BUREAU OF RECLAMATION

Draft Supplemental Environmental Impact Statement

Shasta Lake Water Resources Investigation

Prepared by:

U.S. Department of the Interior
Interior Region 10 · California-Great Basin
Bureau of Reclamation

Estimated Lead Agency Total Costs Associated with Developing and Producing This EIS

$204,000

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Chapter 1. Introduction

Chapter 1.1 Project Background

In August 2015, the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), published a Notice of Availability for the Final Environmental Impact Statement (FEIS) for the Shasta Lake Water Resources Investigation (SLWRI) consistent with the requirements of the National Environmental Policy Act (NEPA). Cooperating agencies pursuant to NEPA for the SLWRI FEIS included the U.S. Forest Service (USFS), Bureau of Indian Affairs, Colusa Indian Community Council of the Cachil Dehe Band of Wintun Indians, and U.S. Army Corps of Engineers (USACE).

The SLWRI is a feasibility study that is one of five studies for potential surface water storage projects included in the 2000 California Bay-Delta Program (CALFED) Programmatic Record of Decision (ROD) and is being conducted under the general authority of Public Law 96-375, which was reaffirmed under Public Law 108-361, also known as the CALFED Bay-Delta Authorization Act.

The CALFED Programmatic Environmental Impact Statement/Report (PEIS/R), completed in July of 2000, considered more than 50 surface water storage sites throughout California and recommended more detailed study of the five sites identified in the CALFED Programmatic ROD. These studies included Shasta Lake Enlargement, Los Vaqueros Reservoir Enlargement, Sites Reservoir, in Sacramento-San Joaquin Delta (In-Delta) storage, and development of storage in the upper San Joaquin River Basin. The SLWRI FEIS relied on evaluations, alternatives development, and screening included in the CALFED PEIS/R, focusing on the subsequent action of evaluating the enlargement of Shasta Dam and Lake. Accordingly, Reclamation tiered its analysis of the SLWRI FEIS to the CALFED PEIS/R.

The SLWRI FEIS evaluated the potential physical, biological, cultural, and socioeconomic effects of implementing alternatives to modify the existing Shasta Dam and Lake, including taking no action. The alternatives evaluated in the SWLRI FEIS, in addition to the No Action Alternative, were potential dam raises of 6.5 feet, 12.5 feet, or 18.5 feet and related reservoir enlargements ranging from 256,000 to 634,000 acre feet. The SLWRI FEIS evaluated the potential environmental effects of alternative plans to enlarge Shasta Dam and Lake to (1) increase anadromous fish survival in the upper Sacramento River, (2) increase water supplies and water supply reliability for agricultural, municipal, industrial, and environmental purposes, and (3) address related water resource problems, needs, and opportunities.

Reclamation prepared the SLWRI Feasibility Report in July 2015 as a companion document to the SLWRI FEIS. The SLWRI Feasibility Report presented the results of planning, engineering, environmental, social, economic, and financial studies and potential benefits and effects of alternatives plans for the SLWRI project. Both the SLWRI Feasibility Report and SLWRI FEIS were submitted to U.S. Congress.

In March of 2018 Congress appropriated $20,000,000 for preconstruction and design phase for SLWRI pursuant to the Water Infrastructure Improvements for the Nation (WIIN) Act. During preconstruction and design Reclamation identified the need to supplement the SLWRI FEIS with additional information. Congress has not authorized construction or appropriated funds for construction. There has been no discharge of dredged or fill material in connection with construction.

Chapter 1.2 Scope of the Supplemental Environmental Impact Statement

Reclamation prepared a Draft SEIS for the SLWRI consistent with the requirements of NEPA. Cooperating agencies pursuant to NEPA for the SLWRI Draft SEIS include the Environmental Protection Agency (EPA) and the USACE.

Pursuant to NEPA, an agency must prepare a supplemental environmental impact statement if the agency makes substantial changes in the proposed action relevant to environmental concerns or there are significant new circumstances or information relevant to environmental concerns that have a bearing on the proposed action or its impacts. An agency may also prepare a supplemental analysis if it determines that the purposes of NEPA will be furthered by doing so. 40 C.F.R. § 1502.9(c).

The purpose of the SLWRI SEIS is to provide information relevant to the application of Section 404(r) of the Clean Water Act (CWA) for the SLWRI, to respond to issues identified by USACE and EPA on the previous EIS, to update operations and modelling to the latest regulatory requirements, and to update information included in the 2015 SLWRI FEIS that is relevant to environmental concerns.

CWA 404(r) states:

> *The discharge of dredged or fill material as part of the construction of a Federal project specifically authorized by Congress, whether prior to or on or after the date of enactment of his subsection, is not prohibited by or otherwise subject to regulation under this section, or a State program approved under this section, or section 301(a) or 402 of the Act (except for effluent standards or prohibitions under section 307), if information on the effects of such discharge, including consideration of the guidelines developed under subsection (b)(l) of this section, is included in an*

> *environmental impact statement for such project pursuant to the National Environmental Policy Act of 1969 and such environmental impact statement has been submitted to Congress before the actual discharge of dredged or fill material in connection with the construction of such project and prior to either authorization of such project or an appropriation of funds for each construction.*

The SLWRI FEIS was developed with consideration of the CWA 404(b)(1) guidelines. In order to apply CWA 404(r), Reclamation has prepared this supplement to provide: (1) an updated and adequate description of the discharges to wetlands and other Waters of the U.S. (WOTUS) resulting from the relocations of infrastructure and recreation structures: (2) a programmatic approach to conducting alternatives analyses and determination of the Least Environmentally Damaging Practicable Alternative for relocation activities with significant impacts to wetlands and other WOTUS: and (3) a compensatory wetland mitigation plan for all significant and unavoidable impacts to wetlands and other WOTUS.

Reclamation developed the 2015 SLWRI FEIS with consideration to the current operational requirements for Shasta Dam at the time the EIS was written, including the 2008/2009 Biological Opinions (BOs) from the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for the coordinated operations of the Central Valley Project (CVP) and State Water Project (SWP) and the 1986 Coordinated Operation Agreement (1986 COA). Reclamation reinitiated consultation with USFWS and NMFS and received new BOs in 2019. The 1986 COA was amended in 2018. Reclamation has updated Shasta Dam's operations and modelling using the requirements set forth in the new BOs and the amended COA.

Reclamation has also revised the SLWRI FEIS Chapter 25 on Wild and Scenic River Considerations for the McCloud River and included the revised chapter within this Draft SEIS. The appendices provide documentation on CWA 404(b)(1) requirements (See Appendix A), the calculations for impacts to wetlands and other WOTUS (See Appendix B), and examples of how environmental impacts associated with project relocations will be avoided, minimized, and analyzed for alternatives (See Appendices C and D).

Chapter 2. Supplemental Information on Impacts to Wetlands and other Waters of the U.S.

Chapter 2.1 Background

The USACE Sacramento District administers CWA Section 404 within the project area. Under CWA 404, a permit is required for the discharge of dredged or fill materials into WOTUS unless otherwise exempt. EPA and USACE previously updated the definition of WOTUS in 2015. This definition was repealed on October 22, 2019. The repeal re-codified the regulatory text that existed prior to the 2015 rule, which became effective on December 23, 2019.

Actions typically subject to CWA 404 requirements are those that would take place in wetlands or stream channels, including intermittent streams, even if they have been realigned. For actions occurring within stream channels, the USACE has jurisdiction for any discharge activity below the ordinary high-water mark (OHWM). The OHWM is the line on the shore established by the fluctuations of water. It is indicated by the physical characteristics such as a clear, natural line impressed on the bank; shelving; changes in the characters of soil; destruction of terrestrial vegetation; or the presence of litter or debris.

Reclamation determined the potential impact to WOTUS in the SLWRI FEIS by determining the presence of WOTUS within the project area and evaluating the project's impacts to those areas. The SLWRI Draft SEIS provides additional information on impacts to WOTUS by providing a Preliminary Jurisdictional Determination on wetlands present within the project area and by analyzing potential relocations in greater detail in order to provide a more accurate estimate of the volumes and types of fill being placed into WOTUS. Because there were no impacts to WOTUS associated with dam construction, the SLWRI Draft SEIS focuses solely on impacts resulting from infrastructure and recreation relocations.

The SLWRI Draft SEIS presents a framework, with examples, of how all relocations impacting wetlands will be assessed to avoid and minimize impacts to wetlands. Where impacts cannot be avoided, Reclamation will minimize impacts to wetlands and other WOTUS to the extent practicable and implement appropriate mitigation.

Chapter 2.2 Preliminary Jurisdictional Determination

Reclamation conducted a delineation of wetlands and other WOTUS under federal jurisdiction (jurisdictional waters) in the SLWRI study area to support project related environmental planning and permitting. Reclamation performed the delineation of jurisdictional waters in the impoundment area between 2004 and 2010 and in the relocation areas between 2010 and 2013, using the WOTUS rule that existed prior to 2015 and which was reinstated in 2019. For wetlands, the impoundment area is defined as the area between 1,070 and 1,090 mean sea level elevation (msl) surrounding Shasta Lake. For other waters, the impoundment area includes the lacustrine waters associated with Shasta Lake below 1,070 msl.

Jurisdictional waters occur in the relocation areas as wetlands and other waters. Wetlands include fresh emergent wetlands, fresh emergent wetlands / riparian wetlands, intermittent swales, riparian wetlands, seasonal wetlands, seep / spring wetlands, and vegetated ditches. Other waters include ephemeral streams, intermittent streams, non-vegetated ditches, perennial streams, and seep / spring other waters.

Approximately 46 acres of wetlands and 30,092 acres of other waters occur in the impoundment and relocation areas. Total jurisdictional waters in the impoundment and relocation areas, excluding Shasta Lake at full pool, include approximately 51 acres of wetlands and 103 acres of other waters.

Reclamation compiled the results of this study into a SLWRI report, Delineation of Waters of the United States (Wetland Delineation Report) in May of 2015. The purpose of the Wetland Delineation Report was to document and describe WOTUS in support of a Preliminary Jurisdictional Determination from the USACE, Sacramento Regulatory Office.

Reclamation submitted the Wetland Delineation Report to the USACE, Sacramento Regulatory Office on December 3, 2019 and requested a Preliminary Jurisdictional Determination on the delineated wetlands. Reclamation provided supplemental application information on December 31, 2019 and March 4, 2020.

Reclamation Received a Preliminary Jurisdictional Determination dated April 8, 2020 from the USACE Sacramento District. The Preliminary Jurisdictional Determination covers the approximately 5,638.1-acre project area around Shasta Lake and its related project relocations.

Chapter 2.3 Avoidance and Minimization Procedure

Considering the CWA 404(b)(1) guidelines, consistent with the requirements of CWA 404(r), Reclamation will avoid and minimize impacts for each project relocation that has the potential to impact wetlands and other WOTUS. The amount and detail of information that will be included in the consideration of alternatives for each relocation will be commensurate with the magnitude of the environmental impact and the scope of the project relocation.

All identified wetland impacts associated with project relocations are less than 2 acres (See Appendix B), with the exception of the Lakeshore Fire Guard Station. Lakeshore Fire Guard Station's original design plan would have impacted 7 acres of wetlands. After undergoing the avoidance and minimization procedures outlined within this section, Reclamation reduced the impact to 0.14 acres. For full details of the analysis see Appendix C.

Reclamation will not consider off-site alternatives for project relocations with projected impacts to wetlands and other WOTUS of less than 1 acre. Only 3 project relocations have projected impacts to wetlands and WOTUS of greater than 1 acre. These are the Lakeshore Fire Guard Station (See Appendix C), the Doney Creek Bridge, and the Sacramento River 2nd Crossing (See Appendix D). For these relocations, Reclamation will include the evaluation of both off-site and on-site alternatives. For those activities with minimal individual and cumulative effects, which are all relocations except for the three listed above, Reclamation will only evaluate on-site avoidance and minimization, and the extent of information developed will be commensurate with the effects.

The purpose of each project relocation is to develop a relocation for each feature that mitigates for the loss of the existing recreation, infrastructure, or utility feature due to implementation of the SLWRI project and resultant increase in inundation elevation from 1070 to 1090 msl. This increase in lake elevation will inundate several facilities (campgrounds, marinas, etc.) and infrastructure (roads, bridges, railroad tracks, etc.) that currently exist in and around the lake. Project relocations may be on-site (protecting features from inundation by modifying existing facilities to protect affected areas), or off-site (abandonment of existing features with subsequent replacement at another suitable location). A list of the impacted facilities and infrastructures have been provided in Appendix B.

The existing design plan for each relocation feature has been described in the SLWRI FEIS Engineering Summary Appendix. Reclamation provided thorough details including the location of the alternative, engineering plates, and analyses on the environmental, cultural, and aesthetic impacts of the relocations within the SLWRI FEIS.

Under the CWA 404(b)(1) Guidelines, an alternative is considered "practicable" if it is "capable of being done after taking into consideration cost, existing

technology, and logistics in light of overall project purposes" [40 CFR 230.10(a)(2)]. The SLWRI FEIS evaluated the "No Action" alternative, which included "No Action" for project relocations. Reclamation is not providing any further details regarding the "No Action" Alternative for the CWA 404(b)(1) alternatives analysis.

Reclamation will follow a procedure for identifying project relocation alternatives that prioritize avoidance. Any impacts that cannot be completely avoided will be minimized to the extent practicable. All impacts to wetlands and other WOTUS will be mitigated (See Chapter 2.5 for a description of the mitigation plan).

Avoidance

Reclamation will use the following criteria in the development of project relocation alternatives that completely avoid impacts to wetlands and other WOTUS:

1. Does the alternative effectively serve the same purpose as the feature it is replacing and provide undisturbed service throughout its design period to the public?

2. Does the alternative contain sufficient acreage of developable area in appropriate configurations to both support its role to protect such facilities/capacity from inundation by modifying existing facilities to protect affected areas (i.e., relocate facilities onsite) or abandon existing facilities and replace them at other suitable sites (i.e., relocate facilities offsite)?

3. If the relocation is a recreational facility, does the alternatives conform to the land use plan indicated in the SLWRI FEIS and the USFS Master Implementation Plan?

4. Does the alternative have sufficient available land in close proximity to be used temporarily during construction for easy and safe access for construction traffic and personnel?

5. Is the alternative located in an area able to obtain electric power as required for the entire period of construction for the relocated feature?

6. Does the alternative cause minimal or no disruption to local residents or commercial establishments during the relocation process and the service life of the relocated feature?

7. Are there any other logistical constraints that would preclude the alternative from being implemented?

8. Does the alternative have a development cost per net developable acre that is optimal to the implementation of the SLWRI Project and to the public's federal funds for the project?

9. Does the alternative cause or contribute to new significant impacts to cultural and historic places or to species listed as threatened or endangered under the Endangered Species Act?

10. Are the costs to avoid impacts to wetlands or other WOTUS reasonable?

If a project relocation avoidance alternative is deemed practicable, Reclamation will implement that alternative over any alternative that impacts wetlands or other WOTUS. If no avoidance relocation can be identified as practicable, Reclamation will proceed to minimize the impacts of the relocation.

Minimization

Minimization alternatives will be subject to the same practicable criteria listed in Chapter 2.3:

1. Does the alternative effectively serve the same purpose as the feature it is replacing, and provide undisturbed service throughout its design period to the public?

2. Does the alternative contain sufficient acreage of developable area in appropriate configurations to both support its role to protect such facilities/capacity from inundation by modifying existing facilities to protect affected areas (i.e., relocate facilities onsite) or abandon existing facilities and replace them at other suitable sites (i.e., relocate facilities offsite)?

3. If the relocation is a recreational facility, does the alternatives conform to the land use plan indicated in the SLWRI FEIS and the USFS Master Implementation Plan?

4. Does the alternative have sufficient available land in close proximity to be used temporarily during construction for easy and safe access for construction traffic and personnel?

5. Is the alternative located in an area able to obtain electric power as required for the entire period of construction for the relocated feature?

6. Does the alternative cause minimal or no disruption to local residents or commercial establishments during the relocation process and the service life of the relocated feature?

7. Are there any other logistical constraints that would preclude the alternative from being implemented?

8. Does the alternative have a development cost per net developable acre that is optimal to the implementation of the SLWRI Project and to the public's federal funds for the project?

9. Does the alternative cause or contribute to new significant impacts to cultural and historic places or to species listed as threatened or endangered under the Endangered Species Act?

10. Are the costs to minimize impacts to wetlands or other WOTUS reasonable?

Annual Report

Annually each fiscal year during implementation of the SLWRI Project, Reclamation will compile a report that documents Reclamation's avoidance and minimization efforts as described above. The report will contain a quantification of the impacts to wetlands and other WOTUS prior to avoidance and minimization, a brief outline of each project relocation's avoidance and minimization considerations as described above, and a quantification of the new impacts to wetlands and other WOTUS. This information will be used annually to develop Reclamation's wetland mitigation efforts. In addition, the annual report will include a summary of the wetland mitigation implemented to-date.

In anticipation of the relocation of the Lakeshore Fire Guard Station, Reclamation performed an avoidance and minimization analysis on the Lakeshore Fire Guard Station relocation. This analysis is presented in Appendix C.

Chapter 2.4 Impacts to Wetlands and Other Waters of the United States

The SLWRI FEIS previously identified 31 acres of wetlands and 49 acres of other WOTUS to be converted into lacustrine habitat with the raising of Shasta Dam, resulting in a net loss of approximately 31 acres of wetlands and 49 acres of riverine waters into lacustrine habitat. These waters are located within the inundation zone around the perimeter of Shasta Lake Because the construction process to raise Shasta Dam will require no placement of dredge or fill material into wetlands or other WOTUS, that process and the resultant conversion of some habitats into lacustrine habitat does not require consideration of the CWA 404(b)(1) guidelines.

The SLWRI FEIS previously identified a loss of approximately 2.3 acres of wetlands and 1.6 acres of other WOTUS in total due to all project relocations. In order to adequately describe the proposed discharges to WOTUS, Reclamation recalculated the projected impacts to wetlands and other WOTUS from project

relocations using updated information. By overlaying wetlands identified within the Wetland Delineation Report and projected project relocations in ArcGIS, Reclamation identified the impacts to wetlands and other WOTUS. The summary of these calculations is listed in Table 2-1. A full breakdown by individual relocation feature is available in Appendix B.

Table 2-1. Summary of Discharges

Feature Type	Impacts to Wetlands and other Waters of the U.S.	Fill volume (cubic yards)
Roads	0.39 acres	12430
Dikes	<0.75 acres	4362
Bridges	2.27 acres	12270
Recreation Facilities without Lakeshore Fire Guard Station Avoidance & Minimization	7.57 acres	57662
Recreation Facilities with Lakeshore Fire Guard Station Avoidance & Minimization	0.71 acres	2324

The updated impacts to wetlands and other WOTUS from roads, bridges, and recreation facilities with the Fire Guard Station avoidance implemented is, in total, 3.37 acres, with an estimated impact of <0.75 acres from dikes. This level and type of impact is comparable to the 3.9 acres of impacted wetlands and other WOTUS identified in SLWRI FEIS. The SLWRI FEIS included an analysis of whether the proposed discharges would result in significant degradation of WOTUS, based on factual determinations of the effects to the physical, chemical, biological, and human use characteristics of the aquatic environment. The additional information provided within this supplement has no effect on the determinations made within the SLWRI FEIS, as the fill volumes and wetland delineations were derived directly from the SLWRI FEIS. The supplement provides additional information on the details of the discharges but has no effect on the level of impact from the proposed discharges. Any potential changes would be reductions from the implementation of avoidance and minimization procedures as described in Chapter 2.3 of this supplement.

The majority of impacts are to the various tributaries to Shasta Lake resulting from the relocation of major bridges. Roads and recreation features impact approximately 2 miles total of ephemeral, perennial, and intermittent streams located within the relocation areas. Impacts to wetland features such as vegetated ditches, non-vegetated ditches, seep/spring wetlands, riparian wetlands, and fresh emergent wetlands are all less than 0.1 acres for each wetland type.

Roads & Dikes

The relocation details (feature name, total relocation length, and approximate gross quantity of fill) were taken from the Final Engineering Summary Appendix of the SLWRI FEIS. The total quantity of fill to be placed for these relocations is

130,500 cubic yards. In order to calculate the portion of this volume that would be placed into wetlands, Reclamation overlaid the proposed relocation site for each feature where available over known delineated wetlands and other WOTUS. Wetlands were delineated following USACE Procedures (See Chapter 2.2). When an impact was noted, Reclamation calculated the area of impact using the ArcGIS measuring/calculation tool. All areas and calculated quantities of fill are approximate.

