Creek and/or upstream of Shasta Reservoir) and support that population with associated habitat restoration. Conditions of Approval in the ITP, discussed above, minimize the impacts of construction-related Covered Activities to CHNWR and CHNSR that may be present within the CCF and the permanent alteration of 2,190 acres of tidal perennial habitat in CCF. Operations of the SWP during the Project construction period are subject to the terms of separate CESA and federal ESA authorizations that require flow-based measures to reduce the entrainment of CHNWR and CHNSR into the CCF and monitoring of loss and salvage at the Skinner Fish Facility.

Furthermore, Condition of Approval 10 requires that Permittee annually provides documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative impacts to each Covered Species habitat (10 percent stay-ahead requirement). This measure is necessary and appropriate because of the size and long duration of the Project construction, the scope of the compensatory mitigation actions, the need for additional mitigation project siting and design work, and time period necessary for restoration actions to mature and generate species benefits. Accordingly, CDFW finds that the measures imposed by the ITP to be issued to the Permittee are roughly proportional under CESA to the impacts of the authorized taking of the Covered Species that will result from Covered Activities.

3. The required measures maintain the Permittee’s objectives to the greatest extent possible

The Project objectives are set forth in the Final EIR/EIS in Section 1.0 Project Purpose, Need, and Objectives. Where various measures were available to meet CESA’s minimization and full mitigation obligation, CDFW finds, based on the ITP application, Final EIR/EIS, and the administrative record of proceedings, that the ITP’s required measures maintain the Permittee’s objectives to the greatest possible extent.

4. All measures required as a condition of the ITP are capable of successful implementation

CDFW finds, based on substantial evidence in the ITP application, Final EIR/EIS, and the administrative record of proceedings, that all measures required as a condition of the ITP issued to DWR are capable of successful implementation. As discussed above, the Final EIR/EIS includes a suite of avoidance and minimization measures that will avoid or substantially lessen the prospect of incidental take, and related impacts of any such take, that could result from Covered Activities. These measures are directed at habitat types, individual Covered Species, and other indirect effects.

CDFW finds the measures detailed in the Final EIR/EIS are capable of successful implementation by DWR. In approving the Project, DWR determined the Final EIR/EIS’s mitigation measures, environmental commitments, and avoidance and minimization measures were feasible, and adopted a Mitigation, Monitoring, and Reporting Program to ensure implementation of the measures. The mitigation measures are consistent with mitigation, minimization, and other conservation practices employed and authorized by CDFW in similar permitting contexts.

CDFW finds the conditions of approval required by the ITP issued to DWR as Monitoring, Notification and Reporting Provisions and Minimization Measures, are capable of successful implementation because the ITP is supported by enforceable commitments by DWR and other involved agencies. Additional, monitoring and research as part of the robust Adaptive Management Program provides a mechanism track the effectiveness of minimization and mitigation measures in order to achieve the regulatory standards applicable to the Project. Independent peer review of materials prepared for the federal ESA and CESA processes highlighted the uncertainties surrounding the Project and its impacts to aquatic Covered Species. DWR and CDFW acknowledge that the effects of the Project on fish and aquatic resources is influenced by numerous factors related to the complexity of the ecosystem, changes within the system (e.g., climate change and species population trends), and the imprecision of operational controls and resolution in modeling tools. These factors are further complicated by the scientific uncertainty about some fundamental aspects of the life histories of the aquatic Covered Species and how these species respond to changes in the system, as well as sometimes competing points of view on the interpretation of biological and physical data within the scientific community. CDFW finds that greater certainty as to the aquatic Covered Species and Project-related changes to the dynamics of the Delta cannot be obtained at this time.

Consequently, the ITP requires the establishment of a suite of technical teams, implementation of numerous pre-construction studies to further characterize pre-Project conditions and extensive monitoring, reporting and ongoing studies to track Project impacts and performance, and adopts biological criteria that must be achieved through operational criteria and benefits to species resulting from compensatory mitigation actions. This approach recognizes the uncertainties and dynamic conditions inherent in the Project, while requiring funding and implementation of extensive and ongoing scientific analysis and collaboration between DWR, CDFW and other stakeholders and requiring that certain biological outcomes must be achieved. CESA's implementing regulations direct that "[i]n determining whether measures are capable of successful implementation, the Director shall consider whether the measures are legally, technologically, economically and biologically practicable. This provision does not preclude the use of new measures or other measures without an as yet established record of success which have reasonable basis for utilization and a reasonable prospect for success." (Cal. Code Regs., tit. 14, § 783.4, subd. (c).) CDFW finds that the Conditions of Approval in the ITP are necessary and appropriate and have a basis for utilization due to the unique aspects of the Project discussed above, and finds that the enforceable commitments of the Permittee and CDFW's regulatory authority pursuant to CESA provide a reasonable prospect of success.

CDFW finds that the conditions of approval required by the ITP issued to DWR are capable of successful implementation because the ITP provides for adequate funding to implement the technical teams, pre- and post-construction studies and other Adaptive Management Program components, as discussed further below in Section V.D of these findings.

CDFW also finds that the conditions of approval required by the ITP issued to DWR are capable of successful implementation because the ITP provides for adequate funding to monitor compliance with the Mitigation, Monitoring, and Reporting Program and to comply with required compensatory Habitat Lands requirements through acquisition for protection and restoration and/or to purchase credits at an approved Conservation Bank, as discussed further below in Section V.D of these findings.

C. The ITP is consistent with CDFW's regulations implementing recovery strategies for coho salmon and newly listed species pursuant to Section 2112 and 2114 of the Fish and Game Code.

CDFW may adopt regulations to implement recovery strategies for coho salmon pursuant to Fish and Game Code section 2112 and for newly listed species pursuant to Fish and Game Code section 2114. Coho salmon are not found in the streams within the Project Area. Further, CDFW has not adopted regulations pursuant to sections 2112 and 2114 for any Covered Species in the Project Area. Therefore, CDFW finds that the

ITP that CDFW is issuing to the Authority is consistent with all regulations adopted pursuant to sections 2112 and 2114.

D. The Permittee has ensured adequate funding to implement the required minimization and mitigation measures, and for monitoring compliance with, and the effectiveness of, those measures.

CDFW finds, based on substantial evidence in the ITP application, Final EIR/EIS and the administrative record of proceedings that the Permittee has ensured adequate funding to implement the measures required by the ITP to minimize and fully mitigate the impacts of the taking, and to monitor compliance with, and the effectiveness of, the conservation measures. (See ITP Conditions of Approval 10 and 11.) Because of the complexity of the Project and integration of a detailed Adaptive Management Program, the unique funding structure of the Project and its relationship to Permittee's water supply contractors, SWP funding requirements under state law, and additional mitigation project siting and design work that must take place, CDFW has determined that the following funding assurances approach provides substantial evidence of adequate funding to implement the Conditions of Approval of the ITP.

Estimated costs to implement studies and monitoring required as in Conditions 9.6.10, 9.6.11, and 9.8 of the ITP and to support the required Adaptive Management Program to begin within the near term are identified in a funding assessment developed collaboratively by CDFW, Permittee, NMFS, USFWS and Reclamation. (Implementation Schedule for AMP and Interagency AMP funding spreadsheet, ITP Attachment 5.) The existing annual budget for monitoring, studies, and model development for assessing all aspects for management associated with the CVP and SWP and meeting requirements of the existing biological opinions, CESA authorizations and D-1641 is approximately $66 million. Additional estimated costs for studies and monitoring associated with the ITP could total an additional $50 million per year through the first 10 years following permit issuance. The Permittee in coordination with Reclamation has committed to securing funding for implementation of the necessary studies required by the ITP and to support the Adaptive Management Program as described in Attachment 5 to the ITP.

CDFW has estimated the cost of acquisition, protection, and perpetual management of the HM lands as shown in Table 10.2 of the ITP. The methods used to determine these costs are described in Section 7.1.1 of Permittee's application and are based largely on the detailed cost estimates of relevant conservation measures and other program elements from the 2013 Bay Delta Conservation Plan (BDCP) Public Draft and from Exhibit E Budget and Schedule of the January 2016 Design and Construction Enterprise (DCE) Agreement, with costs expressed in 2014 dollars.