The area of impact for all proposed roads and dikes was found to be minimal (approximately 1.4 acres total). However, in the absence of final design for relocated features, a conservative estimate of 10% of the gross total fill quantity was used to calculate the volume of fill to be discharged into wetlands.

Bridges

In order to calculate the impact to WOTUS, Reclamation used the proposed new approximate alignment of Second Sacramento River Crossing and Doney Creek railroad bridges and Doney Creek and Charlie Creek vehicular bridges as available in SLWRI FEIS. Relocated alignments of McCloud and Dadillas Creek bridges were assumed to be in close proximity of the existing bridges.

Reclamation determined the volume of wetland fill by calculating the total cross-sectional area of the piers/shafts for each relocated bridge below 1070 ft elevation, the current OHWM of Shasta Lake.

Recreation Areas

The recreation relocation areas include locations surrounding existing developments and other sites proposed for development that are subject to physical disturbance as an indirect result of the proposed project (e.g., areas proposed as relocation sites for campgrounds, boat-in campgrounds, boat ramps, marinas, resorts, trail/trail heads, and USFS facilities).

Reclamation calculated the impacts to wetlands and WOTUS by estimating the volume and type of fill associated with each of recreation feature relocations. In order to calculate this data, Reclamation identified relocation sites by cross referencing the scope of work in the Final Engineering Summary Appendix of the SLWRI FEIS and the SLWRI Wetland Delineation Report Appendix G.1 and Table 11; Reclamation overlaid the location of each recreation relocation feature where available over known delineated wetlands and other WOTUS. Wetlands were delineated following USACE Procedures (See Chapter 2.2). When an impact was noted, the estimated area of impact was calculated using the ArcGIS measuring/calculation tool. All areas and calculated quantities of fill are approximate. Reclamation estimated the volume of fill to be placed within that area using the approximate depth of the feature based on the feature's and current site's characteristics (elevation, length, with, and depth). See Appendix C, Table C-4 for full calculations of each feature.

Based on this methodology Reclamation estimates the potential impacts to wetlands and other waters is approximately 57,662 cubic yards of imported fill before avoidance and minimization. The outlier recreation relocation is the Lakeshore Fire Guard Station's proposed relocation in the North Parcel potentially disturbing approximately 7 acres of seasonal wetland with placement of 56,467 cubic yards of imported fill. After avoidance and minimization for the Lakeshore Fire Guard Station (See Appendix C), Reclamation estimates the potential impacts to wetlands and other waters is approximately 2,324 cubic yards of imported fill.

Based on the present construction of recreation features being soil, the new and or modified construction assumed imported fill as the construction material.

Chapter 2.5 Wetland Mitigation Plan

Compensatory mitigation is typically accomplished through permittee responsible mitigation, mitigation banks, or in-lieu fee programs. The SLWRI FEIS Mitigation Measure Bot-4: Mitigate Loss of Jurisdictional Waters commits Reclamation to preparing a conceptual mitigation plan following current USACE guidance and requirements. The mitigation plan will incorporate wetland habitats within lands acquired under Bot-3: Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, Bureau of Land Management (BLM) Sensitive, and California Rare Plants; and Revegetate Affected Areas. Under Bot-3, Reclamation has committed to a minimum 3:1 replacement ratio of acquired lands to impacted lands as described in the SLWRI FEIS. Reclamation will also calculate the recommended mitigation ratios from the USACE South Pacific District Mitigation Ratio Setting Checklist and compare this to the minimum 3:1 replacement ratio described within the SLWRI FEIS. If the mitigation ratio from the Mitigation Ratio Setting Checklist is greater than 3:1, Reclamation will implement the larger ratio. The wetland mitigation plan will include measures for habitat creation, restoration, or enhancement.

In addition to replacement of acquired lands to impacted lands, Reclamation will evaluate the potential to use a mitigation bank for compensatory mitigation. A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or preserved for the purposes of providing compensation for unavoidable impacts to WOTUS. EPA and USACE consider mitigation banks to be the preferred alternative because the mitigation has already been completed.

There is one mitigation bank available near the project area located within Shasta County, California. The Stillwater Plains Mitigation Bank – Phase II & III, Permit No. SPK-1996-00064 has federal available credits for constructed channels, seasonal wetlands, emergent marsh creation, vernal pool/swales, vernal pool/swale creation, and emergent marsh. Participation in this mitigation bank

program would be Reclamation's first choice when developing a compensatory mitigation plan.

An in-lieu fee programs would allow Reclamation to make payments to a program that would conduct wetland and WOTUS restoration, creation, enhancement, or preservation. In-lieu fee programs are generally administered by government agencies or other non-profit organizations that have established agreements with EPA or USACE to use in-lieu fee payments collected by other agencies. The SLWRI project is located within the project area for the Sacramento District California In-Lieu Fee Program.

The Sacramento District In-Lieu Fee Program is administered by the National Fish and Wildlife Foundation's Impact-Directed Environmental Accounts program, which receives, manages, and disburses funds designated for specified conservation, mitigation, or restoration purposes arising from judicial and regulatory proceedings. The program provides vernal pool credits for impacts to vernal pool wetlands and aquatic resource credits for impacts to wetlands (excluding vernal pools) and other WOTUS. The SLWRI Project area is located outside of the vernal pool wetlands area for the in-lieu fee program. However, aquatic resource credits for impacts to wetlands (excluding vernal pools) and other WOTUS could be available.

Reclamation will develop the Wetland Mitigation Plan once final details to wetlands and other WOTUS is known. Reclamation intends to prepare a Wetland Mitigation Plan, but the specific details of the plan, such as exact type and acreage of wetlands to be mitigated and the type of compensatory mitigation to be used, cannot be known until final engineering plans for project relocations have been developed. At a minimum, Reclamation has committed to a 3:1 replacement ratio of acquired lands to impacted lands and has identified a mitigation bank and in-lieu fee program within the SLWRI project area.

Chapter 3. Supplemental Information on Stormwater and Other Point-Source Discharges

Chapter 3.1 Background

All point sources that discharge into waters of the United States must obtain a National Pollutant Discharge Elimination System (NPDES) permit under provisions of Section 402 of the CWA. The NPDES permit process also provides a regulatory mechanism for controlling nonpoint-source pollution created by runoff from construction and industrial activities, and general and urban land use, including runoff from streets. Projects involving construction activities (e.g., clearing, grading, or excavation) with land disturbance greater than one acre must file a notice of intent with the appropriate Regional Water Quality Control Boards to indicate their intent to comply with the General Permit for Discharges of Stormwater Associated with Construction Activity (Construction General Permit Order 2009-0009-DWQ, which went into effect and replaced Order 99-08-DWQ on July 1, 2010). This general permit establishes conditions to minimize sediment and pollutant loadings and requires preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) before construction. The SWPPP is intended to help identify the sources of sediment and other pollutants, and to establish best management practices (BMPs) for stormwater and nonstormwater source control and pollutant control. A sediment monitoring plan must be included in the SWPPP if the discharges occur directly to a water body listed on the Section 303(d) Total Maximum Daily Load list for sediment.

By following CWA 404(r) Reclamation is not subject to CWA 404(r) regulations under CWA 402 if information on the effects of the discharge, including guidelines developed under CWA 404(b)(1), are included in an EIS. Reclamation utilized existing CWA 402 permits as a guideline to describe the effects of the proposed discharges. The proposed discharges fall under two categories: first, stormwater discharges from construction disturbing greater than one acre; second, point-source low-threat discharges generally covered under NPDES General Permits.

Chapter 3.2 Stormwater Discharges

Stormwater discharges resulting from construction projects greater than 1 acre are covered under the NPDES Program outlined in Section 402 of the Clean Water Act. Such discharges are covered under CWA 404(r) if the discharges have been adequately described within the EIS with consideration of the guidelines set forth in CWA 404(b)(1).

Under CWA 402, Reclamation's construction activities would fall under the California State Water Resources Control Board Order 2009-009-DWQ Construction General Permit NPDES General Permit No. CAS000002 for construction projects greater than 1 acre. Separate application and coverage under the General Permit is not required because Reclamation will comply with CWA 404(r). However, Reclamation will follow California State water quality standards outlined within the general permit.

The Construction General Permit contains effluent monitoring and limitations based upon the type of discharge and the risk level of the discharge. Reclamation will evaluate the risk level of each discharge for each construction project disturbing greater than 1 acre and develop a monitoring plan based upon the requirements in the Construction General Permit. Monitoring plans may include bioassessment monitoring, effluent monitoring, and receiving water monitoring.

Development of a Storm Water Pollution Prevention Plan

Regardless of the risk level of the discharge, Reclamation will develop a site-specific SWPPP as required by the Construction General Permit. The SWPPP will identify BMPs to prevent or minimize erosion and the discharge of sediments and other contaminants with the potential to affect beneficial uses of or lead to violations of water quality objectives for surface waters. The SWPPP would include site-specific structural and operational BMPs to prevent and control impacts on runoff quality, and procedures to be followed before each storm event. BMPs would control short-term and long-term erosion and sedimentation effects and stabilize soils and vegetation in areas affected by construction activities. The SWPPP would contain a site map that shows the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, drainage patterns across the project, and general topography both before and after construction.

Additionally, the SWPPP would contain a visual monitoring program, a chemical monitoring program for "non-visible" pollutants that would be implemented if a BMP fails, and a sediment monitoring plan to be implemented if a particular site discharges directly to a water body listed on the CWA 303(d) list for sediment. BMPs for the project could include, but would not be limited to, silt fencing, straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrances.

As part of the SWPPP, Reclamation would develop and implement a spill prevention and control plan to minimize effects from spills of hazardous, toxic, or petroleum substances for project-related construction activities occurring in or near waterways. The accidental release of chemicals, fuels, lubricants, and non-storm drainage water into water bodies would be prevented to the extent feasible. Spill prevention kits would always be close by when hazardous materials would be used (e.g., crew trucks and other logical locations). Feasible efforts would be

implemented so that hazardous materials would be properly handled and the quality of aquatic resources would be protected by all reasonable means during work in or near any waterway. No fueling would be done within the ordinary high-water mark, immediate floodplain, or full pool inundation area, unless equipment stationed in these locations could not be readily relocated. Any equipment that could be readily moved out of the water body would not be fueled in the water body or immediate floodplain. For all fueling of stationary equipment done at the construction site, containments would be installed so that any spill would not enter the water, contaminate sediments that may come in contact with the water, or damage wetland or riparian vegetation. Any equipment that could be readily moved out of the water body would not be serviced within the ordinary high-water mark or immediate floodplain.

Development of an Erosion and Sediment Control Plan

Reclamation will prepare and implement an erosion and sediment control plan to control short-term and long-term erosion and sedimentation effects, and to stabilize soils and vegetation in areas affected by construction activities. The plan would include all of the necessary local jurisdiction requirements regarding erosion control, and would implement BMPs for erosion and sediment control, as required. Types of BMPs may include, but would not be limited to, earth dikes and drainage swales, stream bank stabilization, and use of silt fencing, sediment basins, fiber rolls, and sandbag barriers.

Chapter 3.3 Other Point-Source Discharges

Point source discharges are covered under the NPDES Program outlined in Section 402 of the Clean Water Act. Such discharges are covered under CWA 404(r) if the discharges have been adequately described within the EIS with consideration of the guidelines set forth in CWA 404(b)(1).

Reclamation identified several discharges that could result from the raising of Shasta Dam or as a result of the construction activities involved with implementing relocations around Shasta Dam. The identified discharges would typically be covered under the Waste Discharge Requirements for Dewatering and Other Low Threat Discharges to Surface Waters NPDES General Permit No. CAG995001, administered by the California Regional Water Quality Control Board – Central Valley Region. Reclamation will follow the permit conditions outlined within the NDPES General Permit No. CAG995001 in lieu of applying for permit coverage to address state water quality standards.

Reclamation will minimize all potential discharges by prioritizing the capture and proper disposal of these discharges at a wastewater treatment facility. If the discharges are unable to be captured, Reclamation will follow the testing and pollutant limits outlined by NPDES General Permit No. CAG995001.

As defined by NPDES General Permit No. CAG995001, low threat discharges are relatively pollutant-free discharges that pose little threat to water quality when treated with simple, low technology treatments and/or controlled with BMPs to eliminate or reduce pollutants and minimize volume, rate, and duration of the discharge.

Some discharges may require treatment, such as settling out sediment or dichlorination to remove specific pollutants prior to discharge and/or BMPs to assure that the discharge does not create conditions of pollution or nuisance.

Discharges to surface waters of the North Coast Region that meet the definition of "low threat," may include, but are not limited to, the following categories of discharges anticipated during construction of the SLWRI Project:

1. Discharges from construction dewatering of groundwater, captured storm water, or any non-stormwater. Potential pollutants include sediment, naturally occurring metals and salts, temperature, and pH. Such discharges are typical for construction projects and may occur from the construction in and around the dam as well as in relocation construction areas.

2. Discharges resulting from maintenance, disinfection, cleaning, or flushing of water supply wells, pipelines, tanks, and reservoirs. Potential pollutants include chlorine, chlorine byproducts, naturally occurring metals and salts, temperature, and pH. Reclamation anticipates the possibility of these discharges occurring during the decommissioning of water utility lines, water storage tanks at recreation relocations (marinas, resorts, and campgrounds) and USFS facilities (Fire Guard Station and Maintenance Building).

3. Discharges resulting from well development, test pumping, maintenance, and purging of water supply or geothermal wells. Potential pollutants include where sediment, naturally metals or salts, temperature, and pH. Such discharges may occur during well development/construction of a water supply well at recreation relocation sites (campgrounds, resorts, and cabins) and USFS facilities (Lakeshore Fire Guard Station).

4. Discharges from hydrostatic testing of newly constructed pipelines, tanks, and reservoirs used for purposes other than potable water supplies. Potential pollutants include chlorine, chlorine byproducts, naturally occurring metals, temperature, and pH. These discharges may occur during the construction of water utility lines at recreation relocation sites (campgrounds, marinas, and resorts) and new construction of USFS facilities (Fire Guard Station).

5. Discharges resulting from dewatering of uncontaminated dredge spoils. Potential pollutants include sediment, naturally occurring parameters metals or salts, temperature, and pH. These discharges could occur during cut and fill operations at recreation relocation sites (boat ramps, campgrounds, marinas, boat in campgrounds and resorts) and at USFS facilities (Fire Guard Station).

6. Discharges from fire hydrant testing or flushing air conditioning condensate. Potential pollutants include sediment, naturally occurring parameters metals or salts, temperature, and pH. Such discharges could occur during fire hydrant testing and air conditioning installation at recreation relocation sites (campgrounds, resorts, and cabins) and new construction of USFS facilities (Fire Guard Station).

The NPDES program also covers discharges resulting from Marina Operations. Current individual NPDES Permits covering marina discharges include:

- Antlers Resort and Marina Incorporated, DBA Antlers Resort and Marina, and U.S. Department of Agriculture Forest Service
    - Order No. R5-2008-0143, Waste Discharge Requirements/Monitoring & Reporting Program, Adopted on 11 September 2008

- Holiday Harbor Incorporated and U.S. Department of Agriculture Forest Service for Operation of Holiday Harbor Marina
    - Order No. R5-2008-0125, Waste Discharge Requirements/Monitoring & Reporting Program, Adopted on 31 July 2008

- Silverthorn Resort Associates Limited Partnership and U.S. Department of Agriculture Forest Service for Operation of Silverthorn Marina/Resort
    - Order No. R5-2008-0126, Waste Discharge Requirements/Monitoring & Reporting Program, Adopted on 31 July 2008

- U. S. Department of Agriculture, Forest Service and Peloria Marinas, LLC (DBA Bridge Bay Marina at Shasta Lake)
    - United States Department of Agriculture, Forest Service and Peloria Marinas, LLC, dba Digger Bay Marina
        - Order No. R5-2017-0074, Waste Discharge Requirements/Monitoring & Reporting Program, Adopted on 9 June 2017

CWA 404(r) applies only to discharges resulting from the SLWRI Project. As these discharges are existing discharges already covered under individual NPDES permits, Reclamation is not addressing them in this document.

The SLWRI Project will not impact discharges covered by individual permits to these marinas. Any changes in pollutants requiring a permit modification will need to be handled through the Central Valley Regional Water Quality Control Board.

Chapter 4. Supplemental Information on Shasta Dam Operations and Modeling

Chapter 4.1 Background

As a cornerstone of the CVP, Reclamation operates Shasta Dam in accordance to the latest BOs concerning the CVP and its coordinated operations. At the time Reclamation finalized the 2015 SLWRI FEIS, Shasta Dam operated in accordance with the following Biological Opinions issued from the USFWS and NMFS (2008/2009 BOs) and the 1986 Coordinated Operation Agreement (1986 COA):

- The U.S. Department of Interior, Fish and Wildlife Service *2008 Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the CVP and SWP* (2008 USFWS BO)

- The National Marine Fisheries Service *2009 BO and Conference Opinion on the Long-Term Operations of the CVP and SWP* (2009 NMFS BO)

- Coordinated Operations Agreement between Reclamation and DWR for the CVP and SWP, as ratified by Congress (1986 COA)

On August 2, 2016, Reclamation and the California Department of Water Resources (DWR) jointly requested the Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. USFWS accepted the reinitiation request on August 3, 2016, and NMFS accepted the reinitiation request on August 17, 2016.
Reclamation prepared and submitted the Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project Final Biological Assessment on January 31, 2019.

Starting in October 2019, Reclamation has operated Shasta Dam in accordance with the following:

- Amended Coordinated Operations Agreement between Reclamation and DWR for the CVP and SWP, as ratified by Congress (Amended 1986 COA)

- The U.S. Department of Interior, Fish and Wildlife Service *Biological Opinion for the Reinitiation of Consultation on the Long-Term Operation of the Central Valley Project and State Water Project* (2019 USFWS BO)

- The National Marine Fisheries Service *Biological Opinion for the Reinitiation of Consultation on the Long-Term Operation of the Central Valley Project and State Water Project* (2019 NMFS BO)

The 2019 BOs include operational changes for Shasta Dam and the CVP as a whole with regard to Shasta Dam's operational schedule, including timing and magnitude of releases and the amount of storage to be withheld in any given year. As the 2015 SLWRI FEIS modelled its alternatives based upon the 2008/2009 BOs, Reclamation has prepared this supplemental chapter in order to describe the effects of the alternatives operating under the 2019 BOs. In both the 2015 SLWRI FEIS and this Draft SEIS, Reclamation conducted its modeling using the CalSim-II model.

The alternatives in the 2015 SLWRI FEIS included the No Action Alternative, and three dam raise height alternatives for a 6.5-ft, 12.5-ft, and 18.5-ft dam raise. Additional alternatives were included for the 18.5-ft dam raise with changes in the amount of water withheld for cold-water pool storage and varying uses for the additional water deliveries.

Reclamation focused its modeling updates on the 18.5-ft dam raise in order to model the largest change in potential impacts to the environment and the largest potential changes from the 2015 SLWRI FEIS.

Chapter 4.2 Updated Operations and Modeling Results

Reclamation compared two scenarios for Shasta Dam operations. The 2015 scenario is identical to the information presented in the 2015 SLWRI FEIS and includes the No Action Alternative and the 18.5-ft raise, modeled using CalSim-II under the 2008/2009 BOs and 1986 COA. The 2019 scenario models the No Action Alternative and the 18.5-ft raise using the 2019 BOs and the Amended 1986 COA.

Shasta Lake Storage

Reclamation modeled scenarios for Shasta Lake storage and used end of April storage from model results as a proxy for May 1 storage. May 1 storage is used in determining the temperature tier for the upcoming temperature management season for the Sacramento River.

Compared to the 2015 scenario with an 18.5-ft raise, the 2019 scenario with an 18.5-ft raise would increase Shasta Lake storage by 2% or less in all water year types for. Reclamation found the same to be true for a comparison between the 2015 scenario with No Action and the 2019 scenario with No Action. For example, for May 1 storage in dry and critically dry years under the 2015 scenario, the 18.5-ft raise would store 3,689,000 acre-feet of water. Under the 2019 scenario, the 18.5-ft raise would store 3,913,000 acre-feet of water.