Permittee is a party to a long-term water supply contract with each of its 29 water supply customers, referred to as "contractors." Permittee and/or one or more of the SWP contractors or other entities participating in the Project will likely issue revenue bonds to fund the portion of the construction and mitigation costs accruing to SWP contractors. Capital costs associated with mitigation required by this permit will also be funded in this manner. The Permittee has confirmed that the contracts between Permittee and the participating SWP contractors will provide for the payment of debt service and ongoing operation and maintenance costs, including all mitigation and monitoring costs incurred during construction, operation, maintenance and monitoring associated with the Project, including all such activities required by the ITP. Prior to commencement of Covered Activities, Permittee shall furnish CDFW with a copy of the agreement(s) entered into or arrangement made, as required by the Delta Reform Act, described below, to pay for the construction and mitigation costs associated with the Project, including ITP mitigation requiring land purchase, preservation and restoration of compensatory habitat and the perpetual management and monitoring of the compensatory mitigation lands.

The Burns-Porter Act (Act), which created the SWP in 1961, provides that all revenues from the SWP water and power sales be deposited in a special account, and that these moneys may be used for SWP purposes only. The Act also requires that the funds in this account may only be used based on a priority system. The first priority is the maintenance and operations of the SWP facilities. Included within the costs covered by SWP maintenance and operation activities are the costs incurred by Permittee for the preservation of fish and wildlife activities. Permittee’s avoidance, minimization and mitigation measures that will be described in the management plan are considered costs incurred for the preservation of wildlife, and thus are funded by first priority SWP special revenues.

Permittee adjusts the charges to the SWP contractors to ensure the SWP never operates at a deficit. The SWP funding is not subject to Legislative funding processes associated with most other State funds. The water supply contracts require contractors to raise taxes on real property to pay SWP bills if they do not have sufficient funds to pay, and include “take or pay” provisions requiring payment to cover bond debt service regardless of whether water deliveries are reduced because of drought or other conditions. Water Code section 11651 directs any “agency which contracts to purchase from [DWR] any water, use of water, water storage, electric power, or other service shall provide for the punctual payment to [DWR] of all amounts which become due under the contract.” Additionally, the Delta Reform Act (Water Code section 85089), Covered Activities shall not commence until the SWP and CVP Contractors have entered into an agreement or made arrangements to pay for the construction and mitigation costs associated with the Project (including the CESA mitigation requiring land purchase and restoration and enhancement of HM lands and the long term management, and monitoring of the HM lands). These factors contribute to the uniquely secure funding stream provided through the SWP contracts and state law.

Prior to commencement of Covered Activities, Permittee shall furnish CDFW with a copy of: 1) the contract(s) entered into or arrangement made to satisfy California Water Code, section 85089, subdivision (a); and 2) documentation demonstrating that subsequent financial agreements to cover repayment of the Project bonds explicitly identify the costs of long-term management of HM lands as a cost reimbursable by the contractors under the terms of the contracts and the California Water Code. Condition of Approval 10 requires that Permittee annually provides documentation demonstrating that cumulative HM lands permanently protected (and restored where required) for each Covered Species is at least 10 percent greater than the cumulative impacts to each

Covered Species habitat (10 percent stay-ahead requirement). This requirement will ensure that HM lands requirements are met ahead of the related impacts to Covered Species habitat. In addition, Permittee shall provide initial five-year funding strategies documenting detailed cost estimates and funding strategies to pay for construction monitoring and compensatory mitigation implementation, and implementation of the existing monitoring, studies and model development and additional studies and monitoring associated with the ITP. The ITP requires these funding strategies to be updated annually and provided to CDFW over the ITP term.

Under written terms acceptable to CDFW, Permittee shall provide long-term funding for the perpetual management of the HM lands by using revenues derived from the SWP charges to the SWP contractors under long-term water supply contracts, and any subsequent agreements. However if this funding is no longer available, Permittee shall establish a long-term management fund endowment, held in a CDFW-approved fund, that provides funds for the perpetual management, maintenance, monitoring, and other activities on the HM lands.

As a result, SWP revenues, as managed and distributed under the Act, and with additional assurances provided through the Conditions of Approval required by the ITP, provide a secure funding source for the measures included in the ITP to minimize and fully mitigate the impacts of the Project's taking.

In sum, CDFW finds, based on substantial evidence in the administrative record of proceedings, the Permittee has assured adequate funding for purposes of implementing and monitoring compliance with the minimization and mitigation measures required by the ITP.

E. Issuance of the ITP will not jeopardize the continued existence of any Covered Species.

CDFW finds, based on substantial evidence in the ITP application, Final EIR/EIS, and administrative record of proceedings, that issuance of the Permittee's ITP will not jeopardize the continued existence of any of the Covered Species. CDFW's finding is based on the best scientific and other information reasonably available, including various analyses prepared specifically for and during the preparation of the Final EIR/EIS. This information includes, but is not limited to, analysis in the Final EIR/EIS, consultation with CDFW, NMFS, and USFWS staff, and other information included in the administrative record of proceedings. Such other information includes research, field work, meetings, and extensive written analysis regarding the impacts of the Project on the Covered Species by numerous biologists in CDFW, NMFS, USFWS, and the various consulting firms. CDFW's finding is also based on consideration of the Covered Species' capability to survive and reproduce, and adverse impacts of the authorized taking on those abilities, as discussed in detail above under Section IV.B and as minimized and fully mitigated pursuant to the ITP Conditions of Approval, in light of species-specific surveys of the Project Area, where available, known population trends, known threats to the species, and reasonably foreseeable impacts on the species from other related projects and activities. (See Cal. Code of Regs., tit. 14, § 783.4, subd. (b) (See ITP Application Sections 2, 4, and 5, and Appendices 4A, 4B, 4D, and 5A; EIR/EIS Sections 4.3.7 Fish and Aquatic Resources and 4.3.8 Terrestrial Biological Resources; EIR/EIS Executive Summary; EIR/EIS Chapter 3, Design of Alternatives, Environmental Commitments; EIR/EIS Chapter 8, Water Quality; EIR/EIS Chapter 11, Fish and Aquatic Resources; EIR/EIS Chapter 12, Terrestrial Biological Resources; EIR/EIS Appendix 3B, Environmental Commitments AMMs and CMs; EIR/EIS Appendix 5A, BDCP/California WaterFix FEIR/FEIS Modeling, Technical Appendix; EIR/EIS Appendix 5F, Comparison of FEIR Alternatives 2D, 4A, and 5A Modeling Results; EIR/EIS Appendix 5G, Comparison of FEIR'S Alternative 4A Modeling Results to the California Water Fix Section BA Proposed Action Modeling Results; EIR/EIS Appendix 8I, Mercury; EIR/EIS Appendix 8J, Nitrate; EIR/EIS Appendix 8K, Organic Carbon; EIR/EIS Appendix 8L, Pesticides; EIR/EIS Appendix 8M, Selenium; EIR/EIS Appendix 8N, Trace Metals; EIR/EIS Appendix 11A, Covered Species Description; EIR/EIS Appendix 11C, CALSIM II Model Results Utilized in the Fish Analysis; EIR/EIS Appendix 11D, Sacramento River Water Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis; and EIR/EIS Appendix 11E, Sensitivity Analysis to Confirm RDEIR/SDEIS Determinations for Fish and Aquatic Species Using Updated Model Outputs for Alternatives 2D, 4A, and 5A; 2013 Public Draft of the Bay Delta Conservation Plan Appendix 5J; 2016 Biological Assessment for the California Water Fix; 2017 USFWS Biological Opinion for California Water Fix; and 2017 NMFS Biological Opinion for California Water Fix.) CDFW's determinations, below, are based on its consideration of the best scientific and other information that is reasonably available.

In addition, the issuance of the ITP will not jeopardize the continued existence of any Covered Species as follows:

California Tiger Salamander (*Ambystoma californiense*)

As discussed above in Section V.B.1, Covered Activities would result in the permanent loss of 50 acres of suitable upland habitat for CTS and the temporary loss of up to 6 acres of suitable upland habitat for CTS. However, this loss would not jeopardize the continued existence of CTS because the mitigation measures discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of CTS as described in Section V.B.1.a above. These mitigation measures include but are not limited to the preservation and management of 150 acres of suitable upland habitat for CTS and on-site restoration of temporarily impacted habitat. To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CTS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation - HM Lands Criteria for California Tiger Salamander Terrestrial Cover and Aestivation Habitat* and will be consistent with CTS habitat conditions within the East Contra Costa County HCP/NCCP reserve system. Permittee will ensure permanent protection and funding for perpetual management of compensatory CTS habitat, including monitoring for suitable habitat features and presence of CTS. Temporary impacts will be restored on-site according to the requirements outlined in Condition of Approval 10.8 and consistent with the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*.

Furthermore, construction and operation of the Project are not likely to jeopardize the continued existence of CTS because the impacts on suitable CTS habitat would be small relative to the extent of suitable habitat for the species in its range. In addition, breeding habitat would be avoided, and the number of occurrences of CTS within the maximum dispersal distance (1.5 miles) of the alignment is limited.

Swainson's Hawk (*Buteo swainsoni*)

As discussed above in Section V.B.1, Covered Activities would result in the permanent loss of 3,770 acres of SWHA foraging habitat and 22 acres of SWHA nesting habitat. Covered Activities will also result in the temporary loss of 1,114 acres of SWHA foragin habitat. However, this loss would not jeopardize the continued existence of SWHA because the mitigation measures discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of SWHA as described in Section V.B.1.b above. These mitigation measures include but are not limited to the preservation and management of 3,770 acres of SWHA foraging habitat and 44 acres of SWHA nesting habitat. They also include on-site restoration for temporary impacts to 1,114 acres of foraging habitat.

In addition to protecting or restoring suitable nesting habitat as compensatory mitigation, seven suitable nest sites that will be removed by Covered Activities will be mitigated by establishing seven replacement nest sites comprised of five mature suitable nest trees and 15 five-gallon container-sized suitable nest trees planted or transplanted to a location specified in a Vegetation Restoration Plan approved by CDFW and adjacent to conserved foraging habitat. This will ensure full mitigation for SWHA during the temporal gap of restored nesting habitat developing tall, mature trees and will provide a heterogeneous nest site structure that will ensure suitable nest tree survival and sustainability over a long period of time. Permittee will follow criteria for the created nest sites described in 10.3 *Swainson's Hawk Nest Site Replacement* to ensure the nest sites meet the life history needs of SWHA; for example, providing adequate spacing for SWHA territories, nest sites that are close to suitable foraging habitat, and timing that minimizes the impacts of the temporal gap between loss of mature trees and transplanting replacement trees. Additionally, for each suitable nest tree removed, Permittee will plant five five-gallon-container sized native trees to replace the lost trees. These trees will be planted near mature trees in the newly established nest sites and adjacent to conserved foraging habitat. In addition to habitat restoration and conservation Permittee will install bird strike diverters on all new Project transmission lines and an equivalent length of existing transmission lines in the Project Area to mitigate for increased risk of SWHA strikes on powerlines.

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to SWHA, compensatory mitigation lands will meet the criteria for suitable habitat defined in Condition of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Permittee will ensure permanent protection and funding for perpetual management of compensatory SWHA habitat, including monitoring for suitable habitat features and presence of SWHA. Temporary impacts will be restored on-site according to the requirements outlined in Condition of Approval 10.8 and consistent with the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*.

Furthermore, construction and operation of the Project are not likely to jeopardize the continued existence of SWHA because the impacts on suitable nesting and foraging habitat for SWHA would be small relative to the extent of suitable habitat in its range. If active nests would be removed or affected, nest tree removal would occur outside of the breeding season as required by the EIR/EIS and the ITP, and trees would be planted as mitigation in suitable foraging habitat or adjacent to foraging habitat. Compensatory mitigation is proposed for each suitable nest tree that would be removed by the Project.

Giant Garter Snake (*Thamnophis gigas*)

As discussed above in Section V.B.1, Covered Activities would result in the permanent loss of 570 acres of suitable upland habitat and 205 acres of suitable aquatic habitat for GGS. Covered Activities will also result in the temporary loss of 165 acres of suitable upland habitat for GGS. However, this loss would not jeopardize the continued existence of GGS because the mitigation measures discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of GGS as described in Section V.B.1.c above. These mitigation measures include but are not limited to the preservation and management of 615 acres of suitable aquatic habitat and 1,710 acres of suitable upland habitat for GGS. Per Condition of Approval 10.3, if all HM lands intended to provide compensatory mitigation for impacts to GGS meet the requirements of large contiguous blocks of aquatic and upland habitat surrounded by compatible land uses outlined in the USFWS *2015 Revised Draft Recovery Plan for Giant Garter Snake*, and CDFW approves in writing, Permittee shall be required to provide for the permanent protection and management of 410 acres of GGS aquatic habitat and 1,140 acres of upland GGS habitat.

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to GGS, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation* Permittee will ensure permanent protection and funding for perpetual management of compensatory GGS habitat, including monitoring for suitable habitat features and presence of GGS. Temporary impacts will be restored on-site according to the requirements outlined in Condition of Approval 10.8 and consistent with the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*.

Furthermore, construction and operation of the Project are not likely to jeopardize the continued existence of GGS because the impacts on suitable GGS habitat would be small relative to the extent of suitable habitat for the species in its range and the number of occurrences of GGS within the Project Area is limited.

Tricolored Blackbird (*Agelaius tricolor*)

As discussed above in Section V.B.1, Covered Activities would result in the permanent loss of 2,063 acres of foraging-breeding habitat, 1,774 acres of foraging-nonbreeding habitat, 16 acres nesting habitat, and 20 acres roosting habitat suitable for TRBL. The project will also result in the temporary loss of 299 acres of foraging-breeding habitat and 377 acres of foraging-nonbreeding habitat suitable for TRBL. However, this loss would not jeopardize the continued existence of TRBL because the mitigation measures discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of TRBL as described in Section V.B.1.d above. These mitigation measures include but are not limited to the preservation and management of 2,063 acres foraging-breeding habitat, 1,774 acres foraging-nonbreeding habitat, 48 acres nesting habitat, and 40 acres roosting habitat suitable for TRBL. To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to TRBL, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Permittee will ensure permanent protection and funding for perpetual management of compensatory TRBL habitat, including monitoring for suitable habitat features and presence of TRBL. Temporary impacts will be restored on-site according to the requirements outlined in Condition of Approval 10.8 and consistent with the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*.

Furthermore, construction and operation of the Project are not likely to jeopardize the continued existence of TRBL because the impacts on suitable TRBL habitat would be small relative to the extent of suitable habitat for the species in its range. In addition, the number of known successful breeding colonies within the Project Area is limited.

Winter-run Chinook Salmon (*Oncorhynchus tshawytscha)*

As discussed above in Section V.B.1, Covered Activities would result in near- and far-field effects to CHNWR as well as the permanent loss of 1.44 linear miles of channel margin habitat and 31.9 acres of tidal perennial habitat suitable for CHNWR and the temporary loss of up to 20.1 acres of tidal perennial habitat suitable for CHNWR. Covered Activities will also permanently alter 2,190 acres of tidal perennial aquatic habitat in CCF suitable for CHNWR. However, these impacts and habitat loss would not jeopardize the continued existence of CHNWR because the mitigation measures, avoidance and minimization measures, and environmental commitments discussed in the Final EIR/EIS and required by the ITP, Conditions of Approval within the ITP, implementation of the Adaptive Management Program, as well as additional mitigation measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of CHNWR as described in Section V.B.1.e above.

ITP compensatory mitigation

The ITP mitigation measures which provide compensatory mitigation for impacts to CHNWR include but are not limited to: the preservation, restoration and management of 4.3 linear miles of channel margin habitat and 154.8 acres of tidal perennial habitat to compensate for construction- and operations-related impacts. In addition to this compensatory mitigation Permittee is also required to provide $4,000,000 in annual funding for projects to benefit CHNWR and CHNSR in the Sacramento River watershed upstream of the Delta. Using this funding, Permittee shall establish a new population of CHNWR through introduction and reintroduction of fish into Sacramento River tributaries (which may include Battle Creek and/or upstream of Shasta Reservoir) and support that population with associated habitat restoration prior to initiation of the Test Period or within 12 years of permit issuance. Permittee shall focus siting and design of required CHNWR compensatory habitat mitigation for impacts associated with Project operations on restoring 80 acres of spawning and rearing habitat in the upper Sacramento River above the RBDD. Reintroduction and establishment of a new population, ongoing management of the new population, habitat restoration, or other measures shall meet the low extinction risk criteria identified by the Central Valley Technical Recovery Team (CVTRT) (Lindley et al.2007) within the term of this permit. Permittee shall fully fund and implement reintroduction and restoration action effectiveness monitoring and extinction risk monitoring to ensure that the goal is met.