Keswick Dam Releases

Reclamation modeled releases from Keswick Dam for all months in all water year types. The months and water years with the largest magnitude of differences included:

- Critical Years in September. The 2019 scenario would increase flows by 1.2%, compared to an increase of flows of 7.5% under the 2015 scenario.
- Dry Years in March. The 2019 scenario would decrease flows by 5.7%, compared to an increase of flows of 0.1% under the 2015 scenario.
- Wet Years in November. The 2019 scenario would decrease flows by 5.7%, compared to an increase of flows of 0.1% under the 2015 scenario.
- Critical Years in January. The 2019 scenario would increase flows by 0.3%, compared to an increase of flows of 5.4% under the 2015 scenario.

Sacramento River Flows below Keswick Dam

Reclamation modeled maximum Sacramento River flows below Keswick Dam for all months. Maximum flows are not dependent on water year type. The months with the largest magnitude of differences included:

- February. The 2015 scenario would decrease flows by 0.01%, compared to a decrease of flows of 7.49% under the 2019 scenario.
- August. The 2015 scenario would increase flows by 8.4%, compared to a decrease of flows of 0.2% under the 2019 scenario.
- October. The 2015 scenario would increase flows by 6.9%, compared to a decrease of 0.1% under the 2019 scenario.

The differences in all other months were less than 5%.

Reclamation also modeled minimum Sacramento River flows below Keswick Dam for all months. Minimum flows are not dependent on water year type. The months with the largest magnitude of differences included:

- June. The 2015 scenario would decrease flows by 38.9%, compared to a decrease of flows of 0.4% under the 2019 scenario.
- July. The 2015 scenario would decrease flows by 5.4%, compared to a decrease of flows of 0.5% under the 2019 scenario.
- August. The 2015 scenario would decrease flows by 15.1%, compared to a decrease of flows of 0.6% under the 2019 scenario.

- October. The 2015 scenario would decrease flows by 0.03%, compared to an increase of flows of 4.1% under the 2019 scenario.

The differences in all other months were less than 5%.

Sacramento River Flows at Red Bluff Diversion Dam

Reclamation modeled average Sacramento River flow below the Red Bluff Diversion Dam for all months in all water year types. The months and water years with differences larger than 5% were:

- Dry Years in August. The 2019 scenario would increase flows by 1.1%, compared to an increase of flows of 6.3% under the 2015 scenario.

- Critical Years in September. The 2019 scenario would increase flows by 1.0%, compared to an increase of flows of 6.9% under the 2015 scenario.

The differences in all other months in all other water year types were less than 5%.

Sacramento River Flows at Bend Bridge

Reclamation modeled flows in the Sacramento River at Bend Bridge for the months of concern for Yellow-billed cuckoo (March through August). The largest differences included:

- Dry years in August. The 2019 scenario would increase flows by 2.6%, compared to an increase of flows of 6.5% under the 2015 scenario.

- Dry years in March. The 2019 scenario would decrease flows by 2.7%, compared to an increase of flows of 0.1% under the 2015 scenario.

Differences for all other months for all water year types were less than 2%.

Sacramento River Flows at Rio Vista

Reclamation modeled Sacramento River flow at Rio Vista for all months in all water year types. The months and water years with the largest magnitude of differences included:

- Dry Years in August. The 2019 scenario would increase flows by 1%, compared to an increase of flows of 9% under the 2015 scenario.

- Dry Years in September. The 2019 scenario would decrease flows by 0.6%, compared to an increase of flows of 4% under the 2015 scenario.

All other results for all months and water year types were generally within 2% of one another.

Delta Outflow

Reclamation modeled Delta outflow for all months in all water year types. In all months for all water year types, Delta outflow results for the 2019 scenario and 2015 scenario were within 2% of one another.

Temperature

Reclamation previously used the HEC-5Q 2015 model to model temperature changes within the Sacramento River as a result of implementing the alternatives presented in the 2015 SLWRI FEIS. This model was recently updated in 2019 to update the modeling of operating the upper shutters of the Shasta Temperature Control Device. The resulting effect of this model update is a more realistic use of available cold water in model simulation. Reclamation re-ran the model for the 2015 scenario with the updated model and found no significant differences in predicted temperatures under the HEC-5Q 2015 model versus the updated HEC-5Q 2019 model using the same inputs. Those differences that do exist are favorable for temperature management.

Under the 2019 BOs reflected within the 2019 scenario operations have shifted so that the cold-water pool is retained earlier in the temperature management season (May through October) in order to have additional cold-water storage available for releases later in the season. This results in slightly higher temperatures earlier in the season as releases are withheld and lower river temperatures later in the season as additional cold-water storage is available for release. This results in more total time in which Reclamation is meeting the 53.5° F temperature threshold at the below Clear Creek compliance location for salmonid egg incubation.

Reclamation modeled temperature in the Sacramento River under the 2019 scenario for the 18.5-ft raise using the updated HEC-5Q 2019 model. Compared to the temperatures modeled for the 18.5-ft raise under the 2015 scenario, the model predictably reflects the operations as described in the 2019 BOs. In critical years temperatures are higher earlier in the temperature management season and lower later in the season. In other years (wet, above normal, below normal, and dry) results show consistent decreases in temperature across most months.

For example, for the 18.5-ft raise in critical water years the 2015 scenario predicts an average water temperature in the Sacramento River below Keswick Dam of 52.4° F in May and 54.8° F in August. For critical water years in the same location for the 18.5-ft raise under the 2019 scenario, the updated model predicts an average water temperature of 52.9° F in May and 51.6° F in August. All other water year types show consistent decreases in temperature for every month within the temperature management season.

Further downstream, the 18.5-ft raise under the 2019 scenario predicts lower water temperatures in all months and water year types within the temperature

management season compared to the 18.5-ft raise under the 2015 scenario, except in June of critical years and September of wet and above normal years.

Chapter 4.3 Environmental Impacts

Reclamation evaluated which resources had the greatest potential to be impacted by the change in flows under the 2019 scenario. For most environmental resources, the magnitude and severity would not change under the 2019 scenario. Reclamation identified three species, Winter-run Chinook Salmon, Central Valley steelhead, and the Western Yellow-billed Cuckoo that are most likely to respond to small changes in flow and temperature.

Winter-run Chinook Salmon and Central Valley steelhead

Reclamation evaluated potential changes for spawning/egg incubation, rearing to outmigrating juveniles, adult holding, and adult migration for Winter-run Chinook Salmon and Central Valley steelhead in the Upper Sacramento River.

Storage

Both the 2015 and 2019 scenarios resulted in an increase of Shasta Lake storage on May 1, which would remain beneficial for the temperature management season of May through October in the Sacramento River. Increased storage allows for a larger cold-water storage pool, providing additional cold-water for Winter-run Chinook Salmon spawning and egg incubation and for Central Valley steelhead. Minimum flows below Keswick Dam remain at 3,250 cfs to protect against redd dewatering.

Flows

Sacramento River flows during the summer and fall of dry and critical years have the greatest potential to impact juvenile Winter-run Chinook Salmon. During these times, the current reservoir may contain insufficient cold-water storage to provide suitable flows and water temperatures conducive to spawning and rearing. Increased storage allows for a larger cold-water storage pool, providing additional cold-water for Winter-run Chinook Salmon egg incubation and juvenile rearing.

The 2019 scenario results in an increase in minimum flows below Keswick Dam throughout the year, with the largest differences seen in June through August. During the winter season at Red Bluff Diversion Dam, total minimum water flows are up to 500 cfs greater under the 2019 scenario than under the 2015 scenario. An increase in minimum flows and in the cold-water storage capacity increases water quality within the Sacramento River, providing a benefit for migrating adult Winter-run Chinook Salmon.

Maximum flows below Keswick Dam decrease slightly under the 2019 scenario in comparison to the 2015 scenario. A decrease in maximum flows has the potential to adversely affect adult Winter-run Chinook Salmon migrating from the ocean to the upper Sacramento River.

Temperature
The SLWRI Project provides benefits to salmonid spawning and egg mortality by increasing the number of years that can be managed to a more stringent standard. The effect is particularly notable in the number of years that change from Tier 2 to Tier 1, but several other years move up a Tier as well (See Table 4-1).

Table 4-1. Temperature Tier Changes between Scenarios

Tier Classification	2015 Scenario (# of years)	2019 Scenario (# of years)
Tier 1	55	68
Tier 2	15	4
Tier 3	6	6
Tier 4	6	4

The improvement in Tiers reflects the greater availability of cold water, which is also reflected in the temperatures to which the river below can be cooled. Below Keswick Dam, with the exception of June in Critical Dry years and August in Wet years, there is a uniform improvement upon the No Action alternative in all water year types in the temperature management period of May through October.

These temperature improvements have the effect of reducing mortality measured by the Martin and Anderson mortality models, distinguished by their calculation of mortality across, respectively, the entire incubation period from deposition to emergence and the critical period just before hatching. While the tiny amount of mortality experienced in Above Normal years does not improve, all other water year types see mortalities decrease according to both models, with the most significant high mortality numbers in Critical Dry years seeing particularly large reductions.

Summary
Due to the small magnitude of the differences between the 2019 and the 2015 scenario, Reclamation does not expect to see significantly different impacts to Winter Run Chinook Salmon and Central Valley steelhead than what was presented in the 2015 SLWRI FEIS. The largest changes in flow can be seen during minimum flows in June, where the new 2019 scenario offers an increase in Sacramento River minimum flows below Keswick Dam, a benefit to the species. The 2019 scenario offers improvements with temperature management scenarios which reflects the greater availability of cold water throughout the season, providing a benefit to the species and reducing mortality. The overall assessment remains beneficial to the species with an increase in cold-water storage and better temperature management within the Sacramento River.

Western Yellow-billed Cuckoo
Reclamation evaluated potential changes in impacts to the Western Yellow-billed Cuckoo in the project area. Western Yellow-billed Cuckoo has designated Critical Habitat within the project area that was not designated until after the publication of the 2015 SLWRI FEIS.

In order to determine potential changes in the Sacramento River flow near the designated Critical Habitat, Reclamation compared flows under the 2019 and 2015 scenarios from March through August in all water years. Spring flows are important for vegetation recruitment and growth within the Critical Habitat.

The 2019 scenario results in a decrease in flows during dry water years in March. A decrease in flows could result in less riparian vegetation recruitment and growth necessary for Western Yellow-billed Cuckoo Critical Habitat. Flows are within 2% (roughly equivalent) to the 2015 scenario for critical years in March, wet years in April and May, and above normal and below normal years in April. In all other spring months in other water years, the 2019 scenario provides an increase in flows. An increase in flows would provide additional vegetation recruitment and growth necessary for Western Yellow-billed Cuckoo Critical Habitat.

The 2019 scenario results in an increase in flows in most summer months and year types except for dry years in August, above normal years in July, below normal years in July, critical years in July, and wet years in August. In all other summer months in other water years, the 2019 scenario provides an insignificant (less than 5%) increase in flows.

Due to the small magnitude of the differences between the 2019 scenario and the 2015 scenario, Reclamation does not expect to see significantly different impacts to Western Yellow-billed Cuckoo than what was presented in the 2015 SLWRI FEIS.

Chapter 5. Wild and Scenic River Considerations for McCloud River

This chapter describes the effects of the dam and reservoir modifications proposed under SLWRI action alternatives on the wild and scenic river values of the lower McCloud River, one of the major tributaries to Shasta Lake.

This chapter differs from the other chapters in this Draft SEIS in that it concerns only the McCloud River and does not discuss other portions of the primary study area nor the extended study area. The study area for this chapter consists of the lower McCloud River from the McCloud River Bridge to the confluence with Little Bollibokka Creek (Figure 5-1).

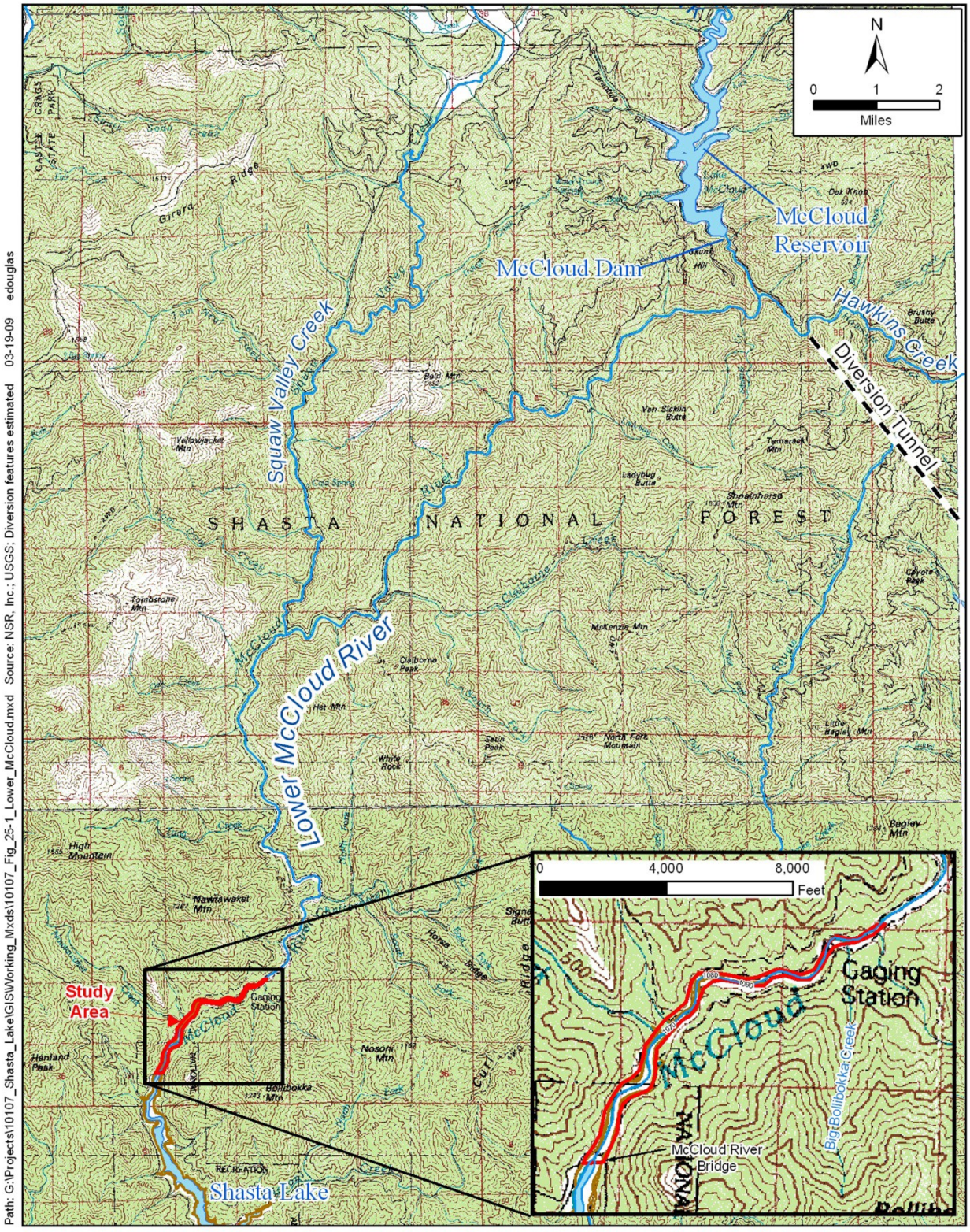

Figure 5-1. Lower McCloud River Study Area

The primary focus of this chapter is the wild and scenic river values of the lower McCloud River, particularly the reach that could periodically be inundated if Shasta Dam and Shasta Lake were enlarged. The discussion and analysis concentrate on the values for which the McCloud River has been determined eligible for listing under the Federal Wild and Scenic Rivers Act ((Federal WSRA); Public Law 90-542, as amended; 16 U.S. Code 1271-1287).

The State of California also did not identify the McCloud River as Wild and Scenic under the State Wild and Scenic Rivers Act. Instead, portions of the river were designated in the California Public Resources Code (PRC) Section 5093.542 as supporting a wild trout fishery.

This chapter also differs from the other chapters in this Draft SEIS; it first provides background information and then discusses the regulatory framework to provide context for the affected environment section. Portions of the 2015 SLWRI FEIS were originally written to support use of the document by the State or state entities under the California Environmental Quality Act. Reclamation has no obligation to analyze state law requirements under the California Wild and Scenic Rivers Act, and this section is therefore being revised to reflect and re-focus the analysis on the federal requirements.

Although the McCloud River is eligible for listing under the Federal Wild and Scenic Rivers Act, Congress has not identified the McCloud River as a federal wild and scenic river. In its Land and Resource Management Plan (LRMP) for Shasta and Trinity Forests, the USFS determined that it would not recommend the McCloud River for such a designation, and that it would instead work with local landowners to develop a Coordinated Resource Management Plan (CRMP) for the river corridor with a product of that plan being retaining the characteristics of the river that made it eligible for listing. This analysis evaluates potential impacts on the characteristics.

Chapter 5.1 Background

Segments of the McCloud River have been determined eligible for listing under the Federal WSRA but the river has not been formally listed as wild and scenic under the Federal WSRA and is not part of the national river system. The USFS evaluated the eligibility of the McCloud River for listing as wild and scenic under the Federal WSRA during preparation of the Shasta-Trinity National Forest (STNF) LRMP in 1994 (USFS 1994). Although the LRMP found the McCloud River eligible for listing, the LRMP direction was to not formally designate any reach of the river as wild and scenic. Instead, the direction was to manage the lower McCloud River under a CRMP (USFS 1995a). The CRMP is a coordinated effort between landowners and stakeholders with a vested interest in the river. The CRMP requires its signatories to protect the outstandingly remarkable values (ORVs) on lands they own or manage to ensure that the river remains eligible for Federal designation as wild and scenic. The CRMP contains a provision stating that the USFS reserves the right to pursue

designation if the CRMP is terminated or fails to protect these values.

California has expressed an opinion that PRC 5093.542 prohibits the State from being involved in the planning or construction of the proposed action. As stated above, Reclamation does not believe California's views are relevant for the purposes of this NEPA analysis. However, because Reclamation previously addressed PRC 5093.542 in the 2015 SLWRI FEIS, it is addressed here as background information.

The California Natural Resources Agency (Resources Agency) evaluated the McCloud River in the late 1980s (Jones & Stokes Associates 1988) to determine whether it was eligible for listing under the PRC. The Resources Agency study found it eligible, but the California legislature declined to add the river to the California wild and scenic river system. The legislature instead passed an amendment to the California Wild and Scenic Rivers Act to protect the river's wild trout fishery below McCloud Dam, PRC Section 5093.542. The PRC was a compromise between the landowners and the State and served to prevent an energy company from constructing three small dams along the river. These structures were planned in the upper watershed of the McCloud and specifically cited in 5093.542(b). However, the legislature separately addressed DWR's participation in the feasibility of enlarging Shasta Dam, authorizing DWR to participate in technical and economic feasibility studies while directing that the agency could not assist or cooperate with planning of any other projects involving construction of a dam, reservoir, diversion, or other water impoundment facility that could have an adverse effect on the free-flowing condition of the McCloud River or on its wild trout fishery (PRC Section 5093.542(c)). In other words, the legislature specifically excepted enlargement of Shasta Dam from the prohibition on assisting or cooperating in projects such as the facilities identified in PRC Section 5093.542(b). Emphasizing the point, the legislature referred to the Shasta Dam project as an "enlargement," and separately referenced other projects as construction of "any dam, reservoir, diversion, or other water impoundment facility" [PRC Section 5093.542(b),(c)].

The Federal WSRA establishes a wild and scenic river corridor— typically at least 0.25 mile on each side of the river and requires Federal agencies to manage the public lands in the corridor to protect the river's free-flowing character and ORVs. In addition, the Federal agency managing rivers that are Federally designated as wild and scenic is required to develop and implement a management plan that will ensure the river's protection.

The USFS defined the lower McCloud River as the portion of the river that is currently periodically inundated by Shasta Lake – referred to in this chapter as the *transition reach* – as part of the lake rather than part of the river. The USFS defined the lower river as extending from McCloud Dam downstream to an elevation of 1,070 feet mean sea level (msl) (approximately 22 total river miles), which corresponds to the current full-pool elevation of Shasta Lake. The USFS determined that this portion of the river does not meet the definition of natural or free flowing because it is downstream of McCloud Dam and some portions of the river offer public access.

In its evaluation, the USFS divided the McCloud River into 10 segments encompassing 46 total river miles: three segments along the upper McCloud River (24 river miles above McCloud Reservoir) and seven segments along the lower McCloud River (22 river miles below McCloud Dam). Numbering of the upper McCloud River segments began at the headwaters and counted downstream, but numbering of the lower McCloud River segments began at the downstream extent and counted upstream. The USFS concluded that all 10 segments of the McCloud River were eligible for listing as a Federal wild and scenic river because they are free flowing, possess good water quality, and exhibit ORVs in the areas of cultural and historical resources, fisheries, geology, and scenic resources. Part of the lowermost segment – Segment 4 – would be periodically inundated if Shasta Lake is expanded. Segment 4 extends from about 5,400 feet upstream from the McCloud River Bridge, beginning at an elevation of 1,070 feet msl, to about Little Bollibokka Creek. The lower extent of this segment corresponds with the current full-pool elevation of Shasta Lake based on Reclamation geographic information system data. Figure 5-2 shows the downstream extent of Segment 4.

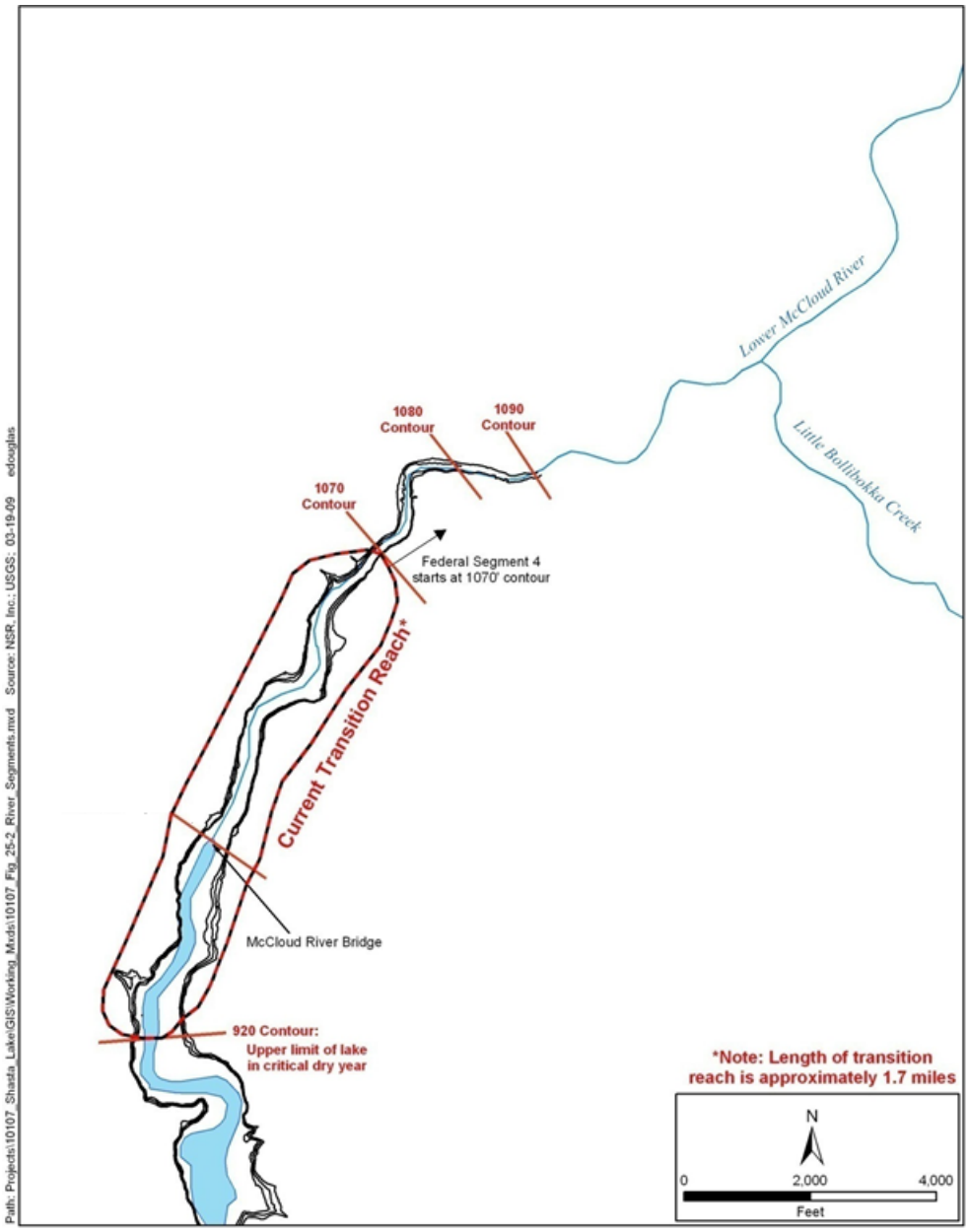

Figure 5-2. Federal Segments of the Transition Reach

Chapter 5.2 Regulatory Framework

5.2.1 Federal

Federal Wild and Scenic Rivers Act

The Federal WSRA, enacted in 1968, established the National Wild and Scenic Rivers System "to preserve rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations." To be eligible for inclusion in the system, a river must be free-flowing and exhibit ORVs. Free-flowing means "existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway" (16 United States Code (USC) Section 1286). ORVs are scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values (16 USC Section 1271). Depending on the specific conditions of a river, it may be designated as "wild," "scenic," or "recreation." Different segments of a single river can receive different designations; in other words, some segments can be designated wild, some scenic, and some recreation or combinations of these designations.

The Federal WSRA does not prohibit water developments that may affect portions of rivers that are eligible for inclusion in the National Wild and Scenic Rivers System. Section 5(d)(1) of the act does, however, require that in all planning for the use and development of water and related land resources, consideration be given to potential national wild, scenic, and recreational river areas by all Federal agencies involved.

Through the development and approval of the STNF LRMP, the USFS determined that segments of the McCloud River are eligible for inclusion in the national system; however, the river has not been formally designated and thus is not afforded protections under the Federal WSRA. Instead, the McCloud River CRMP was developed "to protect the [river's] unique and outstandingly remarkable features," thereby maintaining its eligibility.

The USFS evaluation concluded that the lower McCloud River, from McCloud Dam downstream about 22 miles to the river's transition to Shasta Lake at about 1,070 feet msl, provides outstanding cultural, fisheries, and geologic values, and its corridor has been classified as a highly sensitive visual area by the USFS (USFS 1994 and 1995b). The entire river corridor contains prehistoric and historic sites from past use by Indian tribes, late 1800 and early 1900 resorts, and evidence of historic logging. The lower river provides habitat for several salmonid species: bull trout/Dolly Varden (*Salvelinus confluentus*), which is believed to be extinct; rainbow trout (*O. mykiss*), which has been transplanted all over the world; and brown trout (*Salmo trutta*), a non-native species. Collectively, the rainbow and brown trout in the lower McCloud River are considered to be a "blue ribbon trout fishery" (USFS 1994). Outstanding geologic values include rock outcrops, cascades, and pools. Based on the ORVs,

the STNF determined that the lower McCloud River meets the eligibility requirements for designation under the Federal WSRA.

Shasta-Trinity National Forest Land and Resources Management Plan

The STNF LRMP is a forest-wide land use plan developed to guide resource management within the forest (USFS 1995b). For planning purposes, the STNF is divided into six land allocations for which specific management prescriptions are identified. The land allocations include Congressionally Reserved Areas, Late-Successional Reserves, Administratively Withdrawn Areas, Riparian Reserves and Key Watersheds, Matrix Lands, and Adaptive Management Areas. Management areas were identified within the STNF to establish management direction in response to the issues and resources of each distinct area. The Management Area defined for the McCloud River provides resource direction for recreational use, specifically fishing (i.e., fishery) and viewing waterfalls, and management of old-growth habitat. Management of the wild and scenic river ORVs of the McCloud River is deferred to the CRMP.

Coordinated Resource Management Plan

In 1990, certain public agencies and private parties with interests in the management of lands adjacent to the McCloud River executed a memorandum of understanding to pursue preparation of a CRMP. The memorandum was signed by representatives of the USFS, California Department of Fish and Wildlife (CDFW), The Nature Conservancy, Pacific Gas and Electric Company (PG&E), the Bollibokka Land Company, Crane Mills, McCloud River Co-Tenants, Sierra Pacific Industries, and the Hearst Corporation. In 1991, the same signatories, along with California Trout Inc., signed another memorandum of understanding to establish the framework for and approve the CRMP. The CRMP was adopted in July 1991. In 2007, the property owned by the Bollibokka Land Company was sold to Westlands Water District, which is not a party to the CRMP.

The purpose of the CRMP is to protect the ORVs through coordinating the actions of signatory members on their individual properties. The CRMP has no authority, responsibility, or jurisdiction for protection of the ORVs beyond the actions of the signatory members on their properties. The CRMP provides a framework for coordinating management activities among the participants to ensure that the characteristics of the river that make it eligible for Federal wild and scenic river designation are protected.

Under the terms of the CRMP, the USFS “reserves the right to pursue [Federal wild and scenic river] designation” if the CRMP is terminated or significantly impaired or if it fails to protect the values that make the river suitable for such designation. This would occur if, for any reason, the actions of a signatory member of the CRMP on the signatory member’s land failed to protect the ORVs, as described in the CRMP Memorandum of Understanding.

Chapter 5.3 Affected Environment

This section defines "affected environment" as the wild and scenic characteristics of the lower McCloud River that could be affected by the proposed modifications to Shasta Dam and Shasta Lake. It briefly describes the McCloud River from its headwaters to the McCloud Arm of Shasta Lake. It then describes the various elements including the wild and scenic values of Segment 4 identified in the USFS evaluation.

Descriptions of the river and its characteristics were derived primarily from the following sources:

- Wild and Scenic Rivers Evaluation, Appendix E to the 2015 SLWRI FEIS for the Shasta-Trinity National Forest Land and Resources Management Plan (USFS 1994)
- Lower McCloud River and McCloud Arm Watershed Analyses (USFS 1998a and 1998b)
- McCloud River Wild and Scenic River Report (Jones & Stokes Associates 1988)
- Lower McCloud River Wild Trout Area Fishery Management Plan, 2004 through 2009 (Rode and Dean 2004)
- Lower McCloud River Habitat Typing Report (USFS 2001)

Chapter 5.4 The McCloud River

McCloud River Basin

The McCloud River basin drains an area of approximately 800 square miles (USFS 1998a) in northern Shasta County and southern Siskiyou County, southeast of Mount Shasta. The river originates in an area of the STNF near Colby Meadows at approximately 4,250 feet above msl (Rode and Dean 2004). From its headwaters to Shasta Lake, the river is approximately 59 miles long. McCloud Reservoir, part of PG&E's McCloud-Pit Hydroelectric Project, separates the upper river from the lower river. The lower McCloud River transitions into the McCloud Arm of Shasta Lake upstream from the McCloud River Bridge (Figure 5-3).

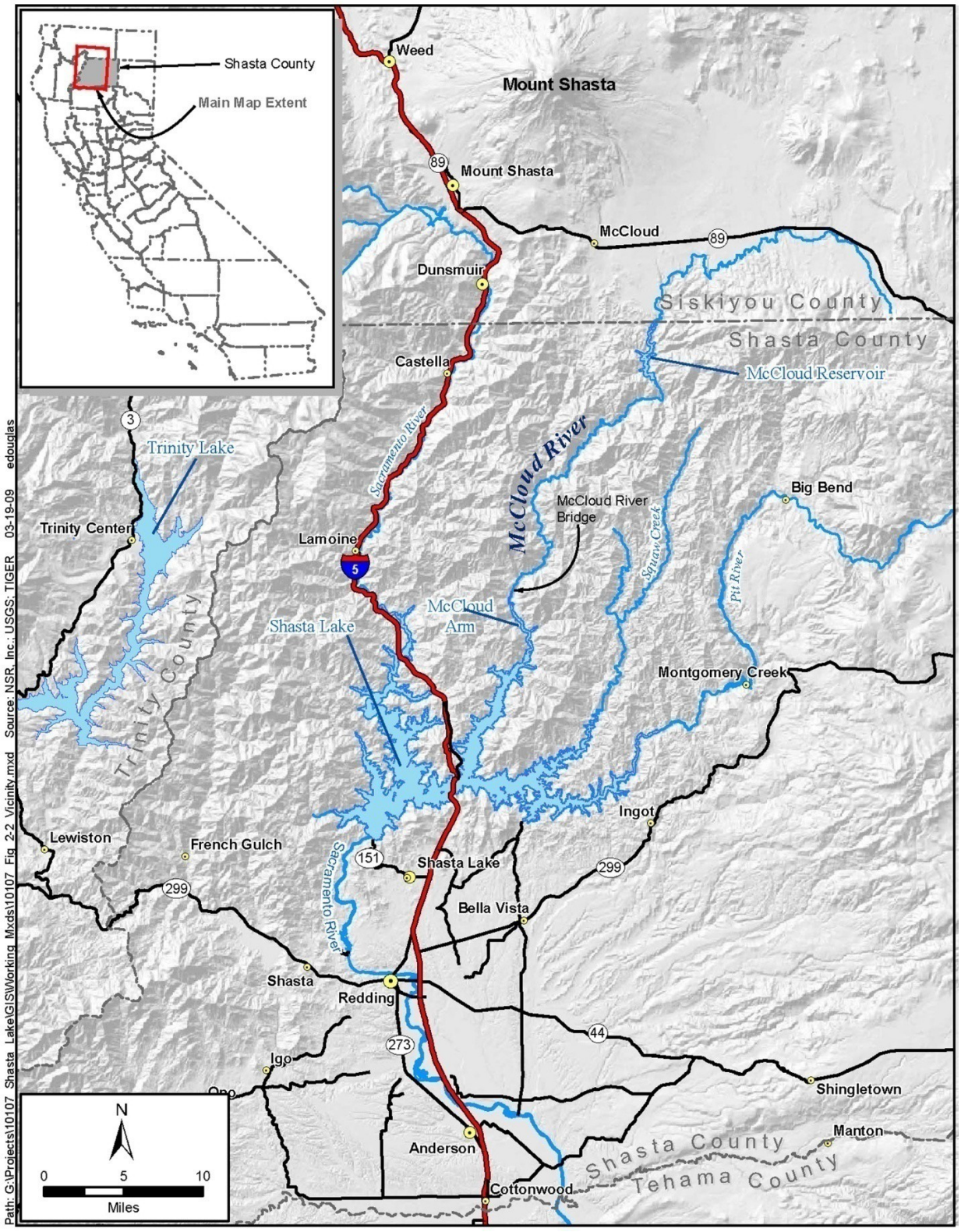

Figure 5-3. Regional Location

Upper McCloud River

The upper McCloud River is an approximately 36-mile reach from the river's origins at Colby Meadows downstream to the transition with McCloud Reservoir. The river basin above the reservoir drains an area of approximately 403 square miles. Mean monthly flows in the upper McCloud River range from 766 cfs in October to over 1,000 cfs in March, April, and May (PG&E 2006).

McCloud Reservoir

The McCloud Reservoir is a major component of PG&E's McCloud-Pit Hydroelectric Project, which was constructed in 1965 and operates under license from the Federal Energy Regulatory Commission (FERC). The McCloud Reservoir is approximately 5 miles long and has a storage capacity of approximately 35,200 acre-feet of water. The McCloud-Pit Hydroelectric Project diverts approximately 75 percent of the upper McCloud River's flow through a pipeline to Iron Canyon Reservoir, then conveys it downslope and discharges it into the Pit River at the Pit 6 powerhouse, upstream from the Pit River Arm of Shasta Lake (PG&E 2006). The remaining 25 percent of flows provide base flow for the lower McCloud River, a considerable reduction from historic flow volumes (Jones & Stokes Associates 1988).

Lower McCloud River

The lower McCloud River flows southwesterly through a deep canyon with steep slopes approximately 22 miles from McCloud Dam downstream to the transition with Shasta Lake. Vegetation along the lower river is predominately mixed-conifer and Douglas-fir forest. This stretch of river receives runoff from a 404-square-mile area of the lower McCloud River basin and the 95-square-mile Squaw Valley Creek basin. It provides exceptional fishing opportunities and includes two long-established fishing clubs, the Bollibokka Club and the McCloud River Club. The Nature Conservancy's McCloud River Preserve also encompasses a portion of the lower McCloud River.

Flows in the lower McCloud River have been controlled by releases from McCloud Dam since 1965 (PG&E 2006). Under its current FERC license,[1] PG&E's McCloud-Pit Hydroelectric Project maintains a minimum instream flow of 50 cfs from May through November and 40 cfs from December through April through controlled releases. Accordingly, flows in the lower McCloud River are highly regulated, and annual flows in the river below McCloud Dam do not follow a pattern typical of an unimpaired mountain river in northern California. Before dam construction, flows in the lower river were considerably higher, estimated to be in the range of 924 to 1,245 cfs (mean monthly flows) from June to October (Jones & Stokes Associates 1988, citing U.S. Geological Survey (USGS) for the period of 1967 to 1985).

McCloud Arm of Shasta Lake

The construction of Shasta Dam between 1938 and 1945 converted part of the

[1] PG&E is currently undergoing FERC relicensing and minimum flows in the McCloud River may increase.

lower McCloud River into the McCloud Arm of Shasta Lake. The McCloud Arm is more than 16 miles long, with approximately 70 miles of shoreline. It drains an area of approximately 41,000 acres (USFS 1998b). Water levels in the arm fluctuate with the lake's water levels, and during periods of lower water levels, a water line, known as the "bathtub ring," is evident along the banks; this bathtub ring extends about 1 mile upstream from the McCloud River Bridge. During extended periods of lower water levels, vegetation may become established on the exposed banks.

The upper extent of the lake encompasses the transition reach, which varies between about 920 and 1,070 feet msl. Because of the effects of Shasta Lake on the McCloud Arm, the STNF determined that the transition reach did not meet the eligibility requirements of a wild and scenic river (USFS 1994). The USFS defined the upper limit of the McCloud Arm as an elevation of 1,070 feet, or approximately 5,400 feet above the McCloud River Bridge. This elevation corresponds to the lower limit of Segment 4 as defined in the STNF LRMP.

The transition reach provides a corridor for fish migrating between Shasta Lake and the lower McCloud River and contributes to the unique fishery of the river. Common fish in the McCloud Arm include native species such as rainbow trout, riffle sculpin, and speckled dace, as well as non-native species (e.g., brown trout, spotted bass) (North State Resources, Inc. 2008).

Water temperatures in the McCloud Arm become warmer as the river transitions to Shasta Lake. The warmer temperatures associated with Shasta Lake support warmwater fish, but the cooler temperatures of the transition reach may prevent some fish from migrating upstream into the lower river. Water temperatures in the transition reach may be suitable for warmwater species.

5.4.1 The McCloud River's Wild and Scenic Values

This section focuses on the wild and scenic river characteristics and ORVs of the lower McCloud River identified by the USFS in the wild and scenic river evaluation performed for the STNF LRMP (USFS 1994) and the wild and scenic river characteristics and extraordinary value protected under the PRC.

The McCloud River's fishery and its free-flowing condition are identified in the USFS evaluation. These characteristics are discussed first, followed by a discussion of the wild and scenic characteristics and values – water quality, geology, cultural/historical resources, and visual quality/scenery – that are identified only in the USFS evaluation.

Throughout the development of the 2015 SLWRI FEIS, Reclamation worked closely with private landowners to collect information, perform technical investigations, and incorporate the best available science to support the 2015 SLWRI FEIS.

Reclamation worked closely with private land owners, including the signatories to the CRMP, to incorporate available information on the McCloud River into the 2015 SWLRI FEIS. The following section includes a brief description of the current transition reach (see Figure 5-1) because the reach of the river that would be newly inundated would likely take on the characteristics of the existing transition reach.

Fishery

The fishery of the lower McCloud River is unique; the river is considered a premier trout fishery and is managed according to CDFW's wild trout policy for the reach from Algoma Campground downstream to the lower end of the Nature Conservancy property, despite the ongoing effects of McCloud Dam and Shasta Lake on the river's flows and water quality, and the more recent impacts of the 2012 Bagley Fire and the 2019 Mountain Fire on the lower McCloud River watershed. To characterize the fishery, this section includes descriptions of the aquatic habitat in USFS Segment 4, and the transition reach as well as the fish species that inhabit the study area.

Aquatic Habitat The lower McCloud River is characterized as a series of alternating riffles, pools, and cascading pocket water occurring along a broad, boulder-studded river channel within a confined, heavily timbered valley. A narrow band of montane riparian vegetation (typically less than 25 feet wide) dominated by willows, white alders, and Oregon ash occurs along the river banks adjacent to steep hill slopes with mixed conifer-Douglas-fir forest (USFS 2001).