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CHNWR, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Permittee will ensure permanent protection and funding for perpetual management of compensatory CHNWR habitat, including monitoring for suitable habitat features and presence of CHNWR.

ITP Conditions of Approval

The ITP contains Conditions of Approval that minimize impacts of Project construction on CHNWR. Generally, these Conditions of Approval include 1) requirements to track and monitor all Project impacts to CHNWR habitat and individuals, 2) restrictions on construction Covered Activities to minimize the risk of exposure of CHNWR to erosion, sedimentation, and contaminants, 3) restrictions on the timing and type of in-water work that may be performed during Project construction, and 4) detailed guidelines governing dewatering and CHNWR salvage operations during in-water Covered Activities.

Impacts of Project operations on CHNWR are minimized through a wide range of Conditions of Approval included in the ITP. Specifically, the ITP includes requirements to 1) utilize operational criteria and real-time operational criteria to govern operations of

Project facilities when CHNWR are likely to be present within the Project Area, 2) establish and coordinate a suite of multi-agency technical teams tasked with developing, reviewing, and approving components of Project design, monitoring and scientific studies needed to bolster the current understanding of CHNWR biology, and 3) implement a phased approach to developing Project operations plans and initiating operation of the NDD intakes that allows for continued monitoring, studies, and review of the impacts of coordinated south and north Delta Project operations on CHNWR. Additionally, the ITP includes operating criteria (described in Condition of Approval 9.9.4, Table 9.9.4-1) for south Delta export facilities that could result in improved conditions for CHNWR over the long-term and ameliorate impacts associated with climate change in the south Delta.

The Conditions of Approval in the ITP that minimize impacts associated with Project construction and operations are comprehensive and broad in scope. They require Permittee to collaboratively develop plans addressing construction timing and methods, continue to fund and support existing monitoring, scientific research on CHNWR in the Delta, and design and implement new scientific studies and to implement the Adaptive Management Program. The ITP requires implementation of a collaborative multi-agency Adaptive Management Program (ITP Attachment 5) to facilitate the review of required plans and support and implement new scientific research, monitoring, and modeling that builds on existing efforts, and through a structured decision-making process to review and make recommendations to integrate results of this research into the ITP, USFWS (2017), and NMFS (2017). Final decision-making authority with respect to the permit requirements is retained by CDFW. The Adaptive Management Program identifies key areas of focused research to resolve uncertainties and evaluate mitigation approaches related to CHNWR. Together, the ITP Conditions of Approval and Adaptive Management Program minimize and mitigate impacts of Project construction and operations on CHNWR.

Biological Criterion 1 requires that the Project result in no more than a 5% reduction in pre-construction juvenile CHNWR survival through the NDD intake reach. Biological Criterion 2 requires that the Project not result in a change in juvenile CHNWR survival through Chipps Island from pre-Project conditions. The biological criteria will be implemented through establishment of baseline, pre-Project survival rates and ongoing monitoring to document survival rates on an annual basis throughout the permit term. The Adaptive Management Program will be used to track results of required monitoring and studies, determine whether the requirements of both biological criteria are being met, and impose additional requirements on Project operations if the biological criteria are not met. In this way the Conditions of Approval in the ITP and the Adaptive Management Program will ensure that CHNWR populations will not decline as a result of the Project over the long-term.

Known threats to the species and reasonably foreseeable impacts

Known population trends for CHNWR, including increased stress to CHNWR resulting from recent drought conditions, are summarized in Attachment BO#146 of the ITP application, excerpted from the Biological Assessment prepared for federal ESA evaluation of the Project, and in other information available to CDFW. In addition to the Project, known threats to the species and reasonably foreseeable impacts to CHNWR from other projects and activities include ongoing operations of the CVP/SWP, limited habitat availability, activities identified in Section 4.3.8.1 of the ITP application, and climate change. Analyses of Project impacts to CHNWR, discussed in Section V.B.1.e, above, generally disclosed the effects of joint operations of the CVP and the Project within the Delta, and the Project includes operational criteria stemming from USFWS (2008) and NMFS (2009) that govern both SWP and CVP facilities.

Several processes, currently ongoing or reasonably foreseeable, are also likely to affect the Project's operations and the status of CHNWR over the course of the permit term. These ongoing processes include the reinitiation of consultation on the biological opinions for CVP/SWP water operations (USFWS 2008 and NMFS 2009), implementation of the Salmon Resiliency Strategy (California Natural Resources Agency 2017), and revisions to the 2006 Water Quality Control Plan.

Reclamation is in the process of reinitiating consultation on the coordinated long-term operation of the CVP/SWP (NMFS 2009 and CDFW's associated Consistency Determination No. 2080-2012-005-00). This broadly-scoped consultation is expected to review and possibly update system-wide operating criteria for the long term operations of the CVP/SWP, consistent with the requirements of ESA Section 7. Reclamation has specifically requested coordination on possible modifications to the existing reasonable and prudent alternative actions addressing Shasta temperature management. Reclamation is also required to control water temperature in the Sacramento River pursuant to State Water Board Order WR 90-5. The State Water Resources Control Board is in the process of developing and implementing updates to the 2006 Water Quality Control Plan. Phase 2 of this process will involve comprehensive changes to the 2006 Water Quality Control Plan to protect beneficial uses of water, including environmental uses, in tributaries to the Delta other than the San Joaquin River. The reinitiation of consultation and the State Water Resources Control Board's update of the 2006 Water Quality Control Plan are expected to be coordinated processes.

In parallel with the reinitiation of consultation of NMFS (2009), the California Natural Resources Agency has developed the Salmon Resiliency Strategy (California Natural Resources Agency 2017), a science-based approach to improving CHNWR viability by implementing specific habitat restoration actions. The Salmon Resiliency Strategy is founded upon the goal of promoting actions to address specific CHNWR life-stage stressors and improve the viability of CHNWR in the Sacramento Valley. It includes a wide range of specific actions including: 1) complete the Battle Creek Salmon and Steelhead Restoration Project, 2) implement the Battle Creek Reintroduction Plan, 3) remove the Battle Creek natural barrier, 4) implement the McCloud Reintroduction Pilot Plan, 5) provide instream flows to support CHNWR in Mill, Deer, Antelope and Butte Creeks, 6) restore fish passage and habitat in upper Sacramento tributaries, 7) restore instream habitats in the upper Sacramento River, 8) remove Sunset Pumps Rock Dam, 9) restore off-channel rearing, streambank and riparian habitats along the Sacramento River, 10) complete fish screen construction on major diversions along the Sacramento River, 11) improve adult fish passage on the Sutter Bypass, 12) improve adult fish passage on the Yolo Bypass, 13) improve juvenile salmonid access to the Yolo Bypass and increase the duration and frequency of flooding, 14) construct Georgiana Slough NPB, and 15) restore tidal habitat in the Delta (California Natural Resources Agency 2017). Many of the actions called for in the Salmon Resiliency Strategy complement and enhance the compensatory mitigation required in the ITP.

Permittee conducted extensive analyses of changes in key abiotic factors, and associated impacts on CHNWR as a result of climate change in 2025 and 2060 in the 2013 BDCP Public Draft and the 2081(b) application (summarized in ICF International 2017). Current global climate change models predict minimal changes in stream flows and water temperature through 2035, as compared to more substantial changes anticipated in the second half of the 21st century (ICF International 2016, Section 5, and ICF International 2017). The ITP's expiration date, December 31st 2042, was selected to balance the time frames of five key factors which influence the status of CHNWR: 1) construction and testing of the coordinated operation of Project facilities, including the NDD intakes, 2) response of the CHNWR population to habitat restoration, 3) response of the CHNWR population to implementation of planned reintroductions, 4) changes in stressors on CHNWR as a result of climate change through 2042, and 5) improved understanding of future changes in stressors as a result of climate change in the second half of the 21st century. From the middle to the end of the 21st century more substantial increases in stressors on CHNWR are predicted to begin. At the same time, uncertainty in predictions from global climate change models also increases (Allen and Luptowitz 2017).

The ITP requires extensive and ongoing evaluation of the Project impacts, which will occur in light of other, related impacts to the species. Throughout the permit term the Permittee is required to utilize operating criteria to meet or exceed Biological Criteria 1 and 2. Through achievement of biological criteria, robust monitoring and scientific research, and implementation of the Adaptive Management Program, the ITP requires Project operations that are responsive to developments in scientific understanding and changes in the status of Covered Fish Species over the permit term. Condition of Approval 6 of the ITP requires that Permittee notify and consult with CDFW regarding modifications to biological opinions, water rights decisions or Project modification to determine whether an amendment to the ITP is necessary to ensure permit issuance criteria are met over the term of the ITP. Furthermore, California Code of Regulations, title 14, section 783.6, subdivision (c), CDFW shall amend the ITP as required by law, regardless of whether Permittee concurs with the amendment, including if CDFW determines that continued implementation of the Project as authorized under the ITP would jeopardize the continued existence of the Covered Species. Therefore, when viewed in light of the population trends, known threats and reasonably foreseeable impacts to CHNWR, including those resulting from the processes described above, the impacts of the taking do not jeopardize the continued existence of CHNWR.

<u>Spring-run Chinook Salmon (*Oncorhynchus tshawytscha*)</u>

As discussed above in Section V.B.1, Covered Activities would result in near- and far-field effects to CHNSR as well as the permanent loss of 1.44 linear miles of channel margin habitat and 31.9 acres of tidal perennial habitat suitable for CHNSR and the temporary loss of up to 20.1 acres of tidal perennial habitat suitable for CHNSR. Covered Activities will also permanently alter 2,190 acres of tidal perennial aquatic habitat in CCF suitable for CHNSR. However, these impacts and habitat loss would not jeopardize the continued existence of CHNSR because the mitigation measures, avoidance and minimization measures, and environmental commitments discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of CHNSR as described in Section V.B.1.e above.

ITP compensatory mitigation

The ITP mitigation measures which provide compensatory mitigation for impacts to CHNSR include but are not limited to: the preservation, restoration, and management of 4.3 linear miles of channel margin habitat and 154.8 acres of tidal perennial habitat to compensate for impacts as a result of Project construction and operations. Permittee is also required to provide $4,000,000 in annual funding for projects to benefit CHNWR and CHNSR in the Sacramento River watershed upstream of the Delta. Using this funding, Permittee shall focus siting and design of required CHNSR compensatory habitat mitigation for impacts associated with Project operations on restoring 80 acres of spawning and rearing habitat in the upper Sacramento River above the Red Bluff Diversion Dam (RBDD) and habitat in the middle Sacramento River (e.g., in Sutter Bypass) and associated tributaries. Permittee shall conduct habitat restoration prior to initiation of the Test Period or within 12 years of permit issuance. Permittee shall fully fund and implement restoration action effectiveness monitoring and extinction risk monitoring.

To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to CHNSR, compensatory mitigation lands will meet the criteria for suitable habitat defined in Conditions of Approval 8.4.1 and the requirements of ITP Attachment 4 – *Covered Species-Specific Criteria for HM Lands Suitable for Compensatory Mitigation*. Permittee will ensure permanent protection and funding for perpetual management of compensatory CHNSR habitat, including monitoring for suitable habitat features and presence of CHNSR.

ITP Conditions of Approval

The ITP contains Conditions of Approval that minimize impacts of Project construction on CHNSR. Generally, these Conditions of Approval include 1) requirements to track and monitor all Project impacts to CHNSR habitat and individuals, 2) restrictions on construction Covered Activities to minimize the risk of exposure of CHNSR to erosion, sedimentation, and contaminants, 3) restrictions on the timing and type of in-water work that may be performed during Project construction, and 4) detailed guidelines governing dewatering and CHNSR salvage operations during in-water Covered Activities.

Impacts of Project operations on CHNSR are minimized through a wide range of Conditions of Approval included in the ITP. Specifically, the ITP includes requirements to 1) utilize operational criteria and real-time operational criteria to govern operations of Project facilities when CHNSR are likely to be present within the Project Area, 2) establish and coordinate a suite of multi-agency technical teams tasked with developing, reviewing, and approving components of Project design, monitoring and scientific studies needed to bolster the current understanding of CHNSR biology, and 3) implement a phased approach to developing Project operations plans and initiating operation of the NDD intakes that allows for continued monitoring, studies, and review of the impacts of coordinated south and north Delta Project operations on CHNSR. Additionally, the ITP includes operating criteria (described in Condition of Approval 9.9.4, Table 9.9.4-1) for south Delta export facilities that could result in improved conditions for CHNSR over the long-term and ameliorate impacts associated with climate change in the south Delta.

The Conditions of Approval in the ITP that minimize impacts associated with Project construction and operations are comprehensive and broad in scope. They require Permittee to collaboratively develop plans addressing construction timing and methods, continue to fund and support existing monitoring and scientific research on CHNSR in the Delta, and design and implement new scientific studies and to implement the Adaptive Management Program. The ITP requires implementation of a collaborative multi-agency Adaptive Management Program (ITP Attachment 5) to facilitate the review of required plans and support and implement new scientific research, monitoring, and modeling that builds on existing efforts, and through a structured decision-making process to review and made recommendations to integrate results of this research into the ITP, USFWS (2017), and NMFS (2017). Final decision making authority with respect to the permit requirements is retained by CDFW. The Adaptive Management Program identifies key areas of focused research to resolve uncertainties and evaluate mitigation approaches related to CHNSR. Together, the ITP Conditions of Approval and the Adaptive Management Program minimize and mitigate impacts of Project construction and operations on CHNSR.

Biological Criterion 1 requires that the Project result in no more than a 5% reduction in pre-construction juvenile CHNSR survival through the NDD intake reach. Biological Criterion 2 requires that the Project not result in a change in juvenile CHNSR survival through Chipps Island from pre-Project conditions. The biological criteria will be implemented through establishment of baseline, pre-Project survival rates and ongoing monitoring to document survival rates on an annual basis throughout the permit term. The Adaptive Management Program will be used to track results of required monitoring and studies, determine whether the requirements of both biological criteria are being met, and impose additional requirements on Project operations if the biological criteria are not met. In this way the Conditions of Approval in the ITP and the Adaptive Management Program will ensure that CHNSR populations will not decline as a result of the Project over the long-term.

Known threats to the species and reasonably foreseeable impacts

Known population trends for CHNSR, including increased stress to CHNSR resulting from recent drought conditions, are summarized in Attachment BO#146 of the ITP application, excerpted from the Biological Assessment prepared for federal ESA evaluation of the Project, and in other information available to CDFW. In addition to the Project, known threats to the species and reasonably foreseeable impacts to CHNSR from other projects and activities include ongoing operations of the CVP/SWP, limited habitat availability, activities identified in Section 4.3.8.1 of the 2081(b) application, and climate change. Analyses of Project impacts to CHNSR, discussed in Section V.B.1.e, above, generally disclosed the effects of joint operations of the CVP and the Project within the Delta, and the Project includes operational criteria stemming from USFWS (2008) and NMFS (2009) that govern both SWP and CVP facilities.

Several processes, currently ongoing or reasonably foreseeable, are also likely to affect the Project's operations and the status of CHNSR over the course of the permit term. These ongoing processes include the reinitiation of consultation on the biological opinions for CVP/SWP water operations (USFWS 2008 and NMFS 2009), implementation of the Salmon Resiliency Strategy (California Natural Resources Agency 2017), and revisions to the 2006 Water Quality Control Plan.

Reclamation is in the process of reinitiating consultation on the coordinated long-term operation of the CVP/SWP (NMFS 2009 and CDFW's associated Consistency Determination No. 2080-2012-005-00). This broadly-scoped consultation is expected to review and possibly update system-wide operating criteria for the long term operations of the CVP/SWP, consistent with the requirements of ESA Section 7. Reclamation has specifically requested coordination on possible modifications to the existing reasonable and prudent alternative actions addressing Shasta temperature management. Reclamation is also required to control water temperature in the Sacramento River pursuant to State Water Board Order WR 90-5. The State Water Resources Control Board is in the process of developing and implementing updates to the 2006 Water Quality Control Plan. Phase 2 of this process will involve comprehensive changes to the 2006 Water Quality Control Plan to protect beneficial uses of water, including environmental uses, in tributaries to the Delta other than the San Joaquin River. The reinitiation of consultation and the State Water Resources Control Board's update of the 2006 Water Quality Control Plan are expected to be coordinated processes.