In 2001, the USFS prepared a Habitat Typing Report to characterize aquatic habitats in the lower McCloud River from the McCloud River Bridge to McCloud Dam. The report divided the lower river into four reaches: McCloud

Dam to Ladybug Creek, Ladybug Creek to Clairborne Creek, Clairborne Creek to Tuna Creek, and Tuna Creek to McCloud River Bridge. The reach from Tuna Creek to McCloud River Bridge includes all of Segment 4 and nearly all of Segment 10, including the portion of the transition reach that is part of Segment 10. Data are not available for the transition reach below the McCloud River Bridge downstream to Shasta Lake.

The dominant aquatic habitat in the reach of the lower river from Tuna Creek to McCloud River Bridge includes runs (20 percent), mid-channel pools (18 percent), low-gradient riffles (18 percent), lateral scour pools from bedrock (11 percent), and pocket water (10 percent) (USFS 2001). This reach provides most of the corner pool (100 percent), glide (89 percent), and cascade (50 percent) habitats in the lower McCloud River.

The portion of the transition reach upstream from McCloud River Bridge is dominated by low-gradient riffles and mid-channel pools, with some pocket water, glides, runs, and lateral scour pools. Glide habitat is the dominant aquatic habitat between the 1,070-foot and 1,080-foot elevations, and pocket water is the dominant aquatic habitat between the 1,080-foot and 1,090-foot elevations. The habitat within the current transition reach represents a fraction (only 3%) of the total available aquatic habitat within the lower McCloud River and provides a small portion of the habitats within the reach from the McCloud River Bridge to Tuna Creek.

The diversity of riffles, flatwater habitat, and pools is influenced by the presence of boulders and cobble substrate and variations in flow conditions. The lower river is dominated by boulders with pockets of gravel present at pool tailouts and in velocity breaks behind large boulders. The riffles are generally higher gradient channel sections with turbulent surface flow and uniform cobble and boulder substrates. While swift pocket water in the lower McCloud River often appears more like a riffle than a run, the habitable eddies, or pockets, created behind the boulders that characterize this habitat type make it functionally more similar to the other flatwater habitats (USFS 2001). Typically, flatwater and pools are the principal habitats used by the trout in the McCloud River for rearing and feeding (Wales 1939, Rode and Dean 2004, USFS 2001).

The USFS (2001) reported that the aquatic habitat within the transition reach had undergone type conversions caused by aggradation and scour of sediments for about 3,700 feet upstream from the McCloud River Bridge. When Shasta Lake is drawn down, large, wide, low-gradient riffles with channel braiding dominate in this reach. When the lake is at full pool and at intermediate levels of drawdown, the transition reach becomes inundated, but a unidirectional current created by the lower McCloud River's inflow is detectable throughout the inundation zone, slowing as it approaches the flat water of Shasta Lake. To varying degrees, this fluctuating backwater effect converts this reach to a deep,

wide, slow-moving riverine habitat transitioning to lacustrine habitat near the bottom of the transition reach.

Fish Species The current composition and distribution of fish species inhabiting the lower McCloud River and Shasta Lake reflect the historic fishery, the operational effects of Shasta Dam and McCloud Dam, and the introduction of nonnative fish species into the river and Shasta Lake. The completion of Shasta Dam in 1945 eliminated all runs of anadromous fish in the river (Rode and Dean 2004). The historic fishery included Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss irideus*), rainbow trout, and the only known California occurrence of the bull trout. The bull trout is believed to have been extirpated from the lower McCloud River and is possibly extinct in California. Today, the fishery is dominated by rainbow trout and brown trout, an introduced species that migrates between Shasta Lake and the lower McCloud River. Other nonnative species also migrate up the lower McCloud River, including spotted bass (*Micropterus punctulatus*), but bass have not been confirmed upstream from Tuna Falls, a high-gradient rapid at the confluence with Tuna Creek. Despite the change in fish species in this 22-mile reach, the lower McCloud River is still considered one of California's premier trout streams.

Fish observed in the river downstream from the Tuna Creek confluence during a survey conducted in summer 2007 included rainbow trout, spotted bass, speckled dace (*Rhinichthys osculus*), sculpin spp. (*Cottus* spp.), Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*) (North State Resources, Inc. 2008). Other fish that occur in this reach include brown trout, brook trout (*Salvelinus fontinalis*), hardhead (*Mylopharodon conocephalus*), and smallmouth bass (*Micropterus dolomieui*). The status of the riverine fish species of the lower McCloud River is identified in Table 5-1.

Rainbow Trout Fluvial and adfluvial populations of rainbow trout use the habitat available throughout the lower McCloud River. The McCloud River rainbow trout became known as "the rainbow of the fish culturist" because eggs from that population accounted for transplants of rainbow trout in the 1880s to the eastern states and several other countries.

The rainbow trout that inhabit the McCloud River are a vigorous, active fish that primarily inhabit swifter portions of pool and pocket water habitats. Adults migrate into the lower McCloud River from Shasta Lake in the spring and fall months, presumably to spawn. Suitable spawning habitat in the study area is limited, and the trout likely migrate further upstream to spawn (North State Resources, Inc. 2008).

Although the genetic origin of these fish has not been evaluated, the numerous strains of rainbow trout planted in Shasta Lake over the years have likely resulted in some introgression among migratory rainbow trout in the lower McCloud River. The degree to which this migratory population of rainbow trout

contributes to the native trout fishery of the river is not specifically known; however, available data do not indicate that it is substantial.

Table 5-1. Riverine Fish Species of the Lower McCloud River

Species	Current Status	Comments
Sacramento sucker (*Catostomus occidentalis*)	Common	Native, non-game species, observed during 2007 surveys
Riffle sculpin (*Cottus gulosus*)	Common	Native, non-game species, observed during 2007 surveys
Smallmouth bass (*Micropterus dolomieui*)	Uncommon	Introduced sport species in Shasta Lake, moves into lower river from lake, warmwater species
Spotted bass (*Micropterus punctulatus*)	Uncommon	Introduced sport species in Shasta Lake, moves into lower river from lake, observed during 2007 surveys, warmwater species
Hardhead (*Mylopharodon conocephalus*)	Uncommon	Native, non-game species
Rainbow trout (*Oncorhynchus mykiss*)	Abundant	Native trout species, subject to special angling regulations, coldwater species, observed during 2007 surveys
Sacramento squawfish (=pikeminnow) (*Ptychocheilus grandis*)	Common	Native, non-game species, observed during 2007 surveys
Speckled dace (*Rhinichthys osculus*)	Common	Observed during 2007 surveys
Brown trout (*Salmo trutta*)	Common	Introduced sport species found throughout the river, migrates from Shasta Lake to spawn in lower river, subject to special angling regulations, coldwater species
Bull trout (*Salvelinus confluentus*)	CE; Extinct	Native, believed extirpated from entire river by mid-1970s, a few restoration experiments performed in upper river tributaries, coldwater species
Brook trout (*Salvelinus fontinalis*)	Rare	Introduced sport species, stocking in upper river and tributaries discontinued, very rarely observed in lower river, coldwater species

Sources: Wales 1939, Tippets and Moyle 1978, Rode and Dean 2004, Moyle 2002, CDFW, unpublished data, North State Resources, Inc. 2008
Key:
CE = California Endangered
CDFW = California Department of Fish and Wildlife

Rainbow trout typically mature in their second to third year and move upstream to spawn in the lower McCloud River and its tributaries from February to June. The eggs typically hatch in 3 to 4 weeks, depending on water temperature, and fry emerge 2 to 3 weeks later. The fry remain in quiet waters close to shore, among cobbles, or under overhanging vegetation for several weeks. As the fish grow, they move into swifter water habitats.

In the river, this species forms feeding station hierarchies, which they aggressively defend, and prey on aquatic and terrestrial insects drifting in the current. They also eat active bottom invertebrates. It has been reported that

McCloud River rainbow trout tend to be more bottom-oriented when feeding than rainbow trout elsewhere.

In reservoirs, rainbow trout form loose schools and feed on both invertebrates and other fish, although fish dominate their diet as they grow larger. Preferred prey in Shasta Lake is the threadfin shad. Trout growth in Shasta Lake is more rapid than for fluvial trout. The optimum temperature range for growth and for completion of most life stages of rainbow trout is between 50 and 70 degrees Fahrenheit (°F), though they seem to prefer and thrive at temperatures in the lower two-thirds of this range. Rainbow trout in lakes and streams seldom live for more than 6 years.

Brown Trout Like the rainbow trout, fluvial and adfluvial populations of non-native brown trout use habitat throughout the lower McCloud River, but this species migrates more between the lake and river. It is not as abundant as the rainbow trout. CDFW biologists suggest that this species occupies an ecological niche previously occupied by bull trout in the lower McCloud River (Rode and Dean 2004).

Only some of the brown trout migrating from Shasta Lake that passed a lower river counting weir were observed upstream in the CDFW Wild Trout Management Area (Segments 7, 8, 9, and 10), so the actual extent of the spawning grounds of migratory brown trout is not fully known.

Brown trout mature in their second or third year. Some fish may mature in the river while others may migrate to Shasta Lake to feed, returning to spawn on a recurring basis. The stimulus for upstream migration is often a rise in stream flow or changing lake temperatures. Spawning takes place from November through December when water temperatures fall below 50°F. Eggs typically hatch within 7 to 8 weeks, depending on water temperature. Fry emerge from the gravel 3 to 6 weeks later. The habitats used by juvenile brown trout are similar to those used by rainbow trout; however, as brown trout grow, they tend to select habitats with slower water and more cover. In the riverine environment, brown trout prefer slow, deep pools with abundant boulder and bedrock ledge cover. The timing of emigration of juvenile brown trout to Shasta Lake is not known.

Fluvial brown trout have diets similar to those of rainbow trout, but appear to feed more on the stream bottom for benthic prey than rainbows. As brown trout grow, their diet expands to include larger invertebrate prey and fish. Larger brown trout are voracious predators, especially on fish, including young salmonids. In Shasta Lake, adult brown trout prefer threadfin shad as a staple prey.

Brown trout growth in the lower McCloud River appears to increase after age 3, which has been attributed to their migration to Shasta Lake to exploit the forage fish populations. Brown trout growth is best at temperatures ranging from 45 to

69°F, though they seem to prefer and dominate other trout species near the upper half of this range.

Spotted Bass and Smallmouth Bass Black basses and other sunfishes dominate in the littoral zones of Shasta Lake. Spotted bass and smallmouth bass are now the most common species of black bass in Shasta Lake, with spotted bass having become most frequent over the past 20 years. Both spotted and smallmouth bass occupy shallow, low-gradient habitat offered by Shasta Lake and its tributaries. They can be found throughout Shasta Lake and in the lower ends of the main tributary streams, including the lower McCloud River. However, the extent to which black bass have colonized the lower McCloud River is not currently known.

Smallmouth bass and spotted bass share similar life histories, and these similarities may account for their persistence in Shasta Lake compared to that of largemouth bass, which have declined in numbers. Both smallmouth and spotted bass mature in their second or third year and spawn in the late spring. Smallmouth will spawn at cooler temperatures (55 to 61°F) than spotted bass (greater than or equal to 65°F). Both species seek quiet shallow areas over mud, sand, gravel, and rocky, debris-littered bottoms to spawn in both lakes and streams. This type of spawning habitat is available in the transition reach of the lower McCloud River, especially when lake levels are high.

Juvenile bass feed on small invertebrates until they are large enough to prey on small fish and large invertebrates. Temperature preferences and optimal growth for both species of black basses is attained in the range from 68 to 81°F. Because of the year-round cool temperatures (less than or equal to 68°F) of the lower McCloud River, temperatures preferred by bass only occur during the late summer and early fall months upstream from the transition reach. Therefore, the temperature regime of the lower McCloud River may limit intrusions of bass from the lake. However, spotted bass were observed in the lower river below the confluence of Tuna Creek during summer fish surveys (North State Resources, Inc. 2008).

Free-Flowing Condition

The Federal WSRA defines *free flowing* as “existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway” (16 USC Section 1286).

Base flows in the lower McCloud River are predominantly controlled by releases from McCloud Reservoir in accordance with PG&E’s FERC license and include precipitation and inflow from tributaries. The lower McCloud River experiences seasonal fluctuations and large variations in base flows from storm events only (USFS 1998a). Releases from McCloud Reservoir into the lower river are heavily regulated, with a minimum release requirement of 50 cfs from May through November and 40 cfs from December through April; the releases are typically well above these minimum requirements and tend to stay above 100 cfs due to tributary flows (USFS 1998a). Tributary contributions are the most noticeable flows during storm events, but are substantially reduced during

low-flow conditions. Because of the minimum release requirements from McCloud Reservoir, spring and summer flows are considerably more stable than they would be under unregulated conditions. The “free-flowing” nature of the flows below McCloud Reservoir are regulated in a large part due to the minimum release requirement imposed on PG&E. The 1988 Natural Resources Agency Report specified that the lower reach was not eligible for designation as “free-flowing” because its flows are controlled by the McCloud River Dam and affected by the existing Shasta reservoir.

PG&E monitors lower McCloud River flows in accordance with its FERC license at a gaging station in Segment 4 upstream from Shasta Lake (0.2 mile downstream from Big Bollibokka Creek); the most recent available water data record covers the water year October 2018–September 2019 (USGS 2019). For this period, measured mean monthly flows ranged from 280 cfs in November to a high of 11,800 cfs in February.

Over the course of the year, the transition from lake to river expands and contracts over a distance of about 1.7 miles (only 5400 feet above the McCloud River bridge due to changing water levels in Shasta Lake (Figure 5-2)). During April and May of wet years, the transition reach extends about 1 mile (5,400 feet) upstream from the McCloud River Bridge to the full pool elevation of 1,070 feet msl, the downstream boundary of Segment 4. As described in Chapter 6 of the 2015 SLWRI FEIS, “Hydrology, Hydraulics, and Water Management” Shasta Lake reaches full-pool elevation about one year in three.

Water Quality

The water quality of the lower McCloud River is influenced by natural processes and land use activities, including PG&E’s McCloud-Pit Hydroelectric Project, timber management activities, and roads. Overall, the water quality of the river is rated as good (USFS 1998). Glacial silt gives the river “a beautiful turquoise color typical of rivers draining glacial valleys in British Columbia and Alaska” (Jones & Stokes Associates 1998).

Turbidity and water temperature are two important factors that influence the water quality of the river and affect aquatic habitat. Turbidity is caused by suspended sediment transported from upstream waters and in surface runoff, particularly from disturbed landscapes, such as areas burned by fire, timber harvest areas or roads. Water temperature is affected by a variety of conditions, such as river flows, solar radiation, and density of vegetation along the river, but is closely tied to the temperature of the flows released from the McCloud Reservoir.

The turbidity of the lower McCloud River is influenced by the water quality and water levels of the McCloud Reservoir and runoff from upland areas throughout the basin. Turbidity levels are generally low during most of the year, ranging from 5–10 nephelometric turbidity units, but can spike to more than 900 units during periods of intense rainfall and flood flows (PG&E 2006).

Sediment becomes trapped at McCloud Dam and is released into the lower river during large storm events, temporarily increasing turbidity levels, especially in the upper segments of the lower river. Testing of the McCloud Dam bypass valve can cause high turbidity for a short period when sediment is discharged from the reservoir into the lower McCloud River. Surface runoff, especially after the first storms of the wet season, can contribute large amounts of turbid runoff from upland areas.

The length of the transition reach depends on the water year type. As the transition reach moves upstream, sediment within the reach is remobilized and turbidity levels respond accordingly. Periodic fluctuations in water levels can result in erosion along the banks and localized increases in turbidity levels in the transition reach and the McCloud Arm.

The year-round cool water temperature regime of the lower McCloud River inhibits the productivity of its fishery, but provides high-quality holding habitat for salmonids, contributing to the river's unique value as a tributary to Shasta Lake. The controlled releases from McCloud Dam appear to have a direct bearing on the water temperatures downstream. Water temperatures tend to be higher in Segment 4 than immediately below McCloud Dam. Data recorded at PG&E's monitoring station on the river just upstream from Shasta Lake (0.2 mile downstream from Big Bollibokka Creek) indicate that water temperature ranges from the high 30s to the upper 60s (°F), with lower temperatures in the winter and higher temperatures in the summer (PG&E 2006).

The infusion of cooler water from the lower McCloud River influences water temperatures in the transition reach throughout the year. The degree of influence depends on the amount of discharge from the river and Shasta Lake levels. The temperatures throughout the lower McCloud River also control to some degree the distribution of the warmwater fishery known to occupy the river below Tuna Falls.

Outstandingly Remarkable Values Identified in USFS Evaluation

Cultural/Historical Resources Cultural resources include archaeological sites, historical structures and sites, and areas of religious or cultural significance to Native Americans. Significant resources that provide important information on the prehistory and history of an area or that are considered sacred to Native Americans can contribute to wild and scenic river values.

The McCloud River basin was part of a major center of occupation by the Wintu people, who occupied the McCloud River area at the time of Euro-

American contact in the 1800s. Although much of the Wintu territory was overrun with miners and other opportunistic Euro-Americans, the lower McCloud River was left largely untouched due in part to a lack of easily mined materials and the ruggedness of the terrain (Yoshiyama and Fisher 2001), but also because of the resistance of the Wintu to incursions into their territory. Because of its generally undisturbed nature, the significance of the lower McCloud River to prehistoric and ethnographic records of this area of California's history is considered to be great (Jones & Stokes Associates 1988).

Within the 0.25-mile corridor deemed eligible by the USFS, three formally recorded sites and other known sites contribute to the lower river's ORVs because they provide important information on the use of the area from before the Late Archaic Period (1300 to 150 before present, calibrated using radiocarbon dating) to the Historic Era (1840 to present). Three Wintu villages, called Tsekerenwaitsogi, Klolwakut, and Boloibaki, are thought to have been located in the general area of the present-day Bollibokka Club headquarters (Guilford-Kardell 1980), which is part of the former Wintu territory. These villages likely represent the typical lifestyle of the Wintu at the time of Euro-American contact, when they lived in permanent villages near rivers and streams and were semi-sedentary, foraging people (DuBois 1935). As part of the Wintu occupation of this area, prehistoric, historic, and modern Traditional Cultural Properties, sacred locations, and important use areas are located throughout the lower McCloud River basin (outside of the 0.25 mile corridor), including features such as mountains, unique landforms, caves, distinctive rock outcrops, waterfalls, pools, springs, and resource gathering areas.

Point McCloud Bridge (known as McCloud River Bridge in this chapter) is a historical resource that was constructed in 1940 and altered in 1986; the bridge would be subject to relocation in conjunction with SLWRI activities. The Bollibokka Club is a historical resource located on the north bank of the river between the confluence of Big Bollibokka Creek on the east and Wittawaket Creek on the west. Buildings associated with the club were built between the 1860s and 1920s by Austin and Rueben Hills, the founders of Hill's Brothers Coffee, and previous owners (Lucas and Stienstra 2007). A log cabin dates from the 1860s, and other structures date from the ownership of the Hills Family, including the clubhouse built in 1924 and a structure built of river cobble in 1915 (Whitney 2004). Although these resources could be eligible for listing on the National Register of Historic Places, they have not been formally evaluated.

The fishery of the lower McCloud River was also very important to prehistoric and historic uses of the area. The Native Americans in the lower McCloud River basin conducted communal fish drives of salmon or steelhead at night, which brought together many communities and provided opportunities for trade and social networking, including the parsing out of the catch among the people and villages involved (DuBois 1935). Fish, including salmon, steelhead, Sacramento sucker, freshwater shellfish, and lamprey, were an important part of the Native American diet in this area. When the northern mines opened in the 1800s,

settlers moved into the area, and the McCloud River and other rivers' fisheries provided important sources of food. In the early years of settlement, fish and game in the area were used for subsistence; however, this changed with the formation of the State of California and increased fishery management and recreational fishing.

Geology The lower McCloud River flows through a number of geologic formations, including the McCloud Limestone formation. This formation contains fossilized remains of invertebrate and vertebrate fauna that provide important scientific information on the history of California, and it has a high potential for research. According to the USFS (1998b), the limestone features exposed at a number of locations around Shasta Lake are unique and contribute to worldwide paleontological knowledge. The McCloud Limestone contains 36 species of corals, some of which may form the basis of a new taxonomic group.