In parallel with the reinitiation of consultation of NMFS (2009), the California Natural Resources Agency has developed the Salmon Resiliency Strategy (California Natural Resources Agency 2017), a science-based approach to improving CHNSR viability in the Sacramento River watershed by implementing specific habitat restoration actions. The Salmon Resiliency Strategy is founded upon the goal of promoting actions to address specific CHNSR life-stage stressors and improve the viability of CHNSR in the Sacramento Valley. It includes a wide range of specific actions including: 1) complete the Battle Creek Salmon and Steelhead Restoration Project, 2) remove the Battle Creek natural barrier, 3) provide instream flows to support CHNSR in Mill, Deer, Antelope and Butte Creeks, 4) restore fish passage and habitat in upper Sacramento tributaries, 5) restore instream habitats in the upper Sacramento River, 6) remove Sunset Pumps Rock Dam, 7) restore off-channel rearing, streambank and riparian habitats along the Sacramento River, 8) complete fish screen construction on major diversions along the Sacramento River, 9) improve adult fish passage on the Sutter Bypass, 10) improve adult fish passage on the Yolo Bypass, 11) improve juvenile salmonid access to the

Yolo Bypass and increase the duration and frequency of flooding, 12) construct Georgiana Slough NPB, and 13) restore tidal habitat in the Delta (California Natural Resources Agency 2017). Many of the actions called for in the Salmon Resiliency Strategy complement and enhance the compensatory mitigation required in the ITP.

Permittee conducted extensive analyses of changes in key abiotic factors, and associated impacts on CHNSR as a result of climate change in 2025 and 2060 in the 2013 BDCP Public Draft and the 2081(b) application (summarized in ICF International 2017). Current global climate change models predict minimal changes in stream flows and water temperature through 2035, as compared to more substantial changes anticipated in the second half of the 21st century (ICF International 2016, Section 5 and ICF International 2017). The ITP's expiration date, December 31st 2042, was selected to balance the time frames of four key factors that influence the status of CHNSR: 1) construction and testing of the coordinated operation of Project facilities, including the NDD intakes, 2) response of the CHNSR population to habitat restoration, 3) changes in stressors on CHNSR as a result of climate change through 2042, and 4) improved understanding of future changes in stressors as a result of climate change in the second half of the 21st century. From the middle to the end of the 21st century more substantial increases in stressors on CHNSR are predicted to begin. At the same time, uncertainty in predictions from global climate change models also increases (Allen and Luptowitz 2017).

The ITP requires extensive and ongoing evaluation of the Project impacts, which will occur in light of other, related impacts to the species. Throughout the permit term the Permittee is required to utilize operating criteria to meet or exceed Biological Criteria 1 and 2. Through achievement of biological criteria, robust monitoring and scientific research, and implementation of the Adaptive Management Program, the ITP requires Project operations that are responsive to developments in scientific understanding and changes in the status of Covered Fish Species over the permit term. Condition of Approval 6 of the ITP requires that Permittee notify and consult with CDFW regarding modifications to biological opinions, water rights decisions or Project modifications to determine whether an amendment to the ITP is necessary to ensure permit issuance criteria are met over the term of the ITP. Furthermore, California Code of Regulations, title 14, section 783.6, subdivision (c), CDFW shall amend the ITP as required by law, regardless of whether Permittee concurs with the amendment, including if CDFW determines that continued implementation of the Project as authorized under the ITP would jeopardize the continued existence of the Covered Species. Therefore, when viewed in light of the population trends, known threats and reasonably foreseeable impacts to CHNWR, including those resulting from the processes described above, the impacts of the taking do not jeopardize the continued existence of CHNWR.

Delta Smelt (*Hypomesus transpacificus*)

As discussed above in Section V.B.1, Covered Activities would result in near- and far-field effects to DS and the permanent loss of 500.6 acres of shallow water habitat and 25.3 acres of tidal perennial habitat suitable for DS. However, these effects and habitat loss would not jeopardize the continued existence of DS because the mitigation measures, avoidance and minimization measures, and environmental commitments discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of DS as described in Section V.B.1.f above.

ITP compensatory mitigation

The ITP mitigation measures that provide compensatory mitigation for impacts to DS include but are not limited to: the preservation, restoration, and management of 1,827.7 acres of habitat suitable for DS that will expand the diversity, quantity, and quality of rearing and refuge habitat in the tidal portions of the Delta and Suisun Marsh. To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to DS, siting and design of compensatory mitigation lands will be informed by the specifications and habitat crediting process defined in the Guidance for Smelt HM Lands Suitable for Compensatory Mitigation (ITP Attachment 8). Permittee will ensure permanent protection and funding for perpetual management of compensatory DS habitat, including monitoring for suitable habitat features and presence of DS.

ITP Conditions of Approval

The ITP contains Conditions of Approval that minimize impacts of Project construction on DS. Generally, these Conditions of Approval include 1) requirements to track and monitor all Project impacts to DS habitat and individuals, 2) restrictions on construction Covered Activities to minimize the risk of exposure of DS to erosion, sedimentation, and contaminants, 3) restrictions on the timing and type of in-water work that may be performed during Project construction, and 4) detailed guidelines governing dewatering and DS salvage operations during in-water Covered Activities.

Impacts of Project operations on DS are minimized through a wide range of Conditions of Approval included in the ITP. Specifically, the ITP includes requirements to 1) utilize operational criteria and real-time operational criteria to govern operations of Project facilities when DS are likely to be present within the Project Area, 2) establish and coordinate a suite of multi-agency technical teams tasked with developing, reviewing, and approving components of Project design, monitoring and scientific studies needed to bolster the current understanding of DS biology, and 3) implement a phased approach to developing Project operations plans and initiating operation of the NDD intakes that allows for continued monitoring, studies, and review of the impacts of coordinated south and north Delta Project operations on DS. Additionally, the ITP includes operating criteria (described in Condition of Approval 9.9.4, Table 9.9.4-1) for south Delta export facilities that could result in improved conditions for DS over the long-term and ameliorate impacts associated with climate change in the south Delta.

The Conditions of Approval in the ITP that minimize impacts associated with Project construction and operations are comprehensive and broad in scope. They require Permittee to collaboratively develop plans addressing construction timing and methods, continue to fund and support existing monitoring and scientific research on DS in the

Delta, and design and implement new scientific studies and to implement the Adaptive Management Program. The ITP requires implementation of a collaborative multi-agency Adaptive Management Program (ITP Attachment 5) to facilitate the review of required plans, support and implement new scientific research, monitoring, and modeling that builds on existing efforts, and through a structured decision-making process to review and make recommendations to integrate results of this research into the ITP, USFWS (2017), and NMFS (2017). Final decision-making authority with respect to the permit requirements is retained by CDFW. The Adaptive Management Program identifies key areas of focused research to resolve uncertainties and evaluate mitigation approaches related to DS. Together, the ITP Conditions of Approval and Adaptive Management Program minimize and mitigate impacts of Project construction and operations on DS.

Biological Criterion 3 requires that the Project does not result in an overall decrease in the population size of DS from pre-Project conditions. This biological criterion will be implemented through establishment of baseline, pre-Project datasets characterizing the abundance and distribution of DS and LFS, a DS lifecycle model, ongoing monitoring, scientific research, and adaptive management to document survival rates on an annual basis throughout the permit term. The Adaptive Management Program will be used to track results of required monitoring and studies, determine whether the requirements of the biological criterion are being met, and impose additional requirements on Project operations if the biological criterion is not met. In this way the Conditions of Approval in the ITP and the Adaptive Management Program will ensure that DS populations will not decline as a result of the Project over the long-term.

Known threats to the species and reasonably foreseeable impacts

Known population trends for DS, including increased stress to DS resulting from recent drought conditions, are summarized in Attachment BO#146 of the ITP application, excerpted from the Biological Assessment prepared for federal ESA evaluation of the Project, and in other information available to CDFW. In addition to the Project, known threats to the species and reasonably foreseeable impacts to DS from other projects and activities include ongoing operations of the CVP/SWP, limited habitat availability, activities identified in Section 4.3.8.1 of the ITP application, and climate change. Analyses of Project impacts to DS, discussed in Section V.B.1.f, above, generally disclosed the effects of joint operations of the CVP and the Project within the Delta, and the Project includes operational criteria stemming from USFWS (2008) and NMFS (2009) that govern both SWP and CVP facilities.

The ITP includes spring outflow criteria which require Permittee to maintain Delta outflow in March, April, and May each year at levels consistent with the beginning of the 21st century to minimize impacts of Project operations over the long term, despite changes in flows associated with climate change. In the Sacramento River, comparisons of late-long term climate change scenarios (2060) indicate that climate change is expected to cause small increases in mean monthly flows between December and March and reduced flows during April through July (ICF International 2017, Table SR1 through SR4). As such, the ITP spring outflow criteria minimize changes in Delta outflow throughout the permit term, during months when outflow is otherwise expected to decline through 2060.

In addition to the spring outflow criteria required by the ITP, several processes, currently ongoing or reasonably foreseeable, are also likely to affect the Project's operations and the status of DS over the course of the permit term. These ongoing processes include the reinitiation of consultation on the biological opinions for CVP/SWP operations (USFWS 2008 and NMFS 2009), implementation of the Delta Smelt Resiliency Strategy (California Natural Resources Agency 2016), and revisions to the 2006 Water Quality Control Plan.

Reclamation is in the process of reinitiating consultation on the coordinated long-term operation of the CVP/SWP (USFWS 2008 and CDFW's associated Consistency Determination No. 2080-2011-022-00). This broadly-scoped consultation is expected to review and possibly update system-wide operating criteria for the long term operations of the CVP/SWP, consistent with the requirements of ESA Section. The State Water Resources Control Board is also in the process of developing and implementing updates to the 2006 Water Quality Control Plan. Phase 2 of this process will involve comprehensive changes to the Water Quality Control Plan to protect beneficial uses of water, including environmental uses, in tributaries to the Delta other than the San Joaquin River. The reinitiation of consultation and the State Water Resources Control Board's update of the 2006 Water Quality Control Plan are expected to be coordinated processes.

In parallel with the reinitiation of consultation with USFWS (2008), the California Natural Resources Agency has developed the Delta Smelt Resiliency Strategy (California Natural Resources Agency 2016), a science based approach to improving the status of DS and achieving a population growth rate greater than 1 by improving DS vital rates and habitat conditions. To accomplish this objective the strategy identifies a suite of actions intended to benefit DS and promote their resiliency to future drought conditions and variation in habitat conditions. Specifically, the Delta Smelt Resiliency Strategy includes proposed management actions to address DS environmental drivers and habitat attributes, those that show promise and which would be considered as part of the AMP include: 1) aquatic weed control, 2) north Delta food web adaptive management, 3) outflow augmentation, 4) reoperation of the SMSCG, 5) supplement sediment supply in the low salinity zone, 6) augment spawning habitat, 7) improve food production at the RRDS, 8) coordinated operations of managed wetland operations in Suisun Marsh, and 9) launch a new Delta field station and fish technology center to support DS research, 10) near-term DS habitat restoration, and 11) Franks Tracks restoration feasibility study (California Natural Resources Agency 2016). Many of the actions called for the Delta Smelt Resiliency strategy complement and enhance the compensatory mitigation required in the ITP.

Permittee conducted extensive analyses of changes in key abiotic factors, and associated impacts on DS as a result of climate change in 2025 and 2060 in the 2013 BDCP Public Draft and the 2081(b) application (summarized in ICF International 2017). Climate change has the potential to impact DS when increased thermal stress constricts the ability of juvenile and adult DS to use available habitat in the Delta beginning in

2030 (ICF International 2016, Section 5 and ICF International 2017). This thermal stress is expected to increase in the second half of the 21st century. The ITP's expiration date, December 31st 2042, was selected to balance the time frames of five key factors that influence the status of DS: 1) construction and testing of the coordinated operation of Project facilities, including the NDD intakes, 2) changes in DS populations are a result of DS habitat restoration, 3) changes in DS populations are a result of implementation of actions in the Delta Smelt Resiliency Strategy, 4) changes in stressors on DS as a result of climate change up to 2042, and 5) improved understanding of changes in stressors as a result of climate change in the second half of the 21st century. From the middle to the end of the 21st century more substantial increases in stressors on DS are predicted to begin. At the same time, uncertainty in predictions from global climate change models also increases (Allen and Luptowitz 2017).

The ITP requires extensive and ongoing evaluation of the Project impacts, which will occur in light of other, related impacts to the species. Throughout the permit term the Permittee is required to utilize operating criteria to meet or exceed Biological Criterion 3. Through achievement of Biological Criterion 3, comprehensive assessments of DS habitat availability, species distribution and abundance, and the magnitude of stressors on the species as a result of operations of the CVP/SWP annually throughout the Test Period and Full Project Operations and implementation of the Adaptive Management Program, the ITP requires Project operations that are responsive to developments in scientific understanding and changes in the status of Covered Fish Species over the permit term. Condition of Approval 6 of the ITP requires that Permittee notify and consult with CDFW regarding modifications to biological opinions, water rights decisions or Project modifications to determine whether an amendment to the ITP is necessary to ensure permit issuance criteria are met over the term of the ITP. Furthermore, California Code of Regulations, title 14, section 783.6, subdivision (c), CDFW shall amend the ITP as required by law, regardless of whether Permittee concurs with the amendment, including if CDFW determines that continued implementation of the Project as authorized under the ITP would jeopardize the continued existence of the Covered Species. Therefore, when viewed in light of the population trends, known threats and reasonably foreseeable impacts to DS, including those resulting from the processes described above, the impacts of the taking do not jeopardize the continued existence of DS.

Longfin Smelt (*Spirinchus thaleichthys*)

As discussed above in Section V.B.1, Covered Activities would result in near- and far-field effects to LFS and the permanent loss of 500.6 acres of shallow water habitat and 25.3 acres of tidal perennial habitat suitable for LFS. However, these effects and habitat loss would not jeopardize the continued existence of LFS because the mitigation measures, avoidance and minimization measures, and environmental commitments discussed in the Final EIR/EIS and required by the ITP, as well as additional measures required by the ITP, minimize and fully mitigate the impacts of the authorized take of LFS as described in Section V.B.1.f above.

ITP compensatory mitigation

The ITP mitigation measures that provide compensatory mitigation for impacts to LFS include but are not limited to: the preservation, restoration, and management of 1,827.7 acres of habitat suitable for LFS that will expand the diversity, quantity, and quality of rearing and refuge habitat in the tidal portions of the Delta and Suisun Marsh. To ensure protected habitat used as compensatory mitigation fully mitigates for impacts to LFS, siting and design of compensatory mitigation lands will be informed by the specifications and habitat crediting process defined in the Guidance for Smelt HM Lands Suitable for Compensatory Mitigation (ITP Attachment 8). Permittee will ensure permanent protection and funding for perpetual management of compensatory LFS habitat, including monitoring for suitable habitat features and presence of LFS.

ITP Conditions of Approval

The ITP contains Conditions of Approval that minimize impacts of Project construction on LFS. Generally, these Conditions of Approval include 1) requirements to track and monitor all Project impacts to LFS habitat and individuals, 2) restrictions on construction Covered Activities to minimize the risk of exposure of LFS to erosion, sedimentation, and contaminants, 3) restrictions on the timing and type of in-water work that may be performed during Project construction, and 4) detailed guidelines governing dewatering and LFS salvage operations during in-water Covered Activities.

Impacts of Project operations on LFS are minimized through a wide range of Conditions of Approval included in the ITP. The ITP includes requirements to 1) maintain Delta outflows that are protective of LFS every year from March 1 – May 31, 2) utilize operational criteria and real-time operational criteria to govern operations of Project facilities when LFS are likely to be present within the Project Area, 3) establish and coordinate a suite of multi-agency technical teams tasked with developing, reviewing, and approving components of Project design, monitoring and scientific studies needed to bolster the current understanding of LFS biology, and 4) implement a phased approach to developing Project operations plans and initiating operation of the NDD intakes that allows for continued monitoring, studies, and review of the impacts of coordinated south and north Delta Project operations on LFS. Additionally, the ITP includes operating criteria (described in Condition of Approval 9.9.4, Table 9.9.4-1) for south Delta export facilities that could result in improved conditions for LFS over the long-term and ameliorate impacts associated with climate change in the south Delta.