Because of its very diverse fossil faunas, the mountainous terrain between the McCloud and Pit arms of Shasta Lake is perhaps California's single most important area for paleontological research (Munthe and Hirschfield 1978, cited in USFS 1998b). The limestone outcrops on the ridge immediately northwest of McCloud River Bridge (several hundred vertical feet above Shasta Lake) have produced several large Mississippian and Pennsylvanian invertebrate faunas. Because this period is poorly represented on the West Coast, this fossiliferous limestone is important to understanding the late Paleozoic evolution in this part of the country (USFS 1998b). Limestone outcrops adjacent to the McCloud Arm also provide habitat for several special-status species, such as Shasta salamander, Shasta eupatorium, Howell's cliff-maids, and Shasta snow-wreath (Reclamation 2003).

Exposed outcrops of the limestone formation are visible from the lower McCloud River in and upslope of the transition reach and contribute to its scenic values.

Visual Quality/Scenery The visual setting of the lower McCloud River upstream from Shasta Lake includes views of the river, limestone rock outcrops, adjacent coniferous and oak forests, and infrastructure associated with the Bollibokka and McCloud River clubs. A USGS stream gage has also been in place for a number of years. The pristine nature of the lower river provides for high-quality scenic views. However, the scenic views of the lower McCloud River are enjoyed by only a limited number of viewers, consisting primarily of private landowners, club members, and their guests.

Views of the river include "picturesque cascading whitewater, and deep, long, green- or turquoise-colored pools," with Douglas-fir and black and canyon oaks dominating the steep slopes and hillsides along the river (Jones & Stokes Associates 1988). Several buildings are present at the Bollibokka Club headquarters, but these structures blend in with the visual setting. The transition reach exhibits some evidence of fluctuating surface water elevations associated

with changes in water levels of Shasta Lake. Areas that are noticeably affected by the reservoir levels exhibit "a bathtub ring of steep, treeless slopes with occasional deposits of alluvium."

The Forest Service previously concluded scenic views make most of the lower McCloud River, including Segment 4, eligible as a scenic river under the Federal WSRA (USFS 1994). To be classified as a scenic river, the river must be free of impoundments, be accessible in places by roads, and have a river basin/shoreline that is largely undeveloped. Segment 4 does not contain any human-made or other impoundments that affect its free-flowing conditions. Roads to the Bollibokka Club provide access to portions of Segment 4 for members of the club and their guests. Currently, public access is limited to pedestrians on USFS lands along the shoreline of Shasta Lake. For these reasons, the USFS has determined that this segment meets the eligibility requirements of a scenic river under the Federal WSRA.

Chapter 5.5 Environmental Consequences and Mitigation Measures

This section identifies how the characteristics of the lower McCloud River that make it eligible for listing under the Federal WSRA could be affected by each alternative and whether the alternatives would conflict with the provisions of the STNF LRMP and the CRMP.

5.5.1 Methods and Assumptions

This analysis of environmental consequences focuses on the effects of proposed modifications to Shasta Dam and Shasta Lake on the McCloud River's free-flowing conditions, its water quality, and the ORVs (cultural resources, fisheries, geology, and scenery) that make it eligible for listing as a wild and scenic river under the Federal WSRA. In large part, the environmental effects are based on computer modeling of water levels, known elevations of the existing bathtub ring that is observable in the transition reach, and the anticipated changes in the environment due to fluctuations in water levels and expansion of the transition reach. Physical effects to the free-flowing conditions, water quality, and ORVs are analyzed in terms of their effects on the eligibility of the river for wild and scenic river designation. While aquatic habitat data are used to quantify the relative impact to the fishery values, a qualitative analysis is provided for most resources because of a lack of quantitative data and the subjective nature of the values. Information to support the analysis was generated from available literature and planning documents and technical studies prepared as part of the 2015 SLWRI FEIS as well as other chapters within the 2015 SLWRI FEIS.

CalSim Modeling

The CalSim-II computer model was used to assist in the evaluation of the potential impacts of the project alternatives on water-related resources. The model used historical data on California hydrology to represent the variety of

weather and hydrologic patterns, including wet periods and droughts, under which water storage and conveyance facilities would be operated. Two scenarios (base cases) of demands for, and storage and conveyance of, water were used in model runs: 2005 facilities and demands ("existing conditions") and forecasted 2030 demands and reasonably foreseeable projects and facilities ("future conditions"). A model run was conducted for each of these base cases combined with each alternative so that the effects of the No-Action Alternative and the action alternatives could be evaluated for both existing and future conditions.

The analysis focuses on the environmental effects in the portion of Segment 4 that would periodically be inundated. These effects are discussed in the following section.

Gage Data

PG&E, in coordination with USGS, monitors lower McCloud River flows in accordance with its FERC license for the McCloud-Pit Hydroelectric Project at a gaging station just upstream from the McCloud River Bridge, approximately 0.2 mile downstream from Big Bollibokka Creek (USGS 11368000 McCloud River above Shasta Lake, California). The station measures mean, minimum, and maximum monthly flows in the lower McCloud River. The most recent available water data record covers the water year of October 2018 to September 2019 (USGS 2019). This data was used to describe flow conditions in the lower McCloud River.

Water Quality Monitoring

Current and historical water quality monitoring data for the McCloud River have been collected by Federal and state agencies as well as PG&E and The Nature Conservancy. The California Department of Water Resources maintains water quality information on the McCloud River in the California Data Exchange Center database. The Nature Conservancy monitors water quality at the McCloud River Preserve. Water quality monitoring of the lower McCloud River includes measures of water temperature, dissolved oxygen, pH, specific conductance, and turbidity, as well as correlated data on weather, air temperature, and debris movement. PG&E monitors water quality in compliance with its FERC license. Available information on water quality was used to describe the setting of the lower river and assess changes in water quality that would occur as a result of the Shasta Dam modification alternatives.

Habitat Typing

The USFS stream habitat typing performed in 1999 and 2000 (STNF, December 2001 unpublished data report, as found in USFS 2001) was used to describe aquatic habitat in the lower McCloud River and to assess the changes in aquatic habitat from implementation of the Shasta Dam modification alternatives. The habitat typing data were used in conjunction with the CalSim-II modeling results, digitized orthophotographs, and high-resolution topographic data to provide habitat maps and graphic depictions of the distribution of aquatic

habitat in the lower river below Little Bollibokka Creek. A longitudinal profile, using water surface elevations, was generated to illustrate habitats; it does not provide an accurate representation of channel geometry.

A quantitative evaluation of the aquatic habitats was performed using digital images and the USFS habitat typing data in an integrated geographic information systems environment. Longitudinal habitat delineation was determined from the habitat typing data, with minor adjustments to match photo-interpreted habitat, and incorporated into the geographic information systems in conjunction with water surface elevations generated through the CalSim-II modeling results. Estimates of aquatic habitat areas were generated from digitized wetted stream perimeters. These measurements were based on orthophotographs taken April 25, 2001. While the absolute amount of riverine habitat can vary with flow, the relative proportions of different types of habitat remain relatively constant. Therefore, Reclamation used the relative proportions of aquatic habitat types to compare impacts to the transition reach with the entire lower river.

5.5.2 Criteria for Determining Significance of Effects

The following significance criteria were developed based on guidance provided by the Federal Guidance and consider the context and intensity of the environmental effects as required under NEPA. (Please see the 2015 SLWRI FEIS Chapter 3, “Considerations for Describing the Affected Environment and Environmental Consequences) for an explanation of the distinction under NEPA.) Impacts of an alternative on the wild and scenic river values of the lower McCloud River would be significant if project implementation would:

- Affect the eligibility for Federal listing as a wild and scenic river of any portion of the lower McCloud River above the 1,070-foot elevation
- Conflict with the STNF LRMP or with management of the McCloud River under the CRMP

5.5.3 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, Reclamation would not pursue an action to enlarge Shasta Dam to help increase anadromous fish survival in the upper Sacramento River and address the growing water supply reliability issues in California. Water levels in Shasta Lake and the transition reach would continue to fluctuate similar to current conditions. USFS Segment 4 would not be affected by this alternative.

Impact WASR-1 (No-Action): Effect on McCloud River's Eligibility for Listing as a Federal Wild and Scenic River Under the No-Action Alternative, the current maximum elevation of water levels in the transition reach would not be increased, and Segment 4 would not be affected. Fluctuations in water levels would continue to be similar to current conditions, with water levels reaching the maximum elevation of 1,070 feet msl – the downstream boundary of Segment 4 – in the transition reach for a brief period (typically a few days in May) during wet years.

The average monthly water surface of Shasta Lake would continue to fluctuate based on the water year, with a maximum elevation of 1,053 feet msl in April of an average water year and 1,070 feet msl in April and May of a wet year. These fluctuations would not affect the free-flowing conditions and water quality of Segment 4. The ORVs that make the river eligible for designation as a Federal wild and scenic river would continue to be affected only by ongoing natural processes and land use activities, and all of Segment 4 would remain eligible for listing under the Federal WSRA.

Impact WASR-2 (No-Action): Conflict with Shasta-Trinity National Forest Land and Resource Management Plan Under the No-Action Alternative, the STNF LRMP would continue to be implemented as it has in the past, with no changes in the management of the McCloud River's free-flowing condition, water quality, and ORVs.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 would involve a 6.5-foot raise of Shasta Dam, which would increase the lake's gross pool by 8.5 feet and enlarge the total storage space in the lake by 256,000 acre-feet. This increase would equate to an increase of about 1,100

acres of surface area occupied by Shasta Lake when the lake is full. CP1 includes measures to increase water supply reliability while contributing to increased survival of anadromous fish. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 70,000 acre-feet and 35,000 acre-feet, respectively, of the increased storage capacity in Shasta Lake would be reserved to specifically focus on increasing municipal and industrial (M&I) deliveries.

Impact WASR-1 (CP1): Effect on McCloud River's Eligibility for Listing as a Federal Wild and Scenic River Under CP1, the increased gross pool of Shasta Lake would expand the current transition reach up to the 1,078-foot elevation, resulting in adverse effects on the characteristics of approximately 1,470 feet of Segment 4. The rest of the McCloud River would remain eligible for designation as a Federal wild and scenic river. This impact would be significant.

Under CP1, approximately 1,470 feet, or 11 percent, of Segment 4 would be periodically inundated. This increase in the transition reach to a maximum elevation of 1,078 feet msl would equate to a 16 percent increase over the current transition reach. The length of time during the year when the transition reach is inundated and the maximum elevation of the inundation area would vary by the type of water year (wet, above normal, below normal, average, dry, or critical).

Within the expanded transition reach, flow conditions and fisheries would periodically be affected, with the timing and duration of the effects similar to those that occur in the current transition reach. Over time, the expansion of the bathtub ring would affect water quality, geology, and visual quality/scenery in the affected portion of Segment 4. Erosion of soils along the river could expose buried cultural resources, and periodic inundation could permanently alter cultural resource values and features in the transition reach important to Native Americans. These effects could reduce the total length of the lower McCloud River that is eligible for wild and scenic river designation by about 1,470 feet (approximately 1.2 percent of the total length of the lower river).

Free-Flowing Conditions Under CP1, the currently free-flowing section of the lower McCloud River would be reduced by about 1,470 feet or about 1.2 percent. The flow characteristics of the affected portion of Segment 4 would periodically be modified, resulting in slower moving waters and a wider river channel. When inundated, the affected portion would retain some current, but flow velocities would decrease with distance downstream. This modification would not meet the definition of a free-flowing river under the Federal WSRA.

Because free-flowing conditions are a fundamental requirement for wild and scenic river eligibility, the 1,470-foot reach of Segment 4 that would be affected by CP1 would become ineligible for listing under the Federal WSRA.

Water Quality As Shasta Lake's water levels rise, vegetation and soils along the banks of the affected portion of Segment 4 would become inundated. Most or all of the vegetation that is inundated would eventually die and be washed or fall into the river, bringing with it sediment and other materials that could affect water quality. Soils in the affected portion of Segment 4 would erode as water levels rise and fall, causing an increase in turbidity. These effects would likely be most noticeable during the initial inundation periods, since the river corridor is likely to eventually stabilize as the soil is eroded to bedrock.

Within the approximately 1,470-foot reach of Segment 4 that would be affected under CP1, water temperatures would fluctuate relative to temperatures immediately upstream. Similar to flow, these changes would vary by water year type. Increased turbidity and warmer water temperatures would be most noticeable along the affected portion of Segment 4 because this area has not been previously exposed to periodic inundations.

Adverse effects on water quality would be associated with the periodic fluctuations in the water levels of Shasta Lake. Because water quality is a fundamental requirement for wild and scenic river eligibility, the 1,470-foot reach of Segment 4 that would be affected by CP1 would become ineligible for listing under the Federal WSRA.

Outstandingly Remarkable Values As described above under Affected Environment, the ORVs that make Segment 4 of the McCloud River eligible for listing as a wild and scenic river are cultural/historical resources, fisheries, geology, and visual quality/scenery.

Cultural/Historical Resources Under CP1, erosion of rock outcrops and expansion of the bathtub ring in an approximately 1,470-foot reach of Segment 4 could expose buried or previously undiscovered prehistoric cultural resources associated with Wintu occupation of the area and historic recreational uses of the area. As this reach becomes inundated, any exposed resources would be susceptible to the effects of water, which could damage or otherwise alter their values, affecting their eligibility for listing on the National Register of Historic Places and reducing their importance for providing information on past use within the corridor. As the water recedes, exposed resources would be susceptible to wind and rain and could be visible, potentially exposing them to theft or vandalism. These adverse effects would be localized along the corridor of the affected portion of Segment 4 and would likely only affect a small portion of the cultural resources that may be associated with the lower McCloud River basin.

The historic structures associated with the Bollibokka Club occur outside of the area that would be affected by the expanded transition reach and would not be affected. However, unrecorded resources associated with the Wintu village locations may occur within the corridor along the river and could be subjected to periodic inundation, deposition, and scour within the upper portions of the

expanded transition reach. Portions of three other recorded sites could also be subject to similar impacts within the expanded transition reach, which could result in damage to resources within the sites. Although these sites may provide information on the area's history or prehistory, none of these sites has been evaluated for listing on the National Register of Historic Places.

Sacred sites important to Native Americans have not been specifically identified, and access to lands adjacent to the reach that would be periodically inundated under CP1 is limited because all of these lands are privately owned.

The cultural resources located along the 1,470-foot reach of Segment 4 that would be affected under CP1 would be subject to the effects of periodic inundation.

Fisheries Aquatic habitat in the 1,470-foot extension of the transition reach would be affected during periodic inundations, resulting in potential adverse effects on the fish that occur in the river. Potential adverse effects on fish could include a reduction in spawning habitat for trout in the expanded transition reach and an increase in the range of warmwater fish in the lower McCloud River. Fishing opportunities would not be affected more than they are now with the periodic fluctuations in river levels.

Under CP1, the transition reach would be extended by about 1,470 feet to the 1,078-foot elevation, resulting in a larger inundation area when Shasta Lake water levels are the highest. Aquatic habitat in the affected portion of Segment 4 consists primarily of flatwater habitat (52 percent glide, 19 percent mid-channel pool, and 13 percent run), with pocket water (11 percent) and a small, low-gradient riffle (5 percent) in the lower portion of the segment. With the periodic inundations, sediment deposition could cause flatwater habitat to convert to riffle habitat, resulting in a reduction in flatwater habitat of less than 3 percent of the total lower McCloud River's flatwater habitat. During the inundation period, riffle and pool habitat (approximately 1.2 percent of the total lower McCloud River) would be converted to flatwater habitat. Also, riparian vegetation along the newly inundated banks of the affected portion of Segment 4 would be expected to die, which could affect water temperatures and reduce cover for fish in this reach. The extent of these effects would depend on the frequency, duration, and surface elevation of the inundation, which would vary depending on the type of water year and water levels of Shasta Lake.

The migration of fish, especially trout, between the lower McCloud River and Shasta Lake is an important attribute of the unique trout fishery. Many of the rainbow and brown trout that occupy the lower McCloud River spend part of their lives rearing in Shasta Lake, feeding on the abundant prey in the lake and attaining large sizes that would not be possible if they reared only in the river. Upon returning to the river to spawn, these lake-reared fish provide the trophy-sized trout, particularly brown trout, for which the lower McCloud River is renowned (Rode and Dean 2004). Based on a survey that extended up to Tuna

Falls (North State Resources, Inc. 2008), the reach of Segment 4 that would periodically be inundated does not contain any barriers or impediments to fish movement or migration, and CP1 would not create any. Consequently, trout migration through the transition reach to upstream spawning areas would not be impaired.

Conversely, warmwater fish movement between the lake and river is not likely to be facilitated by the expanded transition reach. Warmwater fish from Shasta Lake, such as spotted bass, have been observed throughout the lower McCloud River, at least up to the confluence with Tuna Creek (North State Resources, Inc. 2008). Nonnative warmwater species inhabiting Shasta Lake (e.g., smallmouth bass and spotted bass) are known to exploit riverine and transitional habitats and are effective predators of juvenile trout. No barriers have been observed in the transition reach that could prevent warmwater fish from moving upstream, and no barriers would be created by the expansion of the transition reach. Warmwater fish would continue to be able to move between the lake, the transition reach, and lower McCloud River (Segment 4).

Aquatic habitat changes could affect how fluvial resident trout use habitat within the affected portion of Segment 4. General effects may range from temporary displacement of trout to upstream habitats at high water levels to degraded riverine habitat suitability within the transition reach.

Suitable spawning habitat for rainbow and brown trout in the expanded transition reach is limited because of the few pools and riffles available during the spring and fall when these species spawn. Based on the USFS habitat data and more recent reconnaissance surveys, the amount of spawning gravels in the expanded transition reach represents only a small percentage of the suitable spawning habitat in the lower McCloud River. However, any effect on spawning habitat would be considered adverse.

Geology During periods of maximum inundation in the 1,470-foot portion of Segment 4 that would be affected under CP1, some rock outcrops may become inundated and could erode, but the overall geologic value of the McCloud Limestone features would not be adversely affected.

Visual Quality/Scenery The visual quality of the affected portion of Segment 4 would decrease as the vegetation along the banks becomes inundated and eventually dies, the bathtub ring expands, and evidence of flow is reduced. These conditions would be similar to those in the current transition reach. The affected portion of Segment 4 would no longer have the qualities that contributed to its classification by the USFS as “scenic.”

CP1 would result in making approximately 1,470 feet of the lower McCloud River ineligible for listing as wild and scenic.

Impact WASR-2 (CP1): Conflict with Shasta-Trinity National Forest Land and Resource Management Plan The inundation of approximately 1,470 feet of Segment 4 would not conflict with the provisions in the STNF LRMP to

protect the ORVs that make the McCloud River eligible for listing under the Federal WSRA. Although raising Shasta Dam would result in inundation of part of Segment 4, the McCloud River and the adjoining lands in this part of the segment are not National Forest System lands and therefore not subject to the LRMP. Management of the river's ORVs under the STNF LRMP and the CRMP would not be affected. No land use changes would occur along the river, and the USFS and signatories to the CRMP would be able to continue implementing provisions of their plans that apply to the river.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP2 would involve a 12.5-foot raise of Shasta Dam, which would increase the lake's gross pool by 14.5 feet and enlarge the total storage space in the lake by 443,000 acre-feet. This increase would equate to an increase of about 1,850 acres of surface area when the lake is full. CP2 also includes measures to increase water supply reliability while contributing to increased survival of anadromous fish. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 120,000 acre-feet and 60,000 acre-feet, respectively, of the increased storage capacity in Shasta Lake would be reserved to specifically focus on increasing M&I deliveries. CP2 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Lake would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Impact WASR-1 (CP2): Effect on McCloud River's Eligibility for Listing as a Federal Wild and Scenic River Impact WASR-1 (CP2) would be similar to Impact WASR-1 but would affect 1,270 feet more of Segment 4 than CP1.

Implementation of CP2 would reduce the total length of the McCloud River that is eligible for wild and scenic river designation by about 2,740 feet (approximately 2.3 percent of the total length of the lower river). The rest of the lower McCloud River would remain eligible for listing.

Under CP2, approximately 2,740 feet, or 21 percent, of Segment 4 would be periodically inundated. The transition reach would increase to a maximum elevation of 1,084 feet msl, which would extend it by about 2,740 feet (a 30 percent increase over the current transition reach), inundating a larger portion of the lower McCloud River within the study area and Segment 4. The inundated area would increase to approximately 51 total acres (an increase of 18 acres over existing conditions and 9 acres more than CP1 conditions), with a maximum width of approximately 530 feet (an increase of 60 feet over existing conditions) and a total length of approximately 11,740 linear feet (2.22 miles). The extension of the transition reach by approximately 2,740 feet would affect approximately 21 percent of Segment 4. Additional impacts under CP2 compared with CP1 would be minimal and would be limited to the additional 440-foot extension of the transition reach and about 15 additional feet on both sides of the river.