The Conditions of Approval in the ITP that minimize impacts associated with Project construction and operations are comprehensive and broad in scope. They require Permittee to collaboratively develop plans addressing construction timing and methods, continue to fund and support existing monitoring, scientific research on LFS in the Delta, and design and implement new scientific studies (including a new LFS life cycle model) and to implement the Adaptive Management Program. The ITP requires implementation of a collaborative multi-agency Adaptive Management Program (ITP Attachment 5) to facilitate the review of required study plans, support and implement new scientific research, monitoring, and modeling that builds on existing efforts, and through a structured decision-making process to review and make recommendations to integrate results of this research into the ITP, USFWS (2017), and NMFS (2017). Final decision-making authority with respect to the permit requirements is retained by CDFW. The Adaptive Management Program identifies key areas of focused research to resolve uncertainties and evaluate mitigation approaches related to DS. Together, the ITP Conditions of Approval and the Adaptive Management Program minimize and mitigate impacts of Project construction and operations on LFS.

Biological Criterion 3 requires that the Project does not result in an overall decrease in the population size of LFS from pre-Project conditions. This biological criterion will be implemented through establishment of baseline, pre-Project datasets characterizing the abundance and distribution of LFS, a LFS lifecycle model, ongoing monitoring, scientific research, and adaptive management to document survival rates on an annual basis throughout the permit term. The Adaptive Management Program will be used to track results of required monitoring and studies, determine whether the requirements of the biological criterion are being met, and impose additional requirements on Project operations if the biological criterion is not met. In this way the Conditions of Approval in the ITP and the Adaptive Management Program will ensure that LFS populations will not decline as a result of the Project over the long-term.

Known threats to the species and reasonably foreseeable impacts

Known population trends for LFS, including increased stress to LFS resulting from recent drought conditions, are summarized in Attachment BO#146 of the ITP application, excerpted from the Biological Assessment prepared for federal ESA evaluation of the Project, and in other information available to CDFW. In addition to the Project, known threats to the species and reasonably foreseeable impacts to LFS from other projects and activities include ongoing operations of the CVP/SWP, limited habitat availability, activities identified in Section 4.3.8.1 of the ITP application, and climate change. Analyses of Project impacts to LFS, discussed in Section V.B.1.e, above, generally disclosed the effects of joint operations of the CVP and the Project within the Delta, and the Project includes operational criteria stemming from USFWS 2008 and NMFS 2009 that govern both SWP and CVP facilities.

The ITP includes spring outflow criteria which require Permittee to maintain Delta outflow in March, April, and May each year at levels consistent with the beginning of the 21st century to minimize impacts of Project operations over the long term, despite changes in flows associated with climate change. Kimmerer (2009) demonstrated a significant positive relationship between Delta outflow and LFS abundance from January through June each year. In the Sacramento River, comparisons of late-long term (2060) climate change scenarios indicate that climate change is expected to cause small increases in mean monthly flows between December and March and reduced flows during April through July (ICF International 2017, Table SR1 through SR4). As such, the ITP spring outflow criteria minimize impacts of the Project on LFS during the second half of the six-month window identified by Kimmerer (2009), when outflow-influenced LFS abundance would be expected decline through 2060 without the criteria in place.

In addition to the spring outflow criteria required by the ITP, several processes, currently ongoing or reasonably foreseeable, are also likely to affect the Project's operations and the status of DS over the course of the permit term. These ongoing processes include the expiration of the current take authorization for LFS as a result of operations of the SWP (CDFG 2009), evaluation of LFS status and listing under the ESA, implementation of the Delta Smelt Resiliency Strategy, and revisions to the 2006 Water Quality Control Plan.

The current ITP that provides take authorization for LFS associated with operations of the SWP in the Delta (CDFG 2009) expires on December 31, 2018. A new ITP would be necessary to authorize take of LFS prior to the initiation of the Test Period, and must meeting CESA's permit issuance criteria.

The State Water Resources Control Board is in the process of developing and implementing updates to the 2006 Water Quality Control Plan. Phase 2 of this process will involve comprehensive changes to the 2006 Water Quality Control Plan to protect beneficial uses of water, including environmental uses, in tributaries to the Delta other than the San Joaquin River.

In parallel with the expiration of CDFG (2009), the USFWS status review of the LFS Bay Delta DPS, and revisions to the 2006 Water Quality Control Plan, the California Natural Resources Agency has developed the Delta Smelt Resiliency Strategy (California Natural Resources Agency 2016). The Delta Smelt Resiliency Strategy is a science based approach to improving the status of DS and achieving a population growth rate greater than 1 by improving DS vital rates and habitat conditions. Because of the overlap in the distribution of DS and LFS during portions of their life history, many of the actions identified in the Delta Smelt Resiliency Strategy will also benefit LFS and augment the compensatory mitigation required in the ITP. Specifically, the Delta Smelt Resiliency Strategy includes proposed management actions that address LFS environmental drivers and habitat attributes: 1) aquatic weed control, 2) north Delta food web adaptive management, 3) augment spawning habitat, 4) improve food production at the RRDS, 5) coordinated operations of managed wetland operations in Suisun Marsh, 6) launch a new Delta field station and fish technology center to support LFS research and possible LFS culture technology, 9) near-term DS habitat restoration, and 10) Franks Tracks restoration feasibility study (California Natural Resources Agency 2016). Many of the actions called for the Delta Smelt Resiliency strategy complement and enhance the compensatory mitigation required in the ITP.

Permittee conducted extensive analyses of changes in key abiotic factors, and associated impacts on LFS as a result of climate change in 2025 and 2060 in the 2013 BDCP Public Draft and the 2081(b) application (summarized in ICF International 2017). Climate change has the potential to impact LFS when increased thermal stress constricts the ability of juvenile and adult LFS to use available habitat in the Delta beginning in 2030 (ICF International 2016a, Section 5 and ICF International 2017). This thermal stress is expected to increase in the second half of the 21^{st} century. The ITP's expiration date, December 31^{st} 2042, was selected to balance the time frames of five key factors that influence the status of LFS: 1) construction and testing of the coordinated operation of Project facilities, including the NDD intakes, 2) changes in LFS populations in response to habitat restoration, 3) changes in LFS populations in response to implementation of actions in the Delta Smelt Resiliency Strategy, 4) changes in stressors on LFS as a result of climate change up to 2042, and 5) improved understanding of changes in stressors as a result of climate change in the second half of the 21st century. From the middle to the end of the 21st century more substantial increases in stressors on LFS are predicted to begin. At the same time, uncertainty in predictions from global climate change models also increases (Allen and Luptowitz 2017).

The ITP requires extensive and ongoing evaluation of the Project impacts, which will occur in light of other, related impacts to the species. Throughout the permit term the Permittee is required to utilize operating criteria to meet or exceed Biological Criterion 3. Through achievement of Biological Criterion 3, comprehensive assessments of LFS habitat availability, species distribution and abundance, and the magnitude of stressors on the species as a result of operations of the CVP/SWP annually throughout the Test Period and Full Project Operations and implementation of the Adaptive Management Program, the ITP requires Project operations that are responsive to developments in scientific understanding and changes in the status of Covered Fish Species over the permit term. Condition of Approval 6 of the ITP requires that Permittee notify and consult with CDFW regarding modifications to biological opinions, water rights decisions or Project modifications to determine whether an amendment to the ITP is necessary to ensure permit issuance criteria are met over the term of the ITP. Furthermore, California Code of Regulations, title 14, section 783.6, subdivision (c), CDFW shall amend the ITP as required by law, regardless of whether Permittee concurs with the amendment, including if CDFW determines that continued implementation of the Project as authorized under the ITP would jeopardize the continued existence of the Covered Species. Therefore, when viewed in light of the population trends, known threats and reasonably foreseeable impacts to LFS, including those resulting from the processes described above, the impacts of the taking do not jeopardize the continued existence of LFS.

CDFW hereby accepts these findings.

[signature]

July 26, 2017

Charlton Bonham, Director
California Department of Fish and Wildlife

Date

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