During a wet year, the maximum average water surface elevation of Shasta Lake would be 1,080 feet msl, with a peak elevation of 1,084 feet msl during May. This is an increase of 15 feet above the existing maximum average. During an average water year, the maximum average water surface elevation would increase to 1,051 feet msl, an increase of 11 feet above existing conditions. During dry and critical water years, the change would be on the order of 5 to 9 feet in elevation.

The increased gross pool of Shasta Lake would expand the current transition reach up to the 1,084-foot elevation, a 30 percent increase. Flow conditions and fisheries in the 2,740-foot reach of Segment 4 would periodically be affected, with the timing and duration of the effects similar to those in the current transition reach. Over time, the expansion of the bathtub ring would adversely affect water quality, geology, and visual quality/scenery. Erosion of soils along the river could expose buried cultural resources, and periodic inundation could permanently alter cultural resource values and features in the transition reach important to Native Americans.

Free-Flowing Conditions As discussed under Impact WASR-1 (CP1), the flow characteristics of the extended transition reach under CP2 would be periodically modified, resulting in slower moving waters and a wider river channel. This modification would not meet the definition of a free-flowing river under the Federal WSRA. The width of the transition reach would be increased by approximately 30 feet on both sides of the river. Flow conditions and the river's free-flowing nature upstream from the expanded transition reach would remain similar to current conditions.

Because free-flowing conditions are a fundamental requirement for wild and scenic river eligibility, the 2,740-foot reach of Segment 4 that would be affected by CP2 would become ineligible for listing under the Federal WSRA.

Water Quality Under CP2, increased turbidity and warmer water temperatures would be most noticeable along the expanded 2,740 feet of the transition reach and in the 30-foot corridor on either side of the transition reach because these areas have not been previously exposed to periodic inundations. As discussed under Impact WASR-1 (CP1), effects on water quality would be associated with the periodic increases in water levels of Shasta Lake.

Because water quality is a fundamental requirement for wild and scenic river eligibility, the 2,740-foot reach of Segment 4 that would be affected by CP2 would become ineligible for listing under the Federal WSRA.

Outstandingly Remarkable Values As described above under Affected Environment, the ORVs that make Segment 4 of the McCloud River eligible for listing as a wild and scenic river are cultural/historical resources, fisheries, geology, and visual quality/scenery.

Cultural/Historical Resources Impacts would be the same as discussed under Impact WASR-1 (CP1); however, a slightly larger portion of the three recorded sites and possible resources associated with the known Wintu villages would be inundated.

The cultural resources located along the 2,740-foot reach of Segment 4 that would be affected under CP2 would be subject to the effects of periodic inundation.

Fisheries Aquatic habitat in the affected 2,740-foot segment consists of pocket water and a lateral scour pool. The potential conversion of flatwater habitat to riffle habitat in the 2,740-foot segment would be similar to but greater than under WASR-1 (CP1), and overall impacts to aquatic habitat and fish would be similar to those discussed under Impact WASR-1 (CP1).

Geology Impacts would be the same as discussed under Impact WASR-1 (CP1); the geologic values of the lower McCloud River would not be adversely affected.

Visual Quality/Scenery Impacts would be the same as discussed under Impact WASR-1 (CP1). The affected portion of Segment 4 would no longer have the qualities that contributed to its classification by the USFS as “scenic.”

CP2 would result in making approximately 2,740 feet of the lower McCloud River ineligible for listing as wild and scenic.

Impact WASR-2 (CP2): Conflict with Shasta-Trinity National Forest Land and Resource Management Plan The inundation of approximately 2,740 feet of Segment 4 would not conflict with the provisions in the STNF LRMP to protect the ORVs that make the McCloud River eligible for listing under the Federal WSRA.

Impact WASR-3 (CP2): Effects to McCloud River Wild Trout Fishery, as Identified in the California Public Resources Code, Section 5093.542 The impact would be similar to WASR-3 (CP1) but the magnitude of the impact would be greater under CP2 because of the longer transition reach. Under CP2, the proposed modifications to Shasta Dam and Shasta Lake would result in temporary and periodic fluctuations in water levels within the expanded transition reach, affecting about 2.3 percent of the lower McCloud River. Under CP2, the reach affected by Shasta Lake water levels would be extended by about 2,740 feet, a 30 percent increase over the current transition reach; this entire area would be inundated only during peak water levels in the spring of wet years. An impact of the expansion of the transition reach would be conversion of aquatic habitat in a manner similar to the habitat conversion that can be observed in the current transition reach downstream. The overall impacts to the wild trout fishery, including public access and management opportunities in conjunction with fish habitat and populations, are small in the context of the entire lower McCloud River.

CP3, CP4, CP4A, and CP5 – 18.5-Foot Dam Raise, with Variations

CP3, CP4, CP4A, and CP5 would involve an 18.5-foot raise of Shasta Dam, which would increase the lake's gross pool by 20.5 feet and enlarge the total storage space in the lake by 634,000 acre-feet. This increase would equate to an increase of about 2,500 acres of surface area when the lake is full. CP3 focuses on increasing agricultural water supply reliability and increasing anadromous fish survival. CP4, CP4A, and CP5 increase water supply reliability and include enhancements in the upper Sacramento River for anadromous fish survival including gravel augmentation and the restoration of riparian, floodplain, and side channel habitat.

CP3 would increase the ability of Shasta Dam to make cold-water releases and regulate water temperatures for fish in the upper Sacramento River, primarily in dry and critical water years. CP3 would help reduce estimated future water shortages by increasing the reliability of dry and critical year water supplies for agricultural deliveries by at least 63,000 acre-feet per year and average annual deliveries by about 62,000 acre-feet per year. Under CP3, operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, with the additional storage retained for water supply reliability and to expand the cold-water pool for downstream anadromous fisheries.

CP4 would be used to improve the ability to meet temperature objectives and

habitat requirements for anadromous fish during drought years and increase water supply reliability. Of the increased reservoir storage space under CP4, about 378,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. For CP4, operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as in CP1, with 70,000 acre-feet and 35,000 acre-feet reserved to specifically focus on increasing M&I deliveries during dry and critical years, respectively. CP4 includes augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River.

CP4A reserves a portion of the increased storage in Shasta Lake for maintaining cold-water volume or augmenting flows in the Sacramento River as part of an adaptive management plan for anadromous fish survival. Of the increased reservoir storage space under CP4A, about 191,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. For CP4A, operations for the remaining portion of increased storage (approximately 443,000 acre-feet) would be the same as in CP2, with 120,000 acre-feet reserved in dry years and 60,000 acre-feet reserved in critical years for water deliveries. CP4A includes augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River. CP5 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 150,000 acre-feet and 75,000 acre-feet, respectively, of the increased storage capacity in Shasta Lake would be reserved to specifically focus on increasing M&I deliveries. CP5 also includes constructing additional fish habitat in and along the shoreline of Shasta Lake and along the lower reaches of its tributaries; augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River; and increasing recreation opportunities at Shasta Lake.

Impacts associated with CP3, CP4, CP4A, and CP5 would be very similar to those described for CP1 and CP2, but the increased water levels of Shasta Lake would affect a longer reach of the lower McCloud River. Because of their similarities, and in an effort to reduce redundancy, only the differences between the plans are described below.

Impact WASR-1 (CP3, CP4, CP4A, and CP5): Effect on McCloud River's Eligibility for Listing as a Federal Wild and Scenic River Implementation of CP3, CP4, CP4A, and CP5 would reduce the total length of the McCloud River that is eligible for wild and scenic river designation by about 3,550 feet (less than 3 percent of the total length of the lower river). The property along the 3,550 feet river corridor is owned by Westlands Water District and no public access is available. The rest of the lower McCloud River would remain eligible for listing.

Under CP3, CP4, CP4A, and CP5, the extent of the transition reach would increase to a maximum elevation of 1,090 feet msl, which would extend the current transition reach by about 3,550 feet (a 39 percent increase over the

current transition reach), inundating a larger portion of the lower McCloud River within the study area and Segment 4. The inundated area would increase to approximately 60 total acres (an increase of 27 acres over existing conditions, and 9 acres more than CP2 conditions), with a maximum width of approximately 610 feet (an increase of 140 feet over existing conditions) and a total length of approximately 12,550 linear feet (2.38 miles). The extension of the transition reach by approximately 3,550 feet would affect approximately 26 percent of Segment 4. Additional impacts under CP3, CP4, CP4A, and CP5 compared with CP1 and CP2 would be minimal and would be limited to the additional 810-foot extension of the transition reach and about 20 additional feet on either side of the river.

During a wet year, the maximum average water surface elevation of Shasta Lake would be 1,086 feet msl, with a peak elevation of 1,090 feet msl during May. This is an increase of 20.5 feet above the existing maximum average. During an average water year, the maximum average water surface elevation would increase to 1,054 feet msl, an increase of 14 feet above existing conditions. During dry and critical water years, the change would be on the order of 6 to 13 feet in elevation.

The increased gross pool of Shasta Lake would expand the current transition reach by approximately 3,550 feet (810 feet beyond CP2's effects) up to the 1,090-foot elevation, resulting in a 39 percent increase in the transition reach. Within the expanded transition reach, flow conditions and fisheries would periodically be affected, with the timing and duration of the effects similar to those in the current transition reach. Over time, the expansion of the bathtub ring would affect water quality, geology, and visual quality/scenery. Erosion of soils along the river could expose buried cultural resources, and periodic inundation could permanently alter cultural resource values and features in the transition reach important to Native Americans.

Free-Flowing Conditions The flow characteristics of the extended transition reach under CP3, CP4, CP4A, and CP5 would be temporarily modified, resulting in slower moving waters and a wider river channel. This modification would not meet the definition of a free-flowing river under the Federal WSRA. The width of the transition reach would be increased by approximately 70 feet on either side of the river. Flow conditions and the river's free-flowing nature upstream from the expanded transition reach would remain similar to current conditions.

Because free-flowing conditions are a fundamental requirement for wild and scenic river eligibility, the 3,550-foot reach of Segment 4 that would be affected by CP3, CP4, CP4A, and CP5 would become ineligible for listing under the Federal WSRA.

Water Quality Under CP3, CP4, CP4A, and CP5, increased turbidity and warmer water temperatures would be most noticeable along the expanded 3,550-foot reach of the transition reach and in the 70-foot corridor on either side of the transition reach because these areas have not been previously exposed to periodic inundations. Under these plans, the wider affected river corridor could result in greater temporary effects on water quality because more vegetation would be temporarily inundated and more soils would be exposed. As discussed under Impact WASR-1 (CP1), effects on water quality would be associated with the periodic increases in water levels of Shasta Lake.

Because water quality is a fundamental requirement for wild and scenic river eligibility, the 3,550-foot reach of Segment 4 that would be affected by CP3, CP4, CP4A, and CP5 would become ineligible for listing under the Federal WSRA.

Outstandingly Remarkable Values As described above under Affected Environment, the ORVs that make Segment 4 of the McCloud River eligible for listing as a wild and scenic river are cultural/historical resources, fisheries, geology, and visual quality/scenery.

Cultural/Historical Resources Impacts would be similar to those discussed under Impact WASR-1 (CP1). Under CP3, CP4, CP4A, and CP5, the

wider affected river corridor could result in greater effects on cultural resources because of the wider inundated area and increased erosion. Larger portions of the three recorded sites and known Wintu villages would become inundated.

The cultural resources located along the 3,550-foot reach of Segment 4 that would be affected under CP3, CP4, CP4A, and CP5 would be subject to the effects of periodic inundation.

Fisheries Aquatic habitat in the additional 810-foot segment under CP3, CP4, CP4A, and CP5 consists of a mid-channel pool and a lateral scour pool. The potential conversion of flatwater habitat to riffle habitat in the 3,550-foot reach of Segment 4 that would be affected under these plans would be similar to but greater than under WASR-1 (CP1), and overall impacts to aquatic habitat and fish would be similar to those discussed under Impact WASR-1 (CP1).

Geology Impacts would be the same as discussed under Impact WASR-1 (CP1), except additional rock outcrops could become inundated because of the wider affected corridor.

Visual Quality/Scenery Impacts would be similar to those discussed under Impact WASR-1 (CP1). Under these plans, the wider affected river corridor could result in greater effects on the visual setting because of the wider inundated area and increased impacts on vegetation. The water line would also be visible at a higher elevation and could be more noticeable. The affected portion of Segment 4 would no longer have the qualities that contributed to its classification by the USFS as “scenic.”

CP3, CP4, CP4A, and CP5 would result in making approximately 3,550 feet of the lower McCloud River ineligible for listing as wild and scenic.

Impact WASR-2 (CP3, CP4, CP4A, and CP5): Conflict with Shasta-Trinity National Forest Land and Resource Management Plan The inundation of approximately 3,550 feet of Segment 4 would not conflict with the provisions in the STNF LRMP to protect the ORVs that make the McCloud River eligible for listing under the Federal WSRA.

5.5.4 Mitigation Measures

The mitigation measures described in the following section were developed partly in response to comments received on the 2013 SLWRI Draft EIS. While these measures are considered to be potentially feasible and effective in their ability to reduce impacts, this EIS acknowledges that there is uncertainty with respect to reducing impacts to less-than-significant levels.

No-Action Alternative

Under the No-Action Alternative, no action would be taken, including implementation of mitigation measures; rather, existing conditions would continue to change in response to natural processes and human activities. No mitigation measures are required for the No-Action Alternative.

Mitigation Measure WASR-3 (CP1-CP5): Develop and Implement a Comprehensive Multi-scale Wild Trout Fishery Protection, Restoration and Improvement Program Within the Lower McCloud River Watershed The inundation of a portion of the lower McCloud River will affect the habitat available to wild trout and other aquatic organisms. The impacts are similar to, but more specific to the lower McCloud River watershed than those described under Impact Geo-2 in Chapter 4 of the 2015 SLWRI FEIS, "Geology, Geomorphology, Minerals and Soils"; Impact WQ-1 in Chapter 7 of the 2015 SLWRI FEIS, "Water Quality"; and Impacts Aqua-4 and Aqua-7 in Chapter 11 of the 2015 SLWRI FEIS, "Fisheries and Aquatic Ecosystems." This mitigation measure incorporates Mitigation Measures Geo-2, WQ-1, and Aqua-4.

Watershed analysis and assessments prepared for the lower McCloud River watershed document that roads and modified fire regimes have increased sediment contributions to receiving waters, particularly in those watersheds that have been subjected to mining, forest management, and other types of large- scale developments and disturbances (CVWRCB 2011). Reclamation will apply this element of this mitigation measure to protect, restore, and improve the wild trout fishery in the lower McCloud River watershed.

The STNF, through the efforts of the interagency mitigation working group described in Chapter 2 of the 2015 SLWRI FEIS, "Action Alternatives," identified that acquisition of lands along the lower McCloud River is a priority and is consistent with the LRMP to meet a number of resource goals and objectives (e.g., cultural resources, recreation, biological resources).

This mitigation measure requires that Reclamation work with the watershed stakeholders (e.g., CRMP members) to develop a basin plan that identifies deficient areas where riparian and watershed improvements can be made and work with landowners to improve those areas. Reclamation will commit to funding the planning effort, which will be completed within 10 years after construction has been initiated. This plan is intended to reduce the impacts of inundation on the wild trout fishery in the McCloud River and its tributaries. This program would be performed in conjunction with the efforts of the interagency work group described in Mitigation Measure Geo-2 of the 2015 SLWRI FEIS.

5.5.5 Cumulative Effects

Chapter 3 of the 2015 SLWRI FEIS, "Considerations for Describing the Affected Environment and Environmental Consequences," gives an overview of the cumulative effects analysis, including significance criteria, Table 3-1 of the 2015 SLWRI FEIS, "Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area," in Chapter 3 of the 2015 SLWRI FEIS, lists the projects considered quantitatively and qualitatively within the cumulative impacts analysis. This cumulative impacts analysis accounts for potential project impacts combined with the impacts of existing facilities, conditions, land uses, and reasonably foreseeable actions expected to occur in the study area on a qualitative and quantitative level. None of the projects listed in Table 3-1 of the 2015 SLWRI FEIS under Quantitative Analysis would have impacts on the McCloud River in the primary study area and the SLWRI would not have adverse impacts in the extended study area; therefore, the following analysis is based on programs and projects listed in Table 3-1 of the 2015 SLWRI FEIS under Qualitative Analysis that would have potential effects in the primary study area as explained below.

FERC has issued the Final EIS for the relicensing of the McCloud-Pit Project. However, the relicensing process for the McCloud-Pit Project is ongoing, and the conditions that may be required under a new FERC license are uncertain. The potential effects of the relicensing on the lower McCloud River are therefore unknown.

The 2012 Bagley Fire, the 2019 Mountain Fire, and subsequent winter flood events resulted in significant changes to vegetation conditions, erosional processes, and water quality in the lower McCloud River watershed. The impacts of this combination of natural disturbances are ongoing and there is considerable uncertainty on how they are affecting the physical processes and biological resources of the lower McCloud River watershed. Subsequent management activities (e.g., road reconstruction, silviculture) are ongoing throughout the Bagley Fire area.

Appendix A. Clean Water Act 404(b)(1) Analysis

Reclamation prepared the SLWRI Feasibility Report in July 2015 as a comparison document to the SLWRI FEIS. The SLWRI Feasibility Report presented the results of planning, engineering, environmental, social, economic, and financial studies and potential benefits and effects of alternatives plans for the SLWRI project. Both the SLWRI Feasibility Report and SLWRI FEIS were submitted to U.S. Congress.

The SLWRI Feasibility Report determined the least environmentally damaging practicable alternative for the dam raise construction. For project relocations, Reclamation states within the report and within the SLWRI FEIS that additional detailed analyses and documentation prior to any related permit applications and regulatory decision making by the USACE would be required. These additional analyses are presented here within the SLWRI Draft SEIS. Along with the SLWRI FEIS, this document demonstrates compliance with CWA 404(r) and consistency with the CWA 404(b)(1) Guidelines.

Reclamation stated with in the SLWRI FEIS that relevant permits anticipated to be obtained for the proposed action included a CWA Section 401 certification. Reclamation will comply with CWA 404(r) and will not separately obtain permits under CWA Sections 401, 402, and 404 because Reclamation will not be seeking nor receiving CWA 404 permits from USACE. Reclamation will apply CWA 404(r) to the project, the requirements of which have been met through the SLWRI FEIS, SLWRI Feasibility Report, and the SLWRI SEIS.

Reclamation will follow California state water quality standards by following the permit requirements outlined within the general permit, as described in the SLWRI Draft SEIS Chapter 3.

Other potential CWA 402 discharges resulting from the SLWRI Project would fall under the California Stater Water Resources Control Board General Permit Order R5-2013-0074 Dewatering and Other Low Threat Discharges to Surface Waters, NPDES General Permit No. CAG995001. A separate permit is not required pursuant to CWA § 404(r). Application and coverage under the General Permit is not required. However, Reclamation will address California state water quality standards by following the permit requirements outlined within the general permit, as described in the SLWRI Draft SEIS Chapter 3.

Appendix B. Impacts to Waters of the U.S. Calculations

Table B-1. Impacts to Waters of the U.S. from Roads

FEATURE	Identified Features			Details of Conflict with Wetlands		
	Name	Proposed Relocation Details		Conflict (yes/no)	Area of Impacted Waters of the U.S. (acres)[4]	Approximate wetland fill qty(cy) considering average 20 ft wide road
		Segments (#)	Length (lf)			
Roads	Lakeshore Drive	8	13,700	No	N/A	N/A
	Turntable Bay Area	3	6,200	Yes	0.01	275
	Gillman Road	3	1,200	Yes	0.03	1230
	Jones Valley & Silverthorne Areas	3	1600	Yes	0.01	208
	Salt Creek Road	5	5,100	Yes	0.10	1637
	Remaining Roads	8	5,200	Yes	0.24 (estimated)	9080 (estimated)
APPROXIMATE TOTAL FOR ROADS					**0.39**	**12430**

Table B-2. Impacts to Waters of the U.S. from Dikes & Embankments

FEATURE	Identified Features			Details of Conflict with Wetlands		
	Name	Proposed Fill Quantities (cy)		Conflict (yes/no)	Area of Impacted Waters of the U.S. (acres)[4]	Approximate wetland fill qty(cy) (Assumed to be 10% of total fill qty)
		Core, drain, filters	Riprap			
Dikes & Embankments	**Lakeshore Dikes**					
	(i) Doney Creek Dike	75,000	5,900	Maybe	N/A	(750+59)=759
	(ii) Antlers Dike	4,900	400	Maybe	< 0.25	(490+40)=550

	(iii) North Railroad Embankment	17,100	400	Maybe	N/A	(170+40)=210
	(iv) Middle Railroad Embankment	13,400	300	Maybe	N/A	(134+30)=174
	(v) South Railroad Embankment	101,900	2,500	Maybe	N/A	(1019+250)=1269
	Bridge Bay Dikes					
	(i) West Dike	69,000	23,600	Maybe	< 0.25	(690+236)=926
	(ii) East Dike	40,100	7,400	Maybe	< 0.25	(400+74)=474
APPROXIMATE TOTAL FOR DIKES					**TBD**	**4362**

Table B-3. Impacts to Waters of the U.S. from Bridges

FEATURE	Identified Features			Details of Conflict with Wetlands		
	Name	Proposed Fill Quantities (cy)		Conflict (yes/no)	Area of Impacted Waters of the U.S. (acres)4	Approximate wetland fill qty(cy) (Assumed to be total fill qty below 1070 msl)
		Earthwork	Volume of concrete			
Relocated Bridges	**Railroad Bridges**					
	(i) Doney Creek Bridge	0	7,080	Yes	0.87	4000
	(ii) Sacramento River 2nd Crossing	0	11,700	Yes	1.4	8270
	Vehicular Bridges			Yes		
	(i) Charlie Creek Bridge	0	Cast-in-steel-shell piles	Yes	0.002	N/A
	(ii) Doney Creek Bridge	0	Cast-in-steel-shell piles	Yes	0.002	N/A
	(iii) McCloud River Bridge	0	Cast-in-steel-shell piles	Yes	0.002	N/A
	(iv) Didallas Creek Bridge	0	0		0	N/A
Modified Bridges	**Railroad Bridge**					
	(i) Pit River Bridge	0	0	No	N/A	N/A

	Vehicular Bridge					
	(i) Fenders Ferry Bridge	0	0	No	N/A	N/A
APPROXIMATE TOTAL FOR BRIDGES			18,780		**2.27**	**12,270**

Table B-4. Impacts to Waters of the U.S. from Recreation Facilities

No.	Recreation Feature Location[1]	River Arm	Recreation Feature	Impacts to Waters of the U.S.[2]	Area of Impacted Waters of the U.S. (acres)[4]	Relocation Feature				Volume of Fill to Waters of the U.S. (cubic yards)[5]
						Length (feet)	Width (feet)	Depth (feet)	Area (square feet)	
1	**Arbuckle**	Pit	Boat In Campground	No						
2	**Antlers**	Sacramento	Boat Ramp	No						
			Resort/Marina	Yes	0,12			1	5401	200
			Campground	No						
3	**Bailey Cove**	McCloud	Boat Ramp Extend Campground and Day Use Trails/Trail Head	No Yes No	0.025			1	1089	40
4	**Bridge Bay**	Pit River	Marina	No						
5	**Campbell Creek**	McCloud	Resident Tract	No						
6	**Didalis**	Squaw Creek	Resident Tract	No						
7	**Dry Fork Creek Trail**	Sacramento	Trail	No						
8	**Ellery Creek Campground**	McCloud	Campground	No						
9	**Gooseneck**	Sacramento	Boat In Camp	No						
10	**Greens Creek**	McCloud	Boat In Camp	No						
11	**Gregory**	Sacramento	Campground	No						
12	**Holiday Harbor**	McCloud	Boat Ramp	No						
			Marina	No						
			Campground	No						

13	**Hirz Bay** ***Dekkas Rock***	McCloud	Boat Ramp Campground	No Yes	0.02			2	958	71
14	**Jones Valley**	Pit	Boat Ramp Marina Campground Lower	No No No						
15	**Kamloops**	McCloud	Camp	No						
16	**Lakeshore** **Fire Guard Station**	Sacramento	Fire Station South Lakeshore East Campground	Yes No	0.14			5	6098	1129
17	**Lakeview**	McCloud	Marina	No						
18	**McCloud Bridge**	McCloud	Campground and Day Use	Yes	0.09			2	4095	303
19	**Monday Flat**	Squaw Creek	Boat In Camp	No						
20	**Moore Creek**	McCloud	Campground	No						
21	**Nelson Point**	Sacramento	Campground	Yes	0.058			2	2526	187
22	**Pine Point**	McCloud	Campground	No						
23	**Oak Grove**	Sacramento	Campground	Yes	0.244			1	10629	394
24	**Packers Bay**	Pit & Main Body	Trail and Trail Head Boat Ramp Marina	No No No						
	Pine Point	McCloud	Campground	No						
25	**Salt Creek**	Sacramento	Resident Tract Cabins	No						
26	**Upper Salt Creek** **Lower Salt Creek**	Sacramento	Day Use Area Decommissioned Service Campground / access road	No						
27	**Samwell**	McCloud	Nature Trail	No						
28	**Shasta Lake Marina**	Sacramento	Marina	No						
29	**Shasta Lake RV Resort**		RV Resort and Campground	No						
30	**Shasta Caverns East** **Shasta Caverns West**	McCloud	Landing East Landing West	No No						
31	**Sugar Loaf** **Sugarloaf Cove**	Sacramento Sacramento	Boat Ramp Marina Campgrounds	No No No						

32	**Turntable**	McCloud McCloud	Marina Campground	No No						
33	**Digger Bay**	Sacramento	Boat Ramp	No						
34	**Centimudi**	Sacramento	Boat Ramp	No						
35	**Fishermans Point**	Sacramento	Camp Picnic Sites	No						
			Trail	No						
36	**Ski Island**	Pit	Boat In Campground	No						
37	**Silverthorn**	Pit	Boat Ramp	No						
38	**Tsasdi Resort**	Sacramento	Marina Resorts	No No						
APPROXIMATE TOTALS FOR RELOCATION AREAS					**0.577**					**2324**

Notes

1. Recreation Relocation Areas were determined from The Engineering Summary Appendix of SLWRI FEIS, and cross referenced with the SLWRI Delineation of Waters of the U.S.
2. Impacts to Waters of the U.S. were determined by comparing delineated wetlands and other waters of the U.S. with proposed recreation relocation features in ArcMap. Imagery covers the area in and around Lake Shasta acquired by Digital Globe 5/5/2017 and 11/10/2018. The spatial resolution varies from .31 to .05 meters.
3. Fill material is imported fill per the SLWRI FEIS Engineering Summary Appendix.
4. Impacted Waters of the U.S. (acres) = Wetlands (acres) + Other Waters (acres). Impacts are defined as the area permanently affected by the placement of fill within Waters of the U.S.
5. Volume of Fill to Waters of the U.S. (cubic yards) = Wetlands (cubic yards) + Other Waters (cubic yards)

Table B-5. Impacts to Types of Waters of the U.S. from Relocations

Type of Feature		Major Rivers (Acres)[1]	Intermittent Stream (ft)	Perennial Stream (ft)	Ephemeral Stream (ft)	Vegetated Ditch (ft)	Non-Vegetated Ditch (ft)	Seep/Spring Wetland (Acres)	Riparian Wetland (Acres)	Fresh Emergent Water (Acres)	Seasonal Wetland (Acres)
Bridges	Doney Creek Bridge	0.87	0	0	0	0	0	0	0	0	0
	Sacramento River 2nd Crossing	1.4	0	0	0	0	0	0	0	0	0
	Charlie Creek Bridge	0.002	0	0	0	0	0	0	0	0	0
	Doney Creek Bridge	0.002	0	0	0	0	0	0	0	0	0
	McCloud River Bridge	0.002	0	0	0	0	0	0	0	0	0
Roads	Lakeshore Drive		736	788	753	0	0	0.002	0.007	0	0
	Turn Table Bay		0	0	132	0	0	0	0	0.001	0
	Gillman Road		294	280	310	115	115	0	0.018	0	0
	Jones Valley & Silverthorn Areas		201	0	0	0	0	0	0	0	0
	Salt Creek Road		597	0	0	0	0	0.002	0	0	0
Dikes	Doney Creek Dike		0	0	0	0	0	0	0	0	0
	Antlers Dike		79	0	0	0	0	0	0	0	0
	East Bridge Bay Dike		0	0	86	0	0	0	0	0	0
	West Bridge Bay Dike		0	0	0	0	0	0	0	0	0
	North, Middle, & South RR Embankments		0	0	0	0	0	0	0	0	0
Recreation	Antlers RV Park and Campground		1097	0	0	0	0	0	0	0	0
	Bailey Cove Campgrounds and Day Use		289	0	0	0	0	0	0	0	0
	Dekkas Rock		205	0	93	0	0	0	0	0	0
	Lakeshore Fire Guard Station South Parcel		0	0	3212	0	0	0	0	0	0

	McCloud Bridge Campground		0	0	728	0	0	0	0	0	0
	Oak Grove Campground		627	0	255	0	0	0	0	0	0.008
	Nelson Point		0	0	0	0	0	0.006	0	0	0.046
	Total:	**2.28**	**4125**	**1068**	**5569**	**115**	**115**	**0.010**	**0.025**	**0.001**	**0.054**

Notes

1. Impacts from bridges are wholly to the waterbody they span as described in Table B-3.

Appendix C. Lakeshore Fire Guard Station Avoidance & Minimization

C.1 Introduction

Reclamation conducted an alternatives analysis for the relocation of the Lakeshore Fire Guard Station Project (Project) in consideration of the guidelines established under CWA 404(b)(1). The purpose of the Project is to relocate a new Fire Guard Station and demolish the existing Lakeshore Fire Guard Station, as the existing station, is in the vicinity of the Shasta Lake shoreline that will be impacted by the high reservoir pool by raising Shasta Dam.

The current Lakeshore Guard Station (LGS) is operated by the US Forest Service (USFS) on land adjacent to Shasta Lake, Shasta County, California. The subject property includes two sites, the north site and the south site, being considered for the relocation. As presented within the Engineering Summary Appendix in the SLWRI FEIS, the project would have the greatest impact upon wetlands and other waters of the U.S. out of all the relocations necessary for implementation of the SLWRI dam raise.

The subject property is located near the unincorporated community of Lakehead in the County of Shasta, California. The property comprises portions of Assessor's Parcel Numbers (APNs) 082-130-002 and 083-350-001. The property is bounded on the north by a residential development, on the west by Interstate Highway 5, on the south by a campground and a Pacific Gas & Electric (PG&E) transmission line easement, and on the east by Union Pacific Railroad (UPRR) property. The north site comprises the northern approximately 45 acres of APN 082-130-002. The south site comprises the southern approximately 11 acres of APN 082-130-002 and the northern approximately 9 acres of APN 083-350-001. The north and south sites are separated by approximately 90 acres of vacant land on APN 082-130-002. The north site is nearly bisected from the east by UPRR property that formerly was used for a turning wye.

C.2 Avoidance

Reclamation considered the feasibility of avoiding wetlands and avoiding all discharges of fill materials to wetlands and waters of the U.S. in both potential relocation sites, the north site and the south site. Reclamation found that avoiding wetlands within both locations was technologically feasible but prohibitively expensive. The costs of the avoiding wetlands, including design, site development (cut and fill), water supply development, and construction costs would increase substantially with the reduction in the amount of developable area and would not be feasible.

C.3 Minimization

Reclamation considered minimizing its impacts to wetlands and other waters of the U.S. in the north and south sites. The north site contains substantially greater areas of wetlands than the south site (7.5 acres versus 0.28 acres). The south site provided greater opportunity to reduce potential impacts to wetlands and WOTUS by virtue of having fewer acres of wetlands and WOTUS within the project area.

Within the south site Reclamation identified opportunities for minimization through a reconfiguration of the facility layout. Roads, utilities, buildings, parking, and staging areas were able to be modified in such a way to minimize their impacts upon wetlands. After reconfiguration, the project will impact 0.14 acres of wetlands.

C.4 Results

The primary purpose of the CWA 404(b)(1) guidelines is to minimize the impacts to wetlands and other WOTUS and ensure the least impactful alternative is implanted to meet the overall project purpose. Reclamation successfully identified opportunities for minimizing its impacts to wetlands and other WOTUS for the project by selecting the parcel with fewer wetlands and reconfiguring the relocation's structures to minimize its impacts.

Table C-1. Lakeshore Fire Guard Station Alternatives Summary

	Avoidance	**Minimization**
North Parcel	Cost prohibitive	Greater impact to wetlands than south parcel
South Parcel	Cost prohibitive	Smallest impact to wetlands

The Lakeshore Fire Guard Station relocation as presented within the SLWRI FEIS Engineering Summary Appendix would have impacted 7.0 acres of wetlands within the north site. Through consideration of the CWA 404(b)(1) guidelines Reclamation has reduced this impact from 7.0 acres to 0.14 acres, a substantial reduction. As this relocation represented the largest impact to wetlands amongst all relocations necessary as a result of the SLWRI dam raise, it represents a substantial reduction in impacts to wetlands for the entire dam raise project.

Appendix D. Sacramento River 2nd Crossing Bridge Avoidance & Minimization

D.1 Introduction

Reclamation conducted an alternatives analysis for the relocation of the Sacramento River 2nd Crossing Bridge (SCRB) in consideration of the guidelines established under CWA 404(b)(1). The SRCB is operated by the Union Pacific Railroad Company (UPRR) on land adjacent to Shasta Lake, Shasta County, California. The SCRB is the only connection for railroad traffic over existing UPRR tracks across the Sacramento River Arm (SRA) of Shasta Lake.

The purpose of the SCRB relocation is to construct a new bridge to replace the existing bridge that is in the vicinity of the Shasta Lake and will be impacted by the increased height of the reservoir pool caused by raising Shasta Dam. The superstructure and a portion of the foundation piers supporting the existing bridge will then be dismantled.

To support this relocation, the section of the tracks currently existing along the unincorporated community of Lakehead north of the bridge will also need to be relocated. The relocation of the subject bridge, the section of tracks within the Lakehead community and the relocation of another railroad bridge (Doney Creek Railroad Bridge located north of Lakehead Community) were all planned together to ensure minimum disruption of railroad traffic during construction and smooth and safe operation after relocation while staying within the UPRR Right of Way (ROW).

The proposed new bridge relocation will be across the SRA of Shasta Lake and will therefore impact the Waters of the United States (WOTUS) permanently. This impact will be due to construction of bridge foundations (most likely concrete piers) that will be required to be supported over competent bedrock at the lake bottom and built up to the bridge deck elevation.

Preliminary analysis based on the Advance Planning Study conducted during the SLWRI FEIS indicates an approximate area of WOTUS impact due to the foundation for the relocated SRCB of 1.40 acres. There is no other WOTUS delineated within the Arc-GIS imagery that is impacted due the relocation of SRCB.

As indicated above, the impact to WOTUS caused by the relocation of the SRCB will primarily and mostly be due to construction of foundation piers to support the bridge. These piers typically will be supported by the bedrock /competent material at the bottom of the lake. The exact elevation of the competent rock suitable to support the structural and the rolling railroad loads is to be determined through

geotechnical field testing and laboratory analyses that will be conducted during the next phase of the implementing the SLWRI project. The information thus acquired will also assist in determining further foundation details like the diameter of concrete piers, number of piers, depths etc. that will be developed during the final engineering design of the bridge. For this example, to calculate the approximate fill quantity USBR has used the information available within the Engineering Summary Appendix of the SLWRI FEIS. The Advance Planning Study included in SLWRI FEIS provided an estimation of dimensions for piers for the bridge abutments and along the river. It also estimates the foundation elevations for the piers. Using this preliminary information, USBR calculated the approximate volume of fill quantity (concrete) for the SRCB relocation that will go into the river to be approximately 8,270 cubic yards. This quantity will be further refined after completion of final design.

D.2 Avoidance

In consideration of the CWA 404(b)(1) guidelines Reclamation considered the feasibility of completely avoiding all discharges of fill materials to WOTUS. Reclamation considered (1) raising the bridge using a single span bridge support by two abutments and (2) relocating the bridge to a different location that is not adjacent to the current bridge.

To relocate SRSCB as a single-span bridge would require two abutments to support a span in excess of 1000 feet. The bridge would be required to support heavy dynamic railroad loads induced by single-track freight rail traffic moving at significant speeds. A bridge span in excess of 1000 ft between two supports capable to safely withstand such loads and transmit the same to the abutments would require an extremely deep bridge deck with other members making the structure very robust. Such a robust structure cannot be used due to the impracticality of handling, fabrication, launching and other design and construction constraints. Usually, such long single spans are found in high-level bridges crossing deep canyons, where intermittent support is not possible due to the distance between the canyon floor and the bridge deck. In such situations, long single-span bridge decks need to be adequately supported by an arch structure, typically below the deck, to help transmit bridge loads to the abutments. This support is critical in allowing the robustness of the deck to be reduced to practical dimensions.

For the SRSCB to be built as a single span high-level bridge, the railroad track will need to be elevated significantly to provide adequate space between the bridge deck and the top of lake water level to accommodate the arch support structure. Elevating the railroad tracks would require increasing the track grade gradually for several miles on either side of the bridge. Adjusting miles of track would require an enormous effort at the of cost several million dollars and would not be economically feasible.

Relocating the bridge to a different location that is not adjacent to the current bridge would require large quantities of land acquisition to relocate the railroad right of way to relocate the track. The terrain in and around the Shasta Lake is generally hilly. Thus, track relocation will likely require several new tunnels which would have severe adverse effects to the environment, requiring blasting, drilling, and disturbances of large amounts of rock and soil. This would require a monumental effort to completely re-route the UPRR tracks for several miles south and north of the current bridge location involving huge amount of land acquisition, huge quantities of grading and clearing of forest that will be extremely costly and time consuming. Moreover, it is very likely that the construction involved for such relocations will cause permanent damages to the exiting sensitive environmental features of the wilderness adjacent to the Shasta Lake. The cost of this effort will be several orders higher than that of the current project options and would not be economically feasible.

D.3 Minimization

Reclamation considered the possibility of modifying the existing bridge by raising such that it continues to serve its purpose safely and continually after implementation of the SLWRI project. This will include raising the existing bridge to a suitable elevation so that it is not affected by the raised high-water levels of Shasta Lake after raising the Shasta Dam. This option significantly reduces the impact to WOTUS. Reclamation considered the following advantages and disadvantages to this minimization option:

Advantages:

1. Modification of the existing bridge by raising will likely involve strengthening the existing bridge foundation and the deck that may include strengthening the existing piers, constructing some additional piers and strengthening the existing foundation. Thus, the impact to WOTUS (discharge of fill) will likely be significantly less than building a new bridge.

2. This alternative will not require re-alignment of the existing UPRR tracks as there will be no change to the bridge alignment.

3. This alternative will be less expensive than other on-site alternatives

4. This alternative fulfills the project purpose.

Disadvantages:

1. This alternative will require the existing bridge to be raised by a minimum of approximately 20 feet. For the railroad traffic to use the modified bridge the tracks south and north of the bridge would have to be raised. Raising the UPRR tracks for safe railroad traffic (predominantly freight in this case)

would have to be done gradually over a long distance at either side of the bridge. Available land on the southside of the bridge may permit this raise. North of the bridge where the tracks pass through the Lakehead community availability of land to accommodate this raise is extremely limited. Raising the tracks will also increase the footprint of the railroad embankment which may encroach into land beyond the railroad right of way.

2. This effort will involve several restrictions on the railroad traffic that will include imposing speed restrictions and temporary stoppage of regular traffic for long periods of time. This disruption will heavy financial losses UPRR that will add to the cost burden of the project.

Due to the uncertainties involved in raising the bridge, the increased costs of elevating tracks and purchasing land north and south of the bridge, and the increase costs to UPRR, this minimization effort is not feasible.

D.4 Results

The primary purpose of the CWA 404(b)(1) guidelines is to minimize the impacts to wetlands and other WOTUS and ensure the least impactful alternative is implanted to meet the overall project purpose. Reclamation considered the possibilities of completely avoiding wetlands and minimizing its impact to wetlands for the SCRB relocation but found that neither was feasible due to increased costs, logistics, and availability of land for purchase. Reclamation will implement mitigation according to the Wetland Mitigation Plan described in Chapter 2.5 with a minimum replacement ratio of 3:1 for impacted wetlands and other WOTUS